

Utility of the Enhanced Recovery after Surgery Protocol (ERAS Protocol) in Anesthetic Management for Pediatric Surgery in Patients with Down Syndrome: Case Report

Lucía Guadalupe Segovia-Medina*¹, Alexis Emir Noguera-Echeverría², Claudia Basulto-Castro³

¹Anesthesiology Resident. Hospital Regional Elvia Carrillo Puerto, ISSSTE. Facultad de Medicina de la Universidad Autónoma de Yucatán.

²Surgical Resident. Clínica Hospital Mérida, ISSSTE. Facultad de Medicina de la Universidad Autónoma de Yucatán.

³Anesthesiologist. Hospital Regional Elvia Carrillo Puerto, ISSSTE.

ABSTRACT

Introduction: Down syndrome is a common genetic condition affecting approximately 1 in every 1,000 births, caused by a trisomy on chromosome 21. This condition leads to several abnormalities, including cardiac, respiratory, musculoskeletal, and digestive problems such as atresia and duodenal stenosis. The latter may require surgery in childhood, with general or regional anesthesia. The Enhance recovery after surgery (ERAS) Protocol is a set of scientifically supported strategies to reduce surgical stress and improve patient recovery. Although it has been used in adult surgeries for more than 20 years, its implementation in pediatric surgeries is more recent, demonstrating promising results in reducing complications and hospital stays.

Case presentation: 3-year-old female, diagnosed with Down syndrome and duodenal stenosis, with a history of closure of the ductus arteriosus at 2 years of age, electively scheduled for diagnostic laparoscopy. Fasting for 6 hours was indicated prior to surgery. Upon her arrival to the operating room, Midazolam and Paracetamol were administered as anxiolysis. Non-invasive continuous cardiac monitoring was initiated in the operating room, anesthetic induction was performed with Fentanyl, Lidocaine, Propofol and Cisatracurium. Orotracheal intubation with videolaryngoscopy was performed. Anesthetic maintenance was using Sevoflurane, as well as Fentanyl infusion. During the surgical procedure, multiple intra-abdominal adhesions were evident, so it was modified to open surgery, performing duodenal-duodenal anastomosis. Bispectral index (BIS) monitoring was performed throughout the procedure with values of 40-60. The fluid balance remained neutral. For analgesia, caudal block with Ropivacaine was used at the end of the surgery. For the prevention of postoperative nausea and vomiting, Ondansetron was administered. Emersion and extubation were performed without complications. Anesthesiology follow-up was carried out in the first 24 hours, with adequate pain control. Enteral feeding was started after 48 hours and progressively. Hospital discharge took place 72 hours after surgery.

Clinical discussion: The ERAS protocol was implemented for the first time in adult patients undergoing open colectomy; prolonged fasting, prolonged rest, excessive fluid resuscitation, and opioid analgesia were found to favor hospital stay and complications. For anesthetic management, the main points to take into account are: suspend the consumption of clear liquids up to two hours before surgery; in the perioperative phase, a multimodal approach should be focused on reducing postoperative nausea and vomiting. Regarding Regional anesthesia for abdominal surgery, options such as ultrasound-guided transversus abdominis plane (TAP) block or rectus abdominis sheath block can be used safely; when ultrasound is not available, caudal epidural block is the ideal technique in pediatric patients. The administration of fluids in the perioperative period at an average rate of 2-5 ml/kg/h achieves a neutral balance to reduce complications such as pulmonary edema. Monitoring and maintaining temperature reduces surgical site infections, cardiac complications, as well as bleeding. In the postoperative phase, the multimodal analgesia regimen

ARTICLE DETAILS

Published On:
24 February 2024

Utility of the Enhanced Recovery after Surgery Protocol (ERAS Protocol) in Anesthetic Management for Pediatric Surgery in Patients with Down Syndrome: Case Report

continues based on Paracetamol, Ketorolac, regional anesthesia, Gabapentin; in addition to implementing the start of enteral feeding and early ambulation in order to reduce postoperative ileus and favor conditions for hospital discharge.

Conclusion: The ERAS protocol is a tool that has recently been implemented in pediatric surgery with good results. The reduction in fasting time prior to elective surgery, fluid control, the initiation of multimodal analgesia through the use of paracetamol, non-steroidal anti-inflammatory drugs as well as regional anesthesia techniques have a positive impact on the patient and with better results in the postoperative period.

KEYWORDS: Down syndrome, duodenal stenosis, Fasting, anesthetic induction, intubation, videolaryngoscopy, Bispectral index, extubation, Enteral feeding, ERAS protocol, regional anesthesia, postoperative period

Available on:
<https://ijmscr.org/>

INTRODUCTION

Down Syndrome is the most common chromosomal abnormality worldwide, it is estimated that it occurs in 1 in every 1,000 births. Caused by a trisomy on chromosome 21 that results in various alterations such as heart defects, alterations in the airway, lungs, musculoskeletal anomalies, central nervous system, and digestive disorders.¹

Duodenal atresia and stenosis are anomalies that cause complete and partial obstruction of the intestinal lumen; up to 20% of cases are associated with this syndrome and surgical treatment is usually performed during childhood. The anesthetic technique in most of these patients is usually general anesthesia, regional anesthesia, or a combination of both.²

The enhanced recovery after surgery protocol (ERAS protocol) was described since 2001, it is a set of strategies implemented preoperatively, intraoperatively, and postoperatively based on scientific evidence to reduce the stress caused by surgical trauma and at the same time supporting the patient's early recovery, which translates into a decrease in postoperative complications, hospital stay, as well as healthcare costs. Although they have been applied to different surgical specialties for 20 years, this strategy has only been implemented in pediatric patients for a few years, where the results obtained are like adult patients.^{3,4}

CASE REPORT

3-year-old female, weight 13.5 kg, with a history of closure of the ductus arteriosus at 2 years of age, currently without cardiovascular involvement, laboratories (blood count, liver, and kidney function tests within normal ranges for age), with diagnosis of Down syndrome and duodenal stenosis, electively scheduled for diagnostic laparoscopy. He was admitted the day before surgery, where fasting for 6 hours prior to surgery was indicated.

Upon arrival at the operating room, Midazolam 1 mg IV was administered as anxiolysis, as well as Paracetamol IV. Upon arrival in the operating room, non-invasive continuous cardiac monitoring (ECG, NIBP, pulse oximetry, temperature) begins; induction was performed with fentanyl 40 mcg IV, Lidocaine 10 mg IV, Propofol 30 mg IV and

cisatracurium 1.5 mg IV. To manage the airway, orotracheal intubation was performed with Macintosh #1 sheet by videolaryngoscopy, a percentage of glottic opening (POGO) of 100% was observed (**Figure 1**), and #4.0 endotracheal tube was placed, without complications.



Figure 1. Videolaryngoscopy with percentage of glottic opening (POGO) of 100%.

Anesthetic maintenance was preserved by using Sevoflurane until reaching a MAC between 0.8-1 as well as Fentanyl infusion 0.039-0.052 mcg/kg/min. During the surgical procedure, multiple adhesions were evident, so it was not possible to continue laparoscopically, and it was modified to open surgery (**Figure 2**). Duodenum-duodenum anastomosis was performed. Vital signs were stable throughout the procedure and were recorded every 5 minutes.



Figure 2. The surgery began as laparoscopic surgery and was modified to open surgery.

Utility of the Enhanced Recovery after Surgery Protocol (ERAS Protocol) in Anesthetic Management for Pediatric Surgery in Patients with Down Syndrome: Case Report

Bispectral index (BIS) monitoring was performed throughout the procedure with values of 40-60. The fluid balance remained neutral. Total bleeding was 40 ml. For analgesia, a caudal block with 1.5% Ropivacaine (19 ml) was placed at the end of the surgery (Figure 3).



Figure 3. Caudal block with Ropivacaine.

For the prevention of postoperative nausea and vomiting (PONV), Ondansetron was administered. Emersion and extubating were performed when the bispectral index was found to be more than 80 and this was without complications. During the stay in the post-anesthesia care unit, no incidents were reported. Anesthesiology follow-up was carried out in the first 24 hours, where adequate pain control was maintained thanks to the block, without requiring rescue doses of opioids.

Enteral feeding started after 48 hours and progressed. He was discharged from the hospital 72 hours after surgery without other complications.

DISCUSSION

The ERAS protocol was implemented for the first time in adult patients undergoing open colectomy; prolonged fasting, prolonged rest, excessive fluid resuscitation, and opioid analgesia were found to favor hospital stay and complications.^{3,4}

Enhanced recovery after surgery protocols in pediatrics provide a structured, multidisciplinary, evidence-based approach to all aspects of peri-operative care to optimize a child's recovery from surgery.⁵

For anesthetic management, the main points to consider are: The fasting time: It is recommended to suspend the consumption of clear liquids up to two hours before surgery, since prolonged fasting time is associated with postoperative insulin resistance, increases stress, and reduces intravascular volume.

In the perioperative phase, a multimodal approach should be focused on reducing postoperative nausea and vomiting

(PONV) by reducing fasting time and opioid-sparing techniques such as preoperative paracetamol, the use of nonsteroidal anti-inflammatory drugs, and regional anesthesia.^{5,6}

Regarding regional anesthesia for abdominal surgery options such as transversus abdominis plane (TAP) block, ultrasound-guided rectus abdominis sheath block can be used safely; when ultrasound is not available, the caudal epidural block is the ideal technique in the pediatric patient, which produces minimal hemodynamic effects, with a low risk of complications in its placement and that produces adequate analgesia.^{5,7}

The administration of fluids in the perioperative period at a rate of 2-5 ml/kg/h on average, being lower for laparoscopic surgery and higher for open surgery, should aim to achieve a neutral balance to reduce complications such as pulmonary edema. Monitoring and maintaining temperature reduce surgical site infections, cardiac complications, as well as bleeding and transfusion requirements.

In the postoperative phase, the multimodal analgesia regimen continues based on Paracetamol, Ketorolac, regional anesthesia, Gabapentin; in addition to implementing the start of enteral feeding and early ambulation to reduce postoperative ileus and favor conditions for hospital discharge.^{5,8}

CONCLUSION

The Enhanced recovery after surgery protocol (ERAS protocol) is a tool that has recently been implemented in pediatric surgery with good results. As anesthesiologists, reducing fasting time prior to elective surgery, fluid control, the maintenance of the temperature, starting multimodal analgesia through the use of Paracetamol, non-steroidal anti-inflammatory drugs as well as regional anesthesia techniques (epidural block, peripheral nerve block) are widely recommended strategies and they have a positive impact on the patient and should be part of our knowledge and application on a routine basis to obtain better results in the postoperative period as it was in this case.

REFERENCES

- I. Bull, M. J. (2020). Down syndrome. *The New England Journal of Medicine*, 382(24), 2344–2352. <https://doi.org/10.1056/nejmra1706537>
- II. Rich, B. S., Bornstein, E., & Dolgin, S. E. (2022). Intestinal atresias. *Pediatrics in Review*, 43(5), 266–274. <https://doi.org/10.1542/pir.2021-005177>
- III. Brindle, M., Nelson, G., Lobo, D. N., Ljungqvist, O., & Gustafsson, U. O. (2020). Recommendations from the ERAS® Society for standards for the development of enhanced recovery after surgery guidelines. *BJS Open*, 4(1), 157–163. <https://doi.org/10.1002/bjs.50238>

Utility of the Enhanced Recovery after Surgery Protocol (ERAS Protocol) in Anesthetic Management for Pediatric Surgery in Patients with Down Syndrome: Case Report

- IV. Ljungqvist, O., Scott, M., & Fearon, K. C. (2017). Enhanced Recovery After Surgery: A review: A review. *JAMA Surgery*, 152(3), 292–298. <https://doi.org/10.1001/jamasurg.2016.4952>
- V. Rafeeqi, T., & Pearson, E. G. (2021). Enhanced recovery after surgery in children. *Translational gastroenterology and hepatology*, 6, 46–46. <https://doi.org/10.21037/tgh-20-188>
- VI. Roberts, K., Brindle, M., & McLuckie, D. (2020). Enhanced recovery after surgery in paediatrics: a review of the literature. *BJA Education*, 20(7), 235–241. <https://doi.org/10.1016/j.bjae.2020.03.004>
- VII. Greaney, D., & Everett, T. (2019). Paediatric regional anaesthesia: updates in central neuraxial techniques and thoracic and abdominal blocks. *BJA Education*, 19(4), 126–134. <https://doi.org/10.1016/j.bjae.2018.12.003>
- VIII. Hidayah, B. A., Toh, Z. A., Cheng, L. J., Syahzarin, B. D., Zhu, Y., Pölkki, T., He, H., & Mali, V. P. (2023). Enhanced recovery after surgery in children undergoing abdominal surgery: meta-analysis. *BJS Open*, 7(1). <https://doi.org/10.1093/bjsopen/zrac147>