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Ultrasound-Guided transversus abdominis plane block as an elective anesthetic technique for transverse colostomy in a 2-Day old infant with atresia ANI

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Abstract

Anorectal malformations such as atresia ani are congenital anomalies that necessitate early surgical intervention, often in the form of a transverse colostomy to divert fecal flow. In neonates, choosing an anesthetic technique that minimizes systemic impact while providing effective pain control is critical due to their physiological vulnerability. Ultrasound-guided Transversus Abdominis Plane (TAP) block has emerged as a valuable regional anesthesia technique, offering safe and reliable analgesia with minimal respiratory and hemodynamic compromise—making it an appealing option in high-risk neonatal cases. Case Presentation A 2-day-old full-term male neonate (2.3 kg) with anorectal malformation (atresia ani) presented with abdominal distension and absence of meconium passage since birth. Stable vital signs and normal preoperative labs, including coagulation profile, supported surgical intervention. Due to the high anesthetic risk associated with general anesthesia in low-weight neonates, an ultrasound-guided bilateral Transversus Abdominis Plane (TAP) block using 0.2% ropivacaine (0.5 mL/kg per side) was performed as the primary anesthetic technique for a transverse colostomy. Intraoperatively, the infant remained hemodynamically stable, with no need for conversion to general anesthesia. Postoperative recovery was smooth with minimal pain (FLACC score 0–1), no opioids required, and discharge from NICU on day 3 in good condition. Ultrasound-guided Transversus Abdominis Plane (TAP) block proves to be a safe and effective anesthetic technique for neonates undergoing abdominal surgeries such as transverse colostomy for anorectal malformations. It provides adequate perioperative analgesia, minimizes the need for systemic opioids, and reduces the risks associated with general anesthesia in high-risk, low-weight infants. This case demonstrates that TAP block can be a valuable tool in neonatal anesthesia, promoting better recovery and lessening the adverse effects typically seen with conventional anesthetic approaches.

Keywords: Transversus abdominis plane block, TAP block, Neonate, Colostomy, Anorectal malformation, Atresia ANI, Regional anesthesia, Ultrasound-Guided block, Neonatal surgery

Introduction

Atresia ani is a congenital anomaly characterized by the absence of a normal anal opening, leading to obstruction of the distal gastrointestinal tract. It typically presents in the neonatal period with the failure to pass meconium within the first 24 to 48 hours of life, progressive abdominal distension, and sometimes vomiting. Atresia ani affects approximately 1 in 5,000 live births and can occur as an isolated condition or as part of a syndrome involving other organ systems, such as in VACTERL association. Prompt surgical intervention is required to relieve the obstruction and prevent complications such as bowel perforation, electrolyte disturbances, and sepsis. A common initial surgical approach in these neonates is the creation of a diverting colostomy.[1,2]

In neonates undergoing abdominal surgery, anesthetic management is particularly challenging due to immature organ systems, limited physiological reserves, and heightened sensitivity to anesthetic agents. General anesthesia, although commonly used, carries considerable risks in neonates, especially those with low birth weight. These include hemodynamic instability, postoperative apnea, and the potential for long-term neurodevelopmental effects associated with exposure to certain anesthetics. In this vulnerable population, regional anesthesia techniques that reduce or eliminate the need for general anesthesia have emerged as valuable alternatives.[3,4]

The Transversus Abdominis Plane (TAP) block is a regional anesthetic technique that targets the nerves supplying the anterior abdominal wall by depositing local anesthetic in the plane between the internal oblique and transversus abdominis muscles. This approach provides effective somatic analgesia for lower abdominal procedures, including colostomy.

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When guided by high-resolution ultrasound, the TAP block allows precise needle placement and drug delivery, minimizing the risk of complications and enhancing efficacy, especially in neonates with small and delicate anatomical structures.[5]

TAP blocks have been increasingly utilized in pediatric populations for postoperative analgesia and, in select cases, as the primary anesthetic technique. In neonates, successful applications have been reported in surgeries such as hernia repair, laparotomy, and colostomy. The advantages include stable intraoperative vital signs, reduced exposure to systemic anesthetics, decreased opioid requirements, and improved postoperative recovery. Importantly, the TAP block avoids airway instrumentation, which is particularly beneficial in neonates with respiratory vulnerability or where difficult airway is anticipated.[6]

Given the potential risks of general anesthesia in neonates with low birth weight and limited physiological reserve, the use of regional techniques such as TAP block is increasingly considered. This approach can provide sufficient anesthesia and analgesia for a variety of abdominal procedures, with minimal systemic involvement. When combined with light sedation, TAP block may serve as a safe and effective alternative to general anesthesia, especially when performed by experienced practitioners using ultrasound guidance.[7,8]

This case report describes the use of an ultrasound-guided bilateral TAP block as the primary anesthetic technique in a 2-day-old full-term neonate weighing 2.3 kg, undergoing transverse colostomy for atresia ani. The case highlights the clinical decision-making process, anesthetic technique, intraoperative and postoperative outcomes, and emphasizes the role of TAP block in neonatal anesthesia practice. It adds to the growing body of evidence supporting the use of regional anesthesia as a safe and effective option in select neonatal surgeries.

Case presentation

A 2-day-old full-term male neonate, weighing 2.3 kg, was referred to the pediatric surgery unit with a primary complaint of not passing meconium since birth. The baby was delivered via spontaneous vaginal delivery at a rural health center with no reported complications during labor or delivery. The mother, a 24-year-old primigravida, had attended regular antenatal check-ups, with no history of infections, teratogenic drug exposure, or gestational diabetes. The baby cried immediately after birth, but had progressive abdominal distension, and no meconium-stained diapers within the first 48 hours of life.

On initial clinical examination, the neonate appeared active and responsive. Vital signs were stable: heart rate 152 bpm, respiratory rate 42 breaths/min, blood pressure 68/40 mmHg, oxygen saturation 98% on room air, and temperature 36.8°C. Physical examination of the abdomen revealed moderate distension without visible peristalsis or signs of peritonitis. Perineal examination showed complete absence of an anal opening, consistent with a diagnosis of low-type atresia ani. No fistula or meconium staining was observed on the perineum or genitalia. No additional dysmorphic features, limb anomalies, or murmurs were noted on systemic examination.

Laboratory investigations were performed to assess the baby's baseline condition before surgery. Hematological tests showed hemoglobin 17.5 g/dL, hematocrit 52%, white blood cell count 12,300 /µL, and platelet count 290,000 /µL. Renal function was within normal neonatal limits with BUN 14 mg/dL and creatinine 0.6 mg/dL. Electrolyte analysis showed sodium 137 mmol/L, potassium 4.5 mmol/L, and chloride 102 mmol/L. Coagulation studies revealed normal parameters: PT 12.6 seconds, aPTT 33.2 seconds, and INR 1.02, indicating the baby was safe for surgical intervention from a hemostatic standpoint. Blood glucose was 85 mg/dL. Chest X-ray was normal, and an erect abdominal X-ray revealed dilated bowel loops with absence of distal air, supporting the diagnosis.

The baby was managed preoperatively with Nothing Per Oral (NPO), nasogastric tube decompression, and intravenous fluids containing dextrose to maintain euglycemia and hydration. Broad-spectrum intravenous antibiotics (ampicillin and gentamicin) were administered prophylactically. Pediatric anesthesia was consulted for the preoperative evaluation. Given the infant's low weight and the risks associated with general anesthesia particularly respiratory depression and postoperative apnea a

regional anesthetic technique was considered as a safer alternative.

A decision was made to proceed with an ultrasound-guided bilateral Transversus Abdominis Plane (TAP) block as the primary mode of anesthesia. The procedure was conducted under strict aseptic conditions using a high-frequency linear ultrasound probe. A 25-gauge short-bevel needle was inserted in-plane on both sides of the abdomen to reach the fascial plane between the internal oblique and transversus abdominis muscles. A total of 0.5 mL/kg of 0.2% ropivacaine was injected on each side, with proper visualization of spread. Intravenous midazolam at 0.05 mg/kg was used for minimal sedation.

During the colostomy procedure, the patient remained hemodynamically stable: heart rate between 140–148 bpm, blood pressure maintained at 70/42 mmHg, respiratory rate 40–44 breaths/min, and oxygen saturation remained at 98–100% without supplemental oxygen. No signs of pain or distress were observed, and surgical anesthesia was achieved effectively. The surgery lasted 45 minutes and involved creating a transverse loop colostomy in the left lower quadrant. There was no need to convert to general anesthesia or administer intraoperative opioids.

Postoperatively, the infant was transferred to the Neonatal Intensive Care Unit (NICU) for observation. FLACC (Face, Legs, Activity, Cry, Consolability) pain scores were consistently between 0 and 1 during the first 24 hours post-op. No opioid or additional analgesics were required. Enteral feeding was initiated after 24 hours and was well tolerated. Wound inspection on day two revealed clean, dry dressings with no signs of infection or dehiscence. Colostomy functioned well, and there was passage of stool through the stoma.

The baby's condition remained stable throughout the postoperative period. Repeat vital signs remained within the neonatal reference range. Hemodynamic parameters such as heart rate and blood pressure did not fluctuate significantly postoperatively, indicating excellent anesthetic and pain control. On postoperative day 3, the patient was deemed fit for discharge from the NICU with stable vital signs, well-functioning colostomy, and tolerating full enteral feeds. Parents were educated on colostomy care and advised to follow up regularly for definitive repair planning.

This case highlights the safe and effective use of ultrasound-guided TAP block as the sole anesthetic technique for transverse colostomy in a neonate with atresia ani. By avoiding general anesthesia, the risk of airway manipulation and systemic anesthetic exposure was minimized, contributing to stable intraoperative and postoperative outcomes, early recovery, and improved parental satisfaction.

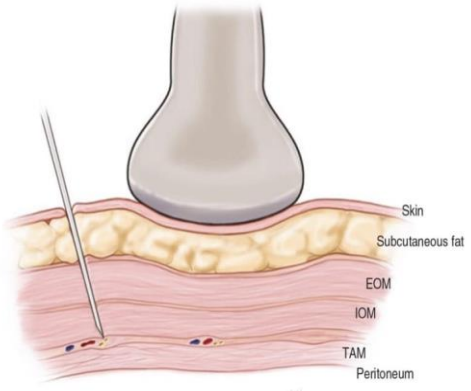

Figure 1. The abdominal wall muscles and the ultrasound transducer in place for performing TAP block are shown.[9]

Figure 2. Subcostal TAP block; Reverse Ultrasound Anatomy with needle insertion in-plane and local anesthetic spread (blue). TA, transversus abdominis; RA, rectus abdominis; IO, internal oblique; EO, external oblique[9]

Figure3 Preinjection short-axis sonogram showing the abdominal wall muscle layers. EOM external oblique muscle, IOM internal oblique muscle, TAM transversus abdominis muscle[9]

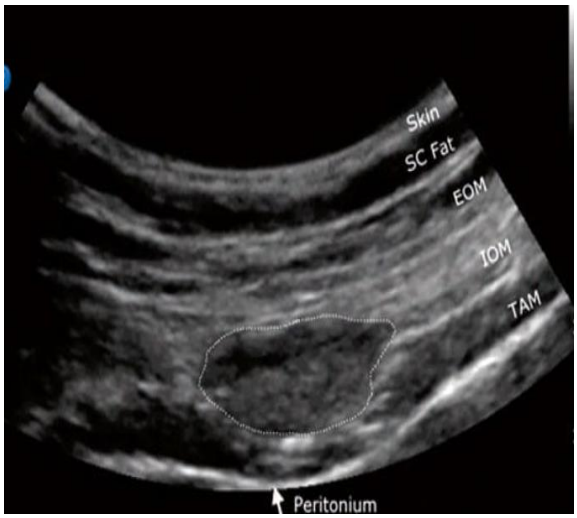

Figure 4. Postinjection short-axis sonogram showing the spread of the injectate in the plane between the Internal Oblique Muscle (IOM) and the Transversus Abdominis Muscle (TAM). Note that the TAM and the peritoneum were pushed away by the injectate[9]

Discussion

This case report describes the successful use of an ultrasound-guided Transversus Abdominis Plane (TAP) block as the primary anesthetic technique for a transverse colostomy in a 2-day-old neonate diagnosed with atresia ani. Atresia ani, a congenital absence of the anal opening, typically presents in the neonatal period with abdominal distension and failure to pass meconium, as seen in our patient. Early surgical diversion, such as colostomy, is often necessary to decompress the bowel and prevent complications like perforation or sepsis. In neonates with low body weight (in this case, 2.3 kg) and no associated anomalies, careful perioperative planning is essential to reduce anesthetic risk.[10]

General anesthesia in neonates carries several risks, including potential respiratory depression, hemodynamic instability, and prolonged recovery due to immature organ systems. Our patient, while clinically stable, was considered high-risk for general anesthesia due to low weight and neonatal age. Thus, a bilateral ultrasound-guided TAP block was employed as the main anesthetic strategy. This technique provides effective regional analgesia for lower abdominal surgeries by blocking sensory input from the lower thoracic and upper lumbar nerves (T6–L1). Using a 25-gauge needle and real-time ultrasound imaging, the ropivacaine was accurately deposited in the neurofascial plane between the internal oblique and transversus abdominis muscles, achieving excellent anesthetic effect.[11, 16]

During the procedure, the infant remained hemodynamically stable, with no significant variations in heart rate, blood pressure, respiratory rate, or oxygen saturation. This confirms the efficacy of the TAP block not only in providing surgical anesthesia but also in maintaining physiologic stability in this vulnerable age group. Minimal sedation with intravenous midazolam (0.05 mg/kg) was used, which allowed spontaneous breathing without the need for intubation. Notably, there was no need to escalate to general anesthesia or administer intraoperative opioids, which minimized postoperative respiratory and gastrointestinal side effects.[12]

Postoperatively, the infant demonstrated excellent pain control, reflected by low FLACC pain scores (0–1), and did not require additional analgesics. The patient resumed spontaneous feeding within 24 hours, had stable vital signs throughout recovery, and was discharged on postoperative day 3. These positive outcomes underscore the benefits of TAP block in reducing opioid exposure, promoting early recovery, and avoiding the risks associated with general anesthesia in neonates. TAP block can also facilitate improved workflow in neonatal intensive

care units by reducing the need for postoperative ventilation and extended monitoring.[13,14]

In summary, this case illustrates that ultrasound-guided TAP block can serve as a safe and effective anesthetic technique for neonates undergoing lower abdominal surgery such as colostomy. Especially in low-weight neonates or those with relative contraindications to general anesthesia, TAP block offers a viable alternative with significant benefits for pain control, hemodynamic stability, and postoperative recovery. This approach, when performed by experienced practitioners, holds promise for broader application in neonatal surgical anesthesia protocols.[15]

Conclusion

This case highlights the successful use of an ultrasound-guided transversus abdominis plane (TAP) block as the primary anesthetic technique for a transverse colostomy in a 2-day-old neonate with atresia ani. The TAP block provided effective surgical anesthesia and postoperative analgesia, maintained stable hemodynamics, and avoided the risks associated with general anesthesia in this high-risk, low-weight patient. This approach demonstrates that with proper technique and monitoring, TAP block is a safe, efficient, and opioid-sparing anesthetic alternative for lower abdominal surgeries in neonates.

Furthermore, this case supports the growing evidence that regional anesthesia techniques, such as the TAP block, can play a vital role in neonatal surgical care, especially when minimizing systemic drug exposure and preserving cardiorespiratory stability are crucial. The favorable outcome in this neonate marked by effective intraoperative analgesia, minimal sedation requirements, and smooth postoperative recovery underscores the potential benefits of incorporating TAP blocks into multimodal anesthesia strategies for selected neonatal abdominal surgeries.

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