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Original Research

Revision Knee Arthroplasties Done at Muhimbili Orthopaedic Institute, Tanzania, between 2007 and 2018

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Abstract

Introduction

There has been a steady rise in the need for Revision Total Knee Arthroplasty (RTKA) due to increasing longevity and expanding indications of primary TKA. Worldwide revision rates vary between 4.9-7.9%. However, in the sub-Saharan African region, revision total knee arthroplasty has rarely been studied.

Broad Objective

To determine the rate and indications for RTKAs in primary TKA surgeries operated at MOI between 2007 and 2018.

Methodology

This was a retrospective study. Revision TKA surgery data was collected from the TKA registry. Univariate analysis and descriptive statistics were used for analysis and presentation of categorical and continuous data. Statistical significance was determined in all relevant associations.

Results

Out a total of 607 primary TKA procedures recorded, 40 required revision, with a mean age of 69.1 years, a female predominance (60%) and a left knee predominance (62.5%), giving a revision rate of 6.59%. The causes of revision TKA included aseptic loosening (47.5%) and periprosthetic infections (32.5%). Both femoral and tibial components were revised in 50% of the surgeries. The mean duration from primary surgery until revision surgery was 4.1 years. Prosthesis infection was associated with early revision surgery (p value 0.008) but most patients had late revision TKA surgery (p value 0.02).

Conclusion

The rate of revision TKA at MOI was similar to worldwide rates. Most revisions were done late (after 2 years), and the predominant cause of revision was aseptic loosening, but infection was positively associated with early revision.

BACKGROUND

Total Knee Arthroplasty (TKA) is the golden standard of care for treatment of advanced degenerative and rheumatologic knee diseases and specific knee fractures. Arthroplasty is the most successful and effective surgical option to reduce pain and restore function in patients with severe osteoarthritis.[1,2] TKA is done commonly worldwide[3-5] and is the most common major orthopaedic procedure in the USA.[6]

TKA was first performed in the 1970s and it has been beneficial to a majority of recipients as it is cost-effective and improves the quality of life of the patients.[7]

Despite the effectiveness of TKA, a significant number of patients face the prospect of revision surgery due to the limited lifespan of the prosthesis and various other causes

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including prosthesis loosening, persistent pain, instability and infection.[8] There has also been a steady rise in the need for Revision TKA (RTKA) due to increasing life expectancy and expanding indications of primary TKA.[9-12]

The cumulative survival rate of TKR was shown to be higher than 90% in the first 8 years, decreasing to 83.5% at 10 years, then maintaining stable results after 10 years.[13] By the year 2030, TKA revisions in the United States will grow by approximately 600%, compared to 2005, to an estimated 268,200 cases per year, with greater than 50% of these revision procedures expected to occur in the younger age groups starting from 2011.[6,8,14]

Studies have categorized the failure causes after total knee arthroplasties into early (within the first 2 years after primary TKA) and late revision. Due to bone loss and soft tissue insufficiency, the overall outcome of revision TKA is not as good as the primary arthroplasty.[15-17] The revision often needs stemmed components and additional augments, in order to address deficient bone stock and soft tissue integrity.[6]

Although aseptic loosening may be the leading cause of revision surgery, advancements in implants and surgical techniques has reduced this complication, and septic complications have instead relatively increased over time.[7,18-20]

There are many indications for TKA in the sub-Saharan Africa, but unfortunately most countries don't have adequate means to offer the service, including the necessary facilities, resources, and healthcare professionals. Although revision TKA is being done in Tanzania, not much is known about its epidemiology to make any significant comparative analysis to other countries. The main aim of the study was to explore the rate and indications of revision knee arthroplasties in primary knee arthroplasty surgeries done at Muhimbili Orthopaedic Institute, located in Dar es Salaam, Tanzania.

METHODOLOGY

Study design and setting

This was a retrospective cross-sectional study conducted at Muhimbili Orthopaedic institute (MOI), the largest orthopaedic and trauma referral institute in Tanzania, located in Dar es Salaam, with a 362-bed capacity, attending an average of 4000 patients per week.

Study population, duration, inclusion and exclusion criteria

The study population included all patients 18 years and above, who underwent primary bicompartmental total knee arthroplasty (posterior stabilised design, cemented fixation) at MOI from 2007 to 2018 and subsequently had revision surgery at MOI. Patients who had their primary or revision TKAs done at other centres, were excluded due to either insufficient data, challenges in contacting and tracing patients and to reduce extraneous variable effect related to differences in centre related treatment protocols and follow up.

Data collection and management

Data was collected, using a structured questionnaire, mainly from MOI's arthroplasty registry books. Data available in the registry included patients' demographic characteristics (name, age and sex), indications for revision TKA surgery (diagnosis), types of surgery done and the surgery team members involved. Time lapse from primary to revision TKA was calculated in years.

Patients with prosthesis infection were confirmed by pre-operative elevated serum infectious markers (C-Reactive Protein and Erythrocyte Sedimentation Rate) and with/without positive organism isolation and culture.

Collected data was stored on a MS Excel (Microsoft Corp., Redmond, WA, USA) database and exported to IBM Statistical Package for the Social Sciences version 25 (IBM Corp., Armonk, NY, USA) software for analysis.

Statistical analysis

Univariate analysis was used for categorical variables. Mean, median, interquartile range and standard deviation were used for continuous variables. Chi-square test, Fisher T exact test and relative risk were used to determine association significance between variables.

A 95% confidence interval (CI) was estimated to quantify the precision of estimates in the population. A 5% alpha (p-value) was used to determine statistical significance during analysis and interpretation.

Ethical Consideration

Ethical clearance was obtained from MOI Ethics Board. Confidentiality of the data was observed throughout the study. The database access was limited only to the investigators.

RESULTS

1. Socio-Demographic Characteristics of the Patients

Table 1 summarises the patients' characteristics stratified by sex. A total of 607 primary TKAs (bicompartmental, posterior stabilised design, cemented fixation) were done between 2007 and 2018, and 40 cases were revised, giving a revision rate of 6.59% (95 % CI 4.75-8.87%).

Female predominance (60%) was seen in revision TKA surgery (24 patients). The age range was 41 years, with a minimum age of 46 years. The mean and median ages were 69.1 years and 71.5 years respectively, with some differences noted between the two genders (mean age difference p-value 0.91, median age difference p-value 0.97).

Table 1. Participants' Summarized Characteristics Stratified by Sex

Characteristic, n (%)	Total, 40 (100)	Male, 16 (40)	Female, 24 (60)
Age in years, mean (IQR)	69.1 (63.5-75)	68.9 (62.5-75.5)	69.2 (64-75)
Age groups in years, n (%)			
45-54	2 (5.0)	1 (50.0)	1 (50.0)
55-64	11 (27.5)	4 (36.4)	7 (63.6)
65-74	12 (30.0)	6 (50.0)	6 (50.0)
75-84	13 (32.5)	4 (30.8)	9 (69.2)
>84	2 (5.0)	1 (50.0)	1 (50.0)
Education level, n (%)			
Primary	22 (55.0)	9 (40.9)	13 (59.1)
Ordinary secondary	10 (25.0)	3 (30.0)	7 (70.0)
Advanced secondary	6 (15.0)	3 (50.0)	3 (50.0)
University	2 (5.0)	1 (50.0)	1 (50.0)
Affected knee, n (%)			
Left	25 (62.5)	10 (40.0)	15 (60.0)
Right	15 (37.5)	6 (40.0)	9 (60.0)
Causes of revision, n (%)			
Aseptic loosening	19 (47.5)	6 (31.58)	13 (68.42)
Infection	13 (32.5)	6 (46.15)	7 (53.85)
Instability	7 (17.5)	3 (42.86)	4 (57.14)
Stiffness	1 (2.5)	1 (100.0)	-
Time of revision, n (%)			
Early (< 2years)	12 (30.0)	6 (50.0)	6 (50.0)
Late (≥ 2 years)	28 (70.0)	10 (35.7)	18 (64.3)
Type of revision, n (%)			
Both components revised	20 (50.0)	7 (35)	13 (65.5)
SD, prosthesis removal, antibiotic spacer, prosthesis exchange	13 (32.5)	6 (46)	7 (54)
Isolated Tibia component revised	5 (12.5)	2 (40.0)	3 (60.0)
Isolated Femoral component revised	2 (5.0)	1 (50.0)	1 (50.0)

Note: n, number; IQR, Interquartile range; SD, Surgical debridement

2. Indications of Revision TKA Surgery and Time Lapse from Primary TKA Surgery to Revision TKA surgery

Majority of the revisions (25 patients or 62.5%) were done on the left knee (95% CI 45.8%-84.0%), compared to the right knee (p-value 0.08). Time period from primary TKA to revision TKA varied from 2 months to 12 years, with a mean period of 4.1 years (SD 2.9 years). More patients had late revisions (i.e. 2 years and above from primary TKA surgery) compared to early revisions; 28 patients (70%) with late revisions (95% CI 53-87%) vs. 12 patients (30%) with early revisions, (95% CI 4.1-55.9%) p-value 0.02.

3. Causes of Revision TKA surgery in the patients

The predominant cause of revision TKA was aseptic loosening of the prosthesis (19 patients, 47.5%), followed by infection (13 patients 32.5%) and prosthetic instability (7 patients, 17.5%) due to unbalanced ligaments, malposition of components and/or improper alignment. Prosthesis infection was revised at an average of 1.3 years (SD 1.2) from the primary TKA and was positively associated with early revision surgery (RR 4.2, 95% CI 1.5-11.3, p value 0.008). Aseptic loosening was revised at an average of 4.7 years (SD 2.5) from the primary TKA and was positively associated with late revision surgery (RR 1.6, 95% CI 1.1-2.5, p value 0.018).

4. Types of Revision TKA surgeries in the patients

From the 40 revisions done, 20 (50%) of them involved only revising both tibia and femoral knee components in the same sitting, while 13 revisions (32.5%) involved a combination of staged surgical debridement, joint washouts, prosthesis removal, use of antibiotics spacers and future prosthesis fixation once infection was deemed clear (normal serum ESR and CRP for 3 months). Isolated same sitting

tibia component revision (5 patients, 12.5%) or femoral component revision (2 patients, 5%) was also observed.

Male patients had a higher risk of early revision (RR 1.5, 95% CI 0.6-3.8, p value 0.49) and a higher risk of infection (RR 1.3, 95% CI 0.5-3.1, p value 0.58) while female patients had a higher risk of late revision (RR 1.2, 95% CI 0.8-1.9, p value 0.31) and aseptic loosening (RR 1.3, 95% CI 0.6-2.8, p value 0.40).

DISCUSSION

There are worldwide variations in TKA revision rates, due to disparities in access to quality healthcare resources and personnel. The study focussed on patients who had both their primary and revision knee arthroplasty surgeries done at MOI. These patients were managed at the same institute and hence exposed to similar treatment protocols, reducing extraneous variables. The incidence rate of 6.59% in this study was similar to Pabinger et al's systemic review which reported an overall 10 year worldwide revision rate of 6.2% ranging from 4.9% to 7.8%.[21] While MOI's revision rate is within acceptable limits, others have reported both lower rates of up to 2.2%[22] and even higher rates of 33.2%(34).

Majority of the patients were females with a mean age of 69.1 years, similar to other previous studies.[18,23] This difference in gender representation was not statistically significant.

It is documented worldwide that most TKA revisions are due to aseptic loosening, infection and polyethene wear.[3, 18,24,25] The causes of revision in this study were similar to multiple other previous studies. Aseptic loosening was the predominant cause of TKA revision in a study that analysed data from 844 patients between 2010 and 2011 attended from 6 hospitals in the USA.[26] Lombardi et al. reported nearly 31.2% of patients who needed TKA revisions were due to aseptic loosening, while Peter et al., reported 39.9% of all TKA revisions were due to aseptic loosening.[3]

Delanois et al analysed TKA revision between 2009 and 2013 from the USA, and reported infection as the aetiology of TKA revision among 20.4% of patient,[27] while Anne et al, found infection as the cause of revision among 36.1% of all revisions[7] and Peter et al found infection among 27.4% as a cause for revision.[3] Owing to differences in patient backgrounds and lifestyles, the causes of TKA failures in sub-Saharan Africa especially Tanzania may differ compared to other parts of the world.

Majority of the revisions (62.5%) were done on the left knee, but no statistical significance was found between the left and right knee (p value 0.08). The mean time period from primary TKA to revision TKA was 4.1 years (SD 2.9) and study did significantly show 70% of the patients had late revisions (i.e., 2 years and above) compared to early revision surgery (p value 0.02). The findings are similar to other studies previously done. Postler et al reported a primary TKA to revision surgery mean time of 6.2 years in 289 TKA surgeries performed,[18] while another study done in the USA highlighted a time lapse from primary TKA to revision TKA was 5.9 years and that 35.3% of all revisions occurred early (28). Another study reported from the USA had comparable proportions of time until TKA revisions where early revisions comprised of 37.6% and late revisions 62.4% among 781 revisions done in 10 years.[3]

An infected prosthesis was 4.2 times more likely to undergo early revision (p value 0.008) while a loose implant was 1.6 times more likely to undergo late revision (p value 0.018). Joint infection is likely to become evident much earlier than aseptic loosening, hence more likely to undergo revision surgery. No statistically significant associations were found between the two genders, causes of revision and early vs. late revision surgery.

CONCLUSION

The rate of revision TKA at MOI (6.59%) was similar to worldwide rates, with a mean age of 69.1 years, and a female predominance of 60%. Most revisions (70%) were done late (after 2 years), and the predominant cause of revision was aseptic loosening (47.5%) which was positively associated with late revision while prosthetic infection was likely to lead to early revision TKA. Both femoral and tibia components were revised in 50% of the revision TKA surgeries. A national arthroplasty surgery protocol and patient registry is recommended for future research on arthroplasty in Tanzania.

STUDY LIMITATIONS

The study focussed only patients who had both their primary and revision knee arthroplasty surgeries done at MOI. Data was mainly collected from the arthroplasty registry, as it was difficult to contact and trace individual patients (not available via telephone) hence the results may not be completely representative of the actual picture of revision TKA surgeries at MOI.

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