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ORIGINAL ARTICLE

# Comparison of Continuous Epidural Analgesia and Intravenous Patient-Controlled Analgesia with Opioids in Terms of Postoperative Pain and Their Complications in Mega-Prosthesis Total Knee Arthroplasty for Bone Cancers

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**Abstract**
Total knee arthroplasty with mega-prosthesis in oncologic patients is a painful surgery and may be associated with nerve injury. Epidural analgesia (EA) with local anaesthetics (LA) is routinely used for pain relief in these patients. At our institute, we came across a high incidence of motor weakness in these patients compelling to shift to patient-controlled analgesia (PCA) with intravenous opioids. We retrospectively analysed our data to find the incidence and reasons for motor weakness and also to compare the efficacy of EA and PCA as analgesics. Over a period of 15 months, 68 patients were operated; out of these, 41 were in EA and 27 in PCA. Demographic details, level of epidural placement, drug used, pain scores, degree of motor weakness, measures taken to relieve the motor weakness and the improvement in symptoms after treatment were recorded. In the IV PCA group, details of drug used, dose of bolus, pain and sedation scores were analysed. Groups were comparable demographically. Motor weaknesses were present in 9 (22%) and 0 patients in EA and IV PCA groups respectively ($p = 0.009$). Average and maximum pain scores were significantly higher on day 1 in the IV PCA group ($p$ of 0.00 and 0.001 respectively). Maximum pain scores were also significantly higher in the IV PCA group on day 2 ($p = 0.010$). Two patients out of 27 in IV PCA were found drowsy. Motor weakness is known with EA but can be managed effectively using a lower concentration of LA or by stopping the infusion of LA.

**Keywords** Analgesia · Arthroplasty · Epidural · Local · Patient-controlled

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## Introduction

Patients undergoing bone cancer surgeries comprise special population. They suffer from pain extending from preoperative period and this sometimes becomes worst after surgery. Also, surgeries involving major bones are destructive so are very painful [1, 2]. These surgeries are sometimes associated with damage to nerves which also causes motor weakness which might lead to permanent damage. The most common major nerve complication associated with total knee arthroplasty (TKA) is peroneal nerve palsy which results in weakness of foot extensors and eventers causing a foot drop, sensory impairment of the anterolateral leg and dorsum of the foot. In our institute, the acute pain team found a high incidence of motor weakness in patients with EA. For this reason, we shifted to intravenous patient-controlled analgesia (IV PCA) with opioids as a modality for analgesia. We

retrospectively analysed the data to statistically evaluate the incidence, causes of motor weakness and the role of EA with local anaesthesia (LA) and IV PCA with opioids for postoperative pain relief and associated complications in megaprosthesis TKA.

## Methods

This retrospective analysis of prospectively collected data was approved by Institutional Ethics Committee. We included data collected from electronic medical records of acute pain services of institute over the period of 15 months.

All patients above 18 years of age who had undergone TKA in our institute with either EA or IV PCA for pain relief postoperatively were included in this study. Patients who underwent bilateral TKA, required reexploration or underwent a revision surgery, with preoperative motor weakness or the patients whose data was missing were excluded from the study.

Patients were divided into two categories, EA and IV PCA groups. All data pertaining to the patient in the form of demographic details, associated comorbidities, ASA physical status, level of epidural placement, drug solution used, pain scores, degree of motor weakness if present, measures taken to relieve the motor weakness and the improvement in symptoms after treatment were recorded. A modified Bromage score of 0–3 was used to assess motor weakness [3] and modified Bromage score $\geq$ 1 was considered as motor weakness. Patients also received paracetamol, diclofenac and tramadol as per requirement, and total dose needed was also noted. Maximum pain score and average pain score on days 1, 2 and 3 of surgery were compared. For assessment purpose, pain score was labelled as mild (score 1–3), moderate (score 4–6) and severe (score 7–10). The drug used in PCA along with the dose of bolus set was recorded. Sedation score was measured on Pasero opioid-induced sedation scale (POSS) from 0 to 3 [4]. Primary outcome measure was motor weakness and secondary outcomes were pain scores and sedation score.

During the 15-month period, data of sixty-eight patients were collected and analysed. All the data was entered and analysed using SPSS software (version 20.0). The values were expressed as mean with standard deviations for numerical data and percentages for categorical data. Comparison of data between the groups was done using ANOVA with repeated measures, the frequency was compared by chi-square test and pain sores were compared by Mann-Whitney tests.

## Results

Out of 68 patients enrolled, 41patients were in EA and 27 patients in IV PCA group. Anaesthesia techniques were general anaesthesia with epidural analgesia in EA group and general anaesthesia only in IV PCA group. No patient was having any motor weakness in preoperative period. Groups were comparable pertaining to demographic data, ASA grading, side and approach of surgery with $p$ values in correspondence to motor weakness. The most common site of epidural catheter insertion was L2–L3 interspace (22 patients, 53.7%) followed by L3–L4 (13, 31.7%) and L1–L2 (6, 14.6%). The 16 G Tuohy's needle was used in 28 patients whereas the 18 G was used in 13 patients. All the patients in both the groups were given round the clock non-opioid co-analgesics (nonsteroidal anti-inflammatory drugs and paracetamol), intravenously on postoperative day (POD) 1 and per-orally on POD 2 and 3.

In EA group, 9 (21.9%) out of 41 patients had neurological deficit; six amongst them had tingling and numbness. Three out of 9 patients with neurological deficit had bilateral motor weakness. None of the patients from the IV PCA group had motor weakness (Table 1). Out of 41 patients with epidural, 37 patients received bupivacaine infusion intraoperatively; the remaining 4 did not. None of the patients who developed motor weakness were applied a tourniquet. Twenty-one patients received 0.1% epidural bupivacaine, 10 received 0.0625% and 6 received 0.125% bupivacaine intraoperatively. As the concentration of local anaesthetic (bupivacaine) increased from 0.0625 to 0.125%, the number of patients having motor weakness also increased from 20 to 33% but this difference was not statistically significant ($p = 0.70$). All 41 patients were attached with a Fornia elastomeric pump (Royal Fornia Medical, China) for continuous infusion; out of these, 29 patients received 0.0625% and 12 patients received 0.05% bupivacaine infusion postoperatively and motor weakness was 24% and 16%, respectively, but this difference was not statistically significant. Eight out of 9 patients with motor blockade recovered with stopping of infusion, but one patient had prolonged block.

Twenty-seven patients received IV PCA (CADD-Legacy® PCA Pump from Smiths Medical, USA) in the postoperative period; out of these, 21 patients received fentanyl PCA with a demand dose of 15 or 20 mg and 6 patients received morphine with a demand dose of 1 or 2 mg.

Maximum and average pain scores (mean ± SD) are described in Table 2. Two (7.4%) patients out of 27 were found

**Table 1** Comparison of weakness in epidural analgesia and IV PCA groups

| Groups | $N$ | Motor weakness | | $p$ value |
|---|---|---|---|---|
| | | Yes | No | |
| EA | 41 | 9 (22%) | 32 (78%) | 0.009* |
| IV PCA | 27 | 0 | 27 (100%) | |

*EA*, epidural analgesia; *IV PCA*, intravenous patient-controlled analgesia
*Statistically significant

**Table 2** Maximum and average pain scores (mean ± SD) in EA and IV PCA groups on days 1, 2, and 3 with *p* values of comparison for motor weakness

| Pain scores/days | Modality | Day 1 | Day 2 | Day 3 |
|---|---|---|---|---|
| Average pain score (mean ± SD) | EA | 1.80 ± 0.67 | 1.46 ± 0.596 | 1.41 ± 0.74 |
| | IV PCA | 2.74 ± 1.19 | 1.85 ± 0.94 | 1.48 ± 0.69 |
| | *p* value | *0.00 | 0.105 | 0.628 |
| Maximum pain score (mean ± SD) | EA | 3.46 ± 1.14 | 2.90 ± 0.94 | 2.95 ± 1.20 |
| | IV PCA | 4.48 ± 1.39 | 3.74 ± 1.48 | 2.93 ± 0.99 |
| | *p* value | *0.001 | *0.010 | 0.764 |

*SD*, standard deviation; *EA*, epidural analgesia; *IV PCA*, intravenous patient-controlled analgesia

*Statistically significant (Mann-Whitney test)

to be occasionally drowsy with a sedation score of 1; one was on fentanyl PCA and the other was on morphine. Sedation scores were comparable between fentanyl and morphine users. No other complication was noted in IV PCA group.

## Discussion

TKA for malignancy being a major and destructive surgery is associated with nerve injury. The problems with postoperative neurological deficit include the following: the surgeon may find it difficult to assess the results of surgery, sensory blockade may delay the identification of compartment syndrome, delayed mobilization and physiotherapy resulting in increased risk of pulmonary complications, venous thrombosis, patient discomfort, medico-legal problems leading to anxiety for the anaesthetist, need for additional imaging such as MRI of the spine with its resulting costs, radiation exposure and patient distress [5].

Although the patients who received a higher concentration of bupivacaine proportionately had higher motor block but this was not statistically significant. Time of mobilization was comparable in both groups receiving epidural and IV PCA. No correlation was found between the level of insertion, attempts of insertion and neurological deficit. Although, Ahmed et al. state that the incidence of lower limb weaknesses was more in patients when the level of insertion was L2–L3 [6]. This may be because their comparison was between lumbar and thoracic epidurals whereas, in our study, only lumbar epidurals were inserted.

The limitation of our study is that patients in groups were unequal in number and there is also a small sample size of 68 patients.

## Conclusion

In conclusion, neurological complications like motor weakness with EA are known and can impair motor assessment after surgery but this can be managed effectively by the vigilant acute pain service team and using a lower concentration of LA.

**Compliance with Ethical Standards** This retrospective analysis of prospectively collected data was approved by Institutional Ethics Committee.

**Conflict of Interest** The authors declare that they have no conflict of interest.

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