NEONATAL ANESTHESIA

Definitions:

- Neonatal period : first 28 days of extrauterine life
- Preterm infant : one that is born at less than 37 weeks gestation
- Conceptional age: day of conception to day of delivery (no longer used)
- Gestational age: first day of last normal menstrual period to day of delivery
  - 2 weeks longer than conceptional age
  - If pregnancy achieved using assistive reproductive technology, gestational age is calculated by adding 2 weeks to conceptional age
- Chronological age: time elapsed after birth
- Post menstrual age (PMA): gestational age + chronological ageCorrected age: subtract number of weeks born before 40 weeks of gestation from the chronological age
  - Used to describe children up to 3 years of age, born preterm

Considerations:

- gestational age and mother's antenatal history
- postmenstrual age and problems of prematurity
- associated congenital abnormalities / syndromes
- problems associated with the surgical condition
- full stomach
- fluid and electrolyte disturbances
- sepsis

Special considerations for the neonate :

- differences in anatomy and physiology compared with the older child
- hypocalcaemia, hypoglycaemia, immature liver function, coagulopathy, temperature regulation
- drug handling differences : doses have to be modified, e.g. thiopentone, morphine, antibiotics
- special attention to asepsis required
- transport to and from NICU / SCN

The Premature / Ex-premature neonate

Needs careful review of:

- Birth events
- Cardiovascular system
  - Congenital heart disease e.g. patent ductus arteriosus (PDA) with medical/surgical therapy
  - Presence of persistent fetal circulation in the ill neonate
- Respiratory system
  - Presence of hyaline membrane disease (HMD), bronchopulmonary dysplasia (BPD), mechanical ventilation, oxygen dependence, apnoeic episodes and efficacy of therapy
- CNS: intraventricular haemorrhage (IVH) – results of ultrasound to be noted
- Eye: retinopathy of prematurity (ROP) and its severity, care with FiO_2. Note the range of SpO_2 that neonate is maintained on in NICU. Ensure functioning air/oxygen blender for transport if the patient is intubated and ventilated.
- Metabolic: prone to hypoglycaemia and hypocalcaemia
- Renal:
  - Impaired ability to concentrate urine - poor tolerance of over/under hydration
  - Poor retention of sodium
  - Poor clearance of drug/metabolites - delayed drug excretion
- Haematological
  - Anemia of prematurity
  - Prone to coagulopathy due to immature liver function
- Acquired infections e.g. MRSA
- Special attention to lines and temperature regulation during transport.

The premature neonate is more prone to apnoeic episodes, especially after anaesthesia. The incidence of postoperative apnoea is 11-37% for infants < 60/52 PMA. The risk of an infant <44/52 PMA developing postoperative apnoea is particularly high.

Infants whose PMAis <60/52 should generally not be done as day cases as they will need postoperative apnoea monitoring.

References:

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ANAESTHESIA IN THE NEONATAL INTENSIVE CARE UNIT

Operations which are done in the NICU include PDA ligation, laparotomy or insertion of drains for necrotising enterocolitis (NEC). These are often premature babies who are critically ill, very small (<1000g) or hemodynamically unstable. Transport may be hazardous and result in hypothermia, haemodynamic instability and inconsistent ventilator therapy.

The decision to operate in the NICU can only be made after mutual agreement between the neonatologist, surgeon and anaesthetist.

Preoperative Review:

Medical Status:

- PMH
- Problems associated with prematurity and its severity
- Respiratory : Apnoeic spells, HMD, BPD - assess its severity, O_2 dependence and the mode of O_2 therapy, SaO_2 on air
- CVS: PDA, CCF, diuretics and anti-failure agents
- Others: ROP and its severity, IVH, hypoglycaemia, hypocalcaemia and jaundice
- Drug Review

Surgical Status:
Sepsis, volume status, presence of shock and coagulopathy
Review fluid requirements.

Equipment:
Long lines, peripheral lines, arterial lines, umbilical catheters. Try not to use (break the sterility) of long lines; use peripheral lines for giving drugs, blood and blood products.

Respiration:
ETT; oral/nasal, markings at gum/nares
Ventilator settings

Drug Review

Investigations:
FBC, U/E/S/Cr, PT/PTT, GXM, CXR. 2D Echo etc.

Premedication:
Prophylactic antibiotics if indicated.

Conduct of Anaesthesia:

The surgery can be done in the NICU OT or in the cubicle, on the Air Shields "Open Care" or with the patient inside the incubator, after discussion with the surgical team.
A sick neonate may decompensate on handling, therefore this should be kept to a minimum.

Pre Anaesthesia checklist:

- Surgeon, scrub nurses and any special equipment
- Blood and blood products are available in the OT blood fridge. Ensure available manpower to get blood at short notice.
- Ventilator and T-piece attached to O_2 source, checked and within reach of the anaesthetist.
- O_2 source: air / O_2 blender available.
- If you are unfamiliar with the ventilator, seek assistance from the neonatologist or NICU respiratory therapist.
- Check post intubation CXR for correct position of ETT, auscultate for equal air entry and adventitious sounds. ETT should be free of secretions and spare ETT available.

- Baseline ABG may be taken if arterial lines are present; check correlation between $PaCO_2$ / $TcCO_2$ / $ETCO_2$, and SaO_2.
- A peripheral line should be set up and an extension with 3 way tap placed within reach of anaesthetist.
- Drugs drawn out and labelled clearly with pre-calculated dosage chart
- Resuscitation equipment available and within reach.

Monitors:
ECG, SaO_2, NIBP or arterial line, temperature, transcutaneous CO_2 $TcCO_2$ / $ETCO_2$ – displays easily seen.

Technique:

- Intravenous anaesthesia is usually used as there is no anaesthesia machine in NICU. The IV technique usually consists of fentanyl/muscle relaxant or ketamine/muscle relaxant or precedex/morphine/muscle relaxant with air/oxygen mixture.
- Check compliance of lungs before and after muscle relaxants are given, adjustment of ventilator settings is usually required after induction and paralysis.
- Check ETT, lines, monitors again if the baby is repositioned for surgery.
- Care should be taken to keep to a "safe" Spo2 (87 - 95%) to avoid ROP.
- Keep meticulous record of fluid intake, fluid boluses to flush drugs from extension line, drug volumes etc.
- There should be 2 anaesthetists present. If an AU nurse is not available, ensure that there is a nurse from NICU is present to assist.
- At the end of the procedure, check that the baby is stable and do a formal hand-over to the neonatologist.