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, Renal Management Clinic (RMC), 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 Renal Management 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.

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UHN Renal Pharmacists  
UHN Nephrology Allied Health
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Division of Nephrology

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.

**Inclusion Criteria**

- 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)

**Exclusion Criteria**

- 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 Renal Management 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, dietician, and the diabetes nurse practitioner (Andrea Miller).

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

Geriatric Nephrology Consult Service

Purpose of the Geriatric Nephrology Consult Service

The Geriatric Nephrology consult service is a multidisciplinary team that aims to support elderly patients through the renal care pathway. We see both inpatients and outpatients and can provide expertise in multiple areas, including:

Adjustment of Nephrology care to optimize function and wellbeing in the setting of geriatric syndromes, such as polypharmacy, falls, cognitive impairment, etc.;
Guidance for patients, families, and/or primary medical team members in the decision-making process around dialysis vs. non-dialytic ESRD management, and advance care planning in the context of CKD/ESRD;

Symptom management in CKD/ESRD;

Discharge planning, e.g. geriatric rehab for dialysis patients.

Team members include a staff nephrologist (Dr. V. Jassal), a nurse practitioner, an occupational therapist, a social worker, and a rotating Nephrology fellow.

We provide the following services:

Inpatient consults at UHN/Mount Sinai;

A 6-station hemodialysis unit at Toronto Rehab Institute (University Ave. site);

Outpatient consults in the UHN Renal Clinics;

Peritoneal dialysis at a long-term care facility;

And consults on some community outpatients in collaboration with Family or Palliative Medicine.

We are available from 9am to 5pm, Monday to Friday. We do not have coverage outside of these hours.

Most consults will be complete after an initial multidisciplinary evaluation, and one or two follow-up encounters.

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:

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 within 4 hours (except for infrequent circumstances where staffing constraints preclude this).
Routine inpatient: for elderly patients with AKI or CKD/ESRD for whom the areas of expertise listed above may be useful.

These patients will be seen within 2 working days.

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:

<table>
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<th>Method</th>
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| 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) |
| 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 |
Referral Form

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 
☐ ESRD modality/Advance care planning
☐ Falls/Functional decline 
☐ Cognitive impairment
☐ Other:

Summary of course in-hospital:

Referrals can be emailed to Samantha Ramsammy at Samantha.Ramsammy@uhn.ca; or faxed to (416) 340-4999 (addressed to Dr. Jassal). Any questions about the referral process can be directed to Samantha Ramsammy at (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 (Renal Management 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

Renal Management Clinic (RMC)

• 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
• Diane Stoker, secretary, ext 14-6389, fax (416) 340-4291
• Isolyn Samuels, clerical ext14-3056, fax (416) 340-4291
How to Refer:

- To refer patient to RMC, fill out RMC referral form and fax along with info to (416) 340-4291
- Patients must be seen as an outpatient by a nephrologist for initial work-up of CKD before referral to RMC, even if seen as 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 they are stable enough to wait; if not, please have them followed in a nephrologists' office.
Renal Management Clinic
REFFERRAL 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 <30 ml/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
RENOAL MANAGEMENT CLINIC - REFERRAL FORM

Referring Nephrologist: ___________________________ Date: ___________________________

Patient Name: ___________________________ MRN: ___________________________

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

Date Of First Nephrology Consultation (ORN requirement): ___________________________

PLEASE CHECK IF COMPLETED:

☐ CKD confirmed by a Nephrologist (i.e. Reversible causes ruled out)
☐ Glomerular filtration rate ≤ 30 ml/min (GFR <10 ml/min will not be accepted)
☐ 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 RMC 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/PCR

4. Other investigations, if done within 1 year of first appointment:
   ☐ EKG, Chest X-Ray, Echocardiogram

Referring Nephrologist’s signature: ___________________________
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

Vascular Access Program Secretary
Sally Lima, ext 14-6993
- Notify Cyndi for vascular access issues, e.g., tunneled central line insertion/removal, permanent vascular access creation
- Report all insertions/removals/changes/line sepsis to Cyndi at daily AM rounds.

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
Physiotherapy/Occupational Therapy

- Bijal Mistry, PTA/OTA, pager (416) 719-3869
- Belinda Wagner, PT, pager (416) 719-3903
- Andrea Dyrkacz, OT, ext. 14-6754, pager (416) 790-4609

**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.
### Criteria for referral:

<table>
<thead>
<tr>
<th>Referral</th>
<th>Appropriate</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT to see for exercise program while patient on outpatient HD</td>
<td>Appropriate</td>
<td>PT to get patient consent and if given, assess and set patient up on exercise program, progress as able/needed.</td>
</tr>
<tr>
<td>Joint assessment (including shoulders, elbows, wrist, hips, knees, ankles, digits)</td>
<td>Appropriate</td>
<td>PT to screen and treat as able.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>Back and neck assessments</td>
<td>In-appropriate</td>
<td>PT unable to safely and properly assess back and neck in outpatient HD setting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Doctor/Nurse Practitioner to write referral for private practice/OHIP funded clinic (see list of OHIP clinics attached) and direct patient to book appointment.</td>
</tr>
<tr>
<td>Gait/balance/falls assessments</td>
<td>Appropriate</td>
<td>PT to assess as able for gait, walker, and falls pre- or post-HD.</td>
</tr>
<tr>
<td>Walker assessments</td>
<td></td>
<td>If unable to assess 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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>Falls and Safety Education</td>
<td>Appropriate</td>
<td>PT to provide education and falls pamphlets to patient and/or patient’s family.</td>
</tr>
<tr>
<td>Chest Physio/Secretion Clearance</td>
<td>Appropriate</td>
<td>PT to screen and treat as able.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If unable to treat or with significant concerns, PT to liaise with Doctor/Nurse Practitioner to refer to family doctor or emergency.</td>
</tr>
<tr>
<td>Third Shift Exercise Program</td>
<td>Appropriate for basic home exercise program</td>
<td>PT to assess 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.</td>
</tr>
</tbody>
</table>
- 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 (maternity leave)

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

RMC:
- Annemarie Cesta; Stephanie Ong Ext 14-6547

CARE Clinic:
- Claudia Summa-Sorgini (maternity leave), Ext 14-6547

GN Clinic:
- Melissa Lan; Alice Thach Ext 14-6547
Hemodialysis Unit

Hemo West (HW) – ext 14-4072, fax (416) 340-3084
Hemo East (HE) – ext 14-5707, fax (416) 340-4892
Deloris Bennett, RN, nurse manager – ext 14-6049
Denise Williams, RN, nurse manager – ext 14-6305
Primrose Mharapara, RN(EC)-NP – ext 14-6450, cell (647)919-2476
Annellie Cristobal, RN, patient care coordinator (PCC) – ext 14-6908
Alicia Jones, RN, patient care coordinator (PCC) – ext 14-8502
Debra Appleton, 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

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 except for stat holidays covered by TWH fellow on-call.

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 any 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. Contact information:

- **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 chart nurse, (416) 597-3422 ext. 3801, fax (416) 977-8719
## Physician Coverage for Hemodialysis Units

<table>
<thead>
<tr>
<th>MWF</th>
<th>Hemo West</th>
<th>Hemo East</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scholey</td>
<td>Barua</td>
</tr>
<tr>
<td>2</td>
<td>Pei</td>
<td>Reich</td>
</tr>
<tr>
<td>3</td>
<td>Richardson</td>
<td>Chan</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TTS</th>
<th>Hemo West</th>
<th>Hemo East</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Richardson</td>
<td>Lok</td>
</tr>
<tr>
<td>2</td>
<td>Lok</td>
<td>McQuillan</td>
</tr>
<tr>
<td>3</td>
<td>Cherney</td>
<td>Merchant</td>
</tr>
</tbody>
</table>

### Nocturnal Dialysis (In-centre)

<table>
<thead>
<tr>
<th>MWF</th>
<th>Richardson /Chan</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTSun</td>
<td>Richardson /Chan</td>
</tr>
</tbody>
</table>

### 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**

**Gomuki Mahendrarajah**, Informatics Coordinator & Data Lead for ORN, **ext 14-6285**

**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 Self Care Dialysis Units

**Cathy Fulton**, RN, manager, **(416) 223-2013**

- **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 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)

• Jane Paterson, RD, MSc, Practice Leader & RMC, ext 14-8591, pager (416) 719-3600
• Karla Dawdy, RD (Inpatient, Pre-dialysis & Home HD), ext 14-4625, pager 719-3114
• Antonia Zettas, RD, CDE (PD, HD HE, In-Centre Nocturnal, DSU), ext 14-6530, pager 790-4519
• Christine Nash, RD, CDE (PD, HD HE, CaRE Clinic, DSU), ext 14-6272, pager 790-4536
• Anjali Sambhi, RD (HD HW & Kidney Transplant Mon/Wed/Fri), ext 14-4103, pager 719-3249
• Samantha Chabior, RD (HD HW & Kidney Transplant Tues/Thurs), ext 14-4103, pager 719-3249

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:

<table>
<thead>
<tr>
<th>Name of Diet</th>
<th>Protein</th>
<th>Phosphorus</th>
<th>Potassium</th>
<th>Salt</th>
<th>Fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERI (Early Renal Insufficiency)</td>
<td>60g</td>
<td>&lt;40 mmol</td>
<td>Must be added if required</td>
<td>&lt;217mmol</td>
<td>Must be added if required</td>
</tr>
<tr>
<td>ESRD Diet (no dialysis)</td>
<td>60g</td>
<td>&lt;40 mmol</td>
<td>&lt;60 mmol</td>
<td>&lt;217mmol</td>
<td>Must be added if required</td>
</tr>
<tr>
<td>Hemodialysis Diet / IPD Diet</td>
<td>80g</td>
<td>&lt;40 mmol</td>
<td>&lt;60 mmol</td>
<td>&lt;217mmol</td>
<td>700 mL</td>
</tr>
<tr>
<td>Peritoneal Dialysis Diet</td>
<td>80g</td>
<td>&lt;40 mmol</td>
<td>Must be added if required</td>
<td>&lt;217mmol</td>
<td>Must be added if required</td>
</tr>
</tbody>
</table>
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 Hemodialysis 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-RMC) 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.

Renal Management Clinic (RMC) RD

All patients are assessed and followed by a nephrology dietitian as part of the multidisciplinary team upon referral to the RMC.

Complex Continuing Care Clinic (CCC) RD

All patients are assessed and followed by a nephrology dietitian as part of the multidisciplinary team upon referral to the CCC 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:

<table>
<thead>
<tr>
<th>Social Worker</th>
<th>Area(s) of Responsibility</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoe Levitt, MSW</td>
<td>Renal Management Clinic, inpatients belonging to RMC clinics and Hemo West, <strong>NEW</strong> nephrology inpatients by last name <strong>A-L</strong></td>
<td>Ext 14-3618, pager (416) 719-2876</td>
</tr>
<tr>
<td>Melissa Rubin, MSW</td>
<td>Hemo East (all days, all shifts), inpatients belonging to Hemo East, <strong>NEW</strong> nephrology inpatients by last name <strong>M-R</strong></td>
<td>Ext 14-6047, pager (416) 719-3731</td>
</tr>
<tr>
<td>Michela Verdirame, MSW</td>
<td>Dialysis Start Unit, PD and Home HD, inpatients belonging to PD and Home HD, <strong>NEW</strong> nephrology inpatients by last name <strong>S-Z</strong></td>
<td>Ext 14-3983, pager (416) 719-2812</td>
</tr>
<tr>
<td>Sunny Diamond, MSW</td>
<td>Hemo West (all days, all shifts)</td>
<td>Ext 14-4768, pager (416) 719-2668</td>
</tr>
</tbody>
</table>
Alerts Dashboard

All patients admitted to the nephrology service (RMC → Home Dialysis → Incenter Hemo) should have an Alerts Dashboard “Kardex” completed to indicate allergies, falls risk, IPAC concerns, advanced directives, or behavioural issues. This kardex is used in all areas where communication across the disciplines is necessary for all care providers 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
<table>
<thead>
<tr>
<th>Section</th>
<th>Details</th>
<th>Entry Date</th>
<th>Date Reviewed</th>
<th>And EPR entered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergies</td>
<td>□ No Known Allergies □ Identified SEE BELOW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ □ □ □ □ □ □ □ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Falls Assessment</td>
<td>□ No Identified Risks □ Risks identified below (add Care Plan)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ □ □ □ □ □ □ □ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand Hygiene</td>
<td>□ Contact: • Gown, • Gloves (use Droplet for “Contact + Droplet”)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Droplet: 2 metres perimeter, • Gown, • Gloves, • Surgical mask • Eye Protection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Airborne: • N95 Mask, • Negative Pressure Room, Keep Door Closed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ □ □ □ □ □ □ □ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Ensure all entries or changes match Patient EPR Chart.
- Use Reference List on the back to add patient-specific entries below.

**Date:**
- Initial Completion
- Revised
- Revised
- Revised
- Recopied

**Completed By:**
- (Signature)
- (Signature)
- (Signature)
- (Signature)
# Alerts Dashboard Reference Sheet

**Allergies**

1. **No Known Allergies**
2. **Identified Allergies**
   - Medication: List Medications and typical reaction
   - Food: List food allergies and typical reaction
   - Environmental: List allergens and reactions (ie perfume / plastic tape...)

**Falls Risk Assessment**

- History of falls – list date if known of last fall(s)
- 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

### 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**

- Who exhibited behavior (patient, family, accompanying visitor)
- 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
  - 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:

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

- 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.

For PD Patients at Toronto Western Hospital

- 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 General Medicine
6ES – ext 14-4487, fax (416) 340-4168

• 9 nephrology beds - No inpatient nephrology service at TWH so all nephrology admissions to TGH

Medical Coverage

Red and Blue Teams (“Acute Care Teams”):
• Acute Care Teams: AKI, undiagnosed renal failure, or ESKD patients undergoing various other procedures, e.g. biopsy, angioplasty
• Team consists of:
  o Attending house staff is responsible for the team, patients and ITER forms.
  o Renal fellow acts as team leader, co-ordinates the work of the team, assists in teaching, and is aware of all patients on team.
  o 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
  o 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
Paulina Bleah, NP ext 14-8501, pager 790-7758, c: (647)532-2094 is responsible for dialysis patients with uncomplicated illness, awaiting placement or rehab, issues related to dialysis and vascular access/PD catheter, and palliative management

1 fellow acts as team leader and is 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, NOT thru NP.

Staff and second 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

Responsibilities of the Yellow Team Nephrology Fellows

The Yellow Team consists of nephrology fellows and a nurse practitioner (NP). One fellow covers Toronto Western (TW) for consults, and another covers Toronto General (TG) in inpatient nephrology with the NP. The focus of the TG rotation is to manage chronic dialysis patients with dialysis-related medical issues, such as peritonitis and vascular access problems, and to learn about managing issues such as palliative care in nephrology. The focus at TW is to provide consultation and manage AKI, CKD, electrolyte disorders, and care of patients on dialysis who require other services such as orthopedics and neurology, which are housed at TW.

Inpatient (TG) Responsibilities

Yellow Team fellow is the inpatient nephrology team leader, and the physician ultimately responsible to know about day to day care of all Yellow Team patients including those assigned to the NP.

Yellow Team fellow reports to staff nephrologist.

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 with her, 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.

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

Admitting/Transferring Patients
For bed flow and advice on admitting directly to the floor, speak with April Guthrie (nurse Manager) or Marcia Cameron (PCC) or charge nurse for the day, who will get approval from the appropriate administrative personnel. Complete the Admission Request Form for patients requiring pre-planned admission (to request the bed, on Hospital intranet, go to departments, select “nursing”, select “nursing practice areas, select 6ES and enter Admission Request Form to complete information. 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, centres without dialysis take immediate priority. UHN patients at a hospital with dialysis services will be transferred based on bed availability. To request a nephrology bed, complete the Hospital Transfer Request Form (On Hospital intranet, go to departments, select “nursing”, select “nursing practice areas”, select 6ES and then enter the Hospital Transfer Request form and complete). 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.

**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 O2 saturation, 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 Interprofessional Patient Centred Care Rounds**
- Bullet rounds every Monday, Tuesday, Thursday, and Friday: 1030-1045
- Extended rounds every Wednesday at 0930-1030 in 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.
Friday Sign-out
Bring 5 edited and updated sign-over lists to assist staff in knowing the status and whom to contact. Review only patients whom you want the weekend team to see or follow up.

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.

Discharges
- It is imperative 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**
- Complete online **discharge summaries** for all Yellow Team patients.
- 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 **specify any condition that would shorten life expectancy to less than 5 years.**
- 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 Dialysis Patients

Patient Destination

- 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.

<table>
<thead>
<tr>
<th>General Internal Medicine</th>
<th>General Surgery (or appropriate sub-specialty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cellulitis</td>
<td>• Abdominal Pain – Surgical Abdomen, peritonitis in non-PD pts</td>
</tr>
<tr>
<td>• Pneumonia</td>
<td>• Cholecystitis</td>
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<tr>
<td>• Pulmonary Embolus</td>
<td>• Gallstone pancreatitis</td>
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<td>• DVT</td>
<td>• Bowel Obstruction</td>
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<tr>
<td>• Unstable Angina</td>
<td>• Unstable GI bleed</td>
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<tr>
<td>• Non-Q MI</td>
<td>• Post-operative complications</td>
</tr>
<tr>
<td>• Cardiac Dysrhythmias (non CCU)</td>
<td>• Arterial thrombosis (vascular service)</td>
</tr>
<tr>
<td>• PVD &amp; complications</td>
<td>• Gangrene requiring amputation (vascular service)</td>
</tr>
<tr>
<td>• TIA/CVA</td>
<td>• Fractures (orthopedic service)</td>
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<td>• Seizures</td>
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<tr>
<td>• GI Bleed</td>
<td></td>
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<tr>
<td>• Acute Renal Failure</td>
<td></td>
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</tbody>
</table>

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

- Urgent Dialysis in a Dialysis or pre-dialysis Patient
  - Volume Overload
  - Electrolyte Emergency i.e. ↑ Potassium

Awaiting out-patient Dialysis spot

- Dialysis patients admitted to other services who are palliative, rehabilitation, or awaiting placement to long-term care facility.
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 Nephro beds at TW, thus patients coming to TW emergency must be assessed, and a note written by the nephro resident on call at TW. If the pt requires a nephro 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 outpt 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 Sheets

- In pts needing follow up and consults to be signed out to the on-call nightly.
- Weekend sign-out Friday at 15:00 in the 8N-828 conference room.
- Prepare written sign-out sheets ~6 per team. Be brief on sign-out sheets.
- 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.

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.

Patient Centered Care Rounds
Held for Yellow Team each Wednesday 10:00 in 6ES Conference Room. To discuss pts medical/social issues and discharge plan.

Teaching Rounds
Mornings:

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

Fri 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

Tues 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
Wednesdays 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, RMC 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 all patient information is confidential. 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)
**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 hemo 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%

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

4. Dialysate
Sodium: standard is 138 mM. May order Na⁺ "Ramping" for pts with intradialytic hypotension or cramping - e.g. Na 145 1\text{st} hr, 140 2\text{nd} hr, 137 3\text{rd} hr, 135 4\text{th} 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 mM. Also 1.25 and 1.00 mM available for hypercalcemia and 1.75 mM 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:

<table>
<thead>
<tr>
<th>Amount of Fleet enema</th>
<th>Final Dialysate Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 mL</td>
<td>1.0 mmol/L</td>
</tr>
<tr>
<td>95 mL</td>
<td>0.8 mmol/L</td>
</tr>
<tr>
<td>47 mL</td>
<td>0.4 mmol/L</td>
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</tbody>
</table>
5. Target weight (TW) and fluid removal.
TW = pt’s euvoletic 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; hemo 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 outpts; "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.
Doctor's Order Sheet
Hemodialysis Unit

**Hemodialysis Orders**

**ALLERGIES:**
- NO KNOWN ALLERGIES
- KNOWN ALLERGIES (Specify)

**PHYSICIAN’S ORDER AND SIGNATURE**

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

1. **TREATMENT:**
   - Daily dialysis (acute/unstable in-patients) for mm/dd/yyyy
   - Chronic dialysis orders ________times per week (Started mm/dd/yyyy)
   - 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 (Belloco™ User Profile 1.4 mean 140)
     - Linear 143 mmol/L to 133 mmol/L (Belloco™ User Profile 1.4 mean 138)
     - Linear 141 mmol/L to 130 mmol/L (Belloco™ 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% (Belloco™ User Profile # 3) (standard)
     - 50% - rest - 30% - rest - 10% - 10% (Belloco™ User Profile # 1)
     - 50% - 30% - 20% - 10% (Belloco™ User Profile # 2)
     - Initial 15 minute rest then straight UF (Belloco™ 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: 1,000 units bolus then 1,000 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: mm/dd/yyyy

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Form D2199 (17/06/2016)

COPIES: ORIGINAL - RETAIN IN CHART, YELLOW - PHARMACY

55
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, Creat, Urea, bicarbonate, Ca++, PO₄, 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 cath 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 hrs (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

(Sustained Low Efficiency Dialysis)

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

* 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.
**Doctor's Order Sheet**

**Nephrology SLED orders**
**Sustained Low Efficiency Dialysis**

**ALLERGIES:**
- NO KNOWN ALLERGIES
- KNOWN ALLERGIES (Specify)

**PHYSICIAN’S ORDER AND SIGNATURE**

(Complete orders as required)

1. **ON ADMISSION:**
   - Start date: __/__/____
   - 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) OR 4.0 mmol/L (with 0.75 mmol Mg)
     - Ca++ 1.5 mmol/L (standard) OR 1.0 mmol/L OR 1.25 mmol/L OR 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: __/__/____ Time: __/__/____**
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 Anticoagulaton 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, creat, PO4, Lactate, Mg, alb

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 ot 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 2^\text{nd} 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 Co-ordinator 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
Algorithm for Central Venous Catheter Related Infection

1. Check definitions (Table 1)
2. Rule out other possible non-catheter related infections
e.g. infected diabetic foot or pneumonia

Patient Hemodynamically Unstable

ABC’s, Stabilize, consider ICU
Check INR
Blood cultures x 2 : 1 is obtained from the catheter and 1 is obtained from the circuit line if a peripheral vein is not feasible.
Blood cultures MUST be done before starting Antibiotics
Inform Diane (x 8238), certified renal fellow or Angio for line removal

Patient Hemodynamically Stable

Check INR
Blood cultures x 2 : 1 is obtained from the catheter and 1 is obtained from the circuit line IF a peripheral vein is not feasible.
Blood cultures MUST be done before starting Antibiotics
HICS will confirm removal strategy based on clinical scenario and patient’s access history

MUST Contact Cyndi Bhola (x3518)
Start Empiric Antibiotics (See Table 2)

Negative blood cultures
- Stop Antibiotics
- Coagulase-negative staphylococcus
- Gram-negative bacilli

Resolution of bacteremia/fungemia and fever in 2-3 days
- Staphylococcus aureus
- Candida species

Persistent bacteremia/fungemia and fever **need to look for persistent cause, e.g. fibrin sheath
- Antibiotics x 14 days
- Guidewire CVC exchange*
  Must contact Cyndi if you want to retain infected CVC

Remove CVC,
Antibiotics x 4 wks
Guidewire CVC exchange*
Consider TEE

Anti fungal x 14 days
Guidewire CVC exchange*
Must contact Cyndi if you want to retain the infected CVC

Antibiotics x 4-6 wks
Look for metastatic infections (thrombosis, endocarditis)

*Note: If there is purulence at the exit site or tunnel, you MUST contact Cyndi (x3518), guidewire exchange is not allowed
<table>
<thead>
<tr>
<th>Definition</th>
<th>Definite</th>
<th>Probable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit site infection</td>
<td>Purulent discharge at exit site</td>
<td>Erythema, tenderness, induration (2 of 3) at exit site without a positive culture of serous discharge</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>Erythema, tenderness, induration (2 of 3) at exit site with a positive culture of serous discharge</td>
<td>Above without discharge but lack of alternative explanation</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Above without discharge but lack of alternative explanation</td>
</tr>
<tr>
<td>Tunnel infection</td>
<td>Purulent discharge or aspirate from a tunnel or pocket site not contiguous with exit site</td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>Above without discharge but lack of alternative explanation</td>
</tr>
<tr>
<td>Catheter-related bacteremia</td>
<td>Confirmation of septic thrombophlebitis with a single positive blood culture</td>
<td>2 or more positive blood cultures with no evidence for source other than the device</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>Single positive blood culture and positive culture of catheter segment with identical organism</td>
<td>Single positive blood culture for <em>S. aureus</em> or <em>Candida</em> with no evidence for source other than device</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>≥10 fold colony count difference in blood cultures drawn from device and peripheral blood</td>
<td>Single positive blood culture for coagulase negative <em>staphylococci, Bacillus, Corynebacterium jeikeium, Enterococcus, Trichophyton or Malassezia</em> in immunocompromised or neutropenic host or in patient receiving total parenteral nutrition with no evidence for source other than a centrally placed device</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>Single positive blood culture from discharge or aspirate from exit site, tunnel or pocket, with identical organism</td>
<td>Single positive blood culture for <em>S. aureus</em> or <em>Candida</em> with no evidence for source other than device</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Culture results</th>
<th>Continue or add, based on sensitivity</th>
<th>Discontinue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulase negative staphylococci</td>
<td>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.</td>
<td>Tobramycin</td>
</tr>
<tr>
<td>Gram negative</td>
<td>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 wk</td>
<td>Cefazolin</td>
</tr>
<tr>
<td>S. aureus</td>
<td>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.</td>
<td>Tobramycin</td>
</tr>
<tr>
<td>MRSA</td>
<td>Vancomycin* see Table 3: Vancomycin Dosing for Hemodialysis x 4 wks*. For home NHD*, see Table 3: Vancomycin Dosing for Hemodialysis and call Pharm Note: for all SA, if SBE, treat for 6 weeks.</td>
<td>Cefazolin</td>
</tr>
<tr>
<td>Enterococci</td>
<td>Vancomycin* see Table 3: Vancomycin Dosing for Hemodialysis with every HD for 2 wks. OR Ampicillin 2 g q 12 h x 2 wks, and Tobramycin 2 mg/kg loading then 1mg/kg post q HD x 2 wks.</td>
<td>Cefazolin</td>
</tr>
<tr>
<td>Fungus (yeast, candida)</td>
<td>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)</td>
<td>Cefazolin</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Organism</th>
<th>Treatment based on sensivities, examples:</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coag neg staph</td>
<td>Septra 1 DS po daily</td>
<td>7 days</td>
</tr>
<tr>
<td>Gram Negative</td>
<td>Ciprofloxacin 500 mg po daily</td>
<td>7 days</td>
</tr>
<tr>
<td>Staph Aureus</td>
<td>Cloxacillin 500 mg po q 6 hr Or Cefazolin 2 gm IV q HD</td>
<td>7 days</td>
</tr>
<tr>
<td>Fungus</td>
<td>Fluconazole 200 mg po daily</td>
<td>7 days</td>
</tr>
</tbody>
</table>

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 amt 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 declotting 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 declotting 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 declot 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 declotting, 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 sc 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° 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 all 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 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.

**Hemodialysis**

- 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
  
  Esp if elderly, smoker, acute on chronic ingestion

**Poison Control** Telephone Number: (416) 813-5900

References:

AKF Nephrology Letter 10:1-20, 1993

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 inpts, 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 TG emerg 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, Creat, Urea, bicarbonate, Ca++, PO₄, 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 nephro 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 Saturdays

The nephrology trainee assigned to TWH consults to be available for the HPDU nurse on call and to see drop-in patients on Saturday. He/she should come at the beginning of the shift before going to TWH.

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 nephro trainee as needed for advice. As much as possible, she will wait for the designated time for the nephro trainee to visit the unit to assess the issues. After hours, the on call nurse is
required to call the nephro trainee on call when medical advice and/or a doctor’s order is 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.

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**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)

AM I______(I)*____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_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.

<table>
<thead>
<tr>
<th>Sample Prescription NIPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Volume: 8 litres (4 exchanges of 2 litre volume overnight no last fill)</td>
</tr>
<tr>
<td>Therapy Time: 9 hours</td>
</tr>
</tbody>
</table>

IPD (Intermittent Peritoneal Dialysis)

AMI_I_I_I_I_I_I_I_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 s.c. insulin, and if in hospital, sliding scale insulin should be ordered.
• Capillary blood glucose monitoring q bag set change (usually every 4-5 hr)

<table>
<thead>
<tr>
<th>Sample Prescription IPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outpatient: 8 litres over 6 hours</td>
</tr>
<tr>
<td>Inpatient: may increase volume and treatment time based order (i.e. 16 litres over 12 hours)</td>
</tr>
<tr>
<td>Exchange volume: 2.0 litres (may range from 750mL to 2.5 litres) don’t use hypertonic dialysate*</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>
Doctor's Order Sheet
Nephrology Program

**Peritoneal Dialysis (PD) Orders**

<table>
<thead>
<tr>
<th>PHYSICIAN'S ORDER AND SIGNATURE</th>
<th>SIGNATURE AND POSITION</th>
<th>ACTION TAKEN PAYMENT</th>
</tr>
</thead>
</table>

(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
     - ☐ % Strength:
   - Cycler Last Fill Volume: ___________ L (day dwell) (included in cycler programming)
   - Cycler Last Fill
     - ☐ % Strength:
     - ☐ Icodextrin (7.5%)
     - ☐ Nutrineal (Amino Acid)
   - ☐ Twin Bag™ Day Exchange with APD (if clinically indicated)
     - at 1400 hrs or __________ (time)
     - ☐ % Strength: __________ Volume: __________
     - ☐ Icodextrin (7.5%)
     - ☐ 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
ALLERGIES:
- NO KNOWN ALLERGIES
- KNOWN ALLERGIES (Specify)

PHYSICIAN'S ORDER AND SIGNATURE

(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 p.m.

For Diagnostic Tests and Procedures:
- Drain p.m. and then refill with last dwell or provide next exchange as clinically indicated

PD Catheter Exit Site Care
- Twice weekly and as needed
- __________________________ (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 p.m. if exudate is present
   b) Cell count & C&S of effluent p.m. 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
   - Other: ____________________________

For fibrin: Heparin 600 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)
   - __________ mEq per litre of peritoneal dialysate for all exchanges

Physician’s Signature ____________________________ Date: _____/_____/_____ Time: _____
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

<table>
<thead>
<tr>
<th>Total Volume = 10 litres over 10 hours, 4 overnight exchanges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange Volume = 2 litres</td>
</tr>
<tr>
<td>Last Fill Volume = 2 litres</td>
</tr>
<tr>
<td>Use 1.5% overnight; and icodextrin for last fill</td>
</tr>
<tr>
<td>Tidal Volume = 80%</td>
</tr>
<tr>
<td>Ultrafiltration requested = 1 litre</td>
</tr>
<tr>
<td>Full drains: no full drains</td>
</tr>
<tr>
<td>(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)</td>
</tr>
</tbody>
</table>
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 dialysing 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:
Defined as

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: NaHCO3 8.4% (1 mEq/mL) add 5 mL per L of dialysate
IPD Dose: NaHCO3 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; ie., 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**
### 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 preop 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 2-3 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.

**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 (e.g. ASA, CLOPIDOGREL, DIPYRIDAMOLE, PRASUGREL) for 7 days prior to the procedure. Restart the day after catheter insertion.
   - HOLD **LOW MOLECULAR WEIGHT HEPARIN** (e.g. ENOXAPRAN, 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.

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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

**POOR FLOW**
(in or out)

- inflow < 200 mL/min
- outflow < 180 mL/min
- Flush with 1 litre
  - combined inflow/outflow

related to

? external tubing kink
? fibrin/blood clot
? constipation
? malposition
? kink in tunnel
? omental wrapping

**IMPROVEMENT**

Irrigate with N/S and heparin (nursing procedure).

x 3 exchanges

failure

**NO IMPROVEMENT**

- Flat plate
  - confirming malposition
  - +/- constipation
    - Increase bowel peristalsis with lactulose po and ss or tap water enema pr

**IMPROVEMENT**

- Reassess with catheter flushes

**NO IMPROVEMENT**

- Consider radiological manipulation; if not successful, surgical replacement

- If uremic, consider hemodialysis

POOR FLOW

IMPROVEMENT

NO IMPROVEMENT

Irrigate with N/S and heparin (nursing procedure).

x 3 exchanges

failure

- Flat plate
  - confirming malposition
  - +/- constipation
    - Increase bowel peristalsis with lactulose po and ss or tap water enema pr

**IMPROVEMENT**

- Reassess with catheter flushes

**NO IMPROVEMENT**

- Consider radiological manipulation; if not successful, surgical replacement

- If uremic, consider hemodialysis

**IMPROVEMENT**

- Reassess with catheter flushes

**NO IMPROVEMENT**
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 (abdo 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 pt 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, eg. if yeast, but continue empiric antibiotics until culture results available.

Blood for CBC, diff, lytes, Cr, urea, Ca, PO₄, alb, 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, q7 days 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 Surg 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

<table>
<thead>
<tr>
<th>Culture results</th>
<th>Continue or add</th>
<th>Discontinue</th>
<th>Frequency (F) and duration (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No growth in 2-3 days</strong></td>
<td>Cefazolin 1.5 g (1 g if &lt;50 kg)</td>
<td>Discontinue Tobramycin/ceftazidime</td>
<td><strong>F: 1 exchange/DAY</strong>&lt;br&gt;<strong>D: Continue for 2 weeks.</strong>&lt;br&gt;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.</td>
</tr>
<tr>
<td><strong>Gram Positive Coag Negative Staphylococcus (CoNS)</strong></td>
<td>Cefazolin 1.5 g (1g if &lt;50 kg)</td>
<td>Discontinue Tobramycin/ceftazidime</td>
<td><strong>F: 1 exchange/DAY</strong>&lt;br&gt;<strong>D: Continue for 2 weeks</strong>&lt;br&gt;</td>
</tr>
<tr>
<td><strong>Gram Positive Methicillin Resistant Coag Negative Staphylococcus (MRSE)</strong></td>
<td>Vancomycin 2g IP (1g if &lt;50 kg)</td>
<td>Discontinue cefazolin and tobramycin/ceftazidime</td>
<td><strong>F: 1 exchange/WEEK</strong>&lt;br&gt;<strong>D: Continue for 3 weeks.</strong>&lt;br&gt;Note: If residual renal function (RRF), (i.e. urine &gt;100 mL/24hr) give: 1 exchange/5 days cont. for 3 weeks</td>
</tr>
<tr>
<td><strong>Gram Positive Staphylococcus aureus</strong></td>
<td>Cefazolin 1.5 g (1g if &lt;50 kg) and consider rifampin 300 mg po BID for the first week of therapy</td>
<td>Discontinue tobramycin/ceftazidime</td>
<td><strong>F: 1 exchange/DAY</strong>&lt;br&gt;<strong>D: Continue for 3 weeks</strong>&lt;br&gt;</td>
</tr>
<tr>
<td>Gram Positive</td>
<td>Methicillin resistant Staphylococcus aureus (MRSA)</td>
<td>Vancomycin 2g IP (1 g if &lt; 50kg) PLUS rifampin 300 mg po BID for the first 2 weeks of therapy.</td>
<td>Discontinue cefazolin and tobramycin/ ceftazidime</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
</tbody>
</table>

**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 if RRF))
- Consider gentamicin 20 mg/L IP in one exchange for synergy.

| 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 if RRF)) Consider gentamicin 20 mg/L IP in one exchange for synergy. | Discontinue cefazolin | 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

| Streptococci (Gram +) | Cefazolin 1.5 g. OR Penicillin G 50,000 u /L loading dose then 25,000 u/L | Discontinue cefazolin | 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) if no RRF, OR Ceftazidime 1.5 g (1g if <50 kg) if RRF

| Gram Negative (e coli, Klebsiella, proteus, serratia) | Tobramycin 60 mg (40 mg if <50 kg) if no RRF, OR Ceftazidime 1.5 g (1g if <50 kg) if RRF | Discontinue cefazolin | F: 1 exchange/DAY D: Continue for 3 weeks |

**Polymicrobial**

- Tobramycin 60 mg (40 mg if <50 kg ) if no RRF OR Ceftazidime 1.5 g (1g if <50 kg) AND Ampicillin 125 mg/L if RRF

<p>| Polymicrobial | Tobramycin 60 mg (40 mg if &lt;50 kg ) if no RRF OR Ceftazidime 1.5 g (1g if &lt;50 kg) AND Ampicillin 125 mg/L if RRF | 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 |</p>
<table>
<thead>
<tr>
<th><strong>Pseudomonas/ Stenotrophomonas</strong></th>
<th><strong>Fungal / Yeast</strong></th>
<th><strong>Mycobacteria</strong></th>
</tr>
</thead>
</table>
| AND metronidazole 500 mg IV/po q8h  
Get surgical consult | Tobramycin 60 mg (40 mg if < 50 kg) if no RRF, OR  
Ceftazidime 1.5 g (1.0 g if <50 kg) if RRF AND Anti-pseudomonas or anti-stenotrophomonas (see Table 2 or 3). Recommended to use 2 antibiotics – may use oral quinolone plus alternate. | 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: |
| | Discontinue cefazolin | **D:** Rifampicin and isoniazid 12 mo.  
Pyrazinamide 3 mo.  
Arrange for Catheter removal |
| | **F:** 1 exchange/day  
**D:** Continue for 4 weeks if cath is in, or for 2 weeks following cath removal.  
Catheter removal if exit site or tunnel infection | |
| | 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. | |
| | If any organism is gram neg, consider bowel perforation. | |
| 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

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dosage/administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceftazidime</td>
<td>125 mg/L IP IN EACH exchange</td>
</tr>
<tr>
<td>Piperacillin-Tazobactam</td>
<td>3.375 g IV q12h</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>500 mg po BID</td>
</tr>
<tr>
<td>Cefepime</td>
<td>1gm IP in 1 exchange per day</td>
</tr>
</tbody>
</table>

Table 6. Antibiotic with anti-stenotrophomonas activity

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dosage/administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimethoprim / sulfamethoxazole</td>
<td>Loading dose: 320 mg/ 1600 mg (20 mL) IP</td>
</tr>
<tr>
<td></td>
<td>Maintenance dose: 40 mg/ 200 mg (2.5 mL) IP in one exchange per day</td>
</tr>
</tbody>
</table>

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 (ie. shorten dwells, hypertonic bags, lcodextrin/Extraneal™ more frequent exchanges, IPD ).
- Note that lcodextrin is compatible with antibiotics, so can be put into lcodextrin 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:


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**

**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 (Sigmoidoscopy/Proctoscopy)
Bowel prep is required for colonoscopy, sigmoidoscopy or 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).

Antibiotic prophylaxis is not necessary for sigmoidoscopy or proctoscopy.

Antibiotic prophylaxis is necessary for colonoscopy:

- Ampicillin 1 g IP in night bag/long dwell prior to procedure or oral amoxicillin 2 g 1 hour before procedure
  If allergic to Penicillin: Clindamycin 600 mg po 1 hour pre or 600 mg IV 30 min pre procedure
- Tobramycin 120 mg IP in night bag/long dwell prior to procedure,
- Metronidazole (Flagyl®) 500 mg po 1 hour pre procedure and 500 mg po 12 hours post procedure.

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 instil 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 1 hour 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 po 1 hour pre procedure

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

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 result 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 Creat* <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.


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:

- ASA should be held for 10 days, warfarin should be held at least 4 days prior to procedure, preferably 5.
- Nephrologist to send requisition and pt notes.
- Use Renal Biopsy standing order form for pre & post bx orders.
- 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.
- 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.
- Consent forms for Blood and Tissue are to be filled out by house staff and signed by patient.
- 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 Creat 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 only” 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.
- 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

Management of Patients with Kidney Transplant

- Kidney transplant patients are admitted under the kidney transplant service.
- Kidney-pancreas patients are admitted under the pancreas transplant service; in special circumstances transplant nephrology may be asked to consult for K-P patients (usually when dialysis is required)
- The kidney transplant service also follows kidney transplant patients admitted to another service, including patients at PMH and Mt. Sinai; patients at Toronto Western Hospital (TWH) are followed by the nephrology fellow covering TWH, with advice from kidney transplant as needed.

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.

Wards, ER and Admissions
- 7C (Multi-Organ Transplant Unit) ext 14-5163 (A side), ext 14-5330 (B side) and 10C (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.
- Consults from ER are handled by the renal transplant service between 8 AM and 6 PM. After that, first call is by fellow covering MOT ward (who is usually not a nephrology fellow), who will contact fellow on call for renal transplant to discuss cases.
- Transplant coordinators will call if they know of a patient who is going to the ER or needs admission; patients expected in the emergency department who arrive between 8 AM and 6 PM, especially when directed by the transplant coordinator, are the responsibility of the renal transplant fellow.

Order Entry and Documentation
- Orders are placed in MOE/MAR, except for those entries which still go on paper.
- **When patients go to the OR, all orders are cancelled, and must be re-entered into MOE/MAR post-operatively.**
- Orders do not need to be re-entered when patients move from the Transplant ACU to PMB 7 or between the A and B wards on 7.
- 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).
• Discharge summaries must be completed within 48 hours of discharge; preferably, they should be ready on the day of discharge.
• If a patient requires returning to dialysis, please contact Anna Gozdzik at ext 14-5129 to discuss modality selection with the patient.
• 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, outpatient medication list, 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 blood 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.
• Please note, when failing transplant patients are followed in Renal Management Clinic by Dr. Schiff, OTTR is not updated. All updated medication lists and history are in a paper chart with the clinic.
• Some important diagnoses to include for new transplants as needed:
  1) PRA (peak) 0, 1-49, or > 50%
  2) Donor-specific antibodies (“No DSA No PRA,” “No DSA PRA positive,” “DSA Class I,” “DSA Class II”)
  3) Extended criteria donor (single or double)
  4) DCD (donation after cardiac death) donor
  5) Delayed graft function (dialysis required in first week post-transplant)
  6) CMV mismatch
  7) EBV mismatch
Note: 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. Contact Lisa Gallant-Labelle (Lisa.GallantLabelle@uhn.ca) to do so.

Rounds, Clinics, and Call Schedules
- Please see the schedule. If time permits, trainees may attend a pre- or post-transplant clinic as well.
- Attendance at the Monday and Thursday morning multi-disciplinary rounds, Monday and Tuesday afternoon seminars, Wednesday morning meeting 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 (Jeffrey.schiff@uhn.ca) for access or ask one of the other trainees to give you access. 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.
- Transplant Pearls (http://medicalpearls.com/topics/transplant-pearls) is a series of twenty questions and answers that cover core topics in transplantation. It is suggested that you register for it at the beginning of your rotation.
- Transplant Now (http://transplantnow.com/) is a free service that provides summaries, commentary and links to important new articles in transplantation, focusing on clinically relevant papers.
New transplants

- Living donor recipients are admitted the day before transplant to the transplant ward; donors are usually admitted under urology and are not followed by renal transplant. Occasionally, a living donor is admitted on 7C, but is still under urology. However, if there is an emergency with the donor after hours, the renal transplant service should see the patient if requested.

- Deceased donor recipients are admitted either by the MOT fellow on call (if after hours) or by the renal transplant service. The renal transplant team must make a decision about whether the patient requires dialysis pre-operatively.

- **ALL** deceased-donor transplant recipients must be seen by a renal transplant trainee 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 the MOT Coordinator before the patient is brought into hospital. It is done for some patients who have a cPRA > 0% (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. A “backup” may also be called in in the setting of a multi-organ donor recipient (e.g. liver-kidney) where there is some concern that the non-renal organ may not be usable.

PRA, DSA and Crossmatching

- Antibodies to HLA antigens are a risk factor for hyperacute and acute humoral rejection

- 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 current pool of local donors, e.g. a patient with a cPRA of 45% will have antibodies against 45% of donors in the GTA 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. There are three different methods to perform the test, complement-dependent cytotoxicity (CDC), the more sensitive flow cytometry and the most sensitive virtual crossmatch.

• As of February 2014, all **deceased-donor transplants** in Ontario require a **negative virtual crossmatch**, with no evidence of a donor-specific antibody in any of the patient’s current or previous testing.

• If the patient is “sensitized” (i.e. has a cPRA > 0% at any time), a **stat cross-match** by flow cytometry may be required. This will be determined by the renal transplant staff. The crossmatch must be negative in order to proceed to transplant.

• Always ask the patient about any recent blood transfusions or pregnancies (including TAB or SAB) in the last 3 months. If the answer is yes, a stat crossmatch may be required.

• Some living-donor transplants will proceed with a history of DSA or a positive crossmatch. These are “desensitization” cases, and require the high immunologic risk protocol below.

**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 ≥ 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

**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 overimmunosuppression and receiving standard criteria donor (SCD) kidney or a kidney with immediate graft function

Defined as:

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

Immunosuppression for New Renal Transplant Recipients

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 (positive family history, gestational diabetes, previous glucose intolerance, HCV positive, Hispanic, black, or BMI >/=30) AND low immunologic risk
High Immunologic Risk Protocol
See definition above

- IVIg 1 gm/kg IV pre-transplant; use standard IVIg order sheet to calculate dose
- 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
- Tacrolimus target 10-15 ng/ml (always a trough level), using Advagraf

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)
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 day 7 and onwards
- Thymoglobulin 3 mg/kg as above
- MPA as above
- Target tacrolimus (Advagraf) to 5-10 ng/ml or target cyclosporine with C2 monitoring to 900-1100 ng/ml

Patients at High Risk of Complications from Overimmunosuppression and Receiving Standard Criteria Donor (SCD) Kidney or a Kidney 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 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 or duration if stable
- Target tacrolimus (Advagraf) to 5-10 ng/ml or target cyclosporine with C2 monitoring to 900-1100 ng/ml

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 DS 1 tab qMWF; for patients with intolerance or sulfa allergy, alternatives are dapsone 100 mg qd; 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; also may be used for EBV-negative recipients who receive a kidney from an EBV-positive donor (“EBV mismatch”), regardless of immunosuppression used; standard dose is 900 mg qd, adjusted for renal function
  
  o 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 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, humoral 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
- 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 plasmapheresis unit. Usual number of plasma exchange sessions is 5. IVIg is usually only given if there will be a 2-3 day break between sessions, and 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 drained for surgery, and ensure that PD catheter is secured.
• 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.
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

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Extension</th>
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<tbody>
<tr>
<td>Colleen Lee</td>
<td>Recipient Renal Transplant</td>
<td>14-5965</td>
</tr>
<tr>
<td>Lee-Anne Hyer</td>
<td>Recipient Renal Transplant</td>
<td>14-6817</td>
</tr>
<tr>
<td>Andrea Norgate</td>
<td>Kidney-Pancreas</td>
<td>14-8866</td>
</tr>
<tr>
<td>Julie Cissell</td>
<td>Living Donor Renal</td>
<td>14-4577</td>
</tr>
<tr>
<td>Michael Garrels</td>
<td>Living Donor Renal</td>
<td>14-5889</td>
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<tr>
<td>Edilyn Llameg</td>
<td>Post Tx</td>
<td>14-5002</td>
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<tr>
<td>Theresa McKnight</td>
<td>Post Tx</td>
<td>14-3599</td>
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<tr>
<td>Carlene Masney</td>
<td>Post Tx</td>
<td>14-6657</td>
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<tr>
<td>Carol Wright</td>
<td>Post Tx</td>
<td>14-5567</td>
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<tr>
<td>Jennifer Ly</td>
<td>Post Tx</td>
<td>14-5614</td>
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<tr>
<td>Transplant Clinic</td>
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<td>14-4113</td>
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<tr>
<td>Transplant Day Unit</td>
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<td>14-5773</td>
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</tbody>
</table>
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, lytes, Ca, PO4, PTH, INR, PTT, LFT's, HIV, HBsAg & Ab, Hep B core, Hep C, CMV IgG, EBV, Varicella Zoster IgG, OGTT (if not diabetic)
  - 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 Xray, Abdominal U/S and iliac Doppler
  - Age-appropriate cancer screening (cervical, breast and colon)
  - 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 yr 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 CrCl <30, patient should be referred to RMC to see Dr. Schiff (see RMC 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.

**Withdrawal of Immunotherapy, Septra**
Discuss with Transplant Nephrologist for management.

**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
  eg. 4 years of steroids, taper over 1 year to zero
- patients on steroids > 10 years may not recover adrenal function.
  Suggest maintain on 7.5 mg/day permanently or until next transplant.
Renal Palliative Care

While dialysis can improve survival, it can also increase the burden of symptoms experienced by the patient. When the patient’s health is declining and treatment becomes more burdensome than beneficial, it would be appropriate to arrange a family meeting to discuss withdrawal of care and collaborate with the palliative care team in assisting the patient/family unit to transition to end-of-life or conservative care. It is important to establish whether the patient has an advanced directive related to their care; this should guide the team’s approach to the palliative care of the patient.

Renal palliative care works best with a team approach. In concert with the palliative care team, the multidisciplinary nephrology team can provide physical, emotional and spiritual support to the patient and, by extension, their family as they prepare for the dying process. Once a decision is made to withdraw from dialysis, death may follow within 7 to 14 days contingent on the patient’s co-morbidities and residual renal function. The “best death” occurs when there is a sudden cardiac arrest secondary to hyperkalemia. Palliative care involvement is important in guiding the management of end-stage pain, agitation and/or delirium, and secretions (commonly referred to as the “death rattle”) with the administration of drugs unique to palliative care, e.g., hydromorphone; haloperidol or methotrimeprazine, and anti-secretory agents such as scopolamine or glycopyrrolate, respectively.
Kidney Failure – Definitions and Approach

Definitions

eGFR is determined by all Ontario laboratories using the 4 variable MDRD equation. 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).*


<table>
<thead>
<tr>
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<tbody>
<tr>
<td>A1</td>
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<td>G3a Mildly to moderately decreased 45-59</td>
</tr>
<tr>
<td>Low risk</td>
<td>G3b Moderately to severely decreased 30-44</td>
</tr>
<tr>
<td>Low risk</td>
<td>G4 Severely decreased 15-29</td>
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<tr>
<td>Low risk</td>
<td>G5 Kidney failure &lt;15</td>
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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, creatine, 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)
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


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
  o 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
  o 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, Calcinurine inhibitors and metformin. Avoid nephrotoxins, e.g. NSAIDS

**References**
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 Ont Works, Ont 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, please call the Renal Pharmacy office at 416-340-4800 Ext 6547 or page renal pharmacist at pager (416) 790-8466 or HD pharmacist (416) 790-0793.”
Dose adjustments of drugs for renal failure

Estimate CrCl using Cockcroft-Gault equation:

\[
CrCl (\text{mL/s}) = \frac{(140 - \text{age}) \times \text{wt (kg)}}{50 \times \text{SCR (umol/l)}} \times 0.85 \text{ for women}
\]

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 s.c. 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).
**Anemia Management Protocol**

Assess Hemoglobin Status: Target Hgb. 100-120g/L

Always consider 2-3 month hemoglobin trend before adjusting dose

1. **Hgb 90g/L or lower**
   - See page 2

2. **Hgb 100-125g/L**
   - Receiving Darbepoetin?
     - No
       - No darbepoetin required. Continue routine Hgb monitoring every 4 weeks. If Hgb trending downwards, assess appropriateness of initiating darbepoetin therapy.
     - Yes
       - On hold or discontinued
         - Maintain dose of darbepoetin and continue routine Hgb monitoring every 4 weeks

3. **Hgb 125g/L or higher**
   - If Hgb increased >10g/L since last measurement, consider repeating Hgb level
   - On hold or discontinued
     - Hgb 126-135
       - Reduce dose if there was no dose reduction at the last monthly bloodwork*. If a dose reduction occurred in the past 6 weeks, maintain current dose. Recheck Hgb at next routine bloodwork.
     - Hgb >135
       - Hold darbepoetin. Recheck Hgb at next routine bloodwork
     - Hgb 126-135
       - Restart darbepoetin at a dose lower than what was given before the hold*. Recheck Hgb at next routine bloodwork

---

**ASSESS IRON STATUS** – Refer to page 3

*See dose adjustment schedule for patients using Darbepoetin Alfa*
Anemia Management continued

If Hgb is 9.9 g/L or lower

Receiving darbepoetin therapy?

NO

Investigate and treat other causes of anemia and Assess appropriateness of starting darbepoetin therapy

If appropriate:

Start darbepoetin at 0.45 mcg/kg and ASSESS IRON STATUS

Recheck Hgb at next routine bloodwork

YES

ASSESS IRON STATUS

If there was no dose increase at or since the last monthly bloodwork:
- Increase current dose – see dose adjustment schedule (page 4)
- Note maximum dose = 100 mcg/week

Otherwise:
- Maintain current dose
- Note: Dose adjustments should not be made within 8 weeks of each other

Continue routine Hgb monitoring every 4 weeks

If fall in Hgb > 10 g/L from last bloodwork, repeat Hgb level. ASSESS IRON STATUS Refer to page 3
Iron Assessment Algorithm

IRON SUCROSE (VENOFER®)

ASSESS IRON STATUS*

NOTE: If TSat < 0.2 and Ferritin > 500
Review Hgb level, darbepoetin alfa dose and patient status. Initiate/continue iron therapy according to clinical judgment.

TSat < 0.2
OR
Ferritin < 200
REPLACE IRON STORES
(unless Hgb consistently >130g/L)

- Initiate IV iron load at a dose of 100 mg 3x/wk for 10 doses. Reassess at next monthly bloodwork (at least 1 week after final dose).
- Continue to repeat IV iron loads until TSat >0.2 and Ferritin >200
- Assess reasons for lack of response after 3 iron loads. Proceed with iron loading or maintenance therapy based on clinical judgment.

TSat 0.2 - 0.5
AND
Ferritin 200 - 500
MAINTAIN IRON STORES

- If not receiving IV iron: Initiate maintenance IV iron at 100 mg q month
- If receiving maintenance iron: Continue current maintenance dosage
- If TSat and ferritin every 3 months and ASSESS IRON STATUS

TSat 0.2-0.5
AND
Ferritin 500-1200
MAINTAIN IRON STORES

- If iron is on hold: Restart iron at half the frequency but same dose (ie. switch from 100mg q month to 100mg q 2 months) This dose becomes the new maintenance dose
- If not receiving IV iron: Reassess at next routine bloodwork (12 weeks)

- If ferritin > 1200
- If ferritin > 500
- HOLD IRON

- If iron bloodwork ever appears very unusual compared to previous results, (eg. with replacement iron stores, TSat goes from <20% to >50%) repeat bloodwork and reassess iron status
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®

<table>
<thead>
<tr>
<th>Eprex Dose</th>
<th>Hemoglobin</th>
</tr>
</thead>
<tbody>
<tr>
<td>U/week</td>
<td>&lt;120 g/L</td>
</tr>
<tr>
<td>&lt;15,000</td>
<td>5x</td>
</tr>
<tr>
<td>≥15,000</td>
<td>4x</td>
</tr>
</tbody>
</table>

Remember to fill out registration form for new Aranesp® therapy and send to Dr. Richardson’s office (BNU-861).

Guidelines for Registering Renal Failure Patients for ESA

(Erythropoietin or Darbepoietin) at UHN and MSH

1. Complete a Ministry of Health EPO registration form (available in the HD units, PD unit, the nephrology ward and through Dr. Richardson’s office)
   - Include the patient’s MRN for identification purposes as well as name
   - Fill out all 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 staff 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 (BNU-861)
   - Write an order for erythropoietin in the patient’s chart

3. For peritoneal dialysis patients
   - 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 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 625 mg = Ca²⁺ 250mg
- Calcium carbonate 1250mg = Ca²⁺ 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:

<table>
<thead>
<tr>
<th>Amount of Fleet enema</th>
<th>Final Dialysate Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 mL</td>
<td>1.0 mmol/L</td>
</tr>
<tr>
<td>95 mL</td>
<td>0.8 mmol/L</td>
</tr>
<tr>
<td>47 mL</td>
<td>0.4 mmol/L</td>
</tr>
</tbody>
</table>

**NOTE:** NEVER ADD FLEET ENEMA DIRECTLY TO BAGS USED FOR CRRT AS THIS WILL CAUSE SEVERE HYPERPHOSPHATEMIA.
Hypocalcemia/\(\text{\(\uparrow\)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 vit \(D_3\) which increases gut absorption of \(Ca^{++}\) (and \(PO_4\)) and suppresses PTH.

- Dose of rocaltriol 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, rpt 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.
# Opioid Analgesic Comparison Chart

<table>
<thead>
<tr>
<th>Opioid</th>
<th>Doses Equivalent to Morphine 10 mg IM or SC</th>
<th>Duration of Analgesia</th>
<th>Consideration in CKD</th>
<th>Dialyzability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Codeine</strong></td>
<td>120 mg IM or SC ** 200 mg Oral ** 1.5 Conversion Injection to Oral</td>
<td>Codeine tablet/syrup 3 to 4h</td>
<td>Caution: consider decrease starting dose to 50% due to prolonged half life</td>
<td>No data (HD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compounds (Tylenol #1, #2, #3) 3 to 4h</td>
<td></td>
<td>Unlikely (PD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Codeine Contin CR 12 h</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Morphine</strong></td>
<td>10 mg IM or SC 30 mg Oral 3</td>
<td>Morphine tablet/syrup (MS-IR® / Statex®) 3 to 4h</td>
<td>Metabolite morphine 6 glucoronide has narcotic activity increase risk of side effects</td>
<td>Yes (HD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M- Eslon® capsule 12 h</td>
<td></td>
<td>No (PD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MS Contin® SR tablet 12 h</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oxycodone</strong></td>
<td>NA IM or SC 15 mg Oral NA</td>
<td>Oxy-IR® 3 to 4 h</td>
<td>Caution</td>
<td>Yes (HD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oxycontin® CR 12 h</td>
<td></td>
<td>No data (PD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percocet® (oxycodone + acetaminophen) 3 to 4 h</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dose 1</td>
<td>Dose 2</td>
<td>Dose 3</td>
<td>Dose 4</td>
</tr>
<tr>
<td>----------------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>Hydromorphone</td>
<td>1.5 mg</td>
<td>7.5 mg</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hydromorphone Contin</td>
<td>12 h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>100 ug</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 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

<table>
<thead>
<tr>
<th>Patient group</th>
<th>Recommended Thromboprophylaxis options&lt;sup&gt;2,3,4&lt;/sup&gt;</th>
<th>Initiation</th>
<th>Duration&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
</table>
| Multi-Organ Transplant               | **Kidney-Pancreas**  
• Pre-op: UFH 5000 units SC 60 mins prior to incision  
• Post-op: UFH 5000 units SC q 12h | 60 mins prior to incision | until discharge       |
| *This lists what is currently contained on pre-printed order sets/EPR screens.* | **Kidney**  
• New transplants – UFH 5000 units SC bid, 1<sup>st</sup> 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 | pre-op in the OR | until discharge |
| Laproscopic 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

<table>
<thead>
<tr>
<th>Nephrology</th>
<th>UFH 5000 units SC bid</th>
<th>1st dosing time after admission</th>
<th>Until Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assessment: tunneled catheter = higher risk for VTE.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patients who should NOT receive UFH:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) fully anticoagulated (Warfarin).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2) Heparin allergy/HIT.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3) active bleed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4) fully mobile with short expected length of stay (&lt;48 hr)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>See Footnote 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If HIT or heparin allergy, no heparin - initiate hematology consult</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note: HD or IP heparin does NOT provide VTE prophylaxis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note: Enoxaparin can accumulate in renal failure, thus avoid.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 × 10⁹/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. (ie 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 Vit 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>
<thead>
<tr>
<th>Drug</th>
<th>Method</th>
<th>Renal Failure dose</th>
<th>Dose after HD</th>
<th>Dose during CAPD</th>
<th>Dose during CRRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acarbose</td>
<td>D</td>
<td>Avoid</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Avoid</td>
</tr>
<tr>
<td>Acebutolol</td>
<td>D</td>
<td>30-50%</td>
<td>None</td>
<td>None</td>
<td>50%</td>
</tr>
<tr>
<td>Acetazolamide</td>
<td>I</td>
<td>Avoid</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Avoid</td>
</tr>
<tr>
<td>Acetohexamide</td>
<td>I</td>
<td>Avoid</td>
<td>Unknown</td>
<td>None</td>
<td>Avoid</td>
</tr>
<tr>
<td>Acetohydrox-</td>
<td>D</td>
<td>Avoid</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>acamid acid</td>
<td>I</td>
<td>Q8H</td>
<td>None</td>
<td>None</td>
<td>q6h</td>
</tr>
<tr>
<td>Acetaminophen</td>
<td>I</td>
<td>Avoid</td>
<td>After HD</td>
<td>None</td>
<td>q4-6h</td>
</tr>
<tr>
<td>ASA</td>
<td>I</td>
<td>Avoid</td>
<td>None</td>
<td>None</td>
<td>100%</td>
</tr>
<tr>
<td>Acyclovir</td>
<td>D,I</td>
<td>Unknown</td>
<td>Unknown</td>
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<tr>
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<td>None</td>
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<td>100%</td>
</tr>
<tr>
<td>Albuterol</td>
<td>D</td>
<td>50%</td>
<td>Unknown</td>
<td>Unknown</td>
<td>75%</td>
</tr>
<tr>
<td>Alcuronium</td>
<td>D</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>Avoid</td>
</tr>
<tr>
<td>Alfentanil</td>
<td>D</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>100%</td>
</tr>
<tr>
<td>Alloplurinol</td>
<td>D</td>
<td>25%</td>
<td>½ dose</td>
<td>Unknown</td>
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</tr>
<tr>
<td>Alprazolam</td>
<td>D</td>
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<td>None</td>
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<td>NA</td>
</tr>
<tr>
<td>Alteplase (tPA)</td>
<td>D</td>
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<td>Unknown</td>
<td>Unknown</td>
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</tr>
<tr>
<td>Altretamine</td>
<td>D</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Amantadine</td>
<td>I</td>
<td>q7d</td>
<td>See UHN Guide</td>
<td>None</td>
<td>q48-72h</td>
</tr>
<tr>
<td>Amikacin</td>
<td>D,I</td>
<td>20-30% q2-48h</td>
<td>See UHN Guide</td>
<td>15-20mg/L/d</td>
<td>30-70% q12-18h</td>
</tr>
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<td>Amiloride</td>
<td>D</td>
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<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>D</td>
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<td>None</td>
<td>None</td>
<td>100%</td>
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<td>D</td>
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<td>None</td>
<td>Unknown</td>
<td>NA</td>
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<tr>
<td>Amlodipine</td>
<td>D</td>
<td>100%</td>
<td>None</td>
<td>None</td>
<td>100%</td>
</tr>
<tr>
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<td>D</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>NA</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>I</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>250mg q12h</td>
<td>NA</td>
</tr>
<tr>
<td>Amphotericin</td>
<td>I</td>
<td>q24-36h</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>q24h</td>
</tr>
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<td>Ampicillin</td>
<td>I</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>250mg q12h</td>
<td>q6-12h</td>
</tr>
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<td>Unknown</td>
<td>Unknown</td>
<td>100%</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>100%</td>
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<td>D</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>NA</td>
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<td>Atenolol</td>
<td>D,I</td>
<td>30-50% q96h</td>
<td>25-50 mg</td>
<td>None</td>
<td>50%q48h</td>
</tr>
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<td>-</td>
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<td>Unknown</td>
<td>Unknown</td>
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<tr>
<td>Atracurium</td>
<td>D</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>100%</td>
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<td>None</td>
<td>None</td>
<td>None</td>
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<td>D</td>
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<td>Yes</td>
<td>Unknown</td>
<td>75%</td>
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<td>None</td>
<td>None</td>
<td>None</td>
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<td>Azlocillin</td>
<td>I</td>
<td>q8h</td>
<td>Dose after HD</td>
<td>Dose for RF</td>
<td>q6-8h</td>
</tr>
<tr>
<td>Aztreonan</td>
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<td>25%</td>
<td>0.5g after HD</td>
<td>Dose for RF</td>
<td>50-75%</td>
</tr>
<tr>
<td>Benazepril</td>
<td>D</td>
<td>25-50%</td>
<td>None</td>
<td>None</td>
<td>50-75%</td>
</tr>
<tr>
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<td>-</td>
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<td>Unknown.</td>
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<td>Drug</td>
<td>Method</td>
<td>Renal Failure dose</td>
<td>Dose after HD</td>
<td>Dose during CAPD</td>
<td>Dose during CRRT</td>
</tr>
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<td>Unknown</td>
<td>Unknown</td>
<td>100%</td>
</tr>
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<td>None</td>
<td>None</td>
<td>100%</td>
</tr>
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<td>D</td>
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<td>Unknown</td>
<td>Unknown</td>
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<td>Unknown</td>
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<td>None</td>
<td>Unknown</td>
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<td>None</td>
<td>None</td>
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<td>D</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
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<td>Unknown</td>
<td>Unknown</td>
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<td>Unknown</td>
<td>Unknown</td>
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<td>None</td>
<td>None</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>NA</td>
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<td>None</td>
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<td>100%</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>NA</td>
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<td>Unknown</td>
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<td>NA</td>
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<td>Carapemycin</td>
<td>I</td>
<td>q48h</td>
<td>Dose after HD</td>
<td>None</td>
<td>q24h</td>
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<td>Captopril</td>
<td>D,I</td>
<td>50% q24h</td>
<td>25-30%</td>
<td>None</td>
<td>75% q12-18h</td>
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<td>None</td>
<td>None</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
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<td>D</td>
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<td>50%</td>
<td>Unknown</td>
<td>50%</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
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<td>Unknown</td>
<td>None</td>
<td>50%</td>
</tr>
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<td>Carvedilol</td>
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<td>None</td>
<td>None</td>
<td>100%</td>
</tr>
<tr>
<td>Cefaclor</td>
<td>D</td>
<td>50%</td>
<td>250 mg after HD250mg q8-12h</td>
<td>NA</td>
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<tr>
<td>Cefadroxil</td>
<td>I</td>
<td>q24-48h</td>
<td>0.5-1.0g after HD0.5g/d</td>
<td>NA</td>
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</tr>
<tr>
<td>Cefamandole</td>
<td>I</td>
<td>q12h</td>
<td>0.5-1.0g after HD0.5-1.0g q12h</td>
<td>q6-8h</td>
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<tr>
<td>Cefazolin</td>
<td>I</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>q12h</td>
</tr>
<tr>
<td>Cefepime</td>
<td>I</td>
<td>q24-48h</td>
<td>1g after HD</td>
<td>Dose for RF</td>
<td>q24h</td>
</tr>
<tr>
<td>Cefixime</td>
<td>D</td>
<td>50%</td>
<td>300 mg after HD200 mg/d</td>
<td>Not recommend</td>
<td></td>
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<tr>
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<td>D,I</td>
<td>0.75g q12h</td>
<td>0.75g after HD0.75g q12h</td>
<td>0.75g q8h</td>
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</tr>
<tr>
<td>Cefmetazole</td>
<td>I</td>
<td>q48h</td>
<td>Dose after HD</td>
<td>Dose for RF</td>
<td>q24h</td>
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<tr>
<td>Cefonicid</td>
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<td>0.1g/d</td>
<td>None</td>
<td>None</td>
<td>None</td>
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<td>1g after HD</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Ceforanide</td>
<td>I</td>
<td>q24-48h</td>
<td>0.5-1.0g after HD None</td>
<td>1g/d</td>
<td></td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>I</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>1g q12h</td>
<td></td>
</tr>
<tr>
<td>Cefotetan</td>
<td>D</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>750 mg q12h</td>
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<td>I</td>
<td>q24-48h</td>
<td>1g after HD</td>
<td>1g/d</td>
<td>q8-12h</td>
</tr>
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<td>200 mg after HDDose for RF</td>
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<tr>
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<td>250 mg after HDDose for RF</td>
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<td>I</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>q24-48h</td>
</tr>
<tr>
<td>Cefibuten</td>
<td>D</td>
<td>25%</td>
<td>300 mg after HD Dose for RF</td>
<td>50%</td>
<td></td>
</tr>
<tr>
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<td>q24h</td>
<td>1g after HD</td>
<td>0.5-1.0g/d</td>
<td>q12-24h</td>
</tr>
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<td>D</td>
<td>100%</td>
<td>See UHN Guide</td>
<td>750 mg q12h</td>
<td>100%</td>
</tr>
<tr>
<td>Drug</td>
<td>Method</td>
<td>Renal Failure dose</td>
<td>Dose after HD</td>
<td>Dose during CAPD</td>
<td>Dose during CRRT</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------</td>
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<td>------------------</td>
<td>------------------</td>
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<td>See UHN Guide</td>
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<td>I</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>1g q12h</td>
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</tr>
<tr>
<td>Celiprolol</td>
<td>D</td>
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</tr>
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<td>Cephalin</td>
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<td>See UHN Guide</td>
<td>NA</td>
<td>NA</td>
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<td>Dose after HD</td>
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<td>1g q8h</td>
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<td>Dose after HD</td>
<td>Dose for RF</td>
<td>NA</td>
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<td>D</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
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<td>NA</td>
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<td>None</td>
<td>Unknown</td>
<td>NA</td>
</tr>
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<td>Unknown</td>
<td>Unknown</td>
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<td>D</td>
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<td>None</td>
<td>None</td>
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<td>See UHN Guide</td>
<td>None</td>
<td>None</td>
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<td>D</td>
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<td>Unknown</td>
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<td>None</td>
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<td>50%</td>
</tr>
<tr>
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<td>Unknown</td>
<td>Unknown</td>
<td>Avoid</td>
</tr>
<tr>
<td>Clofarbin</td>
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<td>Unknown</td>
<td>q12-18h</td>
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</tr>
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<td>Avoid</td>
<td>None</td>
<td>Unknown</td>
<td>q12-18h</td>
</tr>
<tr>
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<td>100%</td>
<td>None</td>
<td>None</td>
<td>Unknown</td>
</tr>
<tr>
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<td>None</td>
<td>Unknown</td>
<td>NA</td>
</tr>
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<td>None</td>
<td>None</td>
<td>100%</td>
</tr>
<tr>
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<td>D</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
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<td>200 mg IV q12h</td>
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<td>Unknown</td>
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<td>50-100%</td>
</tr>
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<td>100%</td>
<td>None</td>
<td>None</td>
<td>100%</td>
</tr>
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<td>None</td>
<td>100%</td>
</tr>
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<td>Clopidogrel</td>
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<td>Unknown</td>
<td>Unknown</td>
<td>Avoid</td>
</tr>
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<td>D</td>
<td>Avoid</td>
<td>Unknown</td>
<td>q12-18h</td>
<td>100%</td>
</tr>
<tr>
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<td>Avoid</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
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<td>50%</td>
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<td>25%</td>
<td>None</td>
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<tr>
<td>Ciprofloxacin</td>
<td>D</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>250mg q8h (200 if IV)</td>
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</tr>
<tr>
<td>Cisapride</td>
<td>D</td>
<td>50%</td>
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</tr>
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<td>Cisplatin</td>
<td>D</td>
<td>50%</td>
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</tr>
<tr>
<td>Claforbacin</td>
<td>D</td>
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<td>Unknown</td>
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<td>D</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>None</td>
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<td>D</td>
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<td>See UHN Guide</td>
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<td>D</td>
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<td>None</td>
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<td>None</td>
<td>None</td>
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<td>None</td>
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<td>None</td>
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<td>Dose after HD</td>
<td>Dose during CAPD</td>
<td>Dose during CRRT</td>
</tr>
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<td>See UHN Guide</td>
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<td>Dose for RF</td>
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<td>Method</td>
<td>Renal Failure dose</td>
<td>Dose after HD</td>
<td>Dose during CAPD</td>
<td>Dose during CRRT</td>
</tr>
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<td>See UHN Guide</td>
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<td>See UHN Guide</td>
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<td>Dose after HD</td>
<td>Dose during CAPD</td>
<td>Dose during CRRT</td>
</tr>
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D = Dose I = Prolonged Interval NA = Not Available
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<th>Dose after HD</th>
<th>Dose during CAPD</th>
<th>Dose during CRRT</th>
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<td>Dose after HD</td>
<td>Dose during CAPD</td>
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<td>Method</td>
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<td>Dose after HD</td>
<td>Dose during CAPD</td>
<td>Dose during CRRT</td>
</tr>
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<td>See UHN GuideDose for RF</td>
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<td>48h</td>
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<td>See UHN GuideDose for RF</td>
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<td>See UHN GuideAvoid</td>
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<td>Yes</td>
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<td>20%</td>
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<td>Method</td>
<td>Renal Failure dose</td>
<td>Dose after HD</td>
<td>Dose during CAPD</td>
<td>Dose during CRRT</td>
</tr>
<tr>
<td>------------------</td>
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<td>--------------------</td>
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<td>------------------</td>
<td>------------------</td>
</tr>
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<td>½ dose</td>
<td>None</td>
<td>50%</td>
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<td>Yes</td>
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<td>See UHN Guide</td>
<td>Dose for RF</td>
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<td>NA</td>
<td>NA</td>
<td>Avoid</td>
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<td>20-40 mg/L/d</td>
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<td>See UHN Guide</td>
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<td>Method</td>
<td>Renal Failure dose</td>
<td>Dose after HD</td>
<td>Dose during CAPD</td>
<td>Dose during CRRT</td>
</tr>
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<td>I</td>
<td>q12-24h</td>
<td>Unknown</td>
<td>Unknown</td>
<td>q8-12h</td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>I</td>
<td>q24h</td>
<td>Yes</td>
<td>q24h</td>
<td>q18h</td>
</tr>
<tr>
<td>Trimetrexate</td>
<td>D</td>
<td>Avoid</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Trimipramine</td>
<td>D</td>
<td>100%</td>
<td>None</td>
<td>None</td>
<td>NA</td>
</tr>
<tr>
<td>Tripleenamine</td>
<td>D</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>NA</td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>D</td>
<td>100%</td>
<td>Unknown</td>
<td>Unknown</td>
<td>NA</td>
</tr>
<tr>
<td>Tubocurarine</td>
<td>D</td>
<td>Avoid</td>
<td>Unknown</td>
<td>Unknown</td>
<td>50%</td>
</tr>
<tr>
<td>Urokinase</td>
<td>D</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Valacyclovir</td>
<td>D,I</td>
<td>0.5 g q24h</td>
<td>Yes</td>
<td>Dose for RF</td>
<td>Unknown</td>
</tr>
<tr>
<td>Valganciclovir</td>
<td>D, I</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>500 mg q24-48h</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>D,I</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>See UHN Guide</td>
<td>500 mg q24-48h</td>
</tr>
<tr>
<td>Vecuronium</td>
<td>D</td>
<td>100%</td>
<td>Unknown</td>
<td>Unknown</td>
<td>100%</td>
</tr>
<tr>
<td>Venlafaxine</td>
<td>D</td>
<td>50%</td>
<td>None</td>
<td>Unknown</td>
<td>NA</td>
</tr>
<tr>
<td>Verapamil</td>
<td>D</td>
<td>100%</td>
<td>None</td>
<td>None</td>
<td>100%</td>
</tr>
<tr>
<td>Vidarabine</td>
<td>D</td>
<td>75%</td>
<td>Yes</td>
<td>Dose for RF</td>
<td>100%</td>
</tr>
<tr>
<td>Vigabatrin</td>
<td>D</td>
<td>25%</td>
<td>Unknown</td>
<td>Unknown</td>
<td>50%</td>
</tr>
<tr>
<td>Vinblastine</td>
<td>D</td>
<td>100%</td>
<td>Unknown</td>
<td>Unknown</td>
<td>100%</td>
</tr>
<tr>
<td>Vincristine</td>
<td>D</td>
<td>100%</td>
<td>Unknown</td>
<td>Unknown</td>
<td>100%</td>
</tr>
<tr>
<td>Vinorelbine</td>
<td>D</td>
<td>100%</td>
<td>Unknown</td>
<td>Unknown</td>
<td>100%</td>
</tr>
<tr>
<td>Warfarin</td>
<td>D</td>
<td>100%</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Zafirlukast</td>
<td>D</td>
<td>100%</td>
<td>Unknown</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Zalcitabine</td>
<td>I</td>
<td>q24h</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Zidovudine</td>
<td>D,I</td>
<td>100 mg q8h</td>
<td>Dose for RF</td>
<td>Dose for RF</td>
<td>100 mg q8h</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Drug</th>
<th>(\text{Creatinine Clearance (CrCl) in mL/min})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\geq 50)</td>
</tr>
<tr>
<td>(Note: The following dosage recommendations are not intended for endocarditis or meningitis treatment)</td>
<td></td>
</tr>
<tr>
<td>acyclovir (IV)</td>
<td>5-10 mg/kg q8h</td>
</tr>
<tr>
<td>acyclovir (PO)</td>
<td></td>
</tr>
<tr>
<td>genital herpes</td>
<td>400 mg tid</td>
</tr>
<tr>
<td>varicella zoster</td>
<td>800 mg 5x/day</td>
</tr>
<tr>
<td>amikacin (initial dosing, once daily dosing)</td>
<td>CrCl (\geq 60)</td>
</tr>
<tr>
<td></td>
<td>15 mg/kg q24h</td>
</tr>
<tr>
<td>Adjust dose based on serum drug levels*</td>
<td></td>
</tr>
<tr>
<td>amikacin (initial dosing, traditional dosing)</td>
<td>CrCl (\geq 50)</td>
</tr>
<tr>
<td></td>
<td>5-7.5 mg/kg load, then</td>
</tr>
<tr>
<td></td>
<td>4-5 mg/kg IV q8h</td>
</tr>
<tr>
<td>Adjust dose based on serum drug levels*</td>
<td></td>
</tr>
<tr>
<td>amoxicillin/</td>
<td>250/125 mg - 250/125 mg - 250/125 mg - 250/125 mg -</td>
</tr>
<tr>
<td>clavulanic acid</td>
<td>500/125 mg q12h</td>
</tr>
<tr>
<td>amphotericin B</td>
<td>5 mg/kg IV q24h</td>
</tr>
<tr>
<td>lipid complex (ABELCET)</td>
<td></td>
</tr>
<tr>
<td>amphotericin B</td>
<td>3-6 mg/kg IV q24h</td>
</tr>
<tr>
<td>liposome (AMBI-SOME)</td>
<td></td>
</tr>
<tr>
<td>ampicillin</td>
<td>1-2 g q4-6h</td>
</tr>
<tr>
<td>azithromycin</td>
<td></td>
</tr>
<tr>
<td>caspofungin</td>
<td></td>
</tr>
</tbody>
</table>

*Adjust dose based on serum drug levels

†Not recommended
<table>
<thead>
<tr>
<th>Drug</th>
<th>Creatinine Clearance (CrCl) in mL/min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≥50</td>
</tr>
<tr>
<td>cefazolin</td>
<td>1-2 g q8h</td>
</tr>
<tr>
<td>ceftazidime</td>
<td>1-2 g q8h</td>
</tr>
<tr>
<td>ceftriaxone</td>
<td>No adjustments required</td>
</tr>
<tr>
<td>cefuroxime axetil (PO)</td>
<td>500 mg q12h</td>
</tr>
<tr>
<td>cephalexin</td>
<td>250-500 mg q6h</td>
</tr>
<tr>
<td>ciprofloxacin (PO)</td>
<td>500-750 mg q12h</td>
</tr>
<tr>
<td>ciprofloxacin (IV)</td>
<td>400 mg q12h</td>
</tr>
<tr>
<td>clarithromycin</td>
<td>250-500 mg q12h</td>
</tr>
<tr>
<td>clindamycin</td>
<td>No adjustments required</td>
</tr>
<tr>
<td>cloxacillin</td>
<td>No adjustments required</td>
</tr>
<tr>
<td>cotrimoxazole (IV)</td>
<td>8-10 mg/kg in 2-4 divided doses daily</td>
</tr>
<tr>
<td></td>
<td>15-20 mg/kg in 2-4 divided doses daily</td>
</tr>
<tr>
<td>cotrimoxazole (PO) (WS = TRIMETHOPRIM 160 MG, SULFAMTHOXAZOLE 800 MG)</td>
<td>1DS bid</td>
</tr>
<tr>
<td>erythromycin</td>
<td>500-1000 mg q6h</td>
</tr>
<tr>
<td>famciclovir (genital herpes)</td>
<td>250 mg q12h</td>
</tr>
<tr>
<td>Drug</td>
<td>Creatinine Clearance (CrCl) in mL/min</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
<td>≥50</td>
</tr>
<tr>
<td>varicella zoster</td>
<td>CrCl &gt;60</td>
</tr>
<tr>
<td></td>
<td>CrCl &gt;50</td>
</tr>
<tr>
<td>fluconazole</td>
<td>50-400 mg q24h</td>
</tr>
<tr>
<td>ganciclovir (IV)</td>
<td>CrCl &gt;70</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
</tr>
<tr>
<td></td>
<td>CrCl &gt;70</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>gentamicin (initial dosing, once daily dosing)</td>
<td>CrCl ≥60</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjust dose based on serum drug levels*</td>
<td></td>
</tr>
<tr>
<td>ganciclovir (IV)</td>
<td>CrCl ≥50</td>
</tr>
<tr>
<td>Adjust dose based on serum drug levels*</td>
<td></td>
</tr>
<tr>
<td>imipenem/cilastatin</td>
<td>500 mg q6h</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>intraconazole</td>
<td>No adjustments required</td>
</tr>
<tr>
<td>ketoconazole</td>
<td>No adjustments required</td>
</tr>
<tr>
<td>linezolid</td>
<td>No adjustments required</td>
</tr>
<tr>
<td>metronidazole</td>
<td>No adjustments required</td>
</tr>
<tr>
<td>moxifloxacin</td>
<td>No adjustments required</td>
</tr>
<tr>
<td>Drug</td>
<td>Creatinine Clearance (CrCl) in mL/min</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td></td>
<td>≥50</td>
</tr>
<tr>
<td>penicillin G</td>
<td>1-4 MU q4-6h</td>
</tr>
<tr>
<td>piperacillin/tazobactam</td>
<td>4.5 g q8h</td>
</tr>
<tr>
<td>tobramycin (initial dosing,</td>
<td>CrCl ≥60</td>
</tr>
<tr>
<td>once daily dosing)</td>
<td>5 mg/kg q24h</td>
</tr>
<tr>
<td>Adjust dose based on serum drug levels*</td>
<td>1.5-2 mg/kg load, then 1.25 mg/kg IV q8h</td>
</tr>
<tr>
<td>valganciclovir</td>
<td>Induction 450 mg q12h</td>
</tr>
<tr>
<td></td>
<td>Maintenance 450 mg q24h</td>
</tr>
<tr>
<td>vancomycin</td>
<td>CrCl ≥65</td>
</tr>
<tr>
<td></td>
<td>1 g q12h</td>
</tr>
<tr>
<td></td>
<td>or 15 mg/kg q12h</td>
</tr>
<tr>
<td></td>
<td>CrCl 50-64</td>
</tr>
<tr>
<td></td>
<td>1 g q24h</td>
</tr>
<tr>
<td>Adjust dose based on serum drug levels*</td>
<td></td>
</tr>
<tr>
<td>voriconazole (IV)</td>
<td>6 mg/kg q12h x 24h, then 4 mg/kg IV q12h</td>
</tr>
<tr>
<td>voriconazole (po)</td>
<td>No adjustments required</td>
</tr>
</tbody>
</table>

References
   Updated by: Carmen Ma, BScPhm, Staff Pharmacist, Nephrology – Oct, 2002
   Revised by: Michael Wong – 2005

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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 (subtherapeutic) 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 subtherapeutic 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

<table>
<thead>
<tr>
<th>Drug</th>
<th>Recommended Dose for IHD</th>
<th>Dose after IHD</th>
<th>Recommended Dose for CVVHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>acyclovir</td>
<td>2.5-5 mg/kg IV q24h</td>
<td>yes</td>
<td>5-10 mg/kg IV q12-24h</td>
</tr>
<tr>
<td></td>
<td>200 mg PO q12h (Herpes simplex)</td>
<td></td>
<td>No adjustment necessary for PO</td>
</tr>
<tr>
<td></td>
<td>800 mg PO q12h (Herpes zoster)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>amantadine</td>
<td>200 mg PO once a week</td>
<td>no</td>
<td>100 mg PO q48-72h</td>
</tr>
<tr>
<td>amikacin</td>
<td>5 mg/kg IV load, then 2.5 mg/kg IV post hemodialysis*</td>
<td>yes</td>
<td>5-7.5 mg/kg load, then 3-4.5 mg/kg IV q12h</td>
</tr>
<tr>
<td></td>
<td>Adjust dose based on trough level**</td>
<td></td>
<td>Adjust dose based on trough level**</td>
</tr>
<tr>
<td>amoxicillin</td>
<td>250 mg PO q12h</td>
<td>yes</td>
<td>500 mg PO q8-12h</td>
</tr>
<tr>
<td></td>
<td>or 500 mg PO q24h</td>
<td></td>
<td>(liquid available)</td>
</tr>
<tr>
<td>amoxicillin/clavulanic acid</td>
<td>250/125 mg PO q12h</td>
<td>yes</td>
<td>-</td>
</tr>
<tr>
<td>ampicillin (IV)</td>
<td>1-2 g IV q12-24h</td>
<td>yes</td>
<td>1-2 g IV q6-12h</td>
</tr>
<tr>
<td>caspofungin</td>
<td>70 mg IV load, then 50 mg IV q24h</td>
<td>no</td>
<td>70 mg IV load, then 50 mg IV q24h</td>
</tr>
<tr>
<td>cefazolin</td>
<td>1 g IV q24h</td>
<td>yes</td>
<td>1 g IV q12h</td>
</tr>
<tr>
<td></td>
<td>or 2 g IV post hemodialysis*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cefotaxime</td>
<td>1-2 g IV q24h</td>
<td>yes</td>
<td>1 g IV q12h</td>
</tr>
<tr>
<td>ceftazidime</td>
<td>1 g IV q24h</td>
<td>yes</td>
<td>1-2 g IV q12-24h</td>
</tr>
<tr>
<td></td>
<td>or 1-2 g post hemodialysis*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ceftriaxone</td>
<td>1-2 g IV q24h</td>
<td>no</td>
<td>1-2 g IV q12-24h</td>
</tr>
<tr>
<td>cefuroxime axetil (PO)</td>
<td>250-500 mg PO q12h</td>
<td>yes</td>
<td>250-500 mg PO q12h</td>
</tr>
<tr>
<td></td>
<td>or 500/125 mg PO q24h</td>
<td></td>
<td>(liquid available)</td>
</tr>
<tr>
<td>cephalexin</td>
<td>250-500 mg PO q12h</td>
<td>yes</td>
<td>250-500 mg PO q12h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(liquid available)</td>
</tr>
<tr>
<td>chloramphenicol</td>
<td>0.25-1 g IV q6h (12.5 mg/kg q6h)</td>
<td>no</td>
<td>-</td>
</tr>
<tr>
<td>chloroquine</td>
<td>500 mg PO x 1 dose, then 250 mg PO weekly (malaria)</td>
<td>no</td>
<td>-</td>
</tr>
<tr>
<td>ciprofloxacin</td>
<td>250-500 mg PO q24h</td>
<td>no</td>
<td>500 mg PO q12-24h</td>
</tr>
<tr>
<td></td>
<td>200-400 mg IV q24h</td>
<td></td>
<td>400 mg IV q12-24h</td>
</tr>
<tr>
<td>clarithromycin</td>
<td>250-500 mg PO q12h</td>
<td>yes</td>
<td>-</td>
</tr>
<tr>
<td>Drug</td>
<td>Recommended Dose for IHD</td>
<td>Dose after IHD</td>
<td>Recommended Dose for CVVHD</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------</td>
<td>----------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>clindamycin</td>
<td>150-300 mg PO q6h</td>
<td>no</td>
<td>150-300 mg PO q6h</td>
</tr>
<tr>
<td></td>
<td>300-600 mg IV q8h</td>
<td></td>
<td>300-600 mg IV q8h</td>
</tr>
<tr>
<td>cotrimoxazole (PO)</td>
<td>1 DS tablet PO q24h</td>
<td>yes</td>
<td>1DS PO q24h</td>
</tr>
<tr>
<td>(DS = trimethoprim</td>
<td>(for indications other than PCP)</td>
<td></td>
<td>(liquid available)</td>
</tr>
<tr>
<td>160 mg, sulfamethoxazole 800 mg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>doxycycline</td>
<td>100 mg PO daily</td>
<td>no</td>
<td>100 mg PO daily</td>
</tr>
<tr>
<td>erythromycin</td>
<td>250-500 mg IV/PO q6h</td>
<td>no</td>
<td>250-500 mg IV q6h</td>
</tr>
<tr>
<td></td>
<td>(1 g q6h causes predictable reversible deafness)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethambutol</td>
<td>Not recommended in patients with GFR &lt;10 mL/min⁺</td>
<td>N/A</td>
<td>15-25 mg/kg q24h</td>
</tr>
<tr>
<td></td>
<td>(No dose adjustment necessary)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>famciclovir</td>
<td>125 mg PO q24h</td>
<td>yes</td>
<td>125 mg PO q12-24h</td>
</tr>
<tr>
<td>Herpes simplex</td>
<td>500 mg PO q48h</td>
<td></td>
<td>500 mg PO q12-24h</td>
</tr>
<tr>
<td>Herpes zoster</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fluconazole</td>
<td>400 mg IV/PO loading dose, then 100-400 mg IV/PO daily to q2days</td>
<td>yes</td>
<td>100–400 mg IV/PO q24h</td>
</tr>
<tr>
<td>foscarnet</td>
<td>45-60 mg/kg post hemodialysis</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>(See guidelines for details)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ganciclovir (IV)</td>
<td>Treatment: 1.25 mg/kg IV post hemodialysis* Maintenance: 0.625 mg/kg IV post hemodialysis*</td>
<td>yes</td>
<td>2.5 mg/kg IV q24h (treatment and maintenance)</td>
</tr>
<tr>
<td>gentamicin</td>
<td>2 mg/kg IV loading dose, then 1 mg/kg IV post hemodialysis*</td>
<td>yes</td>
<td>load, then 12h Adjust dose based on trough level**</td>
</tr>
<tr>
<td>imipenem/cilastatin</td>
<td>250-500 mg IV q12h</td>
<td>yes</td>
<td>500mg IV q6-8h</td>
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<tr>
<td>isoniazid</td>
<td>300 mg PO daily</td>
<td>yes</td>
<td>300 mg PO daily</td>
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<tr>
<td>Drug</td>
<td>Recommended Dose for IHD</td>
<td>Dose after IHD</td>
<td>Recommended Dose for CVVHD</td>
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<tr>
<td>---------------------------</td>
<td>---------------------------------------------------------------</td>
<td>----------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>itraconazole (PO)</td>
<td>100-200 mg PO q12h (Take tablets with food; take solution on empty stomach)</td>
<td>no</td>
<td>100-200 mg PO q12h (liquid available)</td>
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<tr>
<td>ketoconazole</td>
<td>200-400 mg PO daily</td>
<td>no</td>
<td>200-400 mg PO daily</td>
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<tr>
<td>linezolid</td>
<td>600 mg PO/IV q12h</td>
<td>yes</td>
<td>600 mg PO/IV q12h (No adjustment necessary)</td>
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<td>meropenem</td>
<td>500 mg IV q24h</td>
<td>yes</td>
<td>250-500 mg IV q12h</td>
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<td>metronidazole</td>
<td>500 mg IV/PO q12h C. difficile: 500 mg PO q8h</td>
<td>yes</td>
<td>500 mg IV/PO q12h C. difficile: 500 mg PO q8h</td>
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<td>minocycline</td>
<td>200 mg PO x 1 dose, then 100 mg PO q12h</td>
<td>no</td>
<td>200 mg PO x 1 dose, then 100 mg PO q12h</td>
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<td>moxifloxacin</td>
<td>400 mg IV/PO q24h (No adjustment necessary)</td>
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<td>400 mg IV/PO q24h (No adjustment necessary)</td>
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<tr>
<td>nalidixic acid</td>
<td>Not recommended in patients with GFR &lt;10 mL/min†</td>
<td>N/A</td>
<td>Not recommended†</td>
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<td>(Metabolites accumulate)</td>
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<tr>
<td>nitrofurantoin</td>
<td>Not recommended in patients with GFR &lt; 30 mL/min†</td>
<td>N/A</td>
<td>Not recommended†</td>
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<td>penicillin G</td>
<td>1 Million Units (MU) IV q8-12h (maximum dose = 10 MU/day)</td>
<td>yes</td>
<td>0.5-3 MU IV q6h</td>
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<td>penicillin VK</td>
<td>300 mg PO q6h</td>
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<td>300 mg PO q6h</td>
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<tr>
<td>pentamidine isethionate</td>
<td>3-4 mg/kg IV q24h</td>
<td>no</td>
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<td>piperacillin/ tazobactam</td>
<td>3.375 mg IV q12h</td>
<td>yes</td>
<td>3.375 mg IV q6-8h</td>
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<td>pyrazinamide</td>
<td>40 mg/kg PO 3x/week (Give 24 hours before the start of each hemodialysis)</td>
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<td>25-30 mg/kg q24h</td>
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<td>rifampin</td>
<td>300-600 mg PO q24h</td>
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<td>300-600 mg PO q24h</td>
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<tr>
<td>Drug</td>
<td>Recommended Dose for IHD</td>
<td>Dose after IHD</td>
<td>Recommended Dose for CVVHD</td>
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<tr>
<td>--------------</td>
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<td>streptomycin</td>
<td>15 mg/kg IV loading dose, then 9 mg/kg IV post hemodialysis*</td>
<td>yes</td>
<td>15 mg/kg q24-72h</td>
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<tr>
<td>tetracycline</td>
<td>250-500 mg PO q24h (Note: doxycycline is preferred)</td>
<td>yes</td>
<td>250-500 mg q12h</td>
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<tr>
<td>tobramycin</td>
<td>2 mg/kg IV loading dose, then 1 mg/kg IV post hemodialysis*</td>
<td>yes</td>
<td>Adjust dose based on trough level**</td>
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<tr>
<td>vadenciclovir</td>
<td>Not recommended in hemodialysis†</td>
<td>N/A</td>
<td>Induction: 450 mg PO q24h Maintenance: 450 mg PO q48h</td>
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<tr>
<td>vancomycin</td>
<td>See Table 3 on Vancomycin Dosing for hemodialysis and/or discuss dosing with pharmacist</td>
<td></td>
<td></td>
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<tr>
<td>voriconazole (IV)</td>
<td>Not recommended in patients with GFR &lt;50 mL/min due to vehicle for IV preparation†</td>
<td>N/A</td>
<td>Not recommended due to vehicle for IV preparation†</td>
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<tr>
<td>voriconazole (PO)</td>
<td>400 mg PO q12h x 2 days, then 200 mg PO q12h</td>
<td>N/A</td>
<td>400 mg PO q12h x 2 days, then 200 mg PO q12h</td>
</tr>
</tbody>
</table>

* Only give on hemodialysis days.
** Consult with pharmacist for dosage adjustment.
† Pharmacist to discuss therapeutic alternatives with physician.

References
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 by 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)

<table>
<thead>
<tr>
<th>Renal Function</th>
<th>Standard CEMRI</th>
<th>CEMRA</th>
<th>Dialysis</th>
<th>Nephrology Or Radiology Consult Required?</th>
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<tr>
<td></td>
<td>Agent(s)</td>
<td>Dose</td>
<td>Agent(s)</td>
<td>Dose</td>
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<tr>
<td>Normal renal function</td>
<td>Omniscan</td>
<td>MRD</td>
<td>*Any of: Magnevist Gadovist Prohance Multihance</td>
<td>RPD</td>
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<tr>
<td>Moderate renal failure (GFR&lt;30 mL/min)</td>
<td>*Any of: Magnevist Gadovist Prohance Multihance</td>
<td>MRD</td>
<td>Strong relative contra-indication *Any of: Magnevist Gadovist Prohance Multihance</td>
<td>RPD</td>
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<tr>
<td>Severe renal failure (defined as being on dialysis or almost on dialysis)</td>
<td>*An alternate imaging test to CEMRI is recommended *Omniscan NOT to be used</td>
<td>------</td>
<td>CEMRA contraindicated in this patient group</td>
<td>------</td>
</tr>
<tr>
<td>Reliability of the patient’s renal history is uncertain</td>
<td>*Any of: Magnevist Gadovist Prohance Multihance</td>
<td>MRD</td>
<td>*Any of: Magnevist Gadovist Prohance Multihance</td>
<td>RPD</td>
</tr>
</tbody>
</table>

**How To Order Catheter insertions, biopsy, Doppler, Anaesthesia**

**Order Tunneled 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 appro) → 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

<table>
<thead>
<tr>
<th>Service</th>
<th>Phone Number</th>
</tr>
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<tbody>
<tr>
<td>Emerg TG</td>
<td>14-3947</td>
</tr>
<tr>
<td>Emerg TW</td>
<td>13-2777</td>
</tr>
<tr>
<td>Chiropodist - Tracy Oliver</td>
<td>14-6007, pager (416)790-6771</td>
</tr>
<tr>
<td>Fracture Clinic TW</td>
<td>13-5858</td>
</tr>
<tr>
<td>Dialysis Start Unit: 12ES</td>
<td>14-4757</td>
</tr>
<tr>
<td>Hemodialysis Unit West</td>
<td>14-4072, fax 14-4892</td>
</tr>
<tr>
<td>Hemodialysis Unit East</td>
<td>14-5707, fax 14-3084</td>
</tr>
<tr>
<td>Hemodialysis Unit Toronto Rehab</td>
<td>(416)597-3422, ext 3801</td>
</tr>
<tr>
<td></td>
<td>fax (416)977-8719</td>
</tr>
<tr>
<td>Home Peritoneal Dialysis Unit 12ES</td>
<td>14-5672, fax 14-4169</td>
</tr>
<tr>
<td>Home Hemodialysis</td>
<td>14-3736, fax 14-4379</td>
</tr>
<tr>
<td>Interventional Radiology / Angio</td>
<td>14-5339</td>
</tr>
<tr>
<td>Kidney Foundation: Peer Support</td>
<td>(905)278-3003, ext 4973</td>
</tr>
<tr>
<td>Labs</td>
<td>14-5898</td>
</tr>
<tr>
<td>Rapid Response</td>
<td>14-3542</td>
</tr>
<tr>
<td>Micro</td>
<td>14-2526</td>
</tr>
<tr>
<td>Mt Sinai Hospital</td>
<td>(416)596-4200 or (17+ extension)</td>
</tr>
<tr>
<td>Nurse Practitioners (NP)</td>
<td></td>
</tr>
<tr>
<td>Paulina Bleah</td>
<td>14-8501, pager (416)790-7758</td>
</tr>
<tr>
<td></td>
<td>c: (647)532-2094</td>
</tr>
<tr>
<td>Angie Chai</td>
<td>14-3992, pager (416)790-6316</td>
</tr>
<tr>
<td></td>
<td>c: (647)532-2094</td>
</tr>
<tr>
<td>Primrose Mharapara</td>
<td>14-6450, pager (416)790-0431</td>
</tr>
<tr>
<td></td>
<td>c: (647)919-2476</td>
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</tbody>
</table>
Nurse Navigator, Anna Gozdzik 14-5129
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)
Renal Management Clinic fax 14-4291
    Evie Porter, RN 14-3588
    Janice Ritchie, RN 14-6053
    Anna Gozdzik, RN 14-5129
    Isolyn Samuels, clerical 14-3056
    Diane Stoker, clerical 14-6389
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
Toronto Western Hospital (416) 603-2581 or (13+extension)
Toronto Rehab (416) 597-3422
Translation Services 13-6400
Vascular Access Coordinator, Cyndi Bhola 14-3518, pager (416)790-5320
Vascular Lab 14-3589
<table>
<thead>
<tr>
<th>Nephrologists (Assistant)</th>
<th>Address</th>
<th>Office</th>
<th>Pager</th>
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<tbody>
<tr>
<td>Dr. J. Bargman (Shelagh)</td>
<td>8N-840</td>
<td>14-4804</td>
<td>(416)790-6317</td>
</tr>
<tr>
<td>Dr. M. Barua (Naomi)</td>
<td>8N-855</td>
<td>14-8007</td>
<td>(416)714 6720</td>
</tr>
<tr>
<td>Dr. C. Cardella (Lisa)</td>
<td>11 PMB 184</td>
<td>14-4480</td>
<td>(416)790-4932</td>
</tr>
<tr>
<td>Dr. D. Cattran (Aditi, Sasha)</td>
<td>11 PMB 183</td>
<td>14-4187</td>
<td>(416)790-9036</td>
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<tr>
<td>Dr. C. Chan (Sertina)</td>
<td>8N-846</td>
<td>14-3073</td>
<td>(416)790-9833</td>
</tr>
<tr>
<td>Dr. D. Cherney (Marion)</td>
<td>8N-845</td>
<td>14-4151</td>
<td>(416)790-7711</td>
</tr>
<tr>
<td>Dr. E. Cole (May, Bibi)</td>
<td>RFE 1S-409</td>
<td>14-4669</td>
<td>(416)778-3582</td>
</tr>
<tr>
<td>Dr. V. Jassal (Samantha)</td>
<td>8N-857</td>
<td>14-3196</td>
<td>(416)790-8803</td>
</tr>
<tr>
<td>Dr. A. Kaushal</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Dr. J. Kim (Theresa)</td>
<td>11 PMB 129</td>
<td>14-3228</td>
<td>(416)790-0255</td>
</tr>
<tr>
<td>Dr. A. Kovalinka (Bibi)</td>
<td>11 PMB 189</td>
<td>14-6950</td>
<td>(416)714-7029</td>
</tr>
<tr>
<td>Dr. A. Logan (Anna)</td>
<td>MSH 4-435</td>
<td>17-5187</td>
<td>(416)380-5187</td>
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<tr>
<td>Dr. C. Lok (Naomi)</td>
<td>8N-844</td>
<td>14-4140</td>
<td>(416)790-8645</td>
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<tr>
<td>Dr. A. Merchant</td>
<td>8N-819</td>
<td>14-3047</td>
<td>(416)</td>
</tr>
<tr>
<td>Dr. R. McQuillan (Susan)</td>
<td>8N-861</td>
<td>14-5617</td>
<td>(416)790-9027</td>
</tr>
<tr>
<td>Dr. I. Mucsi (Jocelyn)</td>
<td>11 PMB 188</td>
<td>14-4084</td>
<td>(416)715-0171</td>
</tr>
<tr>
<td>Dr. R. Parekh (Andrea)</td>
<td>HSC 686 Bay St.</td>
<td></td>
<td>(416)813-7654, ext 328042</td>
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<tr>
<td>Dr. Y. Pei (Jane)</td>
<td>8N-838</td>
<td>14-4257</td>
<td>(416)790-8988</td>
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<tr>
<td>Dr. H. Reich (Marion, Sasha)</td>
<td>8N-849</td>
<td>14-3439</td>
<td>(416)719-1102</td>
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<tr>
<td>Dr. R. Richardson(Susan)</td>
<td>8N-861</td>
<td>14-3889</td>
<td>(416)790-9663</td>
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<tr>
<td>Dr. D. Ryan</td>
<td>MSH 4-435</td>
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<td>(416)586-5174</td>
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<tr>
<td>Dr. J. Schiff (Lisa)</td>
<td>11 PMB 185</td>
<td>14-3840</td>
<td>(416)790-8296</td>
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<tr>
<td>Dr. J. Scholey (Veronica)</td>
<td>8N-859</td>
<td>14-5093</td>
<td>(416)719-4569</td>
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<tr>
<td>Dr. M. Silverman(Samantha)</td>
<td>8N-848</td>
<td>14-4064</td>
<td>(416)790-8918</td>
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<tr>
<td>Dr. K. Tinckham (Jocelyn)</td>
<td>11 PMB 187</td>
<td>14-8225</td>
<td>(416)790-1368</td>
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</table>
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](http://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 (IHF). In total, 26 regional centres exist across the province, with 69 affiliated sites.

<table>
<thead>
<tr>
<th>LHIN</th>
<th>Regional Dialysis Centers</th>
<th>Contact</th>
<th>Dialysis Facilities</th>
</tr>
</thead>
</table>
| 1. Erie St Clair | Windsor Hôtel Dieu Grace Hospital | [http://hdgh.org/](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/](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.grho.sp.on.ca/](http://www.grho.sp.on.ca/) (519)742-3611 | • Guelph General Hospital  
  • GHR - Freeport Site  
  • North Wellington Health Care (Palmerston) |
| 4. Hamilton Niagara | Niagara Health System  
  [http://www.stjoes.ca/](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 |
<p>| 5. Central West | William Osler Health System (BMH) - Brampton Civic Hospital | <a href="http://www.williamoslerhs.ca/">http://www.williamoslerhs.ca/</a>  (905)494-2120 | Bayshore Stoney Creek (Independent Health Facility)  Headwaters Health Care |
| LiHN Regional Dialysis Centers | Trillium Health Partners  Halton Healthcare Services | <a href="http://trilliumhealthpartners.ca">http://trilliumhealthpartners.ca</a>  <a href="http://www.haltonhealthcare.on.ca">http://www.haltonhealthcare.on.ca</a>  (905)845-2571 | Watline (Renal Care Center)  UHN - Sussex Centre |
| 8. Central | Mackenzie Health (MAH)  Humber River | <a href="http://mackenziehealth.ca/">http://mackenziehealth.ca/</a>  (905)883-1212  <a href="http://www.hrh.ca">http://www.hrh.ca</a> | MAH – Oakridge  MAH – Vaughan  Stevenson Memorial Hospital (Alliston)  UHN - Sheppard Centre  Markham Dialysis Management Clinic |</p>
<table>
<thead>
<tr>
<th>Regional Hospital (HRR)</th>
<th>Contact</th>
<th>(Independent Health Facility)</th>
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<tbody>
<tr>
<td>Regional Hospital (HRR)</td>
<td>a/ (416)249-8111</td>
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| Lakeridge Health (LHC) | \[http://www.lakeridgehealth.on.ca\] (905)576-8711 | - 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) |
| Peterborough Regional Health Centre | \[http://www.prhc.on.ca\] (705)743-2121 | |
| The Scarborough Hospital | \[http://www.tsh.toronto\] (416)-438-2911 | |
| LIHN | Regional Dialysis Centers | Contact | Dialysis Facilities |
| 11. Champlain | Renfrew Victoria Hospital | \[https://www.renfwerefhosp.com\] (613)432-4851 | - 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 |
| Regional Dialysis Centers | | | |
| | The Ottawa Hospital - | | |
| | | | |

203
| 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.osm.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) |
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<th>Time</th>
<th>Monday</th>
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<tr>
<td>0800</td>
<td>Sign In Rounds 8N-828 Conference Room</td>
<td>Sign In Rounds 8N-828</td>
<td>Sign In Rounds 8N-828</td>
<td>Sign In Rounds 8N-828</td>
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<td>0830</td>
<td>Teaching Rounds 8N-828 Conference Room</td>
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<td>Teaching Rounds 8N-828</td>
<td>Teaching Rounds 8N-828</td>
<td>Division Rounds 12N-1276</td>
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<td>Yellow Team Inpatient Care Rounds 7C-746</td>
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<td>Home Dialysis Rounds 12N-1276</td>
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<td>Dialysis Journal Club 8N-828</td>
<td>1245 - 1330 eHOME Rounds 12NU 424</td>
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<td>1500</td>
<td>Interprofessional Education Rounds - Gerrard Wing York U Academy Rm</td>
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<td>Education Rounds 11C-1135</td>
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<td>1600</td>
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<td>City Wide Nephrology Rounds 11C-1135</td>
<td>Renal Biopsy Rounds TBD</td>
<td>Sign Out Rounds 8N-828</td>
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<td>0715</td>
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<td>Weekly rounds, discussion of inpatients</td>
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<td>Renal Rounds, 12NU-1276 (Coffee and light breakfast provided)</td>
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<td>0800</td>
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<td>Multi-Organ Transplant Rounds, Astellas Conference Room</td>
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<td>Post-Transplant Clinic (Dr. Schiff), Transplant Clinic 12th floor PMB</td>
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<td>Ward Rounds 7 PMB</td>
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<tr>
<td>0900</td>
<td>Post-Transplant Clinic (Drs. Cardella and Mucsi), Transplant Clinic</td>
<td>Post-Transplant Clinic (Dr. Cole), Transplant Clinic 12th floor PMB</td>
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<td>Post-Transplant Clinic (Dr. Schiff), Transplant Clinic 12th floor PMB</td>
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<tr>
<td>0930</td>
<td>1000 Ward Rounds 7 PMB</td>
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<td>Post-Transplant Clinic (Dr. Schiff), Transplant Clinic 12th floor PMB</td>
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<td>1245</td>
<td>eHOME Rounds (for most senior fellow, lunch provided) 12NU 424</td>
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<tr>
<td>1300</td>
<td>Post-Transplant Clinic (Dr. Kim), Transplant Clinic 12th floor PMB</td>
<td>1300 – 1400 Discussion of an inpatient case (Dr. Cardella), (lunch provided) 11 PMB 196 OR 1300 - 1600 Post-Transplant Clinic (Dr. Tinckarn)</td>
<td>1300 - 1400 Journal Club 11 PMB 196</td>
<td>Pre-Transplant Clinic (Drs. Cole and Schiff), Transplant Clinic 12th floor PMB</td>
<td>Transplant Program issues/Patient listing meeting 11 PMB 196</td>
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<tr>
<td>1400</td>
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<td>1300 - 1600 FASTRAK (Pre-Transplant) Clinic, Transplant Clinic, 12th floor PMB</td>
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<td>1500</td>
<td>1500 – 1600 Nephrology Core Academic Seminar, Astellas Conference Room, 11th floor PMB</td>
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<td>1600</td>
<td>Transplant Seminar, 11 PMB 204</td>
<td>Transplant Clinic 12th floor PMB</td>
<td>Nephrology City-Wide Rounds, Astellas Conference Room 11th floor PMB</td>
<td>Nephrology Biopsy Rounds Eaton 10-316</td>
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