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A Comparative Study between Continuous Epidural Infusion and Continuous Femoral Nerve Block for Post-Operative Pain Relief in Total Knee Replacement Surgeries

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Abstract

Background: Postoperative pain management in TKR is of imperative importance. Epidural analgesia though considered as a standard technique in postoperative pain management in TKR it was commonly associated with unwanted side effects such as hypotension and urinary retention. FNB is also a common method of analgesia which is a much easier technique to master and has a very low risk of side effects. *Aim:* To compare the efficacy between continuous epidural analgesia and continuous femoral nerve block for post-operative pain relief in Total knee replacement surgeries. *Methodology:* The study was conducted by the department of anaesthesiology of Vinayaka Misssions Kirupananda Variyar Medical College and Hospital,salem for a period of 1 year between Jan 2016–Dec 2016. A total of 60 patients were included in our study. 30 patients received continuous femoral nerve block and 30 patients received continuous epidural analgesia. The patient's pain assessment was done by visual analogue scale and Wong baker faces pain rating scale. Pain assessment was done every 4th hour for 48 hours. Patients were also monitored for any incidence of side effects. *Results:* Among the patients who had received femoral nerve block the visual analogue pain score ranged between 0 and 2, whereas among the patients who had received epidural analgesia the score ranged between 2 and 4. There was a statistically significant difference in the pain perception between the two groups and a similar type of pain perception was also seen with Wong baker faces pain rating scale. Epidural analgesia group of patients experienced higher incidence of side effects like urinary retention, nausea, vomiting and hypotension compared to femoral nerve block and the difference was found to be statistically significant. *Conclusion:* Continuous femoral nerve block can be recommended as an effective alternative to epidural analgesia for postoperative pain management in TKR.

Keywords: Epidural Analgesia; Femoral Nerve Block; Pain Rating Scale; Side Effects.

Introduction

Postoperative pain is the most common complaint following total knee replacement (TKR). When it is sever it delays the recovery period as well as the rate of complication as reported by most of the studies [1,2]. Singelynetal in his study had quoted that postoperative pain in TKR will be exacerbated by movement or reflex spasms of the quadriceps muscle which would invariably delay the postoperative physiotherapy which is considered to be very important from day one in the post TKR patients [3]. Prolonged pain may also lead on to complications related to cardiovascular and respiratory system [4,5].

Olden days management usually includes systemic administration of acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs), and opioids, but studies had proven that they were not able to produceadequate pain relief and it was also associated with certain adverse effects [6,7]. Though opioids were once considered as the gold standard postoperative pain relief drug of late the usage had been minimized due to the various side effects like respiratory depression, nausea, and vomiting [8,9].

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Recently multimodal approaches like regional anesthesia, patient-controlled intravenous or epidural analgesia, and local periarticular injection were considered to be more effective [10]. In 2009, Maheshwari *et al.* in her clinical experiences had mentioned that postoperative pain management after major joint surgeries had been substantially advanced [11].

Epidural analgesia still considered being one of the usefultechniques for pain relief in lower limb arthroplasties, but it is mostly associated with certain unwanted side effects such as hypotension and urinary retention [12].

Femoral nerve block (FNB) is another method of analgesia for postoperative pain control after TKR. One of the major advantage of this technique is it is an easy technique to master and has a very little risk of complications. When this block combines with lateral femoral cutaneous, and obturator nerves which is called as peripheral nerve block it produces an excellent analgesia effect [13]. FNB is usually performed as a single shot or as a continuous block using a catheter and an infusion. Generally continuous nerve blocks have the advantage of providing for a longer postoperative duration than the single-shot nerve blocks. Another major advantage of FNB is it does not provide a motor blockade to the leg which was not operated and so early ambulation is always possible. It also avoids the risk of epidural hematoma which is one of the common complication encountered with epidural analgesia [14,15]. Nerve blocks has the tendency of reducing the need for parenteral or oral analgesia [16].

As of today only very few studies in India had been done on comparing the efficacy between epidural analgesia and femoral nerve block in the postoperative pain management. So the present study was conducted in comparing the efficacy between these two procedures in postoperative patients who had undergone total knee replacement.

Aim

To compare the efficacy between continuous epidural analgesia and continuous femoral nerve block for post-operative pain relief in Total knee replacement surgeries.

Methodology

The study was conducted by the department of anaesthesiology of Vinayaka Misssions Kirupananda Variyar Medical College and Hospital, salem for a period of 1 year between Jan 2016 – Dec 2016. Patients who had been posted for TKR with ASA score 1 and 2 are included in the study. Patients with infected joints and any other co-morbid illness like diabetes, hypertension, obesity or patients on anti-coagulant drugs were excluded from the study. A total of 60 patients were included in our study. In the operating room, standard monitors were set up i.e. ECG, NIBP, Pulse Oximeter. Baseline values were recorded. All patients received spinal anesthesia with heavy bupivacaine 3.5ml with 50 mcgs fentanyl using 26G spinal needle. Dose adjustment was done according to the patient's age and weight.

At the end of surgery 30 patients received continuous femoral nerve block and 30 patients received continuous epidural analgesia. For femoral nerve block, patients were placed in supine position. Under aseptic precautions after draping the femoral area on the operated side, 18 G needle was used to locate the femoral nerve by using a peripheral nerve stimulator at 2Hz 2 ma with pulse width 100 micro seconds. After the needle was felt to have gone through 2 fascial planes, the quadriceps muscle twitch was elicited at an output of 0.2-0.6 mA. 20G Catheter was threaded through the needle 5cm into the femoral sheath. The needle was withdrawn and catheter secured in place by tunneling it 5-7 cm subcutaneously and fixed to the skin to avoid dislodgement. After negative aspiration for blood, test dose of 3ml of 1.5% Lignocaine with Adrenaline (1in 2 lac) was given and signs and symptoms of Intravascular injection was looked for. Once the spinal level regressed to L1 dermatome, 0.1ml/kg/hrof 0.125% Bupivacaine continuous infusion was started. Any further analgesia if required was supplemented with IV Tramadol and paracetamol.

In 30 patients 16G epidural catheter was placed before giving spinal anesthesia. In this group continuous infusion of 0.1ml/kg/hr of 0.125% Bupivacaine was given through the epidural catheter at the end of surgery once the spinal level regressed to L1. Further analgesia if required was given with IV Tramadol and paracetamol. The local analgesic infusion continued until 48 hours after surgery

Patients vital parameters like pulse rate, blood pressure, SpO2 and respiratory rate were assessed regularly for 48 hrs in the postoperative period. The patient's pain assessment was done by visual analogue scale and Wong baker faces pain rating scale. Pain assessment was done every 4th hour for 48 hours. Patients were also monitored for any incidence of side effects. All data were entered and analysed by

using SPSS version 20. Student T tests and Man-Whitney U test were used for deriving the statistical inference.

Results

Table 1 shows the demographic and the perioperative characteristics of the study subjects among the two groups. The mean age in both the groups was between 53 – 54 years and the males and females were almost equally distributed. The duration of surgery was nearly 2 hours in both the groups and the mean tourniquet time was between 84 – 87min in the two groups. So, this suggests that the study population were almost equally matched between the two groups and there was no significant difference among the demographic and operative characteristics. Postoperatively the patient's vital parameters were monitored on a 4 hourly basis for 48 hours. Systolic blood pressure, pulse rate, respiratory rate and SpO2 were measured. There was no significant difference among the vital parameters between the two groups. This suggest that both epidural analgesia and the femoral nerve block are hemodynamically stable without showing much variations in the vital parameters (Table 2).

The postoperative pain perception among the study groups was assessed by visual analog scale. The pain score ranges from 0 -10, where 0 indicates no pain and 10 indicates worst pain. It was measured once every 4 hours for 48 hours. Among the patients who had received femoral nerve block the score ranged between 0 and 2, whereas among the patients who had received epidural analgesia the score ranged between 2 and 4. There was a statistically significant difference in the pain perception between the two groups, where the group which received femoral nerve block experienced less pain than the group which had received epidural analgesia (Table 3). Similarly another pain perception scale called Wong Baker Faces pain rating scale was used to assess the pain postoperatively among the two groups. It is a 2 point scale ranges between 0 and 10. 0 indicates no pain and 10 indicate worst pain. Among the group which received femoral nerve block majority of them

Table 1: Demographic and perioperative characteristics of the study subjects

Parameters	Epidural analgesia group (n=30)	Femoral nerve block group (n=30)	P value
Age	53 ± 10.3	54 ± 9.4	0.731
Gender M/F	15/15	17/13	0.811
BMI	26.4 ± 2.4	27.2 ± 2.2	0.615
Duration of surgery (in mins)	119 ± 24	123 ± 22	0.592
Tourniquet time (in mins)	84 ± 17	87 ± 18.5	0.581

Table 2: Vital parameters of the study subjects in the postoperative period followed up for 48 hours

Vital parameters		Epidural analgesia group (n=30)	Femoral nerve block group (n=30)	P value
Blood pressure (systolic)	12 hrs	113 ± 8.4	116 ± 7.5	0.735
	24 hrs	118 ± 7.4	121 ± 7.2	0.615
	36 hrs	122 ± 8.2	124 ± 6.4	0.812
	48 hrs	120 ± 6.8	119 ± 5.4	0.581
Pulse rate	12 hrs	88 ± 4.5	87 ± 6.2	0.618
	24 hrs	84 ± 5.2	86 ± 5.5	0.783
	36 hrs	83 ± 6	80 ± 4.8	0.681
	48 hrs	80 ± 6.1	78 ± 4.5	0.718
Respiratory rate	12 hrs	15 ± 2.1	15.5 ± 2.4	0.815
	24 hrs	14 ± 1.8	15 ± 2.1	0.651
	36 hrs	14 ± 2.1	14 ± 1.7	0.719
	48 hrs	13 ± 1.8	14 ±1.9	0.814
SPO2	12 hrs	96.2 ± 1.8	96 ± 2.1	0.762
	24 hrs	96.8 ± 2.6	96.5 ± 2.4	0.718
	36 hrs	98 ± 1.6	97.6 ± 1.4	0.813
	48 hrs	97.8 ± 2.1	98 ± 1.6	0.836

Table 3: Distribution of the study subjects based on their postoperative pain perception assessed by Visual Analog Scale

Postoperative duration	Visual analog scale score	Epidural analgesia group (n=30)	Femoral nerve block group (n=30)	P value
12 hrs	0	0	16	<.001
	1	0	10	
	2	10	4	
	3	17	0	
	4	3	0	
Mean score		2.3 ± 1.3	0.7 ± 0.4	
24 hrs	0	0	15	<.001
	1	0	11	
	2	11	4	
	3	16	0	
	4	3	0	
Mean score		2.4 ± 1.3	0.7 ± 0.4	
36 hrs	0	0	6	<.001
	1	0	16	
	2	7	8	
	3	14	0	
	4	9	0	
Mean score		2.4 ± 1.3	0.83 ± 0.6	
48 hrs	0	0	15	<.001
	1	0	11	
	2	12	4	
	3	13	0	
	4	5	0	
Mean score		2.4 ± 1.3	0.7 ± 0.4	

Table 4: Distribution of the study subjects based on their postoperative pain perception assessed by Wong Baker Faces pain rating scale

Postoperative duration	Wong Baker Faces pain rating scale	Epidural analgesia group (n=30)	Femoral nerve block group (n=30)	P value
12 hrs	0	0	22	<.001
	2	11	8	
	4	19	0	
Mean score		3.33 ± 0.94	0.6 ± 0.91	
24 hrs	0	0	22	<.001
	2	12	8	
	4	18	0	
Mean score		3.33 ± 0.94	0.6 ± 0.91	
36 hrs	0	0	9	<.001
	2	11	21	
	4	19	0	
Mean score		3.33 ± 0.94	1.46 ± 0.88	
48 hrs	0	0	9	<.001
	2	11	21	
	4	19	0	
Mean score		3.33 ± 0.94	1.46 ± 0.88	

Table 5: Distribution of the study subjects based on the incidence of side effects

Side effects	Epidural analgesia group (n=30)	Femoral nerve block group (n=30)	P value
Nausea/vomiting	11 (36.6%)	0	<.001
Hypotension	9 (30%)	0	<.001
Pruritus	3 (10%)	0	<.001
Urinary retention	14 (46.6%)	4 (13.3%)	<.001
Supplementation of tramadol injection	8 (26.6%)	2 (6.6%)	<.001

scored 0, whereas among the group which received epidural analgesia majority of them scored 4 and this difference was found to be statistically significant. As the duration of postoperative period extended there was a change among the femoral nerve block group in the pain perception score among the majority of the patients the score had lowered to 2 from 0 (Table 4). This suggests that the pain control was better among the femoral nerve block group than the patients in the epidural analgesia group. The incidence of acute side effects was monitored in both the groups and it was found that the most common side effect was urinary retention followed by nausea/ vomiting and hypotension, and all these side effects were found to be more common in the epidural analgesia than the femoral nerve block group and this difference was found to be statistically significant and supplementation of tramadol injection for pain relief was also more in epidural analgesia group (Table 5).

Discussions

The various pain management techniques following TKA administration of NSAIDs or opioids, epidural block, and peripheral nerve block. Among these available options, peripheral nerve block had gained interest among most of the anaesthetist because of its long term analgesic effect and its very minimal risk of adverse effects. Among the various modes of peripheral nerve blockade which had been experimented on the patients FNB was found to be one of the most common option [17-19]. Our results demonstrated that continuous femoral nerve block showed significantly fewer side effects and with a significantly better pain relief after TKR when compared with epidural analgesia. Participants with peripheral nerve block had significantly fewer incidences of urinary retention, nausea and vomiting among various side effects.

The duration of the surgery and the tourniquet time was almost similar to the time quoted in the study done by Sang-Jin Park etal [20]. In our study we found that the hemodynamic response related to the vital parameters were almost similar in both groups, which is in par with the results quoted by Barrington MJetal [21]. The current study had shown that the femoral nerve block group patients had a better satisfaction when compared to the epidural analgesia with respect to their pain levels and the similar type of results was also mentioned in the study done by Sundarathiti Petal [22], whereas few other studies had stated that there was no significant difference in the pain levels between the femoral nerve block and the epidural analgesia patients [23-25]. Sakai et al [26] have suggested that continuous femoral nerve block is better pain management method for TKR, other studies have found that epidural analgesia is superior to femoral nerve block for pain control [27].

Although epidural analgesiawhich was once considered as the gold standard for pain management after TKR, some studies have shown that many patients suffer various side effects after epidural blockade. Among the various side effects which were reported the most common were urinary retention, pruritus, hypotension, nausea and vomiting and studies had quoted that the side effects occurs in 58-87% of patients [12,24]. Zaric et al [24] compared combined continuous femoral-sciatic nerve block with epidural analgesia after TKR. The frequency of side effects was lower in the peripheral nerve block group than in the epidural group. Whereas the study done by Davies,reported that adverse events were almost similar in both the methods, but he had not included urinary retention in his analysis [28]. Exaggerated dermatomal spreading of neural blockade and epidural opioids are associated with frequent side effects after epidural blockade [29]. The addition of opioids to local anesthetics for epidural blockade also causes postoperative nausea and vomiting [12]. In comparison, peripheral nerve block provides a more localized neural blockade. We did not add an opioid to local anestheticsfor femoral nerve block. In our study side effects occurred in 83.3% (25/30)of the patients in the epidural group and only 13.3% (4/30) of the patients in the femoral nerve block group experienced side effects. Urinary retention and nausea/vomiting were more common in the EPA group. Several other research groups have obtained similar findings and suggested peripheral nerve block an alternative to epidural analgesia for TKR [30,31].

One of the major strength of this study was the same drug with same strength and dosage was infused in both the groups and opiods were not used whereas in few studies different drugs with different strengths were used along with opiods. Limitation of the present study was all the patients were assessed for only 48 hrs and not throughout the postoperative period of 7 days, which is due to the logistics reasons.

Conclusion

This study had shown that the two applied techniques were significantly different in terms of postoperative analgesia where the femoral nerve

block seems to be superior than the epidural analgesia as well as the incidence of postoperative adverse outcomes was lower in the femoral nerve block group than in the epidural analgesia group. Continuous femoralnerve block can be recommended as an effective alternative to epidural analgesia for postoperative pain management in TKR.

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