Revision for Aseptic Loosening of Primary Total Knee Arthroplasty

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ABSTRACT
Background: the modes of failure of total knee replacement(TKR) can be classified as intra-articular or extra-articular, as biological or mechanical, as early or late. Aseptic loosening is one of leading cause of failure of total knee replacement. **Purpose**: it was to spot light on different surgical strategies; to assess the results of 20 cases of revision total knee arthroplasty after aseptic loosening of primary total knee arthroplasty.
Materials and Methods: this is a prospective interventional study which was conducted during the period from June 2016 to April 2019 with mean follow up two years. It included 20 patients (20 knees) which were undergone for revision TKR due to aseptic loosening of knee prosthesis. These cases were operated at Al-Azhar University hospitals (Al Hussein & Bab El Shaeria).
Results: the average knee society score (KSS) was 79 (range from 55 to 94) compared with an average preoperative KSS of 38 (range from 28 to 48). The mean knee function score at the last follow up was 72 (range from 35 to 95) compared with the mean preoperative knee function score of 31 (range from 10 to 55).
Conclusions: results of revision TKA due to polyethelene (PE) wear and its resultant osteolysis were mostly satisfactory to the patients,
Keywords: Aseptic loosening, total knee, revision.

INTRODUCTION

Total knee arthroplasty (TKA), which is primarily used to manage pain and increase function in patients with symptomatic severe knee osteoarthritis, is now the most commonly performed joint arthroplasty procedure in the United States. In 2012, >670,000 knee arthroplasty operations were performed in the United States with an increase of 86% since 2003 [1].

Factors help to the increase in number of TKAs include population growth, aging and increased longevity of the population, expanded demands for performing TKA, especially in persons <65 years of age, obesity, decrease in post operative complications, and increased patient demand [2].

About 1.5 million of patients with primary knee arthroplasty are 50 to 69 years old, underscoring a large population at risk for revision operations and long-term complications [3].

Aseptic loosening is one of the most common causes for revision after total knee arthroplasty. However, the diagnosis may remain difficult until the prostheses are migrated [4].
Finding the etiology of a painful TKA before surgery is extremely important because "in cases of undiagnosed pain, revision is bad and usually associated with bad results" [5].
Aim: **the aim of this study** was to spot light on different surgical strategies and to assess the results of 20 cases of revision total knee arthroplasty after aseptic loosening of primary total knee arthroplasty.

MATERIALS AND METHODS

This is a prospective interventional study which was conducted during the period from June 2016 to April 2019 with mean follow up two years.

It included 20 patients with 20 knees who underwent revision TKR due to aseptic loosening of knee prosthesis due to PE wear and osteolysis. The patients were operated at Al-Azhar University Hospital. The mean age of studied patients was 64,8. 6 patients were males and 14 were females. The mean body mass index (BMI) was26,2.

Ethical statement:

The patients received an explanation about the nature, purpose and potential risks of the study. An informed written consent was taken prior to surgery. **The study was approved by the Ethics Board of Al-Azhar University.**

Statistical analysis

Data were analyzed using Statistical Program for Social Science (SPSS) version 15.0. Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.
The following tests were done**:**

Independent-samples t-test of significance**:** was used when comparing between two means. Probability (P-value):
– P-value < 0.05 was considered significant.
– P-value < 0.001 was considered as highly significant.
– P-value > 0.05 was considered insignificant.
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RESULTS

In this study we used constrained condylar knee prosthesis in(14) patients, posterior stabilizer in (4) patients and rotatory hinged knee in(2) patients.18 patients were primary osteoarthritis and 2 patients

were rheumatoid arthritis.The medial parapatellar arthrotomy was the main approach used in(11) patients, while rectus snip was used in (8) patients and tubercle osteotomy used in one patient. The mean period between primary and revision was(6,2)year ranged from two years and (15) years as shown in table (1).

Table (1) Patient demographic data

Category	
Gender	Male
	Female
Type of implant used in revision surgery	Constrained condylar kr
	Posterior stabilised knee
	Rotatory hinged knee
Diagnosis at time of primary arthroplasty	Osteoarthritis
	Rheumatoid arthritis
Approach	Medial parapatellar arth
	Rectus snip
	Tibial Tubercle-osteoton

| Category	Mean
Age	64 (59-84)
BMI	26.2 (23-30)
Time between primary and revision arthroplasty	6.2(2-15)

(1) Objective Knee Society Score (KSS):

At the last follow up, the average knee society score (KSS) was 79 (range from 55 to 94) compared with an average preoperative KSS of 38 (range from 28 to 48) (Table 2).

Table (2): comparison between pre – operative and post – operative knee score

Variables		Pre - operative (N = 20)	Post - operative (N = 20)	P-value
ML stability	**Mean**	6.5	14.0	**< 0.001***
	±SD	2.4	2.05	
AP stability	**Mean**	6.0	9.5	**< 0.001***
	±SD	2.05	1.5	
Range of motion	**Mean**	14.3	18.6	**< 0.001***
	±SD	2.8	1.5	
Pain	**Mean**	11.0	37.0	**< 0.001***
	±SD	7.2	7.7	
Total	**Mean**	38.8	79.1	**< 0.001***
	SD	9.7	10.2	

Thirteen (65%) knees had excellent results (80 to 100 points), three (15%) had good results (70 to 79 points), three (15%) knees had fair results (range 60 to 69 points) and one (5%) poor result (<60) (fig. 1).
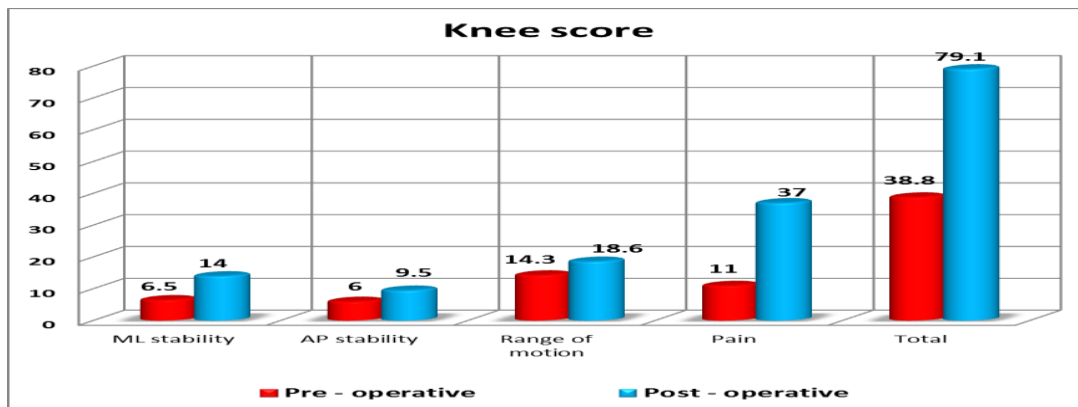
Figure (1): comparison between pre – operative and post – operative knee score.

(2) Knee Function Score (KFS):

The mean knee function score at the last follow up was 72 (range from 35 to 95) compared with the mean preoperative knee function score of 31 (range from 10 to 55) (Table 3). Eight (40%) knees had excellent results (80 to 100 points), eight knees (40%) had good results (70 to 79 points) and two knees (10%) had fair results (range 60 to 69 points) and two knee (10%) had poor result (less than 60) (Fig.2).

Table (3): comparison between pre – operative and post – operative functional score

Variables		Pre - operative (N = 20)	Post - operative (N = 20)	P-value
Total functional score	Mean	31.5	72.5	< 0.001*
	±SD	9.2	8.9	

*: p-value < 0.001 is considered highly significant.

This table shows highly statistical significant difference **(p-value < 0.001)** between pre – operative and post – operative total functional score.
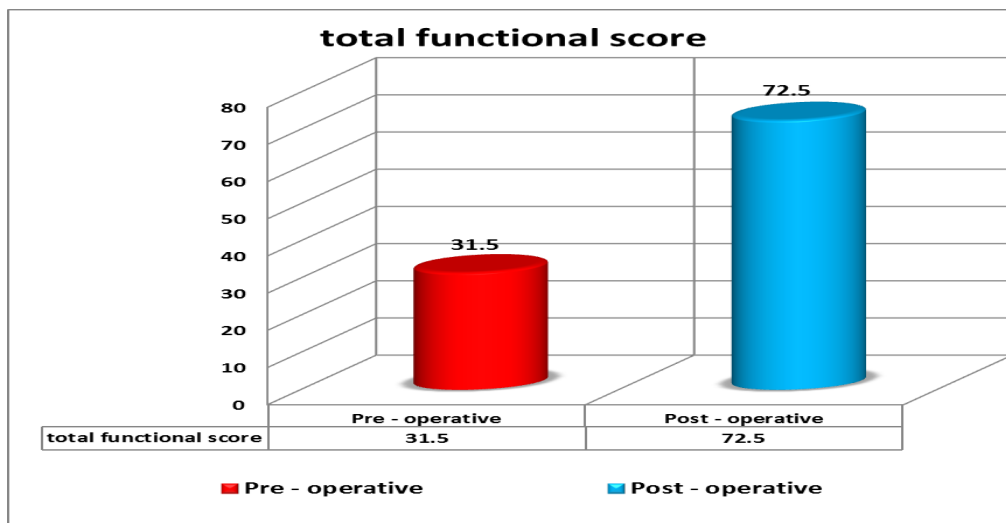

Figure (2): comparison between pre – operative and post – operative total functional score.

(3) Complications:

In studied patients, 2 patients (10%) had infection, 2 patients (10%) had Intra operative condylar fracture, 2 patients (10%) had mid flexion instability, 2 patients (10%) had effusion, 2 patients (10%) had Wound dehesion (fig. 3) while 10 patients (50%) had no complications Table (4)

Table (4): Description of post – operative complications in studied patients

Variables		Studied patients (N = 20)
Complication	Infection	2 (10%)
	Intra operative condylar fracture	2 (10%)
	Mid flexion instability	2 (10%)
	Effusion	2 (10%)
	Wound dehesion	2 (10%)
	No complications	10 (50%)
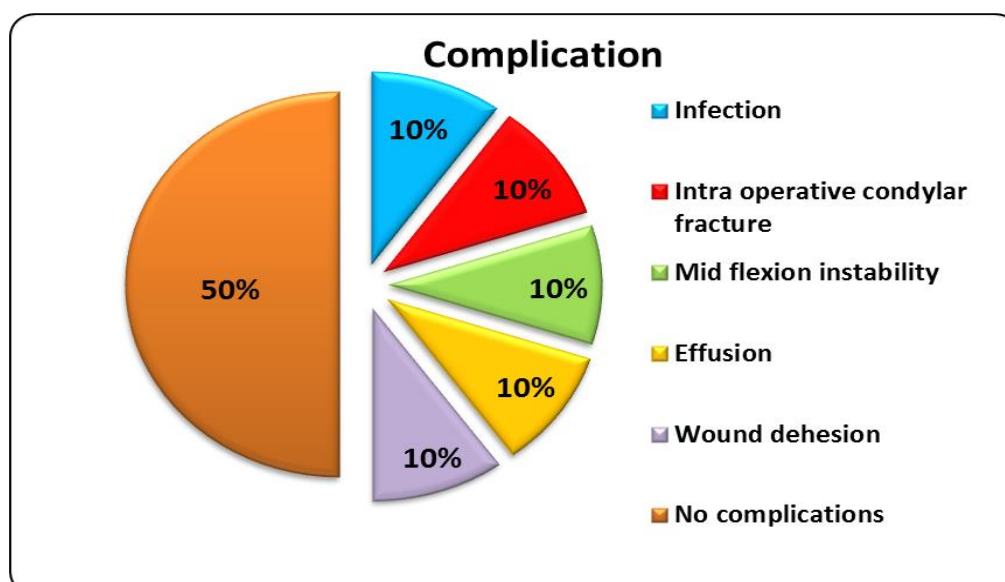
Figure (3): Description of post – operative complications in studied patients.

DISCUSSION

Aseptic loosening following total knee arthroplasty (TKA) is a major cause of revision. Higher risk of revision for aseptic loosening has been reported for mobile-bearing TKAs than fi xed bearing designs [6].

Causes for aseptic loosening in TKR include: wear particle exposure, implant mal alignment, cement mantle thickness, resurfacing the patella and implant design [7].

The main purpose of revision surgery was to establish a stable balanced knee with normal alignment and secure fixation.

Patients with aseptic loosening of knee arthroplasty generally get benefit from the operation of revision in the form of pain relief, restoration of knee alignment and improvement of knee motion and function[8].

In our study the mean ROM (range of motion) improved from 75º (range from 70º-95º) preoperatively to 95º (range from 75º-110º) postoperatively. Fourteen knees showed a ROM between (75º-95º) and six knees between (>95º - 110º) at the last follow up. This change was statistically significant.

The present study showed the benefit from revision total knee arthroplasty for the treatment of aseptic loosening with an increase in the knee society score from 38 preoperatively to 79 postoperatively and improvement of the functional knee score from 31 preoperatively to 72 postoperatively. The improvement in both KSS and KFS was statistically significant. As regarding the knee society score, there were thirteen (65%) knees had excellent results, four knees (20%) had good results and two (10%) knees had fair results one knee (5%) had poor results. On the other hand, the

functional scores showed 8 (40%) knees had excellent results, 8 knees (40%) had good results, 2 knees (10%) had fair results and 2 knees (10%) had poor result.

In retrospective study on the records of 225 revision TKAs operated by **Lee et al.** [9] in a study at one institution, the preoperative KS score was 44.4 on average, which increased to 82.6 at the last follow-up, showing a statistically significant improvement.

In a study of 60 revision TKAs (57 patients) using posterior stabilized (PS), condylar constrained (CCK), or rotating hinge prostheses (RHK), **Vasso and colleagues** [10] examined functional outcomes at a median follow-up of 9 years (range, 4-12 years). At most recent follow-up, mean International Knee Society (IKS) Knee and Function scores were 81 (range, 48-97) and 79 (range, 56-92), mean Hospital for Special Surgery (HSS) score was 84 (range, 62-98), and mean range of motion (ROM) was 121° (range, 98°-132°) (P < .001).

Hwang and colleagues [11] evaluated functional outcomes in 36 revision TKAs and noted that the cemented posterior stabilized (n = 8), condylar constrained (n = 25), and rotating hinge (n = 13) prostheses used did not differ in their mean Knee Society scores (78, 81, and 83, respectively).

In retrospective study by **Tay et al.** [12] of 41 patients , The preoperative Knee Society knee score for the cases was about 28.1, and this improved to 77.2 and 77.6 at 6-month and 2-year follow-up respectively. This was a statistically significant improvement, The Knee Society functional score also improved significantly from a preoperative mean of 40.9 to 59.5 at 6 months and 65.6 at 2 years follow-up. In this study we had 2 patients of wound dehiscence treated by depridement and sutures, 2

patients of fracture lateral condyle treated by cerclage wiring and screws,2 cases of effusion treated by medical treatment and follow up,2 cases of infection treated by depridement and polyethelene exchange for one and rerevision for the other .

Lee et al. [13] had a complication rate of 9.5%. 3 cases showed periprosthetic infection, one case showed aseptic loosening, one case showed periprosthetic fracture and 2 cases showed stem tip pain. *Lee et al* .[9] had Seven patients underwent re-revision TKA using LCCK in 2 years after revision TKA. Six of them suffered from reinfection and 1 had a periprosthetic fracture at a mean of 24.0±2.2 months after revision TKA. One knee was revised at 11 months after revision TKA for femoral shaft periprosthetic fracture. The patient was a 70-year-old woman with osteoporosis. The remaining 6 patients underwent implant removal and cement spacer insertion operation because of reinfection of the operated knee caused by the same.

Suarez et al.[14] cheked the mechanisms of failure of revision TKA, and showed 29% failure rate for septic revision TKAs, with many of these occurring early, within 2 years of surgery. *Kubista et al.*[15] showed a 15.8% re-infection rate in 368 revisions performed for infection, at a median time of 3.6 years follow-up.

Limitation:
1- Reviewed revision TKA data from a single unit.
2- Short period of follow up.
3- The use of different implants could hurt the accuracy of comparison of results.
4- Use of single instrument to measure the clinical outcome.

This study can be improved by obtaining a larger number of patients, which would allow for stratification and accurate subgroup analysis as well. In addition, increasing the period of follow-up would enable us to ascertain the survivorship of our implants in the longer term. Another advantage of longer follow-up would be to follow the trend of functional scores over the follow-up period, which provides a different perspective for the long-term clinical results of the patients undergoing revision TKA.

CONCLUSION

Although the results of revision TKA due to PE wear and its resultant osteolysis are mostly satisfactory for the patients, there are still further precautions that can be taken to optimize the results.The medial parapatellar approach is the main approach used in revisiontaoal knee unless thereis extensive fibrosis.Constained prostheses are used in major cases of revision if there is no severe ligamentous insufficiency. .

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