



NEONATAL HANDBOOK

Leeds Teaching Hospitals Trust

INTRODUCTION

This pocket book is designed to be a useful resource to your time in the Neonatal Department. It complements the larger Handbook that you have also received. We have incorporated as much useful day to day information as we can. If you have any suggestions to improve the contents then please let us know.

Your time in the department should be a time of enjoyment and learning. For many first-timers in neonatology, it can be a steep learning curve. As you gain experience the learning curve will become less steep - but it will never be flat! There are many resources within the department - doctors, nurses, midwives, ward clerks, HCA's, computers and books to help you - use them unashamedly! Enjoy your time here and

NEVER BE AFRAID TO ASK FOR HELP

USEFUL TELEPHONE NUMBERS

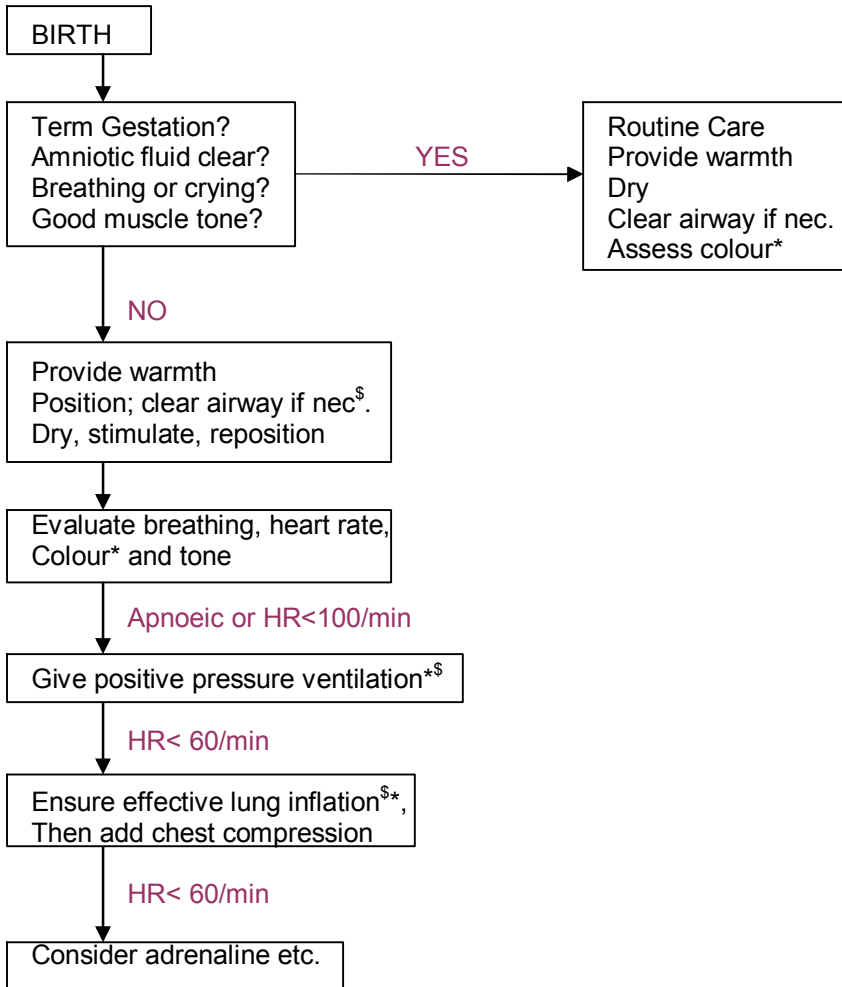
LOCATION	ST. JAMES'	INFIRMARY
Neonatal Unit	65700	27166 ICU 27266 ICU 27165 Surg. 27164 HDU
Transitional Care	65701	27162
Delivery Suite	65372 65781	27169 23831
Delivery Suite Theatre	65376	23817
Postnatal ward	65703 66373	27161
Biochemistry	64293	23285
Blood Bank	65559	
Car Parking	23170	23172
Drug information	65377	23547
ECG	65342	80-5101
EEG	65511	23108
Gas Machine	64791	
Genetics	65205 DNA 65568 Chromosomes	
Guthrie results	65806	-
Haematology	65557	22412
Liver Unit	65773	-
Microbiology	23499	-
PICU	67270	27102

Pharmacy	65168	23291
MRI	65461	28449
Switchboard	65892	0
Ultrasound	64422	26549
Surgical SpR	80-1490	
Drs Dear/Preece	65382	
Dr Newell	65045	
Dr Miall	66982	
Prof. Levene	23905	
Dr. Gill	22936	
Dr. Chetcuti	23622	
Dr. English	22559/28537	
Dr. Harrison	28301/28537	
Mr Dabbs Sec	64741	
Mr Knights Sec	28040	

HAND HYGIENE

- Hand washing is the most important infection control measure. It is **not** optional.
- You must wash your hands **thoroughly** with detergent and water:
 - On entering the ward
 - Before every practical procedure
 - After each contact with body fluids, excretions, non-intact skin or wound dressings
 - If your hands are not longer clean (e.g. after sneezing, picking things up off the floor, eating, visiting toilet etc)
- You must use alcohol gel to decontaminate your hands before every patient contact. The gel must cover every surface of the hands and be allowed to evaporate completely.
- **The last thing you touch before the patient must be the gel.** If you touch charts, pens, monitors, ventilators etc. then use the alcohol gel again. Use the gel when moving between patients, even if all you have touched is the charts or notes.
- Do not wear watches or jewellery (except wedding rings) in the clinical area.
- Do not lean on equipment (e.g. cot-sides) with bare skin, as this skin may not have been cleaned with the gel.
- If you have broken skin / cuts then wear sterile gloves in addition to the above.
- **If you see anyone breaking these rules please remind them of the hand washing policy.**
- Please refer to the trust Handwashing and Universal Infection Control Policies on the intranet.

RESUSCITATION



*consider supplemental oxygen if cyanosis persists

§ tracheal intubation may be considered at several steps

RESUSCITATION DRUGS

Adrenaline 1:10000	iv ET	0.1ml/kg then 0.3ml/kg 0.1-0.3ml/kg dilute with 0.9% saline if <1ml
Naloxone (400mcg/ml)	im	0.5ml (200mcg)
Dextrose 10%	iv	2.5ml/kg
Sodium Bicarbonate 4.2%	iv	2-4ml/kg slowly 1-2 mmol/kg
0.9% saline	iv	10mls/kg

ETT LENGTHS

Gestation	Weight	Diameter (mm)	Nasal (cm)	Oral (cm)
23-24	0.6 kg	2.5-2.7	7.0	6.0
25-26	0.75 kg	2.7	7.5	6.5
27-29	1.0 kg	2.7	8.0	7.0
30-31	1.5 kg	2.7	8.5	7.5
32-33	1.7 kg	3.0	9.0	8.0
34-35	2.0 kg	3.0	9.5	8.0
36-37	2.5 kg	3.0 – 3.5	10	8.5
38-39	3.0 kg	3.0 – 3.5	11	9.0
40	3.5 kg	3.5	12	9.5

POOR RESPONSE TO RESUSCITATION

Don't be a "DOPE"

- Displaced ETT
- Obstructed ETT
- Pneumothorax
- Equipment failure (is the oxygen connected?)

If there is any doubt about ETT position, re-oxygenate using bag-valve-mask and then reintubate. It is easy to forget about equipment failure in the heat of a difficult resuscitation.

BLOOD GASES

Normal ranges are as follows:

pH: 7.35-7.45
>7.25 acceptable

$PaCO_2$: 4.5-6.5kPa
<4.0kPa should be avoided,
<3.5kPa requires urgent correction
higher $PaCO_2$ levels acceptable when compensated

PaO_2 : 8-10kPa
hyperoxia is associated with retinopathy of prematurity

Base deficit >5mmol/l
metabolic acidosis
base deficits >10mmol/l require action,
treating smaller deficits depends on clinical context
essential to consider the underlying cause

FLUIDS

Fluid requirements mls/kg			
DAY	<28/40 OR <1000G	>28/40 OR >1000G	TERM
1	80	60	60
2	100	80	90
3	120	100	120
4	150	120	150
5	165	150	
6	165	165	

DAY 1 10% Dextrose
 DAY 2 Standard Solution
 (10% dextrose, 0.18% saline,
 3mmol / 500mls calcium, 8mmol / 500mls potassium)

TPN

Nitrogen (g/kg/day)

WEIGHT	DAY 1	DAY 2	DAY 3	DAY 4
<1.5kg	0.14	0.28	0.43	0.49
1.5-2.5kg	0.14	0.28	0.43	
>2.5kg	0.14	0.28	0.36	

Fat (g/kg/day)

DAY 1 of TPN	DAY 2 of TPN	DAY 3 of TPN	DAY 4-6 of TPN	>DAY 7 of TPN
1	2	3	3.5	4 if TG<2.5

CHO (g/kg/day)

D1 10% (6-15) then increase by 2g/kg/day up to 18 as tolerated

USEFUL FORMULAE

UAC Length = (3 x Weight) + 9cm
 Xray position 1: T8 – 12
 Xray position 2: L4 - 5

UVC Length = (1.5 x weight) + 5.6 cm
 (or half UAC + 1) cm
 Xray position: at diaphragm

ETT length = weight + 6cm

Bicarbonate (half correction)
 Volume = (0.3 x wt x Base deficit) x 0.5

Glucose (mg/kg/min)
 = (rate x conc (%)) / (Wt x 6)

Oxygenation index
 = (FiO₂ x MAP x 100) / PaO₂ (mmHg)
 OI > 25 → Nitric Oxide
 OI > 40 → ECMO

Blood transfusion

	Threshold for transfusion
Anaemia - first 24 hours	Hb<12g/dl
Ventilated <28 days in O ₂ ≥ 30% <28 days in O ₂ <30 % >28 days	Hb<12g/dl Hb<10g/dl Hb<10g/dl
Nasal CPAP in FiO ₂ ≥ 30% in FiO ₂ <30%	Hb<10g/dl Hb<8g/dl
Stable + Chronic Lung Disease in low-flow O ₂ in air	Hb<8g/dl Hb<7g/dl

Frusumide 1mg/kg only if clinically indicated

ANTIBIOTICS

1 st line (<72 hrs)	amoxicillin and gentamicin
2 nd line (>72 hrs)	vancomycin and ceftazidime
3 rd line (received 1 st line)	meropenem
3 rd line (no previous)	flucloxacillin and gentamicin

GENTAMICIN

Level on 3rd dose. (2nd dose renal failure)	Peak: 5-10 mg/l Trough: < 2 mg/l	60 minutes after dose immediately before dose
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VANCOMYCIN

Levels on 3rd dose Trough: 5-15 mg/l
2nd dose in renal failure 2 hours after the start of a one-hour infusion.

If level high (>15) do not give further dose until level is repeated and in the normal range.

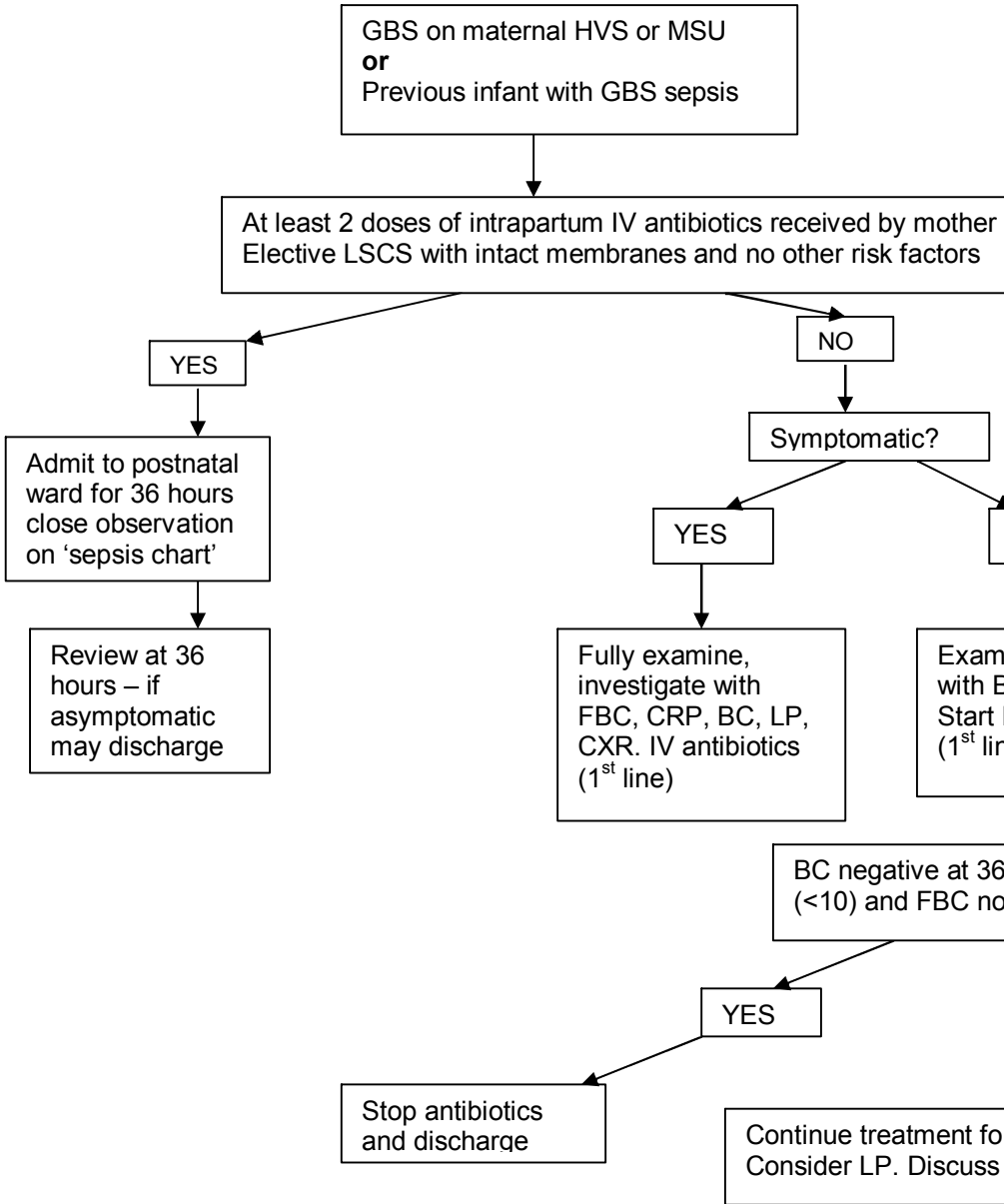
If level high increase dose interval, if low decrease interval, in steps of 6h.
DO NOT adjust dose.

ANTIBIOTIC DOSES

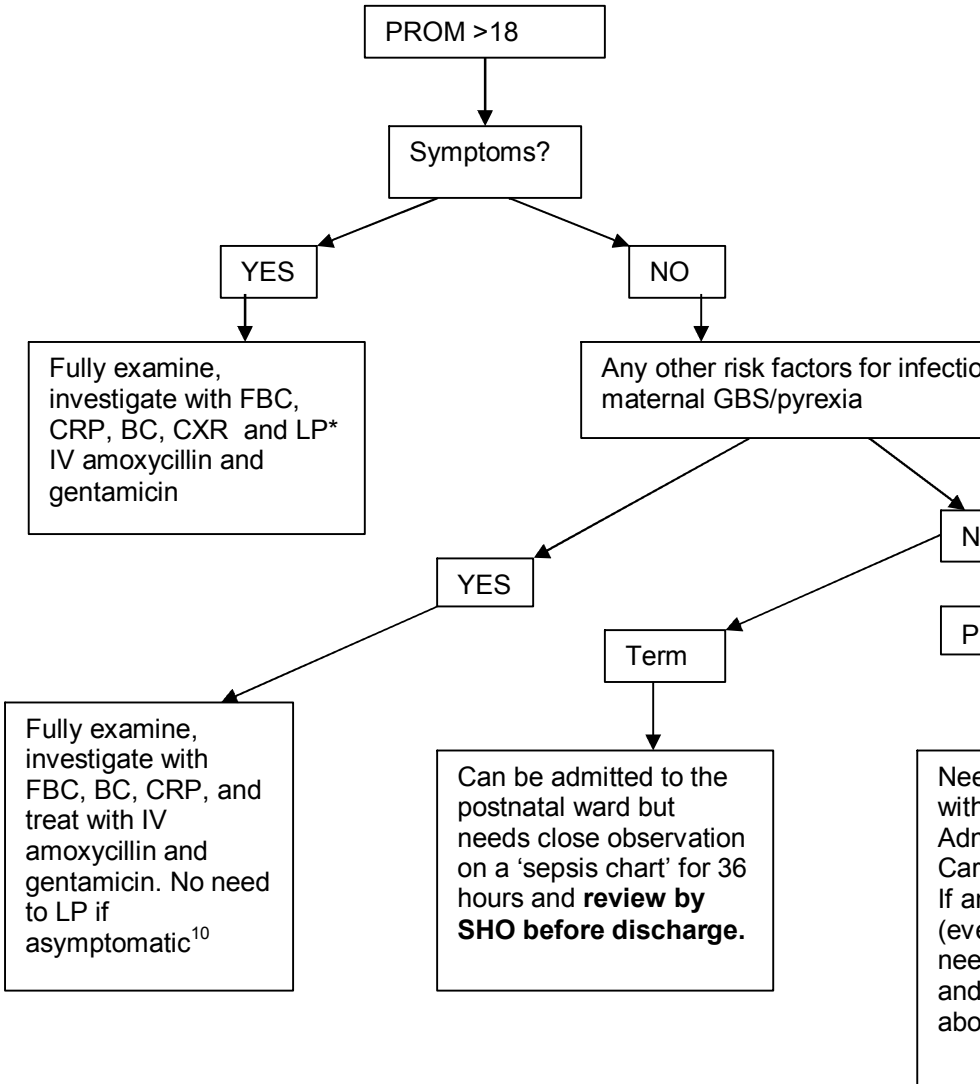
ANTIBIOTIC	INFANT'S AGE (days)	DOSE (mg/kg/dose)	TIME INTERVAL (hours)
Amoxicillin	<7	50	12
	7-14	50	8
	>14	50	6
Gentamicin*	<32 weeks gestation	4	36
	≥32 weeks gestation	4	24
Vancomycin[§]	< 30 week gestation	20	18
	>30 weeks gestation	15	12
	>35 weeks gestation	15	8
Ceftazidime	< 7	25	24
	7- 21	25	12
	21- 28	25	8
	>1 month	25	8
Meropenem	< 7	20	12
	> 7	20	8
	>1 month	10 -20	8
Flucloxacillin	< 7	25	8
	7 – 21	25	8
	>21	25	6

SEPSIS PROTOCOL

Management of a Term Infant where there is Maternal GBS



Management of an infant with PROM for >18 hours



ADMISSIONS

1. To the Neonatal Unit

- Infants < 32 weeks gestation
- Infants with respiratory distress
- Asphyxiated babies requiring prolonged resuscitation
- Infants with suspected severe congenital anomalies
- Infants with apnoeas or seizures
- Infants with suspected sepsis
- Infants of diabetic mothers with poorly controlled blood sugars
- Surgical conditions requiring intensive/high dependency care

2. To Transitional Care

- Birth weight between 1.4 - 2.4 kg
- Gestational 32 - 36 weeks and birth weight > 2.4 kg
- Congenital anomalies not requiring immediate surgery, e.g. cleft lip and palate, Down's syndrome
- Infants of diabetic mothers with difficulty in maintaining blood sugars on the postnatal wards
- Babies with feeding problems requiring nasogastric feeding may be transferred from the postnatal wards
- Babies on the neonatal unit requiring IV antibiotics, once stabilised can be transferred to the TCU for completion of treatment
- Babies initially managed on the neonatal unit who have improved but still require supervision and help
- Infants of substance abusing mothers

BIRTHMARKS

- Port-wine stains – Refer Dermatology
- Capillary haemangiomas, review if they are in a position, or of a size, which might cause problems when they enlarge.
- Mongolian blue spots – no follow up needed. Note in the Parent Held Record to avoid later confusion.

BRACHIAL PALSY

- Refer to paediatric physiotherapists to be seen before discharge.
- Follow up in clinic 4 weeks.
- If severe (total palsy, breech delivery or Horner's syndrome) refer to Prof. Kaye (Plastic Surgery - secretary 22898) .

CLEFT LIP/PALATE

- Generally be nursed on the postnatal ward/transitional care
- Inform Cleft Team (ext. 25115) at earliest opportunity.
- Lip usually repaired within 3 months, palate 6-9 months.
- Breast feeding often possible, may need bottle with special teat.

COOMB'S POSITIVE JAUNDICE(Rhesus or ABO)

- FBC at 2-4 weeks on Neonatal unit.

DOWN'S SYNDROME

- If any concerns a child may have Trisomy 21 or other chromosomal abnormality, opinion of SpR or Consultant **must** be sought before mentioning any concerns to the parents
- Blood for chromosomal analysis **must not** be sent until the situation has been discussed with the parents.
- Down's Syndrome Association leaflet (on NNU) to be offered.
- The baby will normally be followed up by the community developmental paediatrician.

DRUG WITHDRAWAL

- See Protocol/Appendix
- Babies born to mothers using drugs during pregnancy are at risk of developing withdrawal symptoms during the neonatal period
- Never discharge babies home whilst on oral morphine
- Offer Hep. B vaccine

EYE PROBLEMS

- Absent eye / microphthalmia / nystagmus / colobomas / cataracts etc.
- Refer to on call ophthalmology SpR via Switch
- Arrange appropriate investigations, partly depending on presence/absence of other abnormalities.
- Follow-up consider
 - Ophthalmological
 - Genetics (refer to genetics as an out-patient)
 - Neonatal (Baby clinic)

HAEMOGLOBINOPATHY

- Screened on Heel prick test.
- No action needed.

HEART MURMUR

- Any infant with a murmur is to be reviewed by a SpR.
- If asymptomatic, refer to cardiology clinic using Audit form,
- If symptomatic, request **urgent** assessment by on-call Paediatric Cardiologist.

HEPATITIS B

- Immunoglobulin should be given to infants whose mother's are
 - HbsAg Positive & HbeAg Positive
 - HbsAg Positive & Hbe-Antibody Negative
 - HbsAg Positive & 'e' status unknown
 - HbeAg Positive
- Infants of all Hep.B positive mothers should receive vaccine.
- Fill in 2 follow-up forms for St Mary's Hospital and GP from ward clerks

HEPATITIS C

- HCV PCR at 4 weeks
- Clinic appointment at 6 weeks.

HIV

- LOW RISK
 - Planned delivery
 - Known HIV positive mother
 - who has been on treatment and
 - has a low viral load (<50 copies/ml) at 36 weeks onwards
- Baby to receive zidovudine for 4 weeks.
- HIGH RISK:
Women who first present in labour or after birth and are naïve to anti-retroviral drug therapy
 - Maternal viral load is predicted >50 copies/ml at delivery.
 - Mother refused all treatment during pregnancy.
 - Mother received <4 weeks of treatment.
 - Consideration should be given for combination treatment if intrapartum AZT (when indicated) was not administered or there were documented risk factors-prolonged rupture of membranes, weeks premature delivery, breast feeding, chorioamnionitis, placental abruption or foetal scalp monitoring.
- Combination therapy with
 - zidovudine (4 weeks),
 - lamivudine (4 weeks) and
 - nevirapine (2
- In extreme preterm infants (<28 weeks) give i.v. Zidovudine until able to tolerate oral medication. Discuss treatment with consultant.
NB: In all infants receiving combination therapy, prophylaxis with cotrimoxazole is recommended from 6 weeks of age until all HIV RNA PCRs are negative at 3 to 4 months.

Diagnostic tests on the Infant

- In unusual circumstances (HIV-2 infection or very high risk of vertical transmission) discuss with clinical virologist (DNA PCR may be required.)
- 1ml EDTA blood to Public Health Virology lab at Seacroft. Mark with biohazard stickers.
- Day 1
 - HIV PCR. *not be taken at birth or from cord because risk of contamination by maternal blood*
 - Consider Hepatitis serology
 - Check baseline FBC, U&E, LFT
- 4-6 Weeks
 - 2nd HIV PCR. at first out-patient follow up.
 - Repeat FBC, U&E, LFT.
- 3-4 months
 - 3rd HIV PCR. at second review appointment.
 - Repeat FBC, U&E, LFT
- 4-6 months
 - In very preterm infants or where there is a high risk of vertical transmission consider a fourth PCR test

IF THE SCENARIO IS DIFFERENT FROM THOSE LISTED ABOVE
SEEK URGENT EXPERT ADVICE:

Advice may be sought from the adult team - Dr Minton or Dr McGann (via ward 16, SJUH Ext 65621 or 65716) or Dr Jan Clarke (GU medicine LGI extension 22444). Expert advice could also be sought from the Paediatric Infectious Diseases Department at St George's Hospital London-Tel no 0208 725 3262 and ask to speak to the on call consultant.

Complete HIV screening form (from SHO office) and inform Dr.Miall's Sec.

HIP EXAMINATION

- Dislocated, dislocatable or clinically unstable hips
 - Review by neonatal SpR
 - Inform orthopaedic SpR on call or phone then fax referral to Mr Templeton.
- Clicky hips, but stable
 - ultrasound @ 6 weeks (do not book into clinic results go to consultant who will determine follow-up)
 - Parents will be notified of the result following the scan
 - Information sheet to parents
- At risk groups
 - Family history of CDH
 - All breech presentations
 - Significant (i.e. not positional) talipes
 - Arrange ultrasound @ 6 weeks
 - Parents will be notified of the result following the scan
 - Information sheet to parents

Ultrasound request cards **must**

- have Baby's sticker on
- have all clinical details
- when scan must be done
- be sent in an envelope addressed to Radiology
 - LGI B Floor, Clarendon Wing
 - SJUH Chancellor Wing.

HYDROCOELE

- No follow up is needed but inform GP at discharge.
- Advise parents to seek further investigation if the hydrocoele persists beyond 12 months.

HYPOSPADIAS

- Check for other abnormalities.
- Refer to the Paediatric urologist at the time of discharge (Mr Subramaniam ext 64840).
- Advise parents not to circumcise as foreskin may be needed for reconstruction.

INGUINAL HERNIAE

- Need immediate referral to paediatric surgeons (SpR 80-1490).

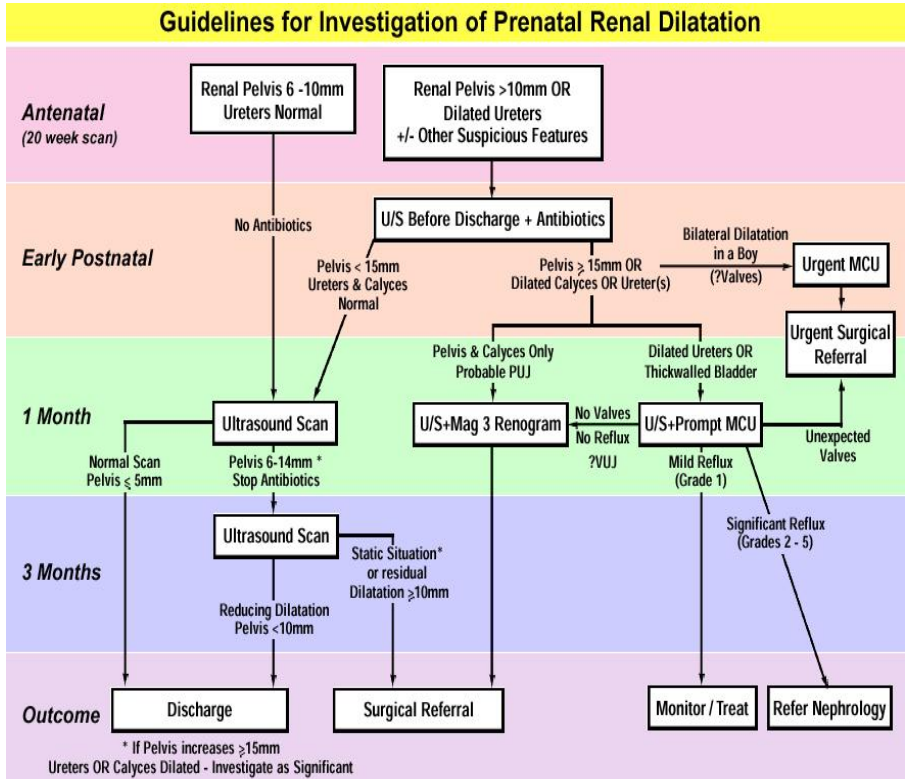
LIMB DEFORMITIES

Congenital abnormalities of the limbs should be referred to Prof. Simon Kaye ext. 22898

POLYCYTHAEMIA

- A free flowing **venous** Hb/FBC is required in those infants who look plethoric and have symptoms suggestive of polycythaemia.
- More common in growth retarded infants.
- Consider treatment if PCV >70 - discuss with SpR/consultant.

RENAL TRACT



RETINOPATHY OF PREMATURITY

- Less than 32w or 1500g
- ≤25w examine at 7w
- 25-32w examine at 7w (postnatal age) or 36w (postconceptual age) whichever is sooner
- Then fortnightly or as clinically indicated
- 2.5% phenylephrine and 0.5% cyclopentoate 1 drop of each to each eye.

SACRAL DIMPLE/HAIRY PATCH

- Indications for spinal ultra sound (US)
 - sacral dimple only when base of dimple cannot be identified
 - sacral hairy patch
 - sacral swelling
- Ensure full details on request card including Consultant name.
- No clinic appointment needed
- Parents will be informed of results by consultant.

SKIN TAGS

- Pre-auricular skin tags and accessory digits refer as an out-patient to the Plastic Surgeons.
- Do not tie off skin tags on a pedicle yourself !
- Audiology is not routinely required: if antenatal renal scan normal, presence of pre-auricular pits / tags does not warrant further renal imaging.

SKIN RASH

- Benign rashes such are very common in neonates
- If in doubt as to aetiology/diagnosis request senior review

TALIPES

- If mild/moderate: refer to physiotherapy as soon as possible who will arrange follow up if necessary.
- If severe: refer to orthopaedic clinic.
- Hip ultrasound in all cases of significant (non-positional) talipes.

TEETH

- Indication for removal
 - interfering with feeding
 - very loose
 - malformed/shell-like (usually soft and deform)
 - in the presence of traumatic ulcerations on tongue/frenulum/lip
- In all other cases natal/neonatal teeth should **not** be removed.
- Refer to the Leeds Dental Institute (Dept. of Paediatric Dentistry) **all** babies with natal/neonatal teeth
- Natal/neonatal teeth are usually normal primary teeth, a new primary tooth will not replace them once they are lost.

- Does not typically result in problems with the permanent teeth.

UMBILICAL HERNIA

- No treatment required.
- Resolves spontaneously by 12-18 months.

UNDESCENDED TESTES

- if unilateral request GP review at 6 week check.
- if bilateral
 - exclude other abnormality e.g. Prader-Willi, ambiguous genitalia, hypospadias
 - refer to Paediatric surgeons
 - Inform parents they will receive outpatient appointment