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Guest Editorial

Inguinal Hernia Repair in Preterm Infants

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Inguinal hernia is a frequent condition in preterm infants, and deciding when to repair it is one of the most crucial aspects of management. Timing of repair involves balancing the risk of hernia-related complications, such as incarceration, with the risks associated with anesthesia in a population prone to respiratory and neurological complications. This updated review will focus extensively on the timing of repair, integrating the latest evidence, while also covering surgical approaches and anesthesia considerations [1,2].

The optimal timing for inguinal hernia repair in preterm infants is heavily debated among neonatologists, pediatric surgeons, and anesthetists. This is because the decision directly affects the risks of incarceration, which can lead to bowel necrosis, and anesthesia-related complications, particularly respiratory failure and neurodevelopmental outcomes [3]. In preterm infants, the incidence of inguinal hernia varies widely, with rates as high as 30% in some populations [2,4]. The thinness of the hernia sac, the fragility of the abdominal wall, and the vulnerability of associated tissues make this group particularly susceptible to complications if the condition is left untreated [5].

One of the primary drivers of early hernia repair is the risk of incarceration. Studies have shown that the risk of incarceration in preterm infants can be significantly higher than in term infants, with estimates of up to 30% of preterm infants experiencing incarceration [2,6]. Incarceration of the hernia can lead to bowel obstruction, ischemia, or testicular atrophy, making prompt repair necessary in many cases [7]. Data from Vaos., *et al*. demonstrated that delaying hernia repair beyond the first week after diagnosis dramatically increases the risk of incarceration by nearly fivefold [7]. Infants with incarcerated hernias not only face an emergency situation but also have poorer overall surgical outcomes and increased perioperative risks [1,7].

For this reason, many surgeons advocate for repairing the hernia as early as possible, often before the infant is discharged from the neonatal intensive care unit (NICU). This approach minimizes the risk of emergency surgery for incarcerated hernia, which is associated with higher morbidity [1]. However, early repair also comes with significant risks, particularly related to anesthesia. Preterm infants, especially those with bronchopulmonary dysplasia or other respiratory disorders, have an increased risk of perioperative complications [5,6]. Studies have shown that infants undergoing surgery under general anesthesia are at a greater risk for postoperative apnea, respiratory failure, and the need for prolonged mechanical ventilation [4]. This has led some experts to recommend delaying surgery until the infant is older and better able to tolerate the anesthetic, typically at a post-conceptional age of around 60 weeks [7].

Crankson., *et al*. reported that delaying surgery until the infant reaches at least 47 weeks of post-conceptional age can reduce the incidence of postoperative apnea and other respiratory complications, making surgery safer for the infant [4,5]. This delay allows time for the infant's respiratory system to mature, potentially decreasing the risks associated with anesthesia [6]. Additionally, some studies

suggest that waiting until the infant is older can reduce the likelihood of surgical complications, such as hernia recurrence, particularly in infants who required mechanical ventilation during their NICU stay [3,7].

Given the risks of both early and delayed repair, many experts advocate for an individualized approach based on the infant's overall clinical status, gestational age, and comorbidities [2]. Some surgeons argue for a middle ground, performing surgery shortly before the infant is discharged from the NICU to avoid the risks of delaying surgery too long but still allowing time for some respiratory maturation [7].

A survey of members of the American Pediatric Surgery Association showed that 63% of surgeons would prefer to repair the hernia just before the infant's NICU discharge [5,6]. In these cases, the hernia repair is delayed long enough to reduce anesthesia risks but is performed while the infant is still in the hospital, minimizing the need for emergency readmissions for incarcerated hernias [7].

A critical factor in deciding when to repair a hernia is the infant's post-conceptional age (PCA). Research consistently shows that infants with a PCA of less than 46 weeks are at a significantly higher risk for postoperative apnea and other respiratory complications [7]. For this reason, some clinicians recommend delaying hernia repair until the infant reaches a PCA of at least 60 weeks [2].

However, this delay increases the risk of hernia incarceration, particularly as the infant begins to grow and move more, placing additional pressure on the abdominal wall [6]. Data from Lautz., *et al*. revealed that for every month hernia repair is delayed, the risk of incarceration increases by more than twofold [7]. Thus, while waiting for the infant's PCA to reach a safer threshold for anesthesia is ideal, this delay must be carefully weighed against the increasing risk of incarceration [3,7].

The decision about when to repair an inguinal hernia also varies significantly based on institutional practices and available resources [5]. Some centers have developed protocols for early repair, using spinal or caudal anesthesia to minimize the risks of general anesthesia, especially in infants with a high risk of respiratory complications [4]. In centers where regional anesthesia expertise is available, early repair can be safely performed, minimizing the risk of incarceration while reducing the perioperative risks associated with general anesthesia [3].

Other institutions, particularly those without ready access to regional anesthesia techniques for infants, may opt to delay surgery and focus on close monitoring of the hernia, allowing the infant's respiratory system to mature before surgery [7]. The lack of consensus on the optimal timing of surgery reflects the complexity of balancing these risks in a highly vulnerable population [2,6].

The choice of surgical technique can also influence the timing of repair. Open surgery is traditionally performed and remains the gold standard for many surgeons due to its well-established outcomes and lower risk of complications [1]. Laparoscopic surgery, although less invasive, typically requires general anesthesia and is associated with an increased risk of pneumoperitoneum, which can exacerbate respiratory problems in preterm infants [4,7].

Some evidence suggests that laparoscopic surgery, while technically more demanding, may offer the advantage of inspecting both inguinal canals during the procedure, reducing the risk of missing a contralateral hernia [6]. However, the risk of iatrogenic complications, such as injury to the spermatic cord, is higher in laparoscopic procedures [5,7]. Consequently, the choice of surgical approach must consider the infant's overall condition and the surgeon's experience with both techniques [2,7].

Anesthesia is a major consideration in the timing of inguinal hernia repair. As previously mentioned, general anesthesia carries significant risks for preterm infants, particularly those with respiratory conditions [4]. Regional anesthesia, including spinal and caudal blocks, has been shown to reduce these risks, leading some centers to prefer early repair using regional techniques [6,7].

However, regional anesthesia is not always feasible, particularly for more complex cases, such as bilateral hernias or when laparoscopic surgery is planned [4,7]. In such cases, general anesthesia may still be necessary, and surgery is often delayed until the infant is older and better able to tolerate the anesthetic [7]. For infants with a PCA of less than 46 weeks, some surgeons recommend preoperative caffeine administration and close postoperative monitoring to reduce the risk of apnea [6,7].

The timing of inguinal hernia repair in preterm infants is one of the most challenging decisions in neonatal surgery. Early repair reduces the risk of hernia incarceration but exposes the infant to the risks of anesthesia-related complications [7]. Delaying surgery allows for respiratory maturation but increases the risk of hernia-related complications, including incarceration [3,7]. An individualized approach, based on the infant's clinical status, PCA, and the availability of anesthesia techniques, is crucial for optimizing outcomes [7,8].

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