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Comparative Evaluation of the Analgesic Efficacy of Transverses Abdominis Plane Block by Using Levobupivacaine and Levobupivacaine With Magnesium Sulfate in Patients Undergoing Laparoscopic Cholecystectomy Surgery

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Abstract: Major abdominal surgeries are associated with severe postoperative pain. If untreated, it can lead to cardiac and respiratory problems thereby increasing postoperative morbidity. Our aim was to evaluate the efficacy of magnesium sulfate as an adjuvant to Levobupivacaine in an ultrasound-guided transversus abdominis plane (TAP) block for postoperative analgesia in Laparoscopic Cholecystectomy surgeries. This randomized, double-blinded clinical study included 60 patients undergoing laparoscopic Cholecystectomy surgeries. All patients were divided into 2 groups of 30 patients each. Group L received a TAP block with 20 mL per side of 0.375% levobupivacaine plus 1ml normal saline. Group M received a TAP block with 20 mL per side of 0.375% levobupivacaine plus 200mg magnesium sulphate (diluted to 1ml). Visual analog scale (VAS) scores, the duration of postoperative analgesia and any side effects were assessed and recorded. The mean postoperative VAS score was significantly reduced in group M compared to group L. The duration of postoperative analgesia was significantly prolonged in group M, compared to group L which was statistically significant. No significant difference in side effects was observed in both groups. The additions of 200 mg of magnesium sulfate to Levobupivacaine in an ultrasound-guided TAP block significantly prolonged the duration of analgesia, and reduced the VAS score in patients who underwent laparoscopic Cholecystectomy, without any significant side effects.
Keywords: Magnesium sulfate, TAP blocks, postoperative pain, abdominal surgery.

INTRODUCTION

Pain can be described as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage[1]. Uncontrolled postoperative pain can cause a range of acute and chronic detrimental effects. Reduction of nociceptive input to the CNS in the perioperative period and optimization of perioperative analgesia can decrease complications and facilitate recovery during the immediate postoperative period and early discharge from hospital[2].

Postoperative pain is one of the worst fears of patient posted for laparoscopic cholecystectomy. Being a major surgical procedure, substantial postoperative pain can be anticipated. Alleviation of postoperative pain is very important to provide early ambulation, decrease analgesic requirement, duration of hospitalization and to reduce postoperative morbidity.

The transversus abdominis plane (TAP) block, a field block [3] whose analgesic efficacy in several abdominal surgeries has been confirmed. It has also been proposed for perioperative analgesia in patients undergoing Laparoscopic Cholecystectomy [4-6].

Bupivacaine, the widely use local anesthetic in regional anaesthesia is available in a commercial preparation as a racemic mixture (50:50) of its two enantiomers, levobupivacaine, S (-) isomer and dextrobupivacaine, R (+) isomer. Severe central nervous system (CNS) and cardiovascular side effects has been reported in the literature, which has been

linked to the R (+) isomer of bupivacaine. The levorotatory isomers were shown to have a safer pharmacological profile with less cardiac and neurotoxic adverse effect [7-9].

Many drugs including opioids have been tried as adjuvant to Levobupivacaine in TAP block but none is ideal. Magnesium also has antinociceptive effects in animal & human models of chronic pain. These effects are primarily based on the regulation of calcium influx into the cell, i.e., "natural calcium antagonism and antagonism of N-methyl-D-aspartate (NMDA) receptor. [10]This study aims to find out the synergistic effect of adding Magnesium sulfate to Levobupivacaine in TAP block in providing perioperative analgesia in **L**aparoscopic Cholecystectomy. The VAS scores, duration of analgesia and the incidence of nausea or vomiting were recorded and compared.

METHODS

After getting approval from the institutional research and ethical committee & written informed consent from the patient, the study was conducted on 60 patients who were scheduled for laparoscopic cholecystectomy procedure at a tertiary care hospital. All patients were of ASA grade I and II, aged 18-65years and weight 50-70kg.The study population were randomly divided using computer generated randomization in to 2 groups of 30 patients in each group.

Group L (Levobupivacaine) n=30:
20 ml of 0.375% Levobupivacaine

Group M (Levobupivacaine + Magnesium Sulfate) n=30:
20 ml of 0.375% Levobupivacaine + 200 mg Magnesium Sulfate

Patients with history of drug allergy, body mass index more than 30, history of opioid tolerance, local or systemic infections, pregnancy & lactation, neurological disorder, bleeding disorder & coagulopathy were excluded from the study. After obtaining written informed consent, the patients were allocated into L group and M group using a random number table.

Name, age and IP number of each patient was recorded in the corresponding proforma. Height and weight were measured and BMI was calculated and recorded. All the patients were given with Tab Alprazolam 0.5mg and Tab Ranitidine 150mg orally at bed time on the night before surgery.

On the day of surgery a peripheral IV line was secured in one of the upper limb & multipara monitor was connected to record heart rate, noninvasive blood pressure, continuous ECG, SPO2 and ETCO2. The patients were premedicated with injection Glycopyrolate 0.005 – 0.01 mg/Kg, Inj Midazolam 0.03-0.06 mg/Kg and InjPentazocin 0.3-0.6 mg/Kg.

Anaesthetic induction and intubation was done with Inj Propofol 1 – 2 mg/Kg and InjSuccinylCholin 1-1.5 mg/Kg then Anaesthesia was maintained with N2O : O2 :: 2:1 and titrated isoflurane inhalation, intermittent InjVecuronium.

Bilateral Subcostal TAP Block was performed by injecting study drugs into subcostal transversus abdominis plane with ultrasound guidance. Hemodynamic data (HR, BP, and SPO2) was collected immediately after induction, at the start of surgery and each 15 mins thereafter.

At the end of surgery, extubation was done when patient fulfilled the required criteria with inj Neostigmine0.3-0.6mg/kg &inj Glycopyrolate0.2mg. Postoperative hemodynamic data (HR, BP), Visual analogue scale (VAS) Score and PONV were recorded at 0, 1, 2, 6, 12 and 24 hours after surgery. Bolus of IV Paracetamol was given whenever postoperative VAS score > 4 for any patient in both the study group. Rescue anti emetic was administered as inj. Ondansetron 4mg intravenously if patient complained of nausea or vomiting.

The subjects were assessed in the post-operative recovery room and later in the post-operative ward at 6, 12 and 24, hours after surgery. Pain, requirement of rescue analgesics, nausea and vomiting and sedation were assessed.

Each patient was asked to assess pain at rest at each time point, using visual analog scale (VAS), an unmarked 10 cm line in which 0=no pain and 10=worst pain imaginable [11]. Nausea was assessed using a categorical scoring system (0=none; 1=mild; 2=moderate; 3=severe).

PERFORMING THE BLOCK

After induction, oblique subcostal TAP blocks were performed under the guidance of a sonosite M-turbo ultrasound machine with a high frequency linear 6–13 MHz ultrasound transducer. The puncture area and the ultrasound probe were prepared in an aseptic manner. The rectus abdominis and underlying transversus abdominis muscles were identified near the costal margin and xiphoid process. An in-plane image was obtained and a 22 gauge Quincke 100 mm spinal needle was inserted through the rectus muscle 2–3 cm medial to the probe. Once the tip of the needle was visualised to be in the plane, 20 ml of 0.375% Levobupivacaine was administered and splitting of fascial plane with the spread of drug was observed.

Using clinical data from similar studies, it was postulated that in order to detect the difference in duration of postoperative analgesia with an expected background standard deviation of one, a type I error of

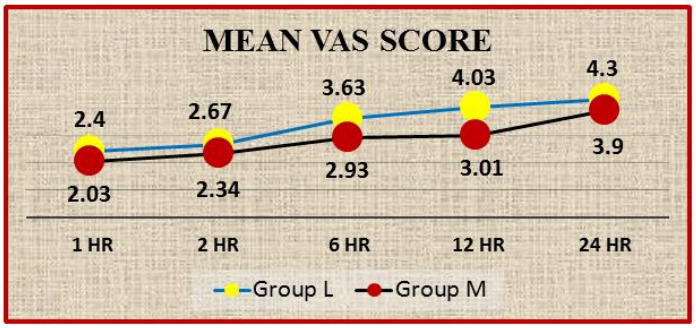
less than 0.05, a power of 90%, a sample size of 28 patients in each group would be sufficient. We studied30 patients in each group to compensate for drop-outs and to account for random errors. Data entry and analysis were done using SPSS Version 19.0 (IBM Corporation, Armonk, NY). Data were presented as number, percentage, and mean ± standard deviation. A chi-square test was used to compare qualitative variables. A Mann-Whitney test was used to compare quantitative variables in the studied groups. The P-value was considered statistically significant when $P < 0.05$.

RESULTS

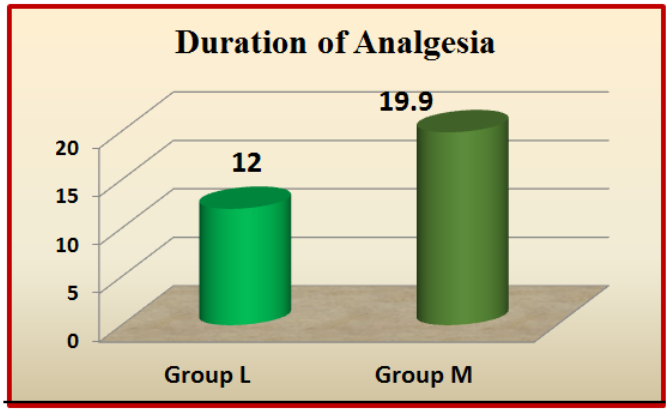
Table-1: (Demographic data)

	Group L(n=30)	Group M(n=30)	P Value
Age in yrs	40.47±4.04	39.57±3.99	0.3888
BMI (Kg/m2)	26±2.72	25.89±1.4	0.8452
HR (BPM)	75.23±7.05	73.63±7.6	0.4015
MAP (mm Hg)	96.9±4.8	96.5±4.9	0.7759
Surgical duration (mins)	82.73±7.18	79.4±9.6	0.1332

There was no statistically significant difference in both groups regarding age, BMI, and duration of surgery. There was also no difference in heart rate and MAP in both groups.(table-1) M group showed better analgesic profile in the 1st postoperative day in the form of lower mean visual analog scale score 6hr (3.63±0.81 for L group, 2.93±0.58 for M group, $P < 0.003$) , 12hr (4.03±0.93 for L group, 3.±0.69 for M group, P value<0.05) and mean VAS score(3.51 ± 1.18 for L group, 2.81 ± 0.88 for M group, P value <0.05). There was longer duration of analgesia (13 ± 8.8 h for L group, 19 ± 6.3 h for M group, $P < 0.05$).(graph 1,2) There was no significant incidence of postoperative nausea and vomiting in both groups.



Graph 1



Graph-2

DISCUSSION

Our study showed that using $MgSo_4$ as an adjuvant in TAP block in cases of laparoscopic cholecystectomy resulted in a better analgesic profile, lower VAS score, lower analgesic consumption, and longer duration of analgesia with no recorded complications.

Al-Refaey A[12] did single blinded randomized controlled trial by adding magnesium sulfate to bupivacaine in transversus abdominis plane block for laparoscopic cholecystectomy. Magnesium sulfate group showed better analgesic profile in the 1st postoperative day in the form of lower mean visual analog scale score and longer duration of analgesia. There was a significant lower incidence of

postoperative nausea and vomiting (PONV). They concluded that adding magnesium sulfate as an adjuvant to bupivacaine in TAP block; during anesthesia for LC improved postoperative analgesia in the form of increased duration, decreased analgesic requirements and PONV which was similar to ours.

Rana S[13] studied Magnesium sulphate as an adjuvant to bupivacaine in ultrasound-guided transversus abdominis plane block in patients scheduled for total abdominal hysterectomy under subarachnoid Block & found that visual analogue scale (VAS) scores were lower in Group BM at 4, 6 and 12 h ($P < 0.05$). Mean duration of analgesia was significantly prolonged in Group BM with lesser requirement of rescue analgesic ($P < 0.05$) up to 12 h.they concluded that MgSO4 (150 mg) as an adjuvant to bupivacaine in USG-guided TAP block reduces post-operative pain scores, prolongs the duration of analgesia and decreases demands for rescue analgesics.

A multimodal analgesic regimen will result in excellent analgesia, and helps to minimize the side effects of single drug administration. No optimum regimen is available, and different techniques continue to evolve.Patient controlled epidural or intravenous opioid analgesic regimens are also available. But these are usually associated with untoward effects like nausea, vomiting and pruritus and reduce overall patient satisfaction. In addition, there is a risk of delayed respiratory depression due to rostral spread of hydrophilic opioids like morphine[14] Also, it may not be possible always to give neuraxial opioids due to availability or logistic issues and/or the presence of medical contraindications.

Patient controlled analgesia can increase patient satisfaction to a certain extent by facilitating greater degree of patient control. But analgesia can be often incomplete and opioid related side effects remain common. Given these issues, there is considerable potential for a regional technique such as TAP block to comprise an effective component of a multimodal regimen [15]. The use of TAP block has succeeded as an analgesic technique after laparoscopic cholecystectomy in the last decade. Also, adding $MgSo_4$ as an adjuvant to local anesthetics in regional procedures has proved its efficacy in many clinical trials. In our study; $MgSo_4$ augmented the postoperative analgesic effect of TAP block. This result coincides with multiple previous studies that used intravenous (IV) $MgSo_4$ either IV bolus or infusion in thoracic, spine, gynecologic, neurosurgery, and abdominal surgeries.

N-methyl D-aspartate (NMDA) receptor is the major affecting site for the effects of magnesium. Magnesium is an antagonist of the NMDA receptor, acting as a noncompetitive antagonist, blocking ion channels in a voltage dependent fashion. This receptor is found in many parts of the body, including the nerve endings, and plays a well-defined role in modulating pain and a number of inflammatory responses.[16]NMDA receptor antagonists could prevent central sensitization that occurs due to the peripheral nociceptive stimulation. The safety of perineural use of $MgSo_4$ has been an issue of debate among the multiple human and animal studies and also in many reports of inadvertent use. Most neurological damage in the form of vaculation or demyelination was related to high dose and concentration of the drug, more than 15% in most reports.In our study; we used $MgSo_4$ of 2.5%, which is too much far from the postulated harmful concentration [17].

The incidence of nausea and vomiting and hence the requirement of antiemetic was significantly reduced in the patients who received the block. This may be secondary to the paracetamol sparing effect of the block. Being a major surgical procedure, substantial postoperative pain can be anticipated. Inadequate postoperative pain relief can negatively impact ambulation thereby increasing chances of DVT and aggravating other comorbid illnesses while effective analgesia improves ambulation and decreases the amount of hospital stay.

There are a number of limitations to this study. First, the study has limited assessment of postoperative analgesia to the first 24 postoperative hours. However, this data indicate that the severity of pain in the control group has diminished substantially by this time, and most patients no longer require systemic paracetamol therapy. Secondly, this study is not a blinded one. The block was performed and assessment was done by the same investigator. This could have led to biases. Thirdly,a dose-response study to determine if a lower dose of levobupivacaine would lead to the same results was not performed. Fourthly, serum Mg level had not been measured to be correlated to the efficacy of TAP block or another group receiving $MgSo_4$should have been added to detect if the potentiation effect is related to a systemic or local action of $MgSo_4$.

CONCLUSION

Addition of magnesium sulfate as an adjuvant to levobupivacaine in subcostal TAP block produces low VAS score and prolonged postoperative analgesia without producing any significant side effects.

REFERENCES

1. International Association for the Study of Pain, IASP task force on taxonomy. Classification of chronic pain.2nd ed. Seattle: IASP Press; 1994. P209-214.
2. McDonnell JG, Curley G, Carney J, Benton A, Costello J, Maharaj CH, Laffey JG. The analgesic efficacy of transversus abdominis plane block after cesarean delivery: a randomized controlled trial.

Anesthesia & Analgesia. 2008 Jan 1;106(1):186-91.
3. Niraj G, Searle A, Mathews M, Misra V, Baban M, Kiani S, Wong M. Analgesic efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing open appendicectomy. British journal of anaesthesia. 2009 Oct 1;103(4):601-5.
4. El-Dawlatly AA, Turkistani A, Kettner SC, Machata AM, Delvi MB, Thallaj A, Kapral S, Marhofer P. Ultrasound-guided transversus abdominis plane block: description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy. British journal of anaesthesia. 2009 Apr 17;102(6):763-7.
5. McLeod GA, Burke D. Levobupivacaine. Anaesthesia. 2001;56:331–41,
6. Charlton S, Cyna AM, Middleton P, Griffiths JD. Perioperative transversus abdominis plane (TAP) blocks for analgesia after abdominal surgery. Cochrane Database of Systematic Reviews. 2009;8.
7. McDonnell JG, O'Donnell BD, Farrell T, Gough N, Tuite D, Power C, Laffey JG. Transversus abdominis plane block: a cadaveric and radiological evaluation. Regional anesthesia and pain medicine. 2007 Sep 1;32(5):399-404.
8. Shibata Y, Sato Y, Fujiwara Y, Komatsu T. Transversus abdominis plane block. Anesthesia & Analgesia. 2007 Sep 1;105(3):883.
9. Abdallah FW, Brull R. Transversus abdominis plane block: a systematic review. RegAnesth Pain Med 2012; 37: 193
10. Siddiqui MR, Sajid MS, Uncles DR, Cheek L, Baig MK. A meta-analysis on the clinical effectiveness of transversus abdominis plane block. Journal of clinical anesthesia. 2011 Feb 1;23(1):7-14.
11. Petersen PL, Stjernholm P, Kristiansen VB, Torup H, Hansen EG, Mitchell AU, Moeller A, Rosenberg J, Dahl JB, Mathiesen O. The beneficial effect of transversus abdominis plane block after laparoscopic cholecystectomy in day-case surgery: a randomized clinical trial. Anesthesia & Analgesia. 2012 Sep 1;115(3):527-33.
12. Al-Refaey K, Usama EM, Al-Hefnawey E. Adding magnesium sulfate to bupivacaine in transversus abdominis plane block for laparoscopic cholecystectomy: A single blinded randomized controlled trial. Saudi journal of anaesthesia. 2016 Apr;10(2):187.
13. Rana S, Verma RK, Singh J, Chaudhary SK, Chandel A. 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 Journal of Anaesthesia*. 2016;60(3):174-179.
14. Tolchard S, Davies R, Martindale S. Efficacy of the subcostal transversus abdominis plane block in laparoscopic cholecystectomy: Comparison with conventional port-site infiltration. Journal of anaesthesiology, clinical pharmacology. 2012 Jul;28(3):339.
15. Jankovic Z, Ahmad N, Ravishankar N, Archer F. Transversus abdominis plane block: how safe is it?. Anesthesia & Analgesia. 2008 Nov 1;107(5):1758-9.
16. Hasanein R, El-sayed W, Khalil M. The value of epidural magnesium sulfate as an adjuvant to bupivacaine and fentanyl for labor analgesia. Egyptian Journal of anaesthesia. 2013 Jul 1;29(3):219-24.
17. Herroeder S, Schönherr ME, De Hert SG, Hollmann MW. Magnesium—essentials for anesthesiologists. Anesthesiology: The Journal of the American Society of Anesthesiologists. 2011 Apr 1;114(4):971-93.