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Original Research Article

Dexamethasone and Magnesium Sulphate as an adjuvant to Ropivacaine in Ultrasound-guided Subcostal Transverse Abdominis Plane block during Laparoscopic Cholecystectomy surgery: A Prospective, randomised comparative study

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Conflict of interest: Nil

Abstract:

Objectives: The present study was to compare the effectiveness of analgesia between dexamethasone and magnesium sulphate as an adjuvant to Ropivacaine in Ultrasound-guided Subcostal Transverse Abdominis Plane block during Laparoscopic Cholecystectomy surgery in terms of VAS score.

Methods: Group A received 18 mL (45 mg) of 0.25% ropivacaine with 2 mL (8 mg) dexamethasone on each side using a USG-guided SCTAP approach. Group B received 18 mL (45 mg) of 0.25% ropivacaine with 2 mL (200 mg) MgSO4 on each side using the same technique. All patients received intravenous (IV) midazolam at 0.02 mg/kg body weight as premedication 20 minutes before the induction of anaesthesia. Laparoscopic cholecystectomy was performed in the reverse Trendelenburg position. After the surgery and prior to extubation, a USG-guided bilateral SCTAP block was performed using a 10 cm Braun Stimuplex needle and a linear USG probe. Postoperative pain assessment was performed by using VAS score.

Results: A total of 60 patients were randomized into two groups (Group A & Group B). Each group had 30 patients. Majorities of cases 56(93.33%) were females. Age, weight and duration of surgery between group A and group B patients was not statistically significant ($p>0.05$). Mean VAS score was statistically significantly ($p<0.05$) lower in group B patients as compared to group A patients throughout the postoperative period. Twelve patients (20%) required rescue analgesia, with a significantly lower proportion in Group B compared to Group A (6.67% vs. 33.33%).

Conclusions: Cholecystitis is preponderance in females' population. Magnesium sulphate (200 mg) as adjuvant to ropivacaine (0.25%) in TAP block for laparoscopic cholecystectomy is significantly better analgesic effect in terms of lower VAS scores as compared to 0.25% ropivacaine with 8 mg dexamethasone.

Keywords: Cholecystectomy, TAP block, Magnesium Sulphate, ropivacaine, VAS Score.

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Introduction

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 [1].

It is widely employed for laparoscopic cholecystectomy (LC). Effective postoperative pain management is crucial in post-operative management to reduce the incidence of respiratory and cardiovascular complications, promote early ambulation and rapid recovery [2].

Laparoscopic cholecystectomy is one of the most commonly performed surgeries and is associated with significant pain, postoperatively [3]. In the past, various methods of postoperative pain control have been tried which include intravenous patient controlled analgesia, patient controlled thoracic epidural analgesia, intraperitoneal injection of local anaesthetics, low-pressure pneumoperitoneum, warmed air supply, etc. But, the complications related to these methods actually outweighed the benefits [3].

Pre-emptive analgesia, by reducing postoperative discomfort, also helps prevent chronic pain, with opioids and NSAIDs being the most commonly used intraoperative analgesics [4]. Though dexamethasone and magnesium sulphate (MgSO4) are the most effective adjuvants for extending the duration of action with lesser side effects, their efficacy in prolonging the subcostal TAP (SCTAP) block is yet to be well established, particularly among the Indian population [2].

Intravenous analgesia involves the side-effects of systemic opioids like respiratory depression, nausea vomiting and urinary retention [5]. Epidural analgesia carries the risk of dural puncture, infection and epidural haematoma [6]. Intraperitoneal injection leads to short duration of analgesia and insufficient pain control [7,8]. Transversus Abdominis Plane (TAP) block, first described by Rafi AN, blocks the sensory nerves in neurofascial plane from T6 to L1 dermatome, thus limiting the complications [9]. Ultrasound accurately visualises the needle and the anatomical structures thus making TAP block a very safe and effective technique for postoperative pain alleviation [10]. It diminishes the use of NSAIDs and opioids, thus lowering side effects associated with them [9,10]. Objectives of the present study was to compare the analgesia between dexamethasone and magnesium sulphate as an adjuvant to ropivacaine in ultrasound-guided subcostal transverse abdominis plane block during laparoscopic cholecystectomy surgery at tertiary care hospital.

Material & Methods

The present study was conducted in the Department of Anaesthesiology, MGM Medical College, Nerul, Navi Mumbai, Maharashtra, India during a period from January 2025 to November 2025. Entire subjects signed an informed consent approved by Institutional Ethical Committee of MGM Medical college, Nerul, Navi Mumbai, Maharashtra, India was sought.

A total of 60 patients with age group 18-65 years were enrolled in the present study. All the patients were categorised into two groups (Group A & Group B). Each group had 30 patients.

Methods

The patients classified as American Society of Anaesthesiologists (ASA) category I or II, and scheduled for elective LC. All patients underwent a pre-anaesthetic evaluation and later randomized into two groups using a closed-envelope method. A computer-generated sequence determined treatment allocation, which was concealed in sealed envelopes and opened sequentially upon patient enrolment. Group A received 18 mL (45 mg) of 0.25% rupivacaine with 2 mL (8 mg) dexamethasone on each side using a USG-guided SCTAP approach. Group B received 18 mL (45 mg) of 0.25% ropivacaine with 2 mL (200 mg) MgSO4 on each side using the same technique. All patients received intravenous (IV) midazolam at 0.02 mg/kg body weight as premedication 20 minutes before the induction of anaesthesia. Standard institutional monitoring practices were followed, including non-invasive blood pressure monitoring, continuous electrocardiography, oxygen saturation via pulse oximetry, and capnography. General anaesthesia was induced with IV fentanyl (1.5 µg/kg body weight) and IV propofol (2 mg/kg body weight). Tracheal intubation was facilitated using IV atracurium (0.5 mg/kg body weight) and maintained with IV atracurium (0.1 mg/kg body weight) and isoflurane at 1–2% minimum alveolar concentration (MAC).

Laparoscopic cholecystectomy was performed in the reverse Trendelenburg position. After the surgery and prior to extubation, a USG-guided bilateral SCTAP block was performed using a 10 cm Braun Stimuplex needle and a linear USG probe. With the patient in the supine position, the skin was disinfected, and the transducer was placed below the xiphoid process to visualize the linea alba. The probe was directed obliquely along the costal margin to view the rectus abdominis muscle. The transverse abdominis muscle was visualized beneath the rectus abdominis. A 10 cm echogenic needle was inserted in-plane medial to lateral until the needle tip reached the fascia between the rectus abdominis (posterior rectus sheath) and the transverse abdominis muscle. A “pop” sensation indicated entry into the TAP plane, confirmed by injecting 1–2 mL of saline. A total of 20 mL of local anaesthetic solution was administered bilaterally. Postoperative pain was evaluated using VAS score on a 10 cm line (0 = no pain; 10 = worst pain) at intervals of 10 minutes, 30 minutes, 2 hours, 4 hours, 8 hours, 12 hours, and 16 hours after shifting the patient to recovery ward.

Rescue analgesics, including IV fentanyl (25 µg) and IV paracetamol (1 g), were administered as needed, with all details recorded.

Statistical Analysis: Data was analysed with help IBM SPSS version 26. Software. Mean and standard deviation were observed. Chi-squared test was applied. P-value was taken less than or equal to 0.05 ($p \leq 0.05$) for significant differences.

Observations & Results

A total of 60 patients were randomized into two groups (Group A & Group B). Each group had 30 patients. All patients were within the ASA categories 1 and 2. Majorities of cases 56(93.33%) were females. Only 4(6.67%) cases were males.

Table 1: Showing the age, weight and duration of surgery.

Parameters	Group A	Group B	P-Value
Age(years)	43.24 ± 11	41.35 ± 9.984	0.488
Weight (Kgs)	58.79 ± 4.245	60.476 ± 7.214	0.274
Duration of surgery (minutes)	86.67 ± 17	84.15 ± 14.246	0.536

When, we compared the age, weight and duration of surgery between group A and group B patients. P-value was found to greater than 0.05. which was not statistically significant differenced.

Table 2: VAS scores at different time interval among the two study groups.

VAS	Group A	Group B	P-value
	Mean ± SD	Mean ± SD	
10 min	1.63 ±1.128	0.34 ±0.552	<0.0001
30 min	1.76±0.794	0.98 ±0.776	0.0003
2 hours	1.62±0.842	1.14±0.752	0.0234
4 hours	1.74±0.824	1.42 ±0.646	0.0995
6 hours	2.42±0.754	1.44 ±0.874	<0.0001
8 hours	2.72±0.854	2.12 ±0.876	0.0094
12 hours	2.57 ±0.834	2.19 ±0.842	0.0843
16 hours	2.94 ±0.962	2.46 ±0.852	0.0453
24 hours	3.42 ±0.721	2.54 ±0.673	<0.0001

The mean VAS scores for postoperative pain in both groups, Group B consistently demonstrated lower mean VAS scores throughout the postoperative period, with statistically significant differences ($P<0.05$) observed at all time points except at 4 hours($P=0.0995$). Although the VAS scores increased over time in both the groups, the scores in Group B remained consistently lower.

Twelve patients (20%) required rescue analgesia, with a significantly lower proportion in Group B compared to Group A (6.67% vs. 33.33%). The total dose of rescue analgesics administered was 2 µg IV fentanyl and 1 g IV paracetamol. There were no complications reported among any of the patients in the study population**.**

Table 3: Requirement for first dose of rescue analgesics.

Time of administration	Group A	Group B
10 min	01	-
8 hours	03	01
12 hours	-	01
16 hours	06	-

Discussions

Laparoscopic cholecystectomy is one of the most commonly performed surgeries and is associated with significant pain, postoperatively [11]. In the past, various methods of postoperative pain control have been tried which include intravenous patient controlled analgesia, patient controlled thoracic epidural analgesia, intraperitoneal injection of local anaesthetics, low-pressure pneumoperitoneum, warmed air supply, etc. But, the complications related to these methods actually outweighed the benefits [11].

Results of the present study demonstrated that addition of magnesium sulphate 2 ml (200 mg) as adjuvant to ropivacaine 18 mL (45mg) of (0.25%) in TAP block for laparoscopic cholecystectomy had better analgesic profile as seen by lower VAS scores in group B patients as compared with 18 mL (45mg) of 0.25% ropivacaine with 2 mL (8 mg) dexamethasone.

The dose of MgSO4 used in this study was selected based on the findings of Gad et al., who evaluated the analgesic efficacy of 200 mg and 100 mg MgSO4 as the sole agent in axillary blocks [12]. Their results showed better pain relief with 200 mg compared to 100 mg, suggesting its superior efficacy for prolonged analgesia. Dexamethasone at a dose of 8 mg was chosen as a comparator based on the study by Ammar et al., which highlighted its effectiveness as an adjuvant for extending the duration of analgesia in regional blocks [13].

The present study showed a female preponderance, with patients' diagnosis of cholecystitis. Both groups experienced a gradual increase in pain scores over time, the MgSO4 group consistently exhibited lower VAS scores. The requirement for rescue analgesics was 5 times lowers in the MgSO4 group compared to the dexamethasone group. These findings align with Gad et al., who concluded that 200 mg MgSO4 is a superior adjuvant compared to dexamethasone 8 mg in LC.25 However, our results contrast with Ammar et al., who found dexamethasone to prolong the duration of TAP block analgesia effectively [13]. Mahgoup et al. reported no significant difference in analgesic duration when comparing MgSO4 and dexamethasone in supraclavicular brachial plexus blocks, suggesting that the variability in results could be attributable to the type of block used [14].

The efficacy of intraperitoneal administration of MgSO4 for postoperative pain relief has been demonstrated in previous studies, showing lower VAS scores and reduced rescue medication requirements [15,16]. Evidence supports the effectiveness of MgSO4 administered via intraperitoneal route and intravenously during LC [17,18]. A comparative study reported that intraperitoneal MgSO4 was safe and effective for postoperative pain management, offering a shorter emergence and extubation time, while intravenous MgSO4 provided better perioperative hemodynamic control [19]. Lu et al. observed that intravenous MgSO4 improved physical comfort, independence, and overall recovery quality from anaesthesia [20]. Studies also indicate that intraperitoneal instillation of ropivacaine with MgSO4 results in significant pain relief and a longer pain-free period during the first 24 hours postoperatively, along with a reduced need for rescue medication [21].

Hebbard et al. also established that subcostal TAP block is more appropriate for supraumbilical and periumbilical surgeries while lateral TAP block is appropriate for infraumblical surgeries [22]. Lee et al. demonstrated that there was a discrepancy in dermatomal spread between subcostal and lateral approaches [23]. A modified subcostal TAP block called oblique subcostal TAP block was first introduced by Hebbard et al [22]. The T6-L1 nerves may be covered by oblique subcostal line, which stretches from xiphoid toward anterior portion of iliac crest. By hydro dissecting TAP along oblique subcostal line, local anaesthetic solution covers the region of T6-L1 nerves. Therefore, local anaesthetic solution in TAP along oblique subcostal line produces analgesia to above and below the umblicus, similar to a dual TAP block.

Another study by Rana et al. evaluated magnesium sulfate's effectiveness as an adjuvant to 0.25% bupivacaine in T.A.P. block in patients undergoing total abdominal hysterectomy (TAH). Sixty-five women posted for TAH were included in study. Patients in Group B (n = 32) received bupivacaine (45 mg) alone, whereas those in Group BM (n = 33) receive bupivacaine (45 mg) with 1.5 mL (150 mg) MgSO4 and 0.5 mL NS in the ultrasound (USG)-guided on each side. After the completion of the surgery TAP block was given. They were evaluated for VAS at 0, 2, 4, 6, 12 and 24 hrs . Visual analogue scores were lower in Group BM at 4hr, 6hr and 12 hr ($p < 0.05$). Up to 12 hrs, mean duration of analgesia and time to first rescue analgesia was prolonged in group BM. Addition of MgSO4 to bupivacaine in ultrasound guided TAP block reduces VAS scores postoperatively, prolonged analgesia duration and decreased need for rescue analgesics [24].

After major abdominal surgery, epidural analgesia is typically regarded as gold standard. However, there are few analgesic choices available when epidural analgesia is unfeasible. Large intravenous opiates doses may be required, which cannot be well tolerated. Transversus Abdominis Plane (TAP) Block was created in an effort to find an alternate method of effectively reducing pain. Abdominal field blocks have been around for a long time and are widely used since they are usually technically unchallenging. The transversus abdominis plane (TAP) block is a form of abdominal field block that reduces pain by numbing the skin, muscles, and parietal peritoneum of the anterior abdominal wall. TAP block is a efficient and safe complement to multimodal postoperative analgesia for abdominal surgery. Several trials have indicated that it is advanced than standard conventional therapy for postoperative pain control.

Conclusions

The present study concluded that the cholecystitis is preponderance in females' population. Magnesium sulphate (200 mg) as adjuvant to ropivacaine (0.25%) in TAP block for laparoscopic cholecystectomy is significantly better analgesic effect in terms of lower VAS scores as compared to 0.25% ropivacaine with 8 mg dexamethasone.

References

1. Morrison J. A case for open inguinal hernia repair. Int J Abdom Wall Hernia Surg 2018;1:69-73.
2. Rayala A, Konduri S, Upadhyayula S, Rachamalla S. Dexamethasone and magnesium sulphate as adjuvants to bupivacaine in ultrasound guided subcostal transverse abdominis plane block during laparoscopic cholecystectomy: A prospective randomized comparative study. Indian J Clin Anaesth. 2025;12(4):641–647.
3. Soliz JM, Lipski I, Hancher-Hodges S, Speer BB, Popat K. Subcostal Transverse Abdominis Plane Block for Acute Pain Management: A Review. Anesth Pain Med. 2017;7(5):e12923. https://doi.org/10.5812/aapm.12923.
4. Crile GW. The kinetic theory of shock and its prevention through anoci-association (shockless operation). Lancet. 1913;182:7–16. https://doi.org/10.1016/S0140-6736(01)65552-1.
5. Hong D, Flood P, Diaz G. The side effects of morphine and hydromorphone patient-controlled analgesia. Anesth Analg. 2008;107:1384-89.
6. Katircioglu K, Hasegeli Levent, Ibrahimhakkioglu HF, Ulusoy B, Damar HA. Retrospective of 34,109 epidural anesthetics for obstetric and gynecologic procedures at a single private hospital in Turkey. Anesth Analg. 2008;107:1742-45.
7. Boddy AP, Mehta S, Rhodes M. The effect of intraperitoneal local anaesthesia Sin laparoscopic cholecystectomy. A systemic review and meta-analysis. Anesth Analg. 2006;103(3):682-88.
8. McAnena OJ, Dar MA, Calleary J, Flynn N. A prospective randomized trial of intraoperative bupivacaine irrigation for management of shoulder-tip pain following laparoscopy. Am J Surg. 1998;176:258-61.
9. Rafi AN. Abdominal field block: A new approach via the lumbar triangle. Anaesthesia. 2001;56:1024-26.
10. El-Dawlatly AA, Turkistani A, Kettner SC, Machata AM, Delvi MB, Thallaj A, et al. Ultrasound-guided transversus abdominis plane block: Description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy. Br J Anaesth. 2009;102(6):763-67. Doi: 10.1093/ bja/aep067. Epub 2009 Apr 17. Erratum in: Br J Anaesth. 2009;103(4):622. PMID: 19376789.
11. YS, Kim CH, Lee GY, Han JI. The analgesic effect of the ultrasound-guided [1] transverse abdominis plane block after laparoscopic cholecystectomy. Korean J Anaesthesiol . 2010;58:362-68.
12. Gad M, Nabil H, Elmetwally M, Elzahaby I. Ultrasound-guided transversus abdominis plane block for total abdominal hysterectomy: Comparison between magnesium sulphate and dexamethasone as adjuvants. Res Opin Anesth Intensive Care. 2019;6(2):243–8. https://doi.org/10.4103/roaic.roaic_24_19
13. Ammar AS, Mahmoud KM. Effect of adding dexamethasone to bupivacaine on transversus abdominis plane block for abdominal hysterectomy: A prospective randomized controlled trial. Saudi J Anaesth. 2012;6(3):229–33. https://doi.org/10.4103/1658-354X. 101213.
14. Mahgoup AAN. The addition of magnesium sulfate or dexamethasone to levobupivacaine for ultrasound-guided supraclavicular brachial plexus block for upper limb surgery: A double-blinded comparative study. Res Opin Anesth Intensive Care. 2015;2(4):116–20. https://doi.org/10.4103/2356-9115.178904.
15. Gorle CS, Abuji K, Soni SL, Nagaraj SS, Sharma A, Jafra A, et al. Effect of intraperitoneal magnesium sulfate in the prevention of postoperative pain in daycare laparoscopic cholecystectomy - A prospective randomized controlled trial. Indian J Pharmacol. 2023;55(3):174–8. https://doi.org/10.4103/ijp.ijp_827_22.
16. Elfiky MAH, Stohy AM, El Mahdy Ibrahim WM, Ibrahim AKT. Comparative study between intravenous and intraperitoneal magnesium sulphate as adjuvant to general anesthesia for pain management in laparoscopic cholecystectomy. Egypt J Hosp Med. 2018;72(11):5695–5704. https://doi.org/10.21608/ejhm.2018.1155 3.
17. Maharjan SK, Shrestha S. Intraperitoneal magnesium sulphate plus bupivacaine for pain relief after laparoscopic cholecystectomy. J Kathmandu Med Coll. 2012;1(1):21–5. https://doi.org/10.31 26/jkmc.v1i1.7251.
18. Mentes O, Harlak A, Yigit T, Balkan A, Balkan M, Cosar A, et al. Effect of intraoperative magnesium sulphate infusion on pain relief after laparoscopic cholecystectomy. Acta Anaesthesiol Scand. 2008;52(10):1353–9. https://doi.org/10.1111/j.1399-6576.2008.018 16.x.
19. Kansal A, Kataria D, Garg S, Taneja S, Mahajan S. Comparison of analgesic effects of intravenous and intraperitoneal magnesiumsulphate in laparoscopic cholecystectomy: A prospective randomized controlled study. Arch Anesthesiol Crit Care. 2022;8(4):310–7. https://doi.org/10.18502/aacc.v8i4.10179.
20. Lu J, Wang J-F, Guo C-L, Yin Q, Cheng W, Qian B. Intravenously injected lidocaine or magnesium improves the quality of early

recovery after laparoscopic cholecystectomy: A randomised controlled trial. Eur J Anaesthesiol. 2021;38(Suppl 1):S1–8. https://doi.org/10.1097/EJA.0000000000001348.
21. Yadava A, Rajput SK, Katiyar S, Jain RK. A comparison of intraperitoneal bupivacaine-tramadol with bupivacaine-magnesium sulphate for pain relief after laparoscopic cholecystectomy: A prospective, randomized study. Indian J Anaesth. 2016;60(10):757 62. https://doi.org/10.4103/0019-5049.191696.
22. P. D. Hebbard, M. J. Barrington, and C. Vasey, "Ultrasoundguided continuous oblique subcostal transversus abdominis plane blockade: Description of anatomy and clinical technique," Regional Anesthesia and Pain Medicine. 2010; 35(5): 436– 441.
23. T. H. W. Lee, M. J. Barrington, T. M. N. Tran, D. Wong, and P. D. Hebbard, "Comparison of extent of sensory block following posterior and subcostal approaches to ultrasound-guided transversus abdominis plane block," Anaesthesia and Intensive Care. 2010; 38(3):452– 460.
24. Shelly Rana, Ravinder Kumar Verma, Jai Singh, Sudarshan Kumar Chaudhary, Ankita Chandel. Magnesium sulphate as an adjuvant to bupivacaine in ultrasound-guided transversus abdominis plane block in patients scheduled for total abdominal hysterectomy under subarachnoid block. Indian J Anaesth. 2016;60:170-174.