

A Prospective Randomised Study Of Comparison Of Intrathecal Ropivacaine (0.75%) 15mg With Fentanyl (25mcg) And Bupivacaine (0.5%) 10mg With Fentanyl (25mcg) For Spinal Anaesthesia For Lower Limb Surgeries

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Abstract: Background: The propyl derivative of the piperidylidides was less toxic than the butyl derivative (bupivacaine). Further work revealed that the nerve blocking properties of the R and S enantiomers were similar but that the S-enantiomer was less cardiotoxic. Thus the S enantiomer of the propyl derivative (Ropivacaine) was chosen for further development. Ropivacaine, structurally resembling bupivacaine, with a propyl group on the piperidine nitrogen atom of the molecule is a relatively new amino-amide anaesthetic agent, similar in chemical structure to bupivacaine has been recently launched in India, for clinical evaluation having various advantages like early onset and shorter duration of action and having lesser cardio toxicity as compared to bupivacaine. The drug ropivacaine, relieves the psychological distress of being immobile for a longer period of time after lower abdominal surgeries. In view of the above context the present study was undertaken for comparison of isobaric ropivacaine and isobaric bupivacaine to determine clinical efficacy of ropivacaine.

Materials and Methods: We conducted this study as a prospective randomized study. A total of 100 adult patients were randomly selected who fulfilled the inclusion criteria. They were divided into groups and study was conducted.

Results: In this study, we measured the results of each drug by its action on onset and peak of sensory and motor blockade.

Conclusion: From our study we conclude that both Bupivacaine and Ropivacaine with 25 mcgms of fentanyl intrathecally, promote satisfactory anaesthesia for lower limb surgeries. The spinal anaesthesia with intrathecal Ropivacaine 15 mg provides a faster motor recovery as compared with Bupivacaine 10 mg which is more suitable for ambulatory lower extremity surgeries of approximately two hours.

Keywords:- ropivacaine, bupivacaine, isobaric, fentanyl, regional anaesthesia and lower extremity surgeries

I. INTRODUCTION

Central neuraxial blockade is probably the most widely used form of regional anaesthesia today. A number of clinical studies suggest that spinal anaesthesia may be superior to general or epidural anaesthesia for certain patients and for certain surgical procedures. The endocrine-metabolic response to surgery appears to be blunted when spinal anaesthesia is employed compared to the response during general anaesthesia.¹ The advantages of spinal anaesthesia are well established and widely accepted. In the underdeveloped and developing countries spinal anaesthesia still takes a major share in the anaesthesiologists work. Even in the well developed countries spinal anaesthesia technique is enjoying good support from the anaesthesiologists. Since the development of spinal anaesthesia technique various local anaesthetics such as cocaine, procaine, etidocaine, tetracaine, lignocaine, bupivacaine were tried and studied for their effects. When these drugs were first developed bupivacaine was chosen to be marketed as a long acting local anaesthetic, its advantages compared to lignocaine being long duration of action and differential sensory-motor block. Little further work was carried out on the other drugs in the group. Bupivacaine, an anilide compound, a most widely used drug for spinal anaesthesia presently, having longer duration of action and associated with few adverse cardiac effects and prolonged duration of sensory and motor blockade so there is a need to overcome these problems. These observations prompted the search for alternative drugs, particularly for ambulatory surgery. However, with time, a number of deaths from cardiac arrest were reported in association with regional anaesthesia using bupivacaine. All appeared to be caused by accidental intravenous injection of these long acting local anaesthetics, and the doses required to produce cardiotoxicity seemed to be close to the convulsant doses. These deaths, and

subsequent recommendations of the United States Food and Drug Administration provided the impetus to develop a safer drug. It was possible that a less fat soluble drug than bupivacaine would be less cardiotoxic.² Several investigators have reexamined the use of older short-acting local anesthetics such as prilocaine or mepivacaine. Others have tested the efficacy of low dosages of bupivacaine. Hyperbaric 5% lidocaine has recently been reported to be associated with transient radicular irritation following single-dose spinal anaesthesia.³ It was noted in 1977 that the propyl derivative of the pipercoloxylidides was less toxic than the butyl derivative (bupivacaine). Further work revealed that the nerve blocking properties of the R and S enantiomers were similar but that the S-enantiomer was less cardiotoxic. Thus the S enantiomer of the propyl derivative (Ropivacaine) was chosen for further development. Ropivacaine, structurally resembling bupivacaine, with a propyl group on the piperidine nitrogen atom of the molecule is a relatively new amino-amide anaesthetic agent, similar in chemical structure to bupivacaine has been recently launched in India, for clinical evaluation having various advantages like early onset and shorter duration of action and having lesser cardio toxicity as compared to bupivacaine. The drug ropivacaine, relieves the psychological distress of being immobile for a longer period of time after lower abdominal surgeries.

In view of the above context the present study was undertaken for comparison of isobaric ropivacaine and isobaric bupivacaine to determine clinical efficacy of ropivacaine.

II. AIMS AND OBJECTIVES

To study the efficacy of intrathecal ropivacaine for spinal anaesthesia for lower limb surgeries by comparing it with intrathecal bupivacaine in terms of following parameters:

- a. Onset of sensory blockade
- b. Onset of motor blockade
- c. Duration of sensory blockade
- d. Duration of motor blockade

III. MATERIAL AND METHODS

STUDY DESIGN:

This is a prospective randomized study of 100 cases. After obtaining approval from ethics committee of Seth G.S.M.C &K. E. M. Hospital and informed consent from patients who fulfil the inclusion criteria's cases were divided randomly into two groups as,

Group R: Received Ropivacaine (0.75%)15mg with 25mcg Fentanyl intrathecally.

Group B: Received Bupivacaine (0.5%)10mg with 25mcg Fentanyl intrathecally.

INCLUSION CRITERIA:

1. Patients undergoing lower limb orthopaedic surgeries under spinal anaesthesia.
2. ASA grade I&II
3. Age between 18 to 75 years.
4. Weight between 40 to 100 kgs.

EXCLUSION CRITERIA:

1. Patients own refusal for participation.
2. ASA grade III & IV
3. Age <18yrs & >75yrs
4. Coexisting severe cardiovascular, respiratory or neurological disorders
5. Contraindications of subarachnoid block like
 - a. Raised intracranial pressure
 - b. Known history of coagulation disorders
 - c. Inflammatory skin lesions at lumbar region
 - d. Hypovolemia
 - e. Marked spinal deformity.
6. Past history of allergy to local anaesthetics and fentanyl
7. Pregnant women &lactating mothers

METHOD:

No premedication was given. After the patient was taken the operation theatre, I.V access was established, full non-invasive monitoring was applied including pulse oximeter, electrocardiography, sphygmomanometer. Preloading was done with Crystalloid solution 10 ml per kg of body weight. Oxygen at 4 litre per minute with Hudson's mask was supplemented. The patient was positioned in the lateral decubitus with the operative limb upper most. Under all aseptic precautionary measures L3-L4 or L4-L5 space

was palpated and local infiltration was done with 2cc of 2% Lignocaine. Sub arachnoid space was reached with 23 G Quincke's spinal needle in a midline or para median approach and confirmed by negative aspiration of blood and free flow of CSF. Then study drug was injected into sub-arachnoid space in respective groups of patients.

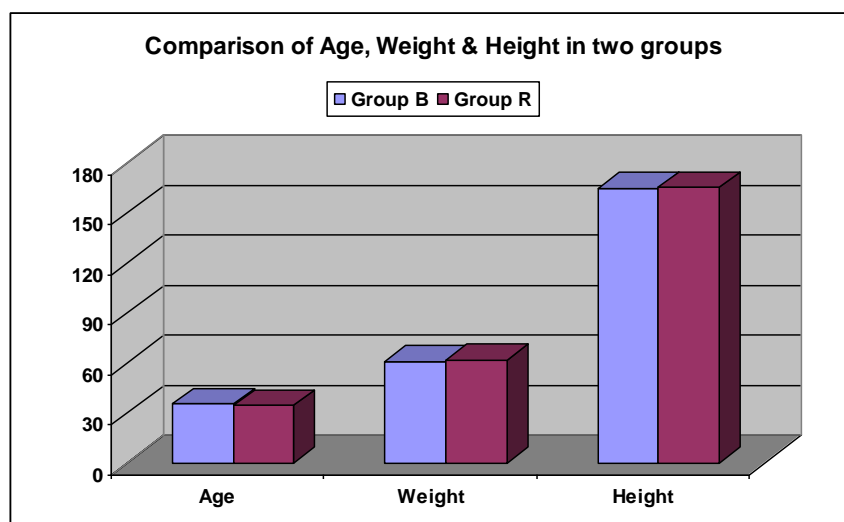
The patient remained in the same position for 10 minutes after spinal injection of drug. Operating table was kept horizontally throughout the procedure. Pulse rate and Blood pressure was recorded 5 minutes till spinal level settled down. Criteria for tachycardia, bradycardia, hypotension and hypertension were any increase or decrease more than 20% from the base line, but treatment was given only if clinically indicated (systolic BP less than 80 mm of Hg or heart rate <50/ minute) Incidence of nausea vomiting were noted.

The upper and lower spread of sensory block was determined using loss of sensation to pin prick and motor block was assessed with Modified Bromage Scale (0=no motor block, 1=inability to raise extended legs, 2= inability to flex knees and 3= inability to flex ankle joints) at timed intervals at 3, 5, 7, 10, 12, 15, 20, 30, 45, 60, 90, 120, 150 and 180 minutes after injecting drug. The assessment was continued till complete regression of sensory and motor block .

IV. OBSERVATION AND RESULTS

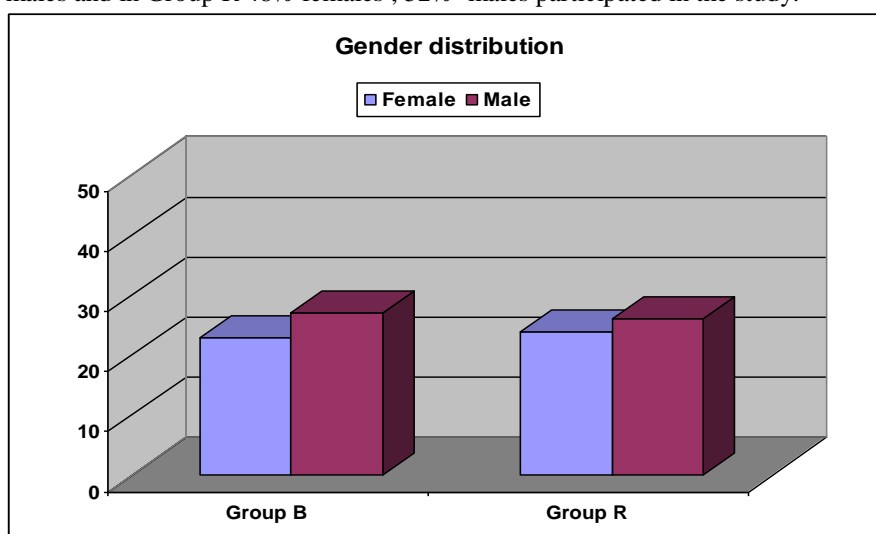
DEMOGRAPHICAL DATA

In this study groups the average age was 35.4 in Group B and 34.42 in Group R. Average height was 60.68 in Group B and 61.76 in Group R. Average weight of patients was 164.80 Group B and 165.36 Group R .The difference in age,height and weight was not statistically significant.



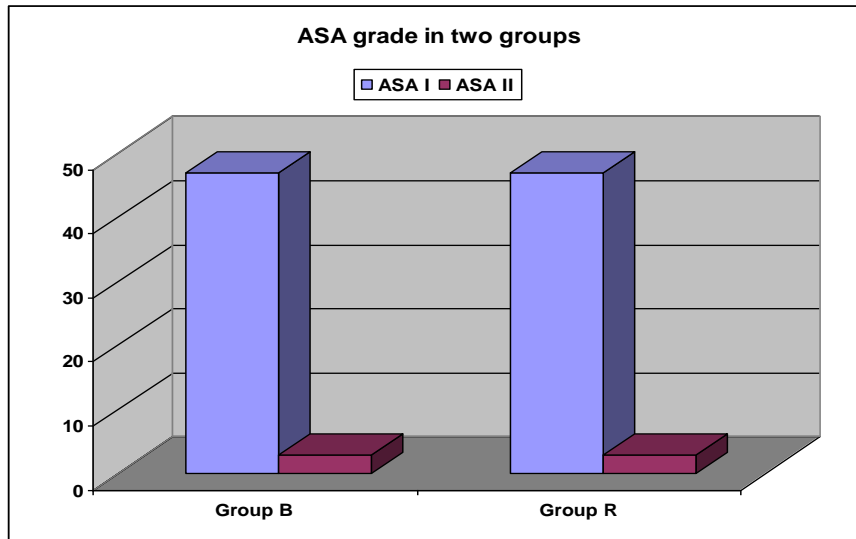
COMPARISON OF GENDER DISTRIBUTION BETWEEN TWO GROUPS

In this study the gender distribution was comparable and there was no significant difference. In Group B 46% females , 54% males and in Group R 48% females , 52% males participated in the study.



COMPARISON OF ASA GRADE BETWEEN TWO GROUPS

In this study in both groups 94% of total patients were ASA I and 6% were ASA II grade and there was no statistical difference among both groups.

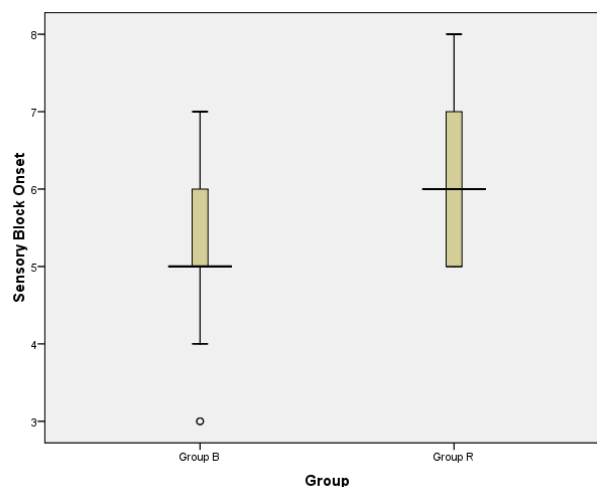


COMPARISON OF ONSET AND DURATION OF SENSORY MOTOR BLOCKADE BETWEEN TWO GROUPS

	Group	N	Mean	Std. Deviation	P value	Significance
SB Onset	Group B	50	5.26	.986	<0.001	Significant
	Group R	50	6.24	1.001		
SB Duration	Group B	50	191.38	3.562	.841	Not significant
	Group R	50	191.24	3.414		
MB Onset	Group B	50	9.72	1.691	<0.001	Significant
	Group R	50	13.18	2.569		
MB Grade III Duration	Group B	50	157.46	3.632	<0.001	Significant
	Group R	50	102.04	4.957		
MB Total Duration	Group B	50	189.92	4.476	<0.001	Significant
	Group R	50	121.04	4.594		

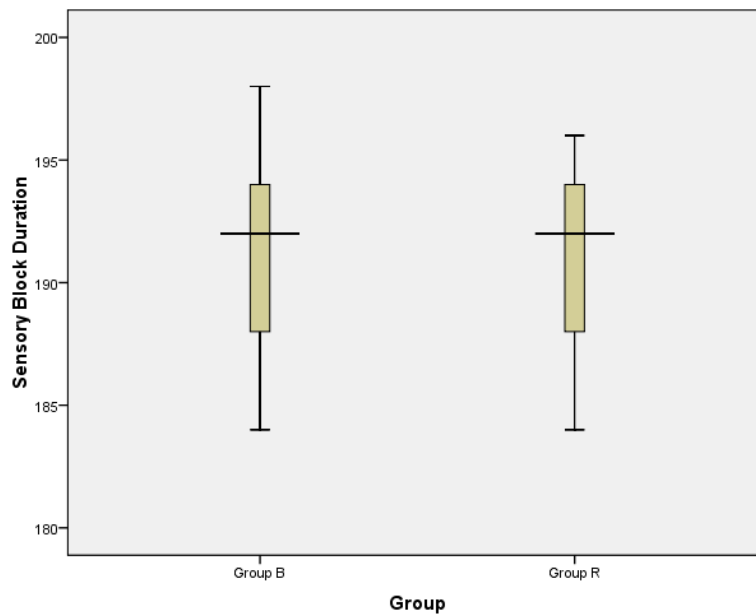
(Unpaired t test) (P<0.05 – Significant)

COMPARISON OF MEAN ONSET TIME FOR SENSORY BLOCKADE BETWEEN TWO GROUPS



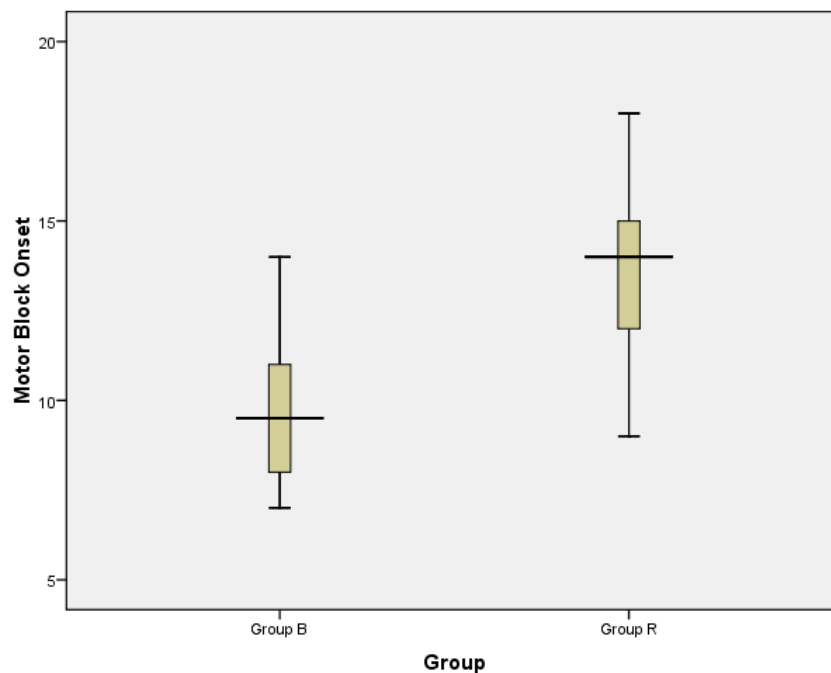
In this study the mean onset time in Group B was 5.26 minutes which was significantly low as compared to 6.24 minutes in Group R.

COMPARISON OF DURATION OF SENSORY BLOCKADE BETWEEN TWO GROUPS



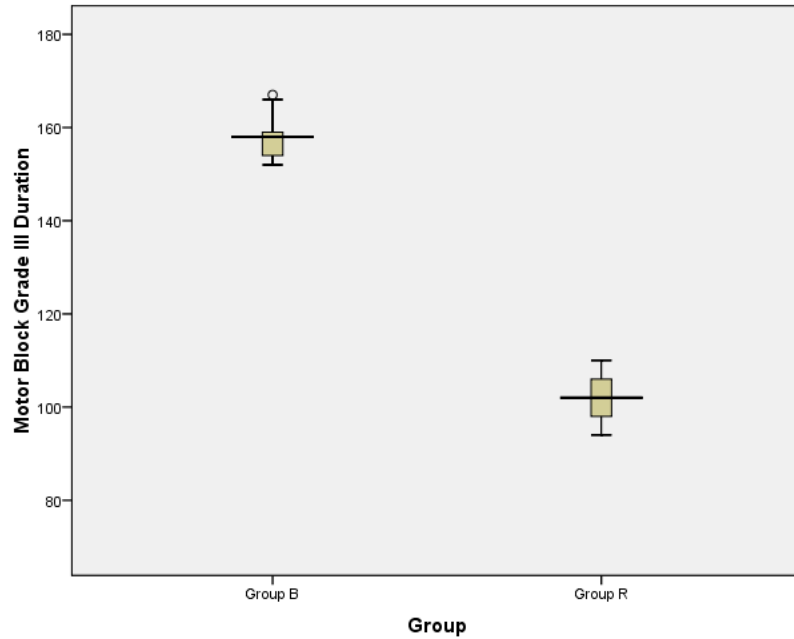
In this study the mean time duration of sensory blockade of Group B was 191.38 minutes and in group R was 191.24 which was comparable in both groups without any significant difference.

COMPARISON OF MEAN ONSET TIME FOR MOTOR BLOCKADE BETWEEN TWO GROUPS



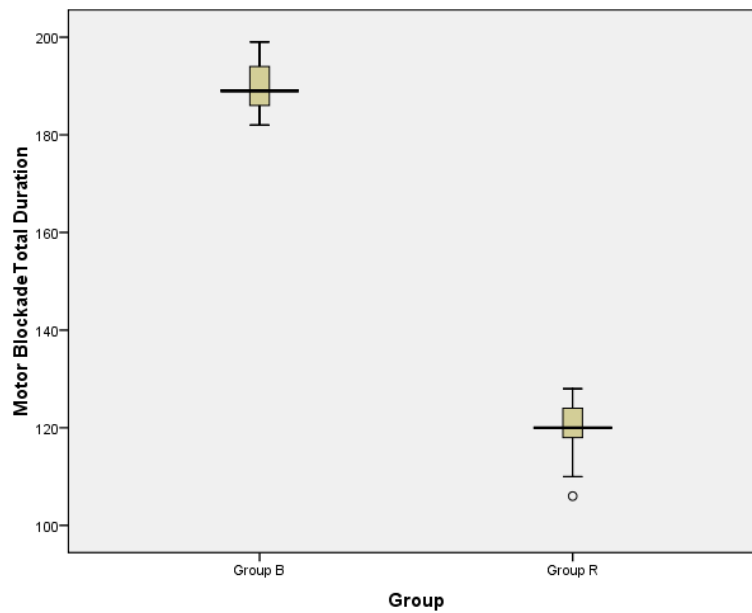
In this study the mean onset time of motor blockade was 9.72 minutes in Group B which was significantly low as compared to 13.18 minutes in Group R

COMPARISON OF MEAN MAX GRADE ACHIEVED FOR MOTOR BLOCKADE BETWEEN TWO GROUPS



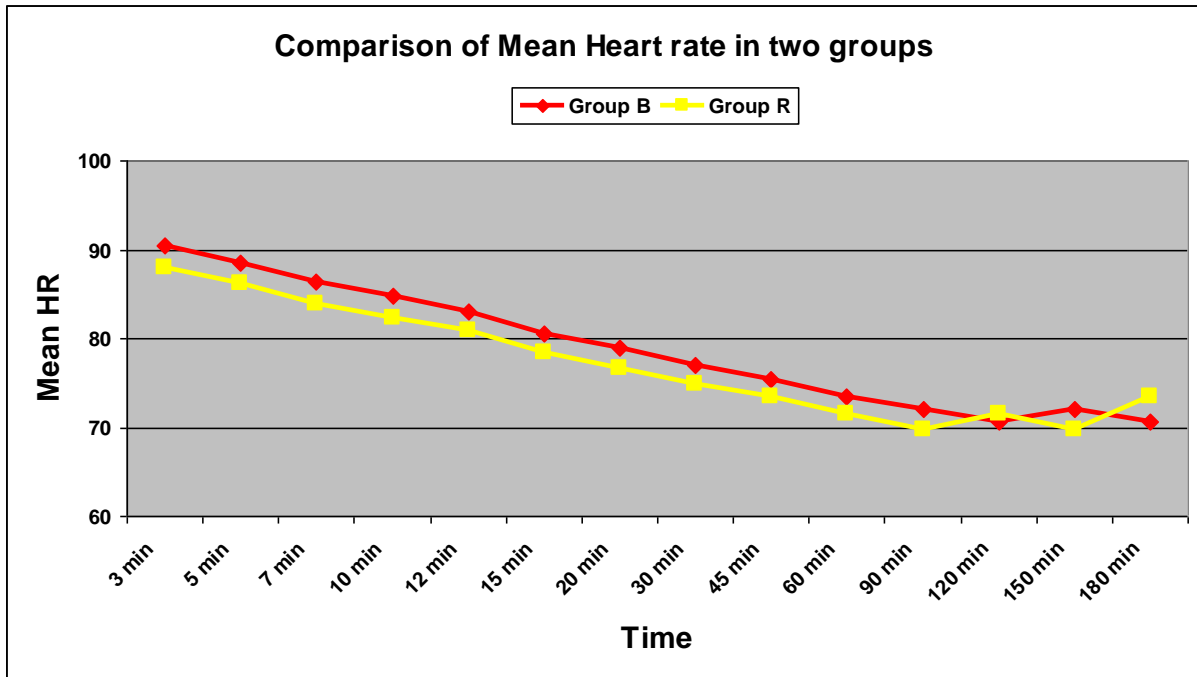
In this study the mean time to achieve Grade III motor block was 102.04 minutes in Group R which was significantly low as compared 157.46 minutes Group B.

COMPARISON OF MEAN DURATION FOR MOTOR BLOCKADE BETWEEN TWO GROUPS

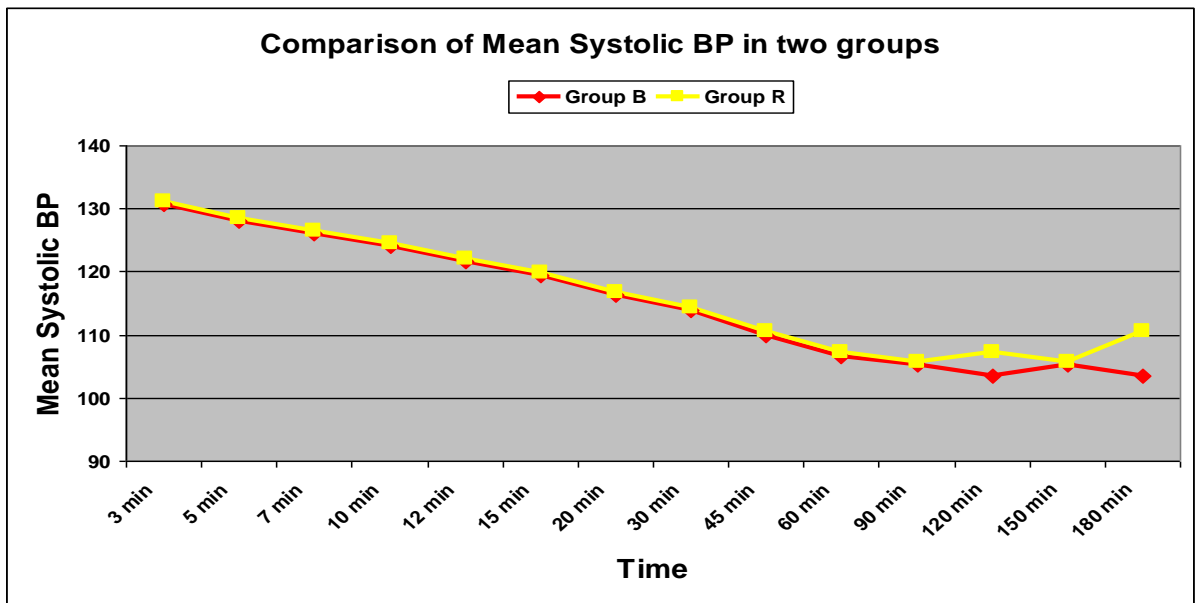


In this study the mean time duration for motor block was 121.04 minutes in Group R which was significantly low as compared 189.92 minutes Group B.

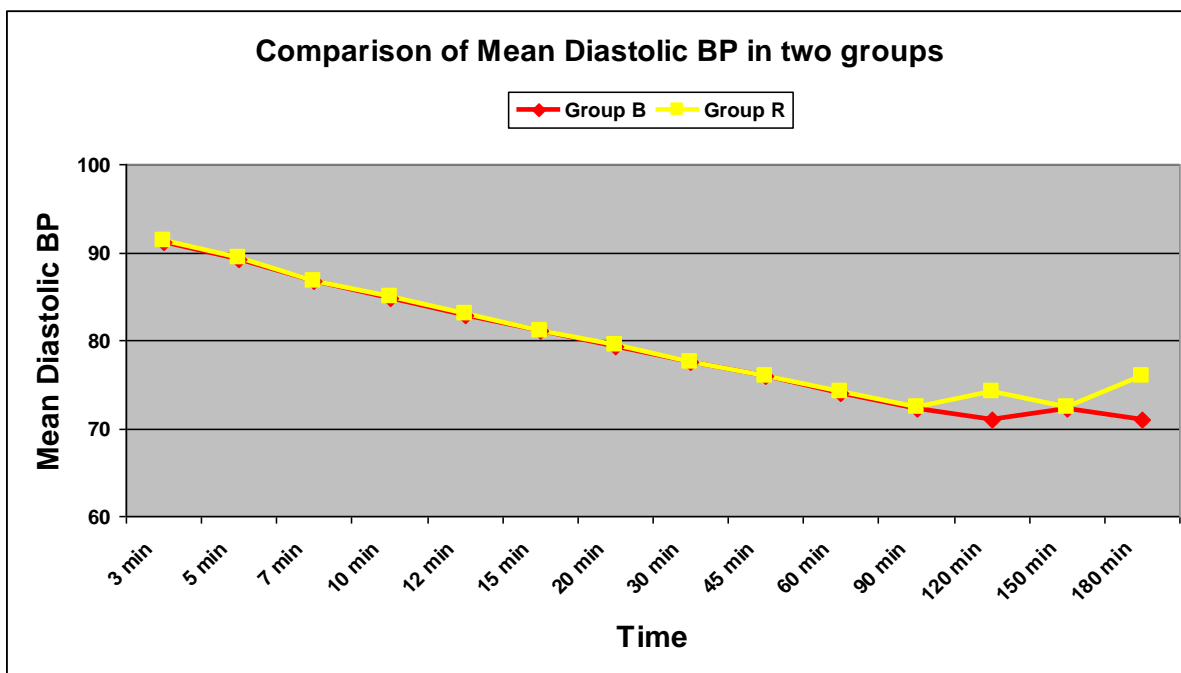
COMPARISON OF MEAN HEART RATE AND BLOOD PRESSURE BETWEEN TWO GROUPS



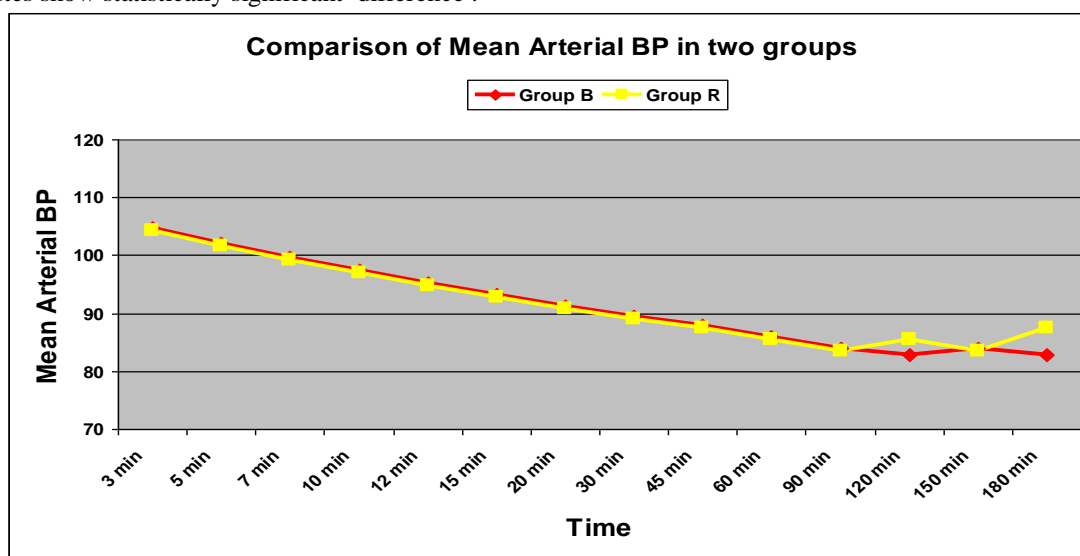
The above table and graph reveal that the mean heart rate among Group B and Group R at 3,5,7,10 and 120 minutes show statistically significant difference .



The above table and graph reveal that the mean systolic BP among Group B and Group R at 120 and 180 minutes show statistically significant difference .



The above table and graph reveal that the mean diastolic BP among Group B and Group R at 120 and 180 minutes show statistically significant difference .



The above table and graph reveal that the mean arterial BP among Group B and Group R at 120 and 180 minutes show statistically significant difference.

V. DISCUSSION

Central neuraxial blockade has been a preferred alternative in the provision of surgical anaesthesia and post-operative analgesia in the last few decades. With increasing awareness of the potential benefits of regional anaesthesia, there has been a resurgence of interest in the role of central neuraxial blockade in anaesthesiology. Developments in multimodal analgesia, newer local anaesthetics and adjuvant drugs, have opened up a plethora of possibilities and offer the potential for greater patient benefit from subarachnoid blocks in the future. Ropivacaine is the pure s(-) enantiomer of propivacaine, and is a long acting amide local anaesthetic agent, eliciting nerve block via reversible inhibition of sodium influx in nerve fibres.

S C Urwin et al conducted a meta analysis of 15 randomised trials comparing the mortality and morbidity associated with general anaesthesia versus regional anaesthesia in patients undergoing hip fracture surgeries. There was a reduced 1-month mortality and incidence of deep vein thrombosis in the regional anaesthesia group. Operations performed under general anaesthesia had a reduction in operation time. No other outcome measures reached a statistically significant difference. There was a tendency towards

a lower incidence of myocardial infarction, confusion and postoperative hypoxia in the regional anaesthetic group, and cerebrovascular accident and intra-operative hypotension in the general anaesthetic group. They concluded that there are marginal advantages for regional anaesthesia compared to general anaesthesia for hip fracture patients in terms of early mortality and risk of deep vein thrombosis.

Christopher Gonano et al compared spinal versus regional anaesthesia in terms of anaesthesia drugs and supply costs. Total costs per case without personnel costs were almost half in the spinal anaesthesia(SA) group compared with the general anaesthesia(GA) group; this was a result of less cost for anaesthesia ($P < 0.01$) and for recovery ($P < 0.05$). This finding was supported by a sensitivity analysis. There were no relevant differences regarding anaesthesia-related times. Patients in the GA group were admitted to the postanesthesia care unit with a higher pain score and needed more analgesics than patients in the SA group (both $P < 0.01$). They concluded that SA is a more cost-effective alternative to GA in patients undergoing hip or knee replacement, as it is associated with lower fixed and variable costs. Moreover, SA seems to be more effective, as patients in the SA group showed lower postoperative pain scores during their stay in the postanesthesia care unit.

The present study intends to compare efficacy of intrathecal ropivacaine with fentanyl and bupivacaine with fentanyl for spinal anaesthesia for lower limb surgeries.

Hundred patients were a part of this prospective, randomised, controlled study and were randomly allocated to two groups.

Group R: In this group Ropivacaine (0.75%)15mg with 25mcg Fentanyl was administered intrathecally.

Group B: In this group Bupivacaine (0.5%)10mg with 25mcg Fentanyl was administered intrathecally.

In both groups a detailed preoperative assessment was done, adequate starvation was confirmed and informed written consent was taken. After intravenous access was secured, patients were preloaded with lactated Ringers solution (10ml/kg body weight) and then administered spinal anaesthesia. They were monitored thereafter and onset and duration of sensory and motor block, time taken to achieve the highest level of sensory blockade, degree of motor blockade were noted.

The demographic profile of both sets of patients was comparable in terms of age, gender, height and weight.

Onset of sensory blockade was determined by loss of pinprick sensation. Mean onset time in group B was found to be 5.26 ± 0.986 minutes while it was 6.24 ± 1.001 minutes in group R. The difference was significant and we conclude that onset of sensory blockade was earlier in Group B compared to Group R. In our study we found that time duration of sensory blockade was 191.38 ± 3.562 minutes in Group B and 191.24 ± 3.414 minutes in Group R, the difference was not found to be statistically significant.

Helena Kallio, Eljas .Veli Snall et al Compared Intrathecal Plain Solutions Containing Ropivacaine 20 or 15 mg Versus Bupivacaine 10 mg in lower limb surgeries.They found that Both Ropivacaine 15mg ad bupivacaine 10 mg provided similar duration of sensory blockade.

B.Whiteside, D.Burke & J.A.Wildsmith et al compared ropivacaine 0.5% (in glucose 5%) with bupivacaine 0.5% (in glucose 8%) for spinal anaesthesia for elective surgery .They found that onset of sensory blockade was earlier with Bupivacaine as compared to Ropivacaine and equal doses of Ropivacaine and Bupivacaine produced sensory blockade of similar onset and duration.

C.J.Chung, So-Ron Choi et al compared hyperbaric spinal Ropivacaine for cesarean delivery with hyperbaric Bupivacaine . They found that hyperbaric Ropivacaine provided similar and effective spinal anaesthesia with shorter duration of sensory and motor block.

In our study the onset time of motor blockade was 9.72 ± 1.691 minutes in group B which was more than 13.18 ± 2.569 minutes in group R, this difference was found to be statistically significant. The time duration of maximum grade (gradeIII) of motor blockade using the modified Bromage scale was significantly higher in group B(157.46 ± 3.632)minutes than in group R (102.04 ± 4.957)minutes.

In our study there was a statistically significant difference in the duration of motor blockade between the two groups.The duration of motor blockade in Group B was 189.92 ± 4.476 minutes which was significantly higher as compared to 121.04 ± 4.594 in Group R.

Jean marc Malinovasky et al compared intrathecal anesthesia with Ropivacaine and Bupivacaine in transurethral resection of bladder and prostate. They found that total duration of motor blockade was not different with both drugs.

Helena Kallio, Eljas .Veli Snall et al Compared Intrathecal Plain Solutions Containing Ropivacaine 20 or 15 mg Versus Bupivacaine 10 mg in lower limb surgeries.They found that Ropivacaine provides faster motor recovery as compared to Bupivacaine.

Michela Camorica , Giorgio Capogna et al studied the relative potencies for motor block after intrathecal Ropivacaine, Levobupivacaine, and Bupivacaine. They found that intrathecal ropivacaine and levobupivacaine are significantly less potent than bupivacaine, which may explain the lesser motor blocking effects of intrathecal ropivacaine and levobupivacaine.

Koltka K, Uludag E et al compared equipotent doses of ropivacaine-fentanyl and bupivacaine-fentanyl in spinal anaesthesia for lower abdominal surgery. They found that duration and intensity of motor block was shorter with Ropivacaine as compared with Bupivacaine.

Danelli G,Fanelli G et al studied spinal Ropivacaine or Bupivacaine for cesarean delivery. They found that spinal anesthesia produced with 20 mg ropivacaine plus 0.1 mg morphine is as effective and safe as that provided by 15 mg bupivacaine plus 0.1 mg morphine, with an earlier recovery of sensory and motor functions after surgery.

VI. CONCLUSION

From our study we conclude that both Bupivacaine and Ropivacaine with 25 mcgms of fentanyl intrathecally, promote satisfactory anaesthesia for lower limb surgeries. The spinal anaesthesia with intrathecal Ropivacaine 15 mg provides a faster motor recovery as compared with Bupivacaine 10 mg which is more suitable for ambulatory lower extremity surgeries of approximately two hours.

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