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Assessment of mid-term outcomes and bone loss/quality in patients undergoing Revision Total Knee Arthroplasty (TKA)

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Background and Aim: Revision total knee arthroplasty (TKA) is one of the most demanding and complex procedures in orthopaedic surgery. This study aimed to evaluate the outcomes of a consecutive series of rTKA in which implant fixation has been obtained in at least two zones. Factors that may contribute to intraoperative management decisions and postoperative outcomes were evaluated. **Materials and Method:** After registry evaluation, 115 patients matched the inclusion criteria and were included in the study. All patients were evaluated pre-operatively, including assessment for periprosthetic joint infection. All patients who underwent RTKA for infection received a two-stage revision with a minimum of 6 weeks between initial debridement and removal of implants and the second-stage revision. **Results:** The mean OKS or the post-operative function outcome was found to be 41.38. The range of motion increased from 900 to 1100 during the one-year post-operative period. Approximately 75% of patients were satisfied with their RTKA and stated that they would undergo an RTKA again. A survival rate of 95.8% was demonstrated among the patients who were able to be contacted. Eight RTKAs in 5 patients demonstrated the failure of TKA and required re-revision. **Conclusion:** Revision TKA is a demanding procedure for both the surgeon and the patient, but if a step-wise approach is used during surgery, bone loss is correctly evaluated and treated, and good implant fixation is obtained, good clinical and radiological outcomes may be achieved at mid-term follow-up.

Keywords: Knee, Arthroplasty, Revision, Bone defects, Long term outcomes

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Introduction

Revision total knee arthroplasty (TKA) is one of the most demanding and complex procedures in orthopaedic surgery. Revision total knee arthroplasty (TKA) is a laborious, technically difficult surgery with poorer results than (in) primary TKA which has become a routine intervention for treating advanced osteoarthritis [1,2].

The main goal of revision total knee arthroplasty (TKA) is to provide a stable, well-functioning implant in the treatment of failed arthroplasty.2 Primary TKA has proven over the past 20 years to be a highly successful surgical procedure, with survivorship rates approaching 95% after a 15-year follow-up period [3].

Revision knee arthroplasty surgery requires that order be restored to the chaos of failure. Once the failed components, cement, and useless weak bone have been removed from the knee, a gaping hole confronts the surgeon [4]. The problems of stability, mobility, fixation, and the reconstruction of bone defects as well as restoration of an anatomic joint line all cry out for attention at once. There are undoubtedly a variety of approaches to revision knee surgery. One thing is certain—an organized approach is essential or the reconstruction is doomed to failure [5].

The reasons for the increased difficulty of surgery and poorer outcomes have been attributed to difficult surgical exposure, stiffness, adhesion of tissues, instability due to ligamentous laxity, and poor bone stock [6]. The revision procedure imparts an additional burden of disability onto patients, and accordingly, most revision patients will never experience an outcome as favourable as their primary procedure [7,8].

The paucity of information available to guide the patient and the surgeon in decision-making and postoperative expectations for RTKA is a current challenge for orthopaedic surgeons [8].

This study aimed to evaluate the outcomes of a consecutive series of rTKA in which implant fixation has been obtained in at least two zones. Factors that may contribute to intraoperative management decisions and

Postoperative outcomes were evaluated.

Material and Methods

Study Setting and Type of Study

The present is the single-centre prospective study performed on the rTKA procedure.

Inclusion Criteria: Inclusion criteria were rTKA performed for any reason by the same surgeon, complete revision, and a minimum follow-up of 24 months.

Exclusion Criteria: Exclusion criteria were revision from unicompartmental knee arthroplasty to total knee arthroplasty or the use of any so-called mega-prosthesis. After registry evaluation, 115 patients matched the inclusion criteria and were included in the study.

Ethical Consideration and Permission

The ethical committee of the institute was informed about the study and the prior clearance certificate was obtained before the start of the study. The patients who satisfied the inclusion criteria were informed about the study and the informed consent was signed before inclusion in the study.

Data Collection: All patients were evaluated pre-operatively, including assessment for periprosthetic joint infection. All patients underwent serum ESR and CRP evaluation, and if significantly elevated according to the criteria proposed by Parvizi et al [9], joint aspiration was performed to evaluate white cells' count and polymorphonucleate percentage.

CT scan was performed in selected patients when component malrotation was suspected or if a more accurate evaluation of bone loss was required. Clinical evaluation was performed focusing on tibiofemoral stability, patellofemoral tracking, and range-of-motion (ROM). Stiffness was defined as a ROM below 70° while ankylosis was defined as ROM below 30°.

All patients who underwent RTKA for infection received a two-stage revision with a minimum of 6 weeks between initial debridement and removal of implants and the second-stage revision. The implant constraint required was determined intraoperatively, with cruciate-retaining (CR) used in 23 patients, posterior-stabilized (PS) used in 53 patients, TC3 used in 29 patients, and a hinged implant used in 10 patients.

Statistical analysis: The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to the data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

The mean OKS or the post-operative function outcome was found to be 41.38. The range of motion increased from 90^0 to 110^0 during the one-year post-operative period.

The reason for revision approached but did not achieve statistical significance ($p = 0.058$), with the stiffness group having the highest OKS and the instability group having the lowest OKS. The reason for revision demonstrated a statistically significant difference between groups for 1-year ROM ($p = 0.009$). ROM was lowest for the stiffness group and greatest for the instability group. The KSS significantly improved from 66.2 points preoperatively to 73.1 points at the final follow-up ($P < 0.001$).

Furthermore, the average postoperative KSS expectation was 8.12 and the KSS satisfaction was 28.1, demonstrating good patient satisfaction. Lastly, the HSS score also significantly improved from 62.1 points preoperatively to 88.2 points postoperatively.

The statistically significant influences on 1-year follow-up on postoperative ROM on the number of previous RTKA done. An increased number of revisions resulted in a lower ROM. Implant type, polyethene thickness, and surgical time did not demonstrate a statistically significant difference in ROM at 1 year postoperatively. Preoperative and 1-year postoperative ROM demonstrated a statistically significant correlation.

Approximately 75% of patients were satisfied with their RTKA and stated that they would undergo an RTKA again. A survival rate of 95.8% was demonstrated among the patients who were able to be contacted. Eight RTKAs in 5 patients demonstrated the failure of TKA and required re-revision. Hospital and orthopaedic charts for all patients were reviewed, with no evidence of failure/re-revision in any patients unable to be contacted by telephone.

Discussion

This is a prospective study including 115 rTKA performed in 115 patients by the same surgeon at an average follow-up of 3 years. The first finding of the study was that the most frequent cause of TKA failure in this series was aseptic loosening, followed by septic loosening. This is similar to other published reports. The second finding of this study was that rTKA is a complex surgery, with a relatively low complication rate (2%), similar to the results of other case series.

However, if the revision is performed following a stepwise approach, such as the three-step technique and the level of constraint is accurately chosen based on bone loss and ligamentous insufficiency good midterm clinical and radiological outcomes may be obtained. One of the main problems challenging the surgeon in rTKA is the evaluation and treatment of bone loss. The most used system to evaluate bone loss is the AORI classification by Engh et al.,[10] which considers the amount and location of bone loss. However, this classification does not account for bone quality.[11]

These patient outcomes following RTKA performed by a single surgeon using a single prosthesis at a single institution are one of the largest and most comprehensive data in the published literature. The preoperative, intraoperative, and postoperative characteristics can be used to guide understanding of the factors influencing patient outcomes after RTKA.[12] Different authors described the biomechanical properties of tantalum, including high biocompatibility, high density, and the possibility of porous structure with increased osteoconductive properties.[13] For all these reasons and because of their osteoconductive and positive biological properties, tantalum cones may be also useful to achieve a good metaphyseal fixation in presence of poor bone quality, allowing for a stable "zonal" fixation as previously described by Morgan.[14]

Rajgopal et al.[15] described no significant difference in outcome measures between RTKAs for septic and aseptic causes of failure in a retrospective review of 142 patient charts with a mean follow-up of 73 months. They concluded that septic failure does not preclude good outcomes of RTKA. In contrast, Barrack et al. reported outcomes following 125 RTKAs with a mean follow-up of 36 months, showing that patients who underwent

RTKA for infection had poorer postoperative functional and clinical outcomes.16

Patient ROM measurements were retrieved from orthopaedic follow-up records, which were retrospectively reviewed. Although ROM was reliably measured with a goniometer by the senior author at set time points, we cannot guarantee that patient ROM remains unchanged during the period from 1 year postoperatively to the time of telephone assessment. Current ROM may give a better insight into this outcome's effect on patient satisfaction; however, we consider the change in ROM after 1 year postoperatively to be minimal in most patients.

Conclusion

Revision TKA is a demanding procedure for both the surgeon and the patient, but if a step-wise approach is used during surgery, bone loss is correctly evaluated and treated, and good implant fixation is obtained, good clinical and radiological outcomes may be achieved at mid-term follow-up.

What does this study add to existing Knowledge?

Considering limitations, this new proposed classification may be a valuable instrument for the surgeon to evaluate not only bone loss but also the bone quality and to choose the right method of fixation required to obtain adequate bone loss treatment and implant fixation. Considering the risk for aseptic loosening due to poor "zonal" fixation, bone losses should be classified also according to bone quality, and surgeons should evaluate the appropriate bone loss treatment also according to the possibility to obtain a strong implant fixation.

Author contribution

- Dr Athawale Tanmay Suneel and Dr Jignesh Singh formulated the aims & objectives with study design and helped in data collection from the medical record department.
- Dr Sudhanshu Chitravanshi, Dr AmoghaSiddesh Narasanagi and Dr Abhay Shaileshbhai Pate contributed to the preparation of the manuscript and Data analysis.

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