

A Comparative Study of Intrathecal Dexmedetomidine and Clonidine as an Adjuvant to Hyperbaric Bupivacaine in Surgeries for Fracture Femur and Tibia

Ramesh Pendela¹

ABSTRACT

Introduction: Intrathecal α_2 -agonists are used as adjuvant drugs to local anesthetics. Study aimed to compare the effect of intrathecal dexmedetomidine and clonidine as an adjuvant to hyperbaric bupivacaine in patients undergoing surgery for fracture femur and tibia.

Material and Methods: We carried a randomized double blind controlled study on patients undergoing elective surgery for fractures of femur and tibia. A total of 100 patients were included in the study and randomly allocated to two groups, Group C: received 2.5 ml of 0.5% hyperbaric bupivacaine with 50 mcg clonidine, Group D: received 2.5 ml of 0.5% hyperbaric bupivacaine with 5 mcg dexmedetomidine. Parameters assessed were level of sensory block and motor level.

Results: The mean onset time for sensory block in Group C and Group D was 8.16 ± 4.02 and 6.12 ± 2.65 minutes respectively, with a statistically significant difference between both the groups. Whereas the mean onset of motor time was 12.32 ± 4.85 and 8.12 ± 3.98 minutes in Group C and Group D respectively, with a statistically significant difference between both the groups.

Conclusion: Dexmedetomidine seems to be valuable adjuvant when regional anaesthesia is incorporated.

Keywords: Bupivacaine, Clonidine, Dexmedetomidine, Femur, Tibia

INTRODUCTION

The concurrent injection of alpha-2 adrenergic agonist drugs improves the nerve block characteristic of local anaesthetics through either local vasoconstriction and facilitation of C fibre blockade or spinal action caused by retrograde axonal transport or simple diffusion along the nerve.¹⁻³

Clonidine and dexmedetomidine are selective α_2 adrenergic agonists with some α_1 agonist property. 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.⁴⁻⁶

The α_2 -adrenergic agonist clonidine has a variety of different actions, including the ability to potentiate the effects of local anesthetics. However, unlike spinal opioids, clonidine does not produce pruritus or respiratory depression. Dexmedetomidine is an S-enantiomer of medetomidine with

a higher specificity for α_2 -adrenoreceptor (α_2 : α_1 , 1620: 1) compared to clonidine (α_2 : α_1 , 220:1).^{7,8}

The present study was carried to compare the effect of intrathecal dexmedetomidine and clonidine as an adjuvant to hyperbaric bupivacaine in patients undergoing surgery for fracture femur and tibia.

MATERIAL AND METHODS

We carried a randomized double blind controlled study on patients undergoing elective surgery for fractures of femur and tibia. The study was done in the department of anesthesia at Prathima Institute of Medical Sciences, Karimnagar, Telangana state, India, from March 2016 to March 2018. The study had institutional ethical clearance and informed consent from all the patients was obtained.

Inclusion Criteria

1. Patients undergoing elective surgery for fractures of femur and tibia

Exclusion Criteria

1. Patients allergic to the drugs being used,
2. Patients with uncontrolled hypertension
3. Patients on therapy with beta blockers and ACE inhibitors
4. Patients with polytrauma and head injury

A total of 100 patients were included in the study and randomly allocated to two groups (Group C and Group D) by a computer-generated randomization chart. Group C: received 2.5 ml of 0.5% hyperbaric bupivacaine with 50 mcg clonidine, Group D: received 2.5 ml of 0.5% hyperbaric bupivacaine with 5 mcg dexmedetomidine.

Procedure

Preoperative evaluation with complete history, clinical examination and routine investigations were carried out on all the patients. One hour before surgery, pre-operative

¹Assistant Professor, Department of Anesthesiology, Prathima Institute of Medical Sciences, Karimnagar, Telangana, India

Corresponding author: Dr. Ramesh Pendela, Assistant Professor, Prathima Institute of Medical Sciences, Karimnagar, Telangana, India

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sedation was given with injection butorphanol 1mg + Injection promethazine 12.5mg. With a 25G spinal needle subarachnoid block was given in sitting position. 2.5 ml Bupivacaine 0.5% along with either 50 mcg (Group C) Clonidine or 5 mcg Dexmedetomidine (Group D) was given intrathecally.

Vital parameters were recorded and the parameters assessed were level of sensory block, motor level and visual analogue score (VAS) every hour for next 4 hours and thereafter till the patient demanded rescue analgesia.

STATISTICAL ANALYSIS

Data were expressed as mean±SD and analyzed by software SPSS Version 20 (IBM SPSS Statistics for Windows, IBM Corp., Armonk, NY: USA). Chi-square test and independent two sample 't'-test for unpaired samples were used. A P value < 0.05 was considered as significant.

RESULTS

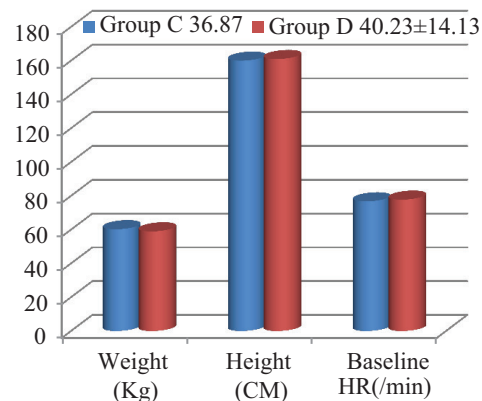
Demographic details when compared between both the groups did not reveal any significant difference (Table 1 and Graph 1).

ASA status when compared between the two groups did not reveal any significant difference (P=0.8454; Table 2).

The mean onset time for sensory block in Group C and Group D was 8.16±4.02 and 6.12±2.65 minutes respectively, with

a statistically significant difference between both the groups. Whereas the mean onset of motor time was 12.32±4.85 and 8.12±3.98 minutes in Group C and Group D respectively, with a statistically significant difference between both the groups. There was a significant difference in the receding time for sensory and motor block which was 4.13±1.09 and 3.68±0.97 minutes for Group C and 5.14±0.87 and 4.56±0.98 minutes for Group D respectively. The need for analgesic was required by 4.78±1.43 and 7.05±1.92 hours in group C and group D respectively, with a statistically significant difference between the groups. (Table: 3).

Vital signs recording revealed that there was a fall in the systolic pressure below 85 mm Hg in 9 and 10 patients in group C and group D respectively, with a statistically insignificant difference between the groups. The fall in diastolic pressure



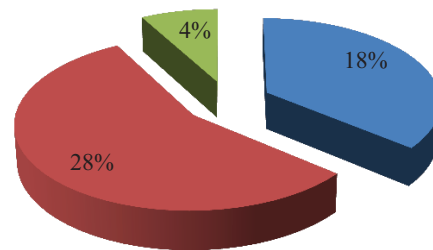
Graph-1: Distribution of subjects according to demographic profile

| Parameter | Group C (n=50) | Group D (n=50) | P value |
|-------------------|----------------|----------------|---------|
| Age in Years | 36.87±14.08 | 40.23±14.13 | 0.2365 |
| Sex (M:F) | 34:16 | 32:18 | 0.9004 |
| Weight (Kg) | 60.23±8.04 | 58.96±6.12 | 0.3763 |
| Height (CM) | 159.98±7.58 | 160.96±6.27 | 0.4828 |
| Baseline HR(/min) | 76.73±8.98 | 77.73±9.18 | 0.5831 |

Table-1: Distribution of subjects according to demographic profile

| Group | ASA I | ASA-II | P-value |
|---------------------------|-------|--------|---------|
| Group C (Clonidine) | 35 | 15 | 0.8454 |
| Group D (Dexmedetomidine) | 32 | 18 | |
| Total | 67 | 33 | |

Table-2: ASA grading



Graph-2: Pie chart showing Fall in parameters below critical level

- Fall in systolic blood pressure below critical level (<85 mm Hg)
- Fall in diastolic blood pressure below critical level (<50 mm Hg)
- Fall in pulse rate below critical level (<50bpm)

| Parameter | Group C (Mean±SD) | Group D (Mean±SD) | P value |
|---|-------------------|-------------------|----------|
| Onset time for sensory block (in mins) | 8.16±4.02 | 6.12±2.65 | 0.0035* |
| Onset time for motor block (in mins) | 12.32±4.85 | 8.12±3.98 | <0.0001* |
| Receding time for sensory block (in mins) | 4.13±1.09 | 3.68±0.97 | 0.0316* |
| Receding time for motor block (in mins) | 5.14±0.87 | 4.56±0.98 | 0.0023* |
| Need of first rescue analgesia (in hrs) | 4.78±1.43 | 7.05±1.92 | <0.0001* |

*=Significant

Table-3: Comparison for sensory and motor block

| Parameter | Group C (No. and %) | Group D (No. and %) | P value |
|---|---------------------|---------------------|---------|
| Fall in systolic blood pressure below critical level (<85 mm Hg) | 9 (18%) | 10 (20%) | 0.7998 |
| Fall in diastolic blood pressure below critical level (<50 mm Hg) | 14 (28%) | 15 (30%) | 0.8264 |
| Fall in pulse rate below critical level (<50bpm) | 2 (4%) | 1 (2%) | 0.5597 |

Table-4: Fall in parameters below critical level

(<50 mm Hg) was seen in 14 and 15 patients in Group C and group D respectively, with a statistically insignificant difference between the groups. There was a fall in pulse rate of <50 bpm in two and one patient in Group C and group D respectively, with a statistically insignificant difference between the groups (Table 4).

DISCUSSION

Postoperative analgesia must be long-lasting, effective with minimum side effects. For spinal anesthesia, bupivacaine 0.5% hyperbaric is most common local anesthetic used. However, its postoperative analgesic duration is limited. Hence, an additive to these local anesthetics is a reliable method to prolong the duration of anesthesia. Many drugs such as opioids (fentanyl, nalbuphine, pethidine, and buprenorphine), benzodiazepines (midazolam), ketamine, and neostigmine have been used.^{8,9}

The most common are opioids, and they have been the mainstay for postoperative pain. Opioids intrathecally prolong the duration of analgesia but can have late and unpredictable respiratory depression, pruritus, nausea, vomiting, and urinary retention. Hence, there was a requirement for better adjuvants which prolongs analgesia without the above side effects of opioids. Intrathecal $\alpha 2$ -agonists are found to have antinociceptive action for both somatic and visceral pain. Hence, these are used as adjuvants to bupivacaine for spinal anesthesia.⁴

In the present study, it was found that, adding dexmedetomidine to bupivacaine decreased the time of onset of sensory block up to T10 level. These findings were similar to Chandra et al and Singh et al.^{1,10} However our findings were different from Kanazi et al who found that the onset of sensory block upto T10 level was faster for clonidine group (7.6 \pm 4.4 mins) as compared to dexmedetomidine group (8.6 \pm 3.7 mins), but the difference found was not significant.⁴ We found a decrease in onset time of motor block after adding dexmedetomidine as compared to clonidine as measured by Bromage scale, the difference being significant. Our findings are in accordance with Chandra et al¹ and Singh et al¹⁰ and in contrast to Kanazi et al.⁴ The mean duration of receding time of sensory and motor block showed an increased duration of sensory block in dexmedetomidine group as compared to clonidine group. The difference between the groups was significant (P<0.05). Our findings are similar to Chandra et al, Kanazi et al and Singh et al who concluded that dexmedetomidine produced significantly longer duration of sensory block as compared to clonidine.^{1,4,10}

The duration of request for supplemental analgesia was more in Dexmedetomidine group. This is in accordance with Chandra et al and Singh et al.^{1,10}

CONCLUSION

Use of Injection dexmedetomidine 5ug in combination with 2.5ml (12.5mg) of 0.5% hyperbaric bupivacaine as compared to Injection clonidine 50ug with 2.5ml of 0.5% hyperbaric bupivacaine intrathecally resulted in faster onset of sensory and motor block, prolongation of sensory and motor block,

prolongation of post-operative analgesia and manageable haemodynamic alterations. Hence, Dexmedetomidine seems to be valuable adjuvant when regional anaesthesia is incorporated but further studies are still needed to establish the safe dose to be used and there should be a favourable risk/benefit ratio for its use in regional anaesthesia.

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