 DOI: 10.18231/2394-4994.2017.0070

# A study to observe the effects of addition of magnesium sulphate as an adjuvant to 0.5% bupivacaine for intrathecal anesthesia in surgeries of lower limbs

**Prabhavathi R[1,*], G. Anand ISAAC[2], P. Narasimha Reddy[3], P. Umanageshwarah[4]**

[1]Associate Professor, [2]Assistant Professor, [3]Professor, [4]PG Student, Dept. of Anaesthesia,

***Corresponding Author:**
Email: prabhavathi95gmc@gmail.com

## Abstract

Intrathecal anesthesia is used commonly for surgical procedures and local anesthetics are associated with relatively short duration of action. A number of adjuvants have been used to prolong the postoperative analgesia.

**Objectives:** This study is to investigate the effects of intrathecal Magnesium sulfate 100 mg, added to hyperbaric Bupivacaine 0.5% on the Spread, duration, regression of spinal block, and duration of postoperative analgesia in patients undergoing lower limb surgeries.

**Materials and Method:** Sixty selected patients were randomized to Group B (n=30) patients who received 0.5% heavy Bupivacaine 3ml (15 mg) + Normal saline 0.2 ml and Group M (n=30) patients who received 0.5% heavy Bupivacaine 3ml(15mg)+50%MgSO4 0.2 ml(100mg) intrathecally for lower limb surgeries. Block characteristics, hemodynamic changes and adverse effects were compared.

**Results:** Efficacy of both the drugs when given intrathecally was studied. Mean time needed for sensory blockade at T10 was 3.3±0.7 min in group B and 4.33±0.9 min in group M and p value (<0.001). The mean of total duration of the sensory block in group B was 171.5±18.76 min while it was 218.5±22.52 min in group M (p value <0.001). Time taken for onset of motor block was 4.96±1.2 min in group B and 7.66±1.26 min in group M (p value <0.001). The mean of total duration of motor block in group B was152.5±11.87 mins while it was190.66±21.2 min in group M (p value <0.001). The total duration of effective analgesia in group B was 168.5±16.56 min and in group M was 225.76±24.81 min (p value <0.001). There was no clinical significance in occurrence of side effects in both the groups.

**Conclusion:** Magnesium sulphate at a dose of 100mg added to 3ml of bupivacaine provided better and extended duration of sensory, motor blockade and total duration of effective analgesia for patients under intrathecal anaesthesia for lower limb surgeries with no sedation.

**Keywords:** Spinal anesthesia, Hyperbaric bupivacaine, Magnesium sulphate, Effective analgesia

**Received:** 16th December, 2016 **Accepted:** 8th February, 2017

## Introduction

Pain is "an Unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.[1]

Regional anesthesia has the advantages of safe, cost effective and prolonged post operative analgesia.[2] With the help of epidural catheters,[3] epidural anesthesia can be prolonged and also by administration of adjuvants[4] along with local anesthetics intrathecal anesthesia can be prolonged.

Lower limb surgeries can be performed under regional, general anesthesia or local, but neuraxial blockade is referred choice.

Intrathecal anesthesia is the technique of choice because of rapid onset, high quality block, lack of catheter related infections, less failure rate and also cost effective. But the disadvantages are limited duration of block and short duration of post operative analgesia.

Nowadays use of adjuvants in intrathecal anesthesia is gaining much popularity with benefit of increased duration of blockade, good patient satisfaction, success rate, optimal resource utilization in comparison to general anesthesia and fast recovery. Effective pain management accelerates functional recovery, facilitates rehabilitation and enables the patients to comeback quickly to their normal activity.

The duration of intrathecal anesthesia can be prolonged by using opioids[5,6] and other drugs like dexmedetomidine(DXM),[7] clonidine,[8] magnesium sulfate,[9] ketamine, midazolam etc. But each drug has its own adverse effects.

Magnesium which is a non competitive antagonist to N-Methyl D-Aspertate receptors has the property to prevent central sensitization from peripheral nociceptive stimulation. The antinociceptive property of Magnesium appears to be relevant not only to chronic pain[10,11] but it also determines intensity of duration, postoperative pain.[12,13]

## Materials and Method

The present study was done at Department of Anesthesiology, Narayana Medical College Hospital during a period of six months June 2016 – November 2016.The review convention was endorsed by the Institutional Ethical Committee. 60subjects were selected from the patients displaying for elective lower limb surgeries after following the incorporation and avoidance criteria set down for the review. Composed

educated assent was appropriately gotten from every one of the members in their own particular dialect.

**Inclusion criteria:** Age – 18-55 years, Sex, ASA I or II, Undergoing elective lower limb surgeries

**Exclusion criteria:** Extremes of ages, Pregnancy, ASA > II, Significant cardiac disease, Significant renal disease, Significant hepatic disease, Neuromuscular disease, Patients on calcium channel blockers, opioids, magnesium sulphate, Contraindications for regional anaesthesia, Contraindication for study medication.

**Procedure:** Sixty adult patients of ASA Grade I and II undergoing lower abdominal surgery were randomly divided into two equal groups (n=30).

Randomization was done by using physical method, where 60 folded papers were placed in a container, each one labeled either group B or group M. A third person was asked to take a folded paper from the container before beginning of the procedure. This is a single blinded study as the patients did not know what drug they were receiving.

On the operating table, routine monitors like (pulse-oximetry, ECG, NIBP) were connected and baseline vital parameters (blood pressure, heart rate, oxygen saturation (SPO2) were recorded. An intravenous line with 18G cannula was placed and Ringer lactate infusion was started at the rate of 15 ml/kg.

**Group B** (n=30) patients received0.5% heavy Bupivacaine 3ml (15 mg) + Normal saline 0.2 ml

**Group M** (n=30) patients received 0.5% heavy Bupivacaine 3ml (15mg) +50%MgSO4 0.2 ml(100mg)

The patients were kept in left lateral position and sub-arachnoid block was performed & drug was given intrathecally in L3- L4or L2-L3 space with 23 gauze Quincke-Babcock spinal needle with hub directed upward. Patients were then made to lie in supine and following were noted.

- Time of initiation of sub-arachnoid block
- Time of onset of sensory block (assessed by pin prick)
- Time to achieve the maximum level of sensory block)
- Total duration of sensory block
- Time taken to achieve complete motor block
- Total duration of motor blockade
- Duration of surgery
- Time of rescue analgesia given

Time of onset of sensory block was taken when there was no pain to pin prick at T10 level. Total duration of sensory block was taken from the time of injection to regression to S1. Motor block was assessed using a modified Bromage scale.

Modified Bromage Scale:

| Score | Bromage scale |
|---|---|
| 0 | The patient is able to move the hip , knee and ankle |
| I | Patient is unable to move the hip but is able to move the knee and ankle |
| 2 | Patient is unable to move the hip and knee but is able to move the ankle |
| 3 | Patient is unable to move the hip knee and ankle |

Total duration of motor block was assessed till blockade regressed to score '0'. Effective analgesic duration was taken from onset of sub-arachnoid block to time of administration of rescue analgesia.

Blood pressure, Heart rate and arterial oxygen saturation was noted every five-fifteen minutes interval intra-operatively and at every thirty minutes interval postoperatively till rescue analgesia was given. Hypotension was defined as > 20% decrease in Mean Arterial Pressure (MAP) from baseline value and was treated with intravenous fluids and intravenous mephenteramine (3 mg) in incremental doses. Bradycardia (pulse < 60 beats / min) was treated with intravenous atropine sulphate 0.5 mg bolus.

**Statistical analysis:** The Statistical software namely Open Epi, Version 2.3 was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

## Results

The present study was conducted to know the efficacy of intrathecal magnesium to 0.5% Bupivacaine heavy for lower limb surgeries.

The demographic profile was compared and there was no statistical significance in between the groups (Table 1).

The mean time to achieveT10 sensory level in gro up M(4.33±1.09min) and in group B(3.3±0.7min) and was statistically significanT (p value <0.001). (Table 1 & Graph 1)

Onset of motor block was prolonged in group M (7.66±1.26min) as compared to groupB (4.96±1.21 min) which was statistically highly significant (P value <0.001).(Table 1 & Graph 2)

Total duration of sensory block was more in group M (218.5±22.52) min when compared to group B (171.5± 18.76) min.(Table 1 & Graph 3)

Total duration of motor block was more in group M (190.66±21.2 min) when compared to group B (152.5±11.87 min).(Table 1 & Graph 4)

Total duration of effective analgesia was higher in group M (225.76±24.81 min) than group B (168.5±16.56 min) (Table 1 & Graph 5).

**Table 1**

| Parameters | Group B | Group M | P Value |
|---|---|---|---|
| Age (in yrs) | 38.93 | 42.36 | >0.05 |
| Sex (F/M) | 14/16 | 15/15 | >0.05 |
| Mean Duration of surgery | 81.25 | 79.7 | 0.05 |
| Onset of sensory block (in mins) | 3.3±0.7 | 4.33±0.9 | <0.001 |
| Onset of motor block (in mins) | 4.96±1.21 | 7.66±1.26 | <0.001 |
| Duration of sensory block (in mins) | 171.5±18.76 | 218.5±22.52 | <0.001 |
| Duration of motor block (in mins) | 152.5±11.87 | 190.66±21.2 | <0.001 |
| Duration of effective analgesia (in mins) | 168.5±16.56 | 225.76±24.81 | <0.001 |

**Table 2: Pulse rate variations at various intervals in both the groups**

| Time in min | Group B PR in b/min | Group M PR in b/min | P-value |
|---|---|---|---|
| Pre op '0' | 81.5 | 79.33 | >0.05 |
| 1 | 82.16 | 77.8 | >0.05 |
| 5 | 78.7 | 77.3 | >0.05 |
| 10 | 74.83 | 73.56 | >0.05 |
| 20 | 75.33 | 72.16 | >0.05 |
| 30 | 74.23 | 72.7 | >0.05 |
| 45 | 80.1 | 83.03 | >0.05 |
| 60 | 84.83 | 84 | >0.05 |
| 90 | 87.43 | 86.83 | >0.05 |
| 120 | 88.56 | 86.2 | >0.05 |
| 180 | 88.8 | 86.36 | >0.05 |
| 240 | 88.06 | 88.23 | >0.05 |
| 300 | 89 | 89.63 | >0.05 |
| 360 | 88.33 | 90.03 | >0.05 |
| 420 | 88.9 | 89 | >0.05 |
| 480 | 87.53 | 88.93 | >0.05 |
| 540 | 89.49 | 87.66 | >0.05 |
| 600 | 89.26 | 87.46 | >0.05 |
| 660 | 87.9 | 86.9 | >0.05 |
| 720 | 89.23 | 87.63 | >0.05 |

**Table 3: MAP variations at various intervals in both the groups**

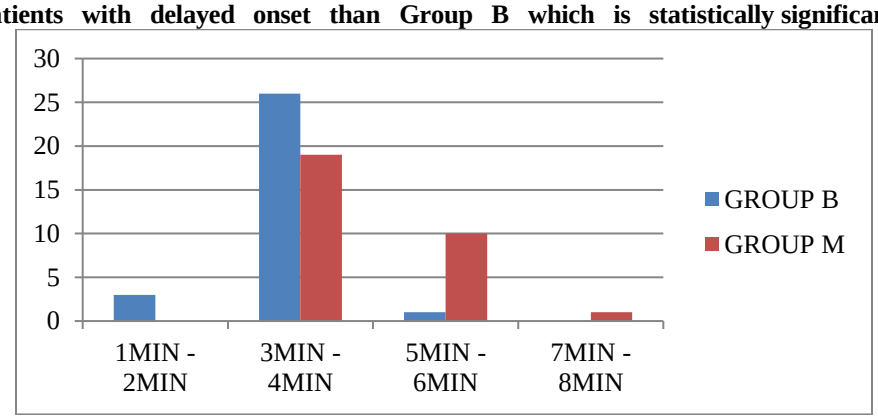
| Time in min | Group-B MAP in MM/HG | Group-M MAP in MM/HG | P-Value |
|---|---|---|---|
| Pre op '0' | 87.2 | 85.9 | >0.05 |
| 1 | 84.13 | 86.76 | >0.05 |
| 5 | 78.58 | 80.23 | >0.05 |
| 10 | 74.2 | 75.26 | >0.05 |
| 20 | 69.5 | 72.1 | >0.05 |
| 30 | 70 | 71.96 | >0.05 |
| 45 | 70.16 | 71.33 | >0.05 |
| 60 | 75.36 | 74 | >0.05 |
| 90 | 80.93 | 78.13 | >0.05 |
| 120 | 84.26 | 82.26 | >0.05 |
| 180 | 87.6 | 85.6 | >0.05 |
| 240 | 87.4 | 85.93 | >0.05 |
| 300 | 82.76 | 82.8 | >0.05 |
| 360 | 84.83 | 81.56 | >0.05 |
| 420 | 85.63 | 83.36 | >0.05 |
| 480 | 83.43 | 82.86 | >0.05 |

| | | | |
|---|---|---|---|
| 540 | 84.16 | 84.4 | >0.05 |
| 600 | 87.3 | 86.73 | >0.05 |
| 660 | 82.53 | 84.86 | >0.05 |
| 720 | 84.66 | 85.03 | >0.05 |

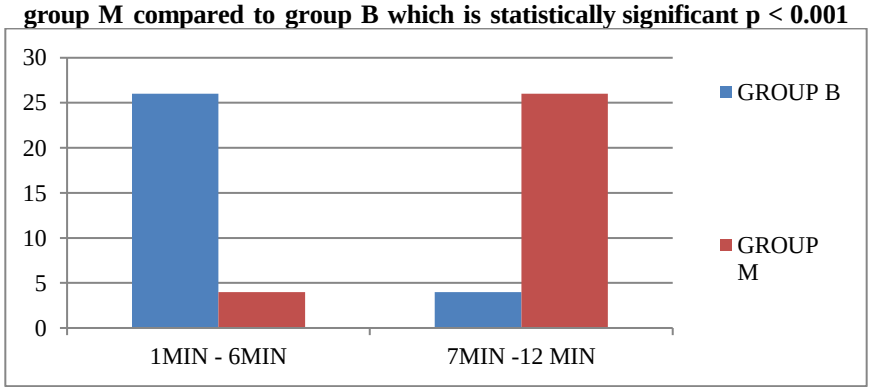
**Table 4: Adverse effects**

| | Group B | Group M | P- Value |
|---|---|---|---|
| Hypotension | 8 | 6 | >0.05 |
| Bradycardia | 6 | 4 | >0.05 |
| Nausea/vomiting | 4 | 5 | >0.05 |
| Resp. depression | -- | -- | -- |
| pruritus | -- | -- | -- |

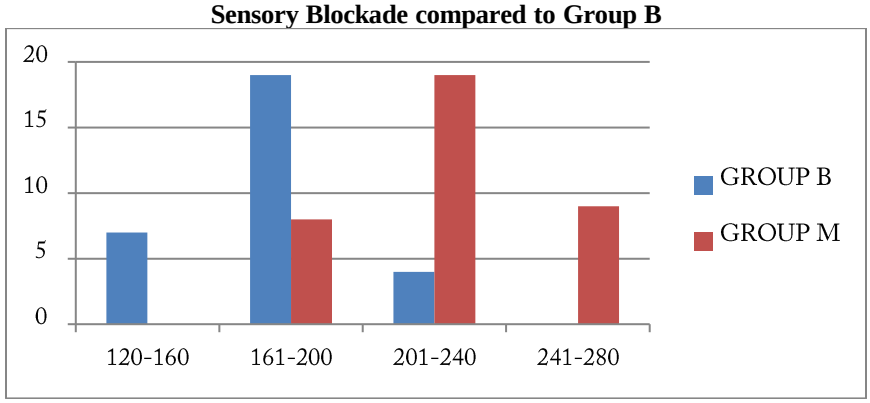
**Graph 1: Shows onset of sensory block in both groups. Group M shows more no. of patients with delayed onset than Group B which is statistically significant p < 0.001**



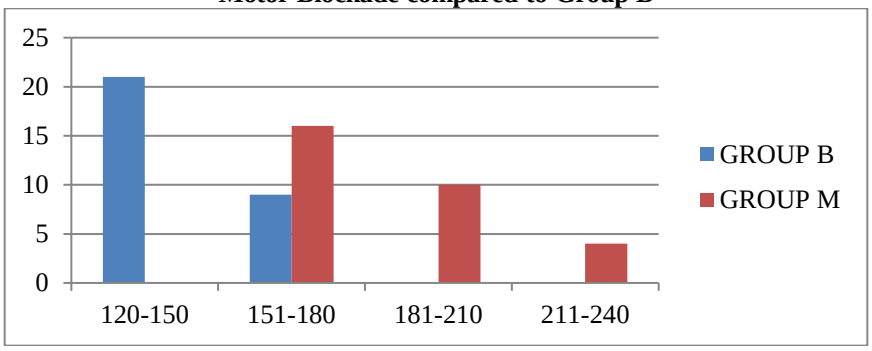

**Graph 2: Shows onset of motor duration in both groups. Onset of motor block is delayed in group M compared to group B which is statistically significant p < 0.001**



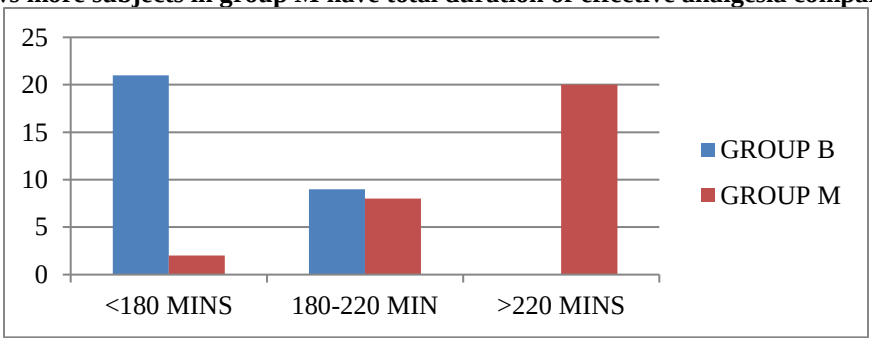

**Graph 3: Shows that Group M has more number of subjects with prolonged Sensory Blockade compared to Group B**



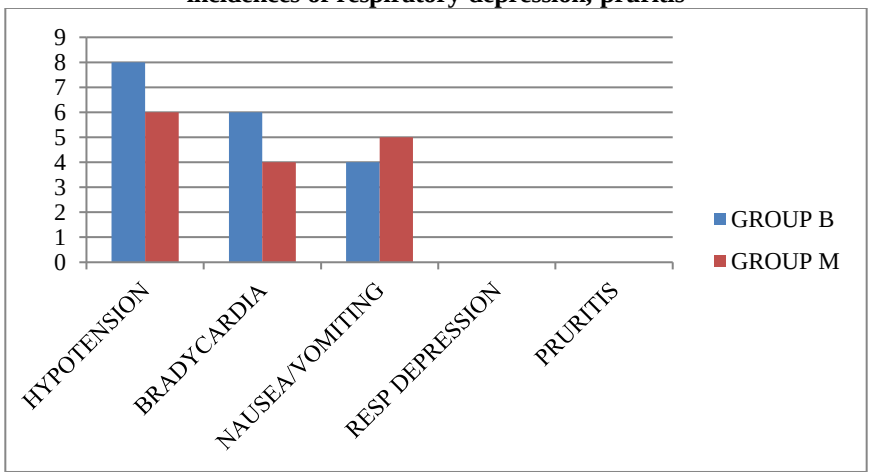
**Graph 4: Shows that Group M has more number of subjects with prolonged Motor Blockade compared to Group B**




**Graph 5: Shows more subjects in group M have total duration of effective analgesia compared to group B**




**Graph 6: Showing complications in both groups. Complications like hypotension bradycardia, nausea/vomitings in both the groups were comparable. There were no incidences of respiratory depression, pruritis**




## Discussion

Spinal anesthesia is regularly utilized in surgical, obstetric, gynecological, orthopedic, urological surgeries. Numerous spinal adjuvants are accessible presently to enhance the nature of LA square and post agent analgesia.[14] Animal studies have exhibited that intrathecal magnesium smothers nociceptive driving forces in neuropathic pain setting.[11] Intrathecal magnesium was initially utilized in humans in 1906. Haubold & Meltzer gave 1000-2000 mg, creating profound sensory and motor block for 3-27 hrs with recovery.[15] In 1985, Lejuste unintentionally infused 1000mg MgSO4 intrathecally[16] in a 22 week pregnant requiring McDonald suture, delivered a intense block enduring 90 min before entire procedure.

M.D. Gita Shoeibi et al[17,18] concluded that 50mg MgSO4 along with Lignocaine heavy when given intrathecally for caesarian sections increased the duration of effective analgesia in magnesium group(160.8±49.1 min) when compared to Group C(113.3±27.3 min) P = 0.001. This is similar to the results of present study P<0.001, but the duration of effective analgesia is still longer in both magnesium (225.76±24.81 min) & control group (168.5±16.5min)

as the local anaesthetic agent used in the present study was bupivacaine & in the previous study it was lignocaine. Complications in both groups were statistically insignificant $p > 0.05$ when compared with results of present study $p > 0.05$.

Dr. Sushrita Paulet al[19] showed that adding 50mg MgSO4intrathecally in patients undergoing lower limb surgeries delayed onset of sensory block as well as time to reach peak sensory block in magnesium group(6.65±1.08 min, 19.26±4.41 min) than control group(5.2±1, 21 min, 14.83±3.46 min) significantly $p < 0.001$. These results are lower than the present study; onset on sensory block in magnesium group was 4.33±1.09 min & in control group 3.3±0.7 min, may be due to observer variation. Time taken for rescue analgesia was more in magnesium group (382±46.9 min) than control group (225.76±24.81 min) $p< 0.001$. In the present study time of rescue analgesia was 225.76±24.81 min. This change may be because of different protocol from the present study.

S. Malleeswaran et al[20] have concluded that addition of 50 mg $MgSO_4$ intrathecally in pre-eclamptic pregnant undergoing caesarean sections delayed the onset of sensory & motor blockade in magnesium group (8.7±0.9, 8.9±1min)compared to control group (7.7±0.8,9.2±0.8 min) $p < 0.001$. Sensory regression to T12& motor to modified Bromage '0' was more in magnesium group(197.8±13.8, 200±17.8 min) than control group (165.7±12, 175.3±18.3min) comparable to the results of present study. Magnesium also required less Diclofenac (147.5±53.9mg) than control group (182.5±58mg).

Deepika Shukla et al[21] concluded that addition of 50 mg intrathecal MgSO4 prolonged the onset of sensory block & motor block in magnesium group(6.46 ± 1.33 and 7.18 ± 1.38min) in comparison with control group 4.14± 1.06 and 4.81 ± 1.03 min) in lower abdominal surgeries. The regression time of block, both sensory up to T10 dermatome and motor to bromage 3 scale, was prolonged in the Mg group (265 ± 65 and 251 ± 51 min) when compared within the control group (194 ± 55 and 140 ± 34 min). The findings of the present study were correlating with this study.

Khalili G et al[22] concluded that addition of 100 mg MgSO4 intrathecally prolongs onset & duration of sensory block in magnesium group(13.3, 106.5 min) compared to control group (11.6,85.5 min) $p < 0.01$. These results were entirely different from the present study. Probably the methodology chosen in the present study may be different from this one. Analgesia requirement was less in magnesium group which correlates present study.

Mitra Sabalameli & Sayed Hamid Pakzadmoghadam[23] concluded that addition of 100 mg $MgSO_4$ intrathecally for caesarean sections prolonged the onset of sensory & motor block compared 50 mg $MgSO_4$ or control group. Total duration of sensory & motor block was more in100 mg MgSO4group (129±22, 111±14 min) compared to adding 50 mg MgSO4 (92±10, 98±11 min) or control group (96±13, 91±12 min). Post-Operative pethedine consumption was lesser in 100 mg MgSO4 group $p <0.001$. Also concluded that post op nausea & vomiting was more in 100 mgMgSO4 group which was not seen in the present study as pregnant patients were excluded.

Marzieh-Beigom Khezri et al[24,25] concluded that addition of 50 mg MgSO4 intrathecally has prolonged onset of sensory block in magnesium group (5.86±1.25 min) compared to a control group (2.7±0.7 min). There was no difference in sensory & motor block duration in both magnesium &control groups. The similar results were obtained by Mridu Palan Nath et al (2012) regarding regression of motor block time for 1st analgesia was low in magnesium group (318.33±74.62 min) than control group (343.76±76.32min). But the total Pethedine consumption was less in magnesium group than control group. In the present study onset and duration of sensory and motor block both were prolonged in group M.

Dr. Charu J Pandya et al[26] have concluded that adding 100mg MgSO4 to lower abdominal surgeries prolongs the onset of sensory & motor block (P <0.01)consistent with the present study.

Dr. Charu J Pandya et al[26] also stated that total duration of sensory &motor block were high in 100mg magnesium group compared to control group. Hemodynamic abnormalities were statistically insignificant in both groups. The duration of effective analgesia was 238±6.77 min in magnesium group when compared to control group 188±6.54 min. The results were similar to present study, where effective analgesia duration was 225.76±24.81 min in magnesium group & 168.5± 16.56 min in control group.

## Conclusion

The present study concludes that addition of 100 mg MgSO4 to 15mg of 0.5% bupivacaine heavy intrathecally in patients undergoing lower limb surgeries significantly prolongs onset of sensory & motor duration, total duration of sensory & motor block, duration of effective analgesia without causing significant side effects.

## References

1. C. I. Ripamonti
Pain management, Ann Oncol (2012) 23 (suppl 10):x2 94-x30.
2. Dinesh Thakur, Chandralekha, MihirGoswami, use of chib a needle inepidural anesthesia: a combined spinal epidurala nesthesia technique,
pissn: National Journalof Community Medicine Vol 2 Issu e 2 July-Sep 2011.
3. R.G.Wheatley, Schug and D. Watson. Safety and efficacy of postoperative epidural analgeesia, Br. J. Anaesth (2001) 87(1):47-6.
4. U bakshi, s chatterjee, s sengupta, d gupta. Adjuvant drugs in centralneuraxial analgesia- a review. The internet journal of anesthesiology.2009 volume 26 number.

5. Pranjali Kurhekar**,** S Madan Kumar**,** D Sampath. Comparative evaluation of intrathecal morphine and intrathecal dexmedetomidine in patients undergoing gynaecological surgeries under spinal anaesthesia: IJA 2016;60(6):382.
6. Shikha Gupta, Supriya Sampley, Suneet Kathuria and Sunil Katyal. Intrathecal sufentanil or fentanyl as adjuvants to low dose bupivacaine in endoscopic urological procedures J Anaesthesiol Clin Pharmacol. 2013;29(4):509–515.
7. Kalso E, Poyhia R, Rosemberg P. Spinal antinociceptive by dexmedetomidine, a highly selective 2-adrenergic agonist.Pharmacol Toxicol. 1991;68:1403.
8. Anil Thakur, Mamata Bharadwaj, Kiran Preet Kaur, Jagadish Dureja, Sarla Hooda, Susheela Taxak, intrathecal clonidine as an adjuvant to hyperbaric bupivacaine in patients undergoing inguinal herniorraphy. Journal of anesthesiology clinical pharmacology 2013:29(1);66-70.
9. Haubold HA, Meltzer SJ. Spinal anesthesia by magn esium sulfate JAMA. 1906;46:647–50.
10. Tramer MR, Schneider J, Marti RA, Rifat K.Role of magn esium sulfatein postoperative analgesia. Anesthesiology.19 96;84:340–7.
11. XiaoWH, Bennett GJ. Magnesium suppresses neuropathic pain response in rats via a spinal site of action. Brain Res 1994;666:168–72.
12. Woolf CJ, Thomas WN. The induction and maintenance of central sensitization is dependent on N-methyl d-aspartate acid receptor activation: implications for the treatment of post injury pain hypersensitivity state.pain.1991:44:293, 9.
13. LysakowaskiC Dumont L Czarnetzki C, Tramer MR. Magnesium as an adjuvant to post operative analgesia: a systemic review of randomized trials. Anaesthesia analog 2007:104-1532-9.
14. N-Rawal analgesia for day care surgery. Br. J Anaesthesia 2001:87:73-87.
15. H A Haubold, S J Meltzer spinal anaesthesia by magnesium sulphate: a report of seven operations performed under its influence, JAMA. 1906;XLVI:647-645.
16. Lejuste M J. Inadvertent intrathecal administration of magnesium sulphate. S Afr Med. J.1985;68:367-8.
17. M.D Gita Shoeibi, M. D. Musthapha Sadegi, M.D. Abolfazlfirozian & M.D Farzaneh Tabassomi, the additional effect of magnesium sulphate to lidocane in spinal anaesthesia for cesarean section: International journal of pharmacology. 3(5(), 425-427, 2007.
18. Mitrajabalameli, Adding different doses of magnesium sulphate for spinal anaesthesia in the cesarean section: A prospective double blind randomized trail.Adv Bio med Res. 2012;1;7.
19. Dr. Suhitrs Paul, Dr. Dhurjoti Prasad. Bhattactarge, Dr. Sandip Ghosh, Dr. Nilay Chatterjee. Efficacy and safety of intrathecal magnesium sulphate as an adjuvant to bupivacaine for lower limb orthopaedic surgery pharmacology online2:570-57492009).
20. S. Malleswaran, N Panda, P. Mathew, R. Bagga, A randomized study of magnesium sulphate as an adjuvant to intrathecal bupivacaine in patients with mild pre eclampsia under going cesarean section, International Journal Of Obstetrics Anaesthesia(2010)19,161-166.
21. Deepika Shukla, Anil Verma, Apoorva Agarwal, H D Pandey & Chitra Tyagi Comparative study of intrathecal dexmeditomedine with intrathecal magnesium sulphate used as adjuvants to bupivacane; J Anaesthesio Clinical pharmacology.2011 Oct-Dec;27940 495-499.
22. Khalili G, Janghorbani M, Sajedi P, Ahmadi G. Effects of adjunct intrathecal magnesium sulfate to bupivacaine for spinal anaesthesia a randomized double-blind trial in patients undergoing lower extremity surgery; J Anaesthesiology 2011 Dec;25(6);892-7.
23. Marzieh-Beigeom Khezri, Siamak Yaghobi, Mahsa Hajikhani, Saeid Asefzadeh, Comparison of post operative analgesic effect of intrathecal magnesium and fentanyl added bupivacaine in patients undergoing lower limb orthopaedic surgery: Acta Anaesthesiologica, Tiwanica. XXX( 2012)1-6.
24. Mitra Jadalameli & Seyed Hamid Pakzadnoghadam. Adding different doses of magnesium sulfate for spinal anaesthesia in cesarean sections, A prospective randomized double blind trial. Add Bio med Res (2011)(1-7).
25. A. P. Morrison, J. M. Hunter, S. H. Halperl and A. Baneergee, effect of intrathecal magnesium in the presence or absence of local anaesthetic with or without lipophilic opoids: a systemic review of meta analysis, Br J anaesthesia.(2013)110(5):702-712.
26. Dr. Charu J. Pandya, Dr. Shivang C. Joshi, Dr. Jignesh P. Mori, A comparative study of bupivacane and bupivacaine with magnesium sulfate in spinal anaesthesia for lower abdominal surgery, IJSR-International journal of scientific research,2 (7,276-278,2013).