



CLINICAL GUIDELINE

Fluid Balance and Elimination

Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA
Child Safe Organisation Statement of Commitment CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations. This is a commitment to a strong culture supported by robust policies and procedures to reduce the likelihood of harm to children and young people.	

This document should be read in conjunction with this [DISCLAIMER](#)

Urine measurements and testing

- Most infants pass urine in the first 24 hours and all well infants should pass urine by 48 hours.
- Renal failure is diagnosed when the urinary output is <0.5 mL/kg/hr in the first day and <1.0 mL/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 e.g. Sepsis, HIE, hypotension.
- Congenital nephrotic syndrome.

To monitor renal function, the following infants should have urine measured and tested until urinary output has normalised, i.e. at least the first 24-48 hours (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 Indomethacin therapy - daily.

Passage of meconium

Failure to pass meconium within 48 hours 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.

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.

Insertion and care of an IDC

Refer to [Urethral Catheterisation](#) guideline

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

Water loss:

- 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.

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 12 hours. From 12-24 hours the minimum acceptable range is 0.5 mL/kg. After then 1-2 mL/kg to maximum 7 mL/kg (ideal 2-5 mL/kg). Specific gravity in the range of SG 1.008-1.015.

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 (< 1 ml/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 (i.e. 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 (i.e. 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. Care needs to be made not to use, or closely monitor, medication with known nephrotoxicity.

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 i.e. 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. Inotropes 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 with consultation from the Renal Team at PCH. The use of peritoneal dialysis is preferable in the near term neonate due to the following:

- Difficulties in maintaining the vascular access needed for haemodialysis.
- Relatively easy to perform and does not require heparinisation.
- Infant does not need to be haemodynamically stable prior to commencement.
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Related CAHS internal policies, procedures and guidelines
CAHS Neonatal Guideline Urethral Catheterisation

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