"EVALUATION OF EFFICACY OF LOCAL ANAESTHETIC INFILTRATION OF THE INCISION SITE AND ERECTOR SPINAE PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING PERCUTANEOUS NEPHROLITHOTOMY – A RANDOMISED OPEN LABEL STUDY."

By

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Dissertation submitted to the

B.L.D.E. (DEEMED TO BE UNIVERSITY)

VIJAYAPURA, KARNATAKA

In Partial fulfilment of requirements for the degree of

DOCTOR OF MEDICINE

In

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Under the guidance of

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LIST OF ABBREVIATIONS

ASA- American society of Anaesthesiologists

PCNL- Percutaneous Nephrolithotomy

ESWL- Extracorporeal shock Wave Lithotripsy

VTE- Venous Thromboembolism

LAI- Local anaesthetic infiltration

ESPB- Erector Spinae Plane Block

PVB- Paravertebral Block

ICNB- Intercostal Nerve Block

USG- Ultrasound Guided

TAH- Total Abdominal Hysterectomy

ECG- Electrocardiogram

mg- milligram

mcg- microgram

ml- milliliters

PCA- Patient controlled analgesia

IV- Intravenous

ABSTRACT

Background:

A common minimally invasive surgical technique for treating renal calculi is percutaneous nephrolithotomy (PCNL), especially in patients with big or complicated stones.Despite its benefits, postoperative pain remains a significant concern, primarily due to renal capsule dilation, renal parenchymal tract trauma, and incision site pain. Effective postoperative pain management is essential to ensure patient comfort, reduce opioid dependency, enhance early ambulation, and prevent complications related to inadequate analgesia. Multiple mechanisms involving both somatic and visceral pain pathways contribute to postoperative pain in PCNL.

This study intends to scientifically analogize ESPB with local anesthetic infiltration for postoperative analgesia in PCNL patients**,** addressing existing knowledge gaps and guiding future clinical practice management in PCNL patients**.**

Material and Methods:

Following the approval of the College Ethical Committee, 60 patients with ASA class I-II undergoing PCNL were enrolled in the study after providing informed consent. They were randomly assigned to either Group A, in which they received 20 ml of 0.25% bupivacaine with 8 mg of dexamethasone as Local anaesthetic infiltration and Group B received erector Spinae Planae Block with 20 ml of 0.25% bupivacaine with 8 mg of dexamethasone.

Postoperative pain relief was compared using the Numeric rating scale (NRS) score between the two groups at 30 minutes, 60 minutes, and second hourly for 6 hours, followed by the sixth hourly up to 24 hours.

Results:

The mean duration of analgesia was higher in patients who received ESPB (744.03+/-24.867 in group B) than patients who received Local Anaesthetic infiltration(18.60+/-1.694 in group A). NRS scores were higher in group A than Group B in the first 24 hours of the postoperative period. The mean time duration to rescue analgesia was higher in group B than group A.

Conclusion:

Accordant to our study ESPB is an efficacious and safe technique for post operative analgesia in patients undergoing percutaneous nephrolithotomy. ESPB is a valuable addition to multimodal analgesia protocols in patients undergoing not only PCNL but also other urological surgeries. In essence we conclude that USG guided erector spinae plane block provides adequate analgesia and has an opioid sparing effect in patients undergoing percutaneous nephrolithotomy surgery.

Keywords: Erector spinae plane block, Local Anaesthetic Infiltration, Percutaneous Nephrolithotomy.

INTRODUCTION

A common minimally invasive surgical technique for treating renal calculi is percutaneous nephrolithotomy (PCNL), especially in patients with big or complicated stones.Despite its benefits, postoperative pain remains a significant concern, primarily due to renal capsule dilation, renal parenchymal tract trauma, and incision site pain [(1)]. Effective postoperative pain management is essential to ensure patient comfort, reduce opioid dependency, enhance early ambulation, and prevent complications related to inadequate analgesia [(2)]. The current analgesic options include systemic opioids, NSAIDs, paracetamol, and regional anesthesia techniques such as local anesthetic infiltration and nerve blocks [(3)]. However, there are significant dangers associated with opioid-based regimens including respiratory depression, nausea, vomiting, and opioid-induced hyperalgesia, necessitating a shift toward opioid-sparing multimodal analgesic strategies [(4)]. Among various regional anesthesia techniques, local anesthetic infiltration and erector spinae plane block (ESPB) have shown promising results in postoperative pain management following PCNL [(5)].

Multiple mechanisms involving both somatic and visceral pain pathways contribute to postoperative pain in PCNL. T8–T11 spinal neurons mediate somatic pain, which comes from the location of the incision, whereas deep visceral pain, which comes from the damage to renal parenchyma and ureteric irritation are communicated through T10-T12 spinal nerves [(1)]. Additionally, pain from nephrostomy tube placement contributes significantly to postoperative discomfort [(2)]. Traditional analgesic regimens, including opioids and NSAIDs, may provide pain relief but are linked to serious gastrointestinal and renal problems, thus regional anaesthetic methods are a more appropriate choice than the traditional analgesic regimens [3]. As a result, regional techniques such as local anesthetic infiltration and ESPB have been widely explored for their ability to provide better postoperative analgesia with reduced systemic side effects [4].

Forero et al. initially described erector spinae plane block (ESPB), an ultrasound-guided inter fascial plane block in which a local anaesthetic is injected between the transverse process and the erector spinae muscle, leading to extensive craniocaudal spread and multi segmental analgesia [5]. Unlike neuraxial techniques, ESPB has minimal hemodynamic effects, fewer complications, and is technically easier to perform [1]. The application of ESPB has been done in thoracic spine surgery (e.g., thoracic fusion, decompression), lumbar spine surgery (e.g., lumbar fusion, laminectomy) and also for fracture fixation (e.g., rib fractures, spinal fractures).

It has also application in thoracotomy (e.g., for lung resection, chest wall procedures), Video-assisted thoracoscopic surgery (VATS) surgeries. For breast cancer surgeries, it is combined with other blocks for a multimodal approach. In abdominal laparotomy, laparoscopic procedures like cholecystectomy, colectomy ESPB provides pain relief postoperatively. In hernia wall repairs it is used for both perioperative and postoperative pain relief.

It has promising results for analgesia in several areas in polytrauma patients and for postoperative analgesia in urological surgeries, making it a promising technique for postoperative pain management in PCNL [2]. The opioid-sparing effect and ability to block both somatic and visceral pain offer a clear advantage over conventional analgesic approaches [3].

Local anesthetic infiltration at the surgical incision site is a widely used and simple technique that provides direct analgesia with minimal risk [1]. However, its major limitation is the short duration of action, typically lasting 2–4 hours, requiring frequent supplementation with systemic analgesics [2]. In contrast, ESPB provides longer postoperative analgesia by blocking multiple dermatomes, leading to longer pain-free intervals, reduced opioid consumption, and improved patient outcomes [3]. Studies comparing ESPB with local anesthetic infiltration in PCNL have consistently demonstrated superior results with ESPB in terms of lower pain scores, prolonged analgesic effects, and decreased opioid use [4].

Many study findings indicate that ESPB offers a clear advantage over local anesthetic infiltration, making it a more effective option for postoperative pain as opioid reduction, improved patient satisfaction, and lower complication rates have not been thoroughly explored [1]. This study intends to scientifically analogize ESPB with local anesthetic infiltration for postoperative analgesia in PCNL patients**,** addressing existing knowledge gaps and guiding future clinical practice management in PCNL patients**.**

Despite the growing evidence supporting ESPB, there remains a lack of direct comparative studies between ESPB and local anesthetic infiltration in PCNL. Additionally, long-term benefits such [2].

If ESPB proves to be superior, it could be integrated into routine clinical practice as a safe, effective, and opioid-sparing alternative for postoperative pain relief in PCNL. Given the increasing concerns regarding opioid over use and related complications**,** ESPB may emerge as a preferred regional anesthesia technique**,** improving postoperative recovery and overall patient outcomes **[3].**

Postoperative pain management is a key factor in optimizing patient recovery in all surgeries. Through this randomized open-label study**,** we aim to scientifically validate the efficacy of ESPB**,** thereby contributing to evidence-based regional anesthesia protocols and improving postoperative pain management in PCNL surgeries **[4].**

AIMS AND OBJECTIVES

Aim

The main aim of this study is to evaluate and analogize the efficacy of local anesthetic infiltration at the incision site versus ultrasound-guided erector spinae fascial plane block for postoperative analgesia in patients undergoing percutaneous nephrolithotomy (PCNL)**,** focusing on pain relief, duration of analgesia, and opioid consumption.

Objectives

Primary objective:

1. The primary objective of the study is to compare postoperative pain relief using the Numeric rating scale (NRS) score between the two groups at 30 min, 60 min, and second hourly for 6 hours, followed by the sixth hourly up to 24 hours.

2. Assessment of duration of the block.

Secondary objective:

1. To compare the time of the first analgesic requirement in both groups.

2. Tramadol consumption in both groups in 24 hours.

3. To check the occurrence of complications.

REVIEW OF LITERATURE

- Singh et al. (2025) conducted a meta-analysis of RCTs comparing ESPB vs. conventional analgesia for postoperative pain in PCNL. The ESPB group showed significantly lower pain scores at 6, 12, and 24 hours, with reduced opioid consumption and fewer side effects. ESPB also provided prolonged analgesia and improved patient satisfaction without major complications. Its technical simplicity and safety make it a promising alternative to traditional pain management. The findings support ESPB as an effective and opioid-sparing strategy for postoperative analgesia in PCNL [7].

- A randomized controlled study was conducted by Bilgin et al. (2023) to investigate the efficacy of erector spinae plane block (ESPB) in treating postoperative pain after percutaneous nephrolithotomy (PCNL) 64 patients participated in the trial and were divided into two groups: one group had got general anaesthesia and ESPB, while the other group got only general anaesthesia. Findings revealed that intraoperative remifentanil consumption and postoperative pain scores were notably lower in the ESPB group, with significantly fewer patients requiring rescue analgesia (15.6% vs. 87.5%, $p < 0.001$). Moreover, the ESPB group had a marked decrease in postoperative tramadol consumption (75 mg vs. 262.5 mg, $p < 0.001$). The study concluded that ESPB is an effective analgesic technique, as it minimizes intraoperative opioid use, alleviates postoperative pain, and lowers the need for additional analgesia in PCNL patients [8].

- Nair et al. (2023) conducted a systematic review of six studies evaluating ultrasound-guided erector spinae plane block (ESPB) for pain relief in bariatric and metabolic surgeries. ESPB substantially reduced opioid use during surgery and 24-hours after surgery while prolonging the time to rescue analgesia. Pain scores were lower at 6 and 24 hours postoperatively, though no significant differences were noted at 0 and 12 hours. The study concluded that bilateral ESPB effectively minimizes opioid use and enhances postoperative pain control[(9).]

- Capuano et al. conducted a systematic review to determine the efficiency of the erector spinae plane block (ESPB) for managing cancer-related pain. The review included 34 studies with a total of 135 patients, comprising one randomized controlled trial, three retrospective observational studies, two clinical case series, and 28 medical case reports. These studies explored ESPB's role in alleviating different types of cancer pain, such as persistent thoracic discomfort, abdominal visceral pain, and agony from bone metastases. Various techniques, including one-shot, continuous infusion, and neurolytic approaches, were analyzed. However, due to significant variations in methods, medications, and the absence of control groups, the current evidence remains inconclusive. Further well-structured comparative studies with standardized protocols are needed to establish ESPB’s effectiveness and safety in cancer pain management.

- The study by Datchinamourthy et al. (2024) explores the efficacy of steady infusion versus programmed occasional bolus techniques in the erector spinae plane (ESP) block for postoperative analgesia in patients undergoing modified radical mastectomy surgeries. It highlights the role of ESP block as an effective regional analgesic technique, reducing opioid consumption and improving pain control. The authors compare two delivery methods, suggesting that the programmed intermittent bolus technique may provide superior analgesia by ensuring better spread of local anesthetic. The findings contribute to the growing body of evidence supporting ESP block as a valuable component of multimodal analgesia for breast surgery**.**

- Guleria et al. (2024) conducted a randomized controlled trial in patients undergoing modified radical mastectomy and found that the addition of 8 mg dexamethasone to 0.25% bupivacaine significantly extended the pain-free duration. The dexamethasone group experienced 17 ± 6.18 hours of analgesia compared to 6.97 ± 4.01 hours in the control group. Additionally, there was a notable reduction in postoperative nausea and vomiting, and patients reported higher satisfaction scores[20].

- A double blinded randomized parallel group study conducted by Ramachandran S, *et al*. comparing erector spinae plane block (ESPB) in percutaneous nephrolithotomy with local anaesthetic infiltration of the incision site for postoperative analgesia found that while LAI provided significant pain relief in the first 2–4 hours, its effect diminished rapidly, requiring frequent supplemental analgesia. In contrast, patients who received ESPB had significantly lower NRS at different time intervals, experienced prolonged pain relief lasting up to 24 hours, with significantly lower opioid consumption and longer duration for first analgesic requirement [1].

- A randomized controlled study conducted by Shah B, *et al.* [2] on erector spinae plane block for post operative analgesia following percutaneous nephrolithotomy under spinal anaesthesia (2022) in a total of 60 patients of American Society of Anaesthesiologists (ASA) grade 1 and 2 concluded that erector spinae plane block (ESPB) reduced visual analog score (VAS), provided sufficient post-operative insensibility to pain , with resemblant hemodynamic changes and adverse effects in comparison to the routine analgesia with tramadol in surgery· [2]

- A randomized controlled trial by Bryniarski,p, *et al.* on erector spinae plane block for perioperative analgesia after percutaneous nephrolithotomy(2021) assesed 68 patients, of which 34 received erector spinae plane block(ESPB) and 34 received standard general anaesthesia with subsequent pain management concluded that erector spinae plane block (ESPB) is an efficient method in management of pain following percutaneous nephrolithotomy (PCNL). [3]

- A double blinded randomized controlled study conducted by Thiagarajan P, *et al*. on efficacity of ultrasound guided erector spinae plane block following breast surgery (2021) in which all 70 patients receive general anaesthesia while group B received added ultrasound guided erector spinae plane block at the level of T5 vertebrae have concluded that ultrasound guided post operative analgesia provides supernal post operative analgesia compared to general anaesthesia alone in patients undergoing one sided non reconstructive breast cancer surgeries. [4]

- A feasibility study by Prasad MK *et al*. on erector spinae plane block guided by peripheral nerve stimulator for post surgical analgesia after total abdominal hysterectomy studied 60 patients of ASA grade I and II in which group 1(n=30) received spinal anaesthesia and group 2 (n=30) received erector spinae plane block under peripheral nerve stimulator before spinal anaesthesia was of opinion that there was considerable reduction in the necessity of rescue analgesia in patients who were given peripheral nerve stimulator-guided erector spinae plane block in the first 24 h after TAH. They concluded that peripheral nerve stimulator - guided erector spinae plane block is effectual in alleviating pain in patients undergoing TAH. s

- A prospective study by Malawat et al. (2020) evaluated the viability of employing the erector spinae plane (ESP) block for postoperative pain management and surgical anesthetic in breast surgeries. The trial, which included 30 patients, found that the ESP block effectively minimized the need for general anesthesia and additional analgesics. It contributed to stable hemodynamics, effective pain control, and high patient satisfaction. The authors reported minimal side effects, indicating that the technique is a safe and practical alternative for such procedures. Their findings support the expanding use of ESP block in regional anesthesia, though they recommended larger studies to confirm its effectiveness [6].

- Kot et al. (2019) conducted a narrative review on the erector spinae plane (ESP) block, focusing on its anatomical aspects, mechanism, and clinical significance. They discussed its broad applicability in managing pain for thoracic, abdominal, and orthopedic procedures. The authors highlighted key benefits, including its simple administration, safety, and low complication rates. Additionally, they explored its role as a potential alternative to traditional neuraxial and peripheral nerve blocks. Although the ESP block has shown promising outcomes, the review emphasized the need for further studies to refine techniques and establish standardized clinical protocols(13).

- Farahata et al. (2022) investigated the role of dexamethasone in ESPB using levobupivacaine for total hip arthroplasty and found that dexamethasone improved postoperative pain scores and extended the duration of analgesia. In a systematic review by Koo et al. (2020), the effects of ESPB on relief of pain after surgery in patients undergoing laparoscopic cholecystectomy were evaluated. Their findings highlighted that ESPB, particularly when combined with dexamethasone, provided effective and prolonged pain relief (27).

CLINICAL ANATOMY

I. Overview of Percutaneous Nephrolithotomy (PCNL)

A well-known minimally invasive surgical technique for treating renal calculi is percutaneous nephrolithotomy (PCNL), especially when dealing with large, intricate, or staghorn calculi that are not suitable for ureteroscopy or extracorporeal shock wave lithotripsy (ESWL) [(1).] Introduced in the late 1970s, PCNL has revolutionized the field of urology by offering high stone-free rates, shorter hospital stays, and reduced morbidity compared to open stone surgery [(2).]

During PCNL, a percutaneous tract is created through the renal parenchyma under fluoroscopic or ultrasound guidance, allowing direct access to the renal pelvis and calyces for stone fragmentation and extraction. This procedure is widely preferred for stones >2 cm in diameter, lower pole stones with unfavorable anatomy, and cases where prior ESWL or ureteroscopy has failed [(3)].

Despite its benefits, PCNL is associated with postoperative complications, particularly significant pain, arising from renal parenchymal trauma, tract dilation, nephrostomy tube placement, and incision site discomfort. The intensity of pain varies depending on factors such as stone burden, operative time, and surgical technique. If not effectively managed, this pain can lead to delayed recovery, increased hospital stay, and higher opioid consumption. Effective postoperative pain management is a critical component of PCNL outcomes [(1, 3).]

Importance of Postoperative Pain Management in PCNL

Postoperative pain following PCNL can be moderate to severe, requiring adequate pain control to ensure optimal recovery. Poorly managed pain not only impacts patient comfort and satisfaction but also leads to physiological stress responses, increasing the risk of cardiovascular and pulmonary complications [2].

Physiological and Clinical Consequences of Poor Pain Management:

Increased Sympathetic Activation: Leads to hypertension, tachycardia, and increased myocardial oxygen demand, it might be particularly problematic for those who already have heart issues.

Respiratory Complications: Patients experiencing severe pain may have shallow breathing due to diaphragmatic splinting, increasing the risk of atelectasis and pneumonia.

Delayed Mobilization: Inadequate pain control restricts early ambulation, predisposing patients to venous thromboembolism (VTE) and delayed return to baseline functional status.

Higher Opioid Consumption: Ineffective pain management exacerbates opioid dependence, which can result in negative side effects including constipation, pulmonary depression , nausea, vomiting, and opioid-induced hyperalgesia [3].

Given these concerns, an effective multimodal analgesia strategy is necessary to provide adequate postoperative pain relief while minimizing opioid use. Regional anaesthesia techniques, particularly local anaesthetic infiltration (LAI) and erector spinae plane block (ESPB) have gained prominence as effective opioid-sparing strategies in PCNL pain management [1, 2].

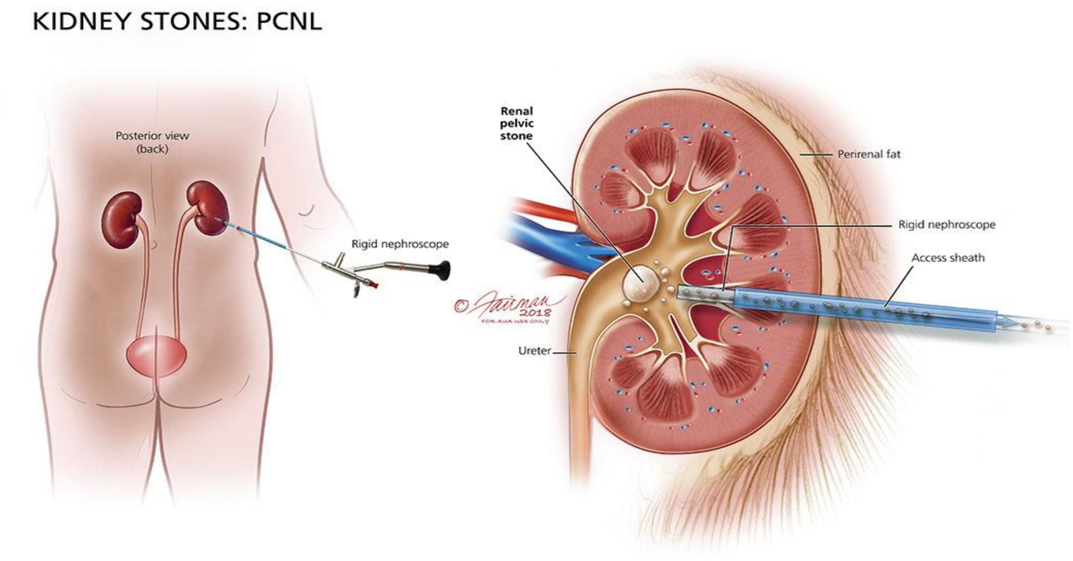

Figure 1 . Percutaneous Nephrolithotomy

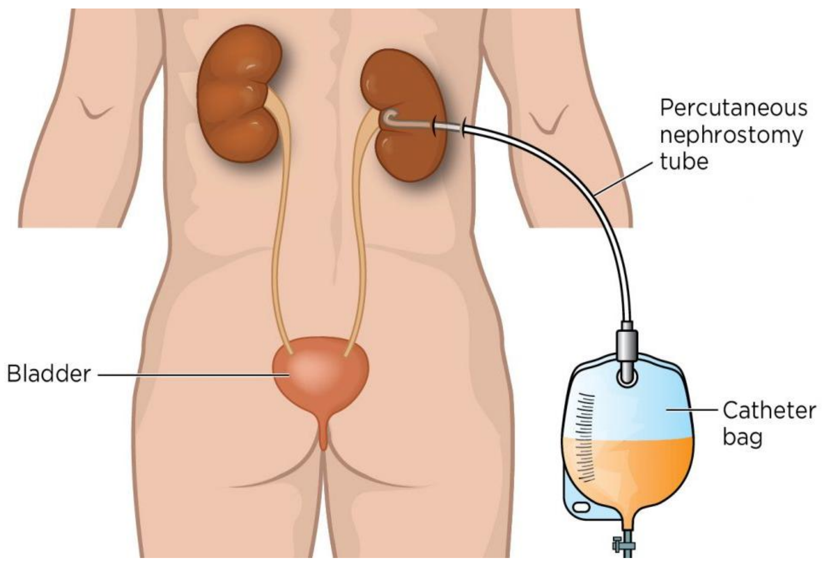

Figure 2. Nephrostomy tube insitu after PCNL

II. Postoperative Pain Mechanisms in Percutaneous Nephrolithotomy (PCNL)

Despite its efficacy in stone removal, postoperative pain remains a significant challenge, arising from various sources including renal capsule trauma, nephrostomy tube-related discomfort, and muscle and fascial injury. Understanding the mechanisms of postoperative pain in PCNL is crucial for optimizing pain management strategies and improving patient recovery. This section explores the sources of pain, the neural pathways involved, and the clinical consequences of inadequate pain control.

1. Sources of Postoperative Pain in PCNL

Postoperative pain in PCNL arises from multiple anatomical structures, each contributing to a unique aspect of the patient's discomfort. The primary sources of pain include trauma to the renal capsule and parenchyma, nephrostomy tube-related irritation, and muscular and fascial injuries caused by the creation of the percutaneous tract [1,2].

2. Renal Capsule Trauma and Parenchymal Injury

PCNL involves the insertion of an access sheath through the renal parenchyma, allowing direct entry into the kidney for stone fragmentation and removal. This process leads to mechanical stretching and microtrauma to the renal capsule and parenchyma, which is richly innervated by sensory nerves [1]. The resulting inflammation and localized ischemia contribute to significant postoperative pain, often requiring multimodal analgesia for adequate control [2].

Bryniarski et al. (2021) reported that renal parenchymal damage during tract creation is a major source of immediate postoperative pain in PCNL patients.

Similarly, Thiagarajan et al. (2021) found that larger tract sizes correlated with higher pain scores, emphasizing the role of tissue trauma in pain perception.

3. Nephrostomy Tube-Related Pain

A nephrostomy tube is often placed postoperatively to facilitate urine drainage and prevent obstruction from residual stone fragments. However, its presence can exacerbate postoperative pain due to constant irritation of the renal cortex and surrounding tissues [(3).]

Liu et al. (2023) found that patients with larger nephrostomy tubes reported higher pain scores compared to those with tubeless PCNL approaches. The pain is thought to result from sustained pressure on the renal capsule, triggering nociceptive activation and discomfort [(4)]. Additionally, Moon et al. (2021) noted that nephrostomy tube movement or accidental dislodgement could intensify pain, further complicating postoperative recovery.

4. Muscle and Fascial Pain from Tract Dilation

The creation of the percutaneous tract requires dilation of muscle and fascial layers, leading to muscle fiber disruption, hematoma formation, and inflammatory reactions. These factors contribute to somatic pain, which is sharp and localized at the incision and tract site.

Patients undergoing mini-PCNL with smaller tracts had significantly lower pain scores compared to those undergoing standard PCNL, suggesting that tract size directly influences the severity of postoperative pain.

III Pain Pathways Involved

The pain associated with PCNL is multifactorial, involving both somatic and visceral pain components, each mediated by distinct neural pathways.

1. Somatic Pain (T8-T11) vs. Visceral Pain (T10-T12) Pathways

Somatic pain arises from cutaneous, muscular, and fascial structures, is well-localized, and is conducted through the T8-T11 spinal nerve roots (6). This pain is typically sharp and exacerbated by movement, corresponding to the site of the percutaneous tract.

Visceral pain, on the other hand, originates from the renal parenchyma and ureters and is transmitted via the T10-T12 nerve roots (6). Unlike somatic pain, visceral pain is diffuse, dull, and often associated with referred pain to the flank or lower abdomen (7).

2. Sympathetic Nerve Involvement in Postoperative Pain

The sympathetic autonomic nervous system plays a crucial bit part in mediating renal and ureteric pain. Pain signals from the kidney travel through sympathetic afferents, converging in the spinal cord at T10-T12, which explains why renal pain is often referred to the lower back, abdomen, and groin (7).

Thiagarajan et al. (2021) noted that sympathetic activation during PCNL can exacerbate pain intensity, leading to increased autonomic responses such as hypertension and tachycardia. This underscores the importance of regional anesthesia techniques that target both somatic and visceral pain pathways to achieve optimal pain control.

Clinical Impact of Poor Pain Control

Inadequate pain management in PCNL can lead to multiple adverse outcomes, including prolonged hospital stay, increased opioid consumption, and reduced patient satisfaction.

Poorly controlled postoperative pain negatively impacts recovery, leading to: Delayed mobilization, increasing the risk of venous thromboembolism (VTE). Shallow breathing and atelectasis, predisposing patients to pulmonary complications. Reduced early rehabilitation, prolonging hospital stays and increasing healthcare costs.

Increased Opioid Use and Associated Side Effects

Poor pain control often necessitates higher opioid doses, leading to: Respiratory depression and increased risk of opioid-induced hyperalgesia. Gastro intestinal dysfunction, including nausea, vomiting, and constipation. There is also increased risk of opioid dependence with prolonged use. Moon et al. (2021) found that patients with inadequate regional anesthesia during PCNL required 40-50% higher opioid doses, leading to increased opioid-related adverse effects.

Role of Multimodal Analgesia in Reducing Complications

Multimodal analgesia is a strategy that combines different analgesic approaches to enhance pain relief while minimizing opioid requirements. Target both somatic and visceral pain pathways for comprehensive pain control. Improve overall recovery outcomes and reduce hospital stays. Thiagarajan et al. (2021) emphasized that multimodal analgesia including regional blocks such as ESPB—significantly reduces opioid consumption and enhances postoperative recovery in PCNL patients.

IV. Regional Anesthesia Techniques for Postoperative Pain Relief

Regional anesthesia techniques have emerged as essential modalities for pain management in PCNL, offering significant advantages over systemic analgesia. which have undesirable side effects. Regional techniques target specific pain pathways, providing effective and prolonged analgesia [2, 3].

Common Regional Anesthesia Techniques Used in PCNL:

1. Local Anesthetic Infiltration (LAI):

Involves injecting local anesthetic at the incision site to block cutaneous and subcutaneous nerve endings. Provides immediate pain relief but has a short duration. Often requires additional opioid or NSAID use for breakthrough pain [1].

2.Erector Spinae Plane Block (ESPB):

In this technique local anesthetic is injected between the erector spinae muscle and the transverse processes of thoracic or lumbar vertebrae under the ultrasound guidance. Produces multi-segmental blockade (T7-T12), covering both somatic and visceral pain components [2]. Provides longer-lasting analgesia (12–24 hours), significantly reducing opioid consumption [3].

3.Paravertebral Block (PVB):

Targets individual spinal nerves within the paravertebral space, leading to extensive unilateral analgesia. Effective but technically challenging, with risks such as pneumothorax and hemodynamic instability [3].

4.Intercostal Nerve Block (ICNB):

Involves blocking the intercostal nerves at multiple levels to provide analgesia for thoracic and upper abdominal surgeries. Requires multiple injections, and the duration of action is limited compared to ESPB [(2).]

V. Local Anesthetic Infiltration (LAI) in Percutaneous Nephrolithotomy (PCNL)

Local anesthetic infiltration (LAI) is a commonly utilized regional anesthesia technique in percutaneous nephrolithotomy (PCNL) for postoperative pain control. This technique involves the direct injection of local anesthetic agents at the incision or nephrostomy site, effectively blocking nociceptive nerve endings and thereby reducing pain perception. This localized action results in immediate pain relief and a reduction in the need for systemic analgesics in the early postoperative period. However, despite its advantages in terms of simplicity, cost-effectiveness, and minimal systemic complications, LAI has significant limitations, including a short duration of action and limited anesthetic spread, often necessitating additional opioid or multimodal analgesia strategies to ensure adequate pain control.

Mechanism of Action

The primary mechanism of LAI is the direct inhibition of nociceptive transmission at the incision site. Local anesthetics, such as lidocaine and bupivacaine, function by blocking voltage-gated sodium channels in nerve fibers, preventing depolarization and subsequent conduction of pain impulses. In the context of PCNL, LAI is administered around the nephrostomy tract, where the highest nociceptive activity occurs due to renal capsule trauma, muscular dissection, and tissue inflammation following tract dilation. The effect of LAI is highly localized, primarily affecting cutaneous and subcutaneous nerve endings, which limits its ability to control deep visceral pain or referred pain from the ureter and renal pelvis.

While LAI provides rapid onset analgesia, its short duration of action (typically 30minutes –4 hours) and restricted spread to deeper structures are major drawbacks. The effectiveness of LAI is dependent on the volume, concentration, and type of anesthetic agent used, with long-acting agents such as bupivacaine preferred due to their prolonged analgesic effect compared to lidocaine. However, even with long-acting agents, the analgesic duration of LAI remains limited, often necessitating the use of opioids or additional regional anesthesia techniques for extended pain control.

Advantages of LAI

One of the primary advantages of LAI is its simplicity and cost-effectiveness. The technique requires minimal equipment, no ultrasound guidance, and can be performed rapidly in the operating room by the surgeon or anesthesiologist. Due to these factors, LAI is widely used in PCNL and other surgical procedures, particularly in settings where advanced regional anesthesia techniques such as ESPB (Erector Spinae Plane Block) or PVB (Paravertebral Block) may not be feasible.

In addition to being simple and easy to administer, LAI has minimal systemic complications compared to opioid analgesics. Opioids are commonly associated with side effects such as nausea, vomiting, respiratory depression, and opioid dependence, whereas LAI provides localized pain relief with minimal systemic absorption (13). This reduces opioid consumption, thereby improving patient recovery and decreasing opioid-related adverse effects such as sedation and gastrointestinal dysfunction [(12)].

Limitations of LAI

Despite its benefits, LAI has several limitations, particularly concerning its short duration of action and limited spread of analgesia. The primary drawback of LAI is its relatively short-lived effect, lasting approximately 30minutes–4 hours depending on the anesthetic agent used (14). Once the anesthetic effect wears off, patients frequently require supplemental systemic analgesics, including opioids and NSAIDs, to manage postoperative pain effectively.

Another limitation of LAI is its restricted coverage. Because LAI is a localized technique, it does not effectively control deep visceral pain originating from the renal parenchyma, ureters, or perinephric structures (15). In contrast, techniques such as ESPB and PVB provide broader, multi-segmental analgesia, covering both somatic and visceral pain pathways. Elsharkawy et al. (2024) (15) demonstrated that patients receiving ESPB had significantly lower pain scores over a 24-hour period compared to those receiving LAI, highlighting the need for longer-acting analgesic options.

The high opioid consumption associated with LAI is another important concern. Since LAI provides only short-term pain relief, patients frequently require additional opioid analgesics to maintain adequate pain control (16). This increased opioid dependence exposes patients to a higher risk of opioid-related side effects, such as nausea, vomiting, respiratory depression, and opioid-induced hyperalgesia.

VI. Erector Spinae Plane Block (ESPB) – A Novel Regional Anesthetic Technique

Erector Spinae Plane Block (ESPB) has emerged as a novel regional anesthetic technique with increasing application in postoperative pain management for various surgical procedures, including percutaneous nephrolithotomy (PCNL). ESPB aims to block the dorsal and ventral rami of spinal nerve roots, providing somatic and visceral analgesia over multiple dermatomal levels. Due to its ease of administration, low risk of complications, and prolonged analgesic effect, ESPB has gained attention as a superior alternative to traditional local anesthetic infiltration (LAI) [19, 20].

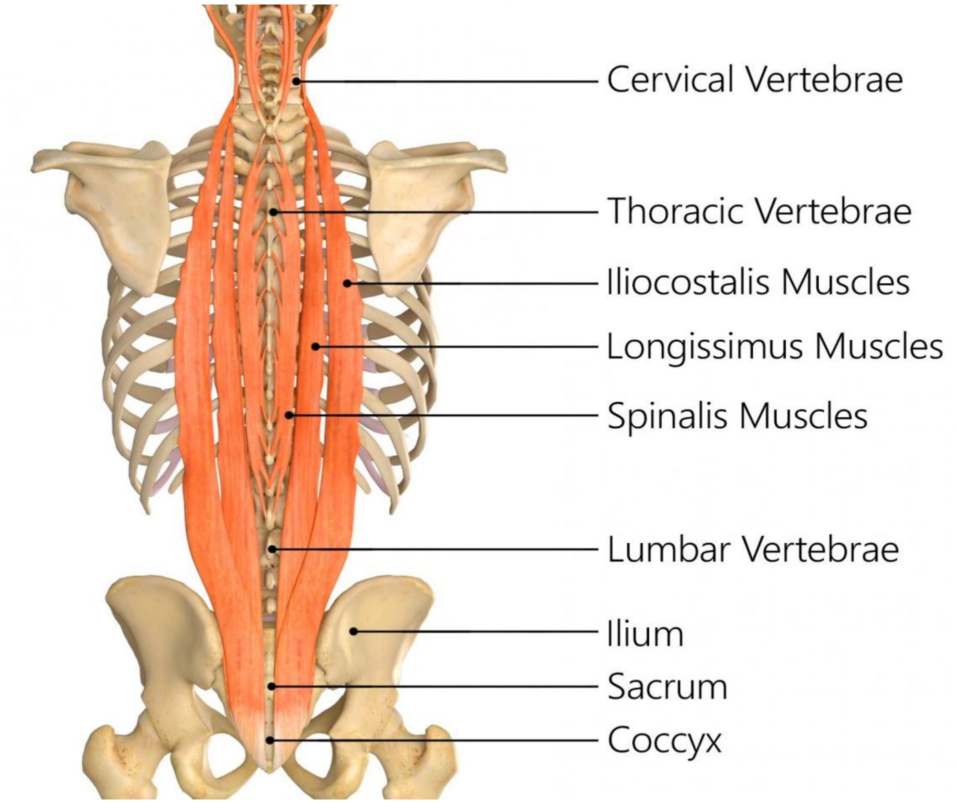

Figure 3. Erector Spinae Muscles

ANATOMY

Erector spinae muscles compromise of 3 muscles named iliocostalis, longissimus and spinalis. These muscles are located parallel along both sides of spine from the base of the skull to pelvis and sacral region, and from the spinous to the transverse processes extending to the ribs. Their size and structure varies at different levels of spine. Erector spinae muscles are innervated by the dorsal rami of the spinal nerves and their function is to extend, laterally bend and stabilize the spine.

The symmetrical erector spinae muscles lie over the transverse process and the lamina. Deep fascial plane of the muscle is separated from the para vertebral space by the transverse process and the inter transverse and costotransverse ligaments and muscles.

Roots of the spinal nerves exit the vertebral canal through the intervertebral foramina and divides into the dorsal and ventral rami. Dorsal rami course posteriorly through the erector spinae muscles to innervate the back musculature and adjacent skin. Ventral rami continue as intercoastal nerves and supply the anterolateral chest and abdominal wall ;communicating rami to the sympathetic trunk in the para vertebral space.

Anatomical Basis of ESPB

ESPB involves the injection of local anesthetic into the fascial plane deep to the erector spinae muscle and superficial to the transverse process of the vertebra. This injection site allows cranial and caudal spread of the anesthetic agent, covering multiple dermatomes and providing extensive pain relief (19). The anesthetic also diffuses anteriorly into the paravertebral and epidural spaces, affecting both dorsal and ventral rami of the spinal nerves [20].

In the context of PCNL, the injection is typically performed at the level of the T10 vertebra, ensuring effective analgesic coverage over the thoracolumbar region, which corresponds to renal innervation. The diffusion of anesthetic to the paravertebral space contributes to visceral pain control, which is a crucial advantage over LAI, which primarily provides localized analgesia [19, 20].

Key Anatomical Features of ESPB

- Injection Site: Between the erector spinae muscle and the transverse process [19].
- Spread of Local Anesthetic: Extends cranially and caudally, reaching dorsal and ventral rami [20].
- Targeted Dermatomes: Covers T7-T12, effectively blocking somatic and visceral pain from renal procedures [21].

Mechanism of Action

The primary mechanism of ESPB is multisegmental sensory blockade, which makes it an ideal choice for PCNL postoperative analgesia. Since ESPB blocks both dorsal and ventral spinal rami, it provides comprehensive analgesia covering both somatic and visceral pain pathways [21].

The local anesthetic spreads through the paravertebral space, inhibiting nociceptive transmission from the kidney, peritoneum, and overlying musculature. This results in reduced post-surgical pain intensity, minimized opioid requirements, and improved patient recovery [22]. Furthermore, sympathetic modulation plays a significant role in ESPB's effectiveness in controlling visceral pain, unlike LAI, which primarily targets cutaneous and soft tissue pain [22].

Key Mechanisms of ESPB in PCNL

- Multisegmental Blockade: Covers T7-T12, effectively reducing both incision site pain and deeper visceral pain [21].
- Sympathetic Modulation: ESPB inhibits sympathetic nerve activity, leading to better control of visceral pain from renal procedures [22]
- ·Superior Analgesic Duration: Prolonged local anesthetic diffusion results in 12-24 hours of effective pain relief [23].

Clinical Advantages of ESPB Over LAI

Compared to local anesthetic infiltration (LAI), ESPB provides superior postoperative pain control due to its wider dermatomal coverage and prolonged analgesia. The following advantages make ESPB a preferred technique for PCNL analgesia [23,24]:

1. Longer Duration of Analgesia (12-24 Hours)

Unlike LAI, which typically lasts 30 minutes-4 hours, ESPB provides sustained pain relief for 12-24 hours. This reduces the need for frequent analgesic administration and improves postoperative recovery (23).

2. Opioid-Sparing Effect and Reduced Side Effects

ESPB significantly reduces opioid consumption compared to LAI, leading to lower incidences of nausea, vomiting, respiratory depression, and opioid-induced hyperalgesia. Studies indicate that patients receiving ESPB require 40-50% less opioid medication postoperatively (24).

3. Better Patient Comfort and Early Mobilization

Due to prolonged analgesia and reduced opioid dependence, ESPB contributes to faster recovery, earlier ambulation, and shorter hospital stays compared to LAI (23).

Key Benefits of ESPB Over LAI in PCNL

Feature	Local Anesthetic Infiltration (LAI)	Erector Spinae Plane Block (ESPB)
Pain Relief Duration	30 minutes -4 hours	12-24 hours (23)
Opioid Requirement	High	Reduced by 40-50% (24)
Coverage	Localized at incision site	Multi-segmental blockade (21)
Visceral Pain Control	Minimal	Effective due to sympathetic modulation (22)
Postoperative Recovery	Delayed	Faster recovery and mobilization (23)

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The Erector Spinae Plane Block (ESPB) has gained prominence as a versatile regional anesthesia technique, particularly in managing postoperative pain for procedures such as percutaneous nephrolithotomy (PCNL). Its efficacy and safety profile have led to comparisons with other regional anesthesia methods, including Local Anesthetic Infiltration (LAI), Paravertebral Block (PVB), and Quadratus Lumborum Block (QLB). This section provides a comprehensive analysis of ESPB in relation to these techniques, focusing on their respective advantages, limitations, and clinical applications.

ESPB vs. Local Anesthetic Infiltration (LAI)

- Local Anesthetic Infiltration involves the direct injection of anesthetic agents into the surgical site to manage postoperative pain. While LAI is straightforward and commonly used, it primarily provides superficial analgesia, which may be insufficient for procedures involving deeper structures, such as PCNL.
- In contrast, ESPB targets the fascial plane deep to the erector spinae muscle, allowing the anesthetic to spread both cranially and caudally, covering multiple dermatomes. This results in more comprehensive analgesia, encompassing both somatic and visceral pain components. A randomized controlled trial comparing ESPB and LAI in PCNL patients found that ESPB provided superior pain relief and significantly reduced opioid consumption in the postoperative period.

ESPB vs. Paravertebral Block (PVB)

- Paravertebral Block involves the injection of local anesthetic adjacent to the vertebral bodies, targeting the spinal nerves as they emerge from the intervertebral foramina. While PVB provides effective unilateral analgesia suitable for thoracic and abdominal surgeries, it requires deep needle placement, which can increase the risk of complications such as pneumothorax and vascular injury.

- ESPB, performed at a more superficial level, offers a safer alternative with a lower risk profile. Both techniques provided comparable analgesia and patient satisfaction. However, ESPB was associated with a safer hemodynamic profile and was quicker to perform, suggesting it may be a more practical choice in certain clinical settings.

ESPB vs. Quadratus Lumborum Block (QLB)

- Quadratus Lumborum Block targets the fascial plane around the quadratus lumborum muscle and is used for abdominal and pelvic surgeries. While QLB can provide effective analgesia, its efficacy in controlling visceral pain, particularly in procedures like PCNL, may be limited.
- ESPB offers more consistent analgesia across thoracolumbar dermatomes, making it particularly suitable for surgeries involving both somatic and visceral components. A randomized controlled trial comparing ESPB and QLB in patients undergoing open nephrectomy concluded that ESPB provided superior postoperative pain control and reduced opioid consumption compared to QLB.

Safety Profile and Potential Complications of ESPB

- The safety profile of ESPB is a significant factor contributing to its growing popularity. Studies have reported a low incidence of complications associated with ESPB, making it a favorable option in various clinical scenarios. Potential side effects include the risk of local anesthetic systemic toxicity (LAST) and hematoma formation, particularly in patients with coagulopathies or those on anticoagulant therapy. However, the incidence of such complications is relatively low., primarily due to its superficial injection site and the use of ultrasound guidance during administration.

Erector Spinae Plane Block (ESPB) Techniques

Erector Spinae Plane Block (ESPB) has emerged as a versatile and effective technique**,** offering both somatic and visceral analgesia. First described by **Forero et al. in 2016**, ESPB involves the deposition of local anesthetic in the fascial plane deep to the erector spinae muscle, targeting multiple segmental nerves by allowing cranio-caudal spread of anesthetic agents. The blockade effectively covers thoracic and lumbar dermatomes**,** making it highly beneficial for postoperative pain relief in thoracic, abdominal, and urological surgeries, including percutaneous nephrolithotomy (PCNL)**.**

The efficacy of ESPB depends on the technique used for its administration. Various approaches, including blind technique, ultrasound (USG)-guided technique, and peripheral nerve stimulator (PNS)-guided technique, have been described in literature. These techniques differ in terms of accuracy, safety, success rate, and feasibility in different clinical settings. A comparative analysis of these methods is essential for optimizing analgesic efficacy and minimizing complication

Techniques for Administering Erector Spinae Plane Block (ESPB)

1. Blind Technique

The blind technique is the simplest and most traditional method of performing ESPB, relying solely on surface anatomical landmarks without imaging or neurophysiological guidance. This method is still used in resource-limited settings where ultrasound or PNS may not be available.

Technical Approach

- The patient is positioned prone or lateral.
- The transverse process of the thoracic vertebrae (T7–T10) is identified by palpation depending upon the surgery and level of analgesia needed.
- A 22-23G spinal or Tuohy needle is inserted perpendicular to the skin until bony contact is made with the transverse process.
- The needle is then withdrawn slightly, and the local anesthetic is injected into the fascial plane.

Advantages

- Simple and cost-effective: Requires no specialized equipment.
- Quick to perform, making it useful in emergency or low-resource settings.

Limitations

- High failure rate due to the lack of direct visualization.
- Uncertain dermatomal spread, leading to inconsistent analgesia.
- Risk of intravascular injection, increasing the potential for local anesthetic systemic toxicity (LAST).
- Difficult in obese patients, where anatomical landmarks are less defined.

2. Ultrasound-Guided Technique (USG) ESPB

The ultrasound-guided (USG) technique is currently the gold standard for administering ESPB due to its real-time visualization of needle placement, precise drug deposition, and reduced complication rates.

Technical Approach

- The patient is placed in a sitting, prone, or lateral position.
- A high-frequency linear ultrasound probe (6-13 MHz) is placed in a parasagittal orientation at the T7-T10 level.
- The transverse process appears as a hyperechoic bony structure beneath the erector spinae muscle.
- A 22G or 23G Quincke spinal needle is inserted in-plane under direct visualization.
- 20-30 mL of local anesthetic (e.g., bupivacaine, ropivacaine) is injected into the fascial plane.

Advantages

- Real-time visualization improves accuracy and ensures proper spread of local anesthetic.
- Significantly lower failure rates compared to blind ESPB.
- Minimizes complications such as vascular or pleural puncture.
- More effective in obese patients, where surface landmarks are unreliable.

Limitations

- Requires operator expertise in ultrasound-guided procedures.
- Additional equipment and time are needed, which may limit its use in some settings.

Scientific Evidence

- Ramachandran et al. (2021) conducted an RCT comparing USG-guided ESPB with local anesthetic infiltration in PCNL patients and found:
    - Significantly lower postoperative pain scores in the USG-ESPB group.
    - Reduced opioid consumption by up to 50%**.**
- Baishya et al. (2022) demonstrated that USG-guided ESPB resulted in a longer duration of analgesia and lower rescue analgesic requirements**.**
- A meta-analysis by Moon et al. (2021) concluded that USG-ESPB was superior in terms of safety and efficacy compared to both blind ESPB and local anesthetic infiltration**.**

Thus, USG-guided ESPB is currently the most recommended technique in clinical practice.

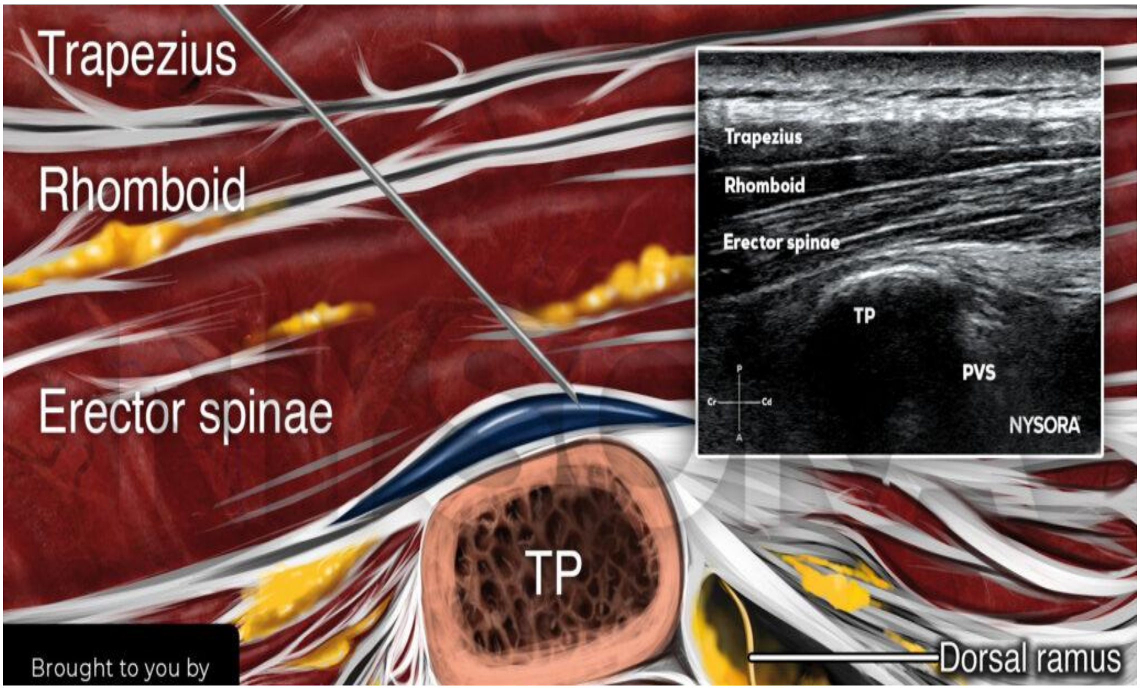


Figure 4. Ultrasound guided image of Erector spinae muscles

3.Peripheral Nerve Stimulator (PNS)-Guided ESPB

The PNS-guided ESPB is a technique that provides electrophysiological confirmation of correct needle placement by stimulating target nerves.

Technical Approach

- The patient is positioned prone or lateral.
- A PNS is attached to a stimulating needle, delivering low-intensity electrical currents**.**
- The needle is advanced until muscle contractions in the target dermatomes (T7-T12) are observed**.**
- Local anesthetic is then injected, confirming proper placement.

Advantages

- Provides additional confirmation of nerve blockade**.**
- Can be useful in situations where ultrasound is not available.

Limitations

- Lower precision than USG**,** as it does not provide direct visualization of the spread of local anesthetic.
- Time-consuming compared to USG-guided ESPB.
- Not widely used, as USG-guidance has largely replaced PNS guidance.

Scientific Evidence

- Prasad et al. (2021) found that PNS-guided ESPB provided effective analgesia**,** but had a lower success rate compared to USG-ESPB.
- Thiagarajan et al. (2021**)** concluded that PNS-ESPB was more reliable than blind ESPB but inferior to USG-ESPB**.**

Due to its limitations and the widespread availability of ultrasound technology, PNS-guided ESPB is rarely used as a primary technique.

Comparative Analysis of ESPB Techniques

Technique	Accuracy	Safety	Effectiveness	Feasibility
Blind Technique	Low	Moderate	Variable	High
USG-Guided ESPB	High	High	High	Requires expertise
PNS-Guided ESPB	Moderate	High	Moderate	Less commonly used

Erector Spinae Plane Block (ESPB) has become a widely accepted regional anesthesia technique for postoperative analgesia in various surgical procedures, including PCNL, thoracic, and abdominal surgeries. The choice of technique significantly impacts block efficacy, safety, and patient outcomes.

Among the available approaches:

- USG-guided ESPB is the gold standard**,** offering high accuracy, better analgesia, and reduced complications**.**
- Blind ESPB, though simple, has a high failure rate and inconsistent outcomes**.**
- PNS-guided ESPB, while an alternative, is less precise and not commonly used.

Recent clinical trials and meta-analyses strongly advocate for USG-guided ESPB as the most reliable and effective technique for regional analgesia in PCNL. Further research is warranted to explore optimal anesthetic drug combinations and long-term analgesic outcomes.

Hemodynamic Stability with ESPB

- One of the notable advantages of ESPB over other regional anesthesia techniques is its minimal impact on hemodynamic stability. Unlike neuraxial blocks, which can cause significant hypotension due to sympathetic blockade, ESPB has been shown to maintain stable hemodynamic parameters. This makes it particularly advantageous in patients where maintaining blood pressure is critical. A study comparing ESPB with other regional blocks found that ESPB had a safer hemodynamic profile, with patients experiencing less hypotension and requiring fewer interventions to maintain blood pressure.

PHARMACOLOGY

Bupivacaine: Pharmacology and its clinical applications

Introduction

Bupivacaine is a long-acting amide local anesthetic widely used in regional anesthesia, neuraxial blocks, and postoperative pain management. It is known for its potent analgesic properties, prolonged duration of action, and differential blockade, making it an essential agent in clinical anesthesia, including Erector Spinae Plane Block (ESPB).

Chemical Structure and Classification

- Chemical name 1-butyl-N-(2,6-dimethylphenyl)-2-piperidinecarboxamide.
- Class: Amide-type local anesthetic.
- Molecular Formula: $C_{18}H_{28}N_2O$.
- pKa: 8.1.
- Partition Coefficient: 27.5 (lipophilic), which enhances tissue penetration.

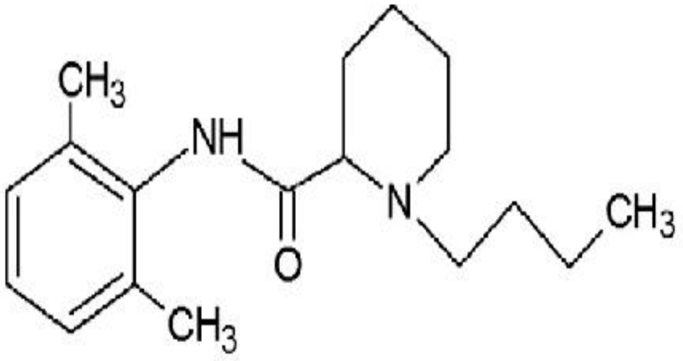


Figure 5. Chemical structure of bupivacaine

Mechanism of Action

Bupivacaine exerts its effect by blocking voltage-gated sodium (Na^+) channels in nerve membranes, inhibiting neuronal depolarization and conduction of pain signals. It preferentially blocks sensory fibers at lower concentrations while requiring higher concentrations for motor blockade.

- Affinity: Higher for small-diameter, myelinated Aδ and C fibers (pain and temperature transmission).
- Duration: Prolonged due to high protein binding (95%), leading to slow systemic absorption and prolonged action.
- Onset: Moderate (5-15 minutes, depending on site and concentration).

Pharmacokinetics

Parameter	Value
Onset of Action	5-15 minutes
Peak Plasma Concentration	20-30 minutes (depends on vascularity)
Duration of Action	3-12 hours (dose-dependent)
Protein Binding	95% (primarily to α1-acid glycoprotein)
Metabolism	Hepatic (CYP3A4, CYP1A2)
Excretion	Renal (6% unchanged)
Half-life	2.7-3.5 hours

Maximum dose of bupivacaine is 3mg/kg. It produces systemic effects after absorption. The rate and extent of absorption depends on dose, site of injection, volume and physiochemical properties of the drug. Bupivacaine is lipid soluble, more potent with less systemic absorption.

Clinical applications

- Regional Anesthesia: Peripheral nerve blocks (ESPB, TAP block, femoral block).
- Neuraxial Anesthesia: Epidural, spinal anesthesia.
- Postoperative Analgesia: Continuous catheter-based techniques.
- Obstetric Analgesia: Epidural for labor and cesarean delivery.
- Cardiac Surgery: Intrathecal bupivacaine for postoperative pain.

Toxicity and Side Effects

- Central Nervous System (CNS) Toxicity:
  - Early signs: Perioral numbness, dizziness, tinnitus, metallic taste.
  - Late signs: Seizures, coma, respiratory depression.
- Cardiotoxicity:
  - Bupivacaine-induced cardiotoxicity (BIC): Bradycardia, ventricular arrhythmias, cardiac arrest.
  - Treatment: Lipid emulsion therapy (Intralipid 20%).
- Hypersensitivity Reactions: Rare, but possible with amide local anesthetics.

Dexamethasone: Pharmacology and Clinical Applications

Introduction

Dexamethasone is a long-acting synthetic glucocorticoid with potent anti-inflammatory, immunosuppressive, and analgesic properties. It is frequently used as an adjuvant in regional anesthesia, including ESPB, to prolong the duration of local anaesthetics and enhance postoperative analgesia.

Chemical Structure and Classification

- Chemical Name: 9-fluoro-11β,17,21-trihydroxy-16α-methylpregna-1,4-diene-3,20-dione.
- Class: Corticosteroid (glucocorticoid).
- Molecular Formula: $C_{22}H_{29}FO_5$.
- pKa: 1.83.
- Potency: 25 times more potent than cortisol.

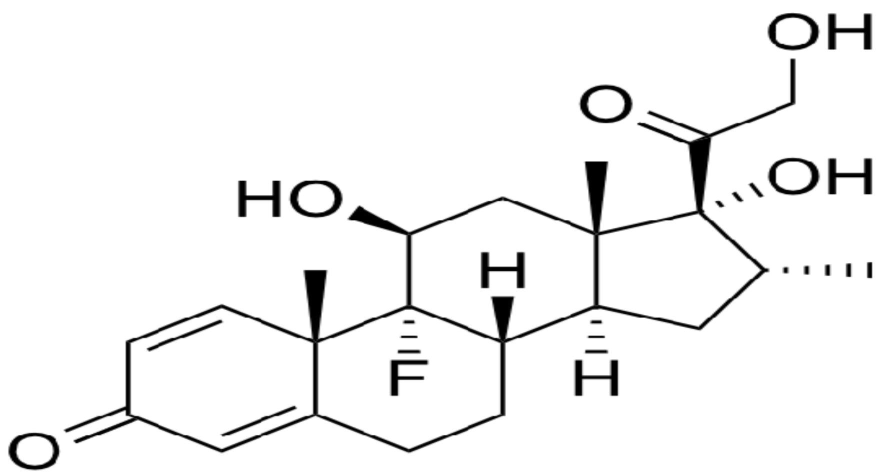


Figure 6. Chemical structure of Dexamethasone

Mechanism of Action:

Dexamethasone exerts its effects through glucocorticoid receptor activation, leading to:

1. Inhibition of phospholipase A2, reducing prostaglandin and leukotriene synthesis.
2. Suppression of pro-inflammatory cytokines (IL-1, IL-6, TNF-α).
3. Upregulation of anti-inflammatory proteins (lipocortin-1).
4. Membrane stabilization of peripheral nerves, reducing excitability and nociceptive transmission.

Pharmacokinetics

Parameter	Value
Onset of Action	1-2 hours
Peak Plasma Concentration	1-2 hours
Duration of Action	36-72 hours
Protein Binding	77% (binds to albumin)
Metabolism	Hepatic (CYP3A4)
Excretion	Renal (majority as inactive metabolites)
Half-life	36-54 hours

Clinical Applications

- Adjuvant in Regional Anesthesia:

    - Prolongs duration of local anesthetics (ESPB, brachial plexus block).
    - Reduces postoperative pain and opioid consumption.
- Anti-inflammatory Therapy:
    - Treatment of autoimmune disorders, allergies, asthma, and rheumatoid arthritis.
- Anti-emetic:
    - Prevention of postoperative nausea and vomiting (PONV).
- Neuroprotection:
    - Reduces postoperative neuropathic pain.
- Critical Care:
    - Management of cerebral edema, septic shock, and COVID-19 ARDS.

Toxicity and Side Effects

- Metabolic Effects: Hyperglycemia, insulin resistance, osteoporosis.
- Immune Suppression: Increased risk of infections.
- Adrenal Suppression: Cushingoid features with chronic use.
- Psychiatric Effects: Mood changes, insomnia, psychosis.
- Gastrointestinal Effects: Gastritis, peptic ulcers.

Role of Bupivacaine-Dexamethasone Combination in ESPB

1. Enhanced Analgesia and Prolonged Block Duration

- Dexamethasone extends the duration of bupivacaine-mediated analgesia by reducing local inflammatory responses and stabilizing neuronal membranes.
- Studies show a 50-100% increase in block duration when dexamethasone is added to bupivacaine in ESPB.

2. Opioid-Sparing Effect

- Reduces opioid consumption postoperatively, leading to fewer opioid-related side effects (nausea, vomiting, sedation).
- Meta-analysis by Knezevic et al. (2021) showed a significant reduction in postoperative opioid requirement when dexamethasone was added to local anesthetics in regional blocks.

3. Anti-inflammatory Action

- Reduces postoperative inflammatory pain, leading to improved recovery and patient satisfaction.
- Prevents exaggerated immune responses, reducing peripheral and central sensitization.

4. Safe and Effective Adjuvant

- Studies indicate that low doses of dexamethasone (4-8 mg) are optimal for prolonging analgesia without systemic side effects.
- High doses (>10 mg IV or perineural) may lead to hyperglycemia and immunosuppression.

Bupivacaine is a long-acting local anesthetic that provides effective sensory blockade in ESPB, while dexamethasone enhances its duration, reduces inflammation, and minimizes opioid use. The combination of bupivacaine and dexamethasone in ESPB has significant clinical advantages, making it an essential component in multimodal analgesia for perioperative pain management.

Collectively studies suggest that incorporating dexamethasone as an adjuvant to bupivacaine in ESPB significantly improves postoperative pain management, reduces opioid consumption, and enhances patient satisfaction across various surgical procedures. However, the efficacy of dexamethasone in ESPB may vary based on surgical type and patient characteristics, necessitating further research to optimize dosing and patient selection.

MATERIALS AND METHOD

SOURCE OF DATA:

This study was be conducted in the Department of Anaesthesiology, B.L.D.E. (Deemed to be University) Shri B M Patil Medical College Hospital and Research Centre, Vijayapura.

METHOD OF COLLECTION OF DATA:

Study Design: Prospective randomized control trial.

Study Period: One and a half year

Sampling Procedure: After establishing the unit of assignment and eligible population, we randomly assigned a sample of eligible population to Group A and Group B through computer generated randomization technique.

STATISTICAL DATA

Sample size:

Using G*Power ver 3.1.9.4 software for sample size calculation, The Total tramadol requirement in 24 h, mg for Case (Mean=100, SD=37.037) and Control (Mean=150, SD=37.037), this study requires a total sample size of 60(for each group 30, assuming equalgroup sizes), so to achieve a power of 99% for detecting a difference in Means: Inequality, two independent means (two groups)(t-test) with 1% level of significance.

STATISTICAL ANALYSIS:

The data obtained is entered in a Microsoft Excel sheet, and statistical analyses are performedusing a statistical package for the social sciences (SPSS) (Version 20). Results are presented as Mean, SD, counts and percentages, and diagrams.

For normally distributed continuous variables between the two groups were compared using an independent sample t-test. For not normally distributed variables, the Mann-Whitney U test is used. For Categorical variables between the two groups were compared using the Chi-square test/Fisher's exacttest. Ifp<0.05 will be considered statistically significant. All statistical are performed two-tailed.

Inclusion criteria:

- All patients undergoing percutaneous nephrolithotomy.
- Age 18–65 years
- American Society of Anesthesiology (ASA) physical status I and II

Exclusion criteria:

- Bleeding diathesis
- Patients in renal failure.
- A dermal infection in the injection site.

Ethical issues :

All participants provided written informed permission for this study following ethical committee approval.

Methodology:

Pre-anaesthetic evaluation: Patients who underwent a comprehensive pre-operative evaluation, which includes the following, were recruited for the study.

History:

History of underlying medical illness, previous history of surgery, previous anaestheticexposure, and hospitalization was taken.

- **Physical examination:**

The patient's general condition, vital signs (heart rate, blood pressure, respiratory rate), height and weight, examination of the cardiovascular system, respiratory system, central nervous system, and vertebral system, and Airway assessment by Mallampati grading was noted.

PROCEDURE :

- This study was conducted in our institute on 60 patients undergoing percutaneous nephrolithotomy.

- The patients were randomly divided into two equal groups by computer generated random numbers of 30 each.
- **Group A** received 20 mL of 0.25% bupivacaine with 8 mg of dexamethasone subcutaneous infiltration at the incision site at the end of surgery.
- **Group B** received an ultrasound-guided erector spinae plane block with 20 mL of 0.25% bupivacaine with 8 mg of dexamethasone after surgery and before extubation.
- The process and how to react to the NRS were explained to each participant. Numbers will be recorded using the 11-point NRS scale, which goes from 0 (no pain) to 10 (worst possible pain).
- After ensuring adequate nil by mouth (NBM) and written informed consent, patients was shifted into the operating theatre.
- Baseline measurements were taken and recorded using standard monitoring techniques using an ECG, NIBP, and pulse oximeter.
- Both groups underwent the same surgical procedure and anesthetic method.
- An 18-G intravenous (IV) line was established, and premedication with ondansetron 0.15 mg/kg, midazolam 0.05mg/kg and glycopyrrolate 0.015 mg/kg was administered.
- Intravenous fentanyl 2 mcg/kg, propofol 2 mg/kg, and were used to induce general anesthesia and atracurium 0.5 mg/kg was the muscle relaxant used.
- After 3 minutes of preoxygenation with mask ventilation intubation was done with an appropriate size endotracheal tube. Once the endotracheal tube

position and bilateral air entry were confirmed, the patients were linked to the anaesthesia workstation.

- The nitrous oxide and oxygen mixture was used to maintain anaesthesia, and the isoflurane concentration was changed to keep the minimum alveolar concentration (MAC) between one and one and a half. For surgery, patients were placed prone, with the proper padding and safety precautions in place. Despite sufficient muscular relaxation and anaesthesia depth, intraoperative tachycardia was managed with an IV fentanyl dosage of 0.5 mcg/kg.

- At the T10 level, Group B underwent ultrasound-guided erector spinae plane block (ESPB). The T10 level was determined and noted by counting from the scapula, a bony marker above.

- After positioning the linear (6–13 MHz) ultrasound transducer (Sonosite M Turbo, USA) in a transverse orientation in the sagittal plane and identifying and marking the T10 spinous process, the probe was slided laterally until the transverse process (TP) was identified on the surgical side. After the probe was turned 90 degrees the sonographic markers, such as the transverse process covering the erector spinae muscles and trapezius, were detected. An 8 cm 23-gauge Quincke spinal needle was inserted parallel to the USG beam at a 30- to 45-degree angle in the cephalocaudal direction until the tip made contact with the corresponding transverse process under very stringent aseptic circumstances. The needle was pulled back a few millimeters once the transverse process made contact. Next, two to three ml of isotonic saline solution were injected to determine the proper plane. After that, 20 milliliters of 0.25% bupivacaine with eight milligrams of dexamethasone were injected between the transverse process and the erector spinae muscle.

- It was noted that the dynamic local anaesthetic extended deep into the erector spinae muscle in a longitudinal pattern (2–3 segments above and below the T10 level) using sonographic guidance. Then the patient was turned supine and extubated.

- Neostigmine 0.09 mg/kg and glycopyrrolate 0.015 mg/kg were used for reversal.
- Group A, at the end of the surgery, received subcutaneous infiltration of 20 mL 0.25% bupivacaine with 8 mg of dexamethasone throughout the incision site using a 38 mm 21 G hypodermic needle by the operating surgeon in the subcutaneous plane involving the skin and subcutaneous plane.
- Numeric rating scores were evaluated following extubation at 30- and 60-minute intervals then every two hours for six hours, and finally every six hours until twenty-four hours after surgery.
- An intravenous infusion of 50 mg of tramadol will be administered if the NRS score was ≥4. The second analgesic was 1 gram of intravenous paracetamol if the pain continued (NRS≥4) even after 30 minutes of tramadol delivery. The timeframe was used to further evaluate the NRS scores. After six hours, the doses of paracetamol and tramadol were given again if the NRS was ≥4. An IV fentanyl bolus (0.5 μg/kg) was given if an NRS score of ≥4 was noted during the interim.

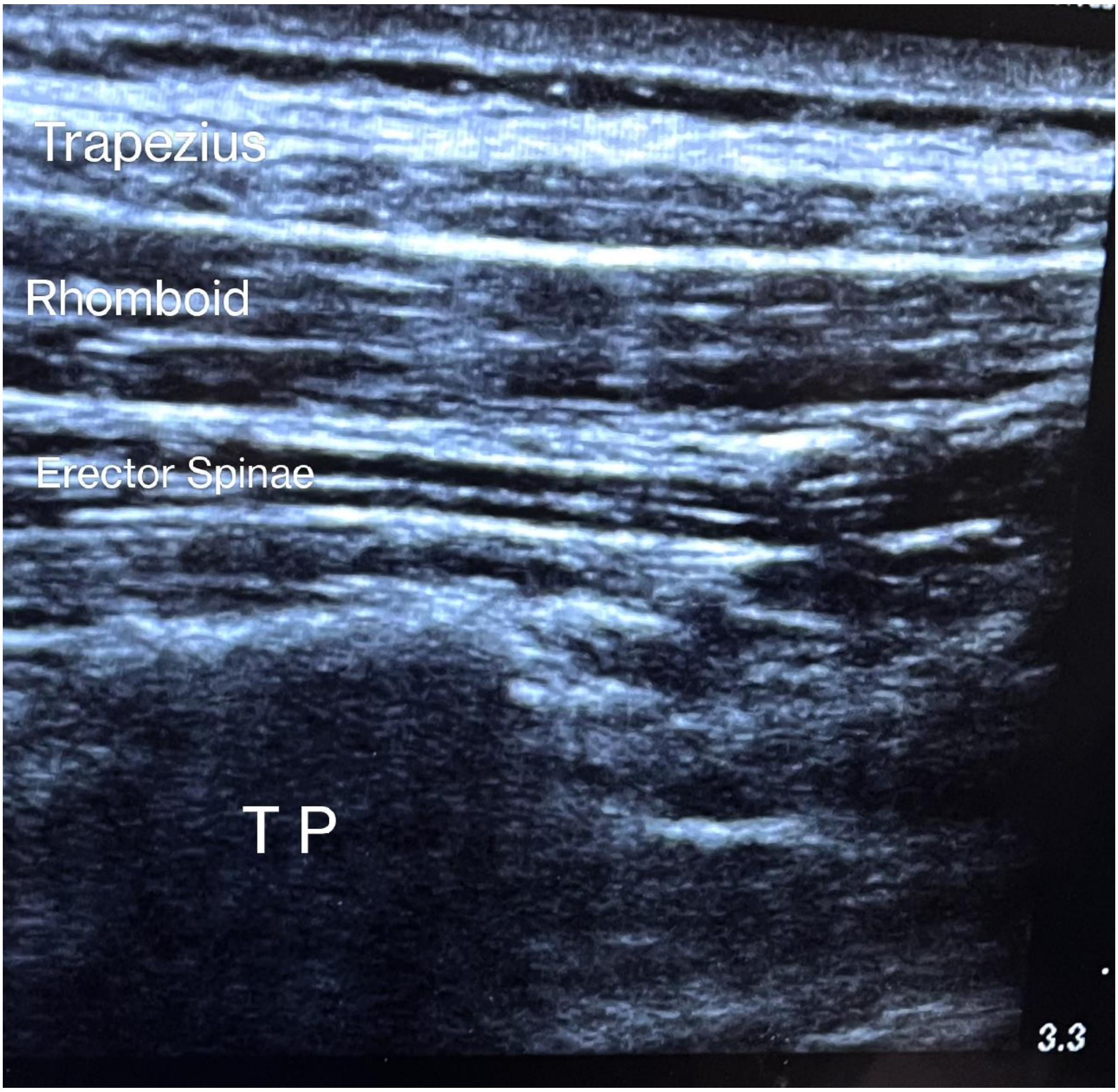


Figure 7. Real time Ultrasound image of ESP Muscles

NRS Score Intensity of pain

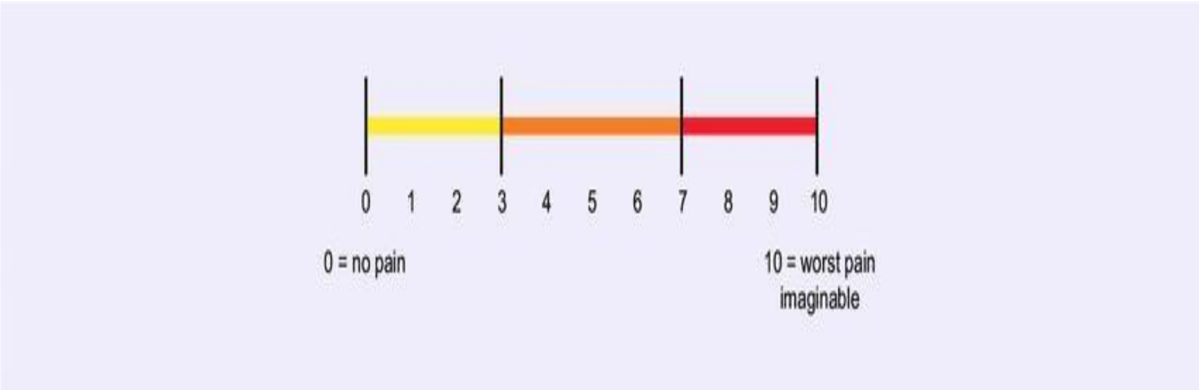
0: No pain to slight pain

1 – 3: Mild pain.

4 – 6: Moderate pain.

7 – 9: Severe pain.

10: Worst possible pain.



INVESTIGATIONS / INTERVENTIONS

Complete blood count,

Urine routine,

Renal function test,

E.C.G ,

Blood sugar level if indicated,

Chest X-ray if indicated ,

Serology were done.

OBSERVATION AND RESULTS

- This randomized open label study was done on 60 patients belonging to ASA class 1 and 2, who were undergoing Percutaneous Nephrolithotomy in B M Patil medical college, Vijayapura from May2023 to December2024.

- Patients were randomized into 2 groups to receive local anaesthetic infiltration and erector spinae plane block for post operative analgesia.

- Group A(n=30) patients received 20ml of 0.25% bupivacaine with 8mg dexamethasone for local anaesthetic infiltration

- Group B (n=30) patients received 20 ml of 0.25% bupivacaine with 8 mg of dexamethasone for erector spinae plane block.

- Data was entered in Microsoft office excel sheet and analysis was done using standard statistical software.

- The results were summarized by routine descriptive statistics namely mean and standard deviation.

- Numerical variables were compared between two groups by Mann-Whitney ‘U’test.

- Analysis done was 2 tailed and $p < 0.005$ was considered to be statistically significant.

1. DURATION OF ANALGESIA

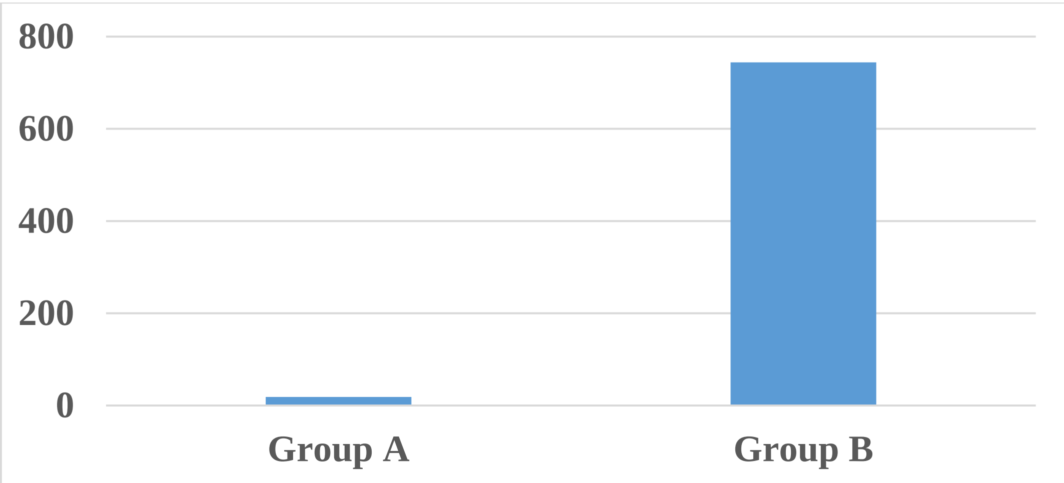
The following table 1 and bar diagram (graph 1) describes the duration of analgesia of patients of group A and group B.

The mean duration of analgesia was higher in group B than group A
(18.60+/- 1.694 in group A)
(744.03+/- 24.867 in group B)

Table 1 Comparison of duration of analgesia (in minutes) in both groups

	Group A		Group B		Mann Whitney U Test	p value
	Mean	SD	Mean	SD		
Duration of Analgesia	18.60	1.694	744.03	24.867	.000	.000

Graph 1 Comparison of duration of analgesia (in minutes) in both groups



2.TIME FOR FIRST ANALGESIC REQUIREMENT (IN MINUTES)

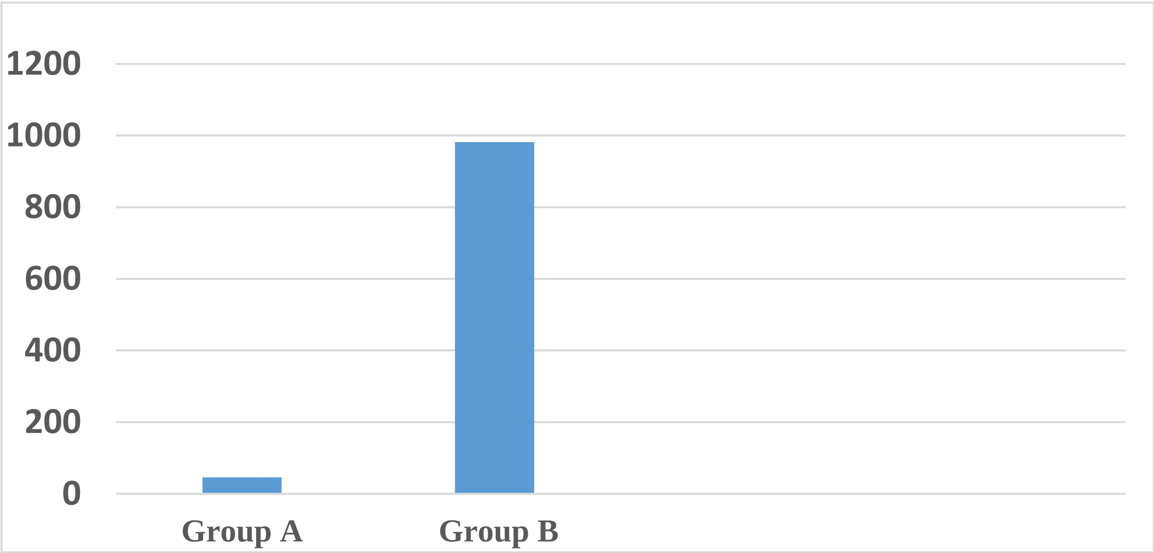
The following table 2 and bar diagram (graph 2) describes the time for first analgesic requirement (in minutes) of patients of group A and group B.

The mean time required for first analgesic requirement was higher in group B than group A.
(45.90+/- 2.964 in group A)
(981.63+/- 26.195in group B)

Table 2 Comparison of time for first analgesic requirement (in minutes) in both groups

Time for first analgesic requirement (in minutes)	Group A		Group B		Mann Whitney U Test	p value
	Mean	SD	Mean	SD		
	45.90	2.964	981.63	26.195	.000	.000

Graph 2 Comparison of time for first analgesic requirement (in minutes) in both groups



3.TOTAL TRAMADOL CONSUMPTION IN 24 HOURS

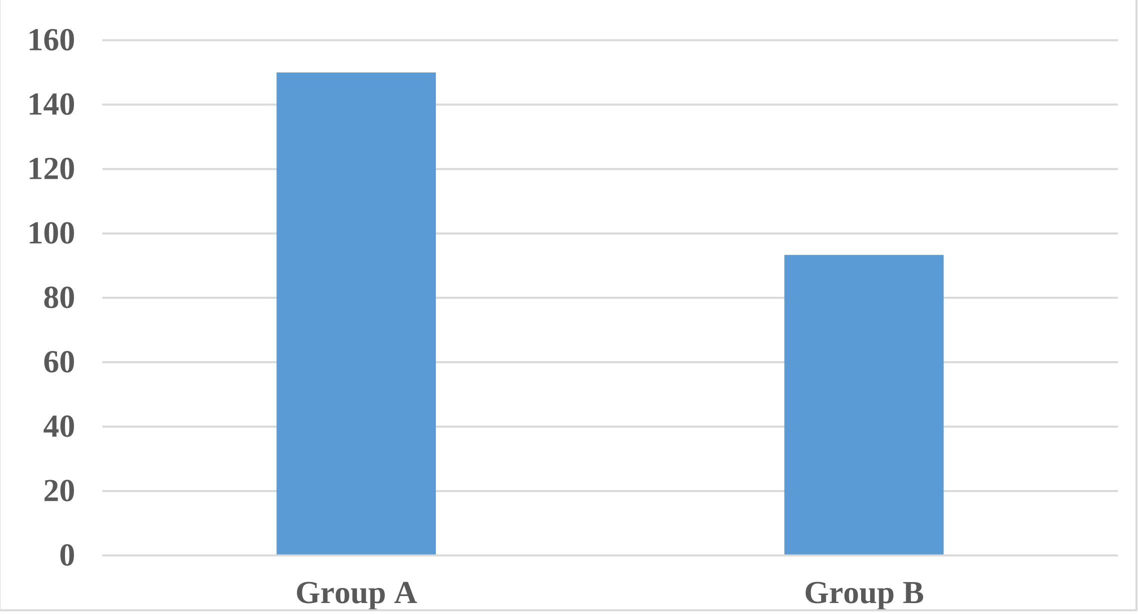
The following table 3 and bar diagram (graph 3) describes total tramadol consumption in 24 hours of patients of group A and group B.

The mean total tramadol consumption in group A was higher than group B.
(150+/- 0 in group A)
(93.33+/- 17.287 in group B)

Table 3 Comparison of total tramadol consumption in 24 hours in both groups

Total tramadol consumption in 24 hours	Group A		Group B		Mann Whitney U Test	p value
	Mean	SD	Mean	SD		
	150	0	93.33	17.287	.000	.000

Graph 3 Comparison of total tramadol consumption in 24 hours in both groups



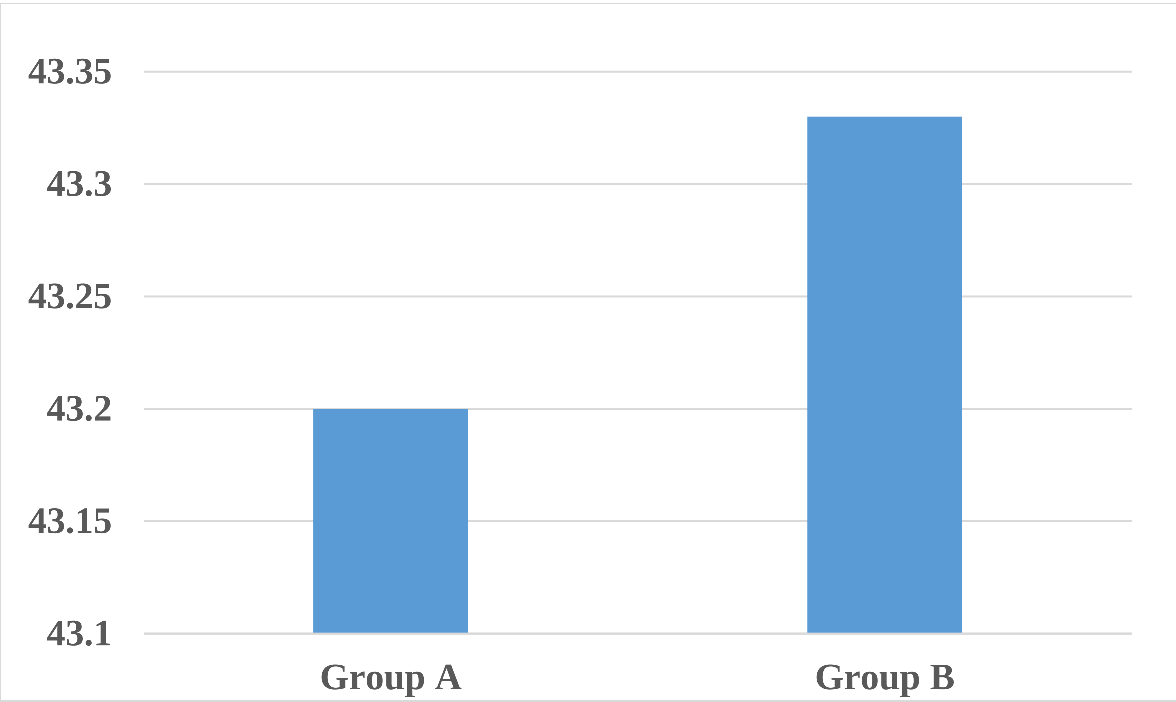
4.AGE

The following table 4 and bar diagram (graph 4) describes the age distribution of patients of group A and group B.
The mean age was similar in both groups .
(43.20 +/- 14.616 in group A)
(43.33 +/- 14.003 in group B)

Table 4 Comparison of age (years)distribution in both groups

Age	Group A		Group B		Mann Whitney U Test	p value
	Mean	SD	Mean	SD		
	43.20	14.616	43.33	14.003	444.500	.935

Graph 4 Comparison of age (years)distribution in both groups



5.NRS SCORES BETWEEN TWO GROUPS AT 30 MINUTES AND 60 MINUTES

The following table 5 and bar diagram (graph 5) describes the NRS scores of patients at 30 minutes and 60 minutes of group A and group B.
The mean NRS scores at 30 minutes and 60 minutes were higher in group A than Group B

Table 5 Comparison of NRS scores at 30 minutes and 60 minutes in both groups

NRS score	Group A		Group B		Mann Whitney U Test	p value
	Mean	SD	Mean	SD		
At 30 minutes	3.00	.455	2.03	.615	118.500	.000
At 60 minutes	4.77	.626	1.00	.587	.000	.000

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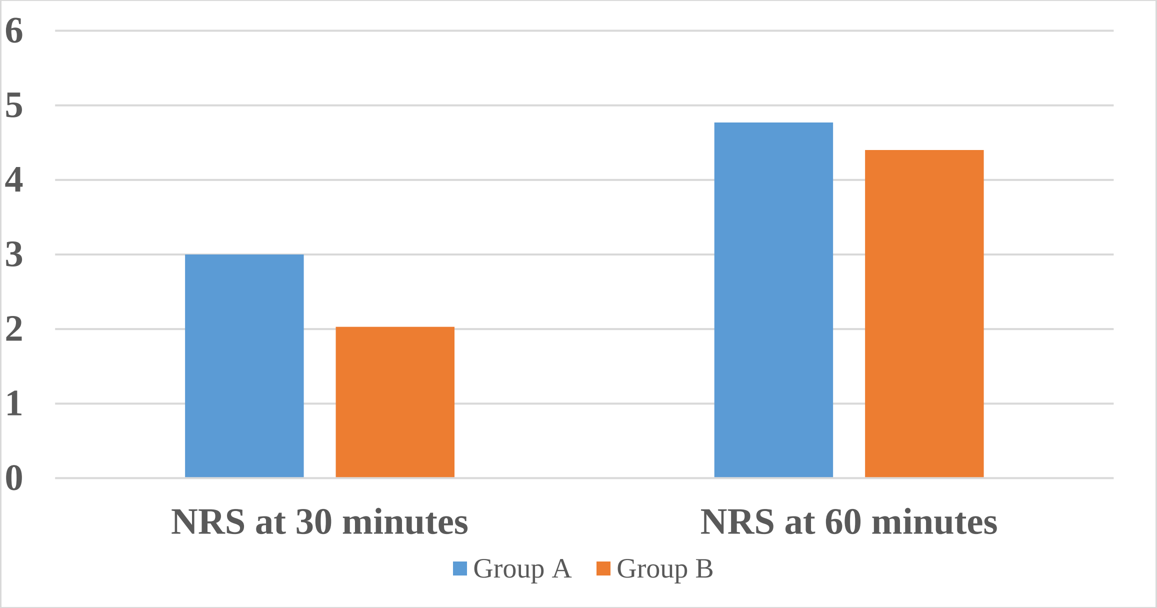
Graph 5 Comparison of NRS scores at 30 minutes and 60minutes in both groups



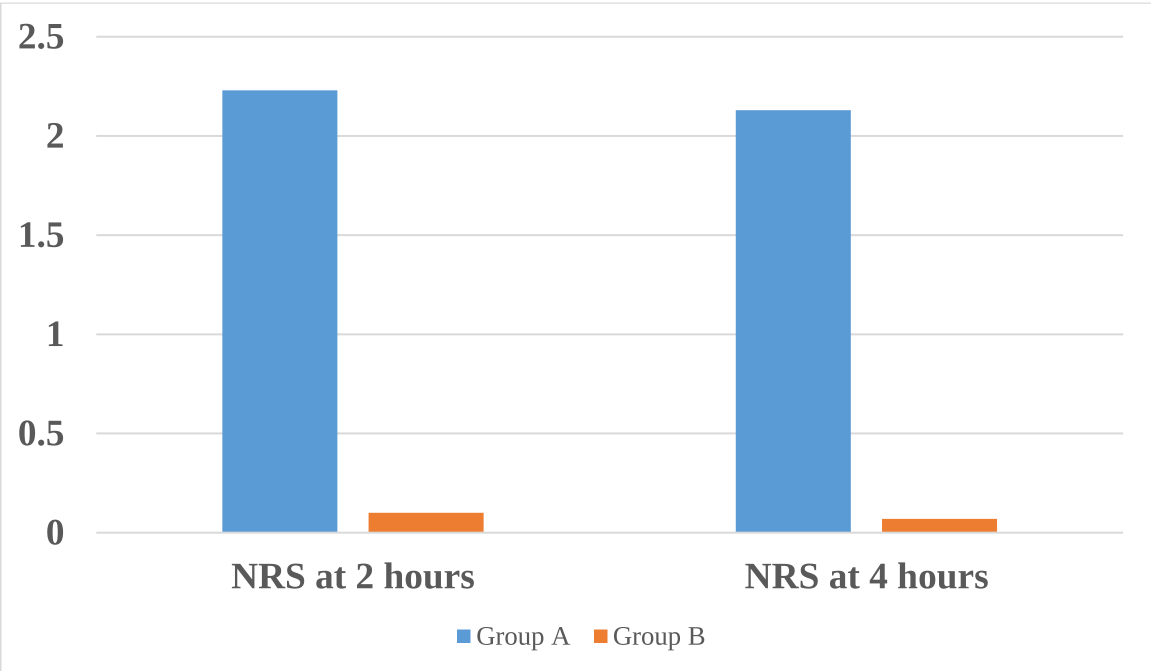
6. NRS SCORES BETWEEN TWO GROUPS AT 2 HOURS AND 4 HOURS

The following table 6 and bar diagram (graph 6) describes the NRS scores of patients at 2 hours and 4 hours of group A and group B.
The mean NRS scores at 2 hours and 4 hours were higher in group A than Group B

Table 6 Comparison of NRS scores at 2 hours and 4 hours in both groups

NRS score	Group A		Group B		Mann Whitney U Test	p value
	Mean	SD	Mean	SD		
At 2 hours	2.23	.430	0.10	.305	.000	.000
At 4 hours	2.13	.346	0.07	.254	.000	.000

Graph 6 Comparison of NRS scores at 2 hours and 4 hours in both groups



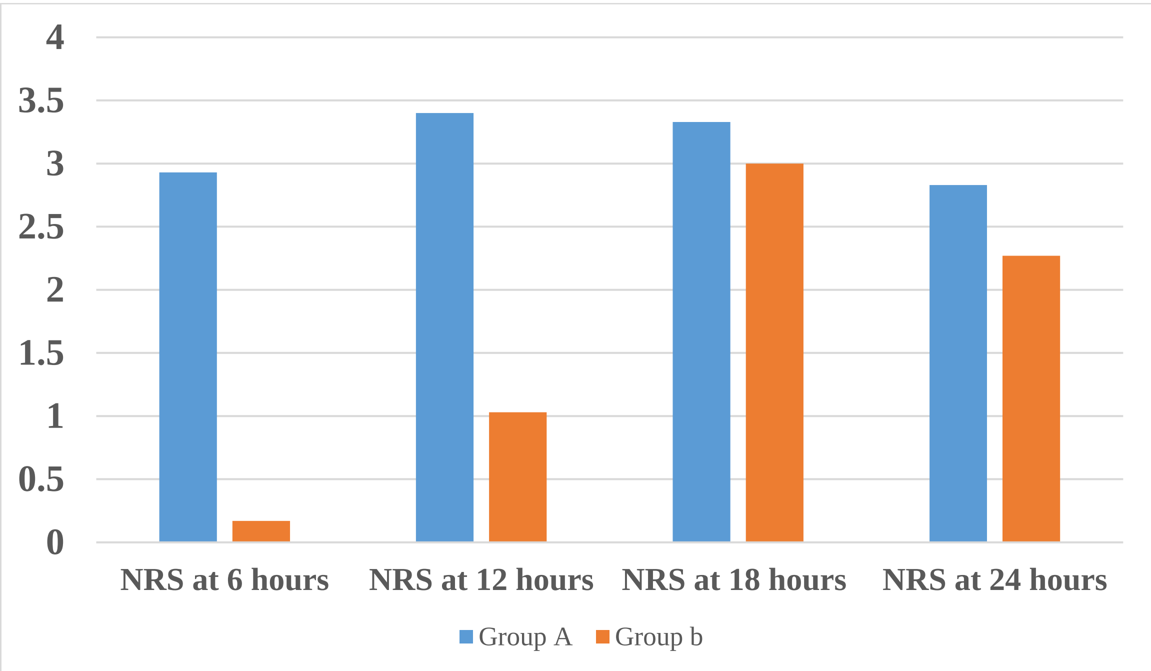
7. NRS SCORES BETWEEN TWO GROUPS AT 6HOURS,12 HOURS, 18 HOURS AND 24 HOURS

The following table 7 and bar diagram (graph 7) describes the NRS scores of patients at 6 hours, 12 hours,18 hours and 24 hours of group A and group B.
The mean NRS scores were higher in group A than Group B at all these time intervals.

Table 7 Comparison of NRS scores at 6 hours,12 hours,18 hours and 24 hours in both groups

NRS score	Group A		Group B		Mann Whitney U Test	p value
	Mean	SD	Mean	SD		
At 6 hours	2.93	.254	0.17	.379	.000	.000
At 12 hours	3.40	.498	1.03	.320	.000	.000
At 18 hours	3.33	.547	3	.00	300	.001
At 24 hours	2.83	.699	2.27	.450	250	.001

Graph 7 Comparison of NRS scores at 6 hours,12 hours,18 hours and 24 hours in both groups



8. EPISODES OF NAUSEA AND VOMITING

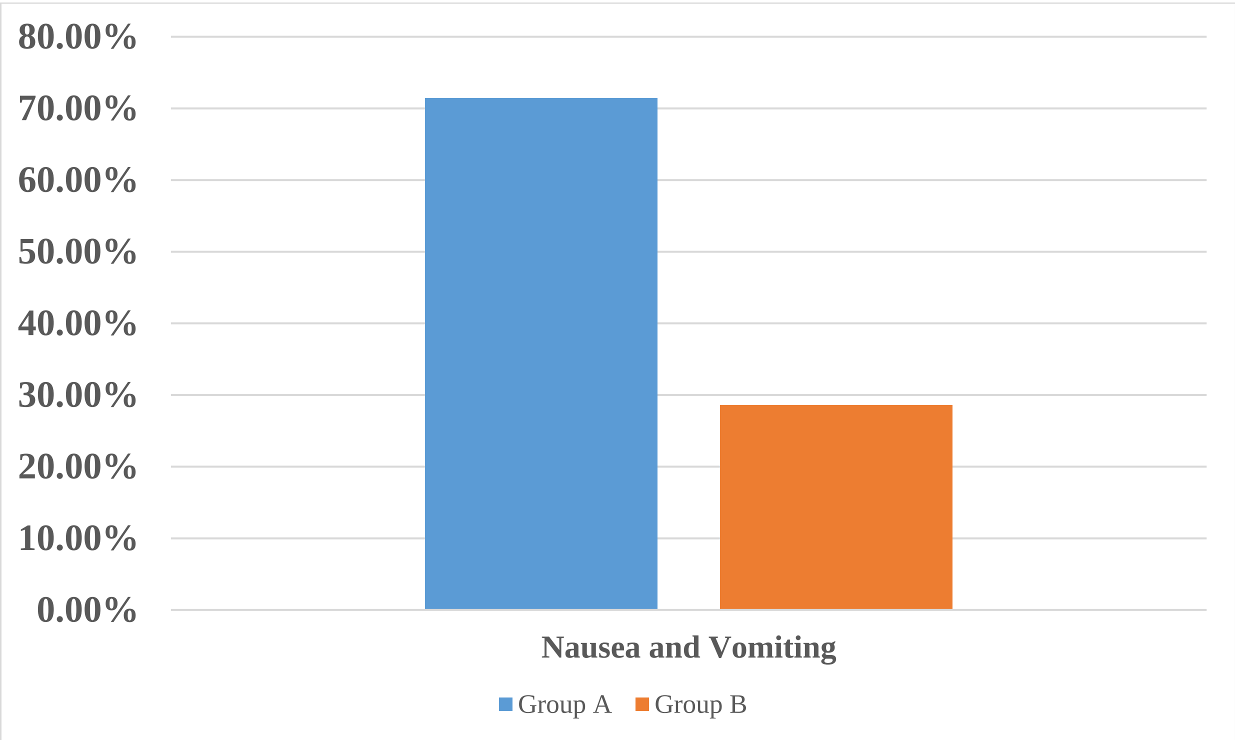
The following table 8 and bar diagram (graph 8) depicts the comparison of episodes of nausea and vomiting in group A and group B.

It shows episodes of nausea and vomiting is more in group A compared to group B**.**

Table 8 Comparison of nausea and vomiting in both groups

	Group A		Group B		Chi Square test p value
	n	%	n	%	
Nausea and Vomiting	5	71.42	2	28.57	.306

Graph 8 Comparison of nausea and vomiting in both groups



DISCUSSION

- Our study evaluates the efficacy of local anaesthetic infiltration of the incision site and erector spinae plane block (ESPB) for postoperative analgesia in patients undergoing percutaneous nephrolithotomy using 20 ml of 0.25% bupivacaine with 8 mg of dexamethasone.
- With the advent of fascial plane blocks pain management and post operative analgesia after surgeries have experienced advances in recent years.
- In our study we have evaluated the efficacy of local anaesthetic infiltration of the incision site and erector spinae plane block for post operative analgesia in PCNL patients using NRS score at time intervals of 30 minutes, 60 minutes, 2 hours, 4 hours, 6 hours , 12 hours, 18 hours and 24 hours.
- In our study we found that the patients receiving the ESPB have relatively lower NRS scores at any given interval of time compared to the patients receiving local anaesthetic infiltration. The mean NRS scores of group B were 2.03+/-0.615 at 30 minutes, 1+/-0.587 at 60 minutes,0.10+/-0.305 at 2 hours,0.07+/-0.254 at 4 hours,0.17+/-0.379 at 6 hours,1.03+/-0.320 at 12 hours,3+/- 0.00 at 18 hours, 2.27+/-0.450 at 24 hours. Whereas the mean NRS scores of group A were 3.00+/-0.455 at 30 minutes, 4.77+/-0.626 at 60 minutes,2.23+/-0.430 at 2 hours,2.13+/-0.346 at 4 hours,2.93+/-0.254 at 6 hours,3.40+/-0.498 at 12 hours,3.33+/- 0.547 at 18 hours, 2.83+/-0.699 at 24 hours.
- A randomized controlled study by Shah *et al* (2) for postoperative analgesia following percutaneous nephrolithotomy under spinal anaesthesia for the first 24 hours following surgery, the ESPB group's VAS scores were between 3 and 4, and they considerably decreased after 4 hours, in contrast to the control group who received tramadol 1.5 mg/kg the VAS scores were higher in the range of 4-7.Our study results were similar to this randomized controlled study.

- In a systematic review and meta-analysis Zhang Y *et al*[30] to verify the clinical analgesic efficacy and safety of erector spinae plane block in patients undergoing breast carcinoma surgery. Pain scores (VAS/NRS) at 1, 6, 12, and 24 h postoperatively in ESPB group of different studies were in the range of 0.5-3 whereas the general anaesthesia group were in the range of 2-6. ESPB group showed lower pain scores than the GA group in the four time periods (1, 6, 12 and 24 h after surgery) in this review. Our study results were akin with this systematic review.
- In our investigation, 20 ml of 0.25% bupivacaine and 8 mg of dexamethasone were given to each group. The efficacy of ESPB given at varying quantities (20 mL vs. 30 mL) for postoperative pain control following mastectomy and axillary lymph node dissection was compared in a study by Bıdak M et al. According to their findings, there was no difference in the management of postoperative analgesia between the 20 mL and 30 mL ESPB groups.
- Erector spinae plane (ESP) block was first described in 2016 by Forero et al. From then it has attracted unexpected attention and has stimulated a thirst in fascial plane blocks in general [31].
- The ESPB is distinctive due to its wide range of applications. It has been employed for managing pain that is acute or chronic in the upper and lower limbs as well as the torso. Its use has extended to areas where regional anesthesia was previously less common, such as cardiac and spine surgeries. Additionally, it has gained acceptance beyond anesthesiology, being utilized in emergency medicine and prehospital trauma care [31].
- It's still unclear how exactly the ESP block works, with multiple theories proposed over the years. It is considered to have a multifactorial effect. Research indicates that local anesthetics can spread into the thoracic paravertebral space, which was originally thought to be the primary mechanism. Additionally, some studies suggest that epidural spread may also occur [32]. A proposed mechanism is it blocks posterior and anterior rami of thoracic/lumbar spinal nerves.
- However, it’s crucial to note that ESPB does not cause pressure-like chest discomfort or pleural line movement on ultrasound, both of which are commonly linked to

thoracic paravertebral blockade. This suggests that the anesthetic spreads gradually rather than rapidly expanding the paravertebral space. [33].

- In our study the mean time duration of analgesia in group A was 18.60 +/- 1.69 minutes and in group B was 744.03 +/- 24.86 minutes after giving 20 ml of 0.25% bupivacaine with 8 mg of dexamethasone both for block and local anaesthetic infiltration.
- In a case study by Kim E. et al., they discovered that the patient's resting/dynamic VAS scores remained below 1 for 12 to 36 hours after surgery after receiving continuous ESPB with catheter in situ for postoperative analgesia following PCNL. Both the dynamic and resting VAS ratings were 0 ,36 hours after surgery. A 1:1 combination of 0.75% ropivacaine (10 ml) and saline (10 ml) with epinephrine (1:200,000) was employed in this investigation. Single dose of injection lasted for a duration of 12 hours. Our study and this study has shown the coequal duration of postoperative analgesia.
- In our study the mean duration for first rescue analgesia in group A was 45.9 +/2.96 minutes and in group B was 981.63 +/ 26.195 minutes. The tramadol consumption in first 24 hours in our study was more in group A (150 mg) than group B (93.33 +/- 17.2 mg).
- Ibrahim et al. evaluated the analgesic impact of preoperative single-shot ultrasound (US)-guided erector spinae plane block (ESPB) at the T11 spinal level in patients receiving PCNL in a randomized controlled trial. Compared to the other group, patients who got ESPB consumed less fentanyl during surgery and took longer to utilize PCA for the first time. Here the duration of analgesia was much shorter. This may be attributed to the preoperative administration of the block where the dose required will be much higher compared to the normal postoperative analgesic dose [35].
- Similar to the findings of the two randomised controlled trials (RCTs) conducted by Kim E and Ibrahim M et al that evaluated ESP block for analgesia after PCNL, the patients in our current study who received the ESPB had lower numeric rating scores and escalated time to first analgesic [34],[35].

- In our study neither of the groups did not have any block related complications except for nausea and vomiting but this will not suffice for the evidence of block safety. In a retrospective analysis of 342 consecutive cases by Oezel L et al, they have reported a one unilateral pneumothorax, in one patient.
- The effectiveness and safety of ESPB used for perioperative pain management in lumbar spinal surgery were investigated by Fu MY et al. in a systematic review and meta-analysis. The ESPB group showed a lower occurence of postoperative nausea, vomiting, somnolence, and itching compared to the control group, and no serious complications related to ESPB were reported [37].
- ESPB is a straightforward technique known for its strong safety profile and broad analgesic effects. It has been increasingly utilized for perioperative pain management in thoracic, abdominal, breast, and orthopedic surgeries [37].
- In our study group A patients have received local anaesthetic infiltration after the surgery which was conventional analgesia routinely used in our institute. Employing patient controlled analgesia in conjunction with multi modal analgesia approaches would have allowed us to more precisely asses opioid use in postoperative period , not only in group A but both of group A and Group B.
- Since the endpoint is striking a bony structure—that is, the appropriate transverse process—ESPB is a rather safe block. However, we advise more research so that ESPB may be contrasted with other regional anaesthesia methods in terms of safety and effectiveness, blocked dermatomes can be mapped to offer more information. To ascertain the utilization of additives in this block, more research is required.

SUMMARY

- Our study evaluates and compares the effectiveness of two pain management techniques—local anesthetic infiltration at the incision site and the erector spinae plane (ESP) block—in patients undergoing PCNL, a minimally invasive procedure to remove kidney stones.
- 60 Patients with ASA grade I-II undergoing PCNL were enrolled in the study after providing informed consent.
- They were randomly assigned to either Group A, in which they received 20 ml of 0.25% bupivacaine with 8 mg of dexamethasone as Local anaesthetic infiltration and Group B received erector Spinae Plane Block with 20 ml of 0.25% bupivacaine with 8 mg of dexamethasone.
- Postoperative pain relief was compared using the Numeric rating scale (NRS) score between the two groups at 30 minutes, 60 minutes, and second hourly for 6 hours, followed by the sixth hourly up to 24 hours.
- The mean duration of analgesia was higher in patients who received ESPB (744.03+/- 24.867 in group B) than patients who received Local Anaesthetic infiltration (18.60+/- 1.694 in group A).
- NRS scores were higher in group A than Group B in the first 24 hours of the postoperative period.
- The mean time duration to rescue analgesia was higher in group B(981.63+/- 26.195) than group A. (45.90+/- 2.964).
- The mean total tramadol consumption in group A was higher than group B. (150+/- 0 in group A) ,(93.33+/- 17.287 in group B)
- Our study have found that ESPB is an effective and safe block than the conventional modes of analgesia.

CONCLUSION

Accordant to our study ESPB is an efficacious and safe technique for post operative analgesia in patients undergoing percutaneous nephrolithotomy.

The combination of bupivacaine with dexamethasone have provided postoperative analgesia for a longer duration of time than the routine conventional modes of analgesia with better hemodynamic stability and lesser side effects which in turn helps in the early mobility and early recovery of the patient with decreased duration of hospital stay.

Given these benefits, ESPB is a valuable addition to multimodal analgesia protocols in patients undergoing not only PCNL but also other urological surgeries. In essence we conclude that USG guided erector spinae plane block provides adequate analgesia and has an opioid sparing effect in patients undergoing percutaneous nephrolithotomy surgery.

REFERENCES

1. Ramachandran S, Ramaraj KP, Velayudhan S, Shanmugam B, Kuppusamy S, Lazarus SP. Comparison of erector spinae plane block and local anaesthetic infiltration at the incision site for postoperative analgesia in percutaneous nephrolithotomy – A randomised parallel-group study. Indian J Anaesth. 2021;65(5):398-403. doi:10.4103/ija.IJA_258_21.
2. Shah B, Cherukuri K, Tudimilla S, Shah KS. Erector spinae plane block for postoperative analgesia following percutaneous nephrolithotomy under spinal anaesthesia – A randomised controlled study. Indian J Anaesth. 2022;66(8):837-41. doi:10.4103/ija.IJA_355_22.
3. Bryniarski P, Bialka S, Kepinski M, Szelka-Urbanczyk A, Paradysz A, Misiolek H. Erector spinae plane block for perioperative analgesia after percutaneous nephrolithotomy. Int J Environ Res Public Health. 2021;18(7):3625. doi:10.3390/ijerph18073625.
4. Thiagarajan P, Thota RS, Divatia JV. Efficacy of ultrasound-guided erector spinae plane block following breast surgery - A double-blinded randomised, controlled study. Indian J Anaesth. 2021;65(4):377-82. doi:10.4103/ija.IJA_355_21.
5. Prasad MK, Rani K, Jain P, Varshney RK, Jheetay GS, Bhadani UK. Peripheral nerve stimulator guided erector spinae plane block for postoperative analgesia after total abdominal hysterectomy: A prospective study. Indian J Anaesth. 2021;65(2):149-55. doi:10.4103/ija.IJA_1010_20.
6. Malawat A, Verma K, Jethava D, Jethava DD. Erector spinae plane block for complete surgical anaesthesia and postoperative analgesia for breast surgeries: A prospective feasibility study of 30 cases. Indian J Anaesth. 2020;64(2):118-24. doi:10.4103/ija.IJA_798_19.
7. Singh A, Sharma AP, Ganesh V, Gupta R, Sharma G, Naik NB, et al. Efficacy of erector spinae plane block for postoperative analgesia after percutaneous nephrolithotomy: A

systematic review and meta-analysis of randomized controlled trials. J Anaesthesiol Clin Pharmacol 2025;41:62-72

8. Bilgin MU, Tekgül ZT, Değirmenci T. The Efficacy of Erector Spinae Plane Block for Patients Undergoing Percutaneous Nephrolithotomy. Turk J Anaesthesiol Reanim. 2023 Jun 16;51(3):179-187. doi: 10.4274/TJAR.2022.22981. PMID: 37455435; PMCID: PMC10339747.
9. Nair AS, Rangaiah M, Dudhedia U, Borkar NB. Analgesic efficacy and outcomes of ultrasound-guided erector spinae plane block in patients undergoing bariatric and metabolic surgeries: A systematic review. J Med Ultrasound 2023;31:178-87
10. Liu J, Fang S, Wang Y, Wang L, Gao L, Xin T, Liu Y. The safety and efficacy of ultrasound-guided erector spinae plane block in postoperative analgesic of PCNL: A systematic review and meta-analysis. PLoS One. 2023 Jul 14;18(7):e0288781. doi: 10.1371/journal.pone.0288781. PMID: 37450461; PMCID: PMC10348577.
11. Capuano P, Alongi A, Burgio G, Martucci G, Arcadipane A, Cortegiani A. Erector spinae plane block for cancer pain relief: a systematic review. J Anesth Analg Crit Care. 2024 Nov 15;4(1):76. doi: 10.1186/s44158-024-00213-y. PMID: 39543760; PMCID: PMC11566050.
12. Datchinamourthy, Thamizharasan; Bhoi, Debesh; Chhabra, Anjolie; Mohan, Virender K.; Kumar, Kanil R.; Ranganathan, Poornima. Comparative evaluation of continuous infusion versus programmed intermittent bolus techniques in erector spinae plane block in modified radical mastectomy – A preliminary randomised controlled trial. Indian Journal of Anaesthesia 68(3):p 273-279, March 2024. | DOI: 10.4103/ija.ija_922_23
13. Kot P, Rodriguez P, Granell M, Cano B, Rovira L, Morales J, Broseta A, Andrés J. The erector spinae plane block: a narrative review. Korean J Anesthesiol. 2019 Jun;72(3):209-220. doi: 10.4097/kja.d.19.00012. Epub 2019 Mar 19. PMID: 30886130; PMCID: PMC6547235.
14. Michel MS, Trojan L, Rassweiler JJ. Complications in percutaneous nephrolithotomy. Eur Urol. 2019;75(5):779-86. doi:10.1016/j.eururo.2018.12.011.

15. Ghomi H, Farzanegan B, Alizadeh F, et al. Postoperative pain after percutaneous nephrolithotomy: A review of the current strategies. Anesthesiol Pain Med. 2020;10(4):e99945. doi:10.5812/aapm.99945.
16. Purdue M, Feeney M, Danaher T, et al. Optimizing postoperative pain management following percutaneous nephrolithotomy: A systematic review. J Urol. 2021;206(2):287-98. doi:10.1097/JU.0000000000001738.
17. Forero M, Adhikary S, Lopez H, Tsui C, Chin KJ. The erector spinae plane block: A narrative review of its uses in acute and chronic pain management. Anesth Analg. 2019;129(2):310-21. doi:10.1213/ANE.0000000000003976.
18. Chin KJ, Lewis S. Opioid-sparing multimodal analgesia using regional techniques in the era of the opioid crisis. Anaesthesia. 2019;74(S1):129-40. doi:10.1111/anae.14532.
19. Gupta K, Rastogi B, Krishan A, Gupta PK, Tiwari AD. Comparative evaluation of the effectiveness of ultrasound-guided erector spinae plane block versus transversus abdominis plane block in patients undergoing abdominal surgeries. Anesth Essays Res. 2021;15(1):45-51. doi:10.4103/aer.AER_3_21.
20. Guleria, J., Sood, A., Chaudhary, U. Comparing the effect of adding 8mg Dexamethasone to 0.25% bupivacaine to plain bupivacaine 0.25% in Erector spinae plain block in Modified radical mastectomy patients: A Randomized Controlled Study.. *Ain-Shams Journal of Anesthesiology*, 2024; 16(1): 1-6. doi: 10.21608/asja.2024.250823.1017
21. Mounika V, Sahu L, Mishra K, Mohapatra PS. A Comparative Evaluation of Post-operative Pain Management Using Erector Spinae Plane Block and Oblique Transverse Abdominis Plane Block in Patients Undergoing Laparoscopic Cholecystectomy. Cureus. 2023 Mar 4;15(3):e35750. doi: 10.7759/cureus.35750. PMID: 37020482; PMCID: PMC10068691.
22. Kukreja P, Paulose R, Kumar M, et al. Postoperative analgesia for PCNL: Erector spinae plane block vs conventional intravenous analgesia. J Endourol. 2022;36(1):12-18. doi:10.1089/end.2021.0429.
23. Ökmen K, Metin Ökmen B. Erector spinae plane block versus quadratus lumborum block for postoperative analgesia in percutaneous nephrolithotomy: A randomized

controlled study. Int Braz J Urol. 2021;47(3):639-49. doi:10.1590/S1677-5538.IBJU.2020.0449.

24. Moon JY, Kim MH, Lee HS, et al. Erector spinae plane block as a postoperative analgesic strategy for PCNL: A systematic review. Pain Physician. 2021;24(6):567-76. PMID:34212789.
25. Mantuani D, Shokoohi H, Maughan EF, et al. Ultrasound-guided erector spinae plane block for acute pain management: A case series. Am J Emerg Med. 2021;46:89-94. doi:10.1016/j.ajem.2021.03.073.
26. El-Boghdadly K, Pawa A, Chin KJ. Erector spinae plane block: A systematic review and meta-analysis of efficacy and safety. Br J Anaesth. 2021;126(3):326-38. doi:10.1016/j.bja.2020.11.041.
27. Aksu C, Gürkan Y. Erector spinae plane block: A review of indications and clinical applications. Turk J Anaesthesiol Reanim. 2021;49(2):93-99. doi:10.5152/TJAR.2021.20058.
28. . Farahata, Tamer & EL-Bahnasawya, Nahla & Heikal, Omnia & El-Mohaimena, Hesham. (2022). Efficacy of Adding Dexamethasone to Levobupivacaine in Erector Spinae Block for Total Hip Arthroplasty. The Egyptian Journal of Hospital Medicine. 87. 2184-2189. 10.21608/ejhm.2022.234280
29. Bıdak M, Çiftçi B, Basım P, Gölboyu BE, Atalay YO. The Erector Spinae Plane Block with 20 or 30 mL of 0.25% Bupivicaine Provides Equivalent Postoperative Analgesia after Mastectomy: A Prospective Randomized Trial. Turk J Anaesthesiol Reanim. 2025 Feb;53(1):5-11. doi:10.4274/TJAR.2024.241730.
30. Zhang Y, Liu T, Zhou Y, Yu Y, Chen G. Analgesic efficacy and safety of erector spinae plane block in breast cancer surgery: a systematic review and meta-analysis. BMC Anesthesiol. 2021 Feb 20;21(1):59. doi: 10.1186/s12871-021-01277-x. PMID: 33610172; PMCID: PMC7896394.
31. Chin KJ, El-Boghdadly K. Mechanisms of action of the erector spinae plane (ESP) block: a narrative review. Can J Anaesth. 2021 Mar;68(3):387-408. English. doi: 10.1007/s12630-020-01875-2. Epub 2021 Jan 6. PMID: 33403545.

32. Sørenstua, M.; Zantalis, N.; Raeder, J.; Vamnes, J.S.; Leonardsen, A.L. Spread of local anesthetics after erector spinae plane block: An MRI study in healthy volunteers. Reg. Anesth. Pain Med. 2023, 48, 74–79
33. Visoiu, M.; Scholz, S. Thoracoscopic visualization of medication during erector spinae plane blockade. J. Clin.Anesth. 2019, 57, 113–114
34. Kim E, Kwon W, Oh S, Bang S. The Erector Spinae Plane Block for Postoperative Analgesia after Percutaneous Nephrolithotomy. Chin Med J (Engl). 2018 Aug 5;131(15):1877-1878. doi: 10.4103/0366-6999.237408. PMID: 30058589; PMCID: PMC6071450.
35. Ibrahim M, Elnabtity AM. Analgesic efficacy of erector spinae plane block in percutaneous nephrolithotomy : A randomized controlled trial. Anaesthesist. 2019 Nov;68(11):755-761. English. doi: 10.1007/s00101-019-00673-w. Epub 2019 Oct 16. PMID: 31620856.
36. Oezel L, Hughes AP, Onyekwere I, Wang Z, Arzani A, Okano I, Zhu J, Sama AA, Cammisa FP, Girardi F, Soffin EM. Procedure-Specific Complications Associated with Ultrasound-Guided Erector Spinae Plane Block for Lumbar Spine Surgery: A Retrospective Analysis of 342 Consecutive Cases. J Pain Res. 2022 Mar 3;15:655-661. doi: 10.2147/JPR.S354111. PMID: 35264883; PMCID: PMC8901415.
37. Fu MY, Hao J, Ye LH, Jiang W, Lv YW, Shen JL, Fu T. Efficacy and Safety of Erector Spinae Plane Block for Perioperative Pain Management in Lumbar Spinal Surgery: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. J Pain Res. 2023 May 3;16:1453-1475. doi: 10.2147/JPR.S402931. PMID: 37163199; PMCID: PMC10164397.
38. De Cassai A, Geraldini F, Freo U, Boscolo A, Pettenuzzo T, Zarantonello F, Sella N, Tulgar S, Busetto V, Negro S, Munari M, Navalesi P. Erector Spinae Plane Block and Chronic Pain: An Updated Review and Possible Future Directions. Biology (Basel). 2023 Aug 1;12(8):1073. doi: 10.3390/biology12081073. PMID: 37626959; PMCID: PMC10452136.

ANNEXURE I

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

BLDE

(DEEMED TO BE UNIVERSITY)

Declared as Deemed to be University u/s 3 of UGC Act, 1956

Accredited with 'A' Grade by NAAC (Cycle-2)

The Constituent College

SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA

Azadi Ka Amrit Mahotsav

BLDE (DU)/IEC/ 946/2023-24 10/4/2023

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this University met on **Saturday, 18th March, 2023 at 11.30 a.m. in the CAL Laboratory, Dept. of Pharmacology,** scrutinized the Synopsis/ Research Projects of Post Graduate Student / Under Graduate Student /Faculty members of this University /Ph.D. Student College from ethical clearance point of view. After scrutiny, the following original/ corrected and revised version synopsis of the thesis/ research projects has been accorded ethical clearance.

TITLE: "EVALUATION OF EFFICACY OF LOCAL ANAESTHETIC INFILTRATION OF THE INCISION SITE AND ERECTOR SPINAE PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING PERCUTANEOUS NEPHROLITHOTOMY -A RANDOMIZED OPEN LABEL STUDY".

NAME OF THE STUDENT/PRINCIPAL INVESTIGATOR: DR.B. VAISHNAVI

NAME OF THE GUIDE: DR.VIJAY V. KATTI, ASSOCIATE PROFESSOR, DEPT. OF ANAESTHESIOLOGY

Dr. Santoshkumar Jeevangi
Chairperson
IEC, BLDE (DU),
VIJAYAPURA

Chairman,
Institutional Ethical Committee,
BLDE (Deemed to be University)
Vijayapura

Dr.Akram A. Naikwadi
Member Secretary
IEC, BLDE (DU),
VIJAYAPURA

MEMBER SECRETARY
Institutional Ethics Committee
BLDE (Deemed to be University)
Vijayapura-586103. Karnataka

Following documents were placed before Ethical Committee for Scrutinization.

- Copy of Synopsis/Research Projects
- Copy of inform consent form
- Any other relevant document

Smt. Bangaramma Sajjan Campus, B. M. Patil Road (Sholapur Road), Vijayapura - 586103, Karnataka, India.

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PLAGIARISM CERTIFICATE SCREEN SHOT

iThenticate Page 2 of 77 - Integrity Overview Submission ID trn:oid:::3618:89763526

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B.L.D.E. (Deemed to be University)
Shri B.M. Patil Medical College Hospital and Research Centre
Vijayapura, Karnataka

INFORMED CONSENT FORM

EVALUATION OF EFFICACY OF LOCAL ANAESTHETIC INFILTRATION OF THE INCISION SITE AND ERECTOR SPINAE PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING PERCUTANEOUS NEPHROLITHOTOMY – A RANDOMISED OPEN LABEL STUDY

I have been briefly explained the reason for doing this study and selected me/my ward as a subject for this study. I have also been given various choices for either being included or not in the study. I understand that I will be participating in the study. I understand that my ward's participation in this study will help in finding out **EVALUATION OF EFFICACY OF LOCAL ANAESTHETIC INFILTRATION OF THE INCISION SITE AND ERECTOR SPINAE PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING PERCUTANEOUS NEPHROLITHOTOMY – A RANDOMISED OPEN LABEL STUDY .**

I understand that medical records produced by this study will become a part of this hospital's records and will be subjected to the confidentiality and privacy regulation of this hospital. The data are used for publication in the medical literature or for teaching purposes. No nameswill be used, and other identifiers such as pictures and audio or videotapes. I understand that Imay see the photograph and videos and hear audiotapes before giving this permission. I understand that I may ask more questions about the study at any time, and Dr B Vaishnavi is available to answer my questions or concerns. If during this study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me and that a copy of thisconsent form will be given to me for careful reading. I hereby understand that my participation is voluntary, and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital.I also understand that Dr B VAISHNAVI will terminate my participation in this study at anytime after he/she has explained the reasons for doing so and has helped arrange for my continued care by my own physician or therapist if this is appropriate.

I understand that in the unlikely event of injury to me/my ward, resulting directly due to my participation in this study, I will report such injury promptly, and medical treatment will be available to me, but no further compensation will be given provided. I understand that I am not waiving any of my legal rights bymy agreement to participate in this study.

I have explained………………………….. the purpose of this research, the procedures required and the possible risks and benefits to the best of my ability.

Date: Dr Vijay. V. Katti Dr B Vaishnavi

(Guide) (Investigator)

Place:

I confirm that Dr B Vaishnavi has explained to me the purpose of this research, the study method I will undergo, and the possible discomforts and benefits I may experience in my own language. I have been explained all the above things briefly in my language, and I understand the same. Therefore, I agree to give consent to be in as a subject in the research project.

Date: **Dr B Vaishnavi**

(Investigator)

Patient's signature

Witness to the above signature.

B.L.D.E. (Deemed to be University)
Shri B.M. Patil Medical College Hospital and Research Centre
Vijayapura, Karnataka

PROFORMA

EVALUATION OF EFFICACY LOCAL ANAESTHETIC INFILTRATION OF THE INCISION SITE AND ERECTOR SPINAE PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING PERCUTANEOUS NEPHROLITHOTOMY – A RANDOMISED OPEN LABEL STUDY

Name: Age/ Sex: I.P No:

Date of admission: Date of surgery:

Group allotted by randomization: Group A / Group B

Type of surgery:

Significant History:

General Physical Examination:

Pallor Y/N Icterus Y/N Cyanosis Y/N Clubbing Y/N

Koilonychia Y/N Lymphadenopathy Y/N Edema Y/N Teeth

Dentures Y/N

Vital

Parameters

Pulse (beats per minute): Blood Pressure:

Respiratory Rate: Temperature:

Systemic Examination

1. CVS 2.RS:

3. C.N.S. 4. Per Abdomen:

Airway Assessment:

Mallampati Grade: Cervical Spine:

Mouth opening: Neck Movement:

A.S.A. Grade:

Investigations

Haemoglobin: TLC:

S. Urea: S. Creatinine:

RBS: Platelet count:

Urine Routine:

Chest Xray: ECG:

Anaesthesia start time:

Surgery start time:

Block administration time:

Surgery end time:

TIME	**NRS SCORE**
30minutes	
60 minutes	
2 hour	
4 hour	
6hour	
12hours	

18hours	
24 hours	

Time to first analgesic dose request inminutes	
Total dose of analgesic post operatively	
Duration of analgesia	

Post-operative complications	Yes	No
Nausea		
Vomiting		
Chest discomfort		

BIO-DATA OF THE GUIDE

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INVESTIGATOR

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MOBILE NO	:	8639771938
EMAIL	:	vaishnavibombay@gmail.com

S.nc	I P No	Name	Age	Se	ASA Gra	Group	NRS at 30 mir	NRS at 60 mir	NRS at 2 hou	NRS at 4 hou	NRS at 6 hou	NRS at 12 hour	NRS at 18 hou	NRS at 24 hou	Duration of pain relief in minu	Time for first analgesic requirement in min	Paracetamol Requirem	Total tramadol consumption in 24	Complicati
1	175881	Bhimaray	50	M	1	A	3	5	2	2	3	4	3	2	15	47	Nil	150	Nil noted
2	128198	Boramma Kashetti	57	F	1	A	3	5	2	3	3	3	3	3	18	45	Nil	150	Nil noted
3	217031	Hritik Bhimu Pawar	22	M	1	A	3	5	2	2	3	3	3	2	20	40	Nil	150	Vomiting
4	192750	Neelamma Patil	60	F	2	A	3	6	2	2	3	3	3	2	18	45	Nil	150	Nil noted
5	194743	Vallisab Halli	34	M	1	A	3	5	2	2	2	4	3	2	17	47	Nil	150	Nil noted
6	217491	Siddamma Patil	55	F	1	A	2	5	3	2	3	4	3	2	18	47	Nil	150	Nil noted
7	220854	Ganapati Pawar	35	M	1	A	3	6	2	2	3	3	3	3	19	46	Nil	150	Nil noted
8	182509	Shivanand Bandi	50	M	1	A	3	4	3	2	3	3	3	3	20	45	Nil	150	Nil noted
9	33646	Pritabai Mohite	54	F	1	A	3	5	2	2	3	4	3	2	16	45	Nil	150	Nausea
10	71313	GirijaBai	43	F	1	A	2	5	3	3	3	4	3	2	16	47	Nil	150	Nil noted
11	247361	Goraknath Rathod	65	M	2	A	3	4	2	2	3	4	3	2	17	49	Nil	150	Nausea
12	240106	Suresh Rao kulkarı	62	M	2	A	4	4	2	2	3	4	3	2	16	35	1gm	150	Nil noted
13	293265	Mahadev I Shegun	46	M	1	A	3	5	2	2	3	3	3	3	18	50	Nil	150	Nil noted
14	327906	Bhavani	25	F	1	A	4	4	2	3	3	3	3	3	18	40	Nil	150	Nil noted
15	43635	Ravatappa Rajanal	45	M	1	A	3	5	2	2	3	3	3	3	17	46	1gm	150	Nil noted
16	339890	Ashwini A Chavan	25	F	1	A	4	4	2	2	3	3	3	2	22	46	Nil	150	Nil noted
17	391942	Vishwanath	60	M	2	A	3	5	3	2	2	3	3	2	20	46	Nil	150	Nil noted
18	382743	Nadagerappa	61	M	2	A	3	4	2	2	3	4	3	2	19	47	Nil	150	Nil noted
19	380317	Suresh Hudi	55	M	1	A	3	4	2	2	3	3	3	2	18	47	Nil	150	Nil noted
20	28356	Deepak patil	30	M	1	A	3	4	2	3	3	4	3	2	20	48	Nil	150	Nil noted
21	48330	Jaffar Awati	19	m	1	A	3	4	2	2	3	3	3	3	21	47	Nil	150	Nil noted
22	46309	Shivayogi Hirol	40	M	1	A	3	5	2	2	3	3	3	2	19	45	Nil	150	Nausea
23	64807	Sanjeev Naik	27	M	1	A	3	5	2	2	3	3	3	3	20	47	Nil	150	Nil noted
24	76041	Ravi Rathod	32	M	1	A	3	5	2	2	3	4	3	2	18	46	1gm	150	Nil noted
25	35743	Ramesh Hallad	48	M	1	A	3	5	2	2	3	4	3	2	19	49	Nil	150	Nil noted
26	90781	Lalsingh Rajput	65	M	2	A	2	5	3	2	3	3	3	2	20	49	Nil	150	Nil noted
27	386421	Rajat Ravindra	23	M	1	A	3	5	2	2	3	3	3	2	20	47	Nil	150	Nil noted
28	277133	Anil Pawar	32	M	1	A	3	5	3	2	3	3	3	2	18	46	Nil	150	Vomiting
29	290098	Sangeeta M	26	F	1	A	3	4	2	2	3	4	3	2	20	46	Nil	150	Nil noted
30	2024/617	Mallappa Natikar	50	M	2	A	3	6	3	2	3	3	3	2	21	47	Nil	150	Nil noted

	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Name	Age		ASA Grac	Grou	NRS at 30 mi	NRS at 60 mi	NRS at 2 hou	NRS at 4 hou	NRS at 6 hou	NRS at 12 hou	NRS at 18 hou	NRS at 24 hou	Duration of block in minutes	Time for first analgesic requirement in minut	Paracetomal Requiremer	Total tramadol consumption in 24 hc	Complications
2	Parvati Laxman Dhal	60	F	1	B	3	1	0	0	0	1	3	3	752	990	Nil	100	Nil noted
3	Goraknath	65	M	2	B	2	1	0	0	0	1	4	3	720	960	Nil	100	Nil noted
4	Muttanna Agasar	54	M	1	B	2	2	0	0	0	1	3	2	730	970	Nil	100	Nil noted
5	Sharadabai Nandu	43	F	1	B	1	1	0	0	0	1	4	2	740	980	Nil	100	Nil noted
6	Sangeeta Jadhav	24	F	1	B	3	1	0	0	0	1	4	3	725	966	Nil	50	Nil noted
7	Chandrasekhar	70	M	2	B	2	1	0	0	0	2	4	3	710	945	Nil	100	Nil noted
8	Girimallesh Madar	23	M	1	B	2	1	0	0	0	1	3	2	742	983	Nil	100	Nil noted
9	Geeta Kurudi	41	F	1	B	2	1	1	0	1	1	4	4	750	990	Nil	100	Nil noted
10	Rahutappa	45	M	1	B	2	1	0	0	0	1	3	4	725	968	Nil	100	Nil noted
11	Vasant Chavan	37	M	1	B	2	1	0	0	0	1	3	2	750	988	Nil	100	Nausea
12	Chandran G ashapur	65	M	2	B	2	1	0	0	0	1	3	3	700	910	Nil	100	Nil noted
13	Gangawwa Gama	65	F	1	B	2	1	0	0	0	1	3	3	744	974	Nil	100	Nil noted
14	Madivalappa	50	M	1	B	2	2	0	0	0	1	3	3	720	960	Nil	100	Nil noted
15	Parameshwar Byage	34	M	1	B	1	1	0	0	0	2	4	4	725	965	Nil	100	Nil noted
16	Parvati	62	F	2	B	3	1	0	0	0	1	4	3	750	990	Nil	100	Nil noted
17	Lalsab Mulla	28	M	2	B	2	0	0	0	0	1	3	4	800	1040	Nil	100	Nil noted
18	Ningawwa	53	F	1	B	2	1	0	0	0	1	3	2	760	995	Nil	100	Nil noted
19	Jayashree S Pavate	49	F	1	B	2	1	1	1	1	1	2	3	750	993	Nil	100	Nil noted
20	Jyoti L Chavan	30	F	1	B	3	0	0	1	1	1	3	3	730	970	Nil	100	Nil noted
21	Jayavva Golappagol	25	F	1	B	2	0	0	0	0	0	3	4	800	1000	Nil	50	Nil noted
22	Dastagirsab Walikar	35	M	1	B	2	0	0	0	1	1	4	3	745	985	Nil	100	Nil noted
23	Mohd Siraj	33	M	1	B	3	1	0	0	0	1	3	2	720	960	Nil	100	Nil noted
24	Prabh Godake	35	M	1	B	1	2	0	0	0	1	3	2	750	990	Nil	100	Nil noted
25	Rehman Mujawar	32	M	1	B	2	1	1	0	1	1	3	3	780	1020	Nil	50	Nil noted
26	Malkari Sidda	32	M	1	B	3	2	0	0	0	1	3	2	770	1010	Nil	100	Nausea
27	Sharanayya Hiremath	41	M	1	B	1	1	0	0	0	1	4	3	730	970	Nil	100	Nil noted
28	Mahadevi	60	F	2	B	1	1	0	0	0	1	4	2	734	974	Nil	100	Nil noted
29	Malkari Sidda	32	M	1	B	2	0	0	0	0	1	3	3	725	965	Nil	100	Nil noted
30	Shantabai	35	F	1	B	2	2	0	0	0	1	3	2	790	1042	Nil	50	Nil noted
31	Lalithabai G	42	F	1	B	2	1	0	0	0	1	4	3	754	996	Nil	100	Nil noted