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"A COMPARATIVE STUDY BETWEEN DEXMEDETOMIDINE AND FENTANYL ADDED TO ROPIVACAINE IN SUBARACHNOID BLOCK"

Anaesthesiology

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ABSTRACT

Background: Many adjuvants are used with local anaesthetics in spinal anaesthesia for better intra and postoperative outcome. Dexmedetomidine, alfa-2 agonist and fentanyl, an opioid are now being used as neuraxial adjuvant. The aim of the present study was to compare the block characteristics of dexmedetomidine and fentanyl when used intrathecally as an adjuvant to 0.5% isobaric ropivacaine. **Material and methods:** Sixty patients scheduled for abdominal and lower limb surgeries were randomly allocated to receive either 2.5 ml of 0.5 % isobaric ropivacaine (12.5 mg) with 0.5 ml dexmedetomidine (5 mcg) intrathecally or 2.5 ml of 0.5 % isobaric ropivacaine (12.5 mg) with 0.5 ml fentanyl (25 mcg) intrathecally. Haemodynamic parameters, onset and duration of sensory and motor block, sedation and pain score were assessed. **Results:** Both groups were comparable in terms of age, weight, sex, ASA grade, onset and side effects of sensory and motor block. Duration of analgesia was significantly prolonged in dexmedetomidine group (361.34±27.25 minutes) compared to fentanyl group (247.7±34.57 minutes) (p value <0.05). Duration of motor blockade was significantly prolonged in dexmedetomidine group (232±14.23 minutes) compared to fentanyl group (177.33±13.27 minutes) (p value <0.05). Sedation and analgesia were better in dexmedetomidine group. **Conclusion:** Study successfully demonstrate that the dexmedetomidine is a better intrathecal adjuvant in spinal anaesthesia as far as patient comfort, stable cardio-respiratory parameters, intra-operative, post-operative analgesia and adverse effects were concerned.

KEYWORDS

Spinal anaesthesia, Dexmedetomidine, Fentanyl, Ropivacaine.

INTRODUCTION

Ropivacaine, as a local anaesthetic is considered to be less cardiotoxic and has a significantly higher threshold for Central Nervous System (CNS) toxicity on a milligram basis than bupivacaine and it provides only a lesser motor blockade with slightly shorter duration of action than bupivacaine.[1] Ropivacaine, a newer long-acting amide local anaesthetic structurally similar to bupivacaine, is available as 0.2%, 0.5%, 0.75% and 1% for neuraxial block.[2]

Intrathecal opioids enhance analgesia from subtherapeutic doses of local anaesthetic and make it possible to achieve successful spinal anaesthesia using what would otherwise be an inadequate dose of local anaesthetic[3]. Fentanyl is a synthetic opioid that has shown to enhance the analgesic potency of ropivacaine for spinal anaesthesia as it causes prolongation of the duration of analgesia in the early post-operative period and improves quality of anaesthesia.

Dexmedetomidine, is an imidazoline derivative more selective for alpha-2 receptors than alpha-1. It acts on both presynaptic and post-synaptic sympathetic nerve terminals and on central nervous system thereby decreasing the sympathetic outflow and nor-epinephrine release causing sedative, anti-anxiety, analgesic, sympatholytic effects. The nociceptive action is due to its effect at the spinal cord alpha 2 receptors. Intrathecal α_2-receptor agonists are found to have anti-nociceptive action for both somatic and visceral pain.[4,5] Dexmedetomidine being sedative with minimal respiratory depressant property, provides intra-operative sedation, alleviates position related discomfort.

However, there are limited studies comparing the dexmedetomidine and fentanyl added intrathecally as an adjuvant to isobaric ropivacaine in subarachnoid block with conflicting results. Hence, we undertook this study to evaluate and compare the efficacy of intrathecal dexmedetomidine vs intrathecal fentanyl as an adjuvant to isobaric ropivacaine in lower abdominal and lower limb surgery under subarachnoid block.

MATERIALS AND METHODS

After obtaining institutional's ethical committee's approval and written informed consent of patients, the present study entitled " A Comparaive Study between Dexmedetomidine and Fentanyl added to Ropivacaine in Subarachnoid Block " was conducted on sixty patients of ASA grade 1 & 2, aged 20 to 60 yrs, either sex, who were undergoing lower abdominal and lower limb surgeries in the Department of Anaesthesiology, Government Medical College and Associated Group of Hospitals, Kota (Rajasthan). All the patients were considered otherwise healthy and not have any other medical treatment.

Patients were randomly allocated by sealed envelope method into following two groups

Group RD(n = 30): Patients received 2.5 ml of 0.5 % isobaric ropivacaine (12.5 mg) with 0.5 ml dexmedetomidine (5 mcg) intrathecally.

Group RF (n =30) :Patients received 2.5 ml of 0.5 % isobaric ropivacaine (12.5 mg) with 0.5 ml fentanyl (25 mcg) intrathecally.

After intravenous insertion of an 18-G cannula in the operating room, all patients were preloaded with Ringer's lactate, 15 ml/kg over 10 mins. All the routine monitors were attached, and the preoperative baseline readings of noninvasive blood pressure, pulse rate (PR), and SpO2 were noted. Patient was placed in the sitting position and after all aseptic precautions, lumbar puncture was performed at L3–4 intervertebral space using a standard midline approach with a 25-G Quincke needle.

After ensuring a free flow of CSF, the study drugs were injected intrathecally according to group allocated. The patient was then placed in supine position immediately after spinal injection. The anaesthesiologists performing the block had recorded the intraoperative data, and a nurse had followed the patients postoperatively until discharged from the postanaesthesia care unit (PACU). Both were blinded to the group to which the patient was allocated.

Sensory blockade was assessed by loss of sensation to pinprick method using 26 G hypodermic needle, bilaterally in the midclavicular line. Sensory level was assessed every min for the first 10 minutes and thereafter every 10 min until regression to S-2 dermatome. Time of onset of sensory blockade was defined as completion of intrathecal injection to the loss of pinprick sensation at umbilical level (T-10 dermatome). Highest level of sensory block and time taken to achieve highest level of sensory block was noted. Duration of sensory anaesthesia was recorded and defined as a time of onset of sensory block to sensory regression to S- 2 dermatome.

Degree of motor blockade was determined according to Modified Bromage scale.(Table 1)

Onset of motor block was defined as a time from intrathecal injection till the patient is unable to flex ankle and foot (modified Bromage score 3). Duration of motor block recorded and was considered as time from onset of motor block to recovery of modified Bromage score 0.

Intraoperatively, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), pulse rate (PR), oxygen saturation (SpO2) were recorded every 5 minutes until the end of surgery and every 15 minutes in the first postoperative hour followed by every 30 minutes for next 6 hours. Hypotension, defined as fall of MAP by >20% from baseline or fall of SBP below 90 mmHg, was treated with incremental intravenous doses of mephentermine 6 mg and IV fluid as required. Bradycardia, defined as HR <50 bpm (beats per minute) or a decrease by >20% from baseline, was treated with injection atropine 0.6 mg intravenously.

All patients were observed for postoperative analgesia. Pain intensity was measured using a 10 cm Visual Analogue Scale (VAS) on 0 to 10 points (0 = no pain and 10 = worst pain), every 30 minutes for 6 hours. VAS score < 3 was considered as effective analgesia. When VAS reaches >3, diclofenac (75 mg) intravenously was given as rescue analgesic. Duration of effective analgesia was measured as the time from intrathecal injection to the first administration of rescue analgesic. The number of patients who required supplemental analgesic, were recorded.

The sedation was assessed intraoperatively and postoperatively by modified Ramsay Sedation scale (Table 2) along with haemodynamic parameters.

All patients were observed postoperatively for any complain of pruritus, nausea, vomiting, hypotension, bradycardia, respiratory depression, and post-spinal shivering. Intra and postoperative complications were noted and will be managed accordingly.

RESULTS

The demographic characteristics were comparable between the groups (Table-3). Onset time of sensory and motor block and time to achieve highest sensory level were significantly higher in group RF as compared to group RD. Time to regression to S1 dermatome was significantly higher in group RD compared to group RF. Duration of motor block was significantly higher in group RD ($P<0.05$), Duration of analgesia was longer in group RD and also number of rescue analgesic doses required was significantly less in group RD ($P<0.05$). Haemodynamic parameters (HR/MAP) were comparable in both the groups(Fig-1-2), Sedation score assessed by Modified Ramsay scale was higher in group RD compared to group RF (Fig-3). The adverse effects noted were also similar in the two groups. Six patients in group RD and four patients in group RF had bradycardia.

DISCUSSION

Ropivacaine is an amide local anaesthetic, which is less toxic to the CNS and cardiovascular system and shows rapid recovery of motor function, which is now heralded as an alternative to bupivacaine. In the previous studies, intrathecal injection of plain ropivacaine produced a sensory block of variable extent and considerable number of patients required general anaesthesia to accomplish surgery. Addition of fentanyl, clonidine, and dexmedetomidine has been studied to see the effect on sensory and motor block characteristics of plain ropivacaine. In the present study, an attempt was made to evaluate the analgesic effects and side-effects of intrathecal dexmedetomidine compared with intrathecal fentanyl when used in subarachnoid block with ropivacaine in patients undergoing lower abdominal surgeries.

The results of our study indicate that intrathecal dexmedetomidine before subarachnoid block hastens the onset of sensory block and motor block and prolongs the duration of analgesia as compared to fentanyl. Faster onset of sensory block may be due to alpha 2 receptor activation induced inhibition of nociceptive impulse transmission. Kannabiran V et al and Selvarajan R et al also observed similar onset of sensory block. In contrast to our study, Kazim M et al and Bajwa S et al observed delayed onset of sensory block in dexmedetomidine group. However, Ravipati P et al found a shorter onset of sensory and motor block in dexmedetomidine group.

In present study, time from injection to highest sensory block level achieved in group RD was significantly shorter as compared to group RF. In contrast to our study, longer time from injection to highest sensory block level was observed in study conducted by Kaur S et al, Bajwa S et al and Kazim M et al in dexmedetomidine group. However, Kannabiran V et al observed a much shorter time to reach highest sensory block with dexmedetomidine as compared to our results.

In our study, time to two segment sensory regression in group RD was significantly longer than group RF. In accordance with our results, Bajwa S et al, Kannabiran V et al, Kazim M et al and Selvarajan R et al also found a longer time for regression to S1 dermatome in patients who received dexmedetomidine as compared to other group. In contrast to our results, Kazim M et al found a earlier time to regression to S1 dermatome in patients receiving dexmedetomidine as compared to fentanyl group.In present study, duration of motor block was significantly longer in group RD as compared to group RF.

Similar results were observed in the study conducted by Selvarajan R et al. In correlation with our study results, Kannabiran V et al and Kazim M et al also observed longer duration of motor block in dexmedetomidine group.

However, Ravipati P et al found shorter duration of motor block as compared to our study.

Duration of analgesia was higher in group RD as compared to group RF and difference was statistically significant with p value of <0.05. In contrast to our study, prolonged duration of analgesia was observed in study conducted by Kannabiran V et al. In our study total number of doses of rescue analgesia was lower in group RD as compared to group RF and difference was significant.

Similarly, Kaur S et al also found a lower number of doses of rescue analgesia who received dexmedetomidine as compared to control group.

Added advantage of using intrathecal dexmedetomidine observed in our study was good sedation experienced by patients who received intrathecal dexmedetomidine which was similarly noticed in other studies.

Alpha-2 adrenergic agonist dexmedetomidine as an adjuvant to isobaric ropivacaine in spinal anaesthesia block significantly prolongs duration of sensory and motor blockade and duration of analgesia as compared to fentanyl. Dexmedetomidine is a better adjuvant in spinal anaesthesia as far as patient comfort, intra-operative and post-operative analgesia is concerned. Overall the experience with dexmedetomidine was quite satisfactory as compared to fentanyl because of its superior sedative and anxiolytic properties during the surgical procedure under regional anaesthesia.

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Conflict of interest: None to declare

Table 1: Modified Bromage scale-

Grade	Response
0	No motor block
1	Unable to raise extended legs
2	Unable to flex knee
3	Unable to flex ankle and foot

Table 2: Modified Ramsay sedation scale

Sedation score	Response
1	Anxious, agitated, restless.
2	Cooperative, oriented, tranquil.
3	Responds to commands only.
4	Brisk response to light glabellar tap or loud noise.
5	Sluggish response to light glabellar tap or loud noise.
6	No response.

Table 3: Demographic characteristics

Variables	Group RD (N=30)	Group RF (N=30)
Age (years)	30.26±11.21	40.8±9.72
Weight (kg)	66.36±8.34	62.96±10.58
Sex (Male/Female)	20/10	18/12
ASA grade (1/2)	16/14	18/12

Table 4: Patient characteristics

Variables	Group RD (N=30)	Group RF (N=30)
Onset time of sensory block (min)	4.63±0.49	6.83±0.87*
Onset time of motor block (min)	8.7±0.79	11.03±0.76*
Highest sensory level(T5/T6) (n)	28/2	1/29
Time to achieve highest sensory level (min)	10.73±0.82	13.16±0.83*
Time to regression to S1 dermatome (min)	278.33±13.19	206.73±20.41*
Duration of motor block (min)	232±14.23	177.33±13.27*
Duration of analgesia(min)	361.34±27.25	247.7±34.57*
Total number doses of rescue analgesic used in 24 hours	1.62±.52	2.48±0.58*

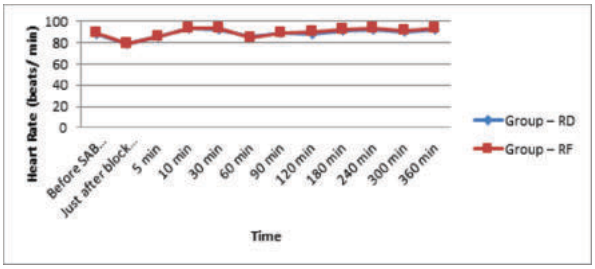

Fig 1: Changes in heart rate

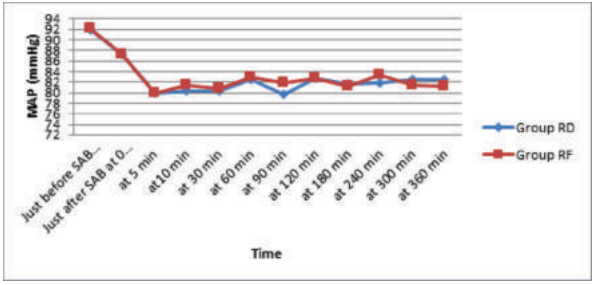

Fig 2: Changes in MAP

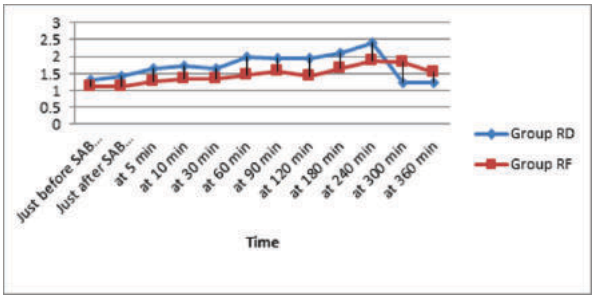

Fig 3: Sedation score

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