Research Article

Comparative study of continuous epidural 0.1% Ropivacaine versus 0.125% Bupivacaine on post-operative pain relief following total knee replacement

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Abstract

Background: Bupivacaine has similar pharmacodynamic and pharmacokinetic properties to Ropivacaine but has shown to have higher cardiac and CNS toxicity and greater separation between sensory and motor block.

Objective: To compare the efficacy of continuous infusion of epidural Ropivacaine and Bupivacaine for post-operative analgesia, study the effect of two drugs in maintaining the hemodynamic stability and post-operative complications of both the drugs.

Materials and Methods: 60 patients were randomly allocated to receive epidural, continuous infusion of 0.1% Ropivacaine (Group A), or continuous infusion of 0.125% Bupivacaine (Group B).

Result: Ropivacaine group has less fluctuation in pulse, systolic blood pressure, diastolic blood pressure, oxygen saturation than Bupivacaine group and difference was statistically significant. Pain relief was batter among Bupivacaine group of patients as compared to Ropivacaine group. And difference was significant. Pain appears early in group of Ropivacaine group as compared to group of Bupivacaine.

Conclusion: 0.1% Ropivacaine produced excellent post-operative epidural analgesia, which was clinically indistinguishable from a 0.125% concentration of Bupivacaine with the advantage of hemodynamic stability, fewer incidences of complication or adverse effect and patient's satisfaction.

KEY WORDS: Ropivacaine, Bupivacaine, epidural analgesia, hemodynamic stability

Introduction

Out of all analgesic techniques, most effective form of analgesia is epidural analgesia. Due to relative motor-sparing effect and long duration of action of Bupivacaine, it is commonly used for epidural analgesia compared with other local anesthetics.[1] Bupivacaine has similar pharmacodynamic and pharmacokinetic properties to Ropivacaine[2] but has shown to have higher cardiac and CNS toxicity[3] and greater separation between sensory and motor block.[4] Significant reduction has observed in severity and incidence motor neural blocked after reduction in dose of Bupivacaine.[5] From minimum local analgesic concentration (MLAC) studies, it can be inferred that 0.1% Bupivacaine with Fentanyl 2 μg ml^{-1}.[6]

Total knee replacement is one of the most commonly performed surgeries. They are usually performed in spinal anesthesia. Therefore present study performed with objectives to compare the efficacy of continuous infusion of epidural Ropivacaine and Bupivacaine for post-operative analgesia, study the effect of two drugs in maintaining the hemodynamic stability and post-operative complications of both the drugs.

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Materials and Methods

After obtaining institutional ethical committee approval and informed patient consent, 60 patients has been studied, aged 50–75 years, weight 50–100kg, height 150–200 cm, ASA I and II scheduled for total knee replacement at Sterling Hospital, Ahmedabad during April 2010–April 2012.

All patients were assessed preoperatively and investigated and had fasted for 6–8 hrs. Patients were randomly divided into two groups equally. Group A patients were given Inj. Ropivacaine 0.1% (8 ml/h) via epidural route and Group B patients were given Inj. Bupivacaine 0.125% (8 ml/h) via epidural route with infusion pump. Under all aseptic and antiseptic precautions, subarachnoid block has been given and put epidural catheter. All the patients were instructed regarding the use of visual analogue scale (VAS) ruler.

After availability of equipments, anesthesia workstation, O_2 supply, Bains circuit, O_2 cylinder, nitrous oxide cylinder and availability of emergency drugs, laryngoscope and endotracheal tube of adequate size were checked, line IV with 18 or 20G vein flow were secured and started IV fluid, preferably Ringer's lactate (RL) at 6–8ml/kg. Then continuous electrocardiogram, pulse oximetry, and noninvasive blood pressure were applied. Inj, Midazolam 0.5 mg was given intravenously as a premedication. Sitting position was given to patient and inter-spinous space between L3 and L4 was identified. Under all aseptic and antiseptic precautions, Inj. Lignocaine 2% 2cc was given in selected space, and then inserted 18G Tuohy needle. Following identification of epidural space with a loss of resistance technique, needle bevel was directed cephalad and epidural catheter was inserted such that catheter tip lie at T12. Test dose of 2% 2cc Inj. Lignocaine was given epidurally. Under due aseptic and antiseptic precautions and with patient in same position sub-arachnid puncture was performed at the L3 – 4 interspaces with 25 G spinal needle using midline approach. With appearance of free flowing CSF Inj. Bupivacaine 0.5 % heavy 4 ml was given slowly. Immediately after subarachnoid injection patient was placed in the supine position. Pulse rate, blood pressure, oxygen saturation and respiratory rate were recorded immediately after intrathecal injection and throughout the surgery.

Result

Table 1 shows that mean weight in group A (60 ± 4.85) and group B (59.8 ± 4.90) was almost same. Height and weight were almost same for Ropivacaine group and Bupivacaine Group, but difference between both groups was not statistically significant. Both Ropivacaine group and Bupivacaine group have 30% male and 70% female participants. Participants were distributed in grade I and II according to American Society of anesthesiologist (ASA). In Ropivacaine group, 60% participants were included in grade I and 40% participants were in grade II. In Bupivacaine group, almost 57% participants were included in grade I and 43% in grade II.

Table 2 shows that Bupivacaine group participants have more post-operative complications like hypotension, bradycardia, motor block, shivering, respiratory depression, etc. than Ropivacaine group. This difference was statistically not significant.

Figure 1 shows that post-operative change in pulse in study participants. Ropivacaine group has less fluctuation in pulse that Bupivacaine group and difference was statistically significant (*t* test = 1.89, *p* value <0.05). Figure 2 shows that post-operative change in systolic blood pressure in study participants. Ropivacaine group has less fluctuation in systolic blood pressure that Bupivacaine group and difference was statistically significant (*t* test = 2.52, *p* value <0.05). Figure 3 shows that post-operative change in diastolic pressure in study participants. Ropivacaine group has less fluctuation in diastolic blood pressure that Bupivacaine group and difference was statistically significant (*t* test = 1.89, *p* value <0.05). Figure 4 shows that post-operative change in oxygen saturation in study participants. Ropivacaine group has less fluctuation in oxygen saturation that Bupivacaine group and difference was statistically significant (*t* test = 5.7, *p* value < 0.05).

Figure 5 shows that pain relief was better among Bupivacaine group of patients as compared to Ropivacaine group. And difference was significant. Pain appears early in group of Ropivacaine group as compared to group of Bupivacaine (Mann Whitney U test = 29.5, *p* value < 0.05).

Discussion

Study observed statistically significant more fluctuation in pulse rate in Bupivacaine group in comparison to group Ropivacaine. Ropivacaine group has less fluctuation in systolic

Table 1: Patients characteristics (*n*=60)

Variable	Ropivacaine group (*n*=30)	Bupivacaine group (*n*=30)	*p* value
Age (years) (mean ± SD)	60 ± 4.85	59.8 ± 4.90	>0.05*
Height (cm) (mean ± SD)	172.33 ±5.39	172.2 ±6.02	>0.05*
Weight (kg) (mean ± SD)	76 ± 11.7	76 ± 10.9	>0.05*
Gender			>0.05**
Male	9 (30%)	9 (30%)	
Female	21 (70%)	21 (70%)	
ASA grade			>0.05**
Grade I	18 (60%)	17 (56.67%)	
Grade II	12 (40%)	13 (43.33%)	

* - *t*-test, ** - Chi-square test

Table 2: Post-operative complication

Complication	Ropivacaine group	Bupivacaine group	*p* value
Hypotension	1(3.33%)	5(16.7%)	0.76*
Bradycardia	0	2(6.66%)	
Motor block	1(3.3%)	2(6.6%)	
Shivering	1(3.3%)	2(6.6%)	
Respiratory depression	0	0	
Total	3	11	

* Chi-square test

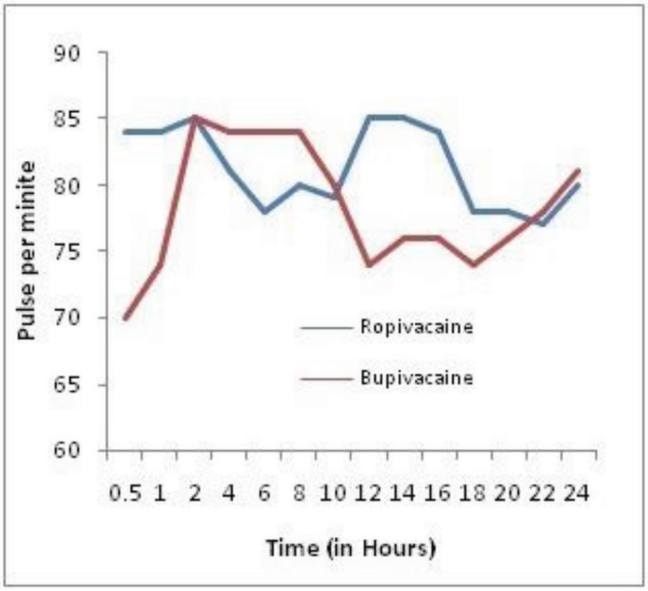

Figure 1: Post-operative changes in pulse (*t* test = 1.89, *p* value <0.05).

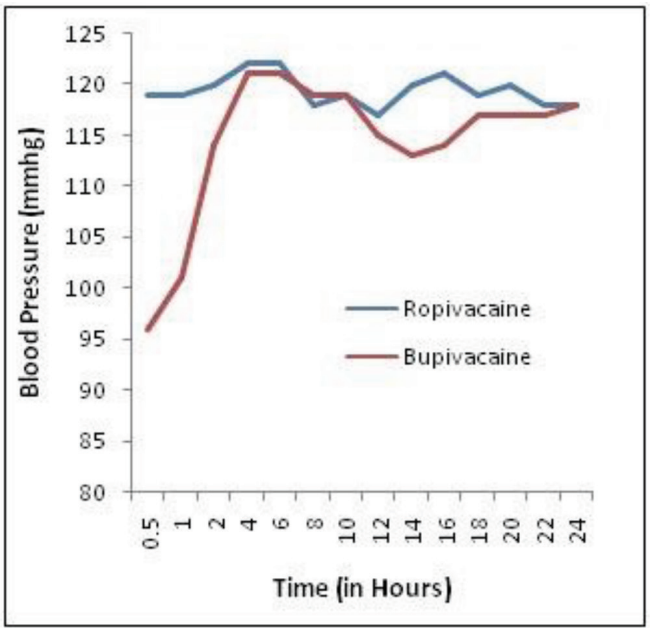

Figure 2: Post-operative changes in systolic pressure (*t* test = 2.52, *p* value <0.05).

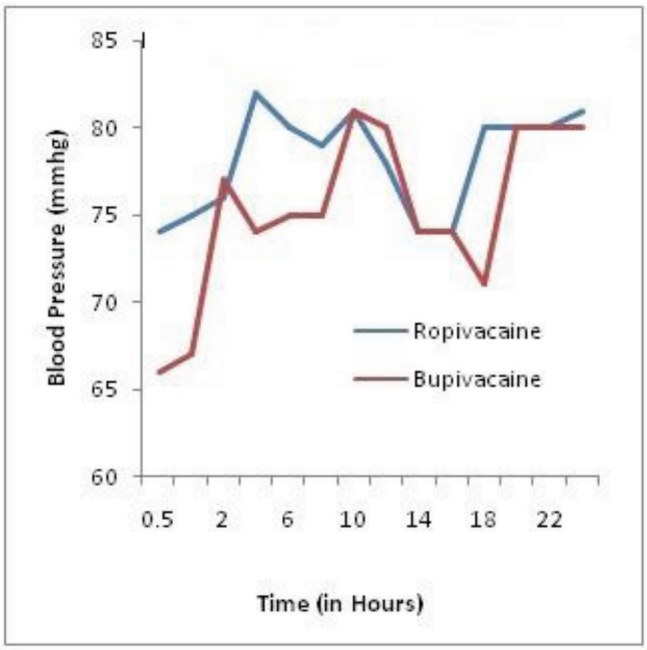

Figure 3: Post-operative changes in diastolic pressure (*t* test = 1.89, *p* value <0.05).

blood pressure, diastolic group, and oxygen saturation than Bupivacaine group and difference was statistically significant. Pain relief was better among Bupivacaine group of patients as compared to Ropivacaine group and appears early in group of Ropivacaine group (after 4 h) as compared to group of Bupivacaine (after 6 h).

In present study, mean age of patient was 60 and 59.8 years for group A and B, respectively. Mean height and weight was almost same in both groups and that was 172.2 and 76, respectively. Similar study done in Guntur[7] has measured mean age 40.3 and 39.3 and height was 164.9 and 165.9, respectively for both groups. Bupivacaine group has more post-operative complications or adverse effects but it was statistically not significant. This finding is not correlated with study findings done in Wardha[8] where Ropivacaine group had more complications than Bupivacaine group but it was also statistically not significant. Study done in Guntur[7] had not found any complication or adverse effect in both groups where study done by Edward et al.[9] has observed more complication in Bupivacaine group than Ropivacaine group.

Regarding VAS scale, present study findings are consistent with study done at Wardha[8] observed pain with higher VAS scale [Ropivacaine group 9.6 and Bupivacaine group 9.17]

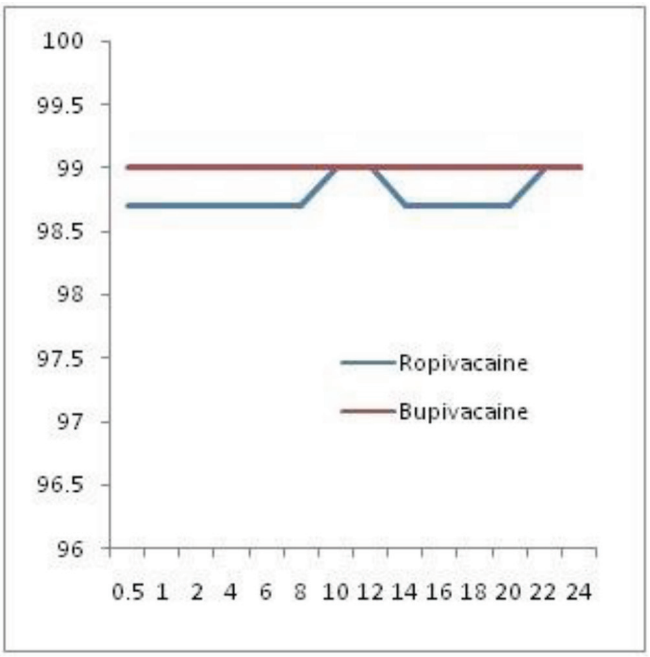

Figure 4: Post-operative changes in oxygen saturation (*t* test = 5.70, *p* value <0.05).

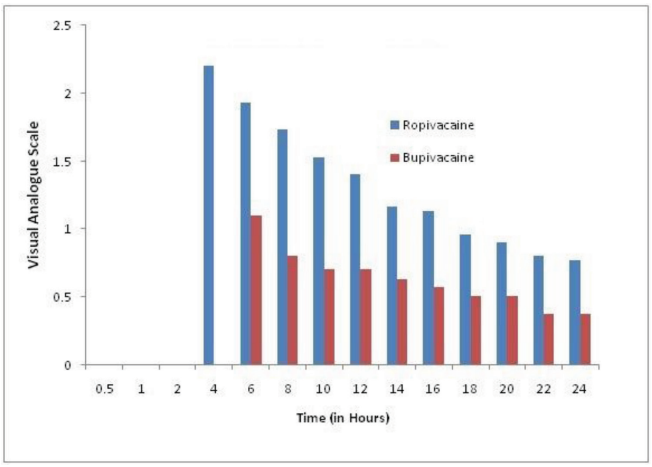

Figure 5: Visual analogue scale (Mann Whitney *U* test = 29.5, *p* value <0.05).

appears after 20 min in both group and study done by Dresner et al.[10] observed higher VAS scale in Ropivacaine group than Bupivacaine group. Similar findings also observed in study done by Muldoon et al.[11] but higher than present study.

Study has not evaluated the extra effect of residual analgesia of spinal anesthesia at the end of surgery with drugs included in study which is a limitation of this study.

Conclusion

Study found that 0.1% Ropivacaine produced excellent post-operative epidural analgesia, which was clinically indistinguishable from a 0.125% concentration of Bupivacaine with the advantage of hemodynamic stability, fewer incidences of complication and adverse effect and patient's satisfaction.

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