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Brief Report

Ultrasound-guided transverse abdominis plane block for ED appendicitis pain control

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ABSTRACT

The ultrasound-guided transversus abdominis plane (TAP) block or TAP block is a well-established regional anesthetic block used by anesthesiologists for peri-operative pain control of the anterior abdominal wall. Multiple studies have demonstrated its utility to control pain for a range of procedures from inguinal hernia repair, laparoscopic cholecystectomies to cesarean sections [1-3]. There are no cases describing the efficacy of the ultrasound-guided TAP block in the emergency department as a part of a multimodal pain pathway for patients diagnosed with acute appendicitis. We developed a pain protocol in conjunction with our surgical colleagues that incorporates the TAP block to reduce opioid use, and better treat acute pain in patients with acute appendicitis diagnosed in the emergency department. We successfully performed ultrasound-guided TAP blocks in 3 patients with computed tomography confirmed appendicitis, reducing pain and need for further opioid use. This interdepartmental collaborative pathway could be an ideal anesthetic plan for patients diagnosed in the emergency department with acute appendicitis.

1. Introduction

The transversus abdominis plane (TAP) block is a frequently used regional anesthetic block with an excellent safety profile [1]. It provides analgesia to the anterior and lateral abdominal wall by disrupting the intercostal, subcostal, iliohypogastric, and ilioinguinal nerves (T7 to L1) [1,2]. These nerves travel in the plane between the internal oblique and transversus abdominis muscles [2] (Fig. 1). The block was originally used by anesthesiologists to achieve pain control in patients undergoing inguinal hernia repairs, and today is used in patients undergoing a range of procedures including bowel resections, appendectomies, and even laparoscopic cholecystectomies [3]. In multiple studies involving patients undergoing surgery, the TAP block has demonstrated significant benefit in reducing pain scores and pre-operative and post-operative analgesic requirements [3-5].

Rafi et al and McDonnell were the pioneers who described this block and Hebbard later explained the ultrasound-guided technique [6,7]. In this procedure, the patient is supine and exposed from the inferior costal margin to the iliac crest as these are the two landmarks for this procedure. A high frequency (13–6 MHz) linear array transducer is placed in transverse orientation above the iliac crest at the mid-axillary line (Fig. 2) so that the external oblique, internal oblique, and transversus abdominis muscle layers are easily visualized (Fig. 3). This allows for optimal access to your target point: the plane between the internal oblique and transversus abdominis muscles. When optimal visualization is achieved, a 20 to 22-gauge 90 mm blunt tipped block needle is placed in-plane and advanced until the needle reaches the interfascial plane between the internal oblique and transverse abdominis muscles. Between 20 ml and 30 ml of a long-acting local anesthetic is injected. Successful deposition can be confirmed by visualization of the expansion of the TAP [8].

The above technique was used in our case series. After completion of the block, the site of injection was labeled on the patient with a marking pen and documented in the electronic health record (EHR). Pain scores and further analgesic medications were obtained from nursing records.

2. Case 1

A 31-year-old male presented to the ED with one day of sharp, right lower quadrant abdominal pain. He had no significant past medical, social, or family history. His presentation vital signs were notable for a heart rate of 124 bpm. On exam, he had tenderness at McBurney's point with guarding. CT abdomen/pelvis with intravenous contrast confirmed non-ruptured appendicitis. The patient's initial pain score was 9/10. He received adjunctive medications, including intravenous hydromorphone (1 mg) and intravenous acetaminophen (1000 mg), and subsequently

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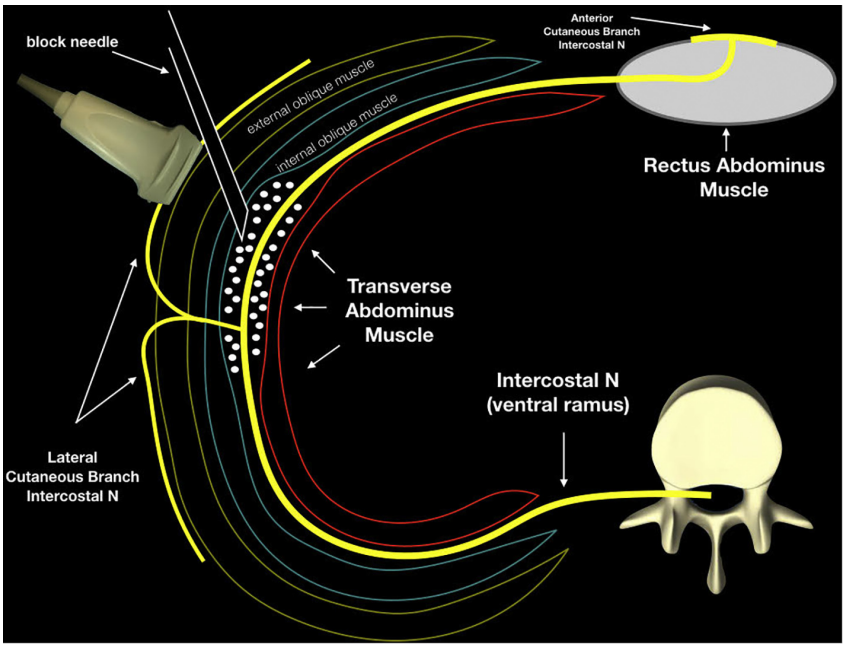

Fig. 1. Schematic representation of the anterior abdominal wall. The intercostal nerves travel between the internal oblique muscle and transverse abdominus muscle allowing for easy access with ultrasound-guidance.

reported a pain level of 5/10. The TAP block was then performed with 30 cc of 0.25% bupivacaine without epinephrine. Shortly after the procedure, his pain was reduced to 2/10. Two hours after the procedure, he had full resolution of his pain. After the procedure, the patient received one additional dose intravenous hydromorphone (1 mg) before going to the operating room 4 h later. The patient was offered a second dose of intravenous hydromorphone which he declined. There were no complications with the nerve block.

3. Case 2

A healthy 31-year-old male presented to the ED with one day of cramping, right lower quadrant abdominal pain. He had no significant past medical, family, or social history. His presentation vital signs were normal. His exam was notable for tenderness at McBurney's point, positive psoas sign, and guarding. CT abdomen/pelvis with intravenous contrast showed evidence of non-ruptured appendicitis. At

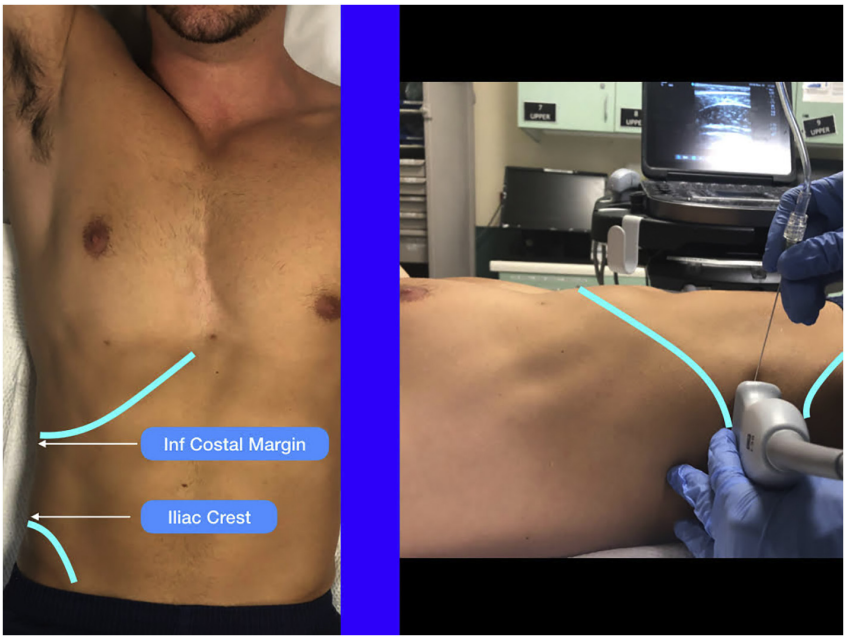

Fig. 2. Place a high frequency linear probe in a transverse plane below the inferior costal margin and above the superior aspect of the iliac crest approximately in the anterior axillary line. An in-plane technique will allow for clear needle visualization. Clear needle tip visualization with a two-person hand-on-needle technique allowed for easy deposition of anesthetic in the desired plane.

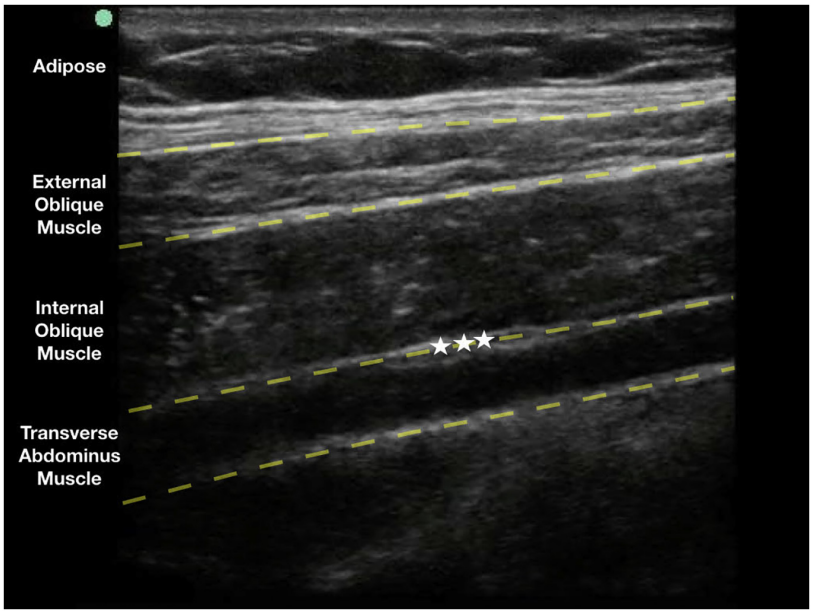

Fig. 3. Ultrasound visualization allows for clear identification of the various abdominal muscle planes. The goal of the block is to deposit local anesthetic in the interfascial plane between the internal oblique muscle and transverse abdominus muscle.

presentation, the patient reported a pain score of 9/10. The patient received intravenous hydromorphone (2 mg) and subsequently reported a pain score of 8/10. The TAP block was then performed using 30 ml of 0.25% bupivacaine without epinephrine. After the block, his pain decreased to 2/10. The patient was offered additional intravenous hydromorphone every 2 h after the block but declined until he went to the operating room 5 h later.

4. Case 3

A 45-year-old female presented to the ED with right lower quadrant pain with fever and anorexia. CT abdomen/pelvis with intravenous contrast confirmed non-ruptured appendicitis, and the patient was admitted to the surgical service for laparoscopic appendectomy. The patient's initial pain score was 8/10, with the patient receiving intravenous acetaminophen (1000 mg) and hydromorphone (1 mg). The patient continued to report a 5/10 pain score and an ultrasound-guided TAP block was performed. The patient's pain score reduced to 2/10 and the patient declined any additional analgesics until she went to the operating room 8 h later.

5. Discussion

In conjunction with the department of surgery at our center, we developed a multidisciplinary joint protocol for TAP blocks in patients with CT confirmed appendicitis in our ED. Our goal was to utilize a multimodal approach to promote optimal emergent pain management for patients with diagnosed appendicitis and hopefully develop a validated protocol that could help reduce reliance on intravenous opioids as the mainstay of analgesia. Patients were included in our protocol if they had a CT confirming the presence of appendicitis. Patients would be excluded if they had an area of localized infection or cellulitis near insertion point or had an allergy to a local anesthetic. Before the diagnosis of appendicitis was radiographically confirmed, the treating physician was allowed to administer intravenous analgesics in standard fashion. Once surgical consultation was completed, patients were consented and the ultrasound-guided TAP block was performed.

Anesthetic volume was based on the patient's body weight. Bupivacaine was readily available and used in all cases. Bupivacaine has been one of the most commonly used local anesthetics in regional and infiltration anesthesia since its introduction in 1963. The onset of action of both bupivacaine and ropivacaine is between 15 and 30 min and their duration of anesthesia is between 4 and 15 h for most peripheral nerve blocks, making them an ideal choice for perioperative analgesia [9]. In the recent TAP block literature, both ropivacaine and bupivacaine are commonly used for local anesthetic agents [10]. Both drugs are well-established long acting anesthetics commonly used for a range of procedures in the operating room, ranging from orthopedic procedures to obstetric deliveries, and are compared favorably in numerous studies [11].

Our case series of patients who received an ultrasound-guided TAP block as a multimodal analgesic protocol for radiographically proven appendicitis demonstrated that this block may be an effective method for pain control and an alternative to the classic monomodal approach with opioids. Our newly instituted collaborative multidisciplinary pain model aims to improve patient care by actively addressing pain and hopefully demonstrating a reliable method to reduce opioid overutilization and the associated negative side effects in patients with confirmed appendicitis.

In conclusion, we believe that the ultrasound-guided TAP block could be an effective analgesic method for patients in the emergency department diagnosed with acute appendicitis. This novel addition and multidisciplinary protocol could benefit patient care by reducing pain while demonstrating the importance of system-based protocols in the care of the acutely ill patients.

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