ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

ORIGINAL RESEARCH

Intrathecal dexmedetomidine vs intrathecal magnesium sulfate as adjuvants to bupivacaine

[1]Dr. Neha Sharma, [2]Dr. Shyam Babu Sharma, [3]Dr. Swati Trivedi, [4]Dr. Saurabh Kulshreshtha

[1,2]Assistant Professor, [3,4]Professor, Department of Anaesthesia, Rama Medical College, Mandhana, Kanpur, Uttar Pradesh, India

Correspondence:
Dr. Neha Sharma
Assistant Professor, Department of Anaesthesia, Rama Medical College, Mandhana, Kanpur, Uttar Pradesh, India

Received: 18 September, 2022 Accepted: 25 October, 2022

Abstract

Background: Dexmedetomidine is an α methylol derivative with a higher affinity for α2-adrenoreceptor than clonidine which has been started to be used as adjuvant to intrathecal hyperbaric bupivacaine. The present study intrathecal dexmedetomidine with intrathecal magnesium sulfate used as adjuvants to bupivacaine.

Materials & Methods: 75 patients classified as American Society of Anesthesiologists status I and II scheduled for lower abdominal and lower limb procedures of both genders were randomly divided into 3 groups of 25 each. Group I patients received intrathecally either 15 mg hyperbaric bupivacaine plus 0.1 ml (10 μg) dexmedetomidine, group II received 15 mg hyperbaric bupivacaine plus 0.1 ml (50 mg) magnesium sulfate and group III received 15 mg hyperbaric bupivacaine plus 0.1 ml saline as control. The onset time to reach peak sensory and motor level, the regression time for sensory and motor block, hemodynamic changes were recorded.

Results: Group I had 13 males and 12 females, group II had 12 males and 13 females and group III had 10 males and 15 females. The mean age in group I, group II and group III was 45.2 years, 46.7 years and 47.4 years respectively. Height was 160.1 cm, 162.3 cm and 163.1 cm, weight was 55.4 kgs, 53.2 kgs and 52.8 kgs and BMI was 21.3 Kg/m2, 22.7 Kg/m2 and 23.1 Kg/m2 respectively. The difference was significant (P< .05). The mean onset of sensory block (hours) was 2.5, 6.2 and 14.3, onset of motor block (hours) was 3.4, 7.2 and 4.9, regression times of sensory block (s) was 322.5, 287.4 and 95.3 and regression times of motor block (s) was 314.2, 290.4 and 174.2 in group I, group II and group III respectively. The difference was significant (P< .05).

Conclusion: Intrathecal dexmedetomidine supplementation of spinal block seems to be a good alternative to intrathecal Mg as it produces earlier onset and prolonged duration of sensory and motor block without associated significant hemodynamic alterations.

Key words: dexmedetomidine, Magnesium, lower limb surgeries

Introduction

Lower abdominal and lower limb surgeries may be performed under local, regional (spinal or epidural) or general anesthesia, but neuraxial blockade is the preferred mode of anesthesia. Spinal block is still the first choice because of its rapid onset, superior blockade, low risk of

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

infection as from catheter in situ, less failure rates and cost effectiveness, but has the drawbacks of shorter duration of block and lack of postoperative analgesia.

Dexmedetomidine is an α methylol derivative with a higher affinity for α2- adrenoreceptor than clonidine which has been started to be used as adjuvant to intrathecal hyperbaric bupivacaine. In humans the largest intrathecal dose used was 10 μg. Intrathecal dexmedetomidine produces its analgesic effect by inhibition of C-fibers transmitters release together with hyperpolarization of post-synaptic dorsal horn neurons. The prolongation of motor effect might be caused by direct impairment of excitatory amino acid release from spinal interneurons.

Intravenous administration of Mg, even at high doses, is associated with limited passage across the blood–brain barrier. Intrathecally administered Mg prolonged spinal opioid analgesia both in rats and in humans. The addition of Mg to spinal anesthesia improved postoperative analgesia in an orthopedic setting. Antinociceptive of Mg effects appear to be relevant not only to chronic pain but it also determines, in part, the duration and intensity of postoperative pain. The present study intrathecal dexmedetomidine with intrathecal magnesium sulfate used as adjuvants to bupivacaine.

Materials & Methods

The present study comprised of 75 patients classified as American Society of Anesthesiologists status I and II scheduled for lower abdominal and lower limb procedures of both genders. A valid written consent was obtained.

Demographic characteristics were recorded. Patients were randomly divided into 3 groups of 25 each. Group I patients received intrathecally either 15 mg hyperbaric bupivacaine plus 0.1 ml (10 μg) dexmedetomidine, group II received 15 mg hyperbaric bupivacaine plus 0.1 ml (50 mg) magnesium sulfate and group III received 15 mg hyperbaric bupivacaine plus 0.1 ml saline as control. The onset time to reach peak sensory and motor level, the regression time for sensory and motor block, hemodynamic changes were recorded.

Results

Table I Distribution of patients

Groups	Group I	Group II	Group III
Method	15 mg hyperbaric bupivacaine plus 0.1 ml (10 μg) dexmedetomidine	15 mg hyperbaric bupivacaine plus 0.1 ml (50 mg) magnesium sulfate	15 mg hyperbaric bupivacaine plus 0.1 ml saline
M:F	13:12	12:13	10:15

Table I shows that group I had 13 males and 12 females, group II had 12 males and 13 females and group III had 10 males and 15 females.

Table II Baseline characteristics

Baseline	Group I	Group II	Group III	P value
Age (years)	45.2	46.7	47.4	0.94
Height (cm)	160.1	162.3	163.1	0.81
Weight (Kgs)	55.4	53.2	52.8	0.95
BMI (Kg/m^2)	21.3	22.7	23.1	0.97

Table II, graph I shows that mean age in group I, group II and group III was 45.2 years, 46.7 years and 47.4 years respectively. Height was 160.1 cm, 162.3 cm and 163.1 cm, weight was 55.4 kgs, 53.2 kgs and 52.8 kgs and BMI was 21.3 Kg/m2, 22.7 Kg/m2 and 23.1 Kg/m2 respectively. The difference was significant (P< .05).

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Graph I Baseline characteristics

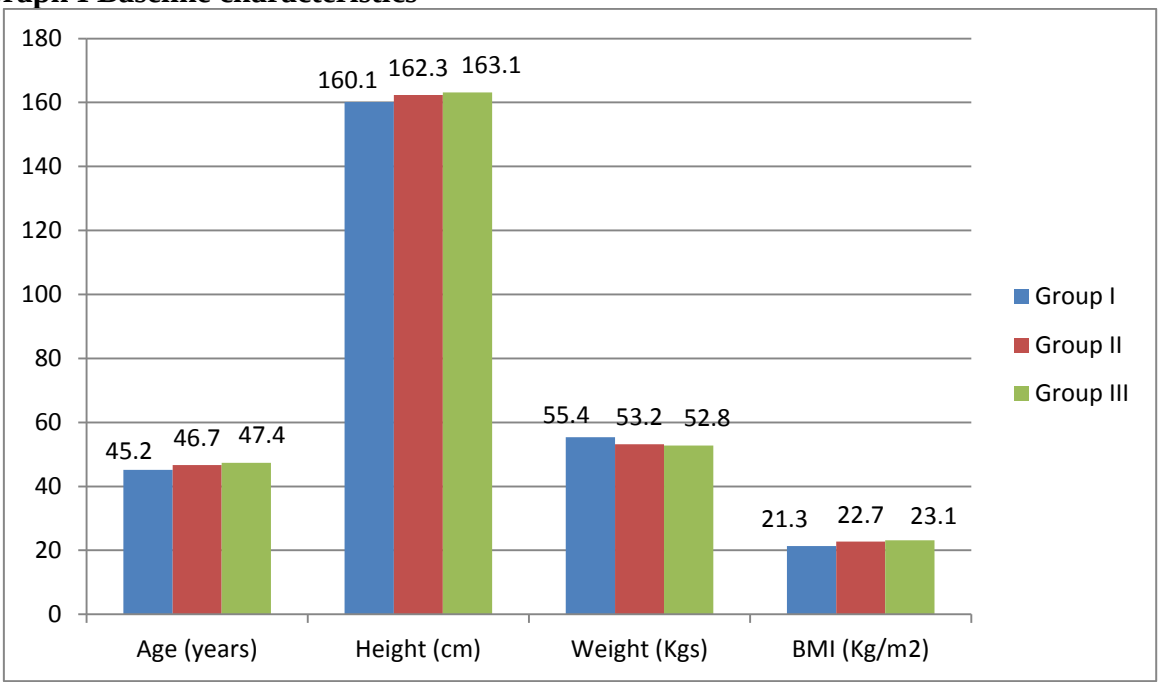

Table III Comparison of parameters

Parameters	Group I	Group II	Group III	P value
Onset of sensory blocks	2.5	6.2	14.3	0.03
Onset of motor block	3.4	7.2	4.9	0.05
Regression times of sensory block	322.5	287.4	95.3	0.01
Regression times of motor block	314.2	290.4	174.2	0.02

Table III shows that mean onset of sensory block (hours) was 2.5, 6.2 and 14.3, onset of motor block (hours) was 3.4, 7.2 and 4.9, regression times of sensory block (s) was 322.5, 287.4 and 95.3 and regression times of motor block (s) was 314.2, 290.4 and 174.2 in group I, group II and group III respectively. The difference was significant (P< .05).

Discussion

Lower abdominal surgeries commonly performed under spinal anesthesia technique because of its rapid onset, less failure rates and cost effectiveness, but it has shorter duration of action and not much effective in view of postoperative analgesia. Many intrathecal adjuvants has been tried in past with the aim of prolonging the duration of block and to solve the purpose of post-operative analgesia. Intrathecal dexmedetomidine produces its analgesic effect by inhibition of C-fibers transmitters release together with hyperpolarization of post-synaptic dorsal horn neurons. The prolongation of motor effect might be caused by direct impairment of excitatory amino acid release from spinal interneurons. The present study intrathecal dexmedetomidine with intrathecal magnesium sulfate used as adjuvants to bupivacaine.

Our results showed that group I had 13 males and 12 females, group II had 12 males and 13 females and group III had 10 males and 15 females. Chakraborty et al investigated the effect of intrathecal administration of dexmedetomidine added to spinal hyperbaric bupivacaine on the duration of sensory and motor block and postoperative analgesic requirements in lower abdominal surgeries. Hundred adult patients posted for lower abdominal surgeries were randomized in two groups. Each patient was given 3.5 ml of drug solution intrathecally that consisted of 3 ml 0.5% hyperbaric bupivacaine and 0.5 ml containing 7.5 µg dexmedetomidine in Group D patients or normal saline in Group B patients. Time to two segment regression, sensory regression to S1, regression of motor block to modified Bromage

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

0 and time to first rescue analgesic were significantly prolonged in dexmedetomidine group along with significantly decreased postoperative pain scores.

We found that mean age in group I, group II and group III was 45.2 years, 46.7 years and 47.4 years respectively. Height was 160.1 cm, 162.3 cm and 163.1 cm, weight was 55.4 kgs, 53.2 kgs and 52.8 kgs and BMI was 21.3 Kg/m2, 22.7 Kg/m2 and 23.1 Kg/m2 respectively. Shukla et al assessed the effect of etomidine and magnesium sulfate given intrathecally with 0.5% hyperbaric bupivacaine for spinal anesthesia. A total of 90 patients classified as American Society of Anesthesiologists status I and II scheduled for lower abdominal and lower limb procedures were prospectively studied. Patients were randomly allocated to receive intrathecally either 15 mg hyperbaric bupivacaine plus 0.1 ml (10 μg) dexmedetomidine (group D, n=30) or 15 mg hyperbaric bupivacaine plus 0.1 ml (50 mg) magnesium sulfate (group M, n=30) or 15 mg hyperbaric bupivacaine plus 0.1 ml saline (group C, n=30) as control. The onset time to reach peak sensory and motor level, the regression time for sensory and motor block, hemodynamic changes and side-effects were recorded. The onset times to reach T10 dermatome and to reach peak sensory level as well as onset time to reach modified Bromage 3 motor block were significantly different in the three groups. The onset time to reach peak sensory and motor level was shorter in group D as compared with the control group C, and it was significantly prolonged in group M. We also found that patients in group D had significant longer sensory and motor block times than patients in group M, which was greater than in the control group C.

We found that mean onset of sensory block (hours) was 2.5, 6.2 and 14.3, onset of motor block (hours) was 3.4, 7.2 and 4.9, regression times of sensory block (s) was 322.5, 287.4 and 95.3 and regression times of motor block (s) was 314.2, 290.4 and 174.2 in group I, group II and group III respectively. Kanazi et al found in their study that the supplementation of bupivacaine (12 mg) spinal block with a low-dose DXM (3 μg) produces a significantly shorter onset of motor block and a significantly longer sensory and motor block than bupivacaine alone.

Conclusion

Authors found that intrathecal dexmedetomidine supplementation of spinal block seems to be a good alternative to intrathecal Mg as it produces earlier onset and prolonged duration of sensory and motor block without associated significant hemodynamic alterations.

References

1. Tramer MR, Schneider J, Marti RA, Rifat K. Role of magnesium sulfate in postoperative analgesia. Anesthesiology 1996;84:340-7.
2. Woolf CJ, Thompson 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 states. Pain 1991;44:293-9.
3. Ko SH, Lim HR, Kim DC, Han YJ, Choe H, Song HS. Magnesium sulphate does not reduce postoperative analgesic requirements. Anesthesiology 2001;95:640-6.
4. Kroin JS, McCarthy RJ, Von Roenn N, Schwab B, Tuman KJ, Ivankovich AD. Magnesium sulfate potentiates morphine antinociception at the spinal level. Anesth Analg 2000;90:913-7.
5. Buvanendran A, McCarthy RJ, Kroin JS, Leong W, Perry P, Tuman KJ. Intrathecal magnesium prolongs fentanyl analgesia: A prospective, randomized, controlled trial. Anesth Analg 2002;95:661-6.
6. Arcioni R, Palmisani S, Santorsola C, Sauli V, Romano S, Mercieri M, et al. Combined intrathecal and epidural magnesium sulfate supplementation of spinal anesthesia to reduce post-operative analgesic requirements: A prospective, randomized, double-blind,

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

controlled trial in patients undergoing major orthopedic surgery. Acta Anaesthesiol Scand 2007;51:482-9.
7. Ozalevli M, Cetin TO, Unlugence H, Guler T, Isik G. The effect of adding intrathecal magnesium sulphate to bupivacaine fentanyl spinal anaesthesia. Acta Anaesthesiol Scand 2005;49:1514-9.
8. Bromage PR. A comparison of the hydrochloride and carbon dioxide salts of lidocaine and prilocaine in epidural analgesia. Acta Anesthesiol Scand Suppl 1965;16:55-69.
9. Martin E, Ramsay G, Mantz J, Sum-Ping ST. The role of the alpha2- adrenreceptor agonist dexmedetomidine in post-surgical sedation in the intensive care unit. J Intensive Care Med 2000;18:29-34.
10. Post C, Gordh T, Minor G, Archer T, Freedman J. Antinociceptive effects and spinal cord tissue concentrations after intrathecal injection of guanfacine or clonidine into rats. Anesth Analg 1987;66:317-24.
11. Malleeswaran S, Panda N, Mathew P, Bagga R. Magnesium as an intrathecal adjuvant in mild pre-ecclampsia. Int J Obstet Anesth 2010;19:161-6.
12. Anupam Chakrabarti, Monotosh Pramanik, Subhash Ranjan Das. A clinical study on effect of dexmedetomidine added to spinal hyperbaric bupivacaine in lower abdominal surgeries. International Journal of Contemporary Medical Research 2016;3(8):2434-2437.
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 Anaesth Clin Pharmacol 2011;27:495-9.
14. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, Al-Yaman R, et al. Effect of lowdose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. Acta Anesthesiol Scand 2006;50:222-7.