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Intrathecal Nalbuphine versus Intrathecal Dexmedetomidine for Postoperative Analgesia of Lower Abdominal and Lower Limb Surgeries

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Abstract

Introduction: Opioids are used as adjuncts with the local anaesthetic for longer duration of action and better postoperative analgesia [4]. Nalbuphine, is a mixed agonist-antagoniste and its analgesic potency is equal to morphine and less side effects like respiratory depression, urinary retention and pruritus. Intrathecaldexmedetomidine increased the duration of analgesia. *Aim*: To compare the duration of postoperative analgesia and the incidence of side effects of intrathecalnalbuphine and intrathecaldexmedetomidine for lower abdominal and lower limb surgeries. *Materials& Methods:* 60 patients of ASA I & II, underwent lower abdominal and lower limb surgeries using spinal blockade included. Group I (n=30) patients received Inj. Bupivacaine heavy 15 mg with Inj. Nalbuphine 0.8 mg. Group II (n=30) patients received spinal anaesthesia with Inj. Bupivacaine heavy 15 mg & Inj. Dexmedetomidine (5 mics) *Results:* The mean onset of sensory block (3.5±0.7 Vs 4.2±0.8) and motor block (1.7±0.7 Vs 2.6±0.9). Both were shorter in nalbuphine group which was statistically significant. The mean duration of analgesia was longer in patients who received dexmetomidine (197±6 min Vs 99.6±6 min), Incidence of hypotension and bradycardia were higher in dexmetomidine group but amenable to medical management. *Conclusion*: Intrathecalnalbuphine (0.8mg) decreases the mean duration of onset of both sensory and motor block. Intrathecaldexmedetomidine prolongs the duration of analgesia but the incidence of bradycardia and hypotension are higher.

Keywords: Spinal Anaesthesia; Nalbuphine; Dexmedetomidine; Lower Abdominal; Lower Lomb Surgeries.

Introduction

Regional anaesthesia, especially spinal blockade or spinal anaesthesia is mostly preferred for lower abdominal and lower extremity surgeries. It has added advantage of reduced stress response and postoperative analgesia [1,2]. Short duration of action and hypotension and bradycardia due to sympathetic blockade are the main disadvantages of spinal anaesthesia. Various drugs or adjuvants are added with the local anaesthetic drugs to increase the duration of action as well as to reduce the unwanted effects [3]. Traditionally, opioids are the most commonly used along with the local anaesthetic for longer duration of action as well as for better postoperative analgesia [4]. Intrathecalopioids are synergistic with local anaesthetics and intensify the sensory block without increasing the sympathetic block. Drugs like morphine can provide postoperative analgesia lasting upto even 24 hours [5]. They act on the opioid-receptors in the dorsal grey matter of spinal cord, resulting in modulation of afferent pain fibres [2]. The usefulness of intrathecal opioids are limited by side effects like pruritus, nausea, vomiting, urinary retention, and delayed respiratory depression [6,7]. Pruritus is due to the activation of central μ receptors and nausea and vomiting are due to the stimulation of the δ–*opioid receptor*s.

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Intrathecal fentanyl and sufentanyl are associated with fewer incidences of nausea and vomiting than intrathecal morphine [8]. Tramadol, a centrally acting narcotic analgesic has been shown to provide effective postoperative analgesia with no risk of respiratory depression after central neuraxial administration [9]. The minimal or no respiratory depressant effect is because of 6000-fold decreased affinity for μ receptors as compared with morphine [10-13].

Nalbuphine, is an opioid drug with an agonist action at μ receptor and an antagonist action at êreceptors (mixedagonist-antagonist). The analgesic potency of nalbuphine is equal to morphine. Nalbuphine has a short duration of action due to high lipid solubility and rapid clearance. The plasma half-life is five hours and the analgesic action lasts for three to six hours. Because of its agonist-antagonist actions, side effects like respiratory depression, urinary retention and pruritus are less likely to occur.

Dexmedetomidine, a highly selective α_2 adrenergic receptor agonist has been used as a sedative, anxiolytic, analgesic and sympatholytic [14]. Kanazi GE et al used dexmedetomidine in humans for the first time for transurethral resection of Prostate [15]. Al-Metwalli RR had shown that it enhances the postoperative analgesia after arthroscopic knee surgery [16]. Intrathecal dexmedetomidine increased the duration of analgesia when administered with local anaesthetics [17]. Analgesic action of alpha 2 – AR agonists is a result of the release of presynaptic C-fibre transmitters and by hyperpolarisation of postsynaptic dorsal horn neurons [18].

In this prospective randomised (simple) study, we have compared the duration of postoperative analgesia and the incidence of sideeffects of intrathecalnalbuphine and intrathecal dexmedetomidine in lower abdominal and lower limb surgeries.

Materials and Methods

After obtaining the approval from the hospital ethics committee, 60 patientsof ASA I & II who had undergone lower abdominal and lower limb surgeries under spinal blockade were included in this prospective, randomised study (simple randomisation). Informed consent was taken from all the patients. The patients were randomly divided into two groups. Group I (n=30) patients received Inj. Bupivacaine heavy 15 mg with Inj. Nalbuphine 0.8 mg. Group II (n=30) patients received spinal anaesthesia with Inj. Bupivacaine heavy 15 mg & Inj. Dexmedetomidine (5 mics). The following patients were excluded from the study: Patients not willing for spinal blockade, infection at the puncture site, medication with beta blockers, ARB drugs and coagulation abnormalities. Patients with spinal deformities and morbidly obese patients were also excluded. Patients were explained how to score the postoperative pain in Visual Analog Scale (VAS). They were instructed to indicate 0 to 10 depending on the severity of pain (0-no pain, 10-severe pain).

The preoperative fasting period was kept at six to eight hours. All the patients were given premedication with Inj.Ranitidine 50 mg & Inj. Ondansetron4 mg intravenously. Standard monitors were applied in the operating room: ECG, Pulse oximetry, non-invasive blood pressure. Spinal anaesthesia was administered under strict aseptic conditions, in sitting position. L3-L4 interspace was chosen and 25G Quinckeneedle was used. After confirming the sub arachnoid space, patients received the above mentioned drugs according to the group. The total volume of 3.5 ml was slowlyinjected intrathecally. After giving the spinal blockadeby using a hypodermic needle in the mid-clavicular line, theloss of sensory level was assessed and the time to achieve L1 level was recorded as onset of sensory block. The following parameters were also noted: the highest sensory level, the time taken for two segment regression time and duration of sensory block. We used modified Bromage scale to assess the motor block. Time to achieve scale 3 was considered as onset of motor block. Bromage scale: Grade 0 – no muscle weakness, Grade I – unable to flex hip, Grade II – unable to flex the knee, and Grade III – unable to flex the ankle.

The following demographic variables were noted: Age, Sex, Weight, BSA, ASA grade. Type and duration of surgery was also recorded. Hemodynamic parameters like heart rate (HR) and blood pressure(BP) were recorded at 2-minute intervals for the first 10 minutes(after the spinal blockade), and then at 15-minute intervals for the duration of the surgery. In the postoperative period, HR and BP were recorded hourly for first six hours and then at the 12^{th}hour and 24^{th} hour respectively.

30% fall in BP from the baseline was defined as hypotension. It was treated with fluids and Inj.Ephedrine. Bradycardia was defined as HR <50 bpm and treated with Inj.Glycopyrrolate 0.2 mg i.v. Additional analgesics were avoided in the intraoperative period. The incidence and time of bradycardia and hypotension in both groups were noted. In addition, the following adverse effects were

recorded:shivering, nausea, vomiting, decrease in O_2 saturation, and pruritus.

In the postoperative period, the time to require the first analgesic drug was noted. This interval was considered as the duration of analgesia. Mean duration of onset of sensory block and motor blockade was noted. All the above mentioned hemodynamic variables and oxygen saturation was recorded.

Statistical Analysis

The data was analysed using Chi-square and T-test where P <0.05 was considered as statistically significant.

Results

60 patients who underwent lower abdominal and lower limb surgeries were included in this study. Table 1 shows the demographic variables among the patients in both groups. They were comparable in both groups. The mean age of the patients in Group I was 41.6± 13 and in Group II was 44.5±10.7.The mean onset of sensory block (3.5± 0.7 Vs 4.2 ± 0.8) and motor block (1.7±0.7 Vs 2.6 ± 0.9) were shown in Table 2. Both were shorter in nalbuphine group than dexmetomidine group which was statistically significant (p = 0.002, 0.0006). The mean duration of analgesia was longer in patients who received dexmetomidine than the nalbuphine group (197 ± 6 min Vs 99.6±6 min), which was statistically significant.The distribution of sensory level in both groups was similar. Regression of sensory level by two segments was faster in nalbuphine group (107 ± 7.9 Vs 122±6.0). Incidence of hypotension and bradycardia (Fig 1, 2& 3) were higher in dexmetomidine group (Table 3) but amenable to medical management with fluids, Inj phenylephrine and Inj Atropine/Glycopyrrolate. The hemodynamic parameters (HR, Blood pressure) were comparable in

Table 1: Baseline Characteristics

Baseline Characteristics	NAL	DEX	P value
AGE	41.6 ± 13.0	44.5 ± 10.7	NS
WT	68.6 ± 5.3	63.5 ± 8.2	NS
BSA	1.5 ± 0.7	1.3 ± 0.6	NS

Table 2: Onset of Sensory & Motor block

Block	NAL	DEX	P Value
Onset of Sensory Block	3.5 ± 0.7	4.2 ± 0.8	0.002*
Onset of Motor Block	1.7 ± 0.7	2.6 ± 0.9	0.0006*
REG to Two Level	107 ± 7.9	122 ± 6.0	NS
Duration of Analgesia	99.6 ± 6	197 ± 6	0.00001*

Table 3: Incidence of Adverse effects

Adverse Events	NAL	DEX	CHISQ. Value	P Value
Hypotension	3	6	1.176	NS
Bradycardia	2	5	1.45	NS

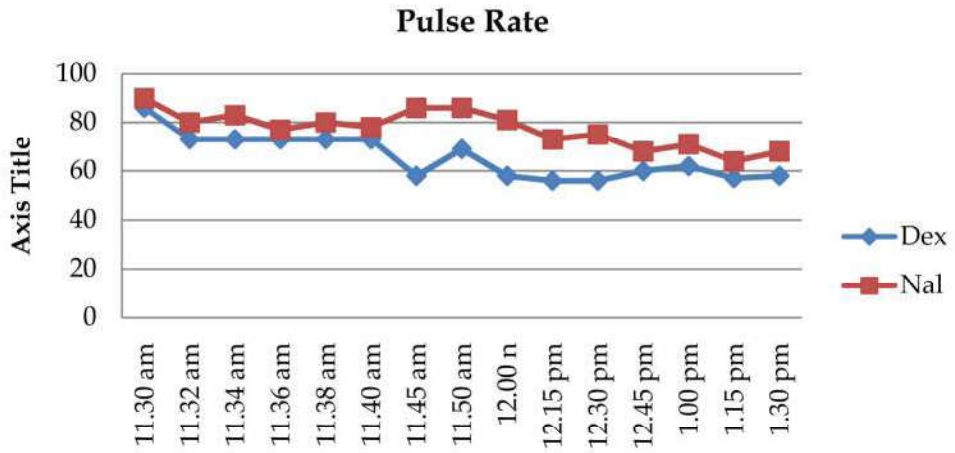

Fig. 1:

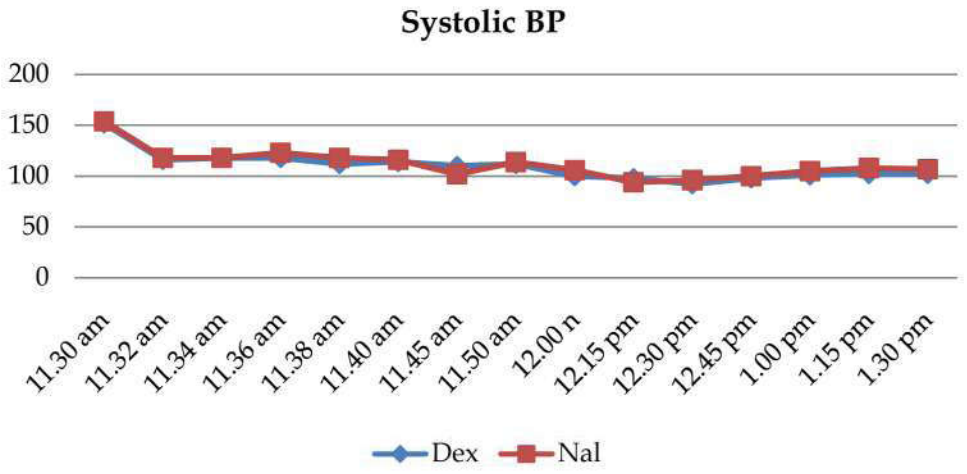

Fig. 2:

both groups.There was no significant difference in side effects between both groups. The perioperative hemodynamicswere comparable in both groups (Graph 1, 2 & 3).

Discussion

Spinal blockade is the most common method of providing anaesthesia for lower abdominal and lower limb surgeries. The advantages of adding opioids with local anaesthetics for spinal anaesthesia include rapid onset of action and prolonged postoperative analgesia. The major drawback of intrathecal opioids are side effects like nausea, vomiting, pruritus and respiratory depression. Opioids with agonist-antagonist activity may reduce the incidence of side effects while providing effective postoperative analgesia. Numerous drugs have been used as adjuncts with local anaesthetics for spinal anaesthesia: fentanyl, buprenorphine, midazolam, ketamine, neostigmine, nalbuphine and dexmetomidine. Intrathecalnalbuphine potentiated the onset and extent of sensory and motor block of spinal anaesthesia and significantly increased the duration of sensory block [19]. Various authors used different doses of nalbuphine with local anaesthetics. Devendra Verma et al studied the effect of intrathecal nalbuphine and concluded that 2 mg of intrathecal nalbuphine was effective in enhancing postoperative analgesia [19]. 0.8 mg of intrathecal nalbuphine was used for postoperative analgesia after caesarean section [27].

The dose of intrathecalnalbuphine varies between studies. 0.8 mg of nalbuphinewas suggested as an adequate dose without any side effects by Culebras et al [20]. Another study by Mukerjee et al had concluded that 0.4 mg of intrathecalnalbuphine prolonged analgesia without any side effects when compared with 0.2 mg and 0.8 mg. We used 0.4 mg of nalbuphine for our study. Even though we found that the onset of motor block was faster in nalbuphine group, other studies did not [22,23].

Dexmetomidine, when used as an adjunct to intrathecal local anaesthetics, provides prolonged postoperative analgesia. Different studies have used different doses. Even though high doses produced longer duration of analgesia, it may increase the cardiovascular complication like hypotension and bradycardia. In their study Sullivan et al suggested that 2.5 mics was the ED50 for the dexmedetomidine to inhibit C fibre response of dorsal horn neurons. We have chosen 5 mics for our study. We found that nalbuphine group had faster onset of sensory block than the dexmedetomidine group. Doses of 5, 10, and 15 mics of intrathecal dexmetomidine had been studied and shown to produce a dose-dependent duration of analgesia with minimal side effects [24, 25 and 26]. We used 5 mics of dexmedetomi-dineintrathecally.

In our study, the onset of sensory and motor block was faster in nalbuphine group than dexmedetomidine group, which was statistically significant. However, the two dermatomal regressions were much slower in dexmedetomidine group. The duration of analgesia was longer in dexmedetomidine group. Intrathecal Dexmedetomidine resulted in longer duration of postoperative analgesia than intrathecalnalbuphine. Gupta et al suggested that dexmedetomidine 5 mics added to the local anaesthetics for spinal anaesthesia resulted in significant prolongation of postoperative analgesia

[28]. Eid et al have shown that the duration of analgesia is proportional to its dose. We have observed that the incidence of hypotension and bradycardia was higher in dexmedetomidinegroup which was managed medically without any adverse outcome [29]. More number of patients in dexmedetomidine group required treatment with Inj. Ephedrine for hypotension than nalbuphine group. This had been found in other studies also [28]. Overall, patients in both groups had similar, stable hemodynamics during the perioperative period. No statistically significant changes in HR and BP. The incidence of adverse events like nausea, vomiting and pruritus were similar in both groups.

There are few limitations in our study: even though we have done simple randomisation, it was not blinded. Our number of patients was small, not enough to have the power to identify the complications.

Conclusion

We would like to conclude that intrathecal nalbuphine (0.8mg) decrease the mean duration of onset of both sensory and motor block. Intrathecal 0.5 micsdexmedetomidine prolongs the duration of analgesia and the incidence of bradycardia and hypotension are higher in dexmedetomidine group.

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