

Paediatric Intensive Care Unit

Guidelines for Undertaking Acute Peritoneal Dialysis Paediatric Intensive Care Unit

Staff relevant to:	All PICU nursing staff trained in extended role. All Consultants and ANP's within PICU.
Approval date:	December 2021
Version:	4
Revision due:	December 2024
Written by:	M McLaughlin
Reviewed by:	K Peace, C Westrope, F Taylor
Trust Ref:	C111/2016

1. Introduction and Who Guideline applies to

The purpose of this guideline is to provide support and direction when caring for a child requiring peritoneal dialysis (PD) this also includes cross-flow PD on the CPICU. Clinical guidelines are 'guidelines' only. The interpretation and application of clinical guidelines will remain the responsibility of the individual. If in doubt consult a senior colleague or expert. Caution is advised when using the guidelines after the review date. Deviation from this guideline must be documented in the nursing notes with an explanation of the circumstance.

This guideline applies to all PICU nursing staff trained in extended role, Consultants and ANP's within PICU.

Contents

1. Introduction and Who Guideline applies to	1
2. Guideline Standards and Procedures.....	2
2.1 CATHETER SELECTION – INCLUDING INSERTION	2
2.2 DRESSING, EXIT SITE AND IMMOBILISATION	2
2.3 CHOICE AND COMPOSITION OF PD FLUIDS	3
2.4 ADDITIVES.....	3
2.5 SETTING UP A MANUAL PD SET	4
2.6 CROSS FLOW PD	5
2.7 FLUSHING A PD CATHETER.....	6
2.8 TROUBLE SHOOTING	7
2.9 LEAKAGE	8
2.10 INFECTION.....	8
3. Education and Training	9

4. Monitoring Compliance	9
5. Supporting References	9
6. Key Words	9
Contact and review details	10

2. Guideline Standards and Procedures

2.1 CATHETER SELECTION – INCLUDING INSERTION

The majority of acute patients will have a PD catheter inserted surgically under GA. This is a Fresenius catheter which will connect directly to the Fresenius PD Paed Plus System.

If a patient has a PD catheter inserted on the unit it may be a Cook catheter. If this catheter is used a Catheter Extension Luer-Lock 25cm connector will be required to connect manual PD set to catheter



Insertion of an acute PD catheter is done using an aseptic technique so assistance will be required. To save time it is useful to prepare the following equipment:

- IV cut down set
- Sterile gown
- Sterile gloves
- Suture
- Local anaesthetic
- Betadine cleaning solution
- Fixing tape – Mefix 10cm
- Appropriate dressing
- Sterile gauze

2.2 DRESSING, EXIT SITE AND IMMOBILISATION

After the catheter has been inserted, it will need to be dressed and immobilised appropriately. Dry, non-occlusive dressings are recommended. If possible, the initial dressing should remain undisturbed for 5-7days. If oozing and/or bleeding occur, the exit site should be cleaned with Normasol and a new dry dressing applied.

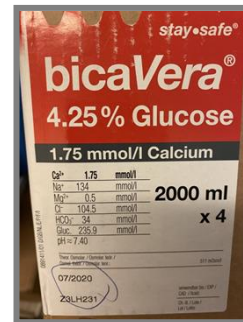
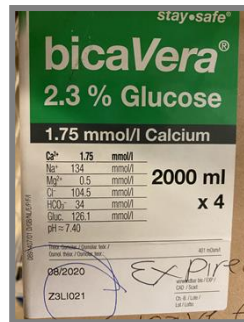
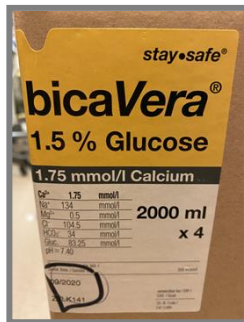
- Silicone catheters are flexible and will exit the abdomen flush with the skin. They can therefore have a dry Mepore dressing applied and a Technol tube holder used to anchor it.
- Rigid PD catheters can exit the abdomen at any angle. Secure dressings are imperative to avoid the catheter being misplaced or falling out. A butterfly dressing using Mefix tape is suggested to aid immobilisation. Keyhole dressings should be avoided as they do not offer adequate immobilisation or protection

2.3 CHOICE AND COMPOSITION OF PD FLUIDS

A wide range of commercially made PD fluids are available with varying compositions.

Bicavera is at present the routine solution of choice for hospital PD. The buffer solution in Bicavera is bicarbonate. Bicarbonate based fluids are used in the acute setting as patients often have a lactic acidosis and some liver impairment so will therefore not tolerate a lactate based fluid well. Lactate is converted into bicarbonate mmol for mmol as long as the liver is functioning normally. Neonates may be particularly intolerant of lactate because of the severity of illness and immature livers.

Bicavera fluid is available with the following glucose concentrations:



Composition once reconstituted:

- Sodium 134 mmol/L
- Calcium 1.75 mmol/L
- Magnesium 0.5 mmol/L
- Chloride 104.5 mmol/L
- Bicarbonate 34 mmol/L
- Osmolarity 358, 401 and 511 mOsmol/L
- pH 7.4

Fluid bags should be changed using a strict aseptic non-touch technique every 24 hours, the PD manual set should be changed every 48 hours.

2.4 ADDITIVES

Currently heparin is the only additive that can be added to dialysate bags. The dose is 500 units per litre – unless prescribed otherwise. Adding drugs to PD bags requires 2 staff members (one of whom is IV competent) and should be done using an aseptic non-touch technique (ANNT). Before adding to dialysis fluid bags, the expiry date, type of fluid and fluid strength should be double checked. Ensure fluid is bag is correctly labelled with a drug additive label.

CALCULATING THERAPY

CYCLE = FILL/DWELL/DRAIN

FILL = This is when the prescribed amount of dialysate fluid is infused into the patients peritoneum

DWELL = The length of time the fluid stays in the peritoneum

DRAIN = This is when the dialysate and any extra fluid removed from the patient are taken out of the peritoneum

FILL VOLUMES = In acute patients this is calculated as ml/kg. As an initial therapy, it is advisable to commence on 10-20ml/kg. This can be increased slowly dependant on patient tolerance. A fill volume of around 30-50 ml/kg is usually well tolerated and should provide adequate dialysis.

DWELL TIMES = These can vary throughout a patient's treatment and it is advisable to check chemistry levels at least twice a day in order to adjust the dialysis to meet the patient's requirements. As a starting point, hourly cycles are usually prescribed. When using a manual PD set this will give a 5-min fill, 45-min dwell and a 10-min drain. When making adjustments to dwell times it is not necessary to alter fill and drain times unless needed.

2.5 SETTING UP A MANUAL PD SET

Equipment required:

- Appropriate strength Bicavera fluid pack
- PD set



- Open fluid pack and manual PD set onto a clean surface, clamp all clamps on the manual set (5 in total plus one roller clamp).
- Attach drainage bag to set and clamp
- Ensure both fluid compartments are mixed and hang fluid bag (and connected drainage bag) on a drip stand
- Connect the manual PD set to the fluid bag and turn the dial to the first set of 3 dots



Do not turn the dial past this point or it will not work and the whole set will need to be discarded!

- Open the blue clamp between the disc and the inflow burette and fill burette with 100mls of fluid
- Ensure the blue ball is floating on top of the fluid
- Open rest of the clamps to prime the set, always keep some fluid in the burette
- Once set is primed, clamp all clamps in the set and fill inflow burette with prescribed volume for the initial fill
- Connect PD set to patient using ANNT

2.6 CROSS FLOW PD

Cross flow PD involves the use of two peritoneal dialysis catheters. One is used for the fill and the other the drain and the process is that of continually filling whilst the other catheter is draining. The advantage of utilising this type of treatment is that there will be no prolonged periods of abdominal extension during the dwell time; therefore there will be less impact on respiratory and cardiac function as a result of this.

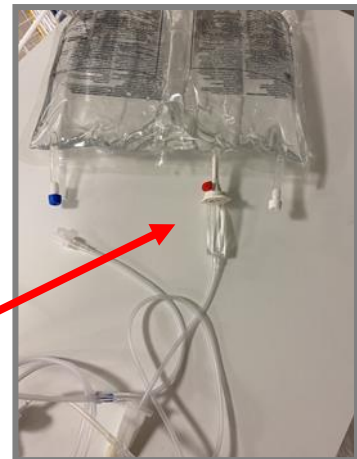
As the dwell time is significantly reduced this will impact on the efficiency of therapy. Small and middle-sized molecules may be cleared less efficiently and fluid removal may be limited. Increasing the glucose concentration may overcome the problems with fluid removal.

Equipment for draining in:

- Appropriate strength Bicavera fluid
- IV infusion set (Alaris) and pump
- Scissors



Using ANNT, open fluid pack onto a clean surface. Cut away the additional tubing set and drainage bag that comes with the Bicavera fluid bags. This can be disposed of as not required. Connect IV infusion set to the fluid bag. Ensure the 2 fluid compartments are then mixed. Once primed the IV infusion set can then be connected straight on to the PD catheter.



Insert IV infusion set into pump and using the completed PD prescription programme pump to required mls/hr.

Equipment required for draining out:

- Vygon syringe adaptor
- Urinary catheter drainage bag



Connect Vygon syringe adaptor to the PD catheter and then to the urinary catheter drainage bag. Measure output every hour and record.

2.7 FLUSHING A PD CATHETER

The flushing of an acute PD catheter is done to combat poor filling and drainage caused by a potential blockage. Flushing should be done using a strict aseptic non-touch technique. **The flushing of a PD catheter should be undertaken after discussion with the Paediatric Consultant Intensivist.**

- Clamp PD set and catheter.
- Clean top of trolley and open out sterile sheet.
- Wash hands
- Open out a 20ml syringe, blue needle, sterile sheet and an Alco-wipe onto the sterile sheet.
- Wash hands for one minute and apply algogel.
- Open Heparin 1000iu/ml and draw up 1ml.
- Open Sodium chloride and draw up 9ml.
- Thoroughly clean around connection and clamp with Alcowipe.
- Place sterile sheet under catheter.
- Detach PD set from catheter ensuring no ends are contaminated.
- Attach syringe to end of catheter, unclamp and flush in slowly (amount to be flushed in is dependent on size of child eg: 2ml neonate, 5ml small child, 10ml large child)
- **Do not aspirate as this can cause damage to the peritoneum.**
- Clamp catheter
- Re-connect manual set and recommence therapy.

2.8 TROUBLE SHOOTING

Problem	Solution
No/reduced flow on fill or drain	<ul style="list-style-type: none"> • Check there are no kinks and that all clamps on lines are open • Check blue ball in outflow burette is floating • Increase height of burette to help with drain in • If fibrin blockage, flush catheter and add heparin to the fluid bags • Reposition patient • If none of these work, change PD set
More fluid removal required	<ul style="list-style-type: none"> • Increase glucose strength of dialysis fluid • Decreasing dwell time will increase fluid removal but will also effect solute removal • Increase fill volumes but cautiously as again will effect solute clearance
Too much fluid being removed	<ul style="list-style-type: none"> • Decrease glucose strength of dialysis fluid • Lengthening the dwell time will remove less fluid
Respiratory distress	<ul style="list-style-type: none"> • Slow fill time if able • Assess ability to reduce fill volumes • Optimise patient position • Consider cross flow PD
Pain/discomfort	<ul style="list-style-type: none"> • Slow fill time if able • Consider warming fluid • Optimise patient position • Assess for signs of peritonitis

Clearance of waste products and electrolytes	
Urea	<ul style="list-style-type: none"> • One hour dwell times are usually sufficient to remove urea at an acceptable rate. • Dwell times can however be lowered to remove more urea.
Potassium	<ul style="list-style-type: none"> • Shorter dwell times are required to remove more potassium. • Half hourly rapid cycling can be used if required. • Continuous dialysis can reduce potassium levels too far and may require adding it to bags.
Sodium	<ul style="list-style-type: none"> • High plasma sodium should be lowered slowly to avoid any adverse effects. 1mmol per hour is a safe reference to use. • Very hypernatraemic patients (eg: >150mmols) should have sodium chloride added to the dialysate to avoid lowering levels too quickly.
Calcium	<ul style="list-style-type: none"> • Calcium contents of the unit prepared solutions can be adjusted according to patient's status. • Pre-made solutions are available with different calcium concentrations ranging from 0 – 1.75mmols/litre.
Creatinine	<ul style="list-style-type: none"> • Creatinine is not removed very well during peritoneal dialysis and requires longer dwell times to increase removal. • It is however, a useful indicator of kidney function and should be observed in the acute setting for any improvement.

2.9 LEAKAGE

Leakage is a common problem with acute peritoneal dialysis. The main cause for this is the early use of PD catheters without the recommended resting period to enable adequate healing or the use of acute PD catheters, which are inserted directly into the peritoneum without tunnelling. If the entry site of the catheter becomes enlarged due to movement, fluid can easily escape along the tract. The patient then becomes an even higher risk for infection.

- To avoid leakage the catheter should be well anchored to restrict any movement in the entry site.
- If leakage occurs a slight pressure dressing should be applied around the site in order to stem the flow of fluid.

Nb: the dressing should be weighed prior to application in neonates so it can be re-weighed if fluid continues to leak and fluid loss is inaccurate.

- Suturing around the entry site may be attempted by the medical staff.
- If leakage continues and becomes a problem then a new catheter should be considered.

2.10 INFECTION

Patients are at a high risk of infection when receiving acute peritoneal dialysis. This is due to the position and placement of the PD catheter and the flow of a glucose based solution in and out of the peritoneum. Potential sites of infection are the peritoneum (Peritonitis) and the catheter exit site. Observations of these two areas are simple to carry out and can aid quick recovery.

Exit site.

The catheter exit site should be carefully examined when changing the dressing. Signs of infection such as redness, oozing, pain and swelling should be looked for and the site should be swabbed if infection is suspected.

Oral or intravenous antibiotics should be prescribed if infection is proved or strongly suspected.

Topical agents such as Mupirocin ointment (Bactroban) can also be used, but long term usage has been shown to cause some resistance.

Peritonitis

Peritonitis is an inflammation of the peritoneum caused by infection. This infection can be introduced to the peritoneum in various ways such as:

- Contamination
- Poor set-up technique
- Exit/tunnel infection
- Through gut wall.

The signs of peritonitis are:

- Cloudy fluid
- Temperature
- Abdominal pain.

Advice should be sought if any of these are seen in an acute patient.

If peritonitis is suspected, samples of the drained dialysate fluid should be obtained and sent for analysis as follows:

- 20ml sample in a universal container sent to microbiology for M, C & S
- 5ml sample aseptically transferred to culture bottle and sent for M, C & S
- 20ml sample in a universal container sent to Haematology for differential white cell count (to exclude eosinophilic peritonitis)

3. Education and Training

Initial training session and ongoing

4. Monitoring Compliance

None

5. Supporting References

Consensus guidelines for the prevention and treatment of catheter-related infections and peritonitis in paediatric patients receiving peritoneal dialysis Warady et al. Peritoneal Dialysis International 2012; Vol 32; (S32-S86)

Fresenius Medical Care PD Paed System Training Manual (2006)

ISPD guidelines/recommendations – Peritoneal dialysis for acute kidney injury Cullis et al Peritoneal Dialysis International 2014 Vol 34 494-517

Nottingham University Hospitals Paediatric Acute PD Guidelines for Nurses Connell R (2018)

Schaefer et al (2007) Worldwide variation of dialysis associated peritonitis in children Kidney International 72 1374-1379

The Renal Association Clinical Practice Guidelines Peritoneal Dialysis in adults and children June 2017

6. Key Words

Bicavera, PD Catheter, Peritonitis, Renal

The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs.

As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

Contact and review details	
Guideline Lead (Name and Title) Kate Peace – Paediatric Renal Critical Care Nurse Claire Westrope – Consultant PICU/ECMO Fiona Taylor – Senior Sister	Executive Lead Chief Nurse
Details of Changes made during review: December 2021 Removed images and size information of Fresenius & Cook catheters Added images of Bicavera solutions Added that PD manual set should be changed every 48hrs & updated PD manual set section Added equipment information for draining in and out, with images Removed antibiotic and electrolyte information as possible additives to new bags Re-formatted trouble shooting table, No/reduced flow on fill - removed 'squeeze burette to re-float the ball@ replaced with increase height of burette, added change set if all other options fail Added respiratory distress and pain/discomfort to problems table	

REQUIREMENT	ACTION
Process for monitoring the effectiveness of this document	Will be audited internally.
Patient version.	No
Groups/persons consulted.	PICU Clinical Nurse Manager, PICU Educators, PICU Consultants, PICU Pharmacists, Nephrology Consultants
This Policy is subject to the Freedom of Information Act	