Peritoneal Dialysis in ICU and PD associated Infections
Content Sourced From

- Beyond Basic course lecture, c/o Dr Komala
- Nepean Hospital Policies
- ISPD Guidelines
- Kimberley Aboriginal Medical Services Council
Usual ICU Cases

• Somebody already on PD - new Peritonitis

• Regular PD patient with non-related issue

• Two types
  – CAPD: continuous ambulatory peritoneal dialysis
  – APD: automated peritoneal dialysis
PD - advantages

• PD
  – Low technical & nursing requirements
  – Low cost
  – Does not require vascular access
  – Mode of choice in children and neonates
Contraindications in an ICU patient

- Absence of intact peritoneum
- Multisystem organ failure with septic shock
- Severe life-threatening hyperkalemia
- Pleuro-peritoneal communication
- Severe respiratory failure
  - Diaphragmatic splinting
Important Factors

• Peritoneal Permeability
• Peritoneal blood flow
  – Cardiac output
  – Blood pressure
  – Splanchnic circulation Surface Area
• Dialysate
  – Solute Characteristics
  – Concentration Gradient
  – Temperature
  – Total Volume in 24 hrs
• Dwell Time
Peritoneal dialysis membrane

- Peritoneum
- Interstitial matrix
- Capillary endothelium
PD Mechanism

- Diffusion (solute movement across membrane)
- Ultrafiltration (water movement)
- Absorption (lymphatic drainage)
Pore Model

Trans-endothelial transport

Transcellular pore (aquaporin)

Small solutes

Small pore equivalent

Glycocalyx

Large pore equivalent

Protein

Interstitium

Capillary Lumen

Transcellular forces

Osmotic pressure dominates

Hydrostatic and osmotic pressures

Hydrostatic pressure dominates
Dialysate dwell time

• ↑ time ⇒
  – ↑ solute clearance
Dialysate dwell time

• ↑ time ⇒
  – ↑ solute clearance
  – ↓ ultrafiltration
Key points - PD

• PD suited to children and in low-resource settings
• PD continued if hemodynamically stable and not critically unwell
• Not suitable for rapid correction of metabolic abnormalities, marked hypercatabolism, severe respiratory failure
• Requires intact peritoneum
• PD patients most likely to present to ICU for the usual problems, namely cardiovascular and septic
Catheter infection

• Exit site infection
  – purulent discharge +/- erythema

• Tunnel infection
  – erythma, tenderness over subcutaneous pathway

• Oral antibiotics
  – if no systemic illness and no peritonitis
  – Minimum 2 weeks
PD Peritonitis

1. Symptoms / signs of peritoneal inflammation
   • pain, tenderness, guarding, rebound

2. Cloudy peritoneal fluid + WCC > 100 x 10^6
   • Neutrophils >15% abnormal
   • Neutrophils >50% strong evidence

3. Bacteria on gram stain or culture
PD Peritonitis

• Incidence 1/9 - 1/53 patient-months
• Estimated mortality 6%

• Routes of Infection
  – Intraluminal
  – Periluminal
  – Transmural
  – Haematogenous

• (Troidle 2006)
Risk Factors

- Diabetes
- Non caucasian
- Obesity
- Temperate climate
- Depression
Treatment Basics

• IV antibiotics if septic
• IP antibiotics if no signs of systemic sepsis
  – More effective than IV antibiotics in this situation
• Intensification of PD regimen
• Intraperitoneal heparin
  – to reduce fibrin adhesion
Antibiotics

• **IP Treatment** (Broad spectrum Gram +ve and –ve)
  – Cephazolin, 1.5g IP
  – Gentamicin, 80mg IP
  – Vancomycin, 30mg/kg (if allergy / MRSA / exit site)

• **IV Treatment**
  – Vancomycin 1g + Gentamicin 80mg

• **Prophylaxis**
  – Nystatin 500,000 units QID (5ml)

• **Monitor for Toxicity**
Mechanical complications

- Catheter blockage – often due to fibrin clots
  - 500 units heparin to 1 or 2 bags a day
- Respiratory distress
  - Consider reducing dwell volume
- Pleural effusion
  - Stop PD, drain effusion, alternative dialysis and drug delivery
- Hernia
  - May need change over to automated PD with low volume till hernia corrected
Metabolic & Volume Complications

• **Hyperglycaemia**
  – Due to high concentration glucose in dialysate
  – Permeability increased → rapid diffusion

• **Fluid Overload**
  – Rapid absorption leads to reduced ultrafiltration
  – Consider Increased Concentration

• **Metabolic Acidosis**
  – Can choose dialysate with bicarbonate instead of lactate
Metabolic & Volume Complications

• Hypotension / Dehydration
• Hypernatremia
  – Monitor fluid status, monitor ultrafiltration
• Hypokalemia
  – Adjust potassium in dialysate, oral K supplementation
• Protein Loss - supplementation
Indications for PD catheter removal

- Refractory peritonitis (failure to respond 5d)
- Refractory exit site or tunnel infection
- Fungal peritonitis (Definite)
- Pseudomonal peritonitis (Likely)
- Consider for:
  - relapsing peritonitis
  - mycobacterium peritonitis
  - multiple enteric organisms
  - Pleural effusion
Key points - PD peritonitis

• ANTIBIOTICS
  – Intraperitoneal antibiotics
  – Systemic antibiotics if septic
  – Antifungal Prophylaxis

• Remove PD catheter if refractory or fungal

• Nepean policy outlines management