Original Research Article

Comparison of onset and duration of blockade between equipotent doses of ropivacaine-fentanyl and bupivacaine-fentanyl in lower abdominal surgeries under spinal anesthesia - A controlled study

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Abstract

Background: Effective analgesia with early ambulation is becoming more important, especially for day care patients. This study aims to compare, onset and duration of blockade between equipotent doses of ropivacaine-fentanyl and bupivacaine-fentanyl in lower abdominal surgeries under spinal anesthesia. **Aim and Objective**: To compare the efficacy of isobaric 0.75 % ropivacaine with isobaric 0.5 % bupivacaine after addition of fentanyl to both group, in spinal anaesthesia for lower abdominal surgeries. **Material and Method:** This hospital based controlled study was done on 100 patients, undergoing elective lower abdominal surgeries under spinal anaesthesia. Patients were distributed into two groups of 50 each i.e Group B (2.5 cc of 0.5% Bupivacaine plus 0.5 cc of Fentanyl) and Group R (2.5 cc of 0.75% Ropivacaine plus 0.5 cc Fentanyl. Following things are required. Weighing machine, I.V. cannula 18G/20G, I.V. infusion sets I.V. fluids crystalloids and colloids, Anaesthesia machine, Cuffed endotracheal tubes of appropriate sizes, Appropriate size masks and bags , Macintosh laryngoscope No. 2, 3 and 4 , Suction apparatus and catheters, Bain's circuit /Closed circuit, Oxygen and nitrous oxide cylinders , Disposable syringes 2ml, 5ml, 10ml, 20 ml , Emergency drugs, DC Defibrillator Eye Ointment ,ECG electrode , Syringes. **Result:** Intrathecal Ropivacaine- Fentanyl required more time for onset of sensory and motor block and provided lower level of sensory block with lesser duration of motor block compared to intrathecal Bupivacaine- Fentanyl. The duration of sensory block and time to request for first post operative rescue analgesia were comparable in both the groups. **Conclusion**: This study concludes that, freshly prepared hyperbaric ropivacaine 15 mg (of 0.75% in 5.0% dextrose) is a better alternative than hyperbaric bupivacaine (0.5%) with fentanyl for patients , who underwent, lower abdominal surgery or lower limb surgery, with faster onset and recovery from sensory and motor blocks, time needed to onset of micturition was also reduced, with better hemodynamic stability.
Key Word: ropivacaine-fentanyl, bupivacaine-fentanyl.

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INTRODUCTION

Since a long time, Spinal anaesthesia[1] has been the most commonly used regional anaesthesia technique for patients undergoing lower limb and lower abdominal surgeries. August bier first performed Spinal anaesthesia[2] is a type of regional anaesthesia[3] where conduction of nerve roots is blocked, using various drugs. For example by injecting intrathecally 10-20 mg of local anaesthetic solution into the cerebrospinal fluid, through a lumbar puncture. Spinal anesthesia a neuraxial block is the most widely exploited form of regional anaesthesia today.

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Many clinical studies have proved that spinal anaesthesia is usually superior to general anesthesia. The advantages of spinal anaesthesia over general anaesthesia: Avoidance of the complications of general anaesthesia like endotracheal intubation can elevates the blood pressure. patients with irritable airway (bronchial asthma or allergic bronchitis) It is less costly. It is simple and easy to perform Preservation of consciousness and maintains patent airway. Decreased pulmonary complications Faster return of normal gastrointestinal function, Decreased incidence of deep vein thrombosis and pulmonary emboli formation compared to general anaesthesia. Decreasing the time duration of motor block is becoming important, mainly for day care patients as it helps in early ambulation. Therefore in surgeries, performed under spinal anaesthesia, early ambulation, by shorter duration of motor block is desirable and beneficial for patients. Since the discovery of spinal anaesthesia technique various drugs of local anaesthesia, such as cocaine, procain, etidocaine, lignocaine, tetracaine, and bupivacaine were tried and comprehensively studied for their effects and side effects. The choice of drug for spinal anesthesia depends on the duration of operation and the quality of postoperative care available, patients surgery should end before their blocks wear off. Now a days local anaesthetic drugs like Bupivacaine and Ropivacaine have been used for spinal anesthesia in surgical procedures. A number of mortality due to cardiac arrest have been reported in regional anaesthesia using Bupivacaine. All deaths, appeared to be caused by accidental intravenous injection of these long acting local anaesthetics drugs. The doses required to cause cardiotoxicity seemed to be close to the convulsant doses. These deaths and subsequent recommendations of the United States Food and Drug Administration provided the reason to develop a safer drug. It was postulated that a less fat soluble drug than bupivacaine would be less cardiotoxic. In 1977 it was found that, the propyl derivative of the pipecoloxylidides was less toxic than the butyl derivative (bupivacaine). Further research showed that the nerve blocking ability of the R and S enantiomers were similar but this S-enantiomer was less cardiotoxic. Therefore the, S enantiomer of the propyl derivative (Ropivacaine) was chosen for further development. Ropivacaine is an amide, Its anesthetic property is similar to that of Bupivacaine. Ropivacaine causes adequate sensory block and shorter duration of motor block in comparison to, intrathecal bupivacaine. This quicker regression of motor block, early recovery and mobilisation. Ropivacaine causes CVS and CNS toxicity at a higher plasma concentration in comparison to Bupivacaine and thus the incidence of CVS and CNS toxicity is lower than that of Bupivacaine. Bupivacaine and Ropivacaine both have a limitation of their analgesia effect. Few surgeries which are expected to be prolonged need adjuvents to increase the analgesic effect of both these drugs. Attempts to find an ideal adjuvant in regional anaesthesia are happening since long. Adjuvants which are able to provide Sedation, stable hemodynamic effective and prolonged post-operative analgesia are preferred to be used in neuraxial anaesthesia. Opioid analogues have been used as additives in spinal anaesthesia to improve the onset of action, prolong the duration of block and to improve the quality of perioperative analgesia. Intrathecal opioids enhance analgesia from subtherapeutic doses of local anaesthetic and make it possible to achieve successful spinal anaesthesia. What would otherwise be an inadequate dose of local anaesthetic.

MATERIAL AND METHOD

Patients distributed into two groups of 50 each i.e Group B (2.5 cc of 0.5% Bupivacaine plus 0.5 cc of Fentanyl) and Group R (2.5 cc of 0.75% Ropivacaine plus 0.5 cc Fentanyl. Following things are required. Weighing machine , I.V. cannula 18G/20G , I.V. infusion sets I.V. fluids crystalloids and colloids, Anaesthesia machine ,Cuffed endotracheal tubes of appropriate sizes ,Appropriate size masks and bags, Macintosh laryngoscope No. 2, 3 and 4, Suction apparatus and catheters ,Bain's circuit /Closed circuit, Oxygen and nitrous oxide cylinders , Disposable syringes 2ml, 5ml, 10ml, 20 ml , Emergency drugs, DC Defibrillator Eye Ointment ,ECG electrode , Syringes.

RESULT

Intrathecal bupivacaine results in complete anaesthetic block of longer duration than ropivacaine. Fentanyl as an adjuvant may improve the quality of spinal block of ropivacaine while maintaining its advantage of early motor recovery. Spinal anaesthesia, is the most commonly used anaesthetic technique in patients undergoing lower abdominal surgeries. Ropivacaine is an amide local anaesthetic with properties similar to those of Bupivacaine. Opioid analogues have been used as additives in spinal anaesthesia to improve the onset of action, prolong the duration of block and to improve the quality of perioperative analgesia. The present study was aimed to compare the isobaric Ropivacaine with isobaric Bupivacaine after the addition of Fentanyl to both the groups. In this study most of the patients in group B (48%) and R (36%) were aged between 51 to 60 years In the present study no statistically significant difference was observed between group B and group R with regard to age group (P0.096NS) and mean age (47.14 ± 9.31 and 42.58 ± 13.96 years respectively; p = 0.058NS mean

weight (61.28± 9.69 and 57.92 ± 13.16 Kgs respectively; p = 0.14NS and mean height (157.02± 8.41 and 159.02± 6.04 Cms respectively; p = 0.17NS) .No significant difference was observed according to gender i.e. groups were comparable according to gender. (P=0.1NS) to ASA grade. (P=0.162NS) No significant difference was observed according to Previous surgery. Most common surgery were ABH followed by TKR than OA I.e demographic data in both the groups were comparable in terms of age, gender, height, weight and duration of surgery. In this study the mean heart rate in group B at beginning was noted as 78.16± 8.79bpm which decreased upto 70.66± 5.52bpm at 45 minutes interval and reached 69.72± 4.32bpm at 90 minutes. In group R, the mean heart rate at beginning was 77.76± 9.17bpm which reduced to 72.86± 7.83bpm at 20 minutes intervals and further reduced to 72.68± 10.41at 90 minutes. However at all the intervals the mean heart rate in group B and R was comparable (p > 0.05) In this study, the mean systolic blood pressure in group B, at two minutes interval was 119.86± 10.88 mm Hg which, reduced upto 119.36± 10.13 mm Hg at 20 minutes duration and further slight rise was noted at 90 minutes duration that is 110.46± 8.75mm Hg. Similarly, in group R, the systolic blood pressure at two minutes duration was 119.36± 10.13 mm Hg which gradually reduced to 111.14± 7.54mm Hg at 10 minutes duration and further slight increase upto 114.16± 10.48mm Hg was noted at 90 minutes duration. However the mean systolic blood pressure at all the intervals in group B and R were comparable (p > 0.05). In the present study, preoperatively the mean diastolic blood pressure in group B and group R (77.40±8.56 and 77.40± 7.690mm Hg respectively; p = 0.13NS). There was a decrease in mean diastolic blood pressure at 30 minutes interval that is, 69.82± 9.356 mm Hg in group B and 70.60±10.339mm Hg in group R but this difference was statistically not significant (p=0.63NS). Further at 90 minutes also the mean systolic blood pressure in group R and B were comparable; p = 0.66 NS). In this study, the mean MAP in group B, at two minutes interval was 89.44±6.462mm Hg which, reduced upto 83.62±9.212mm Hg at 30 minutes interval and further slight rise was noted at 90 minutes duration that is 83.46±7.947mm Hg. Similarly, in group R, the mean MAP at two minutes duration was 87.60± 9.43mm Hg which gradually reduced to 83.54± 6.729mm Hg at 20 minutes duration and further slight increase upto 86.18± 8.114mm Hg was noted at 70 minutes duration. However the mean MAP at all the intervals in group B and R were comparable (p>0.05). these findings were comparable with other studies Boztun N[4] (1999) and Lee YY (2005) Khundongban K (5) (2016) was concluded with better hemodynamic stability. i.e the haemodynamic changes were similar between the groups. In this study, the mean Spo2 in group B, at two minutes interval was 99.72± 0.43mm Hg and in group R it was. 99.96±0.20 However the mean MAP at all the intervals in group B and R were comparable (p > 0.05). In this study, there was a significant delay in mean onset time of sensory block in group R compared to group B (7.76 ± .716v/s 5.32 ± 1.0 minutes; p < 0.001). With regard to duration of sensory block, it was comparable in group B and R (135.96± 7.42 v/s 133.60± 8.27 minutes; p = 0.14NS Our findings were comparable with other studies Boztun N.[4] (1999) showed that and took lesser time for sensory onset and faster regression time in Ropivacaine than , as compared to Bupivacaine Chan-jong chung *et al*[17] (2001)concluded that Ropicacaine caused clinically effective spinal anesthesia with shorter duration of sensory block in comparison to hyperbaric bupivacaine. Lee YY (2005) showed that, The sensory block were similar between the groups. In the present study, in group R, more number of patients i.e 34%, 35% and 18% achieved T6, T7 and T8 as highest level of sensory block, whereas in group B more number of patients i.e 60% and 24% achieved T6, T7as highest level of sensory block (p <0.001S). These observations were comparable with the following studies. Boztun N.(1999) showed that isobaric Ropivacaine 15 mg provided a higher sensory block level as compared to Bupivacaine .Chan-jong chung *et al*[17] (2001)concluded that Sensory blockage till L1 level was earlier in Ropivacaine group, Koltka K (2009) A randomized and double-blind study[13] comparing equipotent doses of Ropivacaine and Bupivacaine (19.5 mg and 13 mg respectively), after adding Fentanyl 20 mcg, in lower abdominal surgery under spinal anesthesis showed that all patients achieved sensory block upto T10 level or even higher. The level of sensory block in group B was T3 to T7 In group R T4 to T9, P < 0.05). In this study, time taken for onset of Modified Bromage Grade l motor block (M1) (6.84± 0.84 v/s 8.46 ± 0.79 minutes) and Modified Bromage Grade 3 motor block (M3) (8.60± 0.99v/s 12.28± 1.29 minutes) were significantly delayed in group R compared to group B (p < 0.001). These observation were similar in other studies Lee YY (2005) showed that, Again there was no difference in the onset time of motor block. Koltka K (2009 duration of motor block (Bromage score >0) was lesser in group R (139 ± 39 minutes) than group B 182 ±46 minutes, P < 0.05). The duration and intensity of complete motor block (Bromage score=3) was also lower in group R (90 ± 25 minutes) Group B (130 ±40 minutes), P < 0.05). i.e motor block being comparable; there was significant early motor recovery with group R whereas group B provided prolonged post-operative analgesia In this study, the mean duration of M3 motor block (109.60± 8.07 v/s 147.8 ± 9.96 minutes)

and duration of total motor block (143.20± 10.39 v/s 192.20± 10.16 minutes) were significantly less in group R compared to group B ($p < 0.001$). Similar finding were reported in following studies Chan-jong chung *et al*[5] (2001) concluded that Ropicacaine caused clinically effective spinal anesthesia with shorter duration of motor block in comparison to hyperbaric bupivacaine. Lee YY (2005) showed that, the duration of motor block, was shorter in the Ropivacaine group compared with the Bupivacaine group. (P=0.003). A Study showed that, Ropivacaine 19.5 mg plus Fentanyl 20 mcg is associated with shorter duration of motor block and lower level of sensory block, in comparison to Bupivacaine 13 mg plus Fentanyl 20 mcg for spinal anaesthesia in lower abdominal surgery. Khundongban K[6] (2016) was concluded that with faster onset and recovery from sensory and motor blocks, i.e Ropivacaine produced good intraoperative analgesia and muscle relaxation similar to that of Bupivacaine group. In this study the comparison of time to request for first post operative rescue analgesia was comparable in both the groups i.e 238.40± 17.42 minutes in group B compared to 227.20.25 ± 19.70 minutes in group R (p=0.003). this finding was comparable with study by Chan-jong chung *et al*[5] (2001) who concluded that time to request for post operative analgesia was earlier in Ropivacaine.

DISCUSSION

Intrathecal bupivacaine results in complete anaesthetic block of longer duration than ropivacaine. Fentanyl as an adjuvant may improve the quality of spinal block of ropivacaine while maintaining its advantage of early motor recovery. Spinal anaesthesia, is the most commonly used anaesthetic technique in patients undergoing lower abdominal surgeries. Ropivacaine is an amide local anaesthetic with properties similar to those of Bupivacaine. Opioid analogues have been used as additives in spinal anaesthesia to improve the onset of action, prolong the duration of block and to improve the quality of perioperative analgesia. The present study was aimed to compare the isobaric Ropivacaine with isobaric Bupivacaine after the addition of Fentanyl to both the groups.

CONCLUSION

This study concludes that , freshly prepared hyperbaric ropivacaine 15 mg (of 0.75% in 5.0% dextrose) is a better alternative than hyperbaric bupivacaine (0.5%) with fentanyl for patients , who underwent, lower abdominal surgery or lower limb surgery, with faster onset and recovery from sensory and motor blocks, time needed to onset of micturition was also reduced, with better hemodynamic stability.

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