

## Original Research Article

# Comparison of functional outcome at three month follow up using knee society score in patients undergoing total knee replacement by ERP and non ERP

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### ABSTRACT

**Background:** Comparison of functional outcome at three month follow up using knee society score in patients undergoing total knee replacement by ERP and Non ERP.

**Methods:** In this prospective study of 29 patients in group (II) who underwent total knee arthroplasty using Enhanced recovery protocol and compared with 29 patients in control group (I) whose data was obtained from hospital database in Lilavati Hospital & Research Centre, Mumbai.

**Results:** The majority of the patients were from the age group of 61-70 years in both group I & II. There was female predominance in our study. The mean length of stay for group I was 5.69 days and for group II 3.28 days. The average knee clinical score in group I was pre op 33.52 which improved to an average post-op score of 82.62 at 3 months and for group II it improved from 34.21 to 84.66 at 3 months. The average pre-op knee functional score was 43.28 which improved to an average post-op score of 85.00 at 3 months in study group II. The average pre-op Knee Society Score was 77.14 which improved to an average post-op score of 169.66 at 3 months follow up for group II.

**Conclusions:** The results of the present study showed that patients who underwent TKA using ERP protocol has reduced length of stay in hospital, significantly improved KSS proving TKA as an effective procedure that is associated with substantial functional improvement.

**Keywords:** ERP, Non ERP, Total knee arthroplasty, Knee functional score, Knee society score, Knee clinical score

### INTRODUCTION

Osteoarthritis (OA) also known as degenerative arthritis or degenerative joint disease or osteoarthrosis, is a group of mechanical abnormalities involving degradation of joints, including articular cartilage and subchondral bone.<sup>1</sup> The word 'osteoarthritis' originated from the Greek word "osteo", meaning "of the bone", "arthro", meaning "joint", and "it is", meaning inflammation, although the "it is" of osteoarthritis is somewhat of a misnomer – inflammation is not a conspicuous feature which is present in rheumatoid or autoimmune types of arthritis. Some clinicians refer to this condition as

osteoarthrosis to signify the lack of inflammatory response.<sup>2</sup> OA knee increases with age (older than 50 years), especially in women.<sup>3</sup> Total knee arthroplasty has become an acceptable method of surgical management for severe, disabling arthropathy. The major indication for total knee arthroplasty is pain, followed in a much lower frequency by instability, loss of motion, and deformity. Knee arthroplasty is very effective in preserving functional knee motion, with relief of pain. Total knee arthroplasty (TKA) is the most widely practiced surgical options for Osteoarthritis of knee all over the world and its application is rising in India.<sup>4</sup> Long-term results have indicated that TKA can provide a

pain-free and comfortable life with increased functional capacity for up to 2–3 decades following surgery.<sup>5</sup> Various studies were done to focus on both economic profitability and patient satisfaction such as by reducing the cost of implants and reducing length of stay by streaming the patients from diagnosis till discharge. In contrast to the more economic orientated and -driven approach, Professor Henrik Kehlet developed a fast-track concept, which focused on optimization of clinical features allowing the patient to recover faster – and then secondarily resulting in a reduction of LOS as convalescence was shortened.<sup>6</sup> Therefore Reduction in perioperative complications, accelerated recovery, and shorter hospital stays are now being evaluated as new goals in the current treatment and rehabilitation of TKA patients. A rapid recovery algorithm was developed and applied to TKA cases in the USA in the 1990s to provide standardization of procedures. This rapid recovery algorithm is defined as an interdisciplinary treatment protocol which aims to shorten recovery time and provide better clinical outcomes.<sup>7</sup> During the last decade, however, there has been increased interest in optimal multimodal perioperative care to enhance recovery (the fast-track methodology). Improvement of analgesia; reduction of surgical stress responses and organ dysfunctions including nausea, vomiting, and ileus; early mobilization; and oral nutrition have been of particular interest.<sup>8</sup> These principles have also been applied to TKA, resulting in improvements in pain treatment with multimodal opioid-sparing regimens including a local anesthetic infiltration technique (LIA) or peripheral nerve blocks to facilitate early mobilization and allowing functional rehabilitation to be initiated a few hours postoperatively ultimately leading to a reduction in LOS.<sup>9</sup> LOS is defined as hospitalization from day of surgery till discharge (including transferrable between department) counted as postoperative nights in hospital.<sup>10</sup> In spite of good evidence base supporting the benefits of rapid recovery surgical programmes, the widespread application and implementation of this approach has not occurred in Indian orthopaedics.<sup>11</sup> Hence we performed this study to evaluate the utility of enhanced recovery protocol (ERP) in the outcome of Total Knee Arthroplasty (TKA) in tertiary care hospital. The purpose of this study was to compare the length of stay and functional outcome of a rapid recovery protocol for TKA with a current standard protocol.

## METHODS

This is a non randomised prospective and retrospective hospital based study carried out at Department of Orthopaedics, Lilavati Hospital & Research Centre (LHRC), Mumbai during the period of April 2015 to December 2016. The study population comprised of 58 patients divided into two group. 29 patients in group 1 (ERP=enhance recovery protocol) and 29 patients in group 2 (NON ERP). Both male and female patients admitted in Lilavati Hospital & Research Centre for knee arthritis between May 2013 and December 2016 by the

same surgeon and underwent primary total knee arthroplasty were included. Revision TKA for any cause and bilateral TKA were excluded from the study. The study was approved and clearance was obtained from the Ethical Committee of Lilavati Hospital and Research Centre, Mumbai. Calculation of their knee score and function score and then it compared with their pre-operative scores.

Data were analysed using SPSS 15.0 (Statistical Package for Social Sciences, Version 15.0).



**Figure 1: Posterior capsule infiltration.**



**Figure 2: Local infiltration consisting of antibiotics+ 20 ml 0.25% bupivacaine+20 ml saline +adrenaline (3 drops) and steroid (depomedrol 80 mg).**

Control group (Group 1) The pre-operative and post-operative scores (KSS) of 3 months follow-up were retrieved from the surgeon's database for comparison and from MRD length of hospital stay, co-morbidities, VAS Score during stay and complications if any, were noted. Clinical assessment was done using the Knee Society Score which is divided into knee score (100 points) and function score (100 points); points were awarded or deducted according to the specific criteria.<sup>12</sup> The knee score and the function Score were considered separately. Study group (Group 2): All patients who underwent

primary total knee arthroplasty between May 2015 and December 2016 by the same surgeon. Control group: (Group 1) All patients who underwent primary Total Knee Arthroplasty between May 2013 and April 2015 by the same surgeon prior to implementation of ERP protocol. Pre-operatively fitness taken for surgery. One day prior to surgery the patients were admitted and the physiotherapy session was given to study population (ERP group 2). After a thorough pre-op evaluation all patients were taken up for surgery by the same surgical team under regional anaesthesia + postoperative nerve block for group II and general anaesthesia or regional anaesthesia with continuous epidural for 48 hours for group I. All patients had a similar medial parapatellar surgical approach. Knee was flexed and anterior cruciate ligament, and menisci were excised and posterior cruciate ligament was either retained or sacrificed depending on the severity of the deformity. Ligament balancing was performed prior to bone resection. Tibia was subluxated anteriorly and externally rotated to improve the exposure to relax the extensor mechanism. Using extramedullary tibial guide, tibial resection was done perpendicular to its mechanical axis with 5 degrees of posterior slope and approximately 6 to 8 mm of proximal tibia removed as measured from intact compartment. The Whiteside line and the trans-epicondylar line were made over the femoral condyles. The hole was placed medial and anterior to the anteromedial corner of the intercondylar notch. Using intramedullary femur resection guide distal femoral cut was done at valgus angle of 5 to 7 degrees, perpendicular to the predetermined mechanical axis of the femur. Trial prosthesis inserted and alignment and stability checked. After satisfactory reduction, the patella was prepared and peg holes made for resurfacing.<sup>13,14</sup> Local infiltration consisting of antibiotics + 20 ml 0.25% bupivacaine + 20 ml saline + adrenaline (3 drops) and steroid (depomedrol 80 mg ) in non-diabetic patient was injected around joints mostly the posterior capsule (Figure 1 and 2) for postoperative pain control in study group population (group II).<sup>7,8</sup> A cut bone surface was cleaned with pulsatile lavage irrigator using saline. All components were cemented in place simultaneously. Patellofemoral tracking was also checked, if not proper then lateral release was done to secure proper tracking. Capsule and extensor mechanism was closed in knee flexed position over negative suction drain. Subcutaneous tissue and skin closed in layers. Compressive dressing was given. The catheter was inserted in adductor canal for continuous infiltration of local anaesthetic drug in group II.



**Figure 3: Post-operative physiotherapy mobilization on same day with walker and adductor block *in-situ*.**



**Figure 4: Postoperative image of right knee TKR.**

**Table 1: Comparison between standard and ERP protocol.**

Category	Standard (non ERP)	ERP
<b>Preoperative</b>	All fitness done after getting admitted.	All fitness done prior to admission. Patient admitted night before surgery and physiotherapy session given.
<b>Intra-operative</b>	General anaesthesia /spinal anaesthesia with epidural catheter without local infiltration. Urinary catheterization done.	Spinal anaesthesia with adductor block and local infiltration. No urinary catheterization.
<b>Immediate post op</b>	NBM for 4-6 hours.	NBM out immediately after surgery.

Continued.

Category	Standard (non ERP)	ERP
<b>First mobilisation postsurgery</b>	Postoperative day 2	On the same day of surgery <sup>15</sup>
<b>Physiotherapy</b>	Daily physiotherapy in single session	Two sessions of physiotherapy
<b>Planning of discharge</b>	Depends on the patient: Individual pain medication and discharge planning was done when the patient felt fit for according to discharge criteria.	A patient knows that early discharge is scheduled.
<b>Removal of catheter</b>	Urinary catheter removal on postoperative day 2	No urinary catheter is used
<b>Pre op physiotherapy</b>	No preoperative physiotherapy session	Preoperative physiotherapy session

## RESULTS

The majority of the patients were from the age group of 61-70 years in both groups which accounts for 48.3% in group I and 44.8% in group II of patients in our study. The mean age was 67.83 for group I and 64.31 for group II with p value (0.13) there was no significance difference in mean age of both group. There was a female predominance in our study. In group I 21 patients (72.4%) were female and 8 patients (27.6%) were males, in group II 22 patients (75.9%) were female and 7 (24.1%) were males. The mean length of stay for group I was 5.69 and for group II 3.28 with p value <0.001 there was significant difference in length of stay between two groups.

### *Knee clinical score*

The average pre-op knee clinical score (KCS) was 33.52 in this study which improved to an average post-op score of 82.62 at 3 months. The difference between the mean of pre-op KCS and post-op KCS at 3 months for group I was 49.10. The p value was significant (p<0.001) when the pre-op and post-op knee clinical scores at 3 months were compared for GROUP I. For Group 2, the average pre-op knee clinical score was 34.21 in this study which improved to an average post-op score of 84.66 at 3 months. The difference between the mean of pre-op KCS and post-op KCS at 3 months for group II was 50.45. The p value was significant (p<0.001) when the pre-op and post-op knee clinical scores at 3 months were compared for Group II. On comparison no significant difference (p=0.095) was found at 3 month post OP KCS follow up between group I and group II.

### *Knee functional score*

The average pre-op knee functional score (KFS) in this study was 43.28 with minimum score of 20 and maximum score 50 which improved to an average post-op score of 79.07 at 3 months with minimum score of 60 and maximum score of 90. The difference between the mean of pre-op KFS and post-op KFS at 3 months was 35.97. The p value (<0.001) shows significant difference between pre-OP and 3 month POST -OP for Group I. For Group 2 the average pre-op KFS in this study was 43.28

with minimum score of 30 and maximum score 50 which improved to an average post-op score of 85.00 at 3 months with minimum score of 75 and maximum score of 90. The difference between the mean of pre-op KFS and post-op KFS at 3 months was 41.72. The p value (<0.001) shows significant difference between pre-OP and 3 month post -OP for GROUP II. On comparison of 3 month KFS there was significant difference between 3 month post OP KFS between group I and group II.

### *Grading of knee clinical score (KCS)*

The clinical score was graded excellent in 12 patients of group I and 18 patients of group II and good in 17 patients of group I and 11 patients of group II. The p value (0.19) shows no significant difference in grading of KCS between two group I and group II. The clinical score was graded excellent in 41.4% for group I and 62.1% for group II and graded good in 58.6% in group I and 37.9% in group II (Table 2).

**Table 2: Grading of KCS.**

KCS	Group I (%)	Group II (%)	Total
<b>Excellent (85-100)</b>	12 (41.45)	18 (62.1)	30
<b>Good (84-70)</b>	17 (58.6)	11 (37.9)	28
<b>Fair (69-60)</b>	0 (0.0)	0 (0.0)	0
<b>Poor (&lt;60)</b>	0 (0.0)	0 (0.0)	0
<b>Total</b>	29 (100)	29 (100)	58

**Table 3: Grading of KFS.**

KFS	Group I (%)	Group II (%)	Total
<b>Excellent (85-100)</b>	10 (34.5)	23 (79.3)	33
<b>Good (70-84)</b>	17 (58.6)	6 (20.7)	23
<b>Fair (60-69)</b>	2 (6.9)	0 (0.0)	2
<b>Poor (&lt;60)</b>	0 (0.0)	0 (0.0)	0
<b>Total</b>	29 (100)	29 (100)	58

### *Grading of KFS*

The functional score was graded excellent in 10 patients of group I and 23 patients of group II, good in 17 patients of group I and 6 patients of group II and 2 patients was

graded fair in group I. The p value ( $p=0.002$ ) shows significant difference in grading of KFS between two group I and group II (Table 4).

### Knee society score

The average pre-op knee society score (KSS) in our study was 76.79 which improved to an average post-op score of 160.66 at 3 months follow up. The minimum pre-op score is 37 and maximum score is 98 which improved to minimum score of 137 and maximum of 180 at 3 month post-op. Mean difference between pre-op and 3month post-op is 83.87. The p value ( $<0.001$ ) shows significant difference between preop and 3 month post op KSS for group 1. The average pre-op KSS in our study was 77.14 which improved to an average post-op score of 169.66 at 3 months follow up. The minimum pre-op score is 51 and maximum score is 98 which improved to minimum score of 153 and maximum of 180 at 3 month postoperatively. Mean difference between pre-op and 3 month post-op is 92.52. The p value ( $<0.001$ ) shows Significant difference between preop and 3 month post op KSS for group II.

The mean difference between two groups at 3 month follow up post-op is 6.03. P value=0.001 shows difference between two groups at 3 month post op KSS (Table 4).

**Table 4: Comparison of 3 month KSS between group I and group II.**

3 month KSS	Mean±SD
Group 1 (n=29)	160.66±12.11
Group 2 (n=29)	169.66±6.95
t value, significance and p value	T =3.5, S, p=0.001

### VAS score during stay in hospital

The mean vas score during stay on day 1 is 1.79 for group I and 1.21 in group II, p value ( $p=0.003$ ) which is significant difference between two groups on day 1. Mean on day 2 for group 1 is 1.48 and 1.28 for group 2, p value ( $p=0.18$ ) is not significant. The day 3 mean are 1.41 and 1.15 for group I and group II respectively without significant. The p value ( $p=0.003$ ) shows significant difference in vas score between two groups on day 1. For rest of the days there is no significant difference in vas score between two groups.

## DISCUSSION

TKR is one of the commonest and a successful operation in today's Orthopaedic practice to treat advanced arthritis. Almost in every parts of the world the number of TKR surgery is increasing year after year. Total Knee Arthroplasty can provide excellent pain relief and restoration of function for patients. Many factors can influence the success of knee replacement surgery, including patient selection, prosthesis design, the extent

of the damage to the joint, the accuracy of the surgical technique in terms of soft tissue balancing and limb alignment, and the effectiveness of the post-operative rehabilitation programme.<sup>16</sup> In the literature, TKA has an established place in the treatment of knee osteoarthritis in younger patients and is considered to be an effective intervention.<sup>17,18</sup> All these studies have reported to relieve pain, improve function and quality of life with a 'good' or 'excellent' outcome in more than 90% of patients.

A rapid recovery (enhanced recovery protocol) algorithm was developed and applied to TKA cases in the USA in the 1990s to provide standardization of procedures. There are studies in literature showing the benefits of following fast track (enhanced recovery) protocols. In our study mean age was 67.83 for group I and 64.31 for group II, the majority of the patients were between the age group of 61-70 years in both groups which accounts for 48.3% in group I and 44.8% in group II. The youngest patient was 50 years of age in group I and 48 years of age in group II and the oldest patient was of 83 years in both groups. Out of which 21 patients (72.4%) were female and 8 patients (27.6%) were males in group I and in group II 22 patients (75.9%) were female and 7(24.1%) were males. There was female predominance in our study but no significant difference in 2 groups for Age distribution and Gender distribution. Various studies which also shows female predominance in their studies but different mean age of patients.

Koksal et al in their retrospective study found female predominance like our study but there median age were 64 for group 1 (non Erp) and 68 for group 2 (ERP) which is different from our study.<sup>19</sup> Dhawan et al in their consecutive study found female predominance in both group but average age 72 for males and 69 for females in group 1 (NON ERP) and in group 2 (ERP) average age for male and female was 71 years, which is different from our study.<sup>20</sup> Hertog et al in their randomized prospective study had predominance of female in both groups and average age of 68.25 in control group and 66.58 in fast track group.<sup>21</sup> The minimum length of stay of our study was 4 days and maximum length of stay was 9 days for group I with mean length of stay 5.69. For group II the minimum length of stay was 2 days and maximum 6 day with mean of 3.28. These shows significant difference between two groups, with patients following enhanced recovery protocol (group II) has decreased length of stay as compared to patients following standard protocol (group I). Various studies have similar outcome like our study in term of length of stay for patients following enhanced recovery protocol (rapid recovery/fast track protocol).

Koksal et al in their retrospective study conducted at Turkey applied rapid recovery protocol to 96 patients (Group 1) and the standard protocol to 108 (Group 2) they found reduced length of stay for rapid recovery protocol with average postoperative length of hospital stay of  $3.7\pm 1.3$  days.<sup>19</sup> The average postoperative length

of hospital stay was  $6.3 \pm 2.5$  days in standard protocol. Jorgensen and Kehlet et al in their prospective study conducted on 3112 patients at Lundbeck foundation, Denmark who underwent primary THA and TKA concluded that in fast track THA and TKA with LOS of  $\leq 4$  days, discharge to home is feasible and safe, including in elderly patients with co morbidities.<sup>22</sup> McDonald et al in their prospective study on 1081 patients undergoing ERP protocols with 1 year follow up were compared with 735 patients with non ERP protocols.<sup>23</sup> The median length of stay was reduced from postoperative day 6 to day 4 ( $p < 0.001$ ). Husted et al in their study conducted from 2000 to 2009 in Denmark demonstrated that successful implementation of fast track surgery programme in TKA and THA lead to reduced the length of stay from median 10-11 days in 2000 to 4 days in 2009.<sup>10</sup> The KSS is widely used outcome in TKA, and is suitable instrument to allow comparison, KSS focuses on joint function such range of motion of joint and perception of pain.

In our study average pre-op KSS was 76.79 which improved to an average post-op score of 160.66 at 3 months follow up in (group I) patients with standard protocol, and in patients undergoing enhanced recovery protocol (group II) the average pre-op KSS was 77.14 which improved to an average post-op score of 169.66 at 3 months follow up. The mean difference between two groups at 3 month post-op follow up is 6.03 with P value ( $p = 0.001$ ) showed significant difference between two group in KSS. The functional component of KSS i.e. KFS also showed the significant difference between two groups at 3 month of post op follow up ( $p = 0.001$ ), with mean pre-op KFS of 43.28 which improved to an mean post-op score of 79.07 at 3 months in group I. In group II mean pre-op KFS was 43.28 which improved to mean post-op score of 85.00 at 3 months post op follow up. However clinical component of KSS i.e., KCS did not show significant difference between two groups ( $p = 0.095$ ) at 3 month of post-op follow up with mean pre-op KCS for group I was 33.52 which improved to an mean post-op score of 82.62 at 3 months post-op follow up and mean pre-op KCS for group II was 34.21 which improved to mean post-op score of 84.66 at 3 months. Available literature also shows improved KSS in fast track group compared to standard group.

Hertog et al in their randomized prospective clinical study compared fast track rehabilitation with standard postoperative rehabilitation in TKA patients and evaluated AKSS (American KSS) as primary criteria and analysis of AKSS at visit 1 (5-7 days of surgery) showed an increase in AKSS score for fast track group compared to standard group, however at subsequent visits all AKSS scores were numerically higher in fast track group than in standard group but difference were not significant.<sup>21</sup> Vas score in our study showed significant difference on day 1 with mean vas score on day 1 is 1.79 for group I and 1.21 in group II with  $p$  value = 0.003 with no significant differences on subsequent days in vas score between two

groups. So our results shows that following enhanced recovery protocol significantly decreases length of stay in hospital which directly decreases the economical burden on patient and over all improves patients satisfaction. Our study reported better functional results in patients who received the rapid recovery protocol which is demonstrated by improved KSS function scores.

## CONCLUSION

We conclude that Enhanced recovery protocol in Total Knee Arthroplasty is safe and effective treatment for refractory joint pain and deformity in Indian patients, promising decrease in length of stay, improved functional outcome and excellent pain relief.

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