**Review Article**

**Analgesic Effect of Truncal Nerve Blocks In Hernia Repair Surgery**

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**How to cite this article:** Tune B and Zhao S (2021) Analgesic Effect of Truncal Nerve Blocks In Hernia Repair Surgery. Int J Nurs & Healt Car Scie 01(16): 2021-93.

**Submission Date:** 03 November, 2021; **Accepted Date:** 22 November, 2021; **Published Online:** 29 November, 2021

**Abstract**

In recent years, methods to encourage opioid sparing or opioid free anesthesia has been expedited by the opioid pandemic.Peripheral nerve block anesthesia has become a popular choice in reducing the need for narcotics while also serving as a long-acting analgesic. This study’s finding aims to measure the effects of implementing regional anesthesia to routine hernia repairs. The results suggests that peripheral nerve blocks are adjuvants that should be used to decrease postoperative recovery time as well as overall opioid consumption.

**Keywords:** Abdominal Surgery; Hernia Surgery; Peripheral Nerve Blocks; QL; TAP

**Introduction**

Peripheral nerve block anesthesia and analgesia has become an important adjuvant to multimodal analgesic strategies over the last decade. Its implementation has been pivotal in reducing long term opioid use in patients after surgery [1]. In addition, successful truncal nerve blocks, in combination with other analgesic modalities, often lead to analgesic efficacy similar to neuraxial techniques [2]. With the use of ultrasound guidance, truncal nerve blocks is a skill that can be mastered with relative ease, and does not possess the same risk profile as some neuraxial blockade [3]. Moreover, regional anesthetic nerve blocks attenuate the physiological and psychological stress during the perianesthetic phase, and lead to reduced postoperative morbidity and mortality [1-3,4]. Along with decreased postoperative pain and decreased opioid requirements, the addition of peripheral nerve block analgesia interventions encourage early ambulation, decrease complication rates, decreased length of hospital stay, and decreased inpatient cost [3,4].

Many varieties of truncal peripheral nerve blocks have emerged since its first introduction. The Quadratus Lumborum Block (QL), a posterior variant of the Transversus Abdominis Plane (TAP) block that offer more visceral analgesic coverage from dermatomes T6-L1, is often incorporated into a multimodal analgesia regimen for many lower abdominal surgical procedures to include, but not limited to: cesarean sections, hernia repairs, hysterectomies, bowel resections, appendectomies, cholecystectomies, and the obese population [2-4,5,6]. For upper truncal analgesia, specific peripheral nerve blocks such as the Erector Spinae Plane (ESP) block and Pectoralis Nerve (PEC) blocks offer great anesthetic and analgesic coverage for thoracotomies, mastectomies, and cardiac procedures [7,8].

**Significance of the Issue**

Inadequate postoperative pain control possesses many risks and potential complications to include, but not limited to: increased hospitalization time, increase opioids consumption, increased morbidity, and decreased patient satisfaction [1,8].  Studies have shown that in select surgeries, if pain management is not adequate, the development of Chronic Post-Surgery Pain (CPSP) is significant [9].

In the face of our current opioid crisis, alternative multimodal analgesic methods should be explored as a preventative measure for potential opioid dependence.  It is estimated that one out of fifteen patients who receives prescription opioids after surgery develop opioid abuse or dependency behaviors [1]. In addition, the Center for Disease and Control (CDC) estimates that 128 deaths each day are related to opioid overdose [10]. Opioid-related morbidity or adverse events puts overwhelming pressure on the Healthcare System. The mean cost of hospitalization for patients that experienced adverse events in comparison to non-opioid-related events is: $25,599 vs $17,374, mortality 3% vs 1%, length of stay for surgical patients 6.8 vs 5.2, and the 30-day readmission 8.9% vs 7.1% [11]. This begs the question related to fiscal responsibility and overall system sustainability.

**Rethinking Pain Management**

Historically, epidural analgesia has been the gold standard for truncal and upper truncal pain relief however, with the accessibility and accuracy of the modern-day ultrasound, there is increased utilization of regional analgesic techniques and methods [12].The ultrasound-guided QL, TAP, ESP, and PECs blocks are regional techniques that provide a simple and safe adjunct to truncal surgeries. These myofascial blocks can provide excellent recognizable sonoanatomy, especially in patients who are not candidates for epidural placement or have difficult neuraxial anatomy [13]. These peripheral nerve blocks carry great utility as a single-shot injection or as a continuous indwelling catheter analogous in analgesia to thoracic epidural injection and infusions, but with less hemodynamic sensitivity. The peripheral nerve blocks also allow for selective dermatomal blockade which the epidural does not provide. The range of dermatomes reached can be anywhere from cervical to lumbar just like an epidural, utilizing a combination of different blocks while also minimizing the side effects that are present with epidurals [13-15]. For routine postoperative pain control, epidural analgesia may no longer be the best option, nor is it considered the gold standard any longer with modern-day anesthesia practices [13-15].

One of the biggest advantages of ultrasound-guided peripheral nerve blocks of the truncal region is its flexible application and relatively easy acquired technique. These blocks may be performed with the patient in the supine position, however, it is well recorded the success that providers have performing the QL and ESP blocks in prone or lateral position as well [14,16]. In comparison to the epidural, positioning is usually particular and requires much more cooperation from the patient [12]. Under ultrasound guidance, performing peripheral nerve blocks significantly reduces incidence of complications in comparison to traditional landmark-based procedures [15]. The ultrasound needle is under constant visualization, and the local anesthetic spread may be simultaneously seen by the clinician performing the block [15]. Since myofascial blocks are dependent upon the local anesthetic spread between the muscle plane, they have a slower onset time, providing analgesia without causing sympathectomy or systemic vasodilation that neuraxial anesthesia often does [12-16].

Although multiple studies have identified inconsistent analgesia resulting from varied local anesthetic spread, it is still certain that when the local anesthetic reaches the dorsal and ventral rami it provides very effective analgesia [12,16-19]. In cadaver studies, evidence reveals that peripheral nerve blocks such as the ESP, paravertebral, and QL are more likely to infiltrate the epidural or paravertebral space, whereas other nerve blocks such as the TAP, and PECs are more dependent on the local anesthetic targeting certain nerve roots [2,6,15,17,20,21]. Thus, as more research is conducted, more data may be used to improve the predictability, reproducibility, and efficacy for the analgesic effects of these blocks.

The goal for this project assumes that implementing the use of the QL, TAP, PECs, or ESP block in a small rural hospital that routinely performs truncal surgeries, will encourage the implementation for enhanced recovery after surgery (ERAS) pain management protocols. The subsequent outcomes hopefully result in decreased opioid consumption, decreased recovery time, decreased opioid induced side effects, and increased patient satisfaction. Additionally, the increase in better patient safety and outcomes is encouraged as healthcare progressively leans towards opioid sparing or opioid-free practices. Therefore, a selection of case studies and comprehensive literature reviews were selected for the measurement of the interventions.

**Methods**

In order to compare the efficacy of the regional blocks, hernia repair cases within the past two years have been examined from May 2018 to August 2018 in which anesthesia care was delivered by a former anesthesia practice group, and May 2020 to August 2020 of which care was delivered by the current anesthesia group. This timeframe appropriately reflects two different sets of anesthesia providers who utilize different analgesic techniques on the same surgical procedures. Twenty patients from a former anesthesia group that did not utilized truncal blocks for hernia repair analgesia were randomly chosen and compared to twenty patients from the new anesthesia group whom received a truncal block for postoperative analgesia. The former anesthesia group providers utilized opioids as the primary method for analgesia management, with occasional epidural usage as the solution for acute and postoperative pain management. The latter group of anesthesia providers practice opioid-sparing techniques, which includes primarily peripheral nerve blocks and non-opioid analgesics. The quantity and frequency of opiate administration and other analgesic medication are recorded in the postoperative period as well as the total postoperative recovery time.

Patients included in this study are all scheduled for a hernia repair either epigastric, inguinal, or umbilical with the same surgeon. In the group that received a nerve block, it was either a TAP, QL or the occasional ESP if appropriate. All blocks were performed under ultrasound guidance utilizing a Sonosite II linear or curvilinear probe. The Pajunk brand of echogenic needles were utilized, and the patients received dose appropriate volume (not exceeding 2.5mg/kg) of 0.5% Ropivicaine. Exclusion criteria included patients who had chronic pain syndromes, chronic opioid use, blood pressure management in recovery, or any other complications that required additional time in the recovery that is not pain related.

The statistical results will be calculated with data analysis software. All opioid analgesics that are administered in the postoperative phase will be converted to morphine equivalents using a standardized and accepted conversion table.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Age** | **M/F** | **Procedure** | **Anesthesia** | **Par Time** | **Medication** | **Total Medications** |
| 25 | F | Lap Epigastric Hernia Repair | Gen | 54 | Fentanyl 50 mcg | Fentanyl 550 mcg |
| 24 | F | Lap Epigastric Hernia Repair & Umbilical Hernia Repair w/ Mesh | Gen | 104 | Meperidine 25 mg, Fentanyl 25 mcg | Meperidine 225 mg |
| 58 | M | Lap Umbilical Hernia Repair | Gen | 94 | 0 | Morphine 37 mg |
| 29 | M | Lap Umbilical Hernia with Mesh and Right Inguinal Hernia | Gen | 96 | Fentanyl 50mcg |  |
| 61 | F | Lap Biateral Inguinal Hernia Repair | Gen | 80 | 0 |  |
| 60 | F | Lap Umbilical Hernia | Gen | 103 | Fentanyl 50 mcg |  |
| 21 | M | Lap Bilateral Inguinal Hernia Repair with Mesh | Gen | 111 | Meperidine 25 mg |  |
| 56 | F | Lap Epigastric and Umbilical Hernia Repair with Mesh | Gen | 95 | Morphine 10 mg Meperidine 25 mg |  |
| 61 | M | Lap Bilateral Inguial Hernia Repair | Gen | 77 | Fentanyl 50 mcg |  |
| 44 | M | Lap Umbilical Hernia Repair with Mesh | Gen | 82 | Fentanyl 50 mcg |  |
| 40 | M | Lap Umbilical Hernia Repair with Mesh | Gen | 81 | Fentanyl 50 mcg |  |
| 52 | M | Lap Incisional Hernia Mid Abdomen with Mesh | Gen | 63 | Fentanyl 25 mcg |  |
| 45 | M | Lap Umbilical Hernia Repair with Mesh | Gen | 87 | Fentanyl 25 mg x 2 Meperidine 25 mg |  |
| 45 | F | Lap Incisional Hernia Repair | Gen | 100 | Meperidine 25 mg |  |
| 70 | F | Right Inguinal Hernia Repair Incisional Hernia with Mesh | Gen | 92 | Fentanyl 50 mcg, Meperidine 25 mg x 2 |  |
| 56 | M | Lap Epigastric and Umbilical Hernia Repair with Mesh | Gen | 72 | Fentanyl 25 mcg x 2 |  |
| 20 | M | Lap Left Inguinal Hernia Repair with Mesh | Gen | 121 | Meperidine 25 mg |  |
| 29 | M | Lap Umbilical Hernia Repair with Mesh | Gen | 63 | Fentanyl 50 mcg |  |
| 47 | F | Lap Umbilical Hernia Repair, Inguinal Hernia with Mesh | Gen | 104 | Morphine 27 mg |  |
| 58 | M | Left Inguinal Hernia Repair with Mesh | Gen | 75 | Meperidine 25 mg |  |
|  |  |  |  | **AVE 87.7** |  | **TOTAL 114.5 mg Morphine Equivalents** |

**Table 1:**  Hernia repairs with no peripheral nerve block (20 Patients).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Age** | **M/F** | **Procedure** | **Anesthesia** | **Par Time** | **Medication** | **Total Medications** |
| 30 | F | Umbilical Hernia Repair | Gen+Block | 62 | 0 | Fentanyl 400 mcg |
| 36 | F | Right Inguinal Hernia Repair | Gen+Block | 52 | 0 | Meperidine 175 mg |
| 28 | F | Lap Umbilical Hernia Repair with Mesh | Gen+Block | 60 | 0 | Morphine 14 mg |
| 44 | F | Lap Umbilical Hernia Repair with Mesh | Gen+Block | 75 | Meperidine 25 mg, Fentanyl 50 mcg |  |
| 48 | M | Lap Left Inguinal Hernia Repair | Gen+Block | 87 | Meperidine 25 mg, Fentanyl 50 mcg |  |
| 47 | F | Lap Incisional Hernia Repair with Mesh | Gen+Block | 67 | Fentanyl 100 mcg |  |
| 35 | M | Lap Umbilical Hernia Repair | Gen+Block | 67 | Meperidine 25 mg |  |
| 38 | M | Lap Right Inguinal Hernia Repair | Gen+Block | 86 | Meperidine 25 mg, Fentanyl 50 mcg |  |
| 37 | M | Incarcerated Umbilical Hernia Repair | Gen+Block | 65 | 0 |  |
| 65 | M | Lap Left Inguinal Incarcerated Hernia Repair with Mesh | Gen+Block | 72 | Morphine 4 mg |  |
| 58 | F | Lap Umbilical Hernia Repair | Gen+Block | 56 |  |  |
| 59 | M | Open Repair of Large Incarcerated Left Inguinal Hernia Repair w/ Mesh | Gen+Block | 60 | 0 |  |
| 50 | F | Lap Incarcerated Incisional Hernia Repair | Gen+Block | 62 | Fentanyl 50 mcg, Meperidine 25 mg |  |
| 55 | M | Lap Left Inguinal Hernia Repair with Mesh | Gen+Block | 60 | Fentanyl 50 mcg |  |
| 36 | F | Open Periumbilical Incisional Ventral Hernia Repair | Gen+Block | 72 | Meperidine 25 mg |  |
| 75 | M | Right Inguinal Hernia Repair | Gen+Block | 58 | 0 |  |
| 38 | F | Lap Periumbilical Hernia Repair with Mesh | Gen+Block | 70 | Fentanyl 25 mcg |  |
| 45 | M | Lap Umbilical Hernia Repair | Gen+Block | 67 | Fentanyl 25 mcg |  |
| 57 | F | Lap Lysis of Adhesions, Repair of Recurrent Incisional Hernia | Gen+Block | 61 | Meperidine 25 mg |  |
| 59 | M | Lap Repair of Right Inguinal Hernia | Gen+Block | 45 | Morphine 10 mg |  |
|  |  |  |  | **AVE 65.2** |  | **TOTAL 71.5 mg Morphine Equivalents** |

**Table 2:** Hernia repairs with the addition of peripheral nerve blocks (20 Patients).

**Results**

As shown above, the average time spent in the Post Anesthesia Care Unit (PACU) was decreased by 22.5 minutes. The total amount of analgesic medication administration was reduced as follows: Fentanyl 150 mcg, (550-400 mcg) Demerol 50 mg (225-175 mg), and Morphine 23 mg (37-14 mg). Outliers were not included such as patients who received Dilaudid, Ofirmev, Ketorolac or any other non-opioid analgesics.

To equally quantify the amount of opiate administration, all opioids were converted into Morphine equivalents from the table below:

|  |  |
| --- | --- |
| Fentanyl 100 mcg | Morphine 10 mg |
| Meperidine 100 mg | Morphine 10 mg |

**Table 3:** Morphine equivalents of other narcotics [22].

The overall morphine equivalents that were given to patients without nerve blocks totaled to 114.5 mg and the patients who received a nerve block received the total morphine equivalent of opioids of 71.5 mg. This amounts to a 62% decrease in overall opiate utilization for these surgical procedures and patient population.

**Limitations**

Due to the retrospective nature of the study, some limitations include the inability to regulate the number of opiates given during the preoperative or intraoperative period to create a control group. Also, depending on provider preference, experience, and/or patient habitus, the peripheral nerve blocks performance may have varied. Each block innately possesses qualities that may skew patient’s perception of pain and therefore, could also change the opiate requirement for adequate analgesia. In addition, observations are purely limited to the immediate postoperative period in the post anesthesia recovery area. Follow-up within the 24-hour period would have been ideal to further evaluate long-term analgesia, but that information is unobtainable.

**Discussion**

As this retrospective study has demonstrated, the implementation of a peripheral nerve block program greatly reduces postoperative recovery time, opioid administration, increased morbidity associated with opioid administration, decreases nursing labor, and increases patient and surgeon satisfaction. This study, while limited, has provided great insight to the potential benefits of utilizing peripheral nerve blocks for hernia repair procedures. In addition, it demonstrates how utilizing adjunct methods can greatly decrease postoperative pain and improve patient satisfaction and over all outcomes. The average time in the PACU for patients without nerve blocks was 87.7 minutes while the patients who had a nerve block had an average PACU time of 65.2 (total decrease of 22.5 minutes). The overall decrease in Fentanyl is 150mcg, Demerol decreased by 50 mg, Morphine decreased by 23 mg. The overall decrease in opioid use, and the decreased time in PACU with the peripheral nerve block group clearly justifies the advantage that regional anesthesia can partake.

Since the implementation of ERAS protocols which includes multimodal analgesic techniques, the gold-standard epidural is becoming less popular [17]. It is quickly being replaced by peripheral nerve blocks as it avoids issues that are normally associated with epidurals such as: serious neurological complications, high failure rates, as well as a number of cardiovascular complications [17]. In addition, peripheral nerve blocks may be performed to cater the patient’s surgical analgesia needs. Different types of blocks can provider for different coverage and one, or a combination of several may be used to decrease pain.

**Types of Truncal Blocks for Abdominal Surgeries**

**Transversus Abdominis Plane Block**

The Transversus Abdominis Plane (TAP) block is a regional block that focuses on analgesia of the anterolateral abdominal wall. With the utilization of ultrasound-guidance, the TAP block is a safe and simple technique that can provide short term analgesia in patients undergoing anterolateral abdominal wall surgery [4]. However, depending on the location and size of surgical incision, a combination of subcostal (T6-T9), lateral (T10-T12), posterior (T9-T12), oblique subcostal (T6-L1) TAP blocks may need to be used to provide appropriate analgesia [4,5,20]. Other disadvantages include the need for a bilateral block for midline incisions, the block is dependent upon the clinician’s technique performing the block, and finally patient’s anatomy and body habitus [4,5,20].TAP blocks are usually performed at the facility where certain conditions limits the depth of visualization of patient anatomy.

**Quadratus lumborum**

The Quadratus Lumborum (QL) block is an ultrasound-guided abdominal wall block providing longer lasting analgesia due to the spread of Local Anesthetics (LA) towards the thoracic paravertebral space and sympathetic nerves in the thoracolumbar fascia [6]. The QL differs from the TAP in that it is a posterior abdominal wall block, and requires the LA spread into the thoracolumbar fascia. This fascia extends posterior to connect with the lumbar paravertebral region providing visceral analgesia--a feature to which the TAP is inferior in comparison. Variants of this block are classified as, (1) QL1 lateral to the QL muscle, (2) QL2 posterior to the QL muscle, and (3) QL3 anterior to the muscle also known as the transmuscular approach [17]. QL blocks are generally the block of choice at this rural facility as it provides both visceral and somatic coverage for a wide variety of abdominal surgeries.

**Erector Spinae Plane Block**

The Erector Spinae Plane (ESP) block is a novel peripheral nerve block that provides somatic and visceral analgesia by blocking the dorsal and ventral rami of the spinal nerves [18].The ESP’s extensive cranio-caudal spread of local anesthetic can potentially be used for procedures requiring dermatome coverage from T1-S4 as recent gender-assignment surgeries have suggested [23].The ESP has already been proven to provide analgesia for patients post cardiac procedures that is similar to that of the TEA without the potential risks of an epidural hematoma, hypotension, and sympathectomy [19,24]. In abdominal surgeries, it is comparatively more effective in reducing opioid consumption compared to the TAP block [21]. It’s analgesic effects is comparable and some research has shown to be superior to QL blocks as well because of its reliable local anesthetic spread into the epidural space [18,21]. Because it may be performed at all dermatome levels, it can be used for analgesia for the entire trunk making it one of the most versatile and flexible blocks to utilize. Providers at the facility administers this block when patient habitus makes QL blocks challenging or as a rescue block if QL block did not provide adequate analgesia. This block may be performed in the sitting, prone or lateral position so providers can coordinate with patients to help facilitate the best and most comfortable method of delivery [18,23].

**Multimodal Pain Management Recommendations for Practice**

Peripheral nerve blocks are an excellent adjunct to postoperative pain management, however their efficacy in conjunction with other anesthetic techniques and medication can synergistically produce better analgesia when compared to traditional opioid administration methods alone [25]. Ultimately, pain is a complex phenomenon that can quickly deteriorate into a chronic and complex syndrome affecting multiple receptors. Therefore, a patient specific anesthesia and analgesic plan, with associated interventions need to be considered.

In conclusion, the results of this study provide evidence that the implementation of truncal peripheral nerve blocks has the potential to reduce postoperative pain in patients undergoing hernia repairs by 62%% as well as decrease post-anesthesia care unit admission times by 22.5 minutes. As the healthcare delivery model progresses towards opioid-sparing techniques, the addition of peripheral nerve blocks have proven to be an essential component of ERAS and opioid sparing anesthesia and analgesia. Along with other multimodal adjuncts, these additions may further decrease the need for opiates, leading to improved postoperative outcomes, decreased opioid related side-effects, decreased postoperative recovery time, and increased patient satisfaction. These results provide strong evidence that peripheral nerve block analgesia is here-to-stay and will be a staple in postoperative pain management. It is recommended to routinely incorporate a truncal peripheral nerve block in hernia surgeries to reduce opioid consumption, and PACU recovery time. Future studies should focus on providing a controlled preoperative and intraoperative setting so that measurements may be more standardized to decrease variability. An extended 24-hour observation and opioid consumption record should also be made available to compare the long-term effects of these peripheral blocks verses narcotics. Even with the limitations of this study, truncal blocks have proved to be a useful and versatile adjunct to today’s anesthesia and patient population. Furthermore, implementing a cost and benefit analysis may be of interest for facilities with limited resources to further justify the use of peripheral nerve blocks.

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