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EPIDURAL ANALGESIA VERSUS FEMORAL NERVE BLOCK AFTER TOTAL KNEE REPLACEMENT: COMPARISON OF EFFICACY AND SAFETY

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ABSTRACT

Aim of Study: To compare procedure of post-operative pain relief in TKR between epidural analgesia and femoral nerve block. We compared analgesic efficacy, side effects, post-operative knee rehabilitation and duration of hospital stay. **Materials and Methods:** Fifty cases posted for elective unilateral TKR under spinal anaesthesia were randomly divided into two groups. Patients in group E received epidural analgesia (0.125% bupivacaine 15 ml) and group F received femoral nerve block (0.125% bupivacaine 15 ml). Analgesic efficacy in term of onset of action & duration of analgesia was assessed by using VAS (0 to 10cm) for 24hr. No of rescue analgesic doses and side effects were also assessed. **Results:** in group E: VAS score >6 in epidural (7.31+/- 0.52) and in group F: VAS score (6.85 +/-0.34) which suggest longer duration of pain relief in epidural analgesia. Total incidence of side effects 27% in case of group E compared to 5% in group F. Hypotension, Nausea,. Itching, Back pain, are common side effects in group E. Patient satisfaction was greater with group F. Although post-operative knee rehabilitation and hospital stay were not different. **Conclusion:** There is longer duration of pain relief in epidural analgesia but group F represents optimal analgesia with fewer side effects and greater patient satisfaction. Femoral block is safe, cheap & easy. Required less skill, equipment and cost effective. So for age related safety purpose, femoral block has higher value for pain relief in TKR even than epidural gives more analgesia.

KEYWORDS: Total knee replacement, post-operative analgesia, Epidural analgesia, Femoral nerve block.

INTRODUCTION

Major knee surgery such as Total knee replacement is associated with moderate to severe post-operative pain which can contribute to immobility-related complications, delay in hospital discharge and interfere with functional outcome. Epidural analgesia has been popular for reduced blood loss & fewer thromboembolic complications using neuraxial techniques. A recent systemic review comparing lumbar epidural blockade with peripheral nerve blockade for post-operative analgesia reported better pain score in both techniques with fewer side effects in peripheral nerve blockade.

Peripheral nerve block provide effective unilateral analgesia with lower incidence of side effects, less motor block & fewer neurological complication compared to epidural analgesia. Various nerve block used in pain relief after TKR but femoral nerve block remains the mainstay because of its major nerve supply with or without supplementation of sciatic or obturator nerve block. This randomized controlled study compared the benefits of femoral nerve block with epidural analgesia for postoperative knee replacement surgery.

MATERIALS AND METHODS

50 adult patients, ASA 1-2, age above 20 yrs. scheduled for elective Total knee replacement surgery were randomly divided into two groups after approved by the ethics committee. Patient were familiarised with VAS & their informed written consent obtained. Patient with ASA 3 or above, Spine abnormality (scoliosis or kyphosis), Hypotensive episodes previous, Local anaesthetic toxicity OR drug toxicity, Low platelet count, Patient with high PT or INR, Raised ICT, Uncooperative patient, Neuropathies, Patient on anticoagulant, Infection at local site & Severe mitral or aortic stenosis were excluded from the study. Pre-operatively all pt. were hydrated with lactated ringer's solution 10 ml/kg.

All patient operated under spinal anaesthesia. in group E pt. epidural catheter inserted before spinal anaesthesia.in group F pt. femoral nerve block given by using nerve locater after completion of surgery.in both groups, 15 ml of bupivacaine 0.125% is injected after completion of surgery. After that, patients were transferred to post anaesthesia care unit. vitals were observed at 1, 2, 3, 4, 6, 8, 12, 18 & 24 hr. requirement of rescue analgesic doses in 24hr & side effects like nausea, vomiting, itching, hypotension any other were recorded.

Serial VAS Score was estimated to determine the following.

1) To observe the time of pain onset in hours after first dose. Pain in this situation was VAS Score>5(not including 5 in pain). This time is the time of drug given.
2) To observe the duration of pain relief in hours (duration is from the time of dose given to the VAS score >5) and number of doses given for pain relief for 24 hours.
3) To observe VAS Score at 1,2,3,4,6,8,12,18 and 24 hours. Patient was given a form to note down VAS Score and decide grade of pain on its own. During this period we also observed hemodynamic data such pulse, blood pressure.
4) Patient was observed for the same duration of time for supplementation dose.

A supplemental dose given to patient in case of group E (Epidural) was supplementation of Inj. Bupivacaine 0.125% 10-12 ml and in case of group F (Femoral) was Inj. Tramadol 1.5 mg/ml intravenous. In both situations Inj. Ondansetron was given to prevent side effect nausea or vomiting.[1]

5) Patient was also observed for any complication or side effects occur to them and drug given to relieve that situation. After 24hr, pt. was sent to the ward.

Statistical analysis

Power analysis using Stat-Mate 2.0 (GraphPad Software, San Diego, CA) showed that a sample size of 50 has an 90% power to relieve pain after TKR, with an α of 0.05.Chi square test was used for analysis of differences in age, sex, ASA grading and distribution of both group. In our study, quantitative data are presented in terms of mean ± SD or range. Results on continuous measurements are presented as mean ± SD and results on categorical measurements are presented as number (%). Student's t test (two-tailed, independent) was used to find out the significance of study parameters on a continuous scale between two groups on metric parameters. Significance was defined as $P < 0.05$. All statistical comparisons were accomplished with EpiInfosoftware (version 3.5.3, CDC Atlanta) and also assessed in Microsoft excel version 13 in data analysis.

OBSERVATION AND RESULTS

All the 50 patients have completed the study without any significant complication. There were no significant differences among the two treatment groups with regard to demographics data. The mean onset of time which is considered as VAS>5 in our study in group E 7.31± 0.52 & in group F 6.85 ± 0.35 which is highly significant($p<0.0006$).

Table 1: Consort chart

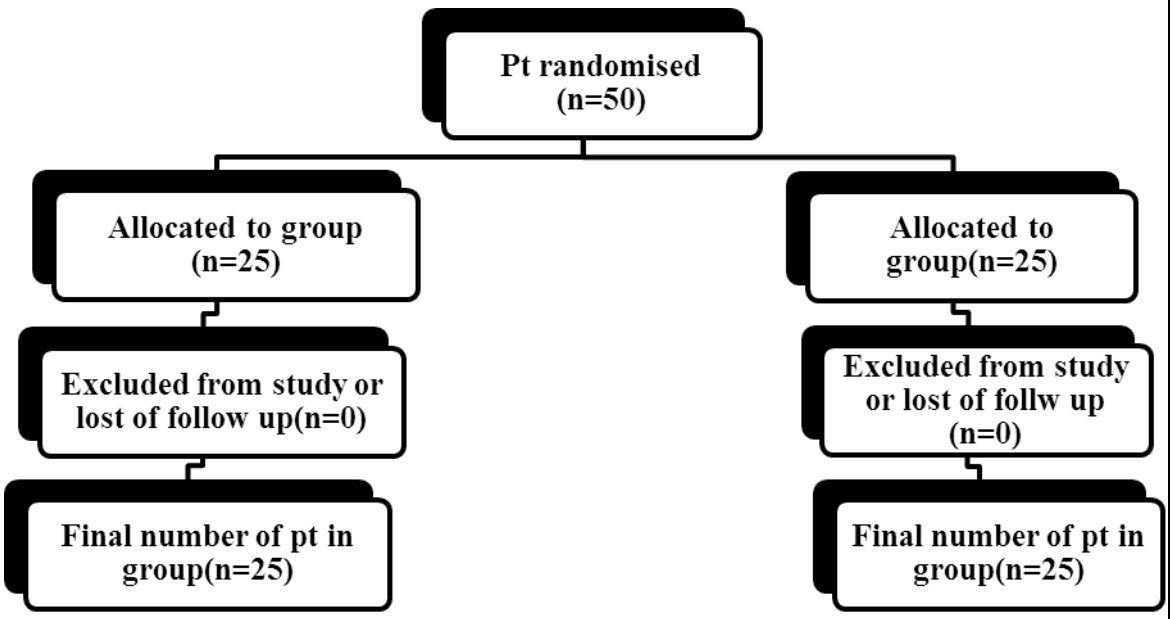

Table 2: Mean onset of action

Mean Time of Pain Onset	E	F	P Value
	7.31 ± 0.52	6.85 ± 0.34	0.0006

VAS score > 5, In Group E: 7.31 ± 0.52hr, Group F: 6.85 ± 0.34hr which is highly significant (P-value 0.0006 which is < 0.05).

Suggest that longer duration of pain relief in Group E.

Data is significant at 8 hours and 24 hours. Due to pain induced increased in pulse and blood pressure (P value < 0.005). But when comparing two groups data is highly insignificant with p value not < 0.005.

First 3 hours there is no pain for any group. After 4 hours mean VAS score is high in Group F compared to Group E p value < 0.05 except at 8 hours and 24 hours due to the early top up dose in Group F.

- Side effects are more in Group E compare to Group F.
- None of the any group of patient developed infection or drug toxicity.
- Hypotension (20% decrease in mean blood pressure), nausea, itching and back pain are more common in Group E compare to Group F. Total incidence of side effects in Group E: 27% & Group F: 5%.

DISCUSSION

Good postoperative analgesic management bring most gratifying smile on the patient's face in addition to other benefits like attenuation of the neuroendocrine stress response, reduction of postoperative pulmonary and cardiac complications, an opportunity to institute physiotherapy early that will in turn promote early mobilisation and put the patient on fast track mode. The patient required a postoperative analgesic regimen that is highly effective, has minimal side effect, is intrinsically safe and can be easily managed away from the hospital or surgical centre. This aspect is highly appropriated after Total Knee Replacement surgery. So we choose postoperative pain management in TKR patients. 2

Earlier studies comparing the two techniques show results consistent with the present study. In one study Salinas *et al.* 3 compared the single shot Femoral block with continuous Femoral catheter for postoperative pain relief after TKR. He concluded that pain relief after surgery decrease in hospital length stay and requirement of rescue analgesia in and also there was increase in range of motion and long term functional recovery in continuous catheter. So for that matter continuous catheter technique is more beneficial than single shot but economy purpose is main problem.

As in previous study Richman *et al.* 3 is favouring the use of peripheral nerve block is superior to intravenous opioids after major knee surgery in terms of side effect and uses of rescue analgesia and reduction in dose of top up drug.

In another study Singelyn *et al.* 5,6,7,8 discuss the use of three different group of analgesia after major knee surgery. He compared between intravenous PCA morphine (A), CEA (B) and Continuous 3 in 1 block (C). He concluded that there was significant decreased in pain score, side effect, duration of hospital stay and supplemental analgesia in group B and C as compared with group A. When compared for overall side effect group C was better while 3 in 1 block is more effective when compared with other two groups. This result is also in favour of our study.

Sanbiron *et al.* held a study same as Singelyn *et al.* except in this study he used femoral block instead of 3 in 1 block. His result also same as the previous study and favouring use of femoral block.

In contrast to above study some studies suggested that TKR pain relief cannot be relieved by sole femoral block. Due to extensive nerve supply of knee joint additional sciatic block or 3 in 1 block may be used for pain relief after major knee surgery.

Weber *et al.* 9, 10 proved that there was definite benefit to add sciatic block with femoral block for pain relief after major knee surgery like TKR. His results were comparable and there is decrease in VAS score and additional analgesia and duration of hospital stay.

He reported that 67% of the patients who had a femoral block required sciatic block post-operatively. In fact, there are nearly an equal number of studies arguing sufficient and insufficient pain relief at knee joint with femoral blockade alone.

Cook P *et al.* 11, Ben-David *et al 12*, Pham dang *et al.* 13 also had the similar kind of studies and they proved that addition of sciatic nerve block with femoral block has an extra pain relief and decrease in VAS score and postoperative supplemental analgesia. But there is no such difference when overall results compared.

Even the meta-analysis by Fowler *et al*. 14 is in agreement with our finding. The use of tramadol as a rescue analgesic mirrored non-significant difference showed by VAS scores. This study also indicated no difference in pain scores between CEA and peripheral nerve blocks (PNB), even when analysed separately, with or without sciatic block. But when compared with side effect profile femoral block is more superior to the CEA.

In our study there is no significant in age, sex, left or right side knee distribution, femoral or epidural distribution, ASA grading distribution. Mean time of pain onset is higher in epidural group, which is highly significant with p value 0.0006. So it proves that there is increased duration of pain relief with epidural than with femoral group. When we compare both group about mean VAS score at 1, 2, 3, 4, 6, 8, 12, 18 and 24 hours, it is like E:F is 1:1, 1:1, 1:1, 2.076:2.333 (p=0.03), 4.192:5.208 (p=0.0001), 7.846:7.375 (p=0.32), 2.038:3.291 (p=0.001), 5.0:5.833 (p=0.0004) and 7.884:4.625 (p=0.0001). So there is also significant in both groups but there is reversed data at 8 hours and 24 hours which were due to the early onset of pain and additional analgesia given to the patient with femoral group. Otherwise VAS score is comparable with results of other studies. Our results matches with the results of Sundarathitis P et al. (VAS score <5 for 24 hours except at 8 and 16 hours which are 7 and 8 respectively), Singelyn et al. (VAS score <5 for 24 hours except at 9 and 18 hours which are 6 and 8

respectively), Fowler et al. (VAS score <5 for 24 hours except at 8 and 16 hours which are 8 and 7 respectively). The side effects for these 2 groups are highly significant in favour of femoral group. In femoral group only 4.16% patient have side effect 8 which is only simple itching, while in epidural group 26.93% patients have chances of side effect which includes hypotension (7.69%) 15,16,17, itching (7.69%) 18, nausea (7.69%) 18 and back pain (3.84%) 18.

Comparison of rescue analgesia in our study is difficult due to smaller group size and the other problem is that one group has single shot femoral block while other group has epidural catheter. So top up doses given in different route and their mechanism of action is different. So the comparison may be bias. But when we compare individual group with the patients other than our study, in which any of the above technique is not used, there may be some conclusion. In patients other than our study which undergoing TKR requires Inj. Tramadol 2.5 mg/kg intravenous 8 hourly which is significant decreased in femoral group to single dose at the onset of pain 1.5 mg/kg intra venous? These results comparable with results of study of fowler *et al.* 19 and sundarathiti *et al.* 1 In this both study the dosage requirement was same as in our study i.e. 1.5-2 mg/kg in study group compare with 2-2.5 mg/kg in control group and more doses.

CONCLUSION

TKR surgery is very painful surgery and most common diagnosis for that is Osteoarthritis. The age group of the patient is slightly on higher side. The techniques we can use for pain relief are femoral block or epidural catheter. There is high amount of pain relief in epidural analgesia which is for longer duration but for concerning about side effect profile there is very high chances of side effect in epidural group than in femoral group. Femoral block is safe, cheap, easy, required less skill and equipment and cost effective while Epidural procedure is time consuming, requires high skill and more equipment and due to hemodynamic side effect more vigilance require during postoperative monitoring. So for age related safety purpose femoral block has higher value for pain relief in TKR surgery even though epidural gives more analgesia.

Declaration of Conflicting Interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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