UHN Division of Nephrology

DIVISION OF NEPHROLOGY

House Staff/NP Guidebook

Disclaimer: In June 2022 UHN rolled out EPIC, a new health information system. The following years will include continuous updates to enhance the efficiency and accuracy of EPIC's integration with clinical practice. At that time, various sections of this guidebook (such as workflows and orders) may fall out of date. The electronic copy of this guidebook will be more current, but please check with your department for the most updated processes, policies, and documentation.

April 2025

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.

Dr. Christopher Chan, Medical Director, Division of Nephrology and Home Hemodialysis (HD)
Dr. Joanne Bargman, Medical Director, Peritoneal Dialysis (PD)
Dr. Vanita Jassal, Medical Director, Toronto Rehab (TR) Hemodialysis, O'Neill Centre PD
Dr. Charmaine Lok, Medical Director, Hemodialysis Program and Multi-Care Kidney Clinic (MCKC)
Dr. Joseph Kim, Co-Director, Kidney Transplant Program
Dr. Tushar Malavade, Program Director, Adult Nephrology Fellowship Program, University of Toronto

Inpatient services include:

- A 7 inpatient bed on a combined GIM/Nephrology unit (Peter Munk 6A)
- 3 nephrology consult teams that cover inpatients at TGH, TWH, PMH, WCH & MSH.

Outpatient clinical services include:

- Outpatient General Nephrology, AKI Clinic, Oncology-Nephrology Clinic, Glomerulonephritis Clinic, Hereditary Kidney Disease Clinic, Geriatric Nephrology Clinic, Cardiac and Renal Endocrine (CaRE) clinic, MCKC, Home PD Unit, Outpatient HD, Home HD, and Self-Care HD.
- Geriatric and palliative dialysis services at TR - Bickle Centre, Dunn Avenue (short daily HD or nocturnal dialysis for patients in rehab and complex continuing care) and PD services in O'Neill Centre Nursing Home.

UHN Nephrology Philosophy of Care

The philosophy of care at UHN is guided by care that empowers patients living with kidney disease to live well at home and encourages chronic disease self-management, and home/self-care modalities of dialysis (PD, HD, and nocturnal HD).

During this rotation, you will learn how to care for patients with many of the following conditions: acute kidney injury (AKI), chronic kidney disease (CKD), and end-stage kidney disease (ESKD). You will develop the requisite knowledge and skills to manage disorders of fluid and electrolytes, acid-base disturbances, bone mineral metabolism, drug toxicities, and vascular disease. You will also have exposure to atypical cases including glomerular disorders, tubulointerstitial and other diseases. You will become skilled in identifying indications for dialysis. Excellence in clinical decision-making is fundamental to the practice of nephrology, and you will have an opportunity to interact with our expert faculty daily to hone your skills in this higher-level competency.

We hope that this guidebook will assist you in managing your patients during your learning experience. We welcome feedback on this document.

Contributors:

UHN Division of Nephrology, Renal Pharmacists, Nephrology Allied Health, and Nephrology Nurse Practitioners

Guidebook Editor:

Anna Gozdzik, Nurse Navigator Nephrology

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

Division of Nephrology

Specialty Clinics

Acute Kidney Injury Follow-Up Clinic (AKI Clinic)

The AKI Follow-Up Clinic is a 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. Amit Kaushal** and **Dr. Asad Merchant**, and intermittently, by residents and fellows. Patients are booked from 9:30 – 1:00pm.

<u>Inclusion Criteria</u>

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

<u>Exclusion Criteria</u>

- Patients with known CKD, any stage, **AND** already followed by a nephrologist

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

Process:

1. All AKI clinic referrals within UHN should be sent through EPIC
2. For Sinai Health patients enter EPIC referral with UHN MRN, if available. Otherwise, fill out a paper referral and email to amit.kaushal@uhn.ca, asad.merchant@uhn.ca, and susan.erwin@uhn.ca please indicate "***AKI referral***" in the subject line of the email.
3. Administrative Assistants:
    - Susan Erwin, ext. 14-3889

Cardiac and Renal Endocrine Clinic (CaRE 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. Jacob Udell**), endocrinologists (**Dr. Alanna Weisman**), pharmacist (**Stephanie Ong**), dietitian **(Christine Nash)**, diabetes nurse educators, and chiropodist (**Luckzani Balakrishnan**).

Referrals:

- For UHN patients enter a referral in EPIC
- For external referrals fax referrals to (416) 340-4999

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

Elder Kidney Care Service

Purpose

A multidisciplinary team that helps support elderly patients transition along the renal

care pathway. Team members include: staff nephrologists (Drs. V. Jassal and A. Merchant), a nurse practitioner and rotating Nephrology fellow(s).

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

1. Prognostication and shared decision making (e.g., helping discuss pros and cons of dialysis & comprehensive conservative renal care (CCRC); goal setting and advance care planning in the context of kidney disease)
2. Adapting renal care in the setting of geriatric syndromes - consider referral of patients with polypharmacy (>14 medication types), recent falls, dementia/cognitive impairment and/or frailty
3. Symptom management (itch/fatigue/restless legs) in CKD/ESRD
4. Long-term planning, e.g., geriatric rehab for dialysis patients.

We provide the following services:

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

Availability:

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

Referral Process:

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

There are 3 kinds of referrals:

1. Critical inpatient: for elderly patients not currently on dialysis who are expected to require a decision about dialysis initiation in the next 12 to 24 hours, and for whom there is concern about the appropriateness of dialysis or long-term renal care planning. These patients will be seen ASAP with a goal of completing assessment within 4 hours (except for infrequent circumstances where staffing constraints preclude this).

2. Routine inpatient: for elderly patients with AKI or CKD/ESRD for whom the areas of expertise listed above may be useful (goal: see patient within 2 working days)
3. Routine outpatient: for elderly patients with CKD/ESRD for whom the areas of expertise listed above may be useful. These patients will be seen within 2 months.

To make a referral:

Type of Referral	**Method**
Critical inpatient	Page the Geriatric Nephrology fellow directly (through Locating). You will also be asked to place an EPIC order for Geri Neph consult afterwards. Inpatient Consult to Nephrology -> Consulting Team: Nephrology -Geriatric
Routine inpatient	Communicate to Geriatric Nephrology fellow during AM Report or email Geri Neph fellow and Dr. Jassal/Dr. Merchant. You will also be asked to place an EPI order for Geri Neph consult afterwards. Inpatient Consult to Nephrology -> Consulting Team: Nephrology -Geriatric
Routine outpatient	Place EPIC order or for external referrals fill out a standard paper referral. Email Geri Neph fellow and Dr. Jassal/Dr. Merchant. Fax paper referrals to Dr. Jassal's office.

Please see website for more information:

https://www.uhn.ca/Medicine/Clinics/Geriatric_Nephrology_Consult_Services

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:
Dr. Heather Reich
Dr. Arenn Jauhal

Clinic times: Tuesdays and Thursdays 0830-1400

Clinical/Administrative assistant: **Sasha Clarke**, ext. 14-2076
Manager: **Janice Ritchie, RN**, ext. 14-2399
Clinical Coordinator: **Marcia Fisher, RN**, MN ext. 14-2840
Dietitian: **Jane Paterson, RD**, MSc, ext. 14-8591, pager (416) 719-3600
Social Worker: **Jessica Gilbert**, RSW, ext. 14-8334, pager (416) 790 – 0312
Pharmacists: **Karishma Kak & Kiran Battu**, ext. 14-8149

How to Refer:

- For UHN patients enter a referral in EPIC
- For external referrals fax referrals 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)
    - Please include creatinine and proteinuria value (24 hour or ACR)
- Most recent clinic note
- Full patient demographics

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
2. Electrolyte disturbances associated with cancer
3. Cancer-related kidney disease (e.g., myeloma, amyloidosis) and para-neoplastic glomerular disease
4. Cancer survivors with chronic kidney disease

Purpose of the Onco-Nephrology Clinic:

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

Exclusion Criteria:

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

Process:

4. All onco-nephrology referrals within UHN should be sent through EPIC
5. For external referrals please fax to **(416) 340-4999** indicate ***Onco-Nephrology*** on the referral line

Administrative Assistants:

- Jeanny Boquila, ext. 14-6386

Hereditary Kidney Disease (HKD) Clinic

The Hereditary Kidney Disease clinic is a multidisciplinary team that specializes in the care of patients with genetic kidney conditions, including Autosomal Dominant Polycystic Kidney Disease, familial Focal and Segmental Glomerulosclerosis (FSGS) and Tuberous Sclerosis Complex. Our patients have access to cutting-edge genetic testing, genetic counselling, organ-specific imaging and an experienced team of academic physicians with expertise in both medical and surgical management of kidney and non-kidney related complications. In addition, patients have access to the latest research studies in prognostic biomarkers and therapeutic interventions. We currently co-manage more than 500 patients with referring nephrologists from all over Ontario and see at least 200 new patients each year.

Clinic: Wednesdays 8:30 am to 12:30 pm, ext. 14-4257

Contact Information:

Dr. York Pei's clinic:

Administrative Assistants:

- Shiela Jamero, ext. 14-4257
- Jeanny Boquila, ext. 14-5650

Dr. Moumita Barua's clinic:

- Administrative Assistant: Richa Panchal ext. 14-8007

Clinical Coordinator: Yobiga Thevakumaran, RN, ext. 14-2264

Manager: Janice Ritchie, RN, ext. 14-2399

How to Refer:

- Fax referrals to **(416)340-4999,** Attn: Dr. York Pei or Dr. Moumita Barua

Please include a copy of:

- Most recent lab results (including serum creatinine) and diagnostic imaging (i.e. abdominal MRI, CT or ultrasound)
- Most recent clinic note
- Previous genetic testing reports (if available)

Nephrology Team and Affiliated Areas

Multi-Care Kidney Clinic (MCKC)

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

Clinic: Mondays and Tuesdays, ext. 14-2860

- Janice Ritchie, RN, manager, ext. 14-2399
- Zedfrey Salazar, RN, ext. 14-3588
- Sandy Li, RN, ext. 14-6053
- Luckzani Balakrishnan, Chiropodist, ext 14-6007
- Alison Finkelstein, administrative assistant, ext. 14-6883, fax **(416) 340-4291**

How to Refer:

* To refer patient to MCKC, enter an EPIC referral and it will be received by Zedfrey Salazar, RN or Sandy Li, RN.
* Patients must be seen as an outpatient by a nephrologist for initial work-up of CKD before referral to MCKC, even if seen as an inpatient consult.
* Inpatient referrals can be made if work-up has been completed during admission. Patient needs to be presented at eHOME meeting on Wednesdays to discuss suitability. Waiting times for appointments may fluctuate. Please indicate when the patient should be seen in follow up at time of discharge. Patients who cannot be accommodated, will require follow up in a General Nephrologists office until the patient's first MCKC appointment.
* ACR urine is mandatory for all new referrals to MCKC (in EPIC enter **Albumin Screen, Random Urine**).
* MCKC referral criteria – patients must meet the Kidney Failure Risk Index (KFI) target of > 10% risk progressing to ESKD within 2 years.
* https://qxmd.com/calculate/calculator_308/kidney-failure-risk-equation-4-variable

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 patient's home
- Coordinates assigning dialysis outpatient spots
- Helps nephrology teams with disposition planning i.e. rehab or placement in community

Geriatric Rehab

- **Joy Lee, RN(EC) NP – ext. 14-3992, cell (647)539-4036** Responsible for dialysis patients admitted to TRI Bickle Centre
- Responsible for issues related to dialysis including vascular access, renal recovery workup and monitoring.
- Actively participates in conversations around ACP with patient and family and prognostications with support of Staff Nephrologists.

Vascular Access Coordinators

Frank Shih, RN **ext. 14-6158, pager (416) 790-5320**
Gary Manzanilla, RN, **ext. 14-3518**, **pager (416) 790-5320**

- Notify Frank/Gary for vascular access issues, e.g., tunneled central line insertion/removal, permanent vascular access creation
- House staff to enter requests for tunneled central lines in EPIC: tunneled hemodialysis CVC insertion, tunneled hemodialysis CVC exchange (specify if over guidewire or new site tunnel), or tunneled hemodialysis CVC removal (specify if fibrin sheath disruption for infection cases)
- Report all insertions/removals/changes/line sepsis to Frank/Gary at daily AM report

Vascular Access Program Secretary

Sally Lima, ext. 14-6993

PD Access Coordinator

Zita Abreu, RN, **ext. 14-2358**

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

Informatics Team

- **Lynn Lin**, Informatics Coordinator, **ext. 14-6285**
- **Jamal Goddard,** ORRS Data Clerk**, ext. 14-5295**
- **Dinesh Maheswaran,** ORRS Data Clerk, ext. **14-6320**

Physiotherapy/Occupational Therapy

- PT consults, **pager (416) 714-0472**
- OT consults, **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.

OUTPATIENT HEMODIALYSIS PHYSIOTHERAPY REFERAL

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:

- Patient must be stable on HD for minimum 1 month
- Order must be entered in EPIC for physiotherapy
    - Please ask a member of the dialysis team to email the PT once the referral is entered
- Coverage for 1st and 2nd shift only, not for 3rd shift
- Assessment for independent programme on special request

Outpatient Hemodialysis Physiotherapy Referral Guidelines:

*** Third Shift**

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

Referral	Appropriate	Action
PT to see for exercise program while patient on outpatient HD	Appropriate	PT to get patient consent and if given, assess and set patient up on exercise program, progress as able/needed.
Joint assessment (including shoulders, elbows, wrist, hips, knees, ankles, digits)	Appropriate	PT to screen and treat as able. If unable to treat, PT liaises with Doctor/Nurse Practitioner to write referral for private practice/OHIP funded clinic (see list of OHIP clinics attached) and direct patient to book appointment there.
Back and neck assessments	In-appropriate	PT unable to safely and properly assess back and neck in outpatient HD setting. Doctor/Nurse Practitioner to write referral for private practice/OHIP funded clinic (see list of OHIP clinics attached) and direct patient to book appointment.

Gait/balance/falls assessments **Walker assessments**	Appropriate	PT to assess as able for gait, walker, and falls pre- or post-HD. 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.
Falls and Safety Education	Appropriate	PT to provide education and falls pamphlets to patient and/or patient's family.
Chest Physio/Secretion Clearance	Appropriate	PT to screen and treat as able. If unable to treat or with significant concerns, PT liaises with Doctor/Nurse Practitioner to refer to family doctor or emergency.
Third Shift Exercise Program	Appropriate for basic home exercise program	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.

Criteria for referral:

- Medically stable, cleared for cardiovascular training
- Cognitively intact – able to follow instructions, capacity for learning & carry over
- Motivated & interested in exercising during dialysis
- On hemodialysis for >1 months

Contraindications to the exercise program include:

- **Poorly controlled blood pressure** – SBP<90 or >160, DBP <50 or >90
    - unless otherwise specified, documented in writing by MRP for BP parameters
- Uncompensated CHF
- **MI within 6 months**
    - with clearance by cardiologist to resume participation

- 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 LHIN 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 for 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:

- Aline Huynh, pager (416) 790-8466

In-centre HD, Home HD:

- Marisa Battistella: Ext 14-3207, pager (416) 790-0793
- Vanessa Raco: Ext. 14-6547

PD:

- Francesca Lutfy Ext 14-6547

MCKC:

- Vanessa Raco Ext 14-6547

C.a.R.E Clinic:

- Stephanie Ong Stephanie.Ong@uhn.ca

GN Clinic:

- Kiran Battu Ext 14-6547
- Karishma Kak Ext 14-6547

Satellite Hemodialysis Units (Sheppard & Sussex):

- Vanessa Raco: Ext. 14-6547

Medication Reimbursement Specialist:

- Rebecca Lui: ext. 14-6622, Celine Yu: ext. 14-6622

Dialysis Start Unit (DSU)

12 ES, room 411, ext. 14-4757
Janice Ritchie, RN, manager **ext. 14-2399**

For any patient newly starting hemodialysis. 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, be able to dialyze sitting up, and have functioning vascular access.

The DSU can also accommodate patients for IPD. Speak to PD care leader to ask about capacity.

Medical coverage is by Dr. Malavade and home dialysis fellows. Coverage for **statutory holidays** is by the **hemodialysis staff on call**.

Coordinated through **Anna Gozdzik**, **ext. 14-5129**

Home Hemodialysis Unit

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

Janice Ritchie, clinic manager **ext. 14-2399**

The home hemodialysis program provides training for patients 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.

Peritoneal Dialysis Unit

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

Janice Ritchie, RN, manager ext. 14-2399, cell (416)669-7329

Miriam Santiago, RN, charge nurse, ext. 14-5672

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

Liat Hall-Chippy, RN, Advanced Practice Nurse Educator (APNE) – ext. 14-8726

- 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 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).

Dialysis Unit Toronto Rehab at Bickle Centre

There is a large inpatient satellite hemodialysis service at the TR Bickle centre on 130 Dunn Avenue. This unit provides short daily or conventional hemodialysis for patients who require Geriatric, Low Tolerance Long Duration rehab Or Complex Continuing care level needs. Nephrology support is provided during the day primarily by the Geriatric Nephrology team, **however the medical team covering TWH may be contacted to provide telephone advice during night, weekend and holiday hours**. Detailed kidney-specific handover notes are maintained in EPIC via the Handoff tool and Problem List overview"

Fellow covering the TWH

- Responsible for fielding evening, weekend and overnight calls from the dialysis unit at Toronto Rehab Bickle Centre

PLEASE NOTE: several patients at TR have modified care plans to align with their goals of care. Transfer to the nearest emergency room may/may not be appropriate. If unsure, discuss with the staff on call for Geriatric Nephrology or the on-call staff nephrologist.

Contact information:

- **Inpatient Unit**, **TR Bickle Centre** – (416) 597-3422, ext. 2374
- **Dr. Vanita Jassal**, TR hemodialysis nephrologist – **ext. 14-3196**
- **Dr. Asad Merchant**, TR hemodialysis nephrologist – **ext. 14-3047**
- **Joy Lee**, RN(EC)-NP – **ext. 14-3992**, **cell (647)539-4036**
- **Susanne Henseleit**, RN, manager, cell (647) 641 – 5314

Sheppard Centre & Sussex Centre Assisted Self Care Dialysis Units

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

Sheppard Centre (Sheppard and Yonge) – (**416) 979-4442**, **fax (416) 223-3321**

Blessy Kalathiparambil, RN, Clinic Coordinator - Blessymol.Kalathiparambil@uhn.ca

Sheppard Centre Medical Coverage
Dr. Asad Merchant, MD, Nephrologist – Asad.Merchant@uhn.ca

Sussex Centre (Burnhamthorpe Rd, Mississauga) – (**416) 979-4443**, **fax (905) 272-4534**

Herald Garcia, RN, Clinical Coordinator – herald.garcia@uhn.ca

Sussex Centre Medical Coverage
Dr. Charmaine Lok, MD, Nephrologist – Charmaine.Lok@uhn.ca

- Administered from UHN, the Sheppard and Sussex Centre satellite dialysis units offer assisted 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)

Renal Dietitian	Area(s) of Responsibility	Contact Information
Jane Paterson, RD, MSc	Multi-Care Kidney Clinic, GN Clinic	ext. 14-8591, pager (416) 719-3600
Karla Dawdy, RD	Inpatient (Yellow team), Home HD, CKD non-MCKC, Satellite HD	ext. 14-4625, pager (416) 719-3114
Hana Baig, RD	HD West & Kidney Transplant Inpatient	ext. 14-4103, pager (416)719-3249
Abbey Galvez, RD Sarah Martel, RD	Outpatient Kidney Transplant (Mon & Thurs only) Tues – Fri	ext. 14-2738 pager 416-715-0863
_____, RD	PD, HD East, In-Centre Nocturnal, DSU	ext. 14-6530, pager (416) 790-4519
Christine Nash, MSc, RD, CDE	PD, HD East, CaRE Clinic, DSU	ext. 14-6272, pager (416)790-4536

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

Available Kidney Related Restrictions:

Sodium	Potassium	Phosphorus	Fluid	Protein	Diabetic
Low sodium (2.3 g or 100 mmol) *Very low sodium (1.5 g or 65 mmol)	Low potassium (50 to 60 mmol) Moderate potassium (60 to 90 mmol)	Low phosphorus (28 to 32 mmol)	1500 mL/day 1000 mL/day 700 mL/day 500 mL/day	*Pro 100g *Pro 80g *Pro 60g *Pro 40g	Diabetic No added sugar

*Avoid using the 65 mmol sodium and protein diets as they can significantly reduce calories on trays. The 100 gram protein diet can't be combined with renal restrictions. If a patient requires a **diabetic** diet, order a **No Added Sugar Diet** and order appropriate renal restrictions.

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

Additional restrictions (e.g., fluid and potassium) should be added as required. Only order necessary restrictions. 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 on Yellow team. The unit dietitian will be following patients admitted under other services. Please consult the inpatient RD for all patients for any pertinent nutrition issues, such as dysphagia, prolonged nausea/vomiting, severe weight loss or gain, wounds, enteral feeding, TPN/IDPN, multiple food allergies, or any special nutritional needs for inpatient care.

Inpatient Nephrology Transplant RD

The inpatient kidney transplant RD will see all patients admitted to TGH who are in the kidney transplant program. All kidney transplant inpatients located on the transplant

floors are screened and prioritized for care. Please consult the inpatient kidney transplant RD for any pertinent nutritional issues.

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

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

Pre-dialysis (Non-MCKC) RD

Nutrition counselling appointments are available with referral by a UHN nephrologist only. Referrals are screened and scheduled based on priority. Referrals can be made in epic

Multi-Care Kidney Clinic (MCKC) RD

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

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

Based on screening and referral, patients are assessed and followed by a nephrology dietitian as part of the multi-disciplinary team upon referral to the CaRE Clinic.

GN Clinic RD

Based on screening and referral patients are assessed and followed by a nephrology dietitian as part of the multi-disciplinary team.

Renal Social Worker

- Provide support to kidney patients and their family regarding adjustment to chronic kidney disease. Identify and provide resources based on the need across the spectrum of disease severity. Liaise and/or make referrals to community support when necessary.
- Each Renal SW has a variety of areas of responsibility, please contact appropriate person:

Social Worker	Area(s) of Responsibility	Contact Information
Angela Tse, MSW, RSW	Multi-Care Kidney Clinic	Ext 14-3618, pager (416)719-2876
Melissa Rubin, MSW, RSW	Hemo East 1st and 2nd shifts (all days), Nephrology inpatients	Ext 14-7847, pager (416) 719-3731
Tracey Ragnanan, MSW, RSW	PD and Home HD, Dialysis Start Unit, Sheppard & Sussex Satellite Units.	Ext 14-3983, pager (416) 719-2812
Mary Paul, MSW, RSW	Hemo East 3rd shift (all days), Hemo West all shifts & days, Nocturnal	Ext 14-4768, pager (416) 719-2668
Jessica Gilbert, MSW, RSW	GN Clinic	Ext 14-8334, pager (416) 790 - 0312

Nephrology Outpatient Chiropody (Luckzani Balakrishnan, DCh. (H)BSc)

Provides footcare assessments and treatments, including but not limited to: nailcare, callus/corn removal, ingrown nailcare, wart treatments, fungal nailcare/skin treatments, woundcare. Available for patients involved with: In-Center Hemodialysis, Home Hemodialysis, Peritoneal Dialysis, Multi Care Kidney Clinic, Complex Care Clinic. Patients can self-refer themselves or via caregivers/family members, or can be referred to via nurses, practitioners, any staff in circle of care over phone, email, In-Basket or Secure Messaging. Please call 416 340 3131 x 6007 to book directly or email luckzani.balakrishnan@uhn.ca. No Orders need to be placed via EPIC.

Peritoneal Dialysis Off-Unit Nurses

- Off Unit PD TGH/PMH/MSH – **6A Nephrology/Transplant ext. 14-4487**, **pager (416) 715-9232**.
- Off Unit TWH – **8B GIM**, **13-5167**.

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

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

- All nurses are trained to manage PD for patients admitted to one of the 7 nephrology beds on 6A Nephrology/Transplant.
- 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 6A 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.

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

- A core group of nurses is trained to manage PD for patients admitted to 8B General Medicine.
- For patients admitted to TWH general units, or undergoing assessment in the ED, there is at least one nurse assigned from 8B available every shift (24/7) to travel to provide PD (cycler and manual exchanges**). NOTE:** There is only limited use of cycler machines in ED due to lack of plumbing drainage options and there are only 2 machines in total on site.
- For patients admitted to the ICU setting at TWH, there is a core group of nurses able to provide management of manual PD. For cycler management, 8B staff will need to be paged.

Inpatients

Inpatients Nephrology Beds on Nephrology/Multi-Organ Transplant Unit

6A – ext. 14-4487, fax (416) 340-4168

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

Medical Coverage

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

- Acute Care Teams: AKI, undiagnosed renal failure, or ESRD patients undergoing various other procedures, e.g. biopsy, angioplasty
- **Team consists of:**
  - Attending house staff is responsible for the team, patients and *ITER forms*.
  - Renal fellow acts as team leader, co-ordinates the work of the team, assists in teaching, and is aware of all patients on team.
  - Anna Gozdzik (nurse navigator – ext. 14-5129, fax (416) 340-4291) to consult on all new dialysis patients and assist with dialysis options, focusing on home dialysis, outpatient HD spots, palliative management, or for education. To procure dialysis spots, contact the HD managers or patient care coordinators
  - On-call does consults at TGH, MSH, PMH and Women's College Hospital. Covers ward issues in evenings & weekends.

- ***Kidney transplant*** patients are followed by the kidney transplant service; other organ transplants with renal issues are seen by nephrology. Patients with kidney-pancreas (K-P) transplants are seen by K-P service; renal transplant to see if dialysis is needed.

- ***Women's College Hospital*** has no in-patient medicine beds:
  - Patients are sent to the emergency department or for direct admission to yellow team if meet criteria for admission (follow same process as above)

Nephrology Yellow Team (Inpatient/Ward Team):

Team Members

Staff	Rotational
Clinical Fellow	Rotational
Nurse Practitioner (NP)	Jovina Bachynski: ext 14-8501, cell (647) 532-2094
Social Worker (SW)	Melissa Rubin: ext 14-7847
Renal Dietitian (RD)	Karla Dawdy: ext 14-4625
Renal Pharmacist (RPh)	Aline Huynh: ext 14-8149, pager (416) 790-8466
Physical Therapist (PT)	Taylor Tassone
Occupational Therapist (OT)	Zili Xie
Physical Therapy Assistant (PTA)	Lili Patrman
Second Fellow	Rotational – Staff and 2nd Yellow Team fellow cover nephrology consults at TWH

Criteria for Admission/Transfer to Yellow Team

Admissions Policy for Yellow Team

- These guidelines refer to patients with ESKD who are on some form of kidney 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.***
- Table 1 indicates what clinical problems (in the ESKD patient population) would be directed toward General Internal Medicine, General Surgery, and Nephrology, respectively

Table 1. Clinical Conditions Appropriate for Referrals/Admissions to GIM, General Surgery, or Nephrology Services

General Internal Medicine♣	General Surgery (or appropriate sub-specialty)♣	Nephrology
• Acute kidney injury (AKI) • Pneumonia, GI bleed • Pulmonary embolus • DVT • Unstable angina • Non-Q MI • Cardiac dysrhythmias (non-CCU) • PVD & complications, cellulitis • TIA/CVA, seizures	• Abdominal pain – surgical abdomen, peritonitis in non-PD patients • Cholecystitis • Gallstone pancreatitis • Bowel obstruction • Unstable GI bleed • Post-operative complications • Arterial thrombosis (vascular service) • Gangrene requiring amputation (vascular service) • Fractures (orthopedics service)	Dialysis access issues: • PD/HD access creation • Infection • Thrombosis • Radiological/surgical revision • Sepsis r/t access • PD peritonitis • Inadequacy of dialysis Urgent dialysis in a dialysis or pre-dialysis patient: • Volume overload • Electrolyte emergencies (i.e., hyperkalemia)

♣Individuals presenting with clinical conditions under GIM or Gen Surg columns do NOT go to Yellow Team – they are admitted to GIM or Gen Surg with the nephrology acute care team consult following.

- **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 for the definitive decision.**
- Transfers from other services or teams must be staff-to-staff and in discussion with the NP.
- May admit from ER between 08:00 to 16:00 for non-life-threatening admissions after being triaged by the on-call MD.

Mandatory Meetings

	Sign-In Rounds	Sign-Out Rounds	Yellow Team Patient Care Rounds	HPDU Thursday Rounds
When	Monday to Friday at 0800	Monday to Thursday @ 1630; Friday @ 1530	Monday and Thursday at 1030-1100	Thursday at 1000-1030
Where	TG 8NU-828 or Teams	Monday to Thursday: TG 8NU-828 or by phone Friday: TG 8NU-828	6A Conference Room 115	TG 12NU-1276
Who	Nephrology Blue, Red, Yellow, and geriatric nephrology teams; Lani (HD PCC); Frank Shih & Gary Manzanilla (vascular access coordinators); Anna Gozdzik (Nurse Navigator)	Mon-Thu: Nephrology Yellow Team fellow sign off to first on-call Friday: Nephrology Yellow and Red/Blue teams sign off to on-call weekend team	Nephrology Yellow Team: Staff/clinical fellow(s), NP, SW, RD, RPh, PT/OT/PTA, Nurse Navigator 6A: PCC, unit manager, charge nurse	Yellow Team clinical fellow(s) and NP
Why	To review consults, admissions, and discharges from previous day or over the weekend; discuss in-centre or off-unit HD schedule; prioritize vascular access-related interventions in IR.	To sign over salient patient info/issue to the on-call team or individual.	To discuss/provide update to patients' clinical/social issues and disposition planning. Be prepared to give a short presentation of each patient and current plans. Discuss plans with team members. Focus on what patient needs to have in place for treatment and discharge.	To provide update on and discuss plan of care for PD patients admitted under Nephrology Yellow Team

Yellow Team Fellow (TGH) Responsibilities

- Assign yourself to your patients in the Sign-In section in EPIC.
- Attend sign-in rounds each morning. Be aware of when your patients need dialysis, and ensure they are scheduled, and orders are written.
- Assess each assigned patient and determine needs (medical, psychosocial, PT/OT, nutritional). For dialysis patients, target weight, dialysis treatment parameters, lab results and medications should be reviewed.
- New admissions assigned to the fellow are to be seen and assessed; medications, bloodwork, etc. are to be ordered in EPIC by the fellow.
- 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 including: history, physical assessment, medication changes, dialysis, plan of care, consults required, and diagnostic tests planned. A short note with updates should be written daily including assessments 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, fellow, NP, SW, PT/OT, RD, and nursing as needed.
- Generally, after sign-in rounds, meet with NP and staff to review patients and discuss their plans of care.
- 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 in EPIC each day with plans and salient issues for patient. Be brief. Outline for any issues that need follow-up for the on-call resident or fellow. Sign-over to the on-call resident at TG 8NU-828 Mon – Thursdays @ 1630 and Fridays @ 15:30.

Discharging Patients

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

Assess patients 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 (ALC) (e.g., 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 EPIC on admission and update throughout the patient's stay. Be sure to review all medications prior to discharge with the pharmacist and note any changes or new medications in the discharge summary.
    - It **MUST** include date of initial dialysis treatment, cause of kidney failure, whether or not biopsy-proven (where applicable).
    - Include issues for the GP or specific MD to follow up on.
    - Include HD and/or PD prescription in discharge summary
    - It will include follow-up appointments and outpatient referrals (e.g., Thrombosis Clinic). Ensure these referrals are ordered before discharge.
- Update and un-hold the outpatient HD and PD therapy plans in EPIC at discharge.
- 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.
    - For HD: Document in EPIC that the outpatient therapy has been confirmed to be reactivated at discharge using the .NEPHROHDTP smart link.
    - For PD: Inform the HPDU at 14-5672 about the discharge. Ensure the patient has a follow-up appointment with the HPDU within the week after discharge.
- Homecare support services (e.g., PT/OT, PSW [personal support worker] for bathing) through the LHIN should be arranged at least 24 hours before the planned discharge. Referrals for such services go through the RM&R (Resource Matching & Referrals). This will require collaboration with the SW and PT/OT to complete the RM&R referral.
- Work with the SW to ensure outpatient HD schedule and transportation arrangement are secured.

Home Care (Local Health Integration Network - LHIN)

If an individual needs assistance at home, complete the online RM&R referral at least 24 hours prior to discharge. Clearly state what assistance is needed, e.g., wound dressing changes, medication administration (e.g., insulin), physiotherapy, PSW, etc. Complete the "Care Requirements" and "Acute Care Medical Assessment" tabs of the referral. 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 has recently become unable to ambulate or mobilize with an assistive device, or has a decline in self-care abilities, consider rehabilitation after receiving clearance from PT/OT to proceed. PT/OT will determine the patient's eligibility for rehab, and this involves the patient's participation with PT/OT activities during the admission. The SW initiates and sends the RM&R referral after the medical team and PT/OT complete their respective sections. The treatment modality will determine which facility to refer the patient to. For example, Bickle Centre only accommodates rehab for HD patients. Rehab for PD patients can only be accommodated at Providence Healthcare and Bridgepoint Hospital.

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 EPIC. If an ALC patient becomes acute and cannot be transferred due to medical reasons, put an 'ALC removal order' in EPIC. Contact the appropriate nursing staff member regarding the changes (e.g., nurse manager, patient care coordinator, or designate).

CCOT (Critical Care Outreach Team)

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

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 therapy plan. If pt is at Mt Sinai and comes to TGH for dialysis, please order baseline and ongoing BW to be done on EPIC in HD.

Transfers from Consult Teams to Yellow Team

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

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

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

3. At that point, Yellow Team takes over the patient care and becomes primary care team. The consult team no longer follows the patient.

Direct Admissions to Yellow Team

Option: Use the request form in Nephrology Sharepoint -> Morning Handover folder

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

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

For patients who require admission for **high-risk renal biopsy**, speak with Jovina Bachynski (NP), Marcia Cameron (nurse manager) and/or charge nurse for the day to coordinate the admission. The patient flow team requested biopsies be booked from Tuesday to Friday, as there may be challenges in arranging admissions on a Monday.

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

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

This protocol was reached 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 need 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, 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.

Consult (TW) Fellow Responsibilities

- The fellow covering the TWH is also responsible for fielding evening, weekend and overnight calls from the dialysis units at Toronto Rehab Bickle Dunn Avenue site.
- Fellow on call for TWH on weekend will also be on call for the TGH in-center dialysis third shift on Friday and for the TGH PD unit

Admissions at Toronto Western

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

Rounds

Refer to calendar of weekly rounds at end of guidebook.

Handoff Tool in EPIC

- 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.

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

- 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 number
- On-call room 12ES 402 – Don't leave valuables in the room
- On call person to ensure that at least 1 HD pt has orders for the following morning so that HD nurse can start before sign-in.
- **Fellow covering the TWH**
    - Responsible for fielding evening, weekend and overnight calls from the dialysis unit at Toronto Rehab Bickle Centre at 130 Dunn Avenue.
    - Responsible for fielding evening calls from the HPDU nurse on call
    - **On statutory holidays**: responsible for calls or to see drop-in patients in the HPDU

Primer on Kidney Replacement Therapy

Indications for dialysis

1. Volume overload refractory to diuretic therapy
2. hyperkalemia refractory to medical management
3. severe acid base abnormalities refractory to medical management
4. acute intoxications
5. uremia (pericarditis, or encephalopathy)

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

Modalities of Renal Replacement Therapies

The two extracorporeal modalities of RRT are:

1. Hemodialysis, which includes a) Intermittent (Conventional) Hemodialysis (IHD), b) Slow low efficiency dialysis (SLED – offered in ICU settings), c) Continuous veno-venous hemodiafiltration (CVVHDF) – only in MSH ICU, d) nocturnal hemodialysis and e) home hemodialysis; and

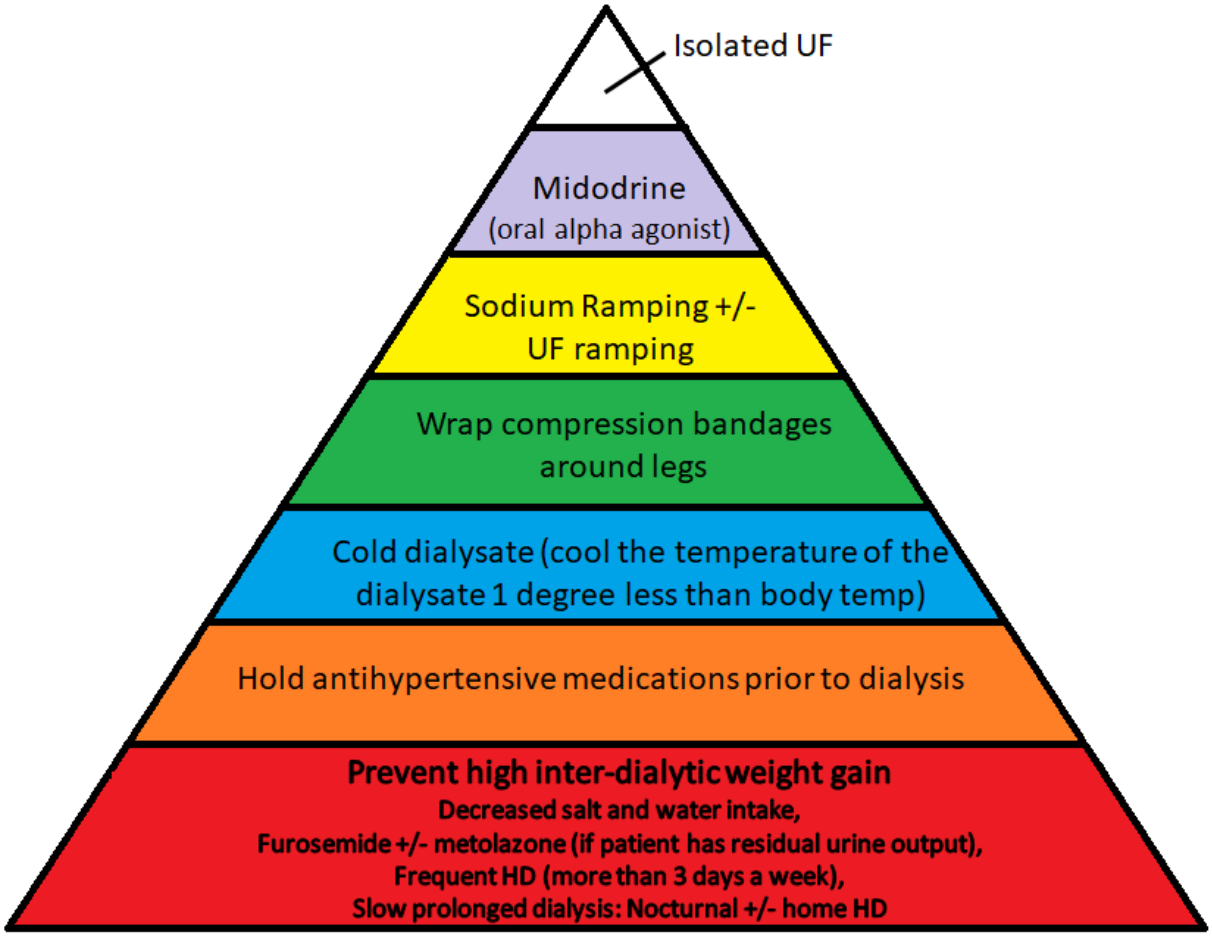
2. Peritoneal Dialysis.

Kidney transplantation is the gold standard of RRT but is a very limited resource. Nocturnal and home hemodialysis are options only for outpatients.

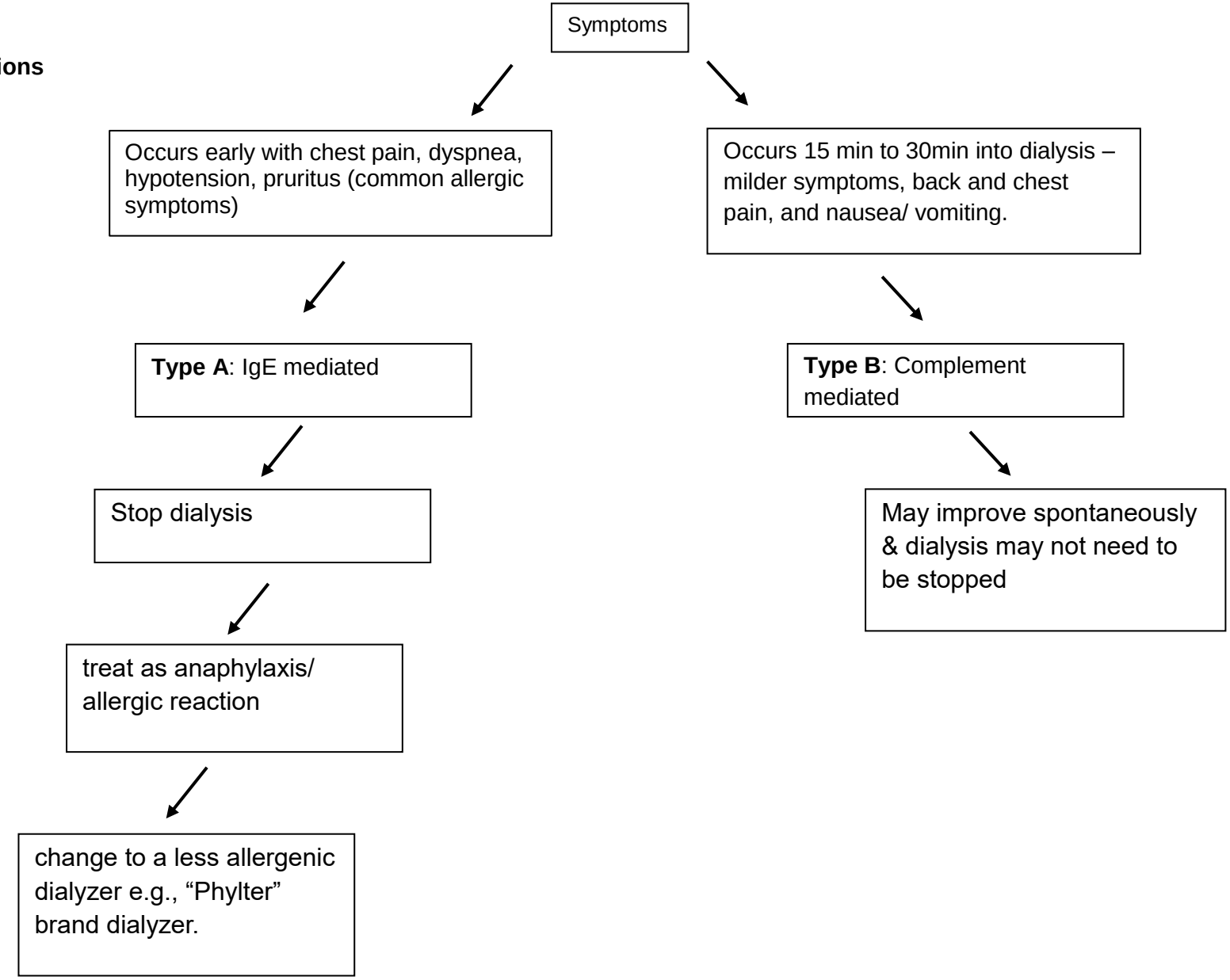
Complications of dialysis

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

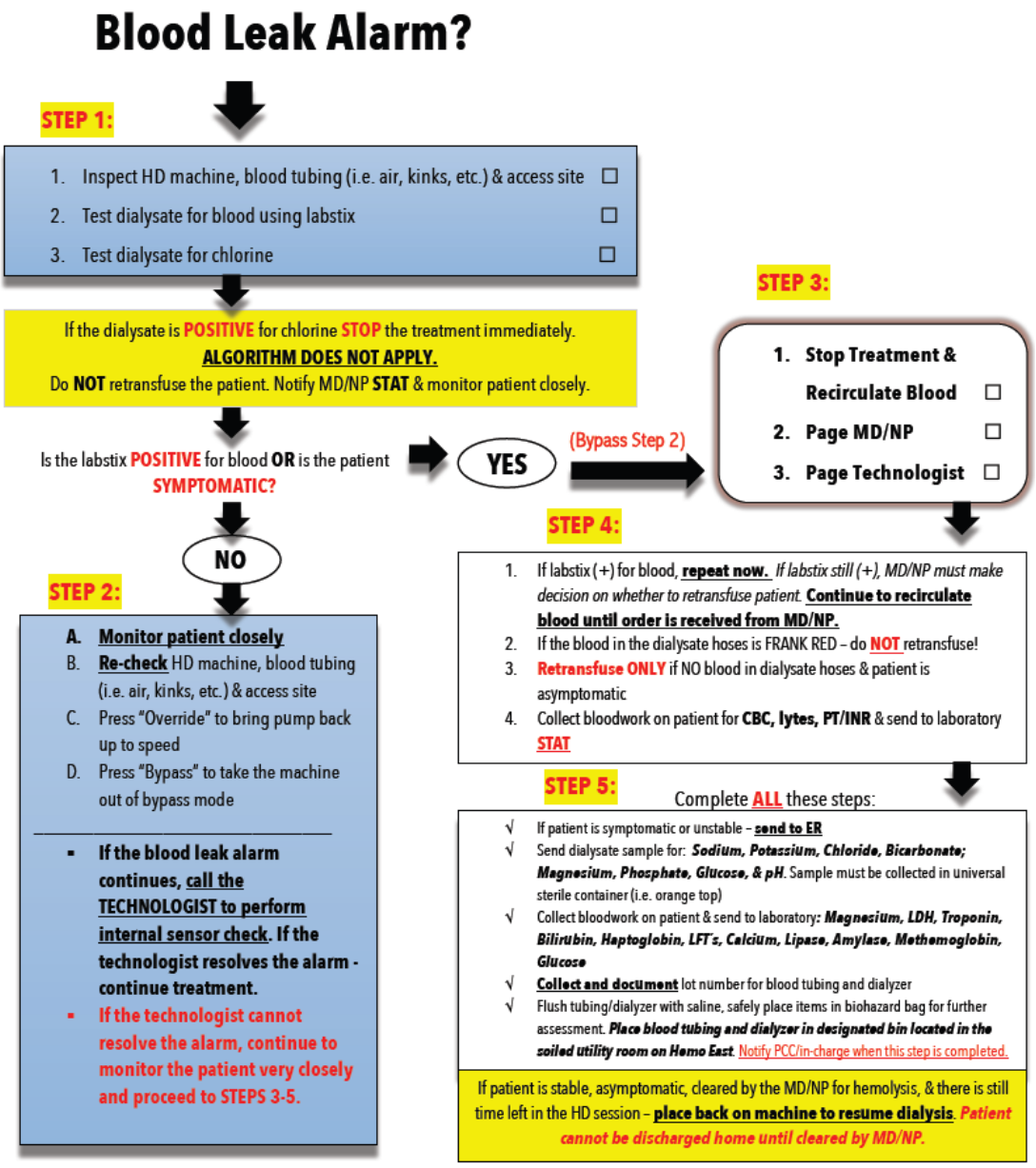
Intradialytic hypotension (IDH): This is defined as a drop of 20mmHg systolic or 10mmHg in the mean arterial pressure in combination with symptoms including cramps, presyncope/ syncope, abdominal pain, chest pain, nausea and vomiting. This is often caused by removal of high volumes of fluid at a rapid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



Dialyzer reactions



Blood Leaks - Algorithm for Blood Leaks in Hemodialysis



Hemodialysis

Instructions

- Enter the orders in EPIC a day ahead if possible. Call the HD unit as soon as you know that an inpatient will require dialysis.
- HD schedule for the day reviewed at morning sign-in
- Urgent HD after hours to be discussed with the renal fellow
- For emergency dialysis Monday to Friday and Saturday until 2230:
    - For TGH, MSH, PMH, or TWH contact Hemo West charge nurse at ext. 14-4072
    - After hours page on-call HD nurse via locating at 14-3155
- For emergency dialysis Saturday 2230 until Sunday at 2230:
    - For TGH, MSH, and PMH on contact the on-call nurse through locating
- Initiation of a new hemodialysis patient whether acute or chronic must be in consultation with a staff Nephrologist, with a catheter in place and verified radiographically.
- CRRT (only at Mount Sinai) and SLED should only be initiated during the day.
- PCCs, 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.
- For UHN patients & patients from Sinai Health coming to TGH use existing hemodialysis therapy plans to order dialysis. Orders must be entered for the weekend and Monday AM, before leaving Friday, and for discharged new HD pts.
- For Sinai Health off unit hemodialysis writer orders in patient's chart.
- 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).

Hemodialysis Unit

Hemo West (HW) – **ext. 14-4072**, fax (416) 340-3084
Hemo East (HE) – **ext. 14-5707**, fax (416) 340-4892
Stephanie Lappan-Gracon, RN, nurse manager – **ext. 14-8502**

Leilani Quijano, RN, patient care coordinator (PCC) PCC - **ext. 14-6908**
Jennifer Lopez, RN, PCC - **ext. 14-6049**

Shabana Samim, RN, advanced practice nurse educator (APNE) – **ext. 14-7938, Cell (416) 648-5266**

Physician Coverage for Hemodialysis Units

MWF	**Hemo West**	**Hemo East**
1	Scholey	Barua
2	Pei	Jauhal
3	Kaushal	Chan
TTS		
1	Kaushal	Lok
2	Lok	Kitchlu
3	Cherney	Merchant
Nocturnal Incentre Dialysis (west unit) 2230 until 0630		
MWF	Chan or Kaushal	

DSU and Home Dialysis (Home Hemo and HPDU)
DSU – MWF - Dr. Malavade and Home Dialysis Fellows **DSU/Home Dialysis**: After-hours, weekends and stat holidays: Staff on-call for hemodialysis

Tips on Ordering Hemodialysis

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 FX120 which is a one-time use dialyzer.

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%

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

4. Dialysate
Sodium: standard is 138 mmol. May order Na^+ "Ramping" for pts with intradialytic hypotension or cramping - e.g. Na 145 1st hr., 140 2nd hr., 137 3rd hr., 135 4th hr., ordered in consultation with fellow or staff. However, is now strongly discouraged for most patients.
Potassium: 1.0, 2.0, 3.0 mmol/L available. Goal is predialysis K^+ 4.0-5.5, post dialysis K^+ 3-3.5. (to guesstimate: 7 – pt’s K^+ = dialysate K+). Standard is 2.0.
Calcium: standard is 1.5 mmol. Also 1.25 and 1.00 mmol available for hypercalcemia and 1.75 mmol available for hypocalcemia.

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

Phosphate: Patients on HD or SLED may develop hypophosphatemia. One way of correcting this is to add Fleet phosphate enema (concentrated sodium phosphate) to the acid concentrate. 100 mL of Fleet additive contains approximately 175 mmol of phosphate – which gets diluted 1:45 by the dialysis machine. 130mL (1 bottle) will give approximately 1.0 mM final phosphate concentration.
(This is from the N

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

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

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

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

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

8. BP maintenance

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

9. Bloodwork

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

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.

Blood Transfusions Tips for EPIC

In the outpatient setting at UHN, a prescriber orders blood/blood product transfusions in Epic using a blood therapy plan. This applies to patients receiving dialysis.

For admitted patients, prescribers use inpatient ordering tools, such as OrderSets, to place blood/blood product transfusion orders. Patients on dialysis are the exception. If the transfusion is to be managed by the dialysis nurse during dialysis, the blood must be ordered using a therapy plan. The prescriber would continue to use inpatient ordering tools for transfusions that are administered outside of the dialysis treatment and when managed by the inpatient nurse.

Important: Blood transfusions to be given during dialysis must be ordered using a blood therapy plan (not dialysis therapy plan). For patients who are admitted and require a blood transfusion during dialysis, the prescriber must use a blood therapy plan (not an OrderSet) to place orders for transfusion. This allows the off unit dialysis nurse to see the orders from within the hemodialysis navigator, their primary documentation activity. Orders for blood placed outside of the therapy plan, even with a dialysis phase of care, do not show up in the nurse's navigator.

Medication Tips for Dialysis Therapy Plans in EPIC

	Circuit Related Medications *Example: circuit heparin or NS, fleet for bath, CV access meds (citrate, heparin, polysporin)*	**All other medications that are recurring** *Example: medications given in more than one session (aranesp, venofer, alteplase (TPA), antibiotics). This includes recurrent PRNs.*	**All one time doses** *Example: benadryl, gravol*
Admitted/ED patients	Order inside inpatient dialysis therapy plan	Order **outside** inpatient dialysis therapy plan	Order **outside** inpatient dialysis therapy plan
Outpatients	Order inside outpatient dialysis therapy plan	Order inside outpatient dialysis therapy plan	Order **outside** outpatient dialysis therapy plan

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* (ask department pharmacist for details)

IV Iron

- Iron sucrose is the standard intravenous iron preparation. Sodium ferric gluconate complex (Ferrlecit ®) may bepha 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 sessions. Maintenance dose 100 mg IV 1 -2/month and 300 mg IV weekly x 3 (non-dialysis).
- Dose - Sodium ferric gluconate complex (Ferrlecit) 125 mg IV with HD x 8 consecutive HD sessions. Maintenance 62.5 mg - 125 mg IV 1-2 times per month.

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

- Patients in the ICU, CCU and Off unit reviewed at AM report
- ICU pts often hemodynamically unstable, with large obligate fluid input, on inotropes, with co-morbid conditions, which complicate their dialysis.
- Conventional HD can worsen hemodynamic instability. SLED and CRRT - Continuous Renal Replacement Therapies - are slower and gentler than conventional HD.
- ALL patients starting HD must have Hgb, Cr, Urea, bicarbonate, Ca++, PO_4, albumin, PTH done PRIOR to first dialysis. (Ontario Renal Reporting System guideline)
- **Many ICU physicians are unfamiliar or uncomfortable with PD and when a PD patient is admitted will ask for conversion to HD. This is often unnecessary and should be discussed with your attending or the PD physicians.**

Peritoneal Dialysis

- In pts with intact peritoneal cavities, PD can be excellent in ICU setting.
- Contact General surgery to implant the PD catheter. Contact Zita 2358 for PD catheter insertions.
- ICU nurses carry out the dialysis - CAPD.
- Notify PD off unit nurse to initiate PD peritonitis protocol.

Sustained Low Efficiency Dialysis (SLED)

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

Orders for SLED (**S**ustained **Low E**fficiency **D**ialysis)

Use the EPIC SLED therapy plan under in Inpatient Dialysis Plan acute/temporary SLED

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.

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

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 and Replacement 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.

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

4. **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.

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

Citrate Anticoagulation

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

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

Indications for Use:

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

Citrate Protocol

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

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

Required Bloodwork:

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

During Treatment: Post filter Ionized Ca, Systemic Ionized Ca

- At 1 hour

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

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

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

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

Problems with Continual Renal Replacement Therapies

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

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 Frank/Gary 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.
- Elevate arm above heart level to assess if draining vein is patent.

Both 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 coordinators Gary ext. 14-3518 or Frank ext. 14-6158.
- Will be seen in Vascular Access Clinic and booked for OR
    - Enter order in EPIC for vascular surgery referral
- 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)

Temporary Percutaneous

•Percutaneous internal jugular vein/ femoral vein temporary CVCs are indicated for the purpose of dialysis for patients with AKI expected to resolve in next 2 weeks, either in the.

- The catheters are placed using Seldinger technique under sterile conditions, preferably using ultrasound image guidance for vein identification. There are dialysis kits and related materials for line insertion available in the procedure room in the hemodialysis east unit (ext. 14-5705).
- An U/S machine is also available in the hemodialysis west unit (ext. 14-4072)
- The patients or families should be consented for the procedure. The risks of the procedure include bleeding, arterial puncture, pain, infection at the site of the line insertion, and pneumothorax in the case of internal jugular access.
- Below is a checklist for all the materials needed for line insertion. A copy is available on the Nephrology Sharepoint drive.
- \
- If catheter is slipping out, never push back in. Change over a guide wire.
- Coagulation parameters should be assessed and optimized. In a patient with a high risk of bleeding, a dialysis line should only be inserted if necessary. The patient may be given light sedation (benzodiazepines) if safe, and pain control (opioids, acetaminophen, local anesthetics such as lidocaine).

- A procedure note should be written in the chart documenting consent, number of attempts at venipuncture, blood loss (if significant), aseptic technique, medications administered, and any complications that ensue. Patient should be examined to ensure that there is no hemodynamic or respiratory compromise.
- If the patient has high levels of urea, then consideration should be given to a short run with decreased blood and dialysate flows. If the patient is severely hyperkalemic or has an intoxication requiring urgent clearance, then that should be prioritized.

Temporary Percutaneous Dialysis Catheter Insertion Checklist

1) Patient meds and blood work checked – CBC, INR, PTT,
    a. anticoagulants, anti-platelets ☐
2) Consent form ☐
3) Dialysis catheter (11.5 French) - femoral (24 cm - should be stiff catheter) **or** right internal jugular (15 cm) **or** left internal jugular (20 cm) ☐
4) Line Kit: Dilator, guide wire, angiocath (intro-needle – 18G x 2.75 inch), 3-0 suture + straight needle, scalpel, port caps ☐
5) Extra guide wire (optional)/angiocath ☐
6) Local anesthesia
    a. lidocaine 1-2% ☐
    b. 10cc syringe ☐
    c. 18G blunt needle – for drawing the lidocaine ☐
    d. 25G x 1.5 inch needle (for lidocaine) ☐
7) Povidone-iodine solution or chlorhexidine swabs x 3 ☐
8) Ultrasound machine ☐
9) Sterile Ultrasound sleeve (cover) + sterile gel ☐
10) 0.9% saline flushes x 4 ☐
11) Gown, sterile gloves, head cover, surgical mask ☐
12) 4x4 gauze (multiple) ☐
13) Pre-filled 4% citrate syringes x 2 (or heparin10,000 units per mL)
    – instill into catheter to dwell at end of procedure ☐
14) CVC sterile patient drape and/ or sterile towels ☐
15) Dressing to cover the line (e.g. tega-derm tape) ☐

Post Procedure (IJ CVCs)

1) Discard sharp instruments in biohazard bin □
2) Chest X ray (confirmation of CVC placement in correct position and check For pneumothorax □
3) Call dialysis unit to arrange dialysis □

Tunneled

Alert:

Some catheters are impregnated with chlorhexidine. Please check patient allergy before catheter insertion.

- ❖ Anaphylactic reactions to chlorhexidine are rare but are being reported increasingly in association with a variety of products.

- ❖ Anaphylaxis has been precipitated by the insertions of a central venous catheters impregnated with chlorhexidine.

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) Enter order in EPIC "IR Hemodialysis catheter insertion/placement (Left/Right)

2) Enter order for CBC, PT/INR

3) Call Gary Manzanilla (ext. 14-3518) or Frank Shih, RN ext. 14-6158

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.
- Does not need to be X-rayed prior to use (inserted under fluoro).
- Will be capped with 4% Citrate at insertion.

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 EPIC, 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 Gary (ext. 14-3518) or Frank ext. 14-6158, if infection suspected, who will review with Hemodialysis Infection Control Subcommittee (HICS).

See Flowchart: Algorithm for Central Venous Catheter Related Infection

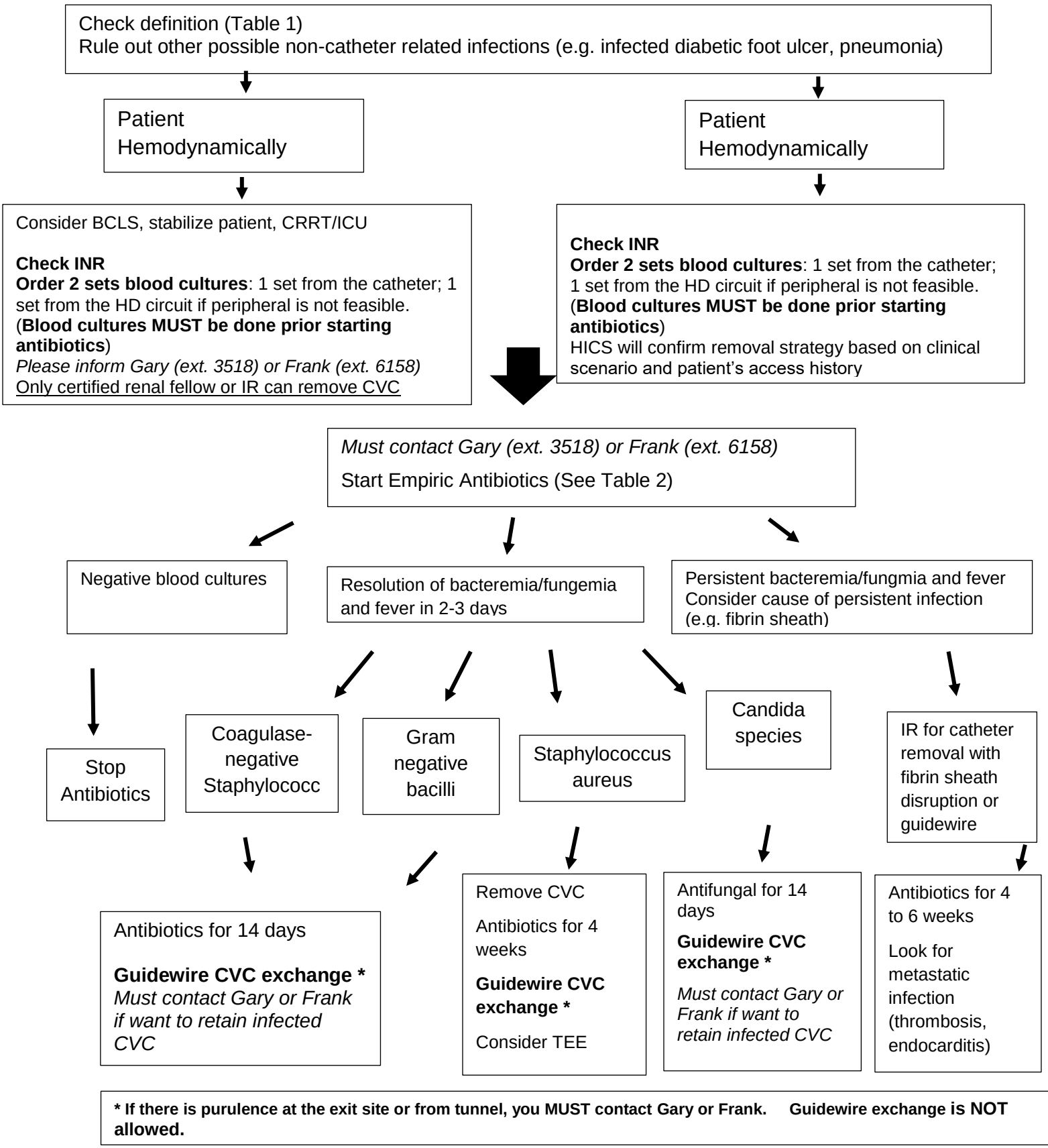
Start empiric antibiotic treatment Protocol:

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

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

Monday to Friday, 0800 to 1600, **Gary Manzanilla** or **Frank Shih**, Vascular Coordinator will arrange CVC removal or guidewire catheter exchange through IR. Fibrin sheath removal is done for infected catheters. After hours, contact the Interventional Radiologist on call to request availability for removal. If IR able to do, place an order in EPIC “IR hemodialysis catheter removal (Left/Right) and in reason for exam indicate check for fibrin sheath and disrupt if present”. 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* (Gary ext. 14-3518 or Frank Shih ext. 14-6158). If patient requires dialysis in the interim, a temporary CVC may need to be inserted.

Algorithm for CVC Related Infection



*** If there is purulence at the exit site or from tunnel, you MUST contact Gary or Frank. Guidewire exchange is NOT allowed.**

Table 1. Definitions of Catheter-Related Infections

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

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

Table 2. Culture and Sensitivity Follow-up

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

If not completely resolved in 7 days, call Gary (ext. 14-3518) or Frank (ext. 14-6158) for further evaluation.

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

Exit Site Infections

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

Table 3. Vancomycin Dosing in Hemodialysis

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

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

Consult pharmacist for dosage recommendations

AV Graft Infection

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

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

Thrombosis Guidelines for Vascular Access

Non-tunneled Catheters:

- If catheter functions poorly during HD, assess fully, including CXR for proper placement
- Try rotating the 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)

Alteplase (Cathflo®) (tPA)

tPA guideline available in hemodialysis therapy plan

Native AV Fistulae:
It usually lasts for several years and is by far the preferred method of chronic vascular access if mature to function.

- One drawback is that when they thrombose, there is usually no effective treatment unless de-clotting can occur early (within 24-72 hours).
- Do not usually require admission for thrombosis. Instead, instruct pt to come early for next HD so that a non-tunneled catheter can be inserted.
- Vascular Access Coordinator, Gary ext. 14-3518 or Frank ext. 14-6158, to be informed so pt is put on the list for creation of a new permanent vascular access.

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

AV Grafts:

- All patients with synthetic AV-grafts should be instructed to take 4 capsules of fish oil/day (1 capsule should contain EPA 400mg and DHA 200 mg) as it has been proven to reduce the rate of thrombosis and interventions
- Thrombosis is not uncommon; patency can usually be resumed by de-clotting procedure (ideal within 24-72 hours; may still be effective within 5 days)
- It is not necessary to admit, but need to contact VA Coordinator Gary, ext. 14-3518, Frank 14-6158, or VA secretary Sally, ext. 14-6993) to arrange the procedure.
- Radiologist will insert catheters and infuse thrombolytic agents to de-clot graft.
- If radiology back-up is not available, unsuccessful or contra-indicated, contact vascular surgery to perform a thrombectomy. This still needs to be followed by an angiogram and angioplasty. Contact Frank/Gary 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 Gary Manzanilla or Frank Shih to follow up.
- Frank/Gary must be notified of all access related problems and procedures
- If a patient is an inpatient and needs de-clotting, order NPO for 4 hr. pre-procedure, and IV saline lock on other arm

Removal of tunneled cuffed hemodialysis catheter
To be carried out only by staff or experienced renal fellow. **Contact Dr. A. Merchant 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:

- Ensure INR is <1.70, no ASA, warfarin x 5 days. If on subcutaneous heparin DVT prophylaxis, hold dose pre and post removal. Patient to be supine during procedure.
- Explain to pt it takes ~ 45 min, and they will have to stay lying down for ~30 min afterward.
- Put a mask on you and the patient (if the patient cannot lie still or is coughing).
- Prepare tray with scalpel blade, needle, syringes, dressing, 4x4's, suture, steri-strips
- **If dressing is in sterile package, open on to tray, if not sterile e.g., Medipore, cut 15cm piece and put on side of table.**
- With procedure gloves, remove old dressing and tape from caps.
- Landmark for cuff (NB to landmark as may not feel cuff after Xylocaine). Be aware that Cardiomed catheters once had a double cuff (2 cuffs side by side), palpate to

see if you can feel an “extra wide” cuff, and prepare to remove if necessary. Single cuff feels ~1cm, double feels ~2cm wide.

- Scrub hands. Gown and glove.
- Clean skin area from cuff site outwards. Clean external catheter, exit site, catheter clamps and caps. Drape - 1 under catheter, 1 covering neck, face – have pt turn head away – they may remove mask at this point.
- Ensure catheter lumens are clamped.
- Insert needle with empty 10 cc syringe into rubber port on cap. Open clamp on that lumen and draw back ~5 mL of citrate (heparin) and blood. (This removes the citrate/heparin and allows lumen to fill with blood in case of accidental puncture of catheter during freezing).
- Clamp lumen and withdraw needle.
- Repeat with other lumen. Set blood filled syringe aside for disposal.
- Fill other 10cc syringe with 10mL Xylocaine then change to small 25g needle for freezing.
- Re-landmark cuff. Freeze skin superficially over cuff, aspirating each time before injecting xylocaine. Freeze superficially either side of cuff. Change angle on needle to 90^{o} and enter to the side of the cuff and inject deeper and under the cuff, aspirating each time. Repeat on other side of cuff. Should use adequate freezing, about 8 mL total.
- Prepare tray while allowing freezing to “take.”
- Prepare scalpel blade on handle. Prepare suture. Set aside for use 2 curved forceps/hemostats, 2 probes (L shaped hooks), 1 pair scissors, scalpel, thumb forceps.
- Check that area is well anaesthetized.

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

- 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.
- 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 anesthesia wears off.
- Document procedure, blood loss, instructions to pt.

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

- Stretch skin and make 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 through 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 anesthesia wears off.
- Document procedure, blood loss, instructions to pt.

Management of Bleeding from HD catheter

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

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

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

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

Amoxicillin 2.0 g po 1 hour pre procedure

Or

Ampicillin 2.0 g IM or IV 30 mins pre procedure

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

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

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

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

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

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

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

Poisonings and Intoxications Requiring Dialysis
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

IV Ethanol

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

- Begin with IV bolus of 0.5 gm ethanol/ Kg
- 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. To be used instead of Ethanol to inhibit alcohol dehydrogenase, thus NO Ethanol to be added to the dialysate or given IV if Fomepizole used.

Dosing of Fomepizole:
Loading: Initial dose is 15 mg/kg IV
Maintenance: After initial IV loading dose, give 10 mg/kg IV every 12 hours until dialysis is started.

Dosing Regimen during Hemodialysis:

Dose at the Beginning of Hemodialysis:

•If less than 6 hours since last dose of fomepizole: Do Not Dose

•If equal to or greater than 6 hours since last dose of fomepizole: Administer next scheduled dose (i.e.10 mg/kg IV)*

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

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

<u>Hemodialysis</u>

- Hemodialysis indicated for serum methanol levels > 10 mmol/L, or even at lower levels if anion gap metabolic acidosis is present.
- Insert 2 catheters – in separate venous sites, order Xenium 210 dialyzer and dialyze at Qb of 300 or more
- DO NOT use Heparin for Methanol Intoxication (reports of brain hemorrhages from methanol), order “Bioflow” if available or use frequent normal saline flushes.

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” if available or frequent normal saline flushes.
- Order appropriate K dialysate (usually 3K if patient not in kidney 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 the same as methanol intoxication, i.e. ethanol + dialysis.

Lithium

- Lithium is well dialyzed
- Hemodialysis for 8-12 hours
  Indications: Li level > 3.5 mEq/L
  Li level >2.5 mEq/L if symptomatic or kidney failure
  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

- <u>Hemodialysis</u>
  Indications: Salicylate level > 7 mmol/L
  Seizures/coma
  Severe metabolic acidosis, especially with kidney failure
  Non-cardiogenic pulmonary edema
  Especially if elderly, smoker, acute on chronic ingestion

Poison Control Telephone Number: (416) 813-5900

Hyperammonemia in ICU

ICU Protocol relevant to lung transplant (LTx) patients:

1. Measure ammonia in every LTx patient on any admission to the ICU routinely for 14 days on the transplant admission or any readmission to ICU during the transplant admission

2. After 14 days, measure ammonia in every LTx patient requiring prolonged sedation (every day till the patient is awake and alert)

3. Measure ammonia in every LTx patient with altered LOC

4. If ammonia >72 mmol/L (normal range 18-72 mmol/L; critical level >100 mmol/L)

- Contact ICU attending - ICU attending calls staff nephrologist for **URGENT HEMODIALYSIS** initiation (hyperammonemia is treated as an **INTOXICATION WITH IHD MANAGEMENT**)
- Repeat ammonia level
- Send blood cultures and consider BAL
- Start empiric IV Abx (moxifloxacin 400mg/day, and doxycycline 100 mg q12h)
- Monitor neuro-vitals q1h
- Contact LTx team
- Contact Transplant ID (cultures for Mycoplasma Hominis, Ureaplasma urealyticum and Ureaplasma parvum)
- Monitor ammonia level q12h until normalized, then q24h for 3 days, and then as per protocol
- IHD management is re-assessed after 2 hemodialysis treatments.

References:

AKF Nephrology Letter 10:1-20, 1993

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

Hepatitis B Immunization Vaccine

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

Vaccination is recommended for patients before they start hemodialysis program **or** as soon as possible after starting on the program. All vaccination for patients will be done using Engerix-B (SKF) hepatitis B vaccine (recombinant) with dosage schedule (Recombivax vaccination can also be used but is currently on backorder). Physicians and or nurses must do teaching about the immunization program. Verbal consent from the patient should be obtained by the physician or NP and documented before writing

the vaccination order. Vaccination then requires a written order stating: “Engerix-B Hepatitis B vaccination protocol.” This one order will be sufficient to cover all 4 injections in the dosage schedule and related blood sampling. It also allows for the booster dose and blood sampling if the patient does not convert (i.e. develop antibodies) after the initial 4 injections.

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

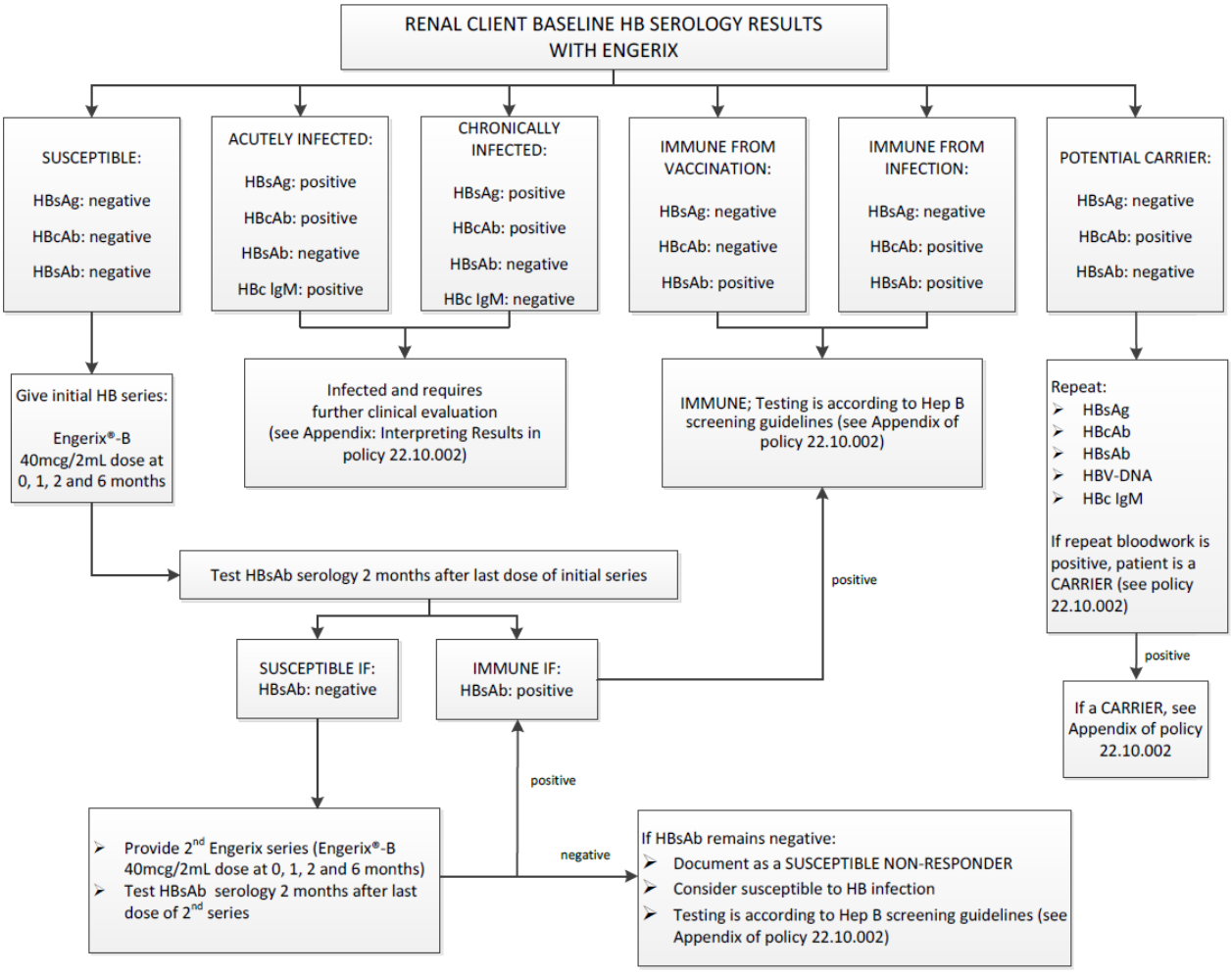
- Patients who are pregnant or suffering from severe febrile infections with temperature > 38C or contagious disease, or
- Hypersensitivity to vaccine components (yeast, aluminum, thimerosal)
- Undergoing chemotherapy
- Active bone marrow/organ transplant
- Conditions leading to decreased immunogenicity
- Other severe immunosuppressing conditions

The resumption of postponed or delayed vaccine will be ordered by an authorized physician or NP after recovery from above conditions or failed kidney transplant. The dosage and schedule will be defined by physician at time of resumption of order.

In a lifetime a patient can only get 2 series of the Engerix vaccination and 1 booster.

Algorithm for Hepatitis B vaccination in hemodialysis is provided below:

Hepatitis B Baseline Serology Results



Peritoneal Dialysis

Home Peritoneal Dialysis Unit (HPDU)

12ES, ext. 14-5672

Open Monday to Friday 0800 to 1600.

After hours call RN (Mon-Fri 1600-2300), pager (416) 715-1326 or through locating 14-3155.

For PD training, clinics and out pt PD issues.

Ordering Peritoneal Dialysis

- Use orders as appropriate to the type of PD (see Peritoneal Dialysis Prescriptions section)
- TGH, PMH, MSH: For ER or inpatients, call TGH 6A ext. 14-4487 or pager (416) 715-9232 to notify PD nurse that the patient will need PD.
- Acute cycler dialysis may be done at TGH emergency department for fluid volume overload, hyperkalemia or any situation requiring frequent PD exchanges. Cycler and CAPD available.
- TWH: for ER or In Patients, discuss with the nurse manager/charge nurse on 8BF 13-5167 ALL patients starting PD must have Hgb, Cr, Urea, bicarbonate, Ca++, PO_4, albumin, PTH done PRIOR to first dialysis. (Ontario Renal Reporting System guideline)

Medical Coverage

Monday to Friday Daytime

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

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

After Hours and Statutory Holidays

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

Responsibilities of the Nephrology Trainee

HPDU

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

days by the PD nephrology trainee while in training or more often as assessed by the triaging nurse. Patients scheduled for training require orders.

Unit Routines

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

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

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

Writing Orders

All updates done in EPIC. A progress note should be written whenever there is any new prescription or significant intercurrent illness.

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 Connectology

Peritoneal Dialysis Transfer Set

PD delivery systems with a Luer-lock transfer set (Baxter) and stay-safe connectology (Fresenius) are not compatible. Whenever a PD patient using the Fresenius PD delivery system is admitted to the Emergency Department (ED), inpatient floors, or the Transplant Day Unit, temporary conversion to the Baxter PD delivery system is required. If the patient with a converted Fresenius-to-Baxter PD catheter is discharged or transferred to a facility that does not use the Baxter system, the patient must be converted back to Fresenius and PIN technology must be applied to the extension set and capped with a stay-safe disinfection cap. This is done by the PD nurses. PD nurses changes this transfer set/catheter adaptor approximately every six months.

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 Harmony Cycler® is the Fresenius cycler that delivers Balance® solution.

At UHN, most 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.

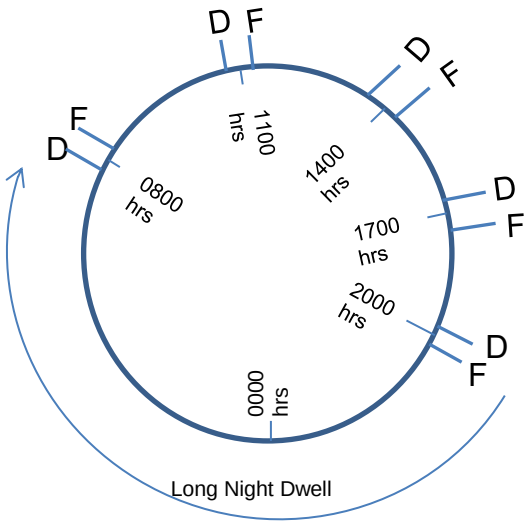
Peritoneal Dialysis Prescriptions

Please see the Primer on Renal Replacement Therapy section for more information about peritoneal dialysis.

For all PD prescriptions, volume and 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 for UHN patients are available from HPDU 12 ES (ext. 14-5672) daily from 0800 to 1545.

Continuous Ambulatory Peritoneal Dialysis (CAPD)

- 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.



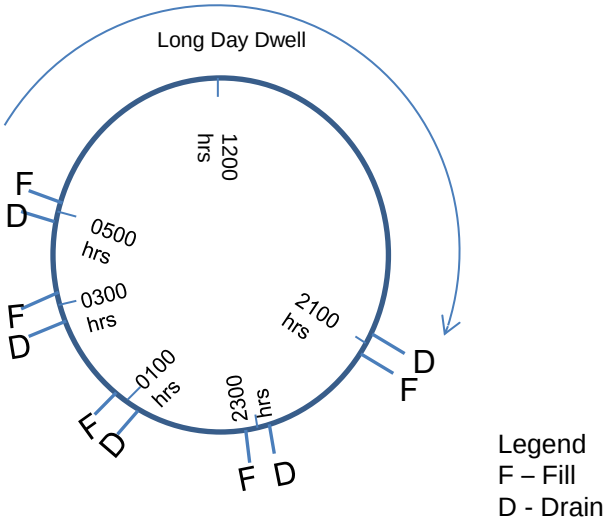
Legend
F – Fill
D - Drain

Sample Prescription of CAPD:

CAPD: 4 exchanges of 2 L each of 2.5%, Target weight 68.0 kg (full)

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

- 3 – 5 exchanges/ night with long day dwell. Exchanges are delivered overnight utilizing a machine with last fill exchange of 500 mLs to 2,500 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.
- E-CCPD is similar to CCPD except the patient does a daytime 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).



<u>Sample Prescription CCPD</u>
Therapy: CCP/IPD
Total volume: 10,000 mLs (2000x4+2000)
Total time: 9 hours
Fill volume for Overnight Exchanges: 2000 mLs
Overnight Exchanges: 4
Last fill: 2000 mLs
Target weight: 70 kg (full)

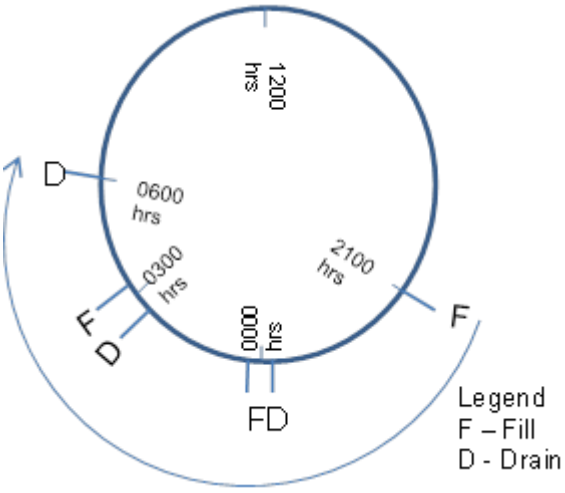
machine will determine dwell time
Exchanges/Cycles must be ordered

Sample Prescription CCPD
Therapy: CCP/IPD
Total volume: 10,000 mLs (2000x4+2000)
Total time: 9 hours
Fill volume for Overnight Exchanges: 2000 mLs
Overnight Exchanges: 4
Last fill: 2000 mLs
Target weight: 70 kg (full)

CAPD manual exchange 2000 mLs mid-day

Nocturnal Intermittent Peritoneal Dialysis (NIPD)

- 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 subcutaneous 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
Therapy CCP/IPD
Total volume: 10,000 mLs (2000x4)
Total time: 9 hours
Fill volume for Overnight Exchanges: 2000 mLs
Overnight Exchanges: 4
Last fill: None
Target weight: 70 kg (full)

Intermittent Peritoneal Dialysis (IPD) for Early Start PD

- Delivered over 8-10 hours.
- Used post-op PD catheter implantation and post hernia repair.
- 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.
- Used for early start strict supine IPD (when using PD catheter prior to 2–3-week break-in period post-insertion).

Sample Prescription CCPD
Therapy: CCP/IPD
Total volume: 4000(1000x4)
Total time: 8 hours
Fill volume for Overnight Exchanges: 1000 mLs
Overnight Exchanges: 4
Last fill: 0ml
Target weight: 70 kg (full)

Tidal Volume

Total UF is the amount of UF volume given to the machine to avoid discomfort during draining by tapping into the tidal reserve. However, this is not the goal UF for the therapy. Total ultrafiltration for the therapy will be available at the end of the therapy. For instance, if 100ml is the total UF inputted into the machine and there are 4 therapy exchanges, the machine will only drain 25ml of the UF during each cycle while the remaining amount of UF will stay in the peritoneal cavity. The machine will drain both the UF and the tidal reserve at the end of the complete drain.

The total UF needs to be assessed regularly. Although you are technically running a tidal program, you may not have a tidal reserve if your total UF is set too high. Conversely, if you set it too low, and the patient has a large UF each night, you run the risk of overfill.

Tidal Volume Calculation Explanation for Tidal Therapy

Total Volume Calculation Explanation for Tidal Therapy

Tidal Prescription: CCPD 2L fill volume at 80 % Tidal x 4 exchanges of 1.5% Last FILL of 2L of Icodextrin (complete drain q3)

Total UF for APD machine- 100ml

	Patient is connected to a machine		Initial Drain → machine drains the patient at the beginning of the therapy
1st Exchange:			
	Patient is filled with 2000ml		At the end of the first exchange, the machine drains 1600ml (80% of 2L) + amount of UF(25ml) for each cycle from the total UF and leaves 400ml + remaining UF in the peritoneal cavity as a cushion to prevent dry pain
2nd Exchange:			
	Patient is filled with 1600 ml as the patient has 400 ml already in the peritoneal cavity to obtain a fill volume of 2000 ml		At the end of the second exchange, the machine drains 1600ml + amount of UF for each cycle(25ml) from the total UF and leaves 400ml + remaining UF
3rd Exchange			
	Patient is filled with 1600 ml as the patient has 400 ml already in the peritoneal cavity to obtain a fill volume of 2000ml		At the end of the third exchange, the machine drains 1600ml + amount of UF for each cycle(25ml) from the total UF and leaves 400ml + remaining UF
4th Exchange			
	Patient is filled with 2000ml as the patient is completely drained at the end of third exchange		At the end of the fifth exchange, the machine drains the patient completely
Last Fill			
	Peritoneal cavity is completely empty and Patient is filled with last fill volume of 2000ml	 à	At the end of the therapy patient will have 2000 ml in the peritoneal cavity

Total Volume: 2000+ 1600+ 1600+ 1600+ 2000=8800

1st exchange	2nd exchange	3rd exchange	4th exchange	Last fill
↑ 2000	↑1600	↑1600	↑1600	↑ 1500

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 **ultrafiltration (UF)** = 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). For sample prescription below 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.

Sample Prescription CCPD
Program: Tidal 80%
Tidal Volume : 1600 (80% 0f 2000ml)
Total volume: 8800 (2000+1600x3)+2000
Total time: 9 hours
Fill volume for Overnight Exchanges: 2000 mLs
Overnight Exchanges: 4
Last fill: 2000ml
Total UF= 100ml using 1.5%
Target weight: 70 kg (full)

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. The exception is post parathyroidectomy in which patients **should use** standard Ca+ bags. PD101 solutions can be ordered but may take 1-2 days to be delivered to the unit. During the interim, consider dialyzing with PD4 solutions and increasing the patient's oral Ca+ intake.
    - Note: 7.5% PD solution is only available in standard calcium concentration.

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

Specialty Solutions

- **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® 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.

- **Inpatients/Patients physically in HPDU**

For pts < 60 kg: cefazolin 1 g IP for 6-hour dwell x 1 dose.

For pts ≥ 60 kg: cefazolin 1.5 g IP for 6-hour dwell x 1 dose.

If **allergic** to cefazolin, use vancomycin 1.5 g IP for 6-hour dwell x 1 dose.

- **Outpatients**

Cephalexin 500 mg PO BID x 3 days.

If **allergic** to cephalexin, use clindamycin 300 mg PO QID x 3 days.

Dry Contamination

- Dry contamination is defined as a clamped system with no risk of bacterial entry into the peritoneal cavity. This can occur when the clamp is closed on the transfer set but the end of the transfer set is touched. The minicap should be replaced for at least five minutes prior to continuing with the procedure.
- Antibiotics are not required.
- Reference: HPDU Patient Manual

Heparin

- Intraperitoneal heparin is administered to minimize the risk of fibrin formation in the peritoneal cavity thereby maintaining catheter patency. A need for heparin may be indicated by the presence of fibrin in the bags or slow drainage.

- Heparin is also added to dialysate as part of the peritonitis protocol to prevent fibrin formation related to the inflammatory process.
- Used in each exchange until the effluent is clear.
- For ALL indications (including peritonitis), the standard dose is 500 units per L of dialysate.
- This order is prebuilt in the PD Therapy Plan in EPIC and typically requires NO modifications (unless a non-standard dose is intentionally desired).

Sodium Bicarbonate

- May be used for infusion pain (not drain pain)
- NOTE: sometimes infusion pain is related to the low PH of the conventional dialysis solution. A trial of pH neutral PD solution may be warranted. Otherwise, sodium bicarbonate can be considered
- Standard Dose: NaHCO3 8.4% (1 mEq/mL) add 5 mL per L of dialysate
- Add to dialysis solution and use immediately after preparation
- A pre-built order is available in the PD Therapy Plan

Lidocaine (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.
- NOTE: Pain-related to PD is best treated with Tidal therapy/PH balanced PD solution (Physioneal). If Tidal therapy/PH balanced solution fails, consideration can be given to intraperitoneal lidocaine.
- Indication must be reevaluated if the pain does not improve with lidocaine.
- Rarely, lidocaine may also be used for severe pain related to peritonitis. (check with pharmacist regarding compatibility with antibiotics if required)
- Suggested dose: 2.5 mL of 1% lidocaine per L dialysate.
- Add to dialysis solution and use immediately after preparation
- A pre-built order is available in the PD Therapy Plan

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.

- Although experience is somewhat limited, results achieved for both obstruction and peritonitis have been fair.
- Please see the Policy “Clearing Occluded Peritoneal Dialysis Catheter - Instilling alteplase (rt-PA) {CATHFLO ®} to unblock PD catheter” for details.
- A pre-built order is available in the PD Therapy Plan

Peritoneal Catheter Insertion - 3 options (laparoscopic, bedside, interventional radiology) UHN PD catheter of choice - Swan Neck, double cuffed coiled PD catheters

The PD catheter access coordinator, Zita Abreu, zita.abreu@uhn.ca ext. 14-2358 to be contacted whenever a PD catheter needs to be inserted by any of the three methods of insertion and for catheter removal or manipulation.

1. **Laparoscopic PD Catheter Insertions**

Abdominal, upper abdominal & pre-sternal options are available at UHN.

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

Dr. Penner performs laparoscopic PD catheter insertions, removals, manipulations with the ability to perform adhesion lysis, omentopexy as well as repair known hernias at time of PD catheter insertion. Dr. Penner performs surgery at Toronto Western hospital only.

TWH Surgical location: POCU 2nd floor of the Main Pavilion, Rm 116 (13-2111)

2. **Bedside PD Catheter Insertions**

Dr. Tushar Malavade Tushar.Malavade@uhn.ca

Dr. Malavade performs bedside percutaneous PD catheter insertions on a case-by-case basis.

3. **Interventional Radiology PD Catheter Insertions**

Dr. Ganesan Annamalai Ganesan.Annamalai@uhn.ca

Dr. Annamalai performs PD catheters insertions at TGH medical imaging department (1st floor Peter Munk building) and at TWH interventional radiology (3rd floor East wing)

on a case-by-case basis for patients with simple previous abdominal surgeries and BMI above normal levels. Dr. Annamalai will also remove PD catheters on a case-by-case basis.

Pre – insertion (laparoscopic insertion)

- Anesthesia consult.
- Endocrine consult if insulin dependent diabetic.
- Hold PO iron, calcium carbonate x 5 days.
- Hold ASA, anti-coagulants (if anticoagulation is essential, please manage with admitting service – e.g. heparin IV)
    - INR target <1.5
- 1 L Peglyte each day x 2 days pre-op
- NPO after Midnight
- Pre-op blood work – CBC, urea, creat, lytes, PT, PTT, INR, Group & screen.
- ECG with cardiac history
- Good wash the night before procedure

Pre – insertion (IR & bedside insertion)

- Hold PO iron, calcium carbonate x 5 days.
- Hold ASA, anti-coagulants (if anticoagulation is essential, please manage with admitting service – e.g. heparin IV)
    - INR target <1.5
- 1 L Peglyte each day x 2 days pre-op
- NPO after Midnight
- Pre-insertion blood work – CBC, urea, creat, lytes, PT, PTT, INR.
- Insert Foley catheter prior to procedure if patient is admitted in hospital
- Good wash the night before procedure

Post- insertion

Peglyte 500 mL everyday x 2 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.

Outpatients: PD catheters are not normally flushed post-op but are flushed weekly for 3 weeks in the home PD unit until PD training starts. Flushes and PD training is arranged by Zita.

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

If a pt urgently requires dialysis, **STRICT SUPINE** IPD may be started with small volume exchanges of 750 – 1000 mL, and then volume gradually increased over a 2-3week period to 1.5-2 L.

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.

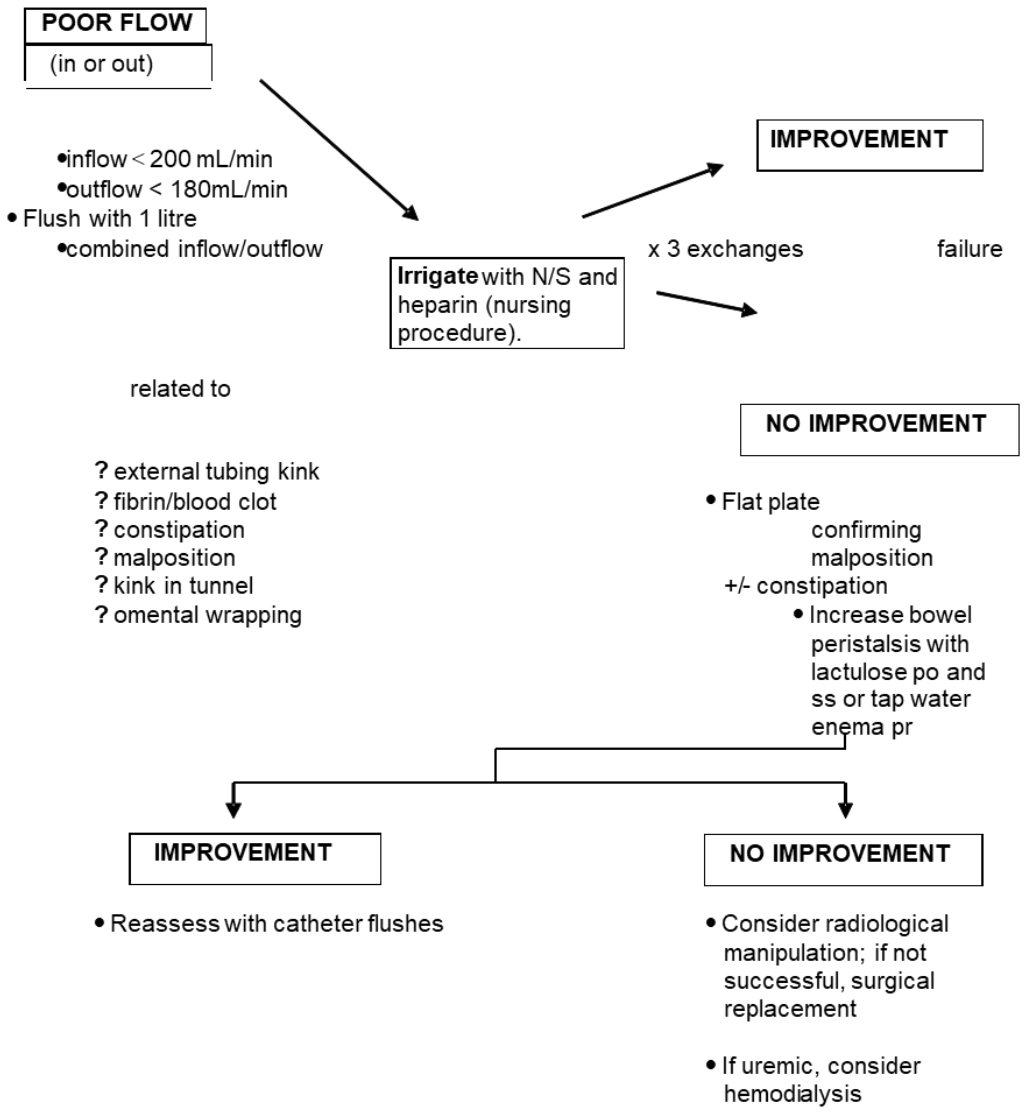
Urgent PD Catheter Removals

- For in-patients who need "urgent" catheter removals, call general surgery on call.

NOTE: If wait for OR is long, IR can be consulted on a case-by-case basis for urgent removal

- Non-urgent catheter removals may be booked through Zita ext. 14-2358
- **NOTE:** If a patient receives a bedside PD catheter insertion, Dr. Malavade can remove the PD catheter at the bedside.

Post- Op Catheter Complications



Management of PD Leaks

Exit Site Leak
These may occur during the first weeks following catheter implantation. For patients at risk for exit site leak post op (i.e. immunosuppressed, diabetic, frail, obese or very thin), PD should be avoided. If the patient requires dialysis, small volume IPD (750 mL) should be administered cautiously. Staff should ensure the patient is completely empty at the conclusion of the flushes or IPD session. If leak does occur, Home PD should be delayed a further 2 to 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 identify the leak location. 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 >100 cells/μL or >50% neutrophils with or without positive cultures in addition to the above symptoms is diagnostic for PD peritonitis. Patients are instructed to bring in the first cloudy bag. If not possible, drained dialysate from patient is sent for C&S, Gram stain, and cell count with differential.

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

Initial Assessment

Clinical examination of abdomen for s/s of peritonitis and PD catheter exit site/tunnel; send exit site swab for C&S if drainage present.
For ER or admitted patients, contact PD Nurse on call (pager (416)715-9232). Enter order for specimen collection for C&S and count and write orders for bag change procedure to follow specimen collection and required medications, see management of peritonitis.

Send first dialysate effluent for C&S and gram stain and cell count with differential. If patient does not have indwelling effluent (IPD or NIPD) order to be filled with min 1L and allow to dwell for minimum 2 hrs before sending sample.

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

Blood for CBC, diff, lytes, Cr, urea, Ca, PO_4, albumin, total protein for In-pts or ER pts. **Start empiric antibiotic therapy immediately. Do not wait for next scheduled PD exchange.**

EPIC NOTE: Empiric protocol is currently built as a Therapy Plan (**Z-Peritoneal Dialysis antibiotics and periprocedural prophylaxis mini–Therapy Plan)** This should be used to order intraperitoneal antibiotics for inpatients at this time (as of June 2023).

This mini–Therapy Plan will soon be converted into 4 separate ORDER SETS:
1. Peritoneal Dialysis Peritonitis Treatment – Inpatient and Outpatient versions
2. Peritoneal Dialysis Peritonitis Prophylaxis – Inpatient and Outpatient versions
Once live in EPIC (aprox early 2024) the ORDER SETS should be used instead.

<u>Empiric Antibiotic Therapy for Peritonitis</u>
(updated version below not yet live in EPIC; Continue to use the "*Z-Peritoneal Dialysis antibiotics and periprocedural prophylaxis mini Therapy Plan*" until order sets are live in early 2024)

IF PATIENT HAS < 100 mL/day URINE

If weight < 60 Kg, Cefazolin 1 g in 1 exchange/day <u>plus</u> Tobramycin 0.6 mg/kg in 1 exchange/day <u>plus</u> Heparin 500 units/L in EACH exchange. Use heparin until effluent clear.

If weight <u>≥</u> 60 Kg, Cefazolin 1.5 g in 1 exchange/day <u>plus</u> Tobramycin 0.6 mg/kg in 1 exchange/day <u>plus</u> Heparin 500 units/L in EACH exchange. Use heparin until effluent clear.

IF PATIENT HAS > 100 mL/day URINE

If weight < 60 Kg, Cefazolin 1 g in 1 exchange/day <u>plus</u> Ceftazidime 1.5 g in 1 exchange/day <u>plus</u> Heparin 500 units/L in EACH exchange. Use heparin until effluent clear.

If weight <u>≥</u> 60 Kg, Cefazolin 1.5 g in 1 exchange/day <u>plus</u> Ceftazidime 1.5 g in 1 exchange/day <u>plus</u> Heparin 500 units/L in EACH exchange. Use heparin until effluent clear.

If *allergic to ceftazidime,* give Tobramycin according to dosing above. Check tobramycin trough level immediately prior to 3rd dose.

If *allergic to cefazolin,* give vancomycin as follows:

If weight < 60 kg, Vancomycin 1.5 g in 1 exchange q 3-7 days (based on serum levels/residual renal function)

If weight ≥ 60 kg, Vancomycin 2 g in 1 exchange q 3-7 days (based on serum levels/residual renal function)

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 days into therapy to ensure the frequency ordered is adequate. Redose vancomycin when the level is 15-20.

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 q3-7 days according to serum levels/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.

Follow-Up

- Order effluent for daily cell count until cell count ≤100 for 3 samples (2x/week for outpatients).
- C&S q 2 days until total of 3 “no growths” (2x/week for outpatients)
- Send full bag to CORE lab.
- Hold calcium and iron supplements if peritonitis is severe (due to constipation)
- PD peritonitis can be very painful, order appropriate analgesia.
- Ongoing antibiotic treatment should be guided by antibiotic sensitivity of the causative organism
- For targeted treatment and duration based on organism, please refer to:

- ISPD peritonitis guideline recommendations: 2022 update on prevention and treatment - PubMed (nih.gov)
- Oral Therapy should NOT be used for initial therapy.
    - May be considered for targeted therapy in some circumstances based on culture and sensitivity (See ISPD guidelines)
    - When oral antibiotics are given, consider holding all phosphate binders and iron supplements.

- Stable patients may be discharged and continue therapy at home via home care. Must submit RM&R Referral and prescription. Inform HPDU to arrange for appropriate outpatient follow-up.

FOR ALL PATIENTS: Order Nystatin 100,000 u/mL, 5 mL PO QID swallow for duration of peritonitis treatment, as prophylaxis against fungal peritonitis. Continue for 1-week post antibiotics.

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

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 or holding of PD for 24-48 hours, 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.
- If fungal/yeast peritonitis, catheter to be removed ASAP, start pt on antifungal treatment and switched to HD for at least 8 weeks.
- For in-patients who need "urgent" catheter removals, call general surgery on call (if called on Friday will most likely be removed on Saturday). Advise Zita ext. 14-2358

- Notify HD unit and arrange U/C line for hemodialysis through Vascular Access Co-ordinator or Angio.
- If UF failure with peritonitis (weight gain/ECFV overload), alter regimen (i.e. shorten dwells, hypertonic bags, Icodextrin/Extraneal™ more frequent exchanges, IPD).

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

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 include 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 (injectable vial, taken orally) at UHN Pharmacies. Hydration is recommended 12 hr. prior to, during, and 12 hr. post procedure (0.45% saline 1mL/kg/h).
- Patient should be instructed to arrive drained ("empty") for angiogram, and CAPD exchanges to resume ASAP after procedure.

Cholangiogram

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

Colonoscopy

Bowel prep is required for colonoscopy.

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

Antibiotic prophylaxis is necessary:

1. Amoxicillin 2 g PO 1 hour before the procedure
   If allergic to Penicillin: vancomycin 1.5 g IP in night bag/long dwell prior to procedure
   AND
2. Tobramycin 120 mg IP in night bag/long dwell prior to procedure*
   If unable to provide tobramycin IP the evening prior, replace with ciprofloxacin 500 mg PO 1 hour pre procedure.
   AND
3. Metronidazole 500 mg po 1hour pre procedure and 500 mg po 12 hours post procedure.

* Vancomycin and tobramycin are compatible together in Dianeal® (compatibility in other solutions unknown)

Patient should be drained ("empty") prior to procedure.
Note: For polyp removal and bowel biopsy, consideration must be given to leave patient empty for 24 hours

Sigmoidoscopy/Proctoscopy
Antibiotic prophylaxis is not necessary for sigmoidoscopy or proctoscopy.

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

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

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

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

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

Cystoscopy
- Prophylactic antibiotics NOT required from PD perspective
- IF antibiotics are prescribed by Urology post procedure to prevent urinary tract infection, the following options are suggested:
    - Ciprofloxacin 500 mg PO once daily OR
    - sulfamethoxazole/trimethoprim 800/160 mg (Septra 1 DS tab) PO once daily*
    - Nitrofurantoin (MacroBID) is CONTRAINDICATED in PD patients.
    - Duration per Urology*

*Use sulfamethoxazole/trimethoprim with caution/limit duration due to risk of side effects such as hyperkalemia.

Patient should be drained (“empty”) prior to procedure

Dental Procedures
Prophylaxis is required for procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa.

Prophylaxis NOT required for: routine cavity filling, routine anesthetic injections through noninfected tissue, dental radiographs, placement of removable prosthodontic or orthodontic appliances, adjustment of orthodontic appliances, placement of orthodontic brackets, shedding of deciduous teeth and bleeding from trauma to the lips or oral mucosa

- Amoxicllin 2 g PO 1 hour pre procedure **OR** Ampicillin 2 g IM or IV 30 minutes pre procedure
- If allergic to Penicillin:
  Cephalexin 2 g PO 1 hour pre procedure*
  OR Azithromycin 500 mg PO 1 hour pre procedure
  OR doxycycline 100 mg PO 1 hour pre procedure

* Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticaria with penicillin

Transthoracic Echocardiogram
No preparation is required

Transesophageal Echocardiogram
- Amoxicillin 2 g PO 1-hour pre procedure
- If allergic to Penicillin: refer to alternatives listed in Dental Prophylaxis section above.

Patient should be drained (“empty”) prior to procedure

ECT (Electroconvulsive Therapy)
Patient should be drained (“empty”) prior to procedure

ERCP (Endoscopic Retrograde Cholangio Pancreatography)
- Amoxicillin 2 g PO 1-hour pre procedure
- If allergic to Penicillin: refer to alternatives listed in Dental Prophylaxis section above.

Patient should be drained (“empty”) prior to procedure

Bronchoscopy

- Amoxicillin 2 g PO 1-hour pre procedure
- If allergic to Penicillin: refer to alternatives listed in Dental Prophylaxis section above.

Patient should be drained (“empty”) prior to procedure

Gastroscopy/Upper GI

- Amoxicillin 2 g PO 1-hour pre procedure
- If allergic to Penicillin: refer to alternatives listed in Dental Prophylaxis section above.

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 PO 1-hour pre procedure.
  If allergic to Penicillin: Clarithromycin* 500 mg PO 1 hour pre-procedure.
  **Check and avoid if drug interactions. For example, calcium channel blockers such as amlodipine*
  AND
- Metronidazole 500 mg 1 hour pre procedure and 500mg 12 hours post procedure.

Patient should be drained (“empty”) prior to procedure

Iliac Dopplers

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

Percutaneous Liver biopsy

- Cefazolin 1 g IP or IV pre procedure.
- If Allergic to cefazolin: vancomycin 1.5 g IP pre procedure

Patient should be drained (“empty”) prior to procedure 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.

References

Toronto Central LHIN: Guidelines for Empiric Treatment of Urinary Tract Infection in Adults https://www.antimicrobialstewardship.com/uti

Trimethoprim/sulfamethoxazole (TMP/SMX) Summary from SHS + UHN Antimicrobial Stewardship Program https://www.antimicrobialstewardship.com/antimicrobials

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Devlin, T. Canadian Association of Gastroenterology Practice Guidelines: Antibiotic prophylaxis for gastrointestinal endoscopy Can J Gastroenterol 1999. Vol 13 No 10

Prevention of Infection after Gynecologic Procedures. ACOG Practice Bulletin No. 195. American College of Obstetricians and Gynecologists. Obstet Gynecol 2018; 131: e172-89

De Vin F, Rutherford P and Faict D. Intraperitoneal Administration of Drugs in Peritoneal Dialysis Patients: A Review of Compatibilty and Guidance for Clinic Use. Peritoneal Dialysis International 2009, Vol. 29, pp. 5–15

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

Other Peritoneal Dialysis Issues

Hemoperitoneum

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

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

Assessment of Peritoneal Dialysis Prescription

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

Peritoneal Equilibration Test (PET)

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

To perform “Fast PET”:

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

- At 4 hours, drain completely and record drain time. Send complete effluent for Cr, Urea, Glucose and Volume.

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

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

PD Exit Site Infection (ESI)

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

Kidney Biopsy

Elective Kidney Biopsy

Before the procedure:

- Discontinue all anti-platelet medication (e.g. ASA, other NSAIDs, clopidrogrel, ticagrelor) 5 days prior to the start of the procedure and restart previous dose once post-procedure hemostasis has been obtain.
    - Consult appropriate services (e.g. cardiology, vascular surgery) before holding anti-platelet medications in patients with drug-eluting or bare metal stents inserted in the past 12 months
- For patients on anticoagulant medications (e.g. warfarin), consult hematology for discussion of bridging anticoagulant in patient with: mechanical valve, atrial fibrillation with prior neurological event, recent (less than three months) venous thromboembolism, intracardiac thrombus, antiphospholipid syndrome
- Hold Warfarin 5 days prior to the start of procedure and restart previous dose once post-procedure hemostasis has been obtain.
- Use Renal Biopsy standing order form for pre & post biopsy orders. (Check EPIC)
- Call Electron Microscopy at ext. 14-3184 and biopsy room at ext. 14-8257 to inform them of biopsy for in-patients.
- Carry out patient admission, note patient's BP (BP should be <160/95 or biopsy may not proceed), examine patient's urine microscopically and identify reasons for biopsy (diagnostic, prognostic or therapeutic).
    - Instruct patients to take antihypertensives even if they are NPO with a sip of water the morning of the procedure.
- Follow instructions on biopsy standing order sheet.
- Patient to be NPO prior to procedure.
- Ensure PT/INR are within (N) range (INR<1.5). If elevated, consider administration of FFP's. Platelets >50.
- If pt uremic, Cr > 150 umol/L chronically, order DDAVP 20 ug in 100 mL N/S IV over 20 min.
- Consult hematology for any unexplained coagulopathy.
- **The biopsy radiologist will cancel the biopsy if appropriate measures to document and correct a coagulopathy are not undertaken.**
- Make sure the post biopsy standing order sheet is in the chart.
- Informed consent is obtained by the radiologist just prior to the biopsy.

- If pt does not speak English, arrange for a family member or hospital interpreter to translate. If no one can translate, consent cannot be obtained and **the biopsy will be cancelled.**
- Enter the procedure into the Electronic Patient Record (EPR) computer system as follows:
- Order entry in EPIC. If there are any problems, call biopsy room at ext. 14-8257.
- Sedatives should **not** be ordered routinely before a biopsy as pt cooperation is required and excessive sedation can make the procedure impossible to do.
- If it is necessary to use sedation, discuss with biopsy interventionist so that consent can be obtained well in advance.
- The following information is provided to assist in informing the patient:
- A biopsy is “low risk” if kidney size is normal, BP is well controlled, platelet count, PT, PTT & INR are normal and the serum Cr is < 150.
- In these circumstances, the only tangible risk is that of bleeding.
- At our institution, the following are the risk estimates:
  - The incidence of gross hematuria is approximately 5-10%,
  - The incidence of significant bleeding sufficient to delay discharge is approximately 1:100. This refers to persistent hematuria, or perinephric hematoma, which usually settles with conservative management.
  - A transfusion is occasionally necessary.
  - Serious bleeding complications sufficient to warrant interventions to stop bleeding are of the order of 1:1000.
  - Kidney biopsy can be life threatening in 1:5,000 – 1:10,000.

Post Biopsy:

- Patients are monitored closely for complications, usually apparent in the first few hours.
- The patient is on bed rest for 12-24 hours if admitted. Usually discharged home next morning.
- Vital signs are done frequently and urine is observed for gross hematuria.
- If a complication occurs, notify the biopsy radiologist.
- Most complications are managed expectantly. For a serious complication, consult urology, and/or interventional radiology if consideration of an ablative procedure is warranted.
- If the patient is stable the next morning, they are discharged and an appointment for follow up should be made with the referring staff nephrologist in ~ 2 weeks’

time to discuss diagnosis and prescription. Advise pt to carry out light activities only for 48 hours post discharge. No heavy lifting or strenuous exercise for 2 weeks. It takes ~ 6 weeks to heal completely, after the first 2 weeks; they can carry out routine activity and moderate exercise.

- Prepare pts case for presentation at biopsy rounds, focusing on indications for the biopsy.

Emergency and Transplant Biopsies:

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

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 be 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.

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

Kidney transplant service workflow

0800-0830	Morning Huddle to discuss overnight events/admissions, assign, sign into patients • Mon, Tues: MaRS room 9006 • Wed: MaRS room 9002 • Thurs: MaRS room 9119 • Fri: MaRS rooms variable
0830-1040	Patient management
1040-1100	Daily Interdisciplinary Rounds (IDR) in 7AB Bubble Room (Room 116)
1100-1500	Inpatient rounds with the attending physician • Times and locations variable
1500-1700	Complete notes, new admissions/consults, etc.
1800	Second-call hands off to MOT on-call, PA, Nocturnist

Weekly meetings

Monday	Tuesday	Wednesday	Thursday	Friday
0800-0830 Inpatient Kidney Transplant Morning Huddle Mon,Tues: 9006 / Wed: 9002 / Thurs, Fri: 9119				
	0800-0900 Inpatient Sit-Down Rounds (MaRS 9006) **Link to join**	**0800-0900** ATC Grand Rounds (MaRS 9006)		**0830-0930** Renal Rounds **Link to join** Password: UHN
1040-1100 Interdisciplinary Rounds (7MB 116)	**1040-1100** Interdisciplinary Rounds (7MB 116)	**1040-1100** Interdisciplinary Rounds (7MB 116)	**1040-1100** Interdisciplinary Rounds (7MB 116)	**1040-1100** Interdisciplinary Rounds (7MB 116)
1300-1330 *Antimicrobial Stewardship (ASP) Rounds (NPs)* ***Link to join***	**1300-1400** Teaching with Dr. Cardella (MaRS 9119) **1600-1700**	**1300-1400** Journal Club / Quality Rounds (MaRS 9006) **Link to join** ***1300-1330*** *ASP Rounds (NPs)*		**1300-1400** Listing/Business Meeting **Link to join**

	Transplant Fellow Seminar Series (MaRS 9006)	***Link to join***		

Team structure

The service is typically composed of an attending physician, two nurse practitioners (NPs), a transplant fellow, and two or more nephrology residents. The transplant fellows serve as the senior fellows on service, and will divide patients and assign consults throughout the day, adjusting workloads according to team members' other commitments (clinics, etc). All calls (weekday and weekend) are expected to be shared by transplant fellows and nephrology residents. Team members not on call are expected to be available for patient care and consults up to 1800 (team members may leave after 1700 if they have completed their work and the second-on-call is not overloaded).

The NPs provide continuity of care as they remain on service throughout the year, and serve as a valuable resource for care protocols. Their hours are from 0800 to 1600, and they do not take consults after 1400 in order to respect these hours. The NPs are heavily involved in improving care of the service, and each perform care-related non-clinical duties 1 day per week (they are not assigned to patient care that day).

Digital access

All patient-related matters **must** be communicated on:

- **MS Teams** (amongst inpatient team members or with allied health teams)
- **Epic Secure Chat** (with consultants)
- Emails

All residents and fellows must have MS Teams and Haiku downloaded on their phones with all notifications turned on. You must download Microsoft Intune Company Portal (default setting) from the App Store prior to starting service. This is a cloud-based tool that gives UHN employees a secure platform for patient-related matters. It can be removed from your mobile phones after the rotation.

BUILDING (TGH, Mars) Access

UHN Access: contact PGME
Service-specific access: email Zoraida Betancourt (zoraida.betancourt@uhn.ca) a photo of your UHN ID badge (front and back)

Patient list, note template access

Under Shared Lists, you should see the ***TGH Kidney Transplant** patient list, where team members can manually add/remove patients.

You are expected to use **Kidney Transplant-specific note templates** for progress notes, work-up admission notes, new recipient (PACU, POD 1-4+) notes, and new transplant discharge summaries. These are available under the SmartPhrase "**.KIDNEYTX**"

Contact inpatient NP Jennifer Park (Jennifer.park@uhn.ca) if you do not have access.

Inpatient kidney transplant team members

Transplant Nephrologists	**Outpatient Nurse Coordinators**
Dr. Carl Cardella (outpatient only)	Juliet Hirst, RN x3599
Dr. Edward Cole	Linda Au-Yeung, RN x6657
Dr. Joseph Kim	Christine Trieu Diep, RN x5002
Dr. Kathryn Tinckam	
Dr. Ana Konvalinka	Caterina Falasca, RN x5614
Dr. Istvan Mucsi	
Dr. Jeffrey Schiff	Danny Chan, RN x5567
Dr. Sunita Singh	N/A

Inpatient Nurse Practitioners (Working Hours: Monday-Friday, 0800-1600)
Andrea Lam (work phone: 437-247-3378)
Jennifer Park (work phone: 416-419-9335)

Kidney Transplant Fellows
Adel El Kaakour
Elaine Phua
Nicolas Vendeville

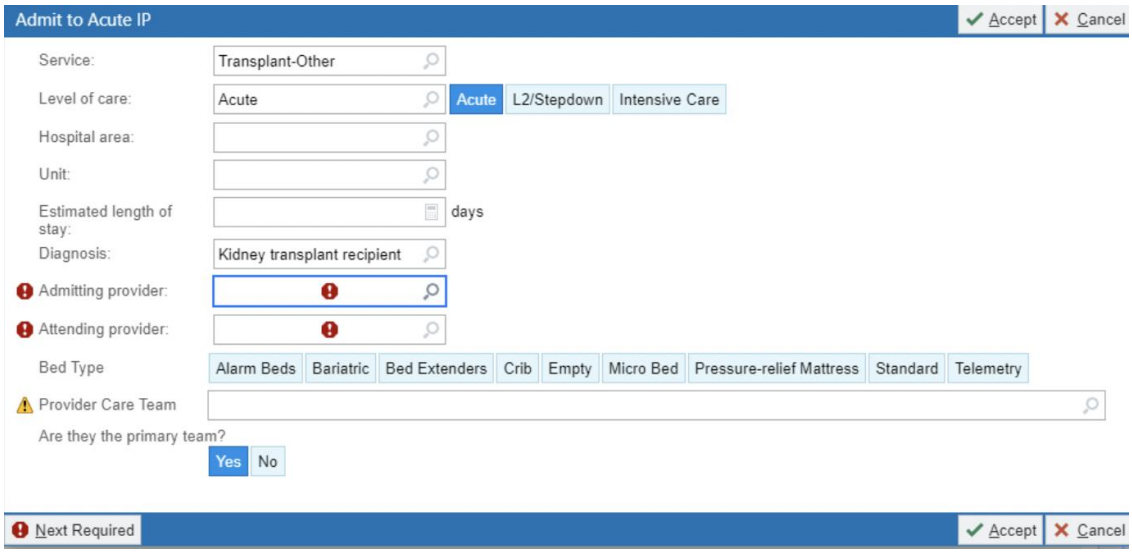
Kidney transplant second-call responsibilities

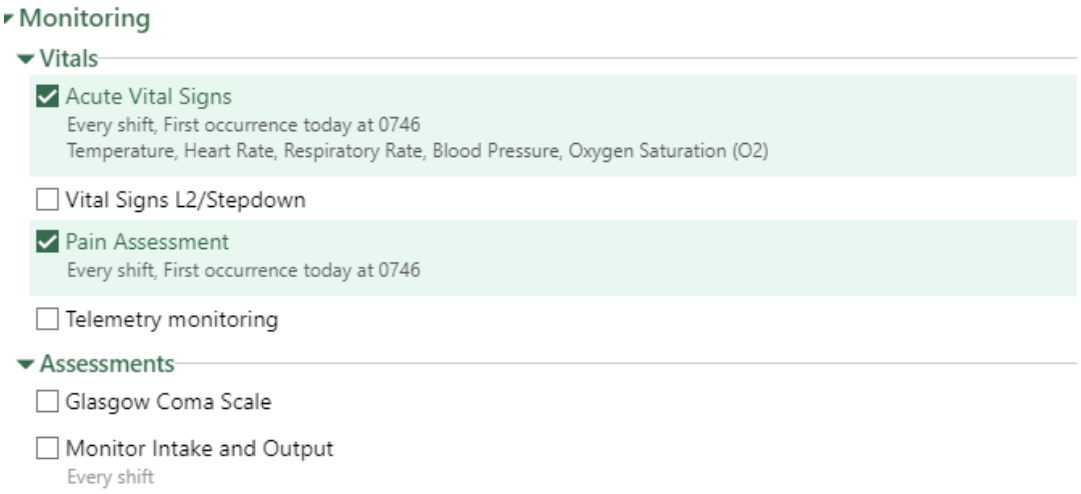
a. **Request Weekday (1800) and Weekend (1400) Handover MS Teams links from Rita Krueger (**rita.krueger@uhn.ca**)**
b. Refer to the I-PASS Handover Model to hand over appropriate patients to the MOT 1st-call, Nocturnist, and PA. Handover times: Weekdays at 1800, weekends/holidays at 1400.
c. **Weekday**: any direct admissions to ward (including work-ups) and PACU patients should be seen by the Second-call until **2100**
d. **Weekends/holidays**: until **1800**
e. **"Saturday helpers" will be the Second-call from Saturday 0800 to Sunday 0800**
f. Appropriately communicate all admissions, acute patients, escalation of care (ex. CCRT called, transferring to ICU, etc.) to Staff nephrologist on call
g. All outside calls should be redirected to the Staff nephrologist on call

ED Admissions / Consults

a. ED consults are expected to be seen within **1 hour**
b. When seeing ED consult, **change MRP to the Staff nephrologist upon your arrival**
c. Use the **Multi Organ Transplant Admission** Order Set to admit the patient

d. Specify the note type as **<u>Consults</u>** and use the UHN Consult Note template.
e. *Please note* when using the **<u>Multi Organ Transplant Admission</u>** Order Set, **the default is an admission to a regular ward bed (Acute inpatient bed)** with **vitals q shift. Based on the clinical condition of the patient, this may need to be changed (i.e., L2/ACU bed or more frequent vitals).** See screenshots below.

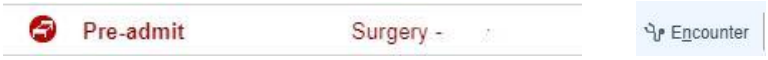




i. **Acute or Level 1 (L1) bed** is a regular ward bed with **no continuous monitoring** and **VS BID**. The patient may be transferred to 6A, 7A/7B or bed-spaced elsewhere in the hospital. Nursing ratio is 5 patients to 1 RN.
ii. **Level 2 (L2/Stepdown) bed,** also called "**Acute Care Unit (ACU)**," is a bed with **continuous cardiac monitoring** and **VS q1h.** Nursing ratio is 2 patients to 1 RN. Consider a L2 bed for patients with hemodynamic instability, tenuous hemodynamics or those at risk for clinical deterioration (sepsis, pulmonary embolus, etc.)

Pre-transplant work-up admissions

a. When we are made aware of a recipient coming in, you can add the patient to the **<u>*TGH Kidney Transplant</u>** patient list before their arrival to the hospital
b. Enter the patient's scheduled transplant Encounter by going into the patient's chart > Chart Review > Encounters > **single click <u>Pre-admit Surgery encounter</u>** > **<u>Encounter</u>**



c. Use the **<u>Pre Operative Multi Organ Transplant Order Set</u>** for admission orders
  i. Click **<u>Admit to Acute IP</u>** and fill in pertinent blanks
  ii. Enter **<u>Code Status</u>**
  iii. Leave all pre-clicked orders as is, and fill out pertinent missing information highlighted
  iv. **Do NOT use the Labs – Now section**. Scroll down to **<u>Kidney Transplant</u>** and specify **<u>Labs</u>** there.
  v. Note that Kidney Transplant > **<u>Nursing Interventions</u>** is only applicable to PD patients
  vi. Under Kidney Transplant > **<u>Medications</u>**, reschedule pre-op Solumedrol, IV antibiotics (Cefazolin or Vancomycin), and SC Heparin to the time of OR. These are administered by Anesthesia immediately pre-op.
d. Specify the note type as **<u>H&P</u>**, delete the UHN H&P Note template. Instead, use the SmartPhrase **<u>.KIDNEYTXWORKUP</u>**.

e. Pre-transplant work-up information (labs, imaging, cardiac/cancer screening, etc.) can be found as scanned files under Chart Review > Media. If you are missing information, double check on ConnectingOntario.

f. Remember to order pre-operative Advagraf (0.12-0.15 mg/kg) as **On call to OR** and reschedule to time of OR

g. Message in the **MS Teams Transplant Surgery** chat: the patient's name, MRN, and induction plan. ATG inductions require CVC line insertion by Anesthesia, which requires early notice.

h. All recipients must consented using the **Transplant Medical Consent** form. **Exceptional Distribution (ExD)** transplant requires an additional consent

- **i.** Forms can be found on the ward or on the MS Teams Kidney Transplant channel
- **ii.** Signed consent forms must be scanned into Epic

Enhanced Recovery After Surgery In Kidney Transplant (ERAS-KT)

Enhanced Recovery after Surgery (ERAS) pathways aim to minimize the perioperative physiologic dysfunction and surgical stress response to promote quicker rehabilitation. Key elements include preoperative counseling, avoidance of unnecessary invasive monitoring, early mobilization, and oral nutrition optimization. ERAS pathways have been successfully implemented in the kidney transplant (KT) population with significant cost savings and decreased length of hospital stay (LOS), with similar clinical outcomes when compared to traditional pathways. **Our aim is to decrease the median LOS from 7 to 4 days in KT recipients by implementing the ERAS pathway at UHN, over a period of 12 months.** The main pillars of this initiative are:

a. Early achievement of therapeutic Calcineurin Inhibitor (CNI) trough level
    i. Give **CNI** [usually Advagraf (0.12-0.15 mg/kg) PO] **On call to OR**
b. Optimization of invasive monitoring
    i. Discontinue invasive monitoring and **transfer out of Acute Care Unit (ACU)** to general ward on **POD 1** (before 0840 if safe to do so)
c. Optimization of IV fluids

i. **No maintenance fluids.** Use clinical judgment to give bolus or start maintenance fluids as appropriate.
ii. **1-to-1 hourly urine replacement** with 0.45% NS on **POD 0**
iii. **1-to-1/2 urine replacement q 4hours** with 0.45% NS on **POD 1** when transferred out of ACU

d. Early mobilization
    i. POD 1: sit up in chair twice, walk with nurse x2-3 (distance as tolerated)
    ii. POD 2: sit up in chair at least 3 times, walk 1 lap at least twice
    iii. POD 3: walk 1 lap at least 3 times
e. Early progression of diet
    i. Patients are started on **Diet As Tolerated (DAT) on POD 0**. Consult the Registered Dietitian (RD) if concerns arise.

New Transplant Recipient Care (PACU)

a. New recipients arriving in PACU should be assessed by the Kidney Tx team in accordance with the members' working hours. **Second-call fellows** should see until **2100** on weeknights, and **1800** on weekdays/holidays
b. Use the **Post Operative to ACU – Transplant Recipient** order set
c. If patient is for Thymoglobulin (rATG), this is a **separate order set**. Use the **Anti-Thymocyte Globulin – Rabbit (ATG) (THYMOGLOBULIN) Orders** order set.
    i. Pre-meds for first dose rATG: Solumedrol 500 mg IV, Tylenol 650 mg PO, Benadryl 50 mg IV
    ii. Pre-meds for subsequent doses: current dose of Prednisone, Tylenol 650 mg PO, Benadryl 50 mg IV
d. Specify the note type as **Progress Notes** and use the SmartPhrase **.KIDNEYTXPACU**
e. Assess the patient in PACU, including serum labs, VBG, ECG, CXR (if applicable)
f. If stable and ready for transfer to ACU, go to the **Transfer** tab > **Transfer Orders** > **Level of care: L2/Stepdown** > **Mark Unreconciled CONTINUE**

New transplant recipient care (POD 1)

a. All POD 1 patients must be **assessed** and **transferred** out of ACU (IF safe) by **8:40 AM**
b. To transfer the patient out from ACU to general ward:
    i. Discontinue **Cardiac Monitoring**, **Advanced Hemodynamic Monitoring**
    ii. Order **arterial line removal**
    iii. Change 1-to-1 hourly urine output replacements to 1-to-1/2 replacement q 4 hours
    iv. Go to the **Transfer** tab > **Transfer Orders** > **Level of care: Acute** > **Mark Unreconciled CONTINUE**
c. If receiving ATG, it must be ordered daily
d. If a patient cannot receive Heparin SC and requires Sequential Compression Device (SCD) as DVT prophylaxis, a bilateral leg Doppler must be done first to rule out DVT
e. Use the note template **.KIDNEYTXPOD1**

New transplant recipient care (POD 1 onwards)

a. Please remember to use the appropriate note template for each POD (ex. **.KIDNEYTXPOD2**)
b. Please refer to the **Kidney Transplant Care Pathwa**y for each POD task/milestone
c. Flag Pharmacy and Discharge Coordinator as soon as the patient is stable for teaching (approx. POD 1-2)
d. Order HD line removal in IR prior to discharge
e. Diet progression and mobilization must be assessed and documented daily

Discharge process

a. All patients' **Expected Discharge Date** must be updated on Epic Monday, Wednesday, Friday
b. Involve appropriate allied health team members in a timely manner via **MS Teams Discharge Planning** chat, paging or Epic consult

c. All home care needs must be communicated to the DC Coordinator or Integrated Care Lead
d. **Patients newly started on glucometer use and/or insulins** must be flagged to the DC Coordinator, Arleen Sterling, for diabetes education prior to discharge
e. In order to discharge a patient, you must complete the **Discharge Medication Reconciliation**. **Discharge tab** > **Discharge Orders**.
    i. Pharmacists will assist with new transplant recipients' prescriptions
    ii. For **readmitted patients**, the assigned team member is responsible for completing the discharge prescriptions and providing education to the patients. If you require assistance, please ask another team member or pharmacist.
    iii. **Discharge prescriptions must be completed one day prior to date of discharge, before 1500.** Before holidays and long weekends, the deadlines may vary. Please note Transplant Outpatient Pharmacy (TOP) requires minimum 24 hours' notice for Blister Packs.
f. All **Discharge Summaries** must be **routed** to the patient's PCP, and their primary transplant nephrologist and nurse coordinator (see #7 above)

New transplant discharges

a. Use the New Kidney Transplant Discharge Summary template, **.KIDNEYTXNEWDC**. Route to PCP, assigned primary nephrologist, and nurse coordinator.
b. If HD no longer needed, expedite HD line removal in IR prior to discharge
c. If patient is going home with **HD or PD catheter**, set up weekly flushes in the Transplant Day Unit
d. For approximately the first 3-4 weeks, **patients are expected to come to TGH twice weekly** for bloodwork and in-person clinic visits. Please ensure they have appropriate transportation and housing accommodations in place. Involve appropriate allied health members (ex. Social Work, Indigenous Patient Navigator, etc.) in a timely manner.

Renal Palliative Care

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

A **palliative approach to renal care** recognizes that CKD is a chronic progressive disease that is irreversible and that both the treatment and the disease cause distressing symptoms.

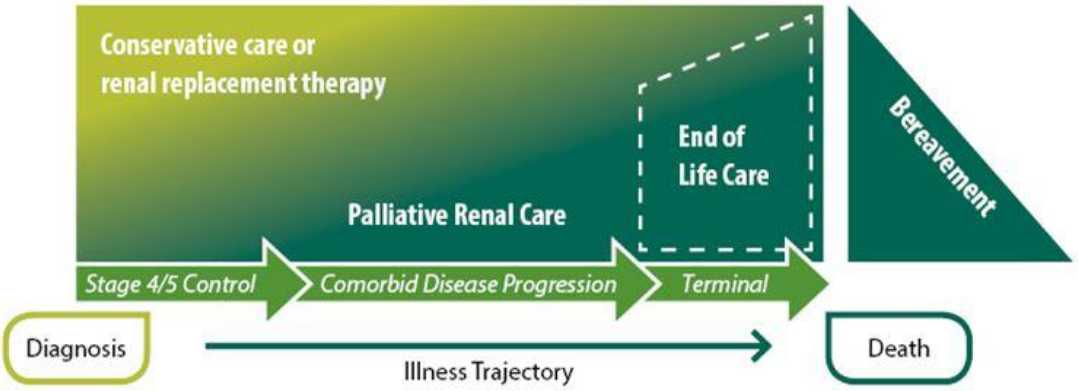
It runs in parallel to disease modifying care, the extent to which will depend on the patient's goals and their disease trajectory (Figure). A palliative approach to care may be provided by the primary MRP team with support from specialist palliative care teams depending on the complexity or severity of the patient symptoms.

Goals of Care:

Goals of care are those goals to be achieved at the end of treatment. For example, these may be to be able to attend the Blue Jays games, or to be able to live independently at home.

These help inform the clinicians which treatment plan(s) is/are best suited to achieving these goals. Prognostication and realistic goal setting is key to **shared decision making** with the patient and family. Setting the goal of care as to live as long as possible should be avoided as it is likely to lead to poor goal/treatment alignment further along the disease trajectory.

Figure: Disease trajectory graph.



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

While dialysis can improve survival in several patients, the treatment can be more burdensome than beneficial in individuals with complex, and severe chronic disease. Patients most vulnerable to the adverse effects of dialysis care include those with functional or cognitive impairment impacting their daily living patterns; features of frailty and often those of advanced age. Adding palliative care to conventional renal care can mitigate suffering and prepare the patient and family for the future.

This may be provided in several ways:

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

Studies suggest that, in several populations, survival is similar to that seen when dialysis is initiated. Patients may choose to not include dialysis as part of their care. The multidisciplinary Elder Kidney Care team can often help with prognostication, and help guide families and patients through discussions around CCRC and palliative dialysis. In the outpatient setting they deliver active medical care, and provide physical, emotional and spiritual support to the patients and, by extension, to their family/social circle. (referral details via Dr. Jassal's office ext. 14-3196).

- **Palliative dialysis**

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

- **Dialysis discontinuation**

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

Helpful definitions:

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

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

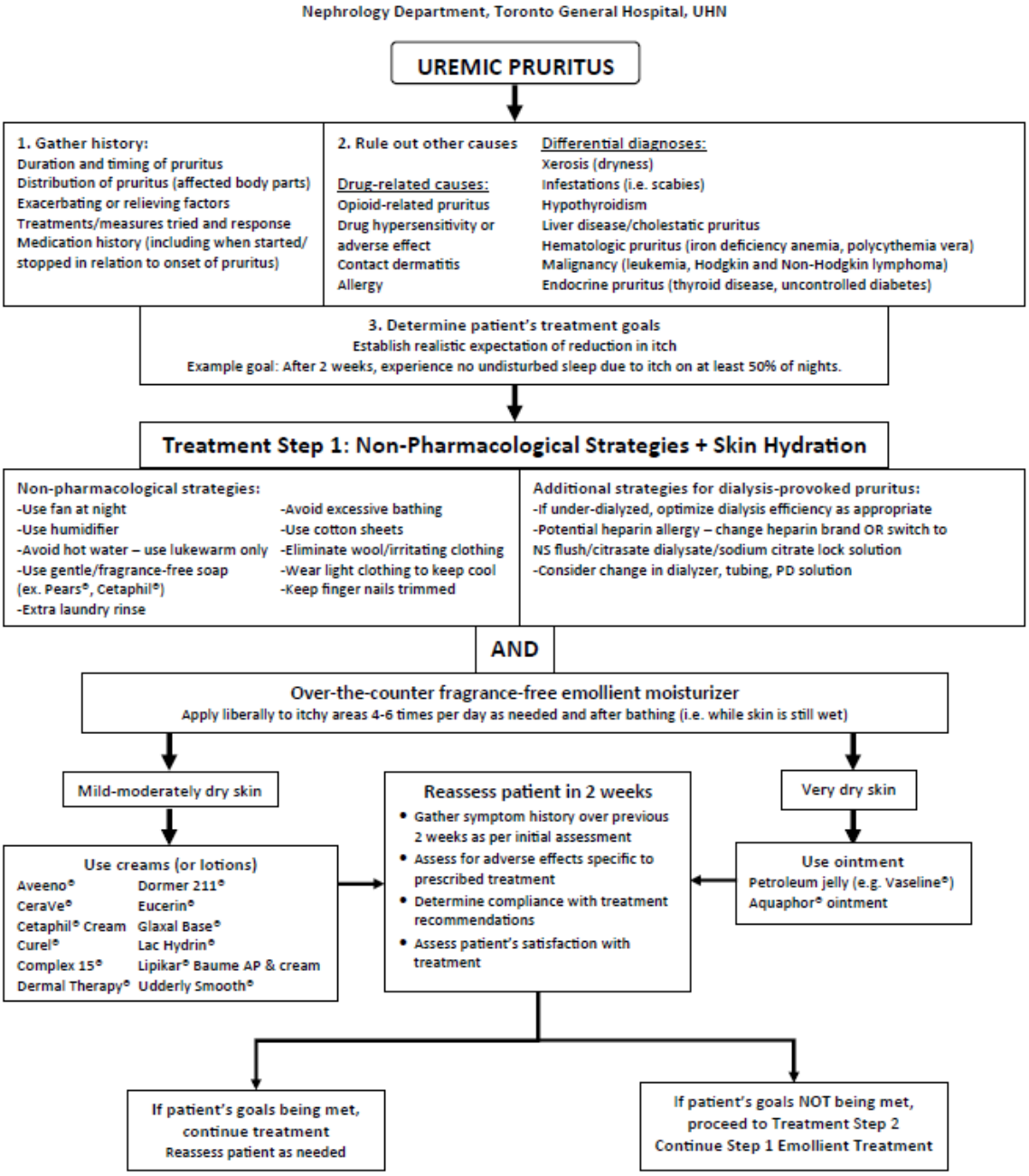
Substitute decision maker(s): this is/are the individual(s), *appointed by law*, to represent the patient's wishes when they are unable to participate in shared decision making. The SDM is/are mandated by law, and when there is a problem (e.g. conflict amongst several children of a widowed lady) the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

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

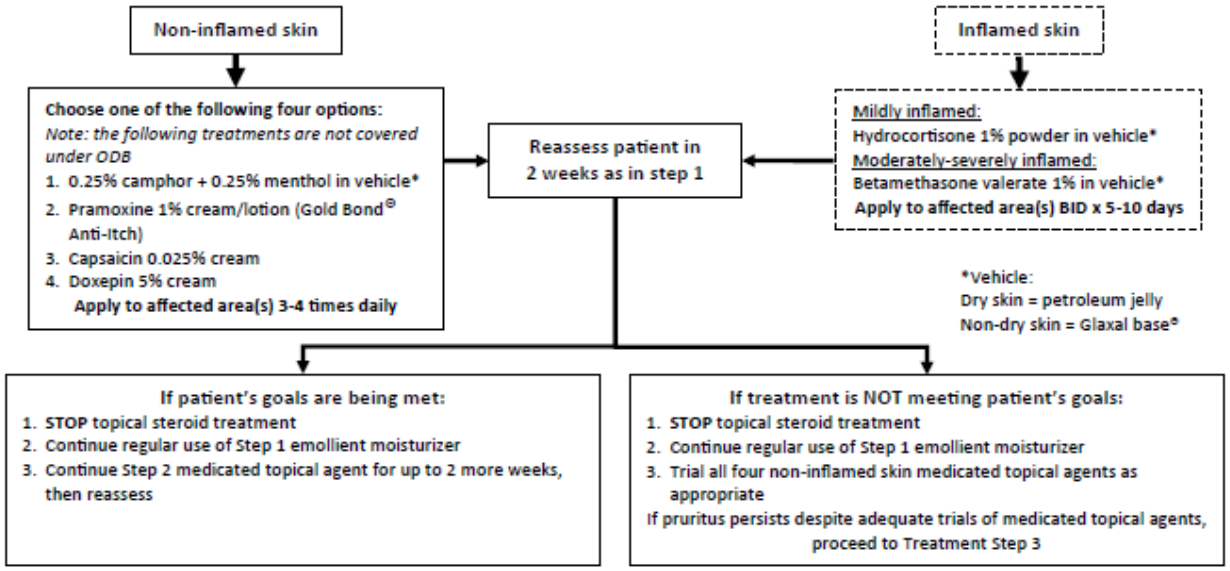
Symptom Management Tools

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

Pruritus Treatment Algorithm for Patients with CKD/ESKD



Treatment Step 2: Medicated Topical Agents



Treatment Step 3: Oral Medications and/or Phototherapy

Discuss risks/benefits of prescribed treatment with patient prior to initiation			
	Treatment	Dose/Details	Comments
FIRST LINE THERAPY	Phototherapy	Narrowband UVB Phototherapy 2-3 times per week	Requires dermatology referral
	Gabapentin	100mg po qHS If no response, titrate up by 100mg every 2 weeks Max of 300mg/day (if on dialysis) and 600mg/day (non-dialysis, CrCl<30mL/min) Give post-dialysis if receiving nocturnal dialysis **Continue treatment at lowest effective dose**	1. Reassess patient every 2 weeks after dose titration as in Treatment Step 1 **2. STOP if treatment is not meeting patient's goals after at least 6 weeks of gabapentin use and proceed to second-line therapy** Assess for adverse effects: e.g. drowsiness, dizziness, ataxia, fatigue, mood changes, peripheral edema, coordination changes, etc.
SECOND LINE THERAPY	Pregabalin	25mg po qHS If no response, titrate up by 25mg every 2 weeks Max of 75mg/day (if on dialysis) and 150mg/day (non-dialysis, CrCl<30mL/min) Give post-dialysis if receiving nocturnal dialysis **Continue treatment at lowest effective dose**	1. Reassess patient every 2 weeks after dose titration as in Treatment Step 1 **2. STOP if treatment is not meeting patient's goals after at least 6 weeks of pregabalin use and proceed to third-line therapy** Assess for adverse effects: e.g. peripheral edema, dizziness, drowsiness, fatigue, headache, ataxia, weight gain, xerostomia, tremor, blurred vision, etc.
THIRD LINE THERAPIES Choose based on patient's other concurrent symptoms and lack of contraindications Reassess patient as in previous steps	Paroxetine	10mg po daily; increase to 20 mg daily if needed	Paroxetine and sertraline preferred in patients with anxiety, depression. Naltrexone not covered by ODB. Contraindicated in patients taking opioids. All four agents can exacerbate fall risk.
	Sertraline	25mg po daily; titrate to 75mg daily if needed	
	Doxepin	10mg po daily at bedtime; max 30 mg daily	
	Naltrexone	12.5mg po once daily; increase by 12.5 mg weekly to max 50 mg daily	
	Antihistamines	Diphenhydramine 25mg po TID prn Hydroxyzine 10mg po TID prn Cetirizine 5-10mg po daily (dialysis: 5mg daily) Loratadine 10mg po daily (dialysis: 10mg q48h) Desloratadine 5mg po daily (dialysis: 5mg q48h)	USE WITH CAUTION Agents listed in descending order of sedative effect. Not covered by ODB.

Management of Contrast Nephropathy

Definition

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

Presentation

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

Risk Factors

Pre-existing CKD stages 3-5

- Diabetes
- CHF
- MM
- Contrast agent
  -High volume

Prevention

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

Recommendations

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

References

KI 1998, vol 53, p. 230-242.
AJKD 1994, vol 24, p. 713-727.
JAMA 2004;29:2328.
NEJM 2000, vol 343 (3) p 180-184 .

Medication in CKD and Dialysis

General Guidelines

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

Furosemide IV Infusion

For doses up to 120 mg: Dilute in 50 to 100 mL and infuse slowly over 10 to 30 min.

For doses greater than 120 mg and up to 240 mg: Dilute to a concentration of 0.2 to 5 mg per mL and infuse slowly at a rate no faster than 4 mg per min. (eg. For a dose of 160 mg, infuse over a minimum of over 40 min.).

Note: Rapid administration increases the risk of ototoxicity due to the high concentrations achieved in a short period of time.

Maximum single dose: 240 mg

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 (LHIN) program
- Residents of long-term care facilities or Homes for Special Care
- Eligible under the Trillium Drug Program
- Receiving benefits from Ontario Works, Ontario Disability Support Program (ODSB) or social assistance

What is covered?

- Formulary medications - Follow the Ontario Drug Benefit Formulary
- Limited Use Products - Covered when patient meets listed criteria
- Must put Limited Use code on actual prescription
- "Exceptional Access Program" (formerly "Section 8") approved meds (see below)

Exceptional Access Program (formerly Section 8)
A source of payment that can be applied for when no formulary alternative is available or suitable

- Application requires Individual Clinical Review
- Meds that are not listed in ODB formulary or which fall under limited use criteria
- Physician is making "special request" for coverage
- Guided by DQTC and other expert medical advisers to review individual requests

What do I need to request for Exceptional Access Program review?

- Prescriber's information
- Patient demographics including OHIP number
- Requested drug (generic name, brand name, dosage strength and drug identification number)

- Detailed summary of condition
- If the patient has taken the drug, provide objective evidence of efficacy (lab results, diagnostic tests, culture and sensitivity reports, etc.)
- Additional information regarding previous therapy, contraindications to formulary medications, concomitant drug therapy
- Desired outcome with requested drug

Before I send out an Exceptional Access Program request, Check: » Is the patient covered by ODB?
» Has the patient tried medications covered by ODB?
» Do I have all the necessary background information to support using this request? (lab results, diagnosis, response to treatment

- **FAX: (416) 327-7526**
- **Follow up information** PHONE: 416-327-8109

If in doubt or require assistance, contact Celine Yu Reimbursement specialist ext 14-6622

Dose adjustments of drugs for renal failure

Estimate CrCl using Cockcroft-Gault equation:

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

Do not use MDRD (eGFR) for drug dosing as it has not been validated.

Commonly prescribed drugs that require dose adjustment

- Antibiotics (penicillins, cephalosporins, quinolones, Vancomycin, Co-trimoxazole)
- H2 receptor blockers
- Allopurinol

- Analgesics
- Antivirals (gancyclovir, acyclovir)

Dose adjustment for dialysis
Consider:

- Type of dialysis (HD vs. PD. vs. CRRT)
- Drug properties (MW, protein binding, water solubility, metabolism)
- Drugs that are renally cleared are usually dialyzable
- Most antibiotics (penicillins & cephalosporins) are dosed after dialysis
- Dose antibiotics per *UHN Guidelines for Antimicrobial Use* (ask department pharmacist for details)
- 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 SC or IV once weekly (dialysis) and 0.7 mcg/kg SC every 2 weeks (CKD)
- 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: 100-110.

Common causes of non-response to EPO include

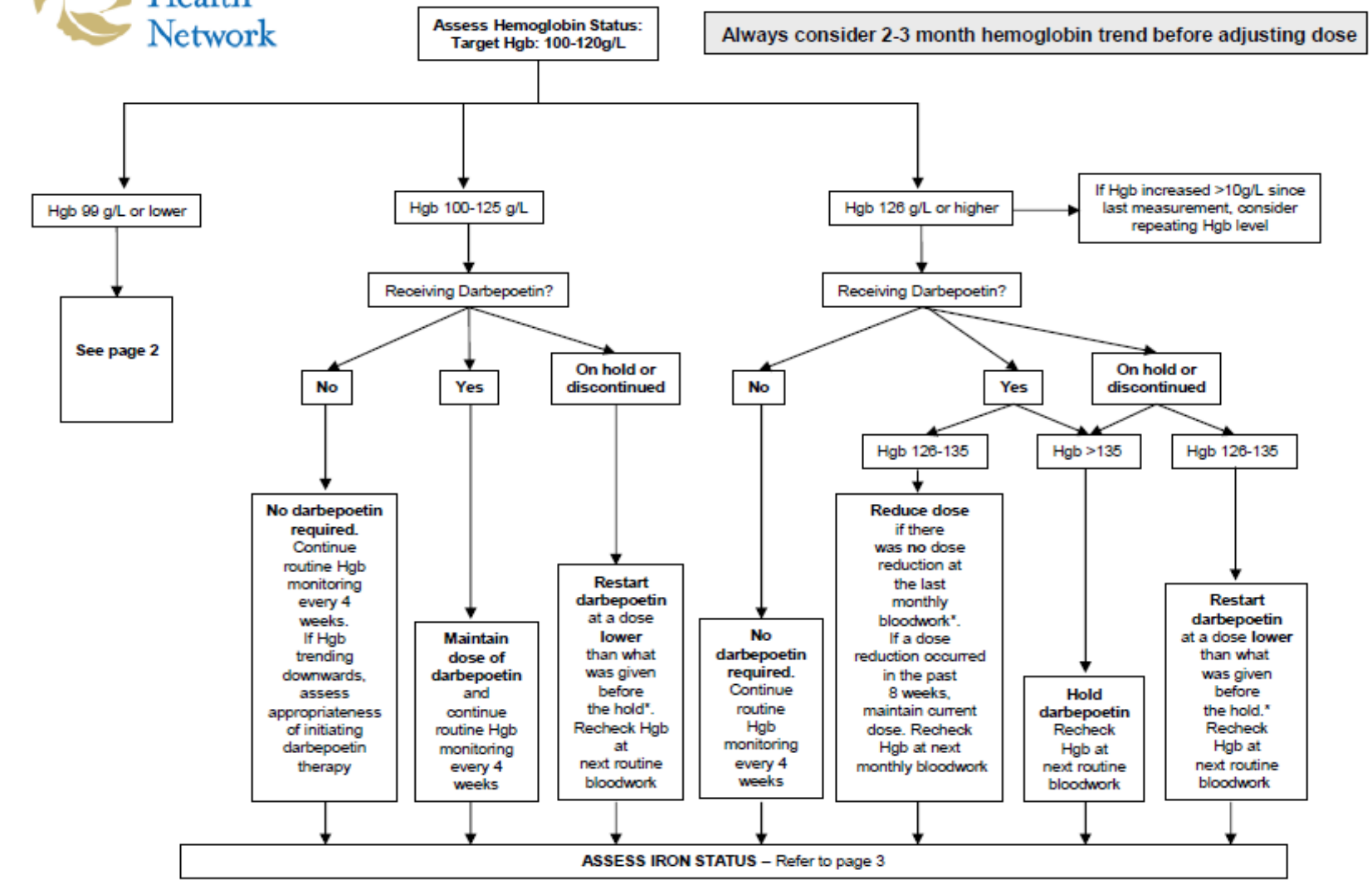
- Iron deficiency
- Blood loss (active bleeding or hemolysis)
- Infection
- Active inflammatory disease
- Malignancy
- Hyperparathyroidism

Anemia Management Protocol for HD

The following protocol was developed for hemodialysis patients by Marisa Battistella, Pharm D. It is for those being managed with IV Iron. Oral iron is also an option (see "Iron" section).

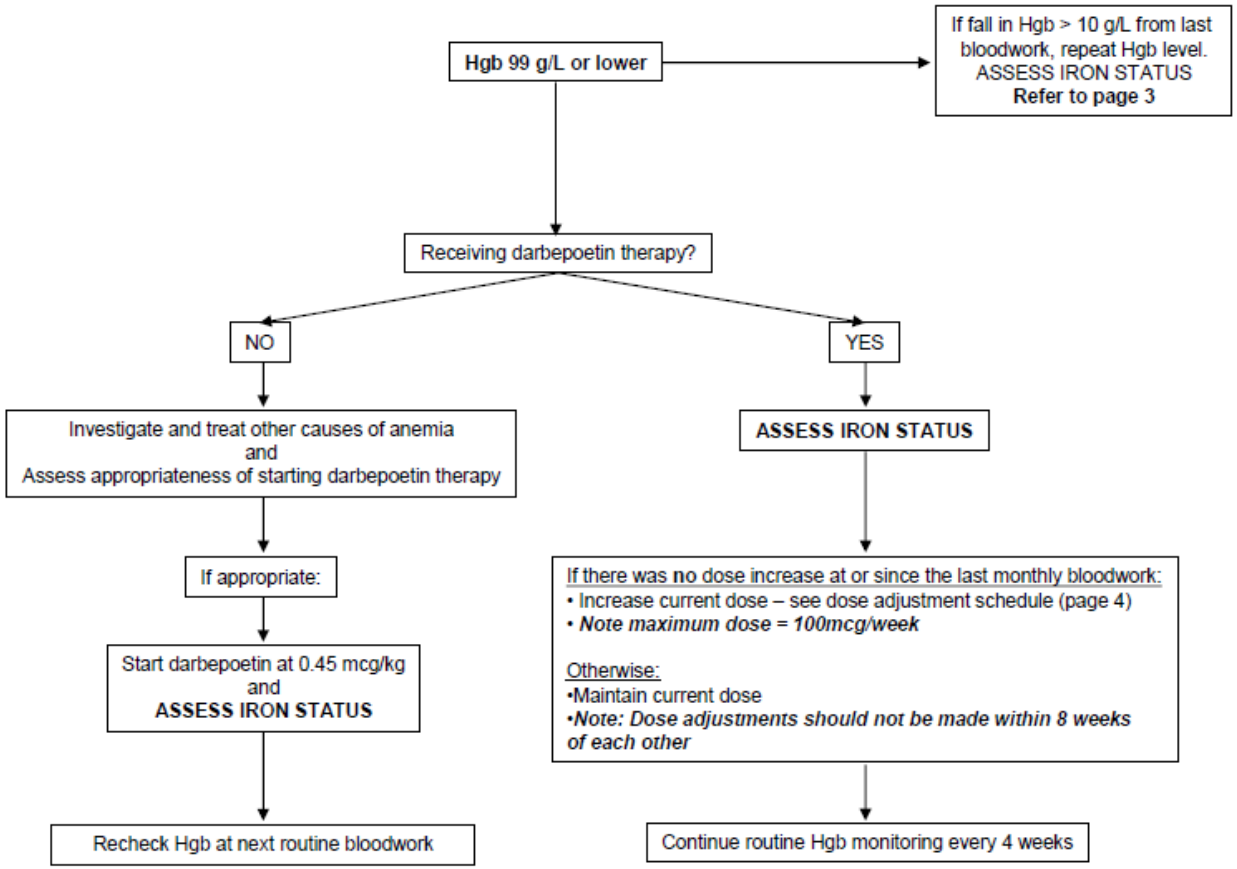
University Health Network

Anemia Management Protocol

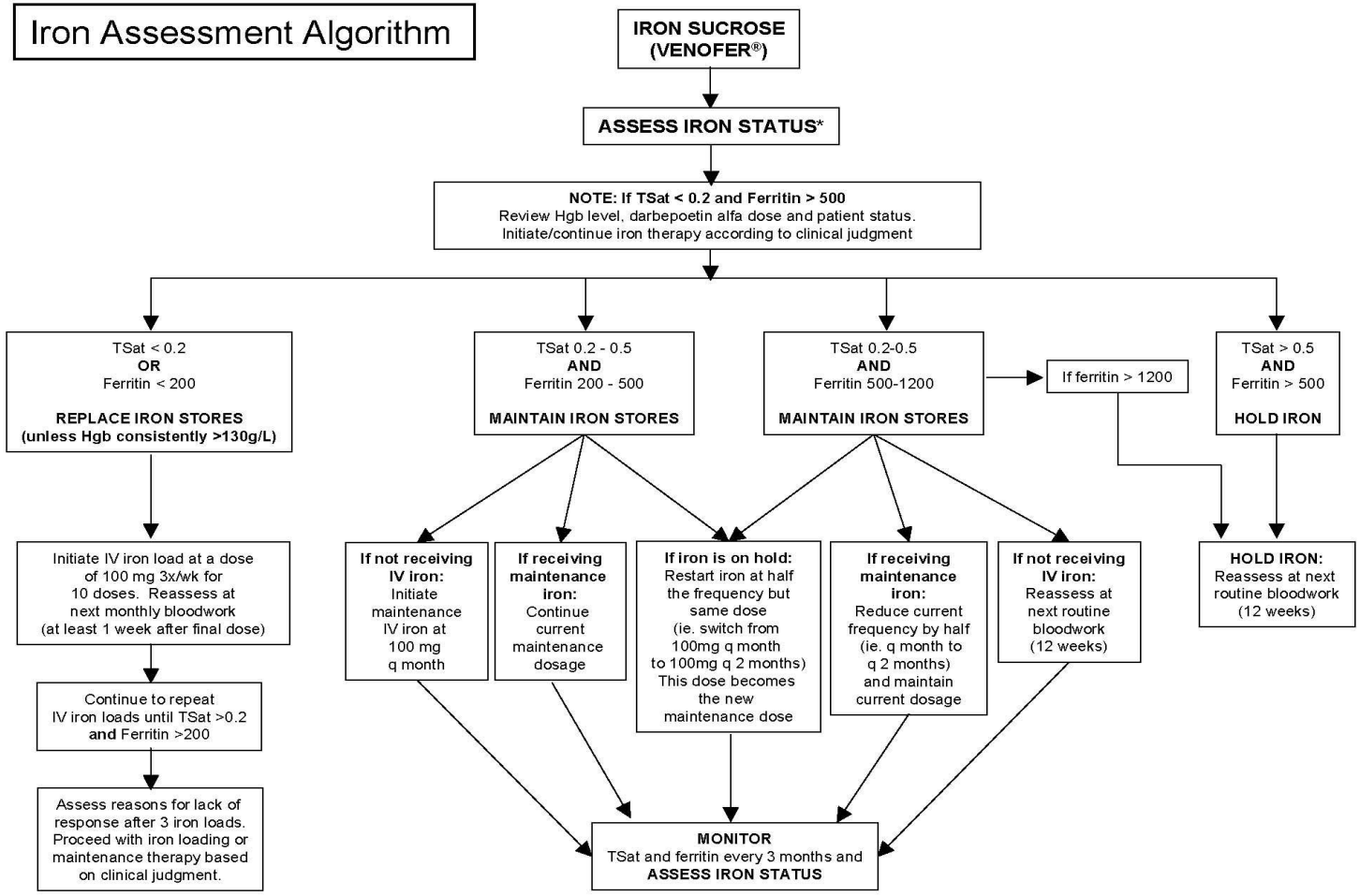


* See dose adjustment schedule for patients using Darbepoetin Alfa

Anemia Management continued



Iron Assessment Algorithm



***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**

Dose Adjustment Schedule for Patients using Darbepoetin Alfa

Current Dose	Increase Dose To	Reduce Dose To
10 mcg q2wk	10 mcg/wk	10 mcg monthly or D/C darbepoetin Reassess monthly
10 mcg/wk	20 mcg/wk	10 mcg q2wk
20 mcg/wk	30 mcg/wk	10 mcg/wk
30 mcg/wk	40 mcg/wk	20 mcg/wk
40 mcg/wk	50 mcg/wk	30 mcg/wk
50 mcg/wk	60 mcg/wk	40 mcg/wk
60 mcg/wk	80 mcg/wk	50 mcg/wk
80 mcg/wk	100 mcg/wk	60 mcg/wk
100 mcg/wk	Max dose 100mcg/wk	80 mcg/wk

Conversion from Eprex® to Aranesp®

Conversion from Eprex® to Aranesp®

In general, an approximate dose conversion of 250 Units of Eprex ® to 1 mcg of Aranesp ® can be used, with dose adjustment as needed thereafter. 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.

Vitamin deficiency

- Replavite® 1 tab daily, a water-soluble vitamin that contains B vitamins, vitamin C and folic acid
- Other multivitamins may contain fat soluble vitamins which may accumulate and cause toxicity and should not be substituted

Hyperphosphatemia

Calcium carbonate is used as a phosphate binder given with meals

Calcium carbonate 1250mg = Ca^{++} 500mg

Tums regular strength = $CaCO_3$ 500mg = Ca^{++} 200mg

Tums extra strength = $CaCO_3$ 750mg = Ca^{++} 300mg

Tums ultra = $CaCO_3$ 1000mg = Ca^{++} 400mg

- For severe hyperphosphatemia with hypercalcemia, aluminum hydroxide can be used short term e.g. Amphogel 15-30 mL TID with meals x 5 days then reassess
- Sevelamer (Renagel®), Lanthanum (Fosrenol®) - Ca-free PO_4 binders - useful for pts with both hyperphosphatemia and hypercalcemia - expensive and as yet not covered by ODB - requires “Exceptional Access Program” (EAP) approval. If the patient is on dialysis and has sustained hyperphosphatemia (>1.8 mmol/L) and hypercalcemia (>2.65 mmol/L) they can be covered through the “Telephone Request Service” through EAP. Call 1-866-811-9893 or 416-327-8109 to provide prescriber and patient details to receive approval and/or consult renal pharmacist.

Hypophosphatemia

- Hold PO_4 binders.

Patients on HD or SLED may develop hypophosphatemia. One way of correcting this is to add Fleet PO_4 enema (concentrated sodium phosphate) to the acid concentrate. 100 mL of Fleet enema contains approximately 175 mmol of phosphate – which gets diluted 1:45 by the dialysis machine.

For 4.5 L or 5.0L acid jugs:

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

NOTE: **NEVER** ADD FLEET ENEMA DIRECTLY TO BAGS USED FOR CRRT AS THIS WILL CAUSE SEVERE HYPERPHOSPHATEMIA.

Hypocalcemia/↑PTH

- The kidneys' production of 1,25 dihydroxy Vitamin D_3 (the active form of vitamin D) declines in CKD; therefore, calcium absorption from the GI tract is also diminished leading to hypocalcemia and hyperparathyroidism
- May use Calcium carbonate between meals as calcium supplement.
- Calcitriol = Rocaltrol, the pharmacological replacement of active vitamin D_3 which increases gut absorption of Ca^{++} (and PO_4) and suppresses PTH
- Dose of calcitriol ranges from 0.25 ug 3x/wk to 1.0 ug OD (may be given po, or IV pulse with HD)

- If pts 25-OHD level is <75, give ergocalciferol, 50,000 u / week x 2 weeks, repeat level, if still low, give once/month x 3 months.

- Cinacalcet (Sensipar) is a new calcimimetic, which is available, however is not covered by ODB, and is very costly. Payment needs to be determined (check private plans) before prescribing this medication.

- Goal PTH = 20-30 pmol/L (normal 7-8); normalization may be a risk factor for adynamic bone disease

Constipation

AVOID

- Magnesium containing products (MOM, Mag citrate)
- Bulk forming laxatives in fluid restricted patients e.g. Metamucil or Prodiem
- Phosphate Fleet enemas d/t high phosphate content (may use Fleet Mineral Oil)

SAFER

- Lactulose, Senna, Polyethylene glycol 3350
- Stimulant laxatives (bisacodyl, cascara)
- Glycerin suppositories prn
- Tap water or mineral oil enemas for severe constipation
- Colyte/Golytely for bowel preps or lower dose (250-500 mL) for very severe constipation.

Analgesia

Opioid Analgesic Comparison Chart

	Doses Equivalent to Morphine 10 mg IM or SC			Brand Name	Duration of Analgesia	Consideration in CKD	
Opioid	**IM or SC ****	**Oral ****	**Conversion Injection to Oral**			**Caution**	**Dialyzability**
Codeine	120 mg	200 mg	1.5	Codeine tablet/syrup	3 to 4h	Caution: consider decrease starting dose to 50% due to prolonged half life	No data (HD) Unlikely (PD)
				Compounds (Tylenol #1, #2, #3)	3 to 4h		
				Codeine Contin CR	12 h		
Morphine	10 mg	30 mg	3	Morphine tablet/syrup (MS-IR ® / Statex®)	3 to 4h	Metabolite morphine 6 glucoronide has narcotic activity increased risk of side effects	Yes (HD) No (PD)
				M- Eslon® capsule	12 h		
				MS Contin® SR tablet	12 h		
Oxycodone	NA		NA	Oxy-IR®	3 to 4 h	Caution	Yes (HD)

		15 mg		Oxycontin® CR	12 h		No data (PD)
				Percocet® (oxycodone + acetaminophen)	3 to 4 h		
Hydromorphone	1.5 mg	7.5 mg	5	Dilaudid®	3 to 4 h	Caution due high potency narcotic	No data (HD) No data (PD)
				Hydromorphone Contin	12 h		
Fentanyl	100 ug	NA	NA	Duragesic® Patch	72 hours	Decrease starting dose by 50%	No (HD) No data (PD)

* Opioids are in order of increasing potency

** All above dose equivalencies are compared to 10 mg of **injectable morphine**. For example, Codeine 120 mg IM = Morphine 10 mg IM = Hydromorphone 1.5 mg IM

Other Considerations:

- It is easier to keep pts out of pain than to get them out of pain, consider standing analgesia with breakthrough as needed.
- Acetaminophen (Tylenol) +/- codeine – max 4 gm acetaminophen/day
- NSAIDs - remember pts are at a higher risk of GI bleed therefore, misoprostal or a proton pump inhibitor should be added for prophylaxis
- All opioids – start at small doses and titrate up for pain relief as excessive sedation may occur

HS Sedation

- Benzodiazepines such as temazepam, lorazepam and oxazepam are hepatically metabolized and safer.
- Also can consider herbal treatment with Melatonin 3-9 mg SL qHS (changed 10 mg to 9 mg b/c only 3 mg SL tabs available in-hospital)

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]

Influenza Treatment & Prophylaxis Dosing

Oseltamivir (Tamiflu) Dosing

Creatinine clearance	Prevention Dose	Treatment Dose
>60 ml/min	75 mg once daily	75 mg BID x 5 days
30-60 ml/min	30 mg once daily	30 mg BID x 5 days
10-29 ml/min	30 mg q48h	30 mg once daily x 5 days
<10 ml/min	30 mg once weekly	75 mg x 1 dose
Patients receiving dialysis	SLEDD: 30 mg after each dialysis session. Consider 75mg once daily in continuous/24h SLED	SLEDD: 75 mg after each dialysis session. Consider 75mg bid for continuous/24h SLED.
	HD (high flux): 30 mg immediately and then after each hemodialysis session	HD (high flux): 75 mg after each hemodialysis session for 5 days
	PD: 30 mg once weekly	PD: 75mg x 1 dose
	CRRT (high flux): 30 mg once daily	CRRT (high flux): 75mg once daily

Proposed dosing guidance for Nirmatrelvir/Ritonavir (Paxlovid) in Chronic Kidney Disease for Treatment of COVID-19

Kidney Function	Treatment Dosing Schedule
GFR> 60 ml/min	300 mg nirmatrelvir plus 100 mg ritonavir both twice daily for 5 days

GFR 30-60 ml/min	150 mg nirmatrelvir plus 100 mg ritonavir both twice daily for 5 days
GFR < 30 ml/min	Day 1: 300 mg nirmatrelvir plus 100 mg ritonavir once Days 2-5: 150 mg nirmatrelvir plus 100 mg ritonavir both ONCE daily
Dialysis and weight ≥ 40kg	Day 1: 300 mg nirmatrelvir plus 100 mg ritonavir once Day 2-5: 150 mg nirmatrelvir plus 100 mg ritonavir both ONCE daily, dosed after dialysis on dialysis days
Dialysis and weight less than 40 kg	150 mg nirmatrelvir plus 100 mg ritonavir q 48 hours for 3 doses dosed after dialysis on dialysis days

COVID-19 Treatment in Dialysis

See this attached document regarding treatment of COVID-19 in Dialysis

Nirmatrelvir Ritonavir (Paxlovid) and Remdesivir Use in Patients on Dialysis with COVID-19 Quick Reference Guide (ontariohealth.ca)

For more information on dosing and drug interactions see the following document:

Paxlovid - What Pharmacists and Prescribers Need to Know (with Appendix) (June 6, 2022) (covid19-sciencetable.ca)

Please note: This information is current as of June 21, 2023. Note that information regarding COVID-19 continues to evolve. Please consult updated references as required.

Approach to Post Parathyroidectomy Management

Post parathyroidectomy, many dialysis patients develop ‘Hungry Bone’ syndrome, due to the reversal of the parathyroid hormone effect (calcium leaching from bones). This can lead to significant decreases in serum calcium, sometimes despite normal or elevated PTH in the immediate post-operative period. These patients therefore need close monitoring and repeat calcium measurements, as well as effective hand over and follow up plans after discharge.

During hospitalization, these patients are admitted under the surgical team, with nephrology consulting for co-management of calcium levels, as well as providing renal replacement support. Given the need for more expedient medication changes, and response to blood levels, the nephrology team can input medication orders directly for these patients if needed and can inform the surgical team of changes thereafter. This is especially important as there have been instances where medication changes were suggested by the nephrology service, but due to the busy nature of surgical specialties, by the time the orders are seen, co-signed and input, the clinical situation had changed requiring reassessment of management plans.

For standardization of practice, the following can serve as a simple protocol for dialysis patient post parathyroidectomy. This is not to be used as a guideline for kidney transplant patients undergoing parathyroidectomy (consult Kidney Transplant team).

1. Ionized calcium levels measured immediately post operatively and q6h thereafter for the first 48h, with frequency to be reassessed thereafter. Target ionized calcium levels are equal to or greater than 1.0 mmol/L. Goal of therapy is to maintain calcium levels without many fluctuations.

2. Nephrology consulted in PACU, to assess patient, and determine dialysis plans. Note that for hemodialysis (HD) patients, heparin should not be used for the first 48-72h post operatively, and consultation with the surgical team is needed if heparin use is in question at any point. Dialysate bath calcium should be increased to 1.75mmol/L, to be reassessed each dialysis session. For peritoneal dialysis (PD) patients, orders should be written to use “normal calcium” bags, as regular PD bags are low in calcium.

3. Patients should be started immediately on Calcium Carbonate 2500 mg PO tid post-operatively, with changes as needed thereafter, assuming patient is able to eat and swallow (consult with surgical team if this is in question). Generally, patients are on this medication for phosphorus binding with meals prior to surgery, but the indication here is to supplement their calcium so ideally should be spaced between meals rather than with them. For the peri-operative period, the focus should be on serum calcium levels rather than phosphorus levels even if they are elevated in the 2.0 to 3.0 mmol/L range. The expectation is that in the medium-long term post-discharge, there will be hormonal and dietary changes necessitating follow up and medication rationalization.

4. Patients should be started on calcitriol 0.5 mcg PO bid post-operatively, with changes as needed thereafter.

5. If the ionized calcium is between 0.9 and 1.0 mmol/L, using additional oral agents (including up-titration of calcitriol and calcium carbonate dosing) should be prioritized over IV calcium dosing.

6. If the patient is symptomatic (perioral numbness, muscle cramps, any rhythm disturbances, Chvostek or Trousseau' signs), or if ionized calcium levels are continuously falling on repeat measurements, or if levels are below 0.9 mmol/L, a bolus of 1-2g of calcium gluconate may be given over 10-20 min, in 50 mL D5W.

An infusion of calcium gluconate may be needed (5 g in 500 mL D5W at 50mL/h) thereafter to maintain calcium until oral medications have take effect, **BUT IF THIS IS BEING CONSIDERED, CALL SURGICAL TEAM STAT TO DISCUSS AS SOON AS POSSIBLE.**

7. Regardless of dialysis modality (in-centre HD, home HD, or PD), the nephrology team consulting on these patients should be clearly identified in the chart (Red vs. Blue), and the out-patient dialysis nephrologist should be informed about these patients to arrange out-patient follow up plan. For in-centre HD patients, please email the associated patient care coordinator for the patient's HD shift. For PD patients, contact HPDU at ext. 14-5672. For home HD patients, contact home HD unit at ext. 14-3736.

8. Medication prescriptions should be given to these patients on discharge for at least 2-3 months refills, to avoid any disruption in management and metabolic

aberrancies. They will need close follow up with calcium, PTH, and phosphorus levels within first 5 days after discharge, twice weekly for first 2-3 weeks, and then weekly thereafter for 4 weeks. Changes to calcium carbonate and calcitriol can then be made by the out-patient teams. **FOLLOW UP PLAN MUST BE CONFIRMED BEFORE DISCHARGE WITH THE APPROPRIATE OUTPATIENT TEAMS.**

NOTE: If the patient was on cinacalcet pre-operatively (unusual and unlikely scenario but possible), then this can be stopped pre-operatively, and communicated to out-patient team to reassess need for this medication in the future.

For any questions or clarifications/comments related to this topic, please contact Tushar Malavade at tushar.malavade@uhn.ca

Table 8. Drug Dosing for HD, CAPD and CRRT

D = Dose I = Prolonged Interval NA = Not Available

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
Acarbose	D	Avoid	Unknown	Unknown	Avoid
Acebutolol	D	30-50%	None	None	50%
Acetazolamide	I	Avoid	Unknown	Unknown	Avoid
Acetohexamide	I	Avoid	Unknown	None	Avoid
Acetohydrox-aminic acid	D	Avoid	Unknown	Unknown	Unknown
Acetaminophen	I	Q8H	None	None	q6h
ASA	I	Avoid	After HD	None	q4-6h
Acrivastine	D	Unknown	Unknown	Unknown	Unknown
Acyclovir	D,I	See UHN Guide	See UHN Guide	Dose for RF	3.5 mg/kg/d
Adenosine	D	100%	None	None	100%
Albuterol	D	50%	Unknown	Unknown	75%
Alcuronium	D	Avoid	Unknown	Unknown	Avoid
Alfentanil	D	100%	Unknown	Unknown	100%
Allopurinol	D	25%	½ dose	Unknown	50%
Alprazolam	D	100%	None	Unknown	NA
Alteplase (tPA)	D	100%	Unknown	Unknown	100%
Altretamine	D	Unknown	Unknown	Unknown	Unknown
Amantadine	I	q7d	See UHN Guide	None	q48-72h
Amikacin	D,I	20-30% q24-48h	See UHN Guide	15-20mg/L/d	30-70% q12-18h
Amiloride	D	Avoid	NA	NA	NA
Amiodarone	D	100%	None	None	100%
Amitriptyline	D	100%	None	Unknown	NA
Amlodipine	D	100%	None	None	100%
Amoxapine	D	100%	Unknown	Unknown	NA
Amoxicillin	I	See UHN Guide	See UHN Guide	250mg q12h	NA
Amphotericin	I	q24-36h	See UHN Guide	See UHN Guide	q24h
Ampicillin	I	See UHN Guide	See UHN Guide	250mg q12h	q6-12h
Amrinone	D	50-75%	Unknown	Unknown	100%
Anistreplase	D	100%	Unknown	Unknown	100%
Astemizole	D	100%	Unknown	Unknown	NA
Atenolol	D,I	30-50% q96h	25-50 mg	None	50%q48h
Atovaquone	-	100%	None	Unknown	Unknown
Atracurium	D	100%	Unknown	Unknown	100%
Auranofin	D	Avoid	None	None	None
Azathioprine	D	50%	Yes	Unknown	75%
Azithromycin	D	100%	None	None	None
Azlocillin	I	q8h	Dose after HD	Dose for RF	q6-8h
Aztreonan	D	25%	0.5g after HD	Dose for RF	50-75%

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
Benazepril	D	25-50%	None	None	50-75%
Bepridil	-	Unknown	None	None	Unknown.
	D = Dose I = Prolonged Interval NA = Not Available				
Betamethazone	D	100%	Unknown	Unknown	100%
Betaxolol	D	50%	None	None	100%
Bezafibrate	D	25%	Unknown	Unknown	50%
Bisoprolol	D	50%	Unknown	Unknown	75%
Bleomycin	D	50%	None	Unknown	75%
Bopindolol	D	100%	None	None	100%
Bretylium	D	25%	None	None	25-50%
Bromocriptine	D	100%	Unknown	Unknown	Unknown
Brompheniramine	D	100%	Unknown	Unknown	NA
Budesonide	D	100%	Unknown	Unknown	100%
Bumetanide	D	100%	None	None	NA
Bupropion	D	100%	Unknown	Unknown	NA
Buspirone	D	100%	None	Unknown	NA
Busulfan	D	100%	Unknown	Unknown	100%
Butorphanol	D	50%	Unknown	Unknown	NA
Capreomycin	I	q48h	Dose after HD	None	q24h
Captopril	D,I	50% q24h	25-30%	None	75% q12-18h
Carbamazepine	D	100%	None	None	None
Carbidopa	D	100%	Unknown	Unknown	Unknown
Carboplatin	D	25%	50%	Unknown	50%
Carmustine	D	Unknown	Unknown	Unknown	Unknown
Carteolol	D	25%	Unknown	None	50%
Carvedilol	D	100%	None	None	100%
Cefaclor	D	50%	250 mg after HD	250mg q8-12h	NA
Cefadroxil	I	q24-48h	0.5-1.0g after	HD0.5g/d	NA
Cefamandole	I	q12h	0.5-1.0g after	HD0.5-1.0g q12h	q6-8h
Cefazolin	I	See UHN Guide	See UHN Guide	See UHN Guide	q12h
Cefepime	I	q24-48h	1g after HD	Dose for RF	Not recommend
Cefixime	D	50%	300 mg after HD	200 mg/d	Not recommend
Cefmenoxine	D,I	0.75g q12h	0.75g after HD	0.75g q12h	0.75g q8h
Cefmetazole	I	q48h	Dose after HD	Dose for RF	q24h
Cefonicid	D,I	0.1g/d	None	None	None
Cefoperazone	D	100%	1g after HD	None	None
Ceforanide	I	q24-48h	0.5-1.0g after	HDNone	1 g/d
Cefotaxime	I	See UHN Guide	See UHN Guide	1g/d	1g q12h
Cefotetan	D	See UHN Guide	See UHN Guide	1g/d	750 mg q12h
Cefoxitin	I	q24-48h	1g after HD	1g/d	q8-12h
Cefpodoxime	I	q24-48h	200 mg after HD	Dose for RF	NA
Cefprozil	D,I	250 mg q24h	250 mg after HD	Dose for RF	Dose for RF

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
Ceftazidime	I	See UHN Guide	See UHN Guide	See UHN Guide	q24-48h
Cefibuten	D	25%	300 mg after HD	Dose for RF	50%
Ceftizoxime	I	q24h	1g after HD	0.5-1.0g/d	q12-24h
Ceftriaxone	D	100%	See UHN Guide	750 mg q12h	100%
Drug	**Method**	**Renal Failure dose**	**Dose after HD**	**Dose during CAPD**	**Dose during CRRT**
	D = Dose I = Prolonged Interval NA = Not Available				
Cefuroxime axetil	D	See UHN Guide	See UHN Guide	Dose for RF	NA
Cefuroxime sodium	I	See UHN Guide	See UHN Guide	Dose for RF	1g q12h
Celiprolol	D	75%	Unknown	None	100%
Cephalexin	I	See UHN Guide	See UHN Guide	Dose for RF	NA
Cephalothin	I	q12h	Dose after HD	1g q12h	1g q8h
Cephapirin	I	q12h	Dose after HD	1g q12h	1g q8h
Cephradine	D	25%	Dose after HD	Dose for RF	NA
Cetirizine	D	30%	None	Unknown	NA
Chloral hydrate	D	Avoid	None	Unknown	NA
Chlorambucil	D	Unknown	Unknown	Unknown	Unknown
Chloramphenicol	D	100%	See UHN Guide	None	None
Chlorazepate	D	100%	Unknown	Unknown	NA
Chlordiazepoxide	D	50%	None	Unknown	100%
Chloroquine	D	50%	See UHN Guide	None	None
Chlorpheniramine	D	100%	None	Unknown	NA
Chlorpromazine	D	100%	None	None	100%
Chlorpropamide	D	Avoid	Unknown	None	Avoid
Chlorthalidone	I	Avoid	NA	NA	NA
Cholestyramine	D	100%	None	None	100%
Cibenzoline	D,I	66% q24h	None	None	100% q12h
Cidofovir	D	Avoid	Unknown	Unknown	Avoid
Cilastin	D	Avoid	Avoid	Avoid	Avoid
Cilazapril	D,I	10-25% q72h	None	None	50%q24-48h
Cimetidine	D	25%	None	None	50%
Cinoxacin	D	Avoid	Avoid	Avoid	Avoid
Ciprofloxacin	D	See UHN Guide	See UHN Guide	250mg q8h (200 if IV)	200 mg IV q12h
Cisapride	D	50%	Unknown	Unknown	50-100%
Cisplatin	D	50%	Yes	Unknown	75%
Cladribine	D	Unknown	Unknown	Unknown	Unknown
Clarithromycin	D	See UHN Guide	See UHN Guide	None	None
Clavulanic acid	D	50-75%	Dose after HD	Dose for RF	100%
Clindamycin	D	100%	See UHN Guide	See UHN Guide	None
Clodronate	D	Avoid	Unknown	Unknown	Unknown
Clofazimine	--	100%	None	None	Unknown
Clofibrate	I	Avoid	None	Unknown	q12-18h
Clomipramine	D	Unknown	Unknown	Unknown	NA
Clonazepam	D	100%	None	Unknown	NA

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
Clonidine	D	100%	None	None	100%
Cloxacillin		See UHN Guide	See UHN Guide		
Codeine	D	50%	Unknown	Unknown	75%
Colchicine	D	50%	None	Unknown	100%
Colestipol	D	100%	None	None	100%
Cortisone	D	100%	None	Unknown	100%
Drug	**Method**	**Renal Failure dose**	**Dose after HD**	**Dose during CAPD**	**Dose during CRRT**
	D = Dose I = Prolonged Interval NA = Not Available				
Cotrimoxazole	See UHN Guide		See UHN Guide		
Cyclophosphamide	D	75%	½ dose	Unknown	100%
Cycloserine	I	q24h	None	None	q12-24h
Cyclosporine	D	100%	None	None	100%
Cytarabine	D	100%	Unknown	Unknown	100%
Dapsone	--	Unknown	None	Dose for RF	Unknown
Daunorubicin	D	100%	Unknown	Unknown	Unknown
Delavirdine	--	100%	None	Unknown	Unknown
Desferrioxamine	D	100%	Unknown	Unknown	100%
Desipramine	D	100%	None	None	NA
Dexamethasone	D	100%	Unknown	Unknown	100%
Diazepam	D	100%	None	Unknown	100%
Diazoxine	D	100%	None	None	100%
Diclofenac	D	100%	None	None	100%
Dicloxacillin	D	100%	None	None	NA
Didanosine	I	q24-48h	Yes	Dose for RF	Dose for RF
Diflunisal	D	50%	None	None	50%
Digitoxin	D	50-75%	None	None	100%
Digoxin	D,I	10-25% q48h	None	None	25-75%q36h
Dilevalol	D	100%	None	None	Unknown
Diltiazem	D	100%	None	None	100%
Diphenhydramine	D	100%	None	None	None
Dipyridamole	D	100%	Unknown	Unknown	NA
Dirithromycin	--	100%	None	Unknown	100%
Disopyramide	I	q24-40h	None	None	q12-24h
Dobutamine	D	100%	Unknown	Unknown	100%
Doxacurium	D	50%	Unknown	Unknown	50%
Doxazosin	D	100%	None	None	100%
Doxepin	D	100%	None	None	100%
Doxorubicin	D	100%	None	Unknown	100%
Doxycycline	D	100%	See UHN Guide	None	100%
Dyphilline	D	25%	⅓ dose	Unknown	50%
Enalapril	D	50%	20-25%	None	75-100%
Epirubicin	D	100%	None	Unknown	100%
Ebastine	D	50%	Unknown	Unknown	50%

Erythromycin	D	See UHN Guide	See UHN Guide	None	None
Esmolol	--	--	None	None	Unknown
Estazolam	D	100%	Unknown	Unknown	NA
Ethacrynic Acid	I	Avoid	None	None	NA
Ethambutol	I	q48h	See UHN Guide	Dose for RF	q24-36h
Ethchlorvynol	D	Avoid	None	None	NA
Ethionamide	D	50%	None	None	None
Ethosuximide	D	100%	None	Unknown	Unknown

Drug	**Method**	**Renal Failure dose**	**Dose after HD**	**Dose during CAPD**	**Dose during CRRT**
	D = Dose I = Prolonged Interval NA = Not Available				
Etodolac	D	100%	None	None	100%
Etomidate	D	100%	Unknown	Unknown	100%
Etoposide	D	50%	None	Unknown	75%
Famcyclovir	I	See UHN Guide	See UHN Guide	Unknown	Unknown
Famotidine	D	10%	None	None	25%
Fazadinium	D	100%	Unknown	Unknown	100%
Felodipine	D	100%	None	None	100%
Fenoprofen	D	100%	None	None	100%
Fentanyl	D	100%	Unknown	Unknown	100%
Fexofenadine	I	q24h	Unknown	Unknown	q12-24h
Flecainide	D	50-75%	None	None	100%
Fleroxacin	D	50%	400 mg post HD	400 mg/d	NA
Fluconazole	D	See UHN Guide	See UHN Guide	See UHN Guide	100%
Flucytosine	I	q24h	Yes	0.5-1.0 g/d	q16h
Fludarabine	D	50%	Unknown	Unknown	75%
Flumazenil	D	100%	None	Unknown	NA
Flumarizine	D	100%	None	None	None
Fluorouracil	D	100%	Yes	Unknown	100%
Fluoxetine	D	100%	Unknown	Unknown	NA
Flurazepam	D	100%	None	Unknown	NA
Flurbiprofen	D	100%	None	None	100%
Flutamide	D	100%	Unknown	Unknown	Unknown
Fluvastatin	D	100%	Unknown	Unknown	100%
Fluvoxamine	D	100%	None	Unknown	NA
Foscarnet	D	6 mg/kg	See UHN Guide	Dose for RF	15 mg/kg
Fosinopril	D	75-100%	None	None	100%
Furosemide	D	100%	None	None	NA
Gabapentin	D,I	300 mg/d	Yes	--	300 mg q12-24h
Gallamine	D	Avoid	NA	NA	Avoid
Ganciclovir	I	See UHN Guide	See UHN Guide	Dose for RF	2.5 mg/kg/d
Ganciclovir oral	D,I	500 mg q48-96h	Yes	Dose for RF	NA
Gemfibrozil	D	100%	None	Unknown	100%

Gentamycin	D,I	20-30% q24-48h	See UHN Guide	3-4 mg/L/d	30-70%q12h
Glibornuride	D	Unknown	Unknown	Unknown	Avoid
Gliclazide	D	Unknown	Unknown	Unknown	Avoid
Glipizide	D	100%	Unknown	Unknown	Avoid
Glyburide	D	Avoid	None	None	Avoid
Gold Na thiomalate	D	Avoid	None	None	Avoid
Griseofulvin	D	100%	None	None	None
Guanabenz	D	100%	Unknown	Unknown	100%
Guanadrel	I	q24-48h	Unknown	Unknown	q12-24h
Guanethidine	I	q24-36h	Unknown	Unknown	Avoid
Drug	**Method**	**Renal Failure dose**	**Dose after HD**	**Dose during CAPD**	**Dose during CRRT**
	D = Dose I = Prolonged Interval NA = Not Available				
Guanfacine	D	100%	None	None	100%
Haloperidol	D	100%	None	None	100%
Heparin	D	100%	None	None	100%
Hexobarbital	D	100%	None	Unknown	NA
Hydralazine	I	q8-16h	None	None	q8h
Hydrocortisone	D	100%	Unknown	Unknown	100%
Hydroxyurea	D	20%	Unknown	Unknown	50%
Hydroxyzine	D	Unknown	100%	100%	100%
Ibuprofen	D	100%	None	None	100%
Idarubicin	--	Unknown	Unknown	Unknown	Unknown
Ifosfamide	D	75%	Unknown	Unknown	100%
Iloprost	D	50%	Unknown	Unknown	100%
Imipenem	D	See UHN Guide	See UHN Guide	Dose for RF	50%
Imipramine	D	100%	None	None	NA
Indapamide	D	Avoid	None	None	NA
Indinavir	--	100%	None	Dose for RF	Unknown
Indobufen	D	25%	Unknown	Unknown	NA
Indomethacin	D	100%	None	None	100%
Insulin	D	50%	None	None	75%
Ipratropium	D	100%	None	None	100%
Isoniazid	D	50%	See UHN Guide	Dose for RF	Dose for RF
Isosorbide	D	100%	10-20 mg	None	100%
Isradipine	D	100%	None	None	100%
Itraconazole	D	See UHN Guide	See UHN Guide	See UHN Guide	100 mg q12-24h
Kandamycin	D,I	20-30% q24-48h	⅔ dose after HD	15-20 mg/L/d	30-70% q12h
Ketamine	D	100%	Unknown	Unknown	100%
Ketanserin	D	100%	None	None	100%
Ketoconazole	D	100%	See UHN Guide	None	None
Ketoprofen	D	100%	None	None	100%
Ketorolac	D	50%	None	None	50%
Labetolol	D	100%	None	None	100%

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
Lamivudine	D,I	25 mg/d (50mg 1st dose)	Yes	Dose for RF	50-150 mg/d (full 1st dose)
Lamotrigine	D	100%	Unknown	Unknown	100%
Lansoprazole	D	100%	Unknown	Unknown	Unknown
L-dopa	D	100%	Unknown	Unknown	100%
Levofloxacin	D	See UHN Guide	See UHN Guide	Dose for RF	50%
Lidocaine	D	100%	None	None	100%
Lincomycin	I	q12-24h	None	None	NA
Linezolid		See UHN Guide	See UHN Guide		
Lisinopril	D	25-50%	20%	None	50-75%
Lispro insulin	D	50%	None	None	None
Lithium carbonate	D	25-50%	Yes	None	50-75%
Lomefloxacin	D	50%	Dose for RF	Dose for RF	NA
Drug	**Method**	**Renal Failure dose**	**Dose after HD**	**Dose during CAPD**	**Dose during CRRT**
	D = Dose I = Prolonged Interval NA = Not Available				
Loracarbef	I	q3-5d	Yes	Dose for RF	q24h
Lorazepam	D	100%	None	Unknown	100%
Losartan	D	100%	Unknown	Unknown	100%
Lovastatin	D	100%	Unknown	Unknown	100%
LMW heparin	D	50%	Unknown	Unknown	100%
Maprotiline	D	100%	Unknown	Unknown	NA
Meclofenamic acid	D	100%	None	None	100%
Mefenamic acid	D	100%	None	None	100%
Mefloquine	--	100%	None	None	Unknown
Melphalan	D	50%	Unknown	Unknown	75%
Meperidine	D	50%	Avoid	None	Avoid
Meprobamate	I	q12-18h	None	Unknown	NA
Meropenem	D,I	250-500 mg q24h	See UHN Guide	Dose for RF	250-500 mg q12h
Metaproterenol	D	100%	Unknown	Unknown	100%
Metformin	D	Avoid	Unknown	Unknown	Avoid
Methadone	D	50-75%	None	None	NA
Methenamine mandelate	D	Avoid	NA	NA	NA
Methicillin	I	q8-12h	None	None	q6-8h
Methimazole	D	100%	Unknown	Unknown	100%
Methotrexate	D	Avoid	None	None	50%
Methyldopa	I	q12-24h	250 mg	None	q8-12h
Methyl prednisolone	D	100%	Yes	Unknown	100%
Metoclopramide	D	50%	None	Unknown	50-75%
Metocurine	D	50%	Unknown	Unknown	50%
Metolazone	D	100%	None	None	NA
Metoprolol	D	100%	50 mg	None	100%
Metronidazole	D	See UHN Guide	See UHN Guide	See UHN Guide	100%
Mexiletine	D	50-75%	None	None	None

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
Mezlocillin	I	q8h	None	None	q6-8h
Miconazole	D	100%	None	None	None
Midazolam	D	50%	NA	NA	NA
Midodrine	--	Unknown	5mg q8h	Unknown	5-10 mg q8h
Miglitol	D	Avoid	Unknown	Unknown	Avoid
Milrinone	D	50-75%	Unknown	Unknown	100%
Minocycline	D	100%	See UHN Guide	None	100%
Minoxidil	D	100%	None	None	100%
Mitomycin C	D	75%	Unknown	Unknown	Unknown
Mitoxantrone	D	100%	Unknown	Unknown	100%
Mivacurium	D	50%	Unknown	Unknown	Unknown
Moricizine	D	100%	None	None	100%
Morphine	D	50%	None	Unknown	75%
Moxalactam	I	q24-48h	Yes	Dose for RF	q12-24h
Drug	**Method**	**Renal Failure dose**	**Dose after HD**	**Dose during CAPD**	**Dose during CRRT**
	D = Dose I = Prolonged Interval NA = Not Available				
Nabumetone	D	100%	None	None	100%
N-Acetylcysteine	D	75%	Unknown	Unknown	100%
N-Acetyl-Procainamide	D,I	25% q12-18h	None	None	50% q8-12h
Nadolol	D	25%	40 mg	None	50%
Nafcillin	D	100%	None	None	100%
Nalidixic acid	D	Avoid	See UHN Guide	Avoid	NA
Naloxone	D	100%	NA	NA	100%
Naproxen	D	100%	None	None	100%
Nefazodone	D	100%	Unknown	Unknown	NA
Nelfinavir	--	Unknown	Unknown	Unknown	Unknown
Neostigmine	D	25%	Unknown	Unknown	50%
Netilmicin	D,I	10-20% q24-48h	⅔ dose after HD	3-4 mg/L/d	20-60% q12h
Nevirapine	D	100%	None	Dose for RF	Unknown
Nicardipine	D	100%	None	None	100%
Nicotinic acid	D	25%	Unknown	Unknown	50%
Nifedipine	D	100%	None	None	100%
Nimodipine	D	100%	None	None	100%
Nisoldipine	D	100%	None	None	100%
Nitrazepam	D	100%	Unknown	Unknown	NA
Nitrofurantoin	D	Avoid	See UHN Guide	NA	NA
Nitroglycerine	D	100%	Unknown	Unknown	100%
Nitroprusside	D	100%	None	None	100%
Nitrosourea	D	25-50%	None	Unknown	Unknown
Nizatidine	D	25%	Unknown	Unknown	50%
Norfloxacin	I	Avoid	NA	NA	NA
Nortriptyline	D	100%	None	None	NA

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
Ofloxacin	D	25-50%	100 mg bid	Dose for RF	300 mg/d
Omeprazole	D	100%	Unknown	Unknown	Unknown
Ondansetron	D	100%	Unknown	Unknown	100%
Orphenadrine	D	100%	Unknown	Unknown	NA
Ouabain	I	q36-48h	None	None	q24-36h
Oxaprozin	D	100%	None	None	100%
Oxatomide	D	100%	None	None	NA
Oxazepam	D	100%	None	Unknown	100%
Oxcarbazepine	D	100%	Unknown	Unknown	Unknown
Paclitaxel	D	100%	Unknown	Unknown	100%
Pancuronium	D	Avoid	Unknown	Unknown	50%
Paroxetine	D	50%	Unknown	Unknown	NA
Para-aminosalicylate	D	50%	Yes	Dose for RF	Dose for RF
Penbutolol	D	100%	None	None	100%
Penicillamine	D	Avoid	1/3 dose	Unknown	Avoid
Penicillin G	D	See UHN Guide	See UHN Guide	Dose for RF	75%
Drug	**Method**	**Renal Failure dose**	**Dose after HD**	**Dose during CAPD**	**Dose during CRRT**
	D = Dose I = Prolonged Interval NA = Not Available				
Penicillin VK	D	100%	See UHN Guide	Dose for RF	NA
Pentamidine	I	q48h	See UHN Guide	None	None
Pentazocine	D	50%	None	Unknown	75%
Pentobarbital	D	100%	None	Unknown	100%
Pentopril	D	50%	Unknown	Unknown	50-75%
Pentoxifylline	D	100%	Unknown	Unknown	100%
Pefloxacin	D	100%	None	None	100%
Perindopril	D	50%	25-50%	Unknown	75%
Phenelzine	D	100%	Unknown	Unknown	NA
Phenobarbital	I	q12-16h	Yes	½ normal dose	q8-12h
Phenylbutazone	D	100%	None	None	100%
Phenytoin	D	100%	None	None	None
Pindolol	D	100%	None	None	100%
Pipecuronium	D	25%	Unknown	Unknown	50%
Piperacillin	I	See UHN Guide	See UHN Guide	Dose for RF	q6-8h
Piretanide	D	100%	None	None	NA
Piroxicam	D	100%	None	None	100%
Plicamycin	D	50%	Unknown	Unknown	Unknown
Pravastatin	D	100%	Unknown	Unknown	100%
Prazepam	D	100%	Unknown	Unknown	NA
Prazosin	D	100%	None	None	100%
Prednisolone	D	100%	Yes	Unknown	100%
Prednisone	D	100%	None	Unknown	100%
Primaquine	--	100%	Unknown	Unknown	Unknown
Primidone	I	q12-24h	⅓ dose	Unknown	Unknown

Drug	Method	Renal Failure dose	Dose after HD	Dose during CAPD	Dose during CRRT
Probenecid	D	Avoid	Avoid	Unknown	Avoid
Probucol	D	100%	Unknown	Unknown	100%
Procainamide	I	q8-24h	200 mg	None	q6-12h
Promethazine	D	100%	None	None	100%
Propafenone	D	100%	None	None	100%
Propofol	D	100%	Unknown	Unknown	100%
Propoxyphene	D	Avoid	None	None	NA
Propanolol	D	100%	None	None	100%
Propylthiouracil	D	100%	Unknown	Unknown	100%
Protriptyline	D	100%	None	None	NA
Pyrazinamide	D	Avoid	See UHN Guide	Avoid	Avoid
Pyridostigmine	D	20%	Unknown	Unknown	35%
Pyrimethamine	D	100%	None	None	None
Quazepam	D	Unknown	Unknown	Unknown	NA
Quinapril	D	75%	25%	None	75-100%
Quinidine	D	75%	100-200 mg	None	100%
Quinine	I	q24h	Yes	Dose for RF	q8-12h
Ramipril	D	25-50%	20%	None	50-75%

Drug **Method** **Renal Failure dose** **Dose after HD** **Dose during CAPD** **Dose during CRRT**

D = Dose I = Prolonged Interval NA = Not Available

Ranitidine	D	25%	½ dose	None	50%
Reserpine	D	Avoid	None	None	100%
Ribavirin	D	50%	Yes	Dose for RF	Dose for RF
Rifabutin	--	100%	None	None	Unknown
Rifampin	D	50-100%	See UHN Guide	See UHN Guide	Dose for RF
Ritonavir	--	100%	None	Dose for RF	Unknown
Saquinavir	--	100%	None	Dose for RF	Unknown
Secobarbital	D	100%	None	None	NA
Sertraline	D	100%	Unknown	Unknown	NA
Simvastatin	D	100%	Unknown	Unknown	100%
Sodium valproate	D	100%	None	None	None
Sotalol	D	15-30%	80 mg	None	30%
Sparfloxacin	D,I	50% q48h	Dose for GFR<10	Unknown	50-75%
Spectinomycin	D	100%	None	None	None
Spironolactone	I	Avoid	NA	NA	Avoid
Stavudine	D,I	50% q24h	Yes	Unknown	Unknown
Streptokinase	D	100%	NA	NA	100%
Streptomycin	I	q72-96h	See UHN Guide	20-40 mg/L/d	q24-72h
Streptozotocin	D	50%	Unknown	Unknown	Unknown
Succinylcholine	D	100%	Unknown	Unknown	100%
Sufentanil	D	100%	Unknown	Unknown	100%
Sulbactam	I	q24-48h	Yes	0.75-1.5 g/d	750 mg q12h
Sulfamethoxazole	I	q24h	1g after HD	1g/d	q18h

Sulfinpyrazone	D	Avoid	None	None	100%
Sulfisoxazole	I	q12-24h	2g after HD	3g/d	NA
Sulindac	D	100%	None	None	100%
Sulotroban	D	10%	Unknown	Unknown	Unknown
Tamoxifen	D	100%	Unknown	Unknown	100%
Tazobactam	D	See UHN Guide	See UHN Guide	Dose for RF	75%
Teicoplanin	I	q72h	Dose for RF	Dose for RF	q48h
Temazepam	D	100%	None	None	NA
Teniposide	D	100%	None	None	100%
Terazosin	D	100%	Unknown	Unknown	100%
Terbutaline	D	Avoid	Unknown	Unknown	50%
Terfenadine	D	100%	None	None	NA
Tetracycline	I	q24h	See UHN Guide	None	q12-24h
Theophylline	D	100%	½ dose	Unknown	100%
Thiazides	D	Avoid	NA	NA	NA
Thiabendazole		See UHN Guide			
Thiopental	D	75%	NA	NA	NA
Ticarcillin	D,I	1-2g q12h	3g after HD	Dose for RF	1-2g q8h
Ticlopidine	D	100%	Unknown	Unknown	100%
Timolol	D	100%	None	None	100%

Drug	**Method**	**Renal Failure dose**	**Dose after HD**	**Dose during CAPD**	**Dose during CRRT**
	D = Dose I = Prolonged Interval NA = Not Available				
Tobramycin	D,I	20-30% q24-48h	See UHN Guide	See UHN Guide	30-70% q12h
Tocainide	D	50%	200mg	None	100%
Tolazamide	D	100%	Unknown	Unknown	Avoid
Tolbutamide	D	100%	None	None	Avoid
Tolmetin	D	100%	None	None	100%
Topiramate	D	25%	Unknown	Unknown	50%
Topotecan	D	25%	Unknown	Unknown	50%
Torsemide	D	100%	None	None	NA
Tranexamic acid	D	10%	Unknown	Unknown	Unknown
Tranylcypromine	D	Unknown	Unknown	Unknown	NA
Trazodone	D	Unknown	Unknown	Unknown	NA
Triamcinolone	D	100%	Unknown	Unknown	Unknown
Triamterene	I	Avoid	NA	NA	Avoid
Triazolam	D	100%	None	None	NA
Trihexyphenidyl	D	Unknown	Unknown	Unknown	Unknown
Trimethadione	I	q12-24h	Unknown	Unknown	q8-12h
Trimethoprim	I	q24h	Yes	q24h	q18h
Trimetrexate	D	Avoid	Unknown	Unknown	Unknown
Trimipramine	D	100%	None	None	NA
Tripelennamine	D	Unknown	Unknown	Unknown	NA
Triprolidine	D	Unknown	Unknown	Unknown	NA

Tubocurarine	D	Avoid	Unknown	Unknown	50%
Urokinase	D	Unknown	Unknown	Unknown	Unknown
Valacyclovir	D,I	0.5 g q24h	Yes	Dose for RF	Unknown
Valganciclovir		See UHN Guide	See UHN Guide		
Vancomycin	D,I	See UHN Guide	See UHN Guide	See UHN Guide	500 mg q24-48h
Vecuronium	D	100%	Unknown	Unknown	100%
Venlafaxine	D	50%	None	Unknown	NA
Verapamil	D	100%	None	None	100%
Vidarabine	D	75%	Yes	Dose for RF	100%
Vigabatrin	D	25%	Unknown	Unknown	50%
Vinblastine	D	100%	Unknown	Unknown	100%
Vincristine	D	100%	Unknown	Unknown	100%
Vinorelbine	D	100%	Unknown	Unknown	100%
Voriconazole		See UHN Guide	See UHN Guide		
Warfarin	D	100%	None	None	None
Zafirlukast	D	100%	Unknown	Unknown	100%
Zalcitabine	I	q24h	Unknown	Unknown	Unknown
Zidovudine	D,I	100 mg q8h	Dose for RF	Dose for RF	100 mg q8h

Adapted from: Arnoff, G.R. in Manual of Nephrology, Fifth Edition, Edited by Robert W. Schriver, Lippincott Williams & Wilkins Press 2000. ISBN 0-7817-2172-5

UHN 2009 Guidelines for Antimicrobial Use. The University Health Network, Toronto, Ont.

Table 9. Antibiotic Dosing in Renal Impairment

Dose Adjustment of Select Medications Based on Calculated Creatinine Clearance (CrCl)

	Creatinine Clearance (CrCl) in mL/min			
Drug	**≥50**	**25-49**	**10-24**	**<10**
(***Note:*** The following dosage recommendations are ***not*** intended for endocarditis or meningitis treatment)				
acyclovir (IV)	5-10 mg/kg q8h	5-10 mg/kg q12h	5-10 mg/kg q24h	50% dose q24h
acyclovir (PO)				
genital herpes	400 mg tid	400 mg tid	400 mg tid	200 mg q12h
varicella zoster	800 mg 5x/day	800 mg 5x/day	800 mg tid	800 mg q12h

Drug	***Creatinine Clearance (CrCl) in mL/min***			
	≥50	**25-49**	**10-24**	**<10**
amikacin (initial dosing, once daily dosing)	**CrCl ≥60** 15 mg/kg q24h	**CrCl 40-59** 15 mg/kg q36h	**CrCl 20-39** 15 mg/kg q48h	**CrCl <20** Not recommended▪
	Adjust dose based on serum drug levels*			
amikacin (initial dosing, traditional dosing)	**CrCl ≥50** 5-7.5 mg/kg load, *then* 4-5 mg/kg IV q8h	CrCl 15-49 5-7.5 mg/kg load, *then* 3-5 mg/kg IV q12h	**< 15** 5-7.5 mg/kg load, *then* 2-3 mg/kg IV q24h	
	Adjust dose based on serum drug levels*			
amoxicillin/ clavulanic acid	250/125 mg - 500/125 mg q12h	250/125 mg - 500/125 mg q12h	250/125 mg - 500/125 mg q12h	250/125 mg - 500/125 mg q24h
amphotericin B lipid complex (ABELCET)	5 mg/kg IV q24h			5 mg/kg IV q24-36h
amphotericin B liposome (AMBISOME)	3-6 mg/kg IV q24h			3-6 mg/kg IV q24-36h
ampicillin	1-2 g q4-6h	1-2 g q6-12h	1-2 g q6-12h	1-2 g q12-24h
azithromycin	No adjustments required			
caspofungin	No adjustments required			
cefazolin	1-2 g q8h	1-2 g q12h	1-2 g q12h	1-2 g q24h
ceftazidime	1-2 g q8h	**CrCl <30** 1-2 g q12h	1-2 g q24h	50% dose q24-48h
ceftriaxone	No adjustments required			
cefuroxime axetil (PO)	500 mg q12h	500 mg q12h	500 mg q12h	500 mg q24h
cephalexin	250-500 mg q6h	**CrCl <40** 250-500 mg q8-12h	250-500 mg q8-12h	50% dose q12-24h
ciprofloxacin (PO)	500-750 mg q12h	**CrCl <30** 500-750 mg q24h	500-750 mg q24h	500-750 mg q24h

Drug	***Creatinine Clearance (CrCl) in mL/min***				
	≥50		**25-49**	**10-24**	**<10**
ciprofloxacin (IV)	400 mg q12h		**CrCl <30** 400 mg q24h	400 mg q24h	400 mg q24h
clarithromycin	250-500 mg q12h		**CrCl <30** 50% dose q12h	50% dose q12h	50% dose q12h
clindamycin	No adjustments required				
cloxacillin	No adjustments required				
cotrimoxazole (IV)	8-10 mg/kg in 2-4 divided doses daily		**CrCl <30** 50% dose in 2-4 divided doses daily	50% dose in 2-4 divided doses daily	Not recommended▪
PCP pneumonia	15-20 mg/kg in 2-4 divided doses daily		**CrCl <30** 50% dose in 2-4 divided doses daily	50% dose in 2-4 divided doses daily	Not recommended▪
cotrimoxazole (PO) (DS = TRIMETHOPRIM 160 MG, SULFAMTHOXAZOLE 800 MG)	1DS bid		1DS q24h	1DS q24h	Not recommended▪
erythromycin	500-1000 mg q6h		500-1000 mg q6h	500-1000 mg q6h	50-70% dose q6h
famciclovir			**CrCl <40**	**CrCl <20**	
genital herpes	250 mg q12h		125 mg q12h	125 mg daily	125 mg daily
varicella zoster	**CrCl >60** 500 mg tid **CrCl >50** 500 mg q12h		**CrCl <40** 500 mg q24h	**CrCl <20** 500 mg q48h	500 mg q48h
fluconazole	50-400 mg q24h		50% dose q24h	50% dose q24h	25% dose q24h
ganciclovir (IV)	**CrCl >70**	**CrCl 50-69**			
Treatment	5 mg/kg q12h	2.5 mg/kg q12h	2.5 mg/kg q24h	1.25 mg/kg q24h	

Drug	***Creatinine Clearance (CrCl) in mL/min***				
	≥50		**25-49**	**10-24**	**<10**
Maintenance	5 mg/kg q24h	2.5 mg/kg q24h	2.5 mg/kg q24h	0.625 mg/kg q24h	
gentamicin (initial dosing, once daily dosing)	**CrCl ≥60** 5 mg/kg q24h		**CrCl 40-59** 5 mg/kg q36h	**CrCl 20-39** 5 mg/kg q48h	**CrCl <20** Not recommended▪
	Adjust dose based on serum drug levels*				
gentamicin (initial dosing, traditional dosing)	**CrCl ≥50** 1.5-2 mg/kg load, *then* 1.25 mg/kg IV q8h		CrCl 15-49 1.5-2 mg/kg load, *then* 1 mg/kg IV q12h	**CrCl <15** 1.5-2 mg/kg load, *then* 0.5-1 mg/kg IV q24h	
	Adjust dose based on serum drug levels*				
imipenem/cilistatin	500 mg q6h		**CrCl <30** 500 mg q8-12h	500 mg q12h	500 mg q12h (<1 g/day); **CrCl <5** Not recommended unless on hemodialysis▪
intraconazole	No adjustments required				
ketoconazole	No adjustments required				
linezolid	No adjustments required				
metronidazole	No adjustments required				
moxifloxacin	No adjustments required				
penicillin G	1-4 MU q4-6h		1-4 MU q8-12h	1-4 MU q8-12h	1-4 MU q12h
piperacillin/ tazobactam	4.5 g q8h		**CrCl <40** 3.375 g q8h	**CrCl <20:** 3.375 g q12h	3.375 g q12h
tobramycin (initial dosing, once daily dosing)	**CrCl ≥60** 5 mg/kg q24h		**CrCl 40-59** 5 mg/kg q36h	**CrCl 20-39** 5 mg/kg q48h	**CrCl <20** Not recommended▪
	Adjust dose based on serum drug levels*				

Drug	***Creatinine Clearance (CrCl) in mL/min***			
	≥50	**25-49**	**10-24**	**<10**
tobramycin (initial dosing, traditional dosing)	1.5-2 mg/kg load, *then* 1.25 mg/kg IV q8h	CrCl 15-49 1.5-2 mg/kg load, *then* 1 mg/kg IV q12h		**CrCl <15** 1.5-2 mg/kg load, *then* 0.5-1 mg/kg IV q24h
	Adjust dose based on serum drug levels*			
valganciclovir				
Induction	450 mg q12h	450 mg q24h	450 mg every 2 days	Not recommended▪
Maintenance	450 mg q24h	450 mg every 2 days	450 mg 2x/week	Not recommended▪
vancomycin	**CrCl ≥65** 1 g q12h ***or*** 15 mg/kg q12h **CrCl 50-64** 1 g q24h	**CrCl 35-49** 1 g q24-36h	**CrCl 21-34** 1 g q48h	CrCl ≤20 15-20 mg/kg loading dose
	Adjust dose based on serum drug levels*			
voriconazole (IV)	6 mg/kg q12h x 24h, *then* 4 mg/kg IV q12h	Not recommended due to diluent▪		
voriconazole (po)	No adjustments required			

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1. McEvoy GK, ed. AHFS Drug Information. Bethesda, MD; American Society of Health-System Pharmacists, Inc. 2002.
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3. Welbanks L, ed. Compendium of Pharmaceuticals and Specialties, 37th Ed. Ottawa, ON; Canadian Pharmacists Association 2002.
4. MICROMEDEX(R) Healthcare Series Vol. 123, expires 3/2005.

Updated by: Carmen Ma, BScPhm, Staff Pharmacist, Nephrology – Oct, 2002

Revised by: Michael Wong – 2005

Antibiotic Dosing Guidelines in Hemodialysis

When making a dosage schedule for patients on hemodialysis, the dose adjustment for the degree of renal function must be determined first, and then the effect of dialysis on the total body clearance of the drug must be taken into account.

For practical purposes, it is most convenient to separate antibiotics into four groups:

1. **HEMODIALYZABLE with a LONG $t_{1/2}$**
   A dose of these drugs should be given immediately after hemodialysis (e.g., the order should be written: cefazolin 1 g daily, give post-dialysis on dialysis days)
2. **HEMODIALYZABLE with a SHORT $t_{1/2}$**
   It is difficult for hemodialysis to have a significant effect on total body clearance for these drugs due to their intrinsically short half-life. Since most of the drugs in this category have a high therapeutic index, it is unnecessary to alter the dose or to supplement the dose after dialysis, with a few exceptions.
3. **NOT HEMODIALYZABLE with a LONG $t_{1/2}$**
4. **NOT HEMODIALYZABLE with a SHORT $t_{1/2}$**

Note: A **LONG $t_{1/2}$** will be one that allows for a dosing interval of 24 hrs or more.

Drugs for which the recommended dosing interval is every 8 to 18 hours and which are hemodialyzable result in the most complex dosing schedule. The time interval from the end of dialysis, when serum levels are low, until the next dose could be between 4 and 14 hours and would therefore be of clinical importance. Also, the amount of additional antibiotic needed at the end of dialysis would be dependent on how close the previous dose was to the start of dialysis, and this could change from day to day. Therefore, the doses suggested have sometimes been modified from those in the literature to avoid q8h-q18h dosage. A q6h interval with the same total daily dose may be given. In this way, there are never more than a couple of hours with low (sub-therapeutic) serum levels.

The usual recommended trough concentrations of drugs are not applicable in patients with severe renal impairment. Because of the extended t1⁄2 of drugs in these patients, the usual trough concentrations are not achievable without an extended period of sub-therapeutic concentrations.

The following recommendations are made assuming:

- Normal hepatic function
- Adult patients
- Patient's glomerular filtration rate (GFR) <10 mL/min (0.16 mL/sec)
- Standard hemodialysis schedules of 3 to 6 hours of hemodialysis every 2 to 3 days

Note: The following dosage recommendations for antimicrobials are not intended for treatment of endocarditis or meningitis. For endocarditis and meningitis, target levels to be determined on a case by case basis by the Infectious Disease Service or the medical team.

Table 10: Dosing Guidelines in Hemodialysis and CVVHD

Drug	***Recommended Dose for IHD***	***Dose after IHD***	***Recommended Dose for CVVHD***
acyclovir	2.5-5 mg/kg IV q24h 200 mg PO q12h (*Herpes simplex*) 800 mg PO q12h (*Herpes zoster*)	yes	5-10 mg/kg IV q12-24h No adjustment necessary for PO
amantadine	200 mg PO once a week	no	100 mg PO q48-72h
amikacin	5 mg/kg IV load, *then* 2.5 mg/kg IV post hemodialysis* **Adjust dose based on trough level****	yes	5-7.5 mg/kg load, *then* 3-4.5 mg/kg IV q12h **Adjust dose based on trough level****
amoxicillin	250 mg PO q12h ***or*** 500 mg PO q24h	yes	500 mg PO q8-12h (liquid available)
amoxicillin/clavulanic acid	250/125 mg PO q12h ***or*** 500/125 mg PO q24h	yes	-
ampicillin (IV)	1-2 g IV q12-24h	yes	1-2 g IV q6-12h
caspofungin	70 mg IV load, *then* 50 mg IV q24h	no	70 mg IV load, *then* 50 mg IV q24h
cefazolin	1 g IV q24h ***or*** 2 g IV post hemodialysis*	yes	1 g IV q12h
cefotaxime	1-2 g IV q24h	yes	1 g IV q12h
ceftazidime	1 g IV q24h ***or*** 1-2 g post hemodialysis*	yes	1-2 g IV q12-24h
ceftriaxone	1-2 g IV q24h	no	1-2 g IV q12-24h
cefuroxime axetil (PO)	250-500 mg PO q12h ***or*** 500 mg PO q24h	yes	250-500 mg PO q12h (liquid available)
cephalexin	250-500 mg PO q12h	yes	250-500 mg PO q12h (liquid available)
chloramphenicol	0.25-1 g IV q6h (12.5 mg/kg q6h)	no	-

Drug	Recommended Dose for IHD	Dose after IHD	Recommended Dose for CVVHD
chloroquine	500 mg PO x 1 dose, *then* 250 mg PO weekly (malaria)	no	-
ciprofloxacin	250-500 mg PO q24h 200-400 mg IV q24h	no	500 mg PO q12-24h 400 mg IV q12-24h
clarithromycin	250-500 mg PO q12h	yes	-
clindamycin	150-300 mg PO q6h 300-600 mg IV q8h	no	150-300 mg PO q6h 300-600 mg IV q8h
cotrimoxazole (PO) (DS = trimethoprim 160 mg , sulfamethoxazole 800 mg	1 DS tablet PO q24h (for indications other than PCP)	yes	1DS PO q24h (liquid available)
doxycycline	100 mg PO daily to BID	no	100 mg PO daily to BID
erythromycin	250-500 mg IV/PO q6h (1 g q6h causes predictable reversible deafness)	no	250-500 mg IV q6h
ethambutol	Not recommended in patients with GFR <10 mL/min▪	N/A	15-25 mg/kg q24h (No dose adjustment necessary)
famciclovir *Herpes simplex* *Herpes zoster*	125mg PO TTS or MWF 250mg PO TTS or MWF	yes	125 mg PO q12-24h 500 mg PO q12-24h
fluconazole	400 mg IV/PO loading dose, *then* 100-400 mg IV/PO daily to q2days	yes	100–400 mg IV/PO q24h
foscarnet (See guidelines for details)	45-60 mg/kg post hemodialysis	N/A	
ganciclovir (IV)	*Treatment:* 1.25 mg/kg IV post hemodialysis* *Maintenance:* 0.625 mg/kg IV post hemodialysis*	yes	2.5 mg/kg IV q24h (treatment and maintenance)

Drug	***Recommended Dose for IHD***	***Dose after IHD***	***Recommended Dose for CVVHD***
gentamicin	2 mg/kg IV loading dose, *then* 1 mg/kg IV post hemodialysis* **Adjust dose based on trough level****	yes	oad, *then* 12h **Adjust dose based on trough level****
imipenem/cilastatin	250-500 mg IV q12h	yes	500mg IV q6-8h
isoniazid	300 mg PO daily	yes	300 mg PO daily
itraconazole (PO)	100-200 mg PO q12h (Take tablets with food; take solution on empty stomach)	no	100-200 mg PO q12h (liquid available)
ketoconazole	200-400 mg PO daily	no	200-400 mg PO daily
linezolid	600 mg PO/IV q12h	yes	600 mg PO/IV q12h (No adjustment necessary)
meropenem	500 mg IV q24h	yes	250-500 mg IV q12h
metronidazole	500 mg IV/PO q12h *C. difficile:* 500 mg PO q8h	yes	500 mg IV/PO q12h *C. difficile:* 500 mg PO q8h
minocycline	*200 mg PO x 1 dose,* then *100 mg PO q12h*	*no*	*200 mg PO x 1 dose,* then *100 mg PO q12h*
moxifloxacin	*400 mg IV/PO q24h* (No adjustment necessary)		*400 mg IV/PO q24h* (No adjustment necessary)
nalidixic acid	*Not recommended in patients with GFR <10 mL/min▪* *(Metabolites accumulate)*	*N/A*	*Not recommended▪*
nitrofurantoin	Not recommended in patients with GFR < 30 mL/min▪	N/A	Not recommended▪
penicillin G	1 Million Units (MU) IV q8-12h (maximum dose = 10 MU/day)	yes	0.5-3 MU IV q6h

Drug	*Recommended Dose for IHD*	*Dose after IHD*	*Recommended Dose for CVVHD*
penicillin VK	300 mg PO q6h	yes	300 mg PO q6h
pentamidine isethionate	3-4 mg/kg IV q24h	no	4 mg/kg IV q24h
piperacillin/ tazobactam	3.375 mg IV q12h	yes	3.375 mg IV q6-8h
pyrazinamide	40 mg/kg PO 3x/week (Give 24 hours **before** the start of each hemodialysis)	no	25-30 mg/kg q24h
rifampin	300-600 mg PO q24h	no	300-600 mg PO q24h
streptomycin	15 mg/kg IV loading dose, *then* 9 mg/kg IV post hemodialysis*	yes	15 mg/kg q24-72h
tetracycline	250-500 mg PO q24h (Note: doxycycline is preferred)	yes	250-500 mg q12h
tobramycin	2 mg/kg IV loading dose, *then* 1 mg/kg IV post hemodialysis* **Adjust dose based on trough level****	yes	oad, *then* 12h **Adjust dose based on trough level****
valganciclovir	Not recommended in hemodialysis▪	N/A	*Induction:* 450 mg PO q24h *Maintenance:* 450 mg PO q48h
vancomycin	See Table 3 on Vancomycin Dosing for hemodialysis and/or discuss dosing with pharmacist		
voriconazole (IV)	Not recommended in patients with GFR <50 mL/min due to vehicle for IV preparation▪	N/A	Not recommended due to vehicle for IV preparation▪
voriconazole (PO)	400 mg PO q12h x 2 days, *then* 200 mg PO q12h	N/A	400 mg PO q12h x 2 days, *then* 200 mg PO q12h

* Only give on hemodialysis days.

** Consult with pharmacist for dosage adjustment.

▪ Pharmacist to discuss therapeutic alternatives with physician.

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Updated by: Carmen Ma, BScPhm, Staff Pharmacist, Nephrology – October 2002
Revised by: Marisa Battistella, PharmD - May 2006

Nephrogenic systemic fibrosis (NSF) and Gd-enhanced MRI

Gd-enhanced MRI should be avoided in dialysis patients, or with any pt with CrCl < 30 mL/min unless absolutely necessary. If done in this group, Nephrology to be consulted first.

- Any patient needing MRI on who is on HD, is to be dialyzed directly after the MRI for 3 consecutive days as prophylaxis against NSF
- Patients on PD should have insertion of temporary line and have HD daily X3 since Gd is not likely removed at an adequate rate by PD.

UHN Policy for NSF:

Nephrogenic systemic fibrosis (NSF) is a recently identified fibrosing disorder. It was initially described as causing thickening and hardening of the skin overlying the trunk and extremities. Subsequent studies showed that some patients had fibrosis of deeper structures including muscle, fascia, lungs, and the heart. This disease, while rare, has a significant mortality rate.

The vast majority of cases, or according to some publications, all cases of NSF, have occurred in patients with kidney failure. The risk appears greatest in patients in end-stage renal disease (ESRD). Increasing epidemiologic evidence has implicated gadolinium-containing contrast agents (Gd). Based on the number of reported cases,

risk appears to be greater with increasing dose of Gd, and with certain types of Gd-agents. The greatest number of NSF cases reported to date has been in patients that have received Omniscan (gadodiamide).

General Guidelines

If the patient has ESRD, the patient should be examined with an alternate imaging modality, other than contrast-enhanced MRI (CEMRI), such as CT, or unenhanced MRI. If CEMRI is thought to be essential, a nephrology consult must be obtained. Nephrology will arrange for dialysis (HD or PD) to be done immediately after the CE-MRI.

Omniscan should never be used in any patient with renal failure (Cr > 150 umol/L or GFR < 30 mL/min). An alternative Gd-agent should be used, such as: Magnevist, Gadovist, Prohance, or Multihance, depending on the preference of the supervising radiologist, and the availability of the agent. If Omniscan is the agent to be used for CE-MRI in any patient, the dose used should never exceed the recommended dose on the Omniscan package insert.

Specific Guidelines: Ordering & Performing Gd-Enhanced MRI & MRA

PATIENTS WITH RENAL FAILURE

1. All clinicians who order MRI should clearly identify on the requisition if the patient is receiving hemodialysis, peritoneal dialysis, or is in renal failure. For those in renal failure but not on dialysis a recent serum creatinine or GFR will be required. The referring physician must consult with a radiologist to determine the best imaging strategy for the patient. Alternative imaging modalities, other than CEMRI, will be considered to determine whether they are acceptable.

- Patients on dialysis. If the patient is on dialysis, a nephrologist must be consulted prior to doing Gd-enhanced MRI of any kind. In general terms, these patients should be examined with an alternate imaging modality, other than CEMRI, such as CT, or unenhanced MRI. If CEMRI is thought to be essential to the health and well-being of

the patient, and there is no acceptable imaging alternative, nephrology will arrange for hemodialysis to be done immediately after the CEMRI.

- Patients in moderate renal failure. (creatinine > 150 umol/L, GFR < 30 mL/min). One of the usual alternatives to CEMRI is CECT, however CECT carries some risk of further worsening renal function in patients with renal impairment (contrast-induced nephropathy). Accordingly, the best imaging strategy for patients with moderate renal failure must be discussed with a radiologist prior to booking the study. The radiologist will weigh the risk-benefit ratio of doing CT, CECT, NCMRI or CEMRI in consultation with the referring physician. A nephrology consult may be required.

PATIENTS WITH NO HISTORY OF RENAL FAILURE

1. UHN and MSH currently have a preferred provider arrangement with the supplier of Omniscan, the most frequently used agent in our hospitals. Since there has not been shown to be any significantly increased risk of NSF in patients with normal renal function with the administration of Omniscan, continue to use Omniscan for CEMRI in patients with no history of renal failure.

2. Regardless of the contrast agent used, do not exceed the recommended dose as delineated in the package insert on a mL/kg basis. The only exception to this rule shall be when direct instructions are given by a radiologist to exceed this dose. The usual indication for a larger dose shall be MRA.

3. If the indication for contrast-enhancement is MRA of the Head, Neck, Heart, Chest, Abdomen or Pelvis, then Gadovist is recommended. Magnevist, Prohance or Multihance may also be used, depending on availability of the agent and the preference of the supervising radiologist.

4. If the indication for contrast-enhancement is MRA of the Legs or Feet, then Magnevist is recommended. Gadovist, Prohance or Multihance may also be used, depending on availability of the agent and the preference of the supervising radiologist.

5. If the radiologist, nurse or MRI technologist has any concerns about the reliability of the patient's renal history, do not use Omniscan. Use an alternate agent, or obtain a serum creatinine or GFR, to obtain an objective measure of the patient's renal function.

** For purposes of this policy, patients should be asked whether or not they have impaired renal function. If they reply, “I do not know if my renal function is impaired”, we will handle these patients as if they did not have impaired renal function. *(Rationale: All patients reported to have had NSF have had severe renal impairment; most were on dialysis. Thus it is extremely unlikely that a patient could have a degree of renal function impairment that would be of concern to us, and be unaware of it).*

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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.

Book Anaesthesia consult: Enter referral in EPIC, page through locating and you can send email to AnesthesiaORSecretary@uhn.ca Include name, MRN, DOB, diagnosis, location, planned OR, staff MD.

Telephone Directory

Ontario regional kidney centres**,** dialysis units, and nephrologist contact information is in Nephrology Sharepoint - > Morning Handover -> Nephrology contacts

Advanced Practice Nurse Educators	
Shabana Samim (Incentre HD, Home Hemo, and satellites, TRI)	14-7938
Pallavi Christian (Incentre HD, Home Hemo, and satellites, TRI)	14-2051
Liat Hall-Chippy (HPDU & DSU, 6A, TWH)	14- 8726
Emerg TG	14-3947
TW	13-2777
Chiropodist – Luckzani Balakrishnan	14-6007, pager 437-881-6977
Fracture Clinic TW	13-5858
Dialysis Start Unit: 12ES	14-4757
Education Coordinator, Dr. Malavade	
Elysia Batista	14-2065, 8N-841
Hemodialysis Unit West	14-4072, fax14-4892
Hemodialysis Unit East	14-5707, fax 14-3084
Hemodialysis Unit TRI Bickle	(416) 597-3422, ext. 2374
Home Peritoneal Dialysis Unit: 12ES	14-5672, fax 14-4169
Home Hemodialysis	14-3736, fax 14-4379
Interventional Radiology / Angio	14-5339
Kidney Foundation: Peer Support	(905)278-3003, ext. 4973

Labs	14-5898
Rapid Response	14-3542
Microbiology	14-2526
Mt Sinai Hospital	(416) 596-4200 or (17+ extension)
Nurse Practitioners (NP)	
Jovina Bachynski	14-8501, pager (416) 790-7758
	cell (647) 532-2094
Joy Lee	14-3992, cell (647) 539-4036
Jennifer Park	14-6623
Nurse Navigator, Anna Gozdzik	14-5129
Multi-Care Kidney Clinic	fax 14-4291
Zedfrey Salazar, RN	14-3588
Sandy Li, RN	14-2399
Alison Finkelstein, clerical coordinator	14-6883
O'Neill Centre	(416) 536-1116, fax (416) 536-6941
On Call Room	14-2541
Psych Consult	14-4451
Pathology – Dr Rohan John	14-4560
PD coordinator, Zita Abreu	14-2358
Princess Margaret Hospital	(416) 946-2000 or (16 + extension)
Sheppard Centre	(416) 979-4442, fax (416) 223-3321
Social Workers	
Tracey Ragnanan	14-3983, pager (416) 719-2812
Melissa Rubin	14-7847, pager (416) 719-3731
Mary Paul	14-4768, pager (416) 719-2668
Angela Tse	14-3618, pager (416) 719-2876
Jessica Gilbert	14-8334, pager (416) 790 - 0312

Sussex Centre	(416) 979-4443, fax (905) 272-4534
Toronto Western Hospital	(416) 603-2581 or (13+extension)
Translation Services	14-5522
Vascular Access Coordinator, Frank Shih	14-6158, pager (416)790-5320
Vascular Access Coordinator, Gary Manzanilla	14-3518, pager (416)790-5320
Vascular Lab	14-3589

Nephrologists (Assistant)	**Address**	**Office**	**Pager**
Dr. J. Bargman (Shelagh)	8N-840	14-4804	(416)790-6317
Dr. M. Barua (Ethelyn)	8N-855	14-8007	(416)714-6720
Dr. C. Cardella (Zoraida)	MaRS 9077	14-4480	(416)790-4932
Dr. C. Chan (Tais)	8N-846	14-3073	(416)790-9833
Dr. D. Cherney (Marion)	8N-845	14-4151	(416)790-7711
Dr. V. Jassal (Samantha)	8N-857	14-3196	(416)790-8803
Dr. A. Jauhal (Jetrine)	8N-829	14-8012	(416) 714-0627
Dr. A. Kaushal (Susan)	8N-861	14-2893	(416)714-0362
Dr. J. Kim (Cindy)	MaRS 9065	14-3228	(416)790-0255
Dr. A. Kitchlu (Jetrine)	8N-842	14-2893	(647)984-9652
Dr. A. Kovalinka (Guilhermina)	MaRS 9068	14-6950	(416)714-7029
Dr. C. Lok (Ethelyn)	8N-844	14-4140	(416)790-8645
Dr. T. Malavade (Susan)	8N-814B	14-7917	(416)714-0409
Dr. A. Merchant (Aditi)	8N-814A	14-3047	(416)715-7251
Dr. I. Mucsi (Lidiia)	MaRS 9062	14-4084	(416) 715-0171
Dr. R. Parekh (Andrea)	HSC 686 Bay St.	(416)813-7654, ext 328042	
Dr. Y. Pei (Shiela)	8N-838	14-4257	(416)790-8988
Dr. H. Reich (Marion, Sasha)	8N-849	14-3439	(416)719-1102
Dr. J. Schiff (Zoraida)	MaRS 9064	14-3840	(416)790-8296

Dr. J. Scholey (Veronica)	8N-859	14-5093	(416)719-4569
Dr. M. Silverman (Samantha)	8N-848	14-4064	(416)790-8918
Dr. S. Singh (Aditi)	MaRS 9067	14-3240	
Dr. K. Tinckham (Cindy)	RFE 1S-409	14-3228	(416)790-1368

Doctors for Surgical Procedures

Dr. M. Cattral	14-3760
Dr. G. Roche-Nagle	14-3552
Dr. L. Tse	14-3275
Dr. T. Lindsay	14-4620
Dr. D. Goldstein (for parathyroidectomy)	14-4767
Dr. G. Oreopoulos (Vascular)	14-3275

Doctors for PD catheter insertions

Dr. T. Penner (OR)	13-6220
Dr. Malavade (bedside)	contact Zita Abreu 14-2358
Dr. Ganesan Annamalai (IR)	contact Zita Abreu 14-2358

Calendar of Weekly Rounds

	Monday	Tuesday	Wednesday	Thursday	Friday
0800	Sign In Rounds 8N-828 Conference Room	Sign In Rounds 8N-828	Sign In Rounds 8N-828	Sign In Rounds 8N-828	Sign In Rounds 8N-828
0830 - 0930	Teaching Rounds 8N-828 Conference Room & Zoom	Teaching Rounds 8N-828 & Zoom	Teaching Rounds 8N-828 & Zoom	Teaching Rounds 8N-828 & Zoom	Division Rounds 12N-1276 & Zoom (coffee & light breakfast)
10:00				PD Rounds 12NU 424	
10:30	Yellow team patient rounds 6A conference room 115			Yellow team patient rounds 6A conference room 115	
1100					
1200				Home Dialysis Rounds 12N-1276 & Teams	
1230		1230 – 1330 General Nephrology Journal Club 8N-828 (lunch provided)	1245 - 1330 eHOME Rounds Teams		
1300					
1400					
1500		Inter-professional Education Rounds Teams	Education Rounds 11C-1135 & Zoom		
1530					Friday Sign-out Rounds 8N-828
1600			City Wide Nephrology Rounds 11C-1135 & Zoom	Renal Biopsy Rounds Zoom – Dr. Jauhal	
1700	Sign-out to on call 8N-828	Sign-out to on call 8N-828	Sign-out to on call 8N-828	Sign-out to on call 8N-828	