Original Article

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A Comparative Study of Clonidine versus Dexmedetomidine as an Adjunct to Hyperbaric Bupivacaine in Spinal Anesthesia for Orthopaedic Lower Limb Surgeries

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Abstract

Background: To compare clonidine versus dexmedetomidine as an adjunct to hyperbaric bupivacaine in spinal anesthesia in lower limb surgeries. **Subjects & Methods:** Ninety patients belonging to physical status American Society of Anesthesiologists (ASA) Classes I and II between 18- 60 years' age group posted for limb surgeries of both genders were randomly divided into 2 groups. Group I were given 3.5 ml volume of injection bupivacaine 0.5% hyperbaric and 0.5 ml normal saline. Group II patients were given 3.5 ml volume of injection bupivacaine 0.5% hyperbaric and 0.5 ml of injection clonidine (30 μg) and group III patients were prescribed 3.5 ml volume of injection bupivacaine 0.5% hyperbaric and 0.5 ml of injection dexmedetomidine (5 μg). Parameters such as sensory onset, motor onset, duration of motor blockade, time for rescue analgesia, VAS and adverse effects were recorded in both groups. **Results:** Common adverse events such as nausea in 3 in group I, 1 in group 1 and 2 in group II, bradycardia 2 in group I, 1 in both group II and III, hypotension 2 in group I and group II and 1 in group III and shivering 1 in group I. Sensory onset duration was 2.9 minutes in group I, 1.5 minutes in group II and 1.3 minutes in group III, motor onset duration was 4.1 minutes in group I, 1.7 minutes in group II and 1.2 minutes in group III, duration of motor blockade was 168.2 minutes in group I, 281.4 minutes in group II and 304.2 minutes in group III, time for rescue analgesia was 168.5 minutes in group I, 345.7 minutes in group II and 367.2 minutes in group III and VAS was 6.0 minutes in group I, 5.0 minutes in group II and 4.8 minutes in group III. A significant difference was found in all parameters ($P< 0.05$). **Conclusion:** α2-agonists with hyperbaric bupivacaine intrathecally have a faster onset of both motor and sensory block, prolonged duration of block and better post operative analgesia.

Keywords: Bupivacaine, Clonidine, Dexmedetomidine, Motor Block.

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Introduction

Limb surgeries may be performed under regional (spinal or epidural) or general anesthesia. Spinal block is still the first choice because of its rapid onset, superior blockade, lower risk of infection, lesser failure rates, and cost-effectiveness but has the drawbacks of shorter duration of block and less postoperative analgesia.[1,2]

Spinal anesthesia was introduced into clinical practice by Karl August Bier in 1898. Unlike spinal opioids, clonidine does not produce pruritis or respiratory depression. It also prolongs the necessary blockade and reduces the amount or concentration of local anesthetic required to produce postoperative analgesia. Spinal anesthesia is popular and commonly used worldwide. The advantages of an awake patient, minimal drug cost and rapid patient turnover has made this a method of choice for many surgical procedures.[3–5]

Most of the clinical studies about the intrathecal α_2 adrenergic agonist are related to clonidine. Clonidine, a selective partial α_2-adrenergic agonist, is being evaluated as an adjuvant to intrathecal local anesthetics without any clinically significant side effects.Dexmedetomidine, a highly selective α_2 adrenergic agonist has evolved as a panacea for various applications and procedures in the perioperative and critical care settings. It is also emerging as a valuable adjunct to regional anesthesia and analgesia, where gradually evolving studies can build the evidence for its safe use in central neuraxial blocks. In various researches, it is hypothesized

that intrathecal 5 μ g dexmedetomidine would produce more postoperative analgesic effect with hyperbaric bupivacaine in spinal anesthesia with minimal side effects. The present study aimed at comparing clonidine versus dexmedetomidine as an adjunct to hyperbaric bupivacaine in spinal anesthesia in limb surgeries.[6–9]

Subjects and Methods

After approval of institutional Ethical committee and informed consent, this prospective randomized clinical study conducted in the department of anaesthesia, Shimoga Institute of Medical Sciences, Shimoga.

Ninety patients belonging to physical status American Society of Anesthesiologists (ASA) Classes I and II between 18- 60 years' age group posted for lower limb surgeries of both genders were enrolled after obtaining their written consent.Patients with allergic history to local anesthetics, dexmedetomidine and clonidine, bleeding or clotting disorders, uncontrolled hypertension or diabetes mellitus, epilepsy, thyroid, renal, hepatic, and cerebrovascular disease were excluded.

Demographic data of all included patients were entered in case history proforma. Patients were randomly divided into 2 groups. Group I were given 3.5 ml volume of injection bupivacaine 0.5% hyperbaric and 0.5 ml normal saline. Group II patients were given 3.5 ml volume of injection bupivacaine 0.5% hyperbaric and 0.5 ml of injection clonidine (30 μg) and group III patients were prescribed 3.5 ml volume of injection bupivacaine 0.5% hyperbaric and 0.5 ml of injection dexmedetomidine (5 μg). Each group comprised of thirty patients each. Parameters such as sensory onset, motor onset, duration of motor blockade, time for rescue analgesia, VAS and adverse effects were recorded in both groups. Results of the present study after recording all relevant data were subjected for statistical inferences using chi- square test. The level of significance was significant if p value is below 0.05 and highly significant if it is less than 0.01.

Results

Group I had 18 males and 12 females, group II had 17 males and 13 females and group III had 19 males and 11 females [Table 1].

Sensory onset duration was 2.9 minutes in group I, 1.5 minutes in group II and 1.3 minutes in group III, motor onset duration was 4.1 minutes in group I, 1.7 minutes in group II and 1.2 minutes in group III, duration of motor blockade was 168.2 minutes in group I, 281.4 minutes in group II and 304.2 minutes in group III, time for rescue analgesia was 168.5 minutes in group I, 345.7 minutes in group II and 367.2 minutes in group III and VAS was 6.0 minutes in group I, 5.0 minutes in group II and 4.8 minutes in group III. A significant difference was found in all parameters (P< 0.05) [Table 2].

There were common adverse events such as nausea in 3 in group I, 1 in group 1 and 2 in group II, bradycardia 2 in group I, 1 in both group II and III, hypotension 2 in group I and group II and 1 in group III and shivering 1 in group I. A significant difference was found in all parameters (P< 0.05) [Table 3, Figure 1].

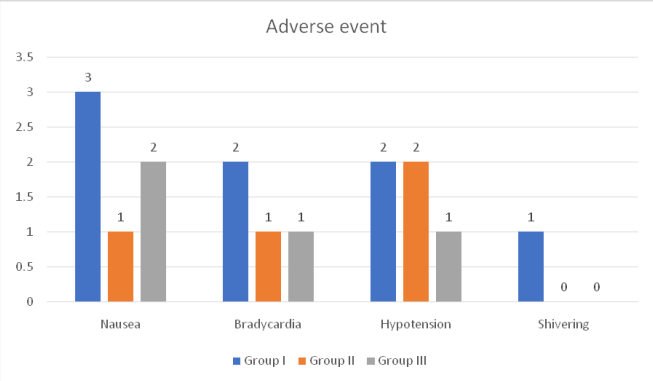

Figure 1: Adverse events

Discussion

Spinal anesthesia is popular and commonly used worldwide. The advantages of an awake patient, minimal drug cost and rapid patient turnover has made this a method of choice for many surgical procedures. These advantages are sometimes offset by relatively short duration of action and complain of postoperative pain. Intrathecal clonidine is being extensively evaluated in last 25 years as an alternative to neuraxial opioids for control of pain and has proven to be a potent analgesic. Dexmedetomidine is a new highly selective, an alpha 2 adrenergic receptor agonist. It has an alpha 2/alpha 1 selectivity ratio which is 8 times higher than that of clonidine.Local anesthetic, bupivacaine, is the most common agent used for spinal anesthesia but has relatively short duration of action. Many adjuvants to local anesthetics have been used intrathecally to improve the quality of intraoperative analgesia and prolong it in the postoperative period. Opioids are commonly used as intrathecal adjuvants without significant motor or autonomic blockade. However, side effects such as pruritus, nausea, vomiting, urinary retention, and delayed respiratory depression have prompted further research toward nonopioid analgesics with lesser side effects.In present study we compared clonidine versus dexmedetomidine as an adjunct to hyperbaric bupivacaine in spinal anesthesia in limb surgeries.[10–12]

Table 1: Distribution of patients

Groups	Group I	Group II	Group III
Agent	Bupivacaine0.5% hyperbaric and 0.5 ml normal saline	bupivacaine 0.5% hyperbaric and 0.5 ml of injection clonidine (30 μg)	Bupivacaine 0.5% hyperbaric and 0.5 ml of injection dexmedetomidine (3 μg).
M:F	18:12	17:13	19:11

Table 2: Comparison of parameters

Groups	Group I	Group II	Group III	P value
Sensory onset (min)	2.9	1.5	1.3	0.04
Motor onset (min)	4.1	1.7	1.2	0.02
duration of motor blockade (min)	168.2	281.4	304.2	0.01
Time for rescue analgesia (min)	168.5	345.7	367.2	0.01
VAS	6.0	5.0	4.8	0.05

Table 3: Adverse events

Adverse events	Group I	Group II	Group III	P value
Nausea	3	1	2	0.05
Bradycardia	2	1	1	0.07
Hypotension	2	2	1	0.09
Shivering	1	0	0	0.05

We selected 90 patients scheduled for lower limb surgeries. Group I had 18 males and 12 females, group II had 17 males and 13 females and group III had 19 males and 11 females. Ganesh et al ompare the effects of intrathecal dexmedetomidine and clonidine as adjuvants to hyperbaric bupivacaine with respect to onset and duration of sensory and motor blockade duration of analgesia and incidence of side effects. Ganesh et al included 150 patients which were randomly divided into Groups B, C, and D each administered with bupivacaine with normal saline, clonidine, and dexmedetomidine, respectively.Mean sensory onset in Group B was 2.8 ± 0.7 min, in Group C was 1.4 ± 0.5 min, and in Group D was 1.2 ± 0.4 min. Mean sensory regression by two segments in Group B was 78.5 ± 9.9 min, in Group C was 136.7 ± 10.7 min, and in Group D was 136.4 ± 11.7 min.[13–15]

Our study found that sensory onset duration was 2.9 minutes in group I, 1.5 minutes in group II and 1.3 minutes in group III, motor onset duration was 4.1 minutes in group I, 1.7 minutes in group II and 1.2 minutes in group III, duration of motor blockade was 168.2 minutes in group I, 281.4 minutes in group II and 304.2 minutes in group III, time for rescue analgesia was 168.5 minutes in group I, 345.7 minutes in group II and 367.2 minutes in group III and VAS was 6.0 minutes in group I, 5.0 minutes in group II and 4.8 minutes in group III. Mahendru et al included 120 American Society of Anesthesiology (ASA) class I and II patients undergoing lower limb surgery under spinal anesthesia. The patients were randomly allocated into four groups (30 patients each). Group BS received 12.5 mg hyperbaric bupivacaine with normal saline, group BF received 12.5 mg bupivacaine with 25 g fentanyl, group BC received 12.5 mg of bupivacaine supplemented 30 g clonidine, and group BD received 12.5 mg bupivacaine plus 5 g dexmedetomidine. The onset time to reach peak sensory and motor level, the regression time of sensory and motor block, hemodynamic changes, and side effects were recorded.Patients in Group BD had significantly longer sensory and motor block times than patients in Groups BC, BF, and BS with Groups BC and BF having comparable duration of sensory and motor block. The mean time of two segment sensory block regression was 147 ± 21 min in Group BD, 117 ± 22 in Group BC, 119 ± 23 in Group BF, and 102 ± 17 in Group BS ($P > 0.0001$). The regression time of motor block to reach modified Bromage zero (0) was 275 ± 25, 199 ± 26, 196 ± 27, 161 ± 20 in Group BD, BC, BF, and BS, respectively ($P > 0.0001$). The onset times to reach T8 dermatome and modified Bromage 3 motor block were not significantly different between the groups. Dexmedetomidine group showed significantly less and delayed requirement of rescue analgesic.[16]

It was observed that common adverse events such as nausea in 3 in group I, 1 in group 1 and 2 in group II, bradycardia 2 in group I, 1 in both group II and III, hypotension 2 in group I and group II and 1 in group III and shivering 1 in group I. Sardesai et al included 60 adult patients having two groups of 30 eachreceived either clonidine 1 μg/kg or dexmedetomidine 1 μg/kg added to 40 ml 0.5% preservative-free lignocaine. Sensorimotor block onset was significantly faster and recovery delayed with dexmedetomidine as compared to clonidine. Intra-operative visual analogue scale (VAS) at 10 min, 15 min and 40 min and post-operative VAS at 30 min and 2 h were significantly higher with clonidine. Fentanyl consumption and sedation were comparable. Duration of analgesia was significantly longer with dexmedetomidine. Haemodynamic parameters were comparable.[17]

Conclusion

Result of our study revealed that α2-agonists with hyperbaric bupivacaine intrathecally have a faster onset of both motor and sensory block, prolonged duration of block and better post-operative analgesia.

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