CASE ONE

It is 4am and a 28 yo woman G3P2 arrives at the triage with abdominal pain who is 39 +3/40 pregnant. It is evident that she is in advanced labour. She is placed in the Resus room.

- **Discuss how you would manage this situation ?**

- Two teams (maternal/neonate) : equipment (Giraffe, delivery kit , towels, drugs/print ?)
- Obstetric emergency call / neonatal if appropriate
- Antenatal hx : gestation, medical hx, complications, prior deliveries, antenatal care, ROM

- **The baby rapidly delivers without any issues. Discuss approach to cord clamping and cutting and initial cares of the breathing term neonate.**

- Delayed clamping 1min in the non compromised neonate
- Peripheral cyanosis is common in first few minutes, central cyanosis is usually rapidly absent if there is adequate ventilation
- Double clamp and cut between (10 -15 cm from neonates umbilicus, can be cut closer later)
- Keep warm wrap in towel gentle stimulation
- In non distressed, breathing, perfused neonate place skin to skin with mother (this can be done prior to cord clamping and cutting)

- **Describe normal transitional physiology and newborn saturations**

- Clearance or alveolar fluid with spontaneous respiration and established FRC
- Rapidly falling pulmonary vascular resistance with rise in systemic resistance
- Reversal of flow to become left to right (change to left dominate system)
- With eventual closure of foramen ovale and ductus arteriorsus

- Neonatal saturations: Remember normal SpO2 in utero sits at around 60% and usually increases to 90% within 10mins of birth. The 25th percentile corresponds to SpO2 40% at birth and 80% at 10min.

- Use right arm to measure pre ductal saturations !

- **Discuss risk factors for need for newborn resuscitation**

MATERNAL	FOETAL	INTRAPARTUM
Premature or prolonged ROM	Multiple gestation	Foetal distress
Antepartum haemorrhage	Preterm (<35) post term (>42)	Abnormal presentation
Diabetes mellitus	IUGR	Prolonged or precipitous labour
Substance use	Polyhydramnios	Thick staining of amniotic fluid
Maternal infection or illness	Congenital anomalies	Instrumental delivery or emergency C section

Absence of antenatal care		
Hypertension		

- **Describe your management if this term newborn was not making adequate respirations and was centrally cyanosed**

- Neonatal emergency call, **follow newborn algorithm** (on the wall), start timer
- Print drugs chart
- Place on pre warmed neonatal resusciteer (Giraffe) gently warm and stimulate, open airway ensure patent +/- neopuff with PEEP (5-10 cmH20) Fi02 21-30 % initially
- Place monitoring (pre ductal SpaO2, ECG, temp) and palpate umbilical pulse/and listen
- Normal FHR 120 - 150bpm
- If HR < 100 despite 30s of warming stimulation start assisted ventilation (term 30-35cmH2O IPAP) inspiratory time 1 to 1.5s at rate of 40-60 breaths per min. If HR rising continue ventilation until > 120 then continue PEEP
- If HR still < 100 after 30s re-position , increase FiO2, continue positive pressure (increase pressure if required) ventilations and ensure chest rise, consider intubation at 2minutes if adequate ventilation and HR > 100 not established

- If HR < 60 despite adequate positive pressure ventilation start compression 3:1, FiO2 100%, prepare for intubation, establish venous access (emergency UV, IO, IV)

- If HR still < 60 after 30s of above intubate continue CPR, adrenaline 3- 5min, fluid bolus, glucose, normothermia

- HR > 60 - 100 continue ventilations, compressions discontinued if HR improving

- Adrenaline 10-30mcg/kg 1:10000 IV, (100mcg/kg via ETT alternative)

- Umbilical vein (single thin walled, two arteries), cord tie at base umbilicus, cut cleanly 2-5cm above base, pre flushed 3.5-5 Fr catheter 1-4cm below skin (should aspirate blood), secure

CASE TWO

A 20 yo female is triaged to ED Assessment room 15 with non-specific abdominal pain. She has severe pain and PV bleeding and is given morphine. She is unsure if she is pregnant, but she has not had a period for potentially 5-6months. She precipitously delivers an obviously pre term neonate.

- C**an you emergently establish gestation and determine viability in the ED ?**

- This is difficult and is not our immediate priority and should be done by experts

- If the neonate is potentially viable then resuscitation should be attempted until the neonatal team deems otherwise

- If possible always gain prenatal history and investigations, this will help guide determining gestation and potential for viability

- If feasible doing a bedside prenatal USS will help determine gestation

- Anatomical appearance is not always accurate means of gestational assessment
- Fused eyelids can be up to 28 weeks
- None or abundant lunugo (fine hairs) < 28 weeks
- Poorly developed ear cartilage < 28 weeks
- Absence of obvious nipples
- Smooth or minimal plantar creases
- Skin thin, red, wrinkled and translucent with easily visible veins, little subset fat

- **What are the limits of gestational viability ?**

- These vary at each institution read your local guidelines

- At MMH **potential viability is at 24 weeks + 0 days to 24weeks + 6 days and > 500g weight**

- Any decision not to resuscitate a borderline preterm neonate should only be made by the neonatal team

- A gestation of 25 weeks or older are all considered potentially viable

- **A fully formed newborn is delivered of unknown gestation. There are agonal gasps by the baby, and displays central cyanosis. How would you manage this situation ?**

- Potentially viable neonate and therefore early resuscitation may improve outcome
- Do not delay cord clamping and cutting
- Transfer Mum and baby to rests room with resusciteer.
- Team for mum and neonate (communication and support), family support person

- Start resuscitation on Giraffe, warm, position airway, monitoring

- Immediate supported positive pressure ventilation with neopuff (PEEP 5cmH2O, IPAP 20-25cmH20)
- Palpate umbilical pulse HR < 60 start compressions 3:1
- Ensure adequate chest rise
- Failure to improve (HR rising above 60) quickly should proceed to intubation within 1min
- Access , adrenaline, Glucose check, ? Naloxone
- Ensure normothermia (heat lamp, wrap, plastic wrap)

- Determine weight using scales on Giraffe ? > 500g

- Consider reversible causes : Hypoglycaemia, prenatal opiates, pneumothorax
- New born BGL < 2.6 mmol/L Glucagon 100-300mcg/kg IM (last 1-2hrs) or if IV access 2ml/kg 10% dextrose

CASE THREE

2wk old term neonate brought into the ED with a ‘breathing difficulties’ and turning blue. He is not feeding well, and seems less responsive. His observations are:

HR 190, RR 70, Temp 35.5 rectal, Central CRT 4s, BP 58/30 (MAP 38)

- **What important history should be obtained ?**

- antenatal/perinatal/postnatal details
- Gestation at birth, birth weight
- Mode of delivery and any complications (meconium, Resp distress)
- Any postnatal support required by neonate
- Peri-partum illness and fevers, Maternal Grp B strep status
- Maternal peri-partum antibiotics
- Any prolonged rupture of membranes

- Feeding hx
- Fhx (familial diseases) and social

- Hx of illness : feeding (tachypnea, cyanosis, poor), fevers, breathing/apnea/colour change, trauma, infectious contacts, rashes, jaundice

- Passing of stools/meconium, wet nappies?

- **What do you look for on exam ?**

- Vitals including BP, SpO2 pre and post ductal
- Head to toe inspection - general appearance, hydration, perfusion
- 4 limb pulses, auscultation HS and chest
- Fontanelles
- CAH (hyper pigmented males, ambiguous genitalia females)
- Weight

- Hypotension

TERM neonate < 50 systolic
5days neonate < 60 systolic
1-12months < 70 systolic

- **The neonate is placed in the Giraffe. He looks poorly perfused and develops brief apneas lasting 5s with desaturation initially responding to stimulation. How would you support and manage this neonate ?**

- Ensure normothermia (Giraffe)
- **Get help**

- Neo puff support with PEEP 5-10cmH2O. Assisted ventilation for apnea using neopuff if required.
- Establish access : IVL, IO
- Check Glucose < 3.8 mmol/L give 2.5ml/kg bolus 10% dextrose and monitor
- IV fluid bolus 10-20ml/kg 0.9 % saline
- IV abs Amoxicillin 50mg/kg and cefotaxime 100mg/kg
- Consider gentamicin/acyclovir (d/w paeds/neonates)
- Bloods - check electrolytes
- CSU
- CXR
- Consider LP if appropriate (do not delay Abs)

- **What are the potential differential diagnoses ?**

- Sepsis and respiratory illness (RSV/LRTI) are the most common
- Always check glucose and electrolytes
- Be aware of NAI

THE MISFITS

T: Trauma, tumor, thermal
H: Heart disease, hypovolemia, hypoxia
E: Endocrine (CAH, DM, thyroid)
M: Metabolic disturbances (electrolyte imbalance)
I: Inborn errors of metabolism
S: Seizures or CNS abnormalities
F: Formula dilution or over-concentration leading to hypo/hypernatremia
I: Intestinal catastrophe (intussusception, volvulus, NEC)
T: Toxins (including home remedies such as baking soda for burping)
S: Sepsis

NEO SECRETS

N: iNborn errors of metabolism
E: Electrolyte abnormalities
O: Overdose
S: Seizures
E: Enteric emergencies
C: Cardiac abnormalities
R: Recipe (formula, additives)
E: Endocrine crisis
T: Trauma
S: Sepsis

SHITS

S: sepsis **H:** heart **I:** in-born errors metabolism **T:** trauma and Toxins **S:** seizures

- **Despite initial resuscitation with IVF 40ml/kg total/IV Abs/neopuff positive pressure ventilation support, the neonate continues to have more prolonged apnea and desaturations with recurrent brief bradycardia to 90bpm lasting 5s. How would you approach this ?**

- GET HELP (ICU, ED SMO, PAEDS SMO)

- **NEONATAL EMERGENCY - call neonatal team for help**

- Prepare for likely RSI with most experienced team available

- Monitoring (HR/RR/Sats/Temp/ETCO2/BP)

- RSI equipment (ETT size 3-3.5 term neonate and calculations)

- BP Systolic should be 60ish mmHg

- Drugs :

Induction (fentanyl 5mcg/kg and rocuronium 1.2mg/kg),

Consider: Atropine pre induction (20mcg/kg)

Pressors :

Dilute bolus adrenaline 1-2mcg/kg for hypoperfusion/bradycardia

Ongoing if required Adrenaline infusion 0.01 - 0.1mcg/kg/min

CASE FOUR

A 5 day old neonate is brought into the ED with poor feeding, rapid and abnormal breathing and pallor. She is a term neonate with no immediate perinatal complications and underwent standard antenatal care.

HR 200 SpaO2 75% (L arm) RR 60 BP 80/50 (R arm) 36.3 (rectal) central CRT 4s

- **What are your potential differential diagnoses?**

- Sepsis, cardiac, metabolic and electrolytes, trauma(NAI), other

- **How would you examine/investigate and manage this neonate?**

  - Get help (paeds, ED, ICU, Neonatal)

  - Initial supplement O2 accept sats 90% initially

  - IV access bloods and cultures, **Glucose**

  - Pre and post ductal saturations and 4 limb BP

  - Feel 4 limb pulses and auscultate HS ? murmurs and chest ? failure

  - ECG for treatable causes

    1. HR >200 and/or inverted p waves in I and aVF: susp SVT -> ? adenosine or cardioversion
    2. Big Q waves in lateral leads = ALCAPA: immediate surgery consult, ***very*** careful diuretics/inotropes
    3. LVH suggests tricuspid atresia ?

  - Treat for sepsis Abs and IVF if appropriate

- **You note a holosystolic murmur and poor pulses in left arm and lower limbs and cyanosis in the lower body. Observations and VBG:**

  BP R arm 82/50 L 45/30 VBG pH 7.05, Lactate 10, Gluc 4
  SpaO2 R arm 80% oa L 68%

  Discuss potential congenital cardiac causes for this presentation?

- Likely duct dependent obstructive systemic lesions : Coarctation, Ao interruption, AS

Three main ways they present with cardiac lesions:

- Shock: obstructed flow to body (e.g. coarct, AS)
- Blue: obstructed flow to lungs (e.g. tricuspid atresia)
- Heart failure (e.g. AV canal defect)

Duct dependent lesions:

- Ductal dependent *pulmonary lesion*: cyanosis/hypoxia with normal (or under-perfused) CXR
- Ductal dependent *systemic lesion*: shock, pre/post-ductal BP/Spo2 differential, congestion on CXR

- **How would you manage this neonate with likely duct dependent lesion?**
- Get help !
- Keep warm, tx for sepsis
- Keep isovolaemic, only small titrated IVF for shock
- Controlled O2 aim pre ductal sats 85 % is okay
- Prepare for the need to intubate with senior support
- Prepare for PGE infusion under Neonatal/PICU advice (apnea and hypotension common)
- Inotropes may be required choice dictated by likely lesion and degree of shock, avoid increasing afterload in systemic obstructive lesions
- Avoid hyperoxia as this will increase pulmonary blood flow and reduce systemic

Duct-dependent for Systemic Blood Flow

With severe left-sided obstructive lesions systemic blood flow is dependent on right-to-left flow through a patent ductus arteriosus, so these babies are duct-dependent. Examples: Hypoplastic Left Heart Syndrome, critical aortic stenosis, coarctation of aorta, interrupted aortic arch.

- **Insert a double lumen umbilical venous catheter**
- Commence a prostaglandin infusion at an initial dose of 10 nanograms/kg/min.
- Do not over-oxygenate the infant (over-oxygenation will result in increased pulmonary blood flow and reduced systemic blood flow).
- Accept oxygen saturations of 75% or above. Reduce inspired oxygen if saturations >85%.
- Contact the paediatric cardiologist on call between 12 midnight and 6.30 a.m.if saturations < 75%, otherwise inform on call paediatric cardiologist at 06.30 a.m.
- The baby is to remain nil by mouth.
- If the infant requires assisted ventilation, ensure that the baby is not over-ventilated. The aim should be to initially ventilate to keep a low-normal arterial pH. Sedation, muscle relaxation, and controlled hypoventilation to further reduce arterial pH may be necessary if there is excessive pulmonary blood flow and reduced systemic blood flow (oxygen saturations >85%, low MAP, tachycardia, cool peripheries).

Duct-dependent Cyanotic Lesions

These lesions are duct-dependent either to ensure adequate pulmonary blood flow (e.g. pulmonary atresia, critical pulmonary stenosis) or to ensure adequate mixing between the systemic and pulmonary circulations (transposition of the great arteries).

- Commence a prostaglandin infusion at an initial dose of 10 nanograms/kg/min.
- Babies with TGA should be nil by mouth until atrial septostomy has been performed. Babies who are duct dependent for pulmonary but not systemic blood flow (Pulmonary Atresia and Tricuspid Atresia) may receive EBM feeds if stable.
- Ensure that at least one extra IV leur is available in the event that the PGE1 infusion tissues.
- If the systemic oxygen saturation is below 75%, call the paediatric cardiologist on call.
- If the infant develops apnoea or the systemic oxygen saturation is below 75% despite prostaglandin, they should be ventilated.
- If the infant develops apnoea but has a systemic oxygen saturation of 75% or above, the dose of prostaglandin can be reduced (but not below 5 nanograms/kg/min). If apnoea continues, the infant should be ventilated.

- If the infant is delivered after midnight but is stable, the paediatric cardiologist should be contacted in the morning by 0700 hours. If unstable, contact the paediatric cardiologist on call.
- OBSTRUCTIVE LEFT HEART LESIONS: ie HLHS, Interrupted aortic arch, Co-arctation, Aortic or Mitral atresia - PICU within 24 hours after discussion with NICU/PICU/Cardiology consultants.