"Comparison of Perineural versus intravenous dexamethasone as adjuncts to Levobupivacaine for Interscalene brachial plexus block in patients undergoing arthroscopic shoulder surgery under General anaesthesia"

DISSERTATION SUBMITTED TO THE

[redacted]

BY

[redacted]

[redacted]

CERTIFICATE

DECLARATION

ABSTRACT

Background: Effective postoperative analgesia is essential following arthroscopic shoulder surgery. Interscalene brachial plexus block using long-acting local anesthetics is widely practiced, and dexamethasone is commonly used as an adjuvant to prolong analgesia. However, the optimal route of dexamethasone administration perineural or intravenous remains a subject of debate.

Aim: [redacted]

Methods: [redacted]

Results: [redacted]

[redacted]

[redacted]

Conclusion: [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Keywords: Interscalene brachial plexus block; Dexamethasone; Perineural administration; Intravenous administration; Levobupivacaine; Arthroscopic shoulder surgery; Postoperative analgesia; Visual Analog Scale (VAS)

ACKNOWLEDGEMENT

LIST OF ABBREVIATIONS

ARCR	Arthroscopic Rotator Cuff Repair
ASA	American Society of Anesthesiologists
BMI	Body Mass Index
BPM	Beats Per Minute
BJA	British Journal of Anaesthesia
CI	Confidence Interval
cm	Centimetre
COPD	Chronic Obstructive Pulmonary Disease
ECG	Electrocardiogram
$ETCO_2$	End-Tidal Carbon Dioxide
GA	General Anaesthesia
gm	Gram
ID	Intravenous Dexamethasone
ISB	Interscalene Brachial Plexus Block
IV	Intravenous
kg	Kilogram
LA	Local Anaesthetic
LMA	Laryngeal Mask Airway
MAC	Minimum Alveolar Concentration
mg	Milligram
min	Minute
ml	Millilitre
MRD ID	Mixed Regimen Dexamethasone – Intravenous Group
MRD PD	Mixed Regimen Dexamethasone – Perineural Group
NPRS	Numeric Pain Rating Scale
PD	Perineural Dexamethasone
PONV	Postoperative Nausea and Vomiting
RCT	Randomized Controlled Trial
SD	Standard Deviation

SPSS	Statistical Package for the Social Sciences
VAS	Visual Analogue Scale
vs	Versus
%	Percentage
α_2	Alpha-2 (Adrenergic Receptor)

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INTRODUCTION

Postoperative pain following shoulder surgery is often severe and is commonly managed with opioids, which are associated with adverse effects such as nausea, vomiting, sedation, and delayed rehabilitation, ultimately affecting functional recovery and quality of life [1,2].

To prolong the duration and quality of peripheral nerve blocks, various local anaesthetic adjuvants such as vasoconstrictors, clonidine, ketamine, and steroids have been investigated, with inconsistent results [6,7].

[redacted]

[redacted]

[redacted]The study evaluates duration of analgesia, postoperative analgesic consumption, time to first analgesic request, and incidence of side effects in order to clarify the optimal route of dexamethasone administration.

AIMS AND OBJECTIVES

Aim:

[redacted]

Objectives:

Primary Objective:

[redacted]

Secondary Objective:

[redacted]

REVIEW OF LITERATURE

Ramprasad Sripada and colleagues 2012 in their review of the literature to assess developments of regional anaesthesia techniques used for shoulder surgery, concluded that Interscalene brachial plexus block (ISB) provides site-specific anaesthesia, effective analgesia with minimal complications, and decreased postoperative opioid use. The most remarkable advance in RA in the past few years is the increased usage of USG and augmenting anaesthetic-analgesic effects with perineural additives (including clonidine, buprenorphine, and likely low-dose dexamethasone) [2].

[redacted] performed a meta-analysis of 24 RCTs to evaluate the dose-dependent analgesic effects of perioperative dexamethasone. [redacted]

[redacted] **2014** did a systematic review and meta-analysis of Nine trials (801 patients) in which 393 patients receiving [redacted]

[redacted]

[redacted]**. 2015** systematically reviewed the safety and efficacy of perineural dexamethasone as an adjunct for peripheral nerve blockade in 29 controlled trials involving 1695 participants. [redacted]

[redacted] **2013** in a prospective, double-blind, randomised, placebo-controlled study [redacted]As

[redacted]

[redacted] **2014** did a study to determine the effects of intravenous and perineural dexamethasone on the [redacted]

[redacted] **2016** conducted a randomised, double-blind, placebo-controlled study to compare [redacted]

[redacted] **2017** did a systematic review and meta-analysis of 11 RCTs to compare the analgesic [redacted]

[redacted]

Injection of perineural dexamethasone should be cautiously balanced in light of the off-label indication for this route of administration [14].

[redacted] **2017** performed a random-effects meta-analysis of 11 randomized controlled trials [redacted]

[redacted]

2018 M Heesen et al. did a systematic review, meta-analysis, meta-regression and trial-sequential analysis. [redacted]

Using GRADE, this evidence is of low quality [16].

[redacted] **2018** evaluated whether perineural (PN) dexamethasone provides superior analgesic benefit compared with intravenous [redacted]. [redacted] The authors concluded that PN dexamethasone does not confer additional clinical benefit over IV administration and that IV dexamethasone may be preferable given safety, simplicity, and avoidance of off-label perineural use [4].

[redacted] **2019** provides important clinical insight into the ongoing debate regarding [redacted]

[redacted]No major adverse effects or hemodynamic instability were observed, reinforcing the short-term safety of both approaches.

[redacted] **2022** evaluated whether perineural dexamethasone provides superior analgesia compared with intravenous dexamethasone [redacted]The authors concluded that both routes provide comparable postoperative analgesia, suggesting that routine perineural administration may not offer meaningful clinical advantages over intravenous use in shoulder arthroscopy patients [19].

[redacted] **2023** randomized controlled trial evaluated whether intravenous dexamethasone as part of multimodal analgesia reduces [redacted]

The authors conclude that low-dose IV dexamethasone is an effective, safe, and practical strategy to reduce rebound pain and improve postoperative recovery after shoulder surgery [20].

2024 evaluated whether perineural dexamethasone offers clinically meaningful

The authors concluded that although perineural dexamethasone statistically prolongs analgesia, the magnitude of benefit is unlikely to be clinically important, and its off-label status should be carefully considered [21].

2024 conducted a comprehensive systematic review, meta-analysis, and trial

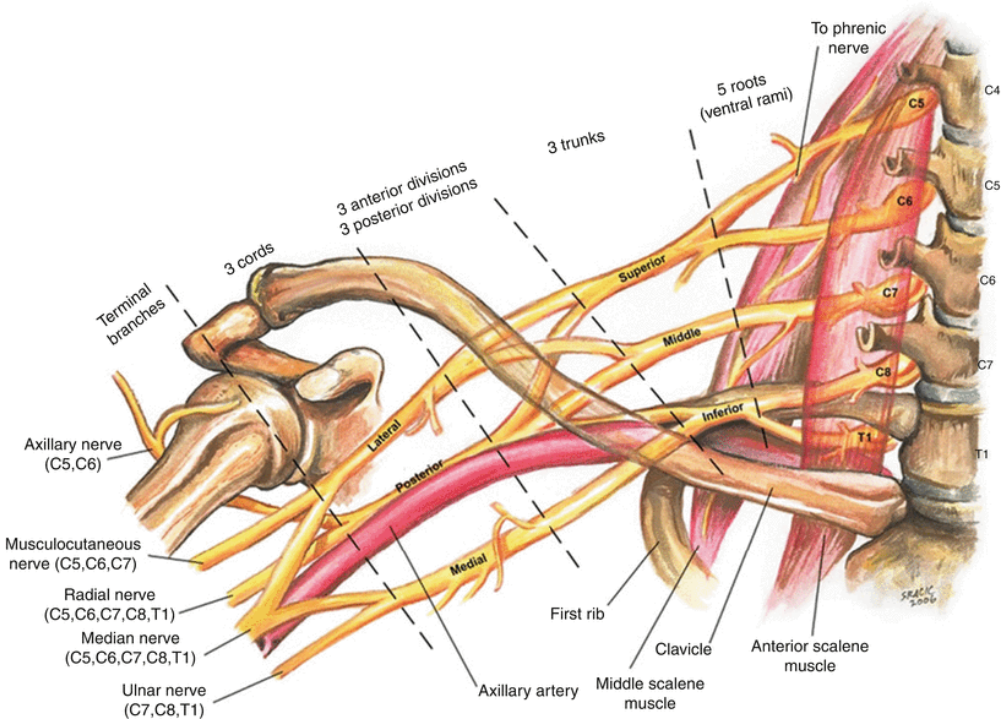


Fig 1: Anatomy of Brachial Plexus

Regional anaesthesia techniques for shoulder surgery

Regional anaesthesia has assumed a central role in the perioperative management of shoulder surgery owing to its ability to provide targeted analgesia while minimizing systemic opioid requirements.

This has led to growing interest in the use of pharmacological adjuvants added to local anaesthetics, with the aim of prolonging analgesia and reducing the need for rescue analgesics [6,7].

Interscalene brachial plexus block (ISB) is widely regarded as the gold standard regional anaesthesia technique for shoulder surgery.

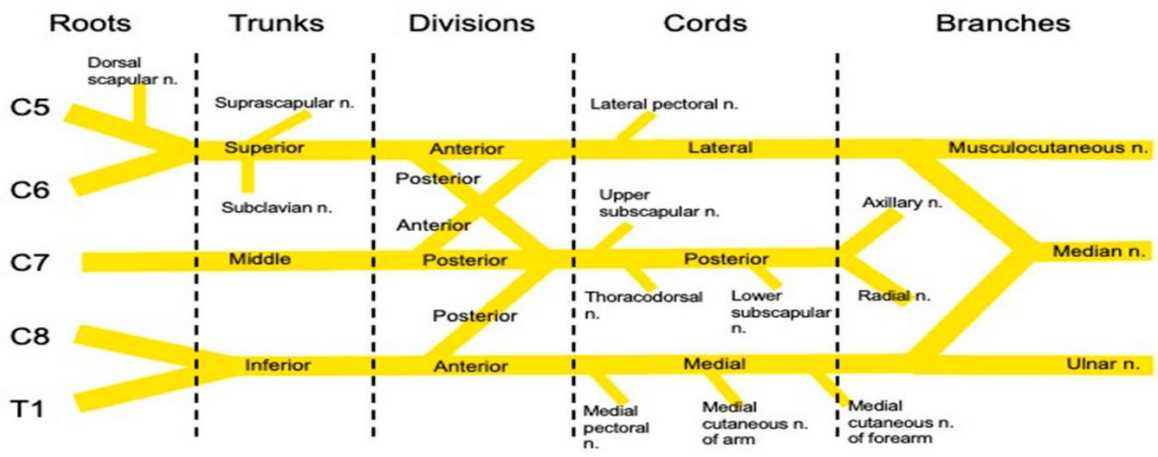


Fig 2: Diagram of brachial plexus. n. = nerve; C5 = Cervical nerve root 5; C6 = Cervical nerve root 6; C7 = Cervical nerve root 7; C8 = Cervical nerve root 8; T1 = Thoracic nerve root 1.

Drugs

Levobupivacaine

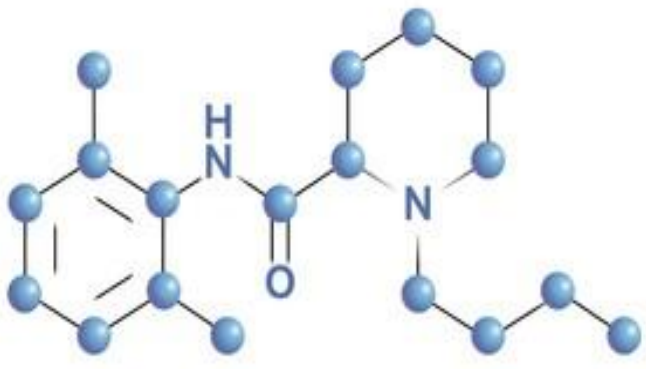


Fig 3: Molecular structure of Levobupivacaine

[redacted]

Levobupivacaine offers several advantages over racemic bupivacaine, making it a preferred agent for regional anaesthesia. [redacted]

[redacted]

[redacted]

[redacted]Its pharmacological profile supports consistent analgesia with a predictable onset and long duration [27].

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

The duration of analgesia from a single-shot interscalene brachial plexus block is limited by the pharmacological properties of the local anaesthetic. [redacted]

[redacted]

[redacted]These limitations necessitate strategies to enhance prolongation, such as adding adjuvants like dexamethasone [30].

To address the limited duration of single-injection nerve blocks, various pharmacological adjuvants have been studied for use alongside local anaesthetics.

Corticosteroids, particularly dexamethasone, have emerged as promising agents due to their anti-inflammatory properties and consistent ability to enhance block duration [9,32].

Corticosteroids such as dexamethasone are highly effective adjuncts in peripheral nerve blocks.

[redacted]

[redacted]

[redacted]Corticosteroids are among the most studied and widely accepted adjuncts due to their effectiveness and favorable safety profile [34].

[redacted]

[redacted]

Their consistent performance has made corticosteroids the preferred adjunct class for interscalene block, especially in shoulder surgery with high analgesic demands.

Table : Corticosteroid Advantages

Benefit	Impact
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

[redacted]

[redacted]

[redacted]

Dexamethasone

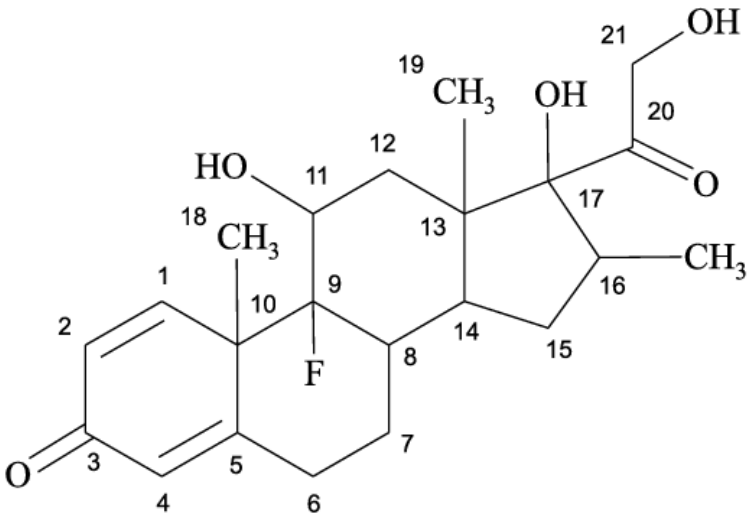


Fig 4: Molecular structure of dexamethasone

[redacted]

[redacted] **(2023)**, in a Bayesian network meta-analysis of 25 randomized controlled trials involving 2,194 patients undergoing shoulder arthroscopy with single-shot interscalene [redacted] Therefore, based on current evidence, dexamethasone can be considered the most effective and clinically practical adjuvant for

interscalene brachial plexus block compared with dexmedetomidine in patients undergoing arthroscopic shoulder surgery [36].

[redacted] **(2023)** conducted a prospective, randomized, double-blind comparative study to evaluate dexamethasone and clonidine as adjuvants to bupivacaine and lignocaine with adrenaline in interscalene brachial plexus block for upper limb surgeries. [redacted] analgesia in interscalene brachial plexus block, with fewer adverse effects and better patient comfort [37].

[redacted]

Beyond anti-inflammatory effects, dexamethasone acts through analgesic and anti-hyperalgesic pathways. [redacted]

[redacted] analgesia when dexamethasone is used as an adjunct in peripheral nerve blocks [39].

[redacted]

Table : Analgesic and Anti-hyperalgesic Effects

Effect	Mechanism
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

Pharmacokinetics Relevant to Anaesthesia

Dexamethasone displays pharmacokinetic properties that support its effectiveness in perioperative analgesia. [redacted]

[redacted]Perineurally administered dexamethasone exhibits slower systemic absorption, allowing more localized activity near the nerve [40].

[redacted]

Table : Pharmacokinetic Features of Dexamethasone

Parameter	Effect
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted])	[redacted]

[redacted]

Dexamethasone offers several perioperative advantages, particularly in surgeries associated with significant pain such as arthroscopic shoulder procedures. [redacted]Its stable [redacted]

Major perioperative advantages include:

- Prolonged duration of sensory block

Table : Perioperative Benefits of Dexamethasone

Benefit	Clinical Impact

Perineural administration of dexamethasone has been shown to significantly prolong the duration of analgesia when added to local anaesthetics for brachial plexus block.

[redacted]

Evidence suggests that perineural dexamethasone may provide greater prolongation with bupivacaine compared to ropivacaine, highlighting heterogeneity in study outcomes [14,16].

Intravenous dexamethasone and systemic analgesic effects

Intravenous dexamethasone has long been used in anaesthetic practice for its systemic anti-inflammatory and antiemetic effects. [redacted]

Safety concerns and adverse effects of dexamethasone

The safety of dexamethasone, particularly when administered perineurally, has been a subject of concern due to its off-label use. [redacted]

Despite reassuring clinical evidence, authors have consistently recommended careful patient selection and consideration of risk–benefit balance, particularly when choosing the perineural route [4,13]

LACUNAE IN LITERATURE

Despite extensive evaluation of dexamethasone as an adjuvant to peripheral nerve blocks, several lacunae persist in the existing literature.

[redacted]

[redacted]

[redacted]

[redacted]

RESEARCH QUESTION

[redacted]

MATERIALS AND METHODS

STUDY SITE- [redacted]

STUDY DESIGN- [redacted]

STUDY POPULATION- [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Inclusion Criteria:

[redacted]

[redacted]

[redacted]

Exclusion Criteria:

[redacted]

[redacted]

[redacted]

METHODOLOGY:

[redacted]

Group ID (Intravenous Dexamethasone)

[redacted]

Group PD (Perineural Dexamethasone Group)

[redacted]

[redacted]

[redacted]

Assessment Procedure:

[redacted]

Criteria for rescue analgesia:

[redacted]

Medication Protocol:

[redacted]

Duration of Sensory Block:

[redacted]

[redacted]

OBSERVATIUON AND RESULTS

Table 1: Gender Distribution of Patients in Perineural Dexamethasone (MRD-PD) and Intravenous Dexamethasone (MRD-ID) Groups Undergoing Arthroscopic Shoulder Surgery Under General Anaesthesia

Gender	Group		Total	p-value
	MRD PD	MRD ID		
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	

[redacted]

[redacted]

[redacted]

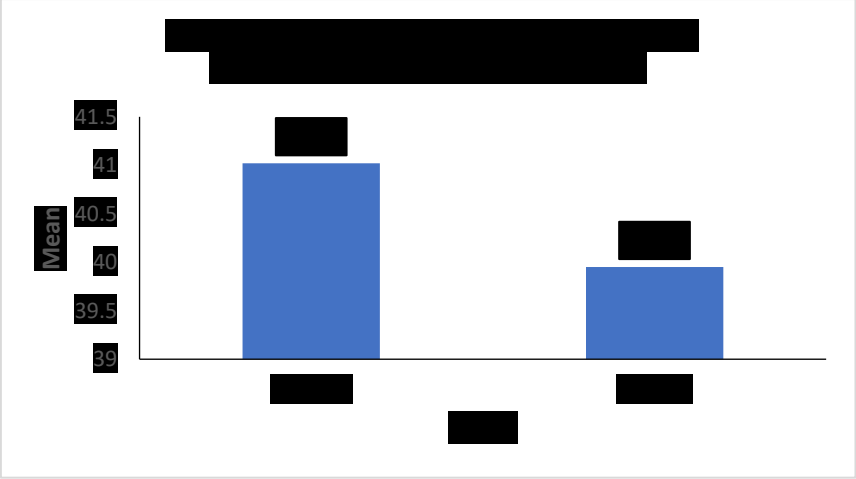
[redacted]

[redacted]Table 2: Comparison of Age Between Perineural and Intravenous Dexamethasone Groups

Group	Number of patients	Age (years)		p-value
		Mean	SD	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	

[redacted]

Graph 1: Comparison of Age Between Perineural and Intravenous Dexamethasone Groups



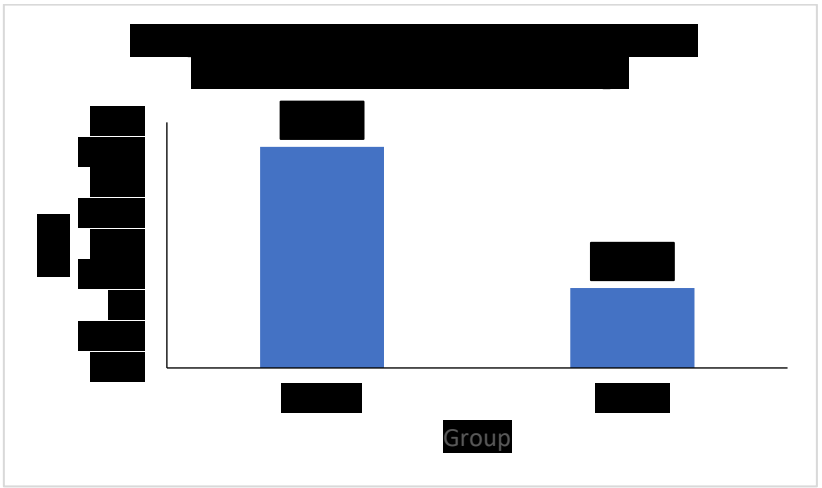
[redacted]The [redacted]

Table 3: Comparison of Height Between Perineural and Intravenous Dexamethasone Groups

Group	Number of patients	Height (cm)		p-value
		Mean	SD	
[redacted]				
[redacted]				

[redacted] ([redacted]) Unpaired t-test used

Graph 2: Comparison of Height Between Perineural and Intravenous Dexamethasone Groups



[redacted]The

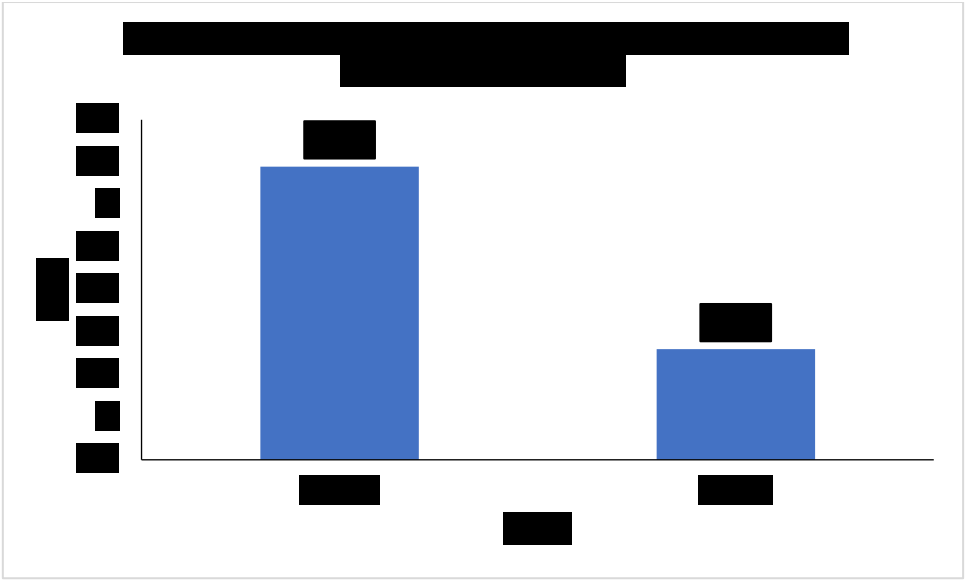
[redacted]

Table 4: Comparison of Weight Between Perineural and Intravenous Dexamethasone Groups

Group	Number of patients	Weight (kg)		p-value
		Mean	SD	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	

[redacted]

Graph 3: Comparison of Weight Between Perineural and Intravenous Dexamethasone Groups



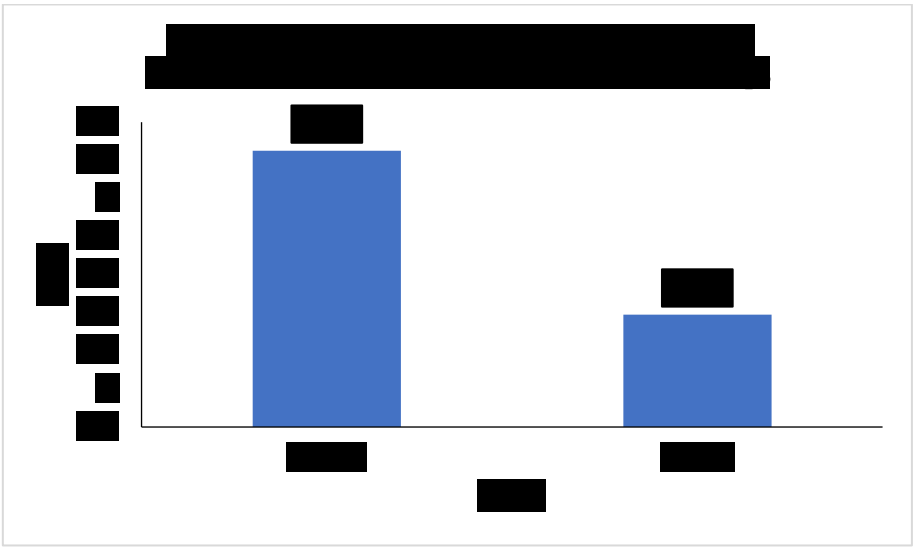
[redacted]

[redacted]

Table 5: Comparison of Body Mass Index (BMI) Between Perineural and Intravenous Dexamethasone Groups

Group	Number of patients	BMI		p-value
		Mean	SD	

Graph 4: Comparison of Body Mass Index (BMI) Between Perineural and Intravenous Dexamethasone Groups



The unpaired t-test showed no significant difference ( ).

Table 6: Comparison of ASA Physical Status Between Perineural and Intravenous Dexamethasone Groups

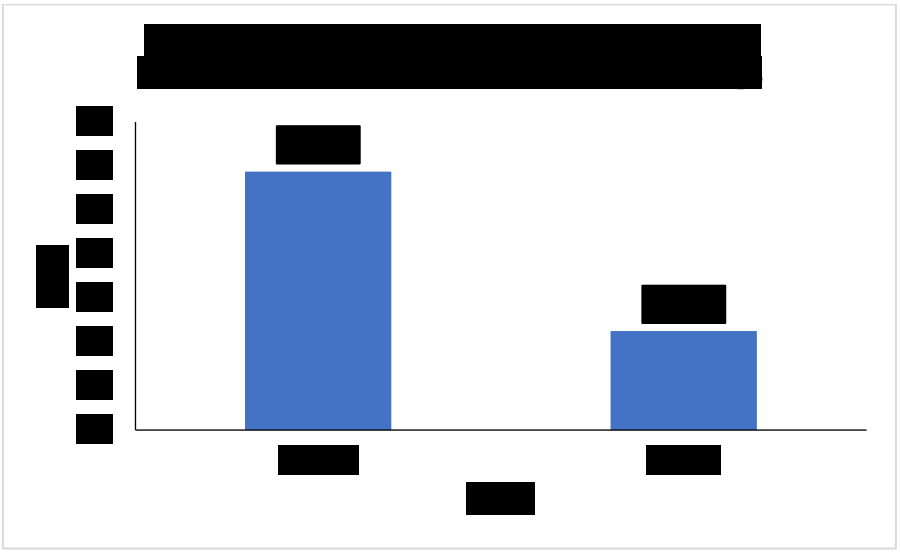
ASA grade	Group		Total	p-value
	MRD PD	MRD ID		

Table 7: Comparison of Duration of Sensory Block Between Perineural and Intravenous Dexamethasone Groups

Group	Number of patients	Duration of sensory blocked (min)		p-value
		Mean	SD	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	

[redacted]

Graph 5: Comparison of Duration of Sensory Block Between Perineural and Intravenous Dexamethasone Groups



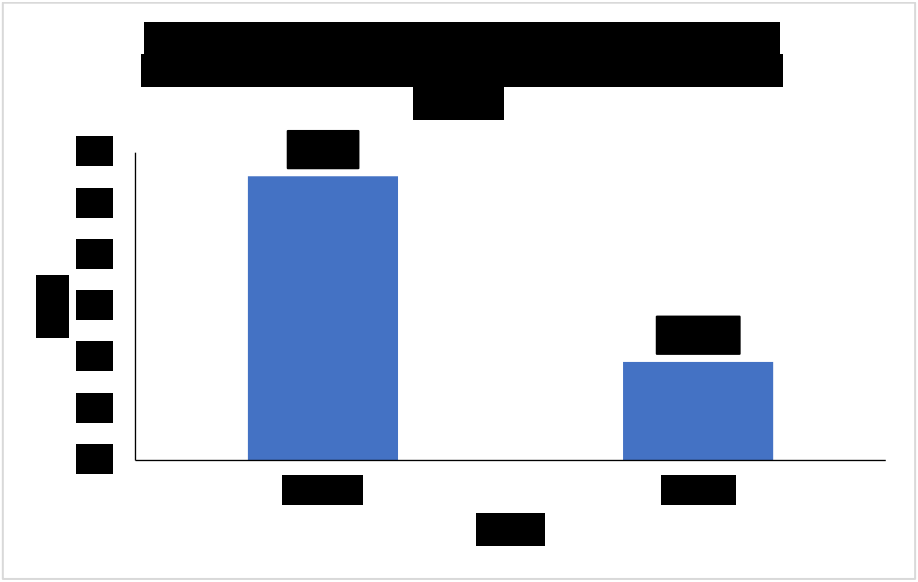
[redacted]

Table 8: Comparison of Time to First Analgesic Requirement Between Perineural and Intravenous Dexamethasone Groups

Group	Number of patients	Duration of requirement of 1st analgesic (min)		p-value
		Mean	SD	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	

[redacted]

Graph 6: Comparison of Time to First Analgesic Requirement Between Perineural and Intravenous Dexamethasone Groups



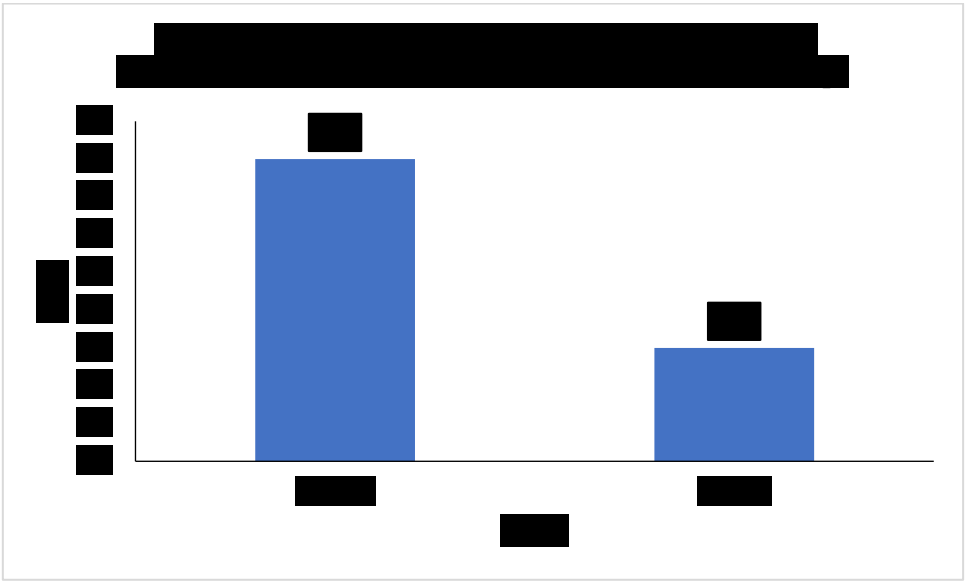
[redacted]

Table 9: Comparison of Time to Second Analgesic Requirement Between Perineural and Intravenous Dexamethasone Groups

Group	Number of patients	Duration of requirement of 2nd analgesic (min)		p-value
		Mean	SD	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	

[redacted]

Graph 7: Comparison of Time to Second Analgesic Requirement Between Perineural and Intravenous Dexamethasone Groups



[redacted]

Table 10: Comparison of Number of Postoperative Analgesic Doses Between Perineural and Intravenous Dexamethasone Groups

Number of analgesic given	Group		Total	p-value
	MRD PD	MRD ID		
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	

[redacted]

Table 11: Comparison of Postoperative Nausea and Vomiting (PONV) Between Perineural and Intravenous Dexamethasone Groups

PONV	Group		Total	p-value
	MRD PD	MRD ID		
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	

[redacted]

[redacted]

[redacted]

Table 12: Comparison of Visual Analogue Scale (VAS) Scores at Different Postoperative Time Intervals Between Perineural and Intravenous Dexamethasone Groups

VAS at	MRD PD			MRD ID			p-value
	Min	Max	Median	Min	Max	Median	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Table 13: Within-Group Comparison of Postoperative Visual Analogue Scale (VAS) Scores Over Time in Perineural and Intravenous Dexamethasone Groups

VAS at	MRD PD			p-value	MRD ID			p-value
	Min	Max	Median		Min	Max	Median	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

[redacted]

DISCUSSION

Among arthroscopic shoulder surgeries, rotator cuff repair, Bankart repair, posterior labrum repair, and SLAP repair are the most commonly performed procedures. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]This finding supports the hypothesis that local perineural administration of

[redacted]

Secondary outcomes included the time to first, second, and third rescue analgesic requirement, as well as overall postoperative analgesic consumption. [redacted]

rescue analgesic when compared to intravenous dexamethasone.

Similarly, the mean (SD) time to second analgesic requirement was [redacted] minutes in the MRD PD group and [redacted] minutes in the MRD ID group, [redacted]

In terms of total postoperative analgesic consumption, [redacted] of patients in the MRD PD group required [redacted]

duration, this did not result in a significant reduction in the number of postoperative analgesic

doses required. [redacted]

The inter-group comparison of Visual Analog Scale (VAS) scores demonstrated that postoperative [redacted]

However, at [redacted] hours, the MRD PD group showed a significantly lower median VAS score ([redacted]) compared to the MRD ID group ([redacted]) with a statistically significant difference (p = [redacted]). [redacted]

The incidence of postoperative nausea and vomiting (PONV) was low and comparable between the two groups. [redacted]

[redacted]

Overall, the findings of this study demonstrate that perineural dexamethasone significantly prolongs [redacted] perineural steroid use and the need for simplicity and safety in routine clinical practice.

[redacted]

The mean (SD) BMI in the MRD PD group was [redacted] ± [redacted] kg/m², while in the MRD ID group it was [redacted] ± [redacted] kg/m², with no statistically significant intergroup difference (p = [redacted]). [redacted]

[redacted]

In the MRD PD group, [redacted] of patients were ASA I and [redacted] were ASA II, while in the MRD ID group, [redacted] were ASA I and [redacted] were ASA II. [redacted]

[redacted]

The mean (SD) duration of sensory block was [redacted] ± [redacted] minutes in the MRD PD group compared with [redacted] ± [redacted] minutes in the MRD ID group, and this difference was highly statistically significant ($p <$ [redacted]). [redacted]

[redacted]These findings align with prior randomized comparisons reporting longer block

The mean (SD) time to first rescue analgesic requirement was [redacted] ± [redacted] minutes in the MRD PD group and [redacted] ± [redacted] minutes in the MRD ID group. [redacted]

[redacted]

The mean (SD) time to second analgesic requirement was [redacted] ± [redacted] minutes in the MRD PD group and [redacted] ± [redacted] minutes in the MRD ID group, with no significant difference (p = [redacted]). [redacted]

[redacted]

In the MRD PD group, [redacted] of patients required no rescue analgesic, [redacted] required one dose, [redacted] required two doses, and [redacted] required three doses. [redacted]

[redacted]

Postoperative pain intensity, assessed using VAS, was comparable between groups during the early postoperative period. [redacted]

[redacted]

The incidence of PONV was low in both groups and did not differ significantly: [redacted] patients ([redacted]) in the MRD PD group and [redacted] patients ([redacted]) in the MRD ID group (p = [redacted]). [redacted]

SUMMARY

This prospective comparative study was conducted to evaluate and compare the analgesic efficacy and side-effect profile [redacted]

The incidence of postoperative nausea and vomiting was low and did not differ significantly between groups, indicating a comparable safety profile for both routes of dexamethasone

administration. [redacted]

CONCLUSION

This prospective comparative study evaluated the analgesic efficacy and side-effect profile of perineural versus intravenous dexamethasone as an adjunct to levobupivacaine for interscalene brachial plexus block in adult patients undergoing arthroscopic shoulder surgery under general anaesthesia. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]Perineural dexamethasone can therefore be considered a more effective adjunct to levobupivacaine for interscalene brachial plexus block in arthroscopic shoulder surgery when prolonged analgesia is desired.

STRENGTHS AND LIMITATIONS

STRENGTHS OF THE STUDY:

- **Prospective comparative design**: [redacted]
- **Well-matched baseline characteristics**: [redacted]
- **Standardized anesthetic technique**: [redacted]
- **Clinically relevant outcomes**: [redacted]
- **Use of appropriate statistical tests**: [redacted]
- **Comprehensive pain assessment**: [redacted]
- **Evaluation of safety profile**: [redacted]

Adequate sample size for primary outcome:

LIMITATIONS OF THE STUDY

Single-center study:

Short follow-up duration:

Use of general anesthesia in all patients:

Lack of blinding:

Rescue analgesic protocol influence:

Limited

[redacted]**Dose-response relationship not studied**: [redacted]

[redacted]

[redacted]

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STUDY PROFORMA

PATIENT INFORMATION SHEET

INFORMED CONSENT FORM

MASTER CHART