Complications and failures of non-tumoral hinged total knee arthroplasty in primary and aseptic revision surgery: A review of 290 cases

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Original article

Complications and failures of non-tumoral hinged total knee arthroplasty in primary and aseptic revision surgery: A review of 290 cases

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ABSTRACT

Introduction:

Hinged total knee arthroplasty (TKA) implants are a commonly used option during revision or even primary surgery, but their complications are not as well-known due to the rapid adoption of gliding

implants. The literature is inconsistent on this topic, with studies having a small sample size, varied follow-up duration and very different indications. This led us to carry out a large multicenter study with a minimum follow-up of 5 years to evaluate the complications after hinged TKA in a non-tumoral context based on the indications of primary arthroplasty, aseptic surgical revision or fracture treatment around the knee.

Hypothesis:

Hinged TKA was associated with a high complication rate, no matter the indication.

Material and Methods:

Two hundred ninety patients (290 knees) were included retrospectively between January 2006 and December 2011 at 17 sites, with a minimum follow-up of 5 years. The patients were separated into three groups: primary surgery (111 patients), aseptic revision surgery (127 patients) and surgery following a recent (< 3 months) fracture (52 patients: 13 around the TKA and 39 around the knee treated by hinged TKA). Patients who had an active infection the knee of interest were excluded. All the patients were reviewed based on a standardized computer questionnaire validated by the SOFCOT.

Results:

The mean follow-up was 71 ± 39 months [range, 0 to 188]. Of the 290 patients included in the study, 108 patients (37%) suffered at least one complication and 55 patients (19%) had to undergo revision surgery: 16 in the primary TKA group (16/111, 14% of primary TKA), 28 in the revision surgery group (28/127, 22% of revision TKA) and 11 in the fracture treatment group (11/52, 21% of fracture TKA). The complications due to the hinged TKA for the entire cohort from most to least common were stiffness (41/290, 14%), chronic postoperative pain (37/290, 13%), infection (32/290, 11%), aseptic loosening (23/290, 8%), general complications (20/290, 7%), extensor mechanism complications (19/290, 6%), periprosthetic fracture (9/290, 3%), mechanical failure (2/290, 0.7%). In the primary TKA group, the main complication leading to re-operation was infection (12/111, 11%), while it was loosening for the revision TKA group (15/127, 12%) and infection (8/52, 15%) for the fracture TKA group.

Discussion:

The 37% complication rate for hinged TKA implants is high, with 19% of them requiring re-operation. The frequency of complications differed depending on the context in which the hinged implant was used (primary, revision, fracture). The complications requiring revision surgery were major ones that

prevented patients from preserving their autonomy (infection, symptomatic loosening, fracture, implant failure). The most found complications – stiffness and chronic pain – rarely led to revision.

Level of evidence: IV; retrospective cohort study

Key words: Total knee replacement, hinged total knee replacement, failures and complications, non-tumoral pathology

1) Introduction

In its 2016 report, the ANSM (French National Agency for Medicines and Health Products Safety) [1] documented a 30% increase in the number of total knee arthroplasty (TKA) procedures between 2008 and 2013 in France. This trend was also observed in other countries [2,3]. Consequently, the number of TKA revisions is expected to grow, with Kurtz et al. [3] predicting a 600% increase in the United States by 2030. Pietrzak et al. [4] showed that the TKA revision surgery rate increased by 6.5 times between 2010 and 2015 for the same team. For these surgical revisions, hinged TKA implants often appear to be the best solution especially when a patient presents with instability or significant bone loss [5-19]. Furthermore, hinged TKA implants have a place in primary surgery with the main indications being major laxity in the collateral ligaments, large deformity, chronic inflammatory arthropathy, neurological conditions and traumatic and post-traumatic lesions [17,20,21].

But published studies on this topic sometimes have a small sample size [22-25] or short follow-up [25-29] and some of the larger studies are now dated, since patients were operated more than 30 years ago [10,16,24,30]. Furthermore, some studies do not differentiate between the tumor indication and non-tumor context [27,31-33]. The complication rates reported in the literature vary greatly depending on the features of the study (Table 1).

With this in mind, we conducted a large multicenter study with a minimum 5 years' follow-up to evaluate the complications of hinged TKA implants used in non-tumor cases in the following indications: primary TKA to treat degeneration or fracture and aseptic TKA revision. We hypothesized that hinged TKA was associated with a high complication rate, no matter the indication.

2) Material and methods

2.1 Patients

In this retrospective, multicenter study (17 French university hospitals), 290 patients (195 women [67%] and 95 men [33%]) were included who had at least 5 years of follow-up. Patients were

operated on between January 2006 and December 2011. The mean patient age at the time when the hinged TKA was implanted was 69 ± 13 years [range, 19 to 96]. The American Society of Anesthesiologist (ASA) score [34] and the patients' autonomy level based on the Devane score [35] are listed in Table 2. Excluded from this study were patients who either had an active infection in the knee in question, had incomplete radiographic records or has no radiological or clinical data at the final follow-up visit.

The patients were separated into three groups: 111 patients (32 men, 79 women) received a hinged TKA during a primary knee replacement, 127 patients (48 men, 79 women) during aseptic revision surgery and 52 patients (15 men, 37 women) as a treatment for a recent (< 3 months) fracture (13 around the TKA and 39 around the knee treated by hinged TKA). The surgical indications are summarized by group in Table 3.

In the context of TKA revision, 72% (91/127) of revised implants were gliding ones, 20% (25/127) were hinged, 6% (8/127) were constrained implants and 2% (3/127) were unicompartmental knee arthroplasty (UKA) implants.

2.2 Methods

The patients were evaluated using a retrospective questionnaire approved by the SOFCOT, which was based on prior studies (SOFCOT and SFHG), established beforehand and identical for each participating research site. The questionnaire captured information from the patient's final clinical examination (joint range of motion, laxity in various planes, skin condition). The available radiographs were also analyzed to capture goniometric data and to look for periprosthetic radiolucent lines based on the classification by Ewald [36]. The data were collected and tabulated by an independent research assistant through an online platform.

Postoperative stiffness was defined as flexion deficit > 10° and/or flexion < 90°. Residual pain was defined as a level ≥ 4 on a visual analog scale (VAS). The presence of a postoperative TKA infection was confirmed with at least one deep and reliable microbiological tissue sample or had to meet the infection criteria set out by the IDSA [37]. Aseptic loosening was characterized by local radiographic modifications when no infection was present: appearance of a radiolucent line ≥ 1 mm or shifting of the implants. Pathologies of the extensor mechanism consisted of extensor mechanism rupture or patellofemoral instability defined by at least one episode of patellar dislocation. A

mechanical complication occurred when the implant broke or disassembled, whether at the hinge or another part of the implant. The occurrence of a periprosthetic fracture was documented.

General complications (vascular, neurological, cardiopulmonary) and mortality after surgery were documented and evaluated based on the classification by Dindo et al. [38]. Special emphasis was placed on mortality occurring within the first year postoperative.

The radiographic assessment of the knee consisted of AP, lateral, Schuss, 30° sunrise and weightbearing long-leg standing views.

During the surgery to implant the hinged TKA, all patients had their bone stock assessed according to the AORI classification [39]: 47% (60/127) of patients had significant bone loss in their tibia and 45% (57/127) in their femur (AORI ≥ type II). Filling of bone defects was accomplished by adding wedges to the tibia or femur. In two cases, allograft bone was needed. The implants used were cemented and had medullary extension stems. None of the implants used in this study were porous-coated.

2.3 Statistical analysis

The statistical analysis was done by the Biostatistics Department of the University of Lille using SAS software (version 9.4, SAS Institute, Cary, NC, USA). The results are presented as counts and percentages for the qualitative variable, and as mean with standard deviation and minimum/maximum values for qualitative variables. Chi^2 and Student's *t* test were used with parametric variables, while the Wilcoxon and Fisher's exact tests were used with non-parametric variables. The significance threshold was $p = 0.05$. Fisher's exact test was used when the sample size was less than 5.

3) RESULTS

3.1 Complications

At a mean follow-up of 71 ± 39 months [range, 0 to 188], 108 of the 290 patients (37%) suffered at least one complication on the hinged TKA. Fifty-five patients (19%) required revision surgery. These complications are summarized in Table 4. The complications in the overall population are listed by the most to least prevalent:

1) Stiffness was the most frequent complication: 14% of patients (41/290). The mean range of motion in patients diagnosed with joint contracture was 76° ± 26° [range, 0 to 120] in flexion, 9° ± 10° [range, 0 to 40] flexion deficit and 0° ± 2° [range, 0 to 10] recurvatum. The patients who had a joint contracture were younger (63.8 years ± 15.6 [range, 25 to 94]) than the rest of the population (71.5 ± 11.1 [range, 19 to 89]) ($p < 0.001$).

2) Chronic postoperative pain was the second most common complication: 13% of patients (37/290) had pain on VAS ≥ 4.

3) Infection was in third place, with 11% of patients (32/290) having suffered a postoperative infection around their hinged TKA implants. These infections mainly occurred in the first 2 years after the implantation, with a mean time to occurrence of 12 months ± 13 [range, 0 to 61] (Table 5).

4) Aseptic loosening of an implant component made up 8% of the complications (23/290) and occurred after an average of 45 months ± 32 [range, 3 to 120]. Loosening affected the femoral implant in 17 knees and the tibial implant in 13 knees. Loosening of the patellar implant occurred in only 1 knee. Both implants (tibia and femur) had loosened in 8 patients. The patients who had implant loosening were younger at the time of implantation (mean age at surgery of 64.1 ± 11 [range, 41 to 82]) relative to those who did not experience implant loosening (70.2 ± 31.1 [range, 19 to 96]) ($p = 0.007$).

5) Complications related to the extensor mechanism made up 7% (19/290) of hinged TKA complications. Eleven patients (4%) had patellar instability while 8 patients (3%) suffered an extensor mechanism rupture.

6) Periprosthetic fractures occurred in 3% of patients (9/290). These mainly occurred in the femur (8 knees) and more rarely in the tibia (1 knee). There were no patellar fractures.

7) Mechanical failures were a rare complication (0.7%, 2/290) with the hinge breaking in one patient and the femoral extension stem breaking in another patient (who also had documented femoral loosening).

3.2 Surgical revisions

In all, 23% of patients (68/290) required a surgical revision because of complications. While joint contracture and chronic postoperative pain were two most common complications, they did not lead to many surgical revisions; in fact, only two patients who had a joint contracture underwent an arthrolysis surgery, with no other revisions required later on.

Of the 32 patients who suffered an infection, 31 patients had to undergo surgical revision that involved major procedures: 12 implant changes, 4 above-knee amputations and 2 tibiofemoral arthrodesis (Table 5). Also, 13 patients underwent joint lavage but the implants were not changed. Only one patient (79-year-old female) did not undergo surgical revision because anesthesia was contraindicated. Seventeen of the 23 patients who had implant loosening underwent revision surgery, with 9 femoral and tibial components, 5 isolated tibial and 3 isolated femoral revisions.

Complications related to the extensor mechanism had a lower surgical revision rate, since only 4/8 patients who suffered an extensor mechanism rupture were re-operated. The revision rate was even lower for patellofemoral instability; 2/11 patients underwent revision surgery, both in the primary surgery group. All the patients who suffered a mechanical implant failure or periprosthetic fracture underwent surgical revision (11 patients).

3.3 General complications and mortality

General complications occurred in 20 of the 290 patients (7%). Two patients (0.7%) had a grade I complication as defined by Dindo et al. [38] (transient common fibular nerve damage). Eleven patients (4%) had a grade II complication: 9 patients (3%) had a deep vein thrombosis and 2 (0.7%) had a pulmonary embolism. Three patients (1%) had a grade IVa complication (two heart attacks and one ischemic stroke). There was one (0.3%) grade V complication: early death due to a stroke. Two strokes (0.7%) and two postoperative heart attacks (0.7%) occurred.

At the follow-up, 40/290 patients (14%) had died. The mean age at time of surgery of the patients who died was 76 years ± 7 [range, 60 to 96]. The mean time between the surgery and death was 57 months ± 35 [range, 0 to 149]. Only 5 deaths occurred during the first year postoperative, including the one patient who suffered a massive stroke and died on the 2nd postoperative day; he was in the revision TKA group (Table 4).

3.4 Complications by group

In the subset of patients who underwent primary TKA with a hinged implant (111 patients), the most common complication was infection (12/111 patients; 11%), following by joint contracture (11/111 patients; 10%) and extensor mechanism damage (8/111 patients; 7%).

In the patients who received a hinged implant in the context of TKA revision (127 patients), the most common complication was stiffness (23/127 patients; 18%), followed by chronic pain (21/127

patients; 16%) and loosening (15/127 patients; 12%). Infection was the fourth most common (12/127 patients; 9%).

In the subset of patients who received a hinged TKA implant because of a fracture, the main complications were infection and pain (8/52 patients each; 15%), then postoperative stiffness (7/52 patients; 13%). The complications by group are summarized in Table 4 and Figures 2 and 3.

4) DISCUSSION

In this study of 290 hinged TKA implants used for non-tumor and non-infection indications with at least 5 years' follow-up, the complication was high since 108 patients suffered at least one complication after surgery (37%), with 55 of them also requiring surgical revision (19%). This high number of complications can be explained by the counting of complications that did not require surgical revision such as chronic pain and stiffness. In fact, surgical revisions were done when the complications threatened the patients' life or autonomy: infection, symptomatic loosening, fracture, implant failure. Despite their high frequency, pain and stiffness are not well studied complications, where a surgical solution is rarely adopted given the complexity of the surgical treatment or the patient's fragility [5,6,11,17,21,22,26,40]. Our study has several strong points, and it was the second largest recent study on hinged TKA done, after the study by Cottino et al. [41]. Contrary to that study, our study did not include hinged TKA implantations performed in an infected joint, which means that we could study the development of postoperative infection more reliably. The multicenter nature of our study allowed us to study a large number of patients and to reduce the center effect. The mean follow-up in our study (71 months) is comparable to other published studies on this topic and allowed us to analyze complications occurring in the short and medium term after hinged TKA implantation (Table 1).

The infection rate in our study (11%; 32 patients) appears to be in the average of the literature [10,11,16,19,24,26,27,29,31-33,42-49]. This complication always requires surgical treatment except if a major contraindication exists. This rate was higher than after gliding TKA (partially constrained or not), which was reported to be 2% in 2013 by Argenson et al. [50]. It is the most serious complication that can endanger the viability of the lower limb. This is one of our most important findings. While prior infections in the operated limb were excluded, the infection rate after hinged TKA remains elevated in our three subsets of patients. The patient's pre-existing local and general medical conditions (Tables

2, 3) bring us to seriously consider the background on which hinged TKA implants are used. In fact, patients in our study were on average older, overweight or even obese, had a history of cardiovascular disease and had limited autonomy in 56% of cases (162 patients).

Aseptic loosening made up 8% of the complications (23 patients), which is consistent with other published studies in which the loosening ranged from 1% to 13% [19,28,29,33,42-45,49]. We included the loosening cases that were not reoperated on (Ewald's radiographic criteria [36]), which may increase the incidence of this complication relative to other studies where surgical revision was the only criterion for labelling loosening as a complication [28,29,33,42,44]. We noticed that aseptic loosening is mainly observed in the subset of patients who were undergoing revision surgery, and mainly occurred at the femur. This trend was also found in the meta-analysis by Chaudhry et al. [28]. These findings can probably be explained by the presence of localized bone defects.

Mechanical failure of TKA implants is now rare because of improvements in their design and the use of hinged rotatory models [15,32,43,49,51,52]. The extensor mechanism continues to be a cause of complications, with patellar instability being more common than extensor mechanism rupture. These findings are also consistent with the literature [11,17,23,27,30-32,41,45,46]. Periprosthetic fractures are rarer but mainly occurred in the femur and always required re-operation as described in the literature [10,16,17,25,30,31,41-46].

General complications were not very common in our study, while their incidence varies greatly in the literature (Table 1) [10,16,17,27,28,30,31,41,45,53]. The high number of complications with hinged TKA implants relative to gliding implants [50] along with the number of deaths found in our study and in the literature highlights the fact that the patient's general health or local medical conditions are against us when implanting hinged TKAs [16,17,20,54,55].

The complication rate varies within the different subsets of patients in our study according to the surgical indication (Fig. 2, 3 and Table 4). The surgical revision and fracture subsets had a higher complication rate, which can be explained by the patients' worse overall health, unfavorable conditions around the knee and complexity of the surgical procedure [7-13,21,42,46,53,56]. In the primary TKA subset, the high rate of infection and mortality is a reminder of the specific predispositions for these patients: either local ones such multiple ligament lesions, considerable knee laxity, large deformity or multiple prior surgeries or in patients who have systemic diseases such as inflammatory arthropathy that involve long-term immunosuppressant therapy [22,24,26,40,41,55,57].

Nevertheless, our study has several limitations: 1) Excluding patients who had an active infection or history of bone/joint infection in their knee helped to limit the bias due to an infection. But

this criterion is also a study limitation since implanting a hinged TKA in an infected knee joint was not studied. This was a conscious choice in order to study the occurrence of an infection more reliably after performing TKA with hinged implants. 2) The retrospective nature of this study is a limitation; while it allowed us to accumulate data from a large set of patients, the data collection was not exhaustive despite using a standardized questionnaire to limit this bias. 3) Even with the large sample size, the subgroup analysis was difficult in some instances because of the rarity of some events; thus one should be cautious about drawing conclusions on some of these analyses.

5) CONCLUSION

Hinged TKA implants are associated with a high complication rate that differs by the surgical indication. The most frequent complications (pain and stiffness) rarely required surgical treatment due to the complexity of the revision procedures and its risks. Infection and periprosthetic fractures require surgical treatment in nearly every case, despite their risk. Problems related to the extensor mechanism and implant loosening were treated surgically or conservatively depending on the patient's discomfort, local conditions and general health. Hinged TKA implants have a place in our prosthetic arsenal but they should be used in a carefully and calculated manner given the frequency of complications.

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Author contributions: Etienne Caron collected data, reviewed the literature and wrote the article. Antoine Gabrion initiated the study and collected data. Matthieu Ehlinger initiated the study and collected data. Nicolas Verdier collected data and reviewed the literature. Brice Rubens-Duval collected data and reviewed the literature. Thomas Néri collected data. Pierre Martz collected data and reviewed the literature. Sophie Putman supervised the study and the writing of the article. Gilles Pasquier initiated the study, collected data, supervised the study and writing of the article.

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Table 1: Complications after hinged TKA in the literature. *: primary surgery, ** revision surgery *** patellofemoral

(*see table excel*)

CFN: Common fibular nerve damage; DVT: Deep vein thrombosis, PE: Pulmonary embolism. The article by Smith et al. [31] compares two sets of patients.

Table 2: Characteristics of the population and subgroups (Mean ± SD and min/max)

	Total	Primary TKA	Revision TKA	Trauma (fracture)	p value
Number of patients	290	111 (38.2%)	127 (43.8%)	52 (18%)	–
Man	95 (32.8%)	32 (28.9%)	48 (37.8%)	15 (28.8%)	0.27
Woman	195 (67.2%)	79 (71.1%)	79 (62.2%)	37 (71.2%)	
Age	69 ± 13 [19 to 96]	68 ± 14 [19 to 94]	69 ± 12 [23 to 89]	72 ± 15 [31 to 96]	0.053
Mean ASA score [34]	2.4 ± 0.6 [1 to 4]	2.2 ± 0.6 [1 to 3]	2.4 ± 0.6 [1 to 4]	2.1 ± 0.7 [1 to 3]	**0.039**
ASA I	27 (9.3%)	14 (12.6%)	3 (2.3%)	10 (19.2%)	
ASA II	163 (56.2%)	60 (54.1%)	74 (58.3%)	29 (55.8%)	
ASA III	99 (34.2%)	37 (33.3%)	49 (38.6%)	13 (25%)	
ASA IV	1 (0.3%)	0 (0%)	1 (0.8%)	0 (0%)	
Mean Devane score [35]	2.60 ± 1.10 [1 to 5]	2.51 ± 0.96 [1 to 5]	2.71 ± 1.12 [1 to 5]	2.54 ± 1.29 [1 to 5]	0.39
Devane 1	33 (11.4%)	10 (9%)	11 (8.7%)	12 (23.1%)	
Devane 2	129 (44.5%)	56 (50.5%)	55 (43.3%)	18 (34.6%)	
Devane 3	74 (25.5%)	28 (25.2%)	36 (28.3%)	10 (19.3%)	
Devane 4	28 (9.7%)	12 (10.8%)	10 (7.9%)	6 (11.5%)	
Devane 5	26 (8.9%)	5 (4.5%)	15 (11.8%)	6 (11.5%)	
Mean BMI	28.8 ± 6.3 [16.4 to 52.1]	29.1 ± 6.7 [16.4 to 52.1]	29.2 ± 5.8 [17.9 to 47.6]	26.7 ± 5.7 [16.4 to 45.3]	0.59

TKA: Total knee arthroplasty, BMI: Body mass index

Table 3: Surgical indication for hinged TKA by group

Primary TKA		Revision TKA		Trauma (fracture)	
Number of patients	111	Number of patients	127	Number of patients	52
Large deformity	61 (55%)	Aseptic loosening	75 (59%)	Post-traumatic sequelae	25 (48%)
Arthropathy	29 (26%)	Ligament laxity	50 (39%)	Fracture in older adult	17 (33%)
Ligament laxity	11 (10%)	Other	2 (2%)	Nonunion	8 (15%)
Primary OA	10 (9%)			Laxity	2 (4%)

OA: osteoarthritis

Table 4: Summary of complications by group (N = number of cases (% by group))

	Total	Primary TKA group	Revision TKA group	Trauma group	p value
Number of patients	290	111	127	52	–
Complications	108 (37.2 %)	32 (28.8 %)	56 (44.1 %)	20 (38.5 %)	0.05
Type of complication					
Stiffness	41 (14.1 %)	11 (9.9 %)	23 (18.1 %)	7 (13.5 %)	0.19
Pain	37 (12.8 %)	8 (7.2 %)	21 (16.5 %)	8 (15.4 %)	0.08
Infection	32 (11.0 %)	12 (10.8 %)	12 (9.4 %)	8 (15.4 %)	0.51
Loosening	23 (7.9 %)	6 (5.4 %)	15 (11.8 %)	2 (3.8 %)	0.39
Extensor mechanism (instability and rupture)	19 (6.6 %)	9 (8.1 %)	6 (4.7 %)	4 (7.7 %)	0.52
Periprosthetic fracture	9 (3.1%)	1 (0.9 %)	7 (5.5 %)	1 (1.9 %)	0.11
Common fibular nerve deficit	2 (0.7 %)	2 (1.8 %)	0 (0%)	0 (0%)	0.32
Mechanical failure	2 (0.7 %)	0 (0%)	1 (0.8 %)	1 (1.9 %)	0.47
Surgical revision	55 (19.0 %)	16 (14.4 %)	28 (22.0 %)	11 (21.2 %)	0.29
Death	40 (13.8%)	19 (17.1%)	12 (9.4%)	9 (17.3%)	0.17
Died within 1 year	4	1	2	1	0.67
Died beyond 1 year	36	18	10	8	0.12
Mean time surgery/death (months)	57 ± 35 [0 to 149]	59 ± 28 [6 to 109]	69 ± 53 [0 to 149]	38 ± 27 [3 to 66]	0.17

Table 5: Infections with their treatment and mean time between surgery and occurrence of infection (N = number of cases) (Mean ± SD and min/max)

	Total	Group Primary TKA	Group Revision TKA	Group Trauma (fracture)	p value
Number of patients	290	111	127	52	-
Infections	32 (11%)	12 (10.8%)	12 (9.4%)	8 (15.4%)	0.51
Revision for infection	31	11 (9.9%)	12 (9.4%)	8 (15.4%)	0.47
Treatment of infection					
Lavage	13	7	4	2	0.35
TKA implant change	12	4	4	4	0.72
Fusion	2	0	1	1	0.71
Amputation	4	0	3	1	0.16
Mean time surgery/infection (months)					
Mean time	12 ± 13 [0 to 61]	8 ± 8 [1 to 26]	18 ± 16 [0 to 61]	7 ± 9 [0 to 27]	0.25

TKA: Total knee arthroplasty

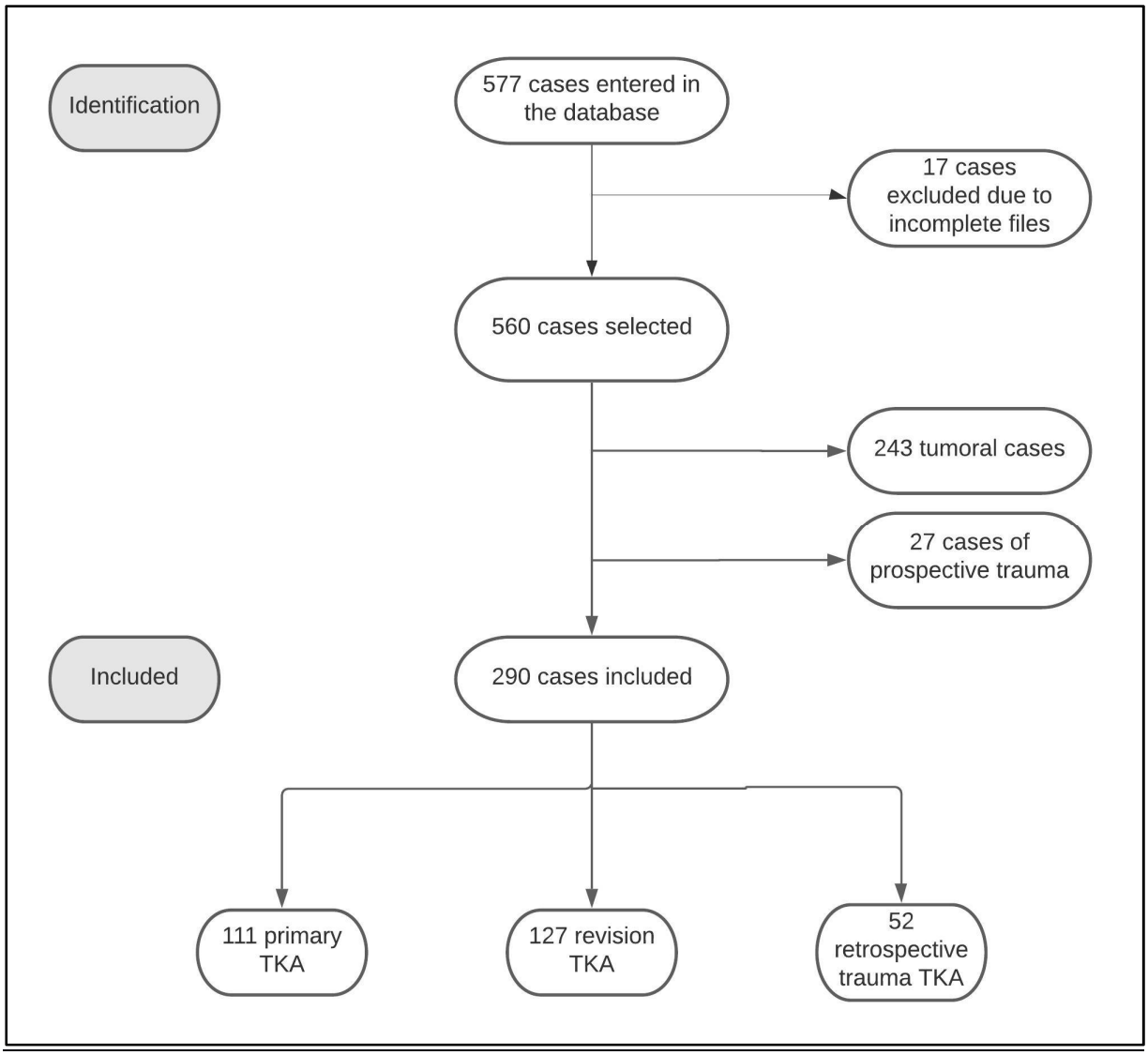
Figure legends

Figure 1: Flow chart

Figure 2: Summary of the various complications (number of cases) in the general population

Figure 3: Diagram of the main complications (in percentage) by group, excluding rare complications (mechanical failures and deficit of the common fibular nerve)

Figure 1 :



TKA : Total knee arthroplasty

Figure 2 :

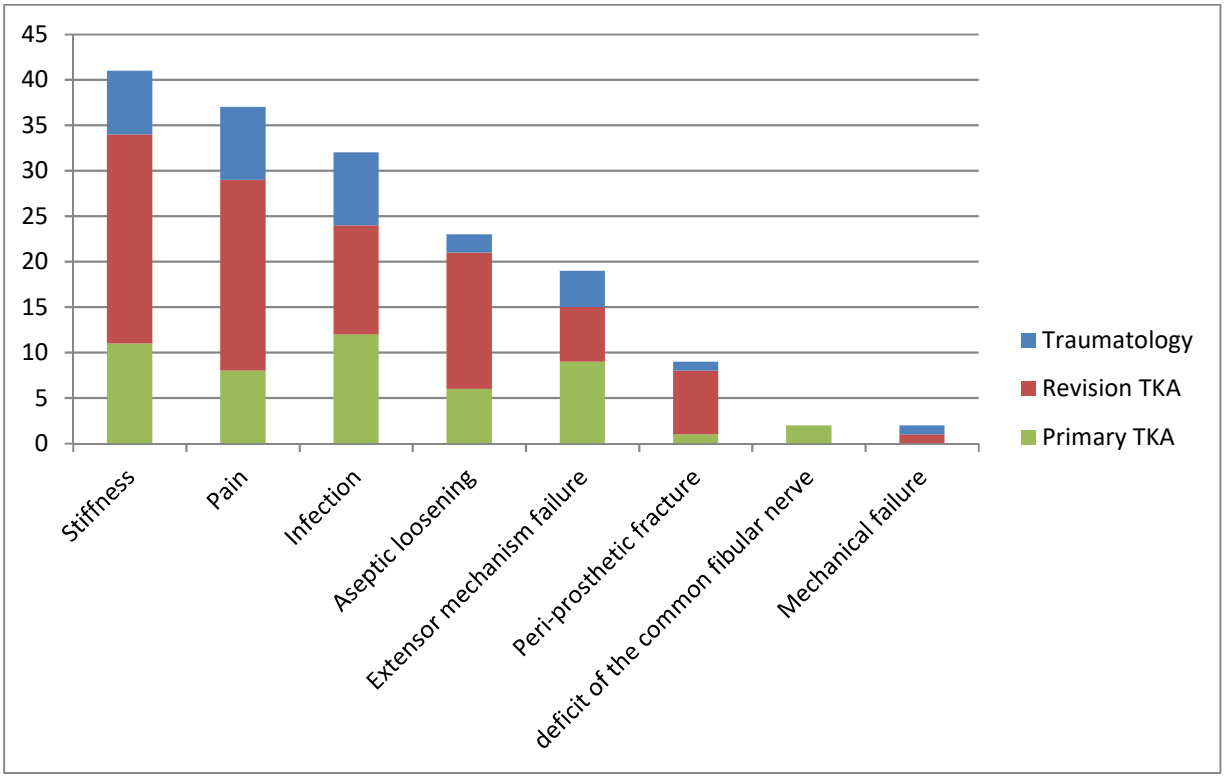
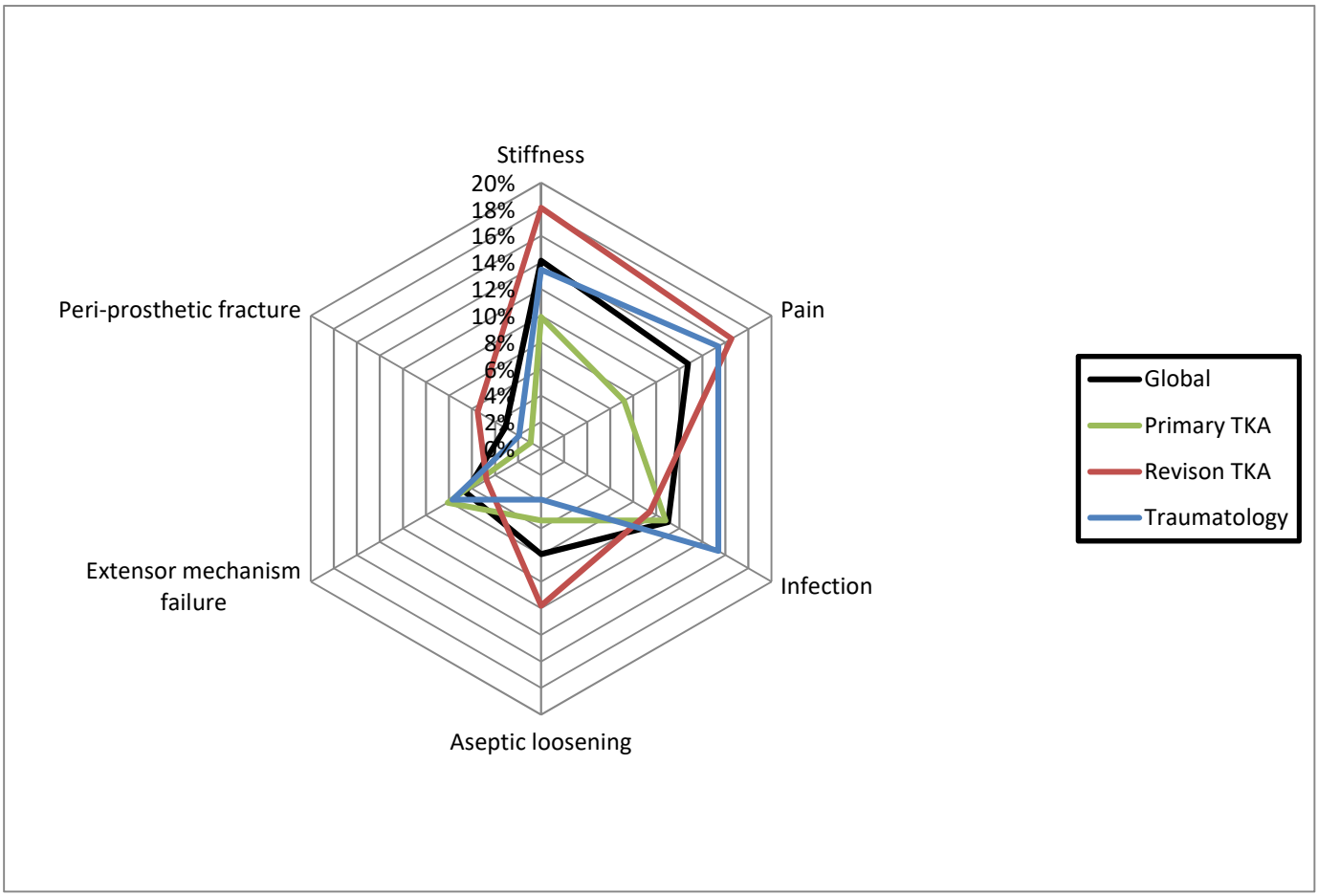

45
40
35
30
25
20
15
10
5
0
Stiffness
Pain
Infection
Aseptic loosening
Extensor mechanism failure
Peri-prosthetic fracture
deficit of the common fibular nerve
Mechanical failure
Traumatology
Revision TKA
Primary TKA

Figure 3 :


Stiffness
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
Pain
Infection
Aseptic loosening
Extensor mechanism failure
Peri-prosthetic fracture
Global
Primary TKA
Revison TKA
Traumatology

Auteur	Effectif	Recul moyen (mois)	Oncologie	Infection	Descellement	Luxation	Bris implant	Rupture appareil extenseur	Instabilité fémoro-patellaire	Douleur	Raideur	Fracture fémur	Fracture tibia	Fracture Patela	NFC	TVP	EP
Notre Serie	290	71	non	11.00%	7.90%	0%	0.70%	2.80%	3.80%	12.80%	14.10%	2.80%	0.30%	0%	0.70%	3.10%	0.70%
Rouquette et al. [29]	40	18	non	17.50%	2.50%			17.50%			5%						
Chaudhry et al. [28]	76	35	non	9.20%	1.30%			1.30%	1.30%			1.30%					
Brown et al. [33]	100	99.8	oui	14%	1%					1%		1%					
Kearns et al. [49]	79	55.2	non	5%	1.30%	2.50%	1.30%	5%			2.50%	3.80%	2.50%	1.30%	1.30%		
Cottino et al. [41]	408	48	non					0.50%	1%			0.10%	1%	0.20%	0.10%	0.20%	
Streitbuerger et al. [42]	61	47	non	1.60%	13.10%							3.30%	6.60%				
Felli et al. [40]	88	73	non							5,5%* 22%**							
Farid et al. [45]	142	57	non	8.40%				4.20%				5.60%	1.40%	0	0.70%		
Sanguineti et al. [47]	45	44.2	non	2.20%		4.40%											
Kowalczewski et al. [22]	12	/	non							8.30%							
Bistolfi et al. [43]	98	155	non	6.10%	11.00%	6.90%	1.00%					1%	0	0			
Smith et al. [31]	174	83	oui	21.80%					1.80%			10.30%		0		4.10%	
Smith et al. [31]	111	83	oui	32.40%					0.90%			15.30%		0			
Friesenbichler et al. [32]	40	48	oui	20%	12.50%		10%	12.50%									
Neuman et al. [23]	24	56	non						4.20%								
Lozano et al. [26]	120	28	non	5.40%						14%***							
Yang et al. [48]	54	180	non	14.00%													
Bistolfi et al. [52]	31	60.3	non												3.00%	0%	
Gudnason et al. [46]	42	106	non	4.80%		2.30%			2.30%			4.80%		0			
Hossain et al. [44]	74	57.7	non	2.70%	2.70%			0%				1.30%		0			
Vaquero et al. [17]	26	46	non	3.30%					3.30%			3.80%	0	0			3.80%
Bae et al. [24]	11	148	non	9.10%		18.20%											
Guenoun et al. [27]	85	36	oui	10.60%					4.20%						2.40%		
Joshi et Navarro-Quilis . [11]	78	94	non	2.60%		3.80%		1.30%	2.60%	4.00%							
Deehan et al. [10]	72	120	non	7.00%								4.20%	0	0		13.90%	
Pour et al. [16]	44	50	non	11.40%								2.70%		0			4.50%
Petrou et al. [30]	100	132	non	2.00%		1.00%			6.00%			1.00%	0	0		3.00%	
Westrich et al. [25]	24	33	non					4.20%				8.30%	0	0			

Authors	Sample size	Mean follow-up (months)	Tumor context	Infection	Loosening	Dislocation	Broken implant	Extensor mechanism rupture	Patello-femoral instability	Pain	Stiffness	Femur fracture	Tibia fracture	Patella fracture	CFN	DVT	PE
Our study	290	71	no	11%	8%	0%	1%	3%	4%	13%	14%	3%	0%	0%	1%	3%	1%
Rouquette et al. [29]	40	18	no	18%	3%			18%			5%						
Chaudhry et al. [28]	76	35	no	9%	1%			1%	1%			1%					
Brown et al. [33]	100	99.8	yes	14%	1%					1%		1%					
Kearns et al. [49]	79	55.2	no	5%	1%	3%	1%	5%			3%	4%	3%	1%	1%		
Cottino et al. [41]	408	48	no					1%	1%			0%	1%	0%	0%	0%	
Streitbuerger et al. [42]	61	47	no	2%	13%							3%	7%				
Felli et al. [40]	88	73	no							5%*/ 22%**							
Farid et al. [45]	142	57	no	8%				4%				6%	1%	0%	1%		
Sanguineti et al. [47]	45	44.2	no	2%		4%											
Kowalczewski et al. [22]	12	/	no							8%							
Bistolfi et al. [43]	98	155	no	6%	11%	7%	1%					1%	0%	0%			
Smith et al. [31]	174	83	yes	22%					2%			10%		0%		4%	
Smith et al. [31]	111	83	yes	32%					1%			15%		0%			
Friesenbichler et al. [32]	40	48	yes	20%	13%		10%	13%									
Neuman et al. [23]	24	56	no						4%								
Lozano et al. [26]	120	28	no	5%						14%***							
Yang et al. [48]	54	180	no	14%													
Bistolfi et al. [52]	31	60.3	no												3%	0%	
Gudnason et al. [46]	42	106	no	5%		2%			2%			5%		0%			
Hossain et al. [44]	74	57.7	no	3%	3%			0%				1%		0%			
Vaquero et al. [17]	26	46	no	3%					3%			4%	0%	0%			4%
Bae et al. [24]	11	148	no	9%		18%											
Guenoun et al. [27]	85	36	yes	11%					4%						2%		
Joshi et Navarro-Quilis . [11]	78	94	no	3%		4%		1%	3%	4%							
Deehan et al. [10]	72	120	no	7%								4%	0%	0%		14%	
Pour et al. [16]	44	50	no	11%								3%		0%			5%
Petrou et al. [30]	100	132	no	2%		1%			6%			1%	0%	0%		3%	
Westrich et al. [25]	24	33	no					4%				8%	0%	0%			