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Comparison of the Ropivacaine and Ropivacaine with Fentanyl in Femoral Nerve Block Prior to Spinal Anaesthesia for Positioning in Orthopedic Lower Limb Surgeries

K. Senthil kumar[1], Rajasekar Janaki[2]

[1]Associate Professor, Department of Anesthesiology, KAP Viswanatham Government Medical College, Trichy, Tamil Nadu 620001, India. [2]Assistant Professor, Government Trinelveli Medical College, Tirunelveli, Tamil Nadu 627011, India.

Abstract

Introduction: Spinal anesthesia is performed for orthopedic lowerlimb surgeries for its dense blockade, rapid onset and pain relief in the postoperative period. femoral nerve block is performed prior to subarachnoid block helps in better positioning of the patient. Our study we had compared the effects of Ropivacaine alone and Ropivacaine with Fentanyl in blocking the femoral nerve prior to subarachnoid block. *Aims & Objectives:* To study the effect of fentanyl added to ropivacaine and ropivacaine alone in pain relief by blocking the femoral nerve prior to positioning the patients for sub arachnoid block. in orthopaedic above knee surgeries. *Materials and Methods:* Sixty ASA-PS I and II patients were posted for orthopedic above knee surgeries. Patients were distributed equally between the groups. One received 20 ml of 0.2% ropivacaine and another group received 20 ml of 0.2% ropivacaine with 50 mcg fentanyl. *Results*: Performing femoral nerve block provides significant improvement in pain scores, patient positioning, number of attempts in performing spinal anesthesia and hence the time taken for spinal anesthesia. Addition of 50 mcg fentanyl to ropivacaine resulted in a statistically same decrease in VAS scores, quality of patient positioning and decreased the number of attempts in performing spinal anesthesia. Patients were hemodynamically stable. *Conclusion*: Fentanyl added to the ropivacaine and ropivacaine alone in femoral nerve block had similar analgesic effect on positioning the patients prior to sub arachnoid.

Keywords: Femoral nerve block; Patient positioning; Ropivacaine; Fentanyl.

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Introduction

Central neuraxial blockade is preferred technique for orthopedic anaesthesia and analgesia [1,2]. Spinal anaesthesia is frequently used for lower limb surgeries due to its rapid onset, dense neural block, less morbidity and mortality which is largely due to a reduction in the incidence of pulmonary aspiration and failed intubation, avoids exposure to depressant anaesthetic drugs, and allows the patient to remain awake during surgery. Injury to periosteum is very painful; patients experience excruciating pain during mobility and positioning of the lower limb. Various modalities can be used to optimize the positing including opioids, nonsteroidal anti-inflammatory drugs, regional blocks [3,4] Blocking the femoral nerve helps in better positioning [5] for subarachnoid block.

Corresponding Author: Rajasekar Janaki, Assistant Professor, Government Trinelveli Medical College, Tirunelveli, Tamil Nadu 627011, India.

E-mail: Janu1881990@gmail.com

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We had compared the analgesic effect of fentanyl added to ropivacaine and ropivacaine alone with for femoral nerve block before positioning the patient for central neuraxial block.

Aims & Objectives

1. To compare the analgesic effect produced by fentanyl added to ropivacaine in femoral nerve block with ropivacaine plain prior to positioning for spinal anaesthesia in patients undergoing orthopaedic above knee surgeries.
2. patient positioning.
3. Time taken to perform spinal anaesthesia.
4. Incidence of any side effects.

Materials and Methods

After obtaining institutional ethical committee clearance and informed written consent from the patient sixty eight patients (including both the sexes, 18-70 years, weight 50 kg, American Society of Anesthesiologists physical status I to II) posted for above knee orthopaedic surgeries were selected randomly based on computer generated random numbers. Patients who could sit comfortably refused for participation in the study or having any contraindication to spinal anaesthesia, FNB or use of local anaesthetic were excluded. FNB group with ropivacaine and FNB with ropivacaine and fentanyl group. Patients were shifted to operation theatre monitors attached baseline values obtained intravenous line secured. Under asepsis and local analgesia an insulated 50 mm 22 gauge needle was introduced 1 cm lateral to the femoral artery and 1.5 cm below the inguinal ligament. Either Ropivacaine 20 mL, 0.2% plain or Ropivacaine 20 mL, 0.2% plain added with fentanyl 50 µg was injected incrementally after a negative aspiration test. FNB group: received 20 ml 0.2% ropivacaine plain 15 min prior to positioning FENT group: received ropivacaine 20 ml along with fentanyl 50 µg 15 min prior to positioning.

Subarachnoid block performed at L3/4 level, Visual analogue score before and after the block are noted at 5 minutes interval. Quality of patient positioning (0=not satisfactory, 1=satisfactory, 2=good, 3= optimal) also recorded. Time taken to perform spinal anaesthesia (time from beginning of positioning to end of spinal) recorded. Additional fentanyl requirement during positioning, time taken to achieve position, quality of positioning, number of attempts and complications were noted. Patients were distributed in two groups through computer generated random numbers table; FNB group with ropivacaine and FNB with ropivacaine and fentanyl group.

Sample size was calculated based on an earlier study, which showed in their pilot study that FNB was more effective to reduce pain, and the mean score was 2 in FNB group. Based on α =0.05, β =0.20 and considering a significant difference at mean difference of 2.2 in pain score, with standard deviation (SD) of 3.0, a sample size of 30 per group was selected. IV line was secured and fluid started, monitors attached and baseline parameters were recorded. In FNB group patients received FNB with ropivacaine 15 min prior to positioning. FNB was performed by one of the two anaesthesiologists. Entry point was infiltrated with 1 ml 1% lignocaine and then an insulated 50 mm 22 gauge needle was introduced 1 cm lateral to the femoral artery and 1.5 cm below the inguinal ligament. 20 mL, 0.2% ropivacaine was injected incrementally after a negative aspiration test. Patients in the FENT group received ropivacaine 20 ml along with fentanyl 50 µg 15 min prior to positioning. Thereafter a spinal block was performed in either the midline or paramedian approach at the L2/3 or L3/4 level, according to the anesthesiologist's decision. Pain scores before and during positioning were recorded. Pain assessment was done using visual analog scale (0 = no pain, 10 = maximal pain). Additional fentanyl requirement during positioning, time taken to achieve position and anaesthesiologist' satisfaction with patient position maintained for spinal block (0 = not satisfactory, 1 = satisfactory, 2 = good, 3 = optimal) and patient satisfaction, e.g., like or dislike (yes or no) were also recorded. Vital parameters; heart rate (HR), mean arterial pressure (MAP) by non-invasive blood pressure and oxygen saturation (SpO_2) were monitored. Statistical analysis was performed with Graph pad calcs software. Parametric variables were described as mean ± SD; qualitative variables were described as number (percentage) and as median and range. Student's *t*-test, Chi-square test or Fisher exact tests were used as appropriate to compare the two groups. $p < 0.05$ was considered as statistically significant.

Methodology

This is a randomized prospective study, including 60 patients scheduled for orthopaedic lowerlimb surgeries under spinal anaesthesia.

Randomization done with computer generated random numbers table; Femoral nerve block group 1 (n=30) (FNB) with ropivacaine and group 2 (n=30) with ropivacaine with fentanyl. Group 1 patients will receive FNB with ropivacaine 20 ml 0.2% after a negative aspiration test. Group 2 patients in the fentanyl group will receive injection fentanyl 50 microgram along with ropivacaine 15 minutes prior to positioning. Hemodynamics monitoring including heart rate, NIBP, oxygen saturation and respiratory rate are recorded. Visual analogue score before and after the block are noted at 5 minutes interval. Also objective assessment can be done with degree of hip flexion before and after the procedure. Quality of patient positioning (0=not satisfactory, 1= satisfactory, 2= good, 3= optimal) shall also be recorded. Pain scores before and during positioning for subarachnoid block are recorded. Time taken from positioning to obtaining a successful lumbar puncture was noted.

Inclusion Criteria

1. Patients of ASA PS I - II.
2. Belonging to age group 18-70 years of both sexes.
3. Undergoing orthopaedic above knee surgeries.

Exclusion Criteria

1. Patients with known allergy to ropivacaine
2. Local infection
3. Patients with sepsis, coagulation abnormality.
4. Patients with renal or hepatic insufficiency, ASA III, IV.
5. Patients with preexisting neurologic deficit in the lower extremities, and inability to comprehend the pain scales.

*Sample Size***:** we had conducted a pilot study on 10 patients. Patients given FNB had lower pain scores (mean = 2) during positioning. Keeping $\alpha = 0.05$, $\beta = 0.20$, mean difference of 2.2 in pain score and estimated standard deviation of 3.46, a sample size of 30 per group was obtained.

Data Collection and Methods

1. Haemodynamics.
2. Pain score before and during positioning using VAS pain score.
3. Quality of positioning of spinal anaesthesia.

Observation and Results

The results obtained were analysed with SPSS (Statistical Package for Social Sciences) version 13. Chi square (to analyze categorical data) and student t test (to compare mean and standard deviation) used to analyse the data.

Patients in both the groups were comparable with respect to their age, sex, height, weight and BMI.

Mean pulse rate, mean systolic blood pressure, mean diastolic blood pressure, mean saturation and mean VAS score measured at preop, 0 Mins, 5 Mins, 10 Mins, 15 Mins and Post op compared using student t test and found no significant difference among both the groups.

Time taken for spinal anesthesia was obtained in all the two groups with two time intervals namely 1.5 Minutes, 2 Minutes and the p values was 0.600 ($p>0.05$) not significant.

Number of attempts were obtained in all the two groups with single attempts in Mean values of 1.03 & 1.03 and the p values was 1.00 ($p>0.05$) not significant.

Quality of patient positioning were obtained in all the two groups Mean values of 2.37 & 2.87 and the p values was 0.00 ($p>0.05$) significant.

Discussion

Spinal anesthesia is frequently used for orthopedic lower limb surgeries for its rapid onset, dense blockade, little risk of anesthetic toxicity and avoidance of airway manipulations. But positioning for spinal anesthesia in orthopedic surgery is difficult. Hence this problem is overcome by femoral nerve block technique.

Sandby-Thomas *et al*. [6] in a national postal survey of trauma anaesthetists reported that nerve blocks were infrequently used whilt injection midazolam, ketamine, propofol, fentanyl, remifentanil, morphine, nitrous oxide, and sevoflurane were frequently used agents. Schiferer et al. [7] demonstrated that FNB provided analgesia after femoral trauma which was adequate for patient transport. Other studies have described the successful use of FNB as analgesia in the emergency department [8,9]. Parker et al. reported that nerve blocks reduced pain score and analgesic requirements [10]. Use of FNB to relieve pain from a fracture of the femur at various other situations [11] is well known and now, is being used for positioning during spinal anaesthesia.

Blocking the femoral nerve improves the quality of patient positioning, number of attempts in performing spinal anesthesia and reduced the pain scores during positioning. Reddy, E., & Rao, B. [12] found out VAS scores after 15 mins in FNB group were 3.1 ± 2.1 compared to 3.9 ± 1.9 in IVF group and during the positioning, 6.2 ± 2.1 and 7.2 ± 2.7 respectively.

Iamaroon et al. [13] studied the effect of femoral nerve block and IV fentanyl for positioning during femur fracture surgery. They observed both groups were similar with respect to pain relief 15 minutes after intervention and during positioning. Time to perform spinal block was 7.0 ± 4.2 and 6.6 ± 4.3 minutes in the FNB and fentanyl groups, respectively (p = 0.74).

In this current study, we compared addition of fentanyl to ropivacaine in femoral nerve block for positioning of spinal anesthesia in orthopedic above knee surgeries.

Both the groups were comparable in demography and type of surgery (Table 1). Preop Vas score in the plain ropivacaine group was 8.9 ± 0.759 comparable with ropivacaine with fentanyl group 9.07 ± 0.785 with no significant statistical difference (p value>0.05). p value >0.05 for vas score after 15 min indicating thet both the groups were similar (Table 2).

Pulse rate, systolic and diastolic blood pressure, saturation monitored at Preop, 0 Mins, 5 Mins, 10 Mins, 15 Mins and Post op. Two groups were similar with stable hemodynamics.

Patient positioning score was significantly different among the groups. The plain ropivacaine group 2.37 ± 0.556 and 2.87 ± 0.346 in ropivacaine with fentanyl group with p value 0.00 (Table 3). The time taken to perform subarachnoid block was compared, 21 (70%) in the plain ropivacaine group and 22 (73%) ropivacaine with fentanyl group were ready for the subarachnoid block at 15 mins (Table 4).

Addition of 50 mcg fentanyl provides same benefit and almost nil side effects (no significant respiratory depression, nausea vomiting or sedation).

Table 1: Sex distribution among groups

	Group			Statistical inference
	A Group	**B Group**	**Total**	
Female	11	8	19	X2=.693 Df=1 .405>0.05 Not Significant
Male	19	22	41	
Total	30	30	60	
		Diagnosis		
#intertrochanteric femur	7	8	15	X2=1.163 Df=3 .762>0.05 Not Significant
#shaft of femur	14	13	27	
Avascular necrosis	8	9	17	
intertrochanteric # femur	1	0	1	
Total	30	30	60	
		Surgery		
ORIF	23	21	44	X2=.341 Df=1 .559>0.05 Not Significant
Total hip replacement	7	9	16	
Total	30	30	60	
		ASA Status		
I	10	23	33	X2=11.380 Df=1 .001<0.05 Significant
II	20	7	27	
Total	30	30	60	
		Time Taken for SAB		
1.5 Min	21	22	43	X2=0.082 Df=1 .774>0.05 Not Significant
2 Min	9	8	17	
Total	30	30	60	

Table 2: VAS

N = 30	VAS	Mean	S.D
Group A	Preop	8.90	0.759
	0 Mins	8.53	0.679
	5 Mins	6.80	.887
	10 Mins	4.07	.907
	15 Mins	1.70	.466
	Post op	1.70	.466
Group B	Preop	9.07	0.785
	0 Mins	8.57	0.679
	5 Mins	6.40	0.855
	10 Mins	4.00	.743
	15 Mins	1.70	.466
	Post op	1.67	.479

Statistical inference are given below

- Preop T=-0.836, Df=58, p=0.47> 0.05 not significant
- 0 Min T=0.183, Df=58, p=0.855> 0.05 not significant
- 5 Mins T=1.779, Df=58, p=0.081> 0.05 not significant
- 10 Mins T=0.311, Df=58, p=0.757> 0.05 not significant
- 15 Mins T=0, Df=58, p=0.081.000> 0.05 not significant
- Post op T=0.273, Df=58, p=0.786> 0.05 not significant

Table 3: Quality Position

Quality position	N	Mean	Sd	
A group	30	2.37	.556	T=-4.182 Df=58 .000<0.05 Significant
B Group	30	2.87	.346	

Table 4: Number of Attempts

No.of attempts	N	Mean	SD	
A group	30	1.03	.183	T=.000 Df=58 1.000>0.05 Not Significant
B Group	30	1.03	.183	

Table 5: PR

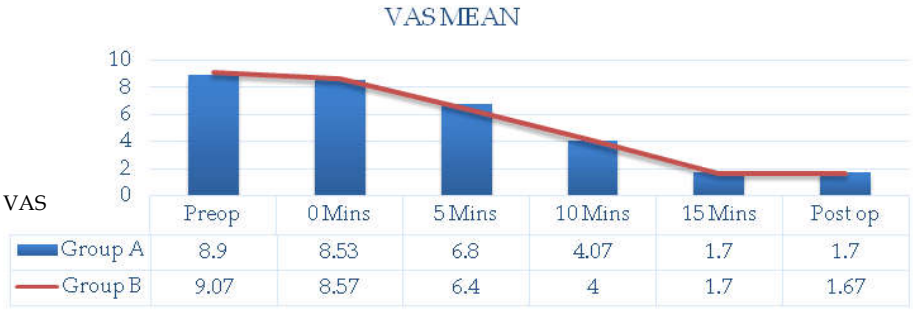
N = 30	PR	Mean	S.D
Group A	Preop	79.20	11.235
	0 Mins	30	79.07
	5 Mins	75.43	11.307
	10 Mins	72.13	11.227
	15 Mins	69.27	9.972
	Post op	65.80	9.718
Group B	Preop	78.53	10.160
	0 Mins	30	83.73
	5 Mins	79.87	11.076
	10 Mins	74.37	16.296
	15 Mins	75.03	10.701
	Post op	72.00	10.770

Statistical inference are given below

- Pre op T=0.241, Df=58, p=0.810> 0.05 not significant
- 0 Min T=1.483, Df=58, p=0.143> 0.05 not significant
- 5 Mins T=-1.534, Df=58, p=0.130> 0.05 not significant
- 10 Mins T=-0.618, Df=58, p=0.539> 0.05 not significant
- 15 Mins T=-2.159, Df=58, p=0.539> 0.05 not significant
- Post op T=-2.341, Df=58, p=0.023> 0.05 not significant

Table 6: SBP

N = 30	SBP	Mean	S.D
Group A	Preop	132.93	7.469
	0 Mins	138.67	6.255
	5 Mins	135.17	6.270
	10 Mins	132.67	7.327
	15 Mins	130.97	6.881
	Post op	128.93	8.283
Group B	Preop	133.73	7.409
	0 Mins	139.20	7.053
	5 Mins	136.27	7.311
	10 Mins	133.17	7.149
	15 Mins	131.40	6.941
	Post op	128.40	10.833



Graph 1: VAS

Statistical inference are given below

- Pre op T=-0.417, Df=58, p=0.679> 0.05 not significant
- 0 Min T=-0.310, Df=58, p=0.758> 0.05 not significant
- 5 Mins T=-0.626, Df=58, p=0.534> 0.05 not significant
- 10 Mins T=-0.268, Df=58, p=0.790> 0.05 not significant
- 15 Mins T=-0.243, Df=58, p=0.809> 0.05 not significant
- Post op T=-0.214, Df=58, p=0.831> 0.05 not significant

Table 7: DBP

N = 30	DBP	Mean	S.D
Group A	Preop	83.37	7.527
	0 Mins	87.63	6.901
	5 Mins	84.67	6.525
	10 Mins	82.97	6.261
	15 Mins	81.00	6.368
	Post op	80.00	6.164
Group B	Preop	83.17	5.837
	0 Mins	86.60	5.581
	5 Mins	83.70	5.086
	10 Mins	82.80	5.255
	15 Mins	79.43	5.070
	Post op	77.20	4.909

Statistical inference are given below

- Pre op T=0.115, Df=58, p=0.909> 0.05 not significant
- 0 Min T=0.638, Df=58, p=0.526> 0.05 not significant
- 5 Mins T=-0.640, Df=58, p=0.525> 0.05 not significant
- 10 Mins T=0.112, Df=58, p=0.911> 0.05 not significant
- 15 Mins T=1.054, Df=58, p=0.296> 0.05 not significant
- Post op T=1.054, Df=58, p=0.045> 0.05 not significant

Table 8: RR

N = 30	DBP	Mean	S.D
Group A	Preop	15.37	.765
	0 Mins	15.33	.661
	5 Mins	30	15.37
	10 Mins	15.37	.809
	15 Mins	15.47	.681
	Post op	15.30	.466
Group B	Preop	15.30	.794
	0 Mins	15.40	.675
	5 Mins	15.53	.681
	10 Mins	15.27	.691
	15 Mins	15.23	.679
	Post op	15.33	.758

Statistical inference are given below

- Pre op T=0.331, Df=58, p=0.742> 0.05 not significant
- 0 Min T=0.387, Df=58, p=0.700> 0.05 not significant
- 5 Mins T=0.891, Df=58, p=0.377> 0.05 not significant
- 10 Mins T=0.515, Df=58, p=0.609> 0.05 not significant
- 15 Mins T=1.329, Df=58, p=189> 0.05 not significant
- Post op T=205, Df=58, p=0.838> 0.05 not significant

Conclusion

We concluded that the addition of fentanyl 50 mcg to ropivacaine provides same pain relief as ropivacaine alone and better positioning for spinal anesthesia.

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