



Historical Cohort of Unicompartmental Knee Arthroplasty in a Chilean University Hospital

Cohorte histórica de artroplastia unicompartmental de rodilla en un hospital universitario chileno

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Abstract

Purpose To describe the patient-reported functional outcome of a cohort of patients undergoing unicompartmental knee arthroplasty (UKA) in a Chilean university hospital.

Methods A historical cohort study was designed. All patients who underwent fixed-bearing UKA between 2003 and 2019 were included. An independent evaluator contacted the patients in June 2020. The Western Ontario and McMaster Universities Arthritis Index (WOMAC) was used to compare UKA procedures (medial or lateral), age (over or under 70 years), and follow up (longer or shorter than 5 years).

Results A total of 78 patients, corresponding to 94 UKAs, were included. The median age was 64 years (range: 43 to 85 years). There were 72 (76.6%) cases of medial UKA. One patient needed revision to total knee arthroplasty (TKA). A total of 60 patients (76.9%), corresponding to 72 UKAs, were successfully contacted by phone for the final follow-up. The median scores on the WOMAC domains were: pain – 1 (range: 0 to 12); stiffness – 0 (range: 0 to 4); and physical function – 2 (range: 0 to 29). The median total score on the WOMAC was 4 (range: 0 to 44). Patients submitted to lateral UKA had better functional scores ($p = 0.0432$), and the total WOMAC score was similar among patients older or younger than 70 years of age ($p = 0.3706$).

Conclusions For patients with unicompartmental knee osteoarthritis, UKA is an effective and reproducible treatment. Age does not seem to affect the functional results, and UKA is an effective treatment in patients over 70 years old. These results should encourage knee surgeons to learn this technique and those responsible for public health policies to consider UKA for knee osteoarthritis.

Keywords

- ▶ unicompartmental knee arthroplasty
- ▶ unicompartmental knee replacement
- ▶ osteoarthritis
- ▶ knee epidemiology

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Resumen

Objetivo Describir el resultado funcional informado por el paciente de una cohorte de pacientes sometidos a artroplastia unicompartmental de rodilla (AUR) en un hospital universitario chileno.

Métodos Se diseñó un estudio de cohorte histórica. Se incluyeron todos los pacientes que se sometieron a AUR de platillo fijo entre 2003 y 2019. Un evaluador independiente se puso en contacto con los pacientes en junio de 2020. Se utilizó el índice de artritis de las universidades de Western Ontario y McMaster (WOMAC) para comparar los procedimientos de AUR (medial o lateral), la edad (mayor o menor de 70 años), y el seguimiento (más o menos de 5 años).

Resultados Se incluyeron 78 pacientes, en un total de 94 AURs. La mediana de edad fue de 64 años (rango: 43 a 85 años). Hubo 72 (76,6%) casos de AUR medial. Un paciente necesitó revisión para artroplastia total de rodilla (ATR). Un total de 60 pacientes (76,9%), correspondientes a 72 AURs (76,7%), fueron contactados con éxito por teléfono para el seguimiento final. La mediana del puntaje en los dominios del WOMAC fue: dolor – 1 (rango: 0 a 12); rigidez – 0 (rango: 0 a 4); y función física – 2 (rango: 0 a 29). La mediana del puntaje total en el WOMAC fue de 4 (rango: 0 a 44). Los pacientes sometidos a AUR lateral lograron mejores puntuaciones funcionales ($p=0,0432$), y el puntaje total en el WOMAC fue similar en pacientes mayores o menores de 70 años ($p=0,3706$).

Conclusiones La AUR es un tratamiento eficaz y reproducible para pacientes con artrosis de rodilla unicompartmental. La edad parece no afectar los resultados funcionales, y la AUR es un tratamiento eficaz en pacientes mayores de 70 años. Estos resultados deberían animar a los cirujanos de rodilla a aprender esta técnica y a los responsables de las políticas de salud pública a considerar la AUR para la osteoartritis de rodilla.

Palabras clave

- ▶ artroplastia unicompartmental de rodilla
- ▶ reemplazo de rodilla unicompartmental
- ▶ osteoartritis
- ▶ rodilla
- ▶ epidemiología

Introduction

Unicompartmental knee arthroplasty (UKA) was first introduced in the 1970s for patients with severe tibiofemoral unicompartmental osteoarthritis.^{1,2}

It is a cost-effective treatment in patients with osteoarthritis of the medial or lateral tibiofemoral compartment, consistently achieving a high rate of patient-reported outcomes in the good/excellent category.³ In addition, a higher rate of return to sport than that of total knee arthroplasty (TKA) is reported.⁴ The United Kingdom arthroplasty register shows that between 8% and 15% of the patients that need knee arthroplasty can be successfully treated with UKA.⁵

Our institution is a university health centre that belongs to the Chilean private care network. Despite this, around half of our patients are covered by public health insurance (the Chilean National Health Fund, Fondo Nacional de Salud, FONASA, in Spanish). In Chile, UKA has not become a widely-used technique such as TKA. Unfortunately, no objective data is available, as the national coding system does not differentiate between UKA and TKA. However, our centre is one with the highest volume of UKA procedures in Chile. Different reasons are given for this lower amount of UKA procedures performed, such as: the lower level of access to the learning the technique, its slower learning curve, and its greater difficulty compared to TKA.⁶ However, UKA has shown

good results in international series both in young and geriatric patients,^{7,8} so it is of great interest to further spread this surgical procedure so that it is incorporated into the arsenal of treatment for patients with knee osteoarthritis in our country.⁹

The purpose of the present study is to describe the patient-reported functional outcomes of a historical cohort of patients undergoing UKA in our centre and compare the results with those of international reports. We hypothesized that the outcomes of our cohort are comparable to those of international series regardless of follow-up, age, and the side of the prosthesis.

Methods

A historical cohort study was designed and carried out at Hospital Clínico Universidad de Chile. Patients who undergo knee arthroplasty at our centre are registered according to the Chilean national code system under number 2104153. All patients that underwent UKA between 2003 and 2019 were included.

The selection criteria to submit patients to UKA are pain located in the compromised compartment, body mass index under 34 kg/m², and a reducible varus or valgus alignment. Patients with diffuse knee pain, moderate or severe

irreducible coronal malalignment, or chondropathy grade ≥ 3 or Kellgren y Lawrence $\geq III$ in the contralateral compartment are not candidates for UKA. If the patient does not complain of anterior knee pain, patellofemoral chondropathy is not an exclusion criterion.¹⁰ Also, UKA is contraindicated for patients with neuromuscular impairment or knee instability – such as anterior cruciate ligament tear. Meanwhile, all patients who underwent TKA or patellofemoral arthroplasty were excluded. **► Figure 1** shows the flow chart of the selection of patients.

All clinical records of patients who underwent knee arthroplasty between January 2003 and May 2019 were revised. The data extracted included the birth date, date of surgery, gender, type of UKA, and side in which it was performed. Also, successive medical controls were reviewed for the following complications: reoperations, superficial infection, deep infection, arthrofibrosis, need for mobilization under anesthesia, tibial subsidence, and referral to the chronic pain unit. Before surgery, all patients undergo a weight-bearing anteroposterior (AP) radiograph, a lateral knee radiograph, a Schuss radiograph, an AP full-length lower limb radiograph, and a magnetic resonance imaging (MRI) scan (**► Figure 2**).

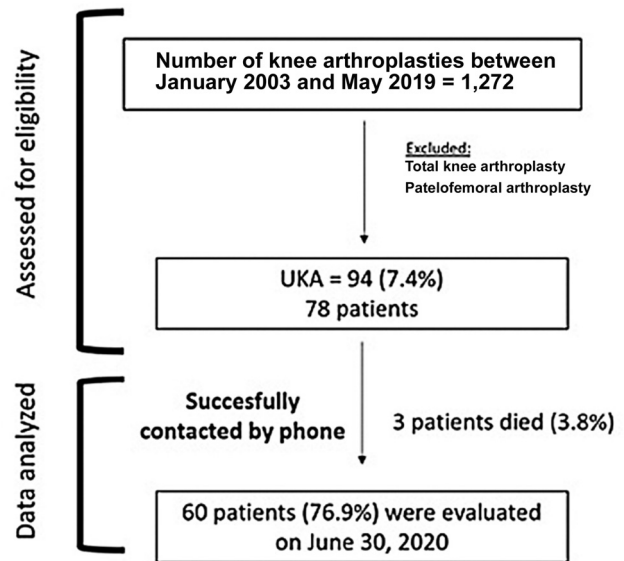


Fig. 1 Flow chart of the selection of patients.

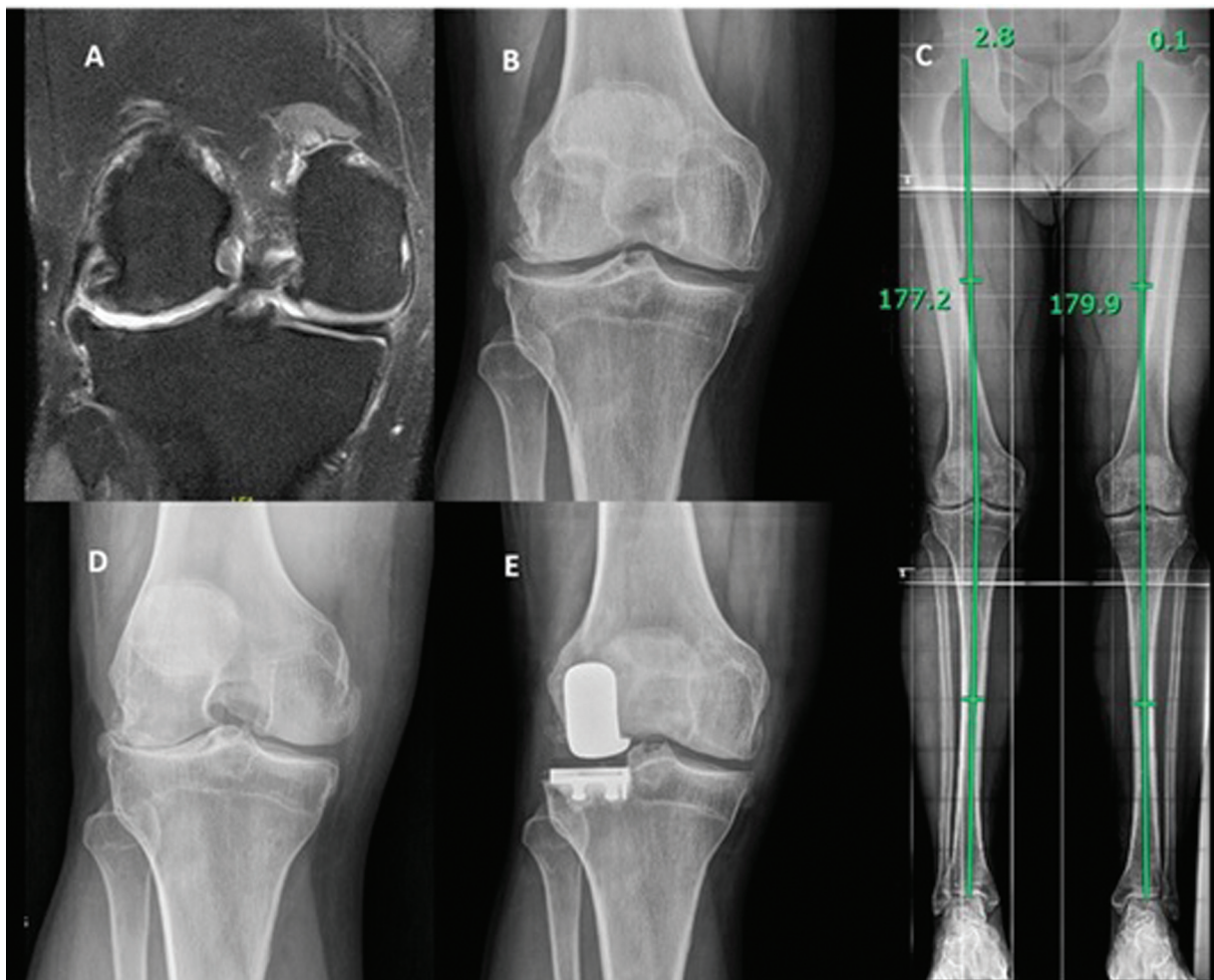


Fig. 2 Imaging studies routinely performed for the selection of patients. weight-bearing anteroposterior (AP) magnetic resonance imaging scan (A), showing severe osteoarthritis of the lateral compartment (B), AP full-length lower limb radiograph (C), Schuss view (D). The postoperative AP knee radiograph is also shown (E).

To avoid selection biases, the postoperative radiograph was revised in all cases to confirm that the patient had undergone UKA. Furthermore, the UKA procedure was corroborated with the patients who were successfully contacted for the phone interview. The clinical records of the patients were extensively revised to reduce the risk of bias inherent to a retrospective study.

All patients underwent surgery by the anterior knee approach. A medial parapatellar arthrotomy was performed in cases of medial UKA; meanwhile, a lateral parapatellar arthrotomy was performed in cases of lateral UKA. Only one fixed bearing model of prosthesis was used: ZUK (Zimmer-Biomet, Warsaw, IN, US) and Journey (Smith & Nephew, London, UK). First, the tibial cut is performed with the aim of preserving as much of the tibia as possible, and to reproduce the native slope. Then, the femoral cut is performed to restore the joint line and to select the appropriate size of the femoral component (►Figure 3).

In June 2020, an independent evaluator (DP) contacted all patients by phone. A validated transcultural adaptation of the Western Ontario and McMaster Universities Arthritis Index (WOMAC) was applied by phone.^{11,12} The WOMAC is an instrument to assess the functional capacity of patients with knee and hip osteoarthritis that was further validated to evaluate knee arthroplasty.¹³ It is considered one of the best self-reported instruments in osteoarthritis patients due to its psychometric properties.¹⁴ It consists of 3 dimensions: 5 items assessing pain (score: 0 to 20), 2 items for stiffness (score: 0 to 8), and 17 items for physical function in daily activities (score: 0 to 68). The score is higher as the patients feel unwell.¹² The scale has been validated to be self-administrated and administrated by phone.¹⁵ Although it is not the primary function of the scale, the scores of the 3 dimensions can be added and reported in standardized way from 0 to 100.¹⁴

Our local ethics committee approved the present study. All patients successfully contacted by phone gave verbal consent to participate in the survey using the telephone form approved by the ethics committee.

Data were summarized as medians, ranges, and interquartile ranges (IQRs, 25th to 75th percentiles). The proportion of patients successfully contacted by phone was

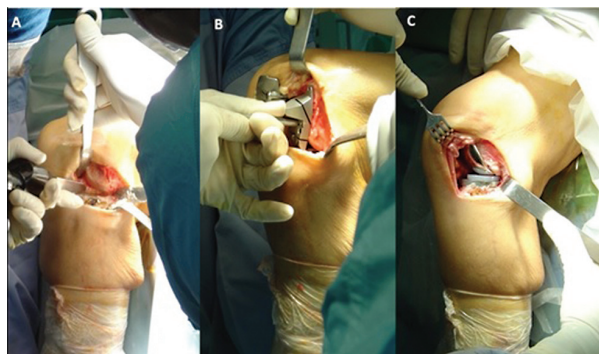


Fig. 3 Lateral UKA was performed through lateral parapatellar arthrotomy. The first tibial cut (A), femoral cut (B), and the UKA (C) are shown.

compared to the total cohort in terms of age (patients older than 70 years of age), gender, the percentage of medial UKAs, the median follow-up, and the proportion of patients with more than 5 years of follow-up. The WOMAC score was compared regarding the type of UKA (medial or lateral), age (older or younger than 70 years of age) and follow-up (longer or shorter than 5 years) using the non-parametric median test.

A significance of 5% was adopted, and a 95% confidence interval was estimated. The data was processed using the Stata (StataCorp LLC, College Station, TX, US) software, version 15.

Results

A total of 78 patients, comprising 94 UKA procedures, were included; 16 patients underwent bilateral UKA (20.5%). The median age was 64 years (range: 43 to 85 years; IQR: 58 to 71 years), and 60 patients (77%) were women. Of the total amount of UKA procedures, 72 were medial (76.6%), and 22 (23.4%) were lateral (►Table 1). The first UKA was carried out in 2003, a year in which only 1 (1.1%) procedure was performed. In 2009 and 2013, only 1 (1.1%) UKA was performed as well. The mode was found in 2016, in which a total of 14 (14.9%) UKAs were performed.

In total, 3 (3.3%) patients required another surgery after the UKA: 1 patient required revision to TKA, 1 patient underwent lateral meniscectomy, and the last patient

Table 1 Comparison between the total UKA cohort and the successfully-contacted UKA cohort

	Total	Follow-up: June 30, 2020
Number of patients	78	60 (76.9%)
Number of UKAs	94	72 (76.7%)
Median age*	64 (43 to 85)	62 (43 to 85)
Older than 70 years of age*	25 (26.6%)	15 (25.0%)
Men*	19 (20.2%)	11 (21.6%)
Medial UKA**	72 (76.6%)	42 (70.0%)
Lateral UKA	22 (23.4%)	20 (30%)
Median follow-up**	5.0 (1.1 to 16.7)	4.7 (1.1 to 16.1)
Follow-up of 5 years or longer**	47 (50%)	35 (48.6%)
Revision to TKA**	1 (1.1%)	0
Tibial subsidence	1 (1.1%)	0
Needed second surgery**	2 (2.1%)	2 (2.8%)
Superficial infection**	2 (2.1%)	2 (2.8%)
Deep infection**	0	0

Abbreviations: TKA, total knee arthroplasty; UKA, unicompartmental knee arthroplasty.

Notes: *Proportion of the total of patients; ** proportion of the total of UKAs.

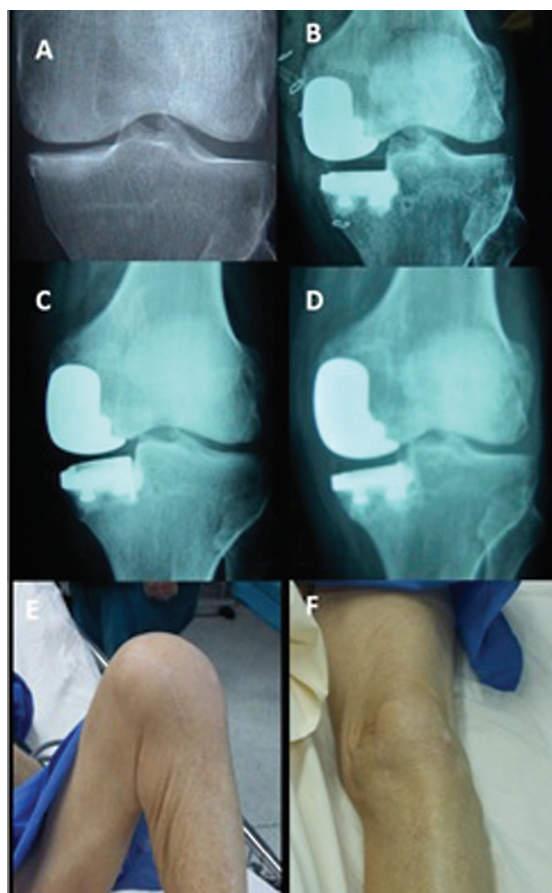


Fig. 4 Tibial Subsidence. Preoperative radiograph (A), immediate AP radiograph (B). After three weeks, an inclination is observed on the AP knee radiograph (C). Bone healing can be observed after three months, without evidence of further subsidence or loosening (D). Knee range of motion at four years of follow-up is shown (E,F).

needed a pes anserine release. Revision TKA for intractable diffuse knee pain was performed after three years in another institution. Among the surgical complications, 2 (2.2%) patients had a superficial infection, and none of the patients had deep infection, required mobilization under anaesthesia, or needed a referral to the chronic pain unit. In total, 1 (1.1%) patient aged 86 years old suffered tibial subsidence that did not require revision. After three months of conservative treatment, the bone was healed, and the patient reached full range of motion (► **Figure 4**). He died eight years after surgery due to cardiovascular disease.

A total of 60 patients (76.9%), corresponding to 72 UKA procedures, were successfully contacted by phone for the final follow-up. At the last follow-up, 3 (3.3%) patients were, and 15 (19.2%) could not be located. The epidemiological characteristics are shown in ► **Table 1**. The median follow-up was of 4.4 years (range: 1.1 to 16.2 years; IQR: 2.5 to 10.1 years). The median pain score on the WOMAC was 1 (range: 0 to 12; IQR: 0 to 3), the stiffness score was 0 (range: 0 to 4; IQR: 0 to 0), and the physical function score was 2 (range: 0 to 29; IQR: 0 to 10). The median total WOMAC score was 4 (range: 0 to 44; IQR: 0 to 13) (► **Figure 5**).

The patients submitted to lateral UKA (n=20, 32%) achieved better total scores on the WOMAC than those

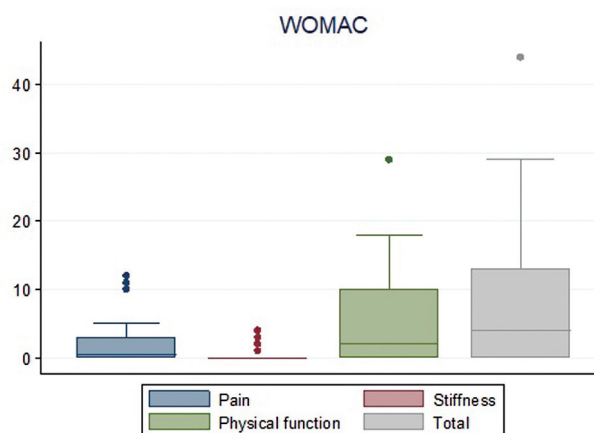


Fig. 5 The WOMAC index and its subdimension distribution.

Table 2 Comparison of WOMAC scores between medial and lateral UKAs

WOMAC dimension	Medial UKA	Lateral UKA	p-value*
Pain	1 (0 to 12)	0 (0 to 4)	0.0160
Stiffness	0 (0 to 4)	0 (0 to 2)	0.0640
Physical function	5 (0 to 29)	0 (0 to 17)	0.0566
Total	6 (0 to 44)	0 (0 to 21)	0.0432

Abbreviation: UKA, unicompartmental knee arthroplasty; WOMAC, The Western Ontario and McMaster Universities Arthritis Index. Note: *Non-parametric median test.

submitted to medial UKA (n=42, 68%). There were only statistically significant differences regarding the total WOMAC score (median test; p=0.04329) and the WOMAC pain score (median test; p=0.0160) (**table 2**).

No differences in WOMAC was found between older than 70 years and younger patients (► **Figure 6**) with a follow-up longer than 5 years had a median total WOMAC score of 8 (range: 0 to 26; IQR: 1 to 13). Meanwhile, patients with

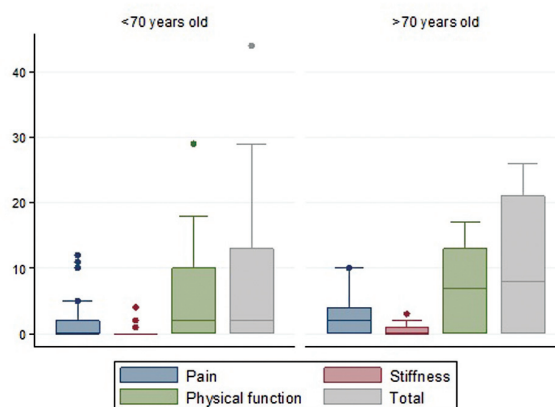


Fig. 6 Distribution of WOMAC scores among patients younger or older than 70 years of age at the time of the surgery.

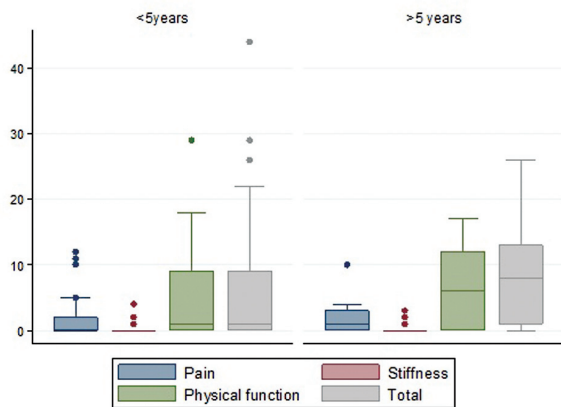


Fig. 7 Distribution of WOMAC scores among patients with follow-up longer or shorter than five years.

follow-up shorter than 5 years have a median total WOMAC score of 1 (range: 0 to 44; IQR: 0 to 9). This difference did not achieve statistical significance (median test; $p=0.1329$) (figure 7).

Discussion

The present study shows that patients undergoing UKA had a high proportion of good/excellent results on the WOMAC index. No differences were found regarding the WOMAC score in terms of age (older or younger than 70 years) and follow-up time (longer or shorter than 5 years). Only 1 (1.1%) revision to TKA was found in the present study, probably because of the number of patients and the broad follow-up time. The median survival time reported¹⁶ using revision to TKA as failure is of 94.4% at 5 years, and of 89.1% at 10 years.

The functional outcomes of the present historic cohort were excellent. Two significant issues are essential to have good results in UKA: patient selection and volume of procedures.¹⁰ Patient selection is crucial to obtain excellent outcomes, especially in centres with a low volume of surgeries performed.¹⁷ A novel preoperative scoring system to predict good results was developed by Antoniadis et al.,¹⁸ which could be helpful to identify the best candidates for UKA.

The coronal alignment of the lower limb has been a hot topic regarding UKA indications.¹⁹ In our approach, the physical exam is mandatory to establish if the malalignment is reducible or fixed. Fixed malalignment between 5° and 10° in the mechanical alignment is considered a relative indication. Particular attention should be paid when an intraarticular malalignment is found, as in UKA procedures, it has consistently shown that good satisfaction is achieved when the articular height and alignment are restored.^{20,21} Meanwhile, more than 10° is a contraindication for UKA. Stress radiographs have been proposed to address the reductibility of the coronal alignment; nevertheless, not consistent findings have been reported.²²⁻²⁴

The volume of surgeries performed is crucial for good outcomes, and the present series shows that our proportion of patients undergoing knee arthroplasty is just above the

one reported in the United Kingdom registry.⁵ Moreover, twelve procedures are reported²⁵ to be the threshold to achieve a lower rate of aseptic failure, so our average of six UKAs per year is insufficient. Hence, we think that the good outcomes of the present study are associated to the fact that the first author (CI) was involved in every case in the first 14 years revised in the present cohort.

Patients with severe femorotibial unicompartmental knee osteoarthritis have three surgical options: TKA, UKA, and osteotomies. These three procedures have been used in different types of patients, but some indications may overlap.²⁷ Cost-effectiveness studies³ show that UKA is more efficient in patients older than 60 years of age; meanwhile, osteotomies are more useful in patients younger than 60 years. Moreover, studies^{27,28} in patients older than 75 years of age show that UKA had similar functional outcomes but a lower complication rate than that of TKA. In our cohort, there were no statistically significant differences regarding the WOMAC score between patients older than 70 years of age and younger patients.

A significant concern in knee arthroplasty design is the ability to reproduce the natural biomechanics. A finite-element study²⁹ showed that UKA is more accurate in reproducing the native biomechanics of the knee than TKA, even if the lower limb alignment is in a mild varus or valgus. These findings are explained as UKA preserves the cruciate ligaments, being more anatomic than TKA. This is essential for current patients, who are more active, demand better results, and expect a better quality of life after joint replacement than decades ago.³⁰ Many of them even aspire to return to sports, which is consistently more likely in patients undergoing UKA than TKA.⁴

The rate of lateral UKA has been reported³¹ to be 5% to 10% of that of the rate of medial UKA, reaching better functional outcomes but a lower survival rate. Nevertheless, a recent systematic review³² showed that the survival rates at 5, 20, and 25 years between medial and lateral PUR are similar. In the present cohort, there is a significant tendency for better results in lateral UKA, but this should be interpreted with caution. Patients who require medial or lateral UKA have a different knee problem, so the trend found shows that lateral UKA is as good a treatment as medial UKA for unicompartmental osteoarthritis. These groups of patients had different knee problems, making it difficult to compare. There is a cultural appreciation that performing a lateral UKA is more complex; however, this is related to the fact that the volume of lateral surgeries performed is lower than that of medial surgeries. Nevertheless, many reports^{33,34} show that good outcomes can be achieved with the lateral procedure, as reported in the present study.

Robotic UKA has been proposed to increase implant orientation and size, functional outcomes and survival rates.^{35,36} Nevertheless, a recent meta-analysis³⁷ shows no difference in the median survival time between robotic-assisted and conventional surgeries. Moreover, the functional outcomes achieved have not been significantly better in robotic-assisted UKA either. Nevertheless, this could be explained by the ceiling effect of the functional-outcome

scales, because robotic-assisted UKA has shown substantially more accuracy in implant orientation.^{38,39} Robotic-assisted surgery is probably the future in UKA. However, for now, a better understanding of the appropriate implant orientations, trained surgeons, and better patient access is needed to improve the results.

A limitation of the present study is that this is not a captive cohort. Therefore, patients could have been revised to TKA at another centre. But we achieved a successful follow up of 76.9% of the patients, reaching a good proportion of the historical cohort. Also, the only revision to TKA reported was performed at another centre, which notified the surgeon (CI) when the revision surgery was done, but this case could not be contacted in 2020.

Conclusion

For patients with femorotibial unicompartmental knee osteoarthritis, UKA is an effective and reproducible treatment. Age seems not to affect the functional results, and UKA is an effective treatment in patients older than 70 years of age. These results should encourage knee surgeons to learn this technique and those responsible for public health policies to consider UKA for patients with knee osteoarthritis.

Roles and Contribution of Authorship

CI: conceptualization, validation, research, data curation, writing (review and editing), visualization, supervision, and project administration.

MB: methodology, formal analysis, research, and writing (original draft preparation, review, and editing).

DP: methodology, formal analysis, research, resources, data curation, writing (preparation of the original draft).

CB: research, resources, data curation, writing (review and editing), supervision.

MP: validation, formal analysis, research, resources, data curation, writing (preparation of the original draft).

AZ: formal analysis, research, writing (review and editing), supervision, project administration.

JH: validation, writing (review and editing), supervision, project administration.

JC: resources, writing (review and editing), supervision, project administration.

Ethics Approval

The present study was approved by the Ethics in Research Committee at Hospital Clínico Universidad de Chile ethics, as stated in certificate number 26, issued on June 26, 2020.

Availability of Data

The datasets used and/or analyzed during the current study can be made available by the corresponding author upon reasonable request.

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Conflict of Interests

The authors no conflict of interests to declare.

References

- Luo TD, Hubbard JB. *Arthroplasty Knee Unicompartmental*, in *StatPearls [Internet]*. 2019StatPearls Publishing
- Marmor L. Marmor modular knee in unicompartmental disease. Minimum four-year follow-up. *J Bone Joint Surg Am* 1979;61(03):347–353
- Smith WB II, Steinberg J, Scholtes S, Mcnamara IR. Medial compartment knee osteoarthritis: age-stratified cost-effectiveness of total knee arthroplasty, unicompartmental knee arthroplasty, and high tibial osteotomy. *Knee Surg Sports Traumatol Arthrosc* 2017;25(03):924–933
- Witjes S, Goutteborge V, Kuijjer PP, van Geenen RC, Poolman RW, Kerckhoffs GM. Return to sports and physical activity after total and unicompartmental knee arthroplasty: a systematic review and meta-analysis. *Sports Med* 2016;46(02):269–292
- Willis-Owen CA, Brust K, Alsop H, Miraldo M, Cobb JP. Unicompartmental knee arthroplasty in the UK National Health Service: an analysis of candidacy, outcome and cost efficacy. *Knee* 2009;16(06):473–478
- Vasso M, Antoniadis A, Helmy N. Update on unicompartmental knee arthroplasty: Current indications and failure modes. *EFORT Open Rev* 2018;3(08):442–448
- Ingale PA, Hadden WA. A review of mobile bearing unicompartmental knee in patients aged 80 years or older and comparison with younger groups. *J Arthroplasty* 2013;28(02):262–267.e2
- Tadros BJ, Dabis J, Twyman R. Short-term outcome of unicompartmental knee arthroplasty in the octogenarian population. *Knee Surg Sports Traumatol Arthrosc* 2018;26(05):1571–1576
- Cook R, Davidson P, White ANIHR Dissemination Centre. Partial knee replacement could be first choice for some patients with osteoarthritis. *BMJ* 2019;367:15994–15994
- Kuipers BM, Kollen BJ, Bots PC, et al. Factors associated with reduced early survival in the Oxford phase III medial unicompartmental knee replacement. *Knee* 2010;17(01):48–52
- Escobar A, Quintana JM, Bilbao A, Azkárate J, Güenaga JJ. Validation of the Spanish version of the WOMAC questionnaire for patients with hip or knee osteoarthritis. Western Ontario and McMaster Universities Osteoarthritis Index. *Clin Rheumatol* 2002;21(06):466–471
- Roos MK, Lohmander LS. EM. *WOMAC Osteoarthritis Index: Reliability, validity, and responsiveness in patients with arthroscopically assessed osteoarthritis*. *Scand J Rheumatol* 1999;28(04):210–215
- Clement ND, Bardgett M, Weir D, Holland J, Gerrand C, Deehan DJ. What is the minimum clinically important difference for the WOMAC index after TKA? *Clin Orthop Relat Res* 2018;476(10):2005–2014
- Pol EN. Evaluación del paciente y medida de resultados. *Aten Primaria* 2014;46(Suppl 1):32–38
- López Alonso SR, Martínez Sánchez CM, Romero Cañadillas AB, Navarro Casado F, González Rojo J. Propiedades métricas del cuestionario WOMAC y de una versión reducida para medir la sintomatología y la discapacidad física. *Aten Primaria* 2009;41(11):613–620
- Bruce DJ, Hassaballa M, Robinson JR, Porteous AJ, Murray JR, Newman JH. Minimum 10-year outcomes of a fixed bearing all-

- polyethylene unicompartmental knee arthroplasty used to treat medial osteoarthritis. *Knee* 2020;27(03):1018–1027
- 17 Hamilton TW, Rizkalla JM, Kontochristos L, et al. The interaction of caseload and usage in determining outcomes of unicompartmental knee arthroplasty: a meta-analysis. *J Arthroplasty* 2017;32(10):3228–3237.e2
 - 18 Antoniadis A, Dimitriou D, Canciani JP, Helmy N. A novel preoperative scoring system for the indication of unicompartmental knee arthroplasty, as predictor of clinical outcome and satisfaction. *Arch Orthop Trauma Surg* 2019;139(01):113–120
 - 19 Deschamps G, Chol C. Fixed-bearing unicompartmental knee arthroplasty. Patients' selection and operative technique. *Orthop Traumatol Surg Res* 2011;97(06):648–661
 - 20 Chen Y, Fang X, Huang Z, et al. Factors affecting the clinical outcomes including patient satisfaction after Oxford unicompartmental knee arthroplasty: a retrospective study. *Arthroplasty* 2020;2(01):1–9
 - 21 Kuwashima U, Okazaki K, Tashiro Y, et al. Correction of coronal alignment correlates with reconstruction of joint height in unicompartmental knee arthroplasty. *Bone Joint Res* 2015;4(08):128–133
 - 22 Kreitz TM, Maltenfort MG, Lonner JH. The valgus stress radiograph does not determine the full extent of correction of deformity prior to medial unicompartmental knee arthroplasty. *J Arthroplasty* 2015;30(07):1233–1236
 - 23 Waldstein W, Bou Monsef J, Buckup J, Boettner F. The value of valgus stress radiographs in the workup for medial unicompartmental arthritis. *Clin Orthop Relat Res* 2013;471(12):3998–4003
 - 24 Zhang Q, Yue J, Wang W, Chen Y, Zhao Q, Guo W. FTFA change under valgus stress force radiography is useful for evaluating the correctability of intra-articular varus deformity in UKA. *Arch Orthop Trauma Surg* 2018;138(07):1003–1009
 - 25 Bini S, Khatod M, Cafri G, Chen Y, Paxton EW. Surgeon, implant, and patient variables may explain variability in early revision rates reported for unicompartmental arthroplasty. *J Bone Joint Surg Am* 2013;95(24):2195–2202
 - 26 Griffin T, Rowden N, Morgan D, Atkinson R, Woodruff P, Maddern G. Unicompartmental knee arthroplasty for the treatment of unicompartmental osteoarthritis: a systematic study. *ANZ J Surg* 2007;77(04):214–221
 - 27 Fabre-Aubrespy M, Ollivier M, Pesenti S, Parratte S, Argenson JN. Unicompartmental knee arthroplasty in patients older than 75 results in better clinical outcomes and similar survivorship compared to total knee arthroplasty. A matched controlled study. *J Arthroplasty* 2016;31(12):2668–2671
 - 28 Siman H, Kamath AF, Carrillo N, Harmsen WS, Pagnano MW, Sierra RJ. Unicompartmental knee arthroplasty vs total knee arthroplasty for medial compartment arthritis in patients older than 75 years: comparable reoperation, revision, and complication rates. *J Arthroplasty* 2017;32(06):1792–1797
 - 29 Hopkins AR, New AM, Rodriguez-y-Baena F, Taylor M. Finite element analysis of unicompartmental knee arthroplasty. *Med Eng Phys* 2010;32(01):14–21
 - 30 Negrín R, Duboy J, Iñiguez M, et al. Robotic-assisted vs conventional surgery in medial unicompartmental knee arthroplasty: a clinical and radiological study. *Knee Surg Relat Res* 2021;33(01):5
 - 31 Heyse TJ, Tibesku CO. Lateral unicompartmental knee arthroplasty: a review. *Arch Orthop Trauma Surg* 2010;130(12):1539–1548
 - 32 van der List JP, McDonald LS, Pearle AD. Systematic review of medial versus lateral survivorship in unicompartmental knee arthroplasty. *Knee* 2015;22(06):454–460
 - 33 Fiocchi A, Condello V, Madonna V, Bonomo M, Zorzi C. Medial vs lateral unicompartmental knee arthroplasty: clinical results. *Acta Biomed* 2017;88(2S):(Suppl 2):38–44
 - 34 Xue H, Ma T, Wen T, Yang T, Xue L, Tu Y. Predictors of Satisfactory Outcomes With Fixed-Bearing Lateral Unicompartmental Knee Arthroplasty: Up to 7-year Follow-Up. *J Arthroplasty* 2021;36(03):910–916
 - 35 Negrín R, et al. Robotic-assisted surgery in medial unicompartmental knee arthroplasty: does it improve the precision of the surgery and its clinical outcomes? Systematic review. *J Robot Surg* 2020;•••:1–13
 - 36 Negrín R, et al. Cirugía Robótica en Artroplastia de Rodilla. *Rev Chil Ortoped Traumatol* 2019;60(02):67–76
 - 37 Gaudiani MA, Samuel LT, Kamath AF, Courtney PM, Lee GC. Robotic-Assisted versus Manual Unicompartmental Knee Arthroplasty: Contemporary Systematic Review and Meta-analysis of Early Functional Outcomes. *J Knee Surg* 2020
 - 38 Robinson PG, Clement ND, Hamilton D, Blyth MJG, Haddad FS, Patton JT. A systematic review of robotic-assisted unicompartmental knee arthroplasty: prosthesis design and type should be reported. *Bone Joint J* 2019;101-B(07):838–847
 - 39 Negrín R, Duboy J, Reyes NO, et al. Robotic-assisted Unicompartmental knee Arthroplasty optimizes joint line restitution better than conventional surgery. *J Exp Orthop* 2020;7(01):94