Definition:

- Neonate: birth to 1 month
- Premature: before 37w completed gest (mortality over 32w = term infant)

Classification according to birth weight **Level of Prem**

- Small for gestational age: term, <2.5kg or 10th percentile
  - Aet: intraut stress or placental insufficiency
  - Imp: inadequate glycogen, fat and nutrient stores
- Limits of viability
  - Above 26w viable
  - Less tha 23w not
  - 23-26w grey area
- Positive predictors of survival
  - Female
  - Birth weight
  - Antenatal steroids
  - Singleton

CardioVaS:

- CO: 300-400ml/kg/min
- Myocard decr compliance -> unable to incr SV
- HR dependent
- vagolytics incr o2 demand
- PDA closes in 24 hours, anatomical closure 2-3 w
- May revert to foetal circulation in resp to:

Oxygen consumption at rest

CCF

Persistent Pulmonary Hypertension of the newborn

- Aet: as above, Prem closure: asphyxia, meconium aspiration, pneumonia, lung hypoplasia
- Deteriorate with incr PVR to RV failiure and arrest
- Mx:
  - Xclude structural cyan heart lesion
  - Haemodynamic support & Reverse triggers
  - Attempt IV vasodilator (systemic hypotension)
  - Inducing alkalosis (HCO3)
  - Nitric oxide or HFOV
- Anaeth if crisis:
  - Reverse trigger
  - 100% o2, IPPV, deepen
  - HCO^3, $MgSO^4$, SNP, Nitric oxide
  - IF RVF: adrenalin

Respiratory system:

- Chest wall compliant
- Transpulm P 0= atelectasis
- Diphragm is weak with min fatigue resist mm
- Increase WOB is poorly tolerated
- Methylxanthine / caffeine improve diaphragm fxn

Respiratory distress syndrome:

- Deficiency of surfactant (shunt via PDA)
- Present: (within 4h)
  - Tachypnoea
  - Recession
  - Grunting
  - Cyanosis
  - Decr breath sounds
- Characterised by:
  - Decr lung vol
  - Decr compliance
  - V/Q mismatch
  - Resp acidosis
- Risk fx:
  - Prem (90% <26w, <34w)
  - Male
  - Caucasian
  - Maternal diabetes
  - Hypothermia

Birth weight (g)	Insens loss (ml/kg/d)	Water requirements (ml/kg/day)		
		Day 1-2	Day 3-7	Day 8-30
<750	100-200	100-200	150-200	120-180
750-1000	60-70	80-150	100-150	120-180
1001-1500	30-65	60-100	80-150	120-180
>1500	15-30	60-80	100-150	120-180

  - Multiple preg
- Management
  - NPO2, Head box, CPAP, IPPV, HFOV
  - Surfactant
- Complication:
  - Pneumothorax
  - Pneumomediatinum
  - Interstitial emphysema

Pathophysiology

- Anaesth mx:
  - PEEP, decr VQ
  - Min Fio2 and P_{AWP},
  - Target PO2 6-10kpa, Sat: 88-93%

Apnoea

- Def: Pause in breathing with cyanosis and/or brady
- 80% <30w PCA, Up to 60w (need 24 hr postop monitoring)
- Mx: **Caffeine** 20mg/kg then 5mg/kg bd (inc MV and CO2 sensitivity and diaphragm fxn)
- Pre-op prevent: caff: 10mg/kg or aminoph 7mg/kg over 30min

Oxygen Toxicity

- Mechanism is unknown
- Risk of ROP, heart, brain, kidneys & Bronchopulmonary dysplasia

Central Nervous System:

- Pain:
  - Ascending pathways develop by 20wks
  - Descending pathways by third trim
  - Prem has increased sensitivity to pain

  Consequences:
  - Breathholding and apnoea
  - Incr BMR
  - Hypoglycemia
  - Increased catecholamines (foetal circulation)
  - Pulmonary hypertension
  - Failiure to thrive

Renal Physiology and Fluid Balance

- GFR at birth: 25ml/min
- Adult level at 2 years
- Neonate:
  - Increase FeNa
  - Limited Urine concentrating abilities
  - Reasonable dilution abilities
  - Limit capacity for glucose absorption
  - Increase urinary ca and na loss
  - TBW: 75% (mostly interstitial)

Electrolytes and Metabolism

- Hypoglycemia: inadequate glycogen stores
- Ca: stores @ 3rd trimester, prems @ risk of: irritability, hypotension, sz, hypotonia

- Others: transcutaneous fluid losses
- Hypothermia: Large surface area, low fat reserve
- Hepatic metabolism: phase 1 metab imm > 2 , decr blood flow due to shunting (ductus venosus or IAP)

Hematology

- Hb: 18-20; 70% HbF- P_{50} leaves neo risk of hypox HCrit >40
- Anti A & B antibodies develop between months 4-6
- If transfusion req: fresh Blood (k+) type specific
- Platelet: unable to increase with stress
- Vit K depnd fx are 50% at birth (asphyxia and infection will affect production)

Neonatal Pharmacology

- PK depend on:
  - Increased Vd, decr protein, imm liver enzymes
  - Decr CO -> decr perfusion to organs -> decr excretion
- Neuronal injury
  - In animal models
  - Anaesth long duration, high dose and no stimuli
  - Aet: ?NMDA
  - Expert opinion:
    - Cannot rule out a risk
    - Not a definite risk
    - Insuff evidence
    - Do not limit doses
    - No preventative startegies
    - Postpone elective surgery until 6mo
- Volatiles: MAC

	<32w PCA	Term	1-6mo
Halothane	-	0.87	1.2
Isoflurane	1.28	1.4	1.5
Sevoflurane	-	3.3	3.2
Desflurance	-	9.16	9.4

- Opiates:
  - Post op apnoea
  - Fenta: variable response and duration
  - Alfenta decr clear and long duration
  - Morphine incre half life (14hrs)

- Induction agents
  - All risk of apnoea (prolong with props)

- Muscle relax
  - Increased ECF counter by decr Cp50 – stand adult dose
  - Sux induce brady with fenta

Anesthetic technique

- Goal:
  - Avoid prolong exposure
  - Alleviate pain and stress while maintain HD

- Pre-op
  - Note: GA, reason for prem, medical intervention, resus status, last po intake
  - Congen anomalies
  - Prmed: Caffeine, sucrose on dummy (sedatv), atropine(counteract)
  - Plan post-op

- Theatre prep
  - Warm theatre

- Monitoring
  - Clinical: colour, chest move, perfusion,
  - Circ: NIBP 3min, IABP: 24G cannula (periph)
    - Pulse ox pre & post ductal: postx=retinal
    - CVP: risk malpos, obstruct due to size
    - Umb vv cath: hepatic vv thromb, (use only is first few days and emergency)
  - Vent: Pawp and PEEP
    - ETCo2 underread: deadspace or high flow
  - NMJ: small mm and cramped space
    - Can use needles but must justify
  - U-output:
    - Difficult to monitor

- Induction
  - RSI:
    - increased ICP, brady, hypertension, desat, breath hold, airway trauma
    - Drain with NGT
  - Airway:
    - Large head
    - Prominent occiput
    - Large tongue
    - Ant and ceph larynx
    - Long epiglottis
    - Intub: 2.5 uncuff ETT: <1.5kg, aim for leak at 20-25cmH20
  - Ventilation
    - IPPV if GA
    - Neonatal lungs vunerable to:
      - Oxidative trauma
      - Volutrauma
      - Shear stress injury
    - Vent: lowest Vt, Fio2 and incr rate
    - Permissive hypercapnoea acceptable provided no Phptn or metb acid
    - If HFOV do pt in ICU
  - Fluids
    - Maintenance (isotonic) with dextrose
    - Holiday and Segars (4:2:1)- overestimates (esp 1st week)
    - Ongoing loss replace without dextrose
    - Synth colloids contain too much Na therefore prefer SHS
    - Preferably use leuk depleted blood
  - Regional anaesthesia
    - Pref with ultrasound
    - May be technically challenging
  - Resus
    - Adrenalin is the drug of choice
    - Atropine if vagal bradycardia
    - Start CPR early if HR <60