VOLUME-8, ISSUE-9, SEPTEMBER-2019 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Anaesthesiology

EVALUATE THE EFFICACY AND SAFETY OF INTRATHECAL PLAIN 0.75% ROPIVACAINE SOLUTION FOR ELECTIVE CAESAREAN SECTION

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ABSTRACT

Background: A prospective, randomised double blind study to evaluate the efficacy and safety of intrathecal plain 0.75% ropivacaine solution for elective caesarean section and also to study its side effects and complications

Material and Methods: 80 patients planned under spinal anaesthesia requiring sensory level upto T4-T6 & duration of 1-2 hours were included in the study. They were divided into two groups of 40 each & received one of the 2 drugs intrathecally.

Group R - 2.4ml isobaric plain 0.75% ropivacaine(18 mg)

Group B - 2ml hyperbaric 0.5% bupivacaine(10 mg)

Results: In our present study, duration of sensory block was shorter in Group R (141.87±13.57 mins)than in Group B (203±18.83 mins) and it was statistically significant. The mean duration of analgesia was less in Group R 189.25±17.30 mins than in Group B 296.25 ± 13.33 mins and the difference was statistically significant. Mean(±SD) onset of motor block was slower in Group R (207.25±38.89 secs) as against Group B (115.12±26.34 secs) and the difference was statistically significant. The time needed to reach Grade 3 motor block was delayed in Group R 6.19±0.88 mins, compared to Group B 4.09±0.86 mins, which is also significant. The mean duration of motor block was significantly less in Group R(174±24.36min) as compared to Group B (252.5±18.63mins).

Conclusion: Use of Ropivacaine in caesarean section patients is associated with shorter duration of both sensory and motor block .Therefore ,ropivacaine is safe and effective without any adverse effect on maternal and neonatal outcome

KEYWORDS : Intrathecal , Ropivacaine , Elective Caesarean Section ,Maternal and Neonatal outcome

INTRODUCTION

Anaesthesia techniques for caesarean sections revolve around general anaesthesia and regional anaesthesia. Spinal anaesthesia is preferred over general anaesthesia as it avoids the unwanted effects of anaesthetic drugs used in general anaesthesia and the stress of laryngoscopy and tracheal intubation, avoids the risk of difficult/failed intubation, more direct experience of childbirth and faster neonatal maternal bonding. It also provides postoperative period free of immediate postoperative pain, which is essential for optimal care of surgical patients associated with reduced maternal mortality. The 2001 obstetric anesthesia workforce survey was performed in conjunction with the Society for Obstetric Anesthesia and Perinatology to estimate and assess current trends in obstetric anesthesia practice as well as to identify potential areas needing improvement [1]

Declining use of hyperbaric lignocaine for achieving spinal anaesthesia resulted in increasing use and popularity of hyperbaric bupivacaine. Although its limited placental transfer and minimal neonatal effects are advantages, cardiovascular toxicity and the longer duration of action is distinctly undesirable considering the fact that average operating time of caesarean section is one hour or less.[2,3]

Ropivacaine, first introduced in 1996 and approved for spinal anesthesia, being a pure S enantiomer, has low lipid solubility and blocks nerve fibers involved in pain transmission to a greater degree than those involved in motor function and tends to produce less motor block which facilitates early movement and also has less cardiac and central nervous system toxicity.

Our study aimed at studying the efficacy and safety of intrathecal plain 0.75% ropivacaine solution for elective caesarean section and also to study side effects and complications during its sub arachnoid use.

MATERIALS AND METHODS

Study design/Type of study - The study was conducted in our tertiary care hospital after Institutional Ethics Committee approval . It is a prospective, randomised double blind study.

Sample size & Duration of study- 80 patients planned under spinal anaesthesia requiring sensory level upto T4-T6 & duration of 1-2 hours were included in the study, after obtaining a written informed consent. Using computerised randomisation charts, they were divided into two groups of 40 each & received one of the 2 drugs intrathecally.

Group R - 2.4ml isobaric plain 0.75% ropivacaine(18 mg)
Group B - 2ml hyperbaric 0.5% bupivacaine(10 mg)

Inclution & Exclution criteria: ASA grade 1 or 2 patients in 20 to 40 years age group posted for elective cesarean section, with height of 140 to 160 cms were included in the study

Data collection procedure : All the patients underwent detailed pre-anaesthetic assessment including detailed medical, surgical and obstetrical history, clinical examination and all necessary investigations. All patients were premeditated with Injection Ondansetron 0.08mg/kg & Injection Ranitidine 1mg/kg intravenous. Patients were pre-loaded with 10ml/kg of lactated Ringers solution 10-20 mins before spinal block.

Proceedures done: Lumbar puncture was performed at L3-L4 interspace & one of the 2 drugs was administered. Patient's heart rate, SpO2, systolic arterial blood pressure, mean arterial blood pressure & ECG were monitored continuously.

Submitted : 17th July,2019	Accepted : 12th August,2019	Publication : 15th September, 2019

Follow-up: The onset of sensory block, maximum level of sensory block achieved & the time required to achieve it, the time for two segment regression and the duration of sensory block was recorded.

Data Analysis : Data analysis was done by using STATA version 10.1,2011 and Microsoft excel software. 2 independent sample t-test and Chi-square test / Fisher's exact test were used for quantitative and qualitative data respectively.

Ethical approval : Taken

Evaluation of the response to intervention : Duration of analgesia was the time from onset of sensory block to the time of first request of analgesia by the patient. Motor block was assessed by modified Bromage scale.During intraoperative and Post-operative period any incidence of bradycardia, hypotension, nausea/vomiting was recorded and managed appropriately. Newborn outcome was assessed by Apgar score at 1 and 5min. Instances of neonatal resuscitation if any were recorded. Other intraoperative observations included any complaint from patients like discomfort or pain. The obstetricians were told to inform if they found inadequate block or abdominal relaxation.

OBSERVATIONS

The age, weight and height of the patients in both groups were comparable.

The mean preoperative pulse rate & BP was comparable in both the groups.

Parameters	GROUP R			GROUP B			P value
	Range	Mean	SD	Range	Mean	SD	
Onset of Sensory Block **(second)**	60-120	94.12	12.80	20-100	46.45	13.69	0.0001
Time to reach maximum level of sensory block **(minutes)**	7-12	9.12	0.99	3-7	5.31	0.86	0.0001
Two segment regression time **(minutes)**	50-100	76.37	12.55	60-110	85.37	14.33	0.0038
Duration of sensory block **(minutes)**	120-180	141.87	13.57	170-250	203.00	18.83	0.0001
Duration of analgesia **(minutes)**	150-220	189.25	17.30	280-320	296.25	13.33	0.0001

There was statistically significant difference between two Groups in onset of sensory block, time to reach maximum level of sensory block, duration of sensory block & of analgesia and 2 segment regression time.

Parameters	No of patients in group						
	GROUP (n=40)			GROUP B (n=40)			P value
	Range	Mean	SD	Range	Mean	SD	
Onset of motor block **(sec)**	120-280	207.25	38.89	60-160	115.12	26.34	0.0001
Onset of grade 3 motor block **(mins)**	4.5-9	6.19	0.88	2.5-2	4.09	0.86	0.0001
Complete regression of motor block **(mins)**	130-240	174	24.36	220-290	252.5	18.63	0.0001

The onset of motor block was faster in group B compared to group R and it was statistically significant. The duration of motor block was significantly prolonged in Group B compared to Group R.

Complications (Yes)	No. of patients in groups				P value
	Group R (n=40)		Group B (n= 40)		
	No	%	No	%	
Nausea	1	2.5	6	15	0.054
Vomiting	2	5	6	15	0.132
Hypotension	3	7.5	5	12.5	0.130
Bradycardia	0	0	0	0	0
Shivering	0	0	3	7.5	0.120

There was no significant difference between intra-operative or post-operative complications in Group R and Group B.

RESULTS

The demographic profile of both sets of patients was comparable in terms of age, weight and height.The mean time of onset of sensory block was delayed in Group R (94.12±12.80 sec),compared to Group B (46.45 ± 13.69 sec) and was statistically significant. So was the mean time to reach sensory block at L1 in Group R (4.36 ± 0.97 mins) compared to Group B (3.01 ± 0.50min).

In our study, time to reach highest sensory level was longer in Group R (9.12±0.99 mins) than Group B (5.31±0.86 mins).There was no statistically significant difference between both the groups in terms of maximum height of sensory block.In our study, time for two segment regression was earlier in Group R (76.37±12.55mins) compared to group B (85.37± 14.33), the difference being statistically significant.

In our present study, duration of sensory block was shorter in Group R (141.87±13.57 mins)than in Group B (203±18.83 mins) and it was statistically significant. The mean duration of analgesia was less in Group R 189.25±17.30 mins than in Group B 296.25 ± 13.33 mins and the difference was statistically significant.

In our study we found that mean(±SD) onset of motor block was slower in Group R (207.25±38.89 secs) as against Group B (115.12±26.34 secs) and the difference was statistically significant. The time needed to reach Grade 3 motor block was delayed in Group R 6.19±0.88 mins, compared to Group B 4.09±0.86 mins, which is also significant. The mean duration of motor block was significantly less in Group R (174 ±24.36min) as compared to Group B (252.5±18.63mins).

None of the neonates required any resuscitation and their Apgar scores at 1 and 5 min were comparable in both the groups. None of the patients in present study complained of intraoperative pain or discomfort. There was no need for administration of supplemental analgesic or general anaesthesia. And neither did the obstetricians comment on inadequate block or abdominal relaxation during the surgery.

STATISTICAL ANALYSIS

After getting the required information, the collected data were coded, tabulated and analysed. The various statistical techniques i.e. the mean, standard deviation and test of significance (t-test and chi-square-test) were used for drawing valid conclusions. Statistical analysis done using student t-test. SPSS 13.0 software was used to calculate p value. $P<0.05$ was taken as statistically significant . A descriptive analysis was done on all variables to obtain a frequency distribution.

The mean + SD and ranges were calculated for quantitative variables. Continuous variables were compared by the Student t test. Proportions were analyzed with the chi-square test

DISCUSSION

Changes in maternal physiology during pregnancy, and the care of both mother and fetus presents unique challenges to obstetric anaesthetists. Also, diverse maternal expectations of the birth experience, demands for neuraxial block, advancing maternal age, obesity, coexisting medical comorbidities, and caesarean section rates have all escalated.

Spinal anaesthesia is widely accepted and standard technique of anaesthesia for caesarean section. In this study, the patients received either plain ropivacaine 0.75% 2.4ml or hyperbaric bupivacaine 0.5% 2.0ml intrathecally. The demographic profile of both sets of patients was comparable in terms of age, weight and height.

In a similar study ,Rani CR et al did comparative study of intrathecal hyperbaric bupivacaine 0.5% & intrathecal isobaric ropivacaine 0.5% for quality and duration of anaesthesia and post-operative analgesia in patients undergoing lower limb surgeries. In this Randomized double-blinded trial they concluded that Isobaric Ropivacaine 0.5% (study group B) provides lesser grade of motor blockade and shorter duration of both sensory and motor blockade for short duration orthopaedic surgeries where prolonged motor blockade is quite undesirable and early mobilization can be planned.[4]

The study by Singh S, Singh VP et al was aimed to compare the intrathecal efficacy and safety of 0.75% isobaric ropivacaine for cesarean delivery with 0.5% heavy bupivacaine in parturients. It was concluded that spinal anesthesia for elective cesarean delivery with intrathecal 24 mg of 0.75% isobaric ropivacaine provided clinically effective surgical anesthesia of shorter duration without compromising neonatal outcome and can be used as an effective and safe alternative to bupivacaine.[5]

Our findings were consistent with C.Radhika Rani et al's (2014) study that used 15mg of Isobaric ropivacaine and 15mg of hyperbaric bupivacaine in lower limb surgeries. They found that the onset of sensory block was significantly delayed in ropivacaine group compared to bupivacaine group.In our study, time to reach highest sensory level was longer in Group R (9.12±0.99 mins) than Group B (5.31±0.86 mins). This was consistent with the study by Surjeeth singh et al 2012 that compared 0.75% isobaric ropivacaine (24mg) and 0.5% bupivacaine (12mg) for cesarean section. They found that the time to reach maximum sensory block was significantly delayed in ropivacaine group than in the bupivacaine group. [4,5]

V.R.R.Chari et al (2013) conducted a study comparing intrathecal 0.75% isobaric ropivacaine with 0.5% hyperbaric bupivacaine in lower abdominal surgeries. They also found that the time to reach peak sensory block was delayed with ropivacaine than with bupivacaine. In contrast, a study conducted by Carrozzini et al (2012) to compare intrathecal Isobaric ropivacaine (15mg) plus 25 micrograms fentanyl against hyperbaric bupivacaine(15mg) plus 25 micrograms fentanyl in elective cesarean section, found that the time to reach T6 level was faster with ropivacaine compared to bupivacaine. In this study, there was no statistically significant difference between both the groups in terms of maximum height of sensory block..[6,7]

There are various studies comparing ropivacaine with other drugs and different dosages of ropivacaine itself . Konda RR et al did a study of hyperbaric bupivacaine versus isobaric ropivacaine for elective caesarean deliveries. Time of onset and regression of sensory and motor blocks, haemodynamics, time of first complaint of pain, neonatal APGAR and side-effects were evaluated.It was concluded that Intrathecal Isobaric Ropivacaine 15 mg provides effective spinal anaesthesia for caesarean delivery. It has slower onset, shorter motor block, early sensory regression and similar postoperative analgesia and APGAR scores as compared to 10 mg of 0.5% hyperbaric bupivacaine. The shorter duration of motor block can facilitate early ambulation and makes Ropivacaine a good alternative for elective caesarean deliveries.[8]

In our present study, duration of sensory block was shorter in Group R (141.87±13.57 mins) than in Group B (203±18.83 mins) and it was statistically significant. This was consistent with the findings of the study conducted by R.R.M .Konda et al. But the findings from the study by Eryilmaz.N et al (2011), comparing intrathecal plain bupivacaine 10mg and isobaric ropivacaine 15mg with opioids for elective caesarean section was not consistent with our findings. They found that the mean time of sensory block regression to L1 was faster in bupivacaine group compared to ropivacaine group and the difference was statistically significant. The intrathecal plain ropivacaine with opioids might be superior to bupivacaine in terms of longer sensory block .[8,9]

Chung CJ, Choi SR et al evaluated the clinical efficacy and safety of spinal anesthesia with 0.5% hyperbaric ropivacaine compared with 0.5% hyperbaric bupivacaine for elective cesarean delivery. Time for sensory block to recede to T10 did not differ between groups. Duration of sensory block was shorter in the Ropivacaine group (188.5 ± 28.2 min vs 162.5 ± 20.2 min;$P < 0.05$). Complete motor block of the lower extremities was obtained in all patients. Ropivacaine also produced a shorter duration of motor blockade than bupivacaine (113.7 ± 18.6 min vs 158.7 ± 31.2 min;$P < 0.000$). The intraoperative quality of anesthesia was excellent and similar in both groups. Side effects did not differ between groups. Eighteen milligrams of 0.5% hyperbaric ropivacaine provided effective spinal anesthesia with shorter duration of sensory and motor block, compared with 12 mg of 0.5% hyperbaric bupivacaine when administered for cesarean delivery.[10]

Khaw KS et al compared, in this prospective, randomized, double-blinded study, the characteristics of spinal anesthesia with plain and hyperbaric ropivacaine for elective cesarean delivery. They hypothesized that the addition of glucose would change the onset, offset, and extent of motor and sensory block from intrathecal ropivacaine. With hyperbaric ropivacaine, they found the following: higher cephalic spread (median [range] maximum block height to pinprick, T1 versus T3 ($P < 0.001$); lower coefficient of variation of maximum block height (17.7% vs 21.9%); faster onset to T4 dermatome). The onset of complete motor block (9.9 [5.3] vs 13.8 [5.4] min, $P = 0.027$) and complete recovery (144.8 [28.4] vs 218.5 [56.8] min, $P < 0.001$) was also faster. No neurologic symptoms were found at 24 h.[11]

Sanli S et al studied that by adding various opioids to the local anaesthetic solution administrated intrathecally improves the analgesic potency of spinal analgesia. The purpose of this study was to evaluate the efficacy and safety of intrathecal fentanyl 10 g added to 15 mg hyperbaric ropivacaine in patients undergoing caesarean section under spinal anaesthesia. Characteristics of spinal block, intraoperative quality of spinal anaesthesia, time to first feeling of pain (complete analgesia), time to first request of analgesics postoperatively (effective analgesia), side-effects and fetal outcomes were evaluated. It was concluded that the

addition of fentanyl 10 g, to hyperbaric ropivacaine 15 mg, for spinal anaesthesia increased the duration of analgesia in the early postoperative period in patients undergoing caesarean delivery.[12]

Parpaglioni R et al tried to find out the minimum local anaesthetic dose (MLAD) of intrathecal levobupivacaine and ropivacaine for Caesarean section. Ninety women were randomly allocated to two groups .To be considered effective, a test solution had to achieve a visual analogue pain score mm or less at skin incision, uterine incision, birth ,peritoneal closure, and at the end of surgery. The MLAD of levobupivacaine was 10.58 mg and the MLAD of ropivacaine was found to be 14.22. The potency ratio between spinal levobupivacaine and spinal ropivacaine was 1.34 .[13]

Gunaydin B et al studied intrathecal hyperbaric or isobaric bupivacaine and ropivacaine with fentanyl for elective caesarean section. Similar study was also done by Kulkarni KR et al in which they did a comparative evaluation of hyperbaric ropivacaine versus hyperbaric 1bupivacaine for elective surgery under spinal anesthesia .Ropivacaine produced a slower onset of sensory block (ropivacaine 4.5 min; bupivacaine 3.2 min; $P < 0.05$) and the mean total duration of sensory block was significantly lesser (ropivacaine155 min; bupivacaine 190.5 min; $P < 0.05$). Patients in the ropivacaine Group R had significantly more rapid recovery from the motor blockade (ropivacaine120 min; bupivacaine 190 min; $P < 0.05$) and passed urine sooner than the patients in bupivacaine Group B (ropivacaine 257 min; bupivacaine 358 min; $P < 0.05$).They also concluded that Ropivacaine 15 mg in dextrose 8.3% provides reliable SA of shorter duration than bupivacaine 15 mg in 8% dextrose.[14,15]

In our study, time for two segment regression was earlier in Group R (76.37±12.55mins) compared to group B (85.37± 14.33), the difference being statistically significant To summerize ,R.R.M. Konda et al's study to compare intrathecal bupivacaine 10mg with isobaric ropivacaine 15mg for elective caesarean section, found that the mean time of onset of two segment regression was faster in ropivacaine group than bupivacaine group, but the difference was not statistically significant. This observation did not correlate with our findings. Surjeeth singh et al and C. Radhika rani et al did not mention about the time of two segment regression in their studies.

In our present study, the mean duration of analgesia was less in Group R 189.25±17.30 mins than in Group B 296.25 ± 13.33 mins and the difference was statistically significant. This is in accordance with C.Radhika rani et al . In our study we found that mean(±SD) onset of motor block was slower in Group R (207.25±38.89 secs) as against Group B (115.12±26.34 secs) and the difference was statistically significant. The time needed to reach Grade 3 motor block was delayed in Group R 6.19±0.88 mins, compared to Group B 4.09±0.86 mins, which is also significant. Thus the observations of delayed onset of motor block as reported by R.R.M.Konda et al ,Radhika rani et al and V.R.R.Chari et al were consistent with our study. It was also observed that the mean duration of motor block was significantly less in Group R(174 ±24.36min) as compared to Group B (252.5±18.63mins). Surjeeth Singh et al, R.R.M. Konda et al, C. Radhika rani et al & V.R.R.Chari et al, in their studies are unanimous regarding shorter duration of motor block with ropivacaine .

Thus, in our study, Ropivacaine was found to be a successful agent for achieving subarachnoid block in parturients undergoing elective caesarean section. The onset of both sensory and motor block was slower compared to bupivacaine. The maximum height of block, the quality of anaesthesia was similar to bupivacaine. In the ropivacaine administered patients both the sensory and motor block was found to be shorter, the later was more pronounced.

CONCLUSION

Thus from above observations we conclude that intrathecal use of plain0.75% Ropivacaine in elective caesarean section patients was associated with shorter duration of both sensory and motor block and thereby providing more rapid recovery and that Ropivacaine is safe and effective without any adverse effect on maternal and neonatal outcome

Funding : No funding required
Conflict of interest: No conflict of interest
Ethical approval : Taken

WHAT THIS STUDY ADD TO EXISTING KNOWLEDGE :

Ropivacaine was found to be a successful agent for achieving subarachnoid block in parturients undergoing elective caesarean section. The onset of both sensory and motor block was slower compared to bupivacaine. The maximum height of block, the quality of anaesthesia was similar to bupivacaine

LIMITATION OF OUR STUDY

1. Small sample size
2. Chances of bias
3. Single center trial

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