Retrospective Review

Transversus Abdominis Plane Block as a Treatment Modality for Chronic Abdominal Pain

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Background: This study describes the use of transversus abdominis plane (TAP) blocks to treat and manage chronic abdominal pain (CAP) in patients who have exhausted other treatment options. Typically, this is a procedure prescribed for treating acute abdominal pain following abdominal surgery. Here we evaluate the use of TAP blocks for longer relief from CAP.

Objectives: To assess the efficacy of TAP blocks for pain control in patients with CAP.

Study Design: This was a retrospective chart review and analysis of TAP blocks performed over 5 years. This project qualified for institutional review board exemption.

Setting: This study was completed at an academic institution.

Methods: We reviewed the charts of 92 patients who received TAP blocks for CAP after previous treatment was ineffective. Some patients underwent multiple TAP blocks, with a total of 163 individual procedures identified. For most blocks, a solution of 0.25% bupivacaine and triamcinolone was injected into the TAP. Efficacy of the injection was measured using pain scores, percent improvement, and duration of relief from pain.

Results: TAP blocks were associated with a statistically significant ($P \leq 0.05$) improvement in abdominal pain scores in 81.9% of procedures. Improvement was 50.3% ± 39.0% with an average duration of 108 days after procedures with ongoing pain relief at time of follow-up were removed. There was a significant reduction in emergency department visits for abdominal pain before and after the procedure ($P \leq 0.05$).

Limitations: This was a retrospective chart review with lack of a control group.

Conclusions: TAP blocks can be extrapolated for treating abdominal pain beyond acute settings. TAP injections can be considered as a treatment option for patients with somatosensory CAP refractory to other forms of pain management.

Key words: Abdominal pain, transversus abdominis plane block, chronic pain, chronic abdominal pain, pain management, somatosensory pain, transversus abdominis plane, steroid injection

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Abdominal pain is the most common complaint presenting to the emergency department (ED), with an estimated 23.0 million visits in 2013 alone, and high resource intensity required to care for these patients (1). Chronic abdominal pain (CAP), in particular, can be an especially difficult condition to manage. Few treatment options exist, and patients are left with medications that may have limited efficacy, lead to addiction, and present with issues in the future (2). In addition, there are currently no well-designed clinical trials evaluating the actual effectiveness of utilizing long-term use of opioid medications for managing CAP (3). For patients who may be refractory to medications, limited relief exists in terms of pain management. Identifying other treatment modalities could increase the quality of life for patients with CAP, whereas reducing the risks associated with opioid usage.

We present a rather novel approach to the management of CAP through the use of the transversus abdominis plane (TAP) block. To our knowledge, this is the first large retrospective study on the use of this procedure for CAP. The TAP block is a procedure that has been historically used for acute abdominal pain management, often following abdominal surgery (4). It was first described by Dr. Rafi (4) in 2001 as an abdominal field block. This original approach relied on a blind landmark technique to advance a needle through the lumbar triangle of Petit. Once the landmark was identified, a local anesthetic agent was injected within the plane between the internal oblique muscle and transverse abdominis muscle (3,5). The thoracolumbar nerves that originate from T6 to L1 spinal roots lie within this plane and supply the anterolateral abdominal wall with sensory innervation. As a result, the local spread of anesthetic agent in this plane allows for blockage of afferent nerve pathways and subsequent analgesia of the anterior abdominal wall (6).

Since its introduction, the TAP block has evolved in technique and approach, including an ultrasound-guided approach to visualize the abdominal wall layers introduced by Hebbard et al (7) in 2007. This has become the gold standard for TAP blocks owing to its increased safety and accuracy (6,7). Using ultrasound guidance, a local anesthetic is injected between the internal oblique muscle and the transverse abdominis muscle in the abdominal wall (5). This provides pain relief to the parietal peritoneum, muscles, and overlying skin of the anterior abdominal wall (2). There have been numerous studies supporting the use and effectiveness of TAP blocks for acute analgesia following various abdominal surgeries, such as inguinal and ventral hernia repair, cholecystectomy, bowel resection, hysterectomy, prostatectomy, and cesarean section, among others (8-13). Additionally, a systematic review found an equivalent safety profile for TAP blocks used for postoperative analgesia versus standard care and placebo, measured in terms of reduced nausea and vomiting incidence, decreased morphine consumption, and delayed time before first patient request for analgesia (14).

However, there are few studies on the use of TAP blocks for treating CAP. A recent retrospective study performed has shown promising results in relieving pain in 79.5% of patients with CAP following a TAP block procedure, whereas significantly reducing the use of gabapentin for pain management (2). This suggests the efficacy of using TAP steroid injections to treat patients suffering from CAP in cases that are refractory to other treatment options. TAP blocks can aid in both diagnostic and therapeutic measures for CAP, as an effective reduction in pain following this procedure may indicate that the pain is somatosensory and derived from the abdominal wall, rather than visceral in nature.

There are few programs that perform TAP blocks for CAP in the United States. Additional randomized controlled trials and reports are necessary to confirm these findings. This study focused on obtaining data from electronic health records on patients receiving TAP blocks with steroid injections for CAP to confirm and strengthen previous findings. This is our second data collection on this same procedure, after our first article was previously published (2).

Methods

This was a retrospective study aimed at gathering data on patients who received TAP blocks for CAP between August 1, 2014 and June 19, 2019 at an academic institution. Patients were identified using current procedural terminology (CPT) codes from the billing system and a data request was completed. CPT codes included those for TAP blocks and diagnostic codes related to CAP.

Data were collected on the patients identified from the dataset using our electronic medical records system (Epic Systems, Madison, WI) and extracted for organization and recording. All data were collected and secured in a HIPAA compliant manner.

Data were collected on patient demographics, surgical history, medication use, comorbid conditions, medical provider, diagnoses, symptoms, ED visits, injection volume and content, side of injection, percent improvement, pain scores, and duration of improvement. Pain scores were measured on the Visual Analog Scale, in which 0 indicates no pain and 10 represents maximum pain. Ninety-two patients were identified that collectively underwent 163 TAP blocks over this time period. Patients identified received anywhere from one TAP block up to 10 blocks. Data were entered into an Excel spreadsheet (Microsoft Corporation, Redmond, WA), then analysis was performed using SPSS Version 22 (IBM Corporation, Armonk, NY).

This project qualified for institutional review board exemption from a large public university.

Technique

The first author performed approximately 71.8% of procedures. For those blocks, a solution of bupivacaine 0.25% and triamcinolone was injected into the TAP. In unilateral blocks, bupivacaine 0.25% mixed with 80 mg of triamcinolone was injected. In bilateral blocks, bupivacaine 0.25% and 40 mg of triamcinolone were injected on each side. For the rest of the blocks (28.2%), which were performed by other providers, different combinations were used, including a local anesthetic (lidocaine or bupivacaine) with a steroid (triamcinolone or dexamethasone).

The abdominal wall layers were identified using a linear ultrasound probe in a sterile fashion, with identification of the external oblique, internal oblique, and transverse abdominis muscles. The overlying skin was anesthetized with local anesthetic. Next a 22-gauge 3.5-inch needle was inserted under ultrasound guidance and advanced using an in-plane technique until it was visualized between the internal oblique muscle and the transverse abdominis muscle. After negative aspiration with the needle to blood, a treatment mixture of 0.25% bupivacaine and steroid was injected, allowing for adequate spread of the medication into the TAP. Attention was given to ensure that the needle did not go below the TAP. The needle was flushed with 1% lidocaine, removed, and a Band-Aid (Johnson and Johnson, New Brunswick, NJ) was applied. For bilateral TAP blocks, the same procedure was performed on the other side using the technique stated earlier.

Statistical Analyses

The SPSS Version 22 (IBM Corporation) software was used for statistical analyses. Categorical data are expressed as number and percentage, and numeric data are expressed as average ± standard deviation with descriptive analysis. A paired t-test was used to analyze before and after procedure variables. *P* values ≤ 0.05 were considered significant.

Table 1. *Patient demographic data (n = 92).*

Variable	Total
Race	
White	81 (88.0%)
African American	8 (8.7%)
Asian	2 (2.2%)
Other	1 (1.1%)
Gender	
Male	30 (30.6%)
Female	62 (67.4)
Age (mean ± SD) (range)	45.1 ± 15.9 (14 to 85)
Body mass index (mean ± SD) (range)	31.3 ± 8.2 (14 to 61)

Abbreviations: SD, standard deviation.

Results

We identified 92 patients that received TAP blocks, with a total of 163 TAP block procedures. Thirty patients were men, whereas 62 were women. Forty-two procedures were performed on the left side, 49 on the right side, and 72 were bilateral. Other demographic data are presented in Table 1.

Patients identified had been referred to the pain clinic for CAP and were offered a TAP block after pain management with medications had failed. Notably, 81.5% of patients reported a history of one or more abdominal surgeries prior to their initial visit to the clinic for CAP. On initial consult, 56.0% of patients attributed the development of chronic pain to the period following their abdominal surgeries (Table 2). Additionally, 65.0% of patients reported gastrointestinal-related symptoms on presentation to the clinic (Table 3).

Twelve patients were lost to follow-up, and 19 patients had missing information on pain scores or duration of improvement. Thirty-three patients did not find the procedure beneficial, whereas 16 patients stated they continued to have ongoing pain relief from the procedure at their last follow-up appointment.

The procedure improved pain in 81.9% of TAP blocks performed. A total of 147 distinct procedures were identified with a statistically significant reduction in pain scores ($P \leq 0.05$). On average, pain scores improved from a mean of 6.1 to a postprocedure pain

Table 2. *Surgeries performed before development of pain.*

Previous abdominal surgery*	n	Previous abdominal surgery*	n
Abdominal laparoscopy	15	Hysterectomy	15
Abdominal lymph node biopsy	1	Inguinal mass excision	1
Abdominal wall debridement with washout	1	Kidney transplant or surgery	16
Abdominoperineal bowel resection	1	Laparoscopic bilateral tubal banding	2
Adrenalectomy	1	Laparoscopic tubal fulguration	1
Appendectomy	31	Liver transplant	3
Breast surgery	13	Ileostomy	4
Biliary tract surgery	31	Lysis of adhesions	7
Bladder surgery	4	Nissen fundoplication	1
Cesarean delivery	14	Oopherectomy	4
Colectomy	8	Ovarian cystectomy	5
Colostomy	4	Pancreas surgery	4
Cystocele repair	1	Photoselective vaporization of prostate	1
Cystoscopy	11	Proctectomy	1
Dilation and curettage	4	Pyloromyotomy	1
Endocrine surgery	1	Retroperitoneal mass removal	1
Endometrial ablation	2	Salpingectomy	3
Exploratory laparotomy	16	Splenectomy	2
Fallopian tube ligation	5	Stomach surgery	5
Groin biopsy	1	Surgical drainage of abdominal abscess	1
Hemicolectomy	1	Thymectomy	1
Hernia repair	26	Xiphoid removal	1
Total surgeries			**273**
Surgeries (mean ± SD) (range)		3.0 ± 2.6 (0 to 11)	

Abbreviations: SD, standard deviation.
*Seventeen patients had no history of abdominal surgery prior to their onset of pain. A total of 81.5% (72/92) of patients had a history of abdominal surgery prior to onset of abdominal pain.

Table 3. *Gastrointestinal-related symptoms on presentation (n = 92).*

Variable	n
Constipation	15
Diarrhea	10
Uro-fecal incontinence	6
Weight change	17
Fever/chills	4
Weakness	8
Insomnia	16
Myalgia	25
Nausea	22
Sleepiness	2
Sweating	8
Vomiting	10

*Sixty patients reported gastrointestinal-related symptoms on presentation, whereas 30 patients did not have symptoms in addition to their abdominal pain.

score of 3.5 (Table 4). Percentage improvement was 50.3% ± 39.0% with an average duration of improvement of 108 days after procedures with ongoing pain relief were removed (Tables 5 and 6). Fifty-three percent of patients had 30 or more days of pain improvement after their blocks.

ED visits for abdominal-related symptoms were also reduced following the procedures ($P \leq 0.05$). On average, ED visits dropped from a mean of 1.5890 ± 3.42779 visits before the procedure to 0.7301 ± 1.90536 visits after the procedure (Table 7).

Discussion

CAP remains a major challenge to health care providers. It consumes health care resources, is difficult to pinpoint an exact etiology of a patient's abdominal pain, and is even more complicated to find a reliable and effective treatment modality. Importantly, CAP

Table 4. *Pain scores before and after TAP block (n = 147).*

Pair	Mean ± SD	*P* Value
Pre-pain score	6.1088 ± 2.32	0.000*
Post-pain score	3.5102 ± 2.71	

*A *P* value of <0.05 was considered statistically significant.

Table 5. *Percentage improvement after block as compared with baseline (n = 132).*

Percentage improvement	n (%)
No improvement	33 (22.4)
1 to 9	0
10 to 19	5 (3.4)
20 to 29	9 (6.1)
30 to 39	3 (2.0)
40 to 49	3 (2.0)
50 to 59	16 (10.9)
60 to 69	4 (2.7)
70 to 79	8 (5.4)
80 to 89	16 (10.9)
90 to 99	12 (8.2)
100	22 (10.9)
Mean ± SD	50.3 ± 39.0

Abbreviations: SD, standard deviation.
*Sixteen patients had ongoing pain relief from their procedures and were removed from this calculation.

Table 6. *Duration of improvement after each procedure (n = 132).*

Duration in days	n (%)
No improvement	33 (25.0)
1 to 50	36 (27.3)
50 to 99	25 (18.9)
100 to 149	13 (9.8)
150 to 199	13 (9.8)
200 to 249	5 (3.8)
250 to 299	1 (0.8)
300 to 349	0
350 to 399	3 (2.3)
400 to 449	1 (0.8)
≥450	2 (1.5)
Mean ± SD (range)	108.0 ± 154.6 (0 to 1062)

Abbreviations: SD, standard deviation.
*Fifteen patients missed follow-up. A total of 33 blocks were reported to be ineffective (25.0%). Sixteen patients had ongoing pain relief at time of the study, and their data have been removed from this table.

Table 7. *ED visits before and after TAP block (n = 163).*

Pair	Mean ± SD	*P* Value
Pre-ED visits	1.5890 ± 3.42779	0.001*
Post-ED visits	0.7301 ± 1.90536	

Abbreviations: SD, standard deviation.
*A *P* value of < 0.05 was considered statistically significant.

affects the day-to-day lives of patients who live with pain. Although the average age of our chart review was 45.1 ± 15.9 years, CAP of functional or organic etiology is also quite common in children and adolescents. According to a 2015 meta-analysis of functional abdominal pain disorders in pediatric populations, the prevalence of CAP in a worldwide pooled population was 13.5%, with the most common diagnosis of irritable bowel syndrome (15). Another study found that the presence of a functional gastrointestinal disorder worsened quality of school life (QOSL) scores for adolescents, and that medical intervention or counseling were needed to improve the QOSL (16). Parents who have children with functional abdominal pain are also highly strained because of the time demands and emotional toll of caring for a child with chronic pain (17). Identifying additional options for treatment and coping would help improve the quality of life of those experiencing CAP.

Diagnosis and treatment of CAP is complex and should involve a thorough history and physical examination to identify the underlying cause. Unfortunately, the direct cause of abdominal pain is not always apparent, can be widely variable, and can make appropriate treatment more challenging. Even if a cause is identified, the available therapeutic modalities may not work to relieve patients of their pain. The direct treatment options available for CAP typically rely on pain medications, celiac plexus blocks, and opioid medications (2,3). For patients with abdominal pain with a visceral origin, celiac plexus blocks can serve a diagnostic and therapeutic purpose in treating abdominovisceral pain (18). Because the celiac plexus provides sensory innervation to many of the organs in the abdominal cavity, regional blockade of this nerve can aid in providing pain relief and indicate a visceral source. Patients with pain from pancreatitis have been shown to benefit from this form of therapy (19). However, not all patients achieve success, and for many patients, opioid therapy is utilized for pain management when other treatments, such as physical therapy, over-the-counter medications, antidepressants, and anticonvulsants, fail.

There are serious risks and undesirable effects associated with opioid pain medications, including opioid use disorder, overdose, and death (20). Although opioids have been shown to be beneficial in managing acute pain following surgery and other chronic pain conditions, there may be a smaller role for these drugs in managing CAP due to effectiveness and associated risks (3,21).

The causes of CAP can be variable, ranging from systemic diseases and abdominal wall pain to functional disorders, such as irritable bowel syndrome or functional dyspepsia (22). This broad differential diagnosis can be overwhelming for providers who are presented with a patient without a clear etiology for their pain. Patients who present with CAP have high uses of the ED and can be subjected to extensive workups that are costly and may not lead to a diagnosis. It should be noted that a patient's history, including past surgical history, and physical examination on presentation, are key clues in identifying inciting factors for pain. We would like to call attention to the role of surgical history in the development of chronic pain. In a survey of patients attending chronic pain clinics in Scotland and England, approximately 20% of patients attributed surgery as one of the causes of their chronic pain (23). Of the patients in our study, 56% identified previous abdominal surgery as the likely inciting factor for CAP. Following surgery, patients may develop adhesions and scarring that may lead to pain. Other causes of CAP not attributed to previous abdominal surgery included pancreatitis, spinal cord injury, pregnancy complications, endometriosis, irritable bowel syndrome, costochondritis, cancer-associated pain, sarcoidosis, and anterior cutaneous nerve entrapment syndrome (ACNES).

ACNES, also referred to as chronic abdominal wall pain, is an often overlooked cause of CAP and accounts for 10% of patients with CAP in the outpatient setting (24-26). Abdominal pain due to ACNES occurs because of the entrapment of the cutaneous branches of the sensory nerves supplying the abdominal wall, resulting in localized pain. This can be due to different mechanical abnormalities, such as fibrosis, scarring, and tissue edema, which can all result from abdominal surgery (24). Pregnancy and oral contraceptives are also risk factors for the development of ACNES and may help explain why it is more common in women. Providers should be aware of this condition as a differential diagnosis for CAP and can look for a Carnett sign on the physical examination to indicate abdominal wall pain. Pain with palpation while a patient is in the supine position with their chin lifted to their chest and abdomen flexed indicates a positive Carnett sign, indicating pain that is likely derived from the abdominal wall. No increased pain with palpation in this position is a sign that the source is likely visceral pain (24). Current treatment options for ACNES include analgesic agents and trigger point injections that can help confirm the diagnosis and somatosensory origin of pain.

Our study provides support for the efficacy of TAP blocks in managing CAP and reducing related visits to the ED. Of the TAP block procedures performed, 81.9% improved pain scores for patients with CAP. In addition, the pain relief lasted 108 days on average, and some patients continue to have ongoing pain relief (Table 6). In addition to providing pain relief, the TAP block can serve as a diagnostic procedure for patients with an undetermined etiology of pain. If the TAP block succeeds as relieving pain, it is likely that the pain is due to somatosensory wall pain. The blocks can be repeated every 3 months for pain relief, although some patients may experience lasting relief. A PubMed search for "chronic abdominal pain" and "transversus abdominis plane" returns only 3 results: 2 case reports, and the retrospective review discussed previously. In one case report, a patient was treated with intermittent TAP blocks for chronic colitis and found this useful for managing chronic pain (27). The other case report found that placement of a TAP catheter with 0.25% bupivacaine was effective in eliminating CAP in a patient during pregnancy (28). An additional case report described a woman aged 60 years with an extensive history of abdominal surgery and CAP refractory to pain medications. She received 2 TAP blocks with almost complete resolution of pain for 2 weeks. The authors hypothesized that neurostimulation of the T6 to L1 nerves could provide longer-term relief, and the patient's abdominal pain was still effectively managed at 3 months during follow-up (29). This provides an example of another potential treatment option for patients who do not receive satisfactory pain relief from other therapeutic modalities.

There are few published research studies on the use of TAP blocks for the treatment of CAP, and we present a retrospective chart review on the efficacy of this procedure for 92 patients. TAP blocks have a good safety profile and should be considered as a treatment option for patients with CAP. As such, TAP blocks are a reasonable option for pain control for patients with CAP, reducing ED visits for abdominal pain, and avoiding side effects and addiction associated with opioid pain medications.

Limitations

This study was a retrospective chart review that was dependent on the accuracy of reporting in our electronic health records. Patients received TAP blocks after other forms of pain management failed. Because this was a retrospective study, we were unable to compare to a control group to assess for a placebo effect. Multiple physicians, who may have had slight variations in technique and steroid injection composition, performed procedures.

Conclusions

TAP blocks with steroid injections should be considered as a treatment option for patients with somatosensory CAP resistant to other therapeutic methods. The block can serve as a diagnostic value; it can provide a guidance to the management of abdominal pain. If the block improves pain, this typically points to somatic and not visceral pain, which can guide practitioners to the next steps in management.

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