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Education Intervention Regarding Utilization of the Quadratus Lumborum Block for Post-Operative Analgesia Following Abdominal Surgery

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Education Intervention Regarding Utilization of the Quadratus Lumborum Block for Post-Operative Analgesia Following Abdominal Surgery

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ABSTRACT

Background: Poor post-operative pain control is associated with patient dissatisfaction, contributes to a delayed recovery, and increases the incidence of post-operative morbidity. The conventional transversus abdominis plane block (TAPB) results in exerting analgesic effects on the muscle, skin, and parietal peritoneum of the anterior abdominal wall, providing somatic analgesia with little to no visceral blockade. The need for visceral blockade to provide optimal postoperative pain relief has led to a more posterior approach that involves injecting the anesthetic adjacent to the quadratus lumborum muscle. The quadratus lumborum block (QLB) results in the spread of local anesthetic solution along the endothoracic and thoracolumbar fascia into the paravertebral space. This space, surrounded by adipose tissue, results in delayed local anesthetic uptake into systemic circulation, leading to prolonged analgesia. Evidence suggests efficacy of the TAPB may be more limited, and that QLB implementation should be considered to provide optimal outcomes for all patients undergoing abdominal surgery.

Objectives: (1) To determine the more effective regional anesthesia technique as it relates to superior post-operative analgesia for patients undergoing abdominal surgery utilizing four databases: Cochrane, MedLine, CINAHL, and PubMed. This systematic review will serve as the basis for objective two. (2) To demonstrate an increase in knowledge in anesthesia providers pertaining to the utilization of the QLB for post-operative analgesia following abdominal surgery.

Methodology: Seven randomized controlled trials (RCTs) were evaluated in this systematic review containing a total of 469 surgical patients. The RCTs found that the QLB provided longer and more effective postoperative analgesia. A majority of the studies also found that patients who received the QLB required fewer opioid analgesics postoperatively, and had lower overall pain scores as compared to the patients who received the TAPB. With this information, a pre-test, educational module, and post-test were created for anesthesia providers to evaluate both baseline knowledge and knowledge growth.

Results: The statistical analysis between the pre-test and post-test showed an increase in provider knowledge. There was also an increase in the providers' likelihood to utilize the QLB for patients undergoing abdominal surgery.

Conclusions: The QLB provides superior pain management with a longer duration of post-operative analgesia, reduced total opioid consumption, and is associated with better overall pain scores than the TAPB after abdominal surgery. Continual implementation of this quality improvement project has the potential to improve the outcomes of surgical patients, ensure more optimal post-operative pain management, and decrease opioid use in patients undergoing abdominal surgery. Overall, the intervention was effective in increasing anesthesia providers' knowledge and confidence regarding the utilization of the QLB as an alternative to the TAPB.

INTRODUCTION

Description of the Problem

According to Meissner and Zaslansky[1] over 300 million surgical procedures are performed worldwide each year. Despite the fact that a majority of these operations improve quality of life, and are also necessary in the treatment of disease, negative repercussions from the surgical procedures can be experienced by patients. Most notably, pain associated with these procedures correlates with short- and long-term negative sequelae for patients, healthcare systems, and healthcare providers.[2] A commonly shared fear among surgical patients which must be necessarily addressed, and also treated appropriately, is pain. Moderate to severe pain, also considered by patients to be unacceptable post-operative pain, has an incidence reporting of between 30-80% on the first post-operative day.[1] Critically, inadequate post-operative pain relief can contribute significantly to morbidity and mortality, patient dissatisfaction with anesthesia, longer hospital stays and increased healthcare costs. Conversely, adverse physiologic effects can be experienced when treating patients with opioids alone. Thus, the treatment of post-operative pain requires a paradigm shift, specifically toward enhanced recovery after surgery (ERAS) protocols and the use of multimodal pain management. The goals are to target pain pathways at multiple sites, implement preventative analgesia, utilize appropriate regional anesthesia techniques, and minimize opioid requirements and consumption.

Clinical Significance

Unsatisfactory patient outcomes highlight post-operative analgesia quality concerns and the issue of pain. Patients, their families, and clinicians, view this as an important issue to address, as poor post-operative pain control, is associated with patient dissatisfaction, contributes to a delayed recovery, and increases the incidence of post-operative morbidity.[3] Patients undergoing abdominal surgery are also at risk for physiologic issues such as ileus, atelectasis, postoperative nausea vomiting (PONV), and myocardial ischemia; a reduction in physical

function including delayed ambulation; and psychological repercussions such as chronic patient states and depression.[4]

After abdominal surgery, post-operative pain management in current practice involves multimodal analgesics, such as patient controlled analgesia (PCA) using opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), along with regional anesthesia techniques, including ultrasound-guided transversus abdominis plane block. NSAID use is associated with an increased risk of bleeding, so their use is dependent on the individual patient's risk factors.[5] Additionally, post-operative opioids have associated adverse effects which limit their use including respiratory depression, a reduction in bowel motility, and longer-term use can lead to dependence and addiction.[5] Regional techniques such as the TAPB have a short average duration of action and thus the potential for ineffective analgesic effects. Thus, the utilization of quadratus lumborum block (QLB) to provide superior post-operative analgesia is the proposed intervention.

Background

The conventional TAPB, which was first described in 2001, results in exerting analgesic effects on the muscle, skin, and parietal peritoneum of the anterior abdominal wall. The TAPB therefore provides the desired somatic analgesia, with little to no visceral blockade. The need for visceral blockade to provide optimal postoperative pain relief has led to a more posterior approach that involves injecting the anesthetic adjacent to the quadratus lumborum (QL) muscle.[6] The posterior part of the iliolumbar ligament and the iliac crest, is the originating point of the QL muscle. It inserts on the 12th rib and the transverse processes of vertebrae L1–L5. Its function is to assist in lateral flexion of the lumbar spine. QLB results in the spread of local anesthetic solution along the endothoracic and thoracolumbar fascia into the paravertebral space.[7] This space, surrounded by adipose tissue, results in delayed local anesthetic uptake into systemic circulation as a result of the lower perfusion in adipose tissue. This leads to prolonged analgesia.[8-9] The comparison of pain scores at specified time intervals of 2, 4, 6, 12 and 24 hours, postoperative opioid consumption after 24 hours, and duration of post-operative opioid analgesia

will be analyzed and discussed. It is also important to mention that bupivacaine and ropivacaine at varying dosages are the most commonly utilized local anesthetics for these block techniques.[10]

The TAPB has played a critical role in opening doors for fascial plane blocks. Its simplicity and safety have improved access to regional anesthesia for patients across the globe. However, evidence suggests that its efficacy might be more limited than presumed.[8] QLB implementation should be considered for all patients undergoing abdominal surgery, to provide more optimal pain control, mitigate physiologic effects of poorly treated pain, minimize postoperative opioid consumption, and prevent adverse effects related to opioid use. The most significant difference between the two methods is the increased duration of the analgesic effect of the QLB, as compared to the TAPB.[10]

Quality Improvement Project Rationale

Many studies have shown that QLB is a novel regional anesthesia technique which can not only improve substantially, patient satisfaction, post-operative pain, and minimize opioid consumption, but can also achieve improved outcomes compared to TAPB along with mitigating its complications. This is considered to be the current standard of practice. The suggested hypothesis is that QLB will provide superior post-operative analgesia and demonstrate longevity in the duration of block. The purpose of this systematic review is to assess the efficacy of QLB versus TAPB on post-operative analgesia for patients undergoing abdominal surgery. The intended outcome is to determine the more effective regional anesthesia technique as it relates to superior post-operative analgesia. Outcome measures include cumulative opioid consumption, duration of post-operative analgesia, side-effect profiles of the blocks, postoperative pain scores, and clinical recovery (including length of hospital stay). This initiative will serve as a means to educate anesthesia providers regarding a superior regional anesthetic technique to address poor post-operative pain control after abdominal surgery including laparoscopic colorectal surgery, laparoscopic cholecystectomy, total abdominal hysterectomy, cesarean section, and lower abdominal surgery in children. One goal of this teaching plan would be to determine if the

implementation of an educational module related to the indications, techniques, and outcome measures of the QLB would make the anesthesia provider more inclined to utilize the QLB as opposed to the TAPB.

The following PICO was formulated: (P) In surgical patients presenting for non-emergent abdominal surgery (I) does an educational module displaying successful implementation of ultrasound-guided quadratus lumborum block (QLB) (C) compared to ultrasound-guided transversus abdominis plane block (TAPB) (O) increase the anesthesia providers' adoption of the quadratus lumborum block?

METHODOLOGY OF LITERATURE REVIEW

Search Strategy and Sources

A literature search was conducted to identify studies on patients undergoing abdominal surgery, who received either a quadratus lumborum (QL) block or a transversus abdominis plane (TAP) block for post-operative analgesia. To direct the search and format of the systematic review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist was used.[11] The quality and relevance of a systemic review is based on the research, and more specifically on any discoveries made, the clarity of the documentation, and the subject of the review itself.[11] Clinicians will find that the systematic review provides a practical tool when employing the PRISMA checklist.[11]

The search utilized Cochrane Database of Systematic Reviews, Medline (ProQuest), Cumulative Index of Nursing and Allied Health Literature (CINAHL), and PubMed electronic database. A PICO format question was used to help develop the key terms and concepts used to search each electronic database. The search terminology included (quadratus lumborum block), (QL block), (transversus abdominis plane block), (TAP block), (post-operative analgesia), (post-operative pain), (pain management), (abdominal surgery), (abdominal wall), and (abdominal muscles). The literature search and screening methodology is outlined below in a PRISMA flow diagram, which provides a visual representation of this systematic review screening process.[11] As

of 6 November 2020, the search was current. The Medline (ProQuest) database resulted in 51 articles, CINAHL revealed 28 results, and the PubMed database yielded 16 articles. A total of 95 articles were retrieved from all three databases. Duplicated articles were removed, leaving 45 articles for further evaluation.

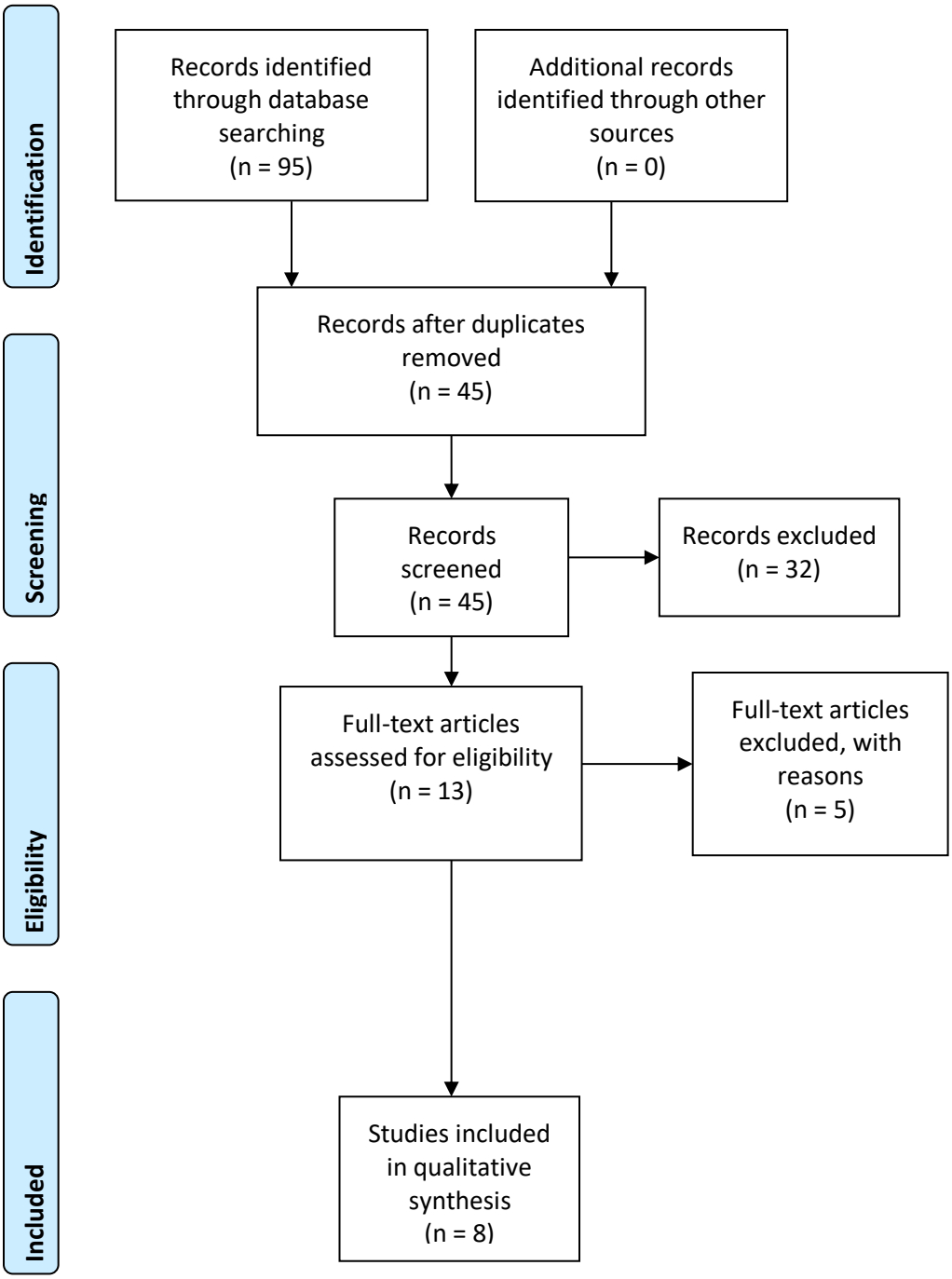


Figure 1. PRISMA Flow Diagram

Study Selection and Screening of Evidence

The preliminary PICO question was used to determine appropriate article titles and screening was initially performed by reading the titles and abstracts. The search strategies were not limited by study type and level of evidence. The retrieved citations were imported to EndNote and checked for duplicate articles. The full texts of the initially identified articles were read, eligible studies were selected and the risk of bias was assessed for each included article.[12] Full-text screening was conducted on the eight articles that were based on strict inclusion and exclusion criteria.

The inclusion criteria for the selection of the articles included articles published in the English language and only articles published within the last ten years (2010 to present day). Other inclusion criteria included selecting randomized controlled trials (RCTs) comparing the use of QL blocks and TAP blocks for analgesia after abdominal surgery. The studies should have patients or intervention groups undergoing general anesthesia for abdominal surgery, receiving either a TAP block or QL block. Other critical information forming part of the evaluation criteria include the primary outcomes of postoperative pain scores and/or post-operative opioid consumption, and secondary outcomes including post-operative nausea and vomiting (PONV) incidence and post-operative analgesia duration. Abdominal surgery for the systemic review included colorectal surgery, cholecystectomies, appendectomies, and hysterectomies. Post-operative pain was measured using a number of different pain scales, depending on the specific articles, including Numerical Pain Intensity Scale (NPIS), FLACC (Face, Legs, Activity, Cry, Consolability) scale, dynamic visual analog scale (DVAS), visual analog scale (VAS), and numeric rating scale (NRS).[1,3,4,5]

All other results were excluded from this systematic review. Several studies were excluded for numerous reasons including the studies that did not measure the correct primary outcomes (i.e., post-operative analgesia) and study designs other than RCTs (e.g., retrospective studies). Obstetrical studies in which patients were strictly undergoing cesarean section were also

excluded. For all other inclusion and exclusion criteria, refer to Table 1. Eight studies met the eligibility requirements and were included in this systematic review.

Table 1. Inclusion and Exclusion Criteria

Inclusion	Exclusion
Population: • Human • Male or Female • Pediatric or Adult surgical patients undergoing general anesthesia for elective abdominal surgery. • American Society of Anesthesiologists (ASA) physical classification of I-IV. Intervention • All studies comparing the use of QL block and TAP block for post-operative analgesia following abdominal surgery. Outcomes: • Significant improvement in post-operative analgesia as quantified by pain score and/or 24 h post-operative opioid consumption. • Secondary outcomes were noted when available and include: post-operative nausea and vomiting (PONV) incidence, post-operative analgesia duration, and less changes in hemodynamics with lower risk of complications and fewer side effects. Type of study: • English language • Full text • Randomized controlled trials (RCTs) • Single or double-blinded study • Prospective RCT • Systematic reviews of RCTs • Publication date 2010 to present	Population: • Obstetrical patients undergoing cesarean section. • Studies which included patients with an ASA classification of V and/or Emergent. • Studies which included patients currently using analgesics or who had current acute or chronic pain. Intervention: • Comparison to any other type of truncal or caudal regional block. Outcomes: • Anything other than studies comparing the efficacy of QL block vs. TAP block in patients undergoing abdominal surgery. Type of study: • Non-English language • Publication date pre-2010 • Dissertations/theses • Questionnaire • Animal studies • Duplicate studies

Collection, Analysis, and Data Items

A systematic method was used to extract the selected studies. The selected studies were vigilantly evaluated using the Johns Hopkins research evidence appraisal tool.[13] The John Hopkins' rating scheme includes 5 levels, based on strength of evidence. Level 1 involves RCTs and systematic reviews of RCTs, with or without meta-analysis.[13] Seven RCTs and one systematic review of RCTs with meta-analysis (Level 1) were included within this systematic

review. Level 2 includes quasi-experimental studies.[13] Level 3 are non-experimental studies and systematic reviews of a combination of RCTs and quasi-experimental studies, or qualitative studies.[13] Level 4 involves the opinion of respected authorities and nationally recognized experts on scientific evidence.[13] Level 5 includes literature reviews, quality improvement evaluations, and case reports.[13]

Johns Hopkins also assigns a quality rating of high, good, or low/major flaw to research evidence. 'High' quality (or level A) consists of evidence that is reliable, generalizable, has adequate control, a sufficient sample size for the study type, and definitive results.[13] An article receives a 'good' ranking (level B) if it has reasonably consistent results with an adequate sample size, some amount of control, and fairly definitive conclusions.[13] A 'low' standard ranking (or level C), has little evidence with findings that are inconsistent, an insufficient sample size, and conclusions that cannot be drawn.[13]

An evaluation table summarizing and categorizing each study's characteristics is displayed below (Table 2). The Johns Hopkins research evaluation tool was used to assign a ranking to each article.[13] Information obtained and evaluated from each RCT included: (1) study type and sample size, (2) surgery type, (3) local anesthetic (LA) utilized in QL block group versus TAP block group, (4) post-operative analgesia success based on pain score or opioid consumption, (5) secondary outcomes, and (6) guidelines provided. After inclusion and exclusion criteria a total of eight articles were utilized for this systematic review.

Table 2. Studies Included in the Appraisal

Author (Year) & Level of Evidence	**Study, Participants, & Setting**	**Surgical Procedure & Intervention**	**Primary Outcomes Measures**	**Secondary Outcomes Measured**	**Findings & Guidelines Provided**
Ellatif and Ahmed (2020)	Randomized controlled study, 34 pediatric patients (17	Laparoscopic appendectomy in children.	Changes of intraoperative hemodynamics and degree of	Total intraoperative fentanyl doses, 1st time to	Suggested that QL block provided superior postoperative

Level 1 Quality B	in each group). No significant differences between the two groups based on age (7-12 years), sex, weight, ASA score (I/II), and operative time.	0.5 mL/kg of 0.25% levobupivacaine was utilized in both the QL block group and the TAP block group.	pain assessed by VAS scale. In the first postoperative 4 h, the VAS score mean values were highly statistically significant lower for QL block group.	rescue analgesic, total paracetamol/ 24 h, hospital stay (days), PONV, and parent satisfaction.	analgesia as compared to TAP block. Limitations of study: laparoscopic appendectomy is minimally invasive surgery that seems to be associated with less postoperative pain compared with laparotomy, and the sensory block plane levels were not tested.
Oksuz *et al.* (2017) **Level 1 Quality A**	Randomized controlled trial, 50 pediatric patients. No significant differences between the two groups based on age (1-7 years), sex, weight, ASA score (I/II), operation type, or operation time.	Lower abdominal surgeries in children (e.g., hernia repair and orchiopexy). 0.5 mL/kg of 0.2% bupivacaine was utilized in both the QL block group and the TAP block group.	In the QL block group, the postoperative 30-minute and 1-, 2-, 4-, 6-, 12-, and 24-hour FLACC scores were lower compared with those of the TAP block group.	Number of patients who required analgesia in the first 24 h postoperatively, parent satisfaction scores, and postoperative complications (hemodynamic instability, PONV).	The QL block provided longer and more effective postoperative analgesia compared with the TAP block. Noted that a limitation of the study could be that measurements could not be taken of the sensory block level of the QL and TAP blocks applied to the children aged 1 to 7 years.

Kumar *et al.* (2018) **Level 1 Quality A**	Prospective, randomized, double-blinded study, with 70 adult patients (35 in each group), between 18 and 60 years.	Lower abdominal surgeries in adults. 20 mL of 0.25% ropivacaine (bilaterally) was utilized in both the QL block group and the TAP block group.	Duration for requirement of first rescue analgesic. The time elapsed before the requirement of first additional analgesic was significantly more in the QL block group than in the TAP block group.	Pain score (NPIS scale 0–10) at rest and total analgesic consumption (morphine in mg). There was a significant difference in pain scores between the two groups at the 1-, 2-, 4-, 6-, 8-, 10-, 12-, and 16-postoperative hours. There was no difference in the pain scores 24 h post-surgery indicating the wearing off of the block in both groups.	Patients who received QL block had a significant improvement in postoperative pain relief with reduced consumption of opioids.
Baytar *et al.* (2019) **Level 1 Quality A**	Single-center, prospective, randomized, controlled, and double-blinded study, with 120 adult patients (60 in each group), between 18 and 75 years old.	Laparoscopic cholecystectomy in adults. 0.3 mL/kg 0.25% bupivacaine (max 20 mL on each side) was utilized in both the QL block group and the TAP block group.	Intraoperative consumption of fentanyl, which was similar in both groups. There was no statistically significant difference in VAS and DVAS scores between patients in group TAP and group QL at 0, 1, 6, 12, and 24 h, nor was there any difference in the 24 h consumption of tramadol.	Hemodynamic parameters, other side effects (agitation, speech difficulties, drowsiness, mental changes, etc.), and patient and surgeon satisfactions.	Both blocks reduced postoperative VAS and DVAS scores and tramadol consumption to a similar level. Ultrasound-guided TAP block can be considered to have the advantages of easier application and a shorter time compared with QL block.

Huang *et al.* (2020) **Level 1 Quality A**	Randomized controlled trial, with 77 adult patients (QL block group = 38, TAP block group = 39), between 40 and 80 years old.	Laparoscopic colorectal surgery for colorectal cancer patients (elective laparoscopic radical resection). 20 mL of 0.375% ropivacaine (bilaterally) was utilized in both the QL block group and the TAP block group.	Cumulative morphine consumption 24 h postoperatively, which was significantly lower in the QL group than in the TAP group.	Cumulative morphine consumption, pain levels measured by VAS, time until earliest single PCA dose of morphine, patient satisfaction, PONV, intraoperative hemodynamics, intraoperative opioid requirement, discharge from hospital.	Pre-operative ultrasound-guided posteromedial QL block significantly lowered postoperative morphine consumption in the first 24 h postoperatively and decreased pain intensity at least from 8 to 24 h in the setting of multimodal analgesia, compared with a pre-operative lateral TAP block.
Deng *et al.* (2019) **Level 1 Quality A**	Randomized double-blind clinical trial study, with 74 adult patients, between 18 and 70 years old.	Laparoscopic colorectal surgery in adults. 20 mL of 0.375% ropivacaine (bilaterally) was utilized in both the QL block group and the TAP block group.	Cumulative consumption of PCIA sufentanil at stationary time intervals (6, 24, and 48 hours) postoperatively. Patients in the QLB group used significantly less sufentanil than TAPB group at 24 and 48 hours, but not at 6 hours.	Resting or moving (dynamic) NRS scores at 2, 4, 6, 24, and 48 hours postoperatively and postoperative side effects. No significant differences in NRS results were found between the two groups at rest or during movement. Incidence of dizziness in the QLB group was lower than in TAPB group.	The QLB is a more effective postoperative analgesia as it reduces sufentanil consumption compared to TAPB in patients undergoing laparoscopic colorectal surgery.

Yousef *et al.* (2018) **Level 1 Quality A**	Randomized, prospective, controlled trial, with 60 adult female patients (30 in each group), between 45 and 60 years old.	Total abdominal hysterectomy in adult females. 20 mL of 0.25% bupivacaine (bilaterally) was utilized in both the QL block group and the TAP block group.	Patients in QL group consumed significantly less fentanyl and morphine than patients in TAP group.	VAS was significantly higher in TAP group than in QL group at all times. Duration of postoperative analgesia was shorter in TAP group than in QL group, and the number of patients requested analgesia was significantly higher in TAP group than in QL group.	Bilateral QL block provided better intraoperative and postoperative analgesia with less opioids consumption compared with bilateral TAP block, in patients undergoing total abdominal hysterectomy.
Liu *et al.* (2020) **Level 1 Quality A**	A total of 8 RCTs involving 564 patients were included.	Abdominal surgeries including cesarean delivery, low abdominal surgery, appendectomy, total abdominal hysterectomy, and laparoscopic cholecystectomy	The meta-analysis showed statistically significant differences between the two groups with respect to postoperative pain scores at 2-, 4-, 6-, 12-, and 24 h; postoperative morphine consumption at 24 h; and duration of postoperative analgesia.	There was no statistically significant difference between the two groups with regard to the incidence of PONV.	The QL block provides better pain management with less opioid consumption than the TAP block after abdominal surgery. In addition, there are no differences between the TAP block and QL block with respect to PONV.

RESULTS OF LITERATURE REVIEW

Definitions and Findings of Outcomes

There were three main outcomes evaluated for this systematic review: post-operative opioid consumption, post-operative pain scores, and duration of post-operative analgesia. Table 2 summarizes all the data collected and each study's outcomes. The matrix table in Appendix B also displays the strengths and weaknesses of each study. Of the eight level 1 evidence articles, seven were rated as high quality and one was rated as medium quality based on Johns Hopkins appraisal scale.[12] In the article appraised as medium quality, the attending intraoperative anesthesiologists and assessors were not blinded to the study group assignment.[14]

Post-operative Opioid Consumption. Huang et al. conducted a single-center, prospective, randomized controlled double-blind study at a tertiary hospital from March to August 2018 to investigate the analgesic efficacy of the pre-operative, ultrasound-guided posteromedial QL block on morphine consumption and pain scores, compared with the ultrasound-guided lateral TAP block, after laparoscopic colorectal surgery.[17] 80 ASA I-II colorectal cancer patients between 40-80 years old, undergoing laparoscopic radical resection were enrolled in the study. 77 patients (group QL=38, group TAP=39) were included in the analysis. Pre-operatively, patients were randomized based on a computerized random number to receive either a QL or TAP block (0.375% ropivacaine 20 mL bilaterally for each group). The standardized postoperative analgesic regimen consisted of 1 gram of paracetamol (acetaminophen) every 8 hours, 40mg of parecoxib every 12 hours, and an IV bolus of morphine administered using a PCA device up to 48 hours postoperatively.[17] The study found that pre-operative ultrasound-guided posteromedial QL block significantly lowered postoperative morphine consumption in the first 24 hours postoperatively (estimated median difference −8 mg, 95% adjusted CI −12 to −6 mg, $P<0.001$), and decreased pain intensity at least from 8 to 24 hours in the setting of multimodal analgesia, compared with a pre-operative lateral TAP block. The first PCA morphine demand was the 6th postoperative hour for the TAP group and 12th hour for the

QL group; $P>0.05$. In terms of secondary outcomes, VAS scores at rest were lower 8, 12 and 24 hours postoperatively in the QL group compared with the TAP group; $P<0.006$. A statistically significant difference was also identified between the groups with respect to VAS scores during movement 8, 12, 24, and 36 h postoperatively in favor of the QL group; $P<0.006$). Additionally, the QL group reported higher overall postoperative analgesia satisfaction scores than the TAP group; $P = 0.014$. PONV occurred in 3 patients (7.9%) in the QL group and 8 patients (20.5%) in the TAP group, and no statistical significance was detected between the groups; $P=0.192$).[17]

Deng et al. conducted a randomized double-blind clinical trial study which was registered in the Chinese registry of clinical trials and carried out between January 2018 and December 2018.[7] The study aimed to compare the QLB method with TAPB for postoperative pain management in patients undergoing laparoscopic colorectal surgery. The study included 74 ASA I-II patients ages 18-70 years scheduled for laparoscopic colorectal surgery. It is worthy to note that a total of 6 patients withdrew from the study before completion, therefore, there is risk of attrition bias. After withdrawal, each group had 34 patients which were included in the study.

Patients' demographic characteristics such as age, sex, BMI, and ASA grades were not significantly different between the 2 groups. Patients were randomly assigned into 2 groups using Excel software. After surgery, patients received bilateral QLB or TAPB with 20mL of 0.375% ropivacaine. Patients in both groups regularly received IV parecoxib (40mg every 12 hour) for postoperative analgesia. They also received sufentanil followed by PCIA pump. When the NRS score exceeded 3, the patients employed the PCIA pump. The max sufentanil dose of bolus per hour was 12mcg. The study found that patients in the QLB group used significantly less sufentanil than TAPB group at 24 and 48 hours ($P<.05$), but no significant difference was observed between the 2 groups at 6 hours after surgery ($P=.33$). In terms of secondary outcomes, there were no significant differences in NRS results between the 2 groups at rest or during movement; $P>.05$. Incidence of dizziness in the QLB group was lower than in TAPB group ($P<.05$) and the occurrence of pruritus, nausea and vomiting were not significantly different

between the 2 groups; *P*>.05. No other complications were observed such as arrythmia or hypotension. This study showed that the QLB is a more effective postoperative analgesia as it reduces sufentanil consumption compared to TAPB in patients undergoing laparoscopic colorectal surgery.[7]

Yousef et al. conducted a single-center, prospective, randomized controlled, double blinded study carried out in the gynecological department of a hospital over a 6-month time period (from July to December 2017).[18] The aim was to compare the effect of bilateral ultrasound-guided QLB versus bilateral ultrasound-guided TAP block on intraoperative and postoperative analgesia in patients undergoing total abdominal hysterectomy under GA. The study included 60 adult female patients, ASA I-II, aged between 45-60 years, scheduled for total abdominal hysterectomy. No patients were excluded from the study. No significant differences were observed between the two groups regarding age, weight, ASA physical status, or duration of surgery. The study found that the mean amount of morphine used per patient postoperatively was significantly higher in the TAP group than in the QL group; *P*=0.001.[18] In terms of secondary outcomes, VAS scores were significantly higher in the TAP group than in the QL group at all measured time intervals postoperatively, and the total amount of fentanyl used per patient intraoperatively was also significantly higher in the TAP group; *P*=0.001. Additionally, the duration of postoperative analgesia was shorter in the TAP group than in the QL group (*P*=0.001) and the number of patients that requested analgesia was significantly higher in the TAP group (*P*=0.017). This study is subjected to some level of reporting bias as there is minimal information as to side effects, such as muscle weakness, from the intervention. The author reports, "With regard to side effects, both groups were comparable and no serious complications were detected. One patient in each group suffered from vomiting and was treated with IV granisetron 4mg."[18] Overall, the study revealed that in patients undergoing hysterectomy, bilateral QLB provided more effective intraoperative and postoperative analgesia with less intraoperative fentanyl consumption, less VAS for postoperative pain, a smaller number of patients needed analgesia

after surgery, and less postoperative morphine consumption compared with bilateral TAP block, which showed shorter duration of postoperative analgesia.[18]

Post-operative Pain Scores. Abd Ellatif and Ahmed conducted a prospective randomized clinical study from October 2018-June 2019 to compare the analgesic efficacy of ultrasound-guided QLB with TAP block.[14] The study included 34 ASA I-II pediatric patients 7–12 years old, scheduled for elective laparoscopic appendectomy. These patients were randomly allocated in two equal groups: QLB and TAP block groups. There was no statistically significant difference ($P>0.05$) between QLB and TAP block groups regarding age, sex, weight, ASA physical status, and operative time. After induction of anesthesia, the QLB group received bilateral ultrasound-guided QLB type 2, using 0.5 mL/kg of 0.25% levobupivacaine, whereas the TAP block group received bilateral ultrasound-guided TAP block using 0.5 mL/kg of 0.25% levobupivacaine. IV fentanyl (0.5 mcg/kg) was given intraoperatively when any increase in mean arterial pressure (MAP) or heart rate (HR) more than 20% of baseline data occurred throughout the procedure. Patients received a 1 mg/kg diclofenac sodium suppository before extubation. The study found that the QLB group had statistically significantly lower hemodynamic changes (MAP and HR) 15 min after performing the block until the end of surgery; $P<0.05$. Researchers also found significantly lower VAS score in the first postoperative 4 hours; $P<0.001$. However, pain scores at the remaining time intervals were not statistically significant different between both groups. In terms of secondary outcomes, a highly significantly lower intraoperative fentanyl dose was used; $P<0.001$. The study also reported a significantly longer time for the first rescue analgesic; the total paracetamol (acetaminophen)/24 h dose was less in QLB group compared with TAP block group; $P<0.001$. Additionally, when comparing parents' and patients' satisfaction between both groups, there was significantly higher satisfaction in the QLB group; $P=0.016$. The duration of hospital stay and PONV were comparable between both groups, with no statistically significant difference; $P=0.128$ and 0.289, respectively.[14] The study reveals that the QLB has to be taken into account as an effective technique for pain management in pediatric

patients undergoing laparoscopic appendectomy, being associated with more intraoperative hemodynamic stability, longer postoperative analgesic time, and less rescue analgesics consumption compared with the classic TAP block.

Liu et al. conducted a systematic review and meta-analysis of 8 randomized controlled trials involving a total of 564 patients.[10] The studies examined the efficacy of the QLB versus the TAPB in regards to abdominal surgeries including cesarean delivery, low abdominal surgery, appendectomy, total abdominal hysterectomy, and laparoscopic cholecystectomy. The primary outcome assessed was post-operative pain scores and the secondary outcomes assessed included opioid consumption, postoperative analgesia duration and PONV incidence.[10] Pain scores reported as visual, verbal, or numeric rating scale scores were converted to a standardized 0 to 10 analog scale for the quantitative evaluations. All opioids were converted into equianalgesic doses of IV morphine for analysis (IV morphine 10mg = IV fentanyl 100mcg = IV sufentanil 10mcg). The following aspects were assessed: random sequence generation, allocation scheme concealment, blinding, accuracy of data results, freedom from selective reporting and other biases. The quality of the outcomes in the meta-analysis was evaluated by the Grading of Recommendations Assessment, Development and Evaluation (GRADE). The meta-analysis shows that the pain scores at 2, 4, 6, 12 and 24 postoperative hours were significantly lower in the QL group than in the TAP group. Additionally, the amount of postoperative morphine consumption was lower in the QL group than in the TAP group, and the duration of postoperative analgesia was longer in the QL group than in the TAP group. There was no statistically significant difference between the two groups with regard to the incidence of PONV.[10] Overall, the analysis revealed that the QL block provides better pain management with less opioid consumption than the TAP block after abdominal surgery.[10]

Duration of Post-operative Analgesia. Oksuz et al. conducted a double-blind, randomized, prospective study between March 2016 and January 2017 to compare the QLB and TAPB for postoperative pain relief after lower abdominal surgery in children.[15] The study

included 53 ASA I-II pediatric patients 1-7 years old who were candidates for unilateral inguinal hernia repair or orchiopexy under general anesthesia. The study included 53 patients who were randomized into 2 groups, TAP block and QL block, after excluding 3 patients who were not eligible. No significant differences were observed between the groups based on age, sex, weight, ASA score, operation type, or operating time. After induction of anesthesia, the QLB group received bilateral ultrasound-guided QLB type 2, using 0.5 mL/kg of 0.2% bupivacaine, whereas the TAP block group received bilateral ultrasound-guided TAP block using 0.5 mL/kg of 0.2% bupivacaine. At the end of surgery, 15 mg/kg acetaminophen IV was administered to all patients. The results of the study showed that the QL block provided more effective pain relief compared with the TAP block and did not have any adverse effects. The study revealed that the number of patients who required analgesia in the first 24 hours postoperatively was significantly lower in the QL block group; $P<0.05$. In the QL block group, the postoperative FLACC scores were lower compared with those of the TAP block group; $P<0.05$. Additionally, parent satisfaction scores were higher in the QL block group; $P<0.05$. Researchers reported that there were no postoperative complications, such as hypotension, arrhythmia, bradycardia, deterioration in vital signs, nausea, or vomiting observed in any of the patients.[15] The study highlighted that in pediatric patients undergoing unilateral inguinal hernia or orchiopexy, the QL block provided longer and more effective postoperative analgesia compared with the TAP block, which has been in use for many years.

In 2018 for over a period of 6 months, Kumar et al. conducted a prospective, randomized, double-blinded study to compare the efficacy of TAP block versus QL block in providing postoperative analgesia for lower abdominal surgeries.[6] The study included 70 ASA I-II adult patients, 18-60 years old, who underwent elective lower abdominal surgery under general anesthesia. The demographic data (age, sex, and body mass index) were comparable between the two groups, as well as duration of surgery. There was an equal number of males and females in both groups. Patients were randomly allocated into two groups, where Group A received TAP

block with 20 mL of 0.25% ropivacaine on each side (n=35) and Group B received QL block with 20 mL of 0.25% ropivacaine on each side (n=35). The TAP block or the QL block was performed on each side at the end of the surgery and before extubation by the anesthesiologist under ultrasound guidance using a linear array transducer of 10Mhz frequency and an in-plane technique. All patients were given acetaminophen 1 gram IV every 8 hours during the first 24 hours after surgery. Patients were given IV boluses of 1mg morphine when NPIS (0–10) score at rest was more than 4 at any time patients complain of pain and hemodynamics monitored. Ondansetron 4mg IV was administered in case of reported PONV. Patients who received QL block had a significant improvement in postoperative pain relief with reduced consumption of opioids. The time to first analgesic requirement was earlier and the total analgesic consumption (morphine in mg) was higher in Group A and Group B, respectively, both of which were statistically significant; $P<0.001$, 95% CI: 1.81–2.98. There was a significant difference in postoperative pain scores (NPIS scale 0–10) at rest, between the two groups, up to 16 hours. There was no difference in the pain scores 24 hours post-surgery indicating the wearing off the block in both the groups. This study revealed that QLB would be a better option for providing postoperative analgesia after abdominal surgeries, in terms of duration for requirement of 1 rescue analgesic, better pain score at rest, and total opioid analgesic consumption.[6] All these factors contribute to faster postoperative recovery and earlier mobilization of patient. The adverse events associated with escalating doses of morphine, such as pruritus, nausea, somnolence, and respiratory depression can also be avoided by lower doses required with QLB. The topographically broader field of action (T6 to L1) and longer duration of pain-relief make it superior to TAP block in providing postoperative pain relief. Although the duration of action differs with each study, there is a significant difference between TAP and QL blocks.[6]

Baytar et al. conducted a single-center, prospective, randomized, controlled, and double-blinded clinical study in 2019 to compare the effectiveness of ultrasound-guided TAP block and QL block as preventive analgesia methods after laparoscopic cholecystectomy.[16] The study

included 120 ASA I-II patients, 18-75 years of age, who were scheduled to undergo elective laparoscopic cholecystectomy. A total of 107 patients (53 in group TAP and 54 in group QL) were ultimately evaluated. It is worthy to note that a total of 13 patients withdrew from the study before completion, therefore, there is risk of attrition bias. Patients were randomly assigned to 1 of 2 groups preoperatively. Patients in group TAP received 0.3 mL/kg bupivacaine with ultrasound-guided bilateral subcostal TAP block; patients in group QL received 0.3 mL/kg bupivacaine with ultrasound-guided bilateral QL block. Ten minutes before the end of the procedure, all patients were given 20 mg IV tenoxicam. For postoperative pain control, an IV PCA device was prepared, and the first bolus dose was administered when the VAS score was >3. The study found that the intraoperative consumption of fentanyl was similar in both groups; $P>0.05$. Additionally, no statistically significant difference was found in VAS and DVAS scores between the groups ($P>0.05$) nor was there any difference in the 24 hours consumption of tramadol. There was no requirement for additional analgesia postoperatively. In terms of secondary outcomes, no statistically significant difference was found between the groups with regard to HR and mean BP ($P>0.05$) nor in intraoperative complications (hypertension, hypotension, tachycardia, bradycardia); $P>0.05$. In the comparison of postoperative complications, PONV was recorded in 3 patients in group TAP and 2 patients in group QL, and HTN was observed in 1 patient in group QL. No statistically significant difference with regard to patient and surgeon satisfaction was found between the groups; $P>0.05$. The duration of anesthesia was significantly longer in group QL (approx. 8 min); $P=0.013$. The study revealed that subcostal TAP and QL blocks reduced postoperative VAS and DVAS scores and tramadol consumption to a similar level.[16] In upper abdominal surgery, such as laparoscopic cholecystectomy, subcostal TAP block applied under ultrasound-guidance can be considered to have the advantages of easier application and a shorter time compared with QL block.[16]

DISCUSSION OF LITERATURE REVIEW

Summary of Evidence

Seven RCTs with a total of 469 patients and one meta-analysis of RCTs with 564 patients were included in this systematic review. Several studies were excluded for various reasons including: the studies that did not measure the correct primary outcomes (i.e., post-operative analgesia) and study designs other than RCTs (e.g., retrospective studies). Obstetrical studies in which patients were strictly undergoing cesarean section were also excluded. Of the eight articles found, seven were rated as high quality, and one was rated as medium quality based on the Johns Hopkins appraisal scale.[12] Due to larger sample sizes, well-defined methodology and inclusion criteria, as well as rigorous statistical methods, seven of the articles met the criteria for high-quality level 1 evidence.[6,7,10,15,16,17,18] The only article appraised by the Johns Hopkins tool as medium-quality level 1 evidence had an adequate sample size, some amount of control, and definitive conclusions.[12,14] The results of this systematic review are summarized below:

- Seven studies found that the QLB provided longer and more effective postoperative analgesia following abdominal surgery compared with the TAP block. [6,7,10,14,15,17,18]
- One study concluded that the QLB is associated with more intraoperative hemodynamic stability than the TAPB.[14]
- Two studies found that when comparing parents' and patients' satisfaction between both groups, there was significantly higher satisfaction in the QLB group.[14,15]
- Six studies found that patients who received the QLB required fewer opioid analgesics postoperatively.[6,7,10,14,17,18]
- Six studies found that patients who received the QLB had lower overall pain scores as compared to the patients who received the TAPB.[6,7,10,14,15,17]
- Three studies found that duration of hospital stay and PONV were comparable between both groups, with no statistically significant difference.[14,16,17]

- Hypertension was observed in one patient in the QL group.[16] Otherwise, there were no other postoperative complications such as hypotension, arrhythmia, bradycardia, deterioration in vital signs, nausea, or vomiting observed in any of the patients.[14]
- One study noted that the incidence of dizziness in the QLB group was lower than in TAPB group.[6]

Limitations of the Quality Improvement Project

The investigators must acknowledge the limitations to this Quality Improvement Project. Part of the inclusion criteria was solely peer-reviewed articles in English, which has the potential to cause language bias and may lead to a flawed conclusion. Another limitation was unpreventably high heterogeneity among a limited number of studies. There were several dissimilarities between the seven RCTs included, and this has the potential to negatively influence the reliability of this systematic review. Many of the articles reported secondary outcomes which were not directly compared for each study, including hemodynamic stability, side effect profiles, and parent satisfaction for the pediatric studies. In two of the studies, researchers reported an inability to measure level of sensory blockade of the QL and TAP blocks.[15,18] It is also important to note that age and specific type of procedure were not uniform across each article. Two of the studies focused solely on pediatric patients undergoing abdominal surgeries and the participants range in age from 1-12 years old.[14,15] Therefore, another limitation within the currently available data is the lack of generalizability of the clinical data to include a more varied demography. Additionally, the depth of anesthesia and specific approach to the induction and maintenance of anesthesia was not consistent across each study. This is a limitation as it is unknown whether or not the specific anesthetic technique might influence the patient's post-operative pain.

In the data extraction, some observation indexes in the literature were only reported as the mean and median, or in the form of graphics and text and could not be included in the analysis (possibly excluding some high-quality studies). Additionally, there was no explicit mention of the

optimal drug type and concentration for the two truncal plane blocks (between differing concentrations of bupivacaine and ropivacaine). This is perhaps the greatest limitation to the support of the Quality Improvement Project recommending the adoption of QL blocks. Although there was a statistically significant difference in postoperative pain scores between patients receiving QL blocks and TAP blocks, a difference in pain scores that is less than 2 points has limited clinical relevance. Despite the limitations, this Quality Improvement Project supports the utilization of the QL block as an alternate to the TAP block for post-operative analgesia following abdominal surgery.

Recommendations for Future Research and Practice

The QL block was first described by Blanco in 2007, and since then the technique has evolved significantly.[8] In upper abdominal surgery, such as laparoscopic cholecystectomy, subcostal TAP block applied under ultrasound guidance can be considered to have the advantages of easier application and a shorter time compared with QL block.[16] The QL block is a deep regional block and is usually performed in the lateral decubitus position. Its application requires more experience and knowledge of sonoanatomy. One of the studies noted that the anesthesia time in the QL group was significantly longer (approximately 8 minutes), which can explained by the above factors.[16] According to Yousef, however, the QLB is not technically difficult to be done because it is a superficial fascial block between posterior abdominal wall muscle (QL and erector spinae).[18] QLB does not aim to target a nerve but rather a fascial plane that is very bright, hyperechoic, and easily dissected. The more superficial point of injection makes it a safer block (bowel injury and intraperitoneal injection are less likely because the needle tip is separated from the peritoneum by the QL muscle) with better ultrasonographic resolution.[18]

To help optimally manage post-operative pain with the utilization of multimodal analgesics, further research must focus on addressing specific differences between the various approaches to the QL block. In many of the articles, different approaches to the QL block were described including QL1 (anterolateral), QL2 (posterior), and QL3 (anterior or transmuscular),

which vary based upon needle position and exact location of deposition of local anesthetic.[7] Additionally, the inclusion of more articles addressing a wider range of abdominal surgeries, with the addition of cesarean sections may offer more comprehensive and generalizable results.

Additionally, there was no statistically significant difference ($P>0.05$) between QLB and TAP block groups regarding ASA physical status for any of the seven RCTs (all patients were ASA I and II), however a recommendation for future research may be to explore the role of the QL block in higher ASA statuses such and III and IV. Further studies are needed to clarify the more subtle clinical differences in pain after receiving a QL block compared with a TAP block after abdominal surgery. Additional studies are required to explore the mechanism of QLB as well as compare QLB and the subcostal TAPB in upper abdominal surgeries. Furthermore, investigations are needed to provide general recommendations for the use of QLB. Optimal local anesthetic and concentration need to be further studied to arrive at a general satisfactory approach. Regardless of choice of either the QL block versus the TAP block, it is clear that a regional anesthetic as part of a multimodal analgesia approach should be used when possible.

CONCLUSION OF LITERATURE REVIEW

Several studies focused on a variety of patient profiles have shown that QLB is a novel regional anesthesia technique which can substantially improve post-operative pain, patient satisfaction, mitigate complications, minimize opioid consumption, and achieve improved outcomes compared to TAPB, which is considered to be the current standard of practice. A barrier to the wider adoption of QLB as the standard of practice, despite its measurably more positive effects, will be the additional cost and time of education necessary to implement wider change. The results of this study have vast anesthetic implications to future anesthesia care and surgical pain management.

METHODOLOGY OF QUALITY IMPROVEMENT

Setting and Participants

The setting will take place through an online survey and a PowerPoint educational module with the members of the Anesthesia Department in a large teaching hospital located in South Florida. The preliminary study will include Certified Registered Nurse Anesthetists (CRNAs). The participation will be based on individuals who were forwarded within the email list provided by the hospital and participants will be asked to provide feedback regarding the educational module and the anesthesia providers' experience. The anticipated sample size will be between 15-20 participants.

Recruitment

The target population consisted of CRNAs who have provided anesthesia for patients undergoing abdominal surgery and have utilized either only the TAP block or the TAP and the QL block for these patients. Participants were identified through an email list provided by the South Florida hospital. The anesthesia providers within the email list were emailed an invitation to participate in the educational module.

Intervention and Procedures

The primary methodology of the proposed project is to have the CRNAs participate in an online PowerPoint educational module that focuses on the post-operative outcomes of patients undergoing abdominal surgery, who have received a QL block for post-operative analgesia. The project will be implemented by conducting an online pre-assessment survey that will assess the anesthesia provider's knowledge about the QL block and its role in post-operative analgesia following abdominal surgery. The existing knowledge and understanding of the anesthesia provider will also be surveyed and will be reported as a part of the entire data collection.

The second phase will include an online PowerPoint presentation. The primary means of learning will be through a voiceover PowerPoint presentation with information regarding the post-operative benefits of utilizing the QL block as opposed to the TAP block for patients

undergoing abdominal surgery. Anesthesia providers' education is essential in bridging existing gaps in knowledge and supporting the need for a superior regional anesthetic technique to ensure patients are provided evidence-based care during the perioperative period. Evidence suggests that the efficacy of the TAP block might be more limited than presumed. Therefore, the need for visceral blockade to provide optimal postoperative pain relief has led to the discovery and utilization of the QL bock.[6] The delivery of the presentation will offer insight for providers regarding the benefits of implementing the QL block into their practice, including longer and more effective postoperative analgesia following abdominal surgery and fewer opioid requirements. [6,7,10,14,15,17,18] The empirical evidence supports an evidence-based project with comprehensive information regarding the utilization of the QL block for patients undergoing abdominal surgery.

The third phase of the project will involve an online post-assessment survey to identify the anesthesia provider's learned knowledge, perception to the intervention and the contents that were delivered. This information will provide greater feedback regarding the impact of the educational intervention and will determine how to best move forward in terms of optimizing the mode of delivery and expanding the components of the educational module. The pre and post-surveys will provide relevant information regarding the effectiveness of utilizing the QL block and will subsequently improve patient satisfaction. At the end of the educational module, feedback will also demonstrate if the educational module will improve anesthesia providers' knowledge and if any changes are necessary for the future so that other anesthesia providers will benefit from the program in the future.

Protection of Human Subjects

Anesthesia providers participating in the survey remained anonymous, and the data was secured by using unique code identifiers. The digital data collected from the pre-test and post-test were protected by a laptop password and antivirus software. Using laptop passwords and antivirus, this ensured the safety of the data. There are no perceived risks to the study as it only

requires the time spent by each anesthesia provider in the educational module which took less than 20 minutes to complete.

Data Collection

For the study, the primary instruments included pre-assessment and post-assessment testing applications to determine the effects of the educational module. Both tests will be conducted using surveys utilizing Qualtrics that will determine if participants have an understanding of the TAP and QL blocks, and their role in post-operative analgesia following abdominal surgery. The survey consisted of 14 questions that focus on knowledge and practice. The pre-test survey will gauge baseline knowledge. In contrast, the post-test survey will determine the participant's knowledge from the educational module and application of knowledge gained to professional practice. The data collected will be confidential, and no subject identifiers will be recorded during any component of the study.

Measurement and Analysis

The investigator for the project will be the DNP student responsible for obtaining the members of the Anesthesia Department at the South Florida teaching hospital via email list for administration of the pre- and post-assessment survey and PowerPoint educational module. Each question will be measured, and the responses recorded to identify the knowledge base before and after the educational module. No personal identifiers will be recorded for each of the study participants so that confidentiality will be protected. The impact of the educational module will be based upon the results of the pre-and post-test survey instruments. Through the statistical analysis, the study results will likely identify patterns that will be used to determine the effectiveness of the educational module and if the module will improve anesthesia providers' knowledge. The co-investigator will store the data collected in a password-protected laptop computer.

RESULTS OF QUALITY IMPROVEMENT

Pre-Test and Post-Test Sample

The pre-test demographics are shown in Table 3., shown below.

Pre-Test Participant Demographics

Demographic	n (%)
Total Participants	10 (100%)
Gender	
Male	3 (30%)
Female	7 (70%)
Age	
25-35	5 (50%)
36-45	4 (40%)
46-55	0 (0%)
56-66	1 (10%)
Ethnicity	
Hispanic	3 (30%)
Caucasian	3 (30%)
African American	1 (10%)
Asian	1 (10%)
Other	2 (20%)
Position/Title	
CRNA	10 (100%)
Level of Education	
Masters	2 (20%)
Doctorate	8 (80%)
Years of Experience	
Less than 1 year	2 (20%)
1 to 5 years	5 (50%)
6 to 10 years	2 (20%)
More than 10 years	1 (10%)

There were 10 participants in the pre-test demographics. The majority of the participants were female (n=7, 70%) instead of male (n=3, 30%) and there was a range of ages represented: 25-35 (n=5, 50%), 36-45 (n=4, 40%), and 56-66 (n=1, 10%). A range of ethnicities was also represented: Hispanic (n=3, 30%), Caucasian (n=3, 30%), African American (n=1, 10%), Asian (n=1, 10%), and other (n=2, 20%). Information was obtained regarding the participant's role at the hospital, and all participants were CRNAs (n=10, 100%). Length of time practicing was also surveyed, finding that the practice period ranged: less than one year (n=2, 20%), 1 to 5 years

(n=5, 50%), 6 to 10 years (n=2, 20%), and more than 10 years (n=1, 10%). The participants consisted of both doctoral-prepared CRNAs (n=8, 80%) and masters-prepared CRNAs (n=2, 20%).

Pre-Test Likelihood of Utilization of the QL Block as an Alternative to the TAP Block for Post-Operative Analgesia Following Abdominal Surgery

The pre-test contained information regarding the utilization of the QL block for post-operative analgesia following abdominal surgery. The survey concluded that less than half of respondents (n=4, 40%) were unaware of the differences in morphine consumption between the two types of blocks, as well as that the most significant difference in outcomes between the two blocks is increased duration of analgesic effect (n=4, 40%). Less than half of the participants also reported being unaware that use of the QL block results in more extensive sensory blockade than the TAP block, among other differences (n=3, 30%). Additionally, when asked how likely they were to utilize the QL block as an alternative to the TAP block, less than half of the participants answered "somewhat likely" (n=2, 20%), while the remainder answered either "somewhat unlikely" (n=6, 60%) or "very unlikely" (n=2, 20%).

Pre-Test Identification of Current Knowledge about Utilization of the QL Block for Post-Operative Analgesia Following Abdominal Surgery

The survey focuses on identifying the benefits of the utilization of the QL block for patients undergoing abdominal surgery. The majority of participants were knowledgeable regarding the physiological and psychological risks for patients undergoing abdominal surgery (n=9, 90%). When asked about the mechanism by which QL blocks provide visceral blockade, half of the participants answered the question correctly (n=5, 50%). When asked about which block is associated with greater hemodynamic stability for pediatric patients undergoing laparoscopic appendectomy, three of the participants answered correctly (n=3, 30%). The participant's scores improved in the post-test when asked about questions pertaining to the difference in the amount of time it generally takes to perform a QL and TAP block (n=10, 100%).

The participants were asked a question involving the specific types of abdominal procedures for which patients experienced improved pain scores. Scores generally improved when comparing the pre- and post- test. Table 4 shows the difference in responses from the pre- to post-test.

Table 4. Difference in Pre- and Post-Test Knowledge

Questions	Pre- test	Post- test	Difference
Physiological and psychological risks for patients undergoing abdominal surgery include?	90%	100%	10%
QL blocks provide visceral blockade by injecting local anesthetic (LA) into which fascia?	50%	90%	40%
In pediatric patients undergoing laparoscopic appendectomy, research suggests that QL blocks are associated with _____ intraoperative hemodynamic stability than TAP blocks.	30%	80%	50%
Research suggests that the difference in block performing times for QL blocks and TAP blocks is?	30%	100%	70%
The estimated post-operative morphine consumption in patients receiving QL blocks as opposed to TAP blocks is?	40%	100%	60%
Patients undergoing which type of procedure experienced improved pain scores when a QL block was utilized instead of a TAP block?	40%	90%	50%
Overall, the QL block may take longer to perform than the TAP block because?	40%	70%	30%
During the 24 hours post-procedure, at what intervals can pain score improvement with QL blocks over TAP blocks be seen in patients undergoing abdominal surgery?	40%	70%	30%
The more superficial point of injection makes the posterior QL block safe because?	40%	80%	40%
The MOST significant difference between QL and TAP blocks is?	40%	100%	60%
Some differences between the QL block and the TAP block are that?	30%	90%	60%
Which of the following plays the most crucial role for adequate spread in fascial plane blocks such as the TAP and QL?	80%	100%	20%
How likely are you to utilize the QL block as an alternative to the TAP block for post-operative analgesia following abdominal surgery?	20%	80%	60%
How likely are you to recommend the use of the QL block as an alternative to the TAP block for post-operative analgesia following abdominal surgery?	20%	80%	60%

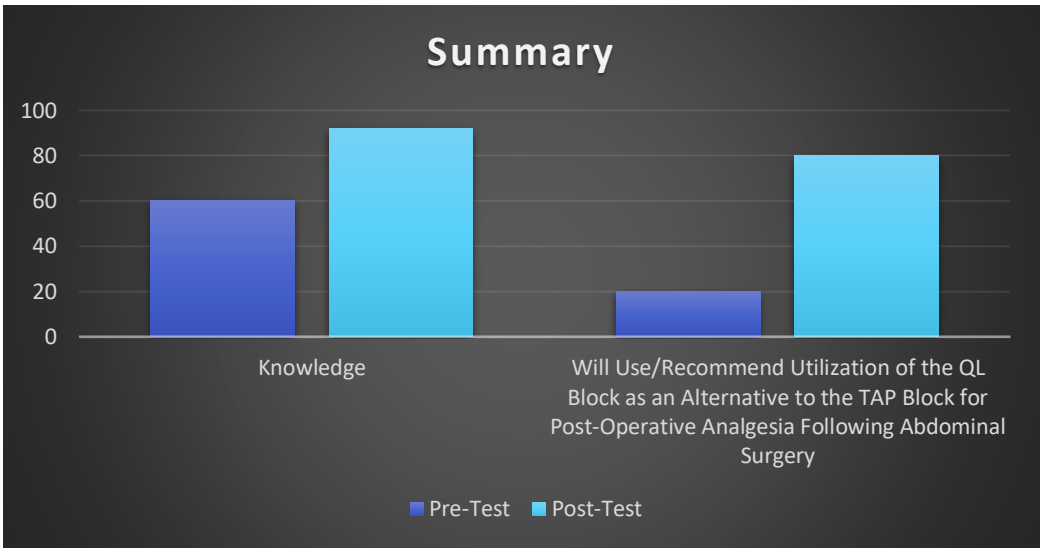
After the online PowerPoint presentation, scores increased on the post-test from the baseline pre-test scores. All of the participants improved their knowledge about utilization of the QL block, including specific post-operative outcomes associated with the QL block. When asked a question about what intervals pain score improvement can be seen with QL blocks over TAP blocks, there was a 30% increase (n=3) in responses. Lastly, the post-test showed that there was a 40% increase in the number of responses when participants were asked why the more superficial point of injection makes the posterior QL block safe (n=4).

Post-Test Likelihood of Utilization of the QL Block as an Alternative to the TAP Block for Post-Operative Analgesia Following Abdominal Surgery

As part of the post-test, when asked how likely the participant was to utilize and recommend the QL block as an alternative to the TAP block for post-operative analgesia following abdominal surgery, the majority answered "extremely likely" (n=8, 80%), indicating a 60% increase from the pre-test score. The post-test showed that eight participants changed their answer to "extremely likely." Therefore, the post-test not only showed an increase in knowledge but also showed that a majority of the participants were "extremely likely" to utilize and recommend the use of the QL block as an alternative to the TAP block.

Perspective of Use in Practice

Overall, the results reflected an improvement in knowledge based on the pre-test and post-test scores. Knowledge showed an average gain of (32%). In addition, the post-test demonstrated that participants are extremely likely (n=8, 80%) to utilize the QL block as an alternative to the TAP block to improve post-operative analgesia for patients undergoing abdominal surgery.



DISCUSSION OF QUALITY IMPROVEMENT

Limitations

Limitations of the study include a small sample size; the survey was emailed to the CRNAs of Anesthesia Department at a teaching hospital in South Florida. There were 32 emails on the list; however, only ten people completed the survey. A larger sample size is preferred to enhance the study's findings and offer a sample size that more accurately mirrors the anesthesia practitioners at the surveyed hospital. The survey link, which included a pre-test, a narrated PowerPoint presentation, and a post-test, was available online for two weeks; extending the time frame may have resulted in more replies. Finally, the project was completed entirely online, preventing it from being delivered through other means.

Future Implications for Advanced Nursing Practice

The literature demonstrated that the implementation of educational modules encouraging utilization of the QL block for post-operative analgesia following abdominal surgery, will likely expand the knowledge base of the anesthesia providers and will demonstrate the importance of implementing an alternate regional anesthetic technique. The TAP block is considered to be the current standard of practice, but the knowledge and evidence-base regarding the QL block is rapidly expanding. Its role in the improvement of post-operative outcomes, most specifically in

post-operative analgesia, demonstrates the importance of continuously learning and growing within the field of anesthesia. Oftentimes a change in practice is met with resistance due to the additional cost and time of education, as well as a lack of comfort. However, based on the research as demonstrated by this Quality Improvement Project, a change in the culture or current standard of practice can significantly improvement patient satisfaction and outcomes.

The anesthesia providers' knowledge will improve when an evidence-based educational module is provided, and it is clear that the utilization of the QL block will improve the outcomes of surgical patients and ensure more optimal post-operative pain management. Overall, the Quality Improvement Project showed that the intervention was effective in increasing anesthesia providers' knowledge and confidence regarding the utilization of the QL block as an alternative to the TAP block.

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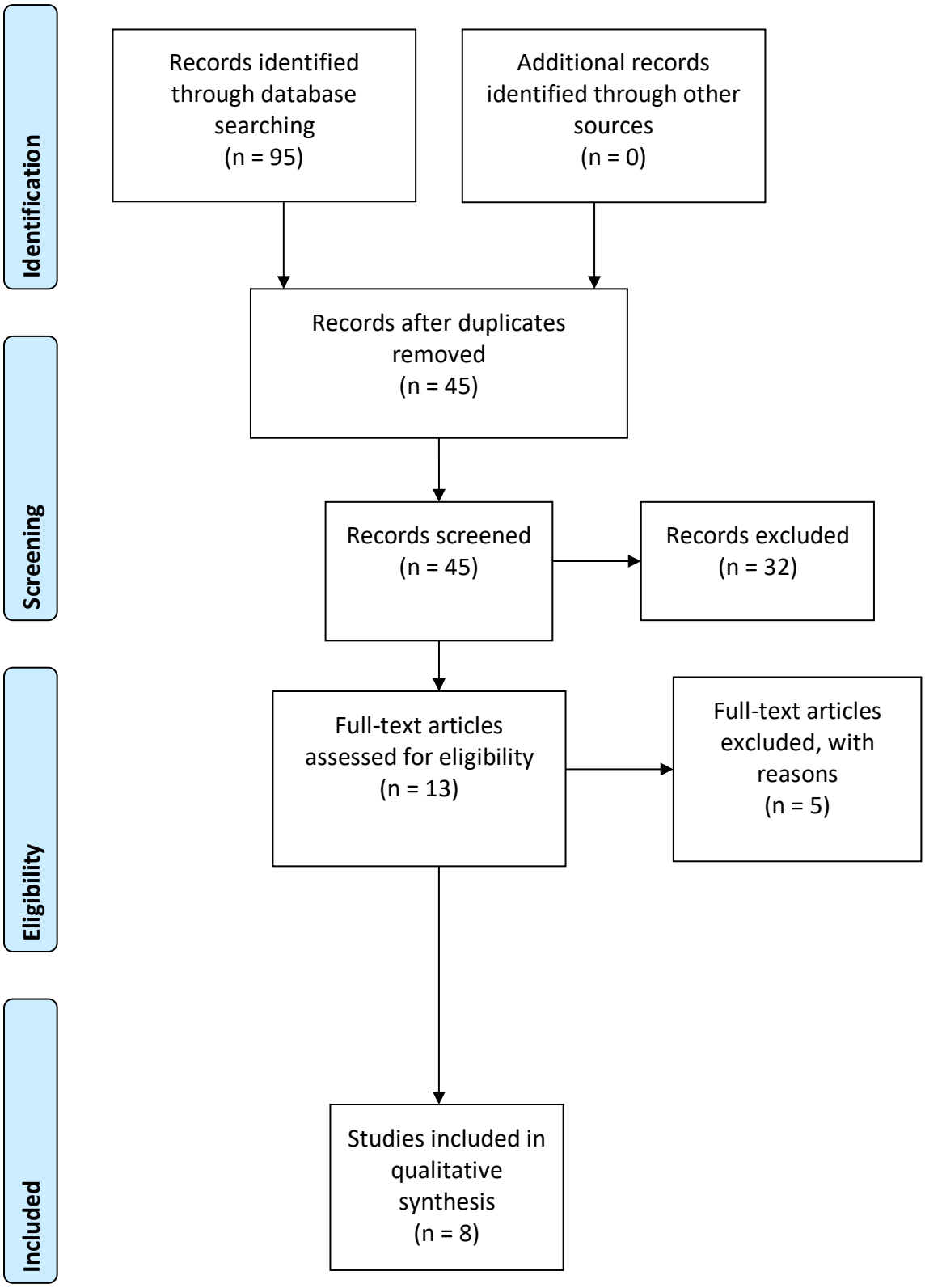
Appendix A: PRISMA Flow Diagram



Appendix B: Matrix Table

Author/Date	Design/Setting	Sample/Characteristics	Major Variables Studied and Their Definitions	Measurement and Data Analysis	Findings/Results	Conclusions	Appraisal: Worth to Practice/Level
Abd Ellatif, Ahmed (2020) Ultrasound-guided quadratus lumborum block versus transversus abdominis plane block in children undergoing laparoscopic appendectomy: a randomized controlled study.	Prospective randomized clinical study in Zagazig University Hospitals from October 2018-June 2019 to compare the analgesic efficacy of US-guided QLB with TAP block. After induction of anesthesia, QLB group received bilateral USG QLB type 2, using 0.5 mL/kg of 0.25% levobupivacaine, whereas TAP block group received bilateral USG TAP block using 0.5 mL/kg of 0.25% levobupivacaine. IV fentanyl (0.5 mcg/kg) was given intraoperatively when any increase in MAP or HR more than 20% of baseline data occurred throughout the procedure. Patients received 1 mg/kg diclofenac sodium suppository before extubation.	34 ASA I-II pediatric patients 7–12 years old, 20–35 kg body weight, scheduled for elective laparoscopic appendectomy were randomly allocated in two equal groups: QLB and TAP block groups. There was no statistically significant difference ($P>0.05$) between QLB and TAP block groups regarding age, sex, weight, ASA physical status, and operative time. The primary outcomes were changes of intraoperative hemodynamics and postoperative pain assessment. Secondary outcomes were total intraoperative fentanyl consumption, the first time of rescue analgesics, total rescue analgesic consumption in the first postoperative 24 h, and degree of parent satisfaction.	IV1=QL block with injection of 0.5 mL/kg of 0.25% levobupivacaine, IV2=TAP block with injection of 0.5 mL/kg of 0.25% levobupivacaine DV1=hemodynamic changes, DV2=total intraoperative fentanyl doses (mcg/kg), DV3=1st time to rescue analgesic (min), DV4=total paracetamol/24 h (mg/kg), DV5=hospital stay (days), DV6=PONV, DV7=parent satisfaction	SPSS version 20 utilized. Continuous variables with a normal distribution were reported as mean ± SD and range. Categorical variables were summarized as frequencies and percentages. Numerical data were evaluated using independent t test and analysis of variance for repeated measures, whereas nonnumerical data were evaluated by $\chi 2$ test. P values less than 0.05 and less than 0.001 were considered statistically significant and highly statistically significant, respectively.	The QLB group had: -Statistically significant lower hemodynamic changes (MAP and HR) 15 min after performing the block until the end of surgery ($P<0.05$). -Highly significantly lower VAS score in the first postoperative 4 h ($P<0.001$). However, pain scores at the remaining time intervals were not statistically significant different between both groups. -Highly significantly lower intraoperative fentanyl dose ($P<0.001$). -And significantly longer time for the first rescue analgesic; the total paracetamol/24 h dose was less in QLB group compared with TAP block group ($P<0.001$). -When comparing parents' and patients' satisfaction between both groups, there was significantly higher satisfaction in the QLB group ($P=0.016$). -The duration of hospital stay and PONV were comparable between both groups, with no statistically significant difference ($P=0.128$ and 0.289, respectively).	QLB type 2 has to be taken into account as an effective technique for pain management in pediatric patients undergoing laparoscopic appendectomy, being associated with more intraoperative hemodynamic stability, longer postoperative analgesic time, and less rescue analgesics consumption compared with classic TAP block.	**Level I Quality B** **Strengths:** -Consistent with the literature, highest level of evidence. -Sample size was calculated using open Epi program, at CI of 95% and power of test 80% -Computer-generated table randomly allocated 34 patients into two equal groups. -The patients and investigators who were responsible for assessing the primary and secondary outcomes were blinded to study group assignment. **Weaknesses:** -Study does not clearly state it is a single- or double-blind study but discusses patients blinded and data collector blinded. -The attending intraoperative anesthesiologists and assessors were not blinded to study group assignment. **Limitations:** -Laparoscopic appendectomy is minimally invasive surgery that seems to be associated with less postoperative pain compared with laparotomy, and the sensory block plane levels were not tested. **Feasibility of use in practice:** -QLB is not technically difficult to be done as it is a superficial fascial block between the posterior abdominal wall muscles (QL and erector spinae). QLB does not target a nerve; it aims to target a fascial plane that is very bright, hyperechoic, and easily dissected. **Investigator recommendations:** -None.

Oksuz *et al.* (2017) Quadratus lumborum block versus transversus abdominis plane block in children undergoing low abdominal surgery: a randomized controlled trial.	Double-blind, randomized, prospective study conducted between March 2016 and January 2017 to compare the QL and TAP blocks for postoperative pain relief after lower abdominal surgery in children. After induction of anesthesia, QLB group received bilateral USG QLB type 2, using 0.5 mL/kg of 0.2% bupivacaine, whereas TAP block group received bilateral USG TAP block using 0.5 mL/kg of 0.2% bupivacaine. At the end of surgery, 15 mg/kg acetaminophen IV was administered to all patients.	53 ASA I-II pediatric patients 1-7 years old who were candidates for unilateral inguinal hernia repair or orchiopexy under GA were randomized into 2 groups: TAP block and QL block. The study included 53 patients, after excluding 3 patients who were not eligible. No significant differences were observed between the groups based on age, sex, weight, ASA score, operation type, or operating time. The primary outcome was whether there was a need for analgesia in the first 24 hours, and secondary outcomes were the time in which the first analgesia was required, FLACC scores, and parent satisfaction.	IV1=QL block with injection of 0.5 mL/kg of 0.2% bupivacaine, IV2=TAP block with injection of 0.5 mL/kg of 0.2% bupivacaine DV1=need for analgesia in the first 24 hours, DV2=the time in which the first analgesia was required, DV3=FLACC scores, DV4=parent satisfaction	SPSS version 17 utilized. Descriptive statistics are presented as mean and SD, and as the number of cases (n) and the corresponding percentage (%) for nominal variables. T tests were performed for normally continuous variables. The Mann-Whitney U test was used for nonparametric variables. The approximate sample size was calculated using the G* Power3 analysis program (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) before the study. A pilot study was conducted on 5 patients from each group. The power analysis applied was made based on the mean number of patients who required analgesia in 24 hours, which was 0.2 (0.44) in the QL group and 0.6 (0.54) in the TAP group. The sample size was calculated at a power of 85% and a significance level of 5%, and it was determined that it would be necessary to have approximately 24 patients per group to obtain significant statistical value.	The results of the study showed that the QL block provided more effective pain relief compared with the TAP block and did not have any adverse effects. The number of patients who required analgesia in the first 24 hours postoperatively was significantly lower in the QL block group ($P < 0.05$). In the QL block group, the postoperative 30-minute and 1-, 2-, 4-, 6-, 12-, and 24-hour FLACC scores were lower compared with those of the TAP block group ($P < 0.05$). Parent satisfaction scores were higher in the QL block group ($P < 0.05$). There were no postoperative complications, such as hypotension, arrhythmia, bradycardia, deterioration in vital signs, nausea, or vomiting observed in any of the patients.	In pediatric patients undergoing unilateral inguinal hernia or orchiopexy the QL block provided longer and more effective postoperative analgesia compared with the TAP block, which has been in use for many years.	**Level 1 Quality A** **Strengths:** -Highest level of evidence with sufficient sample size. -Randomization was achieved using the closed envelope technique. -All blocks (TAP, QL) were performed by the same anesthesiologist. **Weaknesses:** -In addition to the area of spread of the local anesthetic not being fully understood in the QL block, complications may be encountered such as hypotension and muscle weakness, which can be seen in paravertebral and lumbar plexus blocks. -In the current study, no complications developed in either group. However, there was not adequate power to show a difference in uncommon complications. -Hypotension, bradycardia, and deterioration in vital signs was not specifically described. **Limitations:** -Measurements could not be taken of the sensory block level of the QL and TAP blocks applied to the children aged 1 to 7 years.
							Investigator recommendations: -There is a need for much further research in this area with comparisons of the QL, TAP block, and wound infiltration groups in abdominal surgeries for pediatric patients and for adults.

Kumar *et al.* (2018) A comparative study of transversus abdominis plane block versus quadratus lumborum block for postoperative analgesia following lower abdominal surgeries: a prospective double-blinded study.	Prospective, randomized, double-blinded study was conducted over a period of 6 months to compare the efficacy of TAP block versus QL block in providing postoperative analgesia for lower abdominal surgeries. Patients were randomly allocated into two groups, where Group A received TAP block with 20 mL of 0.25% ropivacaine on each side (n = 35) and Group B received QL block with 20 mL of 0.25% ropivacaine on each side (n = 35). The TAP block or the QL block was performed on each side at the end of the surgery and before extubation by the anesthesiologist under ultrasound guidance using a linear array transducer of 10Mhz frequency (MINDRAY) using an in-plane technique. All patients were given acetaminophen 1 g IV every 8 h during the first 24 h after surgery. Patients were given IV boluses of 1 mg morphine when NPIS (0–10) score at rest was more than 4 at any time patients complain of pain and hemodynamics monitored. Ondansetron 4 mg IV was administered in case of reported PONV.	70 ASA I-II adult patients aged between 18 and 60 years of either sex, who underwent elective lower abdominal surgery under GA. Patients were randomly allocated into one of the two groups (Group A or Group B) by computer-generated list of random numbers and were blinded from the technique. Blocks were performed by the attending anesthesiologists at the end of surgery. The primary outcome measured was duration for requirement of first rescue analgesic, and the secondary outcomes measured were pain score (NPIS scale 0–10) at rest and total analgesic consumption (morphine in mg). All 70 patients randomized were included and analyzed for the study. The demographic data (age, sex, and body mass index) were comparable between the two groups, as well as duration of surgery. There was an equal number of males and females in both groups.	IV1=QL block with injection of 20 mL of 0.25% ropivacaine on each side. IV2=TAP block with injection of 20 mL of 0.25% ropivacaine on each side DV1=duration for requirement of 1st rescue analgesic, DV2=pain score (NPIS scale 1-10) at rest, DV3=total analgesic consumption (morphine in mg)	SPSS version 23 was utilized with independent t-test or Mann-Whitney U Test (whichever applicable). The NPIS score was analyzed using Chi square or Fisher's exact t-test and data was expressed a mean±SD. $P < 0.05$ was considered statistically significant. A minimum sample size was 35 for each group with type-1α error of 0.05, with power of the study at 80%.	Patients who received QL block had a significant improvement in postoperative pain relief with reduced consumption of opioids. The time for first analgesic requirement was 243.00 ± 97.36 min and 447.00 ± 62.52 min and the total analgesic consumption (morphine in mg) was 5.65 ± 1.55 and 3.25 ± 0.78 in Group A and Group B, respectively, both of which were statistically significant ($P < 0.001$, 95% CI: 1.81–2.98). There was a significant difference in postoperative pain scores (NPIS scale 0–10) at rest, between the two groups, up to 16 h. There was no difference in the pain scores 24 h post-surgery indicating the wearing off the block in both the groups.	QL block would be a better option for providing postoperative analgesia during abdominal surgeries, in terms of duration for requirement of 1 rescue analgesic, better pain score at rest, and total opioid analgesic consumption. All these factors contribute to faster postoperative recovery and earlier mobilization of patient. The adverse events associated with escalating doses of morphine, such as pruritus, nausea, somnolence, and respiratory depression can also be avoided by lower doses required with QL block. The topographically broader field of action (T6 to L1) and longer duration of pain-relief make it superior to TAP block in providing postoperative pain relief. Although the duration of action differs with each study, there is a significant difference between TAP and QL blocks.	**Level I** **Quality A** **Strengths:** -Consistent with the literature -Highest level of evidence with sufficient sample size. **Weaknesses:** -Not all blocks (TAP, QL) were performed by the same anesthesiologist. **Limitations:** -None specifically mentioned. **Feasibility of use in practice:** -Procedure-related complications are considerably less with QL block. There has been no report of infections following the procedure. The site of needle entry is distant from the abdominal viscera and large blood vessels, thus making the procedure much safer when compared to other abdominal wall blocks. **Investigator recommendations:** -None

Baytar *et al.* (2019) Comparison of ultrasound-guided subcostal transversus abdominis plane block and quadratus lumborum block in laparoscopic cholecystectomy: a prospective, randomized, controlled clinical study.	Single-center, prospective, randomized, controlled, and double-blinded clinical study was conducted to compare the effectiveness of USG TAP block and QL block as preventive analgesia methods after laparoscopic cholecystectomy. Patients were randomly assigned to 1 of 2 groups preoperatively. Patients in group TAP (n = 60) received 0.3 mL/kg bupivacaine with USG bilateral subcostal TAP block; patients in group QL (n = 60) received 0.3 mL/kg bupivacaine with USG bilateral QL block. Ten minutes before the end of the operation, all patients were administered 20 mg IV tenoxicam. For postoperative pain control, an IV PCA device was prepared with an IV solution of 54 ml saline + 6 ml tramadol (300 mg). The bolus dose was set to 5 mL, with a lock-out time of 30 min and no basal infusion. The first bolus dose was administered when the VAS score was >3.	120 ASA I-II patients, 18-75 years of age, who were scheduled to undergo elective laparoscopic cholecystectomy. A total of 107 patients (53 in group TAP and 54 in group QL) were ultimately evaluated. Primary outcomes included pain scores and consumption of rescue analgesics. Pain was evaluated according to resting VAS and DVAS scores. Another anesthesiologist evaluated VAS scores at 0, 1, 6, 12, and 24 h. Also, tramadol consumption during 24 hours and the use of another rescue analgesia (when VAS >5, 1 gr paracetamol was ordered to be given) were recorded by the same anesthesiologist. Secondary outcomes included hemodynamic parameters (BP >140/90 mmHg; HTN, HR >100/min; tachycardia, HR <60/min; bradycardia), side effects (agitation, speech difficulties, drowsiness, mental changes, tinnitus, dizziness, tremors, and numbness), and patient and surgeon satisfactions (very satisfied, satisfied, undecided, and not satisfied).	IV1=QL block with injection of 0.3 mL/kg 0.25% bupivacaine (max 20 mL on each side). IV2=TAP block with injection of 0.3 mL/kg 0.25% bupivacaine (max 20 mL on each side). DV1=pain scores (VAS and DVAS scores). DV2=intraoperative opioid consumption. DV3=number of analgesia doses delivered by the PCA device and the total amount of tramadol consumed. DV4=hemodynamic changes. DV5=intraoperative complications. DV6=postoperative complications. DV6=patient and surgeon satisfactions	For statistical evaluation, SPSS version 22 was utilized. Based on a pilot study, the minimum sample size required was 84 (power of 0.80 and CI of 0.95 as reference). In the descriptive statistics, quantitative data are expressed as mean ± SD and qualitative data are expressed as % values. Conformity to normal distribution was assessed using the Kolmogorov–Smirnov test. For data not exhibiting normal distribution, the Mann-Whitney U test, Kruskal-Wallis test, and the chi-squared tests were used; $p < 0.05$ was considered to be statistically significant.	The intraoperative consumption of fentanyl was similar in both groups. No significant difference was found in VAS and DVAS scores between the groups, nor was there any difference in the 24 h consumption of tramadol. **Primary outcomes** No statistically significant difference: -Between VAS and DVAS scores between patients in group TAP and group QL at 0, 1, 6, 12, and 24 h ($p > 0.05$). -Between the groups with regard to intraoperative opioid consumption (group TAP, 1.63 ± 0.23; group QL, 1.67 ± 0.27; $p > 0.05$). The patients were followed up for a period of 24 h with regard to PCA device use. -In the number of analgesia doses delivered by the PCA device and the total amount of tramadol consumed between group TAP and group QL. There was no requirement for additional analgesia postoperatively. **Secondary outcomes** No statistically significant difference was found: -Between the groups with regard to HR and mean BP ($p > 0.05$). -In intraoperative complications (HTN, $p = 1.000$; hypotension, $p = 0.440$; bradycardia, $p = 0.278$; tachycardia, $p = 1.000$) ($p > 0.05$). In the comparison of postoperative complications, PONV was recorded in 3 patients in group TAP and 2 patients in group QL, and HTN was observed in 1 patient in group QL. No statistically significant difference with regard to patient and surgeon satisfaction was found between the groups ($p > 0.05$). The duration of anesthesia was significantly longer in group QL (approx. 8 min) ($p = 0.013$).	Subcostal TAP and QL blocks under GA before the surgical incision in laparoscopic cholecystectomies reduced postoperative VAS and DVAS scores and tramadol consumption to a similar level. In upper abdominal surgery, such as laparoscopic cholecystectomy, subcostal TAP block applied under US guidance can be considered to have the advantages of easier application and a shorter time compared with QL block.	**Level I** **Quality A** **Strengths:** -Highest level of evidence with sufficient sample size and nicely done blinded techniques. -Randomization was achieved using the sealed envelope technique. **Weaknesses:** -Does not agree with current literature. -Attrition bias **Limitations:** -Laparoscopic cholecystectomy is minimal invasive surgery (less postoperative pain found than that in laparotomy). -The depth of anesthesia was not monitored. **Feasibility of use in practice:** -The QL block is a deep regional block and has to be performed in lateral decubitus position. -The QL block application requires more experience and knowledge of sonoanatomy. **Investigator recommendations:** -None

Huang *et al.* (2020) Posteromedial quadratus lumborum block versus transversus abdominal plane block for postoperative analgesia following laparoscopic colorectal surgery: a randomized controlled trial.	Single-center, prospective, randomized controlled double-blind study conducted at a tertiary hospital (at the Department of Anesthesiology at Peking University First Hospital) from March to August 2018 to investigate the analgesic efficacy of the pre-operative, USG posteromedial QL block on morphine consumption and pain scores, compared with the USG lateral TAP block, after laparoscopic colorectal surgery. Pre-operatively, patients were randomized based on a computerized random number to receive either a QL or TAP block (0.375% ropivacaine 20 mL bilaterally for each group). The standardized postoperative analgesic regimen consisted of 1 g of paracetamol every 8 h, 40 mg of parecoxib every 12 h, and an IV bolus of morphine administered using a PCA device up to	80 ASA I-II colorectal cancer patients between 40-80 years old, undergoing laparoscopic radical resection were enrolled. 77 patients (group QL 38, group TAP 39) were included in the analysis. The primary outcome was cumulative morphine consumption 24 h postoperatively. Secondary outcomes included postoperative pain scores, clinical recovery (time to return of bowel function and length of hospital stay), and side-effect profiles of the blocks.	The independent variables were time and treatment. Time was modelled as a categorical variable. The main effects of time and treatment and the interaction were assessed. IV1=time, IV2=QL block with injection of 20 mL of 0.375% ropivacaine bilaterally, IV3=TAP block with injection of 20 mL of 0.375% ropivacaine bilaterally DV1=cumulative morphine consumption 24 h postoperatively, DV2=pain levels (VAS scores) at rest and during movement, DV3=total pain load (defined as the area under the curve calculated from VAS-time curves), DV4=time until the earliest single PCA dose of morphine, DV5=patient satisfaction with pain management, DV6=side effects associated with morphine use and the block technique (PONV, itching, respiratory depression, Ramsay sedation scores, hypotension,	-SPSS version 24 was utilized. -Descriptive statistics were presented as mean ± SD, median [interquartile range (IQR)], or numbers and percentage where appropriate. -Continuous data were assessed for normality using histograms, normal Q-Q and box plots, and the Kolmogorov-Smirnov test. -T-test was performed when the variables were normally distributed. -Mann-Whitney U test was used for between-group comparisons of non-normally distributed continuous variables except for the pain VAS score. -For postoperative cumulative morphine consumption, a Bonferroni correction for multiple between-group comparisons was used to control for false positive rates. -Generalized estimating equations were used to model pain VAS scores longitudinally to assess the effects of each block type. -Pairwise comparisons -AR1 structure of working correlation matrix was assumed	Pre-operative USG posteromedial QL block significantly lowered postoperative morphine consumption in the first 24 h postoperatively and decreased pain intensity at least from 8 to 24 h in the setting of multimodal analgesia, compared with a pre-operative lateral TAP block, in patients undergoing laparoscopic colorectal surgery. **Primary outcome** -Cumulative PCA morphine consumption 24 h postoperatively was significantly lower in the QL group than in the TAP group (estimated median difference −8 mg, 95% adjusted CI −12 to −6 mg, P < 0.001). The first PCA morphine demand was the 6th postoperative hour for the TAP group and 12th hour for the QL group (P > 0.05). **Secondary outcomes** -No significant difference between the groups in terms of pain VAS scores at rest and during movement, but interactions between the group and time intervals were significant (P < 0.001), which indicated significant differences between groups at some time points. -VAS scores at rest were lower 8, 12 and 24 h postoperatively in the	The pre-operative bilateral, USG, posteromedial QL block reduces morphine consumption and improves analgesia in the setting of multimodal analgesia compared with the lateral TAP block after laparoscopic colorectal radical resection.	**Level I** **Quality A** **Strengths:** -Highest level of evidence with sufficient sample size and nicely done blinded techniques. -Consistent with literature. **Weaknesses:** -Utilization of a new posteromedial approach for the QL block. -No protocol for PONV prophylaxis was performed. **Limitations:** -Having a control group with no regional blocks would be helpful to evaluate exclusively the role of the QL and TAP blocks in the multimodal analgesia protocol. -Sensory level testing was not utilized to assess block success. Instead, the spread patterns of the LA was observed on ultrasound. -Cumulative morphine consumption measured at various intervals could have been affected by the patient's use of morphine for nonsurgical pain such as headache and back pain. -The mean BMI of the patients (=23) is low by western standards
	48 h postoperatively. The PCA device delivered a patient-demand bolus of 2 mg morphine with a lockout interval of 5 min and no background infusion.		quadriceps weakness, hematoma, infection, evidence of systemic toxicity to the local anesthetic), DV7=BP at the time of incision and 5 min after incision, DV8=intraoperative opioid requirement, DV9=time to first flatus, oral intake, diet, ambulation and discharge from hospital, DV10=major complications 30 d after surgery (including severe arrhythmias and cardiac insufficiency)	and robust standard errors were used -A χ2 test or Fisher's exact test was used to compare categorical data. -Probability values smaller than α = 0.05 were considered significant (except for opioid consumption). -Based on a power of 80% and a significance level of 5%, a minimum sample size of 36 patients per group was required. To account for dropouts, 40 patients per group were assigned.	QL group compared with the TAP group (P < 0.006). -A statistically significant difference was also identified between the groups with respect to VAS scores during movement 8, 12, 24, and 36 h postoperatively in favor of the QL group (P < 0.006). -Pain load in the 48 h after surgery was significantly lower in the QL group compared with the TAP group (63.0 [IQR 14.8–101.9] versus 112.0 [IQR 58.5–154.0], respectively, P = 0.003). -The QL group reported higher overall postoperative analgesia satisfaction scores than the TAP group (P = 0.014). -PONV occurred in 3 patients (7.9%) in the QL group and 8 patients (20.5%) in the TAP group, and no statistical significance was detected between the groups (P = 0.192). -Up to 48 h postoperatively, no significant differences were observed in the remainder of the secondary outcome measures.		which might influence block performance. -Block performing times were not noted. **Feasibility of use in practice:** -It takes relatively more time to perform a posteromedial QL block than a lateral TAP block, especially for obese patients. **Investigator recommendations:** -Testing hypotheses about opioid consumption and pain scores in isolation could inflate type I error probability. Joint hypothesis testing would have been more appropriate.

Deng *et al.* (2019) Quadratus lumborum block versus transversus abdominis plane block for postoperative pain management after laparoscopic colorectal surgery a randomized controlled trial.	Randomized double-blind clinical trial study which was registered in the Chinese registry of clinical trials and carried out between January 2018 and December 2018. The study aimed to compare the QLB method with TAPB for postoperative pain management in patients undergoing laparoscopic colorectal surgery. Patients were randomly assigned into 2 groups using Excel software. After surgery, patients received bilateral QLB or TAPB with 20mL of 0.375% ropivacaine. Patients in both groups regularly received IV parecoxib (40mg every 12 hour) for postoperative analgesia. They also received sufentanil followed by PCIA pump, which was programmed to deliver 3mcg sufentanil on demand with a lockout interval of 15 minutes and no background infusion. When the	74 ASA I-II patients ages 18-70 years scheduled for laparoscopic colorectal surgery. 6 patients withdrew from the study before completion. Each group had 34 patients. Patients' demographic characteristics such as age, sex, BMI, and ASA grades were not significantly different between the 2 groups. The primary outcome measure was the cumulative consumption of PCIA sufentanil at stationary time intervals (6, 24, and 48 hours) postoperatively. Secondary outcomes included resting or moving (dynamic) NRS scores at 2, 4, 6, 24, and 48 hours postoperatively and postoperative side effects. All patients were followed up for 48 hours by the same resident anesthesiology who was blinded to the group allocation.	IV1=QL block with injection of 20 mL of 0.375% ropivacaine on each side, IV2=TAP block with injection of 20 mL of 0.375% ropivacaine on each side DV1=consumption of PCIA sufentanil at stationary time intervals, DV2=resting or moving (dynamic) NRS scores, DV3=postoperative side effects (dizziness, nausea/vomiting, pruritis)	SPSS version 19 was utilized. The quantitative variables are expressed as mean ± SD for normally continuous variables. Two-sample student t-test was used to compare 2 groups. The qualitative data are expressed as the number of cases for nominal variables, and comparison was performed using Chi-square test and Fisher exact test. A 2-tailed P <0.05 was considered statistically significant. The power analysis applied was based on the cumulative sufentanil consumption at 48 h after surgery. Based on a pilot study and assuming group means ± SD of 58.9±15.4mg (QLB group) and 71.3±19.6mg (TAPB group), 62 patients were required to achieve a power of 80% and the a-value of 0.05 to detect differences between the 2 groups. Taking into consideration of possible dropouts of 20%, 74 patients were enrolled in the study.	Patients in the QLB group used significantly less sufentanil than TAPB group at 24 and 48 hours (P<.05), but no significant difference was observed between the 2 groups at 6 hours (P=.33) after surgery. -There were no significant differences in NRS results between the 2 groups at rest or during movement (P>.05). -Incidence of dizziness in the QLB group was lower than in TAPB group (P<.05). -The occurrence of pruritus, nausea and vomiting were not significantly different between the 2 groups (P>.05). -No other complications were observed such as arrythmia or hypotension.	The QLB is a more effective postoperative analgesia as it reduces sufentanil consumption compared to TAPB in patients undergoing laparoscopic colorectal surgery.	**Level I** **Quality A** **Strengths:** -Highest level of evidence with sufficient sample size and nicely done blinded techniques. -Consistent with literature. **Weaknesses:** -Block performing times were not noted (article stated that blocks were performed in PACU). -Attrition bias **Limitations:** -None specifically mentioned. **Feasibility of use in practice:** **Investigator recommendations:** -Additional studies are required to explore the mechanism of QLB as well as compare QLB and the subcostal TAPB in upper abdominal surgeries. -Furthermore, investigations are needed to provide general recommendations for the use of QLB.
	NRS score exceeded 3, the patients employed the PCIA pump. The max sufentanil dose of bolus per hour was 12mcg.						

Yousef *et al.* (2018) Quadratus lumborum block versus transversus abdominis plane block in patients undergoing total abdominal hysterectomy: a randomized prospective controlled trial.	Single-center, prospective, randomized controlled, double blinded study carried out in the gynecological department of a hospital over a 6-month time period (from July to December 2017). The aim was to compare the effect of bilateral USG QLB versus bilateral USG TAP block on intraoperative and postoperative analgesia in patients undergoing total abdominal hysterectomy under GA. Patients were randomly allocated into 2 equal groups: Group TAP (n=30) and Group QL (n=30). A computer system was used for randomization by creating a list of number each number referred to one of the two groups. Block randomization was used to ensure equality of the groups.	60 adult female patients, ASA I-II, aged between 45-60 years, scheduled for total abdominal hysterectomy. No patients were excluded from the study. No significant differences were observed between the two groups regarding age, weight, ASA physical status, or duration of surgery. The primary outcome was the total dose of morphine used postoperatively/patient (rescue analgesia) for 24 h. The secondary outcomes were the total dose of fentanyl used intraoperatively, VAS for pain (ranging from 0 to 10, where 0 no pain and 10 maximum pain) was evaluated postoperatively at 30 min and 2, 4, 6, 12, and 24 h postoperative, duration of postoperative analgesia (the time from recovery to the first given dose of morphine), and the number of patients that needed rescue analgesia.	IV1=QL block with injection of 20 mL of 0.25% bupivacaine on each side, IV2=TAP block with injection of 20 mL of 0.25% bupivacaine on each side DV1=total dose of morphine used postoperatively/patient (rescue analgesia) for 24 h, DV2=total dose of fentanyl used intraoperatively, DV3=VAS for pain (ranging from 0 to 10, where 0 no pain and 10 maximum pain) at 30 min and 2, 4, 6, 12, and 24 h postoperative, DV4=duration of postoperative analgesia (the time from recovery to the first given dose of morphine), DV5=the number of patients that needed rescue analgesia	SPSS version 20 was utilized. Data were expressed as mean ± SD, frequency, or frequency and percentage. Independent sample t-test was used to analyze quantitative data. Qualitative data were analyzed using ChiSquare test. $P < 0.05$ was considered to be statistically significant. The total dose of morphine/patient was used to calculate sample size. The sample size was found to be 28 patients in each group assuming a SD of 3.9 mg of morphine as rescue analgesic (from pilot study), α error of 0.05, β error of 0.2, and a power of 80%. Intention was to include 30 patients in each group to compensate for excluded patients.	-The mean amount of morphine used/patient postoperatively was significantly higher in TAP group than in QL group, $P = 0.001$ (14.46 ± 3.4 mg vs. 10.06 ± 3.8 mg, respectively). -VAS for pain was significantly higher in TAP group than in QL group at all the measured time postoperatively. -The total amount of fentanyl used/patient intraoperatively was significantly higher in TAP group than in QL group, $P = 0.001$ (110.6 ± 22.4 mcg vs. 43.16 ± 19.5 mcg, respectively). -Duration of postoperative analgesia was shorter in TAP group than in QL group (8.33 ± 4 h vs. 15.1 ± 2.12 h, $P = 0.001$). -The number of patients that requested analgesia was significantly higher in TAP group than in QL group (23 patients in TAP group vs. 8 patients in QL group, $P = 0.017$). -Both groups were comparable with regard to side effects and no serious complications were detected (one patient in each group suffered from vomiting and were treated with IV granisetron 4 mg).	In patients undergoing hysterectomy bilateral QLB provided more effective intraoperative and postoperative analgesia with less intraoperative fentanyl consumption, less VAS for postoperative pain, a smaller number of patients needed analgesia after surgery, and less postoperative morphine consumption compared with bilateral TAP block, which showed shorter duration of postoperative analgesia.	**Level 1** **Quality A** **Strengths:** -Highest level of evidence with sufficient sample size and nicely done blinded techniques. -Randomization was achieved using the closed envelope technique. -Consistent with literature. **Weaknesses:** -Reporting bias **Limitations:** -Dermatomal levels of the blocks were not assessed. **Feasibility of use in practice:** -QLB is not technically difficult to be done because it is a superficial fascial block between posterior abdominal wall muscle (QL and erector spinae). **Investigator recommendations:** -None
Liu *et al.* (2020) Quadratus lumborum block versus transversus abdominis plane block for postoperative analgesia in patients undergoing abdominal surgeries: a systematic review and meta-analysis of randomized controlled trials.	A total of 8 RCTs involving 564 patients were included.	Abdominal surgeries including cesarean delivery, low abdominal surgery, appendectomy, total abdominal hysterectomy, and laparoscopic cholecystectomy	**Primary outcomes:** Pain scores **Secondary outcomes:** Opioid consumption, postoperative analgesia duration and PONV incidence All opioids were converted into equianalgesic doses of IV morphine for analysis (IV morphine 10 mg = IV fentanyl 100 mcg = IV sufentanil 10 mcg). Pain scores reported as visual, verbal, or numeric rating scale scores were converted to a standardized 0 to 10 analog scale for the quantitative evaluations. The following aspects were assessed: random sequence generation, allocation scheme concealment, blinding, accuracy of data results, freedom from selective reporting and other biases. The quality of the outcomes in the meta-analysis was evaluated by the GRADE.	The statistical analysis was conducted using RevMan 5.3. A heterogeneity test was performed on the included studies and calculated the statistics. When I2 was < 0.5 or p was > 0.1, the level of heterogeneity was low, and a fixed-effects model was applied. Otherwise, a random effects model was used to analyze the sources of heterogeneity. Continuous outcomes are represented as the standardized mean difference (Std.MD) with the associated 95% CI. Dichotomous outcomes are represented as the relative risk (RR) with the associated 95% CI.	The meta-analysis showed that the pain scores at 2, 4, 6, 12 and 24 postoperative hours were significantly lower in the QL group than in the TAP group. The amount of postoperative morphine consumption was lower in the QL group than in the TAP group. The duration of postoperative analgesia was longer in the QL group than in the TAP group. There was no statistically significant difference between the two groups with regard to the incidence of PONV.	The QL block provides better pain management with less opioid consumption than the TAP block after abdominal surgery.	**Level I Quality A** **Strengths:** -Highest level of evidence -Consistent with literature **Weaknesses:** -Due to the limited number (< 10) of included studies, publication bias was not evaluated. -Regarding the sensitivity analysis, there was significant heterogeneity when performing the analysis. **Limitations:** -In the data extraction, some observation indexes in the literature were only reported as the mean and median or in the form of graphics and text and could not be included in the analysis (possibly excluding some high-quality studies). -No explicit mention of the optimal drug type and concentration for the two trunk plane blocks. -Although there was a statistically significant difference in postoperative pain scores between patients receiving QL blocks and TAP blocks, a difference in pain scores that is less than 2 points has limited clinical relevance.

							Investigator recommendations: -Optimal drug type and concentration need to be further studied to arrive at a satisfactory approach. -Further studies are needed to clarify the more subtle clinical differences in pain after receiving a QL block compared with a TAP block after abdominal surgery.

Notes: QLB, Quadratus Lumborum Block; QL, Quadratus Lumborum; TAPB, Transversus Abdominis Plane Block; TAP, Transversus Abdominis Plane; USG, Ultrasound-guided; Mg, milligrams; Mcg, micrograms; mL, milliliters; kg, Kilogram; IV, Intravenous; MAP, Mean Arterial Blood Pressure; BP, Blood Pressure; HR, Heart Rate; HTN, Hypertension; BMI, Body Mass Index; PONV, Post-operative Nausea Vomiting; VAS, Visual Analog Scale; DVAS, Dynamic Visual Analog Scale; NPIS, Numerical Pain Intensity Scale; FLACC, Face, Legs, Activity, Cry, Consolability; NRS, Numeric Rating Scale; RCT, Randomized Controlled Trial; ASA, American Society of Anesthesiologists; GA, General Anesthesia; PCA, Patient-controlled Analgesia; IV1, Independent Variable 1; DV1, Dependent Variable 1; SD, Standard Deviation; CI, Confidence Interval; GRADE, Grading of Recommendations Assessment, Development and Evaluation

Appendix C: IRB Exemption Letter

FIU | FLORIDA INTERNATIONAL UNIVERSITY

Office of Research Integrity
Research Compliance, MARC 414

MEMORANDUM

To:	Dr. Vicente Gonzalez
CC:	Danielle Agostino
From:	Elizabeth Juhasz, Ph.D., IRB Coordinator EJ
Date:	May 25, 2021
Protocol Title:	**"Education Intervention Regarding Utilization of the Quadratus Lumborum Block for Post-Operative Analgesia Following Abdominal Surgery"**

The Florida International University Office of Research Integrity has reviewed your research study for the use of human subjects and deemed it Exempt via the **Exempt Review** process.

IRB Protocol Exemption #: IRB-21-0184 **IRB Exemption Date:** 05/25/21
TOPAZ Reference #: 110238

As a requirement of IRB Exemption you are required to:

1) Submit an IRB Exempt Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved prior to implementation.
2) Promptly submit an IRB Exempt Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
3) Submit an IRB Exempt Project Completion Report Form when the study is finished or discontinued.

Special Conditions: N/A

For further information, you may visit the IRB website at http://research.fiu.edu/irb.

EJ

Miami Beach Anesthesiology Associates, Inc.

Mount Sinai Medical Center • Division of Anesthesia

March 1, 2021

Vicente Gonzalez, DNP, CRNA, APRN
Clinical Education Coordinator
Department of Nurse Anesthesiology Practice
Florida International University

Dr. Gonzalez

Thank you for inviting Mount Sinai Medical Center to participate in Doctor of Nursing Practice (DNP) project conducted by Danielle Agostino entitled "Education Intervention Regarding Utilization of the Quadratus Lumborum Block for Post-Operative Analgesia Following Abdominal Surgery" in the Nicole Wertheim College of Nursing and Health Sciences, Department of Nurse Anesthetist Practice at Florida International University. I have given the student permission to conduct the project using our providers.

Evidence-based practice's primary aim is to yield the best outcomes for patients by selecting interventions supported by the evidence. This proposed quality improvement project seeks to investigate and synthesize the latest evidence.

We understand that participation in the study is voluntary and carries no overt risk. All Anesthesiology providers are free to participate or withdraw from the study at any time. The educational intervention will be conveyed by a 15-minute virtual PowerPoint presentation, with a pretest and posttest questionnaire delivered by a URL link electronically via Qualtrics, an online survey product. Responses to pretest and posttest surveys are not linked to any participant. The collected information is reported as an aggregate, and there is no monetary compensation for participation. All collected material will be kept confidential, stored in a password encrypted digital cloud, and only be accessible to the investigators of this study: Danielle Agostino and Dr. Vicente Gonzalez.

Once the Institutional Review Board's approval is achieved, this scholarly project's execution will occur over two weeks. Danielle Agostino will behave professionally, follow standards of care, and not impede hospital performance. We support the participation of our Anesthesiology providers in this project and look forward to working with you.

Respectfully,

Jampierre (J.P.) Mato, DNP, CRNA, APRN
Executive CRNA Director
SRNA Coordinator/Supervisor
Electronic Mail: Jampierre@bellsouth.net
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Appendix D: QI Project Consent

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CONSENT TO PARTICIPATE IN A QUALITY IMPROVEMENT PROJECT
"Education Intervention Regarding Utilization of the Quadratus Lumborum Block for Post-Operative Analgesia Following Abdominal Surgery"

SUMMARY INFORMATION
Things you should know about this study:

- **Purpose:** Educational module concerning the use of the quadratus lumborum block for post-operative analgesia following abdominal surgery.
- **Procedures:** If you choose to participate, you will be asked to complete a pre-test, review a PowerPoint with voiceover, and then complete a post-test.
- **Duration:** This will take about a total of 20 minutes.
- **Risks:** The main risk or discomfort from this research is minimal.
- **Benefits:** The main benefit to you from this research is to increase the participant's knowledge on the role of the quadratus lumborum block for post-operative analgesia following abdominal surgery.
- **Alternatives:** There are no known alternatives available to you other than not taking part in this study.
- **Participation:** Taking part in this research project is voluntary.

Please carefully read the entire document before agreeing to participate.

PURPOSE OF THE PROJECT
You are being asked to be in a quality improvement project. The goal of this project is to improve anesthesia provider knowledge on the utilization of the quadratus lumborum block for post-operative analgesia following abdominal surgery.

DURATION OF THE PROJECT
Your participation will require about 20 minutes of your time.

PROCEDURES
If you agree to be in the project, we will ask you to do the following things:

RISKS AND/OR DISCOMFORTS
There are no foreseeable risks with you for participating in this project.

BENEFITS
The following benefits may be associated with your participation in this project: An increase in knowledge regarding utilization of the quadratus lumborum block and its role in the management of post-operative analgesia following abdominal surgery. This will help you to provide more

optimal care for surgical patients, while decreasing pain scores. The overall objectives of the program are to increase the quality of healthcare delivery, reduce total opioid consumption, and improve patient satisfaction and post-operative recovery after abdominal surgery.

ALTERNATIVES
There are no known alternatives available to you other than not taking part in this project. However, if you would like to receive the educational material given to the participants in this project, it will be provided to you at no cost.

CONFIDENTIALITY
The records of this project will be kept private and will be protected to the fullest extent provided by law. If, in any sort of report, we might publish, we will not include any information that will make it possible to identify you as a participant. Records will be stored securely, and only the project team will have access to the records.

PARTICIPATION
Taking part in this research project is voluntary. There will be approximately 10 to 15 participants total.

COMPENSATION & COSTS
There is no cost or payment to you for receiving the health education and/or participating in this project.

RIGHT TO DECLINE OR WITHDRAW
Your participation in this project is voluntary. You are free to participate in the project or withdraw your consent at any time during the project. Your withdrawal or lack of participation will not affect any benefits to which you are otherwise entitled. The investigator reserves the right to remove you without your consent at such time that they feel it is in the best interest.

RESEARCHER CONTACT INFORMATION
If you have any questions about the purpose, procedures, or any other issues relating to this research project, you may contact Danielle Agostino at 954-673-8496, dagos006@fiu.edu or Dr. Vicente Gonzalez at 305-348-0062, gonzalv@fiu.edu.

IRB CONTACT INFORMATION
If you would like to talk with someone about your rights of being a subject in this project or about ethical issues with this project, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

PARTICIPANT AGREEMENT
I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. By clicking on the "consent to participate" button below I am providing my informed consent.

Appendix E: QI Project Survey

Pretest and Posttest Questionnaire:

Quadratus Lumborum Block for Post-Operative Analgesia

INTRODUCTION

The primary aim of this QI project is to improve anesthesia provider knowledge pertaining to the utilization of the quadratus lumborum (QL) block for post-operative analgesia following abdominal surgery.

Please answer the questions below to the best of your ability. The questions are meant to measure knowledge and perceptions on the efficacy of the QL block versus the transversus abdominis plane (TAP) block for optimal post-operative analgesia following abdominal surgery.

PERSONAL INFORMATION

1. **Gender:** Male Female Other_____
2. **Age:** 25-35 36-45 46-55 55+
3. **Ethnicity:** Hispanic Caucasian African American Asian Other_____
4. **Position/Title:** _____
5. **Level of Education:** Master's Doctorate Other _____
6. **How many years have you been an anesthesia provider?** Over 10 6-10 years 1-5 years Less than 1

QUESTIONNAIRE

1. **Physiological and psychological risks for patients undergoing abdominal surgery include:**
    a. Post-operative nausea/vomiting (PONV)

b. Atelectasis

c. Depression

d. Myocardial ischemia

e. All of the above

CORRECT ANSWER: e.

2. **QL blocks provide visceral blockade by injecting local anesthetic (LA) into which fascia?**

    a. Endothoracic and nuchal fascia

    b. Endothoracic and thoracolumbar fascia

    c. Nuchal and cervical fascia

    d. Thoracolumbar and cervical fascia

CORRECT ANSWER: b.

3. **In pediatric patients undergoing laparoscopic appendectomy, research suggests that QL blocks are associated with _____ intraoperative hemodynamic stability than TAP blocks.**

    a. More

    b. Less

    c. The same

CORRECT ANSWER: a.

4. **Research suggests that the difference in block performing times for QL blocks and TAP blocks is:**

    a. 5 minutes

    b. 8 minutes

    c. 10 minutes

    d. 15 minutes

CORRECT ANSWER: b.

5. **The estimated post-operative morphine consumption in patients receiving QL blocks as opposed to TAP blocks is:**
    a. More
    b. Less
    c. The same

CORRECT ANSWER: b.

6. **Patients undergoing which type of procedure experienced improved pain scores when a QL block was utilized instead of a TAP block?**
    a. Laparoscopic colorectal surgery
    b. Abdominal hysterectomy
    c. Appendectomy
    d. All of the above

CORRECT ANSWER: d.

7. **Overall, the QL block may take longer to perform than the TAP block because:**
    a. The QL block is a deep regional block
    b. The lateral decubitus position is preferred over the supine position for the QL block as it provides better ergonomics and relevant sono-images of the neuraxial structure
    c. The QL block application requires more experience and knowledge of sonoanatomy
    d. All of the above

CORRECT ANSWER: d.

8. **During the 24 hours post-procedure, at what intervals can pain score improvement with QL blocks over TAP blocks be seen in patients undergoing abdominal surgery?**

a. 2 and 4 hr

b. 2, 4, and 6 hr

c. 2, 4, 6, and 12 hr

d. 2, 4, 6, 12, and 24 hr

CORRECT ANSWER: d.

9. The more superficial point of injection makes the posterior QL block safe because:

a. Bowel injury and intraperitoneal injection are less likely

b. The needle tip is separated from the peritoneum by the QL muscle

c. The targeted fascial plane is very bright, hyperechoic, and easily dissected

d. All of the above

CORRECT ANSWER: d.

10. The MOST significant difference between QL and TAP blocks is:

a. Decreased length of time in PACU

b. Increased duration of analgesic effect

c. Improved pain scores

d. Reduced post-operative opioid consumption

CORRECT ANSWER: b.

11. Some differences between the QL block and the TAP block are that:

a. A single-injection TAP block provides a relatively short duration of analgesia (6–12 h) with occasional patchy or variable coverage

b. QL blocks result in more extensive sensory blockade than TAP blocks (T7-L2 vs. T10-T12)

c. The paravertebral space, surrounded by adipose tissue, results in delayed LA uptake into systemic circulation as a result of the lower perfusion in adipose tissue. This leads to prolonged analgesia.

d. All of the above

CORRECT ANSWER: d.

12. **Which of the following plays the most crucial role for adequate spread in fascial plane blocks such as the TAP and QL?**

    a. Visualization of the needle on ultrasound

    b. Large volume of local anesthetic

    c. Dose of local anesthetic

    d. Patient positioning

CORRECT ANSWER: b.

13. **How likely are you to utilize the QL block as an alternative to the TAP block for post-operative analgesia following abdominal surgery?**

    a. Very likely

    b. Somewhat likely

    c. Somewhat unlikely

    d. Very unlikely

14. **How likely are you to recommend the use of the QL block as an alternative to the TAP block for post-operative analgesia following abdominal surgery?**

    a. Very likely

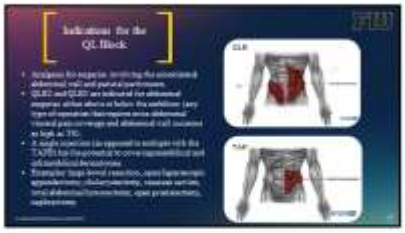
    b. Somewhat likely

    c. Somewhat unlikely

    d. Very unlikely

Appendix F: Educational Module


Approaches to the QL Block


Indications for the QL Block


Potential Complications of the QL Block


Study Findings


Recommendations for Practice


FIU
Summary


References


References