Interventional Treatment of Chronic Abdominal Pain in Children

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Introduction

Chronic abdominal pain is a frequently encountered problem in the pediatric population. Children with recurrent abdominal pain are at increased risk for developing chronic pain in adulthood; this may be due to mechanisms associated with heightened central sensitization [1, 2]. Pediatric chronic abdominal pain syndromes frequently involve a somatosensory component. Peripheral nerve blockade has become an important therapeutic measure for the management of such abdominal pain states. Serial peripheral nerve blocks and continuous peripheral nerve blocks (CPNBs) have been reported effective in facilitating physical therapy [3] and controlling pediatric chronic pain in both inpatient and outpatient settings [4]. Peripheral nerve blocks may be utilized as adjunctive therapy in children with functional abdominal pain or to treat chronic abdominal wall pain. These procedures are traditionally performed using anatomic landmarks; however, the evolution of ultrasound-guided techniques has led to safer practices with improved success rates [5]. This chapter focuses on indications, procedure description, and potential complications of peripheral nerve blocks for the treatment of pediatric chronic abdominal pain.

Regional blocks of the trunk may be used to provide analgesia in children with chronic abdominal and groin pain. The utilization of ultrasound guidance has made these techniques more popular and effective [6, 7]. Somatosensory components of such pain states are effectively blocked via the transversus abdominis plane, the ilioinguinal/iliohypogastric nerves, or the rectus sheath. Choice of technique is primarily based on the anatomical distribution of pain.

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Transversus Abdominis Plane Block

Anatomy and Indications

The transversus abdominis plane (TAP) block has been described for the treatment of pediatric patients with refractory abdominal neuropathic pain [8]. Postsurgical anterior cutaneous nerve entrapment syndrome (ACNES) has also been successfully managed with serial TAP blocks [9]. US guidance allows visualization of the virtual space between the internal oblique and the transversus abdominis muscles where the thoracolumbar nerve roots (T8–L1) lie. An indwelling catheter may be left in the space for continuous analgesia. We have also performed serial TAP blocks in children with chronic abdominal wall pain with favorable results.

Three muscle layers lie lateral to rectus abdominis muscles: the external oblique, internal oblique, and transversus abdominis (Fig. 12.1). The thoracolumbar nerve roots (T8–L1) traverse the space between the internal oblique and transversus abdominis muscle. These nerves provide sensory innervation to the muscles and skin of the anterior abdominal wall.

Technique

Various techniques have been described to use an in-plane approach with ultrasound guidance that allows needle advancement and placement of local anesthetic into the TAP [10, 11]. A high-frequency linear probe is placed lateral to the umbilicus and moved laterally to demarcate the three muscle layers of the abdominal wall. The needle is advanced using an in-plane technique to the space between the internal oblique and the transversus abdominis. Injection, with incremental aspiration, will create an elliptical pocket of local anesthetic into the space where the nerves traverse.

Complications

TAP blocks are easily performed in the outpatient setting. Potential complications include intravascular injection and peritoneal and/or bowel puncture. These complications are minimized with the use of ultrasound guidance.

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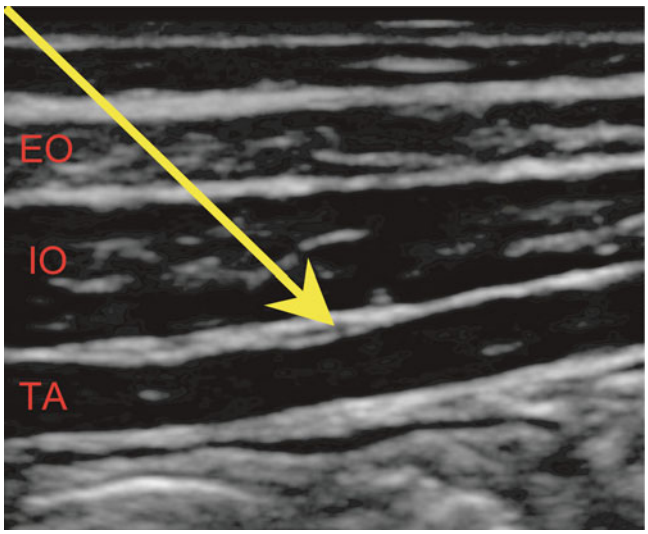

Fig. 12.1 *Arrow* indicating potential space where local anesthetic is deposited (*EO* external oblique, *IO* internal oblique, *TA* transversus abdominis muscle)

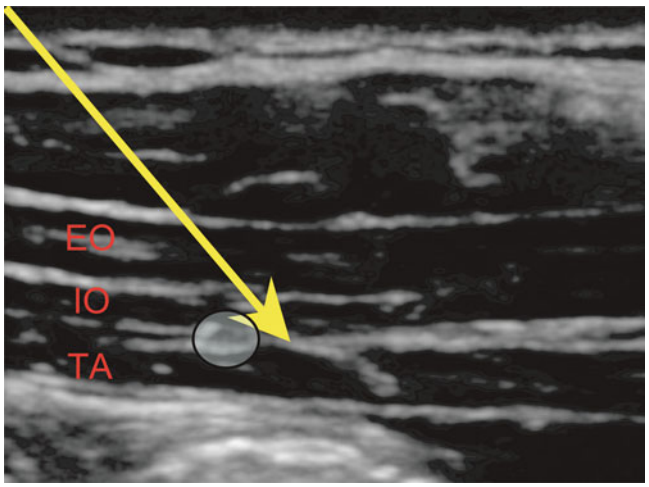

Fig. 12.2 *Arrow* indicating space where local anesthetic injected for ilioinguinal/iliohypogastric nerve block (*EO* external oblique, *IO* internal oblique, *TA* transversus abdominis muscle)

Ilioinguinal/Iliohypogastric (IL/IH) Nerve Block

Anatomy and Indications

The ilioinguinal nerve, which provides sensation to the groin area, can be blocked for therapeutic purposes in patients suffering from chronic pain after previous surgical procedures in the inguinal region. Ilioinguinal neuralgia following hernia repair is an underreported cause of abdominal pain in older children and adolescents [12] and is likely secondary to major nerve dissection during surgery. We have demonstrated the efficacy of performing serial ilioinguinal nerve blocks in adolescents with persistent groin pain following inguinal hernia repair [13]. For cases of refractory pain, we have placed a continuous infusion catheter in this space with good results.

The ilioinguinal/iliohypogastric (IL/IH) nerves originate from T12 and L1 of the thoracolumbar plexus. The nerves traverse the internal oblique aponeurosis just medial to the anterior superior iliac spine (ASIS). IL/IH nerve blocks provide analgesia to the inguinal region and anterior scrotum [14]. Successful placement of these blocks results in equivocal pain relief as provided by caudal blocks for inguinal procedures [15, 16].

Technique

A linear ultrasound probe is placed at the ASIS, in line with the umbilicus. The three abdominal muscle layers are identified (internal oblique, external oblique, and transversus abdominis), although at this level the external oblique muscle layer may be aponeurotic (Fig. 12.2). The inguinal nerve may appear as an ovular structure between the internal oblique and transverse abdominal muscles. The needle is inserted in plane from a lateral to medial approach with incremental needle repositioning. The volume of local anesthetic solution required to block conduction of both nerves has been reported as significantly less with the use of ultrasound when compared to landmark-based techniques [17, 18].

Complications

Bowel puncture and intravascular injection are rare but potentially severe complications. Isolated case reports exist of pelvic hematoma and femoral nerve palsy with performance of II/IH nerve blocks.

Rectus Sheath Block

Anatomy and Indications

Serial rectus sheath blocks have be described as an effective means of providing analgesia for children with chronic abdominal wall pain [19]. This technique is particularly useful for the treatment of periumbilical pain states.

The rectus abdominis muscle lies on the anterior abdominal wall and is separated in the midline by the linea alba. The thoracolumbar nerves (T7–T11) traverse the potential space between the rectus abdominis muscle and posterior rectus sheath. The rectus sheath block is commonly used to achieve periumbilical analgesia for surgical procedures including Single Incision Laparoscopic Surgery (SILS) and umbilical hernia repair [20].

Technique

A linear probe is placed transversely immediately lateral to the umbilicus (Fig. 12.3). The rectus abdominis muscle is visualized as the first major layer beyond the subcutaneous tissue (Fig. 12.4). The posterior sheath lies immediately below the rectus abdominis and sits above the peritoneum. The probe

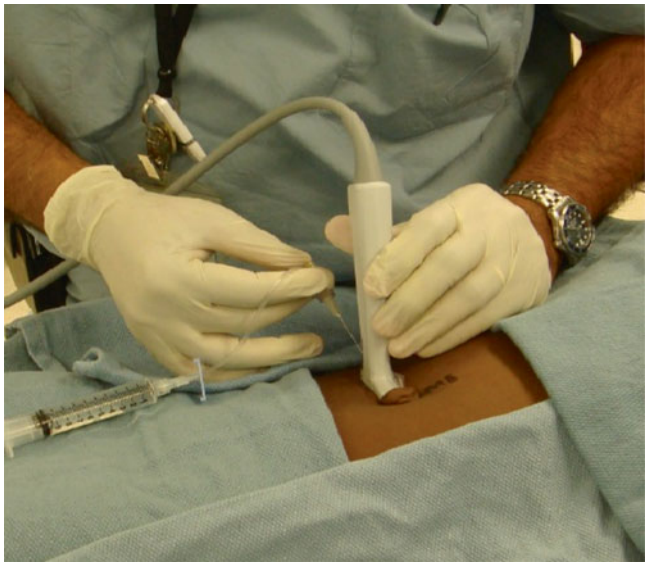

Fig. 12.3 Rectus sheath block performed in a child using an "in-plane" approach

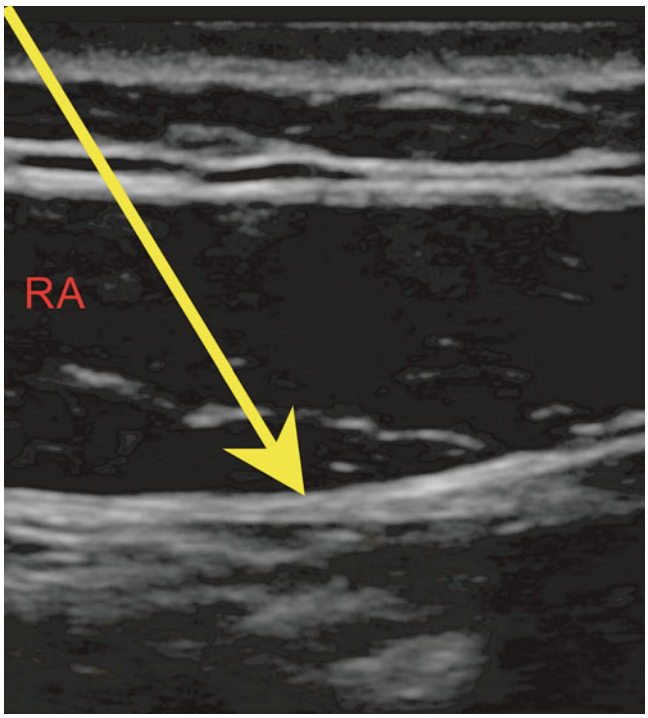

Fig. 12.4 Sonographic image with *arrow* indicating location for local anesthetic placement for rectus sheath block (*RA* rectus abdominis muscle)

is maintained immediately lateral to the umbilicus. A needle is placed in-plane from the lateral aspect of the probe and local anesthetic is deposited in the potential space between the rectus abdominis muscle and its posterior sheath. Approximately 0.1 ml/kg of local anesthetic is used to provide analgesia [21].

Complications

Bowel puncture is a potential complication as the needle is in close proximity to the peritoneum and bowel. Intravascular injection may occur with inadequate negative aspiration, as the inferior epigastric artery is also near needle trajectory.

Conclusion

Peripheral nerve blocks can serve as useful adjuncts to managing chronic abdominal pain conditions in children, especially in cases that are refractory to noninvasive treatments. In this chapter, we have summarized the current knowledge and reported practices of peripheral nerve blocks in managing pediatric chronic abdominal pain. The majority of literature on this topic consists of case reports and retrospective studies. Further evidence about the benefits or potential risks of performing such procedures in children and adolescents, including more prospective, randomized controlled trials, are needed to better guide therapy.

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