



## Original research

## Clinical and functional outcomes of primary total knee arthroplasty: a South American perspective

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## ABSTRACT

**Background:** The aim of this study was to report the clinical and functional outcomes as well as complications after primary total knee arthroplasty in a cohort of Chilean patients.

**Methods:** We retrospectively reviewed 191 total knee arthroplasties performed in 182 patients over an 8-year period, with a minimum follow-up of 2 years. The primary outcome measure was the rate of major complications. Secondary outcomes were minor complications, residual symptoms, level of satisfaction, and the Knee Injury and Osteoarthritis Outcome Score.

**Results:** Global complication rate was 15.5%, reintervention rate was 9.2%, and revision rate was 2.5%. Major and minor complications were seen in 9.2% and 5.1% of patients, respectively. Average Knee Injury and Osteoarthritis Outcome Score was 77 points (14–100), and 90% of patients reported satisfaction with the procedure. At 2-year follow-up, 45.8% of patients had some degree of range of motion limitations.

**Conclusions:** Our results show a medium-term follow-up complication rate comparable to those described in the literature. This is the first series to report on the clinical and functional outcomes after primary total knee arthroplasty in a Chilean population.

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## Introduction

Total knee arthroplasty (TKA) is a widely used technique for the treatment of osteoarthritis (OA) of the knee. During 2012, almost 600,000 TKAs were performed in the United States [1]. By 2030, it is expected that the number of procedures will grow by 673% to 3.48 million [2].

Reports in the literature have shown good outcomes in medium- and long-term follow-up, with typical success rates reported up to 90%–95% at 10–15 years of follow-up [3,4] and implant survival rates greater than 90% [5–7].

Despite the excellent success rates and survivorship, several reports have shown a significant number of patients are not satisfied after a TKA [8].

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The indication of TKA is rising in patients with OA of the knee, the increase has mainly been due to primary TKA; nevertheless, revision or partial prosthetic replacement have resulted in an unvarying incidence during the last 10 years [9].

There are no specific prosthesis registries for the Latin American population; hence, estimations indicate that TKA procedures have doubled their incidence in the last 5 years. This rising incidence of prosthetic knee surgery can be seen as a consequence of the success in clinical and functional outcomes of this procedure on relieving pain and returning functionality explained by the development of better prosthetic designs and better surgical techniques [9].

The purpose of this study was to retrospectively evaluate clinical and functional outcomes and to describe major and minor complications and their causes in patients undergoing primary TKA in our department.

## Material and methods

A retrospective review of our collected TKA data was performed to identify all skeletally mature patients ( $\geq 15$  years) with advanced tricompartmental OA of the knee undergoing primary TKA.

Over an 8-year period (February 2007 to June 2015), 239 patients were identified. After excluding patients with incomplete data, previous partial TKA or TKA, follow-up of less than 24 months, and who were lost to follow-up, a total of 191 TKAs performed in 182 patients were included in the present study. Median follow-up was 49 months (range 24–104 months).

Demographic data including age, gender, and medical comorbidities were recorded from the database and medical records. Mechanical axis, anatomical axis, and mechanical axis deviation were radiographically assessed in preoperative radiographs. The Kellgren and Lawrence system were radiographically measured to classify the severity of knee OA. Complications were assessed through standardized telephone interviews and clinical records. A satisfaction survey was performed and the Knee Injury and Osteoarthritis Outcome Score (KOOS) was used in all patients at the end of follow-up time through a standardized telephone interview.

### Procedure

A total of 2 orthopaedic surgeons were involved in the assessment and management of these patients. The indication for surgery and the surgical strategy was determined by the treating surgeon. Our protocol for TKA was consistent throughout. All the surgeries were performed using a medial parapatellar approach and a measured resection technique. All patients were implanted with a posterior-stabilized TKA. The patella was resurfaced in all cases. All surgeries utilized a tourniquet as part of the technique. The average surgical time was 87 minutes (range 62–93 minutes), and the average tourniquet time was 66 minutes (range 54–78 minutes). Our protocol did not include the use of drains. Moreover, every patient received intravenous prophylactic antibiotics preoperatively, and 3 postoperative doses were administered.

### Management

For postoperative pain management every patient received a selective femoral nerve block and a patient-controlled analgesia pump in combination with intravenous analgesia consisting of a continuous infusion pump of ketoprofen and tramadol (metamizole instead of ketoprofen if any nonsteroidal antiinflammatory drug [NSAID] contraindication) and oral acetaminophen. For patients with a poor pain relief despite of this protocol, we requested an evaluation by the pain unit, and they changed the medications according to the patient's needs. All patients were discharged with a visual analog scale score less than or equal to 4/10. All patients received deep vein thromboembolism (DVT) prophylaxis (Clexane 40 mg/day). The average hospital stay was 4 days (3–7 days). Our rehabilitation protocol consisted of immediate range of motion

(ROM) with continuous passive motion device, gait with tolerated weight-bearing was allowed, and physiotherapy was started on the first postoperative day.

The ambulatory care consisted of pain management with acetaminophen and NSAIDs (ketoprofen, ketorolac, or diclofenac) and pregabalin as a neuromodulator. Ambulatory thromboprophylaxis consisted of oral rivaroxaban until completing 21 days of prophylaxis.

Weight-bearing was allowed as tolerated, with the use of crutches or a walker depending on the patient's ability for a mean of 2 weeks (range 1–3 weeks). Physiotherapy was continued for three months at least, and medical follow-up was conducted monthly until the sixth month and then annually.

### Outcomes

The primary outcome was the incidence of major complications. All complications requiring surgical management were considered as a major complication. Secondary outcomes were minor complications, residual symptoms, level of satisfaction, and the KOOS.

### Statistical analysis

Descriptive statistics were used for the analysis of the results.

### Results

The mean age of the 182 patients was 66 years (range 22–87 years), with 115 women and 67 men and average body mass index of 27.5 (range 19.1–39.1) at the time of surgery. Median follow-up time was 49 months (range 24–127 months).

The mean mechanical axis was  $-0.47^\circ$  (range  $-22^\circ$  to  $14^\circ$ ), the mean anatomical axis was  $6.27^\circ$  (range  $-16.5^\circ$  to  $21^\circ$ ), and the mean mechanical axis deviation was  $-0.57$  cm (range  $-77$  to  $-52$  cm) (Table 1). The severity of knee OA (Kellgren and Lawrence system) was grade 1 in 2.22%, grade 2 in 20%, grade 3 in 46.6%, and grade 4 in 31.1%. The number of compartments affected was 2 (bicompartamental OA) in 11.4% and 3 (tricompartamental OA) in 88.5% (Table 1). The related comorbidities were high blood pressure 57%, dyslipidemia 33%, hypothyroidism 27%, diabetes mellitus 14%, and rheumatoid arthritis 8%. In the patient cohort, 20% of the patients were smokers and 30% of the patients were alcohol consumers (Table 1).

The global complication rate was 14.3%, the global reintervention rate was 9.2%, and the global revision rate was 2.5%. The average time to complications was 8 months (range 2–27 months).

**Table 1**  
Population characteristics.

| Demographics             | Mean | Range         | Radiographic characteristics |       | Related comorbidities |     |
|--------------------------|------|---------------|------------------------------|-------|-----------------------|-----|
| Age (y)                  | 66   | 22 to 87      | Severity of OA <sup>a</sup>  |       | High blood pressure   | 57% |
| BMI                      | 27.5 | 19.1 to 39.1  | Grade I                      | 22.2% | Dyslipidemia          | 33% |
| Mechanical axis (grades) | -0.5 | -22.0 to 14.0 | Grade II                     | 20.0% | Hypothyroidism        | 27% |
|                          |      |               | Grade III                    | 46.6% | Diabetes mellitus     | 14% |
| Anatomical axis (grades) | 6.3  | -16.5 to 21.0 | Grade IV                     | 31.1% | Rheumatoid arthritis  | 8%  |
|                          |      |               | Compartments affected        |       | Smoking               | 20% |
| MAD                      | -0.6 | -77.0 to 52.0 | Bicompartamental OA          | 11.4% | Alcohol consuming     | 30% |
|                          |      |               | Tricompartamental OA         | 88.5% |                       |     |

BMI, body mass index; MAD, mechanical axis deviation.

<sup>a</sup> Kellgren and Lawrence system.

**Table 2**  
Primary outcomes.

| Major complications      |      |
|--------------------------|------|
| Arthrofibrosis           | 5.3% |
| Soft tissue infection    | 1.3% |
| Periprosthetic infection | 2.0% |
| Persistent stiffness     | 0.6% |
| Total                    | 9.2% |

### Primary outcomes

Major complications were described in 9.2% of patients; 5.3% of patients had arthrofibrosis that required manipulation under anesthesia; 1.3% had a major soft tissue infection that required surgical debridement; 2% had a periprosthetic infection that required revision TKA, and 0.6% had persistent stiffness that required revision TKA (Table 2).

### Secondary outcomes

Minor complications were described in 5.1% of patients; 2.6% of patients had a local soft tissue infection; 1.3% had symptomatic venous thrombosis; 0.6% had complex regional pain; and 0.6% had kidney injury secondary to NSAIDs (Table 3). At 2-year follow-up, 18.6% of patients reported residual pain or inflammation, with a mean visual analog scale of 0.64 (range 0–7); 45.8% of patient had some degree of restricted ROM (flexion <120° or extension <−5°), and an 8.2% had a severe restricted ROM (flexion <100° or extension <−10°) (Table 3). The average postoperative KOOS was 77 points (range 14–100 points). The average KOOS for symptoms and stiffness was 89 points (range 10–100 points); for pain, 94 points (range 14–100 points); for function in daily living, 92 points (range 12–100 points); for function in sports and recreation, 30 points (range 0–100 points); and for knee-related quality of life, 81 points (range 0–100 points) (Table 3). Ninety percent of patients reported satisfaction with the procedure.

## Discussion

We described the clinical and functional outcomes after primary TKA in a Chilean population at medium-term follow-up. Our results show an intermediate revision rate compared to international reports described in the literature.

The 2015 Australian annual hip and knee replacement report [10] described a 1% rate for revision surgery at 1-year follow-up and a 5.5% at 10-year follow-up. Sharkey et al. [11] in a retrospective study of 10,000 TKA during 2003 and 2012 described a 7.8% revision surgery in 718 knee prosthesis at 1-year follow-up.

**Table 3**  
Secondary outcomes.

| Minor complications   | ROM restriction | Mean              | ROM range |           |
|-----------------------|-----------------|-------------------|-----------|-----------|
| Superficial infection | 2.6%            | Flexion 100°–120° | 39.5%     | 100°–115° |
| DVT                   | 1.3%            | Flexion <100°     | 6.4%      | 78°–95°   |
| CRPS                  | 0.6%            | Extension 0°–5°   | 10.2%     | 5°–10°    |
| AKI                   | 0.6%            | Extension <5°     | 1.9%      | 7°–10°    |
| Total                 | 5.1%            | Total             | 45.8%     |           |

  

| KOOS                              | Mean | Range  |
|-----------------------------------|------|--------|
| Symptoms and stiffness            | 89   | 10–100 |
| Pain                              | 84   | 14–100 |
| Function in daily living          | 82   | 12–100 |
| Function in sports and recreation | 30   | 0–100  |
| QoL                               | 81   | 0–100  |
| Global KOOS                       | 77   | 14–100 |

AKI, acute kidney injury; CRPS, complex regional pain syndrome; DVT, deep vein thrombosis; QoL, quality of life.

We highlight our low rate of 1.3% of infections with a need for revision surgery. Sharkey et al. [11] described infection as a major cause of revision in early failure (<2 years), responsible for 37.6%, second most common cause of late failure (>2 years), responsible for 21.9%, and the second major cause of overall failure.

With regard to minor complications, the rate of deep vein thrombosis was 1.3%, which is considerably lower than reported in other studies. Fujita et al. [12] in a prospective study of 138 TKA reported 48.6% cases of deep vein thrombosis. In a study by Stulberg et al. [13], of 517 patients, 49 did not have prophylaxis and reported an 84% incidence of DVT, and of 468 patients having DVT prophylaxis, there was a 54% incidence of DVT reported. Complex regional syndrome was seen in 0.6% of our patients. Superficial soft tissue infection was the principal minor complication, with an incidence rate of 2.6%, but there are no good-quality studies in the literature reporting specific incidence rate of this complication [14,15].

Nilsdotter et al. [16], studied the change over time of different subscales of the KOOS over 5 years. They reported that at 6 months of follow-up, the patients had improved in all five scales of the KOOS, and at 1-year follow-up, the patients had improved further in all subscales except in sports and recreation. Finally, at 5-year follow-up, a deterioration was seen in the subscale of activities of daily living. Our study shows excellent global KOOS in most of our patients, with particularly poor scores in function in sports and recreation subscale. The patients with the worst outcomes in the different subscales were unsatisfied with the knee replacement despite that they did not have any complication during the follow-up.

Regarding local outcomes, there are no reports of prevalence of TKA in the Chilean population. This is the first retrospective study to report on the clinical and functional outcomes at midterm follow-up after primary TKA in the Chilean population.

This study has the limitations associated with a retrospective study. Also, it is a single-institution database study and describes the results of only two surgeons of this institution. Nevertheless, it has the strength to widely describe major and minor complications, residual symptoms, and patient satisfaction a functional evaluation of Chilean patients undergoing primary TKA.

## Conclusions

Most of the patients in this study undergoing primary TKA have good functional results and high satisfaction rates at medium-term follow-up time. However, 10% of patients are not satisfied with the procedure. Our results show a lower medium-term complication rates compared to those described in the literature.

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