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A Study to Compare Effects of Magnesium Sulphate and Fentanyl with Bupivacaine for Postoperative Analgesia in Perianal Surgeries

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Abstract

Context: Magnesium prolongs analgesia in humans when given intrathecally. Fentanyl being highly lipid soluble diffuses into spinal cord and binds to dorsal horn receptors rapidly when administered intrathecally. *Aims:* To compare the effects of magnesium sulphate and fentanyl with bupivacaine for post operative analgesia in perianal surgeries. *Material and methods:* 42 patients aged 18-65 years of ASA Grade I and II scheduled for perianal elective surgeries under spinal anaesthesia were allocated equally in two groups according to chit system randomly. Group BF- Inj. bupivacaine 0.5% 1 ml+25 µg fentanyl (preservative free) 0.5 ml. Group BM- Inj. bupivacaine 0.5% 1 ml+100 mg magnesium sulfate (preservative free) diluted to 0.5 ml with normal saline. Patients were observed for onset and duration of sensory and motor blockade, duration of postoperative analgesia and analgesic requirement in first 24 hours. *Statistical analysis:* The statistical analysis was assessed by unpaired t-test on Microsoft excel and IBM SPSS version 21. *Results:* Duration of sensory block, motor block and postoperative analgesia was significantly more in BM group than in BF group ($p<0.001$). Time to rescue analgesia in group BF was significantly less than that in group BM ($p<0.001$). *Conclusion:* Though the onset of motor and sensory block is delayed with intrathecal magnesium sulfate, duration of analgesia is prolonged as compared to intrathecal fentanyl. Total analgesic requirement is significantly more with fentanyl as compared to magnesium.

Keywords: Bupivacaine; Intrathecal; Magnesium; Fentanyl.

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Introduction

John Dyren (1631-1701) said for all the happiness mankind can gain not in pleasure but in rest from pain [1]. Among regional anaesthesia, spinal anaesthesia is a very old and popular anesthetic technique with high success rate and good safety profile. It is easy to perform, has rapid onset of action, good muscle relaxation and early recovery but it has limited duration of action. To prolong the duration of analgesia many opioids have gained popularity as adjuvants. Fentanyl is highly lipid soluble and has rapid onset of analgesia while magnesium prolongs duration of analgesia.

Materials and Methods

This study was carried out at Dhiraj hospital in the department of anaesthesiology. After institutional ethical and research committee approval study was conducted on 42 patients. Preoperatively patients were informed about the anaesthesia procedure & drugs that would be used, its effects & its side effects and were only included in the study after written and informed consent was taken.

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Inclusion criteria

i. Patient willing to sign the informed consent form.
ii. ASA (American Society of Anaesthesiologists) grade I and II.
iii. Between the ages of 18-65 years.
iv. No known allergy to drugs.

Exclusion criteria

i. Patient's refusal for procedure.
ii. Age < 18 & > 65 years.
iii. Known hypersensitivity to local anaesthetics.
iv. Any systemic disease.
v. Contraindication to spinal anaesthesia.

42 patients of ASA I & II of either gender scheduled for perianal surgeries were divided into two equal groups according to chit system randomly. Group BM patients received Inj. bupivacaine 0.5% 1 ml + inj. magnesium sulphate (preservative free) 100 mg diluted to 0.5 ml with 0.9% normal saline and Group BF patients received Inj. bupivcaine 0.5% 1 ml + inj. fentanyl (preservative free) 25 μg (0.5 ml).

Pre-anaesthetic check-up and routine investigations were carried out and were explained about visual analogue scale (VAS). Patients were kept nil per oral overnight before surgery. On the day of surgery in the operating room an intravenous line was secured and inj. Ringer's lactate was started. Patients were premedicated with inj. glycopyrrolate 0.2 mg i.v. and inj. ondansetron 0.1 mg kg^{-1} i.v. Patient was kept in sitting position. Spinal anaesthesia was given in L_{3-4} intervertebral space with a 23 gauge spinal needle after free flow of cerebrospinal fluid under antiseptic and aseptic precautions. Patient was placed supine immediately after the injection and given supplemental oxygen via ventimask.

Assessment of Sensory Blockade:

The sensory block was determined using pin prick test. The height of the block was assessed at 2 and 5 minutes post-injection and at 5-minutes intervals until two consecutive levels of sensory block was identical (i.e fixation of the level), after which assessment was done every 30 minutes. When the sensory block reached at T_{12} level surgeon was allowed to start the surgery. Onset of sensory block was measured from intrathecal injection to loss of pinprick sensation at T_{12}.

Assessment of Motor Blockade

Tested by Bromage scale, time of onset (Time from intrathecal injection to grade 3 motor block) and duration of motor block (Time from Grade 3 to Grade 0 motor block) was recorded.

Intraoperatively all patients of both groups were monitored for pulse rate, systolic & diastolic arterial blood pressure, arterial oxygen saturation (SpO_2), Sensory block: onset, level using pinprick test, Motor block: onset and duration of block using modified Bromage scale. Pulse rate, systolic blood pressure, diastolic blood pressure, SpO_2, were monitored at: 0, 5, 10, 15, 20, 30, 45, 60, 75, 90, 120 minutes. After completion of surgery patients were shifted to recovery room and observed for pulse, blood pressure and SpO_2 every 15 minutes for first half an hour and then every 30 minutes for two hours. Patients were also observed for VAS, sensory level and duration of motor blockade. Duration of analgesia was calculated from the time of intrathecal injection to the time when visual analogue scale was ≥ 4 and Inj. diclofenac sodium 1.5 mg/kg was given i. v. for analgesia. Time to rescue analgesia and total number of analgesics required in the first 24 hours were recorded.

Results

Total 42 patients were allocated for the study. Both groups were comparable in respect to onset and duration of sensory and motor blockade, duration of analgesia and total analgesic requirement in 24 hours.

Table 1: Onset & Duration of Sensory and Motor Block

Time (minutes)	Group BM (n=21) Mean±SD	Group BF (n=21) Mean±SD	p value
Onset of sensory block	5.09 ± 0.62	3.23 ± 0.62	<0.0001
Onset of motor block	4.85 ± 0.79	3.85 ± 0.79	<0.0001
Duration of sensory block	198.80 ± 16.34	155.47 ± 19.67	<0.0001
Duration of motor block	217.00 ± 19.99	165.76 ± 23.38	<0.0001

The mean onset time of sensory analgesia and onset of motor block was significantly earlier in group BF as compared to group BM, which was statistically highly significant ($p < 0.0001$). The mean duration of sensory block and motor block was significantly prolonged in Group BM as compared to Group BF ($p < 0.0001$)

Table 2: Mean Duration of Post-Operative Analgesia

Time (minutes)	Group BM (n = 30)	Group BF (n = 30)	P value
Duration of Analgesia	348.57 ± 44.61	186.90 ± 27.70	<0.0001

The mean duration of analgesia was statistically significantly prolonged in Group BM as compared to Group BF (p<0.0001).

Table 3: Post Operative Analgesic Consumption in 24 Hours

Time (24 Hours)	Group BM (n=21)	Group BF (n=21)	p value
Analgesic consumption	1.28 ± 0.46	2.35 ± 0.48	<0.0001

Analgesic consumption for 24 hours postoperatively was less in Group BM as compared to Group BF which was statistically highly significant (p < 0.0001)

Discussion

Spinal anaesthesia is a simple technique that provides a deep and fast surgical block through injection of small doses of local anaesthetic solution in sub arachid space. It provides excellent operating conditions for surgeries below the umbilicus. In last few decades many agents have been used along with bupivacaine to prolong the intra-operative and post operative analgesia, the opioid being the most common. In Our study, we had observed that the difference in demographic data (Age, Weight, Gender distribution, American Society of Anaesthesiologists status) were statistically not-significant among both groups (p>0.05).

In our study we used 100 mg magnesium sulphate and 25 µg fentanyl because it was a safer dose with minimal side effects, prolonged duration of analgesia compared to other doses as observed by Nath M.P. et al. (2012) [2] , Khezri M.B. et al. (2012) [3] and Yadav M et al. (2015) [4].

Onset of sensory and motor block was delayed in group BM as compared to group BF. The results were also comparable with the studies done by Nath M.P. et al. (2012) [2] and Bharat Arora et al. (2015)[5].

Delayed onset with magnesium could be because of difference in pH and baricity of the solution containing magnesium as reported in study by Bharat Arora et al. [5] in mild pre-eclampsia patients.

Early onset with fentanyl is because of its high lipid solublility which diffuses rapidly into the spinal cord and binds to dorsal horn receptors when administered intrathecally.

In our study the mean duration of analgesia was prolonged in Group BM compared to group BF which was statistically highly significant as observed in various studies [2,5].

Magnesium blocks calcium influx and non-competitively antagonises N-methyl-D-aspartate (NMDA) receptor channels. Magnesium sulphate given intrathecally prolonged analgesia in humans. Magnesium possesses a property of NMDA receptor antagonist. NMDA receptor antagonist plays an important role in prevention of central sensitization of pain.

In our study, there was no statistically significant change in mean pulse rate, systolic blood pressure, diastolic blood pressure and SpO_2 in both groups intra operatively and post operatively (p>0.05) as observed by Nath et al. (2012) [2] and Vasure et al. (2016) [6].

Analgesic requirement in group BF was significantly less than that in group BM. This was comparable with study done by Khezri MB et al. (2012) [3]. There were no intra and postoperative complications with any of the groups as compared with other studies. [2,3].

Conclusion

From the present study we concluded that the supplementation of 100 mg preservative free magnesium sulphate to 1ml 0.5% hyperbaric bupivacaine though significantly delays the onset time of sensory and motor block but prolongs the duration of sensory block, motor block and postoperative analgesia as compared to 25 µg preservative free fentanyl when added to intrathecal 1 ml 0.5% hyperbaric bupivacaine without any side effects. Postoperative analgesic consumption in 24 hrs is less in magnesium group than in fentanyl group.

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Conflict of Interest: None

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