

CLINICAL VIGNETTE

Prematurity and Postoperative Apnea: Modern Anesthetics Meet Old Recommendations

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Introduction

The first studies characterizing the heightened risk of postoperative apnea in former preterm infants exposed to anesthesia occurred in the early 1980s. Many studies followed into the next decade, and subsequently, the most cautious recommendations suggest monitoring patients overnight following procedures until children reach a postconceptual age of 60 weeks. This case report reflects a typical clinical scenario that requires consideration of an infant's gestational and postconceptual age into the postoperative care plan.

Case Report

The patient is a 6-month-old male scheduled for laser photocoagulation treatment of retinopathy of prematurity to both eyes. He was born extremely premature at a gestational age of 24 weeks, and at the time of the procedure, he had attained a postconceptual age of about 53 weeks. His postnatal course was complicated by respiratory distress syndrome requiring endotracheal intubation, mechanical ventilation, and pulmonary surfactant treatment. He had also received intravenous caffeine as treatment of apnea of prematurity. The infant's medical history included treatment for closure of patent ductus arteriosus, intraventricular hemorrhage, and developmental delay.

On the day of his surgery, the infant received general anesthesia for a surgery duration of 70 minutes. This involved endotracheal intubation, as well as administration of anesthetic agents fentanyl, propofol, and sevoflurane. He was extubated and brought to the recovery room, where he stayed for 2 hours without any respiratory complications. Despite the benign course up to that point, given his medical history and age, the patient was admitted to the pediatric ward with pulse oximetry and respiratory monitoring. He was discharged the following day without complication.

Discussion

During the early 1980s, the vulnerability of young, former preterm infants to anesthetic respiratory depression became increasingly recognized.^{1,2} There are a variety of reasons why premature infants are susceptible to apnea during anesthetic exposure, including an immature central nervous system, a dia-

phragm prone to fatigue, lung mechanics that readily develop atelectasis, and a decreased respiratory response to hypercarbia and hypoxia.¹

Early studies of perioperative complications in infants identified younger gestational age at birth and postconceptual age – defined as gestational age plus postnatal age – at the time of surgery as the most significant risk factors for postoperative apnea. For example, in a retrospective study of infants undergoing inguinal hernia repair, nearly all infants with apnea during and up to 12 hours after anesthesia were born at less than 38 weeks gestation.¹ Another study of 214 children found no episodes of apnea in patients older than 46 weeks postconceptual age demonstrating the inverse relationship of apnea with age.² Together, these early studies showed a risk of apnea in preterm infants of about 18%. Furthermore, additional data showed that postoperative apnea persisted in premature infants even up to 60 weeks postconceptual age and for 12 hours in recovery.³

Other studies over the next decade focused on the effect of anesthesia type – comparing general anesthesia, neuraxial anesthesia, and sedation – on the risk of apnea in premature infants. For example, although ketamine normally preserves respiratory drive in adults and children, sedation with ketamine in addition to spinal anesthesia increased the risk of apnea when compared with spinal anesthesia alone.⁴ When spinal anesthesia was performed without sedation, the rate of central apnea was surprisingly similar to that of general anesthesia, although patients given general anesthesia had lower overall oxygen saturation values.⁵

These early studies included the use of drugs such as thiopental, curare, pancuronium, and halothane, even though these drugs are no longer used in today's operating rooms. Newer drugs such as propofol, rocuronium, and sevoflurane, may have reduced risk for apnea compared with the older anesthetics. In fact, the most recent evaluation of postoperative apnea in young infants undergoing inguinal hernia repair demonstrated a 4% risk of postoperative apneic events after general anesthesia compared to 3% risk with spinal anesthesia.⁶ Consistent with

the previously mentioned studies, the most significant risk factor for apnea was the patient's degree of prematurity.

Therefore, current recommendations regarding anesthetic choice and postoperative monitoring for former preterm infants primarily regard postconceptual age and gestational age at birth for determining whether patients require special postoperative monitoring, namely an overnight hospital stay. The exact cut-off for the age at which premature infants no longer need prolonged monitoring remains a mystery due to an inadequate number of study patients at various postconceptual ages. It is likely that a patient is suitable for ambulatory surgery once he or she attains 55 to 60 weeks postconceptual age. Despite the ambiguity, recent evidence continues to reinforce that postoperative apnea in this particular pediatric population is a persistent safety risk despite a new generation of anesthetic technology and medications.

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