



"EFFICACY OF MAGNESIUM SULFATE ADDED TO BUPIVACAINE IN TRANSVERSUS ABDOMINIS PLANE BLOCK FOR POST OPERATIVE ANALGESIA AFTER INGUINAL HERNIORRHAPHY"

Dr. Jyothi Veerappa Angadaki

Mbbs Postgraduate In Department Of Anaesthesiology

Dr. Anitha Hanji S.

Mbbs , Md Professor, Department Of Anaesthesiology

Dr. Samiksha Agarwal

Mbbs Postgraduate In Department Of Anaesthesiology

Dr. Rajendrakumar Ks

Mbbs Postgraduate In Department Of Anaesthesiology

Dr. Adarsh Sr

Mbbs Postgraduate In Department Of Anaesthesiology

Dr. Anusree E V

Mbbs Postgraduate In Department Of Anaesthesiology

ABSTRACT

Background: TAPB is an effective component of multimodal analgesic regimens for various abdominal procedures. MgSO₄ is an ideal adjuvant in TAPB. We studied the efficacy of MgSO₄ as an adjuvant to bupivacaine in TAPB in patients undergoing inguinal hernia repair. **Objectives:** The aim of this study is to evaluate the efficacy of MgSO₄ as an adjuvant to bupivacaine in ultrasound guided TAPB for postoperative analgesia in inguinal herniorrhaphy. 1) To determine duration of postoperative analgesia. 2) To determine the intensity of postoperative analgesia. **Materials And Methods:** 48 cases were divided into 2 groups, Group 1 (n=24) received 18ml of 0.25% bupivacaine with 2ml of 0.9% NaCl, whereas Group 2 (n=24) received 18ml of 0.25% bupivacaine with 2ml MgSO₄(200mg). Patients were evaluated for pain at 0, 1, 2, 3, 4, 8, 12, 16, 20 and 24h. Time to first rescue analgesic and duration of postoperative analgesia was noted. VAS during rest and VAS movement, Time to the first rescue opioid analgesic dose, Duration of analgesia, Total dose of opioid analgesic requirements (mg), Patient satisfaction, Patient ambulation time were also recorded and statistical analysis was done. **Results:** There were no significant differences between the two groups regarding age, BMI, and ASA Score. On comparison of MABP, HR, SP02 among 2 groups there is no much statistical difference among all times noticed. On comparing VAS during rest and at movement, there was a statistically significant decrease in group 2. Time elapsed for demand of rescue analgesia is more in group 2. Total dose of opioid used is statistically more in group 1. Patient satisfaction and duration of analgesia is more towards group 2. **Conclusion:** - MgSO₄ (200 mg) as an adjuvant to bupivacaine in ultrasonography guided TAPB prolongs the duration of analgesia, reduces postoperative pain scores, and decreases demands for rescue analgesics.

KEYWORDS : Transversus abdominis plane, Magnesium sulphate, Postoperative analgesia.

INTRODUCTION:

Inguinal hernia considered the third common disease in surgeries for adult after acute appendicitis and proctologic disorders. About 20 million of inguinal hernia repairs are performed globally. Inguinal herniorrhaphy is frequently associated with persistent postoperative pain.¹

Most of the patients scheduled for surgery endure emotional stress due to their fear of postoperative pain. Major abdominal surgeries are often accompanied by excruciating pain, which, if not adequately managed, can reduce patient comfort and satisfaction, delay mobilization, compromise respiratory and cardiac functioning, and increase healthcare costs.²

The transversus abdominis plane (TAP) block is a fascial plane block where local anaesthetic is deposited in the plane between the internal oblique and the transversus abdominis muscle containing T10-L1 thoracolumbar nerves. Although only the somatic component of pain is blocked, a consistent benefit in terms of prolonged duration of postoperative analgesia and decreased consumption of opioids in the first 24-48 hours.³

Bupivacaine is a potent local anesthetic with unique characteristics from the amide group of local anesthetics.⁴ A number of adjuvants have been used with local anaesthetics, like dexamethasone, magnesium sulphate (MgSO₄), adenosine, buprenorphine and dexmedetomidine in TAP block to prolong the analgesic action in lower abdominal surgeries with varying results.³

The present study finds the efficacy of magnesium sulfate when added to bupivacaine in transversus abdominis plane block for post operative analgesia after inguinalherniorrhaphy.

MATERIALS AND METHODS:

The present study is a prospective randomized comparative study. After approval of Ethical Committee and informed consent obtained from each patient, this study was conducted on 48 patients of age group 20-60 years scheduled for elective inguinal herniorrhaphy with ASA 1 & 2 are selected at Bapuji hospital & Chigateri General District Hospital, teaching hospital attached to J.J.M. Medical College, Davangere.

Aims : The aim of this study is to evaluate the efficacy of MgSO₄ as an adjuvant to bupivacaine in ultrasound guided TAPB for postoperative analgesia in inguinal herniorrhaphy.

Objectives:- To determine duration of postoperative analgesia. To determine the intensity of postoperative analgesia.

Inclusion criteria: ASA 1& 2, Patients aged 20 -60 years, Posted for elective primary unilateral open inguinal hernia repair, Patient given valid written informed consent.

Exclusion criteria: Local infection at the site where the needle for block to be inserted, Long term steroid therapy, BMI more than or equal to 30 kg/m², Patient inability to properly describe postoperative pain to investigator(dementia, delirium, as well as psychiatric and neurological disorders), Coagulation disorders, Preoperative opioid or NSAIDs, Allergy or

contraindication to studied medication or anaesthetic agents, Patients not willing to take part in the study.

METHOD:

48 adult patients who fulfilled all inclusion criteria and exclusion criteria and are willing to participate in this study was selected, informed and written consent was taken from all patients. 48 cases were divided into 2 groups with 24 cases in each group using random number table (simple randomized technique).

- Group 1 (n=24) received 18ml of 0.25% bupivacaine with 2ml of 0.9% NaCl.
- Group 2 (n=24) received 18ml of 0.25% bupivacaine with 2ml MgSO₄ (200mg).

They were evaluated for pain at 0, 1, 2, 3, 4, 8, 12, 16, 20 and 24h. Time to first rescue analgesic and duration of postoperative analgesia was noted.

Procedure:

Preoperative evaluation of patients was carried out through. Pre-anesthetic check-up (History & clinical examination), along with demographic data like age, weight, height and BMI was recorded. Routine laboratory investigations according to ASA guidelines. All patients were explained about the procedure of ultrasound-guided TAPB

All patients were explained about the procedure of ultrasound-guided TAPB and was trained to assess pain using the visual analog scale (VAS), scored from 0-10 (0=no pain, 10=worst pain imaginable).

Peanesthetic preparation and premedication: Standard NPO guidelines was followed, A peripheral line cannula (20G) was secured in all patients then IV Midazolam (0.02mg/kg) was administered to all patients as premedication 2 min before anesthesia.

A multichannel monitor was connected to the patients for continuous monitoring of ECG, heart rate (beats/min), non-invasive arterial blood pressure and peripheral oxygen saturation (SpO₂%) and their baseline vital signs was recorded.

Open repair of inguinal hernia with a mesh was performed using the Lichtenstein's technique. Ultrasound-guided TAPBs was performed under complete aseptic precautions for all patients after induction of general anesthesia.

Anesthetic Techniques: Anesthesia induction was same in both the groups. Patients was premedicated and preoxygenated with 100% oxygen by a face mask for 3 min. Patients was induced with intravenous fentanyl (1 g/kg) and propofol (2 mg/kg) and cisatracurium (0.15 mg/kg) was administered. An appropriate size laryngeal mask airway is used according to body weight and placed in the back of the throat and the cuff is inflated with the appropriate volume of air. The patients were mechanically ventilated, and maintained with isoflurane (1.2–1.5%) in 100% oxygen and incremental doses of cisatracurium (0.03 mg/kg). Then ultrasound-guided TAPB was performed for all patients at the same side of inguinal hernia repair.

Technique of ultrasound-guided transversus abdominis plane block:

Ultrasound guided TAP block helps in identifying the transversus abdominis muscle and potential space above it, called as transversus abdominis plane. In this technique we use high frequency linear probes (6–13 MHz). The probe was positioned transversely on the anterolateral part of the abdominal wall between the costal margin and iliac crest. The abdominal muscles are seen below subcutaneous fat (from superficial to the depth, external oblique, IO, TA, and

peritoneal cavity).

The plane between IO and Transversus abdominis muscle is identified. The probe is moved postero-laterally in mid-axillary line just superior to iliac crest (i.e over the triangle of petit). Then the block needle is inserted in the plane and advanced in an in-plane approach using real-time ultrasonography which facilitates easy needle visualization. After confirmation of tip in the targeted plane 20 ml of drug (bupivacaine 0.25% vs. bupivacaine 0.25% plus 2 ml MgSO₄ 10%, for groups 1 and 2 respectively) is injected with intermittent aspiration technique. Expansion of local anesthetic in the plane as a dark shadow confirms the correct placement of the needle. Inhalational anesthesia was stopped at the end of the surgery and residual neuromuscular block was reversed with atropine (0.01 mg/kg) and neostigmine (0.04 mg/kg), following which patients was extubated and shifted to postoperative care unit for further monitoring. Post op analgesia was controlled in both the groups with ketorolac 30ml IV q6h and nalbuphine 4 mg was given as rescue dose in case of VAS ≥ 4.

Measurements:

Vital Signs: Heart rate (beats/min), non-invasive blood pressure (NIBP) in mmHg, and SpO₂% was recorded.

Vital Signs Of These Patients Were Recorded As Follows:

Before induction of anesthesia, Every 15 min intraoperatively, immediately postoperatively, Hourly for the first 4 h, Every 4 h for the rest of the first 24 postoperative hours.

Pain Assessment:

1. VAS during rest and VAS movement: The severity of the pain was assessed postoperatively on a 10cm VAS, where 0 cm denotes no pain and 10 cm denotes the worst imaginable pain.

Vas Was Recorded As Follows: a) Immediately postoperatively. b) Hourly for the first 4 h. c) Every 4 h for the rest of the first 24 postoperative hours. d) Nalbuphine 4 mg was given intravenous as rescue analgesia when VAS scores ≥ 4 in the first 24 h of postoperative period.

2. **Time To The First Rescue Opioid Analgesic Dose:** The time from end of the surgery to the first analgesic dose (in min).
3. **Duration Of Analgesia:** Duration of analgesia is defined as the time interval from completion of local anesthetic administration till first need of rescue analgesic.
4. **Total Dose Of Opioid Analgesic Requirements (mg):** The total dose of nalbuphine given to the patients postoperatively is calculated.
5. **Patient Satisfaction:** Patient satisfaction with the pain management was rated on a four-point scale as excellent, good, fair, and poor.
6. **Patient Ambulation Time:** It is the time elapsed from the completion of the surgery till the first ambulation.

Statistical Analysis:

Categorical data was represented in the form of frequency and percentage. Association between variables was assessed with Chi Square Test. Quantitative data was represented as Mean & Sd. Inter Group Comparison of variables was done with Unpaired t test. Intra Group comparison was done with paired t test. A P value of <0.05 was considered statistically significant. Data was analyzed with IBM SPSS Version 22 for windows.

RESULTS:

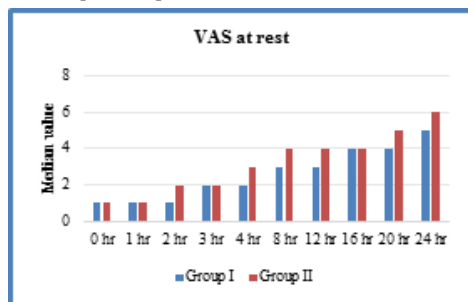
Regarding the demographic data, on comparing the two studied groups, there were no significant differences between the two studied groups regarding age, BMI, and American Society of Anaesthesiologists score.

In the present study, on comparison of MABP among 2 groups, the p value before conduction at 15 min, 30 min, 45 min, 60 min, PACU, 1hr, 2hrs, 3hrs, 4hrs, 8hrs, 12hrs, 16hrs, 20hrs, 24hrs is 0.688, 0.186, 0.001, 0.001, 0.026, 0.666, 0.264, 0.087, 0.014, 0.001, 0.098, 0.045, 0.190, 0.270, 0.071 respectively. Even though statistically significant differences are seen in 30 min, 45mn, 60 min, 3 hrs, 4 hrs, 12 hrs overall there is no much statistical difference among all times noticed

In the present study, on comparison of HR among 2 groups, the p value before conduction at 15 min, 30 min, 45 min, 60 min, PACU, 1hr, 2hrs, 3hrs, 4hrs, 8hrs, 12hrs, 16hrs, 20hrs, 24hrs is 0.343, 0.438, 0.009, 0.031, 0.011, 0.047, 0.001, 0.777, 0.636, 0.269, 0.622, 0.001, 0.793, 0.450, 0.895 respectively. Even though significant differences are seen in 30 min, 45mn, 60 min, PACU, 12 hrs overall there is no much statistical difference among all times noticed.

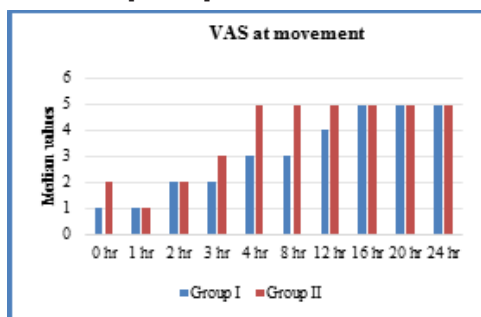
In the present study, on comparison of SpO2 among 2 groups, the p value before conduction at 15 min, 30 min, 45 min, 60 min, PACU, 1hr, 2hrs, 3hrs, 4hrs, 8hrs, 12hrs, 16hrs, 20hrs, 24hrs is 0.589, 0.267, 0.333, 0.623, 0.631, 0.487, 0.884, 0.611, 0.901, 0.801, 0.843, 0.945, 0.920, 0.958, 0.553, respectively. There is no statistically significant difference seen in spO2.

In present study on comparing VAS during rest, there was a statistically significant decrease in group 2 compared with group 1. P values at 2hr, 4hr, 8hrs, 12hrs, 20 hrs, 24hrs postoperatively were less than 0.029, 0.001, 0.013, < 0.001, < 0.001 respectively.



Graph 1: comparison of VAS at rest between 2 groups

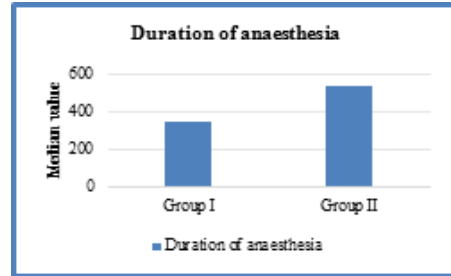
In present study on comparing VAS at movement, there was a statistically significant decrease in group 2 compared with group 1. P values at 0hr, 3hr, 4hrs, 8hrs, 12 hrs, 16hrs postoperatively were less than 0.016, 0.002, <0.001, <0.001, <0.001, <0.001 respectively.



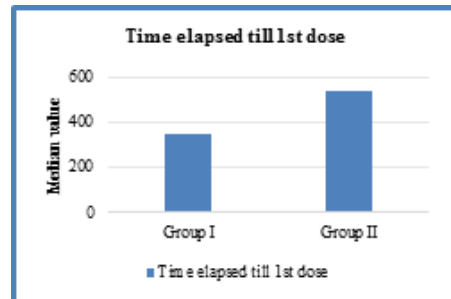
Graph 2: comparing VAS at movement between 2 groups

There was a significant increase in group 2 compared with group 1 regarding duration of analgesia ($P < 0.001$) (Graph 3).

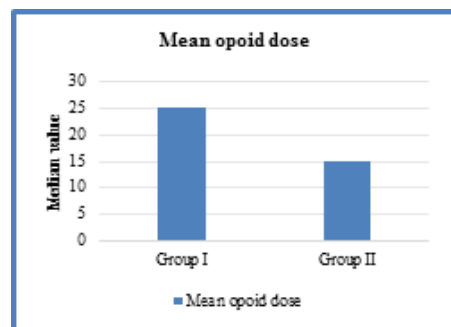
There was a significant increase in group 2 compared with group 1 regarding time elapsed till first rescue analgesic dose ($P < 0.001$) (Graph 4). There was a statistically significant decrease in total rescue analgesic dose required in group 2 compared with group 1 ($P < 0.001$) (Graph 5).



Graph 3: Comparison of duration of analgesia between 2 groups



Graph 4: Comparison of time elapsed till 1st dose between 2 groups



Graph 5: Comparison of mean opioid dose between 2 groups

DISCUSSION :

Inguinal hernias are caused by a defect in the abdominal wall in the groin area and include both inguinal and femoral hernia. Inguinal herniorrhaphy is frequently associated with persistent postoperative pain.¹ Due to their anxiety about experiencing pain after surgery, the majority of patients face mental stress before their procedures.⁵

Ultrasound-guided TAPB has been shown to effectively manage postoperative pain following cholecystectomy, cesarean section, or hernia repair, eliminating the need for a blind approach.⁶

In the present study, regarding the demographic data, on comparing the two studied groups, there were no significant differences between the two studied groups regarding age, BMI, and American Society of Anaesthesiologists score.

In par with our study, study by Balakrishna et al stated that the demographic data and surgical length of both groups were not statistically significant. A study by Becker DE et al majority of the patients were males and Shakil A noticed Inguinal hernias are more prevalent in men.⁷

In the present study, regarding the haemodynamic changes (HR, MABP, SPO2), there is no significant difference between 2 groups. Similar to current study, Siam ME found that both groups showed no significant changes in MABP, heart rate, or SpO2% during or after surgery compared to preoperative

values. A comparison of vital signs (MAPB, heart rate, and SpO₂) at different intervals revealed no significant difference between the two groups.⁸

In the present study, the mean duration of analgesia in Group 1 is 343.8 Min, whereas in Group 2 it is 536.38 min, there was a significant increase in duration of analgesia between 2 groups with a p value of <0.001. Time elapsed till first rescue analgesia in Group 1 is 343.8 Min, whereas in Group 2 it is 536.38 min with a statistically significant decrease in total rescue analgesic dose required in group 2 compared with group 1 (P<0.001).

In accordance with present study, Al-Refaey et al.,⁵ found that adding MgSO₄ to bupivacaine in TAPB improved laparoscopic cholecystectomy outcomes, which aligns with our findings. The study found that adding MgSO₄ improved postoperative analgesia by increasing duration of analgesia (19 ± 2.2 h), decreasing analgesic needs, and reducing the risk of PONV.

Similarly, Abd-Elsalam et al.,⁹ conducted a prospective, randomized, double-blind investigation on 60 women undergoing complete abdominal hysterectomy. The study found that patients who received TAPB with 20 ml of 0.25% bupivacaine and 2ml of MgSO₄ 10% (200 mg), experienced considerably prolonged postoperative analgesia (increase in duration of analgesia) is 15.67 hrs. The mean time of the first request for rescue analgesia was significantly prolonged in group I (15.67 hrs).

In our study on comparing VAS during rest, there was a statistically significant decrease in group 2 compared with group 1. On comparing VAS at movement, there was a statistically significant decrease in group 2 compared with group 1.

In accordance with our study A prospective, randomized, double-blind study was performed by Abd-Elsalam et al.,⁹ noticed that Group I (bupivacaine plus 2ml MgSO₄ 10% (200 mg) had a considerably lower mean postoperative VAS score than group II (0.25% bupivacaine) at all time periods until after 8 hours (0.6, 1, 4, 8, 2.5 at 1hrs, 2hrs, 4hrs, 6hrs, 8hrs in Group I whereas in group II it is 3.1, 1.5, 2.6, 3.5, 2.2 respectively).

Similar to current study, Samir GM¹⁰ et al stated that the addition of dexamethasone or MgSO₄ to bupivacaine reduced the VAS scores and the number of patients experiencing moderate pain. The median VAS was 0 (0-1.5) in groups BS and BM, and 0 (0-0.5) in group BM.

Siam EM⁸ discovered that using MgSO₄ (200 mg) as an adjuvant to bupivacaine in ultrasonographic-guided TAPB improves analgesia duration, reduces postoperative pain scores, and minimizes the need for rescue analgesics. Ezzat Mahmoud Siam remarked Group 2 demonstrated a statistically significant decrease in VAS during rest compared to group 1. The P values at 4, 8, 12, 16, and 20 hours postoperatively were less than 0.001, 0.038, 0.037, 0.015, and 0.006, respectively. Group 2 demonstrated a statistically significant decrease in VAS during movement compared to group 1. P-values at 4, 8, 12, 16, and 20 hours after surgery were less than 0.001, 0.001, 0.009, and 0.037, respectively.

CONCLUSION:

The present study concludes that the present study concludes that the addition of preemptive magnesium sulfate (MgSO₄) to bupivacaine in patients undergoing ultrasound-guided transversus abdominis plane block (TAPB) for inguinal hernia repair resulted in several benefits, including delayed need for opioid pain relief, extended duration of the nerve block, reduced opioid requirements, earlier ambulation, and higher

patient satisfaction, without increasing the risk of local anesthetic toxicity, hematoma, or excessive tissue trauma at the injection site.

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