

# Comparison of Magnesium Sulphate 100mg and Fentanyl 25µg as Adjuvants to Intrathecal Hyperbaric Bupivacaine 0.5% for Infraumbilical Surgeries

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**Abstract:** *Introduction: Intrathecal adjuvants have gained popularity for prolonging the duration and quality of block; opioids (fentanyl and sufentanil) and other drugs like magnesium sulphate, midazolam, clonidine and ketamine are used. Methods: We conducted double blinded, prospective study on total of 90 patients, who were randomly allocated into three groups. Inclusion Criteria: 1. ASA grade I&II. 2. Patients of either gender between ages of 18-60 years. Exclusion Criteria: 1. Patients with severe systemic disease - hepatorenal, cardiovascular diseases and bleeding disorders. 2. Patients with allergy to opioid. Discussion: In our study, it was observed that Bromage score 3 was achieved earliest in group C in 10 min while in other groups it was delayed. Ozalevli et al. observed a similar delay when adding intrathecal magnesium to fentanyl and isobaric bupivacaine (we used hyperbaric bupivacaine in our study Conclusion: Addition of magnesium sulphate at 100 mg dose or fentanyl 25 µg as adjuvants to intrathecal bupivacaine significantly prolongs the duration of analgesia. At these doses, magnesium provides better haemodynamic stability than fentanyl, with fewer side effects. References: Ozalevli M, Cetin TO, Unlugenc H, Guler T, Isik G. The effect of adding intrathecal magnesium sulphate to bupivacaine-fentanyl spinal anaesthesia. Acta Anaesthesiol Scand 2005; 49: 1514-9.*

**Keywords:** fentanyl, magnesium sulphate

## 1. Introduction

Intrathecal adjuvants have gained popularity for prolonging the duration and quality of block; opioids (fentanyl and sufentanil) and other drugs like magnesium sulphate, midazolam, clonidine and ketamine are used.

Fentanyl being highly lipid soluble diffuses into the spinal cord and produces a rapid onset of analgesia.

Magnesium sulphate blocks calcium influx and non-competitively antagonises N-methyl-D-aspartate (NMDA) receptor channels.

Intrathecal magnesium sulphate potentiates duration of analgesia like fentanyl and also avoids the side effects posed by intrathecal fentanyl.

## 2. Methods

We conducted double blinded, prospective study on total of 90 patients, who were randomly allocated into three groups.

Elective surgery of uncomplicated inguinal hernia was done using similar surgical technique.

### Inclusion Criteria

- 1) ASA grade I&II
- 2) Patients of either gender between ages of 18-60 years.

### Exclusion Criteria:

- 1) Patients with severe systemic disease - hepatorenal, cardiovascular diseases and bleeding disorders.
- 2) Patients with allergy to opioid.
- 3) Patients who had already received magnesium sulphate by other route.
- 4) Patients in whom more than two attempts and an approach other than midline was used.
- 5) Other C/I of subarachnoid block.

IV ranitidine 50 mg was given as pre-medication 15min before planned surgery.

↓  
The procedure was explained to the patient and written informed consent was taken.

↓  
Baseline values of HR, SBP, DBP and SpO<sub>2</sub> were recorded.

↓  
Pre loading with IV RL 10 ml/kg done of all patients.

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With aseptic technique, a 25 gauge Quincke L.P. needle was inserted intrathecally via the L3-L4/L4-L5 interspace by midline approach with the patient in sitting position.

↓  
After a successful dural puncture, anaesthetic solution was injected.

↓  
Blinding was achieved through the use of equal amount of drugs (3.5 ml), syringes used were labelled as A, B and C according to their content.

Three groups were labelled as follows:

- 1) Group A - 15 mg bupivacaine (0.5% heavy) with 25 µg fentanyl.
- 2) Group B - 15 mg bupivacaine (heavy) with 100 mg magnesium sulphate (preservative free) total volume - 3.5 ml.  
Magnesium was taken in insulin syringe and then diluted to 0.5 ml with normal saline.
- 3) Group C - 15 mg bupivacaine (heavy) with 0.5 ml of normal saline.

SBP 20% below the baseline was treated with IV RL and IV bolus of mephentermine 6mg.

Duration of analgesia was recorded as the time from intrathecal injection to the time of first complaint of pain or VAS >3.

Rescue analgesia consisted of injection tramadol 50 mg IV.

### 3. Statistical Analysis

The data were analysed using SPSS version 20 and all means are expressed as mean ± standard deviation (SD). The comparisons among the groups were done using ANOVA followed by Bonferroni test for multiple comparisons. Student's *t*-test for the continuous variable (age) and Chi-square test for categorical variables were used.

Reading considered statistically significant when *p* value < 0.05.

Patients were placed in supine position once the drug was administered.

Sensations were tested by pin prick method and the quality of motor block was assessed using Bromage score.

Visual analogue pain scale (VAS) scores were explained to the patient pre-operatively and were recorded up to 24 hr.

Rescue analgesia was given when VAS score was >3 Or time of first complain of pain.

The onset of motor blockade was assessed at 5 min interval till 20 min (M5, M10, M15 and M20).

Somnolence was assessed as per sedation scale:

- 1 = fully awake.
- 2 = somnolent and responds to call.
- 3 = somnolent and responds to verbal stimulation.
- 4 = asleep and responds to only painful stimulation.

SBP and DBP were recorded 5 min before and every 5 min for the first 20 min after the administration of subarachnoid block and thereafter every 5 min till the end of the surgery.

### 4. Results

All the patients in group C achieved a Bromage score of 3 in 10 min while all the patients in group B achieved the same score in 15 min and in group A in 20 min.

In group A, all the haemodynamic parameters (HR, SBP, DBP) were decreased by more than 20% when compared to baseline parameters while in the other two groups (groups B and C), parameters were within clinically acceptable range of ± 20% from baseline [Table 1].

**Table 1:** Comparison of HR, SBP, DBP in the three groups

Timing	Groups	HR (beats/min)		SBP (mm of Hg)		DBP (mm of Hg)	
		Mean±SD	P	Mean±SD	P	Mean±SD	P
Baseline	Group A	88.67±17.83		128.93±16.84		81.40±12.28	
	Group B	87.40±9.16		132.60±17.95		84.93±8.25	
	Group C	88.97±14.56		133.80±13.09		85.33±7.57	
At 5 min	Group A	63.60±16.97	<0.001	97.17±12.42	<0.001	57.33±10.99	<0.001
	Group B	81.10±12.21	<0.05	121.30±10.86	<0.001	74.70±9.19	<0.001
	Group C	82.17±13.55	>0.05	122.03±10.17	<0.001	77.07±6.79	<0.001
At 10 min	Group A	62.20±16.02	<0.001	94.83±11.24	<0.001	56.77±10.42	<0.001
	Group B	78.77±10.71	<0.001	116.30±11.62	<0.001	73.30±8.55	<0.001
	Group C	81.33±15.65	>0.05	117.63±9.18	<0.001	76.87±8.17	<0.001
At 15 min	Group A	61.16±14.87	<0.001	93.20±10.03	<0.001	55.00±9.82	<0.001
	Group B	77.57±11.01	<0.001	115.17±12.13	<0.001	75.47±7.95	<0.001
	Group C	78.97±14.46	<0.01	117.20±8.67	<0.001	76.10±7.54	<0.001
At 20 min	Group A	60.17±14.32	<0.001	90.90±10.04	<0.001	54.37±9.82	<0.001
	Group B	76.70±11.71	<0.001	113.43±10.88	<0.001	73.93±7.63	<0.001
	Group C	77.90±13.62	<0.001	118.13±9.55	<0.001	74.77±6.42	<0.001

HR-Heart rate; SBP-Systolic blood pressure; DBP-Diastolic blood pressure

One patient in Group A and two in Group C had sensory blockade below T10 whereas 9 patients in Groups B had block below T10 [Table 2].

The mean duration of analgesia was statistically significant in group A (374.30 min) and B (328.13 min) as Compared to group C (246.03 min) [Table 3].

**Table 2:** Level of block achieved after 20min

Dermatomal Level	Group A (%)	Group B (%)	Group C (%)
T4	1 (3.3)	1 (3.3)	0 (0)
T6	2 (6.7)	0 (0.0)	4 (13.3)
T8	5 (16.7)	4 (13.3)	8 (26.7)
T9	2 (6.7)	2 (6.7)	2 (6.7)
T10	19 (63.3)	14 (46.7)	14 (46.7)
T11	1 (3.3)	7 (23.3)	0 (0)
T12	0 (0)	2 (6.7)	2 (6.7)
Total	30	30	30

The mean duration for complete motor recovery was maximum in group A (291.93 min) followed by group B (228.10 min) and was least in group C (211.93 min).

**Table 3:** Comparison of mean duration of analgesia, complete recovery and rescue analgesic requirement

Group	Duration of analgesia (min)	Complete recovery (min)	Rescue analgesics (number)
Group A	374.30 ± 128.058	291.93 ± 89.011	10
Group B	328.13 ± 115.302	228.10 ± 96.180	11
Group C	246.03 ± 67.273	211.93 ± 43.924	18

## 5. Discussion

In our study, it was observed that Bromage score 3 was achieved earliest in group C in 10 min while in other groups it was delayed.

Ozalevli *et al.* observed a similar delay when adding intrathecal magnesium to fentanyl and isobaric bupivacaine (we used hyperbaric bupivacaine in our study).

It could be because of difference in pH and baricity of the solution containing magnesium sulphate (group B) that contributed to the delayed onset.

Increase in metabolism of bupivacaine due to activation of cytochrome p450 by magnesium, this may be the reason for lesser duration of analgesia.

Unlugenc *et al.* in their study on intrathecal magnesium showed that it does not affect the onset or maximal level of sensory blockade.

In our study, maximum number of patients achieved the block up to T10 level.

Group B patients had a reduced total consumption of tramadol in the first 24 h after surgery.

Duration of analgesia was prolonged in group A as well as in group B as compared to groups C.

## 6. Conclusion

Addition of magnesium sulphate at 100 mg dose or fentanyl 25 µg as adjuvants to intrathecal bupivacaine significantly prolongs the duration of analgesia. At these doses, magnesium provides better haemodynamic stability than fentanyl, with fewer side effects.

## 7. Futuristic Goals

Addition of higher doses of magnesium sulphate could replace fentanyl, thereby avoiding opioid side effects, like sedation, pruritus, respiratory depression, hypotension and bradycardia.

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Conflicts of interest – Nil

## References

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