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Title of the article: the epidemiology of revision knee arthroplasty at a tertiary care center in india.

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Abstract: Total knee arthroplasty is now one of the most frequently performed orthopaedic surgery worldwide. Thus revision rates have increased significantly and are expected to rise further in the coming years. Through this study, we attempt to understand the common modes of failure of total knee arthroplasty in India. A retrospective study design reviewing revision cases of total knee replacement operated between January 2014 to September 2015 for the etiology, time period since index procedure, age, sex and functional outcome after revision.). There were 35 cases of revision knee replacement during this period. The demographic data and underlying etiology for primary total knee replacement were reviewed. The mean interval from primary total knee replacement to revision procedure was 2 to 130 months .The mean age of the patients undergoing surgery was 66 years. The minimum follow up was 12 months. Clinical evaluation was performed using knee society score [9]. The mean knee society score was 89.2 for revision group. The most common cause of revision were infection (52%), aseptic loosening (23%), instability (20%) and periprosthetic fracture (5%). The average time period between primary and revision total knee replacement was 74 months for aseptic loosening group, 4 months for the infection group .82 months for instability group and 60 months for the periprosthetic fracture group. Female patients accounted for the majority of the revision cases 30 out of 35 (86%). There was a mean improvement in ROM from 100.2° to 109.7° ($p < 0.0001$), whereas mean KSS improved from 33.2 to 89.2 ($p < 0.0001$). In our experience of Indian population, periprosthetic infection is the most common cause of revision. Functional and radiological outcome improved after revision. Demographic data like age and sex might be associated with causes of revision.

Aims: To find out patient outcome , mode of failure and most common etiological factor for revision of total knee replacement by a single surgeon at a tertiary care Indian centre. Also whether patient demographics and underlying etiology has any bearing on cause of revision.

Settings and Design: A retrospective study design reviewing revision cases of total knee replacement operated between January 2014 to September 2015 for the etiology, time period since index procedure, age, sex and functional outcome after revision. Patients having total knee arthroplasty failure due to infection, aseptic loosening, instability, and periprosthetic fracture were included in study.

Methods and Material: We retrospectively reviewed 1349 cases of total knee replacement at our hospital , operated by a single surgeon(S.P.) between January 2014 to September 2015 (Apollo specialty hospital Bangalore). There were 35 cases of revision knee replacement during this period (primary as well as referred).The demographic data and underlying etiology for primary total knee replacement were reviewed. The mean interval from primary total knee replacement to revision procedure was 2 to 130 months .The mean age of the patients undergoing surgery was 66 years. The minimum follow up was 12 months.

Statistical analysis used: Clinical evaluation was performed using knee society score [9]. Clinical evaluation and ROM were measured passively by a single physiotherapist. It was compared with pre operative values. Descriptive statistical analysis was calculated for continuous study variable. We used the chi square test to compare the dichotomous response satisfaction rates between the different implant groups and to determine the association between etiology of revision and demographic variables of age [10].

Results: The mean knee society score was 89.2 for revision group. The most common cause of revision were infection (52%), aseptic loosening (23%), instability (20%) and periprosthetic fracture (5%). The average time period between primary and revision total knee replacement was 74 months for aseptic loosening group, 4 months for the infection group .82 months for instability group and 60 months for the periprosthetic fracture group. Female patients accounted for the majority of the revision cases 30 out of 35 (86%). There was a mean improvement in ROM from 100.2° to 109.7° ($p < 0.0001$), whereas mean KSS improved from 33.2 to 89.2 ($p < 0.0001$)

Conclusions: In our experience of Indian population, periprosthetic infection is the most common cause of revision. Functional and radiological outcome improved after revision. Demographic data like age and sex might be associated.

Keywords: Revision total knee arthroplasty, causes, epidemiology of failure of total knee replacement in india,

I. Introduction

Total knee replacement is one of the most commonly performed orthopaedic procedures all over the world and due to its success its indications have been increased significantly. As a result younger and active patients are also undergoing total knee replacement if indicated. The number of total knee replacements is projected to increase by 601%from 2005 to 2030 [(1)].Accordingly, the rate of revision would also increase.
One of the most important considerations in revision total knee replacement is soft tissue integrity and bone stock which are often compromised.

The objective of the study was to find out patient outcomes, mode of failure and most common etiological factor for revision in Indian population on a large scale cohort of total knee replacement patients from a single tertiary referral centre. We attempted to analyze the mode and duration to failure for various causes. Also to compare clinical and radiological outcome using knee society score of different implant types.

II. Subjects and Methods

We retrospectively reviewed 1349 cases of total knee replacement at our hospital between January 2014 to September 2015 by a single surgeon (Apollo specialty hospital Bangalore). There were 35 cases of revision knee replacement during this period. The follow up postoperatively was 1 year. The interval from primary total knee replacement to revision procedure was 2 to 150 months. No patients were recalled specifically for the study. All data were sourced from the medical records. The time period between primary and revision total knee replacement was 74 months for aseptic loosening group, 4 months for the infection group 82 months for instability group and 60 months for the periprosthetic fracture group. A distinction can be made into early failure (less than 2 years) and late failure (more than 2 years)[3] .The cause of failure was evaluated by using a detailed history clinical examination , radiography, intra operative findings , inspection of the explanted components and results of hematological tests and tissue cultures. Our exclusion criteria included patients with debridement, washout and liner exchange and fracture fixation. Our inclusion criteria was patient showing signs of infection, instability, aseptic loosening and periprosthetic fracture (both clinically and radiologically). Routine clinical and radiographic follow up was undertaken at 3 month, 6 months and yearly thereafter for all patients. The hospitals database gave us information about demographic and clinical data including sex, age, cause of failure and time from primary total knee replacement to revision knee replacement, implant type and clinical and radiological outcome. Radiographic assessment included analysis of limb alignment and radiolucencies as per the knee society protocol. Isolated wear with absence of osteolysis and migration was differentiated from mechanical loosening intra operatively. Osteolysis was defined as a lesion greater than 5mm that was not present on immediate postoperative films [{4}] .Instability was evaluated using varus valgus and anterior posterior drawer stress radiographs.

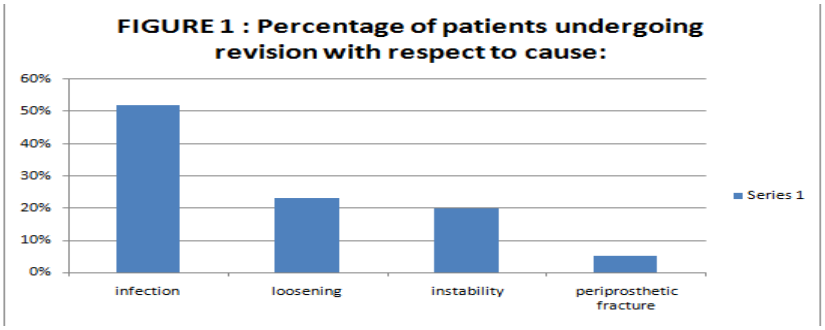
Standard technique for revision total knee replacement was performed. Incision was usually through previous scar with a standard extensile medial parapatellar arthrotomy. In difficult exposure tibial tubercle osteotomy was performed[5].

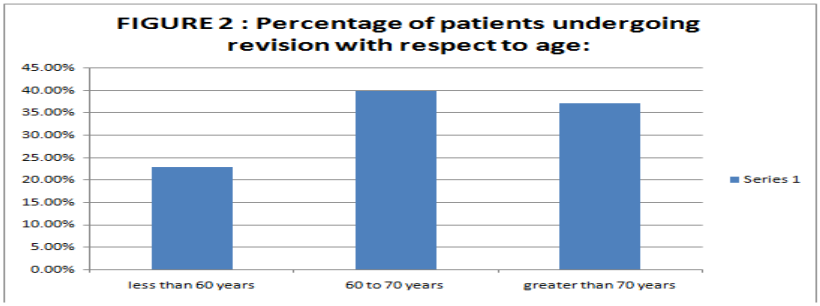
The choice of implant was dependent on soft tissue integrity and bone stock which was planned after thorough preoperative and intra operative evaluation. Three designs have been used for revision. The modular posterior stabilized design which is used if adequate soft tissue envelope and with good varus-valgus and antero-posterior stability[(2)].Constrained implant like condylar constrained design have been used in varus-valgus instability or increased flexion gap laxity[2]. The rotating hindge knee design was reserved for very severe cases of instability and eldery individuals[2]. Our implant of choice was a cruciate substituting prosthesis[6]. In cases of partially intact or partially functioning collateral ligaments, cases with valgus-varus deformities of greater than 15° or with flexion-extension gap mismatches that may predispose to cam dissociation of a standard modular PS design, a semi constrained implant was considered[7]. We would use a rotating hinge prosthesis in cases in which there is complete absence of collateral ligament support or in cases of very severe valgus-varus deformity and flexion contracture, which would necessitate the complete release of the collateral ligaments Revision in infection was done as a staged procedure with delayed prosthetic exchange.
Clinical evaluation was performed using knee society score [9]. Clinical evaluation and ROM were measured passively by a single physiotherapist. It was compared with pre operative values. Descriptive statistical analysis was calculated for continuous study variable. We used the chi square test to compare the dichotomous response satisfaction rates between the different implant groups and to determine the association between etiology of revision and demographic variables of age [10]

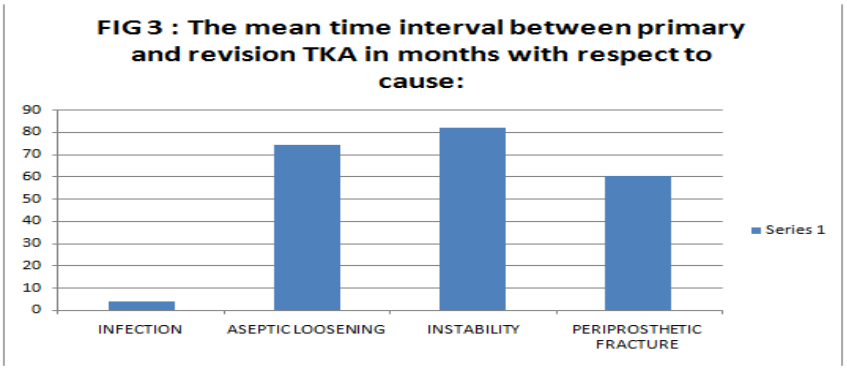
III. Results

A total of 1349 total knee arthroplasties were performed in which we had a revision burden of 35 knees (3.2%).The mean age group of patients undergoing revision were 72 years. The most common cause of revision were infection(52%) , aseptic loosening(23%), instability(20%) and periprosthetic fracture(5%){fig 1} . The mean age group of patients undergoing revision were 72 years. The mean time period between primary and

revision total knee replacement was 74 months for aseptic loosening group , 4 months for the infection group , 82 months for instability group and 60 months for the periprosthetic fracture group{fig 3}. A significant difference was noted between pre- and post revision surgery ROM and KSS scores for all three implant group. There was a mean improvement in ROM from 100.2° to 109.7° ($p < 0.0001$), whereas mean KSS improved from 33.2 to 89.2 ($p < 0.0001$).







IV. Discussion

More than 76 000 TKAs are performed annually in the United Kingdom and risk of revision following primary TKA for osteoarthritis (OA) ten years post-operatively is < 5%.[11] This figure is consistent across a number of registries including 4% in Sweden, 5% in New Zealand, and 6.8% in Australia [11-15]

Pooled data from registries worldwide identifies that the most common indication for revision surgery is aseptic loosening (29.8%), followed by infection (14.8%) and pain (9.5%) [16].

In a recent literature regarding current modes of failure in TKA: infection, instability, and stiffness predominate [17]. Historically, polyethylene wear and its sequelae (osteolysis, late instability, aseptic loosening) were common causes for revision total knee arthroplasty (TKA). Recently, polyethylene manufacturing has become more consistent; furthermore, a clearer understanding of the importance of oxidation on polyethylene performance led to packaging of the polyethylene bearings in an inert environment. This improved the quality and consistency of polyethylene used in TKA, raising the question of whether different failure modes now predominate after TKA such as infection. Still osteolysis and instability arising from polyethylene wear continues to be an important cause in late onset causes of revision TKA .

In another study comparing causes of revision of total knee replacement in united states in which clinical, demographic, and economic data were reviewed and analyzed from 60,355 revision TKA procedures performed in the United States between October 1, 2005 and December 31, 2006. The most common causes of revision TKA were infection (25.2%) and implant loosening (16.1%), and the most common type of revision TKA procedure reported was all component revision (35.2%). Revision TKA procedures were most commonly performed in large, urban, nonteaching hospitals in Medicare patients ages 65 to 74 [18]. This study is in consistency with our findings of infection being the most common cause and also the age group of around 72 years undergoing revision TKA.

Another study reviewing the revision burden at the five referral centers in Hokkaido(japan) was 3.3%, and the most common cause of revision TKA was mechanical loosening followed by infection. Demographic data such as age and sex might be associated with particular causes of revision TK. There is limited information regarding the cause of revision TKA in Asia, especially. Owing to differences in patient backgrounds and lifestyles, the modes of TKA failures in Asia may differ from those in Western countries [19].

Another study reviewing causes of revision of total knee replacement in korea showed despite a recent remarkable increase in TKA use and differences in demographic features, the causes and risk factors for failures in Korea were similar to those of Western countries. Infection was the most common cause of failure, but loosening has emerged as the most common cause in more recent years, which would prompt us to scrutinize the cause and solution to reduce it [20].

As per the above two studies there is still a debate regarding the most common cause of failure of TKA in the Asian continent. At our centre,infection being the most common cause. Early failures are surgeon dependent and infection. Late failures are most likely to be due to osteolysis and loosening.

Also loosening is not properly defined in above studies. In another study revision knee data from six joint arthroplasty centers were compiled for 2010 and 2011 to determine mechanism of failure and time to failure. Aseptic loosening was the predominant mechanism of failure (31.2%), followed by instability (18.7%), infection (16.2%), polyethylene wear (10.0%), arthrofibrosis (6.9%), and malalignment (6.6%). Mean time to failure was 5.9 years (range 10 days to 31 years). 35.3% of all revisions occurred less than 2 years after the index arthroplasty, 60.2% in the first 5 years. In contrast to previous reports, polyethylene wear is not a leading failure mechanism and rarely presents before 15 years. Implant performance is not a predominant factor of knee failure. Early failure mechanisms are primarily surgeon-dependent[21]. In another study to identify the modes of failure after total knee arthroplasty (TKA) in patients >55 years of age and to compare with those >55 years of age in patients who underwent revision TKA. In the ≤55 years of age group, the most common cause of TKA failure was polyethylene wear (45%) followed by infection (26%) and loosening (17%). The interval from primary TKA to revision was 8.6 years (range, 1 to 17 years) [22,23].

Studies published from 2010 onwards demonstrate that infection is the most common indication for revision within two years of the primary procedure, and aseptic loosening is the most common indication for late revision. Polyethylene wear and its sequelae of osteolysis and late instability are now uncommon. However, this was the dominant indication for revision in studies published prior to 2006, accounting for almost 25% of all revisions. Advancement in surgical techniques, tribology and polyethylene manufacturing (gamma sterilisation in inert environments and the use of highly cross-linked polyethylene) may have contributed to fewer polyethylene- and implant-related failures.Comparison between various studies and common causes for revision are mentioned in {table 1}.

In a study comparing modes of failure of TKA in rheumatoid arthritis by determining the Knee Society knee score and function scores, radiographic evidence of failure, and overall survival of the revision procedure in these patients.Of retrospectively reviewed 39 patients with rheumatoid arthritis who underwent 45 TKA revisions from 1994 to 2006. Twenty-seven of the 45 TKA revisions were for mechanical failure of the prosthetic components and 18 for infection. Five of the 27 knees (19%) revised for mechanical failure subsequently failed a second time. Five of the 18 patients who underwent revision for infection died within 6 months and three of the remaining knees failed secondary to reinfection. Excluding the knees that failed, the average Knee Society knee score and function score improved in both subgroups. Two knees had radiographic evidence of non progressive tibial radiolucencies. The probability of survival for all knees (revision as the end point) was 76% ± 9% at 5 years. Thus confirming the previously reported high mortality and subsequent failure rates following revision total knee arthroplasty for both mechanical issues and infection in patients with rheumatoid arthritis and emphasize the potential difficulties in treating these patients[24].Thus even in rheumatoid arthritis mechanical issues and infection plays a major role for revision.

V. Limitation Of Study

Our study is limited by small volume comparing 35 knees along with short term follow up of around one year. Still it provides an insight into the cause and epidemiology of trends of revision in Indian population.

Revision surgery being a difficult procedure considering the economic and technique involved, especially in Indian scenario.

VI. Conclusion

In our experience of Indian population, periprosthetic infection is the most common cause of revision. Functional and radiological outcome improved after revision. Demographic data like age and sex might be associated.

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