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Original article

## Outpatient total knee arthroplasty: Readmission and complication rates on day 30 in 61 patients

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### ABSTRACT

**Background:** Total knee arthroplasty (TKA) on an outpatient basis is controversial due to concerns about patient safety. In France, only 1.1% of TKAs performed in 2017 were outpatient procedures. Nevertheless, recent advances in the multi-modal and multidisciplinary management of TKA patients combined with optimisation of the various components of perioperative care are increasing the use of outpatient TKA. However, studies on outcomes remain scarce. The primary objective of this work was to compare readmission rates within 30 days after TKA between patients managed as outpatients and as inpatients. The secondary objectives were to compare complication rates and patient satisfaction between the two groups.

**Hypothesis:** After outpatient TKA, the day-30 rates of readmission and complications are similar to those seen after inpatient TKA.

**Material and methods:** A retrospective single-centre study of consecutive patients who underwent TKA between April 2014 and July 2017 was performed. Readmissions, complications, and patient satisfaction were collected.

**Results:** Of 574 patients, 61 were selected to undergo outpatient TKA and 513 had inpatient TKA. The day-30 readmission rate was 2/61 (3.3%) in the outpatient group and 25/513 (4.9%) in the inpatient group. The overall complication rate was 8% in the outpatients and 7.2% in the inpatients. The satisfaction rate was high in the outpatient group, with 80% very satisfied and 20% satisfied patients.

**Conclusion:** When performed in appropriately selected patients, outpatient TKA is not associated with a higher readmission rate compared to inpatient TKA.

**Level of evidence:** IV, retrospective comparative study.

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## 1. Introduction

Hospital stay lengths after total knee arthroplasty (TKA) have declined gradually in recent years due to the application of multidisciplinary strategies for optimising perioperative care, an approach known as fast track surgery [1,2]. In addition to decreasing hospital stay lengths by 2 to 3 days, these strategies are associated with better functional scores and with decreases in complication or readmission rates and in overall costs [3–5]. Fast track surgery involves modifying the organisation of the clinical pathway based on the available scientific evidence in order to optimise each component of patient care [6,7]. Some surgical teams apply the principles of fast track surgery to perform TKA as an outpatient

procedure [8–10]. Good outcomes of outpatient TKA have been reported in the US. In France, however, no data are available, leaving room for concern about the validity and safety of outpatient TKA [6–12].

The primary objective of this work was to compare readmission rates within 30 days after TKA between patients managed as outpatients and as inpatients. The secondary objectives were to compare complication rates and patient satisfaction between the two groups. The working hypothesis was that, after outpatient TKA, the day-30 rates of readmission and complications were similar to those seen after inpatient TKA.

## 2. Material and methods

A retrospective comparative study was conducted in consecutive patients who underwent TKA at a single-centre between April 2014 and July 2017. Patients were selected to outpatient surgery

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if they met none of the following criteria: being alone at home on the evening of the procedure, taking curative-dose anticoagulant therapy, having insulin-dependent diabetes and/or uncontrolled arterial hypertension, and patient or family unwilling to have the procedure on an outpatient basis. Of 78 patients deemed eligible for outpatient surgery, 17 refused due to concern about pain management. In all, of the 574 patients, 61 (11%) had outpatient TKA and 513 inpatient TKA.

### 2.1. Protocol

Each phase of the procedure was explained to the patient by a specially trained nurse. Mental, medical, organisational, and administrative preparation of the patient is key to successful outpatient surgery. The patient and support person must acquire a clear understanding of the entire perioperative process. They should receive, read, understand, and sign information documents. This preparatory visit aims to reassure, motivate, and educate the patients to ensure their full adherence to the programme.

During the preoperative visit, the anaesthesiologist supplies the patient with crucial information about postoperative risks, pain management, and the anaesthetic procedure.

Iron supplementation was prescribed to patients with preoperative anaemia defined as a haemoglobin level below 13 g/L in males and 12 g/L in females. Patients with malnutrition were started on a high-calorie diet preoperatively. Patients did not receive anti-anxiety medications routinely.

The analgesic premedication consisted of paracetamol, 1 g, and pregabalin, 75 mg (or 50 mg in patients older than 75 years).

General anaesthesia was preferred, using short-acting drugs and a multi-modal analgesic regimen designed to minimise morphine requirements. Patients were offered a can of apple juice 2 hours before the scheduled time of surgery in compliance with modern fasting guidelines. Patients received droperidol (1.25 µg), dexamethasone (0.2 mg/kg; minimum, 8 mg), tranexamic acid [1 g as a slow intravenous injection (IV) at anaesthesia induction then 1 g orally after 6 and 12 hours], prophylactic antibiotic therapy in compliance with current guidelines with a second dose 30 minutes before the end of the procedure, nefopam (20 mg as a slow IV injection), paracetamol (1 g), and ketoprofen (100 mg).

Surgery was performed using conventional TKA techniques, with no tourniquet and no postoperative drainage. None of the patients underwent urinary catheterisation. In all the study patients, the same surgeon implanted an Advance® Medial Pivot knee system (aMP™, MicroPort Orthopedics, Arlington, TN, USA). Before prosthesis implantation, ropivacaine (2 mg/mL, 150 mL), ketoprofen (30 mg), and adrenalin (0.5 mg) were injected into the joint at several sites. The dressing was fashioned and the immobilisation system was then put in place by the surgeon. Cryotherapy with dynamic compression (Game Ready®, CoolSystems, San Diego, CA, USA), a recently introduced method of proven efficacy [13–15], was started in the post-anaesthesia care unit (PACU) and continued until patient discharge. Patients with inadequate pain control also received either tramadol (100 mg as a slow IV injection) or titrated morphine in the PACU. The peripheral venous line was obturated when the patient left the PACU, and all medications were given orally (paracetamol, 1 g qid; long-acting ketoprofen, 100 mg bid; and oxycodone, 10 mg every 4 hours if the visual analogue pain score was > 3, with a maximum of 4 daily doses; ondansetron, 4 mg every 8 hours in the event of nausea; and esomeprazole, 20 mg qd).

The patient left the PACU room when the Aldrete score [16] was equal to 10 and immediately ate a meal in the seated position. Pain, vital signs, and urinary output were then monitored every 2 hours. Patients were discharged home when the Postanaesthetic Discharge Scoring System score [17] was at least 9, as validated by the surgeon. Early mobilisation was started as soon as the

patient arrived on the ward. Patients wore their normal clothes and received help from physical therapists to walk with, then without, canes and to walk up and down stairs. A nurse phoned the patient on the next day to repeat the instructions and answer the patient's questions.

Follow-up at home was provided by an office-based nurse working in liaison with the hospital. The nurse followed specific instructions received from the hospital and completed the hospital patient information form at each visit.

Admitted patients were managed using the same enhanced recovery protocol according to the same tight standards.

Complications were recorded by reviewing the full medical files on day 30 after TKA. In addition, at least 3 months after TKA, each patient was interviewed by telephone to obtain information on any complications not managed at our hospital and to complete a satisfaction questionnaire [11].

### 2.2. Statistics

Between-group differences in continuous variables were assessed using Student's *t*-test or Wilcoxon's test, depending on distribution as evaluated by the Shapiro–Wilk test. Comparisons of categorical variables relied on the Chi<sup>2</sup> test or Fisher's exact test. Values of  $p \leq 0.05$  were considered significant. The statistical analyses were performed using XLSTAT 2012 software (Addinsoft, Paris, France).

## 3. Results

Hospital stay length in the inpatient group was 2.9 days on average and decreased over the study period, from 3.5 days in 2014 to 2.2 days in 2017. None of the patients scheduled for outpatient surgery required conversion to inpatient management. Table 1 reports the main features of the patients in the two groups.

The day-30 readmission rate was 3.3% (2/61) in the outpatient group and 4.9% (25/513) in the inpatient group ( $p=0.75$ ). The reasons for readmission in the outpatients were knee pain on day 2 in 1 patient and a febrile episode unrelated to the surgery on day 17 in the other. In the inpatient group, the most common complications were medical (deep vein thrombosis,  $n=2$ ; respiratory disorders,  $n=2$ ; febrile episodes,  $n=3$ ; postoperative anaemia,  $n=2$ ; and cardiac events,  $n=5$ ), although surgical complications were recorded also (postoperative pain,  $n=10$ ; patello-femoral dislocation reduced in the emergency room,  $n=1$ ).

The number of patients who visited the emergency room during the first 30 days but did not require admission was 3 (4.8%) in the outpatient group (1 case each of haematoma, pain, and epistaxis) and 12 (2.4%) in the inpatient group (surgical complications,  $n=7$ ; medical complications,  $n=5$ ) ( $p=0.21$ ). The overall complication rate was 8.2% among outpatients and 7.5% among inpatients ( $p>0.05$ ) (Table 2). No patient in either group experienced complications requiring revision surgery within the first 30 days.

**Table 1**  
Main features in the study patients.

	Outpatient group $n=61$	Inpatient group $n=513$	<i>p</i> -value
Mean ASA score	1.6	2.1	> 0.05
% male	62%	49%	0.06
Age, years, mean (range)	65.4 (44–78)	70.5 (47–86)	> 0.05
% patients living in the same region as the hospital	66%	51%	< 0.05
Day-30 readmission rate	3.3%	4.9%	0.75
Day-30 emergency room visit rate	4.8%	2.4%	0.21
Complication rate	8.2%	7.2%	> 0.05

**Table 2**

Complications in the outpatient and inpatient groups. The surgical complications were related to the total knee arthroplasty procedure.

	Surgical complications	Non-surgical complications
Outpatient group(61 patients)	3	2
Inpatient group(513 patients)	19	18

The satisfaction rate was high in the outpatient group: 80% of patients were very satisfied and 20% satisfied with the procedure. No patient was dissatisfied or regretted having followed the outpatient pathway.

#### 4. Discussion

The results of this study confirm the working hypothesis: neither the readmission rate nor the complication rate was higher after outpatient TKA than after inpatient TKA.

The first limitation of this study is the retrospective design. Second, patients in the outpatient group tended to be younger, although the difference was not statistically significant. Third, functional outcomes were not compared between the two groups. Finally, we did not compare the patient satisfaction rate between the two groups.

Some centres have been performing TKA as an outpatient procedure for about 15 years [10–18]. This practice remains controversial in the literature due to concerns about a higher early complication rate, frequent readmission, suboptimal perioperative pain management [19,20], and poorer functional outcomes [5–21] compared to inpatient TKA. Nevertheless, studies have established that outpatient TKA does not induce a higher complication rate [22], produces comparable functional outcomes [9–22], and is associated with better patient satisfaction [11] compared to inpatient TKA.

##### 4.1. Readmission rate

Reported readmission rates vary across studies. A single study, by Springer et al. [11] showed a higher 1-month readmission rate in the outpatient group (12%) than in the inpatient group (6%). However, this difference was not statistically significant, and the study had a high lost-to-follow-up rate of 28%. Kolisek et al. [9] recorded no readmissions among 64 patients who had outpatient TKA, and the readmission rate in a study by Berger et al. was 3.6% [5]. Otero et al. [23] found no differences in readmission rates according to hospital stay length after TKA. Lovecchio et al. [24] also reported similar readmission rates between the two groups (2.4% vs. 2%). The readmission rate in our outpatient population was 3.3% (Table 3).

##### 4.2. Complication rate

In previous studies, complications rates were not higher after outpatient than after inpatient surgery. Courtney et al. [12] studied

**Table 3**

Readmission rates after inpatient and outpatient arthroplasty reported in the literature.

	Number of cases	Readmissions after outpatient surgery (%)	Readmissions after inpatient surgery (%)	p-value
Springer et al.	166	12	6	NS
Kolisek et al.	64	0	–	
Berger et al.	111	3.6	–	
Otero et al.	1156	1.93	1.85	NS
Lovecchio et al.	1968	2.4	2	NS
Our study	574	3.3	4.9	NS

NS: non-significant.

over 150 000 arthroplasty procedures in the US, of which 1220 were done on an outpatient basis, and found that the complication rate was halved in the outpatient group (8% vs. 16%). Otero et al. [23] reported that the difference in complication rates between the two groups was not statistically significant. In an assessment of over 1800 patients undergoing TKA or total hip arthroplasty, Lovecchio et al. [24] recorded the complication rates after outpatient surgery and after surgery followed by overnight admission. The complication rate was higher in the outpatient group, chiefly due to a higher blood transfusion rate (4% vs. 0%). However, the study report fails to give information on the patient selection criteria, protocol for preparing patients for outpatient surgery, and blood transfusion criteria. None of our patients required secondary blood transfusion. The main complications after TKA reported in the literature are related to blood loss (anaemia, haematoma, bleeding) [25,26]. Consequently, the various blood-sparing techniques reported in our study protocol are of paramount importance. We also found a complication rate of 8%.

##### 4.3. Patient satisfaction

Ambulatory procedures are associated with high patient satisfaction rates. Springer et al. [11], for instance, reported that the overall satisfaction rate was 93% after outpatient surgery compared to 82% after inpatient surgery. In addition, 94% of patients said they would recommend the outpatient procedure to their family and friends. Kolisek et al. [9] reported similar patient satisfaction rates in the outpatient and inpatient groups.

In our study, the satisfaction rate was very high, with 80% very satisfied and 20% satisfied patients. No patient was dissatisfied.

##### 4.4. Patient selection

Patients at low risk for readmission and complications should be selected based on validated criteria. In 2016, Kort et al. [27] reported patient selection criteria developed based on expert opinion. Among these criteria, based on work by Berger et al. [5] and Gromov et al. [28], we did not use age, body weight, or distance from home to hospital, since the results were independent from these variables. Nevertheless, the literature teaches that the use of predefined criteria that are validated in a multidisciplinary manner is crucial.

Outpatient TKA is part of a quality-care approach involving a careful review of each detail of the surgical, anaesthesiologic, and organisational process, with the goal of optimising patient management and postoperative outcomes. This approach requires a change in the overall management philosophy, within a modern and efficient organisation geared toward patient information and education. The discharge home should not be viewed as a switch to home care but as a return to the patient's usual living conditions.

#### 5. Conclusion

In appropriately selected patients, outpatient TKA is not associated with a higher readmission rate compared to inpatient TKA.

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#### Contributions of each author

X. Cassard performed the surgical procedures and coordinated the study.

V. Garnault did the statistical analysis and reviewed the article.

B. Corin participated in collecting the data.  
D. Claverie edited the anaesthesia protocol.  
J. Murgier wrote the article and collected the data.

#### Disclosure of interest

The authors declare that they have no competing interest.

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