e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15 (12); 1543-1548

Original Research Article

Magnesium Sulphate Vs Dexamethasone as Adjuvant to Ropivacaine in Ultrasound Guided Transverse Abdominis Plane Block for Patients Undergoing Total Abdominal Hysterectomy under Spinal Anaesthesia: A Randomised Control Study

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Received: 25-09-2023 / Revised: 28-10-2023 / Accepted: 30-11-2023
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Conflict of interest: Nil

Abstract:

Background & Aim: Total abdominal hysterectomy (TAH) is considered the second most common gynecological surgery in females with significant postoperative pain. Transverse abdominal plane (TAP) block is an effective regional anaesthesia technique that targets sensory supply of anterolateral abdominal wall. Its efficacy can be improved by using multiple adjuvants which prolong the duration of analgesia. We evaluated magnesium sulphate (MgSO4) vs dexamethasone as adjuvant to ropivacaine in TAP block for patients undergoing TAH under spinal anaesthesia.

Methods: Sixty patients undergoing TAH were randomized into Group M and Group D and were administered ultrasound guided TAP block immediate postoperatively with 0.25% ropivacaine along with MgSO4 and dexamethasone as adjuvant respectively. Patients were studied for their postoperative pain scores and requirement of rescue analgesics. Students't test was used to compare the pain score and Cox proportional hazard model was used to study need of rescue analgesic.

Results: Both groups had similar pain scores during the first 6 hours post operatively. However, at 8- and 12-hours pain score was significantly lower in patient in Group M [2.32 vs 3.16 p value 0.015 and 2.78 vs 4.23 p value 0.0003 respectively]. Requirement of rescue analgesic was higher in Group D [HR 3.13, CI 1.84, 5.31, P Value 0.000010]. At 24 hour the pain score was again similar in both groups.

Conclusion: Addition of MgSO4 was more effective as an adjuvant than dexamethasone to ropivacaine in ultrasound guided TAP block for patients undergoing TAH under spinal anaesthesia.

Keywords: Adjuvant, Dexamethasone, Magnesium sulphate, Postoperative pain, Ropivacaine, Transversus abdominis plane block, Total abdominal hysterectomy.

Introduction

Patients undergoing total abdominal hysterectomy (TAH) under spinal anaesthesia have significant postoperative pain of anterior abdominal wall incision as well as visceral pain.[1] The incidence of post-operative pain is about 32%, thus warranting effective post-operative analgesia. Transverse abdominal plane (TAP) block is an effective regional anaesthesia technique that targets sensory supply of anterolateral abdominal wall derived from T6-L1.[2]–[4] A TAP block reduces opioid consumption and its associated adverse effects (nausea, vomiting, respiratory depression, hypotension etc.).[5] It is simple and easily executed without any infringement on epidural space along with effective analgesia postoperatively. The duration of TAP block is limited to the effect of administered local anaesthetic (LA) agents. However, recently

adjuvants such as epinephrine, ketamine and clonidine are added to LA solution in concentrations advocated for other peripheral blocks to prolong the effect of TAP block with promising results.[2] Magnesium sulphate (MgSO4) is N-methyl-D-aspartate receptor blocking agent that prevents central sensitization caused by peripheral nociceptive stimulation. Dexamethasone is a steroid with anti-inflammatory response that may reduce pain caused by tissue damage after surgery. Both MgSO4 and dexamethasone have been used as adjuvants along with bupivacaine in TAP block.[2],[6] Ropivacaine the s-enantiomer of bupivacaine; has better anaesthetic potency, longer duration of action, favourable toxicity profile compared to bupivacaine.[7],[8]

However, the adjuvant of choice along with ropivacaine is yet understudied. We decided to study the effect of MgSO4 and dexamethasone as adjuvants in TAP block with ropivacaine in patients undergoing TAH.

Methods

The study is a randomized, double blinded, prospective comparative study conducted with a study population of 60 patients. The study was approved by the institutional ethical committee performed in accordance with Helsinki declaration of 1978, amended in 2013.

Patients undergoing total abdominal hysterectomy between the ages of 40 and 60 years and ASA grading 1-2 were included in the study. Exclusion criteria included allergies to local anesthetic agents / any drugs used in the study, patient's refusal, contraindication to subarachnoid block, those who were given general anesthesia for surgery, morbid obesity, chronic NSAIDS /OPIODS user or coagulation abnormalities. Thirty patients were assigned to each group of the study. Patients were randomized to each group by a random number generator until 60 patients were recruited. Consent for the TAP block was taken from each patient prior to their elective surgery.

All patients were administered spinal anesthesia with 0.5% hyperbaric bupivacaine 3ml with fentanyl 25mcg using 26G Quincke needle in sitting position under strict aseptic precautions. Bilateral ultrasound guided TAP block was administered postoperatively immediately following surgery.

The test solution (20 mL ropivacaine 0.25% combined with either 150mg MgSO4 (Group M) or 4 mg of dexamethasone (Group D) was prepared by the attending anesthesiologist supervising the block and given unlabeled to the anesthesiologist who completed the block [Figure 1].

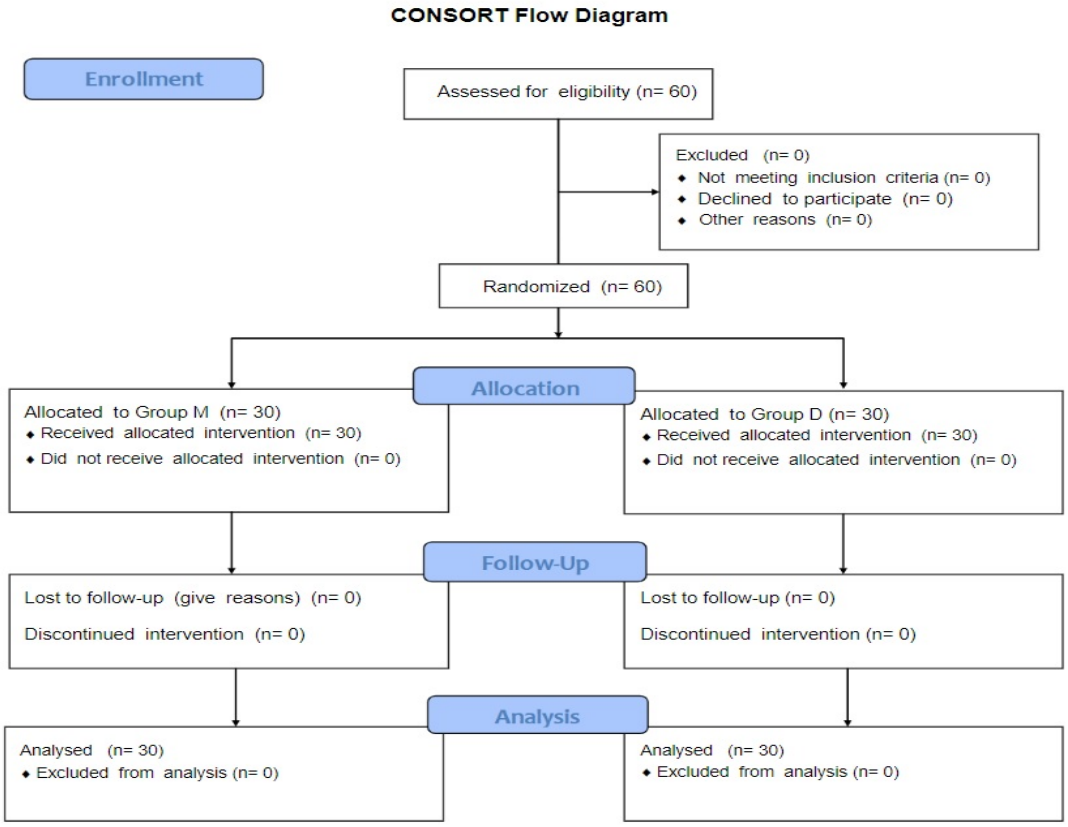

Figure 1:

Patients were shifted to postoperative ward for monitoring. Pain scores using the visual analogue scale (VAS) were assessed at 2,4,6,8,12, and 24-hour to determine the post-block pain scores. Rescue drug tramadol was given intravenously in dosage of 1mg/kg if VAS score went above 4 at any time. The timing of rescue tramadol medication use, associated nausea, vomiting was also recorded. Our primary endpoint was score at 12 hours, with 24-hour pain scores and requirement of rescue analgesic considered secondary endpoints. Summary statistics were reported for demographics, baseline variables, and pain scores at different time points.

Continuous variables were summarized by using mean (standard deviation), and categorical variables were summarized by using frequency (percentages).Sample size was calculated based on an initial pilot study with 10 patients in each group. This revealed a mean VAS score of 2.84 and 4.12 in the two groups with a pooled standard deviation of 1.42. Calculating for alpha error of 0.05 and power of study of 85% revealed a sample size of 20 in each group; a sample size of 30 was chosen to accommodate any study dropout and limited sample of pilot study. The differences between the 2 intervention groups were compared by using students' t-test. To compare the use of rescue analgesic to account for potential correlation within patients among measures at multiple time points Cox proportional hazard model was used calculate hazard ratio.

The patient who was administered rescue analgesic was not considered at risk for requiring rescue analgesic for the next four hours. The means, as well as their 95% confidence intervals (CIs) for each group at different time points, were calculated. P-value < 0.05 was considered as significant.

Results

All 60 patients enrolled completed the study. Demographic data and duration of surgeries were similar in the two groups [Table 1].

Table 1: Demographic profile of patients

Parameter	Group M	Group D	P Value
Age (years)	49.4 ± 5.34	48.3 ± 6.12	0.46
BMI (kg/m2)	22.78 ± 2.75	21.94 ± 2.56	0.22
ASA class (I/II)	26/4	23/7	0.31
Duration of Surgery (mins)	112.4 ± 27.8	121.6 ± 31.2	0.23

Data presented as mean ± standard deviation or numbers. ASA: American Society of Anesthesiologist. The difference in visual analog scale scores was statistically insignificant at 2,4,6 and 24-hour. At 8- and 12-hour patients in Group M had significantly less pain as compared to Group D. **[Table 2, Figure 2]**

Table 2: Post-operative pain scores

Time from surgery	Group M		Group D		P Value
	Mean	SD	Mean	SD	
2h	0.82	0.74	0.96	0.84	0.49
4h	1.54	1.18	1.76	1.34	0.50
6h	1.92	1.4	2.24	1.46	0.38
8h	2.32	1.26	3.16	1.34	0.015
12h	2.78	1.31	4.23	1.62	0.0003
24h	3.62	1.94	4.36	2.12	0.16

SD: standard deviation

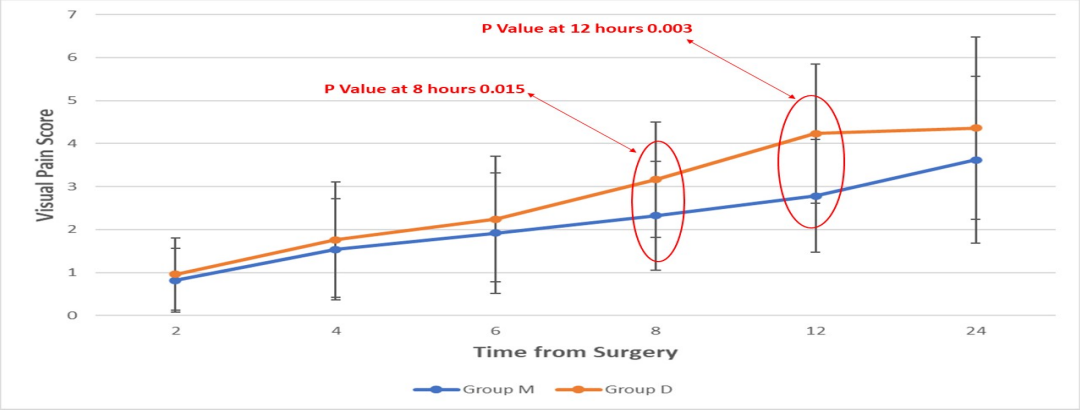

Figure 2:

The mean time to rescue dose of tramadol was earlier in Group D than Group M (8.3± 0.2 hours vs 14.2 ± 0.3 hours, P value <0.05). The demands for rescue analgesic in Group D and Group M and the patients at risk for use of rescue analgesic at various intervals are shown in **Table 3.**

Table 3: Use of rescue analgesic in two groups

	Group M		Group D	
	Patient at risk	**Event**	**Patient at risk**	**Event**
0-4 Hours	30	0	30	2
4-8 Hours	30	0	28	8
8-12 Hours	30	3	22	20
12-24 Hours	27	18	10	8

Event: requirement of rescue analgesic. On giving rescue analgesic the patients were excluded for the next 4 hours from being at risk of pain. Majority of patients in Group D demanded rescue analgesic in the first 12 h, and patients in Group M required rescue analgesic after 12 h. Patients in Group D were more likely to need rescue analgesic compared to Group M [HR 3.13, CI 1.84, 5.31, P Value 0.000010] **[Figure 3].**

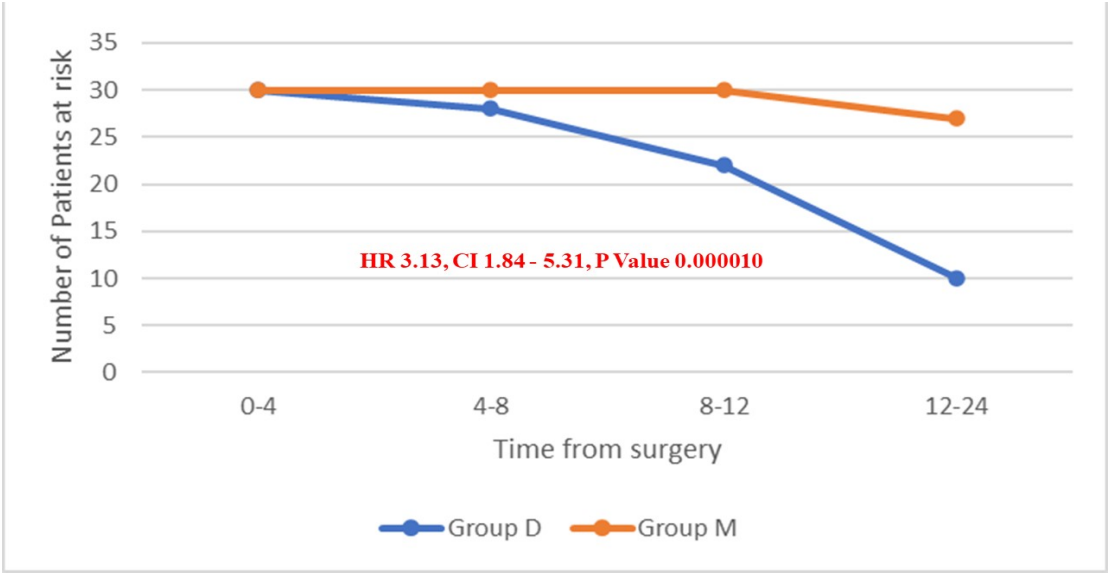

Figure 3:

Total rescue analgesic requirement was lower in Group M. Postoperative nausea and vomiting was less in Group M.

Discussion

The benefits of good postoperative analgesia include a reduction in the postoperative stress response and morbidity, better patient satisfaction and improved outcome. The advantages of TAP block include simple and effective analgesic technique, appropriate for surgical procedures where parietal peritoneum is a significant component of postoperative pain, very minimal complication rate and can be performed even if neuraxial techniques are contraindicated.[9] Ultrasound guidance makes TAP block simpler, reliable, safe, with a high rate of success, and low incidence of complications.[3],[4],[10] The analgesic efficacy of ropivacaine in TAP block has been studied[11] and our study shows similar analgesic benefits. Unfortunately, duration of TAP block is limited by the efficacy of LA administered and the dose used, which is again dependent on the maximum permitted dose for that agent. This has led to the use of adjuvants such as clonidine, dexmedetomidine to prolong the effect of LA in TAP block.[12]–[14] The realization of analgesic potency of MgSO4 by virtue of its NMDA receptor antagonist has led to its use via various routes for providing pre-emptive analgesia and to prolong post-operative analgesia.[15]–[18] Rana et al concluded that the addition of MgSO4 in a dose of 150 mg provided a pronounced prolongation of the duration of sensory and motor blocks compared with adding MgSO4 100 mg, without systemic or neurotoxicity.[16] Therefore, we decided to use 150mg of MgSO4 in our study as adjuvant. Our study shows significantly lower VAS scores with the use of MgSO4 at 8 and 12 h after the block. The results are comparable to the various published studies[15],[17],[19] as the authors also found significant reductions in post-operative VAS scores with the use of MgSO4. In a study by Imani et al [11] they found addition of MgSO4 to ropivacaine

in TAP block does not affect the post-hysterectomy pain. This finding is refuted in our study, the difference may be because of applied anaesthesia technique. It is prudent to point out that in study by Imani also there was trend to benefit which did not achieve statistical significance. In another systematic review[20] conducted on 34 studies, the superiority of this type of block over other postoperative pain management techniques was demonstrated. However, further studies were strongly recommended by the researchers on how the block is performed, the dosage of medications administered, and the use of adjuvant drugs in various surgical procedures.[20] Our study corroborates the findings of most studies in meta-analysis and finds addition of MgSO4 more effective than dexamethasone for TAP block.

Conclusion

This study showed that addition of 150 mg of MgSO4 was more effective as an adjuvant than 4mg of dexamethasone added to 0.25% ropivacaine 20 ml given on each side in ultrasound guided TAP block for TAH under spinal anaesthesia.

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