NCCU CLINICAL GUIDELINES
SECTION: 16

ELIMINATION AND FLUID BALANCE

Section 16 Elimination and Fluid Balance

Date created: 2006
Date revised: This section is under review Oct 2014

Neonatology Clinical Guidelines
King Edward Memorial / Princess Margaret Hospitals
Perth Western Australia
Authorisation and review by
Neonatal Coordinating Group

URINE MEASUREMENTS AND TESTING

Most infants pass urine in the first 24hrs and all well infants should pass urine by 48hrs.

Renal failure is diagnosed when the urinary output is <0.5mL/kg/hr in the first day and <1.0mL/kg/hr thereafter with a rising serum creatinine.

Infants with renal malformations detected prenatally or within the neonatal period, require assessment and follow-up in all cases.

HAEMATURIA

Can be misdiagnosed when a female infant has had a small vaginal bleed, or when pink urate crystals are in the nappy.

CAUSES

- Very sick infant with DIC
- Emboli from UAC
- Trauma post SPU /IDC insertion
- HIE with associated tubular or cortical necrosis
- Thrombosis or renal artery or vein
- UTI
- Malformation (urethral valves, hydronephrosis).

PROTEINURIA

Is rare as a primary finding.

CAUSES

Illnesses which compromise renal perfusion eg. Sepsis, HIE, hypotension.
Congenital nephrotic syndrome.

To monitor renal function, the following infants should have urine measured and tested until urinary output has normalised, ie. At least the first 24 - 48hours:
(Normal ranges for urine: pH 5 – 8, SG 1008 – 1030 (if no glycosuria, proteinuria or haematuria).

- On admission
- Asphyxiated infants
- Infants receiving total IV therapy – test once per shift until stable then as necessary.
- Infants on TPN – 8/24 until blood sugar level has stabilised and then as necessary.
- Hyperglycaemic infants – if PGL >7mmol/L, test for glucose.

- Infants on dexamethasone – daily until dose decreasing.
- Infants on Indomethicin therapy – daily.

PASSAGE OF MECONIUM

Failure to pass meconium within 48hrs of birth may indicate obstruction. Close observation is needed until the infant has passed meconium. Check for imperforate anus at birth. Passage of a Meconium plug may be associated with Hirschsprung's disease. Meconium ileus is strongly associated with cystic fibrosis.

FAECES FOR OCCULT BLOOD

Testing faeces for occult blood is indicated in infants with evidence of gastrointestinal disorders.

PROCEDURE

1. Using the spatula, place a smear of faeces onto the filter paper.
2. Place the tablet onto the faeces, ensuring a part of the tablet is touching the filter paper.
3. Place one drop of distilled water onto the tablet.
4. Allow 5-10 seconds for the water to penetrate the tablet.
5. Place second drop of water onto tablet ensuring it runs down the side of the tablet onto specimen and filter paper
6. Observe filter paper for 2 minutes for the appearance of any trace of blue colour surrounding the tablet, any change after 2 minutes is irrelevant.

REDUCING SUBSTANCES

Testing urine and faeces for reducing substances should be considered in the following infants;

- Infants with ongoing hyperglycaemia.
- Infants with hyperbilirubinaemia.
- Infants with feed intolerance.
- Infants with persistent diarrhoea.

PROCEDURE

1. Using dropper, place 10 drops of water into test tube.
2. Using dropper, place 5 drops of specimen into test tube.
3. Add 1 clinitest tablet to test tube.
4. Await reaction – Do not shake during reaction process or for 15 secs afterwards.
5. Refer to colour chart for result.

INSERTION AND CARE OF AN IDC

https://healthpoint.hdwa.health.wa.gov.au/policies/Policies/CAHS/PNPM%2003.05.03%20Urinary%20Catheterisation%20-%20Insertion%20and%20Management.pdf
[PMH Paediatric Nursing Practice Manual: Urinary Catheterisation]

To relieve bladder distension where neurological disorders or medications prevent bladder emptying and / or to monitor urine output.

Selection of catheter size should be based on age, weight, medical condition and the reason for insertion.

In general: non ballooned catheters are used. If IDC is placed in theatre, often a ballooned IDC is used.

This is a 2 person sterile aseptic technique. See ANTT Practice Principles for Indwelling Urinary Catheter.
http://wnhs.hdwa.health.wa.gov.au/__data/assets/pdf_file/0008/146582/Urinary_Catheter.pdf

EQUIPMENT

- Dressing pack
- Sterile gloves
- Catheters - Preterm 5Fr
    - Newborn 6Fr
    - Infant 6 or 8Fr
- Sterile lubricating jelly
- 0.2% Chlorhexidine irrigation solution (Catheterisation Preparation Solution - Chlorhexidine gluconate 60mg/30mL)
- IDC drainage bag and connector
- Specimen container
- Leukostrips / adhesive tape.

PROCEDURE

Consider sucrose
Restrain and comfort as appropriate

IF AT ANY TIME YOU CONTAMINATE THE CATHETER, DISCARD IT AND START AGAIN.

FEMALE

1. Double glove the hand that is to separate the labia majora, keep the hand that is to handle the catheter sterile.
2. Separate the labia majora (and keep separated until IDC in)
3. Using the 1st forceps swab area thoroughly with soln twice, labia minora first then urinary meatus (use each swab once only).
4. Using 2nd forceps insert the lubricated catheter into the bladder and watch for flow of urine.

5. Release labia majora and remove 2nd glove.
6. Obtain specimen for labs if necessay and attach to drainage bag.
7. Secure in place with leukostrips and tape to thigh.
8. Observe drainage amount, record hourly. Observe for trauma at insertion site.

MALE

1. Seek medical advice if you have any doubts about undertaking the procedure.
2. Follow procedure for female catheterisation re equipment. Double gloving is not required.
3. Hold the shaft of the penis using sterile gauze / drape.
4. Gently retract the foreskin until the meatus is just visible.
5. Using the 1st forceps swab area thoroughly with soln twice, the glans first then urinary meatus (use each swab once only).
6. Using 2nd forceps insert the lubricated catheter into the bladder and watch for flow of urine.
7. Obtain specimen for labs if necessary and attach to drainage bag.
8. Secure in place with leukostrips and tape to suprapubic region.
9. Observe drainage amount, record hourly.
10. Observe for trauma at insertion site.

FLUID BALANCE

Neonates have very different physiological and body composition characteristics compared to older children and adults. For example; higher BMR and total body water (TBW) and fluid requirements per Kg. They also have much less ability to excrete sodium. This results in narrower margins for safety when calculating and balancing fluids and electrolytes.

The balance of intake and output should be an ongoing assessment. Once clinical signs of fluid overload or deficit occur, it may be difficult to regain balance. **It is crucial to assess the infusion rate and site hourly.**

Prevention of an imbalance of fluid and electrolytes can be divided into:

1. Maintenance needs – keeping the infant in a zero balance by recognising and accurately recording losses:
   - Normal ~ urine, stool, IWL.
   - Abnormal ~ loose stools, drain / gastric and ostomy losses.

2. Deficit needs – weight loss >10% in the first 7 days caused by:
   - Unrecognised losses from 3rd spacing, VLBW infants (high IWL)
   - Renal dysfunction, sepsis

FACTORS AFFECTING FLUID BALANCE

<u>Water loss</u>

- Radiant warmers/ >IWL from low ambient humidity

- Phototherapy
- Preterm infants (thin skin and larger surface area:body mass ratio)
- Inadequate humidification of respiratory gases
- Loose stools / high ostomy / gastric losses
- Osmotic diuresis from hyperglycaemia/glycosuria

Water overload
Excess fluid administration
Inappropriate sodium administration
Conditions associated with inappropriate ADH (e.g. RDS)

FLUID AND ELECTROLYTE STATUS

The infants fluid status is monitored via measurements of body weight, urine output, urine specific gravity, BP measurements, serum sodium, and physical examination.

Weight is affected by gestational age, intrauterine growth, maternal fluid balance in labour/delivery, postnatal age and health of infant. Daily weights are needed for at least the first 7 days in infants requiring intensive care, if the infant is stable enough. The initial weight loss in the first 3 days is considered a normal physiological loss of interstitial fluid (approx 5 -10%).

Urine output – urine is normally is passed in the first 12hrs. From 12 –24hrs the minimum acceptable range is 0.5mL/kg. After then 1-2mL/kg to maximum 7mL/kg (ideal 2-5mL/kg). Specific gravity in the range of SG1.008 – 1.015.

Serum sodium – initially infants require no sodium intake. Daily measurements of sodium, potassium, urea, creatinine, glucose and calcium in sick infants and VLBW infants are needed to monitor levels.

MANAGEMENT

Should be directed toward correcting the cause.

ACUTE RENAL FAILURE

Acute renal failure (ARF) in the neonatal period is common and usually manifests as abnormal biochemistry (rising creatinine and urea) and decreased urine output (<1ml/kg/hr). A good history and careful examination is the starting point and may identify the most likely cause. The cause will, in most instances, dictate the direction of investigations needed and further management.

Newborn kidneys are fully formed by 36 weeks gestation but the tubules remain short and immature and even at term the kidneys are considered functionally immature. The GFR and blood flow are low in the newborn period and this immature tubular function affects its ability to concentrate urine or excrete a water load. The preterm infant is particularly susceptible as in addition to these factors they are also unable to conserve sodium.

ARF is defined under 3 categories:

1. **Pre-renal**
   - Inadequate intravascular volume: dehydration, third-spacing, blood loss, excess GIT losses.
   - Inadequate perfusion pressure: hypoxia / ischaemia, hypotension, sepsis, PDA

2. Renal (intrinsic)

- Acute tubular necrosis: hypoxia / ischaemia, nephrotoxic drugs (ie. gentamicin), toxins (endogenous)
- Vascular: renal vein thrombosis, aortic / renal artery thrombosis
- Congenital: Multicystic / polycystic kidney disease.

3. Post-renal (obstructive)

- Congenital: masses, altered anatomy uni or bilaterally. (ie. Posterior Urethral valves)
- Acquired: fungal balls, heavy sedation or muscle relaxation drugs.

INVESTIGATIONS

After detailed history and examination, complete the following as indicated:

- Urinalysis – microscopy, culture and biochemistry.
- U&Es and FBC
- Blood culture
- Coagulation studies
- Blood gas analysis
- Blood Pressure
- Ultrasound scan of the renal structures as indicated.

MANAGEMENT

It is important to recognise developing ARF promptly. If measures to prevent and minimise predictable complications are instituted immediately it may avoid the need for crisis management.

Fluid Balance

Great care is needed in recording accurate balances to know exactly what and how much is being infused and how much the output is. Cumulative 24 hourly intake balances are critical in the regulation of intake/output control and should be recorded for all newborn infants requiring intensive care in the first 7 days. Cumulative intake balances are to be continued until the infant is stable.

Hyperkalaemia is a common problem in ARF so stop all potassium-containing fluids and remove potassium from TPN. Hyponatraemia is very common. Restrict fluids and/or assist water removal with diuretics (see below).

Aim to minimise volumes, it may be necessary to concentrate solutions to achieve provision of nutrients ie. Glucose, sodium. Include drug volumes / flushes in total balances if applicable. Intake amounts and solution concentrations should be directed by losses, the infants body weight and the U&E values. Enteral feeds may need to be stopped.

Urine output

Cumulative 24 hourly output balances are critical in the regulation of intake/output control and should be recorded for all newborn infants requiring intensive care in the first 7 days. Cumulative output balances are to be continued until the infant is stable.

Trying to maintain some urine output with medical therapies is a balance of risks and benefits. Iontropes have a role in unstable infants with hypotension and hypovolaemia that has not

responded to fluid resuscitation by improving myocardial contractibility, organ perfusion, peripheral resistance and hence blood pressure.

There is currently no good evidence to support the use of 'low dose' dopamine in the course of ARF although it may cause some small and short-term improvement in renal blood flow and urine output without any evident adverse effects.

Diuretic therapy (Frusemide) can potentially assist renal function, a continuous infusion may be more effective and less toxic than bolus doses. Continued high doses in a neonate that is not responding is likely to be not only counter productive, but also ototoxic and nephrotoxic.

Dialysis

Metabolic derangements that are unable to be corrected by medical therapies require the initiation of dialysis. The use of peritoneal dialysis is preferable in the neonate due to the following:

- difficulties in maintaining the vascular access needed for haemodialysis
- relatively easy to perform and does not require heparinization
- infant does not need to be haemodynamically stable prior to commencement
- long-term dialysing can be performed even on infants with low birth weights

Refer to PMH & see Renal Procedure Manual PMH for further information and management on dialysis.

FURTHER READING

For information on dialysis see PMH ward 8A renal protocols / nursing practice manual.

Merenstein, B & Gardner, S (2006). Handbook of Neonatal Intensive Care, 6th Ed. Mosby. USA

Andreoli, SP (2004). Acute Renal Failure in the Newborn. Seminars in Perinatology, Vol 28, No 2 (April): pp 112-123

Moghal, NE & Embleton, ND (2006). Management of acute renal failure in the newborn. Seminars in Fetal & Neonatal Medicine (In press)

Friedrich, J, Adhikari, N, Herridge, M and Beyene, J (2005). Meta-Analysis: Low-Dose Dopamine Increases Urine Output but Does Not Prevent Renal Dysfunction or Death. Annals of Internal Medicine. 142,510-524

Beale, J; Hollenberg, S; Vincent, J; Parrillo, J. (2004). Vasopressor and inotropic support in septic shock: An evidence-based review. Critical Care Medicine. 32, 11.