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# On-Table Parameters to Watch for in Knee Arthroplasty - A Retrospective Analysis of Intraoperative Factors

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**Abstract:** ***Background: Total knee replacement (TKR) is done for severe degenerative arthritis of the knee joint, with the increasing number of the cases in developing countries to undergo TKR. There is an increase in economic burden in patients who go through these procedures in terms of surgery cost, implant cost and the cost of stay in hospitals, the latter being the most common variation. Various preoperative, intraoperative and postoperative factors decide the length of hospital stay and the economic burden in patients. The aim of our study was to determine all intraoperative parameters which are responsible for increased stay in hospital leading to increased cost burden in patients and ways to reduce the hospital stay by optimizing the patients preoperatively and to effectively manage them intra-operatively, so as to reduce the length of stay but still providing best of care to the patients. Material and methods: This study was done in our institute. It's a retrospective study done in 1022 patients who underwent elective total knee replacement for arthritis of knee joint and fractures that may need TKR. Various intraoperative parameters have been studied in this study such as surgery time, intraoperative blood loss, intraoperative blood transfusion and types of anesthesia and its effect on the length of stay of the patients in terms of economic burden. Results: We looked into the intraoperative parameters during total knee replacement and found that all these parameters have a significant role to alter the duration of hospital stay. Conclusion: Our study concluded that most of the intraoperative parameters responsible for total knee replacement are non-modifiable as one cannot predict the intraoperative complication which can lead to increased surgery time which ultimately leads to increased intraoperative blood loss and need for intraoperative blood transfusion. Type of anesthesia given at the time of surgery was also responsible for the increase in length of stay. No surgery is free of complications and so surgeons should be mentally prepared for all the events. Better preoperative optimization of patients and preoperative planning may reduce these events.***

**Keywords:** Total knee replacement, length of stay, intraoperative complications

## 1. Introduction

The need for the number of Total knee replacement is increasing as the subcontinent patients have. Due to the sedentary lifestyle of the people and increase in life expectancy there is a sudden surge in degenerative arthritis of the knee even in young patients especially females. As India being a developing country most of the time patients present in the late stage of arthritis where there is no role of conservative management for end stage arthritis. [1, 2] Total knee replacement has become a high demanding surgeries, but still the high cost of surgery, implant and the hospital stay increase the economic burden both to the patients and the country with reduced bed availability. [1] In addition to the economic burden there is an increase in morbidity to the patients because of rehabilitation and delay in returning back to work or doing normal day to day activities. [3]

## 2. Material and Methods

We did a retrospective study and all patients who underwent unilateral total knee arthroplasty in our institution from 2012 to 2019 were included in the study. All patients above the age of 18 year who underwent primary total knee arthroplasty were consented and included in the study. Patients who underwent revision TKR or multi-staged TKR were excluded from the study. Factors taken into consideration were surgery time, intraoperative blood loss, need for intraoperative blood transfusion and type of anesthesia; all these variables were equated to their length of hospital stay (LOS).

All knee replacements were performed by senior arthroplasty surgeons under general or spinal anesthesia. Tourniquets were used for all patients. Preoperative prophylactic antibiotics were administered briefly before surgery. All total knee replacements were performed through median parapatellar approach. Use of drain and implant were based on surgeon choice. Postoperatively adequate analgesics and antibiotics were administered. All patients were started on chemical DVT prophylaxis and mechanical prophylaxis for 2 days. Full weight bearing mobilization as tolerated along with quadriceps and hamstring strengthening exercises were started on postoperative day one. Serial wound inspection of the wound was done on postoperative days 2, 5, 9 and 12.

Patients were planned for discharge when they have clean wounds on inspection with no sign of infection, good knee flexion which is equal to preoperative knee flexion or more, VAS score of less than 3 and able to walk independently with walker support.

The primary outcome of this study was Length of stay (LOS) which is defined as the number of days in hospital from the day of admission to day of discharge inclusive. All the details were collected from the institutional Medical records department after concealing the personal details.

## 3. Result

Total numbers of patients included in the study were 1022 out of which 706 were female and 316 were male.917 patients underwent TKA for primary osteoarthritis knee joint, 96 for arthritis of knee joint secondary to rheumatoid arthritis and 9 patients underwent proximal tibia fracture. Various intraoperative parameters were taken into consideration which includes intraoperative blood loss, surgery time, type of anesthesia and intraoperative need for blood transfusion and its effect were noted in terms of patient's length of stay, depicted in [Tab.1]

Surgery time was one of the most important factors determining the length of stay as it was directly or indirectly associated with intraoperative blood loss and need for blood transfusion. As the surgery time increases the risk for blood loss and need for intraoperative blood transfusion also increases ultimately leading to increase in hospital stay. Surgery time was categorized as less than 90 min, 91-120 min, 121-160 min and more than 160 min. As the surgery time increases the mean duration of hospital stay also increases significantly. With mean duration of hospital stay for less than 90 min surgery was 6.04 days which increased to 7.38 days when surgery time was increased more than 160 min with significant p-value of 0.003. (Fig.1)

Intraoperative blood loss was taken into consideration when patients with more blood loss stayed for long duration compared to patients with less blood loss. Patients with blood loss of <150ml, 151-300 ml, 301-500 ml, > 500 ml stayed for a mean duration of 6.09 days, 6.78 days, 6.84 days and 7.29 days respectively. As the blood loss increases the length of stay also increases significantly (p-value of 0.001). (Fig.2)

Patients with more intraoperative transfusions require more blood transfusion. Patients with no need for blood transfusion intraoperatively stayed for a mean duration of 6.33 days compared to patients with 1 unit and 2 unit blood transfusion stayed for mean duration of 8.36 and 11.06 days respectively. With significant increase in length of stay as the unit of transfusion increases (p-value 0.001). (Fig.3)

Most patients underwent spinal anesthesia. Indication for general anesthesia includes patients with spinal deformity, inability to give spinal anesthesia intraoperatively (uncooperative patient) and failed spinal anesthesia. Total of 972 patients underwent spinal anesthesia. In 50 patients general anesthesia was used because of spinal deformity, inability to give spinal anesthesia intraoperatively or failed spinal anesthesia. Mean duration of stay in patients with spinal anesthesia was 6.24 compared to general anesthesia which was 8.46 which was significant (p-value-0.001). (Fig.4)

**Table 1**

| Parameter | Sample (n), % | Mean +/-SD | Mean | P-value |
|---|---|---|---|---|
| **Surgery time** | | | | |
| • < 90 min | 187 (18.3%) | 6.04+/-3.904 | 6.04 | 0.003 |
| • 91-120 min | 328 (32.1%) | 6.50+/-3.523 | 6.5 | |
| • 121-160 min | 346 (33.9%) | 6.75+/-3.152 | 6.75 | |
| • > 160 min | 161 (15. .8%) | 7.38+/-3.072 | 7.38 | |
| **Intraoperative blood loss** | | | | |
| • < 150 ml | 352 (34.4%) | 6.09+/-3.252 | 6.09 | 0.001 |
| • 151-300 ml | 441 (40.1%) | 6.78+/-3.560 | 6.78 | |
| • 301-500 ml | 177 (17.3%) | 7.29+/-3.512 | 6.84 | |
| • > 500 ml | 82 (8%) | 6.84+/-2.998 | 7.29 | |
| **Intraoperative blood transfusion** | | | | |
| • No transfusion | 891 (87.2%) | 6.33+/-3.157 | 6.33 | 0.001 |
| • 1 Unit | 113 (11.1%) | 8.36+/-3.691 | 8.36 | |
| • 2 Units | 18 (1, 8%) | 11.06+/-6.975 | 11.06 | |
| **Types of anesthesia** | | | | |
| • Spinal anesthesia | 972 (95.1%) | 6.24+/-3.004 | 6.24 | 0.001 |
| • General anesthesia | 50 (4.9%) | 8.46+/-3.527 | 8.46 | |

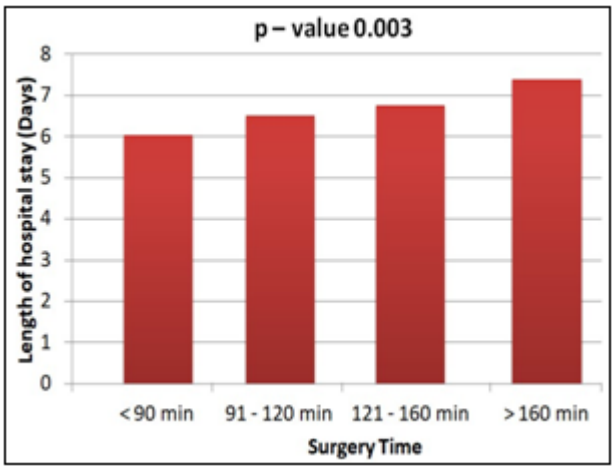


**Figure 1:** Effect of surgery time on length of hospital stay.

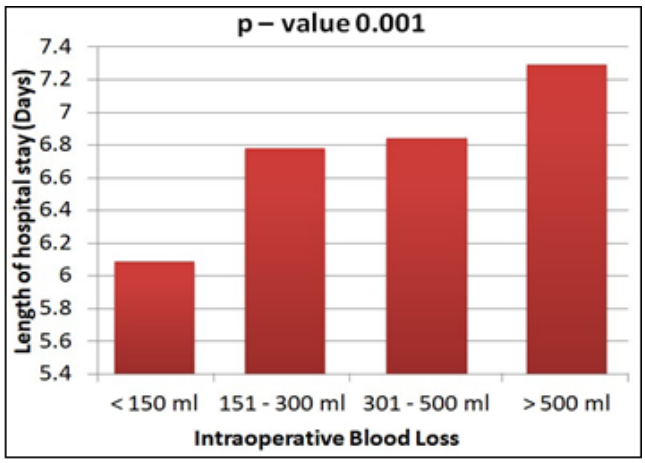


**Figure 2**: Effect of intraoperative blood loss on length of hospital stay.

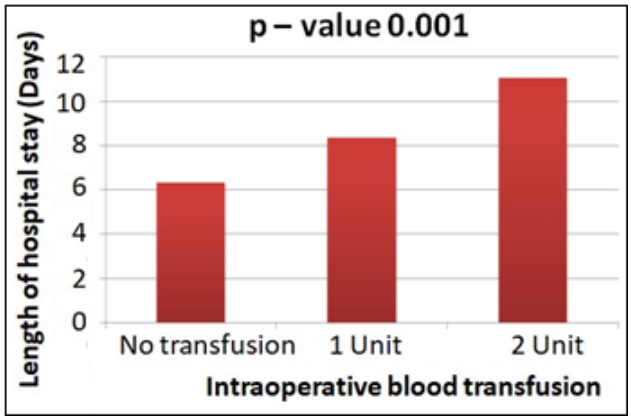


**Figure 3:** Effect of Intraoperative blood transfusion on length of hospital stay.

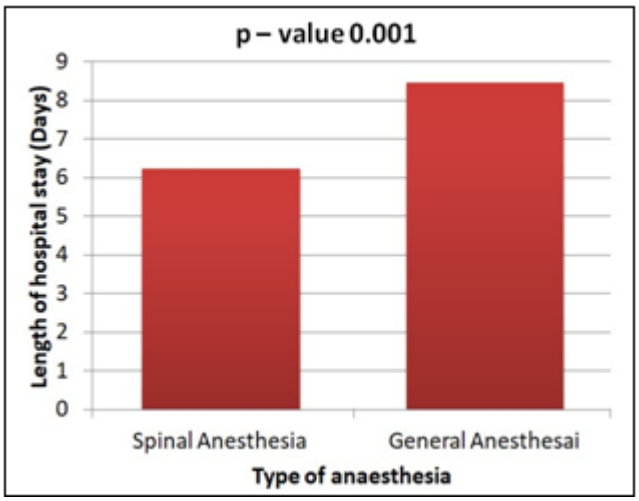


**Figure 4**: Effect of type of anesthesia on length of hospital stay

## 4. Discussion

Chronic osteoarthritis of knee, treated by total knee replacement which has become gold standard. [15]. One of the most expensive procedures in modern era is replacement surgeries

Decreasing the length of stay in hospital has few benefits such as reducing bed turnover rate and also decreasing patient waiting time for the elective surgery. It can also reduce the cost of the treatment which will reduce patient medical expenses and chance of cross infection, as an elongated hospital stay is prone for infection. [16, 17]

The objective of this study was to validate the intraoperative complications which affect the length of stay in the hospital following the primary total knee replacement, by analyzing the various intraoperative parameters such as surgery time, intraoperative blood loss, intraoperative blood transfusions and type of anesthesia. We found significant association between these variables and the length of stay.

Identifying the intraoperative parameters that increase the length of stay will help us understand intraoperative complications which can be modified and can be catered according to the patient's need and proper orthopaedic interventions can be made. We studied four intraoperative factors which may affect the morbidity of patients leading to increase in length of stay and cost. Previous studies have also shown that these factors may lead to an increase in length of stay. [5, 6] Patients with no intraoperative complication have a shorter length of stay. But, since intraoperative complications can not be predicted it is always necessary to be prepared for the worst. Proper preoperative planning and preoperative optimisation have shown to reduce intraoperative complications. [7]

Our study has shown patient length of stay is significantly reduced in case there is no intraoperative complication or less intraoperative complications. Longer operative time is one of the major factors which lead to prolonged LOS as it is directly associated with increase in intraoperative blood loss leading to need for intraoperative blood transfusion. Ifeoma et al have also shown similar results with increase in

duration of surgery. [8] Other reason for morbidity may be because as the surgery time is increase there is tourniquet associated hypoxia and ischemia to the tissues leading to swelling of leg, weakening of quadriceps with thigh pain. [9, 10] All these factors make postoperative mobilization and rehabilitation difficult which lead to increase in hospital stay. Even there is higher chance of infection due to prolonged surgery leading to fever postoperatively and delay in discharge from hospital. [11]

Additionally many times patients might want to stay for longer duration in hospital due to lack of a caregiver in home or when they are staying alone, as they have the right to decide when to get discharged. In these situations it may act as a bias to study as in many cases records are not available if the patient got discharged late due to surgeon discretion or because of their own decision. [12]

Our studies have shown patients who received general anesthesia stay for longer duration in hospital compared to people who receive spinal anesthesia. Studies have shown that various confounding factors (Eg. BMI, Hb, Comorbids) along with type of anesthesia may affect length of stay. [14] There is decrease in 30 days postoperative mortality and shorter LOS after total knee and hip arthroplasty when patient underwent surgery under Regional anesthesia (Spinal Anesthesia) compare to those who underwent surgery under general anaesthesia. [18]

Gulraj S. Matharu suggested regional anesthesia should be used as reference standard for patients undergoing total hip and total knee replacement as it decreases length of stay in hospital, readmission and complication after surgery. [19]

Our study has some limitations as it's a retrospective study and all data was retrieved from medical records which may not be accurate. Second we were not able to identify patients who got discharged late because of their own decision or because of surgeon discretion as these data were not available.

Despite all these limitations our study has successfully shown statistical correlation between the intraoperative complication and the length of stay. We found all four factors studied in our study to be statistically significant with length of stay. This study is the first of its kind in the South Indian population. In developed countries most of the time fast-track protocols are followed, but in developing countries long length of stay is common. [5, 13] So it's important in developing countries to identify factors responsible for increased length of stay following TKR.

## 5. Conclusion

Our study concluded that most of the intraoperative parameters responsible for total knee replacement are non-modifiable as one cannot predict the intraoperative complication which can lead to increased surgery time which ultimately leads to increased intraoperative blood loss and need for intraoperative blood transfusion. Type of anesthesia given at the time of surgery was also responsible for the increase in length of stay. No surgery is free of complications and so surgeons should be mentally prepared for all the events. Better preoperative optimization of patients and preoperative planning may reduce these events.

**Abbreviation**
TKR-Total knee replacement
LOS-Length of Stay
DVT-Deep vein thrombosis
VAS score-Visual analog scale score
CONFLICT OF INTEREST: Nil

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