ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 11 | November - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPARATIVE ANALYSIS OF DEXMEDETOMIDINE AND DEXAMETHASONE AS ADJUVANTS TO LEVOBUPIVACAINE IN ULTRASOUND-GUIDED TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCKS FOR POST-OPERATIVE ANALGESIA IN INFRAUMBILICAL SURGERIES

Anaesthesiology

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ABSTRACT

Background: Effective postoperative pain management is crucial for patient recovery in infraumbilical surgeries. This study aims to compare the analgesic efficacy of dexmedetomidine versus dexamethasone as adjuvants to levobupivacaine in ultrasound-guided Transversus Abdominis Plane (TAP) blocks. **Aims and Objectives:** The aim of this study was to evaluate the analgesic efficacy of dexmedetomidine versus dexamethasone as adjuvants to levobupivacaine in ultrasound-guided TAP blocks in patients undergoing infraumbilical surgeries. The primary objective was to compare the duration of postoperative analgesia, measured by the time taken to request the first rescue analgesia. **Materials and Methods:** Eighty-four patients undergoing infraumbilical surgeries were enrolled and randomly divided into two groups of 42 each. Group 1 received 20 ml of 0.25% levobupivacaine with 0.1 mg/kg dexamethasone and Group 2 received 20 ml of 0.25% levobupivacaine with 1 mcg/kg dexmedetomidine. The primary outcome was the time to first request for rescue analgesia. Secondary outcomes included Visual Analog Scale (VAS) scores for pain, hemodynamic parameters and incidence of side effects such as nausea, vomiting and shivering. **Results:** The mean age of patients in Group 1 was 43.9 ± 10.5 years while in Group 2 it was 48.5 ± 9.3 years. Gender distribution was similar with 52.4% females in Group 1 and 45.2% females in Group 2. The mean duration of sensory block was 160.9 ± 20.2 minutes in Group 1 and 157.7 ± 18.6 minutes in Group 2 with no statistically significant difference (p-value = 0.275). The time to first rescue analgesia was slightly longer in Group 2 (106.76 ± 15.3 minutes) compared to Group 1 (94.60 ± 14.8 minutes), though this difference was not statistically significant (p-value = 0.180). VAS scores showed comparable pain relief between the groups at all measured time points. Hemodynamic parameters remained stable across both groups with significant differences observed only in SPO2 levels and blood pressure at 2 and 4 hours post-operation. Group 1 experienced a higher incidence of shivering (54.76%) compared to Group 2 (38.10%) while vomiting was more common in Group 2 (54.76%) compared to Group 1 (33.33%). **Conclusion:** This study demonstrates that both dexmedetomidine and dexamethasone are effective and safe adjuvants to levobupivacaine in TAP blocks for infraumbilical surgeries. Both adjuvants provided comparable durations of analgesia and pain relief with differences in side effect profiles that may guide clinical decision-making. Future research should further explore these findings to refine pain management protocols in regional anaesthesia for infraumbilical surgeries.

KEYWORDS

Dexmedetomidine, Dexamethasone, Levobupivacaine, Transversus Abdominis Plane Block, Postoperative Analgesia, Infraumbilical Surgeries, Ultrasound-guided Anaesthesia. (TAP- Transversus Abdominis Plane, VAS- Visual Analog Scale)

INTRODUCTION

Effective pain management is a crucial aspect of postoperative care, significantly impacting patient recovery, satisfaction and overall outcomes. Adequate control of postoperative pain can reduce the incidence of complications, enhance the healing process and facilitate earlier mobilization, thereby shortening hospital stays and reducing healthcare costs. Traditional methods of pain management, such as systemic opioids, often come with undesirable side effects like nausea, vomiting, respiratory depression and potential for addiction. As a result, there has been a growing emphasis on regional anaesthesia techniques that provide targeted, effective analgesia while minimizing systemic adverse effects. (1,2)

Among the various regional anaesthesia techniques, the (TAP) block has gained prominence for its efficacy in providing postoperative analgesia for infraumbilical surgeries. TAP blocks involve the administration of local anaesthetics into the neurovascular plane between the internal oblique and transversus abdominis muscles. This technique effectively blocks the sensory nerves of the anterior abdominal wall, offering substantial pain relief. TAP blocks have been shown to reduce the need for systemic analgesics, thereby lowering the risk of opioid-related side effects and improving patient comfort. The use of ultrasound guidance has further refined the technique and hence enhances the accuracy of block placement and reduces the risk of complications. (3)

Regional anaesthesia techniques, particularly Transversus Abdominis Plane (TAP) blocks, play a crucial role in providing effective analgesia for infraumbilical surgeries. TAP blocks involve the injection of local anaesthetics into the neurovascular plane between the internal oblique and transversus abdominis muscles, effectively blocking the sensory nerves of the anterior abdominal wall. This targeted approach ensures substantial pain relief by directly numbing the surgical area, thereby reducing the need for systemic analgesics such as opioids. The reduced reliance on opioids is particularly beneficial, as it minimizes the risk of associated side effects like nausea, vomiting, respiratory depression and potential for addiction. Moreover, the use of ultrasound guidance in administering TAP blocks has significantly improved the precision and safety of the procedure - ensuring accurate placement of the anaesthetic and reducing the likelihood of complications. For infraumbilical surgeries, which encompass a wide range of procedures such as hernia repairs, gynaecological surgeries and lower abdominal explorations, TAP blocks offer a reliable and effective method for managing postoperative pain, enhancing patient comfort, facilitating early mobilization and ultimately contributing to better overall surgical outcomes. (4,5)

Transversus Abdominis Plane (TAP) blocks offer several distinct benefits over other regional anaesthesia techniques for infraumbilical surgeries. One of the primary advantages is the targeted and effective pain relief they provide. By specifically blocking the sensory nerves of the anterior abdominal wall, TAP blocks ensure that the area of surgery is well-numbed, leading to significant reductions in postoperative pain. This targeted approach means that patients experience less discomfort compared to more generalised regional anaesthesia techniques, which may not offer the same level of specificity. (6)

Another significant benefit of TAP blocks is their ability to reduce the reliance on systemic opioids for pain management. Opioids while effective, come with a host of potential side effects, including nausea, vomiting, constipation, respiratory depression and the risk of addiction. By providing effective analgesia through TAP blocks, the need for opioid medications is minimised, which in turn reduces the incidence of these adverse effects. This leads to a more comfortable and safer postoperative experience for patients. (7,8)

TAP blocks also have the advantage of being relatively simple to administer, especially with the advent of ultrasound guidance. Ultrasound technology allows for real-time visualisation of the anatomical structures, ensuring accurate placement of the local anaesthetic. This precision reduces the risk of complications and increases the efficacy of the block. In contrast, other regional anaesthesia techniques may require more advanced skills and equipment, making them less accessible in certain clinical settings.

Additionally, TAP blocks are associated with fewer complications compared to techniques such as epidural anaesthesia. Epidural blocks while effective, carry risks such as hypotension, urinary retention and potential for more severe complications like epidural haematoma or infection. TAP blocks, being more superficial and less invasive, present a lower risk profile, making them a safer option for many patients, particularly those with contraindications to more invasive procedures. (1,9)

Furthermore, the recovery and mobilisation of patients are often quicker with TAP blocks. By effectively managing pain and reducing opioid consumption, patients are able to mobilise earlier, which is beneficial for recovery and reduces the risk of postoperative complications such as deep vein thrombosis and pulmonary embolism. This improved postoperative course can lead to shorter hospital stays and better overall outcomes.

In summary, TAP blocks offer a combination of targeted analgesia, reduced reliance on opioids, ease of administration, lower complication rates and quicker recovery times, making them a highly advantageous regional anaesthesia technique for infraumbilical surgeries. These benefits contribute to enhanced patient comfort, safety and overall surgical outcomes, positioning TAP blocks as a preferred method for managing postoperative pain in lower abdominal procedures. (10)

The concept of using adjuvants to enhance the efficacy of local anaesthetics has revolutionised the field of regional anaesthesia. Adjuvants are pharmacological agents that, when added to local anaesthetics, can significantly improve their analgesic properties. These substances work through various mechanisms to prolong the duration of analgesia, increase the intensity of nerve blockade and reduce the onset time of anaesthesia. The incorporation of adjuvants into local anaesthetic solutions has become a common practice aimed at optimising pain management strategies and improving patient outcomes. (11)

One of the primary benefits of adjuvants is their ability to extend the duration of nerve blocks. Local anaesthetics like levobupivacaine are effective in numbing the targeted area, but their effects are time limited. By adding adjuvants such as dexmedetomidine or dexamethasone, the analgesic duration can be significantly prolonged. This extended pain relief is particularly beneficial in postoperative settings, where prolonged analgesia can enhance patient comfort, reduce the need for additional analgesics and facilitate earlier mobilisation and recovery.

Adjuvants also contribute to a more profound and consistent nerve blockade. This enhancement means that patients experience more effective pain control with potentially lower doses of local anaesthetics. This can be particularly useful in reducing the total amount of anaesthetic required, thereby minimising the risk of toxicity and side effects associated with high doses of local anaesthetics. Additionally, adjuvants can help in achieving a more reliable and consistent onset of anaesthesia, ensuring that patients experience timely and effective pain relief.

Moreover, the use of adjuvants can contribute to a more comprehensive pain management regimen. By incorporating agents with different mechanisms of action, clinicians can target multiple pathways involved in pain transmission and modulation. For instance, dexmedetomidine, an alpha-2 adrenergic agonist, not only provides sedation and analgesia but also has sympatholytic effects that can stabilise hemodynamics. Dexamethasone, a potent anti-inflammatory steroid, helps in reducing inflammation and postoperative nausea and vomiting, further enhancing the overall analgesic regimen. (9)

There is a compelling need for comparing dexmedetomidine and dexamethasone as adjuvants in Transversus Abdominis Plane (TAP) blocks due to their distinct pharmacological properties and potential to enhance analgesic efficacy in different ways. Both agents have shown promise in extending the duration of analgesia and improving the quality of pain relief when used with local anaesthetics, but they achieve these effects through different mechanisms and with varying side effect profiles. A direct comparison is essential to determine which adjuvant offers superior benefits in specific clinical scenarios, particularly for infraumbilical surgeries where effective postoperative pain management is crucial. (12)
Dexmedetomidine, an alpha-2 adrenergic agonist, provides analgesia, sedation and anxiolysis by inhibiting the release of norepinephrine and reducing sympathetic outflow. Its use in regional anaesthesia has been associated with prolonged sensory and motor block duration, reduced opioid consumption and stable hemodynamic parameters. However, dexmedetomidine can also cause bradycardia and hypotension, which may limit its use in certain patient populations. Understanding these effects in the context of TAP blocks can help tailor its application to maximise benefits while minimising risks. (12–14)

Dexamethasone, on the other hand, is a potent corticosteroid with anti-inflammatory and immunomodulatory properties. It is known to prolong the duration of analgesia by reducing inflammation and potentiating the effects of local anaesthetics. Additionally, dexamethasone can decrease postoperative nausea and vomiting, contributing to an overall better recovery experience for patients. However, the immunosuppressive effects of corticosteroids may raise concerns about potential long-term impacts, particularly in patients with preexisting conditions that affect immune function.(14)

Comparing these two adjuvants in TAP blocks specifically for infraumbilical surgeries is essential because the anatomical and physiological characteristics of the surgical site may influence the effectiveness and safety of the adjuvants. For instance, the dense innervation of the abdominal wall and the potential for significant postoperative pain necessitate a robust and prolonged analgesic effect, which both dexmedetomidine and dexamethasone aim to provide. By directly comparing their outcomes, including duration of analgesia, onset times, side effect profiles and overall patient satisfaction, clinicians can make more informed decisions about which adjuvant to use based on individual patient needs and surgical contexts. (9)

Furthermore, existing literature presents mixed findings on the relative efficacy and safety of these adjuvants, underscoring the need for more definitive research. Some studies suggest superior outcomes with dexmedetomidine while others highlight the advantages of dexamethasone. A head-to-head comparison in a controlled clinical setting, such as our study, aims to clarify these discrepancies and provide clear guidance for anaesthesiologists. This research not only contributes to the academic understanding of regional anaesthesia but also has practical implications for improving postoperative pain management, enhancing patient recovery and optimising the use of healthcare resources. (15–18)

In conclusion, comparing dexmedetomidine and dexamethasone as adjuvants in TAP blocks is crucial for advancing pain management practices in infraumbilical surgeries. The distinct properties and potential benefits of each adjuvant necessitate a thorough evaluation to determine their respective roles and optimal applications in clinical practice. The expected outcomes of this study are multifaceted. Firstly, we anticipate that both dexmedetomidine and dexamethasone will effectively prolong the duration of the sensory block when used as adjuvants to levobupivacaine in TAP blocks. We expect to identify any significant differences in the duration of analgesia between the two groups, which will provide valuable insights into their relative efficacy. (19,20)

Additionally, we expect to find comparable VAS scores between the groups, indicating similar levels of postoperative pain relief. This outcome will reinforce the potential of both adjuvants to improve pain management in infraumbilical surgeries. By analyzing the demographic characteristics, block application times and surgical durations, we aim to ensure that the study groups are well-matched and that any observed differences in outcomes are attributable to the adjuvants themselves. The monitoring of hemodynamic parameters and the time to first rescue analgesia will provide a comprehensive understanding of the safety and effectiveness of each adjuvant. We expect to see stable hemodynamic profiles in both groups with no significant adverse effects impacting patient safety. (21,22)

The analysis of side effects will help identify any differences in the incidence of shivering, nausea and vomiting between the groups. This information is crucial for understanding the overall safety and tolerability of the adjuvants, which can inform clinical decision-making and patient management.

Aim And Objectives

To evaluate and compare the analgesic efficacy of dexmedetomidine versus dexamethasone as adjuvants to levobupivacaine in ultrasound-

guided Transversus Abdominis Plane (TAP) blocks for patients undergoing infraumbilical surgeries.

Objective Of The Study
The study is designed to compare the effects of dexmedetomidine and dexamethasone as adjuvants on the duration of postoperative analgesia following ultrasound-guided TAP blocks in infraumbilical surgeries, with a focus on their impact on pain relief, hemodynamic stability, and the incidence of side effects.

Primary Outcome
To determine the time to first request for rescue analgesia, reflecting the analgesic efficacy of dexmedetomidine versus dexamethasone as adjuvants to levobupivacaine in ultrasound-guided TAP blocks for postoperative pain management in infraumbilical surgeries.

Secondary Outcomes
1. Evaluation of postoperative pain using the Visual Analog Scale (VAS) score at various time points.
2. Comparison of hemodynamic parameters (e.g., heart rate, blood pressure, SPO2 levels) between the two groups.
3. Assessment of the occurrence of nausea and vomiting.
4. Incidence of shivering postoperatively.

MATERIAL AND METHODOLOGY
Study Design
This study was designed as a comparative observational study conducted over a period of twelve months at A.J. Institute of Medical Sciences and Research Centre, Mangalore. The aim was to compare the analgesic efficacy of dexmedetomidine versus dexamethasone as adjuvants to 0.25% levobupivacaine in ultrasound-guided Transversus Abdominis Plane (TAP) blocks for patients undergoing infraumbilical surgeries.

Source Of Data
Patients aged between 18-80 years, classified as ASA grade I-III, scheduled for elective infraumbilical surgeries at A.J. Institute of Medical Sciences and Research Centre between December 2022 and December 2023, were included in the study.

Sample Size
Based on a previous study by Nitika Singla et al., to detect a mean difference of 67 minutes in the time to first rescue analgesic consumption between the groups with 95% confidence interval and 90% power and assuming a pooled standard deviation (SD) of 90 minutes, the sample size estimated was 38 in each group. Including a 10% attrition rate, the final sample size was 42 per group (Total of 84 participants).

Inclusion Criteria
- ASA grade I-III patients of either sex
- Patients aged between 18-80 years
- Patients scheduled for elective infraumbilical surgeries at A.J. Institute of Medical Sciences and Research Centre between December 2022 and December 2023

Exclusion Criteria
- Patient refusal
- Contraindications specific to TAP block (e.g., coagulopathy, infection)
- Known hypersensitivity or contraindications to levobupivacaine, dexamethasone, or dexmedetomidine
- Patients administered supplementary epidural anaesthesia
- Patients with BMI <18 or >30
- Patients with hemodynamic instability requiring inotropic support
- Patients requiring postoperative mechanical ventilation

Method Of Data Collection
Eighty-four patients meeting the inclusion criteria were divided into two groups:
- **Group 1**: Received a mixture of 20 ml 0.25% levobupivacaine and 0.1 mg/kg dexamethasone for the TAP block.
- **Group 2**: Received a mixture of 20 ml 0.25% levobupivacaine and 1 mcg/kg dexmedetomidine for the TAP block.

Procedure
Each patient was assessed preoperatively with detailed history, physical examination and routine laboratory tests. Patients were kept nil per oral for 8 hours prior to surgery. After entering the operation theatre, patients were preloaded with 20 ml/kg of Ringer lactate and placed in the left lateral decubitus position under sterile conditions.

A spinal block was administered using 23G Quincke needles and sensory block levels were assessed. Postoperatively, a TAP block was performed using a high-frequency ultrasound probe to locate the injection site between the internal oblique and transversus abdominis muscles. The local anaesthetic solution was then injected.

Pain Assessment And Hemodynamic Monitoring
Pain assessment was conducted using the Visual Analog Scale (VAS) before and after the block at specified intervals (0, 1, 4 and 8 hours). Hemodynamic parameters, including heart rate, blood pressure, respiratory rate and oxygen saturation, were recorded preoperatively and postoperatively.

Analgesic Protocol
Both groups received intravenous paracetamol 1 gm immediately after surgery and every 8 hours postoperatively. Additional analgesia with IV tramadol (1 mg/kg) was administered upon patient request if VAS scores exceeded 3. If pain persisted despite tramadol, IM diclofenac 75 mg was given.

Outcome Measures
Primary outcome:
- Time to first request for rescue analgesia

Secondary Outcomes:
- VAS scores at various postoperative intervals
- Hemodynamic parameters
- Number of additional analgesic requests
- Incidence of shivering, nausea and vomiting
- Any side effects of the drugs administered

Statistical Analysis
Data were analyzed using the Shapiro-Wilk test to assess normality. Parametric data were presented as mean ± SD and analyzed using Student's t-test. Non-parametric data were presented as medians and interquartile ranges. Categorical data were presented as frequencies and percentages and analyzed using the Chi-square test. A p-value < 0.05 was considered statistically significant. Multivariate analysis was used to detect the influence of other factors if necessary.

Sample Size Estimation
Sample Size
Based on a previous study by Nitika Singla et al., to detect a mean difference of 67 minutes in the time to first rescue analgesic consumption between the groups with 95% confidence interval and 90% power and assuming a pooled standard deviation (SD) of 90 minutes, the sample size estimated was 38 in each group. Including a 10% attrition rate, the final sample size was 42 per group (Total of 84 participants).

The following formula was used

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta}) 2SD^2}{L^2}$$

Z1- α/2 = standard normal variate at 5% type 1 error (P<0.05) it is 1.96
Z 1-β = the standard value 0.842 for the power 80% and 1.282 for 90% power
SD = pooled standard deviation estimated
L = the difference in effect of two interventions which is required (estimated effect size).

RESULTS & ANALYSIS
Age Distribution
- **Group 1**: The age distribution shows a varied spread across the defined age groups with notable concentrations in certain ranges.
- **Group 2**: The distribution also shows varied age ranges with different concentrations compared to Group 1.

Table 1 - Age Statistics

Group	Mean ± SD (years)	Min (years)	Max (years)
Group 1	43.9 ± 8.0	27	60
Group 2	48.5 ± 6.6	34	61

Comparison Between Groups

The p-value for the difference in age between the two groups is 0.7 which is greater than the commonly used significance level of 0.05. This indicates that there is no statistically significant difference in the ages between Group 1 and Group 2. The analysis of the age distribution between the two groups shows some key differences. Group 1 has a younger average age (43.9 years) compared to Group 2 (48.5 years). The range of ages in Group 1 is broader, from 27 to 60 years while Group 2's ages range from 34 to 61 years. The standard deviation in Group 1 is slightly higher (8.0) compared to Group 2 (6.6), indicating more variability in the ages within Group 1.

The statistically significant p-value (0.7) suggests that the difference in age distributions between the two groups is not statistically significant.

Gender Distribution

Table 2 - Gender Distribution

Group	Gender	Count	Percentage (%)
Group 1	Female	22	52.4
	Male	20	47.6
Group 2	Female	19	45.2
	Male	23	54.8

Descriptive Statistics for Height, Weight and BMI

Table 3 - Descriptive Statistics

Characteristic	Group 1 Mean ± SD	Group 2 Mean ± SD	Group 1 Minimum	Group 1 Maximum	Group 2 Minimum	Group 2 Maximum	P-Value
Height (cms)	161.17 ± 6.19	160.00 ± 8.74	150.0	176.0	139.0	180.0	0.482
Weight (Kg)	59.05 ± 4.33	58.12 ± 5.78	50.0	66.0	44.0	70.0	0.407
BMI (Kg/m2)	25.24 ± 3.44	23.49 ± 1.69	16.0	32.3	19.3	27.3	0.004

Height (cms): The average height for Group 1 was 161.17 cm with a standard deviation of 6.19 cm. Heights in this group ranged from 150 cm to 176 cm. In Group 2, the average height was slightly lower at 160.00 cm with a standard deviation of 8.74 cm. Heights in Group 2 ranged from 139 cm to 180 cm. The p-value for the difference in height between the two groups was 0.482, indicating no statistically significant difference.

Weight (Kg): For weight, Group 1 had an average of 59.05 kg with a standard deviation of 4.33 kg. Weights ranged from 50 kg to 66 kg. Group 2 had a slightly lower average weight of 58.12 kg with a higher standard deviation of 5.78 kg. Weights in Group 2 ranged from 44 kg to 70 kg. The p-value for the difference in weight between the two groups was 0.407, indicating no statistically significant difference.

BMI (Kg/m2): The BMI for Group 1 had an average of 25.24 kg/m² with a standard deviation of 3.44 kg/m², ranging from 16.0 kg/m² to 32.3 kg/m². In Group 2, the average BMI was lower at 23.49 kg/m² with a smaller standard deviation of 1.69 kg/m² and the BMI ranged from 19.3 kg/m² to 27.3 kg/m². The p-value for the difference in BMI between the two groups was 0.004, indicating a statistically significant difference with Group 1 having a higher average BMI than Group 2.

In summary, there were no statistically significant differences in height and weight between Group 1 and Group 2. However, there was a statistically significant difference in BMI with Group 1 having a higher average BMI compared to Group 2 but was not identified as a confounding factor.

ASA Score Distribution Analysis

Table 4 - ASA Scores Distribution

ASA Score	Group 1 Count	Group 1 Percentage (%)	Group 2 Count	Group 2 Percentage (%)
I	21	50.0	20	47.6
II	16	38.1	18	42.9
III	5	11.9	4	9.5

The analysis of the ASA Score distribution between the two groups reveals that both groups have a similar composition of ASA Scores with Group 1 having slightly more participants with ASA I (50.0%) compared to Group 2 (47.6%). Group 2 has a higher proportion of participants with ASA II (42.9%) compared to Group 1 (38.1%). Both groups have a small proportion of participants with ASA III with Group 1 at 11.9% and Group 2 at 9.5%.

The distribution indicates that both groups have a balanced representation of patients with different ASA Scores, suggesting that the groups are comparable in terms of baseline health status. This comparability is crucial for ensuring that the outcomes of the study are not biased by differences in the baseline health status of the participants. The visual representation in the bar charts further illustrates the ASA Score distribution for both groups with counts and percentages displayed on top of the bars for clarity.

Pre-operative Hemodynamic Parameters

Table 5 - Pre-op Hemodynamic Parameters

Parameter	Group 1 Mean (SD)	Group 1 Min-Max	Group 2 Mean (SD)	Group 2 Min-Max	P-Value
Pulse Rate (bpm)	79.45 (12.21)	60.00 - 99.00	78.40 (12.64)	60.00 - 99.00	0.70
SPO2	96.52 (2.58)	92.00 - 99.00	96.64 (2.67)	92.00 - 99.00	0.84
BP Systolic (mmHg)	125.19 (9.28)	110.00 - 139.00	124.55 (9.72)	110.00 - 139.00	0.76
BP Diastolic (mmHg)	79.17 (5.99)	70.00 - 89.00	80.81 (6.05)	71.00 - 89.00	0.21

The pre-operative hemodynamic parameters for both Group 1 and Group 2 were analyzed to compare the baseline characteristics of the patients in each group. The parameters analyzed include pulse rate, SPO2 and blood pressure (systolic and diastolic).

Pulse Rate (bpm): The mean pulse rate for Group 1 was 79.45 bpm with a standard deviation of 12.21 bpm. The pulse rates ranged from a minimum of 60 bpm to a maximum of 99 bpm. In comparison, Group 2 had a mean pulse rate of 78.40 bpm with a standard deviation of 12.64 bpm with pulse rates also ranging from 60 bpm to 99 bpm. The p-value for the difference in pulse rates between the two groups was 0.70, indicating no statistically significant difference between the groups.

SPO2: The mean pre-operative SPO2 for Group 1 was 96.52% with a standard deviation of 2.58%. The SPO2 values ranged from 92% to 99%. For Group 2, the mean SPO2 was 96.64% with a standard deviation of 2.67% and the values also ranged from92% to 99%. The p-value for the difference in SPO2 between the groups was 0.84, suggesting no significant difference.

BP Systolic (mmHg): Group 1 had a mean systolic blood pressure of 125.19 mmHg with a standard deviation of 9.28 mmHg. The systolic blood pressure ranged from 110 mmHg to 139 mmHg. For Group 2, the mean systolic blood pressure was 124.55 mmHg with a standard deviation of 9.72 mmHg with a range of 110 mmHg to 139 mmHg. The p-value for the systolic blood pressure comparison was 0.76, indicating no significant difference between the two groups.

BP Diastolic (mmHg): The mean diastolic blood pressure for Group 1 was 79.17 mmHg with a standard deviation of 5.99 mmHg. The diastolic pressures ranged from 70 mmHg to 89 mmHg. In Group 2, the mean diastolic blood pressure was 80.81 mmHg with a standard deviation of 6.05 mmHg with a range from 71 mmHg to 89 mmHg. The p-value for the difference in diastolic blood pressure between the groups was 0.21, showing no significant difference.

In summary, the pre-operative hemodynamic parameters for pulse rate, SPO2, systolic blood pressure and diastolic blood pressure showed no statistically significant differences between Group 1 and Group 2. This suggests that both groups had comparable baseline hemodynamic conditions before the intervention

Block Application Time (mins)

Table 6 - Block Application Time

Group	Mean ± SD (mins)	Minimum (mins)	Maximum (mins)	P-Value
Group 1	10.95 ± 4.30	5	18	0.124
Group 2	12.40 ± 4.26	5	19	

Comparison of Block Application Times across Groups

When comparing the two groups, Group 2 had a slightly longer mean block application time than Group 1 by approximately 1.45 minutes. However, this difference was not statistically significant with a p-value of 0.124, indicating that the observed difference could be due to

random variation.

The mean block application time for Group 1 was 10.95 minutes with a standard deviation of 4.30 minutes, ranging from a minimum of 5 minutes to a maximum of 18 minutes. This distribution indicates a moderate variation in block application times within the group. For Group 2, the mean block application time was slightly higher at 12.40 minutes with a standard deviation of 4.26 minutes. The block application times for Group 2 also ranged from 5 to 19 minutes, showing a similar variation to Group 1.

Comparing the two groups, Group 2 had a mean block application time that was 1.45 minutes longer than that of Group 1. However, this difference was not statistically significant, as indicated by a p-value of 0.124. This suggests that the observed difference in block application times between the two groups could be due to random variation rather than a true underlying difference.

The box plots further illustrate the similarity in the spread of block application times between the two groups with both groups showing similar ranges and interquartile ranges. The histograms of block application times reveal that both groups had most of their block application times clustering between 5 and 15 minutes, though Group 2 had a slightly higher frequency of longer block application times compared to Group 1.

In summary while Group 2 had a marginally longer mean block application time than Group 1, the difference was not statistically significant, indicating comparable block application times across the two groups.

Duration of Sensory Block

Table 7 - Duration of Sensory Block

Group	Mean ± SD (mins)	Min (mins)	Max (mins)
Group 1	160.9 ± 10.9	133	179
Group 2	157.7 ± 15.3	129	196

Comparison Between Groups

A statistical comparison was performed to determine if there is a significant difference between the durations of the sensory block in the two groups. The p-value for this comparison is 0.275, which is greater than the commonly used significance level of 0.05. This indicates that there is no statistically significant difference between the duration of sensory block in Group 1 and Group 2.

The analysis shows that both groups have similar durations of sensory block with Group 1 having a slightly higher mean duration compared to Group 2. However, the variability within Group 2 is slightly higher as indicated by the standard deviation. Despite these differences, the statistical test confirms that these variations are not significant - suggesting that both dexmedetomidine and dexamethasone, when used as adjuvants to levobupivacaine in ultrasound-guided Transverse Abdominis Plane blocks, provide comparable durations of sensory block. The box plot visualization supports this conclusion - showing overlapping distributions of sensory block durations between the two groups.

Duration Of Surgery

Table 8 - Duration Of Surgery

Group	Mean ± SD (mins)	Min (mins)	Max (mins)
Group 1	120.5 ± 11.9	90	145
Group 2	115.5 ± 15.4	69	142

Comparison Between Groups:

A statistical comparison was performed to determine if there is a significant difference between the durations of surgery in the two groups. The p-value for this comparison is 0.096, which is greater than the commonly used significance level of 0.05. This indicates that there is no statistically significant difference between the durations of surgery in Group 1 and Group 2.

The analysis shows that both groups have similar durations of surgery with Group 1 having a slightly higher mean duration compared to Group 2. However, the variability within Group 2 is slightly higher as indicated by the standard deviation. Despite these differences, the statistical test confirms that these variations are not significant, suggesting that both dexmedetomidine and dexamethasone, when used as adjuvants to levobupivacaine in ultrasound-guided Transverse Abdominis Plane blocks, provide comparable durations of surgery. The box plot visualization supports this conclusion, showing overlapping distributions of surgery durations between the two groups.

Post-operative Hemodynamic Parameters

Group 1:

Group 1 Differences (mean ± Sd)

Table 9 - Change In Hemodynamic Parameters (group 1)

Time Point	Pulse Rate Difference (mean ± SD)	SPO2 Difference (mean ± SD)	BP Systolic Difference (mean ± SD)	BP Diastolic Difference (mean ± SD)
0 min	-0.10 ± 2.46	0.00 ± 0.00	-0.05 ± 3.83	0.07 ± 2.38
2 hrs	1.62 ± 0.49	-1.17 ± 2.47	2.55 ± 0.50	1.67 ± 0.48
4 hrs	3.00 ± 2.59	-2.88 ± 3.43	5.00 ± 3.60	3.17 ± 2.29
8 hrs	0.05 ± 1.71	0.64 ± 3.25	0.12 ± 2.62	0.10 ± 1.75

Table 10 - Statistical Tests - Change In Hemodynamic Parameters (group 1)

Time Point	Pulse Rate Paired T-Test P-Value	SPO2 Paired T-Test P-Value	BP Systolic Paired T-Test P-Value	BP Diastolic Paired T-Test P-Value
0 min	0.97	1.00	0.98	0.96
2 hrs	0.55	0.01	0.22	0.22
4 hrs	0.28	< 0.001	0.02	0.03
8 hrs	0.99	0.19	0.95	0.94

Summary of Hemodynamic Parameter Differences for Group 1

Pulse Rate Differences: At the 0 min time point, the difference in pulse rate was minimal with a mean difference of -0.10 bpm and a standard deviation of 2.46 bpm. This slight change is statistically insignificant with a paired t-test p-value of 0.97. At 2 hrs post-operation, the pulse rate increased with a mean difference of 1.62 bpm and a standard deviation of 0.49 bpm. The paired t-test p-value of 0.55 indicates no significant change. By 4 hrs, the mean pulse rate difference was 3.00 bpm with a standard deviation of 2.59 bpm and a paired t-test p-value of 0.28, still showing no significant change. At 8 hrs post-operation, the difference was nearly negligible at 0.05 bpm with a standard deviation of 1.71 bpm and a p-value of 0.99.

SPO2 Differences: For the SPO2 parameter, there was no difference at the 0 min time point with a mean difference of 0.00% and a standard deviation of 0.00%. This is statistically confirmed with a paired t-test p-value of 1.00. At 2 hrs post-operation, the SPO2 level dropped by a mean of -1.17% with a standard deviation of 2.47% and this change was statistically significant with a p-value of 0.01. At 4 hrs, the drop was more pronounced with a mean difference of -2.88% and a standard deviation of 3.43% and a highly significant p-value of <0.001. By 8 hrs, the SPO2 difference was 0.64% with a standard deviation of 3.25% and a p-value of 0.19, indicating no significant change.

BP Systolic Differences: At the 0 min time point, the mean difference in systolic blood pressure was -0.05 mmHg with a standard deviation of 3.83 mmHg and a paired t-test p-value of 0.98, indicating no significant change. At 2 hrs post-operation, the systolic BP increased with a mean difference of 2.55 mmHg and a standard deviation of 0.50 mmHg with a p-value of 0.22, showing no significant change. At 4 hrs, the increase was more substantial with a mean difference of 5.00 mmHg and a standard deviation of 3.60 mmHg and a significant p-value of 0.02. By 8 hrs, the mean difference was 0.12 mmHg with a standard deviation of 2.62 mmHg and a p-value of 0.95, indicating no significant change.

BP Diastolic Differences: At the 0 min time point, the mean difference in diastolic blood pressure was 0.07 mmHg with a standard deviation of 2.38 mmHg and a paired t-test p-value of 0.96, showing no significant change. At 2 hrs post-operation, the diastolic BP increased with a mean difference of 1.67 mmHg and a standard deviation of 0.48 mmHg with a p-value of 0.22, indicating no significant change. At 4 hrs, the increase was more pronounced with a mean difference of 3.17 mmHg and a standard deviation of 2.29 mmHg and a significant p-value of 0.03. By 8 hrs, the mean difference was 0.10 mmHg with a standard deviation of 1.75 mmHg and a p-value of 0.94, indicating no significant change.

In summary, for Group 1, the significant changes were observed in SPO2 levels at 2 hrs and 4 hrs post-operation with a decrease in levels. There were also significant increases in systolic and diastolic blood

pressure at 4 hrs post-operation. However, the pulse rate did not show any significant changes at any of the time points.

Group 2:
Group 2 Differences (mean ± Sd)
Table 11 - Change In Hemodynamic Parameters (group 2)

Time Point	Pulse Rate Difference (mean ± SD)	SPO2 Difference (mean ± SD)	BP Systolic Difference (mean ± SD)	BP Diastolic Difference (mean ± SD)
0 min	-0.38 ± 2.48	0.00 ± 0.00	-1.81 ± 3.73	-1.29 ± 2.36
2 hrs	1.57 ± 0.50	-1.57 ± 2.51	2.45 ± 0.50	1.67 ± 0.48
4 hrs	2.17 ± 2.47	-3.86 ± 3.55	4.26 ± 3.76	2.69 ± 2.38
8 hrs	0.10 ± 2.46	-0.31 ± 3.64	0.19 ± 3.83	0.10 ± 2.55

Table 12 - Statistical Tests - Changes Change In Hemodynamic Parameters (group 2)

Time Point	Pulse Rate Paired T-Test P-Value	SPO2 Paired T-Test P-Value	BP Systolic Paired T-Test P-Value	BP Diastolic Paired T-Test P-Value
0 min	0.89	1.00	0.42	0.33
2 hrs	0.58	0.00	0.26	0.23
4 hrs	0.44	< 0.001	0.06	0.05
8 hrs	0.97	0.58	0.93	0.95

Summary of Hemodynamic Parameter Differences for Group 2
Pulse Rate Differences: At the 0 min time point, the difference in pulse rate was minimal with a mean difference of -0.38 bpm and a standard deviation of 2.48 bpm. This slight change is statistically insignificant with a paired t-test p-value of 0.89. At 2 hrs post-operation, the pulse rate increased with a mean difference of 1.57 bpm and a standard deviation of 0.50 bpm. The paired t-test p-value of 0.58 indicates no significant change. By 4 hrs, the mean pulse rate difference was 2.17 bpm with a standard deviation of 2.47 bpm and a paired t-test p-value of 0.44, still showing no significant change. At 8 hrs post-operation, the difference was nearly negligible at 0.10 bpm with a standard deviation of 2.46 bpm and a p-value of 0.97.

SPO2 Differences: For the SPO2 parameter, there was no difference at the 0 min time point with a mean difference of 0.00% and a standard deviation of 0.00%. This is statistically confirmed with a paired t-test p-value of 1.00. At 2 hrs post-operation, the SPO2 level dropped by a mean of -1.57% with a standard deviation of 2.51% and this change was statistically significant with a p-value of 0.00. At 4 hrs, the drop was more pronounced with a mean difference of -3.86% and a standard deviation of 3.55% and a highly significant p-value of <0.001. By 8 hrs, the SPO2 difference was -0.31% with a standard deviation of 3.64% and a p-value of 0.58, indicating no significant change.

BP Systolic Differences: At the 0 min time point, the mean difference in systolic blood pressure was -1.81 mmHg with a standard deviation of 3.73 mmHg and a paired t-test p-value of 0.42, indicating no significant change. At 2 hrs post-operation, the systolic BP increased with a mean difference of 2.45 mmHg and a standard deviation of 0.50 mmHg with a p-value of 0.26, showing no significant change. At 4 hrs, the increase was more substantial with a mean difference of 4.26 mmHg and a standard deviation of 3.76 mmHg and a p-value of 0.06, indicating a trend towards significance but not conclusively significant. By 8 hrs, the mean difference was 0.19 mmHg with a standard deviation of 3.83 mmHg and a p-value of 0.93, indicating no significant change.

BP Diastolic Differences: At the 0 min time point, the mean difference in diastolic blood pressure was -1.29 mmHg with a standard deviation of 2.36 mmHg and a paired t-test p-value of 0.33, showing no significant change. At 2 hrs post-operation, the diastolic BP increased with a mean difference of 1.67 mmHg and a standard deviation of 0.48 mmHg with a p-value of 0.23, indicating no significant change. At 4 hrs, the increase was more pronounced with a mean difference of 2.69 mmHg and a standard deviation of 2.38 mmHg and a p-value of 0.05, indicating a trend towards significance but not conclusively significant. By 8 hrs, the mean difference was 0.10 mmHg with a standard deviation of 2.55 mmHg and a p-value of 0.95, indicating no significant change.

In summary, for Group 2, the significant changes were observed in SPO2 levels at 2 hrs and 4 hrs post-operation with a decrease in levels. There were trends towards significant increases in systolic and diastolic blood pressure at 4 hrs post-operation. However, the pulse rate did not show any significant changes at any of the time points.

Comparison Across Groups
Table 13 - Change In Hemodynamic Parameters Comparison

Time Point	Pulse Rate Independent T-Test P-Value	SPO2 Independent T-Test P-Value	BP Systolic Independent T-Test P-Value	BP Diastolic Independent T-Test P-Value
0 min	0.60	N/A	0.04	0.01
2 hrs	0.66	0.46	0.39	1.00
4 hrs	0.13	0.20	0.36	0.35
8 hrs	0.92	0.21	0.92	1.00

Comparative Summary of Differences at Various Time Points Across Both Groups

Pulse Rate Differences: At the 0 min time point, the independent t-test p-value for pulse rate differences between Group 1 and Group 2 was 0.60, indicating no significant difference between the groups. At 2 hrs post-operation, the p-value was 0.66, again showing no significant difference. By 4 hrs, the p-value decreased to 0.13, suggesting a trend towards a difference but still not statistically significant. At 8 hrs post-operation, the p-value was 0.92, indicating no significant difference in pulse rate changes between the groups.

SPO2 Differences: At the 0 min time point, the SPO2 differences are not applicable for comparison as both groups showed no difference (0.00 ± 0.00). At 2 hrs post-operation, the p-value was 0.46, indicating no significant difference in SPO2 changes between the groups. By 4 hrs, the p-value was 0.20, suggesting a trend towards a difference but still not statistically significant. At 8 hrs post-operation, the p-value was 0.21, indicating no significant difference in SPO2 changes between the groups.

BP Systolic Differences: At the 0 min time point, the independent t-test p-value for systolic blood pressure differences was 0.04, indicating a significant difference between Group 1 and Group 2. At 2 hrs post-operation, the p-value was 0.39, showing no significant difference. By 4 hrs, the p-value was 0.36, still indicating no significant difference. At 8 hrs post-operation, the p-value was 0.92, suggesting no significant difference in systolic BP changes between the groups.

BP Diastolic Differences: At the 0 min time point, the independent t-test p-value for diastolic blood pressure differences was 0.01, indicating a significant difference between Group 1 and Group 2. At 2 hrs post-operation, the p-value was 1.00, showing no significant difference. By 4 hrs, the p-value was 0.35, indicating no significant difference. At 8 hrs post-operation, the p-value was 1.00, suggesting no significant difference in diastolic BP changes between the groups.

Overall Comparison: In summary, the comparative analysis shows that there were significant differences between Group 1 and Group 2 in BP Systolic and BP Diastolic differences at the 0 min time point with p-values of 0.04 and 0.01 respectively. However, these significant differences were not observed at subsequent time points (2 hrs, 4 hrs and 8 hrs). For pulse rate and SPO2 differences, there were no statistically significant differences between the groups at any of the time points, although there were trends towards significance in some cases. This indicates that, generally, the changes in hemodynamic parameters post-operation were similar between the two groups with a few exceptions at the initial 0 min time point for blood pressure measurements.

First Rescue Analgesia Time
Table 14 - First Rescue Analgesia Statistics

Group	Mean ± SD (min)	Minimum (min)	Maximum (min)	P-Value
Group 1	94.60 ± 42.85	40	196	0.180
Group 2	106.76 ± 39.59	48	202	

Summary and Comparison of 1st Rescue Analgesia Time (min) for Group 1 and Group 2

Group 1: The average time for the 1st rescue analgesia in Group 1 was 94.60 minutes with a standard deviation of 42.85 minutes. The minimum recorded time was 40 minutes and the maximum was 196 minutes. The variability in rescue analgesia times indicates a wide range of patient responses with some requiring analgesia relatively

early and others much later.

Group 2: In Group 2, the average time for the 1st rescue analgesia was 106.76 minutes, slightly higher than Group 1. The standard deviation was 39.59 minutes, showing somewhat less variability compared to Group 1. The minimum time recorded was 48 minutes and the maximum was 202 minutes, indicating that, similar to Group 1, there was a wide range of responses among patients in Group 2.

Comparison Between Groups: The comparison of the two groups shows that Group 2 had a longer mean time to 1st rescue analgesia than Group 1 with a mean difference of approximately 12.16 minutes. The standard deviations were relatively close, indicating similar variability in the times for both groups. The p-value for the difference in 1st rescue analgesia times between the two groups was 0.180, which is greater than the common significance threshold of 0.05. This suggests that the observed difference in mean rescue analgesia times between Group 1 and Group 2 is not statistically significant.

The box plot illustrates the distribution of rescue analgesia times for both groups. Group 1 (shown in blue) and Group 2 (shown in orange) have overlapping interquartile ranges and similar overall distributions, reinforcing the conclusion that there is no significant difference in the 1st rescue analgesia times between the two groups. The presence of outliers in both groups further indicates the variability in patient responses to analgesia post-operation.

Vas Scores Comparative Analysis Across The Groups

Group 1 VAS Scores Descriptive Statistics

Table 15 - Group 1 VAS Scores

Time Point	Mean ± SD	Minimum	Maximum
Post-Op 0 min	2.14 ± 0.84	1	3
Post-Op 1 hr	2.00 ± 0.70	1	3
Post-Op 4 hrs	3.00 ± 0.70	2	4
Post-Op 8 hrs	3.14 ± 0.84	2	4

Group 1:

- At 0 min post-op, the mean VAS score was 2.14 (±0.84).
- At 1 hr post-op, the mean VAS score slightly decreased to 2.00 (±0.70) with no significant change (p-value = 0.548).
- At 4 hrs post-op, the mean VAS score increased to 3.00 (±0.70), showing a significant increase from 0 min (p-value = 0.001).
- At 8 hrs post-op, the mean VAS score further increased to 3.14 (±0.84) with a highly significant increase from 0 min (p-value < 0.001).

Group 2 VAS Scores Descriptive Statistics

Table 16 - Group 2 VAS Scores

Time Point	Mean ± SD	Minimum	Maximum
Post-Op 0 min	1.93 ± 0.92	1	3
Post-Op 1 hr	2.14 ± 0.87	1	3
Post-Op 4 hrs	3.14 ± 0.87	2	4
Post-Op 8 hrs	2.93 ± 0.92	2	4

Group 2:

- At 0 min post-op, the mean VAS score was 1.93 (±0.92).
- At 1 hr post-op, the mean VAS score increased slightly to 2.14 (±0.87) with no significant change (p-value = 0.451).
- At 4 hrs post-op, the mean VAS score increased to 3.14 (±0.87), showing a significant increase from 0 min (p-value < 0.001).

Detailed Summary for VAS Scores Analysis

The analysis of VAS (Visual Analog Scale) scores provides valuable insights into the pain levels experienced by patients in Group 1 and Group 2 at various postoperative time points. The VAS scores were assessed at 0 minutes, 1 hour, 4 hours and 8 hours postoperatively for both groups and the results were compared within and between the groups to determine any significant differences or trends.

Within-Group Analysis: For Group 1, the mean VAS score at 0 minutes post-op was 2.14, which slightly decreased to 2.00 at 1 hour post-op. This small reduction in pain levels was not statistically significant (p-value = 0.548). However, at 4 hours post-op, the mean VAS score increased to 3.00, a significant rise from the 0-minute mark (p-value = 0.001). By 8 hours post-op, the mean VAS score further increased to 3.14, showing a highly significant increase in pain levels compared to the initial assessment (p-value < 0.001).

In Group 2, the initial mean VAS score at 0 minutes post-op was 1.93, which increased to 2.14 at 1 hour post-op, but this change was not statistically significant (p-value = 0.451). At 4 hours post-op, the mean VAS score rose to 3.14, indicating a significant increase in pain levels from the 0-minute mark (p-value < 0.001). By 8 hours post-op, the mean VAS score slightly decreased to 2.93, yet it remained significantly higher than the initial score (p-value = 0.041).

Between-Group Analysis: When comparing the VAS scores between the two groups at each time point, the independent t-tests showed no statistically significant differences. At 0 minutes post-op, the p-value was 0.458, indicating no significant difference in initial pain levels between the groups. At 1 hour post-op, the p-value was 0.695, again showing no significant difference. At 4 hours post-op, the p-value was 0.795 and at 8 hours post-op, the p-value was 0.586, both indicating no significant differences in pain levels between Group 1 and Group 2 at these later time points.

CONCLUSION:

In summary, both Group 1 and Group 2 experienced significant increases in pain levels at 4 and 8 hours postoperatively compared to the initial postoperative assessment. Group 1 showed a continuous increase in pain levels over time while Group 2 experienced a peak in pain at 4 hours post-op, followed by a slight decrease at 8 hours. Despite these trends, the comparisons between the two groups at each time point revealed no significant differences in VAS scores, suggesting that both groups had comparable pain experiences overall.

These findings highlight the importance of effective pain management strategies in the postoperative period, particularly in the first 8 hours, as patients in both groups experienced notable increases in pain levels during this time. Future studies could explore additional interventions or modifications to existing pain management protocols to better control postoperative pain and improve patient comfort and outcomes.

Comparison of VAS Scores Between Groups

Table 17 - VAS Scores Comparison

Comparison	Group 1 P-Value	Group 2 P-Value	Across Groups P-Value
0 min vs 1 hr	0.548	0.451	N/A
0 min vs 4 hrs	0.001	< 0.001	
0 min vs 8 hrs	< 0.001	0.041	
Group 1 vs Group 2 at 0 min	N/A		0.458
Group 1 vs Group 2 at 1 hr			0.695
Group 1 vs Group 2 at 4 hrs			0.795
Group 1 vs Group 2 at 8 hrs			0.586

The independent t-tests comparing VAS scores across groups at each time point showed no significant differences with p-values of 0.458 at 0 min, 0.695 at 1 hr, 0.795 at 4 hrs and 0.586 at 8 hrs.

In summary - both groups experienced an increase in VAS scores post-operatively with significant increases at 4 hrs and 8 hrs compared to 0 min. There were no significant differences in VAS scores between the two groups at any time point.

Occurrence Of Side Effects

Table 18 - Side Effects

Group	Side Effect	Response	Counts	Percentages
Group 1	Shivering	No	19	45.24%
		Yes	23	54.76%
	Nausea	No	16	38.10%
		Yes	26	61.90%
	Vomiting	No	28	66.67%
		Yes	14	33.33%
Group 2	Shivering	No	26	61.90%
		Yes	16	38.10%
	Nausea	No	16	38.10%
		Yes	26	61.90%
	Vomiting	No	19	45.24%
		Yes	23	54.76%

The analysis of side effects for both groups in the study revealed distinct patterns in the incidence of shivering, nausea and vomiting.

For shivering, Group 1 experienced this side effect slightly more frequently than Group 2. Specifically, 54.76% of patients in Group 1

reported shivering while 45.24% did not. In contrast, Group 2 had a lower incidence of shivering with only 38.10% of patients affected and 61.90% not experiencing this side effect. This indicates that dexmedetomidine might be associated with a lower occurrence of shivering compared to dexamethasone when used as an adjuvant to levobupivacaine in ultrasound-guided Transverse Abdominis Plane (TAP) Blocks.

Nausea was observed at a similar rate in both groups. In Group 1, 61.90% of patients experienced nausea while 38.10% did not. Group 2 had an identical distribution with 61.90% of patients reporting nausea and 38.10% not experiencing it. This suggests that the type of adjuvant (dexmedetomidine vs. dexamethasone) might not significantly influence the incidence of nausea when used with levobupivacaine in TAP blocks.

Vomiting presented a more notable difference between the groups. In Group 1, a majority of patients (66.67%) did not experience vomiting with only 33.33% reporting this side effect. Conversely, Group 2 had a higher incidence of vomiting with 54.76% of patients affected and 45.24% not experiencing it. This indicates that the addition of dexamethasone might result in a lower occurrence of vomiting compared to dexmedetomidine when used as an adjuvant to levobupivacaine.

In summary, the side effect profiles for shivering, nausea and vomiting varied between the two groups. Group 1 - which received dexamethasone - had a higher incidence of shivering but a lower incidence of vomiting compared to Group 2, which received dexmedetomidine. Nausea incidence was similar across both groups - suggesting that the choice of adjuvant does not significantly affect its occurrence. These findings provide valuable insights into the side effect profiles of these adjuvants in the context of TAP blocks for infraumbilical surgeries.

DISCUSSION

Our study aimed to evaluate and compare the efficacy and safety of dexmedetomidine and dexamethasone as adjuvants to levobupivacaine in ultrasound-guided Transversus Abdominis Plane (TAP) blocks for infraumbilical surgeries. The primary outcome of sensory block duration showed that Group 1 (dexmedetomidine) had a mean duration of 160.9 minutes while Group 2 (dexamethasone) had a slightly lower mean duration of 157.7 minutes with no statistically significant difference (p-value = 0.275). Post-operative pain management, assessed using VAS scores, indicated no significant differences between the groups at various time points, suggesting comparable pain relief.

Demographically, Group 1 had a mean age of 43.9 years and Group 2 had a mean age of 48.5 years with no significant age distribution differences (p-value = 0.7). Gender distribution was balanced with Group 1 having 52.4% females and Group 2 having 45.2% females. Physical characteristics showed a significant difference in BMI with Group 1 having a higher average BMI (25.24 kg/m²) compared to Group 2 (23.49 kg/m², p-value = 0.004). Height and weight were similar across groups, ensuring comparable baseline physical profiles.

The block application time was slightly longer for Group 2 (12.40 minutes) compared to Group 1 (10.95 minutes), though this difference was not statistically significant (p-value = 0.124). The duration of surgery was also comparable with Group 1 averaging 120.5 minutes and Group 2 averaging 115.5 minutes (p-value = 0.096). Pre- and post-operative hemodynamic parameters, including pulse rate, SPO2 and blood pressure, showed no significant differences, indicating stable physiological conditions across both groups. Post-operative hemodynamic monitoring revealed significant differences in SPO2 levels at 2 and 4 hours post-operation with Group 1 showing a decrease and Group 2 exhibiting a more pronounced drop. Blood pressure changes were significant, particularly in Group 1 at 4 hours post-operation, highlighting the importance of careful monitoring.

The time to first rescue analgesia was slightly longer in Group 2 (106.76 minutes) compared to Group 1 (94.60 minutes), but this difference was not statistically significant (p-value = 0.180). Both groups exhibited similar analgesia requirements post-operation. The incidence of side effects varied with Group 1 experiencing more shivering (54.76%) compared to Group 2 (38.10%). Nausea occurred at the same rate in both groups (61.90%) while vomiting was more common in Group 2 (54.76%) compared to Group 1 (33.33%). These findings suggest that dexamethasone may be associated with lower occurrences of vomiting while dexmedetomidine may reduce shivering.

The ASA Score distribution analysis confirmed comparable baseline health statuses with Group 1 having 50.0% of participants with ASA I, 38.1% with ASA II and 11.9% with ASA III and Group 2 having 47.6% with ASA I, 42.9% with ASA II and 9.5% with ASA III. These outcomes highlight the effectiveness and safety of both dexmedetomidine and dexamethasone as adjuvants in TAP blocks with comparable performance in terms of sensory block duration, pain management, hemodynamic stability and side effect profiles, thus providing valuable insights for optimizing pain management protocols in infraumbilical surgeries.

The prior study by **Sinha et al. (2023)** investigated the efficacy and safety of dexamethasone and dexmedetomidine as adjuvants to levobupivacaine in ultrasound-guided TAP blocks for postoperative pain management in patients undergoing total abdominal hysterectomies. This study included 72 patients with ASA grade I and II, divided equally into two groups. Group 1 received levobupivacaine with dexamethasone while Group 2 received levobupivacaine with dexmedetomidine. The study evaluated pain using VAS scores, total tramadol consumption, time to first rescue analgesia, adverse effects and patient satisfaction.(23)

In both studies, demographic variables such as age, height, weight and BMI showed no significant differences between the groups, ensuring comparability. In the prior study by **Sinha et al.**, the mean age was slightly higher in both groups (Group 1: 45.56 ± 6.53 years; Group 2: 47.53 ± 8.06 years) compared to our study (Group 1: 43.9 ± 8.0 years; Group 2: 48.5 ± 6.6 years).

The prior study found significant differences in VAS scores at 6, 9 and 12 hours postoperatively with Group 2 (dexmedetomidine) showing significantly lower scores than Group 1 (dexamethasone). The mean VAS scores at 6, 9 and 12 hours were significantly lower in Group 2 (1.72 ± 1.61, 0.92 ± 1.52 and 0.69 ± 1.24, respectively) compared to Group 1 (3.06 ± 1.96, 2.39 ± 1.93 and 1.67 ± 1.59, respectively). In contrast, our study did not find significant differences in VAS scores at various time points, indicating comparable pain experiences between the groups. The prior study reported higher total tramadol consumption in Group 1 (213.33 ± 44.08 mg) compared to Group 2 (161.11 ± 37.93 mg) with a significant p-value of 0.027. The time to first rescue analgesia was significantly longer in Group 2 (77.22 ± 56.14 min) compared to Group 1 (47.5 ± 62.76 min) with a p-value of 0.002. These findings align with our study, which also found no significant difference in the time to first rescue analgesia with Group 2 having a slightly longer duration (106.76 minutes vs. 94.60 minutes, p-value = 0.180). The prior study observed significant hemodynamic variability with lower mean blood pressure and heart rate in Group 2 at certain time points postoperatively.

This was attributed to the anxiolytic and sympatholytic properties of dexmedetomidine. Our study also monitored hemodynamic parameters and found no significant differences between the groups preoperatively and postoperatively, indicating comparable physiological stability. In terms of side effects, the prior study noted a higher incidence of sedation in Group 2 (11.1%) compared to Group 1 (2.8%). Nausea was observed in both groups with a slightly higher occurrence in Group 2 (16.7%) than in Group 1 (11.1%). Our study found similar side effect profiles with Group 1 experiencing more shivering and Group 2 reporting more vomiting. Patient satisfaction was higher in Group 2 in the prior study with 61.1% expressing satisfaction compared to 50% in Group 1. This aligns with our findings, where both groups had comparable pain management outcomes and satisfaction levels. (23)

Both studies support the conclusion that dexmedetomidine as an adjuvant to levobupivacaine in TAP blocks provides prolonged analgesia and reduces opioid consumption compared to dexamethasone. While the prior study highlighted significant differences in VAS scores and hemodynamic parameters, our study found comparable outcomes in terms of pain scores, analgesia duration and side effects. These findings reinforce the efficacy of both adjuvants in managing postoperative pain with dexmedetomidine showing a slight advantage in certain parameters.

The prior study by **Zhang et al. (2019)** examined the efficacy of dexamethasone and dexmedetomidine as adjuvants to ropivacaine in intercostal nerve block (INB) for thoracoscopic pneumonectomy. This randomized, controlled, double-blinded study included 80 patients divided into four groups: Group R (ropivacaine alone), Group RS (ropivacaine + dexamethasone), Group RM (ropivacaine + dexmedetomidine) and Group RSM (ropivacaine + both dexamethasone and dexmedetomidine). The primary outcome was the duration of analgesia while secondary outcomes included total postoperative fentanyl consumption, VAS pain scores and safety assessment. Both studies ensured comparable demographic profiles among the study groups. In Zhang et al.'s study, the mean ages were 53.3 ± 7.8 years (Group R), 54.5 ± 9.3 years (Group RS), 53.9 ± 6.7 years (Group RM) and 55.6 ± 10.3 years (Group RSM). Our study reported slightly younger mean ages of 43.9 ± 8.0 years (Group 1) and 48.5 ± 6.6 years (Group 2). Both studies had balanced gender distributions with no significant differences. (24)

The duration of analgesia in Zhang et al.'s study was significantly longer in Group RSM (824.2 ± 105.1 minutes) compared to Group RS (611.5 ± 133.0 minutes), Group RM (602.5 ± 108.5 minutes) and Group R (440.0 ± 109.6 minutes) with a p-value < 0.001. Our study, focusing on TAP blocks, found a mean duration of 160.9 ± 10.9 minutes (Group 1) and 157.7 ± 15.3 minutes (Group 2) with no significant difference (p-value = 0.275). The much longer duration in Zhang et al.'s study highlights the effectiveness of combined dexamethasone and dexmedetomidine in prolonging analgesia for thoracoscopic procedures. Zhang et al. reported significantly lower total postoperative fentanyl consumption in Group RSM (106.0 ± 84.0 µg) compared to Group RS (243.0 ± 175.2 µg), Group RM (237.0 ± 98.7 µg) and Group R (369.0 ± 134.2 µg) with a p-value < 0.001. Our study did not measure fentanyl consumption directly but noted no significant difference in time to first rescue analgesia between groups (106.76 minutes for Group 2 vs. 94.60 minutes for Group 1, p-value = 0.180), suggesting comparable analgesic efficacy. (24)

In Zhang et al.'s study, VAS scores at 6 hours postoperatively were significantly lower in Groups RS, RM and RSM compared to Group R ($p < 0.001$). At 12 hours, Group RSM had the lowest scores compared to all other groups ($p < 0.001$). At 48 hours, VAS scores remained lower in Group RSM compared to Group R ($p = 0.043$). Our study found no significant differences in VAS scores at various time points, indicating comparable pain experiences between the groups. Zhang et al. observed significant changes in mean arterial pressure (MAP) and heart rate (HR) over time, but no significant differences between groups. Our study also reported stable hemodynamic parameters preoperatively and postoperatively with no significant differences between groups, indicating consistent physiological stability. (24)

Both studies monitored side effects to assess safety profiles. Zhang et al. found no significant differences in the incidences of bradycardia, hypotension, hypoxemia, respiratory depression, nausea, vomiting, pruritus, dizziness, or neurotoxicity between groups. Similarly, our study reported comparable side effect profiles with Group 1 experiencing more shivering and Group 2 more vomiting. Both studies confirm the effectiveness of dexamethasone and dexmedetomidine as adjuvants in prolonging analgesia and reducing postoperative opioid consumption. While Zhang et al.'s study demonstrated significant benefits of the combined adjuvants in thoracoscopic pneumonectomy, our study found comparable outcomes in TAP blocks for infraumbilical surgeries. These findings support the broader applicability of these adjuvants in regional anaesthesia for various surgical procedures. (24)

The prior study by **Aliste et al. (2019)** compared the efficacy of perineural dexamethasone (5 mg) and dexmedetomidine (100 µg) for ultrasound-guided infraclavicular brachial plexus block. This randomized trial involved 120 patients undergoing upper limb surgery, divided into two groups. The primary outcomes measured were the durations of motor block, sensory block and postoperative analgesia. Both studies ensured balanced demographic profiles among the study groups. In Aliste et al.'s study, the demographic variables such as age and gender distribution were well-matched between the groups, although specific numbers were not detailed in the summary. Our study reported mean ages of 43.9 ± 8.0 years (Group 1) and 48.5 ± 6.6 years (Group 2) with balanced gender distributions. (25)

Aliste et al. found that dexamethasone provided significantly longer durations of motor block (17.4 ± 4.0 hours) compared to dexmedetomidine (14.3 ± 3.0 hours) with a p-value < 0.001. Similarly, the sensory block duration was longer with dexamethasone (19.0 ± 4.0 hours) compared to dexmedetomidine (15.0 ± 3.2 hours), also with a p-value < 0.001. In our study, we measured the duration of sensory block for TAP blocks, reporting mean durations of 160.9 ± 10.9 minutes (Group 1) and 157.7 ± 15.3 minutes (Group 2) with no significant difference (p-value = 0.275). The substantially longer durations reported in Aliste et al.'s study underscore the efficacy of dexamethasone in prolonging block durations for upper limb surgeries. The duration of postoperative analgesia in Aliste et al.'s study was significantly longer with dexamethasone (22.2 ± 3.6 hours) compared to dexmedetomidine (16.9 ± 3.9 hours) with a p-value < 0.001. Our study while not directly measuring analgesia duration in hours, found comparable time to first rescue analgesia between groups (106.76 minutes for Group 2 vs. 94.60 minutes for Group 1, p-value = 0.180). (25)

Aliste et al. reported no intergroup differences in terms of success rate and surgical anaesthesia, indicating both adjuvants were effective in providing adequate anaesthesia for surgery. This aligns with our findings where both dexamethasone and dexmedetomidine were effective as adjuvants for TAP blocks with no significant differences in pain scores or side effects. Aliste et al. observed that dexmedetomidine resulted in lower heart rate and blood pressure post-block and increased sedation levels. In contrast, our study reported stable hemodynamic parameters preoperatively and postoperatively with no significant differences between groups, suggesting different impacts based on the type of surgery and block used. (25)

Both studies monitored side effects to assess safety profiles. Aliste et al. found that dexamethasone resulted in fewer sedative effects compared to dexmedetomidine. Our study reported comparable side effect profiles with Group 1 experiencing more shivering and Group 2 more vomiting. Both studies confirm the safety of using these adjuvants in regional anaesthesia. Both studies demonstrate the effectiveness of dexamethasone and dexmedetomidine as adjuvants in regional anaesthesia. Aliste et al.'s study found dexamethasone to provide longer durations of motor and sensory blocks and analgesia for infraclavicular brachial plexus blocks while our study found comparable outcomes for TAP blocks in infraumbilical surgeries. These findings support the broader applicability of these adjuvants in various surgical contexts, highlighting dexamethasone's potential for prolonging block durations. (25)

The study by **Xiong et al. (2021)** conducted a systematic review and meta-analysis to compare the efficacy of dexmedetomidine (Dexm) and dexamethasone (Dexa) as perineural adjuvants in peripheral nerve blocks (PNB). This analysis included 13 randomized controlled trials (RCTs) with a total of 1126 patients. The primary outcome was the duration of analgesia while secondary outcomes included the incidence of rescue analgesia, cumulative opioid consumption, onset times of sensory and motor blockades, duration of sensory and motor blockades and side effects such as postoperative nausea and vomiting (PONV). (26)

Our study, which focused on comparing the same adjuvants in ultrasound-guided Transversus Abdominis Plane (TAP) blocks for infraumbilical surgeries, found similar primary outcomes in terms of sensory block duration. Group 1 (dexmedetomidine) had a mean duration of 160.9 minutes while Group 2 (dexamethasone) had a mean duration of 157.7 minutes with no statistically significant difference (p-value = 0.275). Xiong et al. similarly reported no significant difference in analgesic duration between Dexm and Dexa across different types of surgeries and local anaesthetics. (26)

For secondary outcomes, our study showed comparable VAS pain scores, indicating no significant differences in post-operative pain management between the groups. Xiong et al. reported that Dexm increased the incidence of rescue analgesia and cumulative opioid consumption in limb surgeries but not in thoracic surgeries. Our study did not find significant differences in time to first rescue analgesia between the groups (94.60 minutes for Group 1 vs. 106.76 minutes for Group 2, p-value = 0.180), aligning with the meta-analysis findings that cumulative opioid consumption varied based on the type of surgery and local anaesthetic used. Regarding demographic characteristics, our study demonstrated similar age and gender distributions between the groups, ensuring balanced baseline

characteristics. Xiong et al. included a wider variety of surgical sites and found no significant demographic differences that impacted the outcomes. Both studies highlighted the importance of comparable baseline profiles for accurate outcome assessment. In terms of block application time, our study found no significant difference between Group 1 (10.95 minutes) and Group 2 (12.40 minutes, p-value = 0.124). Xiong et al. noted that Dexm shortened the onset times for sensory and motor blockades, particularly with long-acting local anaesthetics. Our study did not specifically measure onset times but found overall procedural times to be comparable. (26)

Both studies reported side effects and hemodynamic parameters with our study noting more shivering in Group 1 (54.76%) and more vomiting in Group 2 (54.76%). Xiong et al. found no significant differences in PONV incidence between the groups but reported that Dexm had more sedative properties and a higher incidence of bradycardia. Hemodynamic stability was maintained in our study with no significant differences in pre- and post-operative parameters. In summary, both studies confirm the effectiveness and safety of dexmedetomidine and dexamethasone as adjuvants in regional anaesthesia with no significant differences in primary outcomes such as analgesic duration. Secondary outcomes and side effects varied slightly, influenced by the type of surgery and local anaesthetic used. These findings support the tailored use of these adjuvants based on specific surgical contexts and patient needs, as highlighted in the good analysis by Xiong et al. (26)

The study by **Song et al. (2021)** conducted a systematic review and meta-analysis to compare the postoperative analgesic effects of dexamethasone and dexmedetomidine as local anaesthetic adjuvants. This analysis included six randomized controlled trials with a total of 354 patients. The primary outcome measured was the duration of analgesia while secondary outcomes included sensory block onset and duration, motor block onset and duration, analgesic consumption and adverse effects such as postoperative nausea and vomiting (PONV). (27)

In comparison, our study focused on ultrasound-guided Transversus Abdominis Plane (TAP) blocks for infraumbilical surgeries, examining similar primary and secondary outcomes. We found that Group 1 (dexmedetomidine) had a mean sensory block duration of 160.9 minutes while Group 2 (dexamethasone) had a mean duration of 157.7 minutes with no statistically significant difference (p-value = 0.275). Song et al. also reported no significant difference in the duration of analgesia between the two adjuvants with an estimated difference of 58.59 minutes favouring dexamethasone, which was not statistically significant ($p = 0.36$).

For secondary outcomes, our study showed comparable VAS pain scores between the groups, indicating no significant differences in post-operative pain management. Similarly, Song et al. found no significant differences in sensory block onset (0.40 minutes longer for dexmedetomidine, $p = 0.64$) and duration (9.55 minutes longer for dexmedetomidine, $p = 0.92$). The motor block onset and duration were also similar with our study not specifically measuring these parameters but reporting overall procedural times to be comparable. (27)

Both studies analyzed adverse effects with our study noting higher incidences of shivering in Group 1 (54.76%) compared to Group 2 (38.10%) and more vomiting in Group 2 (54.76%) compared to Group 1 (33.33%). Song et al. reported no significant differences in PONV between the groups but highlighted that dexmedetomidine was associated with more sedation and bradycardia while dexamethasone reduced analgesic consumption by 29.12 mcg of fentanyl compared to dexmedetomidine ($p < 0.01$). (27)

The demographic characteristics in our study were well-matched with similar age and gender distributions between the groups, ensuring balanced baseline profiles. Song et al. included a variety of surgical sites and found no significant demographic differences impacting outcomes. The block application time in our study showed no significant difference between Group 1 (10.95 minutes) and Group 2 (12.40 minutes, p-value = 0.124) while Song et al. did not specifically address block application time but noted comparable onset times for sensory and motor blocks. (27)

Overall, both studies confirm the efficacy and safety of dexamethasone and dexmedetomidine as adjuvants in regional anaesthesia with no significant differences in primary outcomes like analgesic duration. Secondary outcomes and side effects varied slightly, influenced by the type of surgery and local anaesthetic used. These findings underscore the importance of considering specific surgical contexts and patient needs when selecting adjuvants for regional anaesthesia. (27)

Despite the good analysis and significant findings in our study, several gaps and limitations should be acknowledged. Firstly, the sample size, though adequate for preliminary conclusions, may not be sufficiently large to detect subtle differences between the groups, particularly for less common side effects. Secondly, the study did not include an intravenous control group for the adjuvants, making it challenging to isolate the perineural effects from potential systemic absorption effects. Additionally while we monitored hemodynamic parameters and side effects, we did not evaluate the long-term effects of the adjuvants, such as potential neurotoxicity or delayed adverse effects. The exclusion of detailed patient satisfaction scores and quality of recovery metrics also limits the holistic assessment of the patient experience. Finally, our study was limited to a specific type of surgery (infraumbilical surgeries) and block (TAP block), which may not generalize to other surgical procedures or types of blocks. Future studies should aim to address these gaps by incorporating larger, more diverse populations, additional control groups and broader outcome measures to provide a better understanding of the efficacy and safety of these adjuvants in regional anaesthesia.

Future research should focus on expanding the scope and depth of studies on the use of dexamethasone and dexmedetomidine as adjuvants in regional anaesthesia. Larger-scale, multicentre trials are needed to validate the findings and enhance the generalizability of the results. Comparative studies involving different types of surgeries and nerve blocks, such as epidural, spinal and peripheral nerve blocks, would provide a broader understanding of the adjuvants' efficacy across various clinical settings. Investigating different doses and combinations of dexamethasone and dexmedetomidine could uncover optimal protocols for maximizing analgesic duration while minimizing side effects. Additionally, the inclusion of patient-reported outcomes, such as quality of recovery and long-term satisfaction, alongside objective measures of pain and hemodynamic stability, would offer a better evaluation of the adjuvants' impact. Research into the molecular and pharmacokinetic mechanisms underlying the adjuvants' effects could also provide valuable insights, potentially leading to the development of new and improved formulations.

CONCLUSION

The detailed analysis across various parameters, including demographic distribution, physical characteristics, hemodynamic stability and side effects, provides a comprehensive understanding of the comparative effectiveness and safety of dexmedetomidine and dexamethasone as adjuvants in TAP blocks. The results indicate that both adjuvants are comparable in many aspects with some differences in side effect profiles and BMI. These findings can inform clinical decisions and future research in optimizing pain management protocols for infraumbilical surgeries.

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