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Factors Associated with a Short-Term Revision of Total Knee Arthroplasty

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Abstract: Background: To present the short-term complications that required revision surgery on total knee arthroplasty (TKAs) performed during the 2012-2013 period. Objective: To study the relation of complication appearance and type with the prosthesis model and surgical team experience. Methods: Study of patients undergoing TKA at our center between January 2012 and June 2013. Surgical teams were stratified according to the experience of the surgeon. Two different implants were utilized for this study. The following postoperative data were collected: indication for review, time of follow-up from the intervention to the indication for review (in months) and the reason for revision. A total of 322 TKAs were performed. The follow-up time from the placement of the first prosthesis was 35.48 ± 10.23 months. A revision was indicated for 60 of the 322 implanted prostheses (18.6%). The most frequent causes were aseptic loosening in 22 cases (37.9%), and anterior pain in 19 cases (32.8%). According to the prosthetic model, 11 revisions belonged to the A model (18.3%), and 49 (81%) to the B model. These results were statistically significant ($p < 0.001$). Odds Ratio 5.78 (95% CI: 2.87-11.62). In teams with no expert in arthroplasty, the percentage of revision for instability was 8.3%; in teams with one expert, it was 4%; and in teams with two experts, it was 0%. Discussion: There is an increase in the number of reviews in knee arthroplasty surgery. The reasons for failure of total knee arthroplasty depend on several factors, including surgical techniques, implants, demographic variants, etc. The experience of the surgeon seems to influence the number of revisions. Patellofemoral kinematics also influences the evolution of total knee arthroplasty. One of the most important factors is the trochlear groove. Although the optimal troclear design has not been established. Conclusions: The prosthetic model seems to influence the survival of total knee arthroplasty. It is preferable that the surgical team always include a surgeon with expertise in knee arthroplasty.

Keywords: Revision, Total Knee Arthroplasty, Prothesis Model, Surgical Team Experience

1. Introduction

Total knee arthroplasty (TKA) is currently one of the most frequently used procedures in traumatology and the most effective treatment for advanced osteoarthritis [1, 2]. An increase in the number of this intervention is foreseen in the coming decades [3] due to the evolution of the implants, surgical technique, and patient selection. Despite this, revision rates remain high and may increase in the future [3]. The cost of revision arthroplasty is higher and the results worse compared to primary arthroplasty [4, 5], with increased risk of re-revision [6]. According to the MEDICARE database, 8% of the TKAs performed in the USA between 1990 and 2002 were reviewed, many of them during the early

postoperative period [7].

Knowledge of the reasons for TKA failure is critical for improving the results and decreasing the associated medical and socioeconomic costs. In 2005, a series of changes were made to define and improve the registry of causes of failure in total arthroplasty to improve the results [8]. Most studies on knee prosthesis revisions are performed on a single surgeon, a single implant and a single center [9-12], reporting a low number of failed arthroplasties. However, demographic studies continue to report large numbers of revisions [13, 14].

The reasons for revision may vary, and accurate diagnosis and appropriateness of treatment are essential to avoid recurrence.

Objective: To present the short-term complications that required revision surgery in our center on TKAs performed during the 2012-2013 period.

To study the relation of complication appearance and type with the prosthesis model and surgical team experience.

2. Method

Retrospective study of patients undergoing TKA at our center between January 2012 and June 2013. The cut-off point of the revision is defined at the time of its indication.

The variables gender, age, medical history and laterality were collected. Surgical teams were stratified according to the experience of the surgeon and teams, i.e., those with two expert surgeons, one expert surgeon or no expert surgeon. An expert surgeon performed more than fifty of those procedures per year[25].

In our service, all surgeons perform TKA, the choice of implant was surgeon dependent. Two different implants were utilized for this study. Surgical time and postoperative stay of the patient were also recorded. Type of prosthesis model (A or B) is analyzed, the implant A is a constant anatomical and deep bending radius with enlarged posterior condyles while the prosthesis B is multi-radius.

The following postoperative data were collected: indication for revision, time of follow-up from the intervention to the indication for revision (in months) and the reason for revision.

The qualitative variables are expressed as percentages and the quantitative variables as means and standard deviations. Normal distribution of the quantitative variables was determined using the Shapiro-Wilk test. The statistical significance tests used for comparisons between variables were Chi-Square for qualitative variables and Student's T and Mann-Whitney U tests for quantitative variables. A value of $p < 0.05$ was considered statistically significant. Statistical analyses were performed using SPSS software version 23 (SPSS Inc., Chicago, IL, USA).

3. Results

During the months of January 2012 to June 2013, a total of 322 TKAs were performed. The majority of patients were female (248 cases [77%]). The mean age was 70.25 years ± 6.82. Right laterality was observed in 174 cases (54%).

An expert knee team performed 152 (47.2%) arthroplasties, an expert knee surgeon performed 114 (35.4%), and a team without an expert knee surgeon performed 56 (17.4%).

Regarding the model, 159 (49.4%) A prostheses and 163 (50.6%) B prostheses were placed. The mean surgical time was 98.04 ± 24.5 minutes.

The follow-up time from the placement of the first prosthesis was 35.48 ± 10.23 months. (Table 1 represents basical characteristics of the sample).

Table 1. *Demographic characteristics of the sample.*

Demographic features	**N 322**
Age (years)	70,25
Gender	
Male	74
Female	248
Side	
Right	174
Left	148
Type of Prosthesis	
A	159
B	163
Medical History	
DM	
HTA	
Surgeon expertise	
2 expert surgeon	152
1 expert surgeon	114
No expert surgeon	56
Revision	60
Surgical time (minutes)	98,04
Follow up (months)	35,48

Data are presented as No. (%) or mean (SD).
Abbreviations: DM (Diabetes Mellitus), HTA (Arterial Hypertension)

A revision was indicated for 60 of the 322 implanted prostheses (18.6%). The most frequent causes were aseptic loosening in 22 cases (37.9%), and anterior pain in 19 cases (32.8%). Misalignment was found in 6 arthroplasties (10.3%) that required revision. Infection occurred in 4 patients (6.9%). Three patients (5.2%) were reviewed for stiffness, 2 (3.4%) for instability, and 2 for periprosthetic fractures and other diagnoses (1.7% each). (Figure 1).

Table 2. *Distribution of revision surgeries according to type of prostheses and experience of surgery team.*

	Revision TKA N = 60		**p**
	A	**B**	
Type of TKA	11 (18,3 %)	49 (81,7%)	<0,001

	Revision TKA N = 60			**p**
	2 experienced	**1 experienced**	**0 experienced**	
Surgeon expertise	21/152	25/114	14/56	0,098

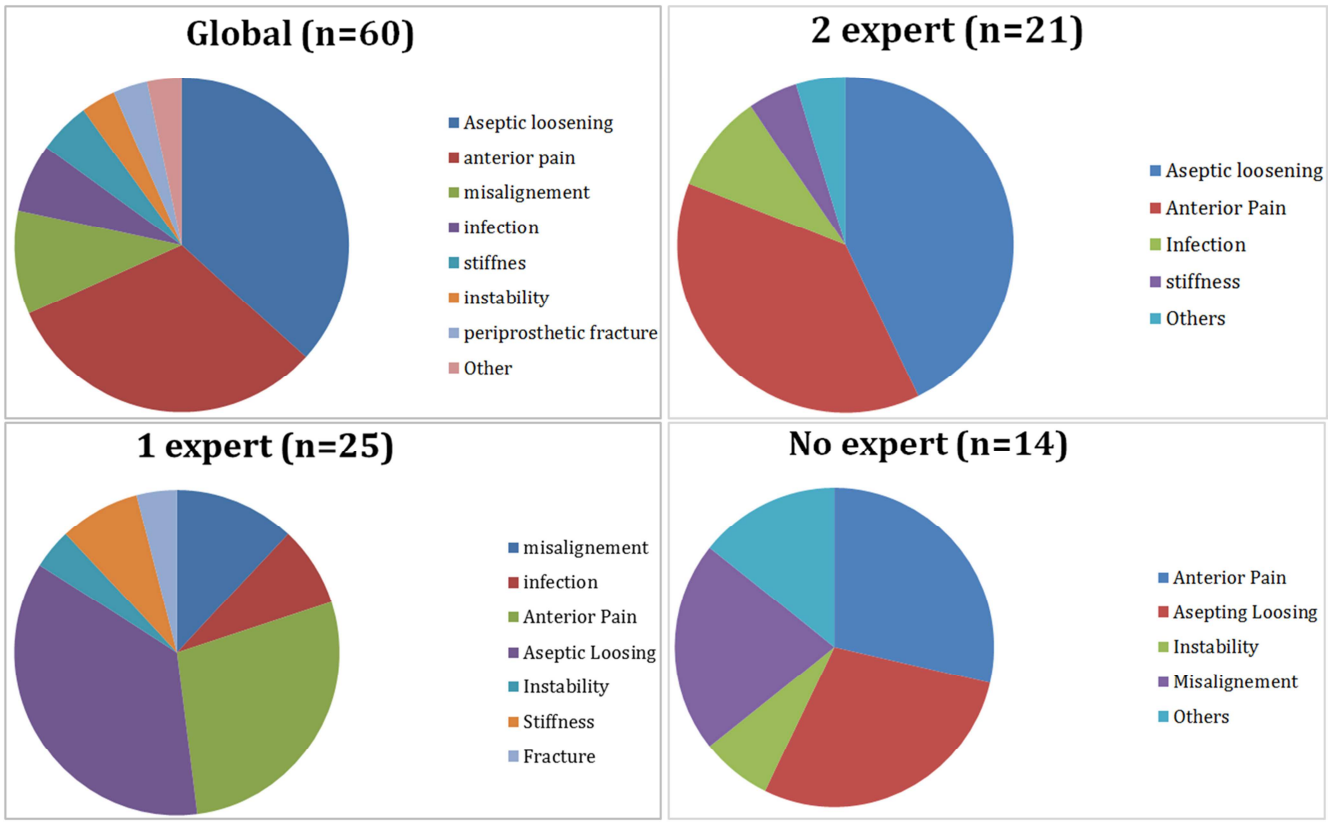

Figure 1. *Causes of revision surgery.*

According to the prosthetic model, 11 revisions belonged to the A model (18.3%), and 49 (81%) to the B model. These results were statistically significant (p <0.001). Odds Ratio 5.78 (95% CI: 2.87-11.62). (table 2) (Figure 2).

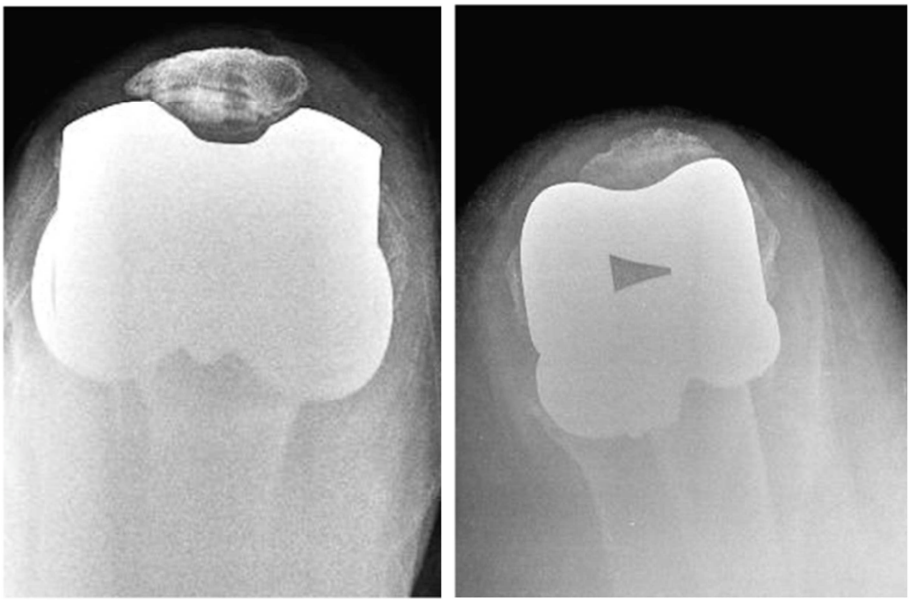

Figure 2. *Differences in the trochlear surface of two prosthetic models.*

Regarding the surgical team, 56 prostheses were implanted by a team without expert surgeons, of which 14 (25%) were reviewed. The team with an expert surgeon performed 114 arthroplasties, 25 (21.9%) of which required a revision. The team with two expert surgeons performed 152 surgeries; 21 (13.8%) required a revision. These data were not statistically significant (p = 0.098).

The least-experienced surgical team used 35 (62.5%) B prostheses and 21 (37.5%) A prostheses. The team with one experienced surgeon performed 54 (47.4%) arthroplasties with the A model and 60 (52.6%) with the B model. The most experienced team performed 84 (55.3%) arthroplasties with

the A model and 68 (44.7%) with the B model. This distribution did not show statistically significant differences ($p = 0.06$).

In teams with no expert in arthroplasty, the percentage of revision for instability was 8.3%; in teams with one expert, it was 4%; and in teams with two experts, it was 0%. At the same time, misalignment was presented on three occasions each in teams with no or one expert ($p = 0.60$).

4. Discussion

The novelty of our study is the reversal of causes of short-term revision of TKA, with aseptic loosening being the leading cause rather than infection. There is an increase in the number of reviews compared to other studies, possibly related to surgical experience and the prosthesis type.

Most available studies refer to a single center, a single surgeon and a single type of prosthesis, showing excellent results [9-12]. However, overall revision rates are much higher [13, 14]. In this study, are compared two prosthesis models and level of surgical experience.

The revision rate was 18.6% (60 out of 322) during a follow-up period of 36 months, higher than procedures in the USA (10%) [15] and South Korea (2% -3.1%) [16].

The reasons for failure of total knee arthroplasty depend on several factors, including surgical techniques, implants, demographic variants, etc.

The most common causes of revisión according Sharkey et al [12]. were polyethylene wear, aseptic loosening, and instability, performed over a 3-year period at a single institution. Other investigators have implicated, polyethylene wear, aseptic loosening, pain, osteolysis, instability and stiffness as common causes of TKA failure [11, 17]. In our case, aseptic loosening (37.9%) was the most frequent cause of review, followed by anterior pain (32.8%). Misalignment was present in 10.3% of the reviews. Infection, which is the most frequent cause in short-term reviews [10, 18, 19] , was ranked fourth (6.9%). Revisions due to polyethylene deterioration, as has been common in recent studies, have decreased considerably compared to previous studies due to advances in materials and their manufacture.

Analyzing the revision based on the model of prosthesis highlights the accumulation of cases with B (81.7%); if the surgeon implanted the B model, there was a 30.1% chance of having to revision it in the next 36 months. Patellofemoral kinematics also influences the evolution of total knee arthroplasty. One of the most important factors is the trochlear groove [20], developing "patela-friendly" implants. Although the optimal troclear design has not been established [20]. Other factors, such as the radius of the femoral component may also affect. It seems that the single-radius has certain benefits over the multi-radius, but this has not been clinically proven [21, 22]. Clinical studies have also appreciated differences between different prosthetic models [23, 24].

The experience of the surgeon seems to influence the number of revisions[25], as the percentage of revisions in the team with two experts was almost 50% lower than in teams without experts.

Regarding the causes of revision, are observed that instability and misalignment, two possible causes attributable to the inexperience of the surgeon, was presented in greater proportion in the most inexperienced team.

Our study has limitations, namely the retrospective nature of the study, possible variability in the indication for revision established by different specialists, nonhomogeneous distribution of surgical teams according to the experience of the surgeon, lack of preoperative or postoperative function measurements, patients have not received preoperative education on total knee arthroplasty and absence of radiological grade data for arthrosis prior to TKA.

5. Conclusions

The short-term revision rate in the study was 18.6%, with aseptic loosening and anterior knee pain being the most frequent causes, different with respect to previous studies.

The prosthetic model seems to influence the survival of total knee arthroplasty, therefore, new studies on the design of the prosthesis are necessary.

It is preferable that the surgical team always include a surgeon with expertise in knee arthroplasty.

Conflict of Interest

All the authors do not have any possible conflicts of interest.

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