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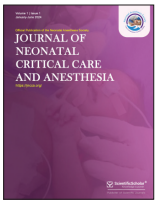

Innovations

Peri-operative Neonatal Resuscitation – Need of the Hour

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ABSTRACT

Perioperative neonatal resuscitation (PoNR) is a specialized care process designed to ensure the stability and well-being of neonates in the perioperative period. Due to their unique physiological characteristics and vulnerabilities, neonates require focused care before, during, and after surgery and anesthesia. The PoNR addresses challenges related to the neonate's unique anatomy and physiology and accompanying medical and surgical conditions. A dedicated neonatal anesthesiologist is critical for providing the best care. This article explores the scope, steps, and scenarios of PoNR and tries to establish the need for PoNR to ensure the best outcome in these neonates.

Keywords: Peri-operative neonatal resuscitation, Neonates, Surgery, Anesthesia, Resuscitation

INTRODUCTION

Perioperative neonatal resuscitation (PoNR) refers to specialized care provided to a baby during the immediate perioperative period and aims to stabilize the neonate's vital functions through maintaining airway (A), breathing (B), and circulation (C) to ensure the best possible outcome (ABC of resuscitation). It is essential because neonates exhibit unique physiological characteristics and vulnerabilities that require special attention and interventions.[1-5]

NEED OF PoNR

Neonates are highly vulnerable in the perioperative period because of the following factors: [6]

i. Immaturity – All organ systems are immature and still developing including respiratory, cardiovascular, nervous, abdominal, and neuromuscular. They do not function optimally, which increases their vulnerability
ii. Transitional changes are occurring to adapt to the extrauterine life
iii. They have limited physiological reserves and the ability to compensate for stress and a changing environment such that even minute disruptions can lead to physiological instability and a pre-arrest condition requiring vigilant monitoring, early recognition, and prompt intervention
iv. Immature hepatobiliary-renal system – Administering anesthesia to neonate requires precise dosing and careful monitoring due to poor drug metabolism and excretion. Responses to drugs may be varied and unanticipated[1,7]
v. Congenital disorders – Surgical neonates may have other anomalies and syndromes and may be in respiratory distress, which may get exacerbated because of the surgical condition and associated physiological, metabolic, and biochemical consequences. Specialized resuscitation techniques are required to support ABC, especially intraoperatively, to ensure adequate ventilation and gas exchange
vi. Neonates are poikilothermic, which makes them susceptible to surrounding temperature and hypothermia, especially under anesthesia
vii. They have limited vascular capacity and the ability to adapt to large fluid shifts and surgical losses making them prone to fluid and electrolyte imbalance. They need meticulous assessment of fluid and electrolyte losses and precise replacement
viii. They are extremely prone to hypoglycemia even with a minimal fasting period. It is crucial to maintain blood glucose levels for good surgical outcome and neurological well-being
ix. Immune immaturity makes them susceptible to infection and stringent infection prevention measures are required at all times.

These factors add to the risk of surgery, anesthesia, and drugs and necessitate a specialized team approach in perioperative management. Proper resuscitation and

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Table 1: Scope of PoNR – differences between PoNR and neonatal resuscitation.

	Neonatal resuscitation	PoNR
Settings	Performed at the time of birth, in the birthing area	Refers to resuscitative efforts required in the perioperative period and takes place in the operation room n the surgical setting
Goal	Help transition from intrauterine to extrauterine life. Focuses on establishing breathing, circulation, and normothermia	To manage and stabilize vital functions during the perioperative period. Besides the basic ABC of resuscitation, it addresses the surgical stress and anesthesia-related issues in surgical neonates
Interventions	Drying, warming, stimulation, oral suction, mask ventilation, administering oxygen	Additional interventions vary depending on the specific needs of the baby and surgery undertaken – specialized monitors, an adjustment in anesthesia administration, advanced airway, ventilation and hemodynamic management, and temperature control
Team composition	Obstetricians, neonatologists, midwives, nurses, respiratory therapist	Surgical team (surgeons, neonatal anesthesiologist, surgical nurses, and assistants)

PoNR: Peri-operative neonatal resuscitation

Table 2: Steps of PoNR.

Essential steps	Components
Training	All involved health-care professionals need specialized training in neonatal resuscitation measures (especially neonatal chest compression and ventilation).
Anticipate/prepare	The team should be aware of pre-natal and newborn history. Arranging necessary equipment, medications, pre-warmed OT, and skilled team
Equipment/medications	Necessary equipment and medications be readily available in the perioperative area including face masks, endotracheal tubes, and neonatal-specific medication dosage charts
Team communication	Establish protocols for clear communication among team members to co-ordinate resuscitation efforts, assigning roles to team members to streamline actions during emergency
Anticipation/planning	Anticipate potential resuscitation needs based on the neonate's pre-operative condition and surgical procedure. Develop contingency plans for different scenarios that may arise.
Umbilical access	Consider establishing umbilical venous and arterial lines to facilitate rapid access to medications and fluid administration.
Thermoregulation	Ensure a warm environment to prevent hypothermia and heat loss using radiant warmers, warm blankets or incubators.
Secure airway	Ensure patency by head positioning and clearing secretions or obstruction. In case of respiratory distress or compromised airway, definitive endotracheal tube placement is required.
Assess/support breathing	Evaluate the baby's respiratory efforts, rate, and pattern. Provide respiratory support as needed – CPAP/PPV
Assess/support circulation	Evaluate heart rate, perfusion, and early intervention for hypotension/bradycardia/arrhythmias by way of fluids, medications, and cardiac compression.
Monitoring	Continuously monitor heart rate, respiratory rate, oxygen saturation, blood pressure, and temperature to detect any changes promptly
Fluid/electrolyte balance	Ensure proper hydration and monitor the internal milieu of the baby
Blood glucose	Monitor blood glucose and administer glucose as needed.
Post-resuscitation care	Continued post-resuscitation stabilization and monitoring.
Family communication	Communicate with the neonate family during and after the resuscitation process
Administer anesthesia	Experienced anesthesiologist to administer general or regional anesthesia.
Minimize stress/pain	Non-pharmacological (swaddling, comfort measures, and sucrose). Pharmacological measures (opioids)
Surgical procedure	Performed by a dedicated neonatal surgeon with precision and special care.
Documentation	Ensure documentation of all resuscitation efforts, interventions, responses, and outcomes.
Post-operative care	Continued monitoring of vitals, ensuring appropriate pain and wound care.
Transition to NICU	Continued care in NICU for ongoing monitoring and support

PoNR: Peri-operative neonatal resuscitation, NICU: Neonatal intensive care unit, CPAP: Continuous positive airway pressure, PPV: Positive pressure ventilation, OT: Operation theater

Table 3: Scenarios of PoNR.

Anticipated PoNR	Unanticipated PoNR
This is subdivided into three categories - Maternal conditions that can pose a risk to neonate, e.g., maternal diabetes (risk of neonatal hypoglycemia) and maternal HT (impaired perfusion) Fetal conditions diagnosed during pre-natal screening require specific interventions during the perioperative period, e.g., fetal growth restriction with low physiological reserves. Other conditions based on the type of surgery or medical conditions, e.g., neonate with congenital heart defects undergoing cardiac or non-cardiac surgery	Includes - Unforeseen respiratory distress/failure Sudden changes in HR/rhythm/BP Unanticipated anesthesia-related complications Sudden blood loss Massive embolism PEA

In both situations, the key to successful PoNR lies in a well-coordinated team effort, timely identification of issues, prompt intervention, and support of NB vital functions. PoNR: Peri-operative neonatal resuscitation, HT: Hypertension, HR: Heart rate, BP: Blood pressure, PEA: Pulseless electrical activity, NB: Newborn

vigilant monitoring in the perioperative period are crucial to ensure the best possible care for these babies and minimize complications.[5,8]

SCOPE OF PoNR

The PoNR and routine neonatal resuscitation are two distinct aspects of neonatal care each serving different purposes and taking place in different contexts. Table 1 outlines the major differences between PoNR and neonatal resuscitation.

STEPS OF PoNR

All personnel involved in providing care to sick surgical neonates are required to be specially trained to identify pre-arrest situations and manage them to avoid perioperative mortality [Table 2].

SCENARIOS OF PoNR

The PoNR can be categorized into two main scenarios – anticipated and unanticipated [Table 3]. Anticipated PoNR refers to the situation where health-care team is aware of potential issues/complications that may arise during the perioperative period allowing the team to prepare in advance and have the necessary resources/expertise available. Unanticipated PoNR refers to a situation where the health-care team encounters unexpected issues during the perioperative period that require immediate resuscitative efforts, and the team may not get time and must be prepared to respond quickly and effectively.

CONCLUSION

The PoNR is a critical aspect of neonatal care that focuses on the perioperative period providing specialized care to address the unique vulnerabilities of neonates before, during, and after surgery and anesthesia. The PoNR process involves a dedicated team, specialized training, and a systematic approach to ensure the well-being and stability of neonates during this critical period. Coordinated efforts are essential to optimize outcomes and provide the best possible care.

Ethical approval

Institutional review board approval is not required.

Declaration of patient consent

Patient's consent is not required as there are no patients in this study.

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Conflicts of interest

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Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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