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Original Research Article

A comparative study between isobaric levobupivacaine and isobaric levobupivacaine with fentanyl in patients posted for lower abdominal and lower limb surgeries under spinal anaesthesia

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Abstract

Introduction: Spinal anaesthesia can be intensified by adding low dose opioids along with intrathecal local anesthetics without an effect on sympathetic blockade. We sought to evaluate the safety and efficacy of intrathecal levobupivacaine plain versus levobupivacaine plus fentanyl in lower abdominal and lower limb surgeries.

Materials and Methods: In a prospective randomized double blind study, 60 American Society of Anesthesiologists grades I and II patients of either sex, 18-55 years of age were enrolled for the study after obtaining Ethical Committee clearance and informed consent. They were randomly divided into two groups of 30 each, Group A- 2.5ml of 0.5% isobaric levobupivacaine + 0.5ml Normal saline and Group B-2.5 ml of 0.5% isobaric levobupivacaine + 25 µg fentanyl intrathecally. Sensory and motor block characteristics, haemodynamics and side effects were assessed.

Results: The onset of sensory block and time to reach T10 level was rapid in Group B (2.10±0.75 and 5.6±1.22 min) in comparison to Group A (2.75±0.67 and 7.70±1.46min P < 0.0007). Most patients in Group B had maximum sensory block of T6 and a Bromage scale of 3 which was achieved earlier than in Group A(P=0.010).In Group A highest level of sensory block was T8 with Bromage scale of 2. The duration of both sensory and motor block was longer in Group B(165.5±12.05) (P<0.0001) compared to Group A(141.00±9.86 min). Data was analyzed using "Chi-square test" and "unpaired t-test."

Conclusion: Fentanyl added to Levobupivacaine results in early onset and prolonged duration of sensory and motor block with stable haemodynamics.

Introduction

Lower abdomen and lower limb procedures are most commonly performed surgeries. These surgeries are done on an elective/emergency basis and this helps in early rehabilitation and resuming of normal life. These procedures cause more pain. Hence it is essential to provide adequate intraoperative and postoperative analgesia. The incidence of cardiorespiratory complications is decreased and early ambulation[1,2] and complete recovery is seen when good postoperative analgesia is provided leading to lesser medical cost. We can perform both regional anesthesia and general anesthesia for lower abdomen and lower limb surgeries. Spinal anesthesia is a simpler procedure when compared to epidural and is easily performed. It helps to avoid the problems of general anesthesia like intraoperative blood loss, stress response, polypharmacy. Spinal anesthesia also provides a faster onset of sensory and motor blockade[3] with less failure rates, less postoperative morbidity and preservation of mental status and normal reflexes. A quest for search of newer and safer anesthetic agents in anesthesiology practice has been there always.[4] Local anesthetics starting from older drugs like cocaine to newer ones like levobupivacaine have some advantages and disadvantages. Lignocaine used previously, has been banned for intrathecal use because of the risk of transient neurological symptoms.[5] Bupivacaine a drug used regularly is known to cause cardiotoxicity and neurotoxicity on inadvertent intravascular injection.[6] Levobupivacaine, a levorotatory isomer of bupivacaine has a good pharmacokinetic profile[7-9] is effective and less cardiotoxic and neurotoxic. Therefore it is preferred for spinal anesthesia even in the elderly.[10,11] Adjuvants like opioids (morphine, fentanyl), ketamine, clonidine, dexmedetomidine are added to intrathecal local anesthetics in order to potentiate the effects.[4,12] Fentanyl, because of its increased lipophilic quality leads to a decreased rostral spread and is a safe drug for potentiation of local anesthetic effect.[13] This study was undertaken to compare the effects of levobupivacaine and levobupivacaine with fentanyl in patients posted for lower abdomen and lower limb surgeries under spinal anesthesia.

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Materials and Methods

An informed written consent was obtained along with ethical committee clearance. 60 patients of American society of Anesthesiologists (ASA) grade I and grade II, both male and female who were in the age group of 18 to 55 years scheduled to undergo lower abdominal and lower limb surgeries were randomly divided into 2 groups of 30 each. We required a minimal sample size of 20 per group keeping the power of at 80% and confidence interval of 95%(1-α),we took 30 patients in each group to compensate for the dropouts. Patients with comorbidities coming under ASA III and IV, obese patients, those with history of local anesthetic hypersensitivity, coagulation abnormalities, local infection and severe hypovolemia were excluded from the study. All patients were assessed the day before surgery and were kept nil orally in the night before surgery. Tablet Rantac 150mg and tablet Anxit 0.5mg oral premedication was given. In the operating room, an 18G IV cannula was secured and ringer lactate at 8 to 10 ml/kg/hr was used to preload the patients. Pulse oximetry, Non invasive blood pressure and ECG were connected.

1. Group A received Inj. 0.5% levobupivacaine 2.5ml(12.5mg) isobaric with Inj. normal saline 0.5ml.
2. Group B received Inj. 0.5% levobupivacaine 2.5ml(12.5mg) isobaric with Inj. fentanyl 0.5ml(25μg).

Basal heart rate, blood pressure, ECG and SPO2 were noted. Lumbar puncture was done under aseptic precautions using 25G spinal needle at L3-L4 intervertebral space and the pre-assigned drug was injected and patient was made to lay down with operating table kept flat.

Sensory parameters evaluated were: 1. Sensory block onset time; 2. Time required to attain T10 level; 3. Sensory block at highest dermatome; 4. two segment regression time; 5. Rescue analgesia request time (duration of analgesia). The time between injection of the drug to the time patient had feeling of tingling sensation in the legs was considered as onset time for sensory block. Time taken to obtain T10 level is from the time of giving block to the time when patient had no sensation at T10 level. Rescue analgesia request time (duration of analgesia) was the time between the injection to the time the patients perceived of surgical site pain.

Motor parameters evaluated were: 1. Onset time for motor block; 2. Degree of motor block; 3.Motor block duration. Assessment of motor blockade was done using Modified Bromage Scale. Time of onset of motor block was the time from paresis started to complete loss of power (Bromage 4). The time between the injection and complete recovery of motor block (Bromage 0) was taken as the duration of motor block.

All the vital parameters were checked every 5min for the first 30min and every 10min throughout the surgery and postoperative period with continuous ECG and SPO2 monitoring. A fall in systolic blood pressure of 30% or more from the values before the block or <100mmHg was considered as hypotension and with IV ephedrine increments was used to correct it. Heart rate <50bpm was a taken as bradycardia and was treated with 0.02mg/kg IV atropine. After shifting patients to recovery area, they were observed till the complete recovery of sensory and motor blockade. Mean ± SD (Min-Max) was used for continuous measurements and results on categorical parameters are presented in Number (%). 5% change was considered to be significant. Student's t test, chi-square, Fischer exact were used to compare parameters as appropriate. Statistical software used for analysing data were SAS9.2 and SPSS 15. p value less than 0.05 was significant.

Results

The two groups were similar in age, sex, height, weight and type of surgery.

Sensory Block

The mean sensory block onset time in Group A was 2.76±0.67min, and in Group B it was 2.10±0.75min and was faster in Group B than in Group A. It was highly significant with P value 0.0007. The mean time to achieve T10 level in Group A was 7.70±1.46min and in Group B was 5.26±1.22min., being faster in Group B when compared to Group A that was highly significant with P<0.0001. The maximum sensory block obtained was T6 and seen in 8 patients (26.6%) in Group B and in only one patient (3.3%) in Group A. The number of patients who obtained a sensory level of T8 was 22(73.3%) in Group B while only 16 patients (53.33%) could achieve a level of T8 in Group A. More number of patients achieved a higher level of sensory block in Group B and this difference was highly significant (P<0.0001). The mean time taken for sensory block to regress by two segments in Group A was 85.0±14.34min and in Group B was 114.86±10.67min and was found to be significantly longer(p<0.0001) in Group B. The mean time when patients requested for rescue analgesia in Group A was 155.16±12.14min and in Group B was 240.66±20.70min. Hence the duration of sensory block was longer in Group B than in Group A and was statistically highly significant (p<0.0001).

Motor Block

The mean onset time for motor block in Group A was 5.03±0.8min and in Group B it was 3.63±0.96min, onset being faster in Group B and with a high level of significance (p<0.0001).20 patients in Group B could achieve a Bromage scale of 3, while only 3 patients in Group A achieved a bromage scale of 3. This implies that the density of motor block was more in Group B and was highly significant (p=0.010). The mean motor block duration in Group B was 165.50±12.05min and was significantly longer than in Group A in which it was 141.00±9.86min(p<0.001). Hemodynamic parameters did not vary significantly between the two groups.

Discussion

Extensive studies have been done to evaluate the choice between regional (spinal and epidural)[14] and general anesthesia to perform lower limb and lower abdominal

surgeries. A lower incidence of morbidity and mortality has been reported in the early postoperative period when spinal anesthesia was performed.[15] Spinal anesthesia is often used, the advantage being relatively less amount of local anesthetic injection leads to a profound nerve block.[16] The properties of local anesthetic desirable for spinal use are rapid onset of action, intense analgesia and motor blockade, prolonged action with adequate postoperative analgesia, minimal cardiorespiratory changes and early ambulation with result in decrease cost of medical care.

Bupivacaine, a racemic (50:50) mixture containing of S and R enantiomers has been regularly used since the time it was introduced in 1956 because it has longer duration of action and minimal placental transfer. The cardiotoxic and neurotoxic effects due to its R enantiomer were reported[17] in 1979. Hence the need for other local anesthetic arose and levobupivacaine, the S enantiomer of bupivacaine was used in clinical practice in 1999 and approved in 2004 in the European Union for spinal anesthesia. Levobupivacaine having lower lipid solubility and higher protein binding blocking both sensory and motor nerve fibres with less cardiotoxicity.[18,19] Numerous studies have been conducted to establish the equipotency, superior hemodynamic profile and safety in elderly of levobupivacaine over bupivacaine.[10]

Addition of intrathecal adjuvants to local anesthetics improves the quality as well as duration of block which is desirable for longer procedures and to provide postoperative analgesia. Drugs like opioids, clonidine, ketamine and neostigmine are used as adjuvants to prolong the spinal duration.[12] Fentanyl, a phenylpiperidine compound and a μ receptor agonist is being used more often as an adjuvant to spinal anesthesia newer opioids like fentanyl are highly lipid soluble with high affinity for opioid receptor. They are associated with the an early onset and longer duration of analgesia when added in lower doses with fewer side effects acting synergistically with local anesthetics.[20] We chose 25μg of fentanyl as an adjuvant as this was the dose found effective in most studies.

There were few studies which compared levobupivacaine plain and levobupivacaine with fentanyl, so this study was conducted. There was no difference between the groups with respect to age, sex, duration and type of surgery.

The mean onset time for sensory block was 2.76±0.67min in Group A and 2.1±0.75min in Group B, the onset being faster in Group B. Monica et al compared levobupivacaine 2.5ml and hyperbaric bupivacaine 2.5ml in patients under going knee arthroplasty surgeries and found the mean time for sensory block onset with levobupivacaine to be 3min similar to our study.[21] Filitz et al when comparing 1.5ml of levobupivacaine and 10μg fentanyl with hyperbaric bupivacaine 1.5ml and 10μg fentanyl in patients undergoing caeserean section, found out that, the time for sensory block onset with levobupivacaine and fentanyl was 2min which is same as our study.[22] In a study conducted by Nesrin et al, levobupivacaine 2.2ml and fentanyl 10μg versus levobupivacaine 2.2ml in caeserean sections, the onset time for sensory block was 1.5min in levobupivacaine-fentanyl group and corresponds to our study[23] and 8min in levobupivacaine group which is different from our study. The mean time required to attain T10 level was 7.74±1.46min in Group A and 5.26±1.22min in Group B, being faster in Group B. Joginder Pal Attri et al compared levobupivacaine 2ml with levobupivacaine 2ml and 25μg fentanyl in patients undergoing infraumbilical surgeries. In their study, the level of T10 block was reached in levobupivacaine group at 7.6±1.46min and in levobupivacaine-fentanyl group at 4.8±1.5min[24] and is similar to our study. In a study done by Nesrin et al, the time taken to reach T10 sensory level was found to be 11min in levobupivacaine group and 2.5min in levobupivacaine-fentanyl group being significantly shorter in levobupivacaine-fentanyl group and coresponds to our study. The maximum sensory block obtained was T6 and seen in 8 patients (26.6%) in Group B and in only one patient (3.3%) in Group A. The number of patients who obtained a sensory level of T8 was 22(73.3%) in Group B while only 16 patients (53.33%) could achieve a level of T8 in Group A. More number of patients achieved a higher level of sensory block in Group B and this difference was highly significant ($P<0.0001$). Joginder et al in their study found higher number of patients with T6 level in levobupivacaine-fentanyl group compared to levobupivacaine group.[24] In a study done by Nesrin et al, a highest level of T4 was seen in both levobupivacaine-fentanyl and levobupivacaine group which differs from our study. The mean two segment regression time was found to be 85.0±14.34min in Group A and in Group B it was 114.86±10.67min. Joginder et al observed the time for 2 segment regression to be 95.58±5.3min in levobupivacaine group and 106.62±6.17min in levobupivacaine-fentanyl group, where as Nesrin et al found the 2 segment regression time in levobupivacaine group to be 93.7min and in levobupivacaine-fentanyl group it was 96.48min.The findings of our study is similar to that of Joginder et al where the two segment regression time is delayed in levobupivacaine -fentanyl group. The mean time when patients requested rescue analgesia was 155.16±12.14min in Group A and was earlier compared to Group B where it was 240.66±20.70min. This was similar to the observations made by Joginder et al, in which the time for rescue analgesia in levobupivacaine group was 168.16±11min and in levobupivacaine-fentanyl group was 265±26min. Hence, the addition of fentanyl to levobupivacaine for spinal anesthesia increases the duration of sensory block.

The mean onset time for motor block was 5.03±0.8min in Group A while it was 3.63±0.96min in Group B and faster in Group B. Nesrin et al also noted similar findings with onset time for motor block of 3min in levobupivacaine-fentanyl group and 10min in levobupivacaine group. In the study conducted by Joginder et al, it was 12min in levobupivacaine group and 8.3min in levobupivacaine-fentanyl group being shorter in levobupivacaine-fentanyl group and correlates with our study. In Group B, 20 patients had motor blockade of Bromage scale 3(66.7%) as compared to only 10 patients (33.33%) in Group A. Thus,

the motor block was dense in Group B compared to Group A. The mean duration of motor block in Group B was 165.50±12.05min and in Group A was 141.00±9.86min. These findings were similar to the observations by Joginder et al, where the mean duration of motor block was 152.7±9.7min in levobupivacaine group and 188.52±9.8min in levobupivacine-fentanyl group. Nesrin et al also reported a prolonged motor block duration in levobupivacaine-fentanyl group (levobupivacaine group-129.73±35.08min, levobupivacaine-fentanyl group- 152.24±35.87)

Hemodynamic parameters were similar between the two groups with hypotension observed in 13.3% patients in levobupivacaine group compared to 6.7% in levobupivacaine-fentanyl group (p=0.389). The side effects of fentanyl are dose related and none of the patients reported pruritus, nausea and vomiting.

Conclusion

Fentanyl added to levobupivacaine results in statistically significant faster onset of sensory and motor block with minimal changes in hemodynamics.

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Conflict of Interest: None.

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