

## Dialysis

Dialysis is indicated if there are life-threatening complications like:

- fluid overload manifesting as
  - pulmonary oedema
  - congestive cardiac failure or
  - refractory hypertension
- electrolyte / acid-base imbalances:
  - hyperkalaemia ( $K^+ > 7.0$ )
  - symptomatic hypo- or hypernatraemia or
  - refractory metabolic acidosis
- symptomatic uraemia
- oliguria preventing adequate nutrition
- oliguria following recent cardiac surgery

The choice of dialysis modality depends on:

- experience with the modality
- patient's haemodynamic stability
- contraindications to peritoneal dialysis e.g. recent abdominal surgery

Refer to section on 'acute peritoneal dialysis' for further details.

## Medications

Avoid nephrotoxic drugs if possible; if still needed, monitor drug levels and potential adverse effects. Check dosage adjustment for all drugs used.

# ACUTE PERITONEAL DIALYSIS

## Introduction

The purpose of dialysis is

- to remove endogenous and exogenous toxins and
- to maintain fluid, electrolyte and acid-base equilibrium until renal function returns

*Peritoneal dialysis (PD)* is the simpler modality in infants and children as it is technically simpler and easily accessible even in centers without paediatric nephrologists.

## Contraindications to Acute PD

- abdominal wall defects or infection
- bowel distension, perforation, adhesion or resection
- communication between the chest and abdominal cavities

## Types of Catheter Access

- a *soft PD catheter* implanted percutaneously or surgically (preferred)
- a *straight rigid catheter* if a soft PD catheter is not available

Table 1. Indications for dialysis

### Acute renal failure

pulmonary oedema  
 refractory hypertension  
 oliguria following recent heart surgery  
 symptomatic electrolyte  
 or acid-base imbalance  
 - hyperkalaemia ( $K^+ > 7.0$ )  
 - hypo- or hypernatraemia  
 - acidosis ( $pH < 7.2$ ,  
 or  $< 7.3$  with hyperkalaemia)  
 uraemia

### Inborn errors of metabolism

encephalopathy  
 hyperammonaemia  
 severe metabolic acidosis

### Site of insertion

- commonest site is at the midline infra-umbilical position 1 inch below the umbilicus
- in small children, where the space below the umbilicus is limited, alternative sites include insertion lateral to the inferior epigastric artery as shown in the dotted lines in the diagram, two-thirds of the distance from the umbilicus to the left last rib (just lateral to the border of rectus muscle)
- ensure that the catheter is inserted way below any enlarged spleen or liver.

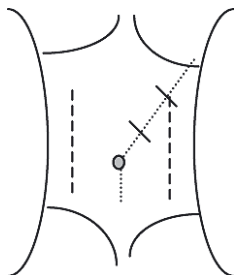


Fig 1. Site of insertion and direction of catheter introduction

### Procedure of PD catheter insertion

1. consent for first peritoneal dialysis
2. bladder must be emptied; catheterise the bladder in unconscious, ill patients
3. the procedure must be done under aseptic technique
4. prepare the set of PD lines and spike the PD fluids
5. clean the area with povidone iodine and drape the patient
6. infiltrate insertion site with lignocaine; additional IV sedation may be needed
7. for small infants or patients with very scaphoid abdomen, infiltrating the abdominal cavity with 10 – 15 ml/kg PD fluid using 20G or larger branula prior to catheter insertion will help prevent traumatic puncture of underlying viscus
8. for technique of catheter insertion - see boxes 2 and 3
9. connect the catheter to the PD line via the connector provided in the set.
10. bleeding from the insertion site can be stopped by a purse-string suture.

Table 2. Technique of insertion of different PD catheters

#### Acute stiff PD catheter

1. check catheter for any breakages (by withdrawing the stylette) before insertion.
2. make a small skin incision (slightly smaller than the diameter of the catheter) using a sharp pointed blade. Do not cut the muscle layer
3. introduce the catheter with the stylette perpendicular to the abdominal wall while controlling the length with the dominant hand, until the peritoneum is pierced. The stylette is then withdrawn and the catheter gently pushed in, directing it towards either iliac fossa until all the perforations are well within the peritoneal cavity

#### Soft PD catheter (Seldinger technique)

1. Cooke's set 15F
2. advance the needle provided in the set connected to a syringe perpendicularly until peritoneum is breached (a give is felt)
3. thread and advance the guide wire through the needle aiming for either iliac fossa
4. remove the needle. Using the guide wire, introduce the dilator and sheath through a skin nick into the abdominal cavity
5. remove the dilator and guide wire while retaining the sheath in the abdomen
6. introduce the soft PD catheter through the sheath into the abdominal cavity directing it to either iliac fossa until the external cuff fits snugly at the skin
7. peel off the sheath and secure the catheter via taping or a skin stitch

**Table 3. The PD Prescription****Exchange volume**

Start at 20 ml/kg and observe for discomfort, cardiorespiratory changes or leakage at catheter site  
The volume can be increased to a maximum of 50ml/kg or 1000 -1200ml/m<sup>2</sup> body surface area.

**Cycle Duration**

First 6 cycles are rapid cycles i.e. no dwell time. The cycle duration depends on needs of the patient. However, the standard prescription usually last an hour:

- 5-10 minutes to instill (depending on exchange volume)
- 30-40 minutes dwell
- 10-15 minutes to drain (depending on exchange volume)

The cycles can be done manually or with an automated cycler machine if available.

**PD Fluids**

Type of PD fluids:

- 1.5%, and 4.25% dextrose (standard commercially available)
- Bicarbonate dialysate<sup>1</sup>, useful if lactic acidosis is a significant problem

PD is usually initiated with 1.5% - if more rapid ultrafiltration is required higher glucose concentration by mixing various combinations of 1.5 and 4.25% solutions can be used. Watch for hyperglycaemia.

**Duration of PD**

The duration of PD depends on the needs of the patient

The usual practice is 60 cycles but at times more cycles may be needed based on biochemical markers or clinical needs. Peritonitis is frequent when dialysis is prolonged or when acute catheters are used for more than 3 to 4 days.

<sup>1</sup>Note: In centers with continuous renal replacement therapy, the bicarbonate solution used for CRRT (Continuous Renal Replacement Therapy) can be used. In centers where this is not available, the assistance of the pharmacist is required to constitute a physiological dialysis solution. The contents and concentrations are Table 4.

**Monitoring while on PD**

- oversee the first 3 cycles of dialysis to ensure good flow.
- check for turbidity, leakage and ultrafiltration every two hours.
- input / output chart, vital signs and PD chart should be kept up-to-date. Turbid effluent must be noted to the doctor.
- send PD fluid for cell count and culture and sensitivity at start and end of PD and when the effluent is turbid.
- blood urea, serum electrolytes and creatinine should be requested according to patients needs. In stable patients, once daily should be more than sufficient.
- blood urea and electrolyte results to be reviewed by the doctor and potassium chloride to be added into dialysate if necessary.

*(1 g of potassium chloride in 10 ml ampoule is equivalent to 13.3 mmol of potassium.  
Hence adding 3 ml to 1 litre would result in dialysate with 4.0 mmol/l of potassium)*

**Common Complications**

- poor drainage (omental obstruction, kinking)  
*for temporary PD cannulas*
  - re-position
  - reinsert catheter if above unsuccessful
- for surgically implanted catheters*
  - irrigation
  - add heparin (500 units/ litre) into PD fluids

**Table 4. Pharmacy constituted PD-Bicarbonate solution 1.5% dextrose 3000ml / bag**

Content	Quantity (ml)
NaCl 0.9%	1374.00
NaCl 20%	13.23
Sodium Bicarbonate 8.4%	120.00
Magnesium Sulphate 49.3%	1.11
Dextrose 50%	90.00
Water for injection	1401.66

- peritonitis
  - diagnostic criteria* :
    - abdominal pain, fever, cloudy PD effluent, PD effluent cell count > 100 WBC/mm<sup>2</sup>
  - treatment*:
    - intraperitoneal antibiotics (empirical Cloxacillin + Ceftazidime) for 7 to 14 days
    - adjust antibiotics once culture results known (dosage as given in the table)
- exit site infection
  - send swab for culture
  - remove PD catheter that is not surgically implanted
  - systemic antibiotics may be considered
- leaking dialysate
  - at exit site – resuture immediately
  - leakage from tubings – change dialysis set, empiric intraperitoneal antibiotics for one to two days may be needed
- blood stained effluent
  - if mild observe. It should clear with successive cycles.
  - if heavy, but vital signs stable, run rapid cycles.
    - transfuse cryoprecipitate. consider blood transfusion and DDAVP.
    - if bleeding does not stop after the first few cycles, stop the dialysis.
  - if heavy, patient in shock, resuscitate as for patient with hypovolaemic shock.
    - stop dialysis and refer surgeon immediately.*

Table 4. Guidelines for intraperitoneal antibiotic use

<b>Paediatric Antibiotic Dosing Recommendations</b>			
<b>Administration should be via intraperitoneal route unless specified otherwise.</b>			
	<b>continuous therapy</b>		<b>intermittent therapy</b>
	<b>loading dose</b>	<b>maintenance dose</b>	
<i>Glycopeptides</i>			
Vancomycin	500 mg/L	30 mg/L	30 mg/kg q 5-7 days
<i>Cephalosporins</i>			
Cephazolin/cephalothin	250 mg/L	125 mg/L	15 mg/kg q 24 hrs
Cefuroxime	200 mg/L	125 mg/L	15 mg/kg q 24 hrs
Cefotaxime	500 mg/L	250 mg/L	30 mg/kg q 24 hrs
Ceftazidime	250 mg/L	125 mg/L	15 mg/kg q 24 hrs
<i>Antifungals</i>			
Amphotericin B	1 mg/kg IV	1 mg/kg/day IV	---
Fluconazole	---	---	3-6 mg/kg IP, IV, or PO q 24-48 hrs (max 200 mg)
<i>Aminoglycosides</i>			
Amikacin	25 mg/L	12 mg/L	
Gentamicin	8 mg/L	4 mg/L	
Netilmycin	8 mg/L	4 mg/L	
<i>Penicillins</i>			
Amoxicillin	250 -500 mg/L	50 mg/L	
<i>Combinations</i>			
Ampicillin/Sulbactam	1000 mg/L	100 mg/L	
Imipenem/Cilastin	500 mg/L	200 mg/L	