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Transversus Abdominis Plane (TAP) Block Education

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Keywords

transversus abdominis plane, opioids, regional anesthesia

Disciplines

Nursing

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Severe pain in the genitourinary (GU) population after abdominal surgery remains a major problem, that can impact surgical healing, recovery of bowel function, and prolong hospital length of stay. The current gold standard for managing postoperative pain includes opioid administration, such as fentanyl, hydromorphone and morphine. Inadequate pain control and excessive opioid use after abdominal surgery are associated with numerous adverse effects. The utilization of transversus abdominis plane (TAP) blocks during abdominal surgeries have shown to provide postoperative pain relief and decrease opioid consumption. A large government hospital is implementing TAP blocks in their GU division. Prior to their implementation, the Doctoral of Nursing Practice (DNP) candidates facilitated a didactic and simulation-based teaching about TAP blocks to improve providers knowledge and competency. This evidence-based practice project followed a descriptive design that consisted of a pre-test, immediate post-test, and a one-month post-test. Eleven study participants were analyzed using repeated measures across three time points. A statistically significant increase in overall knowledge scores (p = 0.023) was observed. Education and simulation prior to implementation of a new clinical intervention is vital for its success. The increase in median test scores demonstrates the success of the project's design and sheds light on its future implications for robust knowledge dissemination.

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Severe pain after abdominal surgery is an ongoing problem. In 2014, 17.4 million hospital visits in the United States resulted in nearly 22 million surgical procedures (Steiner, Karaca, Moore, Imshaug, & Pickens, 2018). Abdominal surgery encompassed approximately 16%, or nearly 3.5 million of these procedures (Steiner et al., 2018). Postoperatively, patients undergoing abdominal surgery report on average a four to six out of ten on a numeric pain rating scale (Bacal, Rana, McIsaac, & Chen, 2018). Comparatively, patients undergoing craniotomies report an average pain score of two out of ten, and those who have had mastectomies report a three out of ten (Bacal et al., 2018). Contemporary pain management strategies for patients receiving abdominal surgeries consist of systemic opioid administration, subcutaneous local anesthetic infiltration and epidural catheter placement (Bacal et al., 2018). Opioid administration after surgery is associated with numerous adverse side effects such as sedation, immobility and prolonged hospital stays. Additionally, opioid use places the patient at risk of physical dependence and psychological addiction. Moreover, in certain patient populations, epidural catheter placement is not warranted, or may even be contraindicated due to anatomical abnormalities.

A large government-run medical institution at the forefront of global scientific research is interested in exploring alternative pain management strategies for their abdominal genitourinary (GU) surgical patients with contraindications to traditional neuraxial anesthesia secondary to disease pathology. This hospital cares for a multitude of patients with rare diseases such as Von Hippel-Lindau (VHL) syndrome. VHL is a familial cancer predisposition syndrome associated with various malignant and benign neoplasms, mainly of the retina and cerebellum along with spinal and renal cells (Kaelin, 2007). Serial partial nephrectomies for renal tumor debulking are often required for patients with VHL. These patients present unique anesthetic challenges due to the presence of spinal hemangioblastomas, or blood vessel tumors in their spine, which pose a contraindication to thoracic epidurals as a principal pain management modality. Thus, it is of particular interest to this facility to explore alternative and efficacious pain management strategies for their unique patient population. Moreover, broad utilization of the TAP block has the potential to impact global pain management strategies as well as benefit a wide-range of patients.

Significance

Controlling pain is critical for patient's recovery, decreasing length of stay, and reducing hospital costs. Current modalities for pain management after abdominal surgeries include opioids, epidural analgesia and subcutaneous local anesthetic. Among the modalities, opioids, such as fentanyl, hydromorphone and morphine remain the drugs of choice for postoperative pain relief (Carrié & Biais, 2014). However, opioid usage is associated with various adverse outcomes. Following abdominal surgery, patients with opioid-associated ileus will have an increased length of stay ranging from 4.8 to 5.7 days, resulting in a total cost from $9,945 to $13,055 and 30-day readmission rate from 2.3% to 5.3% when compared to patients without ileus (Gan et al., 2014).

In spite of a well-documented analgesic effect, postoperative opioid use comes with additional adverse effects such as nausea, vomiting, respiratory depression, gastrointestinal paralysis, and decreased level of consciousness (Liu, Xie, Zhang, & Chai, 2018). Furthermore, opioids may lead to impaired immune function. In vitro and animal studies have shown the exogenous opioids such as fentanyl and morphine have been found to impair the function of macrophages, natural killer (NK) cells, T-cells and weaken the gut barrier (Plein & Rittner, 2017). Fentanyl has been seen to block the cytotoxic properties of NK cells. As NK cells play a vital role in killing tumor cells, potential implications of opioids on cancer progression may be of concern (Zajaczkowska et al., 2018). Lastly, chronic opioid use exposes patients to physical dependency as well as the potential for misuse and abuse (Kalkman, Kramers, van Dongen, van den Brink, & Schellekens, 2019). The negative impact of poorly controlled pain and excessive opioid consumption can put tremendous burden on the patient's recovery as well as increase hospital inpatient costs. Therefore, reducing pain and decreasing opioid usage has the potential to reduce hospitalization costs, patient length of stay, and opioid-related adverse effects.

An evidence-based practice solution to mitigate this problem is the utilization of transversus abdominis plane (TAP) blocks (Soltani-Mohammadi, Dabir, & Shoeibi, 2014). Through the use of landmark or ultrasound guided techniques, a local anesthetic agent is deposited into the transversus abdominis plane; the plane located between the internal oblique and transversus abdominis muscles within the abdomen. Blocking sensory innervation to the abdominal wall has allowed surgical patients to experience decreased postoperative opioid requirements and improved pain scores (Bacal et al., 2018). A meta-analysis conducted by Liu et al. (2018) assessed the effectiveness of TAP blocks for pain control following colorectal abdominal surgery. This study found that TAP blocks reduced pain intensity and decreased postoperative opioid consumption (Liu et al., 2018). A systematic review of 57 randomized control trials (RCTs) conducted by Ma, Duncan, Scarfe, Schumann, and Cameron (2017) found similar results. This study reviewed a variety of abdominal surgeries, further cementing TAP blocks as an efficacious pain treatment modality. Although the literature supports the general use of TAP blocks for abdominal surgery, there existed no meta-analysis or systematic review pertaining specifically to their use in the GU patient population. Therefore, it was of importance to this project to perform a more focused review of the literature to investigate TAP block efficacy in this population.

Literature Review

In order to examine the effect of TAP block on postoperative pain scores, a literature search was conducted in May 2019 in Pubmed, Embase, Cinahl, and Scopus. The search terms used included genitourinary (GU, urolog*) AND abdominal surger* (laparoscopic abdominal surger*, robotic assisted abdominal surger*) AND transverse abdominis plane block (TAP block) AND pain (opioid* OR analgesia OR opiate*). The search was limited to articles published in English and no other exclusion criteria were applied.

A total of 72 articles were identified through the comprehensive database searches. A total of ten additional articles were added through cross-referencing meta analyses and systematic reviews that presented in the initial database search. All articles were imported into RefWorks and five duplicates were removed. A total of 77 articles were screened. After screening titles and abstracts, 44 articles were excluded. Articles that did not pertain to abdominal or genitourinary surgeries were excluded. Additionally, articles regarding other regional modalities that were not TAP blocks were excluded. Thirty-three articles met inclusion criteria as they pertained to major abdominal surgeries and examined the utilization of TAP blocks and their role in patient pain outcomes and/or postoperative opioid consumption. These 33 articles were eligible for full-text analysis. After reading the full-text articles, 19 were excluded with reasons. Figure 1 illustrates the selection process through a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009). A final 14 studies were selected to be included in the table of evidence as shown in Table 1.

The final 14 articles were read by two independent researchers and rated for their quality of evidence using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach as outlined by Guyatt et al. (2011). Any disagreements in quality assessment was handled by a third researcher and the level of evidence was settled by the majority. Quality was rated as very low, low, moderate, or high according to GRADE.

In evaluating the body of evidence that pertains to the question of interest, an overall quality rating was designated. Through utilization of the aforementioned GRADE process, the authors of this paper deemed the quality of this body of evidence as “high.” Our final review consisted of 11 RCTs, one non-randomized control trial, and two observational studies. According to GRADE, RCTs start as high quality of evidence while observational studies start as low quality of evidence. Our body evidence therefore started as “high.” Articles could be rated higher based on a large effect size, a dose-response gradient, and if all plausible confounding variables reduce a demonstrated effect. However, no articles were rated higher by the independent researchers. Some articles were rated lower based on risk of bias, inconsistency, indirectness, imprecision, and publication bias. Despite the concerns, both independent reviewers felt that the evidence was strong enough to not GRADE the body of literature down. The overall “high” designation given to our body of evidence implies a strong sense of fidelity of its respected findings. The GRADE recommendation reflects our assessment that the evidence reflects its true effect.

Of these 14 articles, 10 found the utilization of TAP Blocks in the GU surgical patient population resulted in a statistically significant reduction in postoperative pain scores, postoperative opioid consumption or both. The remaining four articles found no reduction in postoperative pain scores or opioid consumption. A multimodal analgesic approach aims to provide adequate analgesia while decreasing opioid consumption and subsequently mitigating the undesirable side effects that are associated with opioid use. This review suggests that the TAP block is a safe procedure that can provide satisfactory analgesia to genitourinary patients. More research is needed to determine the appropriate timing of TAP block administration and the efficacy of any additional adjuncts to the local anesthetic solution.

Project Aims

The use of TAP blocks in the GU patient population to reduce postoperative pain and opioid consumption is supported by the literature. The aim of this project is to increase practitioner knowledge regarding TAP blocks and to increase practitioner competence in performing this procedure. Since this technique is not routinely utilized at the facility, a knowledge gap was identified among practitioners. To address this knowledge gap, the Doctoral of Nursing Practice (DNP) candidates implemented an educational intervention. This student-led intervention consisted of a presentation of a student-prepared educational video alongside a hands-on simulation session. Practitioners who participated in this project included anesthesiologists and certified registered nurse anesthetists (CRNAs).

Methods

The large government hospital will be implementing TAP blocks in GU patients undergoing major abdominal surgery in an effort to control postoperative pain through a multimodal approach and reduce opioid consumption. The clinical research center has 200 inpatient beds and 12 operating rooms. The final sample included 11 anesthesia practitioners, which encompassed CRNAs and anesthesiologists. A student-led educational intervention was performed at the facility. All participants completed a pretest, immediate post-test, and one-month post-test as well, as a hands-on simulation session. All study participants' results were matched across the three time points.

Intervention

The DNP group utilized the The Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) Model to design their intervention. The JHNEBP Model provides a schematic to ensure that the latest research findings and best practices are quickly and appropriately incorporated into patient care (Dearholt & Allan, 2017). Using the Practice question, Evidence, Translation (PET) framework the JHNEBP Model demonstrates how to incorporate best evidence into clinical practice rapidly (Dearholt & Allan, 2017). The practice question that was posed asked how to improve pain after abdominal surgery using opioid-sparing techniques. Through a comprehensive literature search, the DNP group found the use of TAP blocks to be supported in the literature. The goal of the DNP group was to translate this evidence at the local institution and ensure the incorporation of TAP blocks into their standard of care.

To ensure the success of providers in performing a new technique, Miller's Pyramid of clinical competence was utilized as a framework. The goal of the DNP group was to facilitate the progression of anesthesia providers from the base of the pyramid, which signifies knowledge of a technique, to the top of the pyramid, in which a provider is able to independently perform said technique (Miller, 1990). This is in congruence with the Theory of Planned Behavior, which states that an individual is more likely to perform a given behavior if they feel that they are able to competently perform the behavior (Ajzen,1991). Thus, the primary educational intervention was designed to advance knowledge into practice. The primary intervention consisted of both video technology and simulation education, constructed to address gaps in knowledge as well as to strengthen provider skillset and improve confidence, making them more likely to perform this technique independently.

To develop the educational intervention, a regional block expert was recruited. The regional block expert's extensive training in the field of regional anesthesia made them a qualified expert in teaching this technique. The train-the-trainer model is widely used in healthcare and is effective in increasing the trainees knowledge and skill in both content and delivery (Lane & Mitchell, 2013). This was put into practice in that the DNP group members first learned the technique while simultaneously learning how to teach others the technique. In addition, a Coursera certification course offered by the University of Michigan, titled "Instructional Methods in Health Professions Education" was obtained. This course provided education on interdisciplinary ways to improve objective teaching skills to healthcare professionals. The project members then developed an evidence-based, educational intervention which included the indications for use, instructions on proper technique , and associated complications of TAP blocks.

Measures

This study utilized a pre-test, immediate post-test, and one-month post-test design. This design was chosen to assess baseline provider knowledge, then subsequently to assess the effectiveness of the educational intervention, as well as long-term knowledge retention. Moreover, this design allowed the same practitioner to be tracked along three different time points. Anesthesia practitioners involved in the care of GU patients receiving TAP blocks at the specific institution were identified and included in the sample size. All participation was voluntary and no financial compensation was provided. Two separate evaluation methods were used to measure the effectiveness of the educational intervention, a knowledge assessment questionnaire and a competency assessment tool. First, a questionnaire, "Knowledge and Confidence Assessment," that was developed by O'Driscoll et al. (2018), was distributed to the providers via an email listserv to obtain baseline provider knowledge (see Figure 2). Next, the DNP group members traveled to the institution to conduct an in-person education session. Education was provided through the educational video as well as through the demonstration of proper TAP block administration technique on an anatomical simulation model: a Blue Phantom TAP block ultrasound training model manufactured by CAE Healthcare. In the literature, it is clear that simulation-based sessions increase providers competency, knowledge and confidence in performing peripheral block procedures (Udani, Kim, Howard, & Mariano, 2015). This session included time for learners to practice TAP blocks on the simulation models. During this session, two DNP group members evaluated provider competency in performing TAP blocks using an evidence-based tool, "The Ultrasound-Guided Regional Anesthesia Competency Assessment tool," adapted from O'Driscoll et al. (2018, see Figure 3 and Figure 4), which is a valid and reliable tool. Lastly, to measure the effectiveness of the video educational intervention, the knowledge-based questionnaire was re-distributed immediately after the training as well as four weeks following implementation. Post-intervention quantitative data compared to pre-intervention quantitative data identified knowledge retention and the effectiveness of the didactic and simulation teaching session. Data was de-identified and reported in the aggregate.

Results

Data was collected and imported into Excel, and statistical analysis was performed using RStudio software (2019). Scores were reported as either correct or incorrect. Each participant was asked to rate their level of confidence for each survey question. Confidence intervals were scored from 0 to 100 percent. If a response to a question was omitted, the data was marked as incorrect or zero. Participant demographic characteristics were recorded and analyzed using descriptive statistics. The data set was not normally distributed, therefore nonparametric statistics were utilized. The Friedman test was used to compare repeated measures within individual median knowledge scores and median confidence interval scores across all three time points. Additionally, the Friedman test overall *p* value is reflective of the median score changes within the group. A $p < .05$ was used to determine statistical significance. The competency scores that were acquired following the in-person simulation were analyzed using descriptive statistics. Questions 12 and 13 were omitted on the competency assessment tool since a nerve stimulator monitor was not used during the simulation session (see Figure 4).

Eleven participants completed the pre-test, immediate post-test, one-month post-test, and simulation session. Every participant was part of the anesthesia department and holds a doctoral degree. There were eight females and three males. Ten individuals have greater than 10 years of experience and one individual has between 5-10 years of experience. There were four individuals between the ages of 25-44, four individuals between 45-54, and three individuals who are greater than 55 years old. The participants' demographic information is displayed in Table 2.

Among the 11 participants, there was a statistically significant difference in the distribution of participant test scores over time using the Friedman test, $\chi^2 = 7.5$, $p = 0.023$. Post hoc pairwise comparisons using Wilcoxon signed-rank indicated a significant increase in the median baseline score from 75 [69, 88] to a median post-test score of 88 [81, 100], $p = 0.048$, as well as between baseline and follow up with a median of 88 [88, 100], $p = 0.019$ (see Figure 5). However, no statistically significant difference was observed between immediate post-test and one-month post-test scores, indicating a degree of sustained knowledge retention at time of retesting (see Figure 5). No statistically significant difference was observed in participants' confidence across time points using the Friedman test, $\chi^2 = 4.2$, $p = 0.121$ (see Figure 6).

Over half of the simulation participants were deemed clearly superior, n=6, 54.5%, in performing a TAP block using ultrasound (see Table 3). Minimal assistance was provided during the simulation session. Ten participants (90.9%) were deemed competent in performing TAP blocks with minimal assistance using the validated assessment tool. There were 20 steps evaluated on the Assessment Competency Tool for a total maximum score of 40. Out of the 11 participants, M =31.36, SD = 3.23 (see Table 3).

Discussion

Successfully implementing a new evidence-based project in a facility is a complex process. Educational materials that cater to auditory, visual, and kinesthetic learners influence knowledge and confidence in performance. After analyzing the results of the questionnaire, provider confidence interval scores were not statistically significant. However, there was a statistically significant increase in median test scores from pre-test to immediate post-test, indicating an improvement in provider knowledge subsequent to the educational intervention. Moreover, there was a statistically significant increase in the median pre-test results to median one-month post-test results which demonstrated knowledge retention.

Overall simulation scores demonstrated that all practitioners possessed baseline competence in performing TAP blocks. All participants scored a zero on assessing discomfort during the simulation, which is a limitation of performing the study on the Phantom Model. Since the study is specific to TAP blocks on simulation models, no national studies were available for comparison of data. The hands-on simulation gave practitioners time to become familiar with the equipment and key steps of the procedure. The return demonstration that was facilitated during the simulation is consistent with the “Shows How” step on Miller’s Pyramid of Clinical Competence. The providers involved in the educational intervention transitioned from a cognitive portion of the pyramid to a behavioral one, in which all providers demonstrated successful baseline competence (Miller, 1990). The “Shows How” step requires that a learner successfully integrates knowledge and skills and deems a clinician competent in a specific task (Miller, 1990). Ten clinicians that participated in the complete educational intervention successfully transitioned to the “Shows How” portion of the pyramid. The “Shows How” component is foundational to the final step of the pyramid, the “Does” step in which the clinician integrates the performance into their actual practice (Miller, 1990). Moreover, based on the Theory of Planned Behavior, an individual's conviction on their ability to execute a behavior is in direct relation to their future actions (Ajzen,1991). Thus, the improvement in knowledge as well as the baseline clinical competence in performing TAP blocks suggests that providers will be more likely to implement the technique if the opportunity arises. After the video presentation and simulation session, the group received positive feedback from the participants. The video is easily accessible to practitioners at the institution and allows an opportunity for participants to continue to enhance their knowledge, competency, and confidence.

In the future, the educational video can be utilized to educate the nursing staff in the perioperative as well as the post-operative setting. Expansion of this project to include bedside nursing staff would provide rationale for performing TAP blocks, thus aiding in their delivery of more informed post-operative care. The education of perioperative and postoperative nursing staff is at the core of interdisciplinary, patient-centered care. Next, TAP blocks can be utilized in a number of abdominal surgeries, such as colorectal, gastrointestinal, and gynecologic services (Ma et al., 2017). A wide population of patients can benefit from this opioid-sparing technique and surgical providers across the hospital should be educated and trained to perform TAP blocks. Lastly, anesthesia providers should consider utilizing indwelling TAP block catheters for the continuous administration of local anesthetic. An indwelling catheter offers the potential to obtain prolonged postoperative analgesia which can be particularly beneficial for patients that undergo complex and open abdominal procedures (Bakshi, Mapari, & Paliwal, 2015).

Limitations

Our study has several limitations. A power analysis was not performed because the recommended sample size was not easily obtainable due to the limited number of anesthesia practitioners at the facility. Additionally, there was a loss to follow-up for the immediate post-test and one-month post-test. While 17 practitioners took the pre-test, only 11 completed all 3 components. Moreover, in the pre-test, the survey did not mandate a completion of the confidence interval field. As a result, participants left fields blank which prevented results matching across all three time points. Future studies may more accurately assess knowledge protocols by requiring participants to complete the survey in its entirety. Lastly, the pre-test and one-month post-test were conducted online while the immediate post-test was conducted in person on a paper document. The inconsistent survey material may have influenced the results since participants left fields blank, which were deemed as incorrect.

Conclusions

Pain, in association with surgery, is a problem that will require ongoing attention. The TAP block is a procedure proven to reduce postoperative pain scores and opioid consumption. Its proper implementation and application is essential for improving a multitude of patient outcomes. Recognition of a knowledge gap regarding TAP blocks at our institution necessitated an intervention. Through the utilization of an educational video, alongside an in-person simulation training, a statistically significant improvement in provider knowledge was observed. The increase in post-intervention median test scores provided evidence to the success of the project design and sheds light on its future implications for robust knowledge dissemination.

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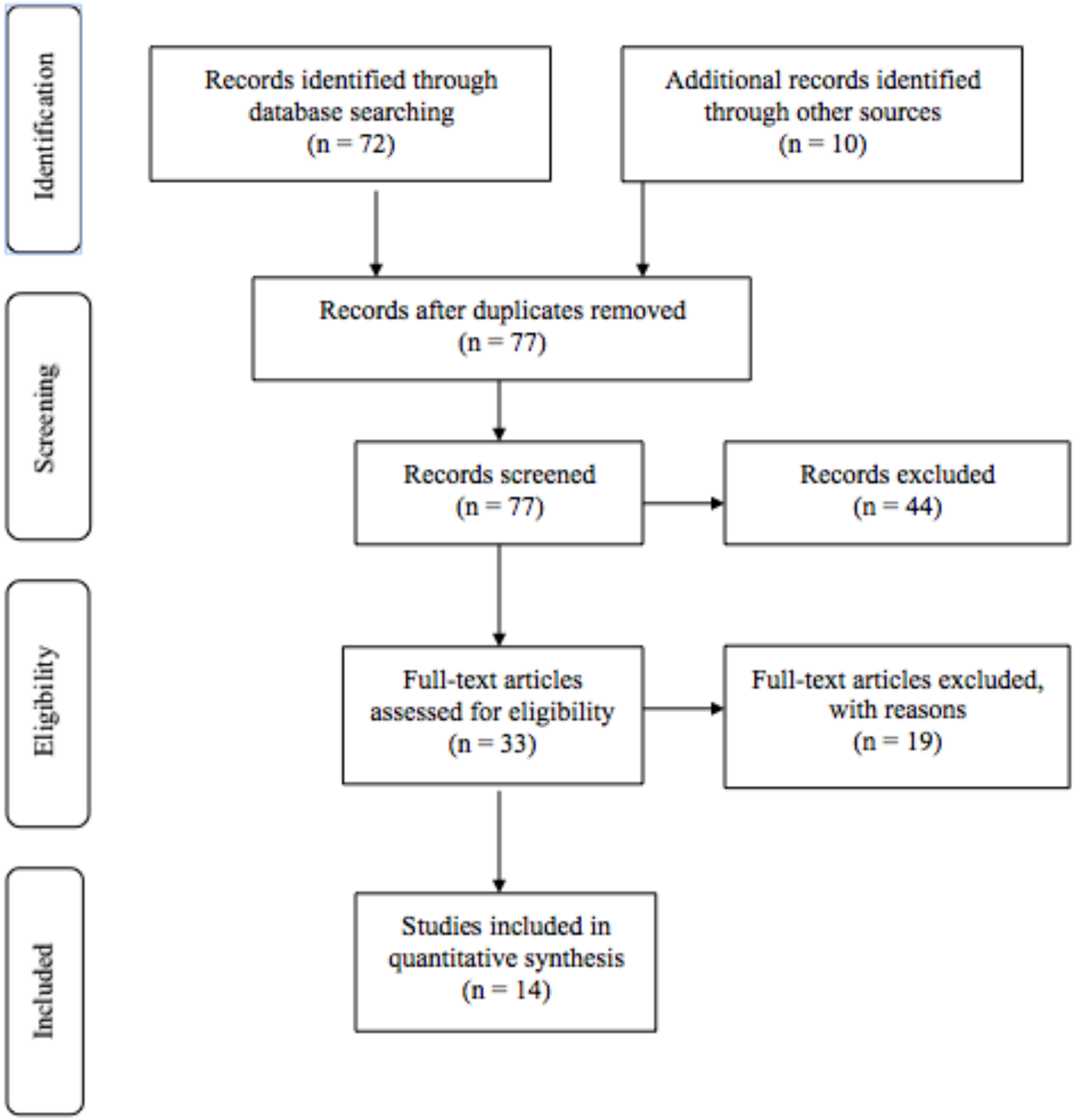

Figure 1. PRISMA flow diagram of article selection process. A final 14 articles were included in the quantitative synthesis. PRISMA = Preferred Reporting Items for Systematic Review and Meta-Analyses.

Table 1

Primary Evidence for TAP Block Effect on Postoperative Pain

Authors	Year	Study design	Study sample and setting	GRADE[a]
Freir, N. M., Murphy, C., Mugawar, M., Linnane, A., and Cunningham, A. J.	2012	Randomized control trial	65 adults with end-stage renal disease undergoing cadaveric renal transplantation at Beaumont Hospital in Dublin, Ireland	No quality concerns
Hosgood, S. A., Thiyagarajan, U. M., Nicholson, H. F., Jeyapalan, I., and Nicholson, M. L.	2012	Randomized control trial	46 patients undergoing laparoscopic donor nephrectomy at the University Hospitals of Leicester, United Kingdom	No quality concerns
Elkassabany, N., Ahmed, M., Malkowicz, S. B., Heitjan, D. F., Isserman, J. A., and Ochroch, E. A.	2013	Randomized control trial	32 patients scheduled for a retropubic radical prostatectomy at the Veterans Affairs Medical Center in Philadelphia, Pennsylvania	Indirectness concerns
Milone, M., Di Minno, M. N., Musella, M., Maietta, P., Iacovazzo, C., and Milone, F.	2013	Randomized control trial	33 patients undergoing retroperitoneal varicocele repair in Naples, Italy	No quality concerns

Note. TAP = transversus abdominis plane; GRADE = Grading of Recommendations, Assessment, Development, and Evaluation.
[a]The GRADE approach is a system for grading the quality of evidence. Articles were rated lower based on risk of bias, inconsistency, indirectness, imprecision, and publication bias. Articles were rated higher based on a large effect size, a dose-response gradient, and if all plausible confounding variables reduce a demonstrated effect.

Table 1

Primary Evidence for TAP Block Effect on Postoperative Pain

Authors	Year	Study Design	Study sample and setting	GRADE[a]
Parikh, B. K., Waghmare, V. T., Shah, V. R., Mehta, T., Butala, B. P., Parikh, G. P., and Vora, K. S.	2013	Randomized control trial	60 patients who underwent left sided retroperitoneoscopic donor nephrectomy at the IKDRC-ITS, Ahmedabad, Gujarat, India	No quality concerns
Skjelsager, A., Ruhnau, B., Kistorp, T. K., Kridina, I., Hvarness, H., Mathiesen, O., and Dahl, J. B.	2013	Randomized control trial	73 patients undergoing an open radical retropubic prostatectomy at the Copenhagen University Hospital, Denmark	No quality concerns
Aniskevich, S., Taner, C. B., Perry, D. K., Robards, C. B., Porter, S. B., Thomas, C. S., . . . Clendenen, S. R.	2014	Randomized control trial	21 patients undergoing laparoscopic removal of a single kidney for either tumor or living donor nephrectomy at Mayo Clinic, Jacksonville, Florida	Risk of bias, indirectness concerns
Soltani Mohammadi, S., Dabir, A., and Shoeibi, G.	2014	Randomized control trial	44 patients who were scheduled as kidney recipients at Dr. Shariati Hospital of Tehran University of Medical Services	No quality concerns

Note. TAP = transversus abdominis plane; GRADE = Grading of Recommendations, Assessment, Development, and Evaluation; IKDRC-ITS = Institute of Kidney Diseases and Research Centre and Institute of Transplantation Sciences.

[a]The GRADE approach is a system for grading the quality of evidence. Articles were rated lower based on risk of bias, inconsistency, indirectness, imprecision, and publication bias. Articles were rated higher based on a large effect size, a dose-response gradient, and if all plausible confounding variables reduce a demonstrated effect.

Table 1

Primary Evidence for TAP Block Effect on Postoperative Pain

Authors	Year	Study Design	Study sample and setting	GRADE[a]
Farag, E., Guirguis, M. N., Helou, M., Dalton, J. E., Ngo, F., Ghobrial, M., . . . Goldfarb, D.	2015	Retrospective case-control study	63 adult renal transplant recipients, at the Cleveland Clinic in Ohio	Risk of bias concerns
Azawi, N. H., Mosholt, K. S. S., and Fode, M.	2016	Retrospective case-control study	82 patients who had a radical nephrectomy at the department of urology, Roskilde Hospital in Denmark	Risk of bias concerns
Maquoi, I., Joris, J. L., Dresse, C., Vandenbosch, S., Venneman, I., Brichant, J. F., and Hans, G. A.	2016	Randomized control trial	101 patients undergoing open prostate surgery in Liege, Belgium	Risk of bias concerns
Shaker, T. M., Carroll, J. T., Chung, M. H., Koehler, T. J., Lane, B. R., Wolf, A. M., and Wright, G. P.	2018	Randomized control trial	67 patients who were scheduled to undergo major abdominal surgery in Grands Rapids, Michigan	Indirectness concerns

Note. TAP = transversus abdominis plane; GRADE = Grading of Recommendations, Assessment, Development, and Evaluation.
[a]The GRADE approach is a system for grading the quality of evidence. Articles were rated lower based on risk of bias, inconsistency, indirectness, imprecision, and publication bias. Articles were rated higher based on a large effect size, a dose-response gradient, and if all plausible confounding variables reduce a demonstrated effect.

Table 1

Primary Evidence for TAP Block Effect on Postoperative Pain

Authors	Year	Study Design	Study sample and setting	GRADE[a]
Cacciamani, G. E., Menestrina, N., Pirozzi, M., Tafuri, A., Corsi, P, De Marchi, D.,…Artibani, W.	2019	Randomized control trial	100 patients undergoing RARP at Azienda Ospedaliera Universitaria Integrata in Verona, Italy	No quality concerns
Shahait, M., Yezdani, M., Katz, B., Lee, A., Yu, S., and Lee, D.	2019	Retrospective non-randomized control trial	206 consecutive patients who were scheduled for RARP in Philadelphia, Pennsylvania	No quality concerns

Note. TAP = transversus abdominis plane; GRADE = Grading of Recommendations, Assessment, Development, and Evaluation; RARP = robot-assisted radical prostatectomy.
[a]The GRADE approach is a system for grading the quality of evidence. Articles were rated lower based on risk of bias, inconsistency, indirectness, imprecision, and publication bias. Articles were rated higher based on a large effect size, a dose-response gradient, and if all plausible confounding variables reduce a demonstrated effect.

Liposomal Bupivacaine (Exparel) and Transversus Abdominis Plane (TAP) Blocks Pre-Education Knowledge and Confidence Assessment

For each of the following multiple-choice questions, please select the most correct answer *and* then indicate the level of confidence with which you made your selection for questions 2-10.

This survey is anonymous and is intended to improve clinical practice through education.

1. Regional anesthesia that I provide is based on current evidence.
   a) Strongly disagree b) Disagree
   c) Neither agree nor disagree d) Agree
   e) Strongly agree

2. Our hospital utilizes appropriate regional anesthesia techniques for appropriate patient populations.
   a) True b) False

0% 10 20 30 40 50 60 70 80 90 100%
No Confidence — Moderate Confidence — Complete Confidence

3. The total dose of Exparel is ______ mg and is diluted with a total of ______ mL of ______.
   a) 266 mg/ 30 mL/ sterile saline
   b) 150 mg/ 40 mL/ sterile water
   c) 35 0mg/ 10 mL/ sterile saline
   d) 50 mg/ 20 mL/ sterile saline

0% 10 20 30 40 50 60 70 80 90 100%
No Confidence — Moderate Confidence — Complete Confidence

4. Exparel has a special ______ formulation that allows it to be delivered as a ______.
   a) liposomal; continuous infusion
   b) protein; continuous infusion
   c) liposomal; single shot
   d) protein; single shot

0% 10 20 30 40 50 60 70 80 90 100%
No Confidence — Moderate Confidence — Complete Confidence

5. The onset of action of Exparel is ______.
   a) 5 minutes b) 40 minutes
   c) 90 minutes d) 120 minutes

0% 10 20 30 40 50 60 70 80 90 100%
No Confidence — Moderate Confidence — Complete Confidence

6. The duration of action of Exparel is ______.
   a) 4-6 hours b) 6-12 hours
   c) 12-24 hours d) 24-72 hours

0% 10 20 30 40 50 60 70 80 90 100%
No Confidence — Moderate Confidence — Complete Confidence

7. The transversus abdominis plane (TAP) is located between the ______.
   a) internal and external oblique muscles
   b) internal oblique and transversus abdominis muscles
   c) transversus abdominis and rectus abdominis
   d) external oblique muscles and aponeurosis

0% 10 20 30 40 50 60 70 80 90 100%
No Confidence — Moderate Confidence — Complete Confidence

8. TAP blocks inhibit nociception from distal spinal nerve receptors that innervate the ______.
   a) abdominal skin, abdominal muscles, and parietal peritoneum
   b) abdominal muscles and parietal peritoneum
   c) abdominal skin only
   d) none of the above

0% 10 20 30 40 50 60 70 80 90 100%
No Confidence — Moderate Confidence — Complete Confidence

9. Innervation is supplied to the abdominal wall from these spinal nerves:
   a) T4-T12 b) T6-T12
   c) T7-L1 d) T12- S3

0% 10 20 30 40 50 60 70 80 90 100%
No Confidence — Moderate Confidence — Complete Confidence

10. TAP blocks can be performed with the use of ultrasound.
    a) True b) False

0% 10 20 30 40 50 60 70 80 90 100%
No Confidence — Moderate Confidence — Complete Confidence

Figure 2. Knowledge Questionnaire. Adapted from "Implementation of an education program for an ultrasound-guided liposomal bupivacaine transversus abdominis plane (TAP) block protocol for open abdominal procedures," by O'Driscoll, L., Girolamo, R. G., Crerar, C., Williamson, W., Moore, C., Wofford, K., and Bonds, R. (2018), *American Association of Nurse Anesthetists, 86*(6), p. 482.

Item	Score				
	1	2	3	4	5
Preparation for procedure (monitors, IV access etc)	Did not organize well		Equipment generally organized		All equipment organized
Patient interaction	No rapport; patient unaware; no sedation		Rapport generally established		Strong rapport established and maintained
Asepsis (sterile gloves, site and probe cleansing)	Many errors in asepsis		Generally proper aseptic technique		Excellent aseptic technique
Respect for tissue	Use of unnecessary force		Carefully handles tissue, occasional unintentional damage		Consistently handles tissue appropriately
Time and motion	Many unnecessary movements		Some unnecessary movements		Economy of movements, maximum efficiency
Instrument handling	Repeated tentative and awkward movements		Occasional awkward move		Fluid movement, no awkwardness
Flow of procedure	Frequent stops, unsure of next move		Some forward planning with reasonable progression		Obviously planned course of procedure, effortless flow
Knowledge of procedure	Deficient knowledge		Knows all important steps		Familiarity with all aspects of procedure
Overall performance	Very poor		Competent		Clearly superior
Overall should the candidate pass/fail:					

Figure 3. Assessment Tools. Adapted from "Implementation of an education program for an ultrasound-guided liposomal bupivacaine transversus abdominis plane (TAP) block protocol for open abdominal procedures," by O'Driscoll, L., Girolamo, R. G., Crerar, C., Williamson, W., Moore, C., Wofford, K., and Bonds, R.(2018), *American Association of Nurse Anesthetists, 86*(6), p. 482. Copyright 2018 by American Association of Nurse Anesthetists.

	Assessment steps	Not performed	Performed poorly	Performed well
1	Patient positioning			
2	Placement of u/s machine for proper visualization			
3	Selection of correct transducer probe			
4	Correct settings for depth and gain			
5	Appropriate holding of probe			
6	Orientation to u/s screen in relation to sides of probe			
7	Correct identification of anatomy and target			
8	Use of Doppler function to rule out vasculature			
9	Needle alignment to probe			
10	Ability to maintain view of needle			
11	Efficiency in regaining needle image			
12	Recognition of proper nerve stimulation (if utilized)			
13	Ensure current is no less than 0.2 mA if nerve stimulator used			
14	Ask for aspiration to rule out intravascular injection			
15	Visualization of needle tip prior to injection			
16	Ask for 1-2 ml local anesthetic injection to rule out intraneural/intravascular injection			
17	Ask patient or assess for signs of discomfort			
18	Ask for aspiration every 5 ml increments of injection			
19	Recognition of proper needle position			
20	Perform appropriate needle tip adjustment			
21	Assessment of ease of injection			
22	Recognition of correct local anesthetic spread in relation to nerve.			

Figure 4. Assessment Tools. Adapted from "Implementation of an education program for an ultrasound-guided liposomal bupivacaine transversus abdominis plane (TAP) block protocol for open abdominal procedures," by O'Driscoll, L., Girolamo, R. G., Crerar, C., Williamson, W., Moore, C., Wofford, K., and Bonds, R. (2018), *American Association of Nurse Anesthetists, 86*(6), p. 482. Copyright 2018 by American Association of Nurse Anesthetists.

Table 2

Baseline Characteristics of Sample

	Participants (n=11)
Department Affiliation	Anesthesia (11) Surgery (0) Nurse (0) Urology (0) Missing (0)
Level of Education	Associates/Bachelors (0) Doctorate (11) Missing (0)
Age	25-44 (4) 45-54 (4) >55 (3) Missing (0)
Gender	Male (3) Female (8) Missing (0)
Years Experienced	<5 years (0) 5-10 years (1) >10 years (10) Missing (0)

Note. n = number of participants.

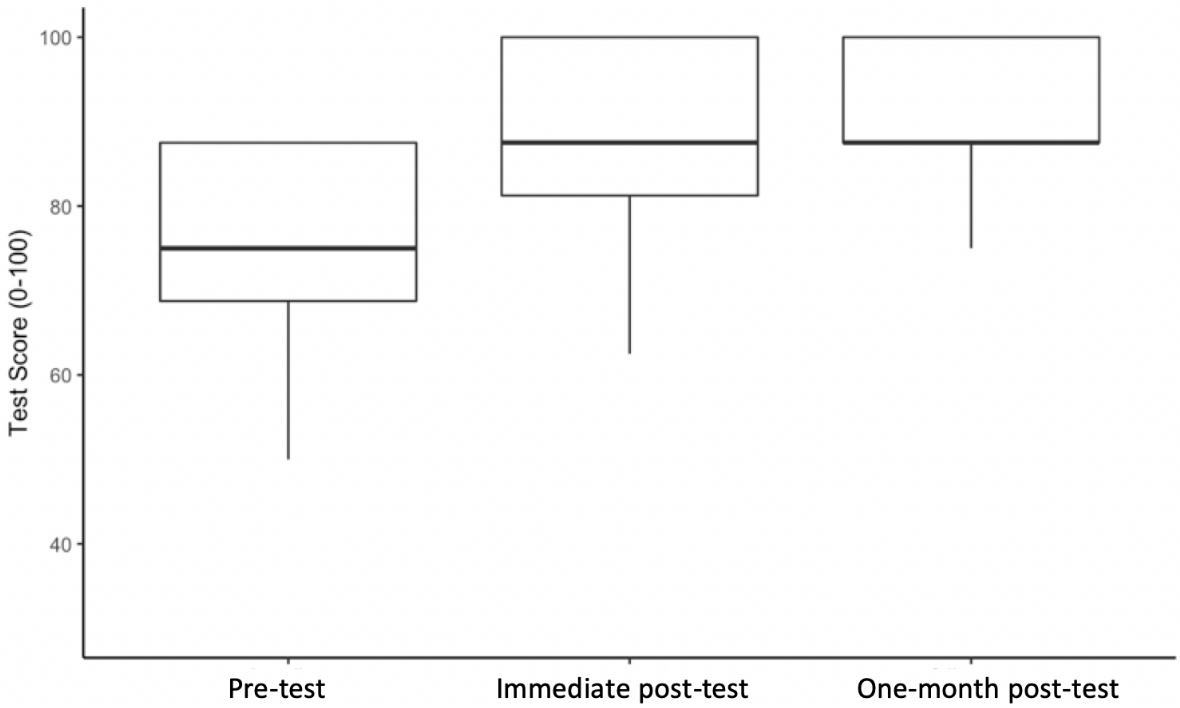

Figure 5. Comparison of the 11 individuals pre-test, immediate post-test and one-month post-test total score over time using the Friedman test. Thick black lines represent the median. Note the y-axis starts at 30.

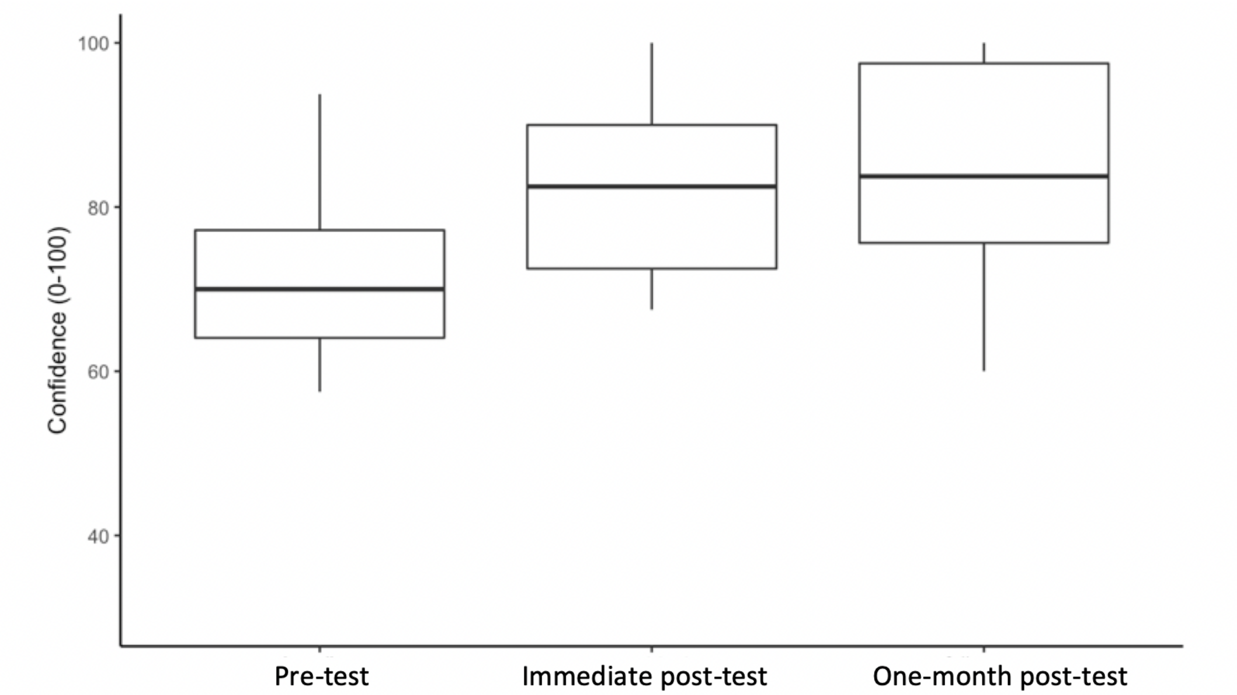

Figure 6. Comparison of the 11 individuals pre-test, immediate post-test and one-month post-test confidence score over time using the Friedman test. Thick black lines represent the median. Note the y-axis starts at 30.

Table 3

Validated instrument distributions (n=11)

Overall performance	n (%)
Clearly Superior	6 (54.5)
Competent	4 (36.4)
Very Poor	1 (9.1)

Note. n = number of participants.