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Research Article

Bilateral Ultrasound-Guided Transversus Abdominis Plane Block as the Sole Anesthetic for Diverting Transverse Colostomy in a Two-Day-Old Neonate with Anorectal Malformation: A Case Report

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Abstract

Background: Atresia ani, part of the spectrum of anorectal malformations, usually requires surgery within the first days of life and a diverting transverse colostomy is the common first stage procedure to relieve the obstruction. Because newborns have very little physiological reserve, the anesthetic technique must control surgical pain without destabilizing breathing or circulation. An ultrasound guided Transversus Abdominis Plane (TAP) block anesthetizes the abdominal wall while leaving the airway untouched and spontaneous breathing preserved; for this reason, we considered it for a high risk infant.

Case Presentation: A two day old full term boy weighing 2.3 kg presented with increasing abdominal distension and had not passed meconium since delivery; examination revealed atresia ani. Vital signs and preoperative laboratory results, including coagulation tests, were normal. Because general anesthesia posed a substantial risk for this low birth weight neonate, the transverse colostomy was performed under a bilateral ultrasound guided TAP block alone (ropivacaine 0.2%,0.5 mL/kg per side) with light intravenous midazolam sedation. Heart rate, blood pressure and oxygen saturation remained stable throughout the 45 minute procedure and general anesthesia was never needed. Face, Legs, Activity, Cry and Consolability (FLACC) pain scores stayed at 0-1 without any opioid and the infant left the (Neonatal Intensive Care Unit) NICU in good condition on postoperative day 3.

Conclusion: In this neonate, TAP block was satisfactory for colostomy formation and for postoperative analgesia without need of opioids and airway instrumentation and systemic effects of general anesthesia. In specifically chosen neonates undergoing lower abdominal surgery, this block can be an effective substitution to general anesthesia in the hands of a skilled surgeon and may lead to easier outcomes.

Keywords: Anorectal malformation; Colostomy; Neonate; Regional anesthesia; Transversus abdominis plane block

Introduction

In atresia ani, the anal canal fails to open to the perineum, so the bowel ends blindly and the newborn develops a distal intestinal obstruction. The anomaly occurs in about 1 in 5,000 live births and may be isolated or part of a broader pattern of defects, such as the Vertebral defects, Anal atresia, Cardiac defects, Tracheoesophageal fistula, Esophageal atresia, Renal anomalies and Limb abnormalities (VACTERL) association. It usually becomes apparent within 24-48 hours of birth, when no meconium is passed and the abdomen becomes progressively distended, sometimes with vomiting. Prompt relief of the obstruction is needed to prevent perforation, fluid and electrolyte imbalance and sepsis, and a diverting colostomy is the usual first stage operation [1,2].

Anesthetizing a neonate for abdominal surgery is challenging: Organ systems are still maturing, physiological reserve is limited and sensitivity to anesthetic drugs is high. General anesthesia is the standard approach, but in neonates particularly those with low birth weight it may be complicated by hemodynamic instability and postoperative apnea and the long term neurodevelopmental effects of early exposure to some anesthetic agents remain a concern. As a result, interest has grown in regional techniques that reduce or even remove the need for general anesthesia in this population [3,4].

The posterior abdominal wall is evoked by ventral rami of the lower thoracic and first lumbar spinal nerves, which are located between the internal oblique and transversus abdominis muscle and pass from the sub thoracic line to the intersex to the abdominal wall. Placing local anesthetic within this compartment, the TAP, constricts these nerves and supplies somatic analgesia necessary for lower

abdominal procedures (i.e., colostomy). Because neural layers of the tissues of newborns are thin, together, they bind together at a much higher resolution than imaging studies suggest, it is of importance for high resolution ultrasound in that we observe the needle tip in real time and the delivery of injectate, both of which greatly enhance block success and minimize complications [5].

In children, the TAP block is used mainly for postoperative pain relief, although in selected cases it has served as the primary anesthetic. Reports in neonates cover inguinal hernia repair, laparotomy, and colostomy, and describe more stable intraoperative vital signs, smaller doses of systemic anesthetics and opioids, and quicker recovery after surgery. A further advantage is that no airway device is required, which matters for newborns with respiratory compromise or a predicted difficult airway [6].

For low birth weight neonates with little physiological reserve, these advantages may outweigh the familiarity of general anesthesia. Published experience suggests that, with ultrasound guidance, an experienced operator and light sedation, the block alone can be sufficient for several types of abdominal surgery, so that systemic anesthetic exposure is kept low [7,8].

We report a two day old full term boy weighing 2.3 kg with atresia ani whose transverse colostomy was performed under a bilateral ultrasound guided TAP block, without general anesthesia.

The rationale for this choice, the block technique and the intraoperative and postoperative course are described. Our experience suggests that, in carefully selected newborns, regional anesthesia can be a safe and effective alternative.

Case Presentation

A two day old full term boy weighing 2.3 kg was referred to the pediatric surgery service because he had not passed meconium since birth. He was born by spontaneous vaginal delivery at a rural clinic and labor and delivery were uncomplicated. His mother, a 24 year old primigravida, had attended regular antenatal visits and reported no infection, teratogenic drug exposure, or gestational diabetes during pregnancy. The baby cried immediately after birth, but over the following 48 hours his abdomen became increasingly distended and his diapers remained free of meconium.

On examination of the neonate, he was well respected and inactive. His physical and mental symptoms were normal for this age range: Heart rate, 152 beats/min; respiratory rate, 42 /min; blood pressure, 68/40 mmHg; temperature, 36.8 °C; peripheral oxygen saturation, 98% while breathing room air. The abdomen was relatively shallow and insufficient for peristalsis, peritonitis or blood circulation. The perineum did not show an anal opening consistent with low type atresia ani; there was no fistula, no meconium had been found on the perineum or on genitalia. These lacked other dysmorphic features, limb anomalies, or heart murmurs.

Preoperative laboratory results were as follows: Hemoglobin 17.5 g/dL, hematocrit 52%, white blood cell count 12,300/μL and platelet count 290,000/μL. Renal function was normal for age (Blood Urea Nitrogen (BUN) 14 mg/dL; creatinine 0.6 mg/dL), as were serum electrolytes (sodium 137 mmol/L; potassium 4.5 mmol/L; chloride 102 mmol/L). Coagulation tests Prothrombin Time (PT) 12.6 s, activated Partial Thromboplastin Time (aPTT) 33.2 s, International Normalized Ratio (INR) 1.02) indicated that surgery could proceed safely and blood glucose was 85 mg/dL. The chest radiograph was normal, while an upright abdominal radiograph showed dilated bowel loops without gas in the distal bowel, supporting the diagnosis.

Before surgery, oral intake was withheld, a nasogastric tube was placed for gastric decompression and a dextrose containing intravenous infusion was given to maintain hydration and blood glucose. Intravenous ampicillin and gentamicin were started as broad spectrum prophylaxis. At the pediatric anesthesia consultation, the infant's low body weight and his susceptibility to respiratory depression and postoperative apnea after general anesthesia were weighed and a regional technique was judged to carry less risk.

The first anesthetic, therefore, was a bilateral ultrasound guided TAP block. Following aseptic skin preparation, a high frequency linear probe was also applied at the two front lines and a 25 gauge short bevel needle was passed in the plane to extend in front and down into the plane after continuous imaging, but the needle shifted to its wide side by the anterior oblique and transversus abdominal muscles and sat at a distance of approximately 50 m. Wet applied 2.5 mL/kg of 0.2% ropivacaine onto each side to see that it spread within the plane through ultrasound. This was

for light sedation 0.05 mg/kg Intravenous midazolam 0.25 mg/kg (Inlastic or Nitroline) and light serotonin, (Vitis) administration for re emphasis was given.

The operation lasted 45 minutes and consisted of creating a loop transverse colostomy in the left lower quadrant. Intraoperatively, heart rate ranged from 140 to 148 beats/min, respiratory rate from 40 to 44/min and oxygen saturation from 98% to 100% on room air, with a blood pressure of 70/42 mmHg. The infant showed no signs of pain or distress, surgical conditions were satisfactory and neither intraoperative opioids nor conversion to general anesthesia was required.

After the surgery, he was closely monitored in the NICU. FLACC were 0-1 for the first 24 postoperative hours and there was no opioid or other rescue analgesic given. enteral feeding was performed 24 hours postoperatively and was well tolerated. 2 on day 2 of the operation; wound showed no infection nor dehiscence and stool was passing through a functioning stoma.

Repeated vital sign measurements retained normal neonatal ranges throughout postoperative period. There was no significant change in heart rate, blood pressure or hemodynamic parameters that suggest good anesthetic and analgesic control. However, the absence of significant differences in heart rate, blood pressure, or hemodynamic parameters would imply good control of the operation and use of analgesic Emergency Control Program (ECP). On postoperative day 3, with stable vital signs, a functioning colostomy and full enteral feeding, the infant was discharged from the NICU. His parents were taught how to care for the stoma and were advised to attend regular follow up visits in preparation for definitive repair.

In summary, the colostomy in this infant was completed under TAP block alone. Because general anesthesia was avoided, the airway was not instrumented and systemic drug exposure was minimal; the intraoperative and postoperative periods were uneventful and recovery was rapid (Figure 1-Figure 4).

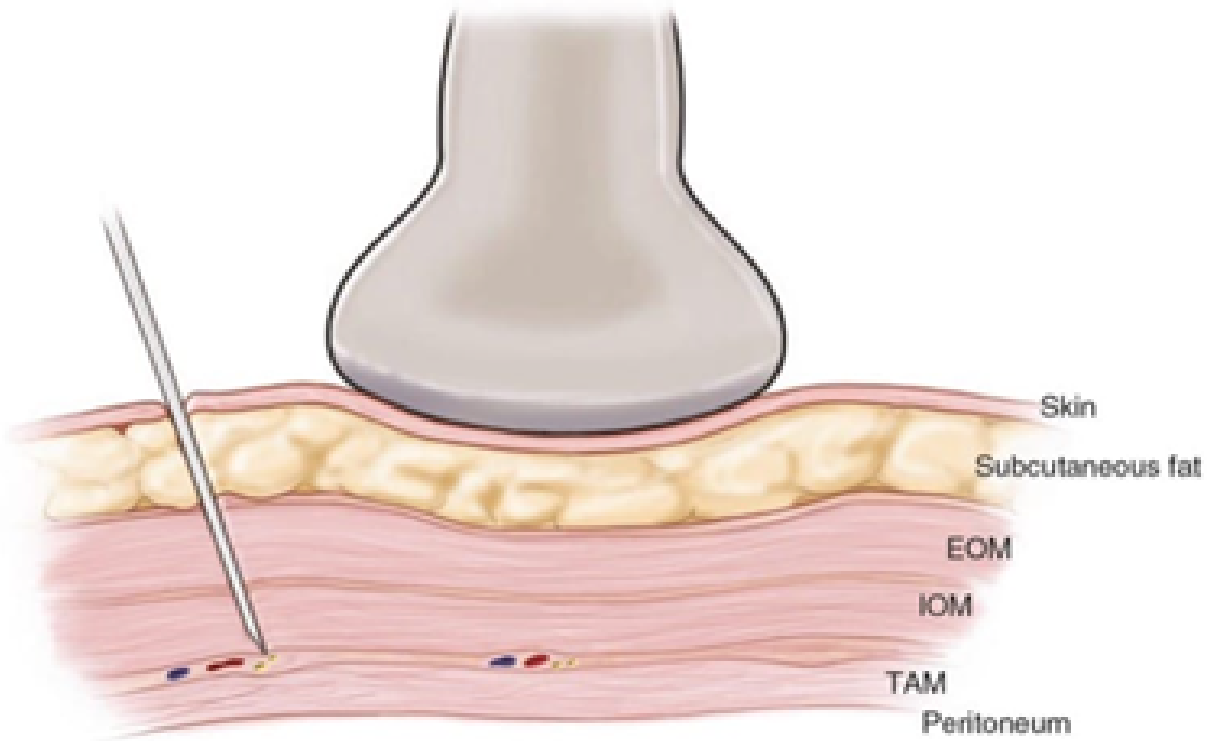


Figure 1. Schematic cross-section of the lateral abdominal wall with the ultrasound probe on the skin. The needle tip is directed toward the neurovascular plane between the internal oblique (IOM) and transversus abdominis (TAM) muscles, deep to the external oblique (EOM).[9]



Figure 2. Bedside setup for an ultrasound-guided TAP block in a neonate: the operator holds the linear probe on the flank and advances the needle under real-time imaging, with the ultrasound screen and patient monitor in view.[9]

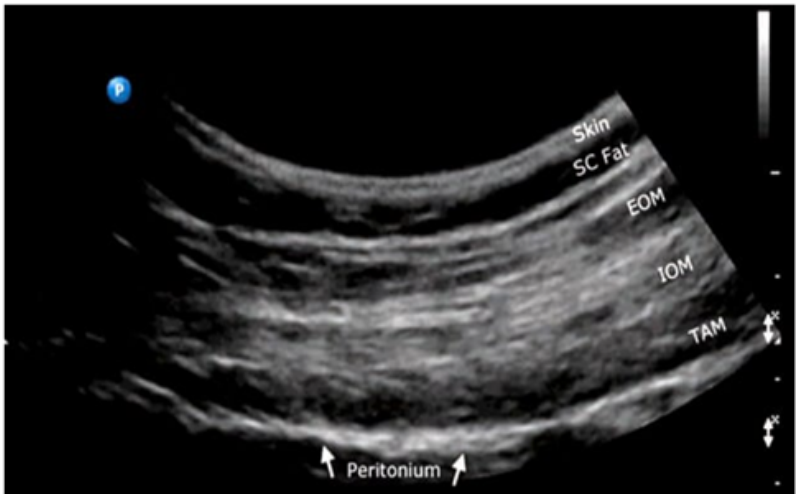


Figure 3. Short-axis ultrasound view before injection, showing the skin, subcutaneous fat, EOM, IOM, TAM, and peritoneum.[9]



Figure 4. The same view after injection: local anesthetic (dotted outline) forms a hypoechoic pool between the IOM and TAM, pushing the TAM and peritoneum deeper.[9]

Discussion

Our patient showed the typical presentation of atresia ani abdominal distension and no passage of meconium within the first two days of life. Early fecal diversion by colostomy is frequently required to decompress the bowel and avoid perforation or sepsis. He had no associated anomalies, but his weight of only 2.3 kg meant that the anesthetic plan had to be designed carefully to keep perioperative risk as low as possible [10].

In newborns, general anesthesia may lead to respiratory depression, hemodynamic instability and delayed recovery owing to immature organ function. Although our patient was clinically stable, his low weight and neonatal age placed him at high risk, and we therefore chose a bilateral ultrasound guided TAP block as the main anesthetic. The block interrupts sensory transmission from the lower Thoracic to the upper Lumbar segments (T6-L1) and offers regional analgesia for lower abdominal surgery. Live ultrasound resulted in the placement of ropivacaine at the precise site of the injection using a 25 gauge needle into the space between the internal oblique and transversus abdominis muscles and block was effective [11].

Blood pressure, heart rate, respiratory rate and oxygen saturation showed no clinically relevant change during surgery, indicating that the block provided adequate surgical conditions while preserving physiological stability in this vulnerable infant. Sedation was intentionally limited to intravenous midazolam 0.05 mg/kg, so spontaneous breathing was maintained and tracheal intubation was unnecessary. Because no intraoperative opioid and no conversion to general anesthesia were needed, opioid related respiratory and gastrointestinal side effects were also avoided [12].

Postoperative pain control was equally effective: FLACC scores remained at 0-1 and no additional analgesic was required. Enteral feeding was tolerated from 24 hours after surgery, vital signs stayed stable during recovery and the infant was discharged from the NICU on postoperative day 3. These results illustrate how the TAP block lowers opioid requirements, supports early recovery and avoids the risks of general anesthesia in neonates. Because it lessens the need for postoperative ventilation and extended monitoring, the block may also ease the workload of neonatal intensive care units [13,14].

Overall, this case shows that an ultrasound guided TAP block can be used safely and effectively as the anesthetic for neonatal lower abdominal procedures such as colostomy. It deserves particular consideration in low birth weight infants and in those for whom general anesthesia is relatively contraindicated, given its benefits for analgesia, hemodynamic stability and recovery. Where operators have sufficient experience, the technique could be incorporated more widely into neonatal surgical anesthesia protocols [15].

Conclusion

In this two day old neonate with atresia ani, a bilateral ultrasound guided TAP block served as the main anesthetic for transverse colostomy. It supplied reliable surgical anesthesia and postoperative analgesia, preserved hemodynamics and provided a low risk, low birth weight infant with a relatively low component anesthetic solution. For low batteries less risk of severe diarrhoea, the TAP block is a safe, efficient, and opioid-sparing technique used in newborn surgery. A further reminder that local strategies like the TAP block have a significant place in neonatal surgery when the scope of systemic drug treatment needs to be very limited and cardiovascular stability was to be respected. This infant's favorable state effective intraoperative analgesia in low sedation and uneventful recovery makes it clear that in multimodal anesthetic practices, the TAP block can be integrated into the multimodal plans of selected neonatal abdominal procedures.

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