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Efficacy of Dexmedetomidine VersusMgSo4 as Adjuvant to Levobupivacaine for Spinal Anesthesia and Postoperative Analgesia

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Abstract:
Background*: Pain is an unpleasant experience linked to significant tissue damage. Most terrible pain will be usually seen within the first 24 hours after surgery. Levobupivacaine was an amide local anaesthetic, that acts by blocking neuronal sodium channels. Recently, usage of adjuvants intrathecally has become popular, as they prolong the duration and quality of block. This study was done with the aim to know and compare the efficacy of dexmedetomidine with magnesium sulphate as adjuvant to levobupivacaine.*
Materials and Methods*: In this interventional study, 100 patients scheduled for various surgeries under spinal anaesthesiawere included. They were randomized into 2 groups of 50 patients each. Group D received Dexmedetomidine and group M received Magnesium sulphate, both as adjuvants tolevobupivacaine. Age, gender, ASA status, motor block, sensory block and hemodynamic parameters were notedand compared between each group.*
Results*: There is no significant difference in mean age, gender, ASA grade between two groups.Onset of sensory and motor blocks were quick in D group patients compared to M group patients.Duration of motor block is significantly more in Group D patients.Total duration of analgesia was significantly more in D group patients as per VAS score. Overall, 17 patients had side effects, which were mild and self-limiting.*
Conclusion: *Levobupivacaine, when combined with dexmedetomidine provided adequate subarachnoid block for patients who were scheduled for various surgeries. Dexmedetomidine is found to better than $MgSO_4$ as it provided earlier onset of block, more duration of block, more duration of postoperative analgesia.*
Key Words: *Dexmedetomidine, Magnesium sulphate, Adjuvants, levobupivacaine, spinal anesthesia*

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I. Introduction

Pain is an unpleasant experience linked tosignificanttissue damage.[1]Most terrible pain will be usually seen within the first 24 hours after surgery. Postoperative pain is a common cause foranxiety among patients scheduled for surgery.If patients remain pain-free during this period, there is an increased chance of early recovery.[2]Relief of pain helps in reducing mortality and morbidity significantly.Levobupivacaine was an amide local anaesthetic, that acts by blocking neuronal sodium channels. Myelinated nerves are blocked more readily compared to the unmyelinated nerve fibres; and small nerve fibres are blocked easily compared to larger ones. Subarachnoid block using local anaesthetics like bupivacaine, levobupivacaine and ropivacaine is a routinely followed technique in elective infraumbilical surgeries. Apart from providing adequate intraoperative anaesthesia, it is also found to be effective in providing pain relief during the initial postoperative period. Recently, usage of adjuvants intrathecally has become popular, as they prolong the duration and quality of block. Quality of spinal anaesthesiacan be improved by adding opioids like sufentanyl, morphine and other centrally acting alpha agonists like clonidine,dexmedetomidine, neostigmine, ketamine, magnesium sulfate [$MgSO_4$], neostigmine. But every pharmacological agent that inhibits pain cause some kind of side effect.Dexmedetomidine[3-4]acts on α_2 receptors. Stimulation of these receptors in brain and spinal cord inhibits excessive neuronal firing. It can cause bradycardia, hypotension, sedation, and analgesia. Antinociceptive effect is responsible for prolongation of sensory block once combined to spinal anaesthetics. Prolongation of motor block happens due to binding of α_2 adrenoceptor agonists to dorsal horn's motor neurons.MgSo4acts by blocking calcium influx and N-methyl-D-aspartate channels producing analgesia.[5] But it can cause side effects like nausea, vomiting, and hypotension at more doses. Literature regarding comparison of efficacy of dexmedetomidine with MgSo4 sulphate with levobupivacaine as adjuvant is less. Hence the current study was undertaken.

Objective: This study was done to know compare the efficacy of dexmedetomidine with MgSo4as adjuvant to levobupivacaine.

II. Material And Methods

This interventional study was done in the Department of anesthesia at NRI medical college, Chinakakani, Andhra PradeshfromJanuary 2022toJanuary 2023.

Study Design: Interventional, single-blinded study

Study Location: This study was done at tertiary care teaching hospital in the Department of anesthesia at NRI medical college, chinakakani.

Study Duration:12 months: January 2022 to January 2023.

Sample size: 100 patients

Sample size calculation: The sample size was calculated as per the expected difference in efficacy of both drugs to be 20% as per Srivatsava Vk et al.[6]

At confidencelevel of 90%, taking error as 4%,the minimum sample size obtained was 48 in each group. So, we included 50 patients in each group considering few drop outs.

Subjects & selection method: The study population was drawn from patients scheduled for various surgeries under spinal anesthesia at NRI Medical College.

Patients were divided into two groups (each group had 50 patients) as per the drug given.

Group D (N=50 patients) –These patients received levobupivacaine along with dexmedetomidine,

Group M (N=50 patients) –These patients receivedlevobupivacaine along withMgSo4.

Inclusion criteria:

1. Patients belonging to ASA grade I and II
2. Either sex
3. Aged 18 to 65 years,
4. Patients undergoing various surgeries under spinal anesthesia
5. Patients who provided informed consent

Exclusion criteria:

1. Pregnant and lactating women
2. Patients with previous allergy todexmedetomidine or MgSo4 or levobupivacaine
3. Patients with coagulopathy
4. Patients with severe hepatic and renal disorders
5. Patients with neuromuscular disorders
6. Patients with skeletal deformities
7. Patients with developmental delay
8. Patients with incomplete data

Methodology:

Patients were randomized into two groups using blind envelope method.

Complete Preanesthetic checkup was done for all patients apart from routine investigations.

Pain was assessed using VAS scores. Alprazolam was given in the dose of 0.25mg the night before surgery. In operation theatre (OT), intravenous line was secured with 18-gauge intricate, and all the patients were given Ringer lactate over 15–20 min. Multipara monitors were applied, and pulse rate, blood pressure, oxygen saturation and electrocardiogram were recorded and monitored every 5 min. Patients were kept in lateral decubitus position. L3 and L4 space was located. Using midline approach, 23-gauge needle was inserted into spinal space. After free flow of cerebrospinal fluid, the medication was injected into the space.

Group D: 50 patients received 3 ml of 0.75% hyperbaric levobupivacainewith 10 mcg of dexmedetomidine

Group M: 50 patients received 3 ml of 0.75% hyperbaric levobupivacaine with50 mg of $MgSO_4$.

Sensory block was assessed by loss of sensation to pinprick in the midline.

Motor block was assessed using modified Bromage scale, which is as follows:

Bromage 0	Subject is able to move the hip, knee and ankle and is able to lift his leg against gravity
Bromage 1	Subject is unable to lift his leg against gravity but is able to flex his knee and ankle
Bromage 2	Subject is unable to flex his hip and knee, but is able to flex his ankle
Bromage 3	Subject is unable to flex his hip, knee and ankle, but is able to move his toes
Bromage 4	Complete paralysis

Image 1 shows modified bromage scale[7]

Oxygen was givenby oxygen mask at the rate of 5 L/min.
1st rescue analgesia was given is VAS score is above 3.Any side effects, if occur, were noted and compared.
Informed consent is taken from every patient. All 100 patients accepted to participate in this study and gave written ICF.

Parameters assessed:
Age
Gender
ASA grade
Onset of sensory block
Onset of motor block
Duration of sensory and motor blocks
VAS score
Side effects
VAS score is assessed on a ten point scale as follows:

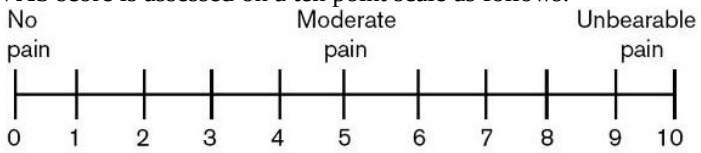


Image 2 shows VAS score[8]

Ethical considerations:
Permission was obtained from the Institutional ethical committee attached to NRI Medical Collegebefore conducting the study. Every patient was explained the whole process and advantages of the study. After he/she accepts, an informed consent form is given in local language or patient understandable language and the person was asked to sign it or put a thumb impression.

Statistical analysis
Data was analyzed using Epi info software version 7.2.5. Student's *t*-test was used to compare numerical parameters between two groups D and M.Chi-square test was used to compare categorical values between two groups. P value <0.05 was considered significant.

III. Results

The current study included 100 patients divided into groups D and M.

Demographic features:
There is no significant difference in the mean age of patients, gender and ASA statusamong patients of both groups, as shown in table 1. Hence the comparison is justifiable without age, gender and ASA grade-related bias.

Table no 1: Shows demographic features of patients in both groups

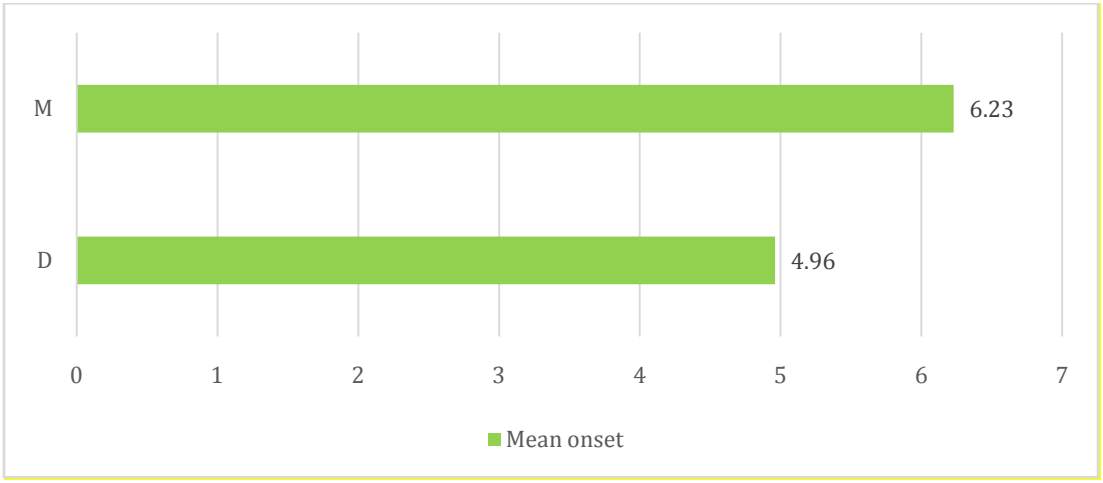
Parameters	Group D	Group M	P Value
Mean Age	52.7±5years	53.4±4.5 years	0.46
Gender	54% of males	56% of males	0.77
ASA Grade	64% ASA grade I	62% patients- ASA grade I	0.76

Sensory block:
Onset of sensory block was quick in D-group patients at T10 level. Duration of sensory block was significantly more in group D patients.

Table 2 shows sensory block characteristics

Parameters	Group D	Group M	P Value
Onset of sensory block at T10 level	4.96±1 minutes	6.23±1.2 minutes	<0.001
Time to achieve maximum sensory level	9.96±1.4 minutes	13.1±2.0 minutes	<0.001

Graph 1 shows mean onset of sensory block in both groups.

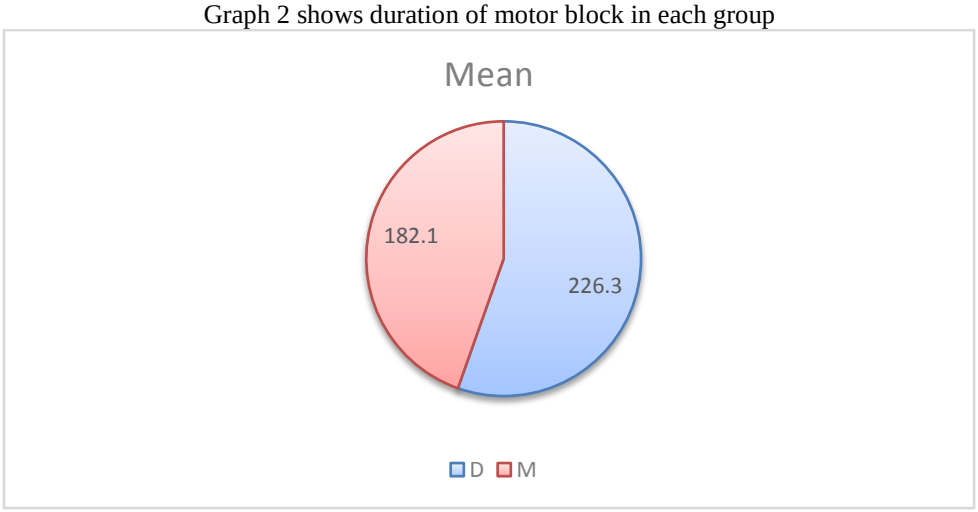


Motor block:
Onset of motor block was quick in group D patients and the duration of motor block was more significantly in group D patients but there is no difference in the maximum bromage scale achieved in both groups.

Table 3 shows motor block features in both groups

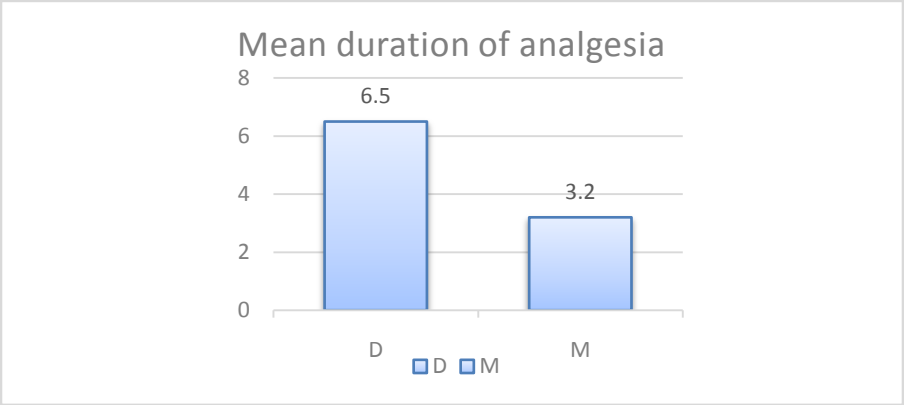
Parameters	Group D	Group M	P Value
Onset of motor block	9.0±1.3 minutes	11.4±2.5 minutes	<0.001
Duration of motor block	226.3±12.4minutes	182.1±17.1minutes	<0.001
Maximum bromage scale achieved	3	3	1(not significant)

Graph 2 shows duration of motor block in each group



Duration of analgesia:
This was more significantly in group D patients compared to group M patients.

Graph 3 shows duration of analgesia in both groups

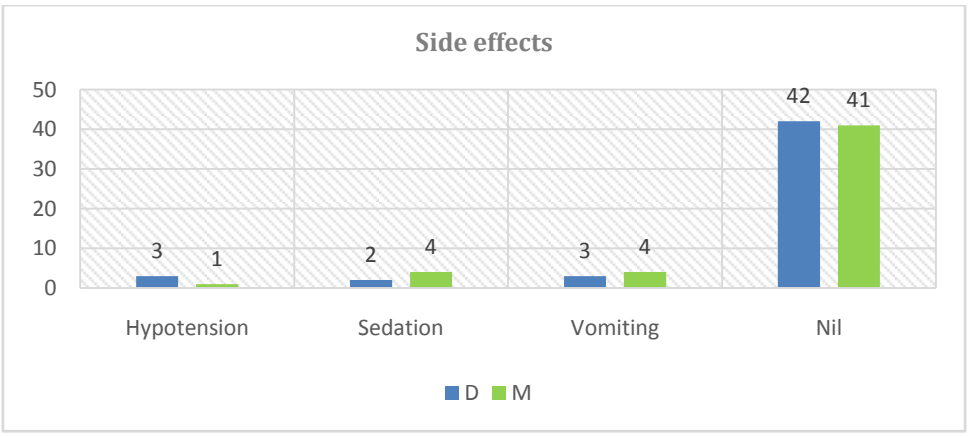


VAS scores at baseline, 6 and 12 hours:
There is no significant difference in the mean VAS score between both groups at baseline. But VAS score was significantly less in Group D patients compared to group M patients.

Table 4 shows VAS scores in both groups

Mean VAS score	Group D	Group M	P Value
Baseline	4.6±1.1	4.5±1.4	0.64
6 hours	2.6±1.0	3.4±1.2	<0.001
12 hours	2.1±1.0	3.0±1	<0.001

Side effects:
Sedation, vomiting and hypotension were seen as side effects. Over 17 patients had side effects, which are mild and self-limiting. Graph 4 shows side effects among two groups of patients



IV. Discussion

Efficacy of local anesthetics can be improved using adjuvants such as opioids, α2 agonists, magnesium, neostigmine, ketamine.[9-10]
In the current study, 50 patients received Dexmedetomidine (Group D) and 50 patients received magnesium sulphate (group M) as adjuvants to levobupivacaine.
There is no significant difference in the mean age, gender and ASA grade of patients of both groups. Onset of sensory and motor blocks was earlier in D group patients significantly compared to M group patients. Duration of blocks and anesthesia were significantly more in D group patients compared to M group patients. Overall side effects were seen among 17 patients. Among them, 8 patients belonged to D group.
In the study of **Makhni R et al.**[11] 50 patients belonging to ASA status I and II,aged 20 to 65 years of either gender scheduled for infra umbilical surgeries under subarachnoid block were included. They were randomized into 2 groups of 25 patients each. Group D patients ropivacaine with dexmedetomidine whereas Group M patients received 75 mg of magnesium sulphate.Study found that there was no significant difference in mean age between groups, similar to our study.The onset of sensory and motor block was quick in Group D patients compared to group M patients, similar to our study.

Refaee H et al[12] did a randomized double-blind study on 36 patients scheduled for lower limb surgeries. 12 patients received dexmedetomidine only, 12 received dexmedetomidine with bupivacaine and 12 received magnesium with bupivacaine. Results showed that both combination groups provided betteranalgesia compared to single drug group. Butdexmedetomidine showed more sedation, similar to our study findings.

Shukla *et al*. and **Naithani *et al*.,**[13-14]also found that the onset of sensory block to be quick and earlier in dexmedetomidine group compared to magnesium given intrathecally, similar to our study findings.

Ozalevli *et al*.also performed a similar study and found delay in onset of spinal anaesthesiawith magnesium and isobaric bupivacaine.[15]

Analgesic action was more for Dexmedetomidine in our study. There was a significant delay in in time for 1st rescue analgesia in groups receiving dexmedetomidine compared to magnesium in the studies done by**Mahendru *et al*.,Gupta *et al*.,**and **Al-Mustafa *et al*.**[16-18]

Small sample size is one of the main limitations in this study.

V. Conclusion

Levobupivacaine, when combined with dexmedetomidine provided adequate subarachnoid block for patients who were scheduled for various surgeries. Both medications were found to be effective in providing adequate surgical anaesthesia, but dexmedetomidine group is found to be better than $MgSO_4$ as it provided earlier onset of block, more duration of block, more duration of postoperative analgesia. Serious side effects were not seen in both groups.

The study is self-sponsored and there are no conflicts of interest.

References

[1]. Kehlet H. Postoperative pain relief – What is the issue? Br J Anaesth. 1994; 72:375–8. [PubMed] [Google Scholar]

[2]. Cohen FL. Postsurgical pain relief: Patients' status and nurses' medication choices. Pain. 1980; 9:265–74. [PubMed] [Google Scholar]

[3]. Indumathi T, Manjula R, Sangeetha C, Vasundhara M. Comparative study of intrathecal ropivacaine and levobupivacaine with fentanyl and magnesium as adjuvants for lower abdominal surgeries. IOSR J Dent Med Sci. 2014; 13:39–43. [Google Scholar]

[4]. Kim JE, Kim NY, Lee HS, Kil HK. Effect of intrathecal dexmedetamidine on low dose bupivacaine spinal anesthesia in elderly patient undergoing transurethral prostatectomy. Biol Pharm Bull. 2013; 36:959–65. [PubMed] [Google Scholar]

[5]. Jagtap S, Chhabra A, Dawoodi S, Jain A. Comparison of intrathecal ropivacaine-fentanyl and bupivacaine-fentanyl for major lower limb orthopaedic surgery: A randomised double-blind study. Indian J Anaesth. 2014; 58:442–6. [PMC free article] [PubMed] [Google Scholar]

[6]. Srivastava VK, Mishra A, Agrawal S, Kumar S, Sharma S, Kumar R. Comparative Evaluation of Dexmedetomidine and Magnesium Sulphate on Propofol Consumption, Haemodynamics and Postoperative Recovery in Spine Surgery: A Prospective, Randomized, Placebo Controlled, Double-blind Study. Adv Pharm Bull. 2016 Mar;6(1):75-81. doi: 10.15171/apb.2016.012. Epub 2016 Mar 17. PMID: 27123421; PMCID: PMC4845545.

[7]. Singh, Dewan & Mohamed, Hajer & Krishnaveni, N & Nag, Kusha. Evaluating the Efficacy of Tramadol as an Adjuvant to Intrathecal Isobaric Levobupivacaine for Elective Infraumbilical Surgeries. Anesthesia: Essays and Researches. 2017; 11. 10.4103/aer.AER_59_17.

[8]. Trial data solutions: A visual analogue scale [Internet]. Trialdatasolutions.com. [cited 2023 Feb 8]. Available from: http://www.trialdatasolutions.com/tds/howto/vas.jsp

[9]. Ko SH, Lim HR, Kim DC, Han YJ, Choe H, Song HS. Magnesium sulfate does not reduce postoperative analgesic requirements. Anesthesiology. 2001; 95:640–6. [PubMed] [Google Scholar]

[10]. Kalso EA, Pöyhiä R, Rosenberg PH. Spinal antinociception by dexmedetomidine, a highly selective alpha-2 adrenergic agonist. Pharmacol Toxicol. 1991; 68:140–3. [PubMed] [Google Scholar]

[11]. Makhni R, Attri JP, Jain P, Chatrath V. Comparison of Dexmedetomidine and Magnesium Sulfate as Adjuvants with Ropivacaine for Spinal Anesthesia in Infraumbilical Surgeries and Postoperative Analgesia. Anesth Essays Res. 2017 Jan-Mar;11(1):206-210. doi: 10.4103/0259-1162.200237. PMID: 28298786; PMCID: PMC5341654.

[12]. Refaee HH, Elela AHA, Hanna MG, Ali MA, Khateeb AME. Dexmedetomidine versus Magnesium as Adjuvants to Bupivacaine-Induced Caudal Block in Children: A Randomized, Double-Blinded, Placebo-Controlled, Trial. Open Access Maced J Med Sci. 2019 Jan 12;7(1):73-76. doi: 10.3889/oamjms.2019.024. PMID: 30740164; PMCID: PMC6352475.

[13]. Shukla D, Verma A, Agarwal A, Pandey HD, Tyagi C. Comparative study of intrathecal dexmedetomidine with intrathecal magnesium sulfate used as adjuvants to bupivacaine. J Anaesthesiol Clin Pharmacol. 2011; 27:495–9. [PMC free article] [PubMed] [Google Scholar]

[14]. Naithani U, Meena MS, Gupta S, Meena K, Swain L, Pradeep DS. Dose-dependent effect of intrathecal dexmedetomidine on isobaric ropivacaine in spinal anesthesia for abdominal hysterectomy: Effect on block characteristics and hemodynamics. J Anaesthesiol Clin Pharmacol. 2015; 31:72–9. [PMC free article] [PubMed] [Google Scholar]

[15]. 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. [PubMed] [Google Scholar]

[16]. Mahendru V, Tewari A, Katyal S, Grewal A, Singh MR, Katyal R. A comparison of intrathecal dexmedetomidine, clonidine, and fentanyl as adjuvants to hyperbaric bupivacaine for lower limb surgery: A double blind controlled study. J Anaesthesiol Clin Pharmacol. 2013; 29:496–502. [PMC free article] [PubMed] [Google Scholar]

[17]. Gupta R, Bogra J, Verma R, Kohli M, Kushwaha JK, Kumar S. Dexmedetomidine as an intrathecal adjuvant for postoperative analgesia. Indian J Anaesth. 2011; 55:347–51. [PMC free article] [PubMed] [Google Scholar]

[18]. Al-Mustafa MM, Abu-Halaweh SA, Aloweidi AS, Murshidi MM, Ammari BA, Awwad ZM, et al. Effect of dexmedetomidine added to spinal bupivacaine for urological procedures. Saudi Med J. 2009;30:365–70. [PubMed] [Google Scholar]