UHN Division of Nephrology

DIVISION OF NEPHROLOGY

House Staff/NP Guidebook

April 2018

Introduction

Welcome to nephrology at the University Health Network. The Division of Nephrology is one of the largest nephrology programs in Canada, encompassing treatment of chronic kidney disease (CKD) with dialysis and transplantation, general nephrology, subspecialty clinics, teaching and research. There are a large number of active staff nephrologists at the Toronto General, Toronto Western, and affiliated hospitals.

Dr. Christopher Chan, Medical Director, Division of Nephrology and Home Hemodialysis
Dr. Joanne Bargman, Medical Director, Peritoneal Dialysis; Education Chair
Dr. Vanita Jassal, Medical Director, Toronto Rehab (TR) Hemodialysis, O'Neill Centre Peritoneal Dialysis
Dr. Charmaine Lok, Medical Director, Multi-Care Kidney Clinic (MCKC), Hemodialysis, and Vascular Access Program
Dr. Joseph Kim, Co-Director, Kidney Transplant Program

Inpatient clinical services consist of a 9-bed nephrology ward on 6 Eaton South (6ES), which is a combined Nephrology/General Internal Medicine unit. General nephrology services are provided by our two consult teams. In general, the nephrology service is always very busy and, therefore, requires much organization and coordination. This guidebook focuses on your rotation in general nephrology and is a guide to the management of nephrology patients utilizing accepted protocols and useful suggestions.

Outpatient clinical services consist of Home Peritoneal Dialysis (PD), Outpatient Hemodialysis (HD), Home HD, Self-Care HD and outpatient clinics including an active Multi-Care Kidney Clinic. In addition, we have a HD unit at Toronto Rehab (TR) on University Ave., which provides HD for patients in rehab at TR and in chronic care at TR's Bickle Centre facility at Dunn Ave, and we provide PD at O'Neill Centre nursing home. Our nephrology service covers all UHN sites as well as consultation for Mount Sinai and Women's College Hospitals. The philosophy of care is toward that of living well at home, self-management, and home/self-care modalities of dialysis (PD, HD, and nocturnal HD).

During this rotation, you will have exposure to, and learn how to manage many of the following conditions: acute kidney injury (AKI), chronic kidney disease (CKD), end-stage kidney disease (ESKD), an understanding of dialysis (HD and PD), hypertensive disorders, renal disorders in pregnancy, tubulointerstitial renal diseases, cystic diseases and other hereditary disorders, glomerular and vascular diseases (including the glomerulonephritides, diabetic nephropathy, and atheroembolic disease), disorders of mineral metabolism (including nephrolithiasis and renal osteodystrophy), disorders of fluid, electrolyte, and acid-base regulation, and disorders of drug metabolism and renal drug toxicity.

We hope that this guidebook will assist you in the management of your patients and in your learning experience. In an effort to continually improve our service, we welcome feedback on this document.

Guidebook Editor
Anna Gozdzik, Nurse Navigator Nephrology ext 14-5129 anna.gozdzik@uhn.ca

Contributors:
Angie Chai, Nurse Practitioner Geriatric Nephrology & Rehab ext 14-3992 Angelique.Chai@uhn.ca
Paulina Bleah, Nurse Practitioner Inpatient Nephrology ext 14-8501 Paulina.Bleah@uhn.ca
Primrose Mharapara, Nurse Practitioner Hemodialysis ext 14-6450 Primrose.Mharapara@uhn.ca
UHN Division of Nephrology
UHN Renal Pharmacists
UHN Nephrology Allied Health

Note: This document is available on http://ukidney.com/uhn and on http://www.nephroed.com with a log in.

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Specialty Clinics

Acute Kidney Injury Follow-Up Clinic (AKI Clinic)

The AKI Follow-Up Clinic is a new UHN initiative aimed at ensuring timely and complete follow-up of patients who have suffered from an acute kidney injury event, either diagnosed at admission or during their hospitalization.

In accordance with the *Kidney Disease*: *Improving Global Outcomes* (KDIGO) guidelines, we aim to follow-up with patients with resolving or non-resolved AKI **within 3 months** after discharge. There is growing evidence to support that AKI leads to increased morbidity and mortality, and increases risk of developing ESKD.

The role of the AKI clinic is manifold. The physician in the clinic assesses whether the AKI is resolving and if there needs to be any further investigation into its etiology. Furthermore, there is a careful review of the patient's medications and their other comorbidities; recommendations are made to optimize their management in the context of their current kidney function. If the patient is felt to have progressed to chronic kidney disease, then follow-up with a nephrologist is arranged.

The clinic is currently run on the first Friday of every month. Patients are seen by **Dr. Robert Richardson** and **Dr. Asad Merchant**, and intermittently, by residents and fellows. Patients are booked from 9:30 – 1:00pm.

<u>Inclusion Criteria</u>

- Age 18 and above
- Hospital admission
- Documented episode of acute kidney injury stage KDIGO 2 and above (i.e., rise in creatinine equal to or greater than 1.5 x the baseline creatinine or requiring dialysis)

<u>Exclusion Criteria</u>

- Patients with known CKD, any stage, **AND** already followed by a nephrologist
- Patients with a renal disease (e.g., glomerulonephritis or PCKD), who will need ongoing follow-up with a nephrologist should be referred directly to a specialized renal clinic and not the AKI clinic.
- Patients considered palliative or with a poor prognosis unrelated to their AKI
- Patients with stage 4 – 5 CKD who will require Multi-Care Kidney Clinic follow up

Contact Information

To book an appointment, please fill out an AKI Follow-Up Clinic Referral form, and fax it to **(416) 340-4999,** or give/mail to **Susan Erwin** at TGH 8N–861 (Dr. Richardson's office).

Cardiac and Renal Endocrine Clinic (C.a.R.E. Clinic)

This clinic has been developed for patients who have needs in two or more of these common areas of medical practice, because it is common for patients to present with these disorders at the same time.

The main goal of the clinic is to get all the medical specialists and healthcare professionals together in one clinic to provide care in an effective and timely manner.

The interdisciplinary team includes the following specialists: nephrologist (**Dr. David Cherney**), cardiologist (**Dr. Michael Farkouh**), endocrinologist (**Dr. Cynthia Luk**), pharmacist, dietitian **(Christine Nash)**, and the diabetes nurse educator (**Elaine Wylie**, **Kitty/Cecilia**).

Fax referrals to **(416) 340-4999**. To inquire about appointments, contact Dr. Cherney's office at **(416) 340-4151**.

Elder Kidney Care Service

Purpose
A multidisciplinary team that helps support elderly patients transition along the renal care pathway. Team members include: a staff nephrologist (Dr. V. Jassal), a nurse practitioner, an occupational therapist, a social worker, and a rotating Nephrology fellow.

We see both inpatients and outpatients and can provide expertise in multiple areas, including:

1. Prognostication and shared decision making (e.g., determining dialysis vs. CCRC; goal setting and advance care planning in the context of CKD/ESRD ;)
2. Adapting renal care in the setting of geriatric syndromes, such as polypharmacy, falls, dementia/cognitive impairment
3. Symptom management in CKD/ESRD
4. Long-term planning, e.g., geriatric rehab for dialysis patients.

We provide the following services:

- Inpatient consults at UHN and Mount Sinai;
- Outpatient consults (CCRC management, geriatric syndromes in dialysis patients)
- Geriatric hemodialysis rehab program at Toronto Rehab Institute (University Ave. site);
- Long term complex continuing care dialysis program at Toronto Rehab Institute (Bickle site)
- Peritoneal dialysis at a long-term care facility (O'Neill Centre)

Availability:

Monday to Friday 0900 to 1700
We do not have coverage outside of these hours.

Referral Process:

Referrals may be made by the primary medical team, or any of the inpatient or outpatient Nephrology services at UHN.

There are 3 kinds of referrals:

1. Critical inpatient: for elderly patients not currently on dialysis who are expected to require a decision about dialysis initiation in the next 12 to 24 hours, and for whom there is concern about the appropriateness of dialysis or long-term renal care planning. These patients will be seen ASAP with a goal to complete assessment within 4 hours (except for infrequent circumstances where staffing constraints preclude this).
2. Routine inpatient: for elderly patients with AKI or CKD/ESRD for whom the areas of expertise listed above may be useful (goal: see patient within 2 working days)
3. Routine outpatient: for elderly patients with CKD/ESRD for whom the areas of

expertise listed above may be useful. These patients will be seen within 2 months.

To make a referral:

Type of Referral	Method
Critical inpatient	Page the Geriatric Nephrology fellow directly (through Locating) You will also be asked to fill out a standard paper or online referral afterwards
Routine inpatient	Fill out a standard paper or online referral Send it via email or fax to Dr. Jassal's office (contact information below)
Routine outpatient	Fill out a standard paper or online referral Send it via email or fax to Dr. Jassal's office (contact information below)

Please see website for more information:

http://www.uhn.ca/MCC/PatientsFamilies/Clinics_Tests/Geriatric_Nephrology_Consult_Services

Link for inpatient referral:

http://www.uhn.ca/MCC/Health_Professionals/Referrals/Documents/Geriatric_Nephrology_Service_Inpatient_Referral.pdf

Link for outpatient referral:

http://www.uhn.ca/MCC/Health_Professionals/Referrals/Documents/Geriatric_Nephrology_Service_Outpatient_Referral.pdf

Elder Kidney Care Service
Inpatient Referral

Referring Service

Referring Staff:		Date of Referral:	
Referring Service (e.g. GIM):			
Referral completed by:		Pager:	

Patient Information

Patient name:		MRN:	
Location:		Age and sex:	

Referral Details

Timing of referral:

☐**Critical (within 4 hours)**
☐**Routine (within 2 working days)**

Reason for referral:

☐Potential candidate for dialysis rehab program
☐Falls/Functional decline
☐Other:
☐ESRD modality/Advance care planning
☐Cognitive impairment

Summary of course in-hospital:

Contact Information

Please email completed referrals to Samantha.Gunness@uhn.ca, or fax it to (416) 340-4999.

Glomerulonephritis Clinic (GN Clinic)

The GN clinic is a specialized clinic that investigates and treats patients with proteinuria who usually have been referred by a nephrologist for a second opinion or specialized

treatment or a family doctor who has tested for and found large amounts of protein and/or blood in the patient's urine. Frequently, the patients have already had a renal biopsy, which has revealed a type of glomerulonephritis. Because this type of patient can have serious kidney disease that can lead to end-stage kidney disease (in some cases, within months or even weeks), the diagnosis and management can be of critical importance. It can be treatment of glomerulonephritis occurring on its own (primary) or secondary to a systemic condition, such as vasculitis.

Contact Information:

Clinic main line: ext 14-4187

Dr. Daniel Cattran's clinic: Thursdays 0830-1400

- Administrative assistant: Aditi Sen, ext 14-8012

Dr. Heather Reich's clinic: Tuesdays 0830-1300

- Administrative assistant: **Marion Butt**, ext 14-3439
- Clinical coordinator: **Shaw Kay** (RN), ext 14-2840
- Clinical/Administrative assistant: **Sasha Clarke**, ext 14-2076
- Manager: Jacqui Cooper, ext 14-2399, c: (416)339-8445

How to Refer:

- Fax referrals for Dr. Cattran to **(416) 340-3714**
- Fax referrals to Dr. Reich to **(416) 340-4999**

Please include a copy of:

- Patient's biopsy (if available)
- Recent lab results and any diagnostics completed (i.e., abdominal ultrasound)
- Most recent clinic note

Oncology – Nephrology Clinic

Categories of patients:

1. Acute kidney injury in the setting of patients receiving acute chemotherapeutic agents including biologics and stem cell therapies[5]
2. Electrolyte disturbances associated with cancer
3. Cancer-related kidney disease (e.g., myeloma, amyloidosis) and para-neoplastic glomerular disease
4. Cancer survivors with chronic kidney disease

Purpose of the Onco-Nephrology Clinic:

1. To ensure timely assessment of patients with cancer who require nephrological care
2. To strengthen academic link between oncology and nephrology
    a. To allow appropriate training and exposure for clinical trainees
    b. To enhance academic deliverables

Exclusion Criteria:

1. Known chronic kidney disease with an established relationship to a nephrologist (Multi-Care Kidney Clinic)
2. Patients considered palliative or with poor prognosis unrelated to their kidney disease
3. Inpatients

Process:

1. All onco-nephrology referrals can be faxed to **(416) 340-4999**.
2. Please indicate ***Onco-Nephrology*** on the referral line.

Hereditary Kidney Disease Clinic

Patient followed by Dr. Pei and Dr. Barua

Contact Information:

Administrative Assistant:
Suja Velengattucherry
suja.velengattucherry@uhn.ca
Ext: 14-5650
Fax: (416)340-4999

Nephrology Team and Affiliated Areas

Multi-Care Kidney Clinic (MCKC)

•Provides multidisciplinary care for patients diagnosed with CKD Stage 4-5 (including failing kidney transplants and other transplant patients with CKD)
•Educates patients about CKD and treatment options
•Plan for transition to dialysis and/or live donor transplant
Arranges for dialysis access

Contact Information

Clinic: Mondays and Tuesdays, ext 14-2860

- Jacqui Cooper, manager, ext 14-2399, c: (416)339-8445
- Evie Porter, RN, ext 14-3588
- Janice Ritchie RN, ext 14-6053
- Anna Gozdzik, RN, ext 14-5129
- Andrea Heywood, RN, ext 14-6548
- Diane Stoker, clerical coordinator, ext 14-6883, fax **(416) 340-4291**
- Isolyn Samuels, clerical coordinator ext14-3056, fax **(416) 340-4291**

How to Refer:

•To refer patient to MCKC, fill out MCKC referral form and fax along with info to (**416) 340-4291**

- Patients must be seen <u>as an outpatient</u> by a nephrologist for initial work-up of CKD before referral to MCKC, even if seen as an inpatient consult.
- Inpatient referrals can be made if work-up has been completed during admission. Patient needs to be presented at eHOME meeting on Wednesdays to discuss suitability. As they may not get an appointment for up a month or more, please ensure patients are stable enough to wait; if not, please have them followed in a nephrologists' office.
- ACR urine is mandatory for all new referrals to MCKC (in EPR enter: **microalbumin random urine**).
- In order for the patient to be seen in MCKC, the ORN requires you to calculate the Kidney Failure Risk Index (KFI) and your patient has to meet the criteria of 'risk of progressing to ESRD (needing transplant or dialysis) of >10% in 2 years '.

University Health Network

Renal Management Clinic
REFERRAL GUIDELINES

PURPOSE OF THE RENAL MANAGEMENT CLINIC

The Renal Management Clinic is an interdisciplinary clinic dedicated to promoting the health of patients with chronic kidney disease (CKD) and aims to:

- Slow the progression of CKD
- Prevent known related co-morbidities
- Assist patients and their families to adapt to and manage chronic illness through education & psychosocial support
- Plan for & facilitate the smooth transition to dialysis and/or kidney transplantation

REFERRAL PROCESS: referral to the clinic must be made by an outpatient nephrologist. Patient's receiving immunosuppressive therapy for GN will be followed in RMC for CKD management along with f/u by referring MD for management of immunosuppressive therapy.

CRITERIA

1. CKD confirmed by a Nephrologist (i.e. Reversible causes ruled out)
2. Glomerular filtration rate ≤ 30 ml/min*
3. Patient informed of purpose of clinic
4. Patient must reside in UHN catchment area

* When GFR <=30ml/min, referral is mandatory; if GFR between 30-60 ml/min then it is up to the discretion of the referring nephrologist. Referrals will NOT be accepted when GFR < 15 ml/min if known established CKD

INFORMATION REQUIRED

1. Contact Information Required:
   - ❑ Patient telephone numbers (home, work, mobile, alternate contact)
   - ❑ Home address
   - ❑ Emergency contact (name & telephone)
   - ❑ Family/General Practitioner's name/address/telephone/fax
   - ❑ Referring Specialist's name/address/telephone/fax/billing number
   - ❑ Other name/address/telephone/fax (e.g., transplant, homecare coordinator)
2. Patient Information Required:
   - ❑ Name of patient
   - ❑ OHIP number
   - ❑ Date of birth
   - ❑ Languages spoken
   - ❑ Updated Medical History
3. Current Height (cm) & Weight (kg)
4. Current list of Medications and Allergies
5. 24 hour urine collection for creatinine clearance and proteinuria, completed within 2 months of first appointment.
6. Laboratory results within 1 month of first appointment:
   - ❑ Serum creatinine & urea
   - ❑ Electrolytes
   - ❑ Calcium & phosphorous
   - ❑ PTH
   - ❑ Albumin
   - ❑ CBC
   - ❑ Iron saturation & ferritin
   - ❑ Hemoglobin A1c (if diabetic patient)
7. Other investigations, if done within 1 year of first appointment:
   - ❑ EKG, Chest X-Ray, Echocardiogram

MULTI-CARE KIDNEY CLINIC - REFERRAL FORM

Referring Nephrologist:_____ Date:_____

Patient Name:_____ MRN:_____

Date Of Referral to Nephrology Clinic (ORN requirement):_____

Date Of First Nephrology Consultation (ORN requirement):_____

Kidney Failure Risk Equation: = _____ (≥ 10% risk of ESKD over 2 years)

PLEASE CHECK IF COMPLETED:

- ☐ CKD confirmed by a Nephrologist (i.e. Reversible causes ruled out)
- ☐ ACR and serum creatinine at time of referral **(must have KFRE of ≥ 10% risk of progressing to ESKD over 2 years)**
- ☐ Patient informed of purpose of clinic
- ☐ Accompanying updated detailed **typed** medical history

REFERRAL PROCESS: referral to the clinic must be made by an outpatient nephrologist. Patient's receiving immunosuppressive therapy for GN or transplant will be followed in MCKC for CKD management along with f/u by referring MD for management of immunosuppressive therapy.

Patients will not be accepted into the renal management clinic unless above has been completed

INFORMATION REQUIRED

1. **Contact Information:**
   - ☐ Patient telephone numbers (home, work, mobile, alternate contact)
   - ☐ Home address
   - ☐ Emergency contact (name & telephone)
   - ☐ Family/General Practitioner's name/address/telephone/fax
   - ☐ Referring Specialist's name/address/telephone/fax/billing number
   - ☐ Other name/address/telephone/fax (e.g., transplant, homecare coordinator)
2. **Patient Information:**
   - ☐ Name of patient
   - ☐ OHIP number
   - ☐ Date of birth
   - ☐ Languages spoken
   - ☐ Current Height (cm) & Weight (kg)
   - ☐ Current list of Medications and Allergies
   - ☐ 24 hr urine collection for creatinine clearance and proteinuria, completed within 2 months of first appt
3. **Laboratory results** within 1 month of first appointment:
   - ☐ Serum creatinine & urea
   - ☐ Electrolytes
   - ☐ Calcium & phosphorous
   - ☐ PTH
   - ☐ Albumin
   - ☐ CBC
   - ☐ Iron saturation & ferritin
   - ☐ Hemoglobin A1c (if diabetic patient)
   - ☐ Urine: ACR
4. **Other investigations**, if done within 1 year of first appointment:
   - ☐ EKG, Chest X-Ray, Echocardiogram

Referring Nephrologist's signature:_____

CONTACT
Multi-Care Kidney Clinic:
Telephone: (416) 340-4800 x 6389
Fax: (416) 340-4291

UHN Toronto General Toronto Western Princess Margaret Toronto Rehab Michener Institute
COURAGE LIVES HERE

☐

Nursing Support Team

Nurse Navigator
Anna Gozdzik, RN, ext **14-5129**; **fax (416) 340-4291**

- Provides education/support for patients starting dialysis emergently. Please refer ANY new inpatient starting dialysis who will need long-term dialysis
- Coordinator for hemodialysis spots in Dialysis Start Unit (DSU)
- Provides education/support for patients starting dialysis in an unplanned manner
- Assists with coordinating outpatient HD, PD, NHD, geriatric rehab
- Refers patients to outside centres for dialysis near their home
- Coordinates assigning dialysis outpatient spots
- Helps nephrology teams with disposition planning i.e. rehab or placement in community

Geriatric Rehab
Angie Chai, RN(EC)-NP, **ext 14-3992**, **pager (416) 790-6316**

Vascular Access Coordinator
Cyndi Bhola RN, **ext 14-3518**, **pager (416) 790-5320**

- Notify Cyndi for vascular access issues, e.g., tunneled central line insertion/removal, permanent vascular access creation
- House staff to enter requests for tunneled central lines in Electronic Patient Record (EPR): Under Nephrology Order set: Diagnostics → "Abd/Thoracic Angio". Enter comment (reason for insertion/removal/guidewire change).
- Report all insertions/removals/changes/line sepsis to Cyndi at daily AM rounds.

Vascular Access Program Secretary
Sally Lima, ext 14-6993

PD Access Coordinator
Zita Abreu, RN, **ext 14-2358**

- Notify for PD catheter issues, i.e., insertions, removals, manipulations
- Arranges PD catheter insertions: laparoscopic, bedside, radiologic, or surgical

Informatics Team

- **Stefan Trohonel**, RN, Informatics Team Lead, ext **14-4762**
- **Gomuki Mahendrarajah**, Informatics Coordinator, **ext 14-6285 (currently on maternity leave)**
- **Meganne Sholdice**, Informatics Coordinator, **ext 14-6285**
- **Jamal Goddard,** ORRS Data Clerk**, ext. 14-5295**
- **Dan McNally,** ORRS Data Clerk, **ext. 14-6320**

Physiotherapy/Occupational Therapy

- **Bijal Mistry**, PTA/OTA, **pager (416) 719-3869**
- **Belinda Wagner**, PT, **pager (416) 719-3903**
- **Sandeep Marwaha**, OT, **ext. 14-6754**, **pager (416) 790-4609** (currently on maternity leave)

Physiotherapy

For inpatient ward, HD, PD units: Physiotherapists assist in rehabilitation needs and planning for discharge, or assessing for rehab hospital.

For outpatients:

OUTPATIENT HEMODIALYSIS PHYSIOTHERAPY REFERALS

Please write referral for PT in Doctors' Orders and indicate what order is for. Clinical notes in patients referencing reason for referral are much appreciated. Guide for referrals below:

- Order must be written in chart for PT
- Coverage for 1st and 2nd shift only, not for 3rd shift
- Assessment for independent programme on special request

Outpatient Hemodialysis Physiotherapy Referral Guidelines:

*** Third Shift**

Unfortunately we are not currently staffed to do exercise programs in third shift while the patients are on hemodialysis. It is possible to set patients up with a basic home exercise program if the patient is willing and able to participate, but we are unable to individualize and make treatments programs patient specific and challenging (especially for those younger in age) as we are unable to monitor and progress it.

Referral	Appropriate	Action
PT to see for exercise program while patient on outpatient HD	Appropriate	PT to get patient consent and if given, assess and set patient up on exercise program, progress as able/needed.
Joint assessment (including shoulders, elbows, wrist, hips, knees, ankles, digits)	Appropriate	PT to screen and treat as able. If unable to treat, PT to liaise with Doctor/Nurse Practitioner to write referral for private practice/OHIP funded clinic (see list of OHIP clinics attached) and direct patient to book appointment there.
Back and neck assessments	In-appropriate	PT unable to safely and properly assess back and neck in outpatient HD setting. Doctor/Nurse Practitioner to write referral for private practice/OHIP funded clinic (see list of OHIP clinics attached) and direct patient to book appointment.
Gait/balance/falls assessments Walker assessments	Appropriate	PT to asses as able for gait, walker, and falls pre- or post-HD. If unable to asses pre or post dialysis Doctor/Nurse Practitioner to write referral for private practice/OHIP funded clinic (see list of OHIP clinics attached) and direct patient to book appointment there. OR Ask Social Work to make referral for CCAC physiotherapy home assessment in order to be able to assess patient when able to fully ambulate and not fatigued post HD.
Falls and Safety Education	Appropriate	PT to provide education and falls pamphlets to patient and/or patient's family.
Chest Physio/Secretion Clearance	Appropriate	PT to screen and treat as able. If unable to treat or with significant concerns, PT to liaise with Doctor/Nurse Practitioner to refer to family doctor or emergency.
Third Shift Exercise Program	Appropriate for basic home exercise program	PT to asses and provide basic home exercise program*. Doctor to refer patient to investigate community sports programs/league, invest in gym membership or home exercise equipment, or invest in a personal trainer.

Criteria for referral:

- Medically stable, cleared for cardiovascular training
- Cognitively intact – able to follow instructions, capacity for learning & carry over
- Motivated & interested in exercising during dialysis
- On hemodialysis for >3 months

Contraindications to the exercise program include:

- Poorly controlled blood pressure – SBP<90 or >160, DBP <50 or >90
- Uncompensated CHF
- MI within 6 months
- Any other cardiac conditions that contraindicate cardiovascular training
- Recent history of unstable angina
- Cardiac arrhythmias, severe valvular disease
- Persistent predialysis hyperkalemia
- Severe renal bone disease
- Fixed musculoskeletal deformities such as paralysis, chronic contractures
- Severe diabetic retinopathy (risk of vitreous bleeding)

NOTE: Requests such as those for low back pain, mobility/safety assessments or return to work should be referred to an outpatient clinic or CCAC physiotherapy. Requirements for manual therapy & electrotherapy (e.g. TENS, muscle stimulation) cannot be assessed on dialysis. Doctors can write a referral for these, or patients can self-refer for services.

Occupational Therapy

Occupational therapy focuses on assessing overall function, i.e., exploring how physical, cognitive and emotional factors influence patient's abilities to participate in ADLs. OT utilizes various strategies to enhance, maintain, or compensate functional challenges. Areas of focus in nephrology include ADL assessment, cognitive assessment, and equipment recommendations, along with providing psychosocial approaches as needed.

Inpatient: ADL assessment, cognitive assessment, equipment recommendations, pressure ulcer management, disposition planning

HD: functional and cognitive assessments, referrals for community service

Renal Pharmacists

- Resource for renal dosing and medication related questions specific to nephrology.
- Provide patient counselling and discharge medication education for admitted patients.

Yellow Team:

- Melissa Lan; Annemarie Cesta, Pager (416) 790-8466

In-centre HD, Home HD:

- Marisa Battistella, Pager (416) 790-0793, Ext 14-3207
- Claudia Summa-Sorgini, Ext 14-6547

PD:

- Bahar Nemati; Sanaz Mozayyan, Pager (416) 790-7790, Ext 14-6547

MCKC:

- Annemarie Cesta; Stephanie Ong Ext 14-6547

CARE Clinic:

- Claudia Summa-Sorgini, Ext 14-6547

GN Clinic:

- Melissa Lan, Ext 14-6547

Satellite Hemodialysis Units (Sheppard & Sussex):

- Annemarie Cesta, Ext 14-6547

Reimbursement Specialist:

- Celine Yu, Ext 14-6622

Hemodialysis Unit

Hemo West (HW) – **ext 14-4072**, fax (416) 340-3084

Hemo East (HE) – **ext 14-5707**, fax (416) 340-4892

Denise Williams, RN, nurse manager – **ext 14-6305**

Annellie Cristobal, RN, patient care coordinator (PCC) – **ext 14-6908**

Alicia Jones, RN, patient care coordinator (PCC) – **ext 14-8502**

Joanne Stephens, RN, patient care coordinator (PCC) - **ext 14-6049**

Primrose Mharapara, RN(EC)-NP – **ext 14-6450, cell (647)919-2476**

Sannie Lai, RN, advanced practice nurse educator (APNE) – **ext 14-8726**

Vanessa Godfrey, RN, advanced practice nurse educator APNE – **ext 14-2051**

- HD Manager, PCC, or charge nurse to be contacted for all patients requiring HD or any changes for inpatients. PCC and charge nurse attend AM sign-in rounds.
- Use standing order sheet for HD orders. Orders to be written for the weekend and Monday AM, before leaving Friday, and for discharged new HD pts.
- ALL patients starting HD **MUST** have **hemoglobin, creatinine, urea, serum bicarbonate**, **calcium**, **phosphate**, **albumin**, **PTH** bloodwork done PRIOR to first dialysis session (Ontario Renal Reporting System guideline).
- HD schedule for the day reviewed at morning sign-in
- Urgent HD after hours to be discussed with the renal fellow
- HD requests from other hospitals - call staff nephrologist on-call. Accommodation is dependent upon availability status noted in sign-in morning meeting.
- Page on-call HD nurse for emergency dialysis after hours and Sundays via locating at **14-3155** (to avoid hemodialysis on Sundays unless urgent.) CRRT (only at Mount Sinai) and SLED should only be initiated during the day.

Dialysis Start Unit (DSU)

12 ES, room 411, ext 14-4757
Jacqui Cooper, clinic manager **ext 14-2399**, **c: (416) 339-8445**

For any patient newly starting chronic dialysis (HD or PD). Focus is modality education and support for dialysis modality. Patient should be stable on hemodialysis, be deemed ready to go to an outpatient dialysis unit (although still may be inpatient), be able to dialyze sitting up, and have a functioning vascular access (CVC or internal). PD requires a functional peritoneal catheter, although problem solving for access is also managed in the DSU. Medical coverage is by Dr. Lok, Primrose, NP, and home dialysis fellows.

Coverage for **statutory holidays** is by the **TWH fellow on-call**. He/she should come by at the beginning of the shift before going to TWH to check in with the staff in the DSU.

Coordinated through **Anna Gozdzik** (ext **14-5129**)

Home Hemodialysis Unit

Norman Urquhart Ground, room 404, ext 14-3736.

Jacqui Cooper, clinic manager **ext 14-2399**, **c: (416) 339-8445**

The home hemodialysis program provides training for patient for nocturnal dialysis. Training usually takes about 8 weeks. Please contact the unit at ext 14-3736 to set up an information session for your patient.

Toronto Rehab (TR)
TGH runs the HD unit at TR for geriatric patients getting rehab at TR-rehab as well as those who reside at TR-Complex Continuing Care (CCC) (Bickle Centre) on Dunn Ave. Consider rehab for <u>any</u> HD patient >60 years old if they have had a prolonged hospital stay, are not managing at home, or need to learn energy conserving techniques. Applications for rehab or CCC are through the social worker. Physician completes the medical treatment/order portion of the application form for TR.

There is also a Day Hospital program which patients can attend 2 days per week for those needing some rehab, but not requiring in-hospital rehab. <u>Contact information:</u>

- **Inpatient Unit**, **TR rehab** – (416) 597-3422 ext 3018
- **Inpatient Unit**, **TR Bickle Centre** – (416) 597-3422 **ext 2235**
- **Dr. Vanita Jassal**, TR hemodialysis nephrologist – **ext 14-3196**,

- **Angie Chai**, RN(EC)-NP – **ext 14-3992**; **pager (416) 790-6316**
- **Natalie Stanton**, RN, HD charge nurse, **(416) 597-3422 ext. 3801, fax (416) 977-8719**

Physician Coverage for Hemodialysis Units

MWF	**Hemo West**	**Hemo East**
1	**Scholey**	**Barua**
2	**Pei**	**Reich**
3	**Richardson**	**Chan**
TTS		
1	**Richardson**	**Lok**
2	**Lok**	**McQuillan**
3	**Cherney**	**Merchant**

Nocturnal Dialysis (In-centre)	
MWF	**Richardson /Chan**
TTSun	**Richardson /Chan**

DSU and Home Dialysis (Home Hemo and HPDU)
Monday to Friday – day shift: Home Dialysis Fellow **After-hours, weekends and stat holidays: consult team on-call**

Peritoneal Dialysis Unit

Home Peritoneal Dialysis Unit (HPDU): 12ES, ext 14-5672, fax 4169

Jacqui Cooper, clinic manager **ext 14-2399**, **c: (416)339-8445**

Zita Abreu, RN, PD access coordinator, **ext 14-2358**

- Peritoneal dialysis (PD) is an excellent choice for chronic dialysis, and all patients should be assessed for ability to carry out PD, even if they require acute dialysis. PD can be started very soon after the PD catheter is inserted, thus **can be used acutely**.
- PD is available at TWH, carried out by staff nurses on 8 Fell (see PD section in this Guidebook).
- All patients on PD need dialysis orders. Patients' usual orders may be faxed from the HPDU (or in PM in HPDU chart via Security), but all acute patients need assessment.
- ALL patients starting **PD MUST** have **hemoglobin**, **creatinine**, **urea**, **serum bicarbonate**, **calcium**, **phosphate**, **albumin**, **PTH** bloodwork done PRIOR to first dialysis session (Ontario Renal Reporting System guideline).

Sheppard Centre & Sussex Centre Assisted Self Care Dialysis Units

Susanne Henseleit, RN, manager, cell (647) 641 - 5314

• **Sheppard Centre** (Sheppard and Yonge) – **(416) 223-2013**, **fax (416) 223-3321**

• **Sussex Centre** (Burnhamthorpe Rd, Mississauga) – **(905) 272-8334**, **fax (905) 272-4534**

- Administered from UHN, the Sheppard and Sussex Centre Assisted Self Care dialysis units offer self-care HD 3x/week or short daily dialysis in a relaxed, quiet, and home-like environment.
- Patients come to TGH for clinic follow-up, diagnostic tests, medical referrals, and for other urgent medical care.

Renal Dietitians (RD)

- Inpatient, **pager (416) 719-3114**
- MCKC & Home HD, **ext 14-4625**, **(416) 719-3600**
- **Linda Cerullo,** RD (HD West & Kidney Transplant), **ext 14-4103**, **pager (416)719-3249**
- **Antonia Zettas**, RD, CDE (PD, HD , In-Centre Nocturnal, DSU), ext 14-6530, pager (416) 790-4519
- **Christine Nash**, RD, CDE (PD, Hemo East, CaRE Clinic, DSU), **ext 14-6272**, **pager (416)790-4536**

The nephrology dietitians are available during daytime hours Monday – Friday.

When ordering diets: ***Do not order** "Renal Diet" or "Diabetic Renal Diet". There are 4 standard renal diets at UHN to choose from.

Order one of the following standard diets:

Name of Diet	**Protein**	**Phosphorus**	**Potassium**	**Salt**	**Fluid**
ERI (Early Renal Insufficiency)	60g	<40 mmol	Must be added if required	<217mmol	Must be added if required
ESRD Diet *(no dialysis)*	60g	<40 mmol	<60 mmol	<217mmol	Must be added if required
Hemodialysis Diet / IPD Diet	80g	<40 mmol	<60 mmol	<217mmol	700 mL
Peritoneal Dialysis Diet	80g	<40 mmol	Must be added if required	<217mmol	Must be added if required

If a patient requires a **diabetic** diet, order a **No Added Sugar Diet** and write appropriate renal restrictions as listed above.

For example: A patient with diabetes on hemodialysis would require the following diet order: no added sugar, 80 grams protein, < 40 mmol phosphorus, < 60 mmol potassium, < 217 mmol sodium, < 700 mL fluid.

Additional restrictions (e.g., fluid and potassium) should be added as required to the standard renal diets. If unsure of what diet to order, please page the **inpatient nephrology RD** at **416-719-3114** or leave a message at **ext 14-4625**.

Inpatient Nephrology RD

The inpatient nephrology RD will see all patients admitted to TGH who are followed by a UHN nephrologist. All nephrology program inpatients are screened and prioritized for care. Please consult the inpatient RD for all new patients to the UHN Nephrology Program or for any pertinent nutrition issues, such as dysphagia, prolonged nausea/vomiting, severe weight loss or gain, wounds, enteral feeding, TPN/IDPN, multiple food allergies, or any special nutritional needs for inpatient care.

Inpatient Nephrology Transplant RD

The inpatient kidney transplant RD will see all patients admitted to TGH who are in the kidney transplant program. All kidney transplant inpatients located on the transplant floors are screened and prioritized for care. Please consult the inpatient kidney transplant RD for any pertinent nutritional issues.

Ambulatory Hemodialysis and Peritoneal Dialysis RD (Includes Nocturnal HD and DSU)

The dietitians assess and educate all new HD and PD patients and provide ongoing nutrition intervention/education for abnormal diet-related biochemistry, malnutrition, significant weight loss/gain, high interdialytic weight gain/fluid overload, blood pressure irregularities, GI disturbances, and enteral feeding/IDPN. Please notify the appropriate RD as listed above with any nutrition concerns.

Pre-dialysis (Non-MCKC) RD

Nutrition counseling appointments are available on Tuesday afternoons by referral only for any patient followed by a nephrologist at UHN or Mt. Sinai. Fax referrals to (416) 340-4291.

Pre-dialysis (Non-MCKC) RD

Nutrition counseling appointments are available by referral only for any patient followed by a nephrologist at UHN or Mt. Sinai. Fax referrals to (416) 340-4291.

Multi-Care Kidney Clinic (MCKC) RD

All patients are assessed and followed by a nephrology dietitian as part of the multi-disciplinary team upon referral to the MCKC.

Cardiac and Renal Endocrine Clinic (C.a.R.E. Clinic) RD

All patients are assessed and followed by a nephrology dietitian as part of the multi-disciplinary team upon referral to the C.a.R.E Clinic

Renal Social Worker

- Provide pre-dialysis patient and family education, counseling regarding adjustment to illness, treatment decision-making, family concerns, locating and arranging the resources necessary for an appropriate and timely discharge.
- Each Renal SW has a variety of areas of responsibility, please contact appropriate person:

Social Worker	Area(s) of Responsibility	Contact Information
Zoe Levitt, MSW	Multi-Care Kidney Clinic, Inpatient Nephrology bed spaced patients	Ext 14-3618, pager (416) 719-2876
Melissa Rubin, MSW	Hemo East 1st and 2nd shifts (all days), Nephrology inpatients	Ext 14-6047, pager (416) 719-3731
Michela Verdirame, MSW	PD and Home HD, Dialysis Start Unit, Hemo East 3rd shift (all days), East Nocturnal, Satellite Units.	Ext 14-3983, pager (416) 719-2812
Sunny Diamond, MSW	Hemo West (all days, all shifts), West Nocturnal	Ext 14-4768, pager (416) 719-2668

Alerts Dashboard

All patients admitted to the nephrology service (MCKC → Home Dialysis → In-centre Hemo) should have an Alerts Dashboard “Kardex” completed to indicate allergies, falls risk, IPAC concerns, advanced directives, or behavourial issues. This kardex is used in all areas where communication across the disciplines is necessary and ensures best quality care. The design of this form matches a parallel Alerts Dashboard on the patient’s electronic EPR chart, but ensures timely transfer of information for the outpatient units that operate using a paper chart the majority of the time.

Each area of the nephrology program has clerical support for the completion of this form to ensure timely addition to each patient’s chart.

Illustrated: Sample of alerts form and reference information on the back

NEPHROLOGY
Patient Care **KARDEX**
ALERTS DASHBOARD

Location: ☐ RMC ☐ Home HD ☐ Home PD ☐ DSU ☐ In-Center

(ensure all entries or changes match Patient EPR Chart) Use Reference List on the Back to add patient specific entries below.

MANDATORY A ALLERGIES	ALLERGIES ☐ No Known Allergies ☐ Identified SEE BELOW O _____ O _____ O _____	Entry Date: _____ Date Reviewed: _____ And EPR entered ☐
MANDATORY F FALLS RISK ASSESSMENT	FALLS ASSESSMENT ☐ No Identified Risks ☐ Risks identified below (add Care Plan) O _____ O _____ O _____ O _____	Entry Date: _____ Date Reviewed: _____ And EPR entered ☐
IPAC Isolation Precautions	√ **Hand Hygiene as per UHN's 4 Moments Protocol FOR ALL – Plus:** ☐ **Contact:** • Gown, • Gloves (use Droplet for "Contact + Droplet") → Indication: _____ i.e. MRSA Carrier ☐ **Droplet:** • 2 metres perimeter, • Gown, • Gloves, • Surgical mask • Eye Protection → Indication: _____ ☐ **Airborne:** • N95 Mask, • Negative Pressure Room, Keep Door Closed → Indication: _____ i.e. TB Carrier	Entry Date: _____ Date Reviewed: _____ And EPR entered ☐
	O _____ O _____ O _____	Entry Date: _____ Date Reviewed: _____ And EPR entered ☐
	O _____ O _____ O _____	Entry Date: _____ Date Reviewed: _____ And EPR entered ☐
Advanced Care Planning	O _____ O _____ O _____	Entry Date: _____ And EPR entered ☐
	O _____ O _____ O _____	Entry Date: Review Date:

UHN Toronto General Toronto Western Princess Margaret Toronto Rehab

ALERTS DASHBOARD REFERENCE SHEET (USE THE FOLLOWING GUIDELINES TO MATCH EPR CATEGORIES)

	ALLERGIES **1. No Known Allergies** **OR** **2. Identified Allergies**	1.  2.  • Medication: List Medications and typical reaction **MANDATORY** • Food: List food allergies and typical reaction • Environmental: List allergens and reactions (ie perfume / plastic tape,..)
	F **MANDATORY** FALLS Risk Assessment	• **History of falls** – list date if known of last fall(s) **MANDATORY** • **Secondary Diagnosis**: (contributing influence) ie hypotension post dialysis / mental status • **Ambulatory Aid:** cane / crutch / walker / wheelchair / glasses • **Gait / Transfer needs:** ie requires mechanical lift / 1-2 person assist • **Other: Add as per individual circumstances to support individualized care**
	 **IPAC**	√ **Hand Hygiene as per UHN's 4 Moments Protocol FOR ALL** **Contact:** • Gown, • Gloves (use Droplet for "Contact + Droplet") ➔ Indication: provide reason for isolation precautions i.e. MRSA Carrier **Droplet:** • 2 metres perimeter, • Gown, • Gloves, • Surgical mask • Eye Protection ➔ Indication: provide reason for isolation precautions **Airborne:** • N95 Mask, • Negative Pressure Room, Keep Door Closed ➔ Indication: provide reason for isolation precautions i.e. TB Carrier
	CODE Status 	• **No CPR** (Blue form on chart – behind this Alerts page)
	BEHAVIOURAL SAFETY ALERT **B**	• **Who exhibited behavior** (patient, family, accompanying visitior) • **Behaviour**: verbal / physical / attempted to use physical / viewed as a threat to use physical force • **Contributing factors:** reported history / pre-existing condition / reaction to prescribed medication / situational stress / drugs or alcohol • **Management Strategies:** as agreed by Healthcare Team
	Advanced Directives	• **Living Will** – copy on chart • **Power of Attorney for Personal Care** – form on chart at the front of the Clinical Notes section, list name and contact information • **Substitute Decision Maker** (SDM): list name and contact information
	Other	• Add Patient Centered Details as required for Transfer of Information o EXAMPLE: TRANSLATION REQUIRED (Languages Spoken, Written, Methods of Communication , Contact for translation

Peritoneal Dialysis Off-Unit Nurses

- Off Unit PD TGH/PMH/MSH – **6ES Nephrology/GIM ext 14-4487**, **pager (416) 715-9232**. **Fax** orders to **(416) 340-4168**.
- Off Unit TWH – **8B GIM**, **13-5167**. **Fax** orders to **(416) 603-5408**.

For UHN patients who require peritoneal dialysis (PD), (when receiving assessment and care in the Emergency Department or upon admission to the most appropriate unit for their care needs), there are nurses trained to provide PD using an off-unit / on-call system, unless admitted to the home units of the PD-trained nurses. To ensure timely service, the following strategies are available:

<u>For PD Patients at Toronto General Hospital (TGH), Princess Margaret (PMH), Toronto Rehab (TR), Mount Sinai Hospital (MSH)</u>

- All nurses are trained to manage PD for patients admitted to one of the 9 nephrology beds on 6ES Nephrology/GIM.

- For patients admitted to any unit at TGH, PMH, MSH (renal consults), or undergoing assessment in the Emergency Department (ED), there is at least one nurse assigned from 6ES available every shift (24/7) to travel to provide PD (cycler and manual exchanges**). NOTE:** There is only a limited use of cycler machine in ED due to lack of plumbing drainage options.

- Patients admitted to TR will need to be switched to hemodialysis temporarily during the admission; the hemodialysis nursing staff will provide maintenance flushing of the PD catheter and PD exit site care.

<u>For PD Patients at Toronto Western Hospital</u>

- A core group of nurses are trained to manage PD for patients admitted to 8B General Medicine.

- For patients admitted to TWH general units, or undergoing assessment in the ED, there is at least one nurse assigned from 8B available every shift (24/7) to travel to provide PD (cycler and manual exchanges**). NOTE:** There is only limited use of cycler machines in ED due to lack of plumbing drainage options and there are only 2 machines in total on site.

- For patients admitted to the ICU setting at TWH, there is a core group of nurses able to provide management of manual PD. For cycler management, 8B staff will need to be paged.

Inpatients

Inpatients Nephrology Beds on Nephrology/Multi-Organ Transplant Unit
6ES – ext. 14-4487, fax (416) 340-4168

- 9 nephrology beds - No inpatient nephrology bed at TWH, so nephrology fellow at TWH follows patients on a consult service basis

Medical Coverage

Red and Blue Teams ("Acute Care Teams"):

- Acute Care Teams: AKI, undiagnosed renal failure, or ESRD patients undergoing various other procedures, e.g. biopsy, angioplasty
- **Team consists of:**
    - Attending house staff is responsible for the team, patients and *ITER forms*.
    - Renal fellow acts as team leader, co-ordinates the work of the team, assists in teaching, and is aware of all patients on team.
    - Anna Gozdzik (nurse navigator – ext 14-5129, fax (416) 340-4291) to consult on all new dialysis patients and assist with dialysis options, focusing on home dialysis, outpatient HD spots, palliative management, or for education. To procure dialysis spots, contact the HD managers or patient care coordinators
    - On-call does consults at TGH, MSH, PMH and Women's College Hospital. Covers ward issues in evenings & weekends.
- Kidney transplant patients are followed by the kidney transplant service; other organ transplants with renal issues are seen by nephrology. Patients with kidney-pancreas (K-P) transplants are seen by K-P service; renal transplant to see if dialysis is needed.
- Women's College Hospital has no in-patient medicine beds, thus if necessary, admit to TGH under Yellow Team and follow as a consult for nephrology issues.

Yellow Team ("Inpatient/Ward Team") and TWH Nephrology:

Team consists of:

- Attending house staff, nurse practitioner (NP), and 2 renal fellows
- **Attending house staff** is most responsible for patients under yellow team and TWH nephrology consults
- **Paulina Bleah**, NP ext. 14- 8501, pager (416) 790-7758, cell (647)532-2094 is responsible for dialysis patients admitted to TGH nephrology in-patient ward with uncomplicated illness, awaiting placement or rehab, issues related to dialysis and vascular access/PD catheter, and palliative care management
- **Fellows** are responsible for patients with acute/complex medical issues, and is a medical resource to NP

- Individuals with AKI do NOT go to Yellow Team, but are admitted under General Medicine with nephrology acute care team consult following.
- May admit from ER between 08:00 to 16:00 for non-life threatening admissions after being triaged by the on-call MD.
- Transfers from other services or teams must be staff to staff, and discussion with the NP.
- Staff and second renal fellow cover nephrology consults at TWH.
- 6ES off-unit PD staff will place a copy of off-unit shift report on PD shared drive for review by HPDU

Yellow Team: Team Culture and Purpose

Yellow Team Culture

Yellow Team Purpose

- Ensure comprehensive patient care that addresses all health care needs of the patient including physical, mental, spiritual and emotional wellbeing
- Ensure comprehensive and individualized discharge planning focused on ensuring safety and quality of life for our patients

Yellow Team Guiding Principles

These are behaviors that are important to demonstrate in order to ensure the team's culture and purpose:

- Inclusive – recognition and value of complementary skills
- Active Listening – receptive and engaged
- Accountable – prepared, provide timely responses, contribute to team work
- Clear & Thoughtful Communication – concise messages and manage tone and delivery
- Supportive – Offer help, share the workload, share positive feedback

Yellow Team Fellow (TG) Responsibilities

- Yellow Team NP is the team leader and works along with the renal fellow. The NP and fellow are responsible to know about day to day care of <u>all</u> Yellow Team patients
- Patients are divided between the fellow and NP according to medical acuity and division of labour. Assign yourself to your patients on the sign-out tool in EPR.
- Attend sign-in rounds each morning in TG 8NU-828 @ 0800. Be aware of when your patients need dialysis, ensure that they are scheduled, and that orders are written.
- Assess each assigned patient and determine needs (medical, psychosocial, physio, nutrition). For dialysis patients, target weight, dialysis treatment, lab results and meds should be reviewed.
- New admissions assigned to the fellow are to be seen and assessed; medications, bloodwork, etc. are to be ordered in EPR by the fellow.
- For a new admission, call the HD or PD unit for the dialysis orders and medication record, including immunization history if needed. Remember that patients may not have Aranesp, Eprex or IV iron written in their own list of medications.
- Advise the patient's usual nephrologist so that they are aware of patient's admission.

- A full clinical note should be written for each patient to include history, physical assessment, medication changes, dialysis, plan, consults required, and diagnostic tests planned. A short note with updates should be written daily and include assessment and plans.
- Discussions with patients and their families are very important, and if required, you can set up a family meeting for major issues such as code status, disposition etc. As appropriate, family meetings include the staff nephrologist, social worker, physiotherapist, dietitian and RN as needed.
- Generally, after sign-in rounds see all of your assigned patients, then meet with NP to review other patients, and assist with medical issues.
- Lead rounds with staff nephrologist to review issues and plans for each patient. Be prepared to have evidence-based rationale for treatment plans.
- Update sign-out sheet on EPR each day with plans and salient issues for patient. Be brief. Outline for any issues that need follow-up for the on-call resident or fellow. Sign-over to the on-call resident at TG 8NU-828 Mon – Thursdays @ 1700 and Fridays at 15:30.

Consults for other Services

When making an elective referral to a consult service (e.g. cardiology), call Locating 3155, to page service and document pertinent issues to be dealt with in the chart.

Discharging Patients

It is essential that discharges are well planned and comprehensive so that patients are able to manage and do not require early re-admission. Identify a discharge date well ahead of time, in consultation with the patient and family.

Assess patient for issues required for discharge, such as transportation, prescriptions, rehabilitation, dialysis requirements, and ambulation. Assess if the patient might need rehab or alternate level of care (nursing home or complex care placement).

When the patient is ready for discharge, ensure that the following are in place:

- Prescriptions
- Discharge Summary – It is helpful to start writing it in EPR on admission and update throughout patient's stay. Be sure to review all medications prior to discharge with the assistance of the pharmacist, and note any changes or new medications in the discharge summary. Include issues for the GP or specific MD to follow up on.
- Notify the HD and/or PD units and the patient's nephrologist (verbal or UHN email) of the patient's discharge and issues for follow-up. New patients should have initial dialysis orders forwarded to the dialysis unit.
- Follow-up appointments
- Referral letters written and faxed as required.

- Homecare (CCAC) referral if needed at least 24 hours before the planned discharge
- Wheeltrans/transportation to dialysis (if not in place, discuss with family and SW)

Home Care (CCAC)

If an individual needs assistance at home, complete CCAC referral on line at least 24 hours prior to discharge. Clearly state what assistance is needed, e.g., wound dressing changes, medication administration (e.g., insulin), physiotherapy, personal support worker (PSW), etc. Complete all sections of the form. If the patient requires Home Plus PD (i.e., assistance with PD at home), ensure at least 72-hour lead time and contact HPDU as well (i.e., booking clinic follow-up appointment or ensuring adequate PD supplies at home).

Rehab

If a patient is unable to ambulate or mobilize with an assistive device, consider rehabilitation at TR-rehab if they are >60, or alternate rehab facility if <60. To arrange rehab, contact the physiotherapist for an assessment and contact the social worker to initiate rehab papers. If the patient is on HD, you must fill out the TR Dialysis Service Application paper form, and give to the SW.

ALC Status

If a patient is declared ALC (alternate level of care), i.e. appropriate to transfer to another facility, but awaiting a bed, the MD will have to enter an 'ALC' order in EPR. If an ALC patient becomes acute and cannot be transferred due to medical reasons, put an 'ALC removal order' in EPR. Contact the appropriate nursing staff member regarding the changes (e.g. nurse manager, patient care coordinator, or designate).

Code Status

It is very important to establish code (CPR, no-CPR) status of our patients. This conversation should be handled with great empathy but present a realistic view and likelihood of survival. Document code status on the Doctors Orders and sign-out sheets, and document discussion in the clinical notes.

CCOT (Critical Care Outreach Team)

The team is available to review patients who are taking a turn for the worse, e.g. with refractory decreased BP or O_2 saturation, and decreased LOC. They will provide assessment and advice, and will recommend transfer to ICU as appropriate and assist with this process. Call through Locating 14-3155.

Weekly Yellow Team Patient Care Rounds

- Team rounds every Monday, Wednesday, and Friday: 10:30-11:00 on 6ES-316.
    - Be prepared to give a short presentation of each patient and current plans. Discuss plans with team members (PT/OT, Pharm, SW, RD, RN).

- Focus on what patient needs to have in place for treatment and discharge.

Consult (TW) Fellow Responsibilities

- Present consults at sign-in at TG 8NU-828 @ 0800. If unable to attend, advise inpatient fellow of consults for previous day.
- Review all patients on sign-out sheet and update as necessary. Meet with staff nephrologist to review patients' issues and plans.
- Remember to review meds and bloodwork for each patient and ensure that they are appropriate for renal patients (i.e., avoid frequent bloodwork and ensure medications are renally-dosed and appropriate.
- If already a dialysis patient, call their dialysis unit (HD or PD) for the most recent dialysis orders, medications, and history. Remember that patients may not have Aranesp, Eprex or IV iron written in their own list of medications.
- Document renal issues, progress, and plans in the clinical notes in the patients' chart; write nephrology suggestions on the Doctors Order sheets in the chart.
- Upon discharge, fill out the nephrology discharge summary and new HD orders and fax to the dialysis unit or bring to sign-in the following morning and give to appropriate nurse manager
- Communicate with patient's nephrologist to update about the patient's hospital stay and discharge plans.
- Coverage for TGH Dialysis Start Unit (DSU) on 12 ES in PD unit on **stat holidays** (Monday, Wednesday, and Friday only); contact Dr. Lok, ext 14-4140 for any inquiries.
- Coverage for the PD unit on **stat holidays**.

Discharges

- It is <u>imperative</u> that discharges are well planned due to the demand for beds.
- Ensure patients are ready for discharge and that the following have been arranged: Homecare (CCAC) services, particularly if the patient requires Home Plus PD (assisted PD), transportation for dialysis, discharge orders, and prescriptions. Ensure that CCAC referral is done at least 24 hours prior to discharge. New HD patients must have their first HD orders written.
- Patients **must be discharged by 11:00 AM**
- <u>Complete online **discharge summaries** for all Yellow Team patients</u>.
- Consult teams prepare paper discharge summaries and fax to the dialysis unit – or bring to morning report, and written HD orders for new patients.
- Discharge summary **MUST** include date of initial dialysis treatment, cause of renal failure, whether or not biopsy-proven (where applicable), specify type of diabetes and weight within the 1st month of treatment, and also <u>specify any condition that would shorten life expectancy to less than 5 years.</u>

- Communicate with the patient's primary nephrologist/nurse to update about the patient's hospital stay, changes in meds, and discharge plans.

Microscope Rooms

- Located in 12 NU clinics. Microscope, centrifuge, slides, sulphosalycilic acid, etc. are available for viewing urine. Please DISPOSE of urine, slides, and pipettes, etc., when finished, and keep this room clean for the next person.

- Contact Security for access after-hours.

Bloodwork

- Because nephrology patients are anemic, order only necessary bloodwork, and remember to cancel orders for repeated BW
- All pts, before starting dialysis or SLED/CRRT, must have Hgb, Cr, Urea, CBC, PTH, Ca, PO_4, Bicarb, Alb [Ontario Renal Reporting System Guideline (ORRS)]
- Check amount of BW ordered on consult pts and suggest less frequent BW unless clinical decisions rely on it, e.g. INR's
- Remember, BW such as daily Cr on someone on chronic dialysis is not helpful
- HD pts can have bloodwork drawn in HD unit unless otherwise indicated. This should be specified on the HD Orders. If pt is at Mt Sinai and comes to TGH for dialysis, please order baseline and ongoing BW to be done on EPR in HD.

Allergies

- Please remember to document allergies on Doctors Orders forms, and check Allergies when ordering medications.

Admissions

Admissions Policy for Yellow Team

- These guidelines refer to patients with ESRD who are on some form of chronic renal replacement therapy, or are pre-dialysis, and require in-patient care. ***This does not refer to patients seen on the consult service or those with renal transplantation.***
- The following tables indicate what clinical problems (in the ESRD patient) would be directed toward General Internal Medicine, General Surgery, and Nephrology respectively

- **N.B. If there is a concern as to which service the patient should be admitted, residents are instructed to contact the STAFF physicians immediately and allow them to make the decision.**

General Internal Medicine	General Surgery (or appropriate sub-specialty)
• Acute Kidney Injury	• Abdominal Pain – Surgical Abdomen, peritonitis in non-PD pts
• Pneumonia, GI bleed	• Cholecystitis
• Pulmonary Embolus	• Gallstone pancreatitis
• DVT	• Bowel Obstruction
• Unstable Angina	• Unstable GI bleed
• Non-Q MI	• Post-operative complications
• Cardiac Dysrhythmias (non CCU)	• Arterial thrombosis (vascular service)
• PVD & complications, Cellulitis	• Gangrene requiring amputation (vascular service)
• TIA/CVA, Seizures	• Fractures (orthopedic service)
Nephrology	
Dialysis Access Issues: • Creation of access (PD or HD) • Infection • Thrombosis • Radiologic/Surgical Revision • Sepsis related to Access	
• Peritonitis (in PD patients)	
• Inadequacy of Dialysis (PD/HD)	
Urgent Dialysis in a Dialysis or pre-dialysis Patient • Volume Overload • Electrolyte Emergencies i.e. ↑ Potassium	

Transfers from Consult Teams to Yellow Team

Criteria: Dialysis patients awaiting out-patient spots, dialysis patients admitted to other services who are palliative, rehabilitating or awaiting placement to long-term care facility. The process for transfer to yellow team is as follows:

1. The primary care team (e.g. Medicine or Surgery) request a transfer to yellow team

2. The consult team (Blue or Red), NOT the primary care team, contacts yellow team for the transfer. Please keep in mind that for transfers to yellow team, patients other acute medical and surgical issues need to be resolved or there is a plan for resolution. Also, if they are Chronic IHD patients or ALC and waiting for placement, application for rehab/CCC or LTC needs to be submitted and discharge summaries up to date before transfer (this helps with transition of care).

3. If yellow team accepts the patient, the consult team signs off by writing an order to "transfer to yellow team under the designated attending staff physician on yellow team."

4. At that point, yellow team takes over the patient care and becomes primary care team. The consult team no longer follows the patient.

Direct Admissions to Yellow Team

For bed flow and advice on admitting directly to the floor, speak with Paulina Bleah (NP), April Guthrie (nurse Manager), Marcia Cameron (PCC) and/or charge nurse for the day, who will get approval from the appropriate administrative personnel. Please check on the isolation status of the patient before asking for bed in case isolation is required. If a bed is available, you will also have to call Admitting TGH (14-3921) with patient's name, MRN, diagnosis, admitting doctor, and bed allocation; otherwise direct referring team to send patient to ER.

For transfers from other hospitals, centers without dialysis take immediate priority. UHN patients at a hospital with dialysis services will be transferred based on bed availability. A UHN patient admitted at another hospital with dialysis service may be repatriated to UHN once a bed becomes available for transfer. Ensure patient is medically stable for transfer directly to a ward bed.

For patients who require admission for **high risk renal biopsy**, speak with Paulina Bleah (NP), April Guthrie (nurse Manager), Marcia Cameron (PCC) and/or charge nurse

for the day to coordinate the admission. The patient flow team has requested for biopsies to be booked from Tuesday to Friday, as there may be challenges in making arrangements for admissions on a Monday.

In cases of **urgent** admission to Yellow Team, you may contact Paulina Bleah (NP) (647-532-2094) or the patient flow coordinators (ext. 14-5500) between 08:00 to 16:00 to get an update on the bed situation on Yellow Team prior to sending the patient to the ER.

DIRECT ADMISSION REQUEST FORM

Name	
MRN	
Admitting MD Name	
Referring hospital/unit	
Reason for admission	
Estimated date of admission	
Approximate time of admission	
Expected LOS	
Isolation	
Additional patient information	
Contact information	

Complete information as outlined on the form and email to paulina.bleah@uhn.ca, april.guthrie@uhn.ca Marcia.cameron@uhn.ca, Preeti.saran@uhn.ca & yasmin.daniel@uhn.ca, include yellow team fellow (s), and house staff, in order for request to be processed.

Management of HD Patients Referred to Emergency Department (ED) with Dialysis related Issues

This protocol was arrived at between the department of nephrology and emergency medicine to expedite the care of patients who suffer complications while undergoing hemodialysis (HD) and are deemed to be in need of assessment. If such a patient is identified in a hemodialysis unit the following should occur:

If the patient's condition warrants admission (e.g.: line sepsis, deterioration in cardiovascular status, decreased LOC, etc.), then the Staff Nephrologist or Nephrology Fellow will contact the resident on-call for the appropriate service, depending on the patient's presenting problem (refer to the attached protocol), who will then arrange direct admission to hospital. This may be a Nephrology bed, in the case of dialysis-related issues, or a GIM or surgical bed, in the case of non-renal issues. In the absence of beds in the appropriate service the patient will then be transported to the ED to be admitted to the appropriate service and consulted on by the Renal Team as needed.

If the patient's condition or deterioration in the hemodialysis unit does not immediately demonstrate the need for admission, then it will be the expectation that the Staff or the Fellow will verbally directly communicate with the physician in the ED on-call for that time period, and that individual will communicate the reason for referral to the ED, any pertinent past medical history, as well as the goal of the referral. The name and MRN of the patient will be communicated to the ED physician or the nurse in charge in verbal or written form.

Patients referred from the HD Unit are quite complex with respect to their pathology. When they are referred to the ED they often present complex and time consuming diagnostic and therapeutic dilemmas. It will be the expectation that the physicians in the ED can call the resident on-call for the Renal Service and use the Resident's advice in the management of this patient.

If a patient is accepted by the nephrology service from another institution then the resident who has accepted the case will communicate this and any other pertinent information to the charge nurse verbally. If the department is in a bed crisis, attempts will be made to admit the patient straight to the floor.

Admissions from Toronto Western

There are no in-patient nephrology beds at TW, thus patients coming to TW emergency must be assessed, and a note written by the nephrology resident on call at TW. If the pt requires a nephrology admission, the TG staff/fellow is to be notified and accept the patient in transfer. If the patient has medical issues, as outlined in the previous table, they would be admitted to the appropriate service at TW and followed in consult by the TW Nephrology resident. HD and CAPD/CCPD (cycler dialysis) are available at TW.

New Nephrology Patients

Any patient "new" to Nephrology coming through emergency should be stabilized and upon discharge, referred to a Nephrologist in their area.

ALL patients starting dialysis (HD or PD) **MUST** have Hgb, Creatinine, Urea, bicarbonate, Ca^{++}, phosphate, albumin, PTH bloodwork done PRIOR to first dialysis. (Ontario Renal Reporting System guideline). Specify and document any condition that would shorten life expectancy to less than 5 years.

Notify Anna Gozdzik (ext 14-5129) of patients new to dialysis, likely needing long term dialysis, who require education, dialysis modality options, or an out-pt HD spot.

Rounds

Refer to Calendar of Weekly Rounds at end of Guidebook

Sign-In Rounds

- Mon - Fri 08:00 **sharp** 8N-828. To co-ordinate patient care for each day
- Review previous days admissions, consults, dialysis, elective admissions, vascular access issues, need for dialysis education
- Very short (1 or 2 sentence) summary of admissions, consults and ward problems - focus on major issues and dialysis needs
- Weekends and holidays, meet team in am to plan the day.
- Consult teams to notify Yellow Team of patients' potentially needing transfer to In-Patient Nephrology unit. Staff to consult Yellow Team Staff.

All teams to notify Anna Gozdzik of patients starting dialysis in order to facilitate education re dialysis modality. Contact Anna Gozdzik for patients requiring chronic outpatient spots, both at UHN and alternate external dialysis units

Sign-out/Handover

- For daily team sign-out during the week days, a representative from each team (Blue, Red, Yellow and TWH) and the resident on-call, fellow on-call and staff on-call must be present. Bring copies and updated sign-out lists to assist staff in knowing the status of the patients
- The **I-PASS** Sign-out tool is the structure that will be used to guide sign-out.

I	**Illness Severity**	• **Stable, "watcher," unstable**
P	**Patient Summary**	• **Summary statement** • **Events leading up to admission** • **Hospital course** • **Ongoing assessment** • **Plan**
A	**Action List**	• **To do list** • **Time line and ownership**
S	**Situation Awareness and Contingency Planning**	• **Know what's going on** • **Plan for what might happen**
S	**Synthesis by Receiver**	• **Receiver summarizes what was heard** • **Asks questions** • **Restates key action/to do items**

(Starmer et al., 2013)

- **Timing and Location:** at TG 8NU-828, Monday to Thursday @ 17;00 and Fridays @ 15:30.
- Sign-out during the weekend is organized as per resident/fellow and attending staff

- Hemo for the weekend and Monday morning should be arranged and Hemo and PD orders written for your own patients before you leave on Friday.

Sign-out Sheets

- Very important but succinct communication tool. Assign your name to your patients, document code status, and update sign-outs daily. Avoid using "today, tomorrow" etc. Very short history and update of issues in point form – not necessary to include ALL information and your thoughts, just important data. Document date of pts first HD, PD or SLED/CRRT. Identify issues for on-call to follow up on for that night or weekend, then erase once done.

Yellow Team Patient Care Rounds

Held for Yellow Team each Monday, Wednesday & Friday 10:30 in 6ES Conference Room. To discuss pts medical/social issues and discharge plan.

Teaching Rounds

Mornings:

Monday to Thursday 08:30-09:00, teaching rounds in the 8N-828 conference room following Sign-In. Nephrology Curriculum.

Friday 08:30-09:30, Division Rounds 12NU 1276. In summer, each team presents a topic on a rotating basis. During year, staff and fellows prepare renal rounds.

Afternoons:

Every other Monday – Interprofessional Hemodialysis Rounds 15:00 – 16:00 Ground floor, NU 108, York UHN Academy

Tuesday 12:30 Dialysis Journal Club, 8N-828. Critical review of dialysis journal article

Wednesday - Astellas Conf Rm 11C **15:00-16:00** Education Rounds.

16:00-17:00 City Wide Nephrology Rounds

Thursday 12:00-13:00 Home dialysis teaching 12N-1276

Renal Biopsy rounds 10 ES-316. Time to be decided. It is the responsibility of the team who admitted the patient for biopsy to present the cases and lead discussion. Dr Rohan John, the pathologist will notify Dr. Reich's (3439) office as to which patient to be presented and she will contact the team as early as possible.

eHOME Rounds

Wednesday at 12:45 in PD conference room 12ES 424

Multidisciplinary discussion of all new dialysis start patients, admitted CKD patients, access planning, and modality selection facilitated by Anna ext 14-5129.
Attended by Dr. Lok, inpatient nephrology NP, kidney transplant service, DSU staff, PD, HHD, PCC from dialysis, MCKC coordinators, Angie (Geri-Neph NP), vascular access coordinator, PD coordinator, and home dialysis fellows.

Ambulatory Care Clinics

- House staff may be scheduled to attend ambulatory care clinics in order to see what is the nephrology care required.
- Clinics are held on 12-NU

On Call

- On-call schedule is posted on the ward and in the resident's room.
- There is always house staff on first call, renal fellow on back-up, and staff nephrologist on call
- New consult pts remain with the team of junior house staff on call.
- Person on call is responsible for all in-patients and consults.
- Please date your consults, make your name legible and pager no.
- On-call room 12ES 402 – Don't leave valuables in the room
- On call to ensure that at least 1 HD pt has orders for following a.m. so HD nurse can start before sign-in.

Confidentiality

Please remember that <u>all patient information is confidential</u>. Shred old sign-out sheets & consult notes (shredder in On Call and Sign-in room). Do NOT discuss patients on elevators or public areas. Do NOT use email for ANY patient info unless on UHN system or ONE pages (with patient's consent). (NEVER utoronto, Hotmail, Yahoo, gmail etc) (UHN email Policy 1.40.014)

Primer on Renal Replacement Therapy

Renal replacement therapy (RRT) is artificial life support for the kidneys – it is a life-saving and life sustaining procedure. It is offered to a select patient population with acute or chronic kidney injury; not only should they have indications for requiring dialysis, but there should be some meaningful benefit to their quantity and quality of life.

On the nephrology service, residents are expected to manage dialysis patients including writing dialysis orders, managing complications and trouble-shooting dialysis related issues. This primer is designed to teach the basics of writing dialysis orders, and will complement RRT lectures residents will receive early in the rotation.

Indications for dialysis

Acutely, the indications for dialysis include: Volume overload refractory to diuretic therapy, hyperkalemia refractory to medical management, severe acid base abnormalities refractory to medical management, acute intoxications, and uremia (pericarditis, or encephalopathy)

Chronically, the symptoms are more subtle, and include symptoms such as low energy, poor appetite, meat aversion, pruritus, confusion, nausea, and vomiting, cramps, and paresthesia. It may also include general malaise, and increasing pill burden.

Modalities of Renal Replacement Therapies

The two extracorporeal modalities of RRT are 1. Hemodialysis, which includes a) Intermittent (Conventional) Hemodialysis (IHD), b) Slow Low Efficiency Daily Dialysis (SLEDD – offered in ICU settings), c) Continuous veno-venous hemodiafiltration (CVVHDF) – only in MSH ICU, d) nocturnal hemodialysis and e) home hemodialysis; and 2. Peritoneal Dialysis. Kidney Allograft Transplantation is the gold standard of RRT, but is a very limited resource. Nocturnal and home hemodialysis are options only for outpatients.

Hemodialysis

Hemodialysis is the predominant modality of renal replacement therapy in patients with acute kidney injuries at UHN. To perform hemodialysis (including IHD, SLEDD and CRRT), a patient must be prepared by obtaining access to their central venous circulation. In the acute setting, a large bore central venous catheter is inserted into

their internal jugular (IJ) vein or femoral vein. More chronic patients have an arteriovenous fistula (AVF) or graft (AVG) created, or less optimally, a tunneled central venous catheter inserted into their IJ or femoral vein. Blood is thus circulated via this access through a dialysis machine, where it interfaces with clean dialysate fluid across a dialyzer membrane. Toxic “uremic” solutes are cleared via the principles of diffusion and convection across the membrane. The process also allows for removal of excess salt and water accumulated in an isotonic fashion. This process is known as ultrafiltration (UF).

Hemodialysis Prescription

When prescribing conventional hemodialysis (IHD), or SLEDD, the following parameters need to be set:

1. **Date of dialysis**: Patients may receive dialysis either on the basis of daily assessment, or, more usually, a 3 times per week schedule. It is important to note their schedule in the dialysis order. This can be written as a specific date, or as a recurring schedule, e.g. Mondays-Wednesdays-Fridays (MWF), or Tuesdays-Thursdays-Saturdays (TTS). In such a case dialysis orders are rewritten only if there is a change in prescription. For a patient who is acutely sick with their medical condition in flux, it may be prudent to do daily assessments of dialysis orders until they are stable. Ideally, dialysis orders should be written one day prior. SLEDD is usually done 6 days/ week. Note that Sunday is an off day, and only emergent cases of dialysis are done.

2. **Duration of dialysis**: **4 hours** is the default duration of each dialysis session. However a patient may receive less depending on the situation. 12 hours/ week is the minimum for chronic patients unless there are extenuating circumstances. One notable exception is a patient who is newly starting dialysis and has a high urea; in such a case, the first session of dialysis is 2 hours, then 2.5 hours for the second, then 3 hours for the third, and then 4 hours for subsequent sessions. This avoids **dialysis disequilibrium syndrome** (to be discussed later). In the ICU, SLEDD is done 8hrs/ session, but may be increased up to 24 hours a day. Note that the same machine is used for IHD and SLEDD. CVVHDF at MSH ICU uses a different machine.

3. **Dialyzer membrane**: The default dialyzer is **FX120**. It is a high flow, high efficiency membrane. If a patient has an allergy to the membrane, then a "**phylter**" dialysis membrane may be used.

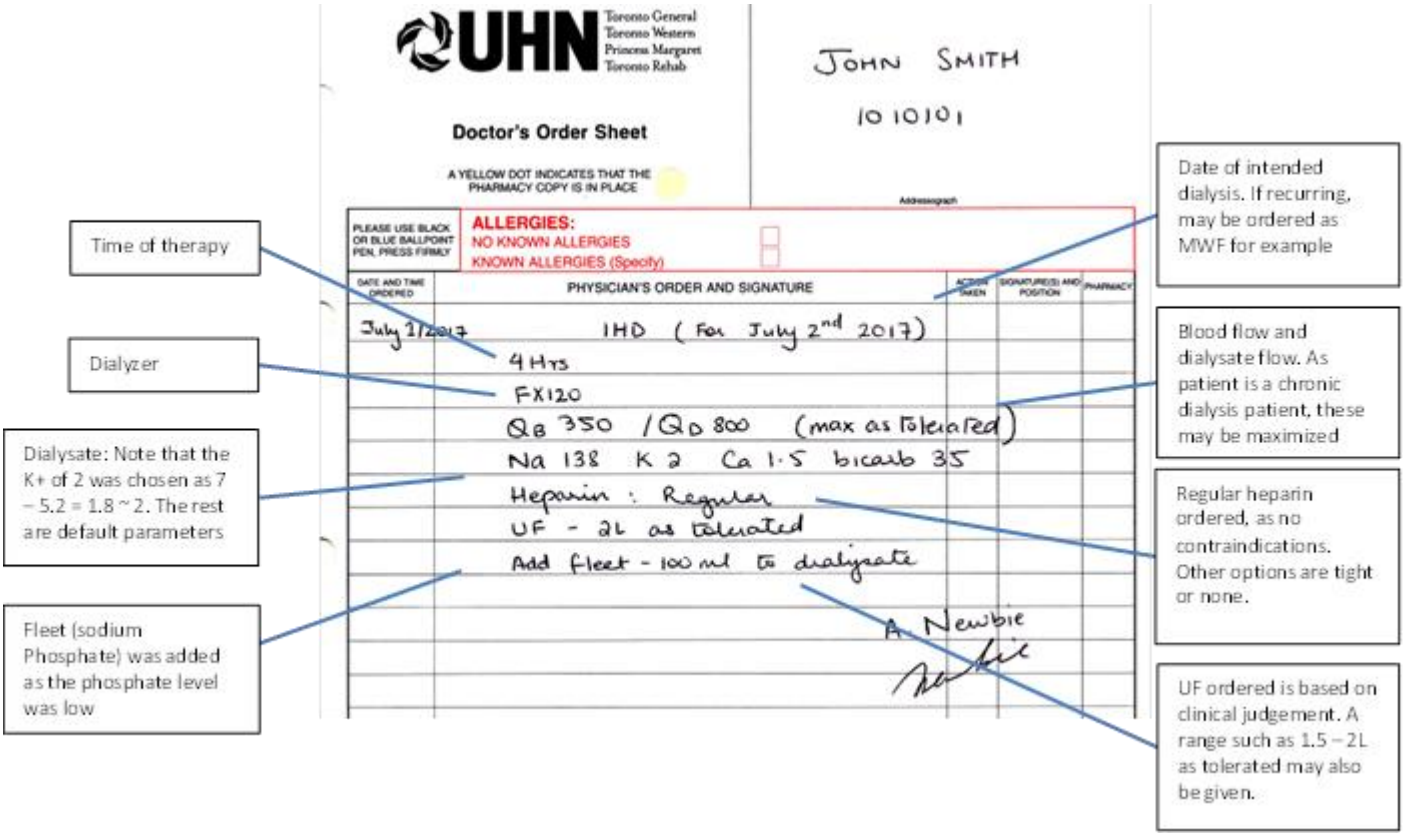
4. **Blood flow and dialysate flow**: These run countercurrent to each other in order to maximize the diffusion gradient between them. **The blood flow (Q_B)** is limited by the access. Highest flow is achieved by fistulas. We set the flow as **350ml/min** or maximum as tolerated. The **dialysate flow (Q_D)** is set as **1.5x** the blood flow, with a maximum of 800ml/min. During the first session of dialysis, the blood flow is limited to 200ml/hr, and then subsequently increased by 50 – 100 ml/ min till max blood flow is achieved (200 → 250 → 300 →400). This avoids dialysis disequilibrium syndrome during the first few sessions. SLEDD uses a max of Q_B 200ml/ min, and Q_D 300ml/ min.

5. **Dialysate:** The dialysate is composed primarily of sodium (Na), Potassium (K), bicarbonate (HCO3), and Calcium (Ca). The usual [Na^+] is **138 mmol/L**. However if the patient is hyponatremic, then a lower [Na^+] can be set (down to 131 mmol/L). It may be useful to match the dialysate sodium to the patient's sodium (unless hyponatremic). To determine the [K^+] in the dialysate bath, **subtract the last [K^+] of the patient from 7**. E.g. if the patients serum [K^+] is 5.1, then use a K bath of 2 mmol/L (7 – 5.1 = 1.9 ~ 2). You can use a [K^+] of 1, 2, 3 or 4mmol/L. Do not leave the patient on a standing 1 or 4 mmol/L K bath. Those should be reassessed each session. The default concentration **of ionized calcium [Ca^{++}_i]** in the bath is **1.5 mmol/L** (we set the [Ca^{++}_i], not total). This is approximately equivalent to a total calcium (corrected for albumin) of 3.0mmol/L. The other available options are 1.0 mmol/L (for hypercalcemic patients), 1.25 mmol/L, and 1.75 mmol/L (for severely hypocalcemic patients). The concentrations available for **bicarbonate** are 30, 35 or 40 mmol/L, with default being **35 mmol/L**. If the phosphate is low, then a bottle of sodium phosphate (fleet enema) can be added into the dialysate. This needs to be specified in the order. 75ml of fleet gives a concentration of approximately 1.0 mmol/L. Patients on SLEDD often require higher K and Phosphate levels in their bath.

6. **Anticoagulation**: **Heparin** is used to anticoagulated the circuit. This can be ordered as "**regular**", which is a 1000u bolus followed by 1000u/hr, or "**tight**", 500u bolus, followed by 500units/hr. If the patient is coagulopathic, has had recent bleed or surgery, or has low platelets, then no heparin/ anticoagulation should be used. A **HITT allergy** is also an absolute contraindication to heparin use. Warfarin use is not a contraindication.

7. **Ultrafiltration:** This is the amount of fluid to be removed per session. This will depend on the clinical examination of the patient, and may also be decided based on the net gain of fluid since their last dialysis session. Changes in weight, if reliable are another way to determine amount of fluid to be removed. When stable, patients often require 2 – 3L to be removed/ session.

Below is an example of a typical dialysis order for a patient who has end stage renal disease (ESRD), usually dialyzed on MWF via a left AV forearm fistula, being admitted for pneumonia. His K+ is 5.2. His PO4 is 0.6.



Complications of dialysis

Dialysis Disequilibrium Syndrome: This is caused by an acute drop in urea levels, which can cause a sudden shift of fluid from the blood intracellularly into the brain causing cerebral edema. This is manifested by symptoms such as confusion, stroke like symptoms, and seizures. To avoid this, chronic kidney disease patients are dialyzed with slow low flow dialysis for the first few sessions, as described above.

Intradialytic hypotension (IDH): This is defined as a drop of 20mmHg systolic or 10mmHg in the mean arterial pressure in combination with symptoms including cramps, presyncope/ syncope, abdominal pain, chest pain, nausea and vomiting. This is often caused by removal of high volumes of fluid at a rapid rate. Patients can usually tolerate up to 10ml/kg/hr of UF rate. A drop in blood pressure during dialysis may be a sign of infection or unstable cardiac disease, and these should be ruled out. Otherwise the following strategies can be used to prevent IDH (Will be discussed during the rotation in detail).

1. Prevent high interdialytic weight gain
    a. Decreased salt and water intake
    b. Frequent HD (more than 3 days a week)
    c. Furosemide +/- metolazone (if patient has residual urine output)
    d. Slow prolonged dialysis: Nocturnal +/- home HD
2. Hold antihypertensive medications prior to dialysis
3. Cold dialysate (cool the temperature of the dialysate 1 degree less than body temp)
4. Wrap compression bandages around legs
5. Sodium Ramping with UF ramping (to be discussed during rotation)
6. Midodrine (oral alpha agonist)
7. Isolated UF

Dialyzer reactions:
Type A: IgE mediated – occurs early with chest pain, dyspnea, hypotension, pruritus (common allergic symptoms). Stop dialysis, and treat as anaphylaxis/ allergic reaction. Need to change to a less allergenic dialyzer e.g. “Phylter” brand dialyzer.

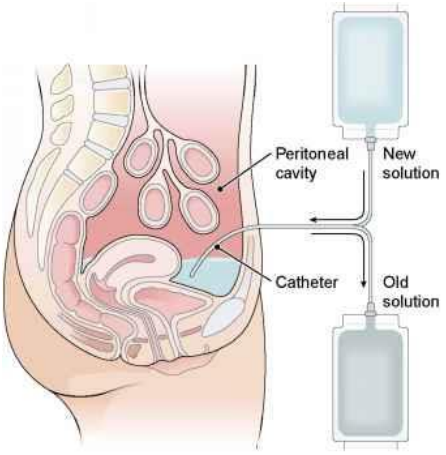
Type B: Complement mediated – occurs 15 min to 30min into dialysis – milder symptoms, back and chest pain, and nausea/ vomiting. May improve spontaneously, and dialysis may not need to be stopped.

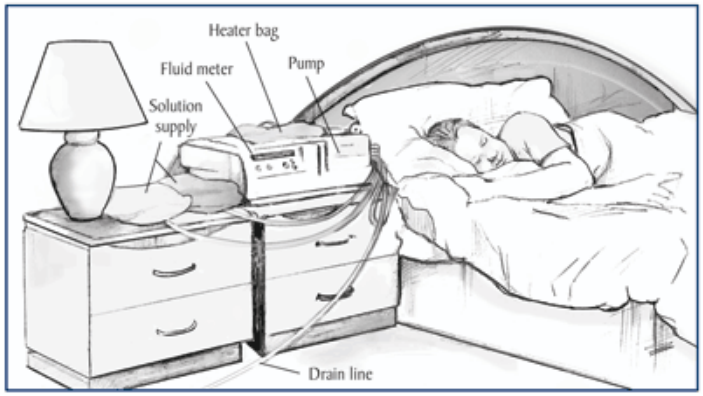
Catheter related bacterial infections

Central venous catheters are a potential source of serious bacteremias and metastatic infections such as endocarditis. Patients with dialysis lines, presenting with fever, rigor and signs of sepsis should be cultured ASAP, and there is a low threshold to cover with broad spectrum antibiotics.

Peritoneal Dialysis

Peritoneal dialysis (PD) is an **ambulatory** modality of dialysis that can be done independently by select patients. The extracorporeal dialysis membrane utilized in hemodialysis is replaced by the **peritoneal membrane** in the abdomen that houses the mesenteric vasculature. Dialysate fluid is infused into the peritoneum, and it interfaces with the blood across the peritoneal membrane according to the same physio-dynamic principles underpinning hemodialysis. The main mechanistic difference is that there is no constant dialysate flow, and the dialysate eventually becomes saturated with uremic toxins, necessitating its drainage. Therefore several cycles of dialysate infusion and drainage are needed for progressive removal of uremic toxins. An indwelling catheter is inserted into the peritoneum that allows access of dialysate into the peritoneal space. Approximately 2 L can be infused (depending on size of person) at a time. Fluid can be instilled and drained either **manually** via gravity using **twin bags** (new solution and old solution bags connected by Y tubing, as in the picture below), or automatically via a machine, called a **cycler**, that is small enough to fit on a bedside table.





Ideally it takes 15 min for the fluid to **fill** and **drain** in and out of the peritoneum. Depending on the type of fluid used, it may **dwell** in the peritoneum for 2 to 4 hours. One cycle or **exchange** of PD includes a fill of PD fluid, which then dwells for a certain amount of time, and then is drained out. Ultrafiltration (UF) is achieved by using dialysate that is hypertonic to the blood, thus causing a shift of salt and water into the

dialysate fluid. Hypertonicity is achieved by adding glucose (dextrose) to the dialysate. PD dialysate comes in strengths of **1.5%** dextrose, **2.5%** dextrose, and **4.25%** dextrose. All three of these are hypertonic, and achieve net UF. There is also a **0.5%** dextrose strength that is hypotonic to blood, and will provide volume to the patient. This may be used in an acutely hypovolemic patient. Unlike hemodialysis, UF cannot be predetermined in PD.

Several continuous cycles occurring over a portion of the day is known as **intermittent PD (IPD)**. If these are done at night using a cycler, then it is referred to as **nocturnal intermittent PD (NIPD)**. **Continuous Ambulatory PD (CAPD)** refers to continuous cycles occurring throughout the day. **Continuous cycler- assisted PD (CCPD)** is a form of 24 hr dialysis where a night time PD is performed with a cycler, and the patient has a long dwell of fluid during the day, which is then drained at the start of the next cycler session the following night. In CAPD and CCPD, the patient has fluid in their peritoneum 24 hours a day.

Peritoneal Dialysis Prescription

There is no standard way to write orders for peritoneal dialysis. They are written in a descriptive fashion that should allow nurses understand and execute the orders as intended. The main components of manual PD orders include: The number of exchanges, the time between exchanges, the strength (dextrose content) of the PD fluid used for any given exchange, and the volume of each fill.

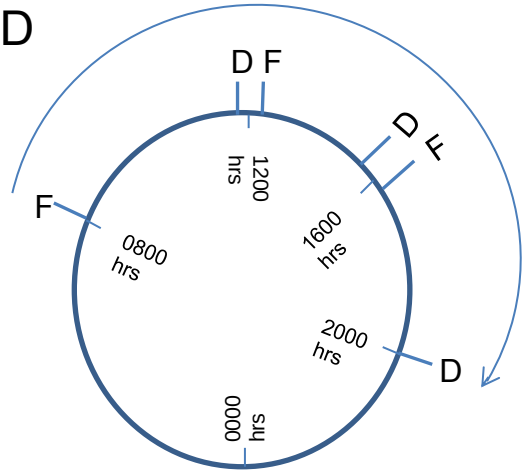
If a patient is receiving CAPD, then there is usually a long dwell at night (for practical purposes). This is known as the **last fill.** The PD fluid may dwell for 8 – 12 hours in the last fill. In that time, the usual PD solutions (1.5%, 2.5% etc.) lose their sugar content and become relatively hypotonic as the glucose diffuses into the blood stream, and there may be net fluid shift into the patient, leading to total body volume increase. To avoid this, a special solution known as **extraneal** is often used that contains icodextrin, a 20 molecule polysaccharide in a concentration of 7.5%. In fact, it has a similar osmolality to 1.5% dextrose solution but maintains its ultrafiltration potential for much longer periods.

Cycler orders are more uniform and are based on the parameters that need to be set on the machine: Total time of therapy, number of exchanges, strength of bags, and total volume of all exchanges summed together. If CCPD is being ordered, last fill volume and bag strength needs to be specified as well (its volume is also included in the total volume).

Following are examples of orders for the different types of PD regimens with depictions of fills and drains over a 24hr period. Exact times for exchanges do not need to be specified, and the nurses have discretion over when the exchange may be done, within reason.

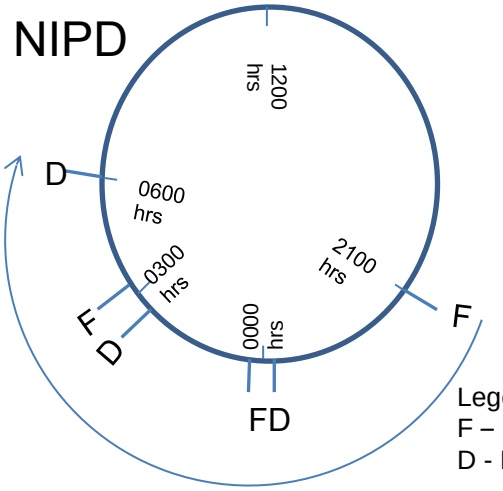
Example 1. IPD: 3 exchanges/ day, q 4hrs, 2L/ exchange x 1.5% for all exchanges

1. IPD



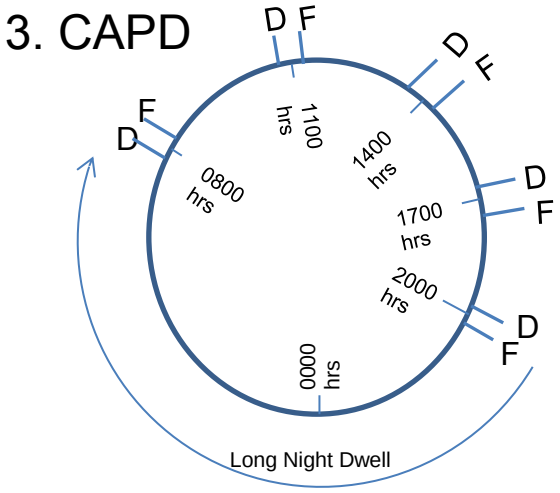
Example 2. NIPD with cycler: Total volume 6L over 9hrs; 3 exchanges.

2. NIPD



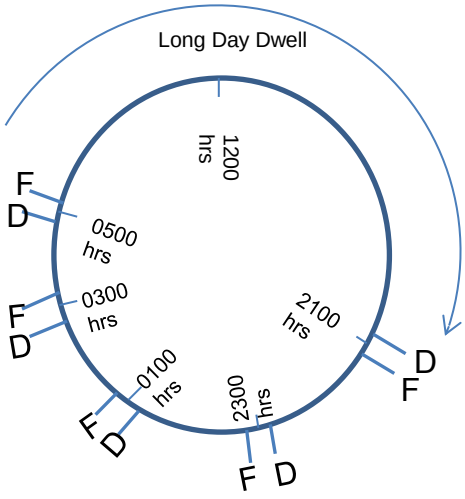
Example 3. CAPD: 4 exchanges of 2L each x 2.5% + last fill of 1.5L x

3. CAPD



Example 4. CCPD: Total volume 9.5L over 8hrs. 4 exchanges. 1.5%/ 2.5% (will receive a mix of the 2 strengths). Last fill 1.5L x 7.5%

4. CCPD



It should be noted that in the last example, the total volume set includes the 1.5L of the last fill. Each exchange with the cycler is therefore 2L volume. When writing orders for manual exchanges (example 1 and 3), bag strengths for each particular exchange may be specified, e.g. “use 1.5% for 2 exchanges, and 2.5% for 1 exchange”. In example 4, note that a mix of strengths is used (1.5%/ 2.5%). That can be conceptualized as the machine mixing the two to produce an intermediate strength, although there are nuances to the process that will be explained during the rotation. Note that in CCPD, the cycler starts by draining the fluid from the day dwell. This is known as the **initial drain.**

Drugs such as antibiotics, potassium chloride, lidocaine, bicarbonate, heparin and insulin can be added to the PD fluid. This will be further discussed on the rotation. One of the complications that patients have is pain during the draining of the fluid. This usually happens as the last bit of PD fluid is drained. This is avoided by leaving some of the fluid in the abdomen. This is known as setting a **tidal**. A tidal of 90% means only removing 90% of the fluid during the drain component.

Complications of PD will be discussed in detail during the rotation. Complications include peritonitis (requires instilling antibiotics or antifungals in the peritoneum), inability to drain the fluid, catheter malfunction, pleural effusion, pain during PD, hernia formation and encapsulating peritoneal sclerosis (EPS), which is an uncommon but serious complication requiring discontinuation of PD. UF failure, that is, inability to get adequate UF, is often another reason to switch to IHD. Strategies to optimize volume status on PD will be discussed during the rotation.

Hemodialysis

Hemodialysis Unit

Chronic Dialysis: Hemo West (HW) Hemo Unit: ext 14-4072. Fax 3084 and Hemo East (HE) Hemo Unit: ext 14-5707, Fax 14-4892

Hours 0730-2300 Mon-Sat, 3 “shifts” of pts each day.

Nocturnal hemodialysis is also done as a fourth shift in the Hemo West unit, with the shift running from 2230 until 0630.

For emergency dialysis at TGH, MSH, PMH, or TWH contact Hemo West charge nurse Monday to Friday and Saturday until 2230. For emergency dialysis at TGH, MSH, and PMH on Saturday 2230 until Sunday at 2230, contact the on-call nurse through locating.

Initiation of a new hemodialysis patient whether acute or chronic must be in consultation with a staff Nephrologist, with a catheter in place and verified radiographically.

ALL patients starting HD must have Hgb, Creatinine, Urea, serum bicarbonate, Ca++, phosphate, albumin, PTH bloodwork done PRIOR to first dialysis (Ontario Renal Reporting System guideline).

Ordering Hemodialysis:

- Use “Hemodialysis Orders” Sheet. Write the orders a day ahead if possible. Call the HD unit as soon as you know that an inpatient will require dialysis.
- When ordering medications which need to be given at dialysis, remember to specify “with dialysis” when ordering on computer, or on MD orders.

Filling out Hemodialysis Orders Sheet

1. “Daily” - all acute or unstable pts, evaluate pt prior to each Rx.
   “Chronic" - stable chronic pts.

2. Dialyzer

For acute-order CorDiaxFx120. The standard dialyzer for chronic HD pts is F80 which is reused using heat reprocessing. Note: there is no reuse for patients with HIV, hepatitis B. If patients are part of the Reuse Program they can have a Reuse F80 Dialyzers ordered for use In-Center while admitted.

3. Method

"Conventional" refers to intermittent HD. HD time includes solute removal + ultrafiltration (UF). Can also have isolated UF if pt very volume overloaded - may permit a greater rate of fluid removal with less hemodynamic compromise. Increase dialysis hours until PRU (Percent Reduction of Urea) (adequacy) is >65%

$$PRU = \frac{\text{Pre Urea - Post Urea}}{\text{Pre Urea}} \times 100$$

4. Dialysate

Sodium: standard is 138 mmol. May order Na^+ "Ramping" for pts with intradialytic hypotension or cramping - e.g. Na 145 1st hr, 140 2nd hr, 137 3rd hr, 135 4th hr, ordered in consultation with fellow or staff. However is now strongly discouraged for most patients.

Potassium: 1.0, 2.0, 3.0 mmol/L available. Goal is predialysis K^+ 4.0-5.5, post dialysis K^+ 3-3.5. (to guesstimate: 7 – pt's K^+ = dialysate K+). Standard is 2.0.

Calcium: standard is 1.5 mmol. Also 1.25 and 1.00 mmol available for hypercalcemia and 1.75 mmol available for hypocalcemia.

Bicarbonate is the standard buffer - 35 and 40 mmol/L are available.

Phosphate: Patients on HD or SLED may develop hypophosphatemia. One way of correcting this is to add Fleet phosphate enema (concentrated sodium phosphate) to the acid concentrate. 100 mL of Fleet enema contains approximately 175 mmol of phosphate – which gets diluted 1:45 by the dialysis machine.
There are 2 sizes of acid jugs, 5.0 and 4.5 L - determine from the nurse which size is being used, it does not change the final concentration.

For 4.5 or 5.0 L acid jugs:

Amount of Fleet enema	Final Dialysate Concentration
120 mL	1.0 mmol/L
95 mL	0.8 mmol/L
47 mL	0.4 mmol/L

5. Target weight (TW) and fluid removal.

TW = pt's euvolemic weight at the end of dialysis - i.e. no peripheral or pulmonary edema, normal JVP, normal BP, and no s/s ECFV depletion - cramps, dizziness, orthostatic hypotension

Stable patients: establish TW by physical exam with reference to patient's current weight; hemodialysis nurses determine amount of fluid to remove using the predialysis and target weight.

Acute In patients: Inpatients are ill and are often losing flesh weight and require frequent assessment and TW adjustment or they may become hypertensive and volume overloaded. In pts who cannot be weighed, you may prescribe "fluid removal goal" in liters. Pts to be assessed pre and post dialysis to ascertain appropriate fluid removal.

6. Heparinization

Regular heparinization = 1000u bolus and 1000u/hr.
Tight = 0 bolus, 500 u/hr
No heparin = 0 bolus, 0 infusion, N/S flushes or Bioflow - use for patients with bleeding, coagulopathy, pre/post-surgery, and HIT+. The risk of tight or no heparinization is dialyzer clotting (blood loss). Need to balance risk of bleeding to risk of clotting system.

7. Blood Flow (Qb)

Standard is "Maximize at RN discretion", up to 400 mL/min. Generally slower Qb's for first few runs to avoid dialysis disequilibrium (e.g. 250 mL/min).

8. BP maintenance

Standard is saline. In some ICU pts already on inotropes, dopamine may occasionally be used.

9. Bloodwork

"Monthly Routine" - only for chronic outpatient; "other" includes any blood tests to be done before or after dialysis. Blood is taken from the dialysis access, saving a venipuncture. **Only order NECESSARY bloodwork**, as dialysis pts are anemic.

Other Hemodialysis Orders

Antibiotics

- Some IV antibiotics are to be given post dialysis, and may be given through the dialysis machine; the HD doses are noted in the UHN Guidelines for Antimicrobial use.

Blood Transfusions

- Blood Transfusions – C&T prior to, and give during HD to allow removal of fluid volume and K^+.
- Pts must sign a consent form for blood transfusion, explained by and signed by MD, try to get consent for 1 year.

IV Iron

- Iron sucrose is the standard intravenous iron preparation . Other preparations including iron dextran or sodium ferric gluconate complex (Ferrlecit ®) may be ordered for patients who are allergic to or intolerant of Venofer. Dose - IV Iron Sucrose (Venofer) - 100 mg IV with HD x 10 consecutive HD's. Maintenance dose 100 mg IV 1 -2/month.
- Dose - IV Iron Dextran - Test dose 25 mg IV with HD, with MD present. If no problems, 75 mg IV then 100 mg x next 9 HD's (rarely used).
- Have Benadryl 50 mg, Solumedrol 100 mg & Adrenalin 1:1000 .3-.5 mL on hand when administering iron dextran.

University Health Network
Toronto General Hospital Toronto Western Hospital Princess Margaret Hospital

Doctor's Order Sheet

Hemodialysis Unit

Hemodialysis Orders

Addressograph

PLEASE USE BLACK OR BLUE BALLPOINT PEN, PRESS FIRMLY

ALLERGIES:
NO KNOWN ALLERGIES ☐
KNOWN ALLERGIES (Specify) ☐

PHYSICIAN'S ORDER AND SIGNATURE	SIGNATURE(S) AND POSITION	ACTION	PHARMACY

(Check ☑ appropriate box(es) and complete orders as required)

1. TREATMENT:

❑ Daily dialysis (acute/unstable in-patients) for_____/_____/_____ (dd / mm / yy)

❑ Chronic dialysis orders _____ times per week (Started: _____/_____/_____ (dd / mm / yy))

Dialyzer: ❑ Fresenius F80 reuse (Standard) **OR** Other:_____

Method: ❑ Conventional dialysis for_____ hours **OR**

❑ Ultrafiltration for_____ hours, dialysis for_____ hours

Dialysate:

❑ Na+: 138 mmol/L (Standard) **OR**_____ mmol/L

Na+ Ramping (Mean based on predialysis serum sodium)

❑ Linear 145 mmol/L to 135 mmol/L (Bellco™ User Profile 1-4 mean 140)

❑ Linear 143 mmol/L to 133 mmol/L (Bellco™ User Profile 1-4 mean 138)

❑ Linear 140mmol/L to 130 mmol/L (Bellco™ User Profile 1-4 mean 135)

❑ Other:_____ (based on average pre-dialysis sodium)

UF Ramping (Use only with Na Ramping):

Percentages for hourly fluid removal (modified for variable treatment times)

❑ 40% - 30% - 20% - 10% (Bellco™ User Profile # 3) (standard)

❑ 50% - rest - 30% - rest - 10% - 10% (Bellco™ User Profile # 1)

❑ 50% - 30% - 10% - 10% (Bellco™ User Profile # 2)

❑ Initial 15 minute rest then straight UF (Bellco™ User Profile # 4)

❑ Other:_____

K+: ❑ 2.0 mmol/L (Standard) ❑ 1.0 mmol/L ❑ 3.0 mmol/L Other:_____

Ca++: ❑ 1.5 mmol/L (Standard) ❑ 1.0 mmol/L ❑ 1.25 mmol/L ❑ 1.75 mmol/L

Bicarbonate: ❑ 40 mmol/L (Standard) ❑ 35 mmol/L **OR** ❑ Other:_____ mmol/L

Additives:_____

Target weight:_____ kg **OR Fluid Removal Goal:**_____ litres.

Heparinization of Dialysis Circuit: (1,000 units/ml)

❑ Regular: 1000 units bolus then 1000 units per hour (Standard)

❑ Tight: 500 units bolus then 500 units per hour

❑ No Heparin with normal saline flushes as per RN discretion

Blood Flow: ❑ Maximize at R.N. discretion **OR** ❑_____ mL/min.

Blood Pressure maintenance: ❑ Normal Saline as needed **OR** _____

2. LABORATORY TESTS:

Out-patient Blood Work: ❑ Monthly Routine **OR** ❑_____

(DO NOT USE THIS FORM FOR MEDICATIONS OR INPATIENT BLOODWORK)

Physician's Signature: _____ Date ____/____/____ (dd / mm / yy) Time: _____

D2116

Form D-2116 (17/06/2009) **COPIES:** ORIGINAL - RETAIN IN CHART, YELLOW - PHARMACY

Dialysis in the ICU and "off-unit" – CRRT (MSH only)

- Patients in the ICU, CCU and Off unit reviewed at AM report
- ICU pts often hemodynamically unstable, with large obligate fluid input, on inotropes, with co-morbid conditions, which complicate their dialysis.
- Conventional HD can worsen hemodynamic instability. SLED and CRRT - Continuous Renal Replacement Therapies - are slower and gentler than conventional HD.
- ALL patients starting HD must have Hgb, Cr, Urea, bicarbonate, Ca++, PO_4, albumin, PTH done PRIOR to first dialysis. (Ontario Renal Reporting System guideline)

Peritoneal Dialysis

- In pts with intact peritoneal cavities, PD can be excellent in ICU setting.
- Contact General surgery to implant the PD catheter. Contact Zita 2358 for PD catheter insertions.
- ICU nurses carry out the dialysis - CAPD.
- ICU and ER nurses are also certified to initiate PD peritonitis protocol.

Sustained Low Efficiency Dialysis (SLED)

- SLED is used in the MSICU, CCU and CVICU and Toronto Western ICUs as the first choice for any patient who is hemodynamically unstable. CRRT is used at the Mount Sinai ICU.
- SLED consists of 6 dialysis treatments per week for 8 hours (Mon – Sat), using a conventional HD machine with standard concentrates, slow Blood pump speed (200 mL/min), slow Dialysate flow (300 mL/min), using a single use dialyzer.
- Heparin anticoagulation as standard, may also do manual flushes or 1-2 liters/hour hemofiltration with saline

Orders for SLED

(**S**ustained **Low E**fficiency **D**ialysis)

	STANDARD	Options
Time	8 h	x
Blood pump speed	200 mL/min	x
Dialysate flow	300 l/min	x
Anticoagulation	Heparin	Saline flushes
Saline hemofiltration	1-2 L/h	x
Dialyzer	Use single use for SLED ONLY	
Sodium	140	x
Potassium	3	1,2,3
Calcium	1.5	1.25,1.5,1.75
Bicarbonate	35	30,35,40
Phosphate	0	May add to dialysate if Pi < 1.0 mmol*

* Patients on HD or SLED may develop hypophosphatemia. See **Ordering Hemodialysis** for Phosphate dialysate additives.

Scheduling of SLED in ICUs

Patients on SLED in MSICU or CVICU should remain on SLED until they leave the ICU, to accommodate their rehabilitation. Since SLED is initiated by the hemodialysis team but monitored by the ICU staff, it means that more treatments can be done later in the day without compromising patient rehabilitation.

The frequency and duration of SLED treatments should be individualized to meet each patient's needs; 6 hours 3 days a week would be considered the minimum acceptable treatment schedule.

It is not necessary to provide a CHD treatment prior to transfer out of the ICU in hemodynamically stable patients.

SUMMARY: WHEN A PATIENT HAS BEEN STARTED ON SLED IN EITHER MSICU OR CVICU, CONTINUE THEM ON SLED UNTIL ICU DISCHARGE.

University Health Network
Toronto General Hospital Toronto Western Hospital Princess Margaret Hospital

Doctor's Order Sheet

Nephrology SLED orders
Sustained Low Efficiency Dialysis

Addressograph

PLEASE USE BLACK OR BLUE BALLPOINT PEN, PRESS FIRMLY

ALLERGIES:
NO KNOWN ALLERGIES ☐
KNOWN ALLERGIES (Specify) ☐

PHYSICIAN'S ORDER AND SIGNATURE	SIGNATURE(S) AND POSITION	ACTION TAKEN	PHARMACY

(Check ☑ appropriate box(es) and complete orders as required)

1. ON ADMISSION:

Start date _____/_____/_____ (dd/mm/yy)
❑ To be continued daily Monday to Saturday. (standard)
❑ To be continued _____days week (between Mon-Sat)

[Sunday/after hours requires shortened SLED orders]
- a daily review of orders is required by Nephrology,
- a newly written Pre-Printed Order sheet is required for ALL changes

2. TREATMENTS:

❑ Dialyzer: Xenium 150 **OR** Other: _____

❑ Duration: 8 hours **OR** Other: _____

Blood Flow: ❑ 200 mL/min. (standard) **OR** _____ mL/min.

Dialysate:

Flow: 300/350 mL/min (standard)

❑ Na^+ ❑ 140 mmol/L **OR** Other: _____

❑ K^+ ❑ 3.0 mmol/L (standard) (with 0.75 mmol Mg) ❑ 4.0 mmol/L (with 0.75 mmol Mg)
OR Other: _____
(note: all other options have 0.375 mmol/L Mg.)

❑ Ca^{++} 1.5 mmol/L (standard) **OR** ❑ 1.0 mmol/L ❑ 1.25mmol/L ❑ 1.75 mmol/L

❑ Bicarbonate: 35 mmol/L **OR** Other: _____

❑ Phosphate 0 mmol/L **OR** Add _____mL sodium phosphate (product provided as Fleet® enema to be used as dialysate additive)
(125 mL = approximately 1 mmol/L phosphate once diluted in dialysate bath)

Heparinization of Dialysis Circuit: (1,000 units/ml)
❑ Regular: 1000 units bolus then 1000 units per hour
❑ Tight/Low: 500 units bolus then 500 units per hour
❑ No Heparin with normal saline flushes as per RN discretion

Saline Hemofiltration (pre-filter): 1 L normal saline / hour
OR Other: _____

Fluid Removal Goal: _____ L. **OR** Target Weight: _____kg.

Blood Pressure maintenance: ❑ Normal Saline as needed (usual bolus 100-200 mL)
OR Other: _____

3. LABORATORY TESTS

- Creatinine, Sodium, Potassium, Calcium, Phosphate, Bicarbonate, bloodwork daily to ensure this bloodwork is available for assessment prior to SLED setup.

Physician's Signature: _____ Date: _____/_____/_____ (dd/mm/yy) Time: _____

D2980S

Continuous renal replacement therapy (CRRT)

- To be ordered ONLY at Mt Sinai
- Slow dialysis and UF with a pump - not dependent on BP
- Requires only a dual lumen catheter as access
- Requires close nephrology supervision
- ICU nurses set up and monitor the system
- Anticoagulation with citrate

CRRT - Guidelines for Doctors Orders

For all order changes, a new CRRT Doctors Order Sheet must be completely rewritten. Use Dr. Order sheet for CRRT

All CRRT orders must be reviewed and reordered at least once weekly by Nephrology.

1. **Modality** :
CVVHD *(Continuous Veno-Venous Hemodialysis).*
CVVHDF *(Continuous Veno-Venous Hemodiafiltration).*
CVVH *(Continuous Veno-Venous Hemofiltration).*
(The standard is CVVHD or CVVHDF)

2 . **Anticoagulation:**
Citrate (regional anticoagulation)

3. Dialysate Solution:
Hemosol BO - Either 0 K+ or 4 mmol/L K+

NOTE: *NEVER ADD* FLEET ENEMA DIRECTLY TO BAGS USED FOR CVVHD AS THIS WILL CAUSE SEVERE HYPERPHOSPHATEMIA. Correct hypophosphatemia parenterally.

4. **Replacement Solutions:** Normal Saline ***or*** **Hemosol BO**.

5. Flow Rates:
Blood Flow Rate: 100 mL/min.(usual), or may order other rate.
Ultrafiltration Rate : ____ mL/h. *(consider **ALL** intake excluding replacement solution).* Dialysate Flow Rate: ____ mL/hour *(Standard- 20 mL/kg/* hour).
Replacement Flow Rate: ____ mL/h*.*

Citrate Anticoagulation

- Citrate is used to anticoagulate the extracorporeal blood circuit during CRRT by binding with calcium, rendering it unavailable to the clotting cascade.
- When the blood returns to the patient, the pts serum calcium mixes with the blood and neutralizes the anticoagulation effect.
- Calcium is administered to the pt to replete calcium stores lost as a result of citrate binding.
- Citrate Anticoagulant Citrate Dextrose Solution USP (ACD) Formula A is supplied in 500 and 1000 mL IV bags by Stores and is ward stock on the Hemo Unit.
- The citrate infusion is administered via infusion pump.

Use "CRRT with Citrate Anticoagulation ICU" - Doctors Order Sheet

Indications for Use:

- Citrate is the standard anticoagulant for CRRT at Mt Sinai Hospital.

Citrate Protocol

Citrate Dextrose Solution USP ACD Formula A in access port @starting rate of 200 mL/h. Titrate per Post-filter Ionized Ca

Calcium Gluconate 24.3g in 1L D5W @ starting rate of 50 mL/h using separate central line. Titrate per Systemic Ionized Ca

Required Bloodwork:

Upon start of treatment: baseline Ionized Ca^{++} post filter and systemic; lytes, bicarb, urea, Cr, PO4, Lactate, Mg, albumin

During Treatment: Post filter Ionized Ca, Systemic Ionized Ca

- At 1 hour
- Q4h x12 hr then q 12h and prn (if no changes to infusion rates)
- Repeat bloodwork 4 hours after each rate change.
  Write order to initiate citrate infusion and the calcium gluconate infusion at specified rates of infusion. Daily evaluation of coagulation status.

Nurses have been educated to notify MD for the following circumstances:

- systemic ionized Ca^{++} < 0.75 or as specified with MD's orders
- when citrate rate is >250 mL / hour
- if patient has gross metabolic alkalosis ($HC0_3$ > 35)

Note: Replacement fluid and dialysate fluid are both automatically removed by the machine.

Problems with Continual Renal Replacement Therapies

- Requires anticoagulation with heparin. Citrate anticoagulation available (see protocol).
- Nephrology (not the ICU staff) responsible for changing dialysis prescriptions as required.

If you have questions or problems, please contact Dr. Lok, at ext 14-4140, pager (416)790-8645 for advice.

Sliding Scales for Citrate Anticoagulation Infusion Rates

Citrate Infusion: Adjust rates as soon as bloodwork results are available, based on normalized Ionized Ca results (corrected to pH 7.4). *(suggested starting rate at 200 mL/h)*

Anticoagulation Citrate Infusion based on post-filter ionized Calcium results:

Post –filter Ionized Ca++ (mmol/L)	**Change Citrate Infusion Rate :**
Use PRISMA Venous Port	
< 0.25	↓ present rate by 10 mL/h
0.25-0.35 (target)	**no change**
0.36-0.45	↑ present rate by 10 mL/h
> 0.46	↑ present rate by 20 mL/h

→ notify Nephrologist when citrate rate is > 250mL/h

Central Line Infusion: Calcium Gluconate 24.3g in 1L D5W *(suggested starting rate at 50 mL/h)*

Systemic Ionized Calcium	**Change Calcium Gluconate Infusion Rate :**
(Use Patient Arterial line)	
< 0.75 mmol/L	↑present rate by 20 mL/h and notify Nephrologist
.75 - .94	↑ present rate by 20 mL/h
.95-1.10	↑ present rate by 10 mL/h
1.11 – 1.20 (target)	**no change to present rate**
>1.20	↓ present rate by 10 mL/h

Replacement Fluid Infusion: (0.9% Sodium Chloride usual solution for replacement)

- Start at 0 mL/h at the beginning of treatment and change based on scale below.
- if blood gas **bicarbonate** is **greater than 30 mmol/L**
  - → start replacement at 250 mL/h
  - → after 12 hr, if bicarb still > 30 mmol/L, increase replacement to 500 mL/h
  - →No further increases without Nephrology order.
- If blood gas bicarbonate is less than 24 mmol/L, stop replacement fluid.
- If serum **sodium** is **greater than 145 mmol/L** with replacement, using a Y connector, hang 1 bag of 0.9% sodium chloride and one bag of 0.45% sodium chloride to run together at equal rates for reinfusion.

Dialysate solution: Prism0cal (= Na 140 mmol/L, bicarb 32 mmol/L, K 0 mmol/L, Ca 0 mmol/L). Prism0cal must **always** be used with both calcium and citrate infusions. It must never be used alone.

Additive: Add __ mEq/L KCl to a 5 L bag for a final concentration of __ mEq/L

Vascular Access (VA) For Hemodialysis

AV Graft

- Connects artery to a vein using synthetic material (e.g. PTFE - "Impra®"), implanted by surgeon usually in forearm, upper arm or thigh (rarely, chest).
- Can be used ~ 2-4 weeks after surgery; newer grafts using new materials will be able to be used within 24 hours, contact Cyndi to find out what type of graft material it is.
- Should auscultate a bruit and feel a thrill.

AV Fistula

- Anastomosis of patients own artery to vein, created by surgeon.
- Requires up to 6 months to mature (average 3 months).
- Should auscultate a bruit and feel a thrill.

Both of these are accessed at HD via large bore needles. The access extremity should be protected and not be used for venipuncture or BP measurements. If the access fails then bloodwork and BP measurements can be done on the arm.

- All patients for chronic HD should have permanent vascular access, preferably an AV-fistula or AV graft. Refer directly to VA coordinator (Cyndi Bhola ext 14-3518).
- Will be seen in Vascular Access Clinic and booked for OR
- For OR, complete standing Vascular Access Orders sheet
- Surgeon is responsible for assessing pt and obtaining consent
- Assess diabetic patients for need of orders for IV in non-access arm

Central Venous Catheters (CVCs)

Percutaneous

- May be placed at the bedside, and is short-term temporary. Used for days (if necessary, weeks). Temporary femoral CVC should be removed/changed after 7 to 10 days and patients cannot go home with a temporary CVC.
- Placed using sterile technique in Internal Jugular (IJ) opposite to the side that the surgically created VA will go, or femoral vein
- Tip of IJ catheter sits at the junction of the superior vena cava and the right atrium.
- Use 13-15 cm for IJ CVC (preferably with curved tips for IJ), 20-24 cm for femoral CVC (preferably straight tips for femoral)
- If available, use portable U/S (in Hemo West ext 14-4072) to assist insertion
- Instill 4% Citrate to catheter lumen volume (indicated on lumens) post insertion. If not available from Pharmacy or in Pyxis, use heparin 10,000 units per mL: draw up 5,000 units (0.5 mL) mixed with enough saline to fill the volume indicated on the catheter lumen.
- Temporary IJ catheters must be sutured, with position verified by CXR and documented before use
- Removed by house staff, fellows and certified hemodialysis nurses or NP's – the date of removal must be reported to Cyndi Bhola during morning report.
- If catheter is slipping out, never push back in. Change over a guide wire.

Tunneled

We use primarily "CardioMed" and "Hemostar" brands.

Advise patients that these tunneled catheters, are **ONLY TEMPORARY** and should be replaced by AV fistula or graft ASAP.

The patient should be informed that a simultaneous surgical consult will be made for creation of an AV-fistula or AV-graft

In order to request a tunneled CVC insertion, the following are required:

1) Referral form

2) Call Cyndi Bhola (ext 14-3518)

Cuffed Tunneled catheter inserted in Angio under fluoroscopy

- Used only until fistula/graft is ready or the patient has exhausted other accesses.
- Change or removal for poor flows and/or infection may require removal by radiology for concurrent fibrin sheath evaluation +/- disruption.
- Entering requests for permanent line insertions and removals in Electronic Patient Record (EPR) as follows: Under Nephrology Order set: Diagnostics → "Abd/Thoracic Angio". Enter comment –reason for insertion/removal.
- Does not need to be X-rayed prior to use (inserted under fluoro).
- Should be capped with 4% Citrate at insertion.

Polysporin Triple

"Polysporin Triple topical antibiotic protocol" should be ordered for all patients with tunneled catheters.

Infection Guidelines for Vascular Access

Hemodialysis Catheter Infection

Diagnose type of catheter infection – exit site, tunnel, and bacteremia. See Table 1, Definitions of catheter related infections.

Look for redness, pain, discharge at the exit site or over catheter tunnel, fever (remember not all renal pts will mount a fever), other s/s of sepsis (nausea, vomiting, malaise, hemodynamic instability etc.).

Obtain exit site and/or blood cultures and sensitivities as appropriate to type of infection (Table 1).

When obtaining blood cultures, one culture should be obtained from the catheter lumen. A second should be from the extracorporeal circuit. When ordering blood cultures in EPR, indicate "from lumen" or "from circuit" respectively.

If a patient with a catheter develops signs and symptoms of sepsis, do not assume the catheter is the source, RULE OUT other sources of infection.

Inform Cyndi (ext 14-3518), if infection suspected, who will review with Hemodialysis Infection Control Subcommittee (HICS).*

See Flowchart: Algorithm for Central Venous Catheter Related Infection

Start empiric antibiotic treatment Protocol:

Cefazolin 2 gm IV post each HD, & Tobramycin 2 mg/kg loading then 1mg/kg post each HD until C&S known. If allergic to Cefazolin, Vancomycin may be given per Table 3: Vancomycin Dosing for Hemodialysis,

For Nocturnal home dialysis patients, Cefazolin 2.0 g loading dose, then 1g daily, and Tobramycin 1 mg/kg q 2nd HD. If allergic to Cefazolin, Vancomycin per loading dose in Table 3: Vancomycin Dosing for Hemodialysis may be given, then call Pharmacy (Marisa) x 3207 for dosing

Monday to Friday, 0800 to 1600, Cyndi Bhola, Vascular Coordinator will arrange CVC removal or guidewire catheter exchange through IR. Fibrin sheath removal is done for infected catheters. After hours, contact the Interventional Radiologist on call to request availability for removal. If IR able to do, place an order in EPR. If it is necessary to remove the CVC immediately (i.e., purulent discharge at exit site, sepsis), the Nephrology Fellow should proceed with bedside removal. For infected catheter sites, the CVC should be out for 48 hours pre re-insertion. Inform HICS* (Cyndi ext 14-3518). If patient requires dialysis in the interim, a temporary CVC may need to be inserted.

Arrange re-insertion by Angio, put order in computer. Under Nephrology Order set: Diagnostics → "Abd/Thoracic Angio". Enter comment to indicate reason for removal.

***HICS** = **Hemodialysis Infection Control Subcommittee.**

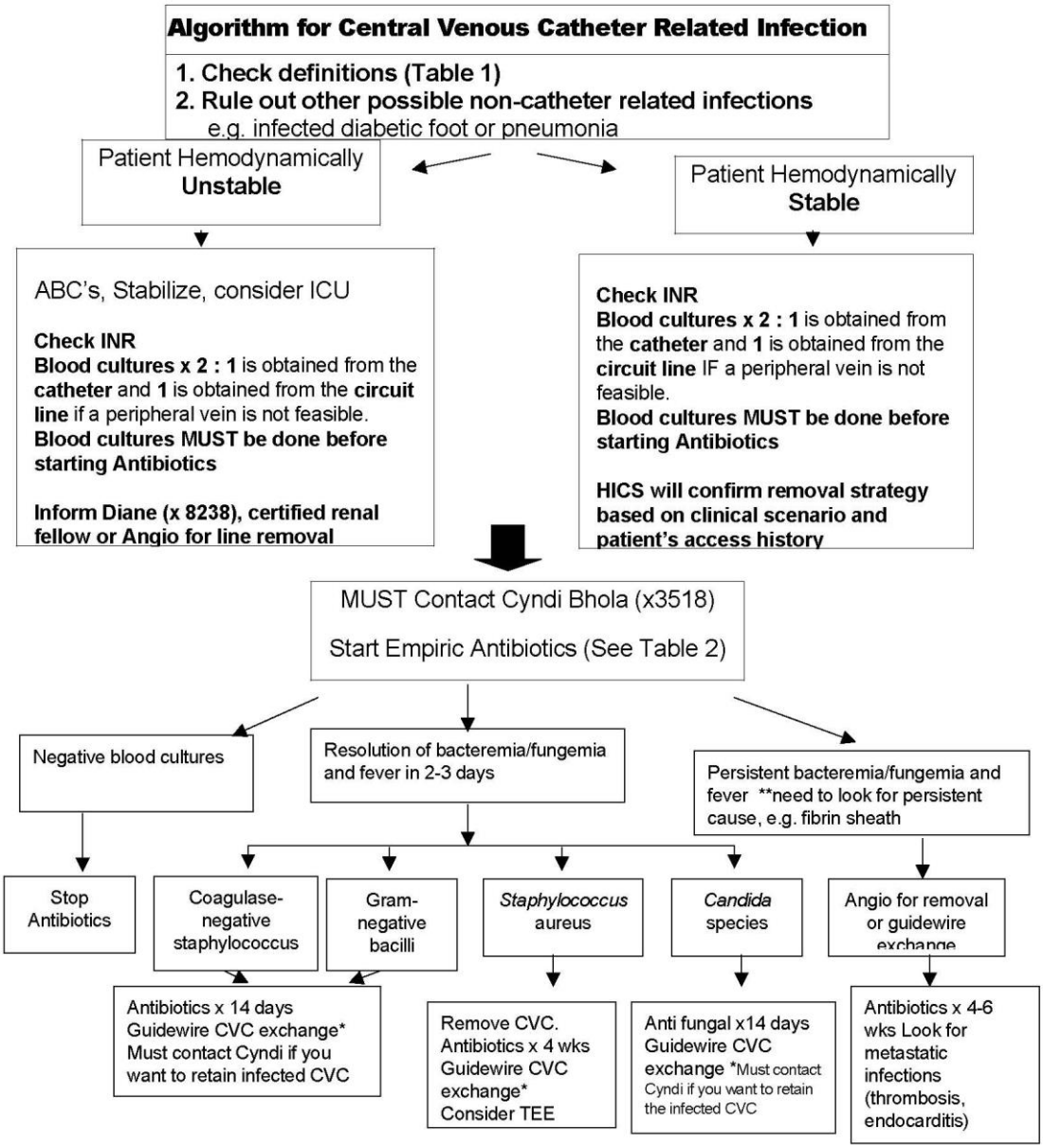
Dr. C. Lok, Nephrologist, ext 14-4140

Cyndi Bhola, Dialysis Vascular Access coordinator , ext 14-3518, pager (416) 790-5320

Marisa Battistella, Pharm, ext 14-3207, pager (416) 790-0793

Infection Control Practitioner, ext 14-4634

Algorithm for Central Venous Catheter Infection



*Note: If there is purulence at the ext site or tunnel, you MUST contact **Cyndi (x3518)**, guidewire exchange is not allowed

Table 1. Definitions of Catheter-Related Infections

Definition	Definite	Probable
Exit site infection	Purulent discharge at exit site Or Erythema, tenderness, induration (2 of 3) at exit site with a positive culture of serous discharge	Erythema, tenderness, induration (2 of 3) at exit site without a positive culture of serous discharge Or Above without discharge but lack of alternative explanation
Tunnel infection	Purulent discharge or aspirate from a tunnel or pocket site not contiguous with exit site Or Erythema, tenderness, induration (2 of 3) at a tunnel or pocket site not contiguous with exit site with a positive culture of serous discharge or aspirate from that site	Erythema, tenderness, induration (2 of 3) at a tunnel or pocket site not contiguous with exit site and serous discharge or aspirate from that site without a positive culture Or Above without discharge but lack of alternative explanation
Catheter-related bacteremia	Confirmation of septic thrombophlebitis with a single positive blood culture Or Single positive blood culture and positive culture of catheter segment with identical organism Or ≥10 fold colony count difference in blood cultures drawn from device and peripheral blood Or Single positive blood culture and positive culture from discharge or aspirate from exit site, tunnel or pocket, with identical organism	2 or more positive blood cultures with no evidence for source other than the device Or Single positive blood culture for *S. aureus* or *Candida* with no evidence for source other than device Or Single positive blood culture for coagulase negative *staphylococci, Bacillus, Corynebacterium jeikeium, Enterococcus, Trichophyton* or *Malassezia* in immunocompromised or neutropenic host or in patient receiving total parenteral nutrition with no evidence for source other than a centrally placed device

Reproduced from Preventing Infections Associated with Indwelling Intravascular Access Devices Health Canada, 1997. Minister of Public Works and Government Services Canada,2002.

Table 2. Culture and Sensitivity Follow-up

HICS will provide recommendations if specific concerns. Cyndi x 3518 (or any HICS member) MUST be notified of any suspected access related infections.

Culture results	*Continue or add, based on sensitivity*	*Discontinue*
Coagulase negative staphylococci	Cefazolin 2 g IV q HD x 2 wks. If resistant to Cefazolin, use Vancomycin See Table 3: Vancomycin Dosing for Hemodialysis. For home NHD pts, Cefazolin 1-2 g IV q HD x 2 wks. If allergic, see Table 3: Vancomycin Dosing for Hemodialysis , and call Pharm	Tobramycin
Gram negative	Tobramycin 2 mg/kg loading then 1mg/kg post HD x 2 wks. For home NHD*, Tobramycin 1 mg/kg q 2nd HD x 2 week	Cefazolin
S. aureus	Cefazolin 2 g IV with every HD x 4 weeks For home NHD, Cefazolin 1-2 g IV q HD x 4 wks. If allergic, see Table 3: Vancomycin Dosing for Hemodialysis Vancomycin* 1 g IV and call Pharm. Note: for all SA, if SBE, treat for 6 weeks.	Tobramycin
MRSA	Vancomycin* see Table 3: Vancomycin Dosing for Hemodialysis x 4 weeks*. For home NHD*, see Table 3: Vancomycin Dosing for Hemodialysis and call Pharm Note: for all SA, if SBE, treat for 6 weeks.	Cefazolin Tobramycin
Enterococci	Vancomycin* see Table 3: Vancomycin Dosing for Hemodialysis with every HD for 2 wks. OR Ampicillin 2 g q 12 h x 2 weeks, and Tobramycin 2 mg/kg loading then 1mg/kg post q HD x 2 wks.	Cefazolin
Fungus (yeast, candida)	Fluconazole 400 mg po loading dose, then 200 mg po daily (give post HD on HD days) x 2 wks. Note: po is ~ 100% bioavailable, thus is preferred route. ANY prescription for oral antibiotics given to patient must also be ordered in patient's dialysis order sheet in their chart. Inform Pharm if IV desired (d/t vomiting, inability to swallow)	Cefazolin Tobramycin

***Vancomycin/Tobramycin – Consult Marisa, Pharm, ext 14-3207 re: need for drug levels**

Exit Site Infections		
Organism	Treatment based on sensitivities, examples:	Duration
Coag neg staph	Septra 1 DS po daily	7 days
Gram Negative	Ciprofloxacin 500 mg po daily	7 days
Staph Aureus	Cloxacillin 500 mg po q 6 hr Or Cefazolin 2 gm IV q HD	7 days
Fungus	Fluconazole 200 mg po daily	7 days

If not completely resolved in 7 days, call Cyndi (ext 14-3518) for further evaluation.

ANY prescription for oral antibiotics given to patient must also be ordered in patient's dialysis order sheet in their chart.

Table 3. Vancomycin Dosing in Hemodialysis

Weight (kg)	Loading Dose	Maintenance Dose
< 70	**1000 mg IV**	**500 mg IV q dialysis**
70 – 100	**1250 mg IV**	**750 mg IV q dialysis**
> 100	**1500 mg IV**	**1000 mg IV q dialysis**

Trough levels should be drawn pre-dialysis with physician's orders.

Consult pharmacist for dosage recommendations

AV Graft Infection

*Infection in an AV graft is a **medical emergency**.*

- More common in a graft than in a native AV fistula. AV fistula buttonhole cannulation may be more susceptible to infection.
- Pts with St aureus may become septic within several hours.
    - If allergic to Cefazolin, see Table 3: Vancomycin Dosing in Hemodialysis.
- Stat vascular surgery consult for assessment and possible removal
- Can rarely be treated with prolonged course of antibiotics, but more likely the graft will need to be removed.
- Assess for septic emboli/ metastasis e.g. bacterial endocarditis.

Suspected HD Vascular Access Infection Report

Patient's name: _____ MRN: _____ Date: _____

□ **NO OTHER SOURCE OF INFECTION FOUND**

□ **Cyndi Bhola 3518** or other member of HICS notified

Exit site infection: □ Purulent discharge □ Serous discharge □ Redness □ Tenderness

Tunnel infection: □ Purulent discharge □ Serous discharge □ Redness of tunnel

□Tenderness of tunnel

Bacteremia: □ Fever >37.7 C □ Rigors during hemodialysis

□ Ensure Cultures sent from : □ Peripheral blood □ Retrograde catheter □ Exit site

AV Fistula or Graft: □ Fever >37.7 C □ Rigors □ Purulent or serosanguinous discharge

□ Redness or streaking □ Any discrete suspicious pustule or lesion

Please return this form to Cyndi at morning rounds

This form is kept in the hemodialysis nursing stations

Thrombosis Guidelines for Vascular Access

Non-tunneled Catheters:

- If catheter functions poorly during HD, assess fully, including CXR for proper placement
- Try rotating catheter within the hub. If no improvement, change over guide wire.
- Try pulling back a fraction of a cm, and re-suture – Never push a catheter back in once pulled back.
- May use tPA
- May need to insert new CVC in new site – be careful to avoid opposite site to preserve vessels for future fistula/graft creation

Tunneled Catheters:

- If poorly functioning, check placement on CXR, if good placement, trial of tPA is reasonable
- Write tPA order (although nursing medical directive)

Accessing HD Catheters

Catheters should ONLY be accessed for IV or blood sampling under emergency circumstances, as this is the patient's lifeline. For policies related to Hemodialysis, go to UHN Intranet, select "Departments – Nephrology – Hemodialysis Manual (i.e. 18.50.002 is Hemodialysis Central Venous Catheters).

To access the catheter, use aseptic technique and have patient supine. Remove gauze, tapes and ensure the clamps are closed. Cleanse with chlorhexidine and place on sterile field. Remove cap, attach sterile 5 mL syringe. Open clamp and withdraw 3-5 mL blood (to remove citrate/heparin). Clamp and remove syringe. Attach 10cc syringe with 5 mL. normal saline, unclamp, and aspirate small amount of blood (to remove any air at catheter tip) then flush in saline. Clamp and remove syringe - attach to IV line.

If drawing blood sample, attach 20 mL syringe, draw out 20 mL blood, set aside with tip on sterile field, attach another syringe, draw appropriate amount of blood, then re-attach 20 mL syringe and return 20 mL of blood. (This serves to ensure that blood sample does not contain saline, citrate or heparin). Remember to clamp before and after each step.

Catheter should be re-flushed and anticoagulated after use, using citrate/heparin.

Alteplase (Cathflow®) (tPA)

- tPA may be instilled using aseptic technique per Protocol "To clear an indwelling intravascular catheter with fibrinolytic agent – Cathflow® (rtPA)", Hemodialysis Policy & Procedure Manual.
- tPA provided as alteplase (Cathflow®), Pharmacy or unit stock. Provided unconstituted in 2 mg. vials. Reconstitute following instructions on vial or as instructed by pharmacy. Amount to be instilled should be volume of line plus 0.2 mL for overfill. Volume of each lumen is written on catheter arm.
- Clean CVC and ports with chlorhexidine swabs, ensure clamps are closed, and with patient flat, attach empty 5 mL syringe, open clamp and aspirate heparin and/or clots. Clamp CVC and remove syringe.
- Use a prepared syringe of tPA for each blocked lumen. Attach syringe, open clamp and instill slowly and gently, using push-pull motion until total volume instilled.
- If unable to instill entire contents, leave syringe attached, wait several minutes and try again. This attempt can be repeated several times
- Leave tPA in for at least 1 hour. If still clotted, leave for 2nd hour, if still clotted repeat with another syringe of tPA -leave longer (may leave for interdialytic period if required; medical order required if tPA is to be instilled for longer than 2 hour period.) If still no results, arrange CVC change.
- If patency restored, aspirate 3-6 mL blood to assure removal of all drug and clot residue. Flush with 10 mL NS, anticoagulate with citrate 4%.

Native AV Fistulae:

Usually last for several years and are by far the preferred method of chronic vascular access if mature to function.

- One drawback is that when they thrombose, there is usually no effective treatment unless de-clotting can occur early (within 24-72 hours).
- Do not usually require admission for thrombosis. Instead, instruct pt to come early for next HD so that a non-tunnelled catheter can be inserted.
- Vascular Access Coordinator, Cyndi – 3518, to be informed so pt is put on the list for creation of a new permanent vascular access.

The key is prevention of thrombus by adequate blood flow and avoidance of hypotension. Therefore, careful monitoring of target weight and avoidance of hypovolemia is essential.

AV Grafts:

- All patients with synthetic AV-grafts should be instructed to take 4 capsules of fish oil/day (1 capsule should contain EPA 400mg and DHA 200 mg) as it has been proven to reduce the rate of thrombosis and interventions
- Thrombosis is not uncommon; patency can usually be resumed by de-clotting procedure (ideal within 24-72 hours; may still be effective within 5 days)

- Not necessary to admit, but need to contact VA Coordinator Cyndi, 3518 or VA secretary Sally (x6993) to arrange procedure.
- Radiologist will insert catheters and infuse thrombolytic agents to de-clot graft.
- If radiology back-up is not available, unsuccessful or contra-indicated, contact vascular surgery to perform a thrombectomy. This still needs to be followed by an angiogram and angioplasty. Contact Cyndi will arrange this unless urgently required in evenings or weekends.
- In order to obtain flow studies and Dopplers for AV grafts, call Vascular Lab 3589 to book study and leave a message with Cyndi Bhola to follow up.
- Cyndi must be notified of all access related problems and procedures
- If a patient is an inpatient and needs de-clotting, order NPO for 4 hr pre-procedure, and IV saline lock on other arm

Removal of tunneled cuffed hemodialysis catheter

To be carried out only by Staff, certified Renal Fellow. Contact Dr. R. McQuillan for advice.

Supplies:

Minor tray (NOT multipurpose)

15 scalpel blade

2% Xylocaine – 10 mL

25 g needle

2 - 10 cc syringes with 18G (red) needles

Dressing for after (Mepore, mefix, tegaderm)

5-8 4x4's (10cm x 10cm gauze sponges)

Suture (3-0) – if not using exit site approach

Chlorhexidine 2% swabs or other appropriate skin cleaner

Gloves – 1 pair non-sterile procedure gloves, 1 pair sterile

Alcohol prep

Steri-strips

Mask

Procedure:

- “P”
- Ensure INR is <1.50, no ASA, warfarin x 5 days. If on Subcut heparin DVT prophylaxis, hold dose pre and post removal. Patient to be supine during procedure.
- Explain to pt it takes ~ 45 min, and they will have to stay lying down for ~30 min afterward.
- Put a mask on you and the patient (if the patient cannot lie still or is coughing).
- Prepare tray with scalpel blade, needle, syringes, dressing, 4x4’s, suture, steri-strips
- **If dressing is in sterile package, open on to tray, if not sterile e.g., Medipore, cut 15cm piece and put on side of table.**
- With procedure gloves, remove old dressing and tape from caps.
- Landmark for cuff (NB to landmark as may not feel cuff after Xylocaine). Be aware that Cardiomed catheters once had a double cuff (2 cuffs side by side), palpate to see if you can feel an “extra wide” cuff, and prepare to remove if necessary. Single cuff feels ~1cm, double feels ~2cm wide.
- Scrub hands. Gown and glove.
- Clean skin area from cuff site outwards. Clean external catheter, exit site, catheter clamps and caps. Drape -1 under catheter, 1 covering neck, face – have pt turn head away – they may remove mask at this point.
- Ensure catheter lumens are clamped.
- Insert needle with empty 10 cc syringe into rubber port on cap. Open clamp on that lumen and draw back ~5 mL of citrate (heparin) and blood. (This removes the citrate/heparin and allows lumen to fill with blood in case of accidental puncture of catheter during freezing).
- Clamp lumen and withdraw needle.
- Repeat with other lumen. Set blood filled syringe aside for disposal.
- Fill other 10cc syringe with 10mL Xylocaine then change to small 25g needle for freezing.
- Re-landmark cuff. Freeze skin superficially over cuff, aspirating each time before injecting xylocaine. Freeze superficially either side of cuff. Change angle on needle to 90^{o} and enter to the side of the cuff and inject deeper and under the cuff, aspirating each time. Repeat on other side of cuff. Should use adequate freezing, about 8 mL total.
- Prepare tray while allowing freezing to “take”.
- Prepare scalpel blade on handle. Prepare suture. Set aside for use 2 curved forceps/hemostats, 2 probes (L shaped hooks), 1 pair scissors, scalpel, thumb forceps.
- Check that area is well anaesthetized.

If cuff is close to exit site (<2.5 cm):

- Approach via exit site with curved forceps/hemostats and blunt dissect cuff from the exit site. It is often helpful to use the L-shaped hooks to work around the cuff. After the cuff is visible, look proximal (to the pt), to identify fibrin-covered catheter beyond the cuff; Remove this fibrin/tissue from the catheter. Try using the gauze as an "abrasive" to remove the fibrous tissue. May have to carefully pinch and tear with the thumb forceps. Do NOT use scalpel when this close to the catheter. Remember that the other end of the catheter is in the person's right atrium, and a small nick could cause a huge bleed, or an air embolus. Use Diane's "crochet hook" technique with the L shaped hook to expedite removal.
- Once the fibrin/tissue is removed around full radius of the catheter, check that catheter slides out easily, by pulling about 2 cm. If it slides easily, have pt take a deep breath hold it. At the same time, apply pressure at IJ site at the neck as well as the catheter exit site with one hand and steadily remove catheter with the other. Check catheter for clots, fractures.
- Have patient breathe normally. Apply pressure for full 5+ minutes. Apply steri-strips to exit site, or sutures if necessary. Apply modified pressure dressing (roll up gauze and cover tightly with Medipore or Mefix dressing.)
- Have pt remain supine x 20-30 min. Advise re shower technique to keep dressing dry and to remove dressing and steri-strips in 1 week. Tylenol plain or ES is usually sufficient for pain after anaesthesia wears off.
- Document procedure, blood loss, instructions to pt.

If cuff is >2.5 cm from exit site, must make an incision:

- Stretch skin and make fairly shallow incision over (or just to the side of) length of cuff plus ~ ½ cm distal and proximal to cuff. Incision is usually ~ 2-2 ½ cm long. Be sure not to cut catheter.
- With curved forceps/hemostats , blunt dissect tissue to the sides and below cuff, freeing up the cuff. (Usually takes ~ 20+ min).
- If you can, clamp on the cuff full thickness of the catheter to help lift it away. Remove fibrin/tissue from the actual catheter, distal and proximal to the cuff. Try using the gauze as an "abrasive" to remove the fibrous tissue. May have to carefully pinch and tear with the thumb forceps. Do NOT use scalpel when this close to the catheter. Remember that the other end of the catheter is in the person's right atrium, and a small nick could cause a huge bleed, or an air embolus. Use Diane's "crochet hook" technique with the L shaped hook to expedite removal.

- When cuff and distal and proximal catheter is clear, clamp catheter above cuff (proximal to pt). Cut catheter distal to cuff and pull distal portion thru the tunnel. Discard.
- Have pt take a deep breath and hold it. At the same time, apply pressure at IJ site in the neck, as well as incision site with one hand and steadily remove catheter with the other. Check catheter for clots, fractures.
- Apply pressure for full 5+ minutes.
- Suture incision line. Steri strips over exit site. Modified pressure dressing (roll up gauze and cover tightly with Mepore or Mefix dressing.)
- If suspicious of infection, send catheter tip for C&S.
- Have pt wait ~ 30 min before getting up. Advise re. shower technique. Suture removal in 10-14 days. Tylenol plain or ES is usually sufficient for pain after anaesthesia wears off.
- Document procedure, blood loss, instructions to pt.

Management of Bleeding from HD catheter

Occasionally, a catheter may bleed from the exit site following insertion or trauma. Attempt to effect hemostasis through continued pressure (resisting the urge to "peek") for at least 15 min. It is useful to see if the source of the bleeding can be identified, or whether it is pulsatile. Check INR and stop antiplatelet and anticoagulant agents.

A hemostatic agent may be used around the exit site, or into the tunnel if possible. We do NOT use Thrombostat® due to very high incidence of anaphylaxis in our unit. Surgicel ®or an alginate dressing product such as Kaltostat® or Biatain Alginate® may be applied to the exit site, and continued pressure applied. If severe and bleeding does not stop within 30 minutes, consider FFP's. If bleeding cannot be controlled, refer the patient back to Angiography if it was a new catheter, or to vascular surgery, if it was due to trauma.

Antibiotic Prophylaxis for Hemodialysis Patients
Any HD patient with a central line or PTFE (Impra®) graft **must** have antibiotic prophylaxis prior to any invasive procedure and **any** dental procedure as follows.

Cystoscopy /GI
Not generally used for upper GI procedures unless suspected liver or gallbladder infection

Amoxicillin 2.0 g po 1 hour pre procedure

Or

Ampicillin 2.0 g IM or IV 30 mins pre procedure

If Allergic to Penicillin**:** Clindamycin 600 mg po 1 hr pre procedure or 600 mg IV 30 min pre procedure

Dental Procedures
For <u>all</u> dental procedures, including cleaning.

- Amoxicillin 2.0 g po 1 hour pre procedure.
  Or Ampicillin 2.0 g IM or IV 30 mins pre procedure

- If allergic to Penicillin: Clindamycin 600 mg po 1 hr pre procedure or 600 mg IV 30 min pre procedure
  Or Cephalexin or cefadroxil 2.0 g po 1 hour pre procedure

  Or Azithromycin or clarithromycin 500 mg (consider dose modification is on calcium channel blocker) po 1 hour pre procedure

Prophylaxis for Contrast (Dye) Allergy
For individuals who have had previous allergy to dye or iodine:

- Prednisone 50 mg 13 hours pre procedure
- Prednisone 50 mg & Benadryl 50 mg 1 hour pre procedure.

Management of Intoxication

All poisonings should be managed with the supervision of renal fellow and staff Nephrologist.

Hemodialysis

- For solutes that have low MW, not protein bound, water soluble
- Concurrent: renal failure, acid-base disturbance, electrolyte or volume abnormality correctable by dialysis
- Requires vascular access (ideally 2) and anticoagulation

Methanol

Management

- Hemodialysis and Ethanol
- Ethanol is given as an antidote - IV. Aim for a blood level of 100 mg% (20-25 mmol/L). The alcohols are distributed across total body water.

IV Ethanol

- Begin with IV bolus of 0.5 gm ethanol/ Kg
- Aim for plasma ethanol concentration of 20-25 mmol/L
- **NOTE**: Must be diluted to a 15% solution or less to be non-toxic. Mix 72 mL absolute ethanol in 500 mL D5W or NS to give a solution of 10 gm/100 mL i.e. 100 gm/L. A 70 Kg man gets 350 mL of this solution or 35 gm. This is followed by a maintenance of 10 gm (100 mL) per hour. Continue infusion even if dialysis is in progress to make up for metabolized ethanol.

Fomepizole

- For acute management of methanol or ethylene glycol intoxication Used instead of Ethanol to inhibit alcohol dehydrogenase, thus NO Ethanol to be added to the dialysate or given IV if Fomepizole used.

Dosing of Fomepizole:

Loading: Initial dose is 15 mg/kg IV

Maintenance: After initial IV loading dose, give 10 mg/kg IV every 12 hours until dialysis is started.

Dosing Regimen during Hemodialysis:

Dose at the Beginning of Hemodialysis:

- If less than 6 hours since last dose of fomepizole: Do Not Dose
- If equal to or greater than 6 hours since last dose of fomepizole: Administer next scheduled dose (i.e.10 mg/kg IV)*

*Fomepizole is removed by dialysis and therefore the frequency of dosing should be increased to every 4 hours during hemodialysis.

Note: Patients on hemodialysis who are treated with fomepizole should NOT have ethanol added to the dialysis bath.

<u>Hemodialysis</u>

- Hemodialysis indicated for serum methanol levels > 10 mmol/L, or even at lower levels if anion gap metabolic acidosis is present.
- Insert 2 catheters – in separate venous sites, order Xenium 210 dialyzer and dialyze at Qb of 300 or more

If Using Ethanol:

- Dialysis nurse to add ethanol to dialysate 320 mL of absolute ethanol (95%) to 5L of acid concentrate (this is to avoid blood ethanol from being dialyzed out).
- DO **NOT** use Heparin for Methanol Intoxication (reports of brain hemorrhages from methanol), order “Bioflow”.
- Order appropriate K dialysate (usually 3K if patient not in renal failure)
- Dialysis often needed for > 10 hours. Change dialyzer q 6 hr.
- Continue to dialyze to methanol level < 5 mmol/L. By the time this result is back, actual level will be lower. D/C dialysis and send final methanol level.
- PD is less effective but may be of some use in those who cannot be hemodialyzed. Add ethanol to the PD fluid.
- Follow ethanol and methanol blood levels q 3-4 hourly with the aid of a chart.

Ethylene Glycol

- Management is same as methanol intoxication, i.e. ethanol + dialysis.

Lithium Management

- Well dialyzed
- Hemodialysis for 8-12 hours
  Indications: Li level > 3.5 mEq/L

  Li level >2.5 mEq/L if symptomatic or renal insufficiency

  Goal: sustained level 1 meq/L 8 hrs post HD

- Dialyze 8-12 hours and monitor post plasma Li levels q4h for 36 hours
- Monitor for post HD rebound as slow equilibration between extra and intracellular lithium May require repeated HD treatments

Salicylates Management

- Hemodialysis
  Indications: Salicylate level > 7 mmol/L

  Seizures/coma

  Severe metabolic acidosis, esp. with RF

  Non-cardiogenic pulmonary edema

  Especially if elderly, smoker, acute on chronic ingestion

Poison Control Telephone Number: (416) 813-5900

References:

AKF Nephrology Letter 10:1-20, 1993

Brady & Wilcox. Therapy in Nephrology & Hypertension, 2003. Chapter 89, p 675-680
Washington Manual

Hepatitis B Immunization Vaccine

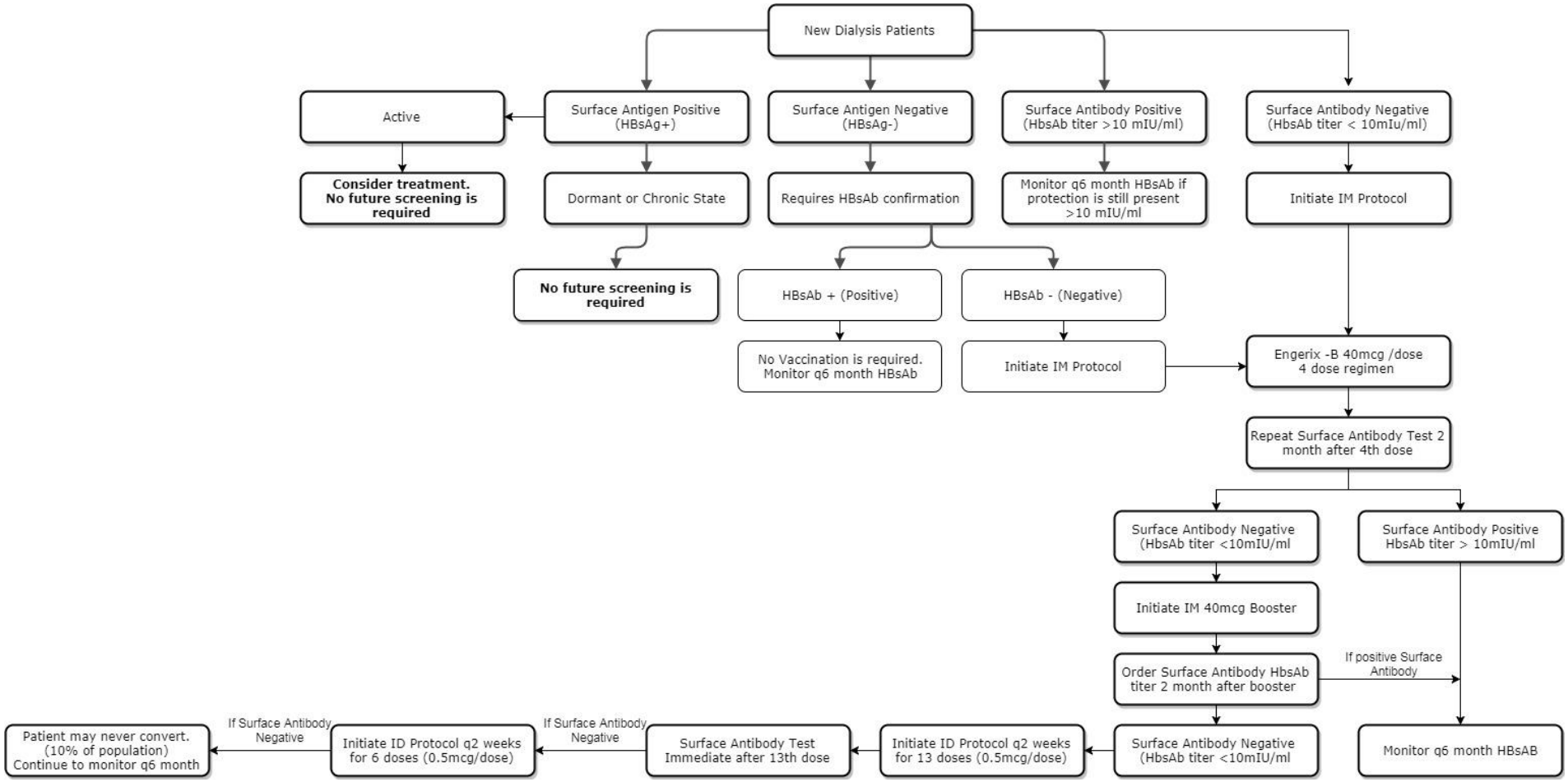
Hepatitis B vaccine is provided as per UHN procedure before or as soon as possible after starting the dialysis program. Vaccination requires a written order by a physician, nurse practitioner or authorized nephrology nurse. The hepatitis B vaccination will be offered to and encouraged for, all chronic and pre-dialysis patients, unless it is **known** that a patient is positive for hepatitis B surface antigen (HBsAg) or antibodies (HBsAb).

Vaccination is recommended for patients before they start hemodialysis program **or** as soon as possible after starting on the program. All vaccination for patients will be done using Engerix-B (SKF) hepatitis B vaccine (recombinant) with dosage schedule. Physicians and or nurses must do teaching about the immunization program. Vaccination requires a written order stating: “Hepatitis B vaccination protocol.” This one order will be sufficient to cover all 4 injections in the dosage schedule and related blood sampling. It also allows for the booster dose and blood sampling if the patient does not convert (i.e. develop antibodies) after the initial 4 injections.

The nephrologist or NP will be consulted if the vaccine should be stopped or postponed for the following reasons:

- patients who are pregnant or suffering from severe febrile infections with temperature > 38C or contagious disease, or
- patients who received a kidney transplant

The resumption of postponed or delayed vaccine will be ordered by an authorized physician or NP after recovery from above conditions or failed kidney transplant. The dosage and schedule will be defined by physician at time of resumption of order. Algorithm for Hepatitis B vaccination in hemodialysis is provided below:


New Dialysis Patients
Surface Antigen Positive (HBsAg+)
Surface Antigen Negative (HBsAg-)
Surface Antibody Positive (HbsAb titer >10 mIU/ml)
Surface Antibody Negative (HbsAb titer < 10mIu/ml)
Active
Consider treatment. No future screening is required
Dormant or Chronic State
Requires HBsAb confirmation
Monitor q6 month HBsAb if protection is still present >10 mIU/ml
Initiate IM Protocol
No future screening is required
HBsAb + (Positive)
HBsAb - (Negative)
No Vaccination is required. Monitor q6 month HBsAb
Initiate IM Protocol
Engerix -B 40mcg /dose 4 dose regimen
Repeat Surface Antibody Test 2 month after 4th dose
Surface Antibody Negative (HbsAb titer <10mIU/ml
Surface Antibody Positive HbsAb titer > 10mIU/ml
Initiate IM 40mcg Booster
Order Surface Antibody HbsAb titer 2 month after booster
If positive Surface Antibody
Monitor q6 month HBsAB
Surface Antibody Negative (HbsAb titer <10mIU/ml
Initiate ID Protocol q2 weeks for 13 doses (0.5mcg/dose)
Surface Antibody Test Immediate after 13th dose
If Surface Antibody Negative
Initiate ID Protocol q2 weeks for 6 doses (0.5mcg/dose)
If Surface Antibody Negative
Patient may never convert. (10% of population) Continue to monitor q6 month

Peritoneal Dialysis

Home Peritoneal Dialysis Unit (HPDU)

(HPDU) 12ES, ext 14-5672

Open Monday to Friday 0800 to 1600.

After hours on call RN (Mon-Fri 1600-2300), pager (416) 715-1326 or through locating

14-3155.

For PD training, clinics and out pt PD issues.

Ordering Peritoneal Dialysis

- Use orders as appropriate to the type of PD (see Peritoneal Dialysis Prescriptions section)
- TGH, PMH, MSH: For ER or inpatients, call ext 14-5330 or pager (416) 715-9232 to notify PD nurse that the patient will need PD.
- Acute cycler dialysis may be done at TGH emergency department for fluid volume overload, hyperkalemia or any situation requiring frequent PD exchanges. Cycler and CAPD available.
- TWH: for ER or In Patients, discuss with the nurse manager/charge nurse on 8BF 13-5167 ALL patients starting PD must have Hgb, Cr, Urea, bicarbonate, Ca++, PO_4, albumin, PTH done PRIOR to first dialysis. (Ontario Renal Reporting System guideline)

Medical Coverage

Monday to Friday Daytime

The home dialysis resident is expected to see IPD patients by noon each day to assess pts, address concerns, and write orders. An admission note and PD orders are to be written for all new PD patients in HPDU to include TW, med, and diet, and weekly progress note.

The nephrology trainee should determine a morning and afternoon check-in time with HPDU and allow at least one hour each visit to discuss with the HPDU charge nurse the training patients' concerns, drop-in pts and peritonitis review. Outside of the designated visit times, the nurses will page the renal nephrology trainee for urgent or unexpected needs.

After Hours and Statutory Holidays

Coverage for statutory holidays and after hours is by the **TWH fellow on-call**. The fellow is to be available for the HPDU nurse on call and to see drop-in patients. He/she should come by at the beginning of the shift before going to TWH to check in with the staff in the HPDU.

Responsibilities of the Nephrology Trainee

HPDU

- **IPD patients.** Assess each patient on IPD by noon. Target weight, dialysis treatment, lab results and meds should be reviewed. Check patient schedule at HPDU reception desk.
  On the patients' first IPD session, outpatient admission orders should be written. These orders should include target weight, frequency and volume of exchanges, medications, investigations, insulin orders for diabetics, etc.
- A clinical note should be written **once weekly** for each patient.
- **Phone calls:** During the day the nurse receives and triages all phone problems and calls the nephrology trainee as needed for advice. As much as possible, she will wait for the designated time for the nephrology trainee to visit the unit to assess the issues. After hours, the on call nurse is required to call the nephrology trainee on call when medical advice and/or a doctor's order are needed.
- **Peritonitis:** The office nurse monitors each case of peritonitis and assesses the patients' symptoms and medications. Cases are reviewed daily with MD.
- **Lab-Data Review:** The PD nephrology trainee should review all lab data and reports as advised by the charge nurse.

- **Drop-Ins:** Some drop-ins are expected and patients are advised to arrive at the time the nephrology trainee is expected to come to HPDU. For urgent drop-ins, the nurse may call the nephrology trainee to assess the patient.
- **Training Patients:** Each diabetic requires assessment and orders written during the first training day. Non-diabetic patients can wait until the second training day unless the training nurse has concerns. Training patients should be assessed every few days by the PD nephrology trainee while in training or more often as assessed by the triaging nurse. Patients scheduled for training require orders.

Unit Routines

Baseline "admission" bloodwork is automatically done when a new PD patient enters the program. This is usually done during the IPD period, or on the first training day in HPDU. Other "routine" blood work is performed at each clinic visit (every 4-8 weeks), while some blood tests are performed every 3 or 6 months. Other baseline investigations include:

- Abdominal ultrasound
- Chest X-Ray
- 2D Echo
- ECG

These tests are typically carried out prior to the first clinic appointment post Home PD training. Patients who request transplant referral are seen by the HPDU ward clerk, to begin the baseline workup tests and make an appointment at the Transplant Assessment Office.

Writing Orders

All changes in therapy including the dialysis prescription, new medications and diagnostic tests should be written in the order section to inform everyone what has been done for the patient (i.e. even when a verbal order has been carried out). Diagnostic tests and bloodwork should be entered in Electronic Patient Record (EPR). A progress note should be written whenever there is any new prescription or significant intercurrent illness. New medications or changes in meds are recorded in the medication sheet by the primary nurse or nurse transcribing the order. Leave the yellow copy of all prescriptions with the chart for filing.

Patients Requiring Referral to Another Service

When you make an elective referral to a consult you must send a written referral letter (this is a legal requirement) detailing the problem to be assessed. Peritoneal Dialysis Systems and Connectology

Peritoneal Dialysis Connectology

Peritoneal Dialysis Transfer Set

A PD transfer set/catheter adapter remains connected to the end of the PD catheter to allow the connection of dialysate bags and Cycler tubing. A PD nurse changes this transfer set/catheter adaptor approximately every six months.

The training nurse will determine the best connectology for each patient during training – considering the patient's abilities/disabilities, comfort/discomfort with pulsatile inflow, and individual needs.

Automated Peritoneal Dialysis (APD) Systems

Systems that utilize a cycler machine to do IPD, CCPD, E-CCPD, and NIPD.

The Home Choice® is the Baxter cycler that delivers Dianeal® solution. This cycler has a pump with a speed of 200 mL per minute.

The FreedomCycler/Newton Cycler® is the Fresenius cycler that delivers Delflex® solution. These cyclers work by gravity.

At UHN, the majority of our patients use the Baxter system.

Continuous Ambulatory Peritoneal Dialysis Systems

Systems that use a manual bag and gravity to do CAPD exchanges. Manual bags are composed of a fill bag with dialysate and a drain bag incorporated in a sterile system. At the end of the exchange the catheter is capped. For home CAPD, our patients generally use either the Twinbag® system by Baxter or the Premier Plus/Stay Safe® system by Fresenius, although there are a variety of others on the market.

Manual System

A Manual system is used for inpatients to do flushes to assess inflow and outflow times and for PD in the ICU. Comes with“Y” tubing and a drip chamber.

Peritoneal Dialysis Prescriptions

For all PD prescriptions, volume & frequency of exchanges, additives and Target Weight (TW) need to be ordered. Specify the TW as “full” or “drained” weight. “Target weight (full)” includes the instilled volume of fluid. An “exchange” includes the fill, dwell and drain time of a specified volume. Individual patient prescriptions and documentation are available from HPDU 12 ES (ext 14-5672) daily from 0800 to 1545.

CAPD (Continuous Ambulatory Peritoneal Dialysis)

AM I___I___I___I_____ PM

- 4 – 5 exchanges/ day with long dwell overnight.
- Dwell times average 4 – 6 hours during day and 8 – 10 hours overnight.
- TW includes the volume of the exchange.
- Patients with diabetes require an order for the frequency of blood glucose monitoring. This usually coincides with PD exchanges but may be less frequent in stable patients.

Sample Prescription of CAPD:

CAPD : 2 litre volume QID, Target weight 68.0 kg (full)

CCPD (Continuous Cyclic Peritoneal Dialysis) and E-CCPD* (Enhanced CCPD)

AMI____(I)*____I_I_I_I_I_I_ PM

- 3 – 5 exchanges/ night with long day dwell. Exchanges are delivered overnight utilizing a machine with last fill exchange of >500 mLs. The last fill is left indwelling during the day for 12 – 16 hours. Patient reconnects to machine at night to drain and resume overnight exchanges.
- *Enhanced CCPD (E-CCPD) is similar to CCPD except the patient does a day time exchange(s) to interrupt the long day dwell (i.e. fluid exchanged manually at 1400 or at most convenient time)
- Overnight exchange volume and day volume may differ. If patient has back pain/hernia, he/she may tolerate larger exchange volume at night with smaller volume during day.
- TW includes the volume of day exchange.

- Patients with diabetes require an order for the frequency of blood glucose monitoring. Patients new to CCPD should check BG's 5 x daily (recommended at 0800,1200,1800,2200 and 0200).
- Patients with diabetes are generally managed with 2 doses of SC insulin, one prior to dialysis on the night cycler and one in the morning post dialysis. The patient may require the larger dose at night.

Sample Prescription CCPD

Total Volume: 10 litres (4 exchanges of 2 litre volume overnight plus last fill of 2 litres)

Therapy Time: 9 hours

Sample Prescription E-CCPD *

Total Volume: 12 litres (4 exchanges of 2 litre volume overnight plus last fill of 2 litres + midday exchange of 2 litres)

Therapy Time: 9 hours

Exchange volume: 2 litres
Target weight: 70 kg (full)

NIPD (Nocturnal Intermittent Peritoneal Dialysis)

AM_____I_I_I_I_I_I_ PM

- Frequent exchanges/ night with <500mL day dwell.
- While it is preferable to have a day dwell, the dry day may be used for patients who do not tolerate day exchanges (i.e. back pain/hernia, recent abdominal surgery or increased fluid absorption)
  Target weight is generally an empty weight unless patient has a small day dwell.
  Patients with diabetes require an order for the frequency of blood glucose monitoring. Patients new to NIPD should check BG's 5 x daily (recommended at 0800,1200,1800,2200 and 0200
  Patients with diabetes are generally managed with 2 doses of SC insulin, one prior to dialysis on the night cycler and one in the morning post dialysis. The patient may require the larger dose at night.

Sample Prescription NIPD
Total Volume: 8 litres (4 exchanges of 2 litre volume overnight no last fill)
Therapy Time: 9 hours

IPD (Intermittent Peritoneal Dialysis)

AMI_I_I_I_I_I_I_I_I_I_I_I_I_ PM

- Rapid exchanges delivered over 12 - 20 hours 2 – 3x per week.
- Used post-op PD catheter implantation, post hernia repair and for rapid fluid removal.
- New catheters use low volume and gradually increase over 1-2 weeks.
- Established catheters use volume tolerated by patient.

- Provides dialysis in supine position and reduces risk of leak.
- Generally weighed empty as off dialysis between treatments
- Patients with diabetes should continue oral hypoglycemic or Subcut insulin, and if in hospital, sliding scale insulin should be ordered.
- Capillary blood glucose monitoring q bag set change (usually every 4-5 hr)

Sample Prescription IPD

Outpatient: 8 litres over 6 hours

Inpatient: may increase volume and treatment time based order (i.e. 16 liters over 12 hours)

Exchange volume: 2.0 litres (may range from 750mL to 2.5 litres) *don't use hypertonic dialysate**

Target weight: 45 kg (empty)*Hypertonic solution can remove more water than sodium, leaving patient hypernatremic at end of session; however, if patients require fluid removal, clinical judgement should be used in determining appropriate bag selection.

University Health Network

Toronto General Hospital | Toronto Western Hospital | Princess Margaret Hospital

Doctor's Order Sheet

Nephrology Program

Peritoneal Dialysis (PD) Orders

Addressograph

PLEASE USE BLACK OR BLUE BALLPOINT PEN, PRESS FIRMLY

ALLERGIES:
NO KNOWN ALLERGIES ☐
KNOWN ALLERGIES (Specify) ☐

PHYSICIAN'S ORDER AND SIGNATURE	SIGNATURE(S) AND POSITION	ACTION TAKEN	PHARMACY

(Please check ☑ appropriate box(es) and complete as required)

1. MONITORING:

Target Weight:_____ kg ❒ Full ❒ Empty
Weights: _____(specify frequency)
Notify MD if patient has abdominal pain or cloudy effluent or exit site has new redness, swelling, pain or exudate

2. TREATMENTS:

❒ **Automated Peritoneal Dialysis (APD) – using Home Choice Cycler**
- ❒ Continuous Cyclic Peritoneal Dialysis (CCPD) (night cycler treatment includes a day dwell)
- ❒ Enhanced automated cycler (eCCPD) (night cycler treatment includes a day dwell AND an additional midday twin bag™ exchange)
- ❒ Night Intermittent Peritoneal Dialysis (NIPD) (night cycler but no day dwell)
- ❒ Tidal (order on routine MD orders sheet indicating tidal % and daily ultra-filtration (UF) requirements)
- ❒ Intermittent Peritoneal Dialysis (IPD) (acute cycler management during the day only)

Cycler Programmed Total Volume _____litres (overnight + last fill)
Overnight exchanges _____(number) X _____ (fluid volume) L
Therapy time: provide _____ hours overnight
- ❒ % Strengths:_____

Cycler Last Fill Volume:_____ L (day dwell) (included in cycler programming)
Cycler Last Fill
- ❒ % Strength:_____

OR
- ❒ Icodextrin (7.5%)

OR
- ❒ Nutrineal (Amino Acid)
- ❒ **Twin Bag™ Day Exchange with APD** (if clinically indicated) at 1400 hrs or _____ (time)
- ❒ % Strength:_____ Volume:_____

OR
- ❒ Icodextrin (7.5%)

OR
- ❒ Nutrineal (Amino Acid)

❒ **Twin Bag™ Day Exchanges: Continuous Ambulatory Peritoneal Dialysis (CAPD)**
Number of Exchanges:_____per 24 hours
Volume: _____ L (day bags)
Volume:_____ L (night bag- if different)
- ❒ % Strength:_____
- ❒ Icodextrin (7.5%) as night-time bag
- ❒ Nutrineal (Amino Acid) one exchange per day (same time as large meal)

Note: this may change as required – order changes on routine Dr's Order Sheets

D6616

PLEASE USE BLACK OR BLUE BALLPOINT PEN, PRESS FIRMLY	**ALLERGIES:** NO KNOWN ALLERGIES ☐ KNOWN ALLERGIES (Specify) ☐			
	PHYSICIAN'S ORDER AND SIGNATURE	SIGNATURE(S) AND POSITION	ACTION TAKEN	PHARMACY

(Please check ☑ appropriate box(es) and complete as required

Peritoneal Dialysis On HOLD

❒ Hold PD and provide peritoneal flush q _____ week(s) with _____ L of dialysate then lock with 5 mL Heparin (5000 units). PD catheter exit site care with each flush and prn.

For Diagnostic Tests and Procedures:
Drain prn and then refill with last dwell or provide next exchange as clinically indicated

PD Catheter Exit Site Care

❒ Twice weekly and as needed
OR
❒ _____(specify frequency)

Start PD Catheter Exit Site Care as per Infected Exit Site Protocol as required

Infected Exit Site Care Protocol
Level 1 – new redness, swelling, pain, or crust: increase to daily dressing change
Level 2 – minimal exudate: use mesalt gauze instead of gauze daily
Level 3 – moderate exudate: after soap wash cleanse with 3% Hydrogen Peroxide then wrap 3% Hydrogen Peroxide soaked gauze around catheter for 5 minutes. Use Mesalt gauze instead of gauze daily
Level 4 – large amount exudate: follow level 3 procedure BID
Level 5 – copious amount exudate: follow level 3 procedure TID

3. LABORATORY TESTS: (Ordered in EPR)

a) Exit Site Swab for C&S prn if exudate is present
b) Cell count & C&S of effluent prn if hazy or cloudy; or to assess peritonitis (effluent must dwell at least 2 hours - ideally 4 hours)
c) **Peritonitis:**
- ❒ Daily Cell Count of effluent x 5 days and then reassess
- ❒ Daily C&S of effluent x 5 days and then reassess

4. MEDICATIONS:

❒ Mupirocin Ointment 2% apply to peritoneal dialysis catheter exit site with each dressing change
OR
❒ Other:_____

For fibrin: Heparin 500 units per litre of peritoneal dialysate for all exchanges as needed
For peritonitis: Heparin 1000 units per litre of peritoneal dialysate for all exchanges until effluent clear
❒ KCL _____ mEq per litre of peritoneal dialysate for all exchanges (max 10 mEq/L)
❒ _____
❒ _____

Physician's Signature:_____ Date: _____/_____/_____ Time:_____
dd mm yy

Tidal Volume

Tidal volume PD refers to a method originally developed to increase dialysis efficiency, but in exceptional circumstances, may also be helpful to relieve “dry pain” between exchanges on a cycler. A certain percent of fluid (residual volume) is left in the abdomen between exchanges, thus the remaining amount to be exchanged is ordered as “% Tidal volume.” Need to order the tidal percentage, the UF volume and complete (“full”) drain frequency.

To program “Tidal” the following parameters must be ordered:

The **tidal percentage** of the total exchange volume to be left dwelling (i.e. an 80% tidal leaves 20% of the fill volume dwelling). For a 2 L exchange volume, a tidal volume of 400 mL will remain dwelling.

The **UF/ultrafiltration** = the total volume of fluid you wish to remove from the patient (the cycler will divide this by the number of exchanges and attempt to remove that volume with each exchange) (i.e. UF 1 litre over 4 exchanges = 250 mL each exchange)

Full Drains: because UF volumes are programmed but dependant on patient physiology it is an estimated volume only and patients risk retaining fluid in their peritoneal cavities. The cycler will provide a “full” drain for the last exchange to remove any accumulated excess, however an extra “full” drain can also be ordered mid-treatment by ordering “*full drains every X exchanges”* (remembering that the Initial Drain counts as the first drain volume.)

Sample Orders

Total Volume = 10 litres over 10 hours, 4 overnight exchanges

Exchange Volume = 2 litres

Last Fill Volume = 2 litres

Use 1.5% overnight; and icodextrin for last fill

Tidal Volume = 80%

Ultrafiltration requested = 1 litre

Full drains: no full drains
(The machine will adjust to allow for the tidal volume, the first exchange will be
2000 mL, the second and third will be 1600 mL)

Peritoneal Dialysis Solutions

Standard Solutions

- Glucose concentrations: 0.5%, 1.5%, 2.5% and 4.25%. Osmolality increases with the increases in glucose concentration. Dianeal® and Delflex® are glucose-based solutions.
- Calcium concentration: standard ("PD101" 1.62 mmol/L) and low calcium ("PD4" 1.25 mmol/L). Note: Most patients use low Ca+ concentration bags with the Luer-lock connections. The exception is post parathyroidectomy in which patients use standard Ca+ bags with the spike connections. PD101 solutions can be ordered, but may take 1-2 days to be delivered to the unit. During the interim, consider dialyzing with PD4 solutions and increasing the patient's oral Ca intake.

- Volume: 1.5L, 2L, 2.5L, 3L, 5L. Not all solutions are available in all volumes.

Specialty Solutions

- **Nutrineal®** : An amino acid based solution used for patients with malnutrition secondary to poor oral intake. Recommend for one 6-hour exchange during the day coinciding with a meal. Consider Nutrineal® equivalent to 1.5% dextrose solution for insulin dosing, although there is no glucose in this solution, thus monitor insulin requirements carefully

- **Extraneal®** (Icodextrin): A glucose polymer (7.5% solution) based solution that metabolizes to maltose, for patients with ultrafiltration problems. Recommended for one 8 to 12-hour dwell per day. Consider Extraneal® equivalent to 2.5% dextrose solution for insulin dosing, although there is no glucose in this solution, therefore monitor insulin requirements carefully*. There is also a risk of allergic skin reactions with Extraneal® so patients should be advised. Additionally, Extraneal® should be avoided in those allergic to corn or cornstarch

  *NOTE: UHN uses a blood glucose meter device which is compatible with icodextrin (the current meter is the NOVA). Alert: some meters are not compatible (maltose is read as glucose) and there is a risk of hypoglycemia if the blood glucose is measured using a device that does not differentiate maltose from glucose.

ALERT
If using Extraneal only use specific brands of glucose monitoring machines as others will give false high readings. Continue to use for 2 weeks after stopping Extraneal® as the maltose continues to be present for 10-14 days.

• Physioneal®: A pH - neutral solution for patients with intractible abdominal pain after all other options have failed (i.e. trying tidal volume, analgesics, or adding xylocaine). For these individuals, it is used in lieu of other solutions for all PD exchanges.

• Extraneal®, Nutrineal® and Physioneal® are only available from Baxter. If patients using another system require these solutions, they should convert to Baxter or use a universal adaptor.

Intraperitoneal (IP) Medications

Antibiotics

See Peritonitis Guidelines (in Peritoneal Dialysis Section)

Wet Contamination:

Defined as an open or unclamped system with the potential for organisms to enter the peritoneal cavity.

For pts < 50 kg: cefazolin (Cefazolin®) 1 g IP for 6 hr dwell x 1 dose.

For pts > 50 kg: cefazolin 1.5 g IP for 6-hour dwell x 1 dose.

If allergic to Cefazolin, use Vancomycin 1 g IP for 6 hr dwell x 1 dose.

Dry Contamination:

Dry contamination is defined as a clamped system with no risk of bacterial entry into the peritoneal cavity. This can occur when the clamp is closed on the transfer set but the end of the transfer set is touched. The minicap should be replaced for at least five minutes prior to continuing with the procedure.

Antibiotics are not required.

Reference: HPDU Patient Manual

Heparin

- Indicated if fibrin is present in bags, for slow drainage and for hemoperitoneum. Used in each exchange for 24 hours and reassessed.
- Used routinely for outpatients coming for IPD treatment
- Use in inpatients by clinical judgement
- Indicated for peritonitis management
  Dose (Non-peritonitis): 500 units/L

  Dose (Peritonitis): 1000 units/L until effluent clears

Erythromycin

- Indicated for gastroparesis - 200 mg IP in one bag daily

Sodium Bicarbonate
For abdominal pain or cramps felt to be related to pH of dialysate

*Note: Bicarb should be added immediately before infused

CAPD Dose: $NaHCO_3$ 8.4% (1 mEq/mL) add 5 mL per L of dialysate

IPD Dose: $NaHCO_3$ 8.4% (1 mEq/mL) add 10 mL per L of dialysate

Metoclopramide (Maxeran)
5 mg/L IP for control of nausea or gastroparesis if oral route not beneficial.

Potassium Chloride

- 2 - 4 mmol/L for hypokalemic patients in-hospital (this level will limit removal of serum K, but will not supplement potassium)
- For severe hypokalemia, can use maximum dose of 10 mmol/L
- Oral supplementation preferred for patients on home dialysis
- For inpatients, if predialysis K< 3.0 mmol/L or if dialysis is to be prolonged (>12 hours), KCL should be added to supplement.
- IP KCl not usually added for CAPD unless in hospital and oral supplements and diet not sufficient.
- Please note, KCl must be ordered each day to be dispensed from the Pharmacy. It comes in mini bags 20mmol/50mL.

Xylocaine without Epinephrine

- Indicated for abdominal cramps or pain only after investigations support that the pain is related to dialysate solution. (i.e. avoid risk of masking pain related to other causes). Not indicated if source of pain is unknown.
  Dose: 1.25 - 5.0 mL/L of 1% or 2% Xylocaine.

Tissue Plasminogen Activator (tPA) – Alteplase (Cathflo®)

- tPA is a fibrinolytic agent that is used for one-way or two-way obstruction (poor or no inflow/outflow) when it is suspected that a thrombus is attached to or occludes the PD catheter.
- tPA is dispensed from Pharmacy in powdered form.
- After reconstitution, instill 4.6 mL, dwell for 2 hours.
- Although experience is somewhat limited, results achieved for both obstruction and peritonitis have been fair.

Insulin Therapy in IPD

- Generally, if pt on s/c insulin, continue the SC dose for both dialysis and non-dialysis days.
- If in hospital, Sliding Scale SC insulin should be ordered, and glucose monitored throughout IPD, every 4 hours.

Insulin Therapy in CCPD

- Pts on CCPD receive subcutaneous insulin twice daily.
- If CCPD is discontinued, adjust dose as glucose load from dialysate no longer received.

Peritoneal Catheter Insertion

2 options (laparoscopic, bedside)

The PD catheter access coordinator, Zita Abreu, ext 14-2358 to be contacted whenever a PD catheter needs to be inserted, removed or manipulated.

Laparoscopic PD Catheter Insertions
Abdominal, upper abdominal & pre-sternal options available at UHN.

Dr. Todd Penner (416)603-5800 ext 6220

Performs laparoscopic PD catheter (Swan Neck, double cuffed coiled PD catheters used at UHN) insertions, removals, re-insertions, adhesion lysis and hernia repairs for PD patients in OR at TW. Referral required:

- For Out-patients, Zita will provide a Pre-Admission package - the pre-op history, physical examination form and the doctor's standing order sheet must be completed and returned to her.
- For In-patients, please write pre-op & post-op orders (see next page), NPO and orders for transportation to TWH POCU 2 hours pre-op. POCU is located on the 2nd floor of the Main Pavilion, Room 116 (ext 13-2111)

Pre-Op: Hold calcium and iron for 1 week pre-op, as well as ASA and anticoagulants (note: assess reason for anticoagulation; i.e., may need heparin reversal if on warfarin for mechanical valve).

A vigorous bowel preparation pre-catheter insertion is extremely important 1-litre Colyte x 2 days, clear fluids 24 hours before O.R. NPO after midnight. The surgeon gives IV cefazolin or vancomycin (if penicillin allergic) perioperatively.

Doctor's Order Sheet for laparoscopic Implantation of Peritoneal Dialysis Catheter

ALLERGIES NO KNOWN ALLERGIES ☐			
DATE AND TIME ORDERED	PHYSICIAN'S ORDER	a	SIGNATURE AND POSITION
	PRE IMPLANT PHASE 1. NPO after MN except for oral meds. 2. M.D. to assess insulin requirements for diabetic patient ☐Yes ☐No ☐ N/A 3. Hold oral hypoglycemics ☐ Yes ☐ No ☐ N/A 4. Chest X-Ray ☐ Yes ☐ No 5. ECG ☐ Yes ☐ No 6. CBC, urea, creatinine, lytes; PT,PTT; crossmatch for 2 units packed cells 7. Chlorhexidine scrub to abdomen x 3 ☐ Yes ☐ No 8. Bowel prep. a) Colyte _____ b) Other, specify _____ 9. Start I.V. _____ 10. Give _____gm. Cefazolin immediately pre-op (to be given by anaesthetist) 11. If patient is allergic to Cefazolin, give _____gm. Vancomycin 2 hrs pre-op over 1 hour.		
	POST IMPLANT PHASE 1. Flush with 1L volumes of 1.5% dialysis solution in and out x 3 exchanges or until effluent clears. 2. Infuse _____ units heparin and cap catheter. 3. Flat plate of abdomen. 4. Ensure immobilizing dressing is in place. Do not change dressing for _____ days unless heavy bleeding occurs. 5. If Cefazolin or Vancomycin not given pre-implant, M.D. to assess antibiotic requirements post-implant. _____ _____ Physicians Signature Date		

Post-Op: Colyte 250 mL every day x 3 days post-op, then start Senokot 1 tablet 2 x a day.

In-patients: PD catheters are flushed post-op at the clinical judgement of the MD or NP (i.e. assess frequency - daily, alternate days, at a minimum weekly), with 2-4 exchanges of 1 L Dianeal 1.5% with 500 u heparin/ L. Flushes are done with patient on left side, right side and supine. If effluent remains bloody after initial flushes, do additional flushes until the effluent clears.

Out patients: PD catheters are not normally flushed post-op, but are flushed weekly for 3 weeks until PD training starting. Flushes and PD training is arranged by Zita.

In a well-functioning catheter, a 1 L inflow should take ~ 5 minutes and outflow should take ~10 minutes regardless of pt's position. It is essential that the pt planning for APD should have good outflow when lying down.

If a pt urgently requires dialysis, **STRICT SUPINE** IPD may be started with small volume exchanges of 750 – 1000 mL, and then volume gradually increased over a 2-3week period to 2 L.

Inpatients generally receive IPD 20 hours 2 x/week if dialysis is required. Outpatient IPD is 6 hours 3 x/week depending on available spots. Pts need a minimum of 2 weeks before PD training starts, and should be instructed to refrain from strenuous activity/lifting and from getting the catheter site wet until training.

Bedside PD Catheter Insertions

Dr. Rory McQuillan, c: (416)340-5617

Dr. McQuillan places bedside peritoneal catheters in patients who are appropriate for this approach. (i.e. no previous midline surgeries, BMI within normal limits, able to lay flat for approx. 1 hour).

Pre-insertion Orders:

Medical Orders for Bedside Peritoneal Dialysis Catheter Insertion

Allergies:

- Must do
    - Optional, MD/NP please check as appropriate
- **Bowel Preparation:**
    - Hold Calcium and Oral Iron for one week prior to catheter insertion
    - Colyte 1L x 3 days prior to PD catheter insertion.
    - Patient may have a light supper the night before the PD catheter insertion. **Nothing to eat or drink after midnight**
- **Medication Instruction:**
    - The day of catheter insertion, instruct the patient to take their usual morning medications with a sip of water and to bring any other medications needed for the remainder of the day.

1. Diabetic Instructions:

- All diabetic patients are to have capillary glucose measure immediately prior to the procedure.

Instructions for Type I diabetics:

- If on PM **INSULIN LONG-ACTING**, take 2/3 of the usual dosage the night before procedure.
- HOLD **INSULIN SHORT-ACTING** the morning of procedure.
- Take 2/3 of the usual dosage of INSULIN LONG-ACTING the morning of procedure.
- Other _____

Instructions for Type II diabetics:

- If on PM **INSULIN LONG-ACTING**, take 2/3 of the usual dosage the night before procedure.
- HOLD oral **HYPERGLYCEMIC** drugs the morning of procedure and re-start once eating post procedure.
- HOLD **INSULIN** the morning of procedure and give usual morning dose once eating post-procedure.
- Other _____

2. Anticoagulant and Antiplatelet Instructions:

- HOLD **WARFARIN** (Coumadin) for 5 days prior to procedure. Restart the day after catheter insertion.
- HOLD **ANTIPLATELET** drugs (i.e. **ASA, CLOPIDOGREL, DIPYRIDAMOLE, PRASUGREL**) for 7 days prior to the procedure. Restart the day after catheter insertion.
- HOLD **LOW MOLECULAR WEIGHT HEPARIN** (i.e. **ENOXAPRARIN, DALTEPARIN**) for 48 hours prior to procedure. Restart the day after catheter insertion.

- Check INR the week of insertion and PRN
- Other

_____

- **Skin Preparation:** Instruct patient to wash well (shower) the night before PD catheter insertion.
- **Antibiotic prophylaxis: (select one)**
  - **CEFAZOLIN** 1 g IV x 1 dose 60 minutes before catheter insertion.
  - **VANCOMYCIN** 1 g IV x 1 dose 60 minutes before catheter insertion.

Post-insertion Orders:

NOTE: Patients with catheters inserted at the bedside are at greater risk of catheter malfunction due to constipation. Please ensure post-insertion bowel routine is strictly adhered to.

The patient is also at higher risk of exit site leak if strict supine PD is not adhered to prior to the 2-3 week healing period.

Post-Op: Colyte 250 mL every day x 3 days post-op, then start Senokot 1 tablet 2 x a day.

In-patients: PD catheters are flushed post-op at the clinical judgement of the MD or NP (i.e. assess frequency - daily, alternate days, at a minimum weekly), with 2-4 exchanges of 1 L Dianeal 1.5% with 500 u heparin/ L. Flushes are done with patient on left side, right side and supine. If effluent remains bloody after initial flushes, do additional flushes until the effluent clears.

Out patients: PD catheters are not normally flushed post-op, but are flushed weekly for 3 weeks until PD training starting. Flushes and PD training is arranged by Zita.

In a well-functioning catheter, a 1 L inflow should take ~ 5 minutes and outflow should take ~10 minutes regardless of pt's position. It is essential that the pt planning for APD should have good outflow when lying down.

If a pt urgently requires dialysis, **STRICT SUPINE** IPD may be started with small volume exchanges of 750 – 1000 mL, and then volume gradually increased over a 2 to 3 week period to 2 L.

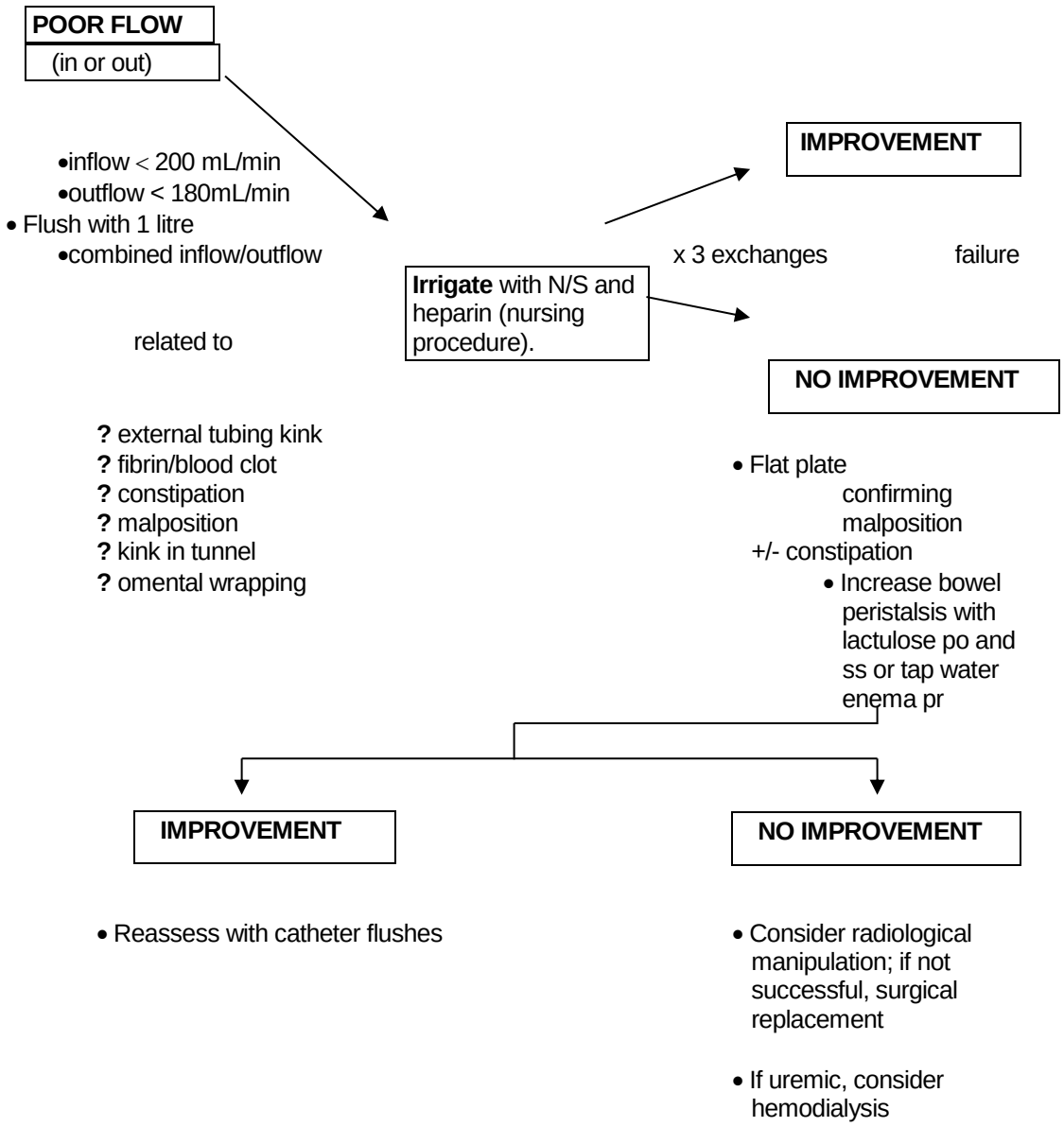
Inpatients generally receive IPD 20 hours 2 x/week if dialysis is required. Outpatient IPD is 6 hours 3 x/week depending on available spots. Pts need a minimum of 2 weeks before PD training starts, and should be instructed to refrain from strenuous activity/lifting and from getting the catheter site wet until training

Urgent PD Catheter Removals

- For in-patients who need "urgent" catheter removals, call general surgery on call. Advise Zita ext 14-2358
- Non-urgent catheter removals may be booked through Zita ext 14-2358
- **NOTE:** If patient received a bedside PD catheter insertion, Dr. McQuillan is able to remove the PD catheter at the bedside.

The PD catheter access coordinator, Zita Abreu, ext 14-2358 to be contacted whenever a PD catheter needs to be inserted or removed, or if a PD patient requires an urgent or elective transfer to Hemodialysis.

Post- Op Catheter Complications



Management of PD Leaks

Exit Site Leak

These may occur during the first weeks following catheter implantation. For patients at risk for exit site leak post op (i.e. immunosuppressed, diabetic, frail, obese or very thin), PD should be avoided. If the patient requires dialysis, small volume IPD (750 mL) should be administered cautiously. Staff should ensure the patient is completely empty at the conclusion of the flushes or IPD session. If leak does occur, Home PD should be delayed a further 2-3 weeks, and the patient may need to be supported with HD temporarily.

Late exit site leak is less common and may be related to accidental pulling on the catheter. Home PD may have to be interrupted and the patient scheduled for 2 -3 weeks IPD until the problem resolves.

Intra-Abdominal Leak/Hernia

Occasionally PD fluid may leak internally and present with swelling in the genitalia or abdominal tissues. Patients may present with evidence of hernia. In these cases, it may be necessary to do a CT Scan (see section on Antibiotic Prophylaxis and Procedure Prep for PD Patients), and possibly have a Surgical consult and temporarily hold Home PD.

When surgical repair is indicated, or until the leak resolves on its own, the patient is usually maintained on IPD because intra-abdominal pressure is lower on IPD, which decreases risk of further leak. When Home PD is resumed, dialysis volumes are usually decreased, and then very gradually increased. Some patients on cyclers may be able to continue dialysis at home by reducing volumes and remaining dry during the day. If patients on CAPD undergo more than one hernia repair and develop a subsequent hernia, it is usually recommended that the patient change to an APD regimen with lower abdominal pressure.

Hydrothorax / Pleuroperitoneal Leak

This is a rare complication which involves leakage of PD fluid into the pleural space, caused by a communication between the peritoneal and pleural spaces. The patient may present with shortness of breath and diminishing PD drain volumes. Immediate treatment is drainage of PD fluid if there is respiratory embarrassment. Diagnosis includes CXR seen as a unilateral accumulation of fluid in the lung (more often the right lung). Thoracentesis may alleviate symptoms, and confirm the diagnosis by analysis of

the pleural fluid. The pleural fluid may be higher in glucose and lower in protein than serum, however if the fluid has been in the pleural space for a length of time, there may not be a significant difference. CT scan with contrast in the PD fluid (see section on Antibiotic Prophylaxis and Procedure Prep for PD Patients) will help to identify the location of the leak. Patients may require IPD or HD to allow for healing of the defect, but if not successful, sealing the defect with pleurodesis may be effective.

Peritonitis Guidelines

Peritonitis generally managed as outpatients unless severe or patients unable to manage at home. Diagnosis requires 2 of the following 3:

- abdominal pain
- cloudy dialysate fluid
- positive culture of dialysate fluid

A PD effluent cell count with WBC >250 cells/μL or >50% neutrophils with or without positive cultures in addition to the above symptoms is diagnostic for PD peritonitis. Patients are instructed to bring in the first cloudy bag. If not possible, drained dialysate from patient is sent for C&S, Gram stain, and cell count with differential.

Consider other causes of abdominal pain, i.e. constipation, pancreatitis, ischemic bowel, cholecystitis, hernia etc. Even if there is true peritonitis, consider "surgical causes" such as appendicitis (abdominal pain is localized rather than diffuse).

Initial Assessment

Clinical examination of abdomen for s/s of peritonitis and PD catheter exit site/tunnel; send exit site swab for C&S if drainage present.
For ER or admitted patients, contact PD Nurse on call (pager (416)715-9232). Enter order for specimen collection for C&S and count and write orders for bag change procedure to follow specimen collection and required medications, see management of peritonitis.
Send first dialysate effluent for C&S and gram stain and cell count with differential. If patient does not have indwelling effluent (IPD or NIPD) order to be filled with min 1L and allow to dwell for minimum 2 hrs before sending sample.

Gram stain can be helpful, i.e. if yeast, but continue empiric antibiotics until culture results available.

Blood for CBC, diff, lytes, Cr, urea, Ca, PO_4, albumin, total protein for In-pts or ER pts.

Management

Empiric antibiotic therapy – start immediately, do not wait for next scheduled PD exchange:

IF PATIENT HAS < 100 mL/day URINE
IF wt < 50 Kg, Cefazolin 1g in 1 exch/day plus Tobramycin 40 mg in 1 exch/day plus Heparin 1000 units/L in EACH exchange. Use heparin until effluent clear.

IF wt > 50 Kg, Cefazolin 1.5 g in 1 exch/day plus Tobramycin 60 mg in 1 exch/day plus Heparin 1000 units/L in EACH exchange. Use heparin until effluent clear.

IF PATIENT HAS > 100 mL/day URINE
IF wt < 50 Kg, Cefazolin 1g in 1 exch/day plus Ceftazidime 1 g in 1 exch/day plus Heparin 1000 units/L in EACH exchange. Use heparin until effluent clear.

IF wt > 50 Kg, Cefazolin 1.5 g in 1 exch/day plus Ceftazidime 1.5 g in 1 exch/day plus Heparin 1000 units/L in EACH exchange. Use heparin until effluent clear.

Note: For patients who are ***allergic to cefazolin,*** give vancomycin
If wt > 50 kg, Vancomycin 2 grams in 1 exch q 5 days if residual renal function, q 7 days if no residual renal function.

If wt < 50 kg, Vancomycin 1 gram in 1 exch q 5 days if residual renal function, q7days if no residual renal function.

If ***allergic to ceftazidime,*** give Tobramycin according to above.

Vancomycin is also to be used as initial therapy for those with known MRSA exit site infections, previous MRSA peritonitis, or those who have recently come from a unit with high incidence of MRSA.

When prescribing vancomycin in a patient who has >100 ml/day URINE, order vancomycin levels 3-4 days into therapy to ensure the frequency ordered is adequate.

Antibiotics must dwell intraperitoneally for at least 6 hours to allow adequate absorption of the antibiotic into systemic circulation. Generally, IP antibiotics can be given into one exchange per day, often in an overnight exchange, as it tends to dwell for a longer period of time. **The exception is Vancomycin, which must NEVER be given daily, but is ordered q 5 or q 7 days according to residual renal function (see above).

If a patient is in hospital, it is often easier to switch them to CAPD during treatment for peritonitis, to allow ease of specimen collection and antibiotic dosing. If the patient must remain on CCPD, antibiotics should be instilled into the last fill and allowed to dwell during the day.

- If fungal/yeast peritonitis, catheter to be removed ASAP, start pt on antifungal treatment and switched to HD for at least 8 weeks.
- Order additional intraperitoneal additives:
    - heparin 1000 u/L until effluent clears
    - individual requirements for KCl, insulin, metoclopramide etc.
- Order effluent for daily cell count until cell count ≤100 (q 2 days if out-patient). C&S daily until first "no growth"; then q 4 days until total of 3 "no growths". Note, in Electronic Patient Record (EPR), Go to "All Order Screens → Nephrology→ Other Common Tests → Dialysis →choose PD Effluent C&S or PD Effluent, cell count. Send full bag to CORE lab.
    - Hold calcium and iron supplements if peritonitis is severe (due to constipation).
    - For urgent catheter removal, call General Surgery on call. Notify Zita ext 14-2358
    - All treatment should be guided by antibiotic sensitivity of the causative organism (see Tables 4, 5, 6).

Nystatin 100,000 u/mL, give 5 mL PO QID swish and swallow for duration of peritonitis treatment, as prophylaxis against fungal peritonitis. Continue for 1-week post antibiotics.

PD peritonitis can be very painful, order appropriate analgesia.

Table 4. Culture and Sensitivity Follow-up

Culture results	***Continue or add***	***Discontinue***	***Frequency (F) and duration (D)***
No growth in 2-3 days	Cefazolin 1.5 g (1 g if <50 kg)	Discontinue Tobramycin/ ceftazidime	**F**: 1 exchange/DAY **D:** Continue for 2 weeks. Note: If no improvement in 5 days, consider cath removal, continue Cefazolin 2 g IV qHD when cath is out. Ask lab re. TB or yeast.
Gram Positive Coag Negative Staphylococcus (CoNS)	Cefazolin 1.5 g (1g if <50 kg)	Discontinue Tobramycin/ ceftazidime	**F**: 1 exchange/DAY **D**: Continue for 2 weeks
Gram Positive Methicillin Resistant Coag Negative Staphylococcus (MRSE)	Vancomycin 2g IP (1g if <50 kg)	Discontinue cefazolin and tobramycin/ceftazidime	**F:** 1 exchange/WEEK **D:** Continue for 3 weeks**.** NOTE: If residual renal function **(RRF),(i.e. urine >100 mL/24hr)** give: 1 exchange/ 5 days cont. for 3 weeks
Gram Positive Staphylococcus aureus	Cefazolin 1.5 g (1g if <50 kg) and consider rifampin 300 mg po BID *for the first week of therapy*	Discontinue tobramycin/ ceftazidime	**F:** 1 exchange/DAY **D:** Continue for 3 weeks

Gram Positive Methicillin resistant Staphylococcus aureus (MRSA)	Vancomycin 2g IP (1 g if < 50kg) PLUS rifampin 300 mg po BID *for the first 2 weeks of therapy*.	Discontinue cefazolin and tobramycin/ ceftazidime	**F:** 1 exchange/WEEK * **D:** Continue for 3 weeks ***NOTE:** If RRF (urine >100 mL/24hr) give Vancomycin in 1 exchange q 5 days and continue for 3 weeks.
Enterococci	Ampicillin 125 mg/L q exchange (If ampicillin resistant, may change to Vancomycin 2 g one exch q 7 days (1g if <50 kg) (q 5 days <u>if RRF</u>) Consider gentamicin 20 mg/L IP in one exchange for synergy.	Discontinue cephalosporins	**F:** Ampicillin EACH exchange, Tobramycin 1 exchange/DAY. Vancomycin 1 exch/WEEK. For VRE, consider quinupristin/ dalfopristin (Synercid) – Consult ID. **D**: Continue for 4 weeks
Streptococci (Gram +)	Cefazolin 1.5 g. OR Penicillin G 50,000 u /L loading dose then 25,000 u/L		**F:** Cefazolin 1 exch/day. OR Penicillin In each exchange **D**: Continue for 2 weeks
Gram Negative (e coli, Klebsiella, proteus, serratia)	Tobramycin 60 mg (40 mg if <50 kg) <u>if no RRF</u>, OR Ceftazidime 1.5 g (1g if <50 kg) <u>if RRF</u>	Discontinue cefazolin	**F**: 1 exchange/DAY **D**: Continue for 3 weeks
Polymicrobial	Tobramycin 60 mg (40 mg if <50 kg) <u>if no RRF</u> OR Ceftazidime 1.5 g (1g if <50 kg) AND Ampicillin 125 mg/L <u>if RRF</u>,	Discontinue cefazolin	**F**: Ampicillin in each exchange Tobramycin in 1 exchange/day **D:** Continue for 4 weeks. Continue 1 week post catheter removal, minimum treatment 4 weeks

	AND metronidazole 500 mg IV/po q8h *Get surgical consult*		If any organism is gram neg, consider bowel perforation.
Pseudomonas/ Stenotrophomonas	Use 2 antipseudomonal drugs Tobramycin 60 mg (40 mg if < 50 kg) <u>if no RRF</u>, OR Ceftazidime 1.5 g (1.g if <50 kg) if RRF AND Anti-pseudomonas or anti-stenotrophomonas (see Table 2 or 3). May use oral quinolone plus alternate.	Discontinue cefazolin	**F**: 1 exchange/day **D:** Continue for 4 weeks if cath is in, or for 2 weeks following cath removal. Catheter removal if concurrent exit site or tunnel infection with the same organism.
Fungal / Yeast	While catheter is STILL IN: fluconazole 200 mg in 1 bag **IP** (dwell x 8 hr) q48h <u>OR</u> amphotericin B 0.5-1.0 mg/kg mg **IV** q24h. If >1 mg/kg needed, contact ID. OR itraconazole 100 mg po q12h. *Arrange for urgent PD catheter removal*.	Discontinue cefazolin and tobramycin/ ceftazidime	When catheter is OUT and patient is on HD: fluconazole 200 mg po daily for additional 2 weeks OR itraconazole 100 mg po q12h for 2 weeks.
Mycobacteria	Rifampin (RIF) 600 mg po daily, Isoniazid (INH) 300 mg po daily. Pyrazinamide (PZA) 1.5 g po daily. Pyridoxine 100 mg po/day to avoid INH induced neurotoxicity. Monitor LFT's. (NOTE:		**D:** Rifampicin and isoniazid 12 mo. Pyrazinamide 3 mo. Arrange for Catheter removal

	Do not use ethambutol except under unusual circumstances because of the risk of ocular toxicity) Consult ID re sensitivities		
All organisms	Nystatin 500,000 u = 5 mL swish and swallow qid for duration of peritonitis treatment plus one week, as prophylaxis against fungal peritonitis.		**F:** qid **D:** Continue for one week after cessation of antibiotics.

Table 5. Antibiotics with anti-pseudomonas activity

Antibiotic	*Dosage/administration*
Ceftazidime	125 mg/L IP IN EACH exchange
Piperacillin-Tazobactam	3.375 g IV q12h
Ciprofloxacin	500 mg po BID
Cefepime	1gm IP in 1 exchange per day

Table 6. Antibiotic with anti-stenotrophomonas activity

Antibiotic	*Dosage/administration*
Trimethoprim / sulfamethoxazole	Loading dose: 320 mg/ 1600 mg (20 mL) IP Maintenance dose: 40 mg/ 200 mg (2.5 mL) IP in one exchange per day

Oral Therapy for PD Peritonitis: ***Based on culture and sensitivity***
When oral antibiotics are given, consider holding all phosphate binders (e.g. calcium carbonate, aluminum hydroxide) and iron supplements.

NOTE: Oral therapy should NOT be considered for initial therapy

Ciprofloxacin 500 mg po BID OR Co-trimoxazole 1 DS tab po daily

OR

Cephalexin 250 mg po TID AND Rifampin 600 mg po daily

Refractory Peritonitis

- If no decrease in cell counts in 3 days or if count fell initially and then increased, repeat culture and consider possibility of secondary peritonitis due to ischemic bowel, cholecystitis diverticulitis or appendicitis
- Refractory peritonitis is defined as failure to respond to appropriate antibiotics within 5 days.
- Consider temporary discontinuation of PD - arrange for temp HD
- Consider conversion to IPD, if suspected microperforation of bowel. IPD allows bowel to rest between treatments.

Catheter removal - required for virtually all fungal peritonitis, and for serious refractory bacterial peritonitis. For in-patients who need "urgent" catheter removals, call general surgery on call (if called on Friday will most likely be removed on Saturday). Advise Zita ext 14-2358

- Notify HD unit, and arrange U/C line for hemodialysis through Vascular Access Co-ordinator or Angio.
- If UF failure with peritonitis (weight gain/ECFV overload), alter regimen (i.e. shorten dwells, hypertonic bags, Icodextrin/Extraneal™ more frequent exchanges, IPD).
- Note that Icodextrin is compatible with antibiotics, so can be put into Icodextrin exchange.
- Stable pts may be discharged and continue therapy at home. Consult HPDU to assess pts ability to administer meds.

For management of any complicated peritonitis (including ESBL organisms), please contact Dr. Joanne Bargman, pager (416)790-6317 or joanne.bargman@uhn.ca

References:

Hussein, M., Mooij, J.M., Roujouleh, H. (2003). Tuberculosis and chronic renal disease. Seminars in Dialysis, 16(1). 38-44.

Li, P.K.T., Szeto, C.C., Piraino, B. (2010) ISPD Guidelines/Recommendations. Peritoneal dialysis-related infections recommendations 2010 update. Perit. Dialy. Int. 30(4) 393-423.

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Piraino, B., Bernardini, J., Brown, E. et al (2011) ISPD position statement on reducing the risks of peritoneal dialysis-related infections. Perit. Dialy. Int 31 (6) 614-630

Toxic Shock Syndrome (TSS) in PD

A rarely occurring phenomenon of TSS has been reported in PD patients with peritonitis, usually caused by toxigenic *staphylococcal aureus*. The criteria for TSS diagnosis includes fever, and hypotension with peripheral vasodilatation. (Indeed, differential diagnosis of severe hypotension in a PD patient with peritonitis includes abdominal catastrophe, such as viscus/ bowel perforation, or *staph aureus*-associated toxic shock syndrome.)

Treatment includes broad spectrum antibiotics delivered intravenously, and peritoneal lavage, carried out by very short dwell (<30 min) CAPD or IPD exchanges. The lavage should be carried out for at least 12 hours. The purpose of the lavage is to remove the toxin that is causing the TSS. Adequate coverage for staph aureus should be ensured, even if cultures are still pending.

Antibiotic Prophylaxis and Procedure Prep for PD Patients

Note: Reference regarding the use of clarithromycin is from Dr. Stephen Vas (previous Infectious Disease lead at UHN).

Cardiac Catheterization / Angiogram -- Dye Exposure

- N Acetylcysteine (Mucomyst®) 600 mg po bid on day before and day of procedure. Available in liquid form at UHN Pharmacies. Hydration is recommended 12 hr prior to, during, and 12 hr post procedure (0.45% saline 1mL/kg/h).
- Patient should be instructed to arrive drained ("empty") for angiogram, and CAPD exchanges to resume ASAP after procedure.

Cholangiogram

Patient should be drained ("empty") prior to test.

Colonoscopy

Bowel prep is required for colonoscopy.

Golytely 4L in the afternoon before the day of procedure (best to be consumed in 3-4 hours). Do not use regular Fleet enema because of risk of increased phosphate (may use Fleet Mineral Oil).

Antibiotic prophylaxis is necessary:

1. Ampicillin 1 g IP in night bag/long dwell prior to procedure **or** oral amoxicillin 2 g 1 hour before procedure
    a. If allergic to Penicillin: Clindamycin 600 mg po 1 hour pre or 600 mg IV 30 min pre procedure

    AND
2. Tobramycin 120 mg IP in night bag/long dwell prior to procedure,
    AND
3. Metronidazole (Flagyl®) 500 mg po 1hour pre procedure and 500 mg po 12 hours post procedure.

Patient should be drained ("empty") prior to procedure.

Sigmoidoscopy/Proctoscopy

Antibiotic prophylaxis is not necessary for sigmoidoscopy or proctoscopy.

Bowel prep is required for sigmoidoscopy/proctoscopy.
Golytely 4L in the afternoon before the day of procedure (best to be consumed in 3-4 hours). Do not use regular Fleet enema because of risk of increased phosphate (may use Fleet Mineral Oil).

Patient should be drained ("empty") prior to procedure.

CT Scan - Abdomen

To assess for PD leak, 100 mL of “Visipaque” (available from Radiology) is added IP to the dialysis solution regardless of the volume of the exchange. It is important to raise the intra-abdominal pressure, thus have the patient hold at least 2 L and walk around (as able) for 2 hours, as this may make the leak more visible on the scan. Drain at end of scan and resume dialysis.

CT Scan for other reasons – if abdominal, thoracic or pelvic, drain prior to procedure.

For inpatients, a written order is required for nurses to instill radiopaque dye into the dialysate for infusion.

Cystoscopy
Bowel prep as per radiology request.

Amoxicillin 2 g po 1 hour pre procedure or Ampicillin 2 g IM or IV 30 minutes pre procedure. If allergic to Penicillin: Clindamycin 600 mg po 1 hour pre or 600 mg IV 30 min pre procedure.

Ciprofloxacin 500 mg po daily x 2 days or Septra 1 SS daily x 2 days

Patient should be drained ("empty") prior to procedure.

Dental Procedures
Amoxicillin 2 g po 1 hr pre, or Ampicillin 2 g IM or IV 30 min pre procedure.

If allergic to Penicillin: Clindamycin 600 mg po 1hour pre or 600 mg IV 30 min pre procedure
OR Cephalexin or cefadroxil 2.0 g po 1 hour pre
OR Azithromycin or clarithromycin 500 mg (consider dose modification is on calcium channel blocker) po 1 hour pre procedure

Echocardiogram
No preparation is required.

ERCP (Endoscopic Retrograde Cholangio Pancreatography)
Amoxicillin 2 g PO 1 hour pre-procedure

Patient should be drained ("empty") prior to procedure.

Gastroscopy/Upper GI
Amoxicillin 2 g PO 1 hour pre-procedure. Patient should be drained ("empty") prior to procedure.

Gynecological procedures
(Invasive procedures i.e. Uterine biopsy and D&C. NOT for routine PAP)

Amoxicillin 2 g 1 hour pre procedure

Metronidazole (Flagyl®) 500 mg 1 hour pre procedure and 500 mg 12 hours post procedure.

If allergic to penicillin, clarithromycin 500 mg 1 hour pre-procedure.

Patient should be drained ("empty") prior to procedure.

Iliac Dopplers
Patient should be drained ("empty") prior to test.

Liver biopsy
Cefazolin 1 g IP or IV pre procedure, patient to be drained, and leave dry for 24 hours following procedure.

Stress Test
Patient should be drained ("empty") prior to test.

Ultrasound - Abdominal, Thoracic, Pelvic
Patient should be drained ("empty") prior to test.

X-Ray – Chest, Abdomen, Pelvic
Patient should be drained ("empty") prior to test.

Other Peritoneal Dialysis Issues

Hemoperitoneum

Small amount of red blood cells can results in bloody appearance to effluent. Causes may be benign to significant pathology. Noted post-surgical implantation of catheters, post abdominal surgery; associated with ovulation and menstrual bleeding; warfarin use; pancreatitis; metastases; ischemic bowel; encapsulating sclerosing peritonitis.

May clear with flushes as in post catheter implantation. Add heparin 500 u/L to prevent catheter obstruction. Heparin is not absorbed across peritoneal membrane and will not have systemic effect on anticoagulation.

Assessment of Peritoneal Dialysis Prescription

Membrane characteristics may be assessed by PET (note Adequest® is no longer being done). This study must be arranged in advance with the Charge Nurse. Prior to the study, the patient must be stabilized on PD for 1 month and be peritonitis free for 1 month.

Peritoneal Equilibration Test (PET)

Determines the rapidity of solutes moving across the peritoneal membrane. Patients with rapid transport characteristics (4 hr D/P Cr* >0.82) are better managed with shorter dwell periods (i.e. CCPD) to minimize dextrose absorption and improve ultrafiltration. Patients with slow transport characteristics (D/P Cr* <0.49) require CAPD with longer dwell periods.

To perform "Fast PET":

- Completely drain any effluent that the patient is dwelling from usual Rx.
- Flush pt with 1.5% dialysate, pts usual volume. Ensure complete drain, weigh the bag and record volume.
- Instill 2 L 4.25% dialysate and record fill time (4.25% 2L is preferable for best UF predictions). Zero hour is defined as the end of fill.
- At 2 hours from zero hour, send blood samples for Cr, Urea and Glucose
- At 4 hours, drain completely and record drain time. Send complete effluent for Cr, Urea, Glucose and Volume.

* Calculate D/P Creatinine (Dialysate Cr / Plasma Cr) by dividing the 4-hour dialysate creatinine by the plasma creatinine.

Ref: Twardowski ZJ, Nolph KD, Khanna R, Prowant BF, Ryan LP, Moore HL, &Nielsen MP (1987). Peritoneal Equilibrium Test. Peritoneal Dialysis Bulletin, 7, 138-147.

PD Exit Site Infection (ESI)

- Characterized by erythema around the exit site ± seropurulent discharge. S aureus ESI's are associated with S aureus nasal carriage. Up to 50% of ESI's are associated with tunnel infections. Oral or IP antibiotics resolve ~ 50% of ESI's.
- Consider catheter removal if patient develops peritonitis with same organism.
- Treatment: Local antiseptic, antibiotics, shave distal cuff if protruding, or revise tunnel. May require catheter removal or replacement.

Kidney Biopsy

Elective Kidney Biopsy

Before the procedure:

- Discontinue all anti-platelet medication (e.g. ASA, other NSAIDs, clopidrogrel, prasugrel, ticagrelor) 5 days prior to the start of the procedure and restart previous dose once post-procedure hemostasis has been obtain.
    - Consult appropriate services (e.g. cardiology, vascular surgery) before holding anti-platelet medications in patients with drug-eluting or bare metal stents inserted in the past 12 months
- For patients on anticoagulant medications (e.g. warfarin), consult hematology for discussion of bridging anticoagulant in patient with: mechanical valve, atrial fibrillation with prior neurological event, recent (less than three months) venous thromboembolism, intracardiac thrombus, antiphospholipid syndrome
- Hold Warfarin 5 days prior to the start of procedure and restart previous dose once post-procedure hemostasis has been obtain.
- Use Renal Biopsy standing order form for pre & post biopsy orders.
- Call Electron Microscopy at ext 14-3184 and biopsy room at ext 14-8257 to inform them of biopsy for in-patients.
- Carry out patient admission, note patient's BP (BP should be <160/95 or biopsy may not proceed), examine patient's urine microscopically and identify reasons for biopsy (diagnostic, prognostic or therapeutic).
- Follow instructions on biopsy standing order sheet.
- Patient to be NPO prior to procedure.
- Ensure PT/INR are within (N) range (INR<1.5). If elevated, consider administration of FFP's. Platelets >50.
- If pt uremic, Cr > 150 umol/L chronically, order DDAVP 20 ug in 100 mL N/S IV over 20 min.
- Consult hematology for any unexplained coagulopathy.
- **The biopsy radiologist will cancel the biopsy if appropriate measures to document and correct a coagulopathy are not undertaken.**
- Make sure the post biopsy standing order sheet is in the chart.
- Informed consent is obtained by the radiologist just prior to the biopsy.
- If pt does not speak English, arrange for a family member or hospital interpreter to translate. If no one can translate, consent cannot be obtained and **the biopsy will be cancelled.**

- Enter the procedure into the Electronic Patient Record (EPR) computer system as follows:
- Order entry →Procedure tab, type in “Biopsy” →Select “Abd Biopsy” (goes under Interventional)→ Kidneys (5) →Left (as approp) →Tomorrow (4) →Reason Screen: (2) see Comment Field →(8) Comment: "localization for kidney biopsy" Provide full patient history→OK→Accept (A). If there are any problems, call biopsy room at ext 14-8257.
- Sedatives should **not** be ordered routinely before a biopsy as pt cooperation is required and excessive sedation can make the procedure impossible to do.
- If it is necessary to use sedation, discuss with biopsy interventionist so that consent can be obtained well in advance.
- The following information is provided to assist in informing the patient:
- A biopsy is “low risk” if kidney size is normal, BP is well controlled, platelet count, PT, PTT & INR are normal and the serum Cr is < 150.
- In these circumstances, the only tangible risk is that of bleeding.
- At our institution, the following are the risk estimates:
  - The incidence of gross hematuria is approximately 5-10%,
  - The incidence of significant bleeding sufficient to delay discharge is approximately 1:100. This refers to persistent hematuria, or perinephric hematoma, which usually settles with conservative management.
  - A transfusion is occasionally necessary.
  - Serious bleeding complications sufficient to warrant interventions to stop bleeding are of the order of 1:1000.
  - Kidney biopsy can be life threatening in 1:5,000 – 1:10,000.

Post Biopsy:

- Patients are monitored closely for complications, usually apparent in the first few hours.
- The patient is on bed rest for 12-24 hours if admitted. Usually discharged home next morning.
- Vital signs are done frequently and urine is observed for gross hematuria.
- If a complication occurs, notify the biopsy radiologist.
- Most complications are managed expectantly. For a serious complication, consult urology, and/or interventional radiology if consideration of an ablative procedure is warranted.

- If the patient is stable the next morning, they are discharged and an appointment for follow up should be made with the referring staff nephrologist in ~ 2 weeks' time to discuss diagnosis and prescription. Advise pt to carry out light activities only for 48 hours post discharge. No heavy lifting or strenuous exercise for 2 weeks. It takes ~ 6 weeks to heal completely, after the first 2 weeks; they can carry out routine activity and moderate exercise.
- Prepare pts case for presentation at biopsy rounds, focusing on indications for the biopsy.

Emergency and Transplant Biopsies:

- Much the same as for electives, except the house staff is responsible for completion of the requisition. Note that requisition needs to be the one with barcode. Available from any of the nephrologists' assistants.
- Pts BP must be within acceptable limits (<160/95)
- Indicate clearly the tests required - usually "light, C4d and BK " for transplants, "light, IF and Electron Microscopy" for native kidney, and if it is "STAT". If it is STAT, make arrangements with pathologist, Dr. Rohan John at ext 14-4560.
- Transplant biopsies to rule out rejection should be labelled "ULTRA RUSH;" preliminary results will be available later that day or the next morning
- Call Electron Microscopy at ext 14-3184 and biopsy room at ext 14-8257 to inform them of biopsy for in-patients.
- Inform Dr Heather Reich at ext 14-3439 of any biopsy being carried out.

Arranging Biopsy at Mount Sinai Hospital

- Page MSH Interventional Radiology Staff to perform biopsy.
- Fill out & fax Mt Sinai Medical Imaging Request Form (Form MS275 05/20078)
- If unable to get done at MSH, call Interventional Radiology at TG to arrange, and follow above procedure.
- In either case, make arrangements with pathologist, Dr. R. John at ext 14-4560.
- Inform Dr Heather Reich 14-3439 of any biopsy being carried out.

Any biopsy, elective or emergency, which is not low risk or which has any unusual features at all, should be discussed in detail with the biopsy interventionist.

Transplant

Transplant Rotation

Wards, ER and Admissions

- 7 PMB (Multi-Organ Transplant Unit) ext 14-5163 (A side), ext 14-5330 (B side), 6ES Multi-Organ Transplant/Nephrology, ext 14-4487, and 10 PMB (Transplant Acute Care Unit) x ext 14-4207.
- These wards include kidney, kidney-pancreas, liver, heart and lung transplant patients. Each organ has its own team.
- Renal transplant patients are admitted under the Renal Transplant service. Kidney-pancreas patients are admitted under the Pancreas Transplant Service, including those whose pancreas transplant has failed but kidney is still functioning; in special circumstances Renal Transplant may be asked to consult (usually when dialysis is required).
- Renal transplant patients may be admitted for: renal transplant, transplant-related problems, graft failure, or for other reasons.
- The service also follows all renal transplant patients admitted to another service, including patients at PMH or Mt. Sinai; patients at the Western are followed by the Nephrology fellow covering the Western, with advice from us as needed.
- Consults from ER are handled by Renal Transplant service between **0800 and 1800**. After that, first call is by fellow covering MOT ward (who is an MOT Fellow), who will contact the fellow on-call for renal transplant to discuss cases.
- The MOT fellow on call will cover ER consults on weekends from 1200 until 0800, and will also cover any inpatient issues from 1200 on weekends. This will give the Renal Transplant on call time free of distractions to finish rounds.
- Transplant coordinators will call if they know of a patient who is going to the ER or who needs admission; patients expected in the Emergency Department who arrive between 0800 and 1800, especially when directed by the Transplant coordinator, are the responsibility of the renal transplant fellow.

Kidney transplant patients needing dialysis

- For kidney transplant patients requiring hemodialysis, the transplant Fellow is responsible for the dialysis orders, and for all aspects of patient care.
- For peritoneal dialysis, call the PD nurse on 6ES (ext 14-4487) or pager 715-9232, and fax orders to (416)340-4168.

- During the weekdays, transplant fellow may call Hemo West (ext 14-4072) to arrange hemodialysis. Kindly inform nephrology on call as a courtesy, so that they are aware of who needs dialysis.
- After hours, and weekends, transplant fellow must call nephrology house staff on call to triage the patient, as the nephrology service is aware of the numbers of patients needing acute dialysis. The nephrology house staff will then call in the HD nurse to do the dialysis, but will NOT do a consult – this is for triage purposes only. Please be prepared to discuss the urgency for dialysis, as patients needing dialysis immediately prior to transplant surgery will have relative priority. If necessary, the second on-call nurse can be called in to perform the dialysis.
- Hemodialysis nurses will liaise with the transplant fellow for orders and patient issues once the triage has been done. Name and pager number should be written clearly on the hemodialysis orders on the doctor's orders sheet.

Order Entry and Documentation

- Medications, labs and radiology orders are placed in MOE/MAR, Some entries (i.e. diet) still go on paper;
- **All orders need to be reviewed after a patient's transplant surgery, as these may need to be changed; if a patient is moved to CICU, CVICU or MSICU, all orders may be cancelled, and this needs to be reviewed to ensure that patients receive appropriate immunosuppression**
- Orders do not need to be re-entered when patients move from the Transplant ACU to 7 PMB or 6ES
- Bloodwork and other tests should be ordered the day before, since patients need blood drawn at specific times to monitor immunosuppressant levels (cyclosporine, tacrolimus, sirolimus)
- The **electronic whiteboards** on 7 PMB and 6ES should be updated regularly to ensure that the right person is paged with any issues regarding a specific patient
- Discharge summaries must be completed within 48 hours of discharge; preferably, they should be ready on the day of discharge
    - If patient is continuing or returning to dialysis, complete dialysis discharge summary (available from dialysis unit) the day of discharge
    - If a patient requires returning to dialysis, please contact Anna Gozdzik (x14-5129) to discuss modality and arrange an outpatient spot.
    - Document patient issues on Sign-out sheet as a form of communication; this is not a legal document, thus other documentation should be on the chart or in OTTR.

OTTR

- OTTR (Organ Transplant Tracking Record) contains the most complete information on each patient, including medical history, medications, allergies and progress notes.
- It also includes the results of bloodwork done at outside labs as well as labs, radiology, pathology and transcriptions done at UHN. **Most patients have their bloodwork done at outside labs and EPR will be incomplete**.
- There is a "Diagnosis" section in OTTR. **It is your responsibility to update this section as necessary**

Some important diagnoses to include for new transplants as needed:

1) Donor-specific antibodies ("No DSA No PRA," "No DSA PRA positive," "DSA Class I," "DSA Class II," "Post-Tx Ab; Negative," "Post-Tx Ab, Positive, no DSA" ""Post-Tx Ab: DSA")
2) Extended criteria donor (single or double)
3) DCD (donation after cardiac death) donor
4) Delayed graft function (dialysis required in first week post-transplant)
5) Exceptional distribution donor
6) CMV mismatch
7) EBV mismatch

Acute rejection should be entered as the grade (borderline, IA, IB etc.) for acute cellular rejection; Antibody-mediated rejection is a separate diagnosis and entry.

- There is an extensive list of diagnoses available; the list is searchable; if the diagnosis does not initially appear, click the "More" button in the search window and try again
- Access to OTTR requires an ID and password, which you will receive at the beginning of the rotation.

Rounds, Clinics, and Call Schedules

- Please see the schedule. If time permits, trainees may choose to attend a post-transplant or pre-transplant clinic.
- Attendance at the Monday and Thursday morning multi-disciplinary rounds, Wednesday morning inpatient review, and Wednesday afternoon Journal Club are mandatory. If there is a conflict with your longitudinal clinic, please inform the attending nephrologist beforehand
- A folder with a variety of primary research and review articles is available in Dropbox. Email Dr. Schiff for access or ask one of the other fellows to share with you. You will still have access to it after your rotation. Please do **NOT** change any of the contents of the Dropbox folder, as this will change the folder for everyone. You can copy the entire folder and save it separately for your own use.

- There is a series of seminars covering core topics in transplantation available through the NephroEd website, http://www.nephroed.com/ . You are expected to watch the relevant video before the Monday Transplant Seminar; you will then have time for more in-depth discussion during the seminar session.

New transplants

- Living donor recipients are admitted the day before transplant to the transplant ward; donors are admitted under Urology or Transplant Surgery and are not followed by the Renal Transplant service. However, if there is an emergency with the donor after hours, the Renal Transplant fellow should see the patient if requested.
- Deceased donor recipients are admitted by the on call for Renal Transplant. The Renal Transplant on-call must make a decision about whether the patient requires dialysis pre-operatively.
- Some deceased donor recipients will require a **stat cross-match** (see below) prior to transplant. This will be decided by the attending on-call in discussion with Trillium before the patient is brought into hospital. It is usually done in patients who are highly sensitized or do not have multiple old serum samples in the lab (see below). In those cases, a "backup" recipient may be brought in. They must also be assessed and ready for transplant, in case the first recipient cannot go ahead because of a positive crossmatch.
- Post-transplant, patients will go to a step-down bed (either on 10 or 7) for the first 2-3 days. These beds offer 1:2 nursing ratios, cardiac rhythm monitoring, arterial line monitoring and more intensive recording of vitals and urine output. Patients in step-down cannot receive pressors, IV nitroglycerin or ventilator support (apart from CPAP that patients use for sleep apnea). If a patient requires such treatment, the Critical Care Outreach Team (CCOT) should be consulted for transfer to ICU.

PRA, DSA and Crossmatching

- Antibodies to HLA antigens are a risk factor for antibody-mediated (humoral) rejection, which can be hyperacute, acute or chronic.
- PRA refers to panel-reactive antibodies: this reflects the **variety** of anti-HLA antibodies a patient has. It is separately measured for class I and class II antigens. In both cases, it is reported as a result from 0 to 100%; it is tested every three months for all patients on the renal transplant waiting list.
- **cPRA** refers to calculated PRA, and represents antibodies against the pool of donors, e.g. a patient with a cPRA of 45% will have antibodies against 45% of the donors over the last several years
- If a patient has anti-HLA antibodies against a particular donor, these are called **donor-specific antibodies** (**DSA**).

- The **crossmatch test** assesses the presence of DSA against a particular donor. This is reported as positive or negative.
- The current allocation algorithm in Ontario requires that any deceased-donor kidney go to a recipient who has no evidence of DSA to the donor on their current or historic PRA testing. This is referred to as a **"negative virtual crossmatch."**
- Depending on the recipient's peak cPRA and the number of cPRA samples available in the HLA lab, the patient may require a **STAT crossmatch (XM)**. This requires blood from the recipient that is drawn when they arrive at the hospital. This test is done by the HLA lab by **flow cytometry** and takes 4-6 hours. The transplant nephrologist on-call will determine whether a stat XM is required and will be called directly with those results. If a stat crossmatch is done**, the recipient cannot go to the OR before the crossmatch result is available and reviewed by the attending nephrologist**.
- When a stat XM is not required, the recipient's serum will be tested for DSA; the result will be available 24-48 hours post-transplant. On rare occasions, this will detect DSA that was not reported on pre-transplant samples; this may require a modification of the immunosuppression plan.
- For living-donor transplants, all crossmatch testing will be done prior to the recipient's admission to hospital, and does not need to be repeated on admission
- In rare cases, a living-donor transplant may be done with a **"positive virtual crossmatch"** or **"positive flow crossmatch."** These patients require **"desensitization"** prior to transplant, which will have taken place before admission. This is also true for ABO-incompatible transplants. These patients will follow the high-risk immunosuppression protocol below.

Immunosuppression for New Renal Transplant Recipients

Definitions of donors and recipients

Extended Criteria Donor (ECD) Kidneys

Age >/= 60 or

Age 50-59 with 2 of:

- CVA as cause of death
- History of hypertension
- Donor creatinine $\geq$ 135 μmol/L

Offered to patients on ECD List with informed consent (consent already done at time of listing, not when recipient brought in for transplant)

- Singles if eGFR ≥ 70 ml/min
- Doubles if eGFR 50-69 ml/min
- Decline if eGFR < 50 ml/min

Decision whether to use ECD kidneys as singles or doubles made by attending nephrologist

Exceptional Distribution Donor

- A donor whose history raises an increased risk of transmissible disease
- This may include higher risks of infections (e.g. HBV, HCV, HIV), cancer or other diseases
- Patients must give informed consent prior to surgery that they will accept an organ from such a donor
- This needs to be documented in the chart
- Additional testing and/or changes in immunosuppressive protocol may be required; this is decided on a case-by-case basis

Hepatitis Virus Positive Donors

- HBV core antibody positive but HBsAb negative – give with informed consent to immunized HBsAb positive recipients
- HBsAg positive kidneys not used
- HCV Ab positive kidneys not used

High Immunologic Risk

Defined as:

- Living donor with positive crossmatch or donor-specific antibody (DSA) – will have undergone “desensitization” prior to transplant
- Use high immunologic risk protocol (see below)

High Risk for Delayed Graft Function

Includes kidneys from:

- Donation after cardiac death donors (DCD)
- Extended criteria donors (ECD)
- Neurologically-deceased donors with longer cold ischemia times

Patients at High Risk of Complications from Immunosuppression and with Immediate Graft Function

Defined as:

- EBV mismatch
- History of multiple skin cancers or serious malignancy
- HbsAg or HCV positive
- Portal hypertension

Immunosuppression Protocols

Immunosuppression protocols

The choice of immunosuppression should always be discussed with the attending staff. The following represents current protocols in the Renal Transplant Program, but variations may occur

Choice of Calcineurin Inhibitor (CNI)

- Tacrolimus (Advagraf) in high immunologic risk and default choice in all other cases
- Cyclosporine (Neoral) in high diabetes risk (risk factors include: positive family history, gestational diabetes, current or previous glucose intolerance, HCV positive, Hispanic, black, or BMI >/=30) AND low immunologic risk (i.e. no DSA)

High Immunologic Risk Protocol
See definition above

- IVIg 1 gm/kg IV pre-transplant; maximum dose 140 g
- Solumedrol 7mg/kg up to 500 mg IV over 30 to 60 min prior to Thymoglobulin; then prednisone 1 mg/kg days 1 and 2, 0.5 mg/kg day 3-4, 0.3 mg/kg day 5-13, 0.2 mg/kg day 14 to 20, 0.15 mg/kg day 21
- Thymoglobulin 1.5 mg/kg/day to **total of 7 mg/kg**; first dose to start ASAP post-op (once patient is in Transplant ACU, not in PACU)
- MPA (Myfortic 720 mg po bid is standard; older patients may be on mycophenolate mofetil, aka CellCept) starting post-op day 0
- Advagraf (tacrolimus) target 10-15 ng/ml (always a trough level)

High Risk for Delayed Graft Function (DGF)

See definition above

- No IVIg pre-op
- Steroid dosing as above
- Thymoglobulin dosed as above to **total of 5 mg/kg**
- MPA dosing as above
- Target tacrolimus (Advagraf) to 5-10 ng/ml or target cyclosporine with C2 monitoring to 900-1100 ng/ml (blood drawn 2 hours post-dose); start Advagraf or Neoral on POD#2

Low Immunologic Risk With Early Graft Function

- No IVIg pre-op
- Solumedrol 7mg/kg up to 500 mg IV over 30 to 60 min prior to Thymoglobulin; then prednisone 1 mg/kg days 1 and 2, 0.5 mg/kg day 3-4, 0.3 mg/kg days 5-6, 5 mg/day for day 7 and onwards
- Thymoglobulin **3-5 mg/kg** as above
- MPA as above
- Target tacrolimus to 5-10 ng/ml or target cyclosporine with C2 monitoring to 900-1100 ng/ml; start Advagraf or Neoral on POD#1

Patients at High Risk of Complications from Immunosuppression and with Immediate Graft Function

See definition above

- No IVIg pre-op
- Solumedrol 7mg/kg up to 500 mg IV over 30 to 60 min prior to Thymoglobulin; then prednisone 1 mg/kg days 1 and 2, 0.5 mg/kg day 3-4, 0.3 mg/kg days 5-6, 5 mg/day for day 7 and onwards
- **Basiliximab** 20 mg IV day 0 and 4 instead of Thymoglobulin
- Start full-dose MPA as above on day 0 but consider reduced dose if stable
- Target tacrolimus to 5-10 ng/ml or target cyclosporine with C2 monitoring to 900-1100 ng/m; start Advagraf or Neoral on POD#1

Prophylaxis post-transplant

- Nystatin 100,000 units swish and swallow qid
- Ranitidine 150 mg po qd; use PPI (pantoprazole) in patients with symptoms on ranitidine

- Septra SS 1 tab qMWF life-long; for patients with intolerance or sulfa allergy, alternatives are dapsone 100 mg qd(after testing for G6PD deficiency; pentamidine 300 mg by inhalation q 4weeks
- Valganciclovir for all recipients who are CMV-positive and receive thymoglobulin; CMV-negative recipients who receive a kidney from a CMV-positive donor ("CMV mismatch"), regardless of immunosuppression used; standard dose is 900 mg daily, adjusted for renal function
    - Standard CMV prophylaxis is three months for patients who are CMV-positive pre-transplant, six months for patients who are CMV mismatch; no valganciclovir for patients who are CMV-positive and receive basiliximab, or CMV donor and recipient negative
- All patients should receive DVT prophylaxis with heparin 5000 units s/c bid from time of admission to time of discharge; this includes readmissions. Do not use low-molecular weight heparin due to problems with drug dosing when renal function is rapidly changing.

Clinical Trials

- There are a variety of clinical trials that are enrolling transplant patients at any given time. When appropriate, patients will usually be approached by members of the Clinical Trials Unit, who will explain the nature of the trial to them. Trials may include novel immunosuppression regimens given in hospital, intraoperative therapy or treatments that will continue as an outpatient. You will be informed if a patient has been consented to a trial, and if there are any specific issues for you to be aware of.

Treatment of acute rejection

Acute rejection should also be confirmed by renal biopsy. Arrange for biopsies by speaking to the biopsy centre in Interventional Radiology. Also, the renal pathologists, Dr. Rohan John (ext. 14-4560) and Dr. Carmen Avila-Casado (ext. 14-3283) should be informed by phone or email that this biopsy is an "ultra-rush" to ensure same-day results.

Treatment needs to take into account type of rejection (cellular, antibody-mediated or both), grade of rejection (i.e. Banff 1A, 1B, 2A, 2B, 3), baseline renal function, patient comorbidities, and degree of chronic changes or scarring. The following are **suggestions only**, and treatment should always be discussed on a case-by-case basis:

- Mild cellular rejections (Banff 1A) are usually initially treated with pulse Solumedrol 7 mg/kg/qd x 3 days. Maximum dose is 500 mg, followed by an oral steroid taper
- More severe cellular rejections are often treated with Thymoglobulin 1.5 mg/kg/d (maximum single dose 150 mg) x 5-10 days. Pre-medicate with acetaminophen and diphenhydramine as per standard thymoglobulin protocol
- Patients who receive thymoglobulin need to be restarted on the same prophylaxis as a new transplant recipient
- Antibody-mediated (humoral) rejection may be treated with plasma exchange and IVIg 1g/kg. Plasma exchange needs to be discussed with Dr. David Barth, director of the Apheresis Unit. Usual number of plasma exchange sessions is 5. IVIg is usually only given in between sessions if there will be a 2-3 day break, but is always given at the end of the course of plasma exchange
- Some cases of humoral rejection may also receive treatment with steroids, Thymoglobulin or rituximab
- All rejections require a reassessment of baseline immunosuppression. Options include: changing cyclosporine to tacrolimus, increasing target tacrolimus levels, changing azathioprine to MMF or increasing MMF dose, starting or increasing steroid dose

PD Catheter Care after Renal Transplant

- Prior to renal transplant, have patient's abdomen drained before going to the operating room, send fluid for cell count and C+S, and ensure that PD catheter is secured.
- Discuss with transplant surgeon whether or not to take out the peritoneal dialysis catheter at time of transplant surgery based on risk of delayed graft function and need for dialysis post-operatively; most patients receiving a living-donor transplant can have their catheters removed; patients receiving an ECD or DCD kidney have a much higher risk of DGF
- After transplant, if dialysis is not required, advise the patient to continue PD catheter exit site care at least twice weekly until arrangements are made for PD catheter removal.
- The catheter should be flushed every two weeks, therefore please call HPDU, ext 14-5672, **for UHN patients only** to advise patient's primary nurse and to arrange PD flushes if the patient is not able to carry them out independently. For external PD patients please call the external primary PD unit.
- Please call the transplant surgeon's administrative assistant to arrange for PD catheter removal.
- If dialysis may be required in the near future, please arrange weekly PD catheter flushes through HPDU (for UHN patients only), or advise patient to flush weekly, and

inform HPDU of patient's status. For external PD patients, call the external primary PD unit.

HD Catheter Care after Renal Transplant

- Tunneled HD catheters should be removed as soon as it is feasible to avoid catheter related infection, ideally, prior to discharge after transplant.
- If there is concern that the catheter may be needed, arrange with patient's HD unit regarding flushing and dressing changes at least weekly.
- Arrange catheter removal through Cyndi Bhola at ext 14-3518, renal fellows, or kidney transplant coordinators.

Issues for Nephrology Patients (not under Transplant team)

Transplant Assessment

- All pts should be screened for transplant eligibility when CrCl <30 ml/min. Include willingness, risk factors, potential living donor.
- Write a Referral letter to transplant nephrologist.
- The following is needed to initiate transplant assessment:
- The patient's blood group.
- Current medication records.
- Bloodwork: CBC, sickle-cell screen, lytes, INR, Ca, PO4, PTH, LFT's, HIV, HBsAg & Ab, Hep B core, Hep C, CMV IgG, EBV, Varicella Zoster IgG , Syphilis, HTLV
- OGTT for all patients without diabetes
- TB skin test
- If Kidney-Pancreas Tx, above plus C-Peptide
- Cardiac status: ECG, 2D Echo; Persantine Stress Test if age > 40 (within the last year if available).
- Chest X-ray, Abdominal U/S and iliac Doppler
- Age-appropriate screening for cervical, breast and colon cancer as per current Canadian guidelines
- The type of dialysis, date of initiation, unit, days and shift if HD
- The patient's height and weight.
- The referring staff physician.
- A social work assessment completed within one year of referral.
- Any significant information e.g. disabilities, language barrier, family/social support, substance abuse, nursing concerns.
- Medical history reports, other consult reports e.g. cardiology, hepatology

Management of Failed/Failing Transplant

Patients to remain on transplant service during the admission for failed transplant, when initiating dialysis. Communicate immunotherapy and steroid plan clearly in discharge summary.

When KFRE equation shows risk of graft failure > 10% at 2 years, patient should be referred to MCKC to see Dr. Schiff (see MCKC Referral form in "Nephrology Team and Affiliated Areas section"). If pt has been stable at CrCl <30, should refer if there is a new decrease in CrCl.

New requirements for MCKC include a urine ACR value and calculated KFRE at 2 years.

Withdrawal of Immunotherapy, Septra:

Discuss with Transplant Nephrologist for management.
Considerations:

- In order to preserve residual renal function in patients transitioning to PD, the calcineurin inhibitor can be withdrawn over 4-8 week, but the antiproliferative agent (azathioprine, mycophenolate or sirolimus) should be continued
- Patients who have an identified donor and are likely to be re-transplanted soon may need to remain on full immunosuppression in order to prevent sensitization that would preclude re-transplant

Withdrawal of Steroids:

- Consult Transplant Nephrology fellow or staff
- rapid reduction to 15 mg/day (if no acute problem)

  2 weeks later reduce to 12.5 mg/day

  2 weeks later reduce to 10 mg/day

  further taper over 1/4 total duration of steroid treatment

  i.e. 4 years of steroids, taper over 1 year to zero

- patients on steroids > 10 years may not recover adrenal function. Suggest maintain on 5-7.5 mg/day permanently or until next transplant.

Post-Transplant Follow-up

- All patients are assigned a primary transplant nephrologist and coordinator at time of discharge from their transplant hospitalization and will be followed by them from then on.
- Please email the transplant nephrologist and coordinator when a patient is discharged from hospital. This will help ensure good continuity of care from the inpatient to outpatient setting.

Renal Transplant Coordinators

Colleen Lee	Renal Transplant Assessment (UHN)	ext 14-8374
Michelle Engson	Renal Transplant Assessment	ext 14-6817
Julie Cissell	Living Donor Renal Transplant	ext 14-4577
Michael Garrels	Listed Renal Transplant	ext 14-5889
Edilyn Llameg	Post Tx	ext 14-5002
Theresa McKnight	Post Tx	ext 14-3599
Linda Au-Yeung	Post Tx	ext 14-6657
Carol Wright	Post Tx	ext 14-5567
Jennifer Ly	Post Tx	ext 14-5614
Robyn Beechey	Pre-Kidney-Pancreas	ext 14-4147
Andrea Norgate	Post Kidney-Pancreas	ext 14-8866
Transplant Clinic		ext 14-4113
Transplant Day Unit (6ES)		ext 14-5773

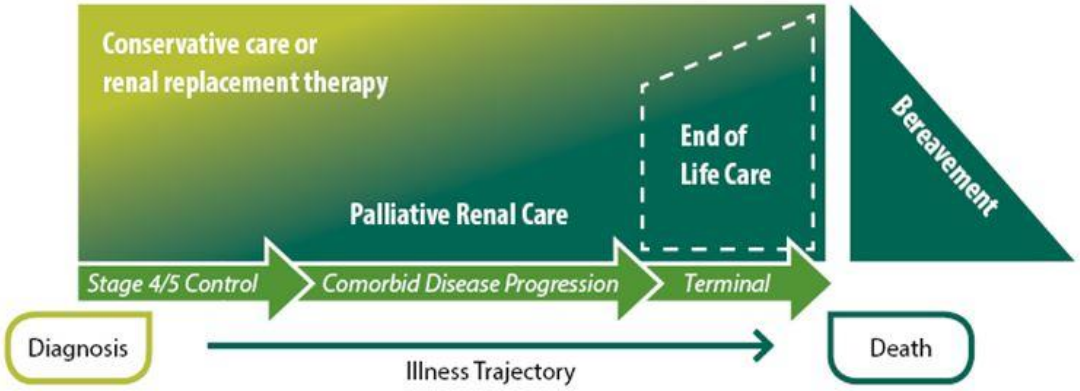
Renal Palliative Care

(derived from Middle French palliatif or Medieval Latin palliativus "under cloak, covert,")

A **palliative renal care approach** recognizes that CKD is a chronic progressive disease that is irreversible.
It runs *in parallel* to disease modifying care, the extent to which will depend on the patient's goals and their disease trajectory (Figure). Palliative care may be provided by the primary MRP team or by a specialist palliative care team depending on the complexity or severity of the patient symptoms.

Goals of Care:
The patient goals of care are those goals to be achieved at the end of treatment. For example these may be to be able to attend the Blue Jays games, or to be able to live independently at home.
These help inform the clinicians which treatment plan(s) is/are best suited to achieving these goals. Prognostication and realistic goal setting is key to **shared decision making** with the patient and family

Figure: Disease trajectory graph.



Adapted with permission from "Advancing High Quality, High Value Palliative Care in Ontario: Declaration of Partnership and Commitment to Action," HPCO, 2011.

While dialysis can improve survival in several patients, the treatment can be more burdensome than beneficial in individuals with complex, and severe chronic disease. Adding palliative care to conventional renal care can mitigate suffering and prepare the patient and family for the future.

This may be provided in several ways:

- **Comprehensive Conservative Renal Care** (CCRC)**.**

Studies suggest that, in several populations, survival is similar to that seen when dialysis is initiated. Patients may choose to not include dialysis as part of their care. The multidisciplinary Elder Kidney Care team can often help with prognostication, and help guide families and patients through discussions around CCRC and palliative dialysis. In the outpatient setting they deliver active medical care, and provide physical, emotional and spiritual support to the patients and, by extension, to their family/social circle.

- **Palliative dialysis**

This is where dialysis treatment is used primarily to alleviate symptoms despite progressive, chronic disease that has already impacted, and will likely continue to impact, the individuals' personal and social functioning. Patients and families are made aware that dialysis will likely not prevent death, but improve the symptoms associated with the deterioration expected over time. With this form of dialysis care patients are supported through discussions about when to stop dialysis (i.e. when the burdens outweigh the benefits) and what occurs as the patients transits to end of life care.

- **Dialysis discontinuation**

Patients and/or families should be advised they may choose to stop dialysis at any time. Once a decision is made to stop dialysis, death will often follow within 7 to 14 days contingent on the patient's co-morbidities and residual renal function. Patients with severe malnutrition and/or intrinsic residual renal function may survive for considerably longer.

Helpful definitions:

End-of-Life care is the term used when the dying process has begun, and care is being provided to ease the symptoms associated with dying. This includes helping those in the patients' circle through their bereavement. At end-of-life the life expectancy is often days to weeks.

A **Power of Attorney for Personal Care** is the individual appointed by the patient to best represent their wishes when they are unable to participate in shared decision making.

Substitute decision maker(s): this is/are the individual(s), *appointed by law*, to represent the patient's wishes when they are unable to participate in shared decision making. The SDM is/are mandated by law, and when there is a problem (e.g. conflict amongst several children of a widowed lady) the Public Guardian and Trustee may be asked to step in.

Making Decisions for Other People from UHN Patient Education:
http://www.uhn.ca/PatientsFamilies/Health_Information/Health_Topics/Documents/Making_Decisions_for_Other_People.pdf#search=making%20decisions

Symptom Management Tools

Pain	Accurate diagnosis – nociceptive vs neuropathic vs other is key to effective management
Nausea	Exclude constipation Consider haloperidol, dimenhydrate or in some circumstances domperidone
Agitation	Exclude delirium / sensory deficit Exclude opiate related toxicity Consider haloperidol and quetiapine
Restless Legs	Exclude precipitating meds (SSRIs, dopamine antagonists) Exclude and treat sleep apnea/sleep disturbance Replenish iron stores Consider low dose gabapentin/pregabalin or dopamine agonists
Pruritus	Consider fan / cooling esp. at night Exclude derm. conditions / dry skin (i.e. Vaseline) Topical Camphor 0.25% + Menthol 0.25% in Ointment base topical to skin prn. (May add steroid cream if severe excoriation present) Consider gabapentin/SSRI (i.e. paroxetine) /antihistamine use if pruritus is ongoing or severe
Excess secretions	Often only seen at the end of life Consider glycopyrrolate, or less frequently scopolamine
Fatigue	Reassess dialysis therapy schedule (if relevant) Assess for sleep disorder or depression/anxiety Consider medical cause i.e. hypothyroidism/anemia May respond to occupational therapy interventions (energy budgeting) Medical treatments of possible benefit *may* include marijuana, SSRI i.e. mirtazapine, short-term steroids

Kidney Failure – Definitions and Approach

Definitions

eGFR is determined by all Ontario laboratories using the 4 variable MDRD equations. You can access the eGFR in our EPR by going to "combined results" and clicking on a serum creatinine value.

Stages of Chronic Kidney Disease (CKD)

Chronic kidney disease is defined as abnormalities of kidney structure or function, present for > 3 months, with implications for health and CKD as classified based on cause, GFR category, and albuminuria category (CGA).*

*www.kdigo.org/clinical_practice_guidelines/pdf/CKD/KDIGO_2012_CKD_G

	Low risk
	Moderately increased risk
	High risk
	Very high risk

GFR categories (ml/min/1.73m²) Description and range				Persistent albuminuria categories Description on range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				< 3 mg/mmol	3 – 30 mg/mmol	>30 mg/mmol
	G1	Normal or high	≥90			
	G2	Mildly decreased	60 - 89			
	G3a	Mildly to moderately decreased	45 - 59			
	G3b	Moderately to severely decreased	30 - 44			
	G4	Severely decreased	15 - 29			
	G5	Kidney failure	<15			

Creatinine assay interference by glucose in hyperglycemia

Medical Staff Bulletin: Vol 18 No 13

Review of external laboratory quality assessment results has identified interference in plasma creatinine measurements by high concentrations of glucose. The interference is significant at plasma glucose levels of > 15 mmol/L. The degree of interference is proportional to the glucose concentration and is most significant for creatinine values in the normal range and up to 200 umol/L.

The positive bias in creatinine results has a relationship of approximately 1 umol/L of creatinine for every 1 mmol/L of glucose. For example, a measured creatinine of 100 umol/L with glucose of 20 mmol/L, the actual creatinine is approximately 80 umol/L. Take this false increase into account in the setting of hyperglycemia, and creatinine levels should be reassessed after glucose levels have normalized.

We are working with the vendor to eliminate this interference. Laboratory reports will contain a comment regarding glucose interference until further notice as follows:

Results are falsely elevated when plasma glucose levels are >15 mmol/L. Creatinine is higher by 1 umol/L for every 1 mmol/L of glucose. Creatinine should be reassessed after glucose levels have normalized

As described previously, the Jaffe creatinine method may be affected by icterus resulting in falsely lowered results. Also, assay-dependent increases may occur with acetoacetate, ascorbic acid, fructose, pyruvate, cephalosporins, creatinine, proline and chronic lidocaine administration. In vivo inhibition of creatinine secretion can occur with cimetidine, trimethoprim (sulphamethoxazole), ciprofloxacin, or fenofibrate

The UHN Laboratory Medicine Program Management team is available to address your concerns. Please do not hesitate to contact your Site Manager if you have any questions or concerns as follows:

TGH: Marni Lollo, ext 14-5215

TWH: Joseph Kuzma, ext 13-5576

PMH: Maria Amenta, ext 14-5022

For more information:

Dr. Paul Yip, ext 14-6931

Biochemist

Bulletin issued on July 9, 2009

Care and referral of adult patients with reduced renal function

Recommendations from the Canadian Society of Nephrology (CSN)

Who should be tested for kidney disease?

The following characteristics identify individuals at high-risk of chronic kidney disease:

- Hypertension
- Diabetes mellitus
- Heart failure
- Atherosclerotic coronary, cerebral or peripheral vascular disease
- Unexplained anemia
- Family history of end stage renal disease (ESRD)
- First nation's peoples

Population screening for chronic kidney disease (CKD) is not endorsed.

What tests to order?

eGFR is endorsed as a measure of kidney function as serum creatinine tends to be ineffective as a marker of early kidney injury.

eGFR may be reported by the laboratory based on conventional mathematical formulas

Calculators and tables are available to calculate eGFR using measured serum creatinine

Web-based calculators: http://egfrcalc.renal.org/

http://www.kidney.org/professionals/kdoqi/gfr_calculator.cfm

http://nkdep.nih.gov/lab-evaluation/gfr-calculators/adults-SI-units.asp

A random urine sample can identify kidney injury. Urine albumin or protein excretion should be quantified with an albumin to creatinine ratio (ACR) or a protein to creatinine ratio (PCR).

24 hour urine collections are the most accurate way of determining protein excretion in patients with proteinuric CKD.

What to do with the results?

Referral to a nephrologist is recommended in the following situations:

- AKI

- eGFR <30 mL/min/1.73m2 (CKD stages 4 and 5)

- Progressive decline of eGFR

- Persistent significant proteinuria ACR>60 mg/mmol, PCR >100 mg/mmol or 24 h protein > 1 g/d)

- Inability to achieve treatment targets or other difficulties in the management of the CKD patient

For more information visit the Canadian Society of Nephrology website at www.csnscn.ca

Management of Contrast Nephropathy

Definition

Proportional rise in creatinine (25-50%) within 48-72 hrs of receiving radiocontrast medium - other causes ruled out

Presentation

Creatinine peak 4-5 days, with return to baseline 7-10 days
Usually non-oliguric
Low FeNa
UA – mild protein; Micro – bland or granular casts

Risk Factors

- Pre-existing CKD stages 3-5
- Diabetes
- CHF
- MM
- Contrast agent
  -High volume

Prevention

- Avoid contrast, if necessary - Low contrast volumes
- Isosmotic medium in CRI (Standard at UHN)
- ECFV repletion/hydration

Recommendations

- Measure renal function before, 48h and 72 hrs after contrast
- Assess clinical circumstances and ensure adequate hydration
- If the patient is in hospital then give
  - Normal Saline IV 1mL/kg/hr 6 -12hrs before and 12-24 hrs after procedure.
- If the patient has not been in hospital, or there is no time available to give an overnight infusion, give
  - NaHCO3 (150cc in 850 cc D5W) at rate of 3 mL/kg/hr starting one hr before procedure and continue at 1 mL/kg/hr for 6 hrs after the contrast study.
- Hold diuretic, ACEI/ARB, Calcineurin inhibitors and metformin. Avoid nephrotoxins, e.g. NSAIDS

References

KI 1998, vol 53, p. 230-242.

AJKD 1994, vol 24, p. 713-727.

JAMA 2004;29:2328.

NEJM 2000, vol 343 (3) p 180-184 .

Medication in CKD and Dialysis

General Guidelines

- Renal pts often require alterations in dosing of medications due to renal failure and/or dialysis. Consult renal pharmacist if there are questions re dosing beyond described in this Guidebook
- When admitting a patient, call the appropriate hemodialysis unit or HPDU to have them fax medication and dialysis orders.
- Remember to order Aranesp/Eprex and Venofer, HD pts may not include these as meds that they are on, as they are given in HD
- All pts to be vaccinated for Pneumococcus, Influenza, Hepatitis and Tetanus per protocols, documented in HD and PD charts.
- See sections "Common Drugs Used in ESRD" and "Drug Dosing for HD, CAPD and CRRT".

Ontario Drug Coverage Overview for CKD Patients

Types of Coverage:

1) Cash
2) 3rd party insurance (through employment, Blue Cross, Liberty Health)
3) Ontario Drug Benefit (ODB)

Ontario Drug Benefit (ODB) Eligibility

- 65 years old or older
- Receiving services from Home Care (CCAC) program
- Residents of long term care facilities or Homes for Special Care
- Eligible under the Trillium Drug Program
- Receiving benefits from Ontario Works, Ontario Disability Support Program (ODSB) or social assistance

What is covered?

- Formulary medications - Follow the Ontario Drug Benefit Formulary
- Limited Use Products - Covered when patient meets listed criteria
- Must put Limited Use code on actual prescription
- “Exceptional Access Program” (formerly “Section 8”) approved meds (see below)

Exceptional Access Program (formerly Section 8)
A source of payment that can be applied for when no formulary alternative is available or suitable

- Application requires Individual Clinical Review
- Meds that are not listed in ODB formulary or which fall under limited use criteria
- Physician is making “special request” for coverage
- Guided by DQTC and other expert medical advisers to review individual requests

What do I need to request for Exceptional Access Program review?

- Prescriber’s information
- Patient demographics including OHIP number
- Requested drug (generic name, brand name, dosage strength and drug identification number)
- Detailed summary of condition
- If the patient has taken the drug, provide objective evidence of efficacy (lab results, diagnostic tests, culture and sensitivity reports, etc.)
- Additional information regarding previous therapy, contraindications to formulary medications, concomitant drug therapy
- Desired outcome with requested drug

Before I send out an Exceptional Access Program request, Check:» Is the patient covered by ODB?
» Has the patient tried medications covered by ODB?
» Do I have all the necessary background information to support using this request? (lab results, diagnosis, response to treatment

- **FAX: (416) 327-8123 or (416) 327-7526**
- **Follow up information** PHONE: 416-327-8109

If in doubt or require assistance, contact Celine Yu Reimbursement specialist ext 14-6622

Dose adjustments of drugs for renal failure

Estimate CrCl using Cockcroft-Gault equation:

$$\text{CrCl (mL/s)} = \frac{(140-\text{age}) \times \text{wt (kg)}}{50 \times \text{SCr (umol/l)}} \quad (\times 0.85 \text{ for women})$$

Do not use MDRD (eGFR) for drug dosing as it has not been validated.

Commonly prescribed drugs that require dose adjustment

- Antibiotics (penicillins, cephalosporins, quinolones, Vancomycin, Co-trimoxazole)
- H2 receptor blockers
- Allopurinol
- Analgesics
- Antivirals (gancyclovir, acyclovir)

Dose adjustment for dialysis

Consider:

- Type of dialysis (HD vs. PD. vs. CRRT)
- Drug properties (MW, protein binding, water solubility, metabolism)
- Drugs that are renally cleared are usually dialyzable
- Most antibiotics (penicillins & cephalosporins) are dosed after dialysis
- Dose antibiotics per UHN Guidelines for Antimicrobial Use
- Discuss with Nephrology fellow/staff or pharmacist

Common problems in the ESRD population and their therapies

Bleeding Complications

- Platelet dysfunction in the uremic environment contributes to bleeding
- Before invasive procedures, advisable to use FFP's or DDAVP
  DDAVP dosing: 0.3 ug/kg/hr to max 20 ug
  Max 20 ug in 100 mL N/S over 20 min
- To stop bleeding, apply direct pressure for prolonged period of time.
  May require Gelfoam
  Never use Thrombostat (high incidence of anaphylaxis in HD pts)

Anemia – Erythropoiesis Stimulating Agents (ESA's)

- Decreased erythropoietin (EPO) production in renal failure contributes to anemia, there are 2 main ESA's - Darbepoetin (Aranesp®) and erythropoietin (Eprex®)
- Most patients require ESA supplementation +/- IV or po iron
- Iron should be monitored (see Iron Assessment Algorithm)
- Darbepoetin (Aranesp®) guidelines: 0.45 mcg/kg Subcut or IV once weekly
- For those on chronic HD at TGH, Aranesp® is given Tuesdays and Fridays.
- The patient may experience an increase in blood pressure; therefore, BP should be well controlled **prior** to initiating ESA's, and monitored following.
- Goal hemoglobin: 100-120.

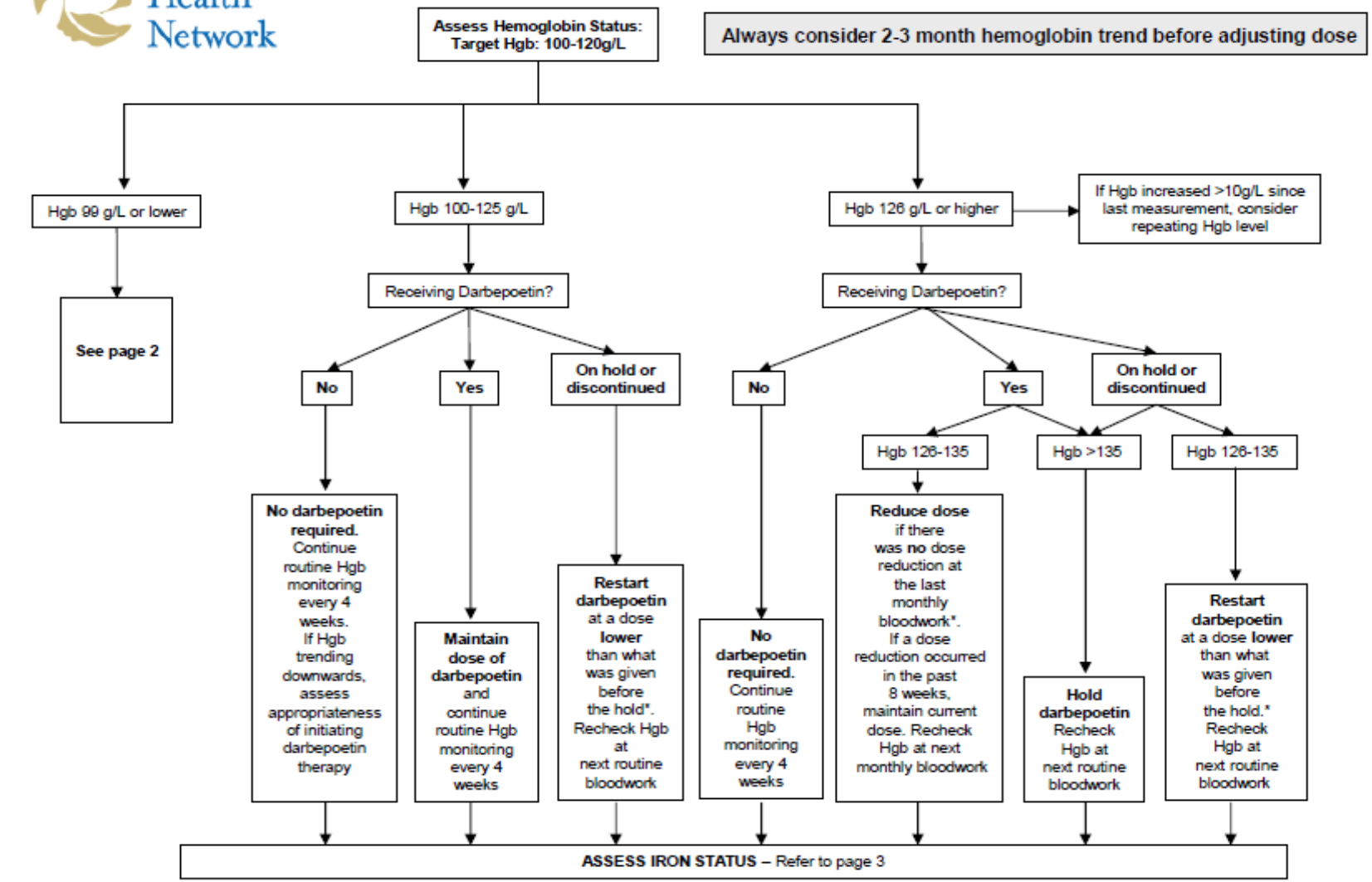
Common causes of non-response to EPO include
- Iron deficiency - Blood loss (active bleeding or hemolysis)
- Infection - Active inflammatory disease
- Malignancy - Hyperparathyroidism

Anemia Management Protocol for HD

The following protocol was developed for hemodialysis patients by Marisa Battistella, Pharm D. It is for those being managed with IV Iron. Oral iron is also an option (see "Iron" section).

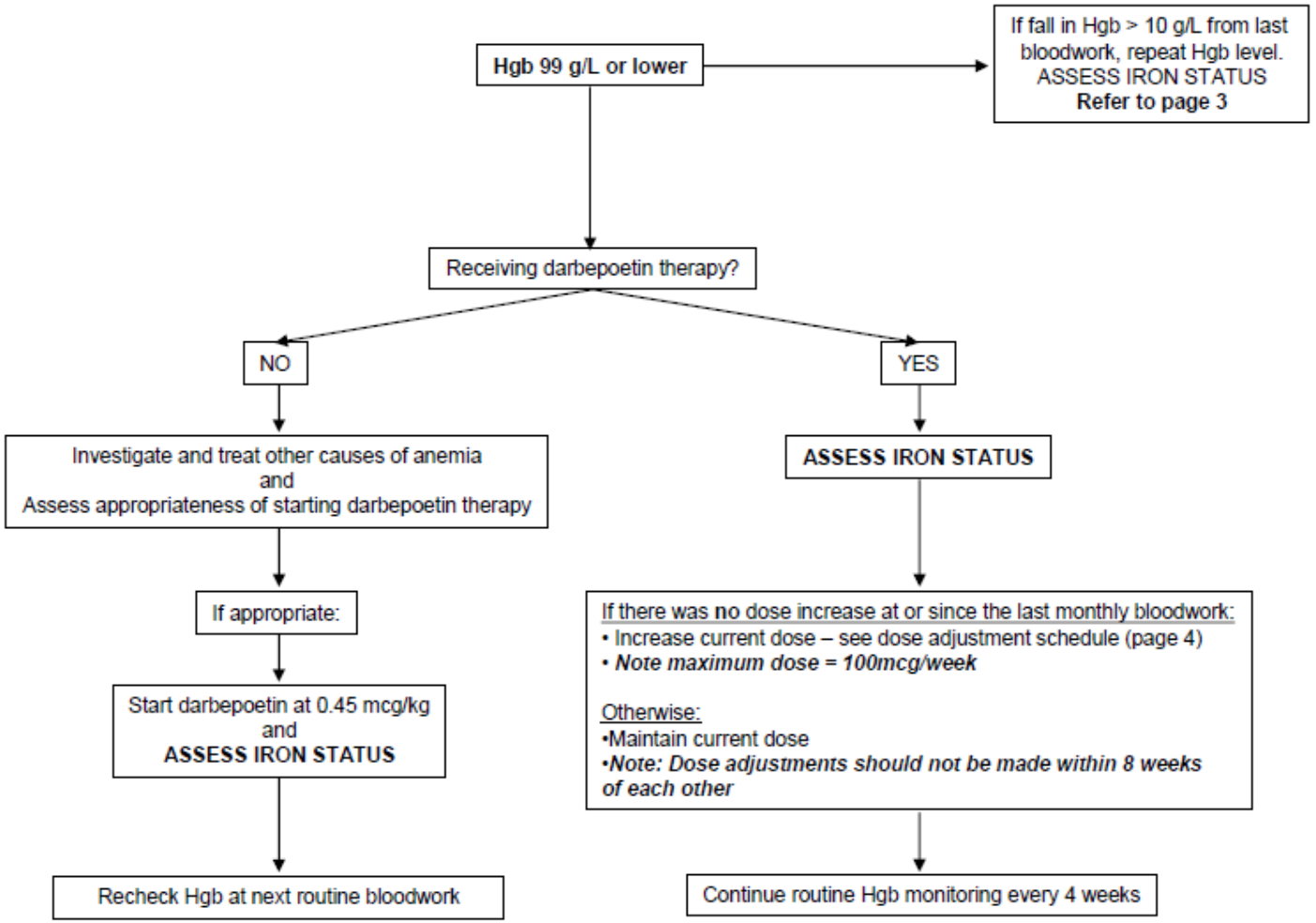
University Health Network

Anemia Management Protocol

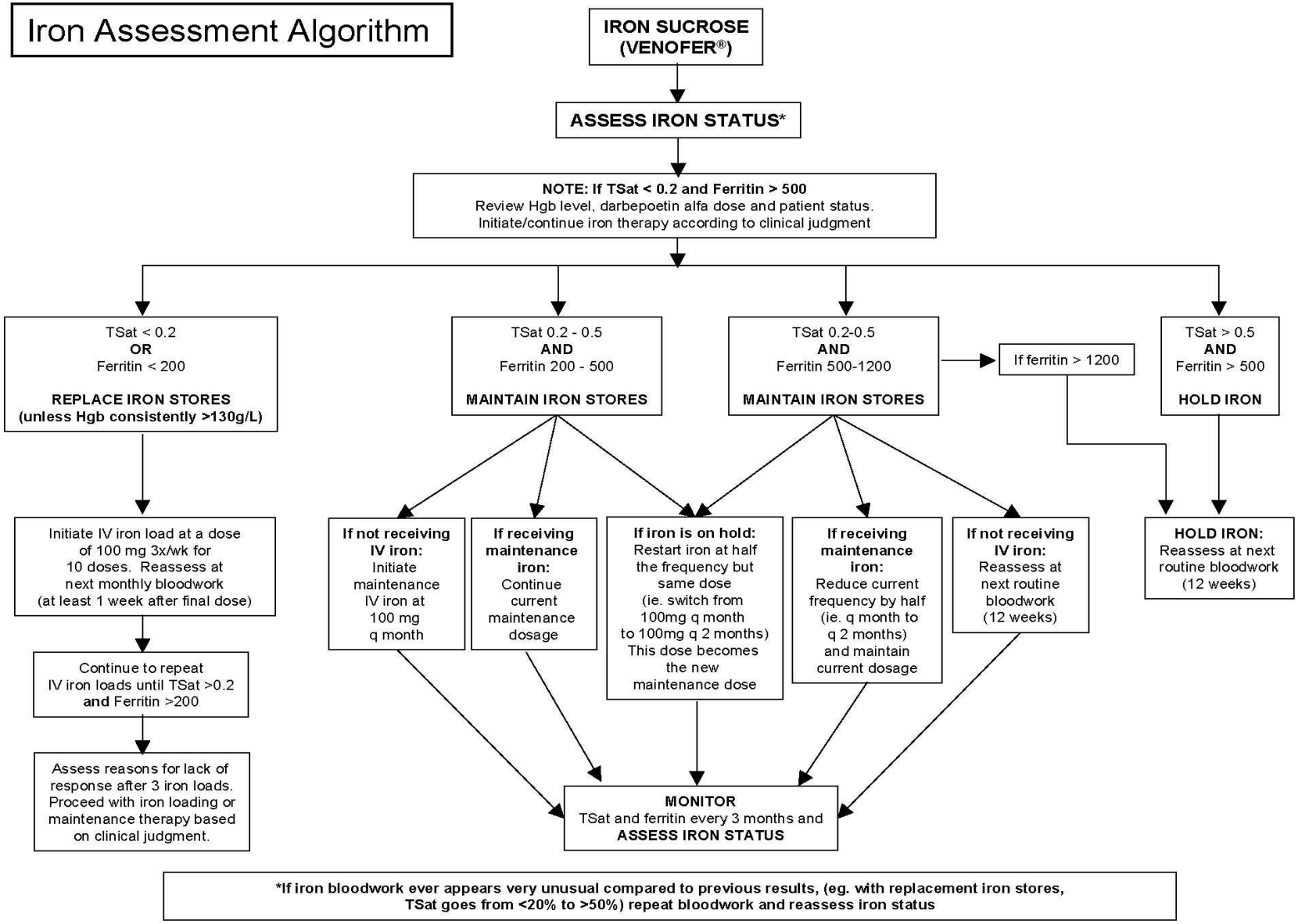


* See dose adjustment schedule for patients using Darbepoetin Alfa

Anemia Management continued



Iron Assessment Algorithm



Dose Adjustment Schedule for Patients using Darbepoetin Alfa

Current Dose	Increase Dose To	Reduce Dose To
10 mcg q2wk	10 mcg/wk	10 mcg monthly or D/C darbepoetin Reassess monthly
10 mcg/wk	20 mcg/wk	10 mcg q2wk
20 mcg/wk	30 mcg/wk	10 mcg/wk
30 mcg/wk	40 mcg/wk	20 mcg/wk
40 mcg/wk	50 mcg/wk	30 mcg/wk
50 mcg/wk	60 mcg/wk	40 mcg/wk
60 mcg/wk	80 mcg/wk	50 mcg/wk
80 mcg/wk	100 mcg/wk	60 mcg/wk
100 mcg/wk	Max dose 100mcg/wk	80 mcg/wk

Conversion from Eprex® to Aranesp®

Aranesp® is the standard ESA used at UHN, however some individuals may come in on Eprex® and need to be converted to Aranesp®. A simple method of conversion is to multiply Eprex® dose by 4 and use 1st 2 digits as the Aranesp® dose.

A more specific method is to multiply weekly Eprex® dose by conversion factor in table below. Aranesp® dose is the 1st 2 digits rounded off. E.g. Pt gets Eprex® 8,000 u/week with Hgb 122 → 8,000 x 4 = **32**,000, therefore give **30** ug Aranesp®

Prefilled syringes available in 10, 20, 30, 40, 50, 60, 80,100 and 150 ug.

Aranesp® start dose: 0.45 ug/kg/wk

Give Aranesp® once per week or once per 2 weeks.

Order Aranesp® IV for patients on HD and SC for all others.

Conversion Factors Eprex® to Aranesp®

Eprex Dose	Hemoglobin	
U/week	<120 g/L	≥120 g/L
<15,000	**5x**	**4x**
≥15,000	**4x**	**3x**

Remember to fill out registration form for new Aranesp® therapy and send to Dr. Richardson's office (8NU-861).

Guidelines for Registering Renal Failure Patients for ESA

(Erythropoietin or Darbepoetin) at UHN and MSH

1. **Complete a Ministry of Health EPO registration form** (available in the HD units, PD unit, the nephrology ward or through Dr. Richardson's office)

- Include the patient's MRN for identification purposes as well as name
- Fill out <u>all</u> spaces including MOH insurance number
- In the section "type of dialysis" check "none" if they are predialysis or transplanted
- In the section "Physician" print the name of the <u>staff</u> physician and your name if different – a signature is not required
- For patients not on dialysis, indicate if they are predialysis or transplant

2. **For center hemodialysis patients**

- After completing the form, send it to Dr. Richardson's office (8NU-861)
- Write an order for erythropoietin in the patient's chart

3. **For peritoneal dialysis patients**

- After completing the registration form, <u>make a photocopy of the top page</u>
- Write a prescription for erythropoietin

- Give the patient **both** the prescription **and** the copy of the registration form to take to TGH pharmacy. The registration form will serve as proof the patient has been registered
- Give the registration form to the ward clerk who will send it to Dr. Richardson's office

4. **For office or clinic outpatients at TWH, TGH, MSH or PMH**

- After completing the registration form, make a photocopy of the top page
- Write a prescription for erythropoietin
- Give the patient **both** the prescription **and** the copy of the registration form to take to either TWH or TGH pharmacy. The registration form will serve as proof the patient has been registered
- Send the registration form to Dr. Richardson's office. There is no need to phone the office since the copy of the registration form has been given to the patient to take to pharmacy

5. For **inpatients** at TGH, TWH, MSH or PMH being registered for EPO for the **first** time

- After completing the registration form make a copy of the top page
- Order Aranesp® /Eprex® in Electronic Patient Record (EPR); give a copy of the registration form to the ward pharmacist
- Send the registration form to Dr. Richardson's office

6. For **inpatients** at TGH, TWH, MSH or PMH who are receiving erythropoietin at other dialysis centers and are transferred here temporarily for care and require erythropoietin

- Write an order for erythropoietin in the chart
- Add a statement to the effect that the patient is registered for erythropoietin at another center
- **Do NOT fill out a registration form for these patients**

7. Note that if a patient comes to the outpatient pharmacy with a prescription for EPO who is not on the registration list or who does not have a photocopy of the registration form, the patient will be asked to return to their nephrologist's office or clinic to be properly registered, or if they go to an outside pharmacy, they will be charged the cost of the meds. **Revised July 2002**

Vitamin deficiency

- Replavite® 1 tab daily, a water soluble vitamin that contains B vitamins, vitamin C and folic acid

- Other multivitamins may contain fat soluble vitamins which may accumulate and cause toxicity and should not be substituted

Hyperphosphatemia

Calcium carbonate is used as a phosphate binder given with meals

Calcium carbonate 1250mg = Ca^{++} 500mg

Tums regular strength = $CaCO_3$ 500mg = Ca^{++} 200mg

Tums extra strength = $CaCO_3$ 750mg = Ca^{++} 300mg

Tums ultra = $CaCO_3$ 1000mg = Ca^{++} 400mg

- For severe hyperphosphatemia with hypercalcemia, aluminum hydroxide can be used short term e.g. Amphogel 15-30 mL TID with meals x 5 days then reassess

- Sevelamer (Renagel®), Lanthanum (Fosrenol®) - Ca-free PO_4 binders - useful for pts with both hyperphosphatemia and hypercalcemia - expensive and as yet not covered by ODB - requires “Exceptional Access Program” (EAP) approval. If the patient is on dialysis and has sustained hyperphosphatemia (>1.8 mmol/L) and hypercalcemia (>2.65 mmol/L) they can be covered through the “Telephone Request Service” through EAP. Call 1-866-811-9893 or 416-327-8109 to provide prescriber and patient details to receive approval and/or consult renal pharmacist.

Hypophosphatemia

- Hold PO_4 binders.

Patients on HD or SLED may develop hypophosphatemia. One way of correcting this is to add Fleet PO_4 enema (concentrated sodium phosphate) to the acid concentrate. 100 mL of Fleet enema contains approximately 175 mmol of phosphate – which gets diluted 1:45 by the dialysis machine.

For 4.5 L or 5.0L acid jugs:

Amount of Fleet enema	Final Dialysate Concentration
120 mL	1.0 mmol/L
95 mL	0.8 mmol/L
47 mL	0.4 mmol/L

NOTE: **NEVER** ADD FLEET ENEMA DIRECTLY TO BAGS USED FOR CRRT AS THIS WILL CAUSE SEVERE HYPERPHOSPHATEMIA.

Hypocalcemia/↑PTH

- The kidneys' production of 1,25 dihydroxy Vitamin D_3 (the active form of vitamin D) declines in CKD; therefore, calcium absorption from the GI tract is also diminished leading to hypocalcemia and hyperparathyroidism
- May use Calcium carbonate between meals as calcium supplement.
- Calcitriol = Rocaltrol, the pharmacological replacement of active vitamin D_3 which increases gut absorption of Ca^{++} (and PO_4) and suppresses PTH
- Dose of calcitriol ranges from 0.25 ug 3x/wk to 1.0 ug OD (may be given po, or IV pulse with HD)
- If pts 25-OHD level is <75, give ergocalciferol, 50,000 u / week x 2 weeks, repeat level, if still low, give once/month x 3 months.
- Cinacalcet (Sensipar) is a new calcimimetic, which is available, however is not covered by ODB, and is very costly. Payment needs to be determined (check private plans) before prescribing this medication.
- Goal PTH = 20-30 pmol/L (normal 7-8); normalization may be a risk factor for adynamic bone disease

Constipation

AVOID

- Magnesium containing products (MOM, Mag citrate)
- Bulk forming laxatives in fluid restricted patients e.g. Metamucil or Prodiem
- Phosphate Fleet enemas d/t high phosphate content (may use Fleet Mineral Oil)

SAFER

- Docusate sodium, Lactulose, senna
- Stimulant laxatives (bisacodyl, cascara)
- Glycerin suppositories prn
- Tap water or mineral oil enemas for severe constipation
- Colyte/Golytely for bowel preps or lower dose (250-500 mL) for very severe constipation.

Analgesia

Opioid Analgesic Comparison Chart

	Doses Equivalent to Morphine 10 mg IM or SC			Brand Name	Duration of Analgesia	Consideration in CKD	
Opioid	**IM or SC ****	**Oral ****	**Conversion Injection to Oral**			**Caution**	**Dialyzability**
Codeine	120 mg	200 mg	1.5	Codeine tablet/syrup	3 to 4h	Caution: consider decrease starting dose to 50% due to prolonged half life	No data (HD) Unlikely (PD)
				Compounds (Tylenol #1, #2, #3)	3 to 4h		
				Codeine Contin CR	12 h		
Morphine	10 mg	30 mg	3	Morphine tablet/syrup (MS-IR ® / Statex®)	3 to 4h	Metabolite morphine 6 glucoronide has narcotic activity increased risk of side effects	Yes (HD) No (PD)
				M- Eslon® capsule	12 h		
				MS Contin® SR tablet	12 h		
Oxycodone	NA	15 mg	NA	Oxy-IR®	3 to 4 h	Caution	Yes (HD) No data (PD)
				Oxycontin® CR	12 h		
				Percocet® (oxycodone + acetaminophen)	3 to 4 h		

Hydromorphone	1.5 mg	7.5 mg	5	Dilaudid®	3 to 4 h	Caution due high potency narcotic	No data (HD) No data (PD)
				Hydromorphone Contin	12 h		
Fentanyl	100 ug	NA	NA	Duragesic® Patch	72 hours	Decrease starting dose by 50%	No (HD) No data (PD)

* Opioids are in order of increasing potency

** All above dose equivalencies are compared to 10 mg of **injectable morphine**. For example, Codeine 120 mg IM = Morphine 10 mg IM = Hydromorphone 1.5 mg IM

Other Considerations:

- It is easier to keep pts out of pain than to get them out of pain, consider standing analgesia with breakthrough as needed.
- Acetaminophen (Tylenol) +/- codeine – max 4 gm acetaminophen/day
- NSAIDs - remember pts are at a higher risk of GI bleed therefore, misoprostal or a proton pump inhibitor should be added for prophylaxis
- All opioids – start at small doses and titrate up for pain relief as excessive sedation may occur

HS Sedation

AVOID

- Chloral hydrate as the active metabolite may accumulate and cause excessive sedation

SAFER

- Benzodiazepines such as lorazepam and oxazepam are hepatically metabolized and safer.

Anti-seizure medications

- Carbamazepine, diazepam, phenobarbital, valproic acid are hepatically metabolized, however, the effect might be enhanced due to low albumin and level should be interpreted with caution.
- Phenytoin (Dilantin®) dosing is unchanged but blood levels require careful interpretation with renal failure:

Corrected blood Phenytoin (Dilantin®) level in patients with Crcl < 20 ml/min:

measured level (µmol/L) ÷ [(albumin (g/L) x 0.01) + 0.1]

Table 7. VTE (DVT) Prophylaxis for Transplant and Nephrology

Patient group	Recommended Thromboprophylaxis options[2,3,4]	Initiation	Duration[3]
Multi-Organ Transplant ***This lists what is currently contained on pre-printed order sets/EPR screens.***	**Kidney-Pancreas** • **Pre-op:** UFH 5000 units SC 60 mins prior to incision • **Post-op:** UFH 5000 units SC q 12h **Kidney** • **New transplants – UFH 5000 units SC bid, 1st dose given pre-op in the OR; continue until discharge** • **Readmissions – UFH 5000 units SC bid from admission until discharge** • **Patients who should not receive UFH: 1) already on full-dose anticoagulation for other reasons 2) patients with heparin allergy/HIT 3) patients who are actively bleeding 4) patients who are fully mobile and with a short expected length of stay (<48 hours)** • **For patients in category 2, consider fondaparinux +/- TED stockings; for patients in category 3, use TED stockings** • **For patients who will be undergoing renal biopsy, hold the dose of UFH prior to the biopsy**	60 mins prior to incision pre-op in the OR admission	until discharge until discharge

	Laparoscopic Kidney Donor • **Pre-op:** UFH 5000 units SC 60 mins prior to incision and T.E.D.s/SCDs in OR • **Post-op:** UFH 5000 units SC q 12h and T.E.D.s/SCDs until POD #2		
Nephrology	• **UFH 5000 units SC bid** • **Assessment: tunneled catheter = higher risk for VTE.** • **Patients who should NOT receive UFH:** • **1) fully anticoagulated (Warfarin).** • **2) Heparin allergy/HIT.** • **3) active bleed** • **4) fully mobile with short expected length of stay (<48 hr)** • **See Footnote 6** • **If HIT or heparin allergy, no heparin - initiate hematology consult** • **If high risk of bleeding (e.g. w/u for hemorrhagic CVA, planned invasive procedure within 24 hr), or admitted with bleed (footnote 6), calf-length TED stockings. When bleeding risk allows, resume/initiate UFH.** • **Note: HD or IP heparin does NOT provide VTE prophylaxis** • **Note: Enoxaparin can accumulate**	1st dosing time after admission	Until Discharge

	in renal failure, thus avoid.		

Abbreviations:
ASAP = as soon as possible **LMWH** = low-molecular-weight heparin

T.E.D.s = ThromboEmbolic Deterrent stockings **TP** = thromboprophylaxis

VTE = venous thromboembolism

Footnotes to the Table:

1. For all patients in whom it is possible and appropriate, early and frequent mobilization and ambulation are essential.

2. ***In general, for weight less than 40 kg or creatinine clearance <30 mL/min, it is suggested that the prophylactic LMWH dose be reduced to the next lower pre-filled syringe dose (i.e., from enoxaparin 40 mg to 30 mg SC once daily). In general, for weight greater than 100 kg, consider doubling the LMWH dose (i.e., from enoxaparin 40 mg once daily to 40 mg SC BID). At weights >120 kg, even higher doses should be considered.***

3. The duration of TP is not based on mobility status alone.

4. Absolute contraindications to anticoagulant TP are: active, clinically-important bleeding, platelets less than 30×10^9/L, major bleeding disorder, heparin-induced thrombocytopenia (a contraindication to heparin and LMWH). Relative contraindications to anticoagulant TP are: recent intracranial hemorrhage, recent peri-spinal bleeding, recent high-risk bleeding surgery.

Approach to Post Parathyroidectomy Management

Post parathyroidectomy, many patients develop 'Hungry Bone' syndrome, leading to marked and severe hypocalcemia, despite normal or elevated PTH, thus need to be carefully monitored and managed. Each patient must be considered individually, however, the following is a suggested approach for management.

Measure serum Ca 2-4x/day for first 4 days in hospital (time of greatest risk), then consider decreasing to 2x/day until pt no longer needs IV Calcium, then daily until stable, and plan for regular monitoring as an out-patient.

Start oral Ca 2-4 gm elemental Ca/day as soon as pt able to swallow (ideally between meals if PO4 is normal or low)

If patient is symptomatic (Chvostek's or Trousseau's sign) or Ca is < 1.9 mmol/L:

Order 1-2 gm Ca gluconate in 50 mL D5W, infuse over 10 – 20 min, followed by 10% Ca gluconate slow infusion. (i.e. add 100 mL of 10% Ca gluconate to 1L D5W or Normal saline) run at 50 mL/hr then titrated to keep serum Calcium (corrected for albumin) at the lower end of normal range.

Consider oral Vitamin D. In a placebo-controlled trial, postop oral calcitriol in doses up to 4 mcg/day ameliorated the postoperative decline in the serum calcium concentration (Clair F, Leenhardt L, Bourdeau A, et al. Effect of calcitriol in the control of plasma calcium after parathyroidectomy. A placebo-controlled, double-blind study in chronic hemodialysis patients. Nephron 1987; 46:18.)

Dialysis is another method of correcting the hypocalcemia. A high calcium bath (1.75 mmol/L) can be used in patients undergoing hemodialysis. Alternatively, intravenous calcium can be administered during dialysis, thereby allowing an earlier switch to outpatient management. Similarly, one to three ampules of calcium gluconate can be added to each bag of peritoneal dialysate in patients treated with continuous ambulatory peritoneal dialysis (www.uptodate.com)

It is very important to follow Ca beyond the first 4 days as it can drop suddenly, thus a discharge plan must include close out-pt follow up of Ca soon after discharge.

Table 8. Drug Dosing for HD, CAPD and CRRT

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval NA = Not Available				
Acarbose	D	Avoid	Unknown	Unknown	Avoid
Acebutolol	D	30-50%	None	None	50%
Acetazolamide	I	Avoid	Unknown	Unknown	Avoid
Acetohexamide	I	Avoid	Unknown	None	Avoid
Acetohydrox-aminic acid	D	Avoid	Unknown	Unknown	Unknown
Acetaminophen	I	Q8H	None	None	q6h
ASA	I	Avoid	After HD	None	q4-6h
Acrivastine	D	Unknown	Unknown	Unknown	Unknown
Acyclovir	D,I	See UHN Guide	See UHN Guide	Dose for RF	3.5 mg/kg/d
Adenosine	D	100%	None	None	100%
Albuterol	D	50%	Unknown	Unknown	75%
Alcuronium	D	Avoid	Unknown	Unknown	Avoid
Alfentanil	D	100%	Unknown	Unknown	100%
Allopurinol	D	25%	½ dose	Unknown	50%
Alprazolam	D	100%	None	Unknown	NA
Alteplase (tPA)	D	100%	Unknown	Unknown	100%
Altretamine	D	Unknown	Unknown	Unknown	Unknown
Amantadine	I	q7d	See UHN Guide	None	q48-72h
Amikacin	D,I	20-30% q24-48h	See UHN Guide	15-20mg/L/d	30-70% q12-18h
Amiloride	D	Avoid	NA	NA	NA
Amiodarone	D	100%	None	None	100%
Amitriptyline	D	100%	None	Unknown	NA
Amlodipine	D	100%	None	None	100%
Amoxapine	D	100%	Unknown	Unknown	NA
Amoxicillin	I	See UHN Guide	See UHN Guide	250mg q12h	NA
Amphotericin	I	q24-36h	See UHN Guide	See UHN Guide	q24h
Ampicillin	I	See UHN Guide	See UHN Guide	250mg q12h	q6-12h
Amrinone	D	50-75%	Unknown	Unknown	100%
Anistreplase	D	100%	Unknown	Unknown	100%
Astemizole	D	100%	Unknown	Unknown	NA
Atenolol	D,I	30-50% q96h	25-50 mg	None	50%q48h
Atovaquone	-	100%	None	Unknown	Unknown
Atracurium	D	100%	Unknown	Unknown	100%
Auranofin	D	Avoid	None	None	None
Azathioprine	D	50%	Yes	Unknown	75%
Azithromycin	D	100%	None	None	None
Azlocillin	I	q8h	Dose after HD	Dose for RF	q6-8h
Aztreonan	D	25%	0.5g after HD	Dose for RF	50-75%
Benazepril	D	25-50%	None	None	50-75%
Bepridil	-	Unknown	None	None	Unknown.

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Betamethazone	D	100%	Unknown	Unknown	100%
Betaxolol	D	50%	None	None	100%
Bezafibrate	D	25%	Unknown	Unknown	50%
Bisoprolol	D	50%	Unknown	Unknown	75%
Bleomycin	D	50%	None	Unknown	75%
Bopindolol	D	100%	None	None	100%
Bretylium	D	25%	None	None	25-50%
Bromocriptine	D	100%	Unknown	Unknown	Unknown
Brompheniramine	D	100%	Unknown	Unknown	NA
Budesonide	D	100%	Unknown	Unknown	100%
Bumetanide	D	100%	None	None	NA
Bupropion	D	100%	Unknown	Unknown	NA
Buspirone	D	100%	None	Unknown	NA
Busulfan	D	100%	Unknown	Unknown	100%
Butorphanol	D	50%	Unknown	Unknown	NA
Capreomycin	I	q48h	Dose after HD	None	q24h
Captopril	D,I	50% q24h	25-30%	None	75% q12-18h
Carbamazepine	D	100%	None	None	None
Carbidopa	D	100%	Unknown	Unknown	Unknown
Carboplatin	D	25%	50%	Unknown	50%
Carmustine	D	Unknown	Unknown	Unknown	Unknown
Carteolol	D	25%	Unknown	None	50%
Carvedilol	D	100%	None	None	100%
Cefaclor	D	50%	250 mg after HD	250mg q8-12h	NA
Cefadroxil	I	q24-48h	0.5-1.0g after	HD0.5g/d	NA
Cefamandole	I	q12h	0.5-1.0g after	HD0.5-1.0g q12h	q6-8h
Cefazolin	I	See UHN Guide	See UHN Guide	See UHN Guide	q12h
Cefepime	I	q24-48h	1g after HD	Dose for RF	Not recommend
Cefixime	D	50%	300 mg after HD	200 mg/d	Not recommend
Cefmenoxine	D,I	0.75g q12h	0.75g after HD	0.75g q12h	0.75g q8h
Cefmetazole	I	q48h	Dose after HD	Dose for RF	q24h
Cefonicid	D,I	0.1g/d	None	None	None
Cefoperazone	D	100%	1g after HD	None	None
Ceforanide	I	q24-48h	0.5-1.0g after	HDNone	1 g/d
Cefotaxime	I	See UHN Guide	See UHN Guide	1g/d	1g q12h
Cefotetan	D	See UHN Guide	See UHN Guide	1g/d	750 mg q12h
Cefoxitin	I	q24-48h	1g after HD	1g/d	q8-12h
Cefpodoxime	I	q24-48h	200 mg after HD	Dose for RF	NA
Cefprozil	D,I	250 mg q24h	250 mg after HD	Dose for RF	Dose for RF
Ceftazidime	I	See UHN Guide	See UHN Guide	See UHN Guide	q24-48h
Cefibuten	D	25%	300 mg after HD	Dose for RF	50%
Ceftizoxime	I	q24h	1g after HD	0.5-1.0g/d	q12-24h
Ceftriaxone	D	100%	See UHN Guide	750 mg q12h	100%

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Cefuroxime axetil	D	See UHN Guide	See UHN Guide	Dose for RF	NA
Cefuroxime sodium	I	See UHN Guide	See UHN Guide	Dose for RF	1g q12h
Celiprolol	D	75%	Unknown	None	100%
Cephalexin	I	See UHN Guide	See UHN Guide	Dose for RF	NA
Cephalothin	I	q12h	Dose after HD	1g q12h	1g q8h
Cephapirin	I	q12h	Dose after HD	1g q12h	1g q8h
Cephradine	D	25%	Dose after HD	Dose for RF	NA
Cetirizine	D	30%	None	Unknown	NA
Chloral hydrate	D	Avoid	None	Unknown	NA
Chlorambucil	D	Unknown	Unknown	Unknown	Unknown
Chloramphenicol	D	100%	See UHN Guide	None	None
Chlorazepate	D	100%	Unknown	Unknown	NA
Chlordiazepoxide	D	50%	None	Unknown	100%
Chloroquine	D	50%	See UHN Guide	None	None
Chlorpheniramine	D	100%	None	Unknown	NA
Chlorpromazine	D	100%	None	None	100%
Chlorpropamide	D	Avoid	Unknown	None	Avoid
Chlorthalidone	I	Avoid	NA	NA	NA
Cholestyramine	D	100%	None	None	100%
Cibenzoline	D,I	66% q24h	None	None	100% q12h
Cidofovir	D	Avoid	Unknown	Unknown	Avoid
Cilastin	D	Avoid	Avoid	Avoid	Avoid
Cilazapril	D,I	10-25% q72h	None	None	50%q24-48h
Cimetidine	D	25%	None	None	50%
Cinoxacin	D	Avoid	Avoid	Avoid	Avoid
Ciprofloxacin	D	See UHN Guide	See UHN Guide	250mg q8h (200 if IV)	200 mg IV q12h
Cisapride	D	50%	Unknown	Unknown	50-100%
Cisplatin	D	50%	Yes	Unknown	75%
Cladribine	D	Unknown	Unknown	Unknown	Unknown
Clarithromycin	D	See UHN Guide	See UHN Guide	None	None
Clavulanic acid	D	50-75%	Dose after HD	Dose for RF	100%
Clindamycin	D	100%	See UHN Guide	See UHN Guide	None
Clodronate	D	Avoid	Unknown	Unknown	Unknown
Clofazimine	--	100%	None	None	Unknown
Clofibrate	I	Avoid	None	Unknown	q12-18h
Clomipramine	D	Unknown	Unknown	Unknown	NA
Clonazepam	D	100%	None	Unknown	NA
Clonidine	D	100%	None	None	100%
Cloxacillin		See UHN Guide	See UHN Guide		
Codeine	D	50%	Unknown	Unknown	75%
Colchicine	D	50%	None	Unknown	100%
Colestipol	D	100%	None	None	100%
Cortisone	D	100%	None	Unknown	100%

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Cotrimoxazole	See UHN Guide		See UHN Guide		
Cyclophosphamide	D	75%	½ dose	Unknown	100%
Cycloserine	I	q24h	None	None	q12-24h
Cyclosporine	D	100%	None	None	100%
Cytarabine	D	100%	Unknown	Unknown	100%
Dapsone	--	Unknown	None	Dose for RF	Unknown
Daunorubicin	D	100%	Unknown	Unknown	Unknown
Delavirdine	--	100%	None	Unknown	Unknown
Desferrioxamine	D	100%	Unknown	Unknown	100%
Desipramine	D	100%	None	None	NA
Dexamethasone	D	100%	Unknown	Unknown	100%
Diazepam	D	100%	None	Unknown	100%
Diazoxine	D	100%	None	None	100%
Diclofenac	D	100%	None	None	100%
Dicloxacillin	D	100%	None	None	NA
Didanosine	I	q24-48h	Yes	Dose for RF	Dose for RF
Diflunisal	D	50%	None	None	50%
Digitoxin	D	50-75%	None	None	100%
Digoxin	D,I	10-25% q48h	None	None	25-75%q36h
Dilevalol	D	100%	None	None	Unknown
Diltiazem	D	100%	None	None	100%
Diphenhydramine	D	100%	None	None	None
Dipyridamole	D	100%	Unknown	Unknown	NA
Dirithromycin	--	100%	None	Unknown	100%
Disopyramide	I	q24-40h	None	None	q12-24h
Dobutamine	D	100%	Unknown	Unknown	100%
Doxacurium	D	50%	Unknown	Unknown	50%
Doxazosin	D	100%	None	None	100%
Doxepin	D	100%	None	None	100%
Doxorubicin	D	100%	None	Unknown	100%
Doxycycline	D	100%	See UHN Guide	None	100%
Dyphilline	D	25%	⅓ dose	Unknown	50%
Enalapril	D	50%	20-25%	None	75-100%
Epirubicin	D	100%	None	Unknown	100%
Ebastine	D	50%	Unknown	Unknown	50%
Erythromycin	D	See UHN Guide	See UHN Guide	None	None
Esmolol	--	--	None	None	Unknown
Estazolam	D	100%	Unknown	Unknown	NA
Ethacrynic Acid	I	Avoid	None	None	NA
Ethambutol	I	q48h	See UHN Guide	Dose for RF	q24-36h
Ethchlorvynol	D	Avoid	None	None	NA
Ethionamide	D	50%	None	None	None
Ethosuximide	D	100%	None	Unknown	Unknown

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Etodolac	D	100%	None	None	100%
Etomidate	D	100%	Unknown	Unknown	100%
Etoposide	D	50%	None	Unknown	75%
Famcyclovir	I	See UHN Guide	See UHN Guide	Unknown	Unknown
Famotidine	D	10%	None	None	25%
Fazadinium	D	100%	Unknown	Unknown	100%
Felodipine	D	100%	None	None	100%
Fenoprofen	D	100%	None	None	100%
Fentanyl	D	100%	Unknown	Unknown	100%
Fexofenadine	I	q24h	Unknown	Unknown	q12-24h
Flecainide	D	50-75%	None	None	100%
Fleroxacin	D	50%	400 mg post HD	400 mg/d	NA
Fluconazole	D	See UHN Guide	See UHN Guide	See UHN Guide	100%
Flucytosine	I	q24h	Yes	0.5-1.0 g/d	q16h
Fludarabine	D	50%	Unknown	Unknown	75%
Flumazenil	D	100%	None	Unknown	NA
Flumarizine	D	100%	None	None	None
Fluorouracil	D	100%	Yes	Unknown	100%
Fluoxetine	D	100%	Unknown	Unknown	NA
Flurazepam	D	100%	None	Unknown	NA
Flurbiprofen	D	100%	None	None	100%
Flutamide	D	100%	Unknown	Unknown	Unknown
Fluvastatin	D	100%	Unknown	Unknown	100%
Fluvoxamine	D	100%	None	Unknown	NA
Foscarnet	D	6 mg/kg	See UHN Guide	Dose for RF	15 mg/kg
Fosinopril	D	75-100%	None	None	100%
Furosemide	D	100%	None	None	NA
Gabapentin	D,I	300 mg/d	Yes	--	300 mg q12-24h
Gallamine	D	Avoid	NA	NA	Avoid
Ganciclovir	I	See UHN Guide	See UHN Guide	Dose for RF	2.5 mg/kg/d
Ganciclovir oral	D,I	500 mg q48-96h	Yes	Dose for RF	NA
Gemfibrozil	D	100%	None	Unknown	100%
Gentamycin	D,I	20-30% q24-48h	See UHN Guide	3-4 mg/L/d	30-70%q12h
Glibornuride	D	Unknown	Unknown	Unknown	Avoid
Gliclazide	D	Unknown	Unknown	Unknown	Avoid
Glipizide	D	100%	Unknown	Unknown	Avoid
Glyburide	D	Avoid	None	None	Avoid
Gold Na thiomalate	D	Avoid	None	None	Avoid
Griseofulvin	D	100%	None	None	None
Guanabenz	D	100%	Unknown	Unknown	100%
Guanadrel	I	q24-48h	Unknown	Unknown	q12-24h
Guanethidine	I	q24-36h	Unknown	Unknown	Avoid

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Guanfacine	D	100%	None	None	100%
Haloperidol	D	100%	None	None	100%
Heparin	D	100%	None	None	100%
Hexobarbital	D	100%	None	Unknown	NA
Hydralazine	I	q8-16h	None	None	q8h
Hydrocortisone	D	100%	Unknown	Unknown	100%
Hydroxyurea	D	20%	Unknown	Unknown	50%
Hydroxyzine	D	Unknown	100%	100%	100%
Ibuprofen	D	100%	None	None	100%
Idarubicin	--	Unknown	Unknown	Unknown	Unknown
Ifosfamide	D	75%	Unknown	Unknown	100%
Iloprost	D	50%	Unknown	Unknown	100%
Imipenem	D	See UHN Guide	See UHN Guide	Dose for RF	50%
Imipramine	D	100%	None	None	NA
Indapamide	D	Avoid	None	None	NA
Indinavir	--	100%	None	Dose for RF	Unknown
Indobufen	D	25%	Unknown	Unknown	NA
Indomethacin	D	100%	None	None	100%
Insulin	D	50%	None	None	75%
Ipratropium	D	100%	None	None	100%
Isoniazid	D	50%	See UHN Guide	Dose for RF	Dose for RF
Isosorbide	D	100%	10-20 mg	None	100%
Isradipine	D	100%	None	None	100%
Itraconazole	D	See UHN Guide	See UHN Guide	See UHN Guide	100 mg q12-24h
Kandamycin	D,I	20-30% q24-48h	⅔ dose after HD	15-20 mg/L/d	30-70% q12h
Ketamine	D	100%	Unknown	Unknown	100%
Ketanserin	D	100%	None	None	100%
Ketoconazole	D	100%	See UHN Guide	None	None
Ketoprofen	D	100%	None	None	100%
Ketorolac	D	50%	None	None	50%
Labetolol	D	100%	None	None	100%
Lamivudine	D,I	25 mg/d (50mg 1st dose)	Yes	Dose for RF	50-150 mg/d (full 1st dose)
Lamotrigine	D	100%	Unknown	Unknown	100%
Lansoprazole	D	100%	Unknown	Unknown	Unknown
L-dopa	D	100%	Unknown	Unknown	100%
Levofloxacin	D	See UHN Guide	See UHN Guide	Dose for RF	50%
Lidocaine	D	100%	None	None	100%
Lincomycin	I	q12-24h	None	None	NA
Linezolid		See UHN Guide	See UHN Guide		
Lisinopril	D	25-50%	20%	None	50-75%
Lispro insulin	D	50%	None	None	None
Lithium carbonate	D	25-50%	Yes	None	50-75%
Lomefloxacin	D	50%	Dose for RF	Dose for RF	NA

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Loracarbef	I	q3-5d	Yes	Dose for RF	q24h
Lorazepam	D	100%	None	Unknown	100%
Losartan	D	100%	Unknown	Unknown	100%
Lovastatin	D	100%	Unknown	Unknown	100%
LMW heparin	D	50%	Unknown	Unknown	100%
Maprotiline	D	100%	Unknown	Unknown	NA
Meclofenamic acid	D	100%	None	None	100%
Mefenamic acid	D	100%	None	None	100%
Mefloquine	--	100%	None	None	Unknown
Melphalan	D	50%	Unknown	Unknown	75%
Meperidine	D	50%	Avoid	None	Avoid
Meprobamate	I	q12-18h	None	Unknown	NA
Meropenem	D,I	250-500 mg q24h	See UHN Guide	Dose for RF	250-500 mg q12h
Metaproterenol	D	100%	Unknown	Unknown	100%
Metformin	D	Avoid	Unknown	Unknown	Avoid
Methadone	D	50-75%	None	None	NA
Methenamine mandelate	D	Avoid	NA	NA	NA
Methicillin	I	q8-12h	None	None	q6-8h
Methimazole	D	100%	Unknown	Unknown	100%
Methotrexate	D	Avoid	None	None	50%
Methyldopa	I	q12-24h	250 mg	None	q8-12h
Methyl prednisolone	D	100%	Yes	Unknown	100%
Metoclopramide	D	50%	None	Unknown	50-75%
Metocurine	D	50%	Unknown	Unknown	50%
Metolazone	D	100%	None	None	NA
Metoprolol	D	100%	50 mg	None	100%
Metronidazole	D	See UHN Guide	See UHN Guide	See UHN Guide	100%
Mexiletine	D	50-75%	None	None	None
Mezlocillin	I	q8h	None	None	q6-8h
Miconazole	D	100%	None	None	None
Midazolam	D	50%	NA	NA	NA
Midodrine	--	Unknown	5mg q8h	Unknown	5-10 mg q8h
Miglitol	D	Avoid	Unknown	Unknown	Avoid
Milrinone	D	50-75%	Unknown	Unknown	100%
Minocycline	D	100%	See UHN Guide	None	100%
Minoxidil	D	100%	None	None	100%
Mitomycin C	D	75%	Unknown	Unknown	Unknown
Mitoxantrone	D	100%	Unknown	Unknown	100%
Mivacurium	D	50%	Unknown	Unknown	Unknown
Moricizine	D	100%	None	None	100%
Morphine	D	50%	None	Unknown	75%
Moxalactam	I	q24-48h	Yes	Dose for RF	q12-24h

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Nabumetone	D	100%	None	None	100%
N-Acetylcysteine	D	75%	Unknown	Unknown	100%
N-Acetyl-Procainamide	D,I	25% q12-18h	None	None	50% q8-12h
Nadolol	D	25%	40 mg	None	50%
Nafcillin	D	100%	None	None	100%
Nalidixic acid	D	Avoid	See UHN Guide	Avoid	NA
Naloxone	D	100%	NA	NA	100%
Naproxen	D	100%	None	None	100%
Nefazodone	D	100%	Unknown	Unknown	NA
Nelfinavir	--	Unknown	Unknown	Unknown	Unknown
Neostigmine	D	25%	Unknown	Unknown	50%
Netilmicin	D,I	10-20% q24-48h	⅔ dose after HD	3-4 mg/L/d	20-60% q12h
Nevirapine	D	100%	None	Dose for RF	Unknown
Nicardipine	D	100%	None	None	100%
Nicotinic acid	D	25%	Unknown	Unknown	50%
Nifedipine	D	100%	None	None	100%
Nimodipine	D	100%	None	None	100%
Nisoldipine	D	100%	None	None	100%
Nitrazepam	D	100%	Unknown	Unknown	NA
Nitrofurantoin	D	Avoid	See UHN Guide	NA	NA
Nitroglycerine	D	100%	Unknown	Unknown	100%
Nitroprusside	D	100%	None	None	100%
Nitrosourea	D	25-50%	None	Unknown	Unknown
Nizatidine	D	25%	Unknown	Unknown	50%
Norfloxacin	I	Avoid	NA	NA	NA
Nortriptyline	D	100%	None	None	NA
Ofloxacin	D	25-50%	100 mg bid	Dose for RF	300 mg/d
Omeprazole	D	100%	Unknown	Unknown	Unknown
Ondansetron	D	100%	Unknown	Unknown	100%
Orphenadrine	D	100%	Unknown	Unknown	NA
Ouabain	I	q36-48h	None	None	q24-36h
Oxaprozin	D	100%	None	None	100%
Oxatomide	D	100%	None	None	NA
Oxazepam	D	100%	None	Unknown	100%
Oxcarbazepine	D	100%	Unknown	Unknown	Unknown
Paclitaxel	D	100%	Unknown	Unknown	100%
Pancuronium	D	Avoid	Unknown	Unknown	50%
Paroxetine	D	50%	Unknown	Unknown	NA
Para-aminosalicylate	D	50%	Yes	Dose for RF	Dose for RF
Penbutolol	D	100%	None	None	100%
Penicillamine	D	Avoid	1/3 dose	Unknown	Avoid
Penicillin G	D	See UHN Guide	See UHN Guide	Dose for RF	75%

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Penicillin VK	D	100%	See UHN Guide	Dose for RF	NA
Pentamidine	I	q48h	See UHN Guide	None	None
Pentazocine	D	50%	None	Unknown	75%
Pentobarbital	D	100%	None	Unknown	100%
Pentopril	D	50%	Unknown	Unknown	50-75%
Pentoxifylline	D	100%	Unknown	Unknown	100%
Pefloxacin	D	100%	None	None	100%
Perindopril	D	50%	25-50%	Unknown	75%
Phenelzine	D	100%	Unknown	Unknown	NA
Phenobarbital	I	q12-16h	Yes	½ normal dose	q8-12h
Phenylbutazone	D	100%	None	None	100%
Phenytoin	D	100%	None	None	None
Pindolol	D	100%	None	None	100%
Pipecuronium	D	25%	Unknown	Unknown	50%
Piperacillin	I	See UHN Guide	See UHN Guide	Dose for RF	q6-8h
Piretanide	D	100%	None	None	NA
Piroxicam	D	100%	None	None	100%
Plicamycin	D	50%	Unknown	Unknown	Unknown
Pravastatin	D	100%	Unknown	Unknown	100%
Prazepam	D	100%	Unknown	Unknown	NA
Prazosin	D	100%	None	None	100%
Prednisolone	D	100%	Yes	Unknown	100%
Prednisone	D	100%	None	Unknown	100%
Primaquine	--	100%	Unknown	Unknown	Unknown
Primidone	I	q12-24h	⅓ dose	Unknown	Unknown
Probenecid	D	Avoid	Avoid	Unknown	Avoid
Probucol	D	100%	Unknown	Unknown	100%
Procainamide	I	q8-24h	200 mg	None	q6-12h
Promethazine	D	100%	None	None	100%
Propafenone	D	100%	None	None	100%
Propofol	D	100%	Unknown	Unknown	100%
Propoxyphene	D	Avoid	None	None	NA
Propanolol	D	100%	None	None	100%
Propylthiouracil	D	100%	Unknown	Unknown	100%
Protriptyline	D	100%	None	None	NA
Pyrazinamide	D	Avoid	See UHN Guide	Avoid	Avoid
Pyridostigmine	D	20%	Unknown	Unknown	35%
Pyrimethamine	D	100%	None	None	None
Quazepam	D	Unknown	Unknown	Unknown	NA
Quinapril	D	75%	25%	None	75-100%
Quinidine	D	75%	100-200 mg	None	100%
Quinine	I	q24h	Yes	Dose for RF	q8-12h
Ramipril	D	25-50%	20%	None	50-75%

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Ranitidine	D	25%	½ dose	None	50%
Reserpine	D	Avoid	None	None	100%
Ribavirin	D	50%	Yes	Dose for RF	Dose for RF
Rifabutin	--	100%	None	None	Unknown
Rifampin	D	50-100%	See UHN Guide	See UHN Guide	Dose for RF
Ritonavir	--	100%	None	Dose for RF	Unknown
Saquinavir	--	100%	None	Dose for RF	Unknown
Secobarbital	D	100%	None	None	NA
Sertraline	D	100%	Unknown	Unknown	NA
Simvastatin	D	100%	Unknown	Unknown	100%
Sodium valproate	D	100%	None	None	None
Sotalol	D	15-30%	80 mg	None	30%
Sparfloxacin	D,I	50% q48h	Dose for GFR<10	Unknown	50-75%
Spectinomycin	D	100%	None	None	None
Spironolactone	I	Avoid	NA	NA	Avoid
Stavudine	D,I	50% q24h	Yes	Unknown	Unknown
Streptokinase	D	100%	NA	NA	100%
Streptomycin	I	q72-96h	See UHN Guide	20-40 mg/L/d	q24-72h
Streptozotocin	D	50%	Unknown	Unknown	Unknown
Succinylcholine	D	100%	Unknown	Unknown	100%
Sufentanil	D	100%	Unknown	Unknown	100%
Sulbactam	I	q24-48h	Yes	0.75-1.5 g/d	750 mg q12h
Sulfamethoxazole	I	q24h	1g after HD	1g/d	q18h
Sulfinpyrazone	D	Avoid	None	None	100%
Sulfisoxazole	I	q12-24h	2g after HD	3g/d	NA
Sulindac	D	100%	None	None	100%
Sulotroban	D	10%	Unknown	Unknown	Unknown
Tamoxifen	D	100%	Unknown	Unknown	100%
Tazobactam	D	See UHN Guide	See UHN Guide	Dose for RF	75%
Teicoplanin	I	q72h	Dose for RF	Dose for RF	q48h
Temazepam	D	100%	None	None	NA
Teniposide	D	100%	None	None	100%
Terazosin	D	100%	Unknown	Unknown	100%
Terbutaline	D	Avoid	Unknown	Unknown	50%
Terfenadine	D	100%	None	None	NA
Tetracycline	I	q24h	See UHN Guide	None	q12-24h
Theophylline	D	100%	½ dose	Unknown	100%
Thiazides	D	Avoid	NA	NA	NA
Thiabendazole		See UHN Guide			
Thiopental	D	75%	NA	NA	NA
Ticarcillin	D,I	1-2g q12h	3g after HD	Dose for RF	1-2g q8h
Ticlopidine	D	100%	Unknown	Unknown	100%
Timolol	D	100%	None	None	100%

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
D = Dose	I = Prolonged Interval	NA = Not Available			
Tobramycin	D,I	20-30% q24-48h	See UHN Guide	See UHN Guide	30-70% q12h
Tocainide	D	50%	200mg	None	100%
Tolazamide	D	100%	Unknown	Unknown	Avoid
Tolbutamide	D	100%	None	None	Avoid
Tolmetin	D	100%	None	None	100%
Topiramate	D	25%	Unknown	Unknown	50%
Topotecan	D	25%	Unknown	Unknown	50%
Torsemide	D	100%	None	None	NA
Tranexamic acid	D	10%	Unknown	Unknown	Unknown
Tranylcypromine	D	Unknown	Unknown	Unknown	NA
Trazodone	D	Unknown	Unknown	Unknown	NA
Triamcinolone	D	100%	Unknown	Unknown	Unknown
Triamterene	I	Avoid	NA	NA	Avoid
Triazolam	D	100%	None	None	NA
Trihexyphenidyl	D	Unknown	Unknown	Unknown	Unknown
Trimethadione	I	q12-24h	Unknown	Unknown	q8-12h
Trimethoprim	I	q24h	Yes	q24h	q18h
Trimetrexate	D	Avoid	Unknown	Unknown	Unknown
Trimipramine	D	100%	None	None	NA
Tripelennamine	D	Unknown	Unknown	Unknown	NA
Triprolidine	D	Unknown	Unknown	Unknown	NA
Tubocurarine	D	Avoid	Unknown	Unknown	50%
Urokinase	D	Unknown	Unknown	Unknown	Unknown
Valacyclovir	D,I	0.5 g q24h	Yes	Dose for RF	Unknown
Valganciclovir		See UHN Guide	See UHN Guide		
Vancomycin	D,I	See UHN Guide	See UHN Guide	See UHN Guide	500 mg q24-48h
Vecuronium	D	100%	Unknown	Unknown	100%
Venlafaxine	D	50%	None	Unknown	NA
Verapamil	D	100%	None	None	100%
Vidarabine	D	75%	Yes	Dose for RF	100%
Vigabatrin	D	25%	Unknown	Unknown	50%
Vinblastine	D	100%	Unknown	Unknown	100%
Vincristine	D	100%	Unknown	Unknown	100%
Vinorelbine	D	100%	Unknown	Unknown	100%
Voriconazole		See UHN Guide	See UHN Guide		
Warfarin	D	100%	None	None	None
Zafirlukast	D	100%	Unknown	Unknown	100%
Zalcitabine	I	q24h	Unknown	Unknown	Unknown
Zidovudine	D,I	100 mg q8h	Dose for RF	Dose for RF	100 mg q8h

Adapted from: Arnoff, G.R. in Manual of Nephrology, Fifth Edition, Edited by Robert W. Schriver, Lippincott Williams & Wilkins Press 2000. ISBN 0-7817-2172-5

UHN 2009 Guidelines for Antimicrobial Use. The University Health Network, Toronto, Ont.

Table 9. Antibiotic Dosing in Renal Impairment

Dose Adjustment of Select Medications Based on Calculated Creatinine Clearance (CrCl)

Drug	*Creatinine Clearance (CrCl) in mL/min*			
	≥50	**25-49**	**10-24**	**<10**
(***Note:*** The following dosage recommendations are ***not*** intended for endocarditis or meningitis treatment)				
acyclovir (IV)	5-10 mg/kg q8h	5-10 mg/kg q12h	5-10 mg/kg q24h	50% dose q24h
acyclovir (PO)				
genital herpes	400 mg tid	400 mg tid	400 mg tid	200 mg q12h
varicella zoster	800 mg 5x/day	800 mg 5x/day	800 mg tid	800 mg q12h
amikacin (initial dosing, once daily dosing)	**CrCl ≥60** 15 mg/kg q24h	**CrCl 40-59** 15 mg/kg q36h	**CrCl 20-39** 15 mg/kg q48h	**CrCl <20** Not recommended†
	Adjust dose based on serum drug levels*			
amikacin (initial dosing, traditional dosing)	**CrCl ≥50** 5-7.5 mg/kg load, *then* 4-5 mg/kg IV q8h	CrCl 15-49 5-7.5 mg/kg load, *then* 3-5 mg/kg IV q12h	**< 15** 5-7.5 mg/kg load, *then* 2-3 mg/kg IV q24h	
	Adjust dose based on serum drug levels*			
amoxicillin/ clavulanic acid	250/125 mg - 500/125 mg q12h	250/125 mg - 500/125 mg q12h	250/125 mg - 500/125 mg q12h	250/125 mg - 500/125 mg q24h
amphotericin B lipid complex (ABELCET)	5 mg/kg IV q24h			5 mg/kg IV q24-36h
amphotericin B liposome (AMBISOME)	3-6 mg/kg IV q24h			3-6 mg/kg IV q24-36h
ampicillin	1-2 g q4-6h	1-2 g q6-12h	1-2 g q6-12h	1-2 g q12-24h
azithromycin	No adjustments required			

Drug	*Creatinine Clearance (CrCl) in mL/min* ≥50	25-49	10-24	<10
caspofungin	No adjustments required			
cefazolin	1-2 g q8h	1-2 g q12h	1-2 g q12h	1-2 g q24h
ceftazidime	1-2 g q8h	**CrCl <30** 1-2 g q12h	1-2 g q24h	50% dose q24-48h
ceftriaxone	No adjustments required			
cefuroxime axetil (PO)	500 mg q12h	500 mg q12h	500 mg q12h	500 mg q24h
cephalexin	250-500 mg q6h	**CrCl <40** 250-500 mg q8-12h	250-500 mg q8-12h	50% dose q12-24h
ciprofloxacin (PO)	500-750 mg q12h	**CrCl <30** 500-750 mg q24h	500-750 mg q24h	500-750 mg q24h
ciprofloxacin (IV)	400 mg q12h	**CrCl <30** 400 mg q24h	400 mg q24h	400 mg q24h
clarithromycin	250-500 mg q12h	**CrCl <30** 50% dose q12h	50% dose q12h	50% dose q12h
clindamycin	No adjustments required			
cloxacillin	No adjustments required			
cotrimoxazole (IV)	8-10 mg/kg in 2-4 divided doses daily	**CrCl <30** 50% dose in 2-4 divided doses daily	50% dose in 2-4 divided doses daily	Not recommended†
PCP pneumonia	15-20 mg/kg in 2-4 divided doses daily	**CrCl <30** 50% dose in 2-4 divided doses daily	50% dose in 2-4 divided doses daily	Not recommended†
cotrimoxazole (PO) (DS = TRIMETHOPRIM 160 MG, SULFAMTHOXAZOLE 800 MG)	1DS bid	1DS q24h	1DS q24h	Not recommended†
erythromycin	500-1000 mg q6h	500-1000 mg q6h	500-1000 mg q6h	50-70% dose q6h

Drug	*Creatinine Clearance (CrCl) in mL/min* ≥50		25-49	10-24	<10
famciclovir			**CrCl <40**	**CrCl <20**	
genital herpes	250 mg q12h		125 mg q12h	125 mg daily	125 mg daily
varicella zoster	**CrCl >60** 500 mg tid **CrCl >50** 500 mg q12h		**CrCl <40** 500 mg q24h	**CrCl <20** 500 mg q48h	500 mg q48h
fluconazole	50-400 mg q24h		50% dose q24h	50% dose q24h	25% dose q24h
ganciclovir (IV)	**CrCl >70**	**CrCl 50-69**			
Treatment	5 mg/kg q12h	2.5 mg/kg q12h	2.5 mg/kg q24h	1.25 mg/kg q24h	
Maintenance	5 mg/kg q24h	2.5 mg/kg q24h	2.5 mg/kg q24h	0.625 mg/kg q24h	
gentamicin (initial dosing, once daily dosing)	**CrCl ≥60** 5 mg/kg q24h		**CrCl 40-59** 5 mg/kg q36h	**CrCl 20-39** 5 mg/kg q48h	**CrCl <20** Not recommended†
	Adjust dose based on serum drug levels*				
gentamicin (initial dosing, traditional dosing)	**CrCl ≥50** 1.5-2 mg/kg load, *then* 1.25 mg/kg IV q8h		CrCl 15-49 1.5-2 mg/kg load, *then* 1 mg/kg IV q12h	**CrCl <15** 1.5-2 mg/kg load, *then* 0.5-1 mg/kg IV q24h	
	Adjust dose based on serum drug levels*				
imipenem/cilistatin	500 mg q6h		**CrCl <30** 500 mg q8-12h	500 mg q12h	500 mg q12h (<1 g/day); **CrCl <5** Not recommended unless on hemodialysis†
intraconazole	No adjustments required				
ketoconazole	No adjustments required				
linezolid	No adjustments required				

Drug	*Creatinine Clearance (CrCl) in mL/min* ≥50	25-49	10-24	<10
metronidazole	No adjustments required			
moxifloxacin	No adjustments required			
penicillin G	1-4 MU q4-6h	1-4 MU q8-12h	1-4 MU q8-12h	1-4 MU q12h
piperacillin/ tazobactam	4.5 g q8h	**CrCl <40** 3.375 g q8h	**CrCl <20:** 3.375 g q12h	3.375 g q12h
tobramycin (initial dosing, once daily dosing)	**CrCl ≥60** 5 mg/kg q24h	**CrCl 40-59** 5 mg/kg q36h	**CrCl 20-39** 5 mg/kg q48h	**CrCl <20** Not recommended†
	Adjust dose based on serum drug levels*			
tobramycin (initial dosing, traditional dosing)	1.5-2 mg/kg load, *then* 1.25 mg/kg IV q8h	CrCl 15-49 1.5-2 mg/kg load, *then* 1 mg/kg IV q12h		**CrCl <15** 1.5-2 mg/kg load, *then* 0.5-1 mg/kg IV q24h
	Adjust dose based on serum drug levels*			
valganciclovir				
Induction	450 mg q12h	450 mg q24h	450 mg every 2 days	Not recommended†
Maintenance	450 mg q24h	450 mg every 2 days	450 mg 2x/week	Not recommended†
vancomycin	**CrCl ≥65** 1 g q12h ***or*** 15 mg/kg q12h **CrCl 50-64** 1 g q24h	**CrCl 35-49** 1 g q24-36h	**CrCl 21-34** 1 g q48h	CrCl ≤20 15-20 mg/kg loading dose
	Adjust dose based on serum drug levels*			
voriconazole (IV)	6 mg/kg q12h x 24h, *then* 4 mg/kg IV q12h	Not recommended due to diluent†		
voriconazole (po)	No adjustments required			

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Updated by: Carmen Ma, BScPhm, Staff Pharmacist, Nephrology – Oct, 2002

Revised by: Michael Wong – 2005

Antibiotic Dosing Guidelines in Hemodialysis

When making a dosage schedule for patients on hemodialysis, the dose adjustment for the degree of renal function must be determined first, and then the effect of dialysis on the total body clearance of the drug must be taken into account.

For practical purposes, it is most convenient to separate antibiotics into four groups:

1. **HEMODIALYZABLE with a LONG $t_{1/2}$**
   A dose of these drugs should be given immediately after hemodialysis (e.g., the order should be written: cefazolin 1 g daily, give post-dialysis on dialysis days)
2. **HEMODIALYZABLE with a SHORT $t_{1/2}$**
   It is difficult for hemodialysis to have a significant effect on total body clearance for these drugs due to their intrinsically short half-life. Since most of the drugs in this category have a high therapeutic index, it is unnecessary to alter the dose or to supplement the dose after dialysis, with a few exceptions.
3. **NOT HEMODIALYZABLE with a LONG $t_{1/2}$**
4. **NOT HEMODIALYZABLE with a SHORT $t_{1/2}$**

Note: A **LONG $t_{1/2}$** will be one that allows for a dosing interval of 24 hrs or more.

Drugs for which the recommended dosing interval is every 8 to 18 hours and which are hemodialyzable result in the most complex dosing schedule. The time interval from the end of dialysis, when serum levels are low, until the next dose could be between 4 and 14 hours and would therefore be of clinical importance. Also, the amount of additional antibiotic needed at the end of dialysis would be dependent on how close the previous dose was to the start of dialysis, and this could change from day to day. Therefore, the doses suggested have sometimes been modified from those in the literature to avoid q8h-q18h dosage. A q6h interval with the same total daily dose may be given. In this way, there are never more than a couple of hours with low (sub-therapeutic) serum levels.

The usual recommended trough concentrations of drugs are not applicable in patients with severe renal impairment. Because of the extended t1⁄2 of drugs in these patients, the usual trough concentrations are not achievable without an extended period of sub-therapeutic concentrations.

The following recommendations are made assuming:

- Normal hepatic function
- Adult patients
- Patient's glomerular filtration rate (GFR) <10 mL/min (0.16 mL/sec)
- Standard hemodialysis schedules of 3 to 6 hours of hemodialysis every 2 to 3 days

Note: The following dosage recommendations for antimicrobials are not intended for treatment of endocarditis or meningitis. For endocarditis and meningitis, target levels to be determined on a case by case basis by the Infectious Disease Service or the medical team.

Table 10: Dosing Guidelines in Hemodialysis and CVVHD

Drug	***Recommended Dose for IHD***	***Dose after IHD***	***Recommended Dose for CVVHD***
acyclovir	2.5-5 mg/kg IV q24h 200 mg PO q12h (*Herpes simplex*) 800 mg PO q12h (*Herpes zoster*)	yes	5-10 mg/kg IV q12-24h No adjustment necessary for PO
amantadine	200 mg PO once a week	no	100 mg PO q48-72h
amikacin	5 mg/kg IV load, *then* 2.5 mg/kg IV post hemodialysis* **Adjust dose based on trough level****	yes	5-7.5 mg/kg load, *then* 3-4.5 mg/kg IV q12h **Adjust dose based on trough level****
amoxicillin	250 mg PO q12h ***or*** 500 mg PO q24h	yes	500 mg PO q8-12h (liquid available)
amoxicillin/clavulanic acid	250/125 mg PO q12h ***or*** 500/125 mg PO q24h	yes	-
ampicillin (IV)	1-2 g IV q12-24h	yes	1-2 g IV q6-12h
caspofungin	70 mg IV load, *then* 50 mg IV q24h	no	70 mg IV load, *then* 50 mg IV q24h
cefazolin	1 g IV q24h ***or*** 2 g IV post hemodialysis*	yes	1 g IV q12h
cefotaxime	1-2 g IV q24h	yes	1 g IV q12h
ceftazidime	1 g IV q24h ***or*** 1-2 g post hemodialysis*	yes	1-2 g IV q12-24h
ceftriaxone	1-2 g IV q24h	no	1-2 g IV q12-24h
cefuroxime axetil (PO)	250-500 mg PO q12h ***or*** 500 mg PO q24h	yes	250-500 mg PO q12h (liquid available)
cephalexin	250-500 mg PO q12h	yes	250-500 mg PO q12h (liquid available)
chloramphenicol	0.25-1 g IV q6h (12.5 mg/kg q6h)	no	-
chloroquine	500 mg PO x 1 dose, *then* 250 mg PO weekly (malaria)	no	-
ciprofloxacin	250-500 mg PO q24h 200-400 mg IV q24h	no	500 mg PO q12-24h 400 mg IV q12-24h
clarithromycin	250-500 mg PO q12h	yes	-

Drug	***Recommended Dose for IHD***	***Dose after IHD***	***Recommended Dose for CVVHD***
clindamycin	150-300 mg PO q6h 300-600 mg IV q8h	no	150-300 mg PO q6h 300-600 mg IV q8h
cotrimoxazole (PO) (DS = trimethoprim 160 mg , sulfamethoxazole 800 mg	1 DS tablet PO q24h (for indications other than PCP)	yes	1DS PO q24h (liquid available)
doxycycline	100 mg PO daily	no	100 mg PO daily
erythromycin	250-500 mg IV/PO q6h (1 g q6h causes predictable reversible deafness)	no	250-500 mg IV q6h
ethambutol	Not recommended in patients with GFR <10 mL/min†	N/A	15-25 mg/kg q24h (No dose adjustment necessary)
famciclovir *Herpes simplex* *Herpes zoster*	125 mg PO q24h 500 mg PO q48h	yes	125 mg PO q12-24h 500 mg PO q12-24h
fluconazole	400 mg IV/PO loading dose, *then* 100-400 mg IV/PO daily to q2days	yes	100–400 mg IV/PO q24h
foscarnet (See guidelines for details)	45-60 mg/kg post hemodialysis	N/A	
ganciclovir (IV)	*Treatment:* 1.25 mg/kg IV post hemodialysis* *Maintenance:* 0.625 mg/kg IV post hemodialysis*	yes	2.5 mg/kg IV q24h (treatment and maintenance)
gentamicin	2 mg/kg IV loading dose, *then* 1 mg/kg IV post hemodialysis* **Adjust dose based on trough level****	yes	load, *then* 12h **Adjust dose based on trough level****
imipenem/cilastatin	250-500 mg IV q12h	yes	500mg IV q6-8h
isoniazid	300 mg PO daily	yes	300 mg PO daily

Drug	***Recommended Dose for IHD***	***Dose after IHD***	***Recommended Dose for CVVHD***
itraconazole (PO)	100-200 mg PO q12h (Take tablets with food; take solution on empty stomach)	no	100-200 mg PO q12h (liquid available)
ketoconazole	200-400 mg PO daily	no	200-400 mg PO daily
linezolid	600 mg PO/IV q12h	yes	600 mg PO/IV q12h (No adjustment necessary)
meropenem	500 mg IV q24h	yes	250-500 mg IV q12h
metronidazole	500 mg IV/PO q12h *C. difficile:* 500 mg PO q8h	yes	500 mg IV/PO q12h *C. difficile:* 500 mg PO q8h
minocycline	*200 mg PO x 1 dose,* then *100 mg PO q12h*	*no*	*200 mg PO x 1 dose,* then *100 mg PO q12h*
moxifloxacin	*400 mg IV/PO q24h* (No adjustment necessary)		*400 mg IV/PO q24h* (No adjustment necessary)
nalidixic acid	*Not recommended in patients with GFR <10 mL/min†* *(Metabolites accumulate)*	*N/A*	*Not recommended†*
nitrofurantoin	Not recommended in patients with GFR < 30 mL/min†	N/A	Not recommended†
penicillin G	1 Million Units (MU) IV q8-12h (maximum dose = 10 MU/day)	yes	0.5-3 MU IV q6h
penicillin VK	300 mg PO q6h	yes	300 mg PO q6h
pentamidine isethionate	3-4 mg/kg IV q24h	no	4 mg/kg IV q24h
piperacillin/ tazobactam	3.375 mg IV q12h	yes	3.375 mg IV q6-8h
pyrazinamide	40 mg/kg PO 3x/week (Give 24 hours **before** the start of each hemodialysis)	no	25-30 mg/kg q24h
rifampin	300-600 mg PO q24h	no	300-600 mg PO q24h

Drug	***Recommended Dose for IHD***	***Dose after IHD***	***Recommended Dose for CVVHD***
streptomycin	15 mg/kg IV loading dose, *then* 9 mg/kg IV post hemodialysis*	yes	15 mg/kg q24-72h
tetracycline	250-500 mg PO q24h (Note: doxycycline is preferred)	yes	250-500 mg q12h
tobramycin	2 mg/kg IV loading dose, *then* 1 mg/kg IV post hemodialysis* **Adjust dose based on trough level****	yes	load, *then* 12h **Adjust dose based on trough level****
valganciclovir	Not recommended in hemodialysis†	N/A	*Induction:* 450 mg PO q24h *Maintenance:* 450 mg PO q48h
vancomycin	See Table 3 on Vancomycin Dosing for hemodialysis and/or discuss dosing with pharmacist		
voriconazole (IV)	Not recommended in patients with GFR <50 mL/min due to vehicle for IV preparation†	N/A	Not recommended due to vehicle for IV preparation†
voriconazole (PO)	400 mg PO q12h x 2 days, *then* 200 mg PO q12h	N/A	400 mg PO q12h x 2 days, *then* 200 mg PO q12h

* Only give on hemodialysis days.

** Consult with pharmacist for dosage adjustment.

† Pharmacist to discuss therapeutic alternatives with physician.

References

1. Aronoff GR, Bennett WB, Berns JS, et al. Drug Prescribing in Renal Failure: Dosing Guidelines for Adults, Fourth Edition. Philadelphia, PA; American College of Physicians. 2002.
2. Aweeka FT, Jacobson MA, Martin-Munley S, et al. Effect of renal disease and hemodialysis on foscarnet pharmacokinetics and dosing recommendations. J Acquire Immune Defic Syndr Hum Retrovirol 1999;20:350-357.
3. McEvoy GK, ed. AHFS Drug Information 2000. Bethesda, MD; American Society of Health-System Pharmacists, Inc. 2002.
4. Welbanks L, ed. Compendium of Pharmaceuticals and Specialties, 37th Ed. Ottawa, ON; Canadian Pharmacists Association 2002.
5. MICROMEDEX(R) Healthcare Series Vol. 123 expires 3/2005.
6. Medical Information from:
   Bayer Inc.
   Hoffmann-LaRoche Limited
   Janssen-Ortho Inc.
   AstraZeneca Pharma Inc.

Updated by: Carmen Ma, BScPhm, Staff Pharmacist, Nephrology – October 2002
Revised by: Marisa Battistella, PharmD - May 2006

Nephrogenic systemic fibrosis (NSF) and Gd-enhanced MRI

Gd-enhanced MRI should be avoided in dialysis patients, or with any pt with CrCl < 30 mL/min unless absolutely necessary. If done in this group, Nephrology to be consulted first.

- Any patient needing MRI on who is on HD, is to be dialyzed directly after the MRI for 3 consecutive days as prophylaxis against NSF
- Patients on PD should have insertion of temporary line and have HD daily X3 since Gd is not likely removed at an adequate rate by PD.

UHN Policy for NSF:

Nephrogenic systemic fibrosis (NSF) is a recently identified fibrosing disorder. It was initially described as causing thickening and hardening of the skin overlying the trunk and extremities. Subsequent studies showed that some patients had fibrosis of deeper structures including muscle, fascia, lungs, and the heart. This disease, while rare, has a significant mortality rate.

The vast majority of cases, or according to some publications, all cases of NSF, have occurred in patients with kidney failure. The risk appears greatest in patients in end-stage renal disease (ESRD). Increasing epidemiologic evidence has implicated gadolinium-containing contrast agents (Gd). Based on the number of reported cases, risk appears to be greater with increasing dose of Gd, and with certain types of Gd-agents. The greatest number of NSF cases reported to date has been in patients that have received Omniscan (gadodiamide).

General Guidelines

If the patient has ESRD, the patient should be examined with an alternate imaging modality, other than contrast-enhanced MRI (CEMRI), such as CT, or unenhanced MRI. If CEMRI is thought to be essential, a nephrology consult must be obtained. Nephrology will arrange for dialysis (HD or PD) to be done immediately after the CE-MRI.

Omniscan should never be used in any patient with renal failure (Cr > 150 umol/L or GFR < 30 mL/min). An alternative Gd-agent should be used, such as: Magnevist, Gadovist, Prohance, or Multihance, depending on the preference of the supervising radiologist, and the availability of the agent. If Omniscan is the agent to be used for CE-MRI in any patient, the dose used should never exceed the recommended dose on the Omniscan package insert.

Specific Guidelines: Ordering & Performing Gd-Enhanced MRI & MRA

PATIENTS WITH RENAL FAILURE

1. All clinicians who order MRI should clearly identify on the requisition if the patient is receiving hemodialysis, peritoneal dialysis, or is in renal failure. For those in renal failure but not on dialysis a recent serum creatinine or GFR will be required. The referring physician must consult with a radiologist to determine the best imaging strategy for the patient. Alternative imaging modalities, other than CEMRI, will be considered to determine whether they are acceptable.

- Patients on dialysis. If the patient is on dialysis, a nephrologist must be consulted prior to doing Gd-enhanced MRI of any kind. In general terms, these patients should be examined with an alternate imaging modality, other than CEMRI, such as CT, or unenhanced MRI. If CEMRI is thought to be essential to the health and well-being of the patient, and there is no acceptable imaging alternative, nephrology will arrange for hemodialysis to be done immediately after the CEMRI.
- Patients in moderate renal failure. (creatinine > 150 umol/L, GFR < 30 mL/min). One of the usual alternatives to CEMRI is CECT, however CECT carries some risk of further worsening renal function in patients with renal impairment (contrast-induced nephropathy). Accordingly, the best imaging strategy for patients with moderate renal failure must be discussed with a radiologist prior to booking the study. The radiologist will weigh the risk-benefit ratio of doing CT, CECT, NCMRI or CEMRI in consultation with the referring physician. A nephrology consult may be required.

PATIENTS WITH NO HISTORY OF RENAL FAILURE

1. UHN and MSH currently have a preferred provider arrangement with the supplier of Omniscan, the most frequently used agent in our hospitals. Since there has not been shown to be any significantly increased risk of NSF in patients with normal renal function with the administration of Omniscan, continue to use Omniscan for CEMRI in patients with no history of renal failure.

2. Regardless of the contrast agent used, do not exceed the recommended dose as delineated in the package insert on a mL/kg basis. The only exception to this rule shall be when direct instructions are given by a radiologist to exceed this dose. The usual indication for a larger dose shall be MRA.

3. If the indication for contrast-enhancement is MRA of the Head, Neck, Heart, Chest, Abdomen or Pelvis, then Gadovist is recommended. Magnevist, Prohance or Multihance may also be used, depending on availability of the agent and the preference of the supervising radiologist.

4. If the indication for contrast-enhancement is MRA of the Legs or Feet, then Magnevist is recommended. Gadovist, Prohance or Multihance may also be used, depending on availability of the agent and the preference of the supervising radiologist.

5. If the radiologist, nurse or MRI technologist has any concerns about the reliability of the patient's renal history, do not use Omniscan. Use an alternate agent, or obtain a serum creatinine or GFR, to obtain an objective measure of the patient's renal function.

** For purposes of this policy, patients should be asked whether or not they have impaired renal function. If they reply, "I do not know if my renal function is impaired", we will handle these patients as if they did not have impaired renal function. *(Rationale: All patients reported to have had NSF have had severe renal impairment; most were on dialysis. Thus it is extremely unlikely that a patient could have a degree of renal function impairment that would be of concern to us, and be unaware of it).*

Walter Kucharczyk, MD, FRCP(C)

Director, MRI at UHN and MSH

In consultation with Dr. Ed Cole, Head, Division of Nephrology, UHN

The risk of the study has to be weighed against the potential benefits. Furthermore, consideration should be given as to whether a different imaging study could be substituted.

Hospital Policy for Gd-MRI and GD-MRA

(MRD = "Manufacturers' Recommended Dose")
(RPD = Radiologist to Prescribe Dose)
(* = depends on availability of agent and radiologist's preference)
(shaded areas indicate change from pre-NSF practice, effective May 10, 2007)

Renal Function	Standard CEMRI		CEMRA		Dialysis	Neprhology Or Radiology Consult Required?
	Agent(s)	Dose	Agent(s)	Dose		
Normal renal function	Omniscan	MRD	*Any of: Magnevist Gadovist Prohance Multihance	RPD		NO
Moderate renal failure (GFR<30 mL/min)	*Any of: Magnevist Gadovist Prohance Multihance	MRD	Strong relative contra-indication *Any of: Magnevist Gadovist Prohance Multihance	RPD	Hemodialysis may be required ASAP Post-MRI	Rad ± Nephro
Severe renal failure (defined as being on dialysis or almost on dialysis)	*An alternate imaging test to CEMRI is recommended *Omniscan NOT to be used	-------	CEMRA contraindicated in this patient group	-------	Hemodialysis will be required ASAP Post-MRI	Rad + Nephro
Reliability of the patient's renal history is uncertain	*Any of: Magnevist Gadovist Prohance Multihance	MRD	*Any of: Magnevist Gadovist Prohance Multihance	RPD		NO

How To Order Catheter insertions, biopsy, Doppler, Anaesthesia

Order Tunnelled U/C catheter: Under Nephrology Order set: Diagnostics → "Abd/Thoracic Angio". Enter comment if necessary.

Order Kidney Biopsy: Order entry →Procedure tab, type in "Biopsy" →Select "Abd Biopsy"(goes under Interventional)→ Kidneys (5) →Left (as approp) →Tomorrow (4) →Reason Screen: (2) see Comment Field →(8) Comment: "localization for kidney biopsy" →OK→Accept (A). If probs, call biopsy room 14-8257.

Book Arterial Doppler: In Electronic Patient Record (EPR), Order Entry → Diagnostics→ Vascular Lab→ Arterial Doppler

Book Anaesthesia consult: Fax 14-3698 or email to AnesthesiaORSecretary@uhn.ca Include name, MRN, DOB, diagnosis, location, planned OR, staff MD.

Telephone Directory

Emerg TG	14-3947
TW	13-2777
Chiropodist - Tracy Oliver	14-6007, pager (416)790-6771
Fracture Clinic TW	13-5858
Dialysis Start Unit: 12ES	14-4757
Hemodialysis Unit West	14-4072, fax14-4892
Hemodialysis Unit East	14-5707, fax 14-3084
Hemodialysis Unit Toronto Rehab	(416)597-3422, ext 3801, fax (416)977-8719
Home Peritoneal Dialysis Unit 12ES	14-5672,fax 14-4169
Home Hemodialysis	14-3736, fax 14-4379
Interventional Radiology / Angio	14-5339
Kidney Foundation: Peer Support	(905)278-3003, ext 4973
Labs	14-5898
Rapid Response	14-3542
Microbiology	14-2526
Mt Sinai Hospital	(416)596-4200 or (17+ extension)
Nurse Practitioners (NP)	
Paulina Bleah	14-8501, pager (416)790-7758 c: (647)532-2094
Angie Chai	14-3992, pager (416)790-6316 c: (647)532-2094
Primrose Mharapara	14-6450, pager (416)790-0431 c: (647)919-2476
Nurse Navigator, Anna Gozdzik	14-5129

Multi-Care Kidney Clinic	fax 14-4291
Evie Porter, RN	14-3588
Janice Ritchie, RN	14-6053
Anna Gozdzik, RN	14-5129
Andrea Heywood, RN	14-6548
Isolyn Samuels, clerical coordinator	14-3056
Diane Stoker, clerical coordinator	14-6883
O'Neill Centre	(416) 536-1116, fax (416) 536-6941
On Call Room	14-2541
Psych Consult	14-4451
Pathology – Dr Rohan John	14-4560
PD coordinator, Zita Abreu	14-2358
Princess Margaret Hospital	(416) 946-2000 or (16 + extension)
Sheppard Centre	(416) 223-2013, fax (416) 223-3321
Social Workers	
Zoe Levitt	14-3618, pager (416) 719-2876
Michela Veridirame	14-3983, pager (416) 719-2812
Melissa Rubin	14-6047, pager (416) 719-3731
Sunny Diamond	14-4768, pager (416) 719-2668
Sussex Centre	(905) 272-8334, fax (905) 272-4534
Toronto Western Hospital	(416) 603-2581 or (13+extension)
Toronto Rehab	(416) 597-3422
Translation Services	14-5522
Vascular Access Coordinator, Cyndi Bhola	14-3518, pager (416)790-5320
Vascular Lab	14-3589

Nephrologists (Assistant)	Address	Office	Pager
Dr. J. Bargman (Shelagh)	8N-840	14-4804	(416)790-6317
Dr. M. Barua (Naomi)	8N-855	14-8007	(416)714 6720
Dr. C. Cardella (Lisa)	11 PMB 184	14-4480	(416)790-4932
Dr. D. Cattran (Aditi, Sasha)	11 PMB 183	14-4187	(416)790-9036
Dr. C. Chan (Sertina)	8N-846	14-3073	(416)790-9833
Dr. D. Cherney (Marion)	8N-845	14-4151	(416)790-7711
Dr. E. Cole (May, Bibi)	RFE 1S-409	14-4669	(416)778-3582
Dr. V. Jassal (Samantha)	8N-857	14-3196	(416)790-8803
Dr. A. Kaushal	8N-829	14-2893	(416)714-0362
Dr. J. Kim (Theresa)	11 PMB 129	14-3228	(416)790-0255
Dr. A. Kovalinka (Bibi)	11 PMB 189	14-6950	(416)714-7029
Dr. A. Logan (Anna)	MSH 4-435	17-5187	(416)380-5187
Dr. C. Lok (Naomi)	8N-844	14-4140	(416)790-8645
Dr. A. Merchant	8N-819	14-3047	(416)715-7251
Dr. R. McQuillan (Susan)	8N-861	14-5617	(416)790-9027
Dr. I. Mucsi (Jocelyn)	11 PMB 188	14-4084	(416) 715-0171
Dr. R. Parekh (Andrea)	HSC 686 Bay St.	(416)813-7654, ext 328042	
Dr. Y. Pei (Jane)	8N-838	14-4257	(416)790-8988
Dr. H. Reich (Marion, Sasha)	8N-849	14-3439	(416)719-1102
Dr. R. Richardson(Susan)	8N-861	14-3889	(416)790-9663
Dr. D. Ryan (Anna)	MSH 4-435	(416)586-5174	
Dr. J. Schiff (Lisa)	11 PMB 185	14-3840	(416)790-8296
Dr. J. Scholey (Veronica)	8N-859	14-5093	(416)719-4569
Dr. M. Silverman(Samantha)	8N-848	14-4064	(416)790-8918
Dr. K. Tinckham (Jocelyn)	11 PMB 187	14-8225	(416)790-1368

Doctors for Surgical Procedures

Dr. M. Cattral	14-3760
Dr. G. Roche-Nagle	14-3552
Dr. L. Tse	14-3275
Dr. T. Lindsay	14-4620
Dr. D. Goldstein (for parathyroidectomy)	14-4767
Dr. G. Oreopoulos (Vascular)	14-3275

Doctors for PD catheter insertions

Dr. T. Penner	13-6220
Dr. Rory McQuillan	contact Zita Abreu 14-2358

Toronto & Area Nephrology

Listings based on Ontario Renal Network (ORN) database www.orn.org

Dialysis and other chronic kidney disease (CKD) services in Ontario are available in hospitals, community-based clinics, independent health facilities and other locations.

Each of Ontario's Local Health Integration Networks (LHINs) has at least one regional CKD centre, the hub for a defined geographic area. The regional centres are linked with affiliated sites, tertiary centres, and/or Independent Health Facilities (IHFs). In total, 26 regional centres exist across the province, with 69 affiliated sites.

LHIN	Regional Dialysis Centers	Contact	Dialysis Facilities
1. Erie St Clair	Windsor Hôtel Dieu Grace Hospital	http://hdgh.org/ (519)257-5111	• Windsor Hôtel Dieu Grace Hospital - McDougall site • Leamington District Memorial Hospital • Bluewater Health – Sarnia • Chatham-Kent Health Alliance
2. South West	London Health Sciences Centre - University Hospital Adam Linton Dialysis Unit (Victoria Hospital)	http://www.lhsc.on.ca/ (519)685-8500	• Alexandra Marine and General Hospital (Goderich) • Grey Bruce Health Services (Owen Sound) • Hanover & District Hospital • Huron-Perth Healthcare Alliance (Stratford) • Tillsonburg District Memorial Hospital • Woodstock General Hospital • Kidney Care Centre (Westmount)
3. Waterloo Wellington	Grand River Hospital Corporation	http://www.grhosp.on.ca/ (519)742-3611	• Guelph General Hospital • GHR - Freeport Site • North Wellington Health Care (Palmerston)
4. Hamilton Niagara	Niagara Health System St. Joseph's Healthcare Hamilton	http://www.niagarahealth.on.ca/ (905)378-4647 http://www.stjoes.ca/	• NHS - Welland site • SJH - Centre for Ambulatory Health Sciences (Stoney Creek) • SJH - Brantford Community Hospital • SJH - Oshweken - Six Nations • Burlington Dialysis Centre • Niagara Falls Kidney Care Centre

		(905)-522-1155	• Bayshore Stoney Creek (Independent Health Facility)
5. Central West	William Osler Health System (BMH) - Brampton Civic Hospital	http://www.williamoslerhs.ca/ (905)494-2120	• Headwaters Health Care
LIHN	**Regional Dialysis Centers**	**Contact**	**Dialysis Facilities**
6. Mississauga Halton	Trillium Health Partners Halton Healthcare Services	http://trilliumhealthpartners.ca (905)813-1100 http://www.haltonhealthcare.on.ca (905)845-2571	• Watline (Renal Care Center) • UHN - Sussex Centre
7. Toronto Central	St. Joseph's Health Centre (SJH) (Toronto) St. Michael's Hospital Sunnybrook Health Sciences Centre University Health Network	http://www.stjoe.on.ca/ (416)530-6000 http://www.stmichaelshospital.com/ (416)864-5050 http://sunnybrook.ca/ (416)480-6100 http://www.uhn.ca/ (416)340-3111	• Queen Elizabeth Centre of Toronto Rehab Institute • Community Renal Centre • Toronto Rehab Institute • Toronto East General Hospital
8. Central	Mackenzie Health (MAH) Humber River	http://mackenziehealth.ca/ (905)883-1212 http://www.hrh.c	• MAH – Oakridge • MAH – Vaughan • Stevenson Memorial Hospital (Alliston) • UHN - Sheppard Centre • Markham Dialysis Management Clinic

	Regional Hospital (HRR)	a/ (416)249-8111	(Independent Health Facility)
9. Central East	Lakeridge Health (LHC) Peterborough Regional Health Centre The Scarborough Hospital	http://www.lakeridgehealth.on.ca (905)576-8711 http://www.prhc.on.ca/ (705)743-2121 http://www.tsh.to/ (416)-438-2911	• Whitby (Oshawa) • Northumberland Hills Hospital (Cobourg) • Ross Memorial Hospital (Lindsay) • Corporate Drive (Scarborough satellite unit) • Yee Hong unit • Ajax-Pickering DMC (Independent Health Facility) • Peterborough DMC (Independent Health Facility)
10. South East	Kingston General Hospital (KGH)	http://www.kgh.on.ca (613)548-3232	• Providence Complex Care • Belleville Dialysis Clinic • Perth and Smiths Falls • Quinte Healthcare Corporation (Bancroft) • Quinte Healthcare Corporation (Picton) • Bayshores Centre Brockville Clinic (Independent Health Facility)
LIHN	**Regional Dialysis Centers**	**Contact**	**Dialysis Facilities**
11. Champlain	Renfrew Victoria Hospital The Ottawa Hospital -	https://www.renfrewhosp.com/ (613)432-4851 http://www.ottawahospital.on.ca/	• St. Francis Memorial Hospital (Barry's Bay) • Pembroke General Hospital • Civic site • Riverside Site • St. Vincent's / Sister of Charity Hospital • Queensway's Carleton Dialysis

	General Campus	(613)722-7000	• Cornwall General • Hawkesbury General Hospital • Winchester Memorial Hospital • Eastern Ontario Dialysis Services Cornwall (Independent Health Facility) • Ottawa-Carlton Dialysis Services (Independent Health Facility)
12. North Simcoe Muskoka	Orillia Soldier's Memorial Hospital (OSM)	http://www.osmh.on.ca (705)325-2201	• Collingwood General and Marine Hospital • Penetanguishene General Hospital • Royal Victoria Hospital (Barrie) • Muskoka Algonquin (Huntsville)
13. North East	North Bay Regional Health Centre Sault Area Hospital Health Science North / Horizon Sante-Nord Timmins and District Hospital	http://www.nbrhc.on.ca/ (705)474-8600 http://www.sah.on.ca/ (705)759-3434 http://www.hsnsudbury.ca 1-866-469-0822 https://www.tadh.com/ (705) 267-2131	• Manitoulin Health Centre (Little Current) • Kirkland and District Hospital (Kirkland Lake) • New Liskeard (Temiskaming) • Sensenbrenner Hospital (Kapaskasing) • St. Joseph's General Hospital (Elliott Lake) • West Parry Sound Health Centre • Moose Factory • Lion's Camp Dorset Corporation - Summer Camp
14. North West	Thunder Bay Regional Health Sciences Centre	http://www.tbrhsc.net/ (807)684-6000	• Fort Frances • Sioux Lookout (Meno Ya Win) • Lake of the Woods District Hospital (of Winnipeg)

Calendar of Weekly Rounds

	Monday	Tuesday	Wednesday	Thursday	Friday
0800	Sign In Rounds 8N-828 Conference Room	Sign In Rounds 8N-828	Sign In Rounds 8N-828	Sign In Rounds 8N-828	Sign In Rounds 8N-828
0830 - 0930	Teaching Rounds 8N-828 Conference Room	Teaching Rounds 8N-828	Teaching Rounds 8N-828	Teaching Rounds 8N-828	Division Rounds 12N-1276 (coffee & light breakfast)
10:00				PD Rounds 12NU 424	
10:30	Yellow team patient rounds 6ES		Yellow team patient rounds 6ES		Yellow team patient rounds 6ES
1100					
1200	Fellows Teaching Rounds 12N-1276 (lunch provided)			Home Dialysis Rounds 12N-1276	
1230		1230 – 1330 General Nephrology Journal Club 8N-828 (lunch provided)	1245 - 1330 eHOME Rounds 12NU 424		
1300					
1400					
1500	Inter-professional Education Rounds - Gerrard Wing York U Academy Rm		Education Rounds 11C-1135		
1530					Friday Sign-out Rounds 8N-828
1600			City Wide Nephrology Rounds 11C-1135	Renal Biopsy Rounds TBD	
1700	Sign-out to on call 8N-828	Sign-out to on call 8N-828	Sign-out to on call 8N-828	Sign-out to on call 8N-828	

Weekly Schedule – Transplant Nephrology

	Monday	Tuesday	Wednesday	Thursday	Friday
0715			Weekly rounds, discussion of inpatients 11 PMB 196		
0800			Multi-Organ Transplant Rounds, Astellas Conference Room 11th floor PMB		
0830					Renal Rounds, 12NU-1276 (Coffee and light breakfast provided)
0900		Post-Transplant Clinic (Drs. Cardella and Mucsi), Transplant Clinic 12th floor PMB	Post-Transplant Clinic (Dr. Cole), Transplant Clinic 12th floor PMB or Kidney-Pancreas Transplant Clinic (Dr. Schiff), Transplant Clinic 12th floor PMB		
0930					Post-Transplant Clinic (Dr. Schiff), Transplant Clinic 12th floor PMB
1000	Ward Rounds 7 PMB			Ward Rounds 7 PMB	
1100					
1200					
1245			eHOME Rounds (for most senior fellow or transplant NP) 12NU 424		
1300	Post-Transplant Clinic (Dr. Kim), Transplant Clinic 12th floor PMB	1300 – 1400 Discussion of an inpatient case (Dr. Cardella), (lunch provided) 11 PMB 196 OR 1300 - 1600 Post-Transplant Clinic (Dr. Tinckam) Transplant Clinic 12th floor PMB	1300 - 1400 Journal Club 11 PMB 196 (lunch provided)	Pre-Transplant Clinic (Dr. Schiff), Transplant Clinic 12th floor PMB Post-Transplant Clinic (Dr. Konvalinka) Transplant Clinic 12th floor PMB	Transplant Program issues/Patient listing meeting 11 PMB 196
1400			1300 - 1600 FASTRAK (Pre-Transplant) Clinic, Transplant Clinic, 12th floor PMB		
1500			1500 – 1600 Nephrology Core Academic Seminar, Astellas Conference Room, 11th floor PMB		
1600	Transplant Seminar 11 PMB 204		Nephrology City-Wide Rounds, Astellas Conference Room 11th floor PMB	Nephrology Biopsy Rounds Eaton 10-316	