



Comparison between Magnesium Sulphate and Buprenorphine as an Adjuvant to Bupivacaine in Ultrasound-Guided Transverse Abdominis Plane Block for Post-Operative Analgesia in Parturients Undergoing Caesarean Section

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(Received: 16 November 2024

Revised: 20 December 2024

Accepted: 04 January 2025)

KEYWORDS

Bupivacaine,
Magnesium Sulphate,
Buprenorphine,
Transversus Abdominis Plane Block, Caesarean Section, Post-operative Analgesia.

ABSTRACT:

Background: This study evaluates the comparative efficacy of Magnesium Sulphate and Buprenorphine as adjuvants to Bupivacaine in an ultrasound-guided Transversus Abdominis Plane (TAP) block for post-operative analgesia in parturients undergoing Caesarean section.

Methods: A prospective, double-blinded, randomized controlled study was conducted on sixty patients (n=60) aged 18–40 years with ASA grade 2 and 3, undergoing elective or emergency Caesarean section. Patients were randomly divided into two groups: Group M (n=30) received 18 ml of 0.25% Bupivacaine with 1 ml Magnesium Sulphate (500 mg) and 1 ml normal saline per side, while Group B (n=30) received 18 ml of 0.25% Bupivacaine with 0.5 ml Buprenorphine (150 mcg) and 1.5 ml normal saline per side. The primary outcome was the duration of post-operative analgesia, while secondary outcomes included the time to first rescue analgesic requirement, total rescue analgesia required over 24 hours, pain intensity using the Visual Analog Scale (VAS), and hemodynamic stability.

Results: Group B demonstrated significantly prolonged analgesia (9.72±0.879 hours) compared to Group M (7.45±1.03 hours) (p<0.001). The requirement for rescue analgesia was lower in Group B (1.7±0.466 doses) than in Group M (2.13±0.68 doses) (p=0.045). VAS scores were significantly lower in Group B at 8, 12, 18, and 24 hours post-operatively (p<0.05). Hemodynamic parameters remained stable in both groups.

Conclusion: The addition of Buprenorphine to Bupivacaine in TAP block provides prolonged post-operative analgesia, reduces the need for rescue analgesia, and minimizes pain intensity without significant hemodynamic alterations. Buprenorphine appears superior to Magnesium Sulphate as an adjuvant for enhanced post-operative pain management in Caesarean section patients.

INTRODUCTION

Post-operative pain management following a Caesarean section is crucial to ensure early ambulation, maternal-

infant bonding, and the prevention of complications such as thromboembolism.[1] Effective pain control also facilitates early recovery and reduces the incidence of



chronic post-surgical pain. Traditionally, post-Caesarean analgesia has been managed using systemic opioids, regional anesthesia techniques, and multimodal analgesia approaches.[2] However, opioid use is associated with significant side effects, including respiratory depression, nausea, vomiting, pruritus, and sedation, which can impact maternal well-being and the ability to care for the newborn.[3] Therefore, regional anesthesia techniques such as the Transversus Abdominis Plane (TAP) block have gained prominence in enhancing post-operative analgesia while minimizing opioid consumption.

The TAP block is a widely used regional anesthesia technique that involves the deposition of local anesthetic between the internal oblique and transversus abdominis muscles.[4] This approach provides analgesia by blocking the anterior divisions of the thoracolumbar nerves (T6-L1), which supply sensation to the anterior abdominal wall. The effectiveness of TAP block in reducing post-Caesarean pain has been well-documented, particularly in multimodal analgesia regimens. However, the duration of analgesia with local anesthetics alone is limited. To enhance the efficacy and prolong the duration of TAP block, adjuvants such as opioids, alpha-2 agonists, corticosteroids, and NMDA receptor antagonists have been explored.

Buprenorphine, a partial mu-opioid receptor agonist, has shown promise as an adjuvant in various regional anesthesia techniques due to its long-lasting analgesic effect and minimal systemic opioid-related adverse effects.[5] It has high receptor affinity and a prolonged duration of action, making it an attractive option for prolonging analgesia in TAP blocks. Additionally, its ability to inhibit sodium ion channels and enhance opioid receptor activation at peripheral nerve terminals may contribute to its prolonged analgesic effects. Studies have demonstrated that Buprenorphine can significantly extend analgesia duration when used as an adjuvant in nerve blocks, reducing the need for rescue analgesia and improving post-operative recovery.

Magnesium Sulphate, an NMDA receptor antagonist, has also been investigated as an adjuvant in regional anesthesia due to its ability to modulate central sensitization and pain transmission.[6] It plays a role in reducing post-operative pain by inhibiting the release of excitatory neurotransmitters and preventing

hyperalgesia. Previous studies have shown mixed results regarding its efficacy in prolonging analgesia duration when used as an adjuvant in nerve blocks.[7] While some research suggests that Magnesium Sulphate can enhance post-operative analgesia, its effect may not be as pronounced as that of opioid adjuvants such as Buprenorphine.[8]

Given the potential benefits of both Buprenorphine and Magnesium Sulphate in prolonging post-operative analgesia, this study aims to compare their efficacy when used as adjuvants to Bupivacaine in ultrasound-guided TAP block for post-operative pain relief in parturients undergoing Caesarean section. By evaluating the duration of analgesia, rescue analgesia requirements, and pain intensity, this study seeks to determine the optimal adjuvant for enhancing the efficacy of TAP block in post-Caesarean analgesia.

AIM

The aim of this study is to compare the post-operative analgesic effects of Magnesium Sulphate and Buprenorphine when added to Bupivacaine for Transversus Abdominis Plane (TAP) block in parturients undergoing Caesarean section.

Methods

Study Design: Prospective, double-blinded, randomized controlled study.

Study Population: Sixty parturients aged 18–40 years, ASA grade 2 and 3, undergoing elective or emergency Caesarean section under spinal anesthesia.

Randomization and Intervention: Patients were randomized into two groups (n=30 each):

- **Group M:** 18 ml of 0.25% Bupivacaine + 1 ml Magnesium Sulphate (500 mg) + 1 ml normal saline per side.
- **Group B:** 18 ml of 0.25% Bupivacaine + 0.5 ml Buprenorphine (150 mcg) + 1.5 ml normal saline per side.

TAP block was administered bilaterally under ultrasound guidance following skin closure. Post-operative monitoring included pain scores, rescue analgesia requirements, and hemodynamic stability for 24 hours.



Outcome Measures:

- **Primary outcome:** Duration of analgesia (time to first rescue analgesic requirement).
- **Secondary outcomes:** Total rescue analgesia requirement, post-operative pain intensity (VAS), and hemodynamic parameters (heart rate, blood pressure, oxygen saturation).

Statistical Analysis: Data were analyzed using SPSS version 21. Descriptive statistics were expressed as mean ± SD. Independent t-tests and chi-square tests were used for inter-group comparisons. A p-value <0.05 was considered statistically significant.

FINDINGS AND RESULTS

Table 1 : COMPARISON OF MEAN AGE AND BMI

Factor	Group M		Group B		p value
	Mean	SD	Mean	SD	
Age	25.23	6.56	26.41	7.34	0.207
BMI	26.87	0.95	27.06	1.28	0.111

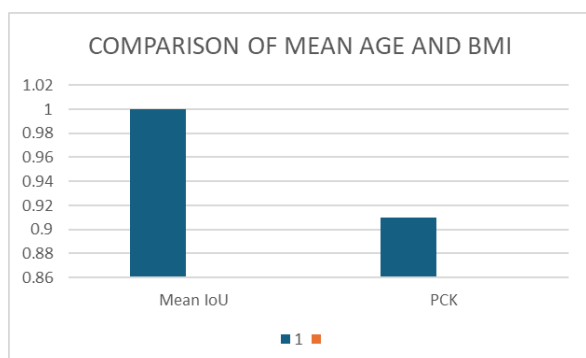


Figure 1 : COMPARISON OF MEAN AGE AND BMI

Table 2 : COMPARISON OF HEMODYNAMICS PARAMETERS

HEART RATE	Group M	Group B	P value
PREOP	86.73±9.61	85.56±8.23	0.41
POSTOP	86.45±12.13	79.56±5.63	0.001
2 HOURS	83.91±9.86	79±5.91	0.007
4 HOURS	78.96±5.62	79.23±5.21	0.685

6 HOURS	84.56±8.82	79.93±4.75	0.001
8 HOURS	83.16±12.83	79.13±5.46	0.001
12 HOURS	84.5±7.97	82.16±12.37	0.021
18 HOURS	87.3±9.53	82.93±10.21	0.712
24 HOURS	83.13±10.93	79.56±5.19	0.001
MAP	Group M	Group B	P value
PREOP	82.93±11.84	87.13±4.15	0.001
POSTOP	91.8±3.86	83.36±7.61	0.001
2 HOURS	91.16±4.11	89.46±8.72	<0.001
4 HOURS	90.76±3.8	91.26±4.2	0.595
6 HOURS	90.76±3.58	86.2±9.98	0.001
8 HOURS	91.33±4.14	83.13±11.28	0.001
12 HOURS	85.23±7.79	82.1±11.18	0.56
18 HOURS	90.8±3.67	84.96±11.56	0.001
24 HOURS	87.46±6.86	86.56±7.53	0.622
SPO2	Group M	Group B	P value
PREOP	99.03±0.85	98.93±0.69	0.271=
POSTOP	99.3±0.46	99.33±0.75	0.419
2 HOURS	98.93±0.69	98.73±0.58	0.365
4 HOURS	98.76±0.626	98.66±0.546	0.47
6 HOURS	98.8±0.61	99.13±0.77	0.201
8 HOURS	98.83±0.64	99.4±0.72	0.553
12 HOURS	98.83±0.59	99.43±0.626	0.766
18 HOURS	98.8±0.61	99.03±0.85	0.079
24 HOURS	98.8±0.66	98.96±0.76	0.453
VAS	Group M	Group B	P value
POSTOP	0.2±0.55	0.16±0.53	0.842
2 HOURS	0.23±0.81	0.3±0.876	0.707
4 HOURS	0.3±0.836	0.26±0.69	0.31



6 HOURS	0.433±1.1	0.46±1.07	0.883
8 HOURS	1.56±10.01	1.13±0.68	0.04
12 HOURS	2.6±0.49	1.73±0.73	0.037
18 HOURS	2.93±1.25	2.46±0.62	0.001
24 HOURS	3.63±0.81	2.33±0.66	0.001

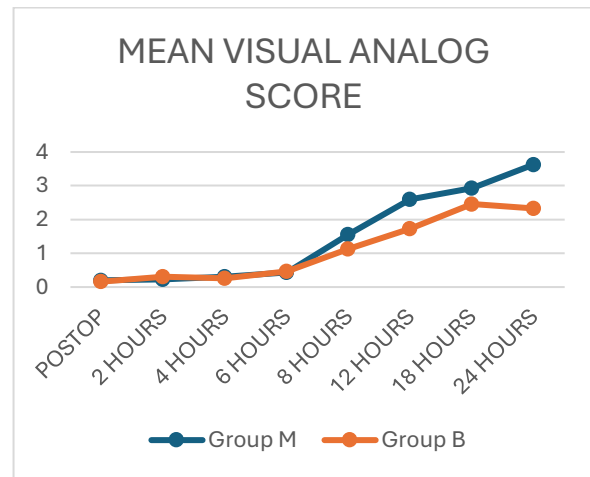


Table 3 : COMPARISON OF ANALGESIC DURATION

Factor	Group M		Group B		p value
	Mean	SD	Mean	SD	
Time for First Dose of Analgesia	7.45	1.03	9.72	0.879	.001
Total Rescue Analgesia	2.13	0.68	1.7	0.466	.045

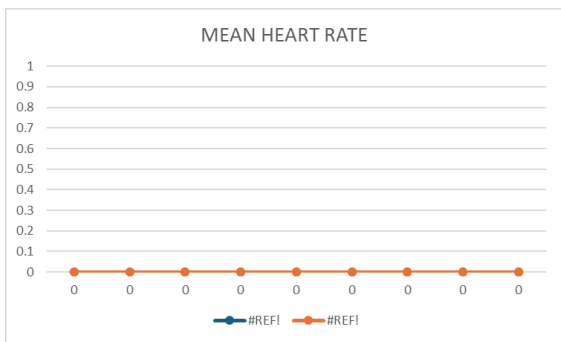


Figure 2 A, 2B, 2C, 2C,2D : MEAN HEMODYNAMICS

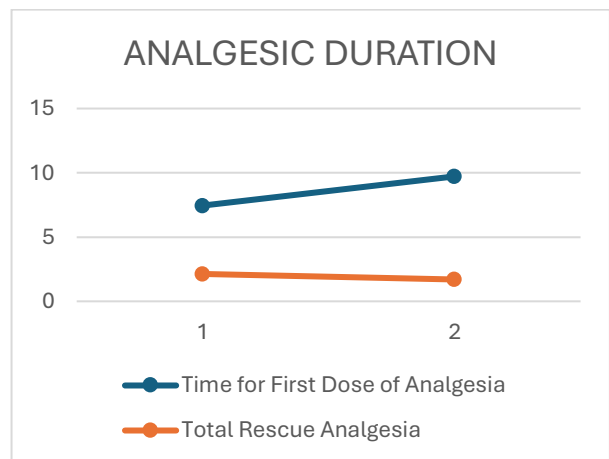
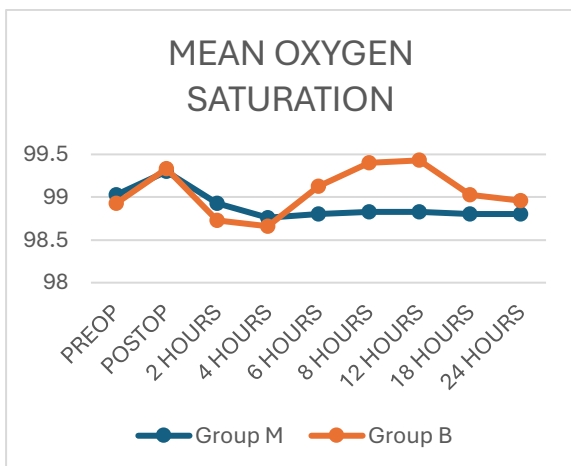
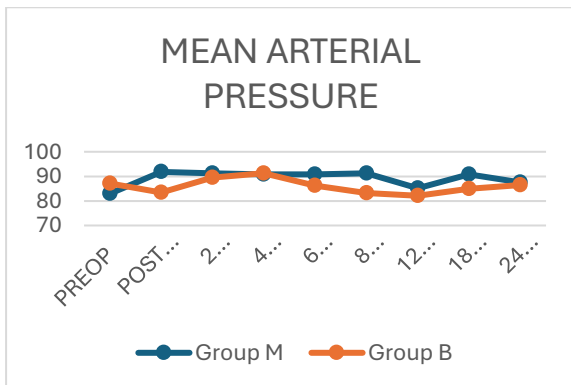


Figure 3 : ANALGESIC DURATION

Findings

The study compared the analgesic effects of Magnesium Sulphate and Buprenorphine as adjuvants to Bupivacaine in TAP block for post-operative analgesia in parturients undergoing Caesarean section. The results indicate that the addition of Buprenorphine significantly prolonged



the duration of analgesia, reduced the requirement for rescue analgesics, and provided superior pain relief compared to Magnesium Sulphate.

1. Duration of Analgesia:

○ Group B (Buprenorphine) exhibited a significantly prolonged duration of analgesia (9.72 ± 0.879 hours) compared to Group M (Magnesium Sulphate) (7.45 ± 1.03 hours), with a statistically significant p-value of <0.001 .

2. Rescue Analgesia Requirement:

○ The requirement for rescue analgesia was lower in Group B (1.7 ± 0.466 doses) than in Group M (2.13 ± 0.68 doses) ($p=0.045$). This indicates that patients in the Buprenorphine group required fewer additional doses of analgesics in the 24-hour post-operative period.

3. Pain Scores (VAS):

○ At 2 and 4 hours post-operatively, both groups had comparable VAS scores, likely due to the residual analgesic effects of spinal anesthesia.

○ However, at 8, 12, 18, and 24 hours, patients in Group B reported significantly lower VAS scores than those in Group M ($p<0.05$), suggesting better sustained pain relief with Buprenorphine.

4. Hemodynamic Stability:

○ Both groups demonstrated stable hemodynamic parameters, including heart rate, mean arterial pressure (MAP), and oxygen saturation (SpO_2), with no significant inter-group differences.

○ There were no notable adverse effects such as respiratory depression, excessive sedation, or nausea, reinforcing the safety of both adjuvants.

SUMMARY OF FINDINGS:

Buprenorphine as an adjuvant to Bupivacaine in TAP block significantly extends analgesia duration, reduces the need for additional analgesics, and enhances post-operative pain relief compared to Magnesium Sulphate. Given its prolonged effect and opioid-sparing properties, Buprenorphine presents itself as a preferred adjuvant for optimizing post-Caesarean analgesia.

DISCUSSION

The findings of this study align with previous research indicating that opioid adjuvants, particularly Buprenorphine, provide extended analgesic benefits when used in TAP block.[9] The prolonged analgesia observed in Group B can be attributed to Buprenorphine's high receptor affinity, long duration of action, and peripheral anti-nociceptive effects.[10] Buprenorphine is a partial μ -opioid receptor agonist with prolonged receptor binding, which accounts for its extended analgesic effect. It inhibits sodium ion channels similar to local anesthetics and enhances opioid receptor activation at the peripheral nerve terminals.[11] The lipophilic nature of Buprenorphine prevents extensive systemic spread, reducing the risk of delayed respiratory depression while providing prolonged pain relief.[12]

On the other hand, Magnesium Sulphate acts as an NMDA receptor antagonist, reducing central sensitization and peripheral pain transmission.[13] While it enhances post-operative analgesia, its efficacy in extending the duration of analgesia is lower than that of Buprenorphine.[14] Prior studies have reported inconsistent results with Magnesium Sulphate in TAP block, possibly due to variations in dosage, patient characteristics, and surgical settings.[15] Studies by **Albrecht et al. (2016)** [16] and **Koinig et al. (2020)** [17] have demonstrated the effectiveness of Magnesium Sulphate in TAP block, but the present study indicates that Buprenorphine provides superior analgesia.

The findings corroborate previous research showing that Buprenorphine in regional anesthesia significantly reduces post-operative opioid consumption and improves patient comfort (**Seervi et al., 2019**[3]; **Kanazi et al., 2010**[4]). **Acharya et al. (2018)**[5] reported that adding adjuvants such as Buprenorphine to local anesthetics in regional blocks significantly prolongs analgesia duration and reduces opioid use. Similarly, **Lee et al. (2012)**[6] demonstrated that Magnesium Sulphate could extend the duration of nerve blocks, although its effect was not as prolonged as that of opioid adjuvants. The use of Buprenorphine in TAP block may contribute to an opioid-sparing approach in post-operative pain management, reducing the reliance on systemic opioids. The reduction in rescue analgesia demand translates into better post-operative recovery and patient satisfaction. Additionally, the absence of significant hemodynamic



instability or adverse effects supports the safety of both adjuvants.

CONCLUSION

Buprenorphine as an adjuvant to Bupivacaine in TAP block significantly prolongs post-operative analgesia, reduces rescue analgesia requirements, and enhances pain relief compared to Magnesium Sulphate. Its opioid-sparing effects and prolonged analgesic duration make it a preferable choice for post-Caesarean pain management.

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