



## Comparison of TAP block with Bupivacaine and Magnesium as an adjunct to bupivacaine in total abdominal hysterectomy patients

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### Abstract

Present study was carried out on 60 female patients in the age group of 35 to 70 years, ASA I-II, scheduled for TAH under subarachnoid block. The enrolled patients were divided into two groups of 30 patients in each group. We compared magnesium in a dose of 100 mg to bupivacaine and plain bupivacaine in TAP block and found that magnesium adjunct to bupivacaine decreases VAS scores postoperatively, prolongs duration of analgesia, decreased number of demands for rescue analgesia, although further studies are still required.

### Introduction

Total abdominal hysterectomy (TAH) is a commonly performed major surgical procedure which results in substantial postoperative pain and discomfort. The incidence of persistent postoperative pain after TAH approaches almost 32%.<sup>1</sup> There by a multimodal approach to postoperative analgesia after TAH is required so as to block nociceptive transmission from both the abdominal wall incision, pelvic and abdominal visceral sites.

With the advent of regional techniques, peripheral blocks remain a preferred choice for analgesia and transversus abdominis plane block (TAP) is one of the newer entry. Various drugs have been studied for prolongation of analgesia through this block. These effects are primarily based on physiological calcium antagonism, that is voltage-dependent regulation of calcium influx into the cell, and noncompetitive antagonism of N-methyl-D-aspartate (NMDA) receptors.<sup>2</sup> It prevents central sensitization from peripheral nociceptive stimulus. Evidence supporting the presence of NMDA receptors in skin<sup>3</sup> and muscles<sup>4</sup> have led the use of NMDA receptor antagonists via different routes

i.e. intravenous regional anesthesia,<sup>5</sup> brachial plexus nerve blocks,<sup>6</sup> neuraxial route<sup>7</sup> and intra-articular route.<sup>8</sup> Many authors have reported that magnesium is associated with a reduced analgesic requirement and less discomfort in the postoperative period.

Whereas studies on the use of magnesium for field block are scarce, we intended to use magnesium sulphate in ultrasound guided TAP block along with bupivacaine and compared it with plain bupivacaine in patients scheduled for total abdominal hysterectomy under subarachnoid block.

### Methodology

After approval by institutional ethics committee the study was carried out on 60 female patients in the age group of 35 to 70 years. Patients were ASA I-II, scheduled for TAH under subarachnoid block. The enrolled patients were divided into two groups of 30 patients in each group. The exclusion criteria included patient's refusal to block, having bleeding disorders, local infection at the site where needle for block was to be inserted, history of seizures, respiratory or cardiac diseases and

patients on calcium channel blockers. Randomisation was achieved by computer-generated random number table

During preanaesthetic visit, the patients were explained about the study purpose, advantages and risks of procedure and instructed to demand analgesia as per requirement and informed written consent was obtained. Patients were educated about the 10 cm visual analogue scale (VAS) during the preoperative assessment. All the patients were kept nil orally for 8 h before surgery and no premedication was given. In the operation theatre, after securing 18-gauge intravenous (IV) cannula, 0.9% sodium chloride (normal saline [NS]) infusion was commenced. After establishing standard anaesthesia monitoring, baseline measurements such as heart rate (HR), non-invasive blood pressure and peripheral oxygen saturation were recorded.

All patients undergoing TAH were given SAB under all aseptic conditions in the right lateral position using 26-gauge Quincke spinal needle at L3–L4 interspace and 15 mg of 0.5% hyperbaric bupivacaine was injected after confirming free flow of CSF. After confirmation of adequate level (T4), surgery was started. After the surgery was over and the SAB sensory level regressed to T8 dermatome, USG-guided TAP block (using SonoSite™ Micromax machine, linear high-frequency probe, 6–13 MHz) was performed under all aseptic precautions with respective drug solutions. After draping the abdominal part between the twelfth rib bone and iliac crest with umbilicus at the centre-external oblique muscle, internal oblique muscle, transversus abdominis

muscle, and their fascia were identified beneath the skin and the subcutaneous tissue.

A 23-gauge spinal needle was advanced by a USG-guided in-plane technique at the anterior axillary line and the exact location of the needle tip checked by USG. After checking the exact location of the needle tip, 1 mL of NS was injected to open the plane and after confirmation of hypoechoic area on USG image, the study solution of 20 mL was injected. Equal amount of the same solution was also injected on the opposite side using identical technique.

The patients in Group B (n = 30) received 18 mL 0.25% bupivacaine (45 mg) with 2 mL NS on either side, whereas the ones in Group BM (n = 30) received 18ml 0.25% bupivacaine (100 mg) + 1 ml(100mg) of MgSO<sub>4</sub>+1 ml N.S. each side.

Postoperatively, the patients were evaluated for pain, nausea or vomiting in the post-anaesthesia care unit at time 0 (time of completion of TAP block), 2, 4, 6, 12 and 24 h by an investigator blinded to the group assignment. Whenever the VAS >4, diclofenac 1 mg/kg was administered intramuscularly as a rescue analgesic and if the pain persisted, tramadol 2 mg/kg IV was administered. Patients were asked to rate average pain they experience postoperatively on a 10 cm VAS: No pain 0 to very severe pain 10.

The primary outcome measure in this study was the post-operative VAS score. The secondary outcome measures included the number of supplemental analgesic requirements, duration of post-operative analgesia that is time to first analgesic request from the time of giving block.

## Results

**Table –1:** Demographic Profile

Parameter	Group B (n=30)	Group BM (n=30)	P value
Age(yrs) Mean±SD	44.6±5.86	44.17±6.68	0.729
Weight(kg) Mean±SD	56.13±5.21	57.50±5.84	0.071
Duration of surgery(min) Mean±SD	94.17±15.26	94.67±15.64	0.602
ASA Grade (No. %)	I	24(80%)	0.738
	II	6 (20%)	

**Table 2:** Comparison of VAS scores

Group (Mean±SD)	0 hrs	2 hrs	4 hrs	6 hrs	12 hrs	24 hrs
Group B	1.87±1.04	1.87±1.71	2.4±1.43	4.53±2.62	4.33±2.23	3.27±1.67
Group BM	1.67±1.40	2.20±2.25	2.4±2.25	3.33±1.77	3.8±1.77	1.87±1.63
P value	0.404	0.902	0.082	0.032	0.045	0.012

**Table 3:** Comparison of mean duration of analgesia (time to first analgesic requirement)

Group	Duration in min (Mean±SD)	P-Value
Group B	397.67±92.84	0.000
Group BM	588.00±181.65	

**Table 4:** Comparison of total number of demands for rescue analgesia at different time intervals

Requirement of analgesia (duration in min)	GROUP B Number (%)	GROUP BM Number (%)
120	1 (3.3)	2 (6.6)
121-240	1 (3.3)	2 (6.6)
241-360	8 (26.6)	2 (6.6)
361-720	28 (93.3)	22 (73.3)
721-1440	8 (26.6)	4 (13.3)

A total number of patients enrolled during the study period were 60, with 30 in each group.

They were comparable with each other with respect to age, weight and duration of surgery and ASA status (Table 1).

There was statistically significant decrease in VAS scores at 6, 12 and 24 h. (Table 2)

Mean duration of analgesia was significantly prolonged in Group BM compared to Group B (Table 3). The number of requirement of rescue analgesic was more in Group B as compared to BM in the first 24 h. (Table 4).

## Discussion

TAP block is an emerging regional anaesthesia technique that provides good analgesia to the skin and musculature of the anterior abdominal wall and proved to be an effective component of multimodal analgesic regimen for abdominal procedures including large bowel resection,<sup>9</sup> open/laparoscopic appendectomy,<sup>10</sup> caesarean section,<sup>11</sup> total abdominal hysterectomy<sup>12</sup> and laparoscopic cholecystectomy.<sup>13</sup> Most randomized controlled trials demonstrate the efficacy of TAP block by showing some combination of reduced opioid requirement in post-operative period, low

pain scores and reduced opioid-related side effects.

As we used magnesium in our study in TAP block because magnesium has drawn attention in the field of anaesthesia and pain medicine as NMDA receptor antagonist. As we know that N methyl-D-aspartate (NMDA) receptors play a major role in central nociceptive transmission, modulation and sensitization of acute pain states. In addition to this central location, NMDA receptors are found in skin, muscle, knee joint and they play a role in sensory transmission of noxious signal.<sup>14</sup>

The primary hypothesis for analgesic property of magnesium on peripheral nerves is the surface charge theory. Akutagawa and colleagues<sup>15</sup> showed that modulation of the external magnesium concentration bathing a nerve bundle resulted in enhancement of the nerve blockade due to LA. Mert and colleagues<sup>16</sup> reported that a high concentration of divalent ions ( $Mg^{2+}$  and  $Ca^{2+}$ ) attracted by the negative charge of the outer membrane surface affected  $Na^+$  channel gating and could cause hyperpolarization which also support that higher concentration of magnesium (150 mg) provided a more pronounced prolongation of block. When nerve fibre is

hyperpolarized, it is more difficult to achieve the threshold level, and then resulted in nerve conduction block.

Another possible mechanism for the analgesic effect of magnesium is the voltage-dependent antagonism of NMDA receptors which lead to prevent central sensitization from peripheral nociceptive stimulation and decrease in acute pain.

So mechanism is likely direct action of magnesium on the peripheral nerve by blocking the release of excitatory neurotransmitter or by potentiating the effect of LA.<sup>17</sup> The direct action of magnesium on the peripheral nerves is supported by the study done by Belgin Buyukakilli and colleagues,<sup>18</sup> who found that magnesium added to bupivacaine resulted in impulse inhibition in a frog sciatic nerve.

In our study, the addition of magnesium to bupivacaine in a dose of 100 mg has led to lower VAS pain scores, prolongation of analgesia in post-operative period, less requirement of rescue analgesia and but further studies are still required for a direct comparison of magnesium in TAP block, though we have tried to compare our results with limited data available in literature.

### Conclusion

Our data supports specific action of magnesium on peripheral nerves leading to better pain scores and decrease in postoperative analgesic requirement. To summarize, the addition of magnesium in a dose of 100 mg to bupivacaine in TAP block decreases VAS scores postoperatively, prolongs duration of analgesia, decreases number of demands for rescue analgesia, although further studies are still required to establish efficacy of magnesium as an adjunct in TAP block.

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