ORIGINAL RESEARCH PAPER

Anaesthesiology

KEY WORDS:

A STUDY TO EVALUATE THE POSTOPERATIVE ANALGESIC EFFICACY OF DEXMEDETOMIDINE ADDED TO INTRATHECAL ROPIVACAINE IN LOWER LIMB ORTHOPAEDIC SURGERIES

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ABSTRACT

Aim: This study was conducted to evaluate the hemodynamic effects and postoperative analgesic efficacy of dexmedetomidine added to intrathecal ropivacaine in lower limb orthopaedic surgeries.

Materials and methods: Fifty patients undergoing elective lower limb orthopaedic surgeries under spinal anaesthesia were randomly allocated into two groups of 25 each. Group R received 3ml of 0.75% Ropivacaine plus 0.5ml of normal saline intrathecally.Group D received 3ml of 0.75% Ropivacaine plus 5µgm of Dexmedetomidine in 0.5 ml of normal saline intrathecally. Time of onset, Highest level of sensory block, time taken to reach the highest level, time to two segment regression, time to sensory regression to S2 dermatome, adverse effects, VAS and sedation scores in the post operative period were recorded.

Results: The time of onset of sensory block was faster in group D (3.52 ± 1.66) when compared with group R (5.04 ± 1.43). In group D, the time to two segment regression was prolonged (116.4 ±14.7) when compared with group R (78.8± 7.8) and was statistically significant. Time to sensory regression to S2 dermatome was 451.6±29.6 minutes in group D and 252.8±16.5 minutes in group R. It was statistically significant. Time of rescue analgesic was 28.7 min in Group D and 12.9 min in Group R (P<0.05). Post op dose of tramadol was less in Group D compared to Group R.

Conclusion: Dexmedetomidine 5 µg as an adjuvant to intrathecal ropivacaine, produces faster onset and longer duration of sensory blockade, with stable hemodynamic parameters and lesser adverse effects.

INTRODUCTION

Lower limb orthopaedic surgeries are most commonly done under spinal anaesthesia as it is very economical and easy to administer. But post operative pain relief is a major problem because spinal anaesthesia using only local anaesthetic drugs are associated with a relatively short duration of action, and thus early analgesic intervention is needed in the postoperative period. A number of adjuvants such as clonidine, midazolam, opioids and others have been studied to prolong the effect of spinal anaesthesia.

The addition of opioids to local anaesthetic solution has disadvantages such as pruritus, nausea, vomiting, urinary retention and respiratory depression. Clonidine when added to intrathecal local anaesthetic agents can cause hypotension, bradycardia and sedation in a dose dependant manner.

Dexmedetomidine, an imidazoline derivative, is 1600 times more selective for $_2$than $_1$receptors and with plasma elimination half life of about 2 hours. It is under evaluation as a neuraxial adjuvant drug as it provides stable hemodynamic conditions, good quality of intraoperative and prolonged postoperative analgesia and with a low incidence of adverse effects.

Hence the present study was conducted to evaluate the hemodynamic effects and postoperative analgesic efficacy of dexmedetomidine added to intrathecal ropivacaine in lower limb orthopaedic surgeries.

AIM OF THE STUDY

The purpose of this study was to evaluate the following parameters when dexmedetomidine was added to intrathecal ropivacaine in lower limb orthopaedic surgeries: 1) Haemodynamic changes 2) Onset and duration of sensory block 3) Postoperative analgesic requirement and sedation.

MATERIALS AND METHODS

After getting approval from the Institutional Ethical Committee, the study was conducted in fifty patients undergoing elective lower limb orthopaedic surgeries under spinal anaesthesia. The patients were randomly allocated into two groups of 25 each by sealed envelope technique.

Inclusion criteria

ASA I&II

Age between 23 to 68 years

Exclusion criteria

Local infection
Bleeding disorder
Heart block
Hypertension
Uncooperative patients

All patients were thoroughly examined preoperatively. The procedure was explained and informed written consent was obtained. They were allocated into the following groups.

Group R - 3ml of 0.75% Ropivacaine plus 0.5ml of normal saline

Group D -3ml of 0.75% Ropivacaine plus 5µg dexmedetomidine in 0.5 ml of normal saline.

On arrival in the operating room, the patients were preloaded with lactated ringer's solution at 15ml/kg. No premedication was given to the patients on the previous night and on the day of surgery. Blood pressure, oxygen saturation, and ECG were monitored in all patients. Under strict aseptic precautions, spinal anaesthesia was performed using 23G Quincke's needle at L3-4 or L4-5 interspace in sitting position. Injections were given over approximately 10 to 15 seconds and the time of injection was noted. Immediately after performing the subarachnoid block all patients were placed in supine position. If oxygen saturation decreased below 90%, oxygen was supplemented through a mask at a rate of 5 litres / minute.

Hypotension, was defined as a decrease in mean arterial blood pressure below 70 mm of mercury or systolic blood pressure less than 90 mm of mercury and treated with incremental doses of ephedrine, (an indirectly acting sympathomimetic drug) 6 mg intravenously and with boluses of ringer lactate or 0.9% normal saline. Bradycardia was defined as HR less than 50 beats per minute and treated with atropine 0.6 mg intravenously. The occurrence of side effects such as shivering, hypotension, nausea, vomiting, itching, pruritus, respiratory depression and sedation were noted.

THE FOLLOWING PARAMETERS WERE OBSERVED

(1) HAEMODYNAMIC PARAMETERS:

- Mean Arterial Pressure

- Heart Rate
- SpO2

(2) SENSORY BLOCK

Sensory block was assessed by loss of pinprick sensation to 23G hypodermic needle in the midaxillary line bilaterally. Sensory level was tested every 2 minutes until the highest level had stabilised for four consecutive tests. The duration of sensory block was the time taken for thesensory regression of two segments from the highest level of sensory block as evaluated by pinprick method. Sensory level was assessed every 10 minutes till the point of two segment regression. Further testing was performed at an interval of 20 minutes until the recovery of S2 dermatome.

Following parameters were recorded from the time of injection of the drug into the intrathecal space.

- Time of onset
- Highest level of sensory block
- Time taken to reach the highest level
- Time to two segment regression and
- Time to sensory regression to S2 dermatome

(3)POSTOPERATIVE ANALGESIA

Postoperatively, pain scores were recorded by using Visual Analogue Score (VAS) between 0 and 10 (0 = no pain, 10 = the most severe pain), initially every hour for 2 hours, then every 2 hours for next 8 hours and after that every 4 hours till 24 hours. Injection diclofenac 75mg intramuscular was given as rescue analgesia when VAS ≥4. It was repeated after 12 hrs. If patients again complained of break through pain Inj. Tramadol 100 mg was given intramuscularly. All patients were followed up for the next one week by a blinded anaesthesiologist. They were asked about the presence of headache, back pain as well as pain, numbness and tingling sensation in the lower extremities. Sedation score was also noted.

STATISTICAL TOOLS

The collected data were recorded in a Master Chart. Analysis was done using Epidemiological Information Package (EPI 2010) developed by Centre for Disease Control, Atlanta.

Using this software range, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated. Kruskul Wallis chi-square test was used to test the significance of difference between quantitative variables and Yate's chi square test for qualitative variables. A 'p' value **less than 0.05** is taken to denote significant relationship.

OBSERVATION AND RESULTS

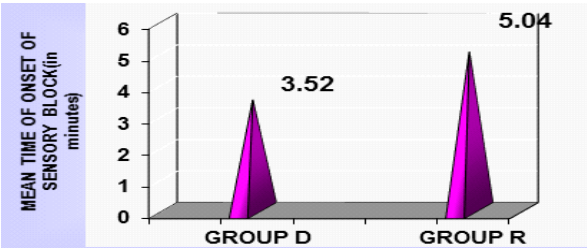
All 50 patients in two groups completed the study without any exclusion. We did an inter group analysis and the results were as followed. The age, sex, ASA grade & average duration of surgery in both groups were comparable. The 'p' values were not statistically significant.The hemodynamic variables (HR, MAP, SpO2) were comparable between the groups and it was not statistically signify

Table 1 : Parameters Studied

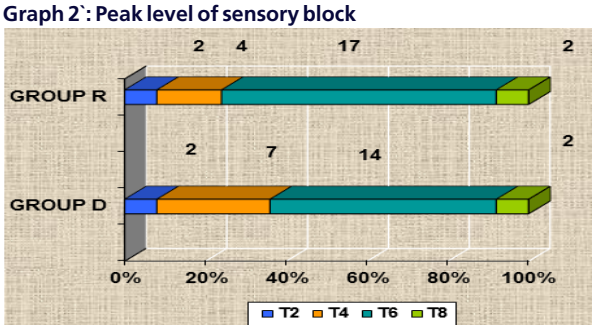
Parameters (Minutes)		Group D (Range, Mean ± SD)	Group R (Range, Mean ± SD)	P value <0.05*
Time of Onset		2-6 3.52 ± 1.66	4-8 5.04 ± 1.43	0.0021*
Time to two segment regression		90-140 116.4 ± 14.7	70-100 78.8 ± 7.8	0.0001*
Time to regression to S2 Dermatome		390-490 451.6 ± 29.6	230-290 252.8 ± 16.5	0.0001*
Time to first rescue analgesics		375-500 456.2 ± 28.7	215-255 236.6 ± 12.5	0.0001*
Peak level of Sensory Block - No. Of cases (Percentage)	T2	2 (8%)	2 (8%)	
	T4	7 (28)%	4 (16%)	
	T6	14 (56%)	17 (68%)	
	T8	2 (8%)	2 (8%)	

The time of onset of sensory block was faster in group D (3.52 ± 1.66) when compared with group R (5.04 ± 1.43) and was statistically significant (p -0.0021).

Graph 1 : Onset of sensory block

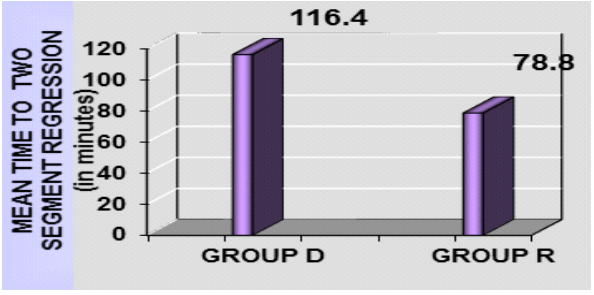


Graph 2`: Peak level of sensory block



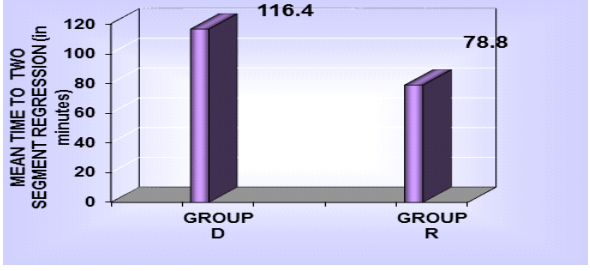
In group D the time to two segment regression was prolonged (116.4 ±14.7) when compared with group R (78.8± 7.8) and was statistically significant.

Graph 3: Time for two segment regression

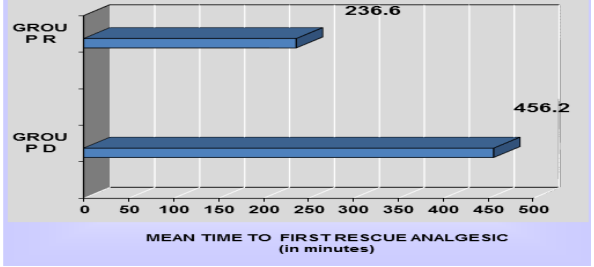


Time to sensory regression to S2 dermatome was in group D 451.6 ± 29.6 minutes and in group R 252.8 ± 16.5 minutes. It was statistically significant.

Graph 4: Time to sensory regression to S 2 dermatome



Graph 5: Time to first rescue analgesic



Group D had a better sedation than Group R but that was not statistically significant.

DISCUSSION

Pain after orthopaedic surgery is often severe. Effective postoperative analgesia has shown to reduce stress response to surgery and fastens the recovery. Adding adjuvants to local anaesthetic in subarachnoid block can improve the quality of anaesthesia, analgesia and decrease the postoperative analgesic requirements.

We conducted a randomized, double-blind, case-control study to evaluate the postoperative analgesic efficacy of intrathecal dexmedetomidine 5µg added to 0.75% ropivacaine in lower limb orthopaedic surgeries .

In our study, we used 3 ml of 0.75 % ropivacaine with 0.5 ml of normal saline or 5µg of dexmedetomidine in 0.5 ml of normal saline. The affinity of dexmedetomidine to alpha 2 adrenergic receptors has been found to be 10 times more than that of clonidine. Moreover, Kanazi et al, found that 3µg of dexmedetomidine and 30 µg of clonidine will be equipotent. Al-Mustafa et al used dexmedetomidine intrathecally with bupivacaine in two different doses 5 µg or 10 µg. So based on the previous studies we used 5 µg of dexmedetomidine intrathecally.

The time of onset of sensory block was less in dexmedetomidine group compared to ropivacaine group and it was statistically significant. But Rajnigupta et al in their study found no difference between the two groups. Al-Mustafa et al in their study found that addition of dexmedetomidine to intrathecal bupivacaine decreased the onset time of sensory block at the dose of 5µg and 10µg.

In our study we found that the time to two segment regression, time to sensory regression to S2 dermatome and the time to first rescue analgesia were prolonged in dexmedetomidine group than ropivacaine group. These results were comparable with the study of Rajni et al. In the present study, the time to two segment regression in dexmedetomidine group was 116.4 ±14.7 minutes which was comparable with the study of Rajni et al (125.6 ±16.5minutes).

In our study, the time to sensory regression to S2 dermatome in group D is 451.6± 29.6 minutes which was comparable with the results of Rajni et al (468.3 ±36.8 minutes). The time to first rescue analgesia in group D is 456.2 minutes which is also comparable to Rajni et al (478.4 ±20.9 minutes).

Al-Ghanem et al. found that the use of intrathecal dexmedetomidine was associated with a decrease in blood pressure and heart rate. These adverse effects were comparable between the two groups. As compared to the study of Rajni et al, the incidence of hypotension is higher in our study and it may be due to more blood loss which to be expected in orthopaedic surgeries.

CONCLUSION

Dexmedetomidine 5 µg as an adjuvant to intrathecal ropivacaine, produces faster onset and longer duration of sensory blockade, with stable hemodynamic parameters and devoid of adverse effects.

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