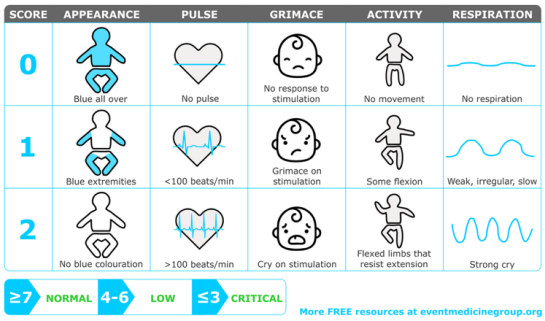
NEONATOLOGY

Newborn EXAMINATION (WITHIN 72 hrs after birth)

Important Q's to ask prior to exam?

- **Had baby passed meconium**
- **Is baby feeding ok?**
- **Any FHx of congenital heart, eye or hip problems?**



GENERAL INSPECTION

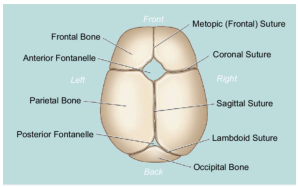
Appearance	CAJCOLD
Posture/tone	Floppy, poor activity
Resp. effort	Tachypnoea, nasal flaring, grunting, intercostal recessions
Skin	See common signs • E.g. erythema toxicorum, milia, naevus flammus, Mongolian spots, haemangiomas
Auxiliary aids	FiO2 (RA or oxygen)
Vernix Caseosa	Yellow- White creamy **NATURAL anti-microbial + Vit E** biofilm covers fetus → protect against bacteria in genital tract • Mixture of desquamating cells and sebum

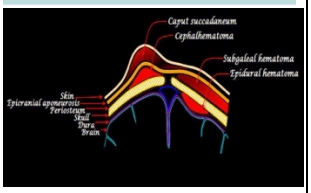
Red flags:

- Peripheral cyanosis(acrocyanosis)
- Jaundice
- Obvious mass (HSM, umbilical hernia)
- Infected umbo stump, eyes
- ARDs
- Poor tone
- No red reflex (Rb)
- Undescended testes
- DDH

HEAD AND NECK

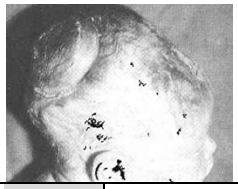
- Head shape & symmetry
- palpate suture lines & fontanelles
- Check for swelling, webbing, skin folds and vein distension
- Move head & neck through full ROM → rotation bilaterally to exclude torticollis
- *Check head position in prone position*

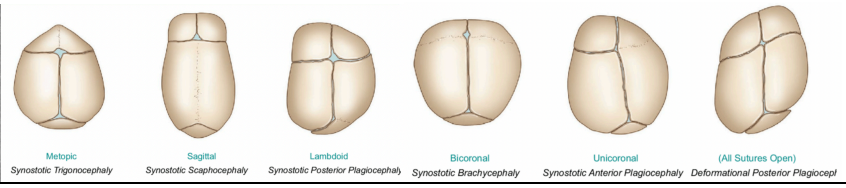




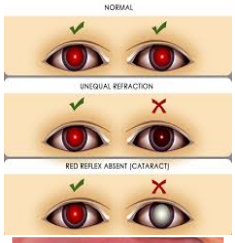
Fontanelle	PP	Cause
Bulging	**Crying, cough, vomit**? OR raised ICP	Hydrocephalus, meningitis, hypoxic ischamic injury, dermoid tumour, hypothyroidism
Sunken	Reduced ICP	Dehydration, hypovol.
Delayed closure		Trisomy 21, rickets, achondroplasia, raised ICP?
Craniosynostosis	Premature closure of ≥ 1 suture	Crouzon's, Apert's syndrome → may RESTRICT brain growth
Exostosis	Benign outgrowth of cartilaginous tissue on bone	Idiopathic

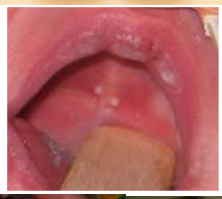
Microencephaly	Macroencephaly	Abnormal shape
• **Familial with AD inheritance** • **Hydrocephalus** *Other conditions* • **Achondroplasia** (skeletal dysplasia) • **Sotos' Syndrome** (Cerebral Gigantism) • **Alexander's Disease** • **Canavan's Disease** • **Neurofibromatosis Type I**	• Familial • **Genetics**: Trisomy 13, 18, 21 • **Teratogen Exposure** (EtOH, RT, Hydantoin) • **TORCH** infection *Other syndromes* • Prader-Willi • Cornelia de Lange, • Rubinstein-Taybi, • Smith-Lemli-Opitz,	• **Caput succedaneum – like EDH** (haematoma **above** periosterum = usu. due to prolonged labour) • **Cephalohematoma – like SDH** (haematoma in sub-periosteal space – communicating veins) • **Plagiocephaly (Positional)** • **Chignon** (vacuum extraction) • **Syndromic condition** *General risk factors of haeamtoma – prolonged labour, instrumentation **Most self-resolve but Comp. of haematoma- jaundice, anaemia, linear skull fractures

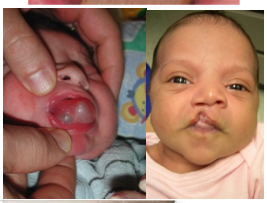




FACE + ENT







Face	• **Dysmorphic features** (e.g. low set ears, nasolabial folds) • **Facial nerve palsy** (facial nerve compression against sacral promontory or via trauma of forceps delivery) → difficulty feeding, drooling on affected side	
Eye	Sit upright → let baby open eyes → • **Red reflex** • **PEARL** • **Retinal / subconjunctival haemorrhages** → common after vaginal delivery (clears spont.) • **Lid oedema** • **Eye colour** (not permanent until 6/12 old) • **Visual behaviour**: Eyes briefly fixate and follow at 20c	**Swollen eyelids/eyes** • **Conjunctivitis** (swollen purulent discharge → swab M/C/S) ○ **Gonorrhoea - Rx: ceftriaxone** ○ **Chlamydia → Rx: azithromycin 20mg./kg for 7 days** ○ **HSV → Rx: antivirals 14 days** ○ **DDx:** Dacrocystocele – blocked tear duct (usu. unilateral) → **Rx: gentle massage** • **Lens opacity** (congenital cataract) assoc. with TORCH infection • **Leukocoria** (Cat's eye reflex) = lens, vitreous, fundus abnormality → • **Coloboma (ocular tissue defect)** ○ Eyelid margin defect = treacher collins syndrome ○ Aniridia (absent iris) =bilateral & poor acuity
Nose	• Listen over nares → check for nasal flaring (increased RR effort) • Choanal atresia = cannot pass through nares →medical ED → oral airway and surgical repair	
Mouth (Size and shape)	• **Microstomia** –Trisomy 18 and 21 • **Macrostomia** – mucopolysaccharidoses • **Thin lips**–Fetal Alcohol Syndrome • **Macroglossia** –hypothyroidism and mucopolysaccharidoses • **Small Chin** –Pierre Robin or OSA	• **Natal teeth** • **Epstein pearls** (white cysts containing keratin) on midline raphe of palate OR gum lines) • **Raculas = small bluish-white swelling (benign mucosal gland cysts)** • **Cleft lip** = *trisomy 13 → repair at 3/12* • **Cleft palate** = *defect* ***starting from uvula – must check w/ finger!!*** *(need repair before age 1 for normal speech)*
Ear	Asymmetry & irregular shape • External ear → hygiene, discharge, excoriation --→ **reflex to voice, bell** • **Ear tags →** increased risk of hearing loss • **Low set ears** (< 1/3rd above horizontal line below lateral canthus of eye) = GU anomaly (e.g. Potter's, Down's, renal) • **Malformed ear** = Down's, Turner's	

Neck

Palpate	Neck masses
Neck muscles • **Webbed neck** = turner's, Noonan's • **LN** = if present = unusual = congenital infection? • **Torticollis** = SCM injury from birth trauma → hematoma and fibrosis causes muscle shortening [*abnormal neck twist → head tilt*]	• Cystic hygromas (most common) • AVM • Teratomas • Dermoid cysts • Thyroglossal duct cysts → surgical consult • abnormal lymphatic tissue

CHEST + LUNGS

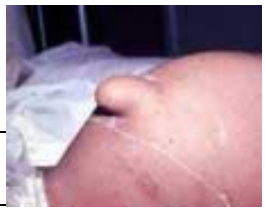
- RDS
- WoB
- S1/S2

Assess	**Stridor, grunting, wheezing, cough, grunting** • **MOUTH BREATHING (ABNORMAL) → *congenital issue* → neonates mainly nasal breathers as breast feeding** • pallor, cyanosis, plethora
Observe breast	• Extra nipple = normal (10% supernumerary) • Absent or hypoplasia of pectoralis major – Poland's syndrome • **Breast enlargement (2° to maternal hormones)** • **Widely spaced nipples – Noonan, Turner's**
Observe lung	Thorax: configuration, symmetry, abnormalities • ***Pectus carinatum*** = M > F - narrow thorax w/ increased AP diameter (**rickets, uncontrolled asthma**) • ***Pectus Excavatum*** = more common + M > F – pitting vs sinking of entire sternum (**CT disorder**)
Vitals	• **Pre (R limb) vs post-ductal (legs) O2 sats → > 2% difference = ?patent ductus arteriosus** • 4 limb BP to see if 20% difference between upper and lower limb = **aortic coarctation**
Auscultate	• L 4th IC space MCL → **soft systolic murmur (grade 2 or less)** = normal due to PFO (**GOES AWAY W/ SITTING UP**) • Any audible GRADE 3 or murmur that persists even after manoeuvres → pathological murmur

Abdo / Umbo / Anus

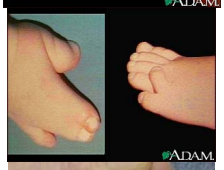
- Soft
- Masses
- Clean umbo
- Patent anus (BO)

Inspect	• Shape, asymmetry, distension, hernias
Palpation for organomegaly	• Distended = obstruction vs ascites ○ Hirschsprung, pyloric stenosis, duodenal atresia • Liver (palpable) = <2cm below R costal margin • NB: spleen, kidney and bladder = NOT easily palpable • **Femoral pulse (> 140bpm) → if slow = aortic coarctation**
Umbo	Check for Signs of bleeding, infection (**omphalitis**), granuloma • Advise to clean + dry with cotton bud (normally falls off after 10-14 days)
Anus	• colour of stools (meconium), • patent anus, marks, fissures, polyps, prolapses



Limbs

- Symmetry
- Thigh- symmetrical creases
- **Thigh swelling (normal – IM injection, abnormal – cellulitis)**
- Fingers/Toes for webbing, count digits
- Feet for talipes positional and fixed

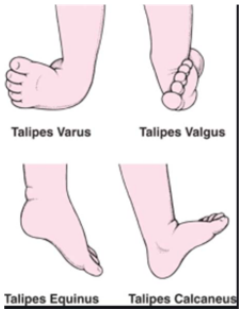


Upper Limbs

Pathology	
Fractured clavicle	• Birth trauma esp. large infants • Pain w/ movement + Moro • SCM spasm on affected side
Polydactyly (Supernumerary digit)	• Autosomal dominant • Extra-digit usu. on foot • Palpable bone present + finger can move → amputate digit when child > 1 y.o.
Syndactyly	Some/all digits/toes wholly or partially united • Can cause fusion of bone with skin
Single palmar crease	Down's
Brachial plexus (C5-T3)	*Birth asymmetry – Moro's test* • **Erb's** (C5-7) = arm adducted, IR, elbow extended, wrist flexed • **Waiter tip = C7 palsy** • **Klumpke's** (C8-T1)= paralysed hand

Lower limbs

Pathology	
Bowing	Normal ➢ Rickets (Vit D def.) ➢ Trauma
Talipes equinovarus (clubfoot)	*Structural vs positional* ➢ *Positional – can be corrected manually* ➢ *Structural (bone involved) – ED surg*
Metatarsus adductus (in-toeing)	• C-shaped/banana foot (foot deviates medially) • Splayed 1st web • Feet pointing to each other → self-resolves in 85% of c ases
Calcaneovalgus deformity	• Limited PF (< 90°) • Everted dorsiflexed feet (up + out)



Risk factors for DDH

- Breech birth OR breech at 36 weeks
- Female (6:1)
- 1st born
- FHx of DDH (1st deg)
- Large baby (>4kg)
- Oligohydramnios (little amniotic fluids)
- Spina bifida

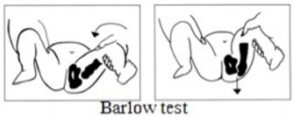
ALL are indications for HIP USS at 6 weeks corrected

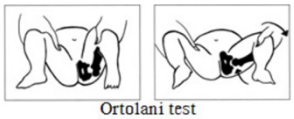
- e.g 30wks premmie with DDH would have hip USS in 16 wks

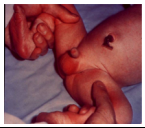
HIPS (Nappy removed)

- LLD
- DDH – hip stability and cong. Hip dislocation

Ortolani test	**anterior pressure on greater trochanter** (push up → ER) = hear for the click for CDH ➢ relocate anteriorly to acetabulum
Barlow's test	push down → adduct → knee pressure
Galeazzi's sign	Compare 2 femur length → LLD – see symmetrical skin folds


Barlow test


Ortolani test

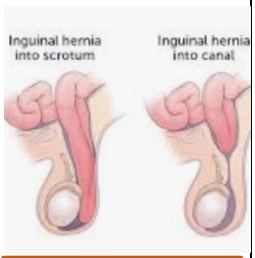


IF DDH suspected

- *USS – check alpha >60 & beta angles < 55 for type (Graf classification – determine mature vs eccentric hip)*
- ***CLASS III GRAF*** → Rx: Need to wear strap harness (if coverage ratio < 40% on USS)
- ***OR*** *can abduct hips to reduce risk of DDH*

REPRO SYSTEM

- **ambiguous genitalia**

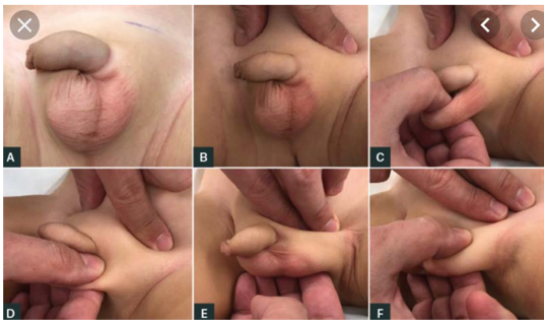
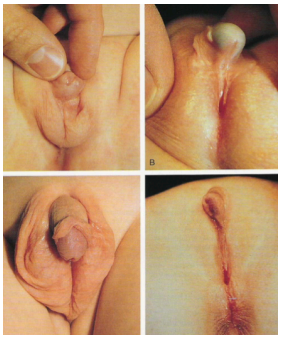


VACTERL

- *Vertebra anomalies*
- *Anal atresia*
- *Cardiac abnormalities*
- *TOF*
- *Oesophageal atresia*
- *Renal anomalies*
- *Limb defects*

	Male	Female

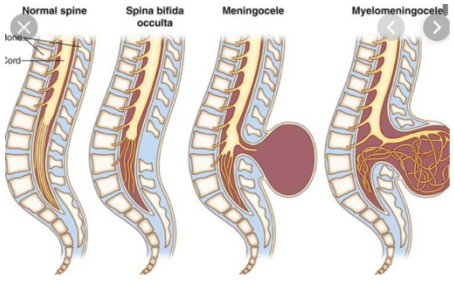
Inspect	Glans, urethral opening, prepuce, shaft
	• **Small penis** = low androgen (TT)
	• **Hypospadia**? Epispadias? = has baby passed urine? → Surgery referral for cosmetics
	• **Chordee** (ventral curvature of penis) = skin tethering, short urethra? → delay circumcision
	• **Communicating hydrocele** = incomplete obliteration of processus vaginalis ➔ painless, tense transilluminable mass
	• **Inguinal hernia** = soft non-tender reducible bulge in inguinal canal esp. with increased intra-abdominal pressure (surgery if incarcerated) → ***surgery ASAP***
		Labia minora, clitoris, hymen:
		• **Clitoromegaly** if:
		  • labia underdeveloped
		  • virilising tumour
		  • steroid usage in pregnancy
		  • CAH – newborn screening → to prevent Addisonian crisis
		• **Vaginal / hymenal skin tag**
		• **Mucous / whitish discharge**
		• Vaginal bleed

Palpate	• Unilateral Retractile = may self-resolve • Palpable ectopic or undescended = may self-resolve • Cryptorchidism (non-palpable) = orchiopexy? → **referral to urologist**	**Ambiguous genitalia → need rapid Dx + Rx** • ***Complications*** = hyperpigmentation, apnoea, seizure, dehydration, HypoTN, hyperK, hypoGlycaemia • ***Social emergency*** = delay naming until sex determined • ***Addisonian crisis (21-OH def.)***
		

SPINE and BACK

- Check tone
- Scolioisis
- Sacral dimples
- Tuft of hair

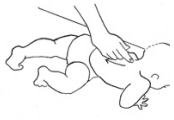
Spina bifida occulta	Spinal meningocele	Myelomeningocele
Normal meninges, SC, spinal root	• Meninges herniates through posterior vertebral arches → covered by skin • Anterior herniation = sphincter dysfn • Normal SC + nerve roots	• Meninges, SC +nerve roots ALL involved • 75% in lumbosacral • Assoc. with MOF → flaccid paralysis of lower extremities + absent reflexes • Assoc. → hydrocephalus, neurogenic bladder, urinary & stool incontinence



Nervous System

1. **Alert + active**
2. **Head lag** (1st few weeks – none by 3/12)
3. **Check tone**
4. **High tone / rigid** = ?withdrawal from meds taken by mother
5. **Low tone** = frog leg position + lifting a "rag doll"
6. **Muscle power**
7. **UMN vs LMN**
8. **Reflexes – primitive**

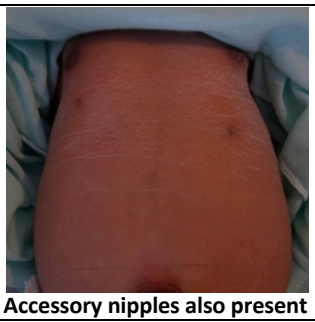
A. **Palmar grasp reflex** - fingers should close/grasp object if placed in palm
B. **Sucking reflex** - newborn instinctively suck anything that touches roof of mouth
C. **Rooting reflex** - a newborn turns head towards anything that strokes cheek or side of mouth
D. **Stepping reflex** - when lifted, if a newborn's feet touch a flat surface they will motion walking by placing one foot in front of the other
E. **Moro reflex** – support newborn's upper back with one hand → simulating backwards drop once or twice with your other hand → arms will then be brought together, and hands clenched as infant cries. [brachial plexus palsy]
F. **Babinski reflex** – Toes point down (LMN lesion)

Primitive Reflex	Rooting	Galant (trunk incurvation)	Moro (check for asymmetry)	Palmar grasp	Tonic neck (fencer)	Stepping
Onset	28 wk GA	28	28-32	35 wk GA	35 wk GA	35-36
Well-established	32-34	40	37	32	4 wks PCA	37 GA
Disappears	3-4 mths	3-4 mths	6 mths	2 mths	7 mths	3-4 mths PCA
Elicit	Stroke cheek or corner of mouth Infant's head turns towards stimulus	• Infant in ventral suspension with chest in palm of examiner's hand • Firm pressure on side of spine → infant flexes pelvis to same side	• Hold infant with one hand holding HEAD with elbow on bed and the other the buttock • Sudden dropping of head in hand → infant's hand opens and extension and abduction of upper limb	Place finger on infant's palm for gasping	Rotate infants head to one side → infant extends arm on rotated side while flexing opp. arm	Touch top of infants foot on edge of table → infant wants to step
			 Absent = hemiplegia, brachial plexus palsy			

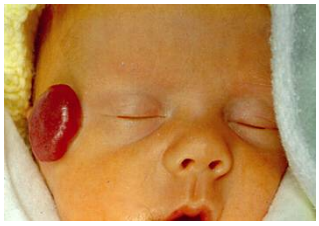
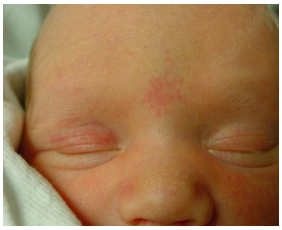
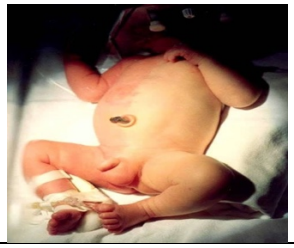
Poor tone
- CNS (CP)
- Primary muscular disorder
- Genetics (Down's, Prader-Willi)

COMMON NEONATAL SPOT DIAGNOSIS

NORMAL

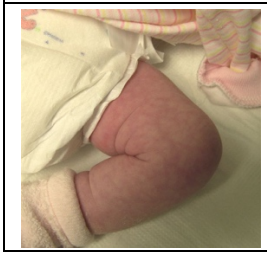
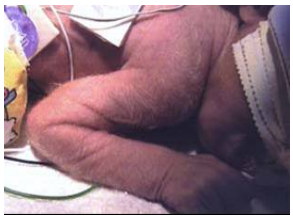
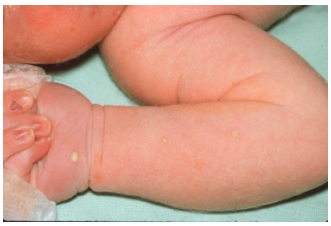
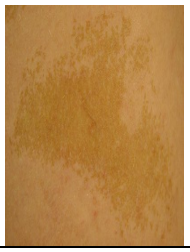
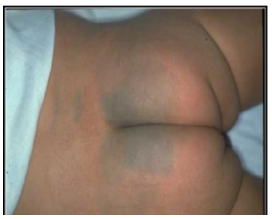
Mild peeling	Vernix caseosa
1 Normal 2 Common in post-term or those intra-uterine growth restriction infants	3 Greasy white protective covering of infants
 **Accessory nipples also present**	

VASCULAR

STARWBERRY Haemangiomas (10%)	Vascular malformations	Naevus flammeus (stork marks)	Harlequin phenomenon
• **high** blood flow ⟶ vascular endothelial- proliferation up to 12 months of age (involute over 5-10 years) • **bright red, raised, lobulated** that **grows** over 12 mths before regressing spontaneously • *Rx*: **timolol (BB) oral OR propranolol** (if blocking eyes and airways) *Complications include*: • bleeding, ulceration, infection • compression of vital organs	• **low** blood flow • SKM involved • congenital malformations that do **NOT** involute spontaneously	• **Most common vascular birthmarks** (50% of newborns) • usu. fades by 2 years but some may persist • **irregular bordered pink macule** composed of dilated, distended capillaries • *Sites*: nape, upper eyelids, nose bridge, upper lip • **Blanches with pressure**	• Unilateral reddening on one side of body • Blanching on other half • Clear line of demarcation • Transient: Secs – mins → . most often during the first few days of life • Vascular manifestation due to the immaturity of ANS in newborn?.
			

PIGMENTATION

***NOTE = small naevus = carries small risk of malignancy**

Livedo reticularis (Cutis marmorata)	Lanugo	Transient Neonatal Pustular Melanosis (TNPM)	Café au lait	Mongolian spot
• **Transient mottling** of the skin • Occurs when baby is **exposed to the cold** • Reduced blood flow to cutaneous capillaries	• Fine facial and body hair • Usu. preterm babies • Lost during 1st month of life	• Small vesicopustules, generally present at birth. • WBCs and no organisms. • Intact vesicle ruptures to reveal a pigmented macule surrounded by a thin skin ring.	**DDx:** • >5 x = NF-1 suspected • McCune Albright Syndrome	• **Most common pigmented** *grey or blue-green* **lesion** in the newborn (melanocytes invade dermis) • **Asians & Africans** • Generally fade by age 7 years
				

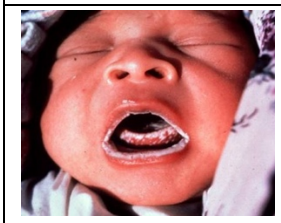
Genitalia / Infections

Oral candidiasis

- White patches on tongue,gums, lips and buccal mucosa
- ***Anti-fungal***: Nilstat/nystatin cream needed

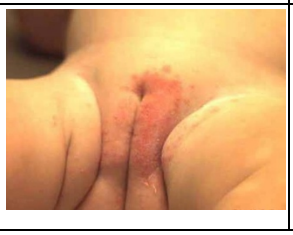
DDx:

➢ Dried BM on tongue is scrapeable unlike candida



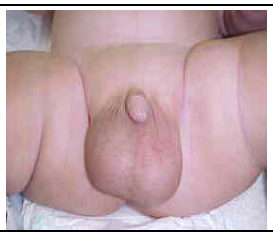
Genital thrush

- red and tender with satellite lesions
- inside skin folds and creases



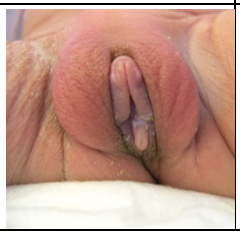
Congenital hydrocoele

- **Translucent swellings surrounding testis**
- Assoc. w/ continuation of process vaginalis
- peritoneal fluid
- Transient = Spontaneous resolves by 1 year



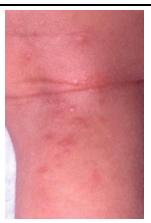
Hymenal tag

- Assoc. with protrusion of redundant vaginal mucosa
- Common
- Regresses spontaneously in first 2 mths



HSV lesion

- **Grouped vesicles in linear distribution** (skin, eye, mouth) → may erode to form ulcers with red base
- Virus acq. At time of birth or exposed several days prior to birth
- **Rx: acyclovir**



CUTANEOUS FINDINGS

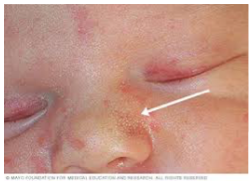
Milia (milk spots)

4 White follicular cysts (retention of keratin and sebum)

5 clustered along cheeks, forehead, nose

6 Resolves in first 4 weeks

Called *Epstein pearls* if spots found on hard palate

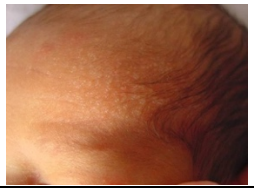


Millaria

Rupturing of obstructed sweat gland forming **superficial vesicles (1-2mm diameter)**

7 Assoc. w/ thermal stress (i.e. overwrapping)

8 *Miliaria rubra* ("prickly heat") = papules and pustules from obstruction in the mid-epidermis.



Erythema Toxic Neonatorum

9 **Benign, self-limiting** → disappear and reappear within 72 hrs (50-70%)

10 Red pustules containing eosinophils

11 Any body part

Sucking blisters

Well demarcated bruises or vesicular

- May be present at birth
- Sites: *usu.* dorsal and lateral aspect of the wrist or fingers.
- XS sucking activity

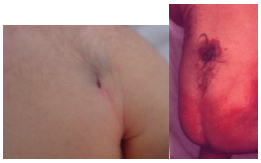
12 *DDx*: bullous impetigo (if there are other similar lesion)

Sacral dimple vs spina bifida

- Dimple = Insignificant

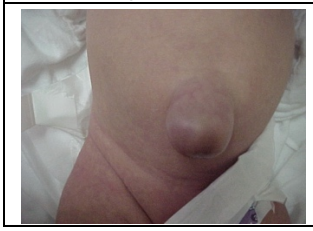
Spinal USS indicated:

- If cannot see base of pit
- If pit within lumbosacral region w/ discoloured or with hairy tuft, it may be assoc. with spinal cord abnormality (spina bidifa)



Umbilical hernia

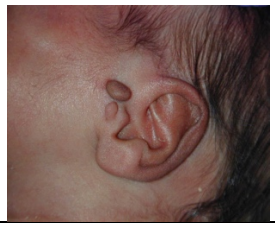
- **Common in pre-term**
- Usu. develops in the 1st month
- Often spontaneously regresses by 6 – 18 month
- Rarely problematic as large opening



Preauricular skin tag

Usually sited anterior to ear

- Maybe associated with renal anomaly



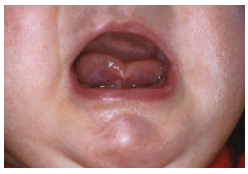
Tongue tie (ankyloglossia)

Assoc. with short frenulum

- Poor **breast feeding** and speech dev.

Rx: cut tie (frenectomy) without anaesthetics

(infection, scar, bleeding)

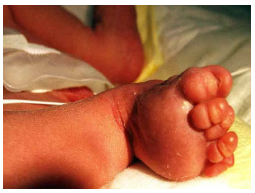


Pedal oedema

- Turner's
- CCF
- Nephrotic syndrome

Rx:

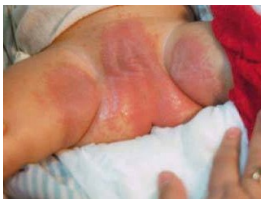
➢ **IV furosemide**



Napkin/contact dermatitis

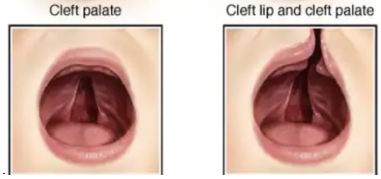
- Spares the skin folds and creases
- May be due to lactose intolerance → digested milk acid

DDx: intertrigo



ISSUES WITH CLEFT PALATE – OPENING IN ROOF OF MOUTH

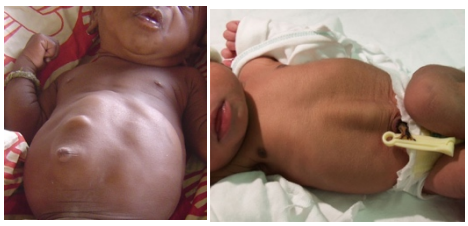
➢ Poor Feed (Unable To Suck), Speech Deficit, Otitis Media
➢ Assoc. w/ folate def. HPA dysfn, TB-Patau



DIASTASIS RECTI

➢ Found in post-partum pregnant women
➢ **Common in newborns**
➢ Separation of recti abdominus muscles due to weakened fascia in linea alba
➢ **NOT A HERNIATION OR PATHOLOGICAL**

➢ **Rx: self-resolves**



Immediately After Birth

- **Skin to skin –** *warm baby, improve maternal bond, improves BF*
- **Clamp the umbilical cord –** *delayed cord clamping*
- **Dry the baby**
- **Keep the baby warm with a hat and blankets**
- **IM Vitamin K (L thigh) –** prevent IVH
- **Label the baby**
- **Measure the weight and length**

Out of the Delivery Room

1) Initiate breast feeding or bottle feeding as soon as the baby is alert enough
2) The first bath is usually delayed until this baby is warm and stable. It can wait days without any issues.
3) Newborn examination within 72 hours
4) Blood spot test
5) Newborn hearing test @ 12 hrs old

Blood Spot Screening (heel prick blood → on screening card taken in 48-72 hrs after birth)

Primary congenital hypothyroidism	• TSH > 10 • Does NOT detect central hyperthyroid	• Thyroids agenesis (most common) • Maldescent of thyroid • Dyshormonegensis (inborn error of thyroid hormone synthesis) • Maternal iodine def.	Thyroxine (for life)
CF	IRT > 100 Sweat test (Cl)	Dysfn CFTR1 gene ➔ thick mucus production (↑ of resp. infection and FTT)	Early Rx
PKU	Genetic test	cannot break down phenylalanine (amino acid) ➢ Mostly foul smelling urine	Low phenylalanine diet
MCAD deficiency	Genetic test	• Can't break down medium chain FA ⟶ hypoglcyeamia hypoketosis • Poor feeding, seizure, vomits and drowsy	Dietary mod
CAH	Genetic test (21-OH)	Cannot produce sex steroids, aldo, cortisol (cannot regulate salt levels, sex charactersitcis)	Steroids + salt replacement
Galactosaemia			

*Many more including: sickle cell disease, Maple syrup urine disease (MSUD), Isovaleric acidaemia (IVA), Homocystine
Results take **6-8 weeks** to come back.

HANDOVER

I	**My name, role, Ward (ICU, SCU or maternity ward), Patient age, sex, bed #** • *In-utero transfer to 3° hospital* = any pre-term (< 37 wks) or high risk (e.g. *cardiac issues, polyhydramnios, congenital issues*) • *Ex-utero transfer to 3° hospital* = baby already delivered (*Not preferable as need to increase respiratory support, long transfer and delay in treatment = increased mortality rate*)	
S	**Diagnosis & Principle issue** • **Reversible ➔ Seizures, hypo/hyperK, hypothermia, asphyxia/hypoxia, hypovolaemic shock, tamponade, toxin/NAS, thrombus, tension pneumothorax** • **ARDS, TTN/HMD, HIE, NEC, nas jaundice, hypoglycemia, DDH, shoulder dystocia, sepsis/shock**	
O	**What was done and why?** • Resus status (HD stable or unstable), Vital signs, interventions (IV access) & drains/devices (IVC, pacemakers) • **Delivery mode with AGPAR** (1 min, 5min, 10min) o any resus needed? • **CTG** – decelerations? Tachy/bradycardia?	
B	**Maternal health (pre-natal)**	• *General health* ➔ **G & P, BMI, thyroid, blood disorders, cardiac issues, FHx** (*asthma, CHD, DM)* • *GDM* • *HTN* (Pre-eclampsia) • *IUTD - Infections* (e.g. GBS, TORCH, UTI) • *Screening* (serology, Rhesus status,. USS, amniocentesis findings - abnormalities)
	Ante-natal	• **Maternal** → APH, labour does not progress, 3rd -4th degree perineal tears • **Baby position** → breech, cephalic • **Delivery comp**. (e.g. NVD, LSCS, instrumental birth – forceps, suction) • **Sepsis RF** (*PPROM, maternal fevers, infections – vaginal swabs ++ GBS)*
	Post-natal	• **Maternal** → PPH • **Pre-term** ➔ TTN/HMD, HIE, NEC, jaundice, hypoglycemia, DDH, shoulder dystocia sepsis • **Term/Late** ➔ meconium aspiration ➔ ↑ aspiration pneumonia • Vitamin K (left) and hep B (right) injections • Modes of feeding (BF or BMS) → quantify oral intakes and outputs (# of wet nappies)
A	***What am I going to do?*** • Continue ventilatory support, weaning • IVF , glucose, feeding (milk), phototherapy, surgery, monitor input/outputs	
R	***What do I need you to do?*** • Put child under care – recommended course of action? • Indications/goals to allow for discharge	

Acute Mx For Pre-term

A	*Intubate*
B	*NBM ➔ CPAP ➔ BiPAP*
C	• *BP, CRT, HR, Pulses*
D	• *IV access*
E	• Immediately **give steroids** – allow premature baby's lungs mature quicker • **ABx – amoxicillin (GBS) + gentamicin (E. coli)** o Or azithromycin (if allergic to penicillin) o Ascending infection (from oligohydramnios) • ***Cord blood ➔ ABG test from umbilical artery reflects foetus*** o **pH Acidosis < 6.9 + high lactate**
F	• *IV drip* - Provide **glucose + fluids**
G	**NGT - TPN** -as have not developed suck coordination until 32-34 weeks • Donor breast milk?
Ix	**Head USS =** IVH, ICH, Hydrocephalus, mass, cyst, meningitis **Renal USS =** VUR (esp. recurrent UTI) **Hip USS =** DDH

CONDITIONS ARISING IN PREGNANCY (Refer to infectious diseases)

	Fetal alcohol syndrome	Congenital toxoplasmosis	Congenital varicella syndrome	Congenital rubella syndrome	Congenital CMV	Congenital Zika syndrome
PP	EToH crosses placenta to disrupt fetal development	Toxoplasma gondii parasite infection (cat faeces)	VZV (chicken pox)	Maternal infection ➢ NO MMR vax ➢ Highest risk in first 3 mths GA	Spread via saliva, urine of asymptomatic children	Spread via Aedes mosq. And sex
Maternal issue	1) Early M/C 2) SGA 3) Pre-term delivery	•	• Pneumonitis, • hepatitis • encephalitis			
Fetal Dysmorphia	• Microencephaly • Thin upper lip • Smooth flat philtrum • Short palpebral fissue	•	• Microencephaly • Limb **hypoplasia (underdeveloped)** • IUGR • Scars/ skin changes following dermatomes		• Microencephaly • IUGR	• Microencephaly • IUGR
Fetal complication	• Learning disability • Hearing and visual issues • Behavioural difficulties • CP	**TRIAD** • Intracranial calcification • Hydrocephalus • Chorioretinitis	• Neonatal sepsis • Chorioretinitis • Learning disability	• Congenital cataracts • CHD (PDA and PS) • Learning disability • Hearing loss	• Vision and hearing loss • Learning disability • Seizures	• Cerebellar atrophy • Ventriculomegaly
Rx	• **NO safe level of EtOH**	•	**If possible chicken pox exposure** ➢ Test IgG varicella ➢ IV varicella Ig if not immune **If skin rashes AND pregnant + > 20GA:** • Oral acyclovir (within 24 hrs)	• **MMR vaccine for pregnancy plans** (2 doses MMR 3/12 apart) • **NO vaccine during** pregnancy (as live)		Any suspected contact → test for: • Viral PCR • Abs to Zika *NO treatment for virus

BIRTH INJURIES

	Cause	Symptoms	Complications	Rx
Caput seccudum (EDH) **Cephalohematoma (SDH)**	Prolonged labour Instrumentation / traumatic	Soft boggy head swelling ➢ Caput seccudum (crosses suture lines) ➢ Cephalohaematoma (does not cross suture lines)	Jaundice Anaemia	Self-resolves Monitor for resolution
Facial Paralysis	Instrumentation (**forceps**) Breech	Weakness of facial nerve on one side	Permanent weakness and paralysis	Sensation returns within 1 month (neurosurg input if not)
Fractured clavicle	LBW Shoulder dystocia Instrumentation / trauma	• Asymmetrical movement of affected arm • Affected shoulder lower than normal shoulder • Pain and distress on arm movement	Injured brachial plexus (erb's or klumpke's palsy)	Immobilise arm ➢ Self-heals
Erb's palsy	Shoulder dystocia LBW Instrumentation / trauma Breech	C5/C6 nerve root damage ➢ Adducted extended arm internally rotated ➢ Waiter's tip	Permanent weakness and paralysis	Resolves within few months (neurosurg input if not)

SUDDEN INFANT DEATH SYNDROME = "cot death"

DEFINE	**Unexplained sudden death usually occurring within first 6/12 of life**
RF	• Pre-term • LBW • Smoking during pregnancy • Male • Formula fed
DDx	*SIDS = diagnosis of exclusion* ➢ Sepsis, DKA, CHD
Prevention	*"There are many ways to reduce the risk:"* • Put baby on back when not supervised • Keep head uncovered • Place feet at foot of bed to prevent sliding down • Keep cot clear of blankets and toys • Avoid smoking + co-sleeping + substance use (alcohol, sleeping tablets)
Post-Rx	Bereavement support for affected families ➢ Social work referral +/- DCJ consult ➢ Referral to coroner

PREMATURITY

Important terms:	
22 wks GA	30% survival
24 wk	90% survival
< 28 wks	***Xtreme pre-term***
28-32 wks	***Very pre-term***
> 32 wks	***Pre-term***
37-42 wks	**neonate**
> 42 wks	**post-term**
1st 24 hrs life	**newborn**

Weight and size terms	
< 2500gm	Low Birth Weight
< 1500gm	Very Low Birth Weight
< 1000gm	Extremely Low Birth Weight
> 90th	LGA
10-90TH	AGA
< 10TH OR infant < 2500 g	SGA

Causes of pre-term deliveries

- *Malnutrition / social deprivation*
- *Maternal sepsis / chorioamnionitis*
- *Smoking*
- *Substance abuse (EtOH, drugs)*
- *Overweight or underweight mother*
- *Maternal co-morbidites (GDM)*
- *Twins*
- *Personal or FHx of prematurity*

Mx before birth

High risk pregnancies (e.g. previous pre-term, short cervix < 25mm or GA < 24wks)

1) *Prophylactic vaginal progesterone – suppository to discourage labour*
2) *Prophylactic cervical cerclage – suture cervix close*

If pre-term established:

1) *Tocolysis w/ nifedipine – suppress labour*
2) *Maternal CS (before 35/40) – reduce morbidity*
3) *IV MgSO4 (before 30/40) – neuroprotection*
4) *Delayed cord clamp – elevate Hb stores*

GENERAL ISSUES WITH PREMATURITY

Pre-term issue	PP	Complications	Management
Poor nutrition	High metabolic demand	FTT	**Parenteral nutrition → NGT (fortified formulas)** ➢ Feed until sucking reflex at **32-34 wks** ➢ Hard to achieve in-utero growth rates
LBW	Underdeveloped + insufficient glycogen storage	hypoglycaemia + jaundice	**supplement** with **donor breast milk** for premmies within 2 hours (esp. if <32 wks GA)
IVH	+++ **Disability rate → 98% risk**	• Seizures • Cerebral Palsy – hemiplegia • Hearing and visual impairment • Learning and behavioural difficulties • PPHTN	• **HEAD USS** • Supportive care – ventilation, circulatory support, acid-base balance • Phenobarbital (cooling) • **Therapeutic hypothermia (33-34 deg) →** reduce inflammation and neuron loss
HIE / asphyxia signs = *meconium in utero pH <7.1 , AGPAR 7 (10 min)*	Brain hypoxia leading to ischaemia ➢ **Acute** hypoxia = **large** placenta + baby ➢ **Chronic** hypoxia = **small** placenta + baby		
ROP	retinal vessels proliferate too quickly → **retinal detachment, SEVERE myopia**	Vision loss (blindness)	**If known LBW/SGA -→ screen at 30-31 wks** ➢ Transpupillary laser photocoagulation to reverse neovascularisation ➢ Cryotherapy OR intravitreal VEGF inhibitor
PDA	**Congenital failure** to close ductus arteriosus (detected via pre and post-ductal)	Acyanotic HD Persistent PHTN	**Ibuprofen (NSAID) →** reduce PG to close it
HMD (Surfactant def.) and/or respiratory distress syndrome	**Pre-term - immature lung development** (has not reached terminal sac stage for type 2 pneumocytes to form)	• Chronic lung disease of prematurity • Pneumothorax • Infection susceptibility (esp. URTI/LRT)	• **Steroids** to accelerate lung maturity • **Surfactant therapy** • **IV Caffeine** • **CPAP + ABx** (Penicillin + gentamicin)
Apnoea of prematurity	> 20 second apnoea episodes w/ transient desats and bradycardia • Cause: infection, anaemia, seizure, GORD, NAS	Chronic lung disease of prematurity	• **Apnoea monitors** • **Tactile stimulation** to restart breathing • **IV Caffeine used →** (↑cAMP) stimulate spont. breathing (longer stronger breathing) • **I + V needed** (if sustained apnoea)
GORD			
NEC	**Bowel becomes necrotic** ➢ Poor feeding, projectile bilous vomit ➢ Absent BS, PR bleeding, distended abdo	Peritonitis and septic shock ➢ Strictures, abscess, recurrence ➢ Short bowel syndrome (post-op)	• NBM + IVF • TPN + ABx • **Donor breast milk** + • probiotics (to improve gut microbiota)
Inguinal hernia		High risk of strangulation	**Surgical hernia repair - mesh**
Immature immune system		Infection susceptibility (esp. URTI/LRT) Sepsis	Blood culture, urine clean catch M/C/S ➢ Empirical ABx + identify source
Neonatal jaundice	Check based on GA age	Kernicterus → CP	**Phototherapy → Plasma Xchange**
Hypothermia	high SA:V ratio = loss of heat immature skin cannot retain heat		• Polyethylene sheet • Radiant heat or humidicrib
Hypoglycemia		Coma/seizures → death	Maintain BSL > 2.6mM
Anaemia of prematurity	Reduced Hb	FTT	Fe or Blood transfusion
Osteopenia of prematurity	Elevated ALP	Risk of fractures	Vitamin D supp.
Electrolyte imbalance		Arrythmias, seizures	IVF – fluid check + EUC

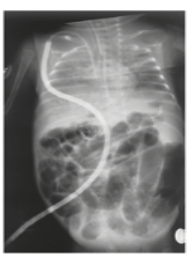
PRE-TERM <32GA at DUBBO Hospital scenario?

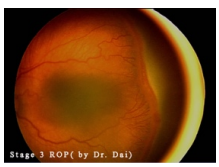
How to deal with refusal to treatment?

- Dubbo **only** has special care nursery (**no NICU unlike John Hunter or Sydney**)
- *Higher complication rate at Dubbo compared to tertiary hospital. Why?*
  - Long-time transfer + increased risk of IVH
  - Paediatrician may not be able have expertise for IV access, intubate
  - Higher cost assoc. if ex-utero
  - Desire for early transfer in-utero to improve survival

*What situations need transfer in-utero to tertiary hospital i.e. should not be delivered? **(in-utero transfer)***

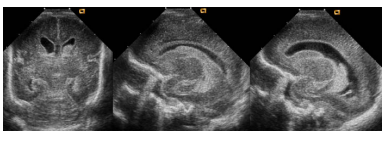
- **PROM** → stops growing due to oligohydramnios→ as no fluid in lungs → lung hypoplasia
- **Congenital syndromes** (e.g. Down's – 50% heart defects, Edward's)
- **Anatomical abnormalities** (e.g. hydrocephalus, shortened limbs etc.) → usu. identified from scans
- **Premmies** (esp. <32 weeks) → lungs have not matured + thus need respiratory support (CPAP) and greater observations (1:1 nurse to infant ratio) + expertise





Dilated bowel loops and intramural gas typical of NEC. There is a central venous line and a nasogastric tube in place

INTRAVENTRICULAR HAEMORRHAGE



- **Baby requires surgery** (e.g. hernia, TOF)

NEONATAL SEPSIS / HIE / RDS

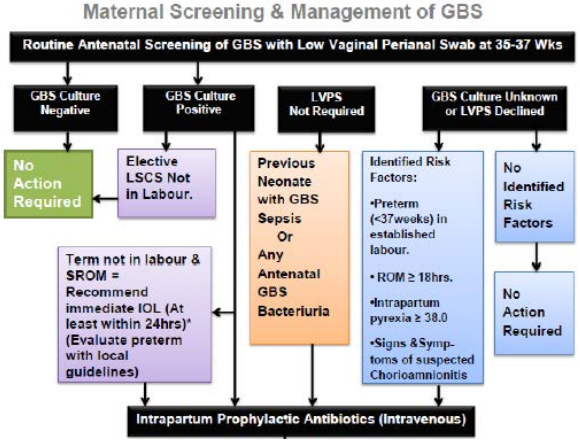
	Neonatal sepsis (urosepsis, meningitis, pneumonia, AOM, pharyngitis)	**Hypoxic Ischaemic Encephalopathy (HIE)**	**Respiratory Distress Syndrome**

PP / comp.	➢ Any infection during neonatal period causes sepsis
	➢ Have low threshold to start empirical ABx
	  ○ Early onset sepsis (< 72 hrs) – 30%
	  ○ Late onset sepsis (> 72 hrs) -10% → usu. nosocomial
		➢ Hypoxia during birth	Pre-term infants with surfactant deficiency esp. if < 32 GA
			➢ NO surfactant = high surface tension + inadequate gas exchange
			➢ High risk of atelectasis

RF	***Maternal*** • *Prolonged labour* • *Vaginal GBS colonisation* • *Previous GBS sepsis* • *Maternal sepsis, Chorioamnionitis (fever > 38), TORCH +ve* • *Premature rupture of membranes (e.g. substance abuse, infection)* • PPROM (> 18h) ***Foetal*** • *IUGR* • *Pre-term* • *Male* • *Twins* • *Absent spleen* • *Birth asphyxia* ***Main causes of neonatal sepsis*** ➢ GBS ➢ E. coli ➢ Listeria ➢ Klebsiella ➢ S. aureus	***Maternal*** • *Prolonged labour* • *Maternal shock* • *Intra-partum haemorrhage* • *Cord prolapse* • ***Nuchal cord*** *(cord wrapped around neck)* ***Foetal*** • *IUGR* • *Pre-term* • *Birth asphyxia*	***Maternal*** • *Prolonged labour* • ***Oligohydramnios*** • ***GDM*** • ***LSCS*** • ***Maternal*** ***Foetal*** • *IUGR* • *Pre-term* • *Birth asphyxia* • *Male*
Cause Clinical Sx	***Non-specific signs*** • Fever, chills • **Reduced tone** • **Seizures** • Abnormal behaviour & mental state • **Signs of shock** (tachypnoea, tachycardia, hypoTN, febrile, prolonged CRT, **looks grey and pale)** • **Focal signs of infection** (e.g swollen red skin, ear discharge, increased WOB or apnoea, abdo pain, dysuria) • **If late onset sepsis ➔ FTT + Jaundice**	**Mild**: • Poor feeding • Irritable and hyperalert **Mod**: • Poor feeding, lethargy • Reduced tone + seizures **Severe**: • Apnoea • Flaccid / absent reflexes • Reduced LOC	• Increased WOB • Tachycardia • Cyanosis (peripheral vs central) • Floppy (reduced tone)
Comp.	➢ **Septic shock** ➢ **DIC and MOF** ➢ **Death**	➢ **Long-term hypoxia = ischaemia → permanent brain damage (CP)**	➢ **Short-term** = PTX, pulmonary haemorrhage, infection, apnoea, IVH, NEC ➢ **Long-term** = chronic lung disease of prematurity, ROP, neurological impairment (ROP, hearing and visual)

Ix	**Indirect infection source: ➔ Take cord blood**
	• **FBC** (left shift WBC)
	• **ESR/CRP** + baseline
	• **CXR –** *pneumonia?*
	• **Cord blood – PO2, lactate, pH, BSL, blood culture**
	Targetted Ix to identify source:
	• **Blood & CSF culture ➔** gram stain + M/C/S
	• **Targeted swab (**gram stain + M/C/S)
	  ○ Ear - **otitis media**
	  ○ Nose – sinusitis, viral multiplex
	  ○ Throat – pharyngitis, tonsillitis
	  ○ Groin/wound - UTI
	  ○ Umbilicus - omphalitis
		• Vitals
		• Hypoxia during perinatal / intrapartum period
		• Acidosis (pH < 7) – umbilical ABG
		• Poor ABGAR scores
		• Signs of MOF
			• Vitals
			• Poor ABGAR scores
			• FBC - anaemia
			• ABG – hypoxia, hypercapnia
			• CXR = ground glass appearance

Mx	***ABCDE Approach – resus***
	Empirical ABx: Gram +ve and -ve coverage
	• **Benzylpenicillin 100mg/kg dose bd** (erythromycin if allergy BUT causes bone loss)
	• **Gentamicin 3.5mg/kg dose daily** → oto + nephrotoxic
	***NO ceftriaxone → causes joint impairment**
	Post-resus care:
	➢ CRP check → 24 hrs
	➢ Blood culture check → 36 hrs
	
	When to stop ABx?
	➢ Clinically well + negative blood cultures < 36 hrs +CRP is normal (< 10)
	➢ Clinical well +negative LP and blood cultures + CRP is normal (< 10)
	➢ Consider LP if CRP > 10
		Refer to neonatologists
		➢ Greater severity – longer recovery, higher mortality rates
		➢ Supportive care – ventilation, circulatory support, acid-base balance
		➢ **Therapeutic hypothermia →** active cooling core temp of baby **(aim for 33 and 34 degrees celcius using rectal probe)**
		  ○ Reduce inflammation and neuron loss
		  ○ Reduce risk of CP, developmental delay, blindness, and death
		  ○ **INSPIRED BY FALKLAND WARS**
			Ante-natal
			➢ Dexamethasone = increase surfactant production (reduce RDS risk)
			
			ABCDE Approach – resus
			➢ I+V
			➢ ETT surfactant
			➢ CPAP
			➢ Supp. O2 – maintain sats between 91-95%



Main Causes of chorioamnionitis:

Mainly infections:

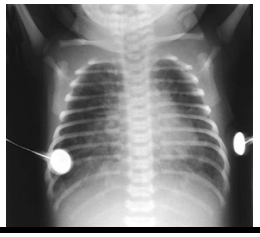
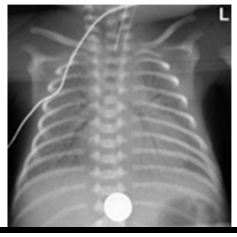
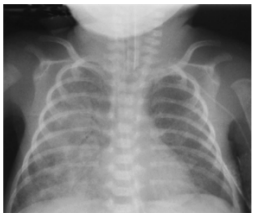
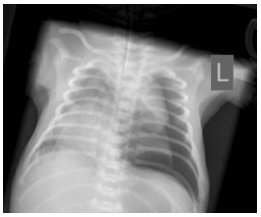
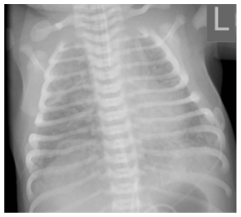
- ***Intrauterine***
  - **Transplacental** (TORCH + Hep B/C, HIV, syphilis, Zika)
  - **Ascending** (E. coli, Klebsiella, Pseudo, Listeria, Candida)
- ***Inter-partum***: HSV2, C+G, candida
- ***Nosocomial***: MSSA/MRSA, GBS, gram-ve

Why are newborns vulnerable?:

Underdeveloped immune system

- No Mucosal IgA at birth
- Neutrophils work (but low in numbers)
- Complement activity 50% of adult
- Transplacental IgG passage = during 3rd trimester (at 30 GA = fetus has 50% of adult activity

RESPIRATORY DISTRESS – COMMON PULMONARY CAUSES

	Transient tachypnoea of the newborn (TTN)	RDS (Hyaline Membrane Disease)	Sepsis/Pneumonia	Pneumothorax	Meconium Aspiration syndrome (MAS)
PP	Retained fetal lung fluid	Surfactant deficiency (Type II pneumocytes)	Any baby w/ resp. distress	Any baby w/ acute deterioration	• Meconium stained liquor (black)
RF	• **LSCS** • **Pre-term (34-36)** • **GDM** • **Male** • Precipitous delivery • mATERNAL SEDATION	• **LSCS** • **Pre-term (37-38)** • **GDM** • **Male** • Multi-gestation	• **Pre-term or PPROM** • **Infection** (*Chorioamnionitis, GBS, HSV active)* • **Mec- stained liquor**	• **Post-term** • Underlying lung disease • **Mec- stained liquor**	• **Post-term** • IUGR • African-American • Peri-natal depression
Clinical features	**Early** Tachypnoea from birth resolves in 1-4hrs	**Worsening** Tachypnoea from birth **over 48 hrs** • Coarse crackles • Central cyanosis	• Distributive shock (warm, tachycardia, tachypnoea, hypoTN) • Toxic looking	Can shine light through the chest from front to back on affected side	• **Early** ARDS Associated with PHT, 2° surfactant def
X-ray	• Pulm venous congest • Fluid in plueral fissure • Hyperinflated lung	• ground glass opacity • air bronchograms	• focal or generalised	Unilateral lobar collapse	• Diffuse Coarse patchy changes in lung fields • *Sequelae*= pneumothorax or pneumonia
Rx	• **Corticosteroids** (accel. Lung maturation) • **Caffeine** (<32GA) –byproduct of theophylline = ↑cAMP → reduce diaphragmatic fatigue • **Artificial surfactant (ETT) –** for lung re-expansion		Empirical Abx • BenPen – GBS • Gentamicin – E.coli	Needle decompression / chest drain	• FiO2 support (mech. Ventilation) • Artificial surfactant
					

OTHER RESPIRATORY DISTRESS CAUSES IN NEWBORN

Structural Resp causes		*Extra-pulm causes*		
URT	*LRT*	*CVS*	*Neuro*	*Other*
• *Choanal atresia* • *Macroglossia* • *Laryngeal web* • *laryngomalacia* • *Subglottic stenosis* • *Pierre-Robin* • *TEF* • *External mass compression*	• ***Pulm. Hypoplasia*** *(assoc. oligo, renal agenesis, pre-term PROM)* • **Congenital cystic adenomatoid malformation** (CCAM) • **Diaphragmatic hernia** • **Congenital chylothorax**	• Acyanotic CHD • Cyanotic CHD • PPHTN (pre vs post-ductal > 10% DIFFERENCE • CM • Cardiac tamponade (pericardial effusion) • Arrythmia • High-output failure (anaemia, sepsis)	• **CNS injury** – SCI, traumatic, prolonged birth • **HIE** – birth asphyxia • **TORCH infection** • **Meningitis** • **Seizures** • **Cerebral malformation** • **NMD –** MG, SMA, DMD	• **Inborn error metabolism** → metabolic acidosis • **Haem** – anaemia, hydrops fetalis, polycythemia, Rh disease • **Hypo** – BSL, temp, Na

Acute Management Protocol

S+S of resp. distress
- Tachypnoea (RR >60/min)
- **Nasal flaring**
- Expiratory **grunt**
- **Chest retraction** /recession
- Cyanosis in RA

➔

Initial Resus:
- **ABCDE**
- IV Access
- Supp. FiO2
- Admit to NICU

➔

Investigations:
- FBC/film
- blood cultures
- ABG (O2, pH)
- CRP/ESR
- CXR
- ECG - arrythmia

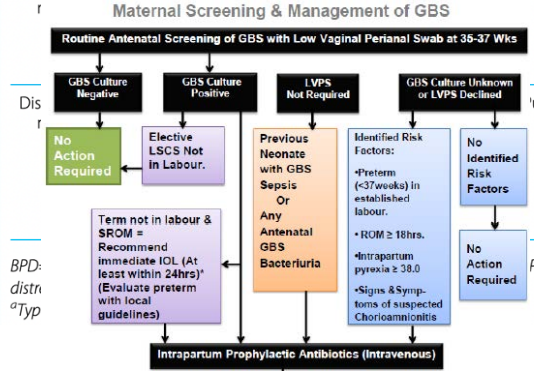
➔

Management:
- FiO2 – CPAP + humidifier
- Bloods (FBC, EUC, ABG)
- IV Abx
- Surfactant
- Caffeine
- Morphine
- Parenteral feeds

DEVELOPMENTAL STAGE	EMBRYONIC	PSEUDOGLANDULAR	CANALICULAR	TERMINAL SAC	ALVEOLAR
Gestation	0–6 weeks	7–16 weeks	17–24 weeks	25–36 weeks	>37 weeks
Structural	Trachea, bronchi	Bronchioles, terminal	Respiratory bronchioles, primitive alveoli	Alveolar ducts, thin-walled alveolar sacs, increasing functional type 2 cells[a]	Definitive alveoli and mature type 2 cells[a]
Dis			'ulmonary hypoplasia, RDS, BPD, alveolar capillary dysplasia	RDS, BPD	TTN, MAS, neonatal pneumonia, PPHN
BPD: distr					

[a]Typ

PHN=persistent pulmonary hypertension of the newborn; RDS=respiratory



TTN, PTX, MAS, SEPSIS, NAS, HMD *and* ***PRE-TERM***

↓

Respiratory Distress Syndrome

↓

+WOB, + RR, Hypoxia

↓

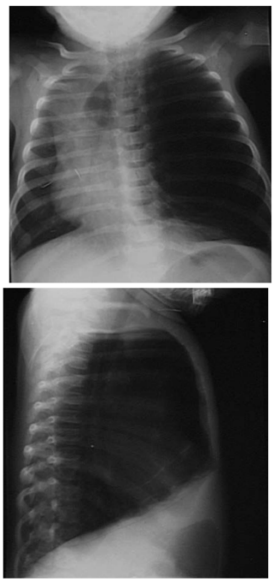
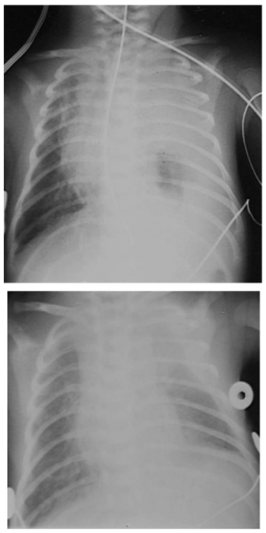
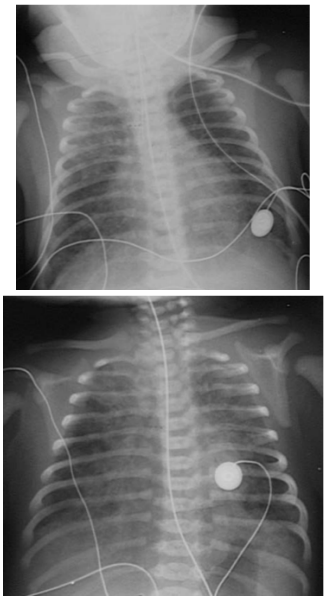
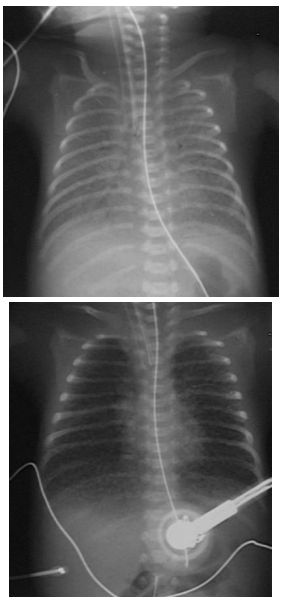
PPHTN

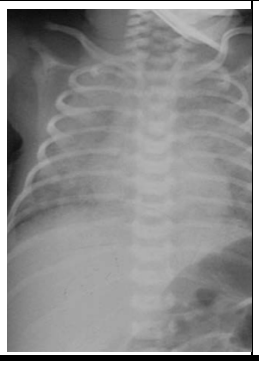
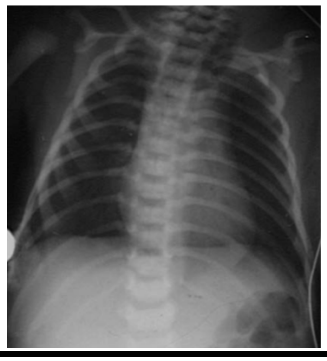
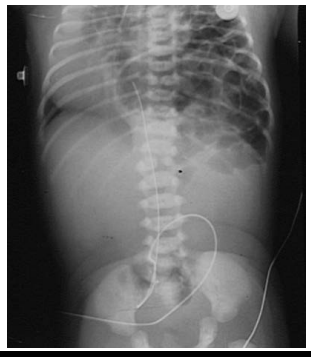
(pre vs post > 10%) or Surfactant deficiency

↓

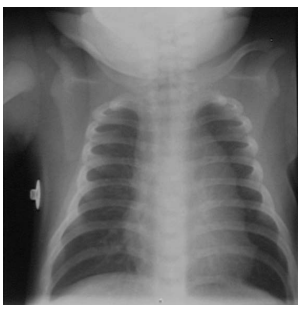
CAFFIENE + CPAP (<32GA)
Surfactant
Parenteral Feeds

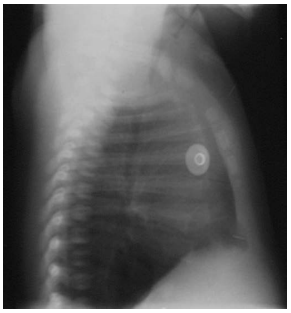
NEONATE X-RAYS – Abnormal

	Congenital lobar emphysema	Chylothorax	Meconium aspiration syndrome	HMD – resp. distress syndrome
PP	Progressive over-distention of a lobe producing atelectasis	Large pleural effusion assoc. w/ ***birth trauma*** • Lymphatic fluid (white fatty)	Fetal distress (SNS response) → meconium stained at birth (amniotic fluid + meconium swallowed)	**Premature infants – cannot produce surfactant**
X-ray	• Lucency mimic pneumothorax • Heart + trachea deviation • Hyperinflated chest	Unilateral effusion • Diffuse white-out opacification	• **Patchy aeration of both lungs** • Over-distension • May lead to pneumothorax or pulm. haemorrhage	• Ground glass appearance = dots of aeration • Air bronchogram at bases
DDx	• *Adenomatoid malformation* • *Bronchogenic cyst* • *Cystic Hygroma*	• *Erythroblastosis* • *CHF* • *Renal disease*	• *TTN* • *Aspiration pneumonia / pneumonitis* • *lymphangiectasia*	*Comp. lead to:* • *Pneumothorax* • *bronchopulm. Dysplasia* • *PDA with CHF*
Mx	**ED**	**Thoracentesis**	**Supportive therapy**	ABCD → surfactant + caffeine and ante-natal steroids for mother
		 **No meniscus sign as supine CXR**		

	Pneumonia	Oesophageal atresia with or without	Diaphragmatic hernia
PP	Intra-uterine infection after birth • GBS • TORCH • E. coli, HiB, HSV	Oesophageal separated and links with trachea → gagging + failure to use NGT	Embryonic defect in posterolateral portion of diaphragm (usu. left) • **PSEUDOglandular stage** • Scaphoid sign of abdomen (bowel in chest)
X-ray	• Patchy infiltrate in perihilar area (spiculated appearance) • Minimal aeration	• Dilated upper oesophagus on PA and lateral films (avoid contrast) • ?gasless abdomen	• Multiple lucencies unilaterally with displaced heart and mediastinum
Mx	**Abx + O2 + IV fluids**	**Surgery**	**Surgery**
Comp.	• Sepsis • Lung abscess	• **Aspiration Pneumonia** • **FTT** (bony abnormality?) • **Congenital issues** (spine, heart, renal, GI)	• Mass effect on lungs = SOB
			

Normal CXR





GDM mothers & Neonate Hypoglycaemia

RISK FACTORS OF HYPOGLYCAEMIA	Why?
• Preterm <37w – **cannot suck** • <2.5kg, IUGR /SGA [**no reserve**]	Lack of glycogen stores & substrate deficiency
• Asphyxia • Hypothermia (<36°C)	XS utilisation of glycogen stores
• Infant of diabetic mother (GDM and IDDM) • LGA infant >4.5kg	↑ insulin
• 'sick' baby: sepsis/infection [not feeding]	Hypermetabolic state
• Poor feeding (no breast milk) • Vomiting	Inadequate provision of substrate

Main Sx:

Asymptomatic +

- Irritable
- Poor feeding
- Lethargy
- Apnoea
- Hypotonia
- Convulsions

When should you test BSLs in neonates?

Any unwell baby

- **Pre-mature babies** (high met. rate, low glycogen stores, IV/NGT dependent as no sucking reflex)
- **Septic baby** (e.g. GBS mother)
- **Poor feeding** (pyloric stenosis), repeated vomiting
- **Respiratory distress**
- **Surgical babies**
- **HIE** (Asphyxia), hypothermic baby
- **GDM mother**
- **SGA/IUGR**
- **BF difficult to establish**

Main Work-Up :

- ***Screen*** = Bed-side glucometer (NOT accurate below 2mM)
- ***Confirm*** = **BSL, ketones, insulin & c-peptide**
  - Avoid lab BSL → RBC consume glucose causing **false positive** hypoglycemia + polycythemia ➔ need to use yellow top tube which kills RBC
  - **Confirm w/** ABG (best & quick)

INSULIN LEVEL CHECK

*Insulin **high >10mU/mL***

↓

Hyperinsulinemia (Resistant Hypoglycaemia)

- **Transient hyperinsulinism** → *baby's pancreas has not shut down and continues to produce more insulin in GDM mother*→ hypoglycaemia
- **Persistent hyperinsulinemic** hypoglycaemia of infancy (beta cell hyperplasia)
- **Beckwith Weideman Syndrome – assoc. w/** beta cell hyperplasia

*insulin **normal/low***

↓

Critical Bloods

- **VBG**
- **ketones**
- **FFA**
- **Insulin**
- **Lactate**
- **Endo:** *TFT, GH, Cortisol → CAH?, pit. Def.?*
- **Urine metabolic screen –** *glycogen storage disorders*

BGL ≤1.6 mmol/L or symptomatic → **RAPID RESPONSE**

BGL 1.7 – 2.5 mmol/L and asymptomatic → **CLINICAL REVIEW**

BGL ≥2.6 mmol/L and asymptomatic → **INCREASED OBSERVATIONS**

➢ *Need to feed – BM or formula*

Apnoea, seizures, cyanosis, lethargy

Transfer immediately to ICU/NICU

BGL <2.6 mMol/L

Normal BSL = **2/3rd BSL of mum ≈ ≥ 2.6mM**

Child with Insulin Dependent Diabetes Mellitus? — Yes → Diabetic patient flowchart

No →

DO NOT DELAY TREATMENT
- Collect blood for gas and diagnostic tests
- Collect Urine sample

Is the patient conscious? — No → IV ACCESS?

GIVE 10% Dextrose via UVC
➢ *since 10% dextrose damage peripheral veins*

Yes →

- <1 yr: milk feed (<48hrs at 60ml/kg/day)
- >1 yr: one dose oral glucose (15-30g) or 125-250ml soft drink / juice, followed by carbohydrate serve (1 slice bread or banana) within 15-20mins

IV ACCESS? — Yes → IV Bolus 10% Dextrose 2ml/kg ➢ *OR IV glucagon*

IV ACCESS? — No → IM Glucagon
- Neonate: glucagon 0.03-0.1 mg/kg
- <25kg: give ½ vial (0.5 Units)
- >25kg: give full vial (1.0 Units)

If not immediately able to commence feed or unwell, start IV Fluids:
- Neonate: 10% Dextrose at 60ml/kg/day (If BGL <1.5 or symptomatic, give IV bolus 10% Dextrose 2ml/kg)
- Child: 0.9% Saline + 5% Dextrose at maintenance

If BSL persistently < 2.6mm

- *0.1-0.3mg/kg IM/IV glucagon* (may not be effective in infants with inadequate glucagon stores)
- *10mg/kg/day IV hydrocortisone*
- **10-15mg/kg/day** *Diazoxide* oral = to treat hyperinsulinemia (STOP insulin release)

BGL >2.6 mMol/L in 30 mins

Yes → Neonates: continue feeds
Child: continue maintenance fluids & gradually introduce food
Check pre-feed BGL

No →

Neonates
- Increase feeds 2hourly with 90ml/kg/day
- If feeds already increased start 10% Dextrose at 60ml/kg/day

Child
- Give 2ml/kg Bolus 10% Dextrose
- Increase maintenance fluids to 10%Dextrose

Recheck BGL hourly until BGL >5mmol/l for 2 hrs - then check 2-4hrly
Seek specialist input (Endocrine/Metabolic/Neonatalogy)

Fluid requirement

- **Acute** = **25% dex gel + formula**
- **Normal** = 10-20mL (40mL/kg/day over # of hours/feed)
- **Diabetic baby** (80mL/kg/day) over # of hours/feed
- **Pre-term babies** (80mL/kg/day) due to large qty of insensitive losses

*NB: Breast milk ≈ 10% dextrose

Complications :

- **If < 2.6mM remains for > 1 hr → sig. brain damage (cerebral palsy)**
  - Ensure above 3mM to reduce risk
- Seizures, brain damage, CP → coma → death

Hypoglycaemia

Critical bloods (VBG, lactate, ketones, FFA, HCO3)

No Acidemia

Low FFA low Ketones
- Genetic hyperinsulinism
- Neonatal hypopituitarism
- Transient neonatal hypoglycaemia
- Perinatal stress hyperinsulinism

High FFA low Ketones
- Fatty acid oxidation defect

Acidemia

High Lactate
- Gluconeogenesis defect
- Glycogen storage diseases

High Ketones
- Ketotic hypoglycaemia
- Glycogenoses
- GH deficiency
- Cortisol def.

Neonate Jaundice (serum bilirubin)

Risk Factors for jaundice

- Cephalohaematoma, Bruising → XS RBC → XS haem
- Preterm
- Infant of diabetic mother (polycythaemia)
- twin twin transfusion → Polycythaemia → XS haem
- Ethnicity eg Asian
- G6PD

Complications (peaks at 4 hrs)

- Yellow discolouration of skin and sclera
- *Unconj. Bilirubin encephalopathy*: **Kernicterus** = toxic to brain
  - Seizures,
  - Sensorineural deadness,
  - Cerebral palsy,
  - intellectual disability (brain damage if SBR > 400)

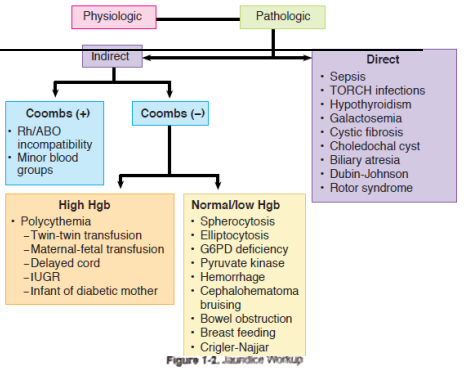
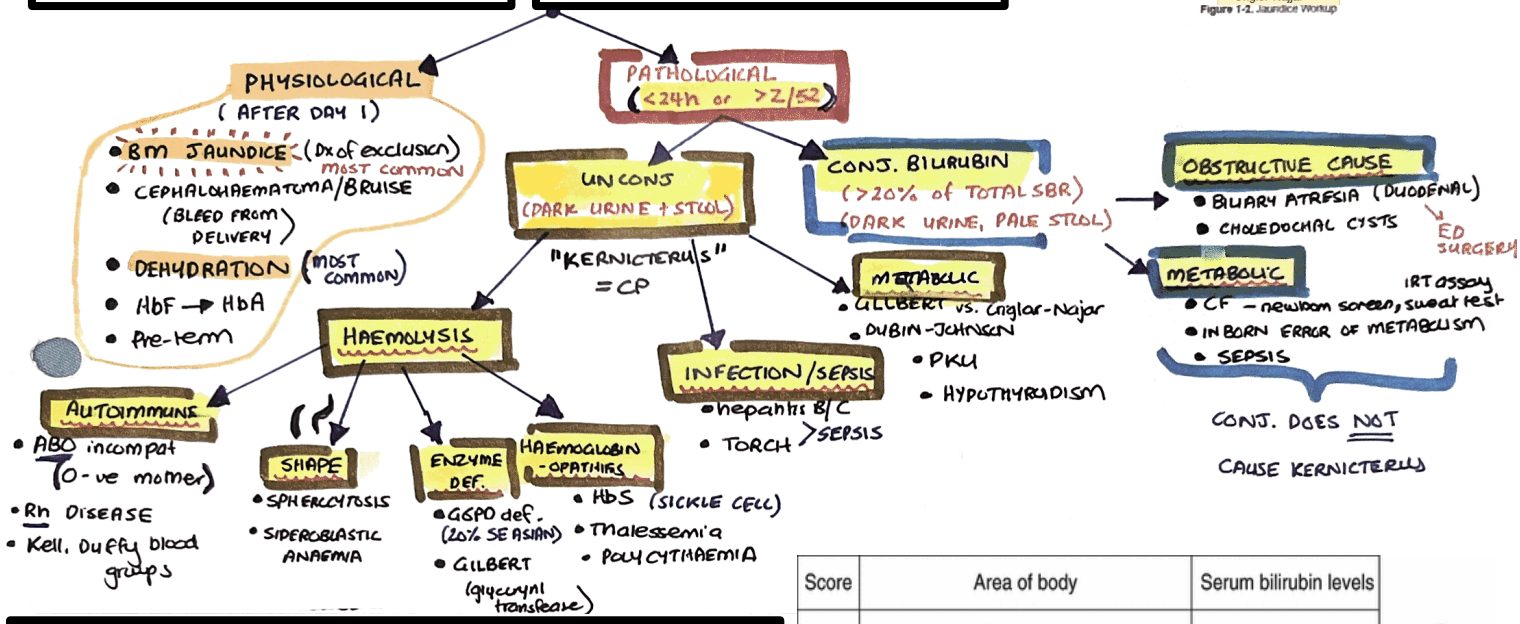


Figure 1-2. Jaundice Workup

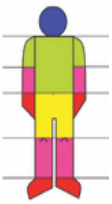


Main Investigations for jaundice

- **FBC** – haemolytic anaemia (↓Hb), polycythaemia (↑Hb)
- **EUC**
- **TFT**
- **LFT** → DIRECT + indirect bilirubin = prolonged jaundice

1) **Measure Conjugated SBR → Kramer score (jaundice level)**
2) *Transcutaneous Bilirubin (TcB)* → ONLY if > 35wks + > 24 hrs old + NOT having phototherapy
3) ***Test cord blood for baby's***
   1) ***Positive Coomb's*** [DAT – direct antiglobulin test) = ABO incompatible OR minor antigens (e.g. Kell, Duffy, C, e, E)
   2) **FBC and blood film =** haemolysis? – reticulocytes, schistocytes
   3) ***Rh isoimmunization***: All mother Rh-ve will have Rh Ab identified measure during pregnancy.
4) Urine and metabolic screen and infection screen

Score	Area of body	Serum bilirubin levels
1	Face (blue)	4–6 mg/dl
2	Chest, upper abdomen (green)	8–10 mg/dl
3	Lower abdomen, thighs (yellow)	12–14 mg/dl
4	Arms, lower legs (pink)	15–18 mg/dl
5	Palms, soles (red)	15–20 mg/dl



Jaundice onset	TcB	Action
< 24 hours	____	Perform SBR
24-48 hours	>140 µmol/L	Perform SBR
48-72 hours	>200 µmol/L	Perform SBR
> 72 hours	>260 µmol/L	Perform SBR

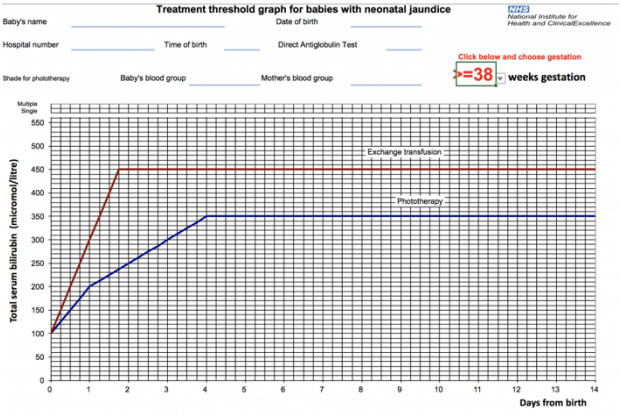
Management for jaundice:

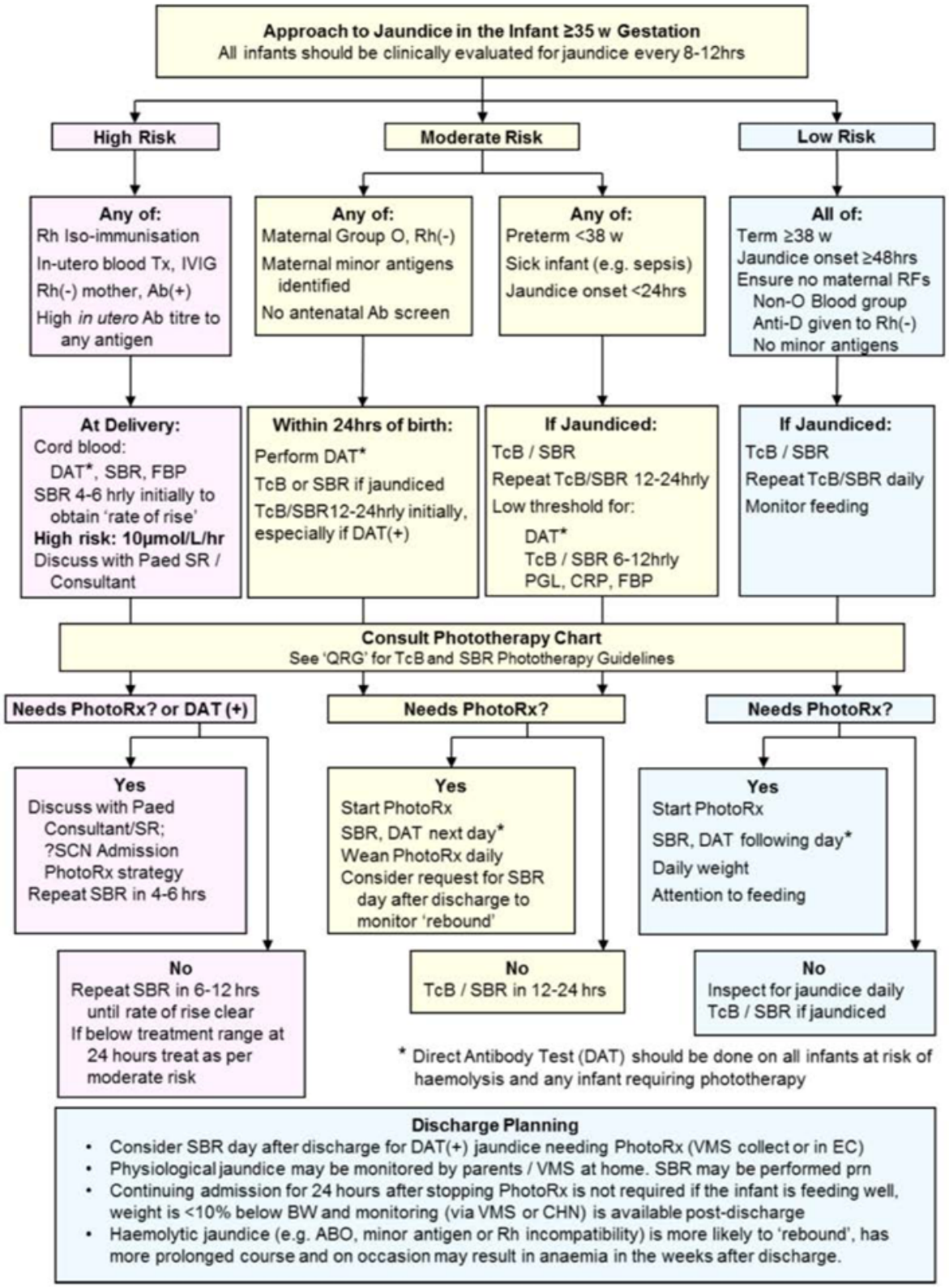
- 400nm convert unconjugated bilirubin into soluble conjugated bilirubin
- Use **specific chart based on GA at birth (i.e. 34, 35, 36 weeks** etc.)
- More immature baby = earlier phototherapy to minimise brain damage

Jaundice < 24hrs	• Measure SBR every 6 hrs until SBR stable or falling • medical ED: Phototherapy with lights (300nm) ○ *also give if they have risk factors*
Jaundice 24hr to 10 days	• Measure SBR every 6 hrs until SBR stable or falling • therapy based on charting the SBR on GA appropriate chart
Unresolved	**Exchange transfusion (last resort)** *→ via central line → many hours to work (removed damaged RBC)* • If chances of encephalopathy is high • If jaundice uncontrolled by intensive phototherapy • disturbed electrolytes > death • **Donor blood given (prevent brain damage)** • **A/E**: kidney damage, electrolyte imbalance, haemolytic reaction, febrile haemolysis, sepsis

Monitor for:

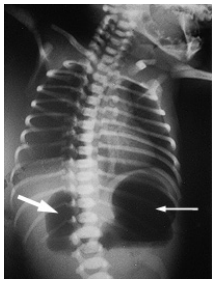
Dehydration	Avoid X-cerbation jaundice
Regular check	TcB and SBR • Greater threshold after each day as brain matures rapidly each day

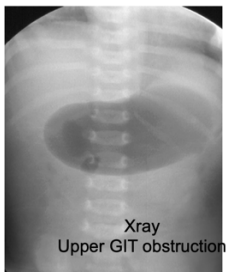


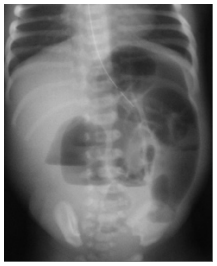

Approach to Jaundice in the Infant ≥35 w Gestation
All infants should be clinically evaluated for jaundice every 8-12hrs
High Risk
Moderate Risk
Low Risk
Any of:
Rh Iso-immunisation
In-utero blood Tx, IVIG
Rh(-) mother, Ab(+)
High in utero Ab titre to any antigen
Any of:
Maternal Group O, Rh(-)
Maternal minor antigens identified
No antenatal Ab screen
Any of:
Preterm <38 w
Sick infant (e.g. sepsis)
Jaundice onset <24hrs
All of:
Term ≥38 w
Jaundice onset ≥48hrs
Ensure no maternal RFs
Non-O Blood group
Anti-D given to Rh(-)
No minor antigens
At Delivery:
Cord blood:
DAT*, SBR, FBP
SBR 4-6 hrly initially to obtain 'rate of rise'
High risk: 10µmol/L/hr
Discuss with Paed SR / Consultant
Within 24hrs of birth:
Perform DAT*
TcB or SBR if jaundiced
TcB/SBR12-24hrly initially, especially if DAT(+)
If Jaundiced:
TcB / SBR
Repeat TcB/SBR 12-24hrly
Low threshold for:
DAT*
TcB / SBR 6-12hrly
PGL, CRP, FBP
If Jaundiced:
TcB / SBR
Repeat TcB/SBR daily
Monitor feeding
Consult Phototherapy Chart
See 'QRG' for TcB and SBR Phototherapy Guidelines
Needs PhotoRx? or DAT (+)
Needs PhotoRx?
Needs PhotoRx?
Yes
Discuss with Paed Consultant/SR;
?SCN Admission
PhotoRx strategy
Repeat SBR in 4-6 hrs
Yes
Start PhotoRx
SBR, DAT next day*
Wean PhotoRx daily
Consider request for SBR day after discharge to monitor 'rebound'
Yes
Start PhotoRx
SBR, DAT following day*
Daily weight
Attention to feeding
No
Repeat SBR in 6-12 hrs until rate of rise clear
If below treatment range at 24 hours treat as per moderate risk
No
TcB / SBR in 12-24 hrs
No
Inspect for jaundice daily
TcB / SBR if jaundiced
* Direct Antibody Test (DAT) should be done on all infants at risk of haemolysis and any infant requiring phototherapy
Discharge Planning
• Consider SBR day after discharge for DAT(+) jaundice needing PhotoRx (VMS collect or in EC)
• Physiological jaundice may be monitored by parents / VMS at home. SBR may be performed prn
• Continuing admission for 24 hours after stopping PhotoRx is not required if the infant is feeding well, weight is <10% below BW and monitoring (via VMS or CHN) is available post-discharge
• Haemolytic jaundice (e.g. ABO, minor antigen or Rh incompatibility) is more likely to 'rebound', has more prolonged course and on occasion may result in anaemia in the weeks after discharge.

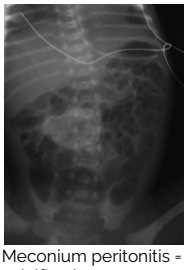
NEONATAL VOMITING

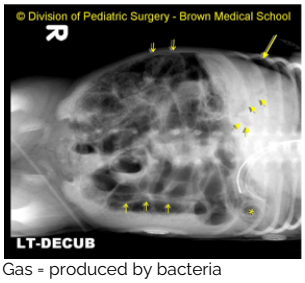
Pathological Vomit		Non-pathological vomit	
Blood stained (red or black)	• **Swallowed blood**: birth (eg APH), breast feeding (cracked nipples) • **Baby bleeding**: upper airway/oral trauma, stress ulceration, haemorrhagic disease	**Small volume "possets**	After feeds (normal) ➢ Weak LES ➢ Mostly liquids ➢ Mostly supine
Bile Stained (green) *= urgent surgical ED*	• **Bowel obstruction**: ● **atresia** (duodenal, small bowel), ● **malrotation / volvulus ➔ ischaemia/ necrosis within hrs** ● anal atresia • **Meconium ileus** • **NEC -**	**Normal vomit**	○ Milky/mucous (no blood ,bile or projectile) ○ Well baby
Projectile Vomiting	• **Duodenal obstruction (double bubble)**, (2-3 weeks: *pyloric stenosis*)		
Unwell	• Sepsis, inborn error of metabolism, CAH		
FTT	• GORD, sepsis, UTI, inborn error of metabolism		
Gastroenteritis	• Vomiting and diarrhoea		








Meconium peritonitis = calcification



Gas = produced by bacteria

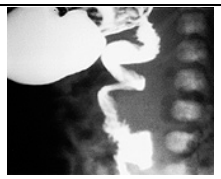
Duodenal atresia

Assoc. w/
- Polyhydramnios (50%) &
- Down Syndrome (30%)

Presents w/:
- bilious or non-bilious vomiting
- Double Bubble - dilated stomach and proximal duodenum

Volvulus

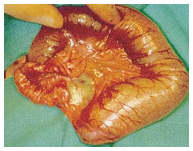
- malrotation of mid-gut
- @ DJ flexure to left of midline
- Narrow mesentery prone to volvulus


Contrast used

Small Bowel Atresia

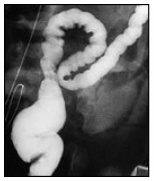
enlarged proximal bowel / atrophic distal bowel

Bowel distension w/ multiple air-fluid levels



Meconium Ileus

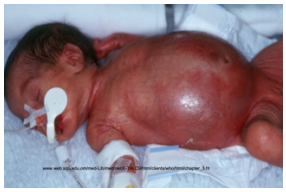
- Assoc. w/ CF (80%)
- Delayed passage of meconium
- Vomiting from Day 1


Microcolon

Necrotising Enterocolitis

Ischaemic gut causing
- Dilated abdomen → absent BS
- Projectile Bilous vomiting (poor feed)
- Blood in stools

Invasion of bacteria into bowel wall → produce gases
- Pneumatosis intestinalis (gas in bowel wall and sign of NEC)
- Dilated fixed bowel loops w/ oedema
- Pneumoperitoneum (free gas in peritoneal cavity – perforation)
- Perforation signs (shock, DIC, sepsis, peritonitis)



Case study for NEC

- 2 y.o. baby
- Yellow green vomitus (every feed)
- NO down's (trisomy 21)

RISK FACTORS FOR NEC:
- Very LBW
- Pre-term
- Resp. distress
- Sepsis
- PDA or other CHD

➔

Exam
- Dehydrated
- Bile stained vomit
- Distended abdomen
- No dysmorphia
- NO **VACTERYL** syndrome (*vertebral, anal, cardiac, trache-oesophageal, , renal, radial limb*)
- Patent Anus

➔

DDx:
- GI – duodenal atresia, malrotation, meconium ileus
- Other – sepsis, metabolic

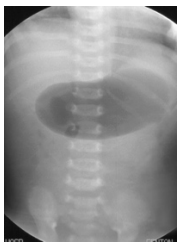
➔

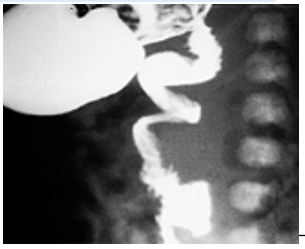
Ix:
- FBC
- EUC
- CRP
- ABG (lactate)
- Blood culture (sepsis)
- AXR

➔

Initial Mx:
- NICU Ax
- Cardio-resp monitor
- NBM
- NGT
- IV Fluids
- Abx – ampicillin + gentamicin (for listerosis + gram-ve cover) → transition to cefotaxime to reduce nephrotoxicity

Further Mx:
- Surgical review – resect necrotic bowel
- Repeat Small bowel contrast study





→ confirms malrotation/volvulus → transfer to surgical unit for Mx

Neonate Abstinence Syndrome (NAS)

55% of Substance use pregnant women did **NOT** regular antenatal care possibly due to:
1. **Stigma & Discrimination** against drugs
2. **Disclosure fear** of DOCS, FACS removal of baby

Table 1 Neonatal withdrawal scoring chart for term infants used at Royal Prince Alfred Hospital (modification of neonatal abstinence scoring system[6,7])

System	Signs	Score	Date and Time in hours
Central nervous system disturbances	High pitched cry	2	
	Continuous high pitched cry	3	
	Sleeps<1 hour after feeding	3	
	Sleeps<2 hours after feeding	2	
	Sleeps<3 hours after feeding	1	
	Mild tremors, disturbed	1	
	Mod-severe tremors, disturbed	2	
	Mild tremors, undisturbed	3	
	Mod-severe tremors, undisturbed	4	
	Increased muscle tone	2	
	Excoriation (specify area)	1	
	Myoclonic jerks	3	
	Generalised convulsions	5	
Metabolic/ vasomotor/ respiratory disturbances	Fever (37.3–38.3°C)	1	
	Fever (38.4°C and higher)	2	
	Frequent yawning (3–4 times)	1	
	Nasal stuffiness	1	
	Sneezing (>3–4 times)	1	
	Nasal flaring	2	
	Respiratory rate>60/min	1	
	Respiratory rate>60/min with retractions	2	
Gastrointestinal disturbances	Excessive sucking	1	
	Poor feeding	2	
	Regurgitation	2	
	Projectile vomiting	3	
	Loose stools	23	
	Watery stools	3	
	TOTAL SCORE		
	SCORER'S INITIALS		

Finnegan score → quantify and diagnose neonatal withdrawal or abstinence (NAS) syndrome after cessation of drugs
*Manage potential domestic violence, social justice, child risk and ensuring we prioritize care for baby

> 8 = sig. withdrawal & high seizure risk
E.g. increase morphine dosage until persistently < 8

	Onset	Duration
Methadone	2-3d	Up to 6 months
Heroin	1-2 days	2-3 weeks
Cocaine	2-3d	Up to 6 months
Benzodiazepines	Up to 6 weeks	Up to 6 months
Alcohol	Immediately	Months
Stimulants	Immediate after birth	2-3 weeks

Drugs causing NAS	MoA	
Opiates/ narcotics /	***Depressant***	• Give neonate morphine if mother on methadone
Hypnotics (benzos, barbits)	***Depressant***	• Beware of benzodiazepine **slow elimination**
Alcohol	***Depressant***	• **Fetal alcohol syndrome – permanent disability = brain damage = CP, seizures** • **Signs** = thin lips, microencephaly, SGA, flat nasal bridge • Undefined toxic level (even 1 or 2 glasses can cause developmental issues)
Cocaine / Amphetamines	***Stimulant***	• **Vasoconstriction → age restriction** → impaired organogenesis → **absent/smaller kidney, holes in brain** ○ Check with Head and KUB USS • **Chronic usage → IUGR, SGA**
Cigarettes: / tobacco	***Stimulant***	• **During pregnancy** = IUGR, LBW, pre-term, cleft lip • **After pregnancy** = addictive smoking → +++ risk of patient harm as she is **neglecting** (care compromise) ○ **Also risk of SIDS** ○ **Paternal smoker = sperm damage + malignancy risk** Can continue breastfeeding while smoking BUT issue of who is looking after child while smoking?
Caffeine	***Stimulant – adenosine blocker***	• Used to prevent apnoea due to respiratory distress
Cannabis	***Hallucinogens***	• *THC fat soluble* → smoking during pregnancy→ goes into bloodstream into breastmilk ○ If breastfeeding → 8x higher concentration since breasts made of lipids ○ Signs = **tremor, altered sleep and increased hand in mouth**
LSD, PCP	***Hallucinogens***	Smiling /talkative + disinhibited thoughts → less withdrawal reflexes
Inhalants		
Psych Agents	***SSRIs***	• Can be continued to manage psychiatric conditions

Managing Neonatal Opioid Withdrawal Syndrome

Withdrawal program: AIM – maintain pregnancy and reduce pre-term labour risk
1. **Free program** – reduces cost for purchasing heroin ➔ address drug-seeking behaviour
2. **Minimise infection risk of** BBV (HIV, Hep B/C)
3. **Need clean urine samples** – if contaminated ➔ child protection services (to minimise future neglect) ➔ contact DCJ (maintain compliance)

Mx of NAS – opiates (avoid "cold-turkey")
1. **Phenobarbitone** - 1st line for sedative withdrawal
2. **Methadone or buprenorphine** - 1st line for NAS due to opiate
   a. *Can discharge infant home w/ morphine [shorter half life - minimise overdose]
   b. If given by drug addict mother → risk of OD and SIDS → ?foster carer
3. ***Methadone*** = ***Full opioid agonist – LONG ACTING 24 hrs***
   a. ↓ drug craving and obstetric complications + ↑ nutrition
   b. During pregnancy → +++ metabolism → ↑ dosage (may increase withdrawal but minimises pre-term baby) ➔ NAS, ADHD, SGA
4. ***Buprenorphine (Temgesic) ➔ Partial opioid agonist ➔*** sublingual to alleviate withdrawal + less sedation/drowsy or OD compared to methadone

Long-term Mx:
1. MDT – social worker, PAEDIATRICS, GP and others
2. Week ONLY Morphine Prescription (minimise abuse + titrate down)
   a. **Weaning: drop by 0.1mL instead of 0.1mg (easier to work out)**
   b. **If unresponsive → increase dosage or hospital Ax**
3. **+++ breastfeed** to reduce severity of withdrawal unless:
   a. HIV +ve, Unknown drug use in last 24 hrs or drug affected
4. **Monitor for:**
   a. **Sleeping, Feeding and weight gain** (hyperphagia)
   b. **Tone** (increased for mths?)
   c. **Irritable , Jittery**
5. *Hep B/C test (after 6 wks)*
   a. If infant continues to maternal hep C Abs by 18/12 → **has hep C**
6. Educate on safe sleep (reduce SIDs and doping)

O/E: - finnegan score (see above)
- **XS yawning and sneezing**
- **Sweating – forehead, upper limb & back of head**
- **Mottled marbled discolouration**
- **Nasal flaring** → RR (30-60)
- **Nasal stuffiness** = noisy respirations to mucous
- **Abnormal tone** (esp. limb and neck) = Intermittent Stiffness (Unusually limp or unusually stiff)
- **Tremors, jerking, other signs of distress** (high-pitched cry)– sign of baby trying to control uncomfortable sensations.

NEONATAL ETHICS:

What if baby is born prematurely (i.e. < 23 wks) with < 50% survival chance?

- NO right or wrong answers but parents should feel well supported throughout experience
- convey hope in communication e.g. 2/3rd of babies make it through (NOT 1/3rd die)

Main issue	***Considerations***	***Ethic considerations***

• **How much cost ($4000)** – who pays for it
• **How burdensome?** – who deserves extra care?
• **Long-term developmental issues**:
  ○ language & cognitive delay
  ○ growth issues
  ○ cerebral palsy
• **Antenatal discussions** e.g. "everything needs to be done" OR "NO resus if born < 26 weeks"
• **MORAL UNCERTAINTY due to**:
  ○ Actions against own judgement
  ○ Disagree with value
  ○ Disagree with choices of parents/colleagues/staff
	• ***"Best interest of baby" = Primary*** *moral consideration*
	  ○ *QoL*
	  ○ *Optimal care*
	  ○ ***Love, protect, family***
	• *Parental wishes? = secondary concern*
	• *Gestational age (fetal wt/birth wt)*
	• *Risk & protective factors*
	• ***Antenatal maternal health*** *= alcohol, drug usage?*
	• ***SES***
		Justice *= fair and equal*
		Autonomy *= respect decision and value their autonomy*
		In NSW:
		• *Abortion (at any GA) is lawful if performed to prevent* ***serious danger*** *to the woman's physical or mental health (including SES pressures)*
		• NB: ACT women can request abortion **without** legal examination by doctor
		
		When to end life? – decision to allow death of baby MUST be ethical and justified → fluids, nutrition, analgesia, cleaned
		• ***Physiological futility*** = will die even w/ continued invasive medical technology (e.g. extreme prem, severe lung or heart hypoplasia)
		• ***ICU Rx has poor prognosis*** = baby will survive w/ very poor QoL e.g. IVH gr4
		•
		• ***Stable baby w/ poor prognosis*** (e.g. trisomy 18, congenital malformations or those that unexpectedly survive after ICU Rx)

Case examples:

Baby 1

- 44 year old primip
- Stable marriage
- Primary infertility
- IVF 8 years before successful
- Twin pregnancy (dichorionic, diamniotic)
- Twin 1 died at 20 weeks, twin 2 (female) with mild IUGR
- Preterm labour at 23 +4 wks
- Outcome: Steroid cover from 23+4, C/S for clinical chorioamnionitis at 23+6, baby had severe respiratory issues, D/C on home oxygen, currently 6 months old, no obvious problems.

Baby 2

- 18 year old primip
- Steady boyfriend, about to start uni
- Initially wanted TOP, but couldn't go through with it
- Uncomplicated pregnancy, well grown baby boy
- Now in preterm labour at 23 +4 weeks
- Outcome: decision for palliative care if baby born before 24 weeks. Baby born on the same day, lived for 20 min.

Baby 3

- 32 year old mother of 3
- Sole parent
- Heavy alcohol intake, no longer doing drugs
- Limited antenatal care, ultrasound at 20 weeks NAD, normal fetal growth
- 1 previous child had NAS, assumption of care after failure to thrive at 8 months of age (2 years ago)
- Remaining 2 children live with mother, aged 12 and 8
- Preterm labour at 23 +4 weeks
- Outcome: decision for initiating intensive care, steroid cover. Labour settled. Baby delivered at 28 weeks, favourable course in NICU. Care assumption by FACS.

Baby 4

- 30 year old mother of 2 healthy children
- Stable relationship
- 3rd pregnancy uncomplicated until some bleeding at 22 weeks.
- Ultrasound demonstrated short limbs with suspicion of a bone fracture, not previously suspected
- Large antepartum haemorrhage at 23 +4 weeks
- Outcome: parental decision for intensive care treatment. C/S after partial steroid cover, unable to resuscitate baby in delivery room. Clinical suspicion of Osteogenesis imperfecta type III.

Babies A, B, C

- Mother: 31, P0102 (twins at 30w)
- Doctor (GP), married
- This pregnancy: triplets (spontaneous!), 2 girls, 1 boy (fetal growth restriction)
- Antenatal discussions:
  - 'Not to resuscitate if born <26 weeks'
- PTL at 23 + 4 weeks
- Outcome: Parental decision for resuscitation and steroid cover from 24+0 weeks, C/S for ongoing contractions 24+5, all three babies survived, boy D/C on home oxygen, mild CP at 2 years of age, all three with normal cognition.

WHEN IS BABY REMOVED?

Assessment made by DCJ

- Home environment
- Compliance to program to prevent NAS
- domestic violence
- financial assessment
- social support
- incarcerated carers

Aim to prevent

- SIDS, NAI, child abuse

Best scenario

- child looked after by grandma as carer or another family member