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Comparative study of different doses of Dexmedetomidine as an adjuvant to Intrathecal hyperbaric bupivacaine in lower limb orthopaedic surgeries

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Abstract

Background: This study is aimed to assess the effect of Intrathecal administration of different doses of Dexmedetomidine with hyperbaric Bupivacaine.

Methods: A prospective randomized double blind study was conducted with 150 consenting patients of ASA grade I and II, scheduled for lower limb Orthopaedic surgeries. Using the lottery method, the patients were randomly allotted into 3 groups, 50 patients in each group. Group A , Group B & Group C.

Results: Post-operative VAS and total analgesic requirement in 24 hours were minimal in group C as compare to B group. All the patients achieved Bromage scale 3 motor block and there was dose dependent prolongation of motor block in B and C groups.

Conclusion: Supplementation of spinal Bupivacaine with Dexmedetomidine significantly prolonged both sensory and motor block compared with intrathecal Bupivacaine alone.

Keywords: Dexmedetomidine, Bupivacaine, Intrathecal.

Introduction

Lower limb injuries are often with multiple fragmented bones and crush injuries of muscle fibres. Repair of such cases may take time which is usually unpredictable, and to prolong the duration of subarachnoid block various intrathecal adjuvants have gained popularity which aim to not only prolong the duration and onset of action, but for better success rate, faster recovery and minimal side effects.

Pain is an unpleasant feeling often caused by intense or damaging stimuli. It has been defined by the International Association for the Study of Pain (IASP) as "An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage". [1]

In 1968, Melzack and Wall put forward their 'gate control theory' proposing that the spinal cord was a potential target site for modulation of pain signals. This changed our concepts about nociceptive transmission and laid the foundation for further research into dorsal horn opioid pharmacology. This led to the discovery of opioid receptors by Pert and Snyder in 1973 and the subsequent identification of dorsal horn opioid

receptors by radioligand techniques in 1977. The first intrathecal administration of opioid in patient was reported by Wang et al, in 1979. [2-3]

Dexmedetomidine is highly selective α2 adrenergic agonist. Dexmedetomidine has been used as intrathecally as an adjuvant and no neurological side-effect is reported in humans. It also provides stable hemodynamic condition, good quality of intra-operative and prolonged post-operative analgesia with minimal side effects. Intrathecal α2 receptor agonists are found to have antinociceptive action for both somatic and visceral pain. [4]

Material and method

Type of study- A prospective randomized double blind study.

Exclusion criteria

1. Patients with hypotension, coagulation defects, spine abnormalities, heart block, arrhythmias etc.
2. Body weight ≥120 kg and height ≤150 cm.
3. Patients on calcium channel blockers, adrenergic receptor blockers, ACE inhibitors.

A prospective randomized double blind study was conducted with 150 consenting patients of ASA grade I and II, scheduled for lower limb orthopaedic surgeries. Using the lottery method, the patients were randomly allotted into 3 groups, 50 patients in each group. Group A , Group B & Group C. The surgeon, patient and the observing anaesthesiologist were blinded to the patient group.

Data analysis

All data were analyzed by Epi-info software. Student t test and ANOVA test for parametric data. Chi square test for non-parametric data.

Result

Table 1: Socio-demographic variable

Variable	Group-A	Group-B	Group-C	P-value
Age in Yrs	35.12±9.12	36.01±9.61	36.21±9.11	>0.05
Male : Female	34:16	37:13	35:15	>0.05
ASA (I:II)	42:8	42:8	41:9	>0.05

All three group were comparable.

Table 2: Out come

Variable	Group-A	Group-B	Group-C	P-value
Time of onset of sensory block	7.25±1.6	8.21±2.7	8.13±2.4	>0.05
Time of onset of motor block	9.38 ±3.4	9.16±2.6	9.12±2.3	>0.05
Duration of sensory block	101.21 ±17.21	115.19±21.12	146.08±20.12	0.01
Duration of motor block	161.03 ±19.12	198.13±26.10	271.06±24.06	0.01

Post-operative VAS and total analgesic requirement in 24 hours were minimal in group C as compare to B group. All the patients achieved Bromage scale 3 motor block and there was dose dependent prolongation of motor block in B and C groups. Similarly regression of motor block to Bromage 0 was significantly prolonged in group C than B and A group. Complete recovery of sensory and motor functions was observed in all the patients.

Discussion

Van Tuijl I [5] added various doses of Clonidine (0, 15 or 30 μg) to 5 mg hyperbaric Bupivacaine and evaluated their effect on the duration of the motor block, analgesic quality and ability to void. They opined that addition of 15 and 30 μg of Clonidine increased the motor block duration by 25 and 34 min, respectively and also resulted in better analgesic quality.

Hutschala D, Mascher H et al [6] added Clonidine to Bupivacaine and found that it enhances and prolongs analgesia after brachial plexus block via a local mechanism in healthy volunteers.

Niemi L et al[7] studied effects of intrathecal Clonidine on duration of Bupivacaine spinal anesthesia, hemodynamics, and postoperative analgesia in patients undergoing knee arthroscopy and found that intrathecal Clonidine significantly prolongs the anesthetic and analgesic effects of Bupivacaine. Kalso A(4)reported that as compared to Clonidine, the affinity of DXM to [alpha] 2 receptors is ten times greater. Results of our study showed that addition of Dexmedetomidine to Bupivacaine although delays onset but, significantly prolongs the duration of sensory and motor block.

Mahmoud M. Al-Mustafa et al [8] added Dexmedetomidine to spinal Bupivacaine for urological procedures. He compared 5mcg (Group D 5) and 10 mcg (Group D 10) of Dexmedetomidine added to 12.5 mg Bupivacaine to Bupivacaine 12.5 mg with normal saline (Control group). The author found that the mean time of sensory block to reach T10 dermatome was 4.7±2.0 minute in D10 group, 6.3±2.7 minute in D5 group and 9.5± 3.0 minute in control group. The mean time to reach bromage 3 scales was 10.4±3.4 minute in D10 group, 13.0±3.4 minute in D5 group and18.0 ± 3.3 minute in control group. Regression time to reach S1 dermatome was 338.9±44.8 minute in D10 group, 277.1±33.2 minute in D5 group and165.5 ± 32.9 minute in control group. Time to reach bromage 0 was 302.9±36.7 minute in D10 group, 246.4.1±24.7 minute in D5 group and140.1 ± 32.3 minute in control group. They found that Dexmedetomidine has dose dependent effect on onset and regression of sensory and motor block.

Conclusion

Supplementation of spinal Bupivacaine with Dexmedetomidine significantly prolonged both sensory and motor block compared with intrathecal Bupivacaine alone.

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