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A Study of Dexmedetomidine as an Adjuvant to Prolong Post Operative Analgesia in Orthopedic Lower Limb Surgeries at Government Teaching Hospital

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Abstract: Spinal anesthesia is most preferred regional anesthesia for lower limb orthopedic procedures. Present study is to assess post-operative analgesia of dexmedetomidine in subarachnoid block for patients undergoing orthopedics lower limb surgeries. **Materials and Methods:**42 patientsaged 20-65 years selected for lower limb surgeries, belonging to ASA class 1 and 2 were given Subarachnoid block using 0.5% Hyperbaric Bupivacaine 2.5ml with 0.5 ml of 5mcg Dexmedetomidine. **Results:**Time taken to the onset of sensory block was found to be 2.16±0.37 minutes. Time to onset of motor block was 3.02±0.42 mins. Total duration of motor block was 237.68 ± 11.62 min. The duration of analgesia was 462.08± 18.32 min. No significant variations in the hemodynamic parameters were noted. **Conclusion:** Dexmedetomidine improves the postoperative analgesia in a dose of 5 mcg and can be safely used inorthopedic lower limb surgeries. **Keywords:** Spinal anaesthesia, Bupivacaine, Dexmedetomidine, Postoperative analgesia, Lower limb surgeries.

Introduction: Perioperative pain management is a major challenge for anesthesiologist and orthopaedic surgeon. Attenuation of the postoperative pain may decrease perioperative morbidity and mortality.[1] Postoperative analgesia prolongation can reduce postoperative complications and facilitate recovery during immediate postoperative period and early discharge of the patients. Spinal anesthesia is the preferred technique for orthopaedics lower limb surgeries due to its rapid onset of action, less failure rate and superior level of blockage.[1, 2] Short duration of action of local anesthetic injected intrathecally needs early analgesic intervention in postoperative period or use of intrathecal adjuvant to local anesthetic.[3]

The alpha 2-adrenoreceptor agonist's Dexmedetomidine and Clonidine are used extensively for sedation and analgesia. The alpha 2-agonist dexmedetomidine prolong the duration of subarachnoid anaesthesia and analgesia.[4] Dexmedetomidine is frequently used as an adjuvant in central and peripheral neural blockade. Dexmedetomidinewas found to prolong both motor and sensory blocks when administered intrathecally in combination with local anaesthetic.[4, 5]Aim of the study is to assess the safety and post-operative analgesia of

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dexmedetomidine in subarachnoid block for patients undergoing orthopedics lower limb surgeries.

Materials and Methods: This clinical study was conducted on 42 patients in the Department of Anaesthesiology with cooperation from the Department of Orthopaedics at District Hospital, Chitradurga, Karnataka from January 2023 to December 2023. After obtaining consent from 42 patients aged 20-65 years of ASA physical status 1 and2 posted for lower limb surgeries were taken up for the study. Patients other than ASA physical status 1 and 2, not willing to study, patients allergy to anesthetics, patients having local infection at the site of block, Patients having cardiovascular diseases, COPD, severe hypovolemia, neurological disorders, psychiatric disorders, spine deformities, previous spine surgeries, coagulation disorders, Pregnancy and lactating patients were excluded from the study.

Patients were pre-medicated with alprazolam 0.5 mg the day before and on the day of surgery in the morning. Preoperatively patient's vital parameters were recorded. Under aseptic conditions with patient in sitting position using a 25 gauge spinal needle at L3-L4 or L4-L5 interspace, 0.5% Hyperbaric Bupivacaine 2.5ml with 0.5 ml of 5mcg Dexmedetomidine was deposited intrathecally after free flow of CSF. Patient was put back to supine position. Time of onset of sensory and motor blockade, maximum level of sensory blockade attained was noted intra operatively. Sedation score using five point scale was noted. Quality of motor blockade was assessed using the Modified Bromage Scale. HR, NIBP and SpO_2 were recorded every2 minutes for the first 20 minutes, every 15 minutes till the end of surgery and every 30 minutes thereafter. Duration of analgesia, sensory and motor blockade and any adverse events like nausea, vomiting, shivering, etc. were noted and treated accordingly. Inj paracetamol 1000mg IV infusion was started when the patient first complained of pain.

Results and Observations: Age of the patients ranged from 20-65 years. Majority of the patients were belonged to the age group 30-50 years. Mean duration of surgery was 90.45 ± 4.86 mins. Time taken to the onset of sensory block was found to be 2.16±0.37 minutes. The shortest duration was 1.6 minutes and longest duration was 3.4 minutes. Maximum number of patients achieved the highest sensory level till T8 whereas only8 patients had sensory level till T10. The time to reach highest sensory level was 8.35 ±0.33 minutes. The duration of sensory block was 268.81 ±12.57 mins. The shortest and longest duration of sensory block were 217 and 285 minutes. The duration of onset of motor block was found to be 3.02±0.42 mins. Time taken for complete motor block was 6.77 ±0.73 mins. Total duration of motor block was 237.68 ±11.62 mins. Duration of analgesia was 462.08±18.32 minutes. In this study the shortest duration of analgesia was 300 minutes and the longest duration was 520 minutes.

Table -1; Mean Values of Parametres

Sl.No.	Mean values	Time in minutes
1.	Duration of onset of sensory block	2.16±0.37
2.	Time to reach Highest Sensory Level	8.35 ±0.33
3.	Duration of Sensory Block	268.81 ± 12.57
4.	Duration of onset of motor block	3.02±0.42

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6.	Total duration of Motor block	237.68 ± 11.62
7.	Duration of surgery	90.45 ± 4.86
8.	Duration of Analgesia	462.08± 18.32

The mean basal heart rate was 104.26 ±7.14 mins. The basal mean SBP was 120.25 ±6.24 mmHg. The basal mean diastolic blood pressure was 74.62±7.22 mmHg. The basal SPO_2 was 99.92%. Majority of patients (84.24%) had a sedation score of 2. None of the patients had a sedation score of more than 2.

Discussion: Subarachnoid block is the most commonly used anaesthesia technique for lower limb surgeries. This technique is simple to perform and the onset of anesthesia is rapid, allowing the surgical incision to be made sooner and also provides good sensory block, motor block with better post-operative analgesia in orthopedics lower limb surgeries.[1,2,3] Dexmedetomidine acts as a α2-agonist on membrane bound G-protein coupled α2- adrenoreceptors. Intracellular pathways include inhibition of adenylatecyclase and modulation of calcium and potassium ion channels. It is known to increase both the sensory and motor block of local anesthetics.[4, 5]

Onset of sensory block: In our study the mean time to onset of sensory was 2.16±0.37 mins. Gupta et al [6] showed significantly earlier onset of peak sensory block and time to reach Bromage 3 level motor block. Sarma J et al [7] reported that spinal block with a low dose of intrathecal dexmedetomidine (5 μg) produces a significantly shorter onset of motor and sensory block and a significantly longer sensory and motor block than bupivacaine alone.

Duration of analgesia: Duration of analgesia is defined as the time taken from the onset of sensory blockade till the patient complains of pain at the site of surgery. In our study the shortest and longest duration of analgesia was 300 minutes and 520 mins. Mean duration of analgesia which is 462.08± 18.32 minutes. Studies [7, 8] found that duration of analgesia is directly proportional to dosage of Dexmedetomidine. Mahendru et al [8] showed that Duration of analgesia was significantly prolonged in 5 microgram dexmedetomidine (478.4±20.9 minutes). The maximum visual analogue scale score for pain was less in group dexmedetomidine (4.4±1.4). Significantly improved analgesic efficacy was seen in dexmedetomidine as intrathecal adjuvant.[6]

Al-Mustafa *et al* .[9] observed dose dependent prolongation of motor and sensory blockade with reduced analgesic requirement with increasing dosages of intrathecal dexmedetomidine (5, 10, and 15 μg). Patients in the groups that received dexmedetomidine had reduced postoperative pain scores and a longer analgesic duration than those who received spinal bupivacaine alone.[7] Patro ss et al [10] implies that better quality of analgesia postoperatively and reduced need of analgesics with the use of intrathecal Dexmedetomidine.

Hemodynamic variations: Dexmedetomidine due to its action on alpha 2 receptors causes a fall in the HR and BP. In our study, there were no clinically significant variations in HR, BP and SPO2.There was a minimal fall in the BP from the basal values during intraoperative period. Incidence of hypotension and bradycardia were low with the addition of dexmedetomidine to

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Bupivacaine in post perative period.[7, 8]cardiovascular profile was found to be remarkably stable throughout the intraoperative and postoperative period.[10]

Sedation score:

In our study majority of patients (84.24%) had a sedation score of 2 whereas remaining patients had a sedation score of 1. alpha 2 agonists produce sedative effect by acting on alpha 2 adrenergic receptors in locus ceruleus .The cause of sedation in higher doses may be due to systemic absorption and vascular redistribution to the higher centres or cephalad migration in CSF.[11] Hala EA Eid *et al.*[12] observed that intrathecal dose of dexmedetomidine causes significantly higher sedation scores which can be beneficial for patients undergoing lengthy complex surgeries.

Complications: Bradycardia, hypotension and nausea, vomiting associated with hypotension occurred due to increased vagal activity after sympathetic block which causes increased peristalsis of gastro-intestinal tract. Dexmedetomidine causes activation of central postsynaptic α2 adrenoreceptor resulting in sympatholytic effects leading to bradycardia and hypotension. Shital Halvadia et al [13] noticed shivering, nausea in fewpatients. In our study we observed that among the 42 patients only two cases had defined hypotension, no other complications were recorded.

The present study was conducted on a small sample of population who were to undergo orthopaedics lower limb surgeries. Further research for a longer duration and adequate sample size may substantiate the above findings. We conclude that Dexmedetomidine, when added to intrathecal hyperbaric bupivacaine significantly enhances the onset of sensory and motor block, duration of postoperative analgesia with hemodynamic stability and lesser side effects in orthopaedics lower limb surgeries.

Conflict of interest: None

Source of income: None.

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