# Neonatal Anesthesia

Dr Ekta Rai
Prof. & Head
Christian Medical College
Vellore

## Definitions

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| **Conception Age (CA)** | *Time elapsed between the day of conception and the day of delivery.<br>*Gestational age is 2 weeks longer than conceptional age.<br>*No longer used |
| **Gestation Age (GA)** | *Time elapsed between the first day of the last normal menstrual period and the day of delivery<br>*Two weeks longer than conception age<br>*For Assistive reproductive pregnancy, gestational age = 2 weeks + conceptional age |
| **Post-natal age (PNA)/ Chronological age** | Time elapsed after birth. |
| **Post Conceptional Age (PCA)** | Conceptional Age+ Post Natal Age |
| **Corrected Gestational Age (CGA) (Preterm Babies)** | *Gestation Age (weeks) + Post Natal age(weeks)<br>*Calculate CGA for child up to 3 years<br>*Corrected Gestational Age (CGA) influences the morbidity and mortality associated to preterm infants. |

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| **Neonates** | Newborn up to first 28 days of extrauterine life. |
| **Preterm Infant**<br>**Term Neonate**<br>**Post term Neonate** | New-born of <37 weeks gestation<br>New-born of 37–40 weeks gestation<br>New-born of more than 42 weeks gestation |
| **Low Birth weight (LBW)**<br>**Very Low Birth Weight (VLBW)**<br>**Extremely Low Birth Weight (ELBW)** | Weight at birth<2500 gms<br>Weight at birth <2000 gms<br>Weight at birth <1500 gms |
| **Small for Gestation (SGA)** | < 5 Percentile |

**Physiological Consideration –** All the Systems are significantly immature.

| System | Physiological Development | Clinical Implication |
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| **Central Nervous System** | Fragile Cerebral vessels<br>Impaired Cerebral Autoregulation | High Risk of Intraventricular hemorrhage (IVH)<br>Neurocognitive outcomes depend on grade of IVH |
| | Ascending Pain pathways are developed but not the descending pathways. | Analgesia is important component of perioperative care |
| **Spinal Cord** | Spinal cord extend upto L3 | Sub arachnoid block( SAB) must be tried below L3 |
| | Dura extends till S3-4 | Increase incidence of dural puncture while giving caudal block |
| | Spinal surface area more and CSF production is more. | More local anaesthetic (LA ) |
| | Myelination incomplete | Lower concentration of LA |
| **Cardiovascular system** | Immature Heart | Stroke volume (SV) is heart rate (HR) dependent.<br>ECF Calcium level should be maintained. |
| | Existence of shunts- PDA, ASD | Avoidance of triggers for transition to fetal circulation which may be difficult to reverse<br>Presence of persistent fetal circulation in the ill neonate(Preterm) |
| **Respiratory & Airway** | | |
| **Gastrointestinal** | Immature liver function<br>Glycogen storage limited.<br>Total protein reduced, albumin reduced and alpha 1 glycoprotein limited.<br>Coagulation factor low | Risk of hypoglycemia<br>Drug doses have to be modified<br>More free LA (More toxicity)<br>Perioperative Vit K administration |

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| **Renal** | GFR= 1/5 of adult GFR<br><br>Tubular function immature<br><br>TBW =90-100% | Fluid management is challenging- poor tolerance of over/under hydration.<br><br>Poor retention of sodium<br>Poor clearance of drug/metabolites - delayed drug excretion |
| **Prematurity related Challenges** | Hyaline Membrane disease (HMD),<br><br>Chronic Lung Disease (CLD)<br><br>Apnoea of prematurity<br><br>Retinopathy of Prematurity(ROP)<br>-Severity<br><br>Anemia of prematurity<br><br>Prone to coagulopathy due to immature liver function<br><br>The premature neonate is more prone to apnoeic episodes, especially after anaesthesia.<br><br>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. | Arrange HDU care<br><br>Minimise FiO2<br>Careful selection of the Spo2 range<br>Air:O2 blender for transportation<br><br>Increased risk of postoperative apnoea<br><br>Infants whose PMA is <45/52 should generally not be done as day cases as they will need postoperative apnoea monitoring. |

**Anesthetic Consideration**

- Gestation age or CGA is an independent factor affecting the outcome of the surgery
- Evaluation of the birth events and its relevance
- Identify the issues of prematurity
- Associated congenital abnormalities/syndromes
- Specific surgical needs
- Temperature maintenance in the perioperative period
- Fluid and electrolyte disturbances
- Immature immune system – high risk of infection and sepsis
- Transportation is challenging

## Anesthesia in neonatal intensive care (NICU)

Critically ill, ELBW, or hemodynamic unstable neonates are operated in NICU as A sick neonate may decompensate on handling, therefore this should be kept to a minimum.

The transport may be hazardous and result in hypothermia, haemodynamic instability and inconsistent ventilator therapy.

Common procedures include- PDA ligation, laparotomy, drain insertions for necrotising enterocolitis (NEC)

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

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.

**Anaesthetic preparation for the operation in NICU**

**Monitoring** – Standard ASA and invasive monitoring according to the sickness and surgical intraoperative requirement. Extensions should be connected to the lines for easy access. The dead space must be counted in the total calculation of the fluids.

**Drugs**- Both resuscitation and anaesthetic drugs must be available

**Suction**- Functional suction for surgeons and anaesthetists must be available.

**Maintenance of temperature**-

**Environment** – Mobile Surgical Lights,

**Drug Chart** – Calculated doses of both anaesthetic and resuscitation drugs, fluid requirement, maximum allowable blood loss must be handy.

**Sterility** – Laminar flow for the ICU, sterility with the long lines( close system must be maintained), peripheral access.
Prophylactic antibiotics if indicated.

Pre anaesthesia Checklist

**Drugs**

**Resuscitation Drugs** – O2: Air blender, O2 source for ventilation and T piece

**Anaesthesia Drugs** – NDMR, Opioids

**Labelling stickers** or their alternatives

**ICU Ventilator** which has more advanced modes, and unavailability of the inhalational gases. Take help from a neonatal respiratory therapist.

**Monitors and display screens -** ECG, $SaO_2$, NIBP or arterial line, temperature, transcutaneous $CO_2$ $TcCO_2$ / $ETCO_2$ – displays easily seen.

**Blood** and its products are available and stored appropriately

Appropriate sized **Equipment**

**Lines** with adequate extensions

**Calibrated ABG** machine available

**Scrubs** and sterile trays for various procedures

Functional Suction

Source of sufficient **light**

**Anaesthetic Aims intraoperatively**

**Must Remember**

IV anaesthetic technique is the only option as the NICU ventilators have no option for delivering the inhalational gas.
Assess the patient, equipment before starting the procedure
Monitor should be visible to both the anaesthetic and surgical teams
Meticulous record keeping
Two anaesthetists are needed
Handing over to neonatologist at the end of operation is important.