



A Comparative Study On Outcome Of Robotic-Assisted Versus Conventional Total Knee Arthroplasty Using Same Implants

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Abstract

Introduction: Robotic knee arthroplasty has emerged as a new trend, garnering attention from orthopedic surgeons globally. It has been hypothesized that the use of robotics enhances the accuracy of implant positioning and alignment restoration thus giving better functional results and patient satisfaction.¹ The objective of this study was to provide an evidence-based comparison between robotic and conventional methods, focusing on functional outcomes.

Materials and methods: In this two arm retrospective observational study 50 patients were selected by simple random sampling each for robotic and conventional tkr(total knee replacement) using implants from same company. They were followed up with functional parameters (Oxford Knee Score) at 6 weeks and 3.5 months.

Results: We found that functional scores were slightly better in robotic group but not statistically significant both at 6 weeks and 3.5 month followup. Complication rates were also comparable in both groups .

Conclusion: The present study demonstrates that robotic-assisted tkr has no significant advantage over conventional tkr with respect to functional score atleast in short term followup

Keywords: Observational study, Oxford Knee Score, same implants, tkr

Introduction

Robotic knee arthroplasty has emerged as a new trend, garnering attention from orthopedic surgeons globally. It has been hypothesized that the use of robotics enhances the accuracy of implant positioning and alignment restoration thus giving better functional results and patient satisfaction.¹ Computer-assisted instruments have been widely used to compensate for the unfamiliar skills of junior surgical doctors, and this newly-emerged technique is also featured for its outstanding merits of higher precision and economic value.²

In the conventional approach, surgeons rely on their skills and experience for precise bone cuts and implant

positioning. While they use guides and instruments, there is a potential for slight variations. Therefore, robotic-assisted approaches have been implemented to increase precision³. On the other hand, the robotic-assisted approach is associated with increased operative time and cost and requires more expensive equipment³. There are three types of robotic systems, namely, autonomous, hands-on, and passive, which differ in terms of surgeon control of the operation⁴. Robotics can assist in performing a minimally invasive approach more consistently, potentially reducing tissue damage and improving recovery times. The objective of this study was to provide an evidence-

based comparison between robotic and conventional methods, focusing on functional outcomes.

Materials And Methods :

Study Design: Institution based two-arm observational study

Place Of Study: Patients attending Outpatient/Inpatient department of CK Birla Hospital, Kolkata.

Sample design: Simple random sampling

Sample size: 50 patients were included in each group.

Patients visiting our hospital and fulfilling the inclusion and exclusion criteria were included in either group A or group B based on mode of management.

Group A: Patients who have undergone robotic assisted tkr

Group B: Patients who have undergone conventional tkr

Implants from Smith & Nephew company were used in both groups. Robot used was CORI.

Inclusion Criteria:

Patients between 55-75yrs with Grade 3 and 4 knee arthritis

BMI less than 30

No history of previous injury or surgery to leg

Exclusion Criteria:

Arthritis due to traumatic or infectious causes

Non-compliance to pre operation and post op follow up

Varus/Valgus deformity more than 15°

Fixed flexion deformity more than 15°

Revision tkr

Study Variables:

Functional: Oxford Knee score(subjective)

Lab investigations in control: Routine blood investigations for PAC

Radiological Investigations: Xray knee- AP(standing), Lat, Skyline view ; Scannogram both lower limbs AP(Standing)

Procedure:

Group A: Smith & Nephew Robot(CORI) assisted tkr .

Group B: Conventional tkr with Smith & Nephew implants .

Mobilisation with walker started from 1st post op day with gradual shift to unaided walking over 2 weeks. Both active and passive range of motion exercises by physiotherapist done for first 2 months.CPM machine was given on case to case basis. Stair climbing started after 1 month.

The patients were followed-up for observation at 6 weeks and 3.5 month. Anteroposterior(standing), lateral and skyline X-ray were taken at 2nd follow-up to evaluate healing progress and bone-implants relationship.

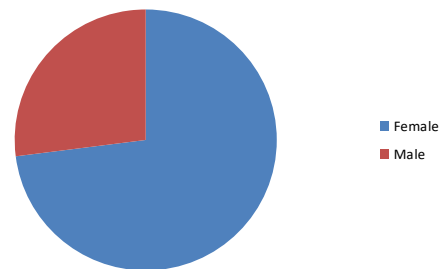
Statistical Analysis Plan: Data obtained from the study will be analyzed using standard statistical methods and SPSS version 25. All data will be compiled on Microsoft Excel. For comparing mean and standard deviation t-test will be used for continuous data and chi-square for categorical data.

Results:

In our study, 73 patients were Female and 27 patients were Male.

The result is significant at $p < 0.05$.(Figure 1)

Figure 1: Pie chart showing distribution of sex



In our study total complication rate was comparable in both groups.

5 patients of Group A underwent repeat surgery (2 for infection, 3 manipulation under anaesthesia for stiffness) whereas 4 patients of Group B underwent repeat surgery (2 for infection, 2 manipulation under anaesthesia for stiffness).

In our study there was no significant ($p=0.306$) difference in Oxford Knee Score of both groups at

6wks follow up as well as at 3.5months (p=0.097).(Table 1)

Table 1 : Oxford Knee Score (scale 0-48, with a higher score indicating a better outcome): Before treatment: <15

Follow up at	Group A	Group B
6 weeks	36.38 +- 4.09	43.78 +- 1.89
3.5 months	35.62 +- 3.24	43.12 +- 2.06

Figure 2: Pre and post-op xrays of robotic-associated tkr and its planning on the robot (shows functional alignment) :



Figure 3: Pre and post-op xrays of conventional tkr (shows mechanical alignment):

Discussion:

In our study, 73 patients were Female and 27 patients were Male.

The result is significant at $p < 0.05$.

The mean age of the present study is in the 6th decade of life, which is comparable to other similar studies, though there is a wide distribution of mean age in between other studies and our study due to early detection in western countries. It is explained by the fact that osteoarthritis is primarily a disease of elderly due to destruction of the cartilaginous framework of the joints. It is also found that there is a female preponderance of osteoarthritis of the knee in our study which is again comparable to other similar studies. This is explained by the loss of effect of estrogen on calcium metabolism, especially in post-menopausal age.

In our study total complication rate was comparable in both groups.

In our study there was no significant (p=0.306) difference in Oxford Knee Score of both groups at 6wks follow up as well as at 3.5months (p=0.097).

In Zien Alabdin Fozo et al. three articles were included in the outcome with 200 patients. The pooled effect estimate showed a significant difference between robotic-assisted arthroplasty and traditional arthroplasty.

In Reda Alrajeb et al.⁵ also differences did not reach statistical significance and both clinical and functional outcomes, as well as the rate of complications, were found to be statistically similar between the groups undergoing robotic and traditional knee replacement surgeries.

In Hu Liang et al.⁶ Knee Society Score (KSS) was evaluated which reflects the status and functions of knee joints: pain, range of motion, stability, etc. Both robot-assisted surgery and conventional ones could elevate KSS for the patients however, this difference is narrowed, and robots could achieve a similar therapeutic effect as conventional.

Limitations Of The Study:

Only 3.5 month follow-up may not be enough to get accurate conclusions and long term follow up is needed.

Conclusion:

The present study demonstrates that robotic-assisted tkr has no significant advantage over conventional tkr with respect to functional score atleast in short term followup.

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