Original Research Article

Comparative study of dexmedetomidine and fentanyl as adjuvants to 0.5% hyperbaric bupivacaine in spinal anaesthesia in elective lower abdominal surgeries

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Abstract

Background: Regional anaesthesia is the preferred technique of choice for lower abdominal and lower limb surgeries. Adjuvants such as Morphine, Fentanyl, Clonidine and Dexmedetomidine have been used to supplement intrathecal local anaesthetics providing possible advantages, such as delayed onset of pain and reduced analgesic requirements. In present study we aimed to compare dexmedetomidine and fentanyl as adjuvants to 0.5% hyperbaric bupivacaine in spinal anaesthesia in elective lower abdominal surgeries at a tertiary hospital. **Material and Methods:** Present study was hospital based, prospective comparative study, conducted in patients of age 20-60 years of either gender, ASA grade 1 and 2, undergoing elective lower abdominal surgeries, willing to participate. 80 patients were randomly assigned into Group F (n=40) and Group D (n=40) by randomly pick-up of sealed envelope by patient. **Results:** 80 patients were randomly assigned into Group F (n=40) and Group D (n=40). General characteristics of study patients such as age (years) , gender (male/female), height (centimeters), weight (kilograms) and ASA grade (I/II) were comparable in both groups and difference was not statistically significant. Onset of sensory block (sec) , onset of motor block (sec), time to reach maximum level of sensory block (min) and time for highest sensory level (min) were comparable in both groups and difference was not statistically significant. Total duration of motor block (min), first request for rescue analgesia (min), highest sensory level achieved and time of two segments regression were better in dexmedetomidine group as compared to fentanyl group and difference was statistically significant. **Conclusion:** Dexmedetomidine group had prolonged duration of motor block, prolonged time of two segments regression and reduced demand for rescue analgesics in 24 hr. as compared to Fentanyl.
Keywords: Dexmedetomidine, Fentanyl, hyperbaric Bupivacaine, Spinal anaesthesia

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INTRODUCTION

Regional anaesthesia is the preferred technique of choice for lower abdominal and lower limb surgeries. It allows the patient to remain awake, minimizes or completely avoids the problem associated with airway management. Adjuvants are added to improve the quality, to accelerate the onset of action and to overcome the problems of spinal anaesthesia. Adjuvants are administered by various routes like epidural, intrathecal and intravenous.[1,2] Adjuvants such as Morphine, Fentanyl, Clonidine and Dexmedetomidine have been used to supplement intrathecal local anaesthetics providing possible advantages, such as delayed onset of pain and reduced

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analgesic requirements.[3] Fentanyl is μ receptor agonist 80 times more potent than morphine as an analgesic added to spinal 0.5% heavy bupivacaine improves quality of spinal analgesia, reduces visceral and somatic pain. However their addition may have side effects like pruritus, respiratory depression, urinary retention, postoperative nausea and vomiting which limits their use.[4,5] Dexmedetomidine is a highly selective α2-adrenergic agonist, used intrathecally, found to have antinociceptive action for both somatic and visceral pain.[6] In present study we aimed to compare dexmedetomidine and fentanyl as adjuvants to 0.5% hyperbaric bupivacaine in spinal anaesthesia in elective lower abdominal surgeries at a tertiary hospital.

MATERIAL AND METHODS

Present study was hospital based, prospective comparative study, conducted in department of anaesthesiology, at Dhonde Hospital, Sangli, India. Study was conducted between July 2020 to March 2021. Study was started after approval of Institutional Ethical Committee.

Inclusion criteria: Patients of age 20-60 years of either gender, ASA grade 1 and 2, undergoing elective lower abdominal surgeries, willing to participate.

Exclusion criteria: American Society of Anaesthesiologists Grade 3 and 4 patients. Patients with known contraindications for spinal anaesthesia. Patients with haemodynamic instability. Patient on antihypertensive and antidepressants, cardiac/respiratory disease.

A detailed history was noted and a complete general and systemic examination was done. Procedure was explained to patients and a written informed consent was taken. In surgical theatre monitors attached to record ECG, NIBP, SpO2, HR and RR. The baseline readings were noted.

80 patients were randomly assigned into Group F (n=40) and Group D (n=40) by randomly pick-up of sealed envelope by patient.

Group F: received 2.5 ml of 0.5% hyperbaric bupivacaine with 0.5ml of 25 mcg fentanyl, total of 3ml

Group D: received 2.5ml of 0.5% hyperbaric bupivacaine with 0.5 ml of 5 mcg dexmedetomidine, total of 3ml.

The patient and observing anaesthesiologist were blinded to the drug group. Under strict aseptic precautions, spinal anaesthesia was carried out in sitting position. The time of injection (0 min) was noted and patient placed in supine position. Vital parameters as heart rate (HR), blood pressure(BP), saturation (SPO2), and respiratory rate (RR) were noted every 5 minutes for first hour then every 10 minutes for next hour and later every 15 minutes thereon. Various parameters such as onset of sensory block, level of maximal sensory blockade, time taken for regression of 2 segments from maximal sensory blockade and time taken for regression to S1 sacral segments from maximal sensory blockade, onset of motor blockade, duration of motor blockade, time of rescue analgesia. After the surgery, patients were monitored in the PACU for vitals like HR, BP, RR and SpO2 every 15 minutes.

Data was analysed using Statistical Package for Social Science SPSS 22.0 software. Independent t test and Chi-square test was used to compare proportion between the groups. p-value < 0.05 was considered for statistical significance.

RESULTS

80 patients were randomly assigned into Group F (n=40) and Group D (n=40). General characteristics of study patients such as age (years), gender (male/female), height (centimeters), weight (kilograms) and ASA grade (I/II) were comparable in both groups and difference was not statistically significant.

Table 1: General Characteristics

Characteristics	Group D (n=40)	Group F (n=40)	P value
Age (years)	32.37 ± 12.75	33.13 ± 11.95	>0.05
Gender			
Male	23	22	>0.05
Female	17	18	
Height (centimeters)	163.1 ± 6.81	160.8 ± 10.6	>0.05
Weight (kilograms)	65.4 ± 11.9	66.3 ± 10.9	>0.05
ASA grade			
I	29	30	>0.05
II	11	10	

Onset of sensory block (sec) , onset of motor block (sec), time to reach maximum level of sensory block (min) and time for highest sensory level (min) were comparable in both groups and difference was not statistically significant.

Total duration of motor block (min), first request for rescue analgesia (min), highest sensory level achieved and time of two segments regression were better in dexmedetomidine group as compared to fentanyl group and difference was statistically significant.

Table 2: Characteristics of sensory and motor block

Characteristics	Group D	Group F	P value
Onset of sensory block (sec)	91.22 ± 31.79	82.25 ± 38.24	0.63
Onset of motor block (sec)	182.83 ± 44.3	186.75 ± 43.62	0.55
Time to reach maximum level of sensory block (min)	20.27 ± 5.12	21.23 ± 4.96	0.56
Total duration of motor block (min)	202.28 ± 31.65	151.48 ± 38.66	<0.001
First request for rescue analgesia (min)	321.43 ± 74.57	211.78 ± 39.88	<0.001
Time for Highest Sensory level (min)	8.17 ± 2.24	7.85 ± 2.12	0.67
Highest Sensory Level Achieved	6 (4 – 8)	8 (6 – 10)	0.046
Time of two segments regression	102.65 ± 21.54	83.35 ± 25.6	<0.001

Intraoperative and Immediate post-operative complications such as hypotension, bradycardia and vomiting were more in dexmedetomidine group, while nausea, pruritis and shivering were more in fentanyl group, but difference was not statistically significant.

Table 3: Intraoperative and Immediate post-operative complications

Complications	Group D (n=40)	Group F (n=40)
Hypotension	4	3
Bradycardia	4	2
Vomiting	4	3
Nausea	1	3
Pruritis	1	2
Shivering	1	3

DISCUSSION

Hyperbaric bupivacaine 0.5% is extensively used for spinal anaesthesia. Though the duration of action of bupivacaine is prolonged compared to lignocaine, it is not enough in prolonged surgeries of more than 2 hours. postoperative pain control is a major problem because spinal anesthesia using only local anesthetics is associated with relatively short duration of action, and thus early analgesic intervention is needed in the postoperative period. The routine doses of bupivacaine are associated with prolonged and intense sensory and motor block and significant sympathetic block, which may not be desirable in some patients. Low dose diluted bupivacaine limits the distribution of spinal block and yield a comparably rapid recovery, but may not provide an adequate level of sensory block.[7] Some drugs have been used as adjuvants in spinal anesthesia to prolong intraoperative and postoperative analgesia including opioids, α2 agonists, neostigmine, vasoconstrictors, etc.[8] Adjuvants decrease dose of local anaesthetic and their side effects. (myocardial depression, hypotension, bradycardia, heart block, and ventricular arrhythmias). Dexmedetomidine has been widely used for anesthesia and analgesic purposes. This drug has sedative, anti-anxiety, analgesic, neuroprotective, and anesthetic-sparing effects.[9] Dexmedetomidine along with other drugs have been used to increase the duration of analgesia in subarachnoid, epidural and caudal blocks.[10,11] Fentanyl is a synthetic opioid with central action, which is used widely for pain control. Intrathecal fentanyl is usually added to other local anesthetics to increase anesthesia and analgesia. It has improved spinal anesthesia and reduced the anesthetic drug related side effects including pruritus, nausea and vomiting.[12] In present study we aimed to compare dexmedetomidine and fentanyl as adjuvants to 0.5% hyperbaric bupivacaine in spinal anaesthesia in elective lower abdominal surgeries. In a similar study by G Suresh,[13] the highest sensory level was better in fentanyl group while time of two segment regression, time of regression to S1 segment, motor blockade and time to rescue analgesia group was better in dexmedetomidine group. The hemodynamic stability, sedation and side effects were similar in both the groups. They concluded that dexmedetomidine may be used as an alternate to fentanyl for intrathecal use in regular use in clinical practice. In another similar study by Nayagam HA *et al.*,[14] there were no significant differences between the groups in the time to reach T10 segment block and time to two segment regression (TTSR); time to reach peak sensory block level (PSBL) and modified Bromage scales significant. peak sensory block level (PSBL) and time to first analgesic request were highly significant. Dexmedetomidine was superior to fentanyl since it facilitates the spread of the block and offers longer post-operative analgesic duration. Shashikala TK *et al.*,[15] noted that patients in dexmedetomidine group had significantly longer duration of sensory and motor block than patients in fentanyl or lone bupivacaine group. The onset time to reach maximum level of sensory block and modified Bromage 3 motor block were not significantly different between the groups. Intrathecal dexmedetomidine is associated with prolonged motor and sensory block, hemodynamic stability and reduced demand of rescue analgesics as compared to fentanyl or lone bupivacaine. Gupta *et al.*,[16] noted that patients in dexmedetomidine group (D) had a significantly longer sensory and motor block time than patients in fentanyl

group (F). The mean time of sensory regression to S1 was 476±23 min in group D and 187±12 min in group F (P<0.001). The regression time of motor block to reach modified Bromage 0 was 421±21 min in group D and 149±18 min in group F (P<0.001). Intrathecal dexmedetomidine is associated with prolonged motor and sensory block, hemodynamic stability, and reduced demand for rescue analgesics in 24 h as compared to fentanyl. Intrathecally fentanyl exerts its effects by combining with opioid receptors in the dorsal horn of spinal cord and may have a supraspinal spread and action. Intrathecal fentanyl when added to spinal local anaesthetics reduces visceral and somatic pain.[17] Intrathecal α2 receptor agonists have antinociceptive actions for both somatic and visceral pain. Intrathecal dexmedetomidine when combined with spinal bupivacaine prolongs the sensory block by depressing the release of C fibres transmitters and by hyperpolarisation of post synaptic dorsal horn neurons. [17,18]

Dexmedetomidine provides stable hemodynamic conditions, good quality of intra-operative analgesia and prolonged post-operative analgesia with minimal side effects.[19] Limitations and shortcomings of present study were small sample size, for elective surgery patients only and from single hospital. Studies with larger number of participants are required to generalise the results and also the patient-to-patient variability of pain perception.

CONCLUSION

Fentanyl and dexmedetomidine along with low dose bupivacaine provide adequate anaesthesia along with hemodynamic stability. Dexmedetomidine group had prolonged duration of motor block, prolonged time of two segments regression and reduced demand for rescue analgesics in 24 hr. as compared to Fentanyl. Dexmedetomidine seems to be a better choice as Intrathecal adjuvant with Bupivacaine for lower abdominal surgeries.

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