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TO STUDY AND COMPARE THE EFFICACY OF FEMORAL NERVE BLOCK VS. ADDUCTOR CANAL BLOCK WHEN USED AS A PART OF MULTIMODAL ANALGESIA REGIMEN IN PATIENTS UNDERGOING TOTAL KNEE ARTHROPLASTY PERFORMED UNDER SUBARACHNOID BLOCK.

Anaesthesiology

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ABSTRACT

Total Knee Arthroplasty (TKA) is a common orthopaedic procedure, consisting of replacing diseased or damaged knee joint surfaces to relieve the pain and disability of osteoarthritis. We aim to study and compare the efficacy of femoral nerve block and adductor canal block when used as a part of a multimodal analgesia regimen in patients undergoing Total Knee Arthroplasty under subarachnoid block. The ASA strongly recommends that a regional blockade with local anaesthetics be considered part of the multimodal approach for pain management. Regional block such as femoral nerve block, with local anaesthetics, remains a well-accepted component of comprehensive multimodal anaesthesia for postoperative pain management. **Objectives:** To assess the effect of femoral nerve block and adductor canal block on the Pain intensity by NRS scale at specific time intervals, till 24 hours post block, the duration of sensory blockade, the duration of motor blockade and to measure the total amount of opioids consumed, till 24 hours post block. **Study Area:** Surabhi Institute of Medical Sciences, Siddipet, Telangana. **Study population:** The study population was limited to the patients undergoing elective TKA under SAB. **Sample size & sample technique:** The sample size was limited to 150 patients systematically divided into two equal groups of 75 patients in each group. **Results:** We found that the mean NRS pain scores at 6 hours, 12 hours and 24 hours in both groups were similar with the difference being statistically insignificant. In group A, The mean NRS pain score at 6 hours was 2.8400 ± 1.4708 and in group B it was 2.6933 ± 1.5594 with a p-value of 0.5544. The mean NRS pain score at 12 hours in group A was 4.9467 ± 1.3939; in group B it was 4.9067 ± 1.2858 with a p-value of 0.8553. The mean NRS pain score at 24 hours in group A was 3.0533 ± 1.4036 and in group B it was 2.9733 ± 1.3252 with a p-value of 0.7202. We found that the difference in duration of sensory block was also not statistically significant in both the groups with a mean duration of sensory block in hours being 9.2400 ±1.8733 in group A and 8.8133 ±1.9844 in group B with a p-value of 0.1778 and the total amount of opioid consumption was also similar in both the groups with the mean opioid (Inj: fentanyl) consumption in micrograms being 132.6000± 31.9666 in group A and 134.3333 ± 30.4841 in group B with p-value of 0.7345

KEYWORDS

Total knee arthroplasty, multimodal analgesia, regional blocks.

INTRODUCTION

Total Knee Arthroplasty (TKA) is a common orthopedic procedure, consisting of replacing diseased or damaged knee joint surfaces to relieve the pain and disability of osteoarthritis. [1] It is estimated that more than 1,20,000 TKRs are performed in India annually. The number of Total knee arthroplasty undertaken annually around the world will increase exponentially as the population ages.[1] Total knee arthroplasty aims to improve function and decrease pain in knee osteoarthritis.

Pain is one of the major concerns for patients undergoing Total Knee Arthroplasty (TKA). TKA is associated with significant post-operative pain that can delay recovery and lengthen hospital stay.[2] Appropriate pain management is a key factor in a patient's early recovery to physical fitness, satisfaction and shorter hospital stay.

TKA is one of the most painful surgical procedures. Effective analgesia in the immediate postoperative period is important to allow the patient to regain mobility, thereby facilitating recovery and decreasing the length of hospital stay. Unrelieved severe postoperative pain can result in pathophysiological responses causing adverse postsurgical outcomes. These adverse outcomes have medical and economic implications, such as impaired early rehabilitation, delayed discharge, unscheduled re-hospitalisation, impaired health-related quality of life and increased risk of chronic pain.[1] Using opioids alone intensifies their familiar side-effect profile, including respiratory depression, postoperative nausea and vomiting (PONV), over-sedation, pruritus and chronic opioid dependence.

On the other hand, the administration of non-steroidal anti-inflammatory medications (NSAIDS), particularly at higher doses, may be associated with gastrointestinal side effects such as gastritis, gastric ulcers, increased bleeding, and renal impairment. Local anaesthetics have been used in peripheral nerve blocks prior to or after surgical procedures. However, their use is sometimes limited due to their short duration of action. Excess dosage of local anesthetics in the blood can cause local anesthetic systemic toxicity leading to cardiovascular collapse and central nervous system side effects (LAST). A multimodal approach to pain control involves the administration of a combination of either multiple analgesics or modalities at various time points during the course of surgery including the perioperative period. [3,4]

In 2012, the American Society of Anesthesiologists (ASA) released an update to its Practice Guidelines for Acute Pain Management in the Perioperative Setting. [5]In this report, the ASA strongly recommends the use of a multimodal approach to pain management whenever possible. The ASA strongly recommends that a regional blockade with local anaesthetics be considered as a part of the multimodal approach to pain management. Regional block such as femoral nerve block, with local anaesthetics, remains a well-accepted component of comprehensive multimodal anaesthesia for postoperative pain management. [6]

AIM AND OBJECTIVES

AIM:

To study and compare the efficacy of femoral nerve block vs. adductor canal block when used as a part of a multimodal analgesia regimen in patients undergoing Total Knee Arthroplasty performed under subarachnoid block.

OBJECTIVES:

Primary objective:

To assess the effect of femoral nerve block and adductor canal block on

- The Pain intensity by NRS scale at specific three-point time intervals, till 24 hours post block.
- The duration of the sensory block.
- The duration of the motor block.

Secondary objective:

- To measure the total amount of opioids consumed, till 24 hours post block.

MATERIALS AND METHODS

1. Place of Study: Surabhi Institute of Medical Sciences, Siddipet, Telangana

2. Study Population: The study population was limited to the patients

undergoing elective Total Knee Arthroplasty under SAB.

3.Study Design: Prospective Observational Comparative Study Design.

4. Sample Size: The total number of patients in the study was 150 divided into two groups of 75 patients each.

GROUP A: 75 patients shot femoral nerve block and GROUP B: 75 Patients- single shot adductor canal block.

All 150 patients received preoperative oral pregabalin 75 mg bd one day before the surgery, IV acetaminophen 1 gm. before the incision intraoperative and was continued every 8 hourly till 24 hours from the time of complete administration of block in the postoperative period, and opioids (inj: fentanyl) for breakthrough pain in the postoperative period by PCA pump.

5. Study Duration: The study was conducted over a period of 2 years from January 2020 - December 2022.

Inclusion Criteria:
1. Age 40-70 years, consented.
2. American Society of Anesthesiologists (ASA) Status I-II.
3. Normal pre-operative mobility.
4. Mentally capable of comprehending and using the Numerical Rating Scale for Pain score.
5. Mentally capable of comprehending and using PCA pump.

Exclusion Criteria:
1. American Society of Anesthesiologists (ASA) Status III and above.
2. Age<40yror>70yr.
3. Patients not consenting to participate in the study.
4. Pre-existing sensory or motor neuropathy.
5. Immunosuppressed patient.
6. Systemic fungal infection.

6. Methodology:
This prospective, time-framed observational study was conducted in Surabhi Institute of Medical Sciences, after clearance from the ethical committee. The patients were recruited from January 2020 to December 2022. 150 patients were systematically divided into two groups, strictly adhering to inclusion and exclusion criteria for this study.

GROUP A: Single shot femoral nerve block with 30 ml 0.5% Ropivacaine under USG guidance

GROUP B: Single shot adductor canal block with 15 ml 0.5% Ropivacaine under USG guidance

All the 150 subjects received preoperative oral pregabalin 75 mg the day prior to surgery, IV acetaminophen 1gm stat before incision intraoperatively followed by 1gm 8 hourly till 24 hours in the postoperative period and opioid (fentanyl) for breakthrough pain in the postoperative period by PCA pump. TKA was performed under SAB.

RESULTS
In this observational audit, 150 patients were studied who underwent Total Knee Arthroplasty under subarachnoid block. Subjects were divided into two groups of 75 patients each namely GROUP A and GROUP B. The patients in GROUP A received single shot femoral nerve block and the patients in GROUP B received single shot adductor canal block. All the 150 subjects received preoperative oral pregabalin 75 mg bd one day prior to surgery, IV acetaminophen 1gm stat before incision intraoperatively followed by 1gm 8 hourly till 24 hours in the postoperative period, and opioids (fentanyl) for breakthrough pain in the postoperative period by PCA pump.

Table 1: The difference between the mean ages in the two groups was not significant, a *p-value* of 0 .3628.

		Number	Mean	SD	Minimum	Maximum	Median	p-value
AGE	GROUP A	75	63.6667	4.1860	53.0000	71.0000	64.0000	0.3628
	GROUP B	75	63.0800	3.6678	52.0000	69.0000	63.0000	

In group A, the mean age (mean± SD.) of patients was 63.6667 ± 4.1860 years. In group B, the mean age (mean± SD) of patients was 63.0800 ± 3.6678 years. The distribution of mean age vs. group was not statistically significant (p=0.3628).

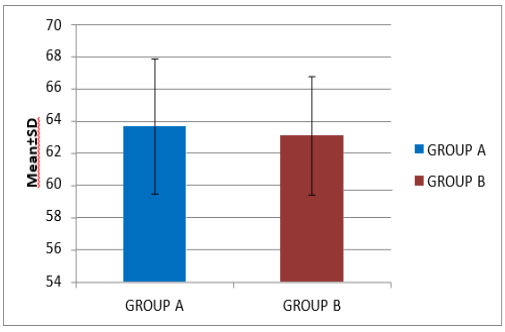

Diagram 1 – Distribution of mean age in both the groups.

Table 2: The difference between the sex in the two groups was not significant, Chi-square value: 3.2290; ***p*-value:** 0.0723

GROUPS			
SEX	GROUP A	GROUP B	TOTAL
Female	31	42	73
Row %	42.5	57.5	100.0
Col %	41.3	56.0	48.7
Male	44	33	77
Row %	57.1	42.9	100.0
Col %	58.7	44.0	51.3
TOTAL	75	75	150
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

In group-A, 31(41.3%) patients were female and 44(58.7%) patients were male. In group-B, 42(56.0%) patients were female and 33(44.0%) patients were male. The association of sex vs. group was not statistically significant (p=0.0723).

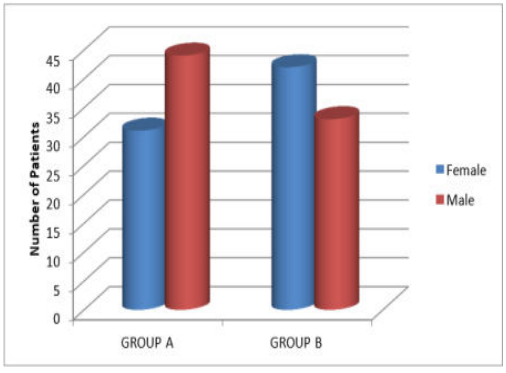

Diagram 2 –The Distribution of sex in both groups.

Table 3: The difference between the ASA in the two groups was not significant, Chi-square value: of 0.2308; and a ***p*-value: of** 0.6309.

GROUPS			
ASA STATUS	GROUP A	GROUP B	TOTAL
1	11	9	20
Row %	55.0	45.0	100.0
Col %	14.7	12.0	13.3
2	64	66	130
Row %	49.2	50.8	100.0
Col %	85.3	88.0	86.7
TOTAL	75	75	150
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

In group-A, 11(14.7%) patients had ASA status 1 and 64(85.3%) patients had ASA status 2. In group-B, 9(12.0%) patients had ASA status 1 and 66(88.0%) patients had ASA status 2. Association of ASA status vs. group was not statistically significant (p=0.6309).

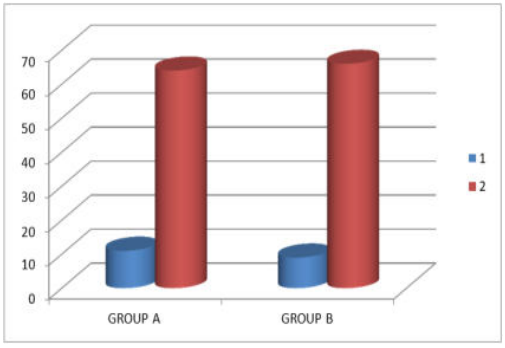

Diagram 3 – The Distribution of ASA in both groups.

Table 4: The difference between the hypothyroidism in the two groups was not significant, Chi-square value: 1.3843; *p*-value: 0.2393

GROUPS			
HYPOTHYROIDISM	GROUP A	GROUP B	TOTAL
NO	67	62	129
Row %	51.9	48.1	100.0
Col %	89.3	82.7	86.0
Yes	8	13	21
Row %	38.1	61.9	100.0
Col %	10.7	17.3	14.0
TOTAL	75	75	150
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

In group-A, 67(89.3%) patients were without hypothyroidism and 8(10.7%) patients were with hypothyroidism.

In group B, 62(82.7%) patients were without hypothyroidism and 13(17.3%) patients were with hypothyroidism. The association of hypothyroidism vs. group was not statistically significant (*p*-value: 0.2393).

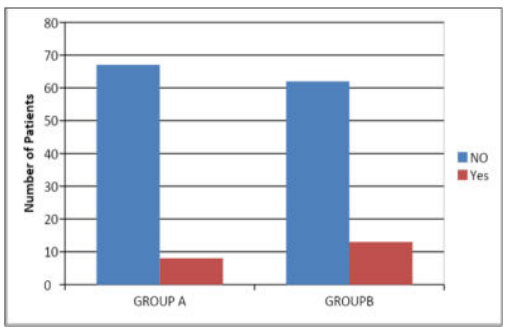

Diagram 4 – Distribution of Hypothyroidism in both groups.

Table 5: The difference between the hypertension in the two groups was not significant, Chi-square value: 1.4297; *p*-value: 0.2318

GROUPS			
HYPERTENSION	GROUP A	GROUP B	TOTAL
NO	52	45	97
Row %	53.6	46.4	100.0
Col %	69.3	60.0	64.7
Yes	23	30	53
Row %	43.4	56.6	100.0
Col %	30.7	40.0	35.3
TOTAL	75	75	150
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

In group-A, 52(69.3%) patients were without hypertension and 23(30.7%) patients were with hypertension.

In group B, 45(60%) patients were without hypertension and 30(40%) patients were with hypertension. The association of hypertension vs. group was not statistically significant (*p*-value: 0.2318).

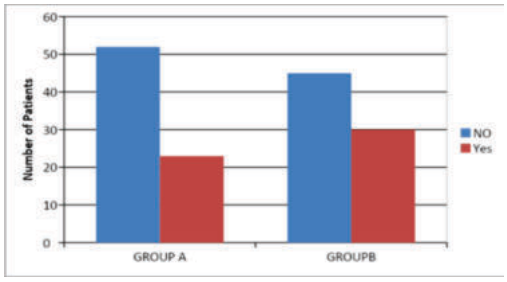

Diagram 5 – Distribution of Hypertension in both groups.

Table 6: The difference between the rheumatoid arthritis in the two groups was not significant, Chi-square value: 0.4286; *p*-value: 0.5126

GROUPS			
RHEUMATOID ARTHRITIS	GROUP A	GROUP B	TOTAL
NO	71	69	140
Row %	50.7	49.3	100.0
Col %	94.7	92.0	93.3
Yes	4	6	10
Row %	40.0	60.0	100.0
Col %	5.3	8.0	6.7
TOTAL	75	75	150
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

In group A, 71 (94.7%) patients were without rheumatoid arthritis and 4(5.3%) patients were with rheumatoid arthritis. In group B, 69(92.0%) patients were without rheumatoid arthritis and 6(8.0%) patients were with rheumatoid arthritis. The association of rheumatoid arthritis vs. group was not statistically significant (*p*-value: 0.5126).

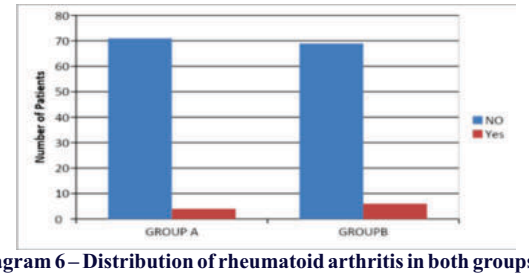

Diagram 6 – Distribution of rheumatoid arthritis in both groups.

Table 7: The difference between the smokers in the two groups was not significant, Chi-square value: 0.5282; *p*-value: 0.4673.

GROUPS			
SMOKER	GROUP A	GROUP B	TOTAL
NO	70	72	142
Row %	49.3	50.7	100.0
Col %	93.3	96.0	94.7
Yes	5	3	8
Row %	62.5	37.5	100.0
Col %	6.7	4.0	5.3
TOTAL	75	75	150
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

In group A, 70 (93.3%) patients were non-smokers and 5(6.7%) patients were smokers. In group-B, 72(96%) patients were non-smokers and 3(4%) patients were smokers. The association of smoking in the group was not statistically significant (*p*-value: 0.4673).

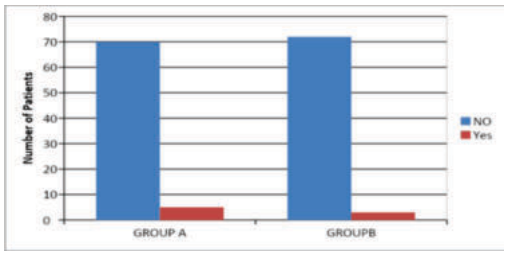

Diagram 7 – Distribution of smokers in both groups.

Table 8: The difference between the diabetes mellitus in the two groups was not significant, Chi-square value: 0.2789; *p*-value: 0.5974

GROUPS			
Diabetes Mellitus	GROUP A	GROUP B	TOTAL
NO	50	53	103
Row %	48.5	51.5	100.0
Col %	66.7	70.7	68.7
Yes	25	22	47
Row %	53.2	46.8	100.0
Col %	33.3	29.3	31.3
TOTAL	75	75	150
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

In group-A, 50(66.7%) patients were without diabetes mellitus and 25(33.3%) patients were with diabetes mellitus. In group B, 53(70.7%) patients were without diabetes mellitus and 22(29.3%) patients were with diabetes mellitus. The association of diabetes mellitus vs. group was not statistically significant (*p*-value: 0.5974).

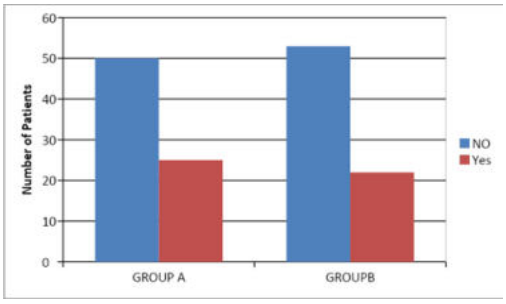

Diagram 8 – Distribution of diabetes mellitus in both groups.

Table 9: The difference between the chronic obstructive pulmonary disease in the two groups was not significant, Chi-square value: 0.0000; *p*-value: 1.0000

GROUPS			
CHRONIC OBSTRUCTIVE PULMONARY DISEASE	GROUP A	GROUP B	TOTAL
NO	66	66	132
Row %	50.0	50.0	100.0
Col %	88.0	88.0	88.0
Yes	9	9	18
Row %	50.0	50.0	100.0
Col %	12.0	12.0	12.0
TOTAL	75	75	150
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

In group A, 66(88.0%) patients were without chronic obstructive pulmonary disease and 9(12.0%) patients were with chronic obstructive pulmonary disease. In group B, 66(88.0%) patients were without chronic obstructive pulmonary disease and 9(12.0%) patients were with chronic obstructive pulmonary disease. The association of chronic obstructive pulmonary disease the group was not statistically significant (*p*-value: 1.000).

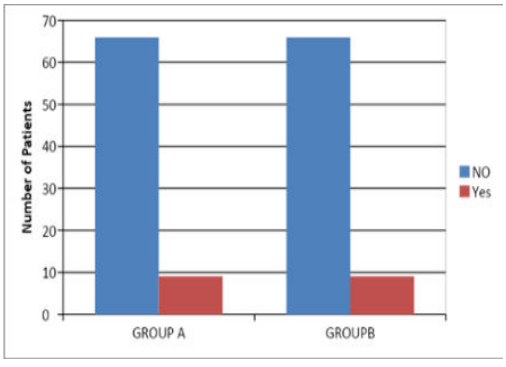

Diagram 9 – Distribution of chronic obstructive pulmonary disease in both groups.

Table 10: The difference between bronchial asthma in the two groups was not significant, Chi-square value: 0.0741; *p*-value: 0.7854

GROUPS			
BRONCHIAL ASTHMA	GROUP A	GROUP B	TOTAL
NO	68	67	135
Row %	50.4	49.6	100.0
Col %	90.7	89.3	90.0
Yes	7	8	15
Row %	46.7	53.3	100.0
Col %	9.3	10.7	10.0
TOTAL	75	75	150
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

In group-A, 68(90.7%) patients were without bronchial asthma and 7(9.3%) patients were with bronchial asthma. In group B, 67(89.3%) patients were without bronchial asthma and 8(10.7%) patients were with bronchial asthma. The association of bronchial asthma vs. group was not statistically significant (*p*-value: 0.7854).

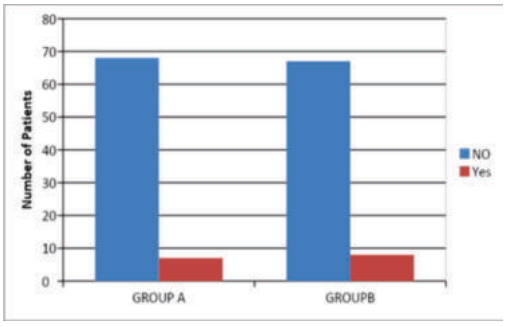

Diagram 10 – Distribution of bronchial asthma in both groups.

Table 11: The difference between the mean NRS PAIN SCORE at 6 HOURS in two groups was not significant, *p*-value: 0.5544

		Number	Mean	SD	Minimum	Maximum	Median	p-value
NRS PAIN SCORE AT 6 HOURS	GROUP A	75	2.8400	1.4708	0.0000	7.0000	3.0000	0.5544
	GROUP B	75	2.6933	1.5594	0.0000	6.0000	3.0000	

In group A, the mean NRS pain score at 6 hours (mean ± SD) of patients was 2.8400 ± 1.4708. In group B, the mean NRS pain score at 6 hours (mean ± SD) of patients was 2.6933 ± 1.5594. The distribution of the mean NRS pain score at 6 hours vs. group was not statistically significant (p=0.5544).

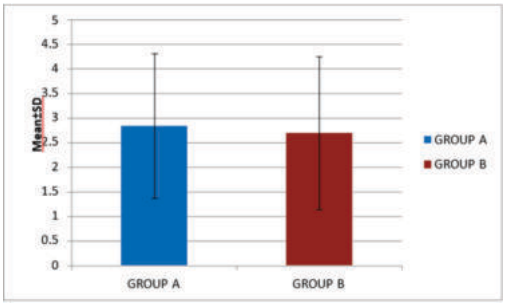

Diagram 11 – Distribution of mean NRS PAIN SCORE at 6 HOURS in both the groups.

Table 12: The difference between the mean NRS PAIN SCORE at 12 HOURS in two groups was not significant, *p*-value: 0.8553

		Number	Mean	SD	Minimum	Maximum	Median	p-value
NRS PAIN SCORE AT 12 HOURS	GROUP A	75	4.9467	1.3939	2.0000	7.0000	5.0000	0.8553
	GROUP B	75	4.9067	1.2858	2.0000	7.0000	5.0000	

In group A, the mean NRS pain score at 12 hours (mean± SD.) of patients was 4.9467 ± 1.3939. In group B, the mean NRS pain score at 12 hours (mean± SD.) of patients was 4.9067 ± 1.2858. The distribution of the mean NRS pain score at 12 hours vs. group was not statistically significant (p=0.8553).

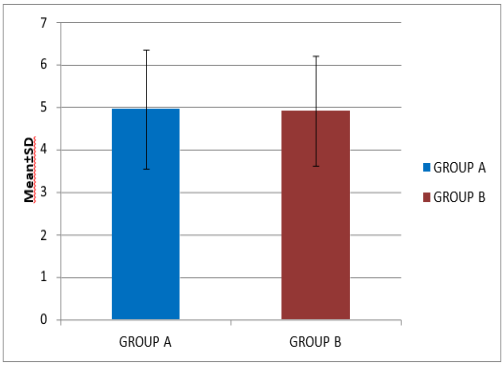

Diagram 12 – Distribution of mean NRS PAIN SCORE at 12 HOURS in both groups.

Table: Distribution of mean NRS PAIN SCORE AT 24 HOURS: GROUPS

		Number	Mean	SD	Minimum	Maximum	Median	p-value
NRS PAIN SCORE AT 24 HOURS	GROUP A	75	3.0533	1.4036	0.0000	7.0000	2.0000	0.7202
	GROUP B	75	2.9733	1.3252	2.0000	6.0000	2.0000	

Table 13: The difference between the mean NRS PAIN SCORE at 24 HOURS in the two groups was not significant, *p*-value: of 0.7202

In group A, the mean NRS pain score at 24 hours (mean± SD.) of patients was 3.0533 ± 1.4036. In group B, the mean NRS pain score at 24 hours (mean± SD.) of patients was 2.9733± 1.3252. The distribution of the mean NRS pain score at 24 hours vs. group was not statistically significant (p=0.7202).

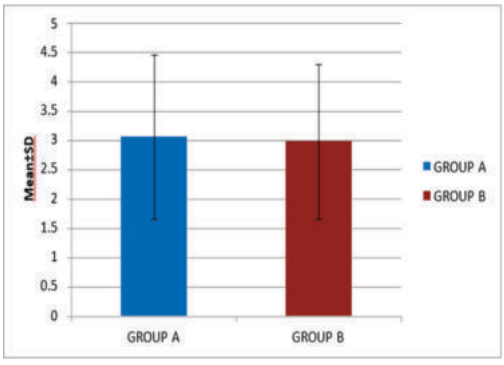

Diagram 13– Distribution of mean NRS PAIN SCORE at 24 HOURS in both the groups.

Table 14: The difference between the mean duration of sensory block in the two groups was not significant, *p*-value: of 0.1778**.**

		Number	Mean	SD	Minimum	Maximum	Median	p-value
DURATION OF SENSORY BLOCK	GROUP A	75	9.2400	1.8733	4.0000	12.0000	10.0000	0.1778
	GROUP B	75	8.8133	1.9844	4.0000	12.0000	9.0000	

In group A, the mean duration of sensory block (mean± SD) of patients was 9.2400 ± 1.8733 hours.

In group B, the mean duration of sensory block (mean± SD.) of patients was 8.8133 ± 1.9844 hours. The distribution of the mean duration of sensory block vs. group was not statistically significant (p=0.1778).

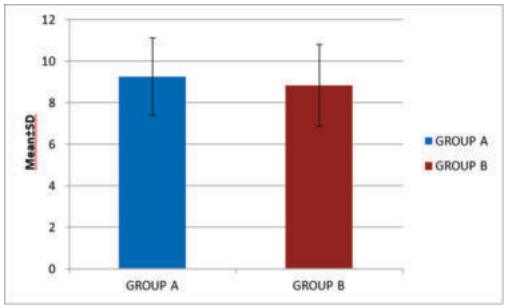

Diagram 14 – Distribution of mean duration of sensory block in both the groups.

Table 15: The difference between the mean duration of motor block in the two groups was significant, *p*-value: <0.0001

		Number	Mean	SD	Minimum	Maximum	Median	p-value
DURATION OF MOTOR BLOCK	GROUP A	75	11.3067	2.1684	6.0000	16.0000	11.0000	<0.0001
	GROUP B	75	8.2400	1.3541	5.0000	11.0000	8.0000	

In group A, the mean duration of motor block (mean± SD) of patients was 11.3067 ± 2.1684 hours. In group B, the mean duration of motor block (mean± SD.) of patients was 8.2400 ± 1.3541 hours. The distribution of the mean duration of motor block vs. group was statistically significant (p<0.0001).

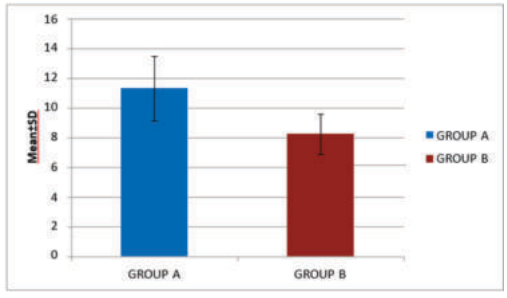

Diagram 15 – Distribution of mean duration of motor block in both the groups.

Table 16: The difference between the mean total amount of opioids consumed in the two groups was not significant, *p*-value: of 0.7345.

		Number	Mean	SD	Minimum	Maximum	Median	p-value
TOTAL AMOUNT OF OPIOIDS CONSUMED	GROUP A	75	132.6000	31.9666	40.0000	210.0000	135.0000	0.7345
	GROUP B	75	134.3333	30.4841	70.0000	210.0000	135.0000	

In group A, the mean total amount of opioids consumed (mean± SD.) of patients was 132.6000 ± 31.9666 mcg. In group B, the mean total amount of opioids consumed (mean± SD) of patients was 134.3333 ± 30.4841 mcg. The distribution of the mean total amount of opioids consumed vs. group was not statistically significant (p=0.7345).

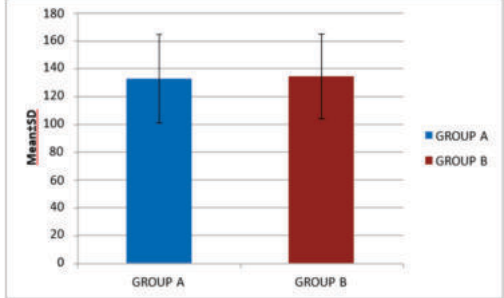

Diagram 16 – Distribution of mean total amount of opioids consumed in both the groups.

Results of Statistical analysis showed that, the demographic variables in both the groups like age, sex and ASA status were similar. The difference was statistically insignificant for age sex and ASA status in both groups with p values being p=0.3628, p=0.0723, and p=0.6309 respectively.

We found that the mean NRS pain scores at 6 hours, 12 hours and 24 hours in both groups were similar with the difference being statistically insignificant. In group A mean NRS pain score at 6 hours was 2.8400 ± 1.4708 and in group B it was 2.6933 ± 1.5594 with a p-value of 0.5544. The mean NRS pain score at 12 hours in group A was 4.9467 ± 1.3939 and in group B it was 4.9067 ± 1.2858 with p value of 0.8553. The mean NRS pain score at 24 hours in group A was 3.0533 ± 1.4036 and in group B it was 2.9733 ± 1.3252 with the p value of 0.7202.

We found that the difference in duration of sensory block was also not statistically significant in both the groups with the mean duration of sensory block in hours being 9.2400 ± 1.8733 in group A and 8.8133 ± 1.9844 in group B with p-value of 0.1778 and total amount of opioid consumption was also similar in both the groups with mean opioid consumption in micrograms being 132.6000 ± 31.9666 in group A and 134.3333 ± 30.4841 in group B with p-value of 0.7345.

We found that the duration of motor block after adductor canal block was significantly shorter than that of femoral nerve block with mean duration in hours being 11.3067 ± 2.16849 in group A and 8.2400 ± 1.3541 in group B with a p-value of <0.0001, which signifies that the difference in the duration of motor block was statistically significant.

DISCUSSION

In this study, we compared femoral nerve block and adductor canal block, as a part of a multimodal analgesia regimen in patients who underwent elective unilateral TKA under SAB, in terms of outcome measures like mean NRS pain score, duration of sensory block, duration of motor block and total amount of opioids consumed till 24 hours from the time of complete administration of the block.

A total of 150 patients included in the study were divided systematically into two groups of 75 patients each, group A (femoral nerve block) and group B (adductor canal block). All the patients in the study received a multimodal analgesia regimen in the form of oral pregabalin 75 mg bd preoperatively one day before surgery, IV acetaminophen 1 gram intraoperatively just before the incision and every 8 hourly till 24 hours in the postoperative period and opioids in the form of fentanyl through PCA pump postoperatively. Patients in group A received femoral nerve block and those in group B received adductor canal block.

Li, Jing-Wen *et al* [6], Pugely AJ *et al* [7] *and* Yong Bok Park *et al* [8] conducted a systemic review of literature in patients who have undergone total knee arthroplasty and found that subarachnoid block was superior to general anaesthesia. Length of hospital stay and postoperative complications were found to be less in patients who have undergone TKA under SAB as compared to those who have undergone TKA under GA.

In our study, we compared the femoral nerve block with the adductor canal block, as a part of a multimodal analgesia regimen to find out the effect of both the blocks on pain relief, duration of sensory block, and duration of motor block and the total amount of opioids consumed till 24 hours from the time of complete administration of block in patients undergoing TKA.

All the patients in our study received subarachnoid block for the surgery. As our study was restricted to 24 hours from the time of complete administration of peripheral nerve block we did not study the length of hospital stay. We did not notice any immediate postoperative complications in our follow-up till 24 hours.

Dixit V *et al* [9] conducted a randomized control trial comparing continuous catheter femoral nerve block (CFNB) to single-injection femoral nerve block (SSFNB) in terms of analgesia, and opioid consumption in patients who received multimodal analgesia regimen. They found that Pain scores did not differ in the catheter and single shot groups with mean pain scores being 3.5±2.4 and 2.9±2.0 respectively with a p-value of 0.266 and the average cumulative opioid (morphine) consumption at the end of 48 hours was 23±29.3 and 22±20 mg with a p-value of 0.863. They concluded that SSFNB block provides equal pain relief compared with CFNB, after TKA with no significant difference in opioid consumption when used along with multimodal analgesia.In our study patients in group A received single shot femoral nerve block as a part of a multimodal analgesia regimen. We noted that mean pain scores in our study in group A (femoral nerve block) were 2.8400 ± 1.4708 at 6 hours, 4.9467 ± 1.3939 at 12 hours and 3.0533 ± 1.4036 at 24 hours and opioid (fentanyl) consumption in micrograms was 132.6000 ± 31.9666. We got similar pain scores at 6 hours 12 hours and 24 hours as with that of **Dixit V et al [9]** . We used fentanyl instead of morphine which was used in the above study and hence the total amount of opioid requirement was non comparable with that of the above study. In our study, we did not administer continuous catheter femoral nerve block, as single-shot femoral nerve block is as effective as CFNB when used along with a multimodal analgesia regimen.

Tan Z *et al* [10] studied and compared the analgesic effect and early rehabilitation between adductor canal block (ACB) and femoral nerve block (FNB) after total knee arthroplasty. They found that there was no statistically significant difference in pain scores between both groups. They also found the quadriceps strength of the ACB group to be superior to the FNB group at 24 hours postoperatively with a *p-value*. Moreover, the ROM were significantly better at 24, 48, and 72 hours postoperatively in the ACB group than in the FNB group at 24, 48, and 72 hours with *p-value* <0 .001. The difference in the total amount of opioid (pethidine) consumption between the ACB (34.25 ± 22.35 mg) and FNB (32.50 ± 20.95 mg) groups postoperatively was not statistically significant with a p-value of 0.57.We got similar results in our study with the difference in mean NRS pain scores between Group A and Group B at 6,12 and 24 hours being statistically insignificant with p values of 0.5544, 0.8553,0.7202 respectively. In the above study done by **Tan Z et al[10],** they also found that the quadriceps strength for the ACB group was superior to that of the FNB group at 24 hours postoperatively with *P* value-0.02. These results were consistent with our study where we found that the duration of motor block after adductor canal block was significantly shorter than that of femoral nerve block with the mean duration being 11.3067 ± 2.16849 hours in group and 8.2400 ± 1.3541 hours in group B with p-value of <0.0001. In the above study done by **Tan Z et al[10]**, they used pethidine as an opioid, in our study we used fentanyl. Hence, the total amount of opioid requirement was non comparable with that of the above study. There was also a difference in the mean total amount of opioids consumed in both studies. The total amount of opioid(pethidine) consumed in the above study in mg was ACB (34.25 ± 22.35 mg) and FNB (32.50 ± 20.95 mg).In our study total amount of opioid(fentanyl) consumption in micrograms was 132.6000 ± 31.9666 in group A and 134.3333 ± 30.4841 in group B.**Karkhur Y *et al* [11]** conducted a systemic review of the literature, comparing the femoral nerve block and adductor canal block following total knee replacement. A total of 1279 patients, from 13 manuscripts were reviewed. Five of these publications were blinded randomized controlled trials (RCTs), three were non-blinded RCTs, and five of these were retrospective studies. Amongst 1279 total patients who were studied 669 received FNB while 610 received ACB. All the patients reviewed underwent primary TKA. They found that opioid consumption was found to be comparable with both interventions on the first and second postoperative day. Patients administered adductor canal block had better quadriceps power, longer ambulation distance, and shorter length of hospital stay.

In our study, the total amount of opioid consumption was similar in both groups with a p-value of 0.7345, suggestive of the difference being statistically insignificant. The results of our study were consistent with those of the above study.

We used the Bromage scale as an indirect assessment of the quadriceps muscle strength in contrast to the above study where few studies used a dynamometer and the others used the Bergs balance scale to assess the muscle strength. Our study was restricted to 24 hours from the time of complete administration of the block in contrast to the above studies which were studied till 48 hours postoperatively. We found that the duration of motor block after adductor canal block was significantly shorter than that of femoral nerve block with mean duration in hours being 11.3067 ± 2.16849 in group A. The above study had similar results.**Results of the systemic review of literature by Li D *et al*[9],** comparing ACB with FNB following total knee arthroplasty showed that, ACB significantly decreases pain score within eight hours (p<0.001) and at 24 hours (p<0.001) after the operation compared to FNB after TKA, and improves quadriceps strength (p<0.001) and

mobilization ability (p<0.001). However, the differences in pain score at 48 hours and opioid consumption were not significant between the two groups.

We got similar results in terms of the total amount of opioid consumption and duration of motor block. The total amount of opioid consumption till 24 hours from the time of complete administration of the block was similar in both the groups with p p-value of 0.7345, suggestive of the difference being statistically insignificant. They studied and compared the mean opioid consumption between both the groups till 48 hours; we did it for 24 hours from the time of complete administration of the block. We found that the duration of motor block after adductor canal block was significantly shorter than that of femoral nerve block with a p-value of <0.0001, suggestive of the difference being statistically significant. Our result was consistent with that of the above study. In our study, we used the "Bromage scale" as an indirect assessment of the quadriceps strength in contrast to the above study where the "TUG (Timed Up and Go) test" was used to assess the muscle strength.

In the above study, they found that the ACB group had better pain control over the FNB group till 24 hours and the difference was statistically significant with p p-value of <0.001. However, in our study, the results were contrasting as we found statistically insignificant differences in pain scores measured at 6, 12 and 24 hours with p values of 0.5544, 0.8553, and 0.7202 between group A and group B.**Yean Chin Lim *et al*** [12] In this randomized study 30 patients undergone TKA to received either ACB or FNB. Baseline tests of quadriceps strength were performed by a hand-held dynamometer and follow-up of muscle strength was done postoperatively by TUG test. Patient-controlled analgesia (morphine) was prescribed for postoperative analgesia. There were no statistically significant differences in morphine consumption in mg at 24 and 48 hours with p-values of 0.85 and 0.83 respectively. No statistically significant difference in quadriceps strength was observed at 24 hours and 48 hours with p-values of 0.84 and 0.79 in the ACB and FNB groups, respectively. They also found that the difference in pain scores was statistically insignificant between the two groups with a p-value of 0.54.

In our study, we found that the mean NRS pain scores at 6 hours, 12 hours and 24 hours in both the groups were similar with the difference being statistically insignificant with p values of 0.5544, 0.8553, 0.7202. The difference in the total amount of opioid consumption in both groups was statistically insignificant with a p-value of 0.7345. The results were similar to the above study.

In the above study, no statistically significant difference was noted for quadriceps strength in both the groups at 24 and 48 hours with p values being 0.84 and 0.79 respectively. In contrast to the results in the above study, we found that the duration of motor block after adductor canal block was significantly shorter than that of femoral nerve block with the mean duration being 11.3067 ± 2.16849 in group A, with a p-value of <0.0001. We used the Bromage scale as an indirect measure of muscle strength to calculate the duration of motor block. The lesser the duration of the motor block earlier the recovery from the motor block, which facilitates early mobilization.**Jaeger *et al*** [13], performed a double-blinded, randomized, controlled study of patients scheduled for TKA with spinal anaesthesia. The patients were randomized to receive either a continuous ACB or an FNB. They found that Quadriceps muscle strength measured by dynamometer was significantly higher in the ACB group compared with the FNB group with the p-value of 0.004. There were no difference between the groups regarding morphine consumption with a p-value of 0.94 and the pain scores at rest with a p-value of 0.21. They concluded that the Adductor canal block preserved quadriceps muscle strength better than FNB and the difference in opioid consumption and pain relief between both groups were statistically insignificant.

We found similar results, the NRS pain scores at 6 hours, 12 hours and 24 hours were statistically insignificant between both femoral nerve block and adductor canal block with p values 0.5544, 0.8553, and 0.702 respectively. Duration of sensory block and the total amount of opioids consumed were also statistically insignificant in both the groups with p values of 0.1778 and 0.7345 respectively. A dynamometer was used to measure the muscle strength in the above study; we used a Bromage scale to calculate the duration of the motor block as an indirect measure of muscle strength. We found a statistically significant difference in the duration of the motor block between the patients who received adductor canal block and femoral nerve block with a p-value of <0.0001, with lesser duration of motor block in patients who received adductor canal block. Few of our results were consistent with those of the above study.

A systematic review of the literature was conducted by **Kopp S L, et *al*** [14], **and Li, Jing-Wen *et al*** [6], with the aim to discuss the current postoperative pain management regimens for TKA. They found that multimodalanalgesia is considered the optimal regimen for perioperative pain management of TKA and improves clinical outcomes and patient satisfaction, through a combination of several types of medications and delivery routes, including preemptive analgesia, neuraxial anaesthesia, peripheral nerve blockade, patient-controlled analgesia and oral opioid/non-opioid medications.

In our study, we compared femoral nerve block and adductor canal block, as a part of a multimodal analgesia regimen. In our study, the multimodal analgesia regimen achieved lower pain scores and decreased opioid consumption till 24 hours in both groups. The mean duration of sensory block (mean± S.D.) in group A and group B was 9.2400 ± 1.8733 and 8.8133 ± 1.9844 hours respectively, with the difference being statistically insignificant (p=0.1778). The duration of sensory block in our study was the duration between the complete administration of peripheral nerve block and the time at which opioid (fentanyl) was consumed by the patient through the PCA pump. Two inferences were made from the above findings. One, the total amount of opioid consumption was practically nil till the duration of the sensory block, thus decreasing the total amount of opioid consumption. Second, the finding of mean pain scores at 12 hours being slightly more as compared to those at 6 hours and 24 hours might be because the effect of peripheral nerve block starts to wear off at around 12 hours.

Jain P *et al* [15], **Huang P *et al*** [16], ***and*** **Walder B *et al*** [17] investigated the analgesic effects of pregabalin, acetaminophen and opioids given by PCA pump respectively, in patients who had undergone TKA. They concluded that pain scores were lower when they were used as a part of a multimodal analgesia regimen.We designed our multimodal analgesia regimen by using pregabalin, acetaminophen and opioids through a PCA pump. With the above multimodal regimen which remained the same for all the patients in our study, we compared femoral nerve block and adductor canal block in patients undergoing TKA. The mean NRS pain score at 6 hours was 2.8400 ± 1.4708 in group A and in group B it was 2.6933 ± 1.5594 with a p-value of 0.5544. The mean NRS pain score at 12 hours in group A was 4.9467 ± 1.3939 and in group B it was 4.9067 ± 1.2858 with p value of 0.8553. The mean NRS pain score at 24 hours in group A was 3.0533 ± 1.4036 and in group B it was 2.9733 ± 1.3252 with the p value of 0.7202.

The mean pain scores were found to be mild to moderate on the NRS pain scale with NRS pain scores being less than 6 at all three specific time intervals till 24 hours in both the groups which shows the effectiveness of multimodal analgesia in the postoperative period following TKA.

Limitations:

The sample size was limited to 150 subjects because of both time and logistic constraints. The duration of our study was limited to two years. A similar study with a larger sample size and longer duration is desirable. The study design is an observational audit, randomized control trials are necessary for better extrapolation and validation of the outcomes and hence this has weakened the cogency of the study. We excluded the patients of ASA-PS Ⅲ from our study. We used subjective assessment to measure muscle strength; objective assessment would have strengthened our results. We studied and compared only four postoperative variables, NRS pain score, duration of sensory block, duration of motor block and amount of opioid consumed till 24 hours. We studied and compared NRS pain scores only at three-point intervals that is at 6, 12 and 24 hours. We did not measure the ambulatory distance and durationof hospital stay as our study was restricted to 24 hours postoperatively. Also, we did not include postoperative complications or side effects caused after 24 hours. In our study, we compared only the total dose of opioids consumed by the PCA pump not considered other analgesics like inj tramadol or inj diclofenac to be given on a when-required basis for severe pain in the postoperative period.

CONCLUSION

Adductor canal block or femoral nerve block when used as a part of a multimodal analgesia regimen in patients undergoing TKA under SAB, has:

- No difference in the pain scores at 6 hours, 12 hours and 24 hours after the administration of the block.
- No difference in the duration of sensory block.
- Duration of motor block is less with adductor canal block as compared to that of femoral nerve block, facilitating early mobilization in the former.
- The amount of Opioids consumed in both the adductor canal block and femoral nerve block are similar.

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