



Regional anesthesia may improve cardiorespiratory complications in preterm inguinal hernia surgery

Aaron P. Leshner¹ · Patricia R. Chess²

Received: 28 May 2020 / Accepted: 22 July 2020 / Published online: 4 August 2020
© Springer Nature America, Inc. 2020

Inguinal hernia repair is the most common major surgical procedure performed in the preterm infant. Timing of repair of inguinal hernia is a controversial topic in pediatric surgery and neonatology, with no firm consensus on optimal timing. On one hand, early inguinal hernia repair likely increases the risk of anesthesia-related complications, usually related to lung prematurity. On the other hand, delayed repair likely increases the risk of hernia-related complications, particularly bowel incarceration and possible necrosis. Further, the role that general anesthesia (GA) plays in neurodevelopmental outcomes is also a growing concern. In fact, these questions have prompted an NIH-sponsored randomized controlled trial to answer this question, called the Hernia in Premies trial ([Clinicaltrials.gov: NCT01678638](https://clinicaltrials.gov/ct2/show/study/NCT01678638)).

Regional anesthesia (RA), including both spinal and caudal anesthesia (CA), is associated with a lower risk of cardiorespiratory events, including apnea, desaturation, and respiratory failure in premature infants [1]. Unfortunately, the use of RA in this vulnerable patient population is inconsistent and there is no level one evidence to support RA versus GA.

In a study, in this issue of the *Journal of Perinatology*, Lamoshi et al. report that neonates undergoing inguinal hernia repair under GA have a higher rate of prolonged postoperative intubation compared to infants treated with CA [2]. This study is based on a retrospective analysis of 97 neonates from a single center, 87.6% of whom underwent GA ($n = 79$) and 12.4% initially underwent CA ($n = 18$).

The primary outcome was extubation success immediately following surgery. The authors found that 32.9% of patients required prolonged intubation (≥ 6 h) after inguinal herniorrhaphy. This number included both patients who were initially treated with GA and those ($n = 6$) who were converted to GA due to hypoxemia. The authors also found that two preoperative risk factors were associated with prolonged intubation: a history of intubation before surgery and a diagnosis of bronchopulmonary dysplasia.

This work sheds light on an important issue: anesthesia and associated risks related to inguinal hernia repair in premature infants. Given the high frequency of this surgery in preterm infants and the relative lack of information in the literature, this is a clinically relevant study while a larger controlled study is performed.

The main limitations of the study are related to its retrospective, single center study design. The CA comparison group only consisted of 18% of the patients included in the study, with 1/3 of those requiring conversion to GA due to hypoxemia. The authors address this limitation in the discussion, although this weakens the broad applicability of the study. In addition, neonates were described as having an average corrected gestational age of 39.9 weeks at surgery. This is relatively early in post conception life for inguinal hernia repair and may have contributed to the seemingly high rate of postoperative intubation of 32.9%. Some recent literature has supported performing inguinal herniorrhaphy early in the outpatient setting to allow the infant time to grow, minimizing anesthetic risks [3], although there is certainly no broad agreement on the topic [4]. The question of GA versus RA is less critical in this setting.

There are no large prospective, randomized studies to address whether RA reduces postoperative apnea, bradycardia, or the use of assisted ventilation compared to GA in this vulnerable population, although there is growing evidence to suggest that RA may be beneficial [5]. It can be challenging to design and carry out a randomized clinical trial in a high-risk premature population. Until such a trial is completed, retrospective cohort studies can provide useful

✉ Aaron P. Leshner
leshera@musc.edu

¹ Division of Pediatric Surgery, Shawn Jenkins Children's Hospital, Medical University of South Carolina, Charleston, SC 29425, USA

² Division of Neonatology, Golisano Children's Hospital, University of Rochester, Rochester, NY, USA

information which can help inform clinicians' clinical decisions.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

1. Krane EJ, Haberkern CM, Jacobson LE. Postoperative apnea, bradycardia, and oxygen desaturation in formerly premature infants: prospective comparison of spinal and general anesthesia. *Anesth Analg*. 1995;80:7–13.
2. Lamoshi A, Lerman J, Dughayli J, Elberson V, Towle-Miller L, Wilding GE, et al. Association of anesthesia type with prolonged postoperative intubation in neonates undergoing inguinal hernia repair. *J Perinatol*. 2020, <https://doi.org/10.1038/s41372-020-0703-4>.
3. Masoudian P, Sullivan KJ, Mohamed H, Nasr A. Optimal timing for inguinal hernia repair in premature infants: a systematic review and meta-analysis. *J Pediatr Surg*. 2019;54:1539–45.
4. Gulack BC, Greenberg R, Clark RH, Miranda ML, Blakely ML, Rice HE, et al. A multi-institution analysis of predictors of timing of inguinal hernia repair among premature infants. *J Pediatr Surg*. 2018;53:784–8.
5. Jones LJ, Craven PD, Lakkundi A, Foster JP, Badawi N, et al. Regional (spinal, epidural, caudal) versus general anaesthesia in preterm infants undergoing inguinal herniorrhaphy in early infancy. *Cochrane Database Syst Rev*. 2015;2015:CD003669.