

NEONATES - FLUIDS AND FEEDS

FEEDING

Breast feed whenever possible. If not, use EBM if available or HSSM if not.
 Cup and spoon or NG 3 hourly feed volumes

Birth weight (kg)	Day							
	1	2	3	4	5	6	7	8
1.5-1.9	10	15	20	25	30	40	45	50
2.0-2.4	15	20	30	35	40	50	55	65
2.5-2.9	20	25	35	40	50	60	70	75
3.0-3.4	20	30	40	50	60	70	70	75
3.5-4.0	25	35	45	60	70	80	80	80

FLUIDS

Intravenous fluid regime (ml/kg/day)				
Day	Weight (kg)			
	<1	1.0-1.5	1.5-2.5	>2.5
1	100	80	60	60
2	120	100	90	90
3	150	130	120	110
4	180	150	150	130
5	200	180	170	150
6	200	180	170	150
7	200	180	170	150
8-13	200	180	170	150
14-20	180	160	150	150
21-27	160	160	150	150
>28	160	150	150	150

Always use the birth weight or current weight - whichever is greater - to calculate fluids.

Usual fluid regimen

	Low birth weight	Full term >2.5kg
Day 1	>1kg: 10% dextrose <1kg: 5% dextrose	10% dextrose
Day 2	10% dextrose + 0.18% saline*	4.3% dextrose/saline
Day 3 onwards	10% dextrose + 0.18% saline* with potassium	4.3% dextrose/saline with potassium

*10% dextrose + 0.18% saline: Add 10 ml 50% dextrose to 90 ml 4.3% dextrose/0.18% NaCl.

Potassium: Add 1g KCl to each litre when urine output well established.

Normal K⁺ levels in newborn are relatively high in the first 10 days (3.5-7.0 mmol/l).

Potassium requirements 2-3 mmol/kg/day after day 2. Requirements increased by high urine flow rates, diuretics, high prostaglandin levels and hyperaldosteronism.

NEONATES - INFECTION (NEONATAL SEPSIS)

Infection in the newborn baby may have originated before, during or after birth.

PREDISPOSING FACTORS TO INFECTION

1. Low birth weight
2. Prematurity
3. Prolonged rupture of membranes (more than 24 hours)
4. Babies with congenital abnormalities
5. Protracted or difficult labour
6. Babies who have been handled a great deal and who have tubes inserted (eg umbilical venous catheter).
7. Maternal fever

DIAGNOSIS OF INFECTION

This is often difficult especially in babies of low birth weight. The symptoms may be vague and non-specific. The following symptoms are suggestive of an infection:

- Poor colour
- Lethargy/inactivity
- Hypotonia
- Irritability
- Poor suck
- Vomiting
- Abdominal distension
- High or low body temperature
- Jaundice
- Cyanotic attacks
- Respiratory distress
- Poor weight gain
- Purpuric spots

The nursing staff will describe babies with a mixture of these signs and symptoms as having “Gone off”: Listen to them, and always consider infection as a likely cause of the problem.

EXAMINATION OF A BABY WITH SUSPECTED INFECTION

1. Look for signs of infection. Check the eyes, the umbilicus, the nails and the skin. There may be septic spots to be found.
2. Examine the joints and limbs. Tenderness may indicate an underlying osteomyelitis or osteoarthritis. Examine the chest for signs of pneumonia.
3. Examine the fontanelle for signs of raised intracranial pressure, although this is not always detectable in babies with neonatal meningitis.
4. Examine the abdomen for distension and tenderness. Auscultate for bowel sounds. Examine the stool for the presence of blood.

INVESTIGATIONS

(Dependent on facilities available.)

1. Swab any suspicious lesion (eg skin, umbilicus or nails).
2. Blood cultures. Taken from a peripheral vein. Clean skin with betadine. Use a scalp vein “butterfly” needle and syringe.
3. White cell count. The neutrophil count is often low (below $2000 \times 10^9/l$) when a newborn baby has an infection.

4. Urine. Collect urine by having a sterile pot ready. Tap over the supra-pubic area for 3 minutes. This will often cause the child to void spontaneously and a clean catch urine can be collected. If unsuccessful a supra-pubic aspiration of urine must be performed.
5. CSF examination. Meningitis is possible with minimal signs but LP should be reserved for significant signs of infection rather than as a routine screening test.
6. Chest x-ray if respiratory distress.
7. Abdominal x-ray if abdominal distension is noted.

TREATMENT (GENERAL)

Treatment should be commenced at the first suspicion of infection. Blood and other appropriate cultures should be taken, if possible, prior to treatment. Because the symptoms and signs of infection are non-specific, some babies who are not infected will inevitably be treated with antibiotics.

Antibiotics can be stopped after 48-72 hours, if infection is subsequently felt to be an unlikely cause of the baby's symptoms and signs, if there is a rapid improvement and bacteriological cultures are negative.

Ampicillin/amoxycillin and gentamicin are currently used for confirmed or suspected neonatal infection. These antibiotics will cover both gram negative and Streptococcal infection. When Staphylococcal infection is suspected, cloxacillin should be given instead of ampicillin.

TREATMENT OF SPECIFIC BACTERIAL INFECTIONS

Meningitis

See separate section, p.262.

Urinary infections

Ideally, treatment should be started after a clean catch urine specimen has been collected or a supra-pubic aspiration has been performed, although treatment should not be delayed by more than 4 hours. In the first week of life, gentamicin is the antibiotic of choice for an acute infection. Cotrimoxazole should be avoided in preterm or jaundiced infants during the first two weeks of life. Subsequently, prophylaxis can be given as a single night time dose of cotrimoxazole (1 ml/kg/dose of 40 mg trimethoprim in 5 ml) and this should be continued until both reflux and obstruction have been excluded.

A renal ultrasound scan is useful to exclude obstruction as this can easily be organised within a few days. Although neonatal urinary tract infection is often contracted from bacteraemia/septicaemia, it is still advisable to organise an MCU as an outpatient after a delay of six weeks on prophylaxis (see UTI, p.378).

Conjunctivitis

First 24 hours: could be gonococcus. Wash the eyes to clear as much pus as possible. Oxytetracycline eye ointment QID for 5 days. Benzyl penicillin IM TID for 5 days. If no rapid improvement, change to ceftriaxone/cefotaxime if available, or add gentamicin if not. Treat both mother and father.

After 24 hours: the most likely organisms are Staphylococcus and E coli, though gonococcus is still possible. Do a swab, gram stain and culture, if possible. Treat with oxytetracycline eye ointment QID for 5 days. Give parenteral antibiotics (ampicillin and gentamicin) if there is any deterioration or if there is conjunctival or lid oedema.

After 1 week: could be chlamydial infection. The baby should have oxytetracycline eye ointment and erythromycin orally for 3 weeks to prevent pneumonitis. The parents should be referred back to the consultant obstetrician for investigation and treatment.

Necrotising enterocolitis

See separate section (p.265) for diagnosis and management. Currently, the most widely used antibiotic regimen for this condition is penicillin, gentamicin and metronidazole, administered intravenously.

DURATION OF TREATMENT

1. Treat confirmed infections in a baby that responds rapidly for 10 days.
2. Treat suspected infections in a baby that responds rapidly for 7 days.
3. If there is a slow recovery treat for 14 days.
4. Treat babies with neonatal meningitis for 21 days.

BABIES OF VDRL +VE MOTHERS

If no signs or symptoms of intrauterine infection:

Give infant: <2.5kg: 120,000 units benzathine penicillin IM stat
>2.5kg: 240,000 units benzathine penicillin.

- If signs of intrauterine infection:**
- blisters or rash especially on palms or soles
 - hepatosplenomegaly
 - petechiae or bruising
 - early onset or prolonged jaundice

Give benzathine penicillin stat and benzyl penicillin (Crystapen):

<2.5kg: 125,000 units IMI BD for 10 days

>2.5kg: 250,000 units IMI BD for 10 days

Check both parents have been treated.

PROLONGED RUPTURE OF MEMBRANES (PROM) - MORE THAN 24 HOURS BEFORE DELIVERY

- IF:**
- a. the baby is well
 - b. the baby is >36 weeks gestation
 - c. the mother is well
 - d. there is no obvious chorioamnionitis (no foul smelling liquor)
 - Treat with ampicillin and gentamicin and stop after 48 hours if the baby remains well.

- IF:**
- a. the baby is sick
 - b. the baby is <36 weeks gestation
 - c. the mother is sick
 - d. there is obvious chorioamnionitis
 - Take blood culture and blood slide
 - Treat with ampicillin and gentamicin for a minimum of 5 days
 - Treat for longer (see above) if there is a slow response or if cultures are positive.

REFERENCES

- Bang AT, Bang RA, Beitule SB et al. Lancet 354:1955-1961,1999. Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India.
- Frank D, Duke T. PNG Med J 43(1-2):121-126,2000. Congenital syphilis in Goroka Base Hospital: incidence, clinical features and risk factors for mortality.
- Taha TE, Biggar RJ, Broadhead RL et al. Br Med J 315: 216-219,1997. Effect of cleansing the birth canal with antiseptic solution on maternal and newborn morbidity and mortality in Malawi: clinical trial.

NEONATES - JAUNDICE

Routinely measure only the total serum bilirubin (SBR). Measure the direct and indirect bilirubin only if jaundice persists beyond 14 days of age, or if the stools are pale.

Healthy baby 2.2 kg or more		
Total bilirubin (mmol/l)	Under 48 hours	Over 48 hours
170-240	Phototherapy	-
240-320	Phototherapy	Phototherapy
320-425	Exchange	Phototherapy
>425	Exchange	Exchange
Cease phototherapy when SBR under 240		

Sick baby 2.2 kg or more OR healthy baby under 2.2 kg		
Total bilirubin (mmol/l)	Under 48 hours	Over 48 hours
170-240	Phototherapy	Phototherapy
240-320	Exchange	Phototherapy
>320	Exchange	Exchange
Cease phototherapy when SBR under 155		

Sick baby under 2.2 kg		
Total bilirubin (mmol/l)	Under 48 hours	Over 48 hours
85-170	Phototherapy	-
170-240	Exchange	Phototherapy
>240	Exchange	Exchange
Cease phototherapy when SBR under 140		

Notes:

1. Neonates may be jaundiced because of infection. Consider cultures of blood, urine and possibly CSF (if indicated). If the baby is not sucking well or if there is any other reason to think there may be infection commence treatment with ampicillin and gentamicin for at least 5 days.
2. Babies under phototherapy require additional fluids. A full term healthy neonate will take care of this by sucking more from the breast. For small or sick babies it is important to give the extra fluids required - either by cup and spoon or by nasogastric tube (give an additional 20% of the daily fluid requirement).
3. Measure the SBR at least daily until the day after stopping phototherapy (longer if the SBR rises again).
4. If the SBR appears to be rising rapidly start phototherapy sooner than indicated above and repeat the test.
5. The levels of bilirubin stated here for exchange transfusion are higher than those normally specified in developed countries. This is because of the higher risk associated with exchange transfusion outside specialist neonatal units and because Rh disease (which causes rapid haemolysis) is rare in Papua New Guinea. In Rh disease, you should do an exchange transfusion at lower bilirubin levels. Furthermore, bilirubin levels appear to be higher in healthy non-Caucasian than in Caucasian babies (Ann Trop Paediatr 5:127-30,1985).

ICTEROMETER

The icterometer is a transparent perspex strip with 5 shades of yellow painted on one side representing increasing degrees of jaundice. The perspex strip is pressed against the neonate's gum (this is much more accurate than pressing it on the skin of the nose) and the nearest colour is matched. It is useful to determine which babies should have a serum bilirubin assay. It should only be washed in water, not detergent or alcohol.

CLASSIFICATION OF CAUSES OF NEONATAL JAUNDICE

