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RAAOT-ACARO Issue

Dr. Gabriel Vindver
President, Asociación Argentina para el Estudio de la Cadera y la Rodilla (ACARO)

Five years ago, we lit a spark: to bring together vocation, science, and camaraderie so that every person with a hip or knee condition would be cared for a little better than yesterday. Today, in the fifth issue of RAAOT-ACARO, that spark is still burning. It is not a trophy on a shelf; it is confirmation that when we come together to think and to work, medicine becomes more humane and more precise.

Sometimes, from the outside, surgery looks easy: an elegant movement that seems to come naturally. But we all know that "effortless" is an illusion. Behind a clean gesture lie long shifts, mental rehearsals, honest debates, video reviews, uncomfortable questions, and the humility to adjust whatever needs adjusting. If something appears simple, it's because there was a mountain of silent work underneath.

We have also learned that we are not machines. We doubt, we get tired, we need to ask for help. And that is okay. Good medicine is born when a team listens to one another, when a timely consult arrives, when rehabilitation is planned with the same care as the incision. We do not operate on X-rays; we accompany real stories that return to the classroom, the job site, the family table.

Let's care for the work climate, too. Respect is not a formality; it is patient safety. A "please," explaining the plan, thanking people for their effort; those small courtesies, repeated, become culture. And culture, over time, becomes outcomes.

To those just joining this community: cultivate curiosity and patience. Celebrate the modest advances, because that is how excellence is built. To our long-time colleagues: thank you for sharing knowledge, reviewing manuscripts, teaching with generosity, and offering a shoulder when it is needed. To our patients: you are the reason behind every meeting and every line written.

This fifth issue is a handshake and an invitation. Let's keep researching, debating with respect, simplifying what is complex, and creating opportunities where they are missing. May every page remind us that merit is not about never failing, but about trying again with greater wisdom.

Dr. GABRIEL VINDVER • givindver@gmail.com https://orcid.org/0000-0003-3858-6687
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Dual Mobility Cup in Patients Younger Than 70 Years: Preliminary Results of a Case Series

María Florencia Molina, Guillermo A. Ricciardi, José D. Mancilla Vargas, Florencia S. Scaglione, Martín Loayza Gómez, Martín A. Pérez

Hip and Knee Disease Department, Orthopedics and Traumatology Service, Hospital General de Agudos "Teodoro Álvarez", Autonomous City of Buenos Aires, Argentina

ABSTRACT

Objective: To evaluate the clinical and radiographic outcomes of patients younger than 70 years who underwent total hip arthroplasty with a dual mobility acetabular cup system. **Materials and Methods:** Retrospective descriptive study of 61 patients (mean age, 62 years) treated with cemented and uncemented dual mobility acetabular components between 2014 and 2019. Mean follow-up was 47 months (range, 36-86). Clinical evaluation included the *Harris Hip Score* and the *Oxford Hip Score*, together with radiographic assessment of both hips. **Results:** Indications for surgery were avascular necrosis of the hip (8 cases), femoral neck fracture (17 cases), and hip osteoarthritis (36 cases). During follow-up, no dislocations or component loosening were observed. One patient reported localized pain associated with trochanteric bursitis. The mean postoperative *Harris Hip Score* was 95 points, and the mean *Oxford Hip Score* was 45, which was a significant improvement. **Conclusions:** The dual mobility cup is a valid option for patients younger than 70 years, regardless of the underlying condition. Its use reduces the risk of prosthetic dislocation and provides good clinical outcomes, while also lowering hospitalization and reoperation costs.

Keywords: Dual mobility cup; primary total hip arthroplasty; adults under 70.

Level of Evidence: IV

Copa de doble movilidad: experiencia en pacientes <70 años. Resultados preliminares de una serie de casos

RESUMEN

Objetivo: Evaluar los resultados clínicos y radiográficos en una serie de pacientes <70 años sometidos a una artroplastia total de cadera con el sistema de copa acetabular de doble movilidad. **Materiales y Métodos:** Estudio descriptivo retrospectivo de 61 pacientes (edad promedio 62 años) tratados con un reemplazo de cadera utilizando componentes acetabulares cementados y no cementados con el sistema de doble movilidad, entre 2014 y 2019. El seguimiento promedio fue de 47 meses (rango 36-86). Para la evaluación se utilizaron el *Harris Hip Score*, el *Oxford Hip Score* y radiografías de ambas caderas. **Resultados:** Los cuadros operados fueron: 8 casos de necrosis avascular de cadera, 17 fracturas mediales de cadera y 36 coxartrosis. En el seguimiento, no se detectaron casos de luxaciones ni de aflojamiento de los componentes. Un solo paciente tuvo dolor localizado que se asoció a bursitis trocantérica. El *Harris Hip Score* funcional promedio fue de 95, mientras que el *Oxford Hip Score* fue de 45, lo que refleja mejorías posoperatorias significativas. **Conclusiones:** La copa de doble movilidad es una opción válida para pacientes <70 años, independientemente de su enfermedad de base. Su uso disminuye las luxaciones de la prótesis y obtiene buenos resultados clínicos, lo cual va acompañado de reducciones en los costos hospitalarios de internación, cirugías de reducción protésica y de revisión.

Palabras clave: Copa de doble movilidad; artroplastia total primaria; adultos menores de 70 años.

Nivel de Evidencia: IV

Received on January 27th, 2024. Accepted after evaluation on June 17th, 2025 • Dr. MARÍA FLORENCIA MOLINA • florenciamolina1989@gmail.com https://orcid.org/0000-0002-3747-044X

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INTRODUCTION

The number of hip arthroplasties has increased over the years, in parallel with rising life expectancy. Likewise, an increase in complications has been recognized.[1] One of the most feared complications with Gibson's posterolateral approach is dislocation of the prosthetic components. The dual-mobility system was developed in 1974 by the French surgeon Gilles Bousquet as a solution that, over time, has gained broad acceptance, displaced self-retaining cups, and, above all, improved biomechanical characteristics.[2] It is indicated in the presence of neurovascular injuries, neurological diseases, abductor (gluteus medius) deficiency, and in patients >70 years of age.[1]

Total hip arthroplasty (THA) in patients <70 years implies that the implant materials will be exposed to daily activities of varying demands, as well as occupational and sports activities, over a long period of time, posing significant challenges related to osteolysis, wear, and stability.[3]

The objective of this study was to evaluate clinical and radiographic outcomes in a series of patients <70 years who underwent THA with a dual-mobility acetabular cup system.

MATERIALS AND METHODS

A descriptive, retrospective study was conducted, reporting preliminary results at 2 years of follow-up, in a series of patients treated with primary THA using a dual-mobility cup at a single center (a tertiary-care institution in the public health system of the Autonomous City of Buenos Aires) between January 2014 and December 2019 (Figures 1 and 2).

A sample was obtained according to the following inclusion criteria: age between 50 and 70 years, both sexes, having undergone THA with a dual-mobility cup (cemented, uncemented, or hybrid).

Exclusion criteria were: oncologic disease, arthritis/collagenopathies, severe cognitive impairment and bedridden status, follow-up <6 months, or noncompliance with postoperative instructions. Data were obtained from inpatient/outpatient medical records and the radiographic archive for the following study variables: pathologic diagnosis, functional scores, age, sex, comorbidities, and surgical risk.

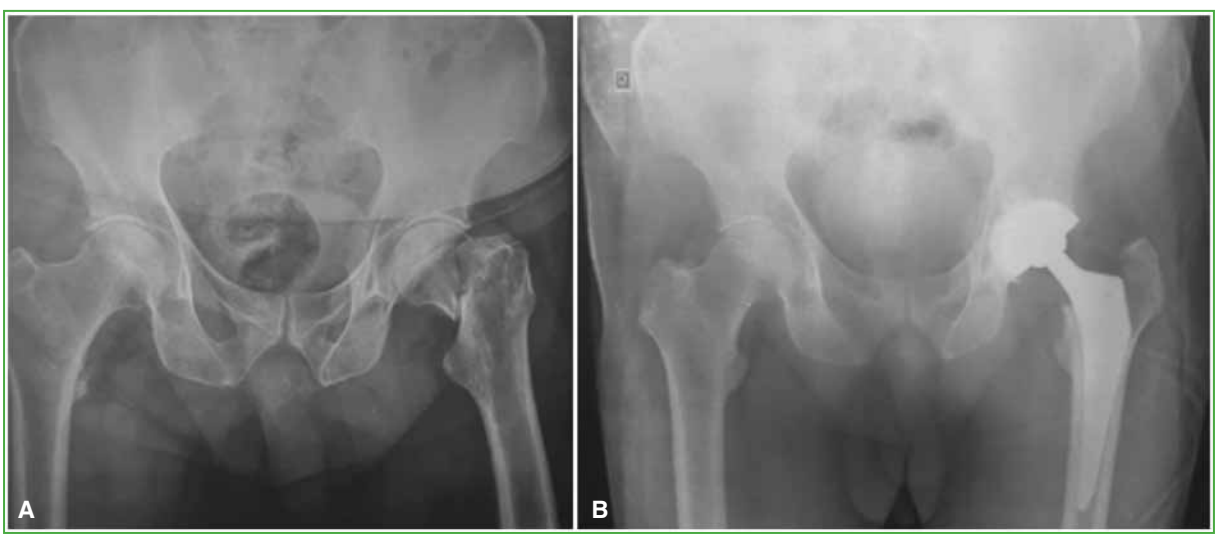

Figure 1. A. Anteroposterior radiograph of both hips in a 65-year-old man showing a subcapital fracture of the left hip. **B.** Postoperative AP radiograph of both hips showing a hybrid dual-mobility prosthesis in the left hip.

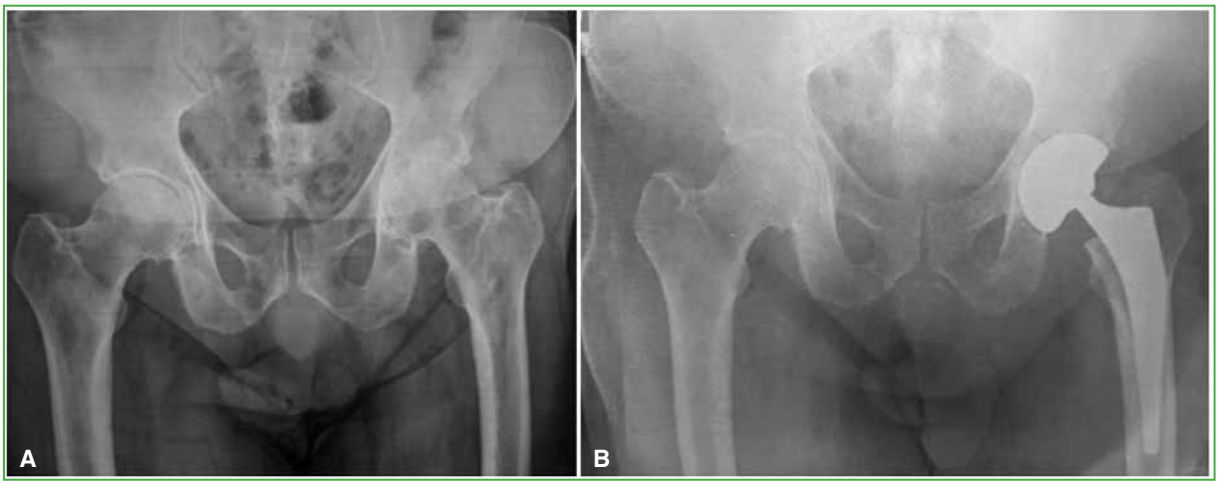

Figure 2. A. AP radiograph of both hips in a 69-year-old woman showing left hip osteoarthritis. **B.** Postoperative AP radiograph of both hips showing an uncemented total dual-mobility prosthesis in the left hip.

All patients were operated using a Gibson posterolateral approach by the same surgical team. Domestically manufactured cups (Polygram®) and French-manufactured cups (SATURNE®) were used. All patients followed the same rehabilitation plan, consisting of sitting and isotonic/isometric exercises starting 24 hours after surgery. For cemented total prostheses, patients were instructed to stand with a 4-point walker and were discharged 48 hours after surgery; for uncemented and hybrid total prostheses, standing was indicated at 3 weeks, with discharge likewise at 48 hours. Finally, all patients were prescribed three weekly sessions of physical therapy, reinforced with daily home exercises. Sutures were removed at 18-21 days postoperatively in all cases. Function was assessed using the modified *Harris Hip Score* (HHS) and the *Oxford Hip Score* (OHS) before surgery and at 6, 12, and 24 months.[4]

The modified HHS, administered via patient questionnaire, evaluates post-hip-surgery outcome by considering pain and hip joint function. Specifically, the functional activities assessed are: gait (limp, support, distance tolerated), stair climbing, putting on socks and shoes, ability to sit, and use of public transport. The maximum score is 100. Scores of 90-100 are considered excellent; 80-89, good; 70-79, fair; and <70, poor. The OHS assesses quality of life in patients with hip osteoarthritis. It comprises 12 questions, each with five response options scored 0-4. The lowest total (0) indicates the most symptoms/difficulty; the highest (48) indicates no impact on quality of life. Quality-of-life categories: excellent >41, good 34-41, moderate 27-33, poor <27.

Radiographic outcomes were evaluated on anteroposterior and lateral projections to detect osteolysis, migration, and radiolucent lines, according to the regions described by DeLee and Charnley for the acetabulum and the Gruen zones for the femoral stem.[5,6]

Sociodemographic variables (age, sex), fixation type (cemented, uncemented, hybrid), and underlying condition (trauma, osteonecrosis, osteoarthritis) were also recorded. This study complies with the guidelines of the Declaration of Helsinki regarding the use of identifiable information in human research. All patients provided consent to participate.

Statistical Analysis

Categorical variables are expressed as frequency and percentage, analyzed with the χ^2 test or Fisher's exact test. Numerical variables are expressed as mean or median according to distribution, with corresponding dispersion measures (standard deviation and range). Student's t-test was used to compare means for normally distributed variables between two groups, and ANOVA for comparisons across three or more groups. The Kruskal-Wallis and Friedman tests were used for nonparametric variables. A p value <0.05 was considered statistically significant. Analyses were performed using SPSS Statistics 25.

RESULTS

A total of 61 patients (30 women and 31 men) underwent THA with a dual-mobility acetabular cup system [cemented, n = 17 (27.9%); hybrid, n = 10 (16.4%); uncemented, n = 34 (55.7%)]. The mean age was 62.5 years. The following underlying conditions were recorded: hip osteoarthritis (36 cases, 59%), subcapital hip fracture (17 cases, 27.9%), and avascular necrosis of the hip (8 cases, 13.1%). Demographic characteristics are shown in Table 1.

Table 1. Description of the sample (n = 61)

Variable	Results	
Age; mean (SD; range)	62.5	(4.4; 53-69)
Gender; n (%)		
Female	30	(49.2)
Male	31	(50.8)
Comorbidities (number); median (range)	0	(0-2)
ASA; n (%)		
ASA I-II	53	(86.9)
ASA III or higher	8	(13.1)
IMC >25; n (%)	17	(27.9)
Type of fixation; n (%)		
Total cemented	17	(27.9%)
Hybrid	10	(16.4%)
Non-cemented	34	(55.7%)
Diagnosis; n (%)		
Hip osteoarthritis	36	(59.0)
Subcapital hip fracture	17	(27.9)
AVN	8	(13.1)

SD = standard deviation; ASA = *American Society of Anesthesiologists* physical status classification system; BMI = body mass index; AVN = avascular necrosis of the hip.

For descriptive purposes, clinical and demographic characteristics were compared among disease groups; age distribution was the only statistically significant difference. Patients with avascular necrosis of the hip were younger (Figure 3). However, in the authors' opinion, given that the sample comprised patients <70 years and considering the preliminary descriptive nature of the study, this difference is not clinically relevant to our investigation. Age, sex, body mass index, comorbidities, and ASA (*American Society of Anesthesiologists*) score are summarized in Table 2.

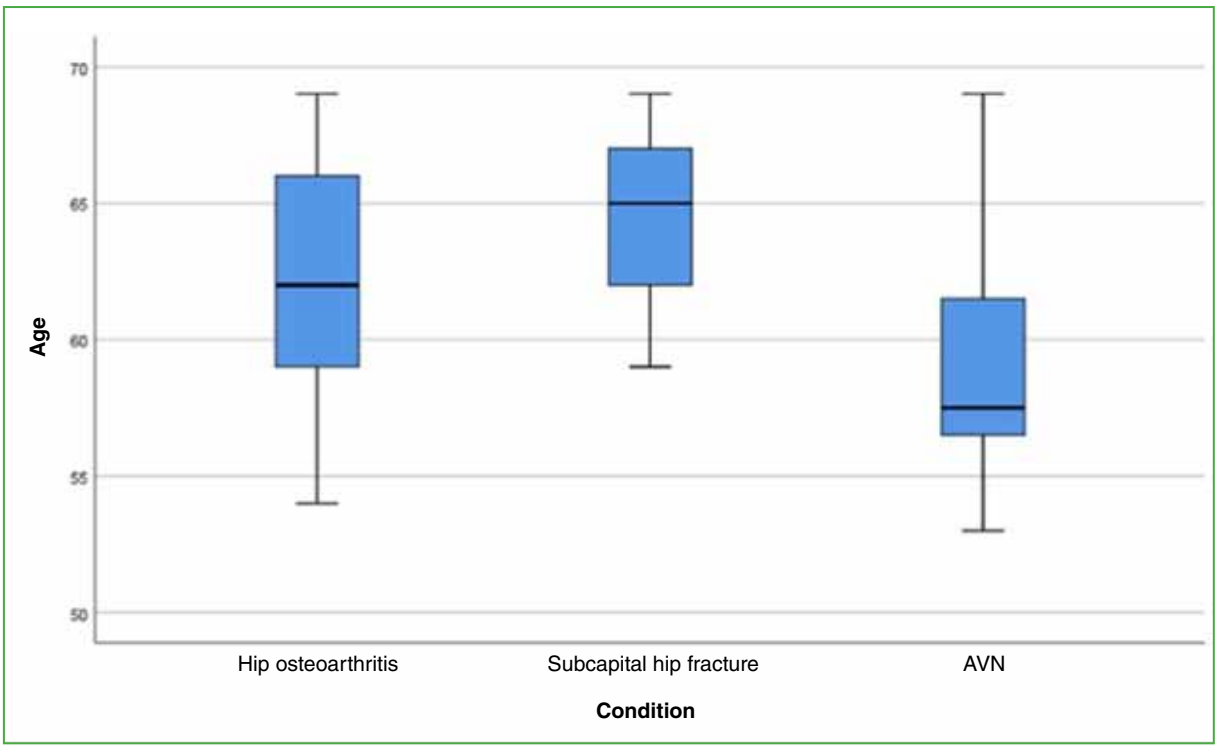

Figure 3. Box plot showing age distribution according to diagnosis.

Table 2. Distribution of age, sex, comorbidities, ASA, and BMI variables according to diagnosis.

Variables	Diagnosis			p*
	Hip osteoarthritis (n = 36)	Subcapital hip fracture (n = 17)	Hip AVN (n = 8)	
Age; mean (SD; range)	62.39 (4.3; 54-69)	64.41 (3.3; 59-69)	59.1 (5.0; 53-69)	**0.017**
Sex; n (%) Female Male	 15 (41.7) 21 (58.3)	 10 (58.8) 7 (41.2)	 5 (62.5) 3 (37.5)	0.365
Comorbidities (number); median (range)	0 (0-2)	0 (0-2)	0 (0-1)	0.726
ASA; n (%) ASA I-II ASA III or higher	 31 (86.1) 5 (13.9)	 15 (88.2) 2 (11.8)	 7 (87.5) 1 (12.5)	0.976
BMI >25; n (%)	8 (22.2)	8 (47.1)	1 (12.5)	0.09

SD = standard deviation; ASA = *American Society of Anesthesiologists* physical status classification system; BMI = body mass index; AVN = avascular necrosis. (*) The p-value was calculated using the ANOVA test for age between groups; the $\chi 2$ test for sex, ASA score, and BMI; and the Kruskal-Wallis test for comorbidities.

Over a preliminary 2-year follow-up, no serious surgery-related complications occurred (infection, prosthesis instability, loosening). One patient had localized pain associated with trochanteric bursitis; the overall complication rate was <2%.

Functional assessments with HHS and OHS reflected favorable early clinical progress, with statistically significant differences between preoperative scores and 2-year scores. Data are summarized in Table 3.

Table 3. Pre- and postoperative comparison according to the *Harris Hip Score* and the *Oxford Hip Score*

Time	Preoperative		6 months		12 months		24 months		p*
Scales; median (range)									
Oxford Hip Score	26	(20-35)	40	(35-42)	45	(40-48)	45	(42-48)	**<0.001**
Harris Hip Score	65	(53-75)	86	(80-96)	93	(88-98)	95	(90-98)	**<0.001**

*The p-value was obtained from Friedman's statistical test for comparing three or more nonparametric dependent samples.

DISCUSSION

The survival rate was 100% at a mean follow-up of 47 months, comparable to the study by Gómez-García, which reported 97.6% at 31 months.[7]

The mean OHS for quality of life was 45, similar to results reported by Matsen et al., who found a mean OHS of 41.8 ± 6.28 at a mean 28.8-month follow-up.[8]

The mean HHS was 95, comparable to that reported by Puch et al. (95.6) at an average follow-up of 11 years.[9]

It should be emphasized that, in our study, the etiology prompting THA was heterogeneous, as scheduled primary replacements in patients with hip fractures due to bone fragility were included. This represents a study limitation due to potential selection bias in further analyses and precludes broad generalization of conclusions. Nonetheless, as a descriptive study intended to present outcomes in a series of patients <70 years, inclusion was accepted per the authors' criteria.

It should also be clarified that, although all included patients were <70 years, there was a significant age difference in the fracture subgroup, with a higher mean age. In our setting, we have experience using dual-mobility cups as a valid option in patients >65 years, with acceptable functional outcomes and a relatively low dislocation rate (0.9%).[10] According to registry data from Sweden and England, and reports by Bozic from the Mayo Clinic group, dislocation is the most common cause of revision within the first year.[11]

CONCLUSIONS

Based on our results, primary THA with a dual-mobility cup in patients <70 years may represent a valid surgical option due to the low dislocation rate and good medium-term survival. However, these are preliminary findings that must be considered in the context of long-term follow-up. We believe it is essential to evaluate implant wear over time and to increase the number of cases, both representing limitations of the present study.

Further research is needed to compare the long-term outcomes of dual-mobility cups (with respect to wear) versus conventional cups. A strength of our study is that the proposed surgery resulted in no complications and enabled return to usual activities.

Conflicts of interest: The authors declare no conflicts of interest.

G. A. Ricciardi ORCID ID: https://orcid.org/0000-0002-6959-9301
J. D. Mancilla Vargas ORCID ID: https://orcid.org/0000-0002-0025-1251
F. S. Scaglione ORCID ID: https://orcid.org/0000-0002-0261-380X
M. Loayza Gómez ORCID ID: https://orcid.org/0000-0001-9079-5641
M. A. Pérez ORCID ID: https://orcid.org/0000-0002-2163-0680

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One-Stage Revision for Periprosthetic Hip and Knee Infections: A Multicenter Experience

Walter F. Martínez,[*] Eduardo J. Bochatey,[**] Fernando A. Lopreite[#]
[*]*Clínica Privada Hispano Argentina, Tres Arroyos, Buenos Aires, Argentina*
[**]*Instituto Argentino de Diagnóstico y Tratamiento, Autonomous City of Buenos Aires, Argentina*
[#]*Orthopedics and Traumatology Service, Hospital Británico de Buenos Aires, Autonomous City of Buenos Aires, Argentina*

ABSTRACT

Introduction: Periprosthetic joint infection (PJI) is a devastating complication after hip or knee arthroplasty. Although two-stage revision is considered the treatment of choice for chronic infections, one-stage revision has emerged as an alternative that reduces morbidity. **Objective:** To report the results and advantages of one-stage revision for chronic PJI of the hip and knee. **Materials and Methods:** Twenty-four patients (16 knees and 8 hips) with PJI, without severe systemic or limb compromise according to McPherson's classification, were included. All underwent one-stage revision and received intravenous antibiotics for at least 10 days, followed by oral therapy for a minimum of 3 months. Comorbidities, clinical outcomes, and infection control were assessed with a minimum follow-up of 1 year. **Results:** Seventy-five percent of patients (18/24) were classified as McPherson host type A, and 91.6% (22/24) had good soft tissue conditions (type I). Infection was controlled in 22 cases (91.6%), while 2 patients had persistent infection. All patients showed improvement in mobility and satisfaction, particularly those treated for knee infections. **Conclusions:** One-stage revision achieved good outcomes in most cases of chronic PJI, with a high infection control rate (91.6%). This strategy reduces the morbidity associated with two-stage revision, provided that patients are carefully selected, the causative pathogen is identified, and antibiotic susceptibility is known.

Keywords: Periprosthetic joint infection; hip; knee; one-stage revision.
Level of Evidence: IV

Revisión en un tiempo para infecciones periprotésicas de cadera y rodilla: experiencia multicéntrica

RESUMEN

Introducción: Las infecciones periprotésicas (IPP) representan una complicación devastadora tras una artroplastia de cadera o rodilla. Aunque la revisión en 2 tiempos se considera de elección para las infecciones crónicas, la revisión en 1 tiempo surge como una alternativa que reduce la morbilidad. **Objetivo:** Comunicar los resultados y las ventajas de la revisión en 1 tiempo para IPP crónicas de cadera y rodilla. **Materiales y Métodos:** Se incluyeron 24 pacientes (16 rodillas y 8 caderas) con IPP, sin compromiso severo del estado general y del miembro inferior según la clasificación de McPherson. Todos se habían sometido a una revisión en 1 tiempo y habían recibido antibióticos intravenosos como mínimo 10 días, seguidos de terapia oral durante, al menos, 3 meses. Se analizaron las comorbilidades, los resultados clínicos y el control de la infección en un seguimiento mínimo de 1 año. **Resultados:** El 75% correspondía a la categoría A de McPherson (tipo de huésped) y el 91,6% tenía buenos tejidos blandos (tipo 1). En 22 pacientes, se controló la infección; 2 continuaron con el proceso séptico. La movilidad y la tasa de satisfacción mejoraron en todos los pacientes, especialmente los tratados de rodilla. **Conclusiones:** La revisión en 1 tiempo logró buenos resultados en la mayoría de los casos de IPP crónicas, con una alta tasa de control de la infección (91,6%). Esta estrategia reduce la morbilidad asociada a la revisión en 2 tiempos, siempre que se seleccione adecuadamente al paciente, se identifique el germen y se conozca la sensibilidad antibiótica.

Palabras clave: Infecciones periprotésicas; cadera; rodilla; revisión en un tiempo.
Nivel de Evidencia: IV

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INTRODUCTION

Periprosthetic joint infections (PJIs) are among the most feared complications following hip or knee arthroplasty due to their significant negative impact on both patient quality of life and healthcare costs.[1,2] The incidence ranges from 0.2% to 2% in primary arthroplasties but may be higher in patients with prior revisions or comorbidities.[3]

The conventional treatment for chronic PJI typically involves a two-stage revision, originally designed to eradicate infection through implant removal and placement of an antibiotic-loaded spacer, followed by a second procedure to insert a new prosthesis.[4,5] However, multiple published series have evaluated the benefits of one-stage revision, highlighting reduced morbidity associated with multiple surgeries and shorter overall treatment duration.[6,7] In this regard, Haddad and colleagues have reported encouraging results in terms of decreased patient suffering and improved short- and mid-term functionality with single-stage revision.[8]

Despite these advances, the choice between one- and two-stage revision remains a matter of debate in the orthopedic community. Several factors influence decision-making, including accurate pathogen identification, soft tissue condition, infection severity, host immunocompetence, and resource availability.[9,10]

The objective of this study was to analyze our multicenter experience with one-stage revision for chronic hip and knee PJIs, describing selection criteria, surgical technique, and infection control outcomes after a minimum follow-up of one year.

MATERIALS AND METHODS

Study Design and Population

A retrospective, multicenter, descriptive observational case series was conducted, including 24 patients with chronic PJI (type III according to the McPherson classification) treated between 2019 and 2022 at three specialized centers. Of the 24 cases, 16 involved the knee and 8 the hip. The minimum follow-up was 12 months to assess infection control, joint function, and patient satisfaction.

Informed consent was obtained from all participants.

Diagnosis and Classification

Diagnosis of PJI followed the criteria established by the *Second International Consensus on Musculoskeletal Infection*.[11] All patients presented with severe pain and restricted range of motion. In every case, radiographic evaluation showed prosthetic component loosening. Laboratory tests revealed C-reactive protein (CRP) levels >10 mg/L and erythrocyte sedimentation rate (ESR) >30 mm/h. Joint aspiration was performed preoperatively in all patients, showing >3000 cells/mL with >70% polymorphonuclear cells. The infecting microorganism and its antibiotic susceptibility were always identified before surgery.

Patients were also classified according to the McPherson PJI staging system (Table 1). This staging system considers the acuteness or chronicity of the infection, the patient's general medical and immunological health status, and local soft tissue status (Table 2).[12,13]

Inclusion and Exclusion Criteria

Inclusion criteria were chronic PJI (McPherson type III), good general condition (categories A and B for the host), and adequate soft tissue condition (categories 1 and 2).

Exclusion criteria included acute infections, inability to identify the causative microorganism, severe systemic illness (McPherson category C), or major soft tissue compromise (category 3 for tissues).

Data Collection Process

Data were extracted from both electronic and paper medical records using a standardized form designed specifically for this study. The information collected included demographic and clinical data, microbiological parameters and joint aspiration results, surgical details (technique, approach, use of antibiotic-loaded calcium

sulfate beads, component replacement), follow-up markers such as inflammatory indices, radiographic outcomes, range of motion, and patient-reported satisfaction.

To ensure data quality and consistency, two independent researchers entered and cross-checked the information in a centralized database, and periodic audits were conducted to resolve discrepancies and minimize errors.

Table 1. McPherson classification for periprosthetic joint infection.

Anatomical complexity	Degree of systemic involvement	Degree of local involvement
Type I: Early postoperative infection (<4 weeks postoperative)	A – No systemic involvement	1 – No local involvement
Type II – Hematogenous infection (<4 weeks duration)	B – Compromised, ≤2 compromising factors	2 – Compromised, ≤2 local compromising factors
Type III – Late chronic infection (>4 weeks duration)	C – Significant compromise, ≥3 compromising factors or one of the following: Absolute neutrophil count <1000 CD4 T cell count <100 Chronic active infection at another site Immune system dysplasia or neoplasia	3 – Significant local compromise ≥3 local compromising factors

Table 2. Systemic and local factors compromising the host according to McPherson's classification.

Systemic factors	Local factors
Immunosuppressive drugs	Multiple incisions with skin grafts
Alcoholism	Active infection >3 months
Hypoxia	Loss of soft tissue due to previous trauma
Malignancy	Subcutaneous abscess >8 cm^2
Diabetes	Synovial skin fistula
Advanced age (>80 years)	Previous periarticular fracture or trauma to a joint
Active chronic dermatitis or cellulitis	Previous local irradiation
Pulmonary insufficiency	Vascular insufficiency in the extremity
Nicotine use	
Intravenous drug abuse	
Chronic indwelling catheter	
Chronic malnutrition	
Kidney failure requiring dialysis	
Systemic inflammatory disease	
Systemic immune compromise	
Liver failure	

Bias and Variability Management

Various strategies were adopted to reduce potential biases and variability inherent in the retrospective design:

Protocol standardization: clear operational definitions and a structured data collection form were used across all centers, ensuring homogeneous data recording.

Multidisciplinary review: a committee of surgeons and internists periodically evaluated the data to identify potential selection or reporting biases.

Statistical adjustments: In the final analysis, multivariable regression models were used to control for confounding variables and assess the independent impact of each factor on outcomes.

Patient Selection Process

Beyond inclusion and exclusion criteria, a rigorous case identification process was implemented:

Systematic search: A comprehensive review of electronic records was conducted using keywords and ICD codes related to chronic hip and knee PJI.

Detailed clinical evaluation: each identified case was assessed by a multidisciplinary team applying McPherson criteria (type III chronic infection, host categories A–B, soft tissue categories 1–2), and exclusion criteria (acute infections, inability to identify the microorganism, patients with severely compromised systemic status or significant skin alterations), along with review of surgical history, comorbidities, and prior treatment response.

Diagnostic confirmation: the diagnosis of chronic PJI was corroborated by microbiological (at least two positive cultures of the same microorganism) and radiological criteria, which allowed only those cases with a confirmed and homogeneous diagnosis to be included.

Surgical Procedure

Antibiotic prophylaxis was tailored to the organism identified in the preoperative aspiration culture. A posterolateral approach was used for hips and an extended medial parapatellar approach with quadriceps snip for knees. The surgical protocol comprised two stages. The first phase, the dirty phase (Figure 1), involved removal of the implant, cement, and all foreign or devitalized tissue. Five samples (bone, interfacial membrane, and joint fluid) were collected for culture; infection was confirmed with ≥2 positive cultures for the same microorganism.

A five-step irrigation and chemical debridement protocol was performed following Kildow et al.:

1. Low-pressure lavage with 3 L of saline solution.
2. Lavage with 100 mL of 3% hydrogen peroxide (H_2O_2) and 100 mL of sterile water for 2 minutes.
3. Lavage with 3 L of saline solution.
4. Lavage with 1 L of diluted 0.36% povidone-iodine, left in the wound for 3 minutes.
5. Low-pressure lavage with 3 L of saline solution.

The bone surfaces were covered with gauze soaked in diluted povidone-iodine, and the skin was closed with simple sutures (end of dirty phase).

For the clean phase (Figure 2), instruments, gowns, and drapes were replaced. The skin was disinfected again with povidone-iodine, sutures were removed, and the joint was washed once more with diluted povidone-iodine and 1 L of saline solution. Finally, new components were implanted.

For knee revisions, cemented prostheses were used, adding antibiotics to the cement (a combination of glycopeptides and aminoglycosides, 2 g per 40 g of polymethylmethacrylate). For hips, four implants were uncemented and three cemented using the same antibiotic formulation.

All patients received intravenous antibiotic therapy for at least 10 days according to sensitivity testing, followed by oral antibiotics for a minimum of 3 months.

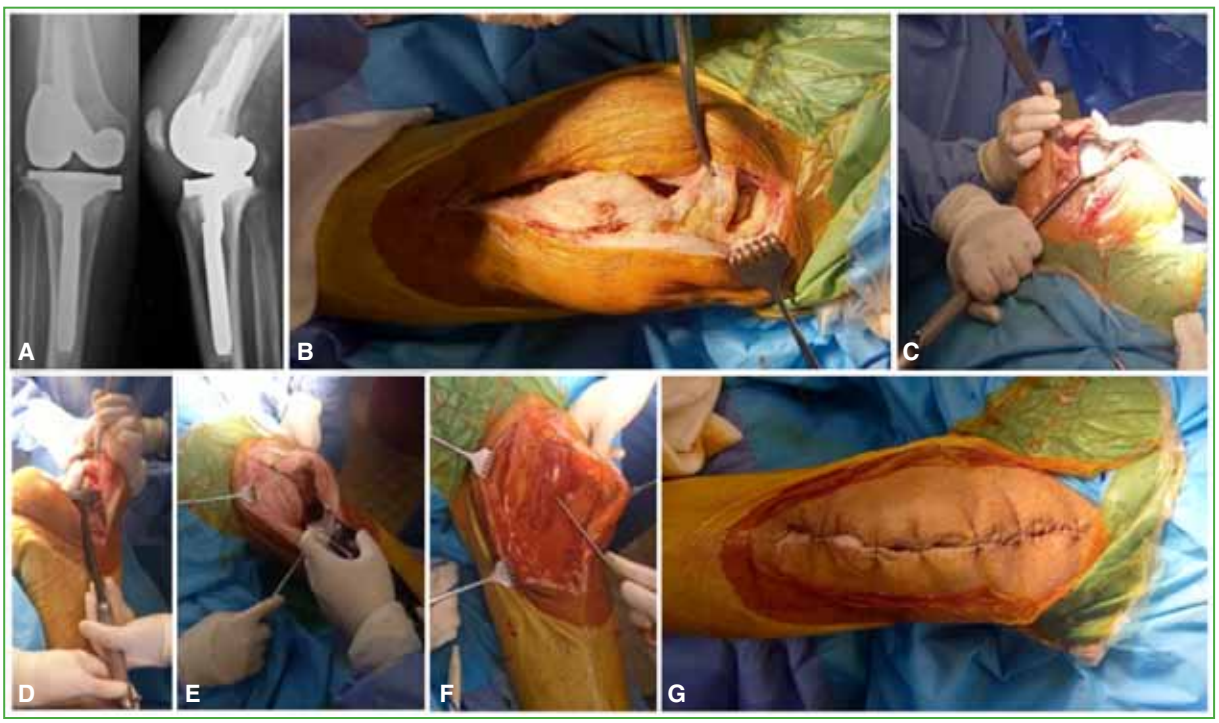

Figure 1. Dirty phase of one-stage revision. **A.** Preoperative radiograph of a knee prosthesis infected with methicillin-resistant *Staphylococcus aureus*. **B.** Extended medial parapatellar incision (quadriceps snip). **C–D.** Removal of prosthetic components. **E–F.** Chemical debridement with hydrogen peroxide and povidone-iodine. **G.** Dermal suture.

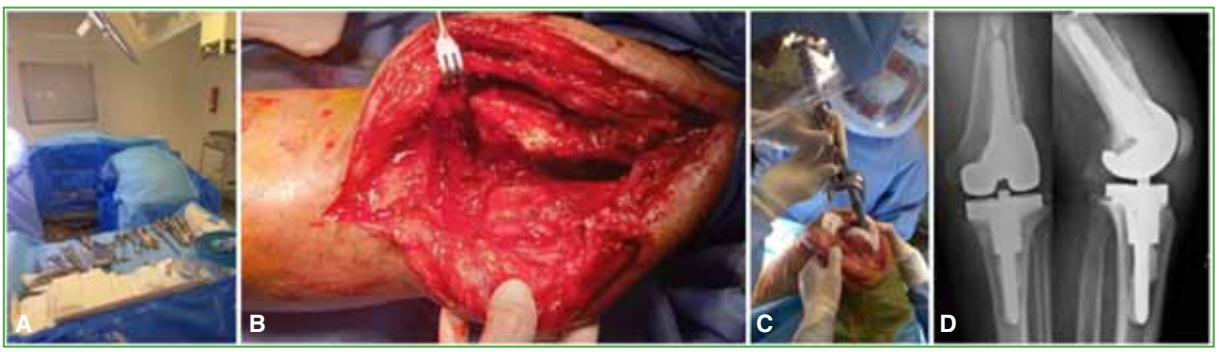

Figure 2. **A.** Complete instrument replacement. **B–C**. Placement of new implants after lavage. **D.** Postoperative radiograph.

Follow-up and Success Definition

Clinical and radiological follow-up was conducted for at least 12 months. Therapeutic success was defined as absence of clinical signs of infection, normalization or reduction of inflammatory markers, and no recurrence during follow-up. Joint mobility (degrees of knee flexion per standardized scales) and patient satisfaction were also assessed.

RESULTS

General Characteristics

The series included 24 patients with PJI: 16 knees and 8 hips. Mean age was 67 years (range 59-82), with a mean follow-up of 14 months (range 12-23). Among knee infections, 9 were women, 2 had diabetes, 1 was a smoker, and 1 had acute renal failure. Among hip infections, 5 were men, 1 had diabetes, and 1 had rheumatoid arthritis. All modifiable risk factors were optimized before surgery.

All infections were chronic (McPherson type III).

Host and Soft Tissue Classification

Eighteen patients were category A and six category B. Regarding soft tissue, 22 were type 1 and two were type 2 (Table 3).

Methicillin-sensitive *Staphylococcus aureus* and *Staphylococcus epidermidis* were the microorganisms with the highest rate of positive cultures in the infected patient population (20.8% and 20.7%, respectively). Table 4 details the incidence rates by type of microorganism.

Table 3. Host and soft tissue category in the McPherson classification. Infection control in the different categories

Degree of systemic/local compromise	Total	Control of PJI	%
A1	17	16	94.1
A2	1	0	0
B1	5	4	80
B2	1	1	100

PJI = periprosthetic joint infection.

Table 4. Microorganisms isolated in 24 periprosthetic joint infections.

Microorganism	n	%
Methicillin-sensitive *Staphylococcus aureus*	5	20.8
Staphylococcus epidermidis	4	16.6
Methicillin-resistant *Staphylococcus epidermidis*	1	4.16
Staphylococcus lugdunensis	1	4.16
Escherichia coli	2	8.3
Enterococcus faecalis	2	8.3
Methicillin-resistant *Staphylococcus aureus*	2	8.3
Streptococcus mitis	1	4.16
Serratia marcescens	1	4.16
Pseudomonas aeruginosa	1	4.16
Proteus mirabilis	1	4.16
Finegoldia magna	1	4.16
Cutibacterium acnes	2	8.3
Total	24	100%

Relevant Statistical Analysis of the Results

Overall infection control

Infection control was achieved in 91.6% of the 24 patients included, at 12 months of follow-up.

Influence of host classification (McPherson)

Patients in category A (without significant comorbidities) represented 75% (18/24) of the sample and achieved an infection control rate of 94.4% (17/18).

In contrast, in patients in category B (with systemic involvement), the control rate was 83.3% (5/6). Although no inferential analysis was performed due to the small sample size, results suggest better outcomes in patients with fewer systemic comorbidities.

Impact of soft tissue status

In subcategory A1 (healthy systemic status and type 1 soft tissue), success reached 94.1%. In contrast, infection control dropped to 50% in patients with compromised soft tissue (type 2). These findings emphasize the importance of local tissue quality in procedural success.

Microorganisms and their influence on outcomes

The most commonly isolated microorganisms were methicillin-sensitive *S. aureus* (20.8%) and *Staphylococcus epidermidis* (16.6%).

It should be noted that the two patients in whom infection control was not achieved were infected with *Pseudomonas aeruginosa* and *Serratia marcescens*, both resistant Gram-negative pathogens with limited antibiotic options, which likely contributed to treatment failure, a relevant finding for future research.

Functional improvement

Average knee flexion improved by 15°, and hip patients achieved earlier gait recovery, corresponding with high satisfaction rates.

Complications

Persistent wound drainage was detected in 2 patients undergoing knee revision, which was resolved after anticoagulation adjustment and rest.

DISCUSSION

One-stage revision has gained growing acceptance for chronic PJI management, especially when patients are carefully selected, pathogens and sensitivities are clearly identified, and aggressive debridement is combined with prolonged antibiotic therapy.[9,14]

Several renowned authors have endorsed the effectiveness of this strategy. Gehrke et al. emphasized the importance of thorough debridement and antibiotic-loaded cement or coated implants to achieve infection control rates of 80-100%.[6,7] Similarly, Haddad and colleagues have emphasized that the main benefit lies in avoiding multiple surgeries, thereby reducing surgical stress and overall recovery time.[8,14]

Our infection control rate of 91.6% aligns with previous reports,[14,15] supporting one-stage revision as a valid option when selection criteria are met: confirmed pathogen, known resistance profile, healthy host with adequate immune response, and preserved soft tissue envelope. Success was highest in McPherson stage A1 patients, consistent with other series.[16] We excluded cases with major systemic compromise (category C) or severe soft tissue defects (category 3), given their high failure rates in single-stage revision.[16,17]

The emergence of quinolone-resistant Gram-negative organisms remains a major challenge, requiring prolonged antibiotic regimens and often leading to reoperation.[18,19] Microbiologic profiling and sensitivity testing are therefore critical in surgical planning.[19,20]

Optimization of systemic factors, such as glycemic control, smoking cessation, and nutritional correction, has also been shown to improve cure rates.[21] Thus, multidisciplinary collaboration among infectious disease specialists, orthopedic surgeons, and microbiologists is essential for success.[22,23]

Despite encouraging results, our sample size is small, and prospective randomized trials are needed to confirm the superiority or equivalence of the one-stage approach compared with two-stage revision.

CONCLUSIONS

One-stage revision for chronic hip and knee PJIs is associated with high infection control rates and substantial improvements in joint function and patient satisfaction. This approach reduces morbidity and expedites recovery by avoiding multiple surgeries. However, success depends on appropriate patient selection, meticulous surgical technique, and comprehensive understanding of pathogen profiles. Larger, prospective studies with robust design are warranted to refine indications and define the limits of this technique.

Statement on generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to improve readability and language. After using this tool, the authors reviewed and edited the content as necessary and assume full responsibility for the content of the publication.

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E. J. Bochatey ORCID ID: https://orcid.org/0000-0003-3645-6563
F. A. Lopreite ORCID ID: https://orcid.org/0000-0002-2065-8649

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Dislocation of Bipolar Hip Hemiarthroplasty in the Elderly: Comparison of the Posterolateral and Anterolateral Approaches

Arturo Aguilar Maldonado, José Luis Lecca Zavaleta
Pelvis and Hip Unit, Traumatology Service, Hospital Guillermo Almenara Irigoyen, Lima, Peru

ABSTRACT
Objective: To compare the risk of bipolar hip hemiarthroplasty dislocation after femoral neck fracture using the posterolateral versus the anterolateral approach. **Materials and Methods:** Patients older than 60 years who underwent bipolar hip hemiarthroplasty for femoral neck fracture between 2020 and 2021 were included. The number of dislocations following the posterolateral or anterolateral approach was recorded. **Results:** Seventy-nine cases were included: 46 (58.8%) were treated with the posterolateral approach and 33 (41.8%) with the anterolateral approach. There were 3 dislocations in the posterolateral group and 2 in the anterolateral group; no significant differences were found (p = 0.655). **Conclusions:** There were no differences in the risk of bipolar hemiarthroplasty dislocation between the posterolateral and anterolateral approaches in the treatment of femoral neck fractures in the elderly.
Keywords: Hip prosthesis; hip dislocation; femoral neck fracture; elderly.
Level of Evidence: III

Luxación de la prótesis bipolar de cadera en adultos mayores. Comparación de los abordajes posterolateral y anterolateral

RESUMEN
Objetivo: Comparar el riesgo de luxación de la prótesis bipolar de cadera con los abordajes posterolateral y anterolateral en el tratamiento de una fractura de cuello femoral. **Materiales y Métodos:** Se incluyó a pacientes >60 años operados con una prótesis bipolar de cadera por fractura de cuello femoral durante 2021 y 2022. Se determinó la cantidad de luxaciones de prótesis colocadas con los abordajes posterolateral o anterolateral. **Resultados:** Se incluyeron 79 casos: 46 (58,8%) operados con un abordaje posterolateral y 33 (41,8%) con un abordaje anterolateral. Se produjeron 3 luxaciones con el abordaje posterolateral y 2 con el anterolateral, no se hallaron diferencias significativas (p = 0,655). **Conclusiones:** No se hallaron diferencias entre los abordajes posterolateral y anterolateral respecto del riesgo de luxación de la prótesis bipolar en el tratamiento de una fractura de cuello femoral en el adulto mayor.
Palabras clave: Prótesis de cadera; luxación de cadera; fracturas de cuello femoral; adulto mayor.
Nivel de Evidencia: III

INTRODUCTION

Femoral neck fractures can be classified by degree of displacement; the most commonly used system is the Garden classification,[1] which divides them into nondisplaced and displaced to improve interobserver agreement.[2] The incidence of avascular necrosis and nonunion is higher in older adults with displaced fractures;[3] therefore, hip arthroplasty is the treatment of choice, and bipolar hemiarthroplasty is an option in older adults with low functional demand.[4]

Hip prostheses can be implanted through several approaches, such as anterior, anterolateral, and posterolateral.[5,6] At our institution, the posterolateral and anterolateral approaches are currently used.

Received on May 27th, 2024. Accepted after evaluation on June 17th, 2025 • Dr. ARTURO AGUILAR MALDONADO • aam_md@hotmail.com https://orcid.org/0000-0002-6721-9803
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In a meta-analysis of five randomized trials and 26 cohort studies, Shuai et al.[7] compared different surgical approaches for hemiarthroplasty and found that the posterolateral approach was associated with more prosthetic dislocations (odds ratio [OR] 3.00). In another meta-analysis by Van der Sijp et al.[8] on surgical approaches for hemiarthroplasty, the risk of dislocation was higher after the posterolateral approach than after the anterolateral approach (OR 2.90; p = 0.003). Notably, both meta-analyses included studies of posterolateral, anterolateral, and anterior approaches. However, Parker's randomized study of 216 patients, included in both meta-analyses, is the only one that compares solely the anterolateral versus the posterolateral approach for hemiarthroplasty, and it found no significant differences in prosthetic dislocation.[9]

At our institution, the anterolateral and posterolateral approaches are used for bipolar hip prosthesis surgery. As we consider the available information inconclusive, we conducted a study to evaluate bipolar prosthesis dislocation with both approaches.

MATERIALS AND METHODS

A retrospective cross-sectional study was conducted including patients >60 years of age with femoral neck fractures who underwent bipolar hemiarthroplasty during 2021 and 2022. Patients with a history or sequelae of Parkinson's disease, cerebrovascular disorder, or disorders of consciousness were excluded.

For the anterolateral approach, the patient was placed in the lateral decubitus position; the technique consisted of dissection through the gluteus medius and minimus tendons with an anterior capsulotomy of the hip joint. For the posterolateral approach, the patient was also placed in lateral decubitus; dissection proceeded through the short external rotators (pelvitrochanteric muscles) with capsulotomy, and both capsule and short external rotators were repaired at the end of the procedure. A bipolar prosthesis was used with a polished straight cemented stem and a modular bipolar cup. Dislocation of the hip prosthesis was defined as loss of continuity between the bipolar cup component and the acetabulum.

Patient data were retrieved from medical records and radiographs in the hospital information system. A data collection form captured: surgical approach, age, sex, comorbidities, postoperative complications, management after dislocation, time from fracture to surgery, and mortality (in months) from the date of surgery. Data were entered into a database for statistical analysis in compliance with patient confidentiality and privacy protocols.

Records were collected confidentially, anonymized, and protected using numeric identifiers, with security measures to prevent unauthorized access. Individual informed consent was not required because no additional data were collected from participants. The study was approved by the Hospital Ethics Committee.

Statistical Analysis

To assess the association between surgical approach (anterolateral vs. posterolateral) and postoperative dislocation, we used contingency analysis. A two-way contingency table was constructed and a χ^2 test of independence was performed; when expected cell counts were low, Fisher's exact test was applied. This determined whether a significant relationship existed between approach and postoperative dislocation.

Age, sex, comorbidity, management after dislocation, and the number and experience of participating surgeons were also analyzed. These variables were summarized descriptively (frequencies and percentages) and their association with approach was explored. Kaplan-Meier survival curves were constructed to analyze mortality with a minimum follow-up of 1 year; months-to-mortality were obtained from the medical record.

Statistical analyses were performed with SPSS version 25. A p value <0.05 was considered statistically significant.

RESULTS

During 2021-2022, eighty-two bipolar prostheses were implanted for femoral neck fractures. Seventy-nine patients met inclusion criteria and were analyzed. Mean age was 89 years (range 64–96); 56 were women (70.9%) and 23 men (29.1%). A posterolateral approach was used in 58.8% and an anterolateral approach in 41.8%. The dislocation rate of bipolar hip prostheses was 6.3% (three cases after the posterolateral approach and two after the anterolateral approach; p = 0.655).

Two patients sustained periprosthetic fractures (2.5%), and three (3.8%) developed periprosthetic joint infection (Table).

Comorbidities were: diabetes mellitus (18 cases; 22.8%), chronic kidney disease (7; 8.9%), hypertension (33; 41.8%), cancer (1; 1.3%), Parkinson's disease (4; 5.1%), and sequelae of cerebrovascular disorder (5; 6.3%).

Table. Indicators for the posterolateral and anterolateral approaches.

	Posterolateral approach		Anterolateral approach		p
Number of patients	**46**		**33**		
Age (years)	83.8 (63-96)		83.4 (65-95)		0.342
Female	32	69.6%	24	72.7%	0.481
Dislocation	3	6.5%	2	6.1%	0.655
Infection	3	6.5%	0	0%	0.192
Periprosthetic fracture	1	2.2%	1	3.0%	0.664
Cumulative mortality	16	34.8%	10	30.3%	0.432

The 1-year mortality rate was 21.51% overall (11 deaths after the posterolateral approach [23.91%] and 6 after the anterolateral approach [18.18%]). Mean time from fracture to surgery was 14.91 days (range 2–51). Survival was lower when surgery was performed more than 7 days after the fracture, although this difference was not statistically significant (p = 0.627) (Figure).

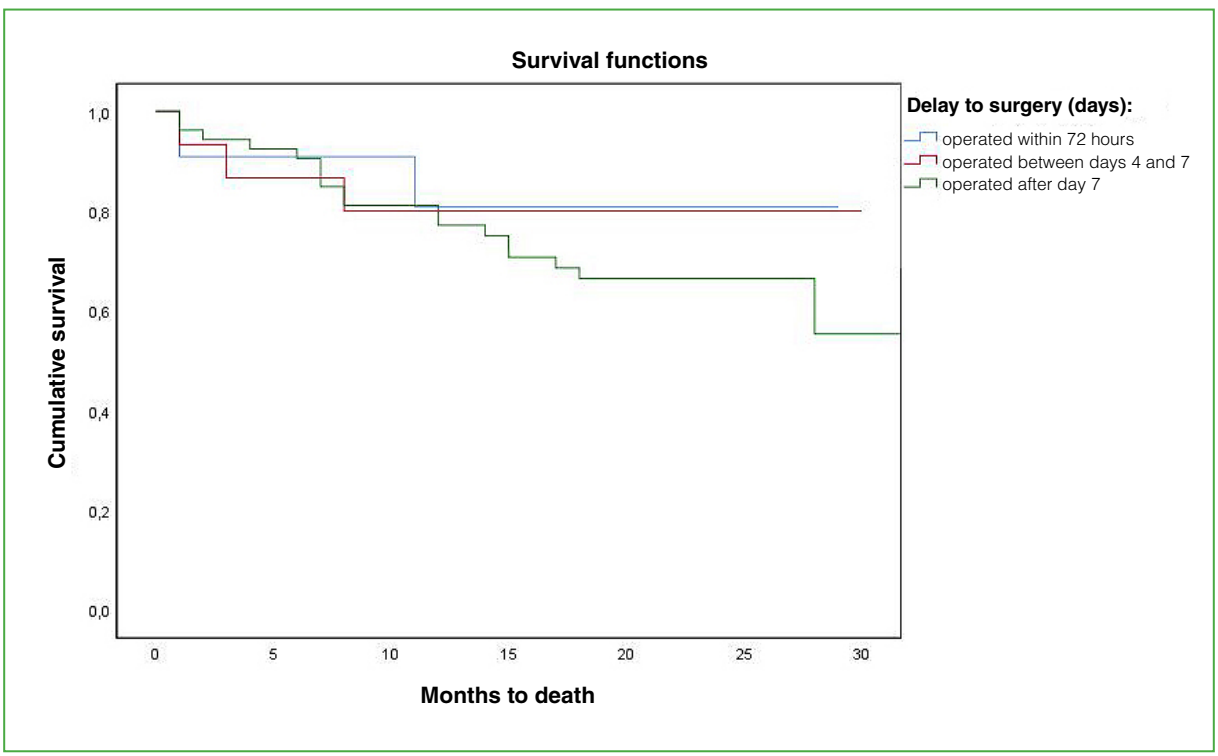

Figure. Cumulative survival in months. Deaths among those operated on within 72 hours, between the 4th and 7th day, and after the 7th day.

Fifteen surgeons from the Hip Unit participated. Twenty-six operations were performed by surgeons with <10 years' experience (five surgeons). Four of the five dislocation episodes of the bipolar prosthesis (two after anterolateral and two after posterolateral approach) occurred in this setting; dislocation risk was higher with less-experienced surgeons ($p = 0.038$).

DISCUSSION

In this study, there were no differences in dislocation episodes between the posterolateral and anterolateral approaches for treating femoral neck fractures with bipolar hemiarthroplasty. Likewise, Parker[9] found no differences in dislocation when comparing anterolateral versus posterolateral approaches for hemiarthroplasty. Mukka et al. conducted a prospective cohort including 102 patients operated through an anterolateral approach and 83 through a posterolateral approach; there were two single dislocation events after the posterolateral approach and only one after the anterolateral approach.[10] Enocson et al., in a retrospective study of 739 hemiarthroplasties, reported an increased risk of hip prosthesis dislocation with the posterolateral approach (OR 3.9).[11]

In our series, the 1-year mortality rate was 21.51%. Survival was higher in those who underwent surgery within the first 7 days after fracture, although this difference was not significant. Guzon-Illescas et al., in a retrospective cohort of 3,992 hip-fracture patients, reported a cumulative mortality of 33%.[12] In the NOREPOS study,[13] 1-year mortality after hip fracture was 33% in men and 21% in women. In our study, 1-year mortality by sex was 39.1% and 30.4%, respectively. Parker reported 1-year mortality of 18.5% with the posterolateral approach and 9% with the anterolateral approach for hemiarthroplasty;[9] in our series, 1-year mortality was similar to Parker's (23.91% with the posterolateral approach vs. 18.18% with the anterolateral approach).

Timing of surgery has also been extensively studied. In a systematic review and meta-analysis, Chang et al. found that surgery performed after 2 days was associated with significantly increased mortality (OR 1.91).[14] Rae et al. reported 30-day mortality of 5.8% in those operated within 2 days versus 9.4% after 2 days, although without significant differences. [15] In our study, survival was significantly higher in patients operated within 7 days of the fracture.

According to our findings, surgeon experience is related to dislocation incidence ($p = 0.038$). Hedlundh et al. also found a relationship between dislocation and surgeon experience.[16]

This study has limitations: its retrospective design, small sample size, and non-homogeneous approach groups. Other factors may have influenced outcomes, such as the wide range in time-to-surgery attributable to hospital processes. Additional morbidity variables that can affect morbidity and mortality (e.g., *American Society of Anesthesiologists* classification, type of anesthesia, operative time, and nutritional status) were not analyzed.

CONCLUSIONS

There are no differences between posterolateral and anterolateral approaches regarding the risk of bipolar prosthesis dislocation in the treatment of femoral neck fractures in older adults. This finding should be interpreted with caution due to the small sample size over the study period, which precludes statistical significance. The prosthesis dislocation rate was higher among patients operated on by surgeons with fewer than 10 years of experience.

Conflicts of interest: The authors declare no conflicts of interest.

J. L. Lecca Zavaleta ORCID ID: https://orcid.org/0000-0002-3658-5309

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Impact of Patellar Thickness in Total Knee Arthroplasty: Clinical and Functional Outcomes and Early Complications

Leonel Pérez Alamino, María Agustina Oláran, Germán Garabano, César Á. Pesciallo
Orthopedics and Traumatology Service, Hospital Británico de Buenos Aires, Autonomous City of Buenos Aires, Argentina

ABSTRACT

Introduction: Total knee arthroplasty (TKA) is effective in restoring function in patients with knee osteoarthritis. Restoration of the native patellar thickness is a critical aspect, but there is no consensus regarding the optimal thickness. The aim of this study was to evaluate the impact of patellar thickness on clinical and functional outcomes, radiological findings, complications, and revision rates in patients undergoing primary TKA. **Materials and Methods:** We conducted a retrospective study of patients who underwent TKA for primary osteoarthritis, with patellar resurfacing, and a minimum follow-up of 24 months. Recorded data included age, sex, body mass index, alignment, preoperative and postoperative patellar thickness, anterior knee pain, Knee Society Score (KSS), Visual Analog Scale (VAS) for pain, complication rates, and revision rates. **Results:** The series included 44 patients (mean age, 70.4 ± 10.8 years), all treated with the same prosthesis model. KSS, VAS, and anterior knee pain scores improved significantly. No significant differences were found between preoperative and postoperative patellar thickness (22.6 ± 2.9 mm vs. 22.0 ± 1.5 mm; p = 0.09). Postoperatively, 15.9% of patients had the same thickness as before surgery, while differences of 1 mm, 2 mm, and 3 mm were observed in 45.5%, 29.5%, and 9.1% of patients, respectively. **Conclusion:** Patellar thickness did not significantly influence clinical or functional scores, complication rates, or revision rates following primary TKA.

Keywords: Total knee arthroplasty; knee replacement; patellofemoral joint; patellar thickness.
Level of Evidence: IV

Impacto del grosor rotuliano en una artroplastia de rodilla. Análisis clínico-funcional y complicaciones tempranas

RESUMEN

Introducción: La artroplastia de rodilla es efectiva para restaurar la función en pacientes con artrosis de rodilla. Un aspecto crítico es la restauración del grosor rotuliano nativo. No hay consenso sobre el grosor rotuliano óptimo en la artroplastia de rodilla. El objetivo de este estudio fue evaluar el impacto del grosor rotuliano en los resultados clínico-funcionales y radiológicos, las complicaciones y la revisión, en pacientes sometidos a una artroplastia total de rodilla. **Materiales y Métodos:** Estudio retrospectivo de pacientes con una artroplastia de rodilla por gonartrosis primaria, con reemplazo del componente rotuliano y un seguimiento mínimo de 24 meses. Se registraron los siguientes datos: edad, sexo, índice de masa corporal, alineación, grosor rotuliano pre y posoperatorio, dolor anterior de rodilla, KSS y puntaje de la escala analógica visual de dolor, tasas de complicaciones y revisión. **Resultados:** La serie incluyó a 44 pacientes (edad media 70.4 ± 10.8 años) operados con el mismo modelo de prótesis. El KSS y los puntajes de la escala analógica visual y de dolor anterior de rodilla se incrementaron significativamente. No hubo diferencias significativas entre los grosores rotulianos pre y posoperatorio (22,6 ± 2,9 vs. 22,0 ± 1,5 mm; p = 0,09). El 15,9% tenía el mismo grosor posoperatorio que antes de la cirugía. En el 45,5%, 29,5% y 9,1%, la diferencia era de 1, 2 y 3 mm, respectivamente. **Conclusión:** El grosor rotuliano no tuvo un impacto significativo en los puntajes clínico-funcionales, las tasas de complicaciones o revisión tras una artroplastia total de rodilla primaria.

Palabras clave: Artroplastia total de rodilla; reemplazo de rodilla; articulación rotulofemoral; grosor rotuliano.
Nivel de Evidencia: IV

Received on April 2nd, 2025. Accepted after evaluation on July 13th, 2025 • Dr. LEONEL PÉREZ ALAMINO • leonelp95@gmail.com https://orcid.org/0000-0002-1563-6947

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INTRODUCTION

Total knee arthroplasty (TKA) is an effective procedure for relieving pain and restoring function in patients with advanced knee osteoarthritis. In Argentina, the prevalence of knee osteoarthritis is significant, leading to a substantial number of TKAs performed each year.[1,2] A critical aspect of TKA is the management of the patellofemoral joint, in particular decisions regarding patellar resurfacing and restoration of native patellar thickness.[3]

The patella plays a fundamental role in knee biomechanics, and alterations in its thickness can influence patellofemoral joint pressures and affect postoperative outcomes. Some studies have shown that deviations from native patellar thickness can impact patients' perception of outcomes and knee range of motion.[4] Conversely, other research suggests that minor increases in patellar thickness may not significantly affect knee flexion angles or functional outcomes.[5] Despite these findings, there is still no consensus on the optimal approach to restoring patellar thickness during TKA.

The variable results reported underscore the need for further research to establish standardized guidelines. It is important to note that there are limited data on Latin American populations, including Argentina, where anatomical factors and lifestyle habits may influence surgical outcomes differently.[6,7] Addressing this gap is essential to develop tailored surgical strategies that improve patient satisfaction and functional outcomes in these regions.

Therefore, the purpose of this study was to evaluate the impact of patellar thickness on clinical-functional and radiological outcomes, as well as complication and revision rates, in patients undergoing TKA for primary knee osteoarthritis.

MATERIALS AND METHODS

We conducted a retrospective study of patients operated on consecutively by the same surgeon at a high-volume TKA center between January 2021 and January 2023. We included patients who underwent primary TKA for severe knee osteoarthritis, received patellar component resurfacing, and completed a minimum follow-up of 24 months. We excluded patients with prior surgery or fractures of the treated knee; diseases such as rheumatoid arthritis or oncologic conditions; or varus/valgus malalignment >20°.

The U2 Knee™ design (United Orthopedic Corporation, Taiwan) was used in all cases. During the study period, 49 patients underwent surgery; 5 (10.2%) were excluded (3 due to prior surgeries and 2 due to rheumatoid arthritis treated with prolonged corticosteroids). The final series comprised 44 patients with a mean follow-up of 53.6 ± 2.4 months. Table 1 summarizes the variables of included patients.

From institutional medical records, we extracted age, sex, operated side, body mass index, range of motion, tourniquet use, and follow-up time.

Surgical Technique

All patients were operated on in the supine position under hypotensive spinal anesthesia, in a laminar-flow operating room, with a tourniquet at the proximal thigh. Cefazolin 1 g (2 g if weight >80 kg) was administered as antibiotic prophylaxis 30 minutes before skin incision. In all cases, a midline anterior approach with a medial parapatellar arthrotomy was used. Soft tissues were then released and balanced to correct deformity according to the mechanical axis (varus/valgus).

After the tibial and femoral cuts were made, patellar thickness was recorded manually with a caliper before the osteotomy, immediately afterward (remaining bony patellar thickness) (Figure), and with the trial polyethylene button, respectively. Stability and tracking were assessed using the trial components. If tracking was inadequate, a lateral retinacular release was performed; if the issue persisted, component rotation was re-evaluated. Before cementing the definitive components, proper patellar tracking throughout the full range of flexion–extension was confirmed.

For final fixation, one dose of high-viscosity bone cement was used per component.

The extensor mechanism was closed with 2-0 Vicryl® using separate figure-of-eight stitches.

All patients followed the same rehabilitation protocol. On postoperative day 1, emphasis was placed on quadriceps and calf isometric exercises, along with sitting at the edge of the bed. On day 2, assisted ambulation with a walker or Canadian crutches began and continued until week 3. If tolerated, patients were instructed to use a cane between weeks 3 and 6, and then to continue unaided.

Table 1. Variables of the patients included in the analysis

Variable	n = 44
Age (mean, SD)	70.4 ± 10.8
Gender n (%)	
Male	24 (54.5)
Female	20 (45.5)
BMI (mean, SD)	28.3 ± 3.6
Patella type (Wiberg) (n, %)	
I	4 (9.1)
II	22 (50.0)
III	18 (40.9)
Femorotibial angle (n, %)	
Varus	35 (79.5)
Valgus	9 (20.5)
Degrees (mean, SD)	4.9 ± 1.7
Caton-Deschamps index (mean, SD)	1.1 ± 0.2
Preoperative range of motion (mean, SD) (°)	
Flexion	106.7 ± 6.8
Extension	8.9 ± 3.6
Preoperative patellar thickness (mean, SD) (mm)	22.6 ± 3.9
Preoperative VAS score (mean, SD)	7.8 ± 0.9
Preoperative KSS (mean, SD)	
Clinical	52.6 ± 6.1
Functional	49.5 ± 5.8
AKP n (%)	31 (70.4)

SD = standard deviation; BMI = body mass index; VAS = visual analog scale; KSS = *Knee Society Score*; AKP = anterior knee pain.

Clinical-Functional Analysis

Anterior knee pain was recorded if the patient reported pain in the patellar region when rising from a chair, climbing or descending stairs, or with flexion >90° while standing prior to surgery.[8] In addition, the visual analog scale (VAS) for pain[9] and the *Knee Society Score* (KSS) were used.[10] Range of motion was assessed with a goniometer.

All data were obtained in a face-to-face interview conducted by an attending surgeon or a fellow trained in knee reconstruction. Preoperative values were compared with those at the last follow-up.

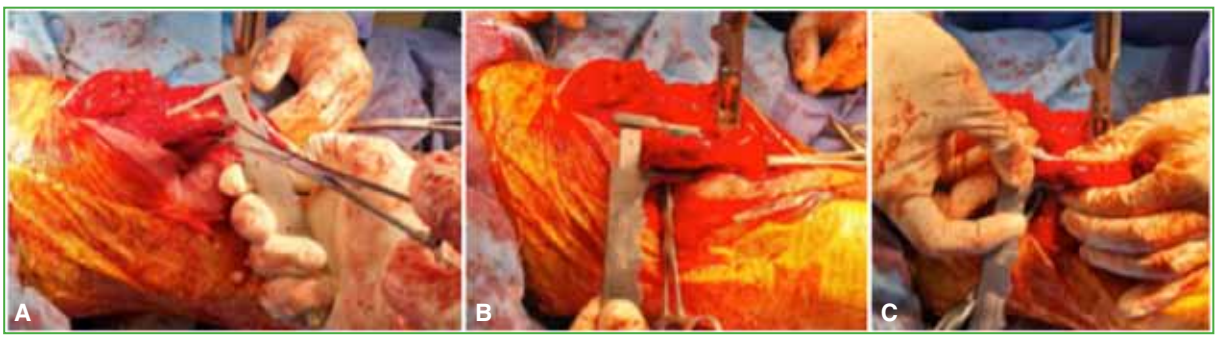

Figure. **A.** Measurement of the patella before osteotomy. **B.** Measurement of the bony remnant. **C.** Measurement with a polyethylene trial button.

Radiographic Analysis

Anteroposterior, lateral, and 30° axial projections were obtained for radiographic assessment.

Alignment was categorized according to the angle formed between the anatomical axes of the femur and tibia: neutral from 5° to 7° of valgus, varus <5° of valgus, and valgus >7° of valgus.[11]

Patellar height was determined using the Caton-Deschamps method.[12]

Complications

Any perioperative patellar complication, such as necrosis, fracture, or maltracking, was documented. We also recorded the revision rate for any cause.

Statistical Analysis

Categorical variables are described as frequency and percentage, and continuous variables as mean and standard deviation or median and interquartile range, depending on distribution. Qualitative variables were compared using the $\chi 2$ test (or Fisher's exact test) or ANOVA. The Student's t-test or Mann–Whitney test was used to compare quantitative data. Pre- and postoperative variables were correlated with Pearson's or Spearman's coefficient, according to distribution.

Statistical significance was set at $p < 0.05$. All data were entered into an Excel spreadsheet (Redmond, USA).

GraphPad Prism 10.0 (La Jolla, CA, USA) was used for analysis.

RESULTS

Clinical-Functional Outcome

There was a statistically significant improvement in range of motion after arthroplasty (flexion: 106.7 ± 6.8° vs. 114.7 ± 3.1°; $p < 0.01$; extension: 8.9 ± 3.6° vs. 3.4 ± 1.0°; $p < 0.01$), and there were no significant differences in patellar height (preoperative 1.1 ± 0.2 vs. postoperative 1.0 ± 0.1; $p = 0.77$).

Comparing preoperative scores (VAS, anterior knee pain, and KSS), a statistically significant improvement was observed on each scale after surgery (Table 2).

Radiological Outcomes

The femorotibial angle changed from 4.9 ± 1.7° (varus) to 2.3 ± 1.2° (valgus).

There were no statistically significant differences between pre- and postoperative patellar thickness (22.6 ± 2.9 mm vs. 22.0 ± 1.5 mm; $p = 0.09$).

Furthermore, no significant differences were found when analyzing patellar thickness by sex (Table 3).

Overall, 15.9% (n = 7) of patients had the same postoperative thickness as before surgery. Differences of 1, 2, and 3 mm were observed in 45.5% (n = 20), 29.5% (n = 13), and 9.1% (n = 4) of patients, respectively, after surgery.

No statistical association was detected in postoperative KSS values (clinical and functional) among patients with differences of 0, 1, 2, or 3 mm after surgery ($p = 0.10$).

Table 2. Pre- and postoperative clinical scores.

Variable	Preoperative	Postoperative	p
VAS (mean, SD)	7.8 ± 0.9	1.7 ± 0.6	<0.01
AKP (n, %)	31 (70.4)	10 (22.7)	<0.01
KSS (mean, SD)			
Clinical	52.6 ± 6.1	83.2 ± 4.7	<0.01
Functional	49.5 ± 5.8	80.8 ± 3.3	<0.01

SD = standard deviation; VAS = visual analog scale for pain; AKP = anterior knee pain; KSS = Knee Society Score.

Table 3. Comparison of patellar thickness according to gender.

Variable	Male	Female	p
Preoperative patellar thickness (mean, SD) (mm)	22.7 ± 2.1	20.9 ± 1.7	0.49
Bone remnant thickness (mean, SD) (mm)	13.9 ± 1.6	14.0 ± 1.5	0.91
Postoperative patellar thickness (mean, SD) (mm)	21.9 ± 1.7	22.0 ± 1.4	0.89

SD = standard deviation.

Complications

No fractures, necrosis, or patellar maltracking were recorded. No revisions had occurred by the time the study was closed.

DISCUSSION

The most important finding of our study was that there were no significant differences in clinical-functional outcomes, complication rates, or revision rates in TKA patients in whom native patellar thickness was not restored.

There was a significant improvement in range of motion after TKA, with flexion increasing from 106.7 ± 6.8° to 114.7 ± 3.1° ($p < 0.01$) and extension improving from 8.9 ± 3.6° to 3.4 ± 1.0° ($p < 0.01$). These findings are consistent with those of Bonifacio et al., who observed an increase in maximum flexion from 99° to 113° in patients undergoing TKA with the same prosthesis design.[13] Regarding VAS and KSS scores, significant improvements similar to those reported by Bartolomeo et al. were also achieved in a study evaluating 62 patients with 63 TKAs using posterior-stabilized prostheses, with values ranging between 88.5 and 86.[14]

Mixed results have been reported regarding the impact of patellar thickness on postoperative outcomes. Some studies suggest that maintaining adequate thickness (typically 24–26 mm for men and 22–24 mm for women)[15] is essential to prevent complications, such as fractures or malalignment,[16,17] whereas others found no direct correlation between patellar thickness and knee biomechanical function after TKA.[18]

In our study, there were no statistically significant differences in pre- vs. postoperative patellar thickness (22.6 ± 2.9 mm vs. 22.0 ± 1.5 mm; $p = 0.09$), including sex-stratified analyses. These results suggest that restoration of patellar thickness was consistent in both sexes.

Excessive thickness at the patellofemoral joint ("overstuffing") has been reported to negatively impact clinical outcomes after TKA.[19,20] An increase of 2 mm or more may significantly raise patellofemoral shear force during knee flexion.[21] With a 1-mm increase, the patella may lateralize, and for every 2-mm increase in total thickness, up to 3° of flexion may be lost.[22]

Although the mean follow-up in our study is relatively short to evaluate the effect of thickness on loosening, there were no significant differences in KSS clinical and functional subscales among patients with 0-, 1-, 2-, or 3-mm differences. We believe that, to achieve satisfactory results in patellofemoral management, ensuring proper tracking is essential, which requires careful attention to soft-tissue releases and component orientation (especially rotation), while respecting joint-line height.

Our study has limitations. It is a retrospective series with a small sample size, few complications, and short follow-up. Nevertheless, we consider it a starting point for future research, since in Argentina and the broader Latin American population, information on patellofemoral management and patellar thickness is scarce.

CONCLUSION

In our study, postoperative patellar thickness did not have a significant impact on clinical-functional scores, complication rates, or revision after primary TKA.

Conflicts of interest: The authors declare no conflicts of interest.

M. A. Oláran ORCID ID: https://orcid.org/0009-0002-8981-4483
G. Garabano ORCID ID: https://orcid.org/0000-0001-5936-0607
C. Á. Pesciallo ORCID ID: https://orcid.org/0000-0002-4461-8465

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Intraosseous Vancomycin for Acute Periprosthetic Knee Infection: A Retrospective Study

Walter F. Martínez,[*] Eduardo J. Bochatey,[**] Fernando A. Lopreite[#]
[*]*Clínica Privada Hispano Argentina, Tres Arroyos, Buenos Aires, Argentina*
[**]*Instituto Argentino de Diagnóstico y Tratamiento, Autonomous City of Buenos Aires, Argentina*
[#]*Orthopedics and Traumatology Service, Hospital Británico de Buenos Aires, Autonomous City of Buenos Aires, Argentina*

ABSTRACT

Introduction: Periprosthetic joint infection (PJI) is an uncommon but serious complication after total knee arthroplasty (TKA), with significant clinical and healthcare implications. This study evaluated the effectiveness of the debridement, antibiotics, and implant retention (DAIR) protocol combined with intraosseous vancomycin administration and modular component exchange in controlling acute infection and improving functional outcomes. **Materials and Methods:** We conducted a retrospective study across three institutions, including 12 patients (7 women, 5 men; mean age, 72.4 ± 6.3 years) with acute PJI treated with DAIR between February 2022 and June 2023. The mean interval between primary TKA and the DAIR procedure was 12.3 days. A standardized protocol was applied, consisting of intraosseous vancomycin delivery, modular component exchange, and pathogen-directed antibiotic therapy. **Results:** The mean surgical time was 95 ± 10 minutes. Infection control was achieved in 11 of 12 cases (91.6%), with one reinfection requiring two-stage revision. The Knee Society Score improved significantly from 42.5 ± 5.8 preoperatively to 88.6 ± 6.3 at 1 year ($p < 0.001$). **Conclusion:** The DAIR protocol with intraosseous vancomycin and modular component exchange appears to be a promising strategy for managing acute periprosthetic knee infection. Larger studies are needed to confirm these preliminary results.

Keywords: Periprosthetic joint infection; knee; intraosseous vancomycin; debridement; implant retention.
Level of Evidence: IV

Vancomicina intraósea para la infección periprotésica aguda de rodilla. Estudio retrospectivo

RESUMEN

Introducción: La infección periprotésica es una complicación poco frecuente, pero grave, tras la artroplastia total de rodilla, tiene un alto impacto clínico y sanitario. Este estudio evalúa la eficacia del protocolo de desbridamiento, antibióticos y retención del implante (*debridement, antibiotics, and implant retention*, DAIR), combinado con la administración intraósea de vancomicina y el recambio de componentes modulares, para controlar la infección aguda y mejorar los resultados funcionales. **Materiales y Métodos:** Estudio retrospectivo en 3 instituciones, que incluyó a 12 pacientes (7 mujeres, 5 hombres; edad media 72.4 ± 6.3 años) con infección periprotésica aguda tratados con DAIR entre febrero de 2022 y junio de 2023. El tiempo promedio desde la artroplastia total de rodilla hasta la cirugía DAIR fue de 12.3 días. Se aplicó un protocolo uniforme con administración intraósea de vancomicina, recambio de componentes modulares y antibioterapia dirigida. **Resultados:** El tiempo quirúrgico medio fue de 95 ± 10 minutos. Se logró el control de la infección en el 91,6%, hubo una reinfección que requirió revisión en dos tiempos. El *Knee Society Score* mejoró de 42,5 ± 5,8 a 88,6 ± 6,3 al año ($p < 0,001$). **Conclusión:** El protocolo DAIR con vancomicina intraósea y recambio modular es prometedor en el manejo de la infección periprotésica aguda de rodilla. Se requieren estudios más amplios.

Palabras clave: Infección periprotésica de rodilla; vancomicina intraósea; desbridamiento; retención de implantes.
Nivel de Evidencia: IV

Received on May 6th, 2025. Accepted after evaluation on July 21st, 2025 • Dr. WALTER F. MARTÍNEZ • wfm5252@gmail.com https://orcid.org/0009-0004-7249-1563
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INTRODUCTION

Total knee arthroplasty (TKA) is a proven and increasingly common procedure. According to the 2023 *American Joint Replacement Registry* report, 194,695 TKAs were performed in the United States.[1] Periprosthetic joint infection (PJI) is the leading cause of knee revision, accounting for 29.5% of all revisions and 50.3% of early revisions.[1]

The use of debridement, antibiotics, and implant retention (DAIR) to treat acute PJI after TKA remains a matter of debate.[2,3] Variable definitions and diagnostic criteria for PJI, pathogen heterogeneity, differences in host immunocompetence, and evolving success criteria partly explain the inconsistent outcomes reported.[4] Strategies such as modular component exchange[5] and intraosseous antibiotic administration[6] have been proposed to improve the effectiveness of DAIR by targeting bacterial biofilms at concentrations unattainable with systemic intravenous therapy.

The aim of this study was to evaluate the efficacy and safety of DAIR supplemented with intraosseous vancomycin and modular component exchange in patients with acute knee PJI, compared with conventional infection-management methods.

MATERIALS AND METHODS

Study Design

We conducted a retrospective, multicenter, observational study at three institutions in Argentina, including patients with acute knee PJI who underwent a DAIR protocol between February 2022 and June 2023. Clinical, radiological, and functional follow-ups lasted at least 12 months. Intraoperative and postoperative adverse events related to intraosseous vancomycin were recorded.

Patient Selection and Inclusion Process

To mitigate selection bias, we systematically searched electronic and paper medical records at each institution to identify all patients presenting with symptoms or signs suggestive of acute PJI (severe pain, erythema, edema, persistent drainage, limited mobility) during the study period. An orthopedic surgeon, an infectious disease specialist, and a radiologist jointly reviewed the cases and confirmed PJI based on the following clinical and laboratory criteria: (1) severe or persistent knee pain; (2) erythema, edema, or wound drainage for at least 7 days; (3) C-reactive protein >100 mg/L; and (4) arthrocentesis with >10,000 cells/mL and >90% polymorphonuclear cells, or two positive cultures with phenotypically identical organisms.

Patients with chronic infection (>6 weeks after primary TKA), an unstable implant, or serious medical conditions contraindicating surgery were excluded.

Fifteen potential cases were identified; three were excluded (two chronic infections >6 weeks and one unstable prosthesis). Thus, 12 patients (7 women, 5 men; mean age 72.4 ± 6.3 years) were included. The mean interval between the index TKA and DAIR was 12.3 days (range, 8–31).

The study adhered to the principles of the Declaration of Helsinki. Informed consent was obtained from all participants.

Data Collection and Bias Management

Data were extracted and coded by an independent investigator not involved in the surgery or postoperative care. A unified database captured demographics, comorbidities, culture results, operative time, blood loss, complications, follow-up duration, and joint function scores.

Reducing Measurement Variability

Knee Society Score (KSS) assessment was standardized across institutions by training evaluators on the same scale. Uniform protocols were followed for sampling and for the DAIR surgical technique to minimize method-related variability.

Interpretation Bias Control

Antibiotic regimens were determined by the Infectious Diseases Service according to pathogen susceptibility and local guidelines.

We recognize the inherent limitations of retrospective designs; documentation is not always standardized. However, all data were double-checked (medical records, operative notes, laboratory reports) to limit omissions of relevant information.

Surgical procedure: standardized DAIR protocol

Intraosseous vancomycin was administered per the protocol of Young et al.[6] Five hundred milligrams of vancomycin were dissolved in 10 mL of normal saline, then diluted in 140 mL of saline (total 150 mL). An incision was made in the adhesive field and skin (Figure 1), cancellous bone was accessed medial to the tibial tubercle using a Jamshidi needle (Figure 2), and the 150 mL preparation was injected (Figure 3). A tourniquet was used in all cases.

Figure 1. Incision in the adhesive field and in the skin medial to the tibial tubercle.

Figure 2. Perforation of the proximal metaphyseal tibial bone, medial to the tibial tubercle, with a Jamshidi needle.

Figure 3. Infusion of 150 mL of the diluted vancomycin preparation.

The knee was approached through a standard medial parapatellar incision. Five representative periprosthetic tissue samples were obtained for culture in enriched media. Extensive debridement of infected tissue and removal of the tibial polyethylene were performed. Exposed metal components were scrubbed with a sterile brush soaked in 0.36% povidone-iodine.

Irrigation followed a five-step protocol based on Kildow et al.:

1. Low-pressure irrigation with 3 L of saline.
2. Irrigation with 100 mL of 3% hydrogen peroxide (H2O2) plus 100 mL of sterile water for 2 minutes.
3. Irrigation with 2 L of saline.
4. Irrigation with 1 L of sterile diluted 0.36% povidone-iodine, left in the wound for 3 minutes.
5. Low-pressure irrigation with 3 L of normal saline.

Gauze soaked in diluted povidone-iodine was placed between prosthetic components, the skin was closed, and instruments, gowns, and drapes were changed. The skin was re-prepped with povidone-iodine, the sutures were removed, and the joint was re-irrigated with diluted povidone-iodine and 1 L of saline. Finally, a new tibial polyethylene insert was implanted.

Microorganisms and Antibiotic Regimens

Isolates among the 12 infections were: methicillin-resistant *Staphylococcus aureus* (MRSA, n=3), methicillin-resistant coagulase-negative *Staphylococcus* (n=1), methicillin-susceptible *S. aureus* (MSSA, n=2), methicillin-susceptible coagulase-negative *Staphylococcus* (n=2), *Streptococcus agalactiae* (n=1), Enterobacterales (n=2), and culture-negative (n=1).

All patients received intravenous antibiotics for at least one week after surgery, followed by oral antibiotics for at least three months, provided clinical status was stable and infection markers improved (decreasing/normalized ESR and CRP, satisfactory wound appearance, and appropriate clinical course).

Study Variables

Variables included demographics (age, sex); surgical data (operative time, intraoperative blood loss); intra- and perioperative complications; time to ambulation; knee function (e.g., KSS); and infection control (resolution of clinical signs and normalization of CRP and ESR).

Treatment success was defined by the criteria of Diaz-Ledezma et al.,[7] which were developed through a consensus reached using the Delphi method. These criteria are based on the eradication of infection, the absence of subsequent surgical interventions, and the absence of deaths associated with prosthesis infection.

Statistical Analysis

Descriptive statistics characterized the cohort (means ± SD or median and interquartile range, as appropriate). Categorical variables are reported as frequencies and percentages. Paired t-tests compared pre- and postoperative KSS values. Significance was set at $p < 0.05$.

RESULTS

Population Characteristics

Twelve patients (7 women, 5 men; mean age 72.4 ± 6.3 years) were included. Six had at least one comorbidity (Table 1).

Table 1. Patient comorbidities.

Comorbidities	Number of patients
Hypertension	6 (75%)
Chronic renal failure	1 (12.5%)
Collagenopathies	1 (12.5%)
Diabetes	2 (25%)

Intraoperative and Postoperative Data

Mean operative time was 95 ± 10 min (range, 80-110). Mean intraoperative blood loss was 180 ± 30 mL (range, 140-220).

No cases of hypotension or bradycardia were observed during intraosseous vancomycin infusion or upon tourniquet release. No histamine-related cutaneous events were recorded.

Perioperative Complications

One patient (8.3%) had wound drainage during the first 72 hours, which resolved with conservative management. Two patients with type 2 diabetes had hyperglycemic events managed by Endocrinology. No other major immediate postoperative complications were observed.

Control of the Infectious Process

Infection control was achieved in 11 of 12 patients (91.6%). There was one recurrence (reinfection). In that case, pre- and intraoperative cultures (arthrocentesis fluid and tissue) were negative; the patient underwent two-stage revision, and intraoperative cultures grew *Pseudomonas aeruginosa*. Imipenem 2 g/day plus ciprofloxacin 1 g/day were given intravenously for 7 days, followed by oral ciprofloxacin 1 g/day during the spacer phase (12 weeks).

Clinical and Functional Outcomes

Patients began weight-bearing on the operated limb at 24 hours postoperatively with a walker. KSS improved significantly in all cases (Table 2).

Table 2. Preoperative *Knee Society Score*, at 6 months, and at one year.

Period	*Knee Society Score* (mean score ± SD)	Score range
Preoperative	42.5 ± 5.8	35-50
Postoperative (at 6 months)	85.3 ± 7.1	75-95
Postoperative (at 12 months)	88.6 ± 6.3	80-98

SD = standard deviation.

Statistical analysis showed a significant improvement in the KSS ($p < 0.001$) between the preoperative period and the 6- and 12-month follow-ups.

Paired Student's t-tests were used to compare preoperative and postoperative KSS scores, with a significance level set at $p < 0.05$. Improvements in KSS scores were statistically significant, indicating significant functional improvement in all patients treated with the DAIR protocol, intraosseous vancomycin, and modular component exchange.

DISCUSSION

Our findings suggest that DAIR supplemented with intraosseous vancomycin, chemical debridement, and modular component exchange is effective and safe for managing acute knee PJI.

DAIR is commonly used in the early postoperative period for acute postoperative or hematogenous infections. While early intervention is generally assumed to improve control, reported success rates for open irrigation and debridement with component retention in acute infection vary widely from 16% to 100% (mean ~50%).[8,9]

Recent studies indicate that host factors, causative microorganism, the timing of intervention, modular component exchange, and symptom duration can influence the outcomes of the DAIR protocol. Duque et al. reported an 80% failure rate in methicillin-resistant *Staphylococcus aureus* infections treated with debridement,[10] while Bradbury et al. reported an 84% failure rate in patients with acute MRSA knee PJI treated with DAIR.[11]

To address the modest outcomes of DAIR in acute PJI, several adjunctive strategies have been proposed. Riesgo et al. combined vancomycin powder and diluted povidone-iodine lavage with DAIR and modular exchange for Staphylococcus infections, achieving an 83% eradication rate versus 63% in controls at ≥1-year follow-up.[12] McQuivey et al. described a two-stage debridement using high-dose antibiotic-loaded cement microspheres between stages plus modular exchange for acute PJI, with 87% eradication in both primary and revision TKA. [13]

Another strategy to improve the results of the DAIR protocol is prolonged oral antibiotic therapy. Siqueira et al. reported higher 5-year survival with suppressive therapy after *S. aureus* infection versus no suppression (57.4% and 40.1%, respectively, p = 0.047).[14] A recent systematic review concluded suppressive therapy after DAIR may benefit *S. aureus* PJI. [15]

Methods to achieve higher tissue antibiotic concentrations via intraosseous administration have also been described.[16] Such levels are otherwise unattainable without systemic toxicity. Low-dose intraosseous delivery has achieved 10–20-fold higher tissue concentrations compared with systemic intravenous administration.[6,17] Despite these elevated concentrations, we observed no significant complications with intraosseous vancomycin, consistent with prior reports.[18] Kildow et al. reported a 92.3% control rate in acute knee PJI treated with DAIR, modular exchange, and intraosseous vancomycin at a mean 16.5-month follow-up.[19]

In our study, we expanded the series to 12 cases, including the successful management of infections caused by methicillin-resistant *Staphylococcus aureus*, methicillin-sensitive *Staphylococcus aureus*, coagulase-negative *Staphylococcus*, *Streptococcus*, and even two cases of enterobacterales, under appropriate antibiotic regimens. Nevertheless, small sample size, retrospective design, and lack of a control group limit generalizability. Prospective studies with larger cohorts are needed to confirm and refine these findings.

CONCLUSIONS

Intraosseous vancomycin, combined with modular component exchange and aggressive debridement (DAIR), appears to be an effective strategy for improving control of acute knee PJI without increasing vancomycin-related adverse events. Although our results are encouraging, prospective, larger studies are required to confirm these observations and to better define selection criteria, optimal timing, and long-term follow-up protocols.

Statement on generative AI and AI-assisted technologies in the writing process

During manuscript preparation, the authors used ChatGPT (OpenAI) to improve readability and language. After using this tool, the authors reviewed and edited the content as necessary and assume full responsibility for the publication's content.

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E. J. Bochatey ORCID ID: https://orcid.org/0000-0003-3645-6563
F. A. Lopreite ORCID ID: https://orcid.org/0000-0002-2065-8649

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Location and Radiological Features of the Synovial Pit and Its Usefulness in Hip Arthroscopy

Agustín O. Perea,[*] Ricardo Munafó Dauccia,[*] Ignacio Troncoso Pesoa[**]
[*]*Hip Unit, Orthopedics and Traumatology Service, Sanatorio de La Trinidad, Autonomous City of Buenos Aires, Argentina*
[**]*Orthopedics and Traumatology Service, CEMIC Hospital Universitario, Autonomous City of Buenos Aires, Argentina*

ABSTRACT

Introduction: The synovial pit is a cystic lesion or notch in the femoral neck, initially regarded as an incidental finding but more recently associated with femoroacetabular impingement (FAI). It is observed in approximately 5% of the general population, with a higher prevalence in men, and in up to 33% of patients with FAI. Its identification is clinically relevant given its association with labral and articular cartilage damage, although its origin may be related to both femoral (cam) and acetabular (pincer) morphological abnormalities, making it difficult to attribute to a single cause. **Materials and Methods:** A total of 388 hip arthroscopies performed between 2018 and 2023 were included. Radiographs and complementary imaging studies were analyzed to classify morphological abnormalities and describe synovial pit characteristics. Measurements included the lateral center-edge angle, acetabular index, and alpha angle. **Results:** In patients with predominantly femoral abnormalities, impingement tended to occur more proximally, and the synovial pit was located in that region; conversely, when acetabular abnormalities predominated, impingement occurred more distally. No other variables reached statistical significance. **Conclusion**: The presence and features of the synovial pit in preoperative imaging, as well as its intraoperative identification during hip arthroscopy, may provide additional insight into the mechanisms of femoroacetabular impingement and its biomechanics.

Keywords: Synovial pit; femoroacetabular impingement; hip arthroscopy; imaging; pincer; cam.
Level of Evidence: IV

Ubicación y características radiológicas de la fosa sinovial y su utilidad en la artroscopia de cadera

RESUMEN

Introducción: La fosa sinovial es un quiste o una muesca en el cuello femoral, que inicialmente se consideró un hallazgo incidental, pero, en los últimos tiempos, se asocia con el impacto femoroacetabular. La prevalencia general de la fosa sinovial es del 5%, predomina en los hombres, y llega al 33% en pacientes con impacto femoroacetabular. Su identificación es relevante por la asociación con daño en el labrum y el cartílago articular, aunque su origen se relaciona tanto con trastornos morfológicos femorales (Cam) como acetabulares (Pincer), lo que dificulta atribuirlo a una causa específica. **Materiales y Métodos:** Se incluyeron 388 artroscopias de cadera realizadas entre 2018 y 2023, y se evaluaron radiografías y estudios complementarios para clasificar los trastornos morfológicos y las características de la fosa sinovial. Algunas de las mediciones fueron: ángulo de cobertura lateral, índice acetabular y ángulo alfa. **Resultados:** En los pacientes con predominio de trastorno femoral, la fricción sería más proximal; por ende, la fosa sinovial se encontraba en dicha zona; en cambio, cuando predomina el trastorno es acetabular, el conflicto sería más distal. El resto de las variables analizadas no alcanzaron un valor significativo. **Conclusión:** Las características de la fosa sinovial en los exámenes preoperatorios, como su identificación durante la artroscopia de cadera podrían ser un dato adicional para comprender el fenómeno de fricción y su biomecánica.

Palabras clave: Fosa sinovial; fricción femoroacetabular; artroscopia de cadera; diagnóstico por imágenes; Pincer; Cam.
Nivel de Evidencia: IV

Received on November 26th, 2024. Accepted after evaluation on August 4th, 2025 • Dr. IGNACIO TRONCOSO PESOA • itroncosopesoa@gmail.com https://orcid.org/0000-0002-7879-0992
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INTRODUCTION

The synovial pit (SP), or synovial herniation pit, was first described by Michael J. Pitt in 1982. It is a small cystic or notched lesion in the femoral neck, of variable location and unknown origin, initially considered an incidental finding but, according to more recent studies, associated with a mechanical effect of femoroacetabular impingement (FAI).[1-3]

On imaging, SPs appear as rounded, oval, or occasionally multilobulated radiolucent lesions measuring <10 mm, with a complete or incomplete thin sclerotic rim. They may contain homogeneous or heterogeneous soft-tissue material (synovial herniation) and are often accompanied by an inflammatory reaction.

The prevalence of SPs is approximately 5% in the general population and is higher in men.[4] With the refinement of computed tomography (CT) and magnetic resonance imaging (MRI) for joint evaluation, the frequency of SP detection has increased significantly. Leunig et al. reported a prevalence of 33% in patients with FAI.[5]

Identifying an SP in the femoral neck can be useful given its association with FAI, as well as its correlation with labral and articular cartilage damage.

Since morphological abnormalities are usually mixed, it is difficult to attribute the appearance or development of SPs solely to femoral (Cam-type) or acetabular (Pincer-type) deformities. This raises several questions:

- Is there a relationship between SPs and the type of morphological abnormality?
- Is there a relationship between SPs and the degree of deformity or morphological abnormality?
- Is there a relationship between SPs and symptom severity or chronicity?
- Could understanding the characteristics of SPs aid in clinical management?

The objective of this study was to analyze the characteristics of SPs in patients with femoroacetabular impingement syndrome and to assess their usefulness in addressing the condition.

MATERIALS AND METHODS

Between 2018 and 2023, 388 hip arthroscopies were performed in our department. The primary diagnosis was femoroacetabular impingement syndrome. A retrospective observational study was conducted to analyze the presence and features of SPs.

The inclusion criterion was availability of CT or contrast-enhanced MRI (arthro-MRI) demonstrating the presence of an SP. The exclusion criteria were absence of surgical treatment, absence of an SP on imaging, or history of joint surgery (due to possible anatomic distortion).

A total of 23 patients (28 hips) met the inclusion criteria: 12 men (52.2%) and 11 women (47.8%). The mean age at surgery was 37.9 years (range, 22–52). The indication for hip arthroscopy was labral tear associated with FAI (Table 1).

All patients presented with hip pain and the diagnostic triad of clinical signs and imaging features consistent with FAI. A comprehensive clinical history and physical examination were performed. Radiographs of both hips (anteroposterior, lateral, and Dunn 45° views) were obtained, along with multi-slice CT with oblique axial cuts of the femoral head and neck, and arthro-MRI with a lidocaine test when indicated.[6] The indication for arthroscopic surgery was based on an overall assessment of clinical and imaging findings.

During the procedure, the labrum was repaired and the morphological abnormality corrected. The SP was identified, and its location and morphology were documented (Figure 1). The following variables were evaluated:

Morphological abnormality: Radiographs were reviewed to classify deformities as Pincer, Cam, or Mixed. For acetabular overcoverage (Pincer), the lateral center-edge angle (Wiberg angle, normal 25°-40°) and the acetabular index (normal 0°-10°) were measured, as well as the acetabular wall crossover sign. For femoral deformity, the alpha angle was measured on the Dunn 45° projection, with <55° (Warwick) considered normal (Figure 2). All measurements were performed by imaging specialists not involved in the study.

SP analysis and location: Axial oblique CT or arthro-MRI slices were used. The center of rotation of the femoral head was determined by fitting a circle to the head contour, and the center of the SP was determined similarly. A line perpendicular to the femoral neck passing through the SP (line A) was drawn, and the distance from the femoral head center to line A (line B) was measured (Figure 3).

Table 1. Patient characteristics

Case	Age	Gender	Disorder	Alpha (°)	CR-SP (mm)	SP Depth (mm)	SP Diam. (mm)	Rim	Shape	FH Diam. (mm)	Wiberg angle (°)	Tönnis angle	Osteoarthritis (Tönnis)
1	46	F	Pincer	49	29	5	4	Complete	Rounded	44	31	3	0
2	52	F	Mixed	59	16	8	10	Complete	Oval	41	35	0	0
3	31	M	Mixed	63	13	3	3	Incomplete	Rounded	50	42	0	0
4	41	F	Mixed	62	8	5	5	Complete	Rounded	45	28	8	1
5	41	F	Mixed	65	6	6	6	Complete	Rounded	46	28	7	1
6	25	M	Mixed	58	10	5	4	Incomplete	Rounded	48	33	6	0
7	48	F	Mixed	55	9	9	10	Complete	Rounded	47	33	5	0
8	31	F	Mixed	76	9	6	7	Complete	Multilobulated	44	36	3	0
9	31	F	Mixed	73	15	3	5	Complete	Multilobulated	44	35	3	0
10	33	M	Cam	71	12	10	10	Complete	Rounded	53	30	5	1
11	24	M	Mixed	56	28	7	5	Complete	Rounded	46	40	0	0
12	33	F	Pincer	46	12	3	2	Complete	Rounded	40	24	10	1
13	33	M	Mixed	60	12	8	12	Complete	Oval	48	35	3	0
14	36	F	Mixed	60	13	14	8	Complete	Multilobulated	42	41	0	0
15	36	F	Mixed	61	12	11	6	Complete	Rounded	42	40	1	0
16	38	M	Mixed	72	8	9	7	Complete	Rounded	44	30	4	0
17	36	M	Mixed	58	14	5	5	Incomplete	Rounded	43	41	0	1
18	22	M	Mixed	53	19	6	8	Incomplete	Rounded	44	34	1	0
19	46	F	Pincer	45	13	4	6	Complete	Rounded	42	30	5	0
20	25	M	Mixed	55	17	6	11	Incomplete	Oval	44	38	0	1
21	46	F	Mixed	57	7	6	4	Complete	Rounded	43	43	0	0
22	25	M	Mixed	65	8	6	5	Complete	Rounded	46	28	8	0
23	37	M	Mixed	55	7	8	7	Complete	Rounded	48	28	3	0
24	50	M	Mixed	67	10	3	3	Complete	Rounded	47	29	5	0
25	50	M	Mixed	73	11	5	3	Complete	Rounded	47	27	5	0
26	51	F	Mixed	65	10	6	3	Complete	Rounded	44	30	6	0
27	51	F	Mixed	63	11	6	7	Complete	Rounded	44	30	6	0
28	42	F	Mixed	55	10	2	2	Complete	Rounded	48	42	0	1

F = female; M = male; CR-SP (mm) = distance from the center of rotation to the synovial pit; SP Depth (mm) = depth of the synovial pit; SP Diam. (mm) = diameter of the synovial pit; FH Diam (mm) = diameter of the femoral head.

Figure 1. Arthroscopic view of synovial pit.

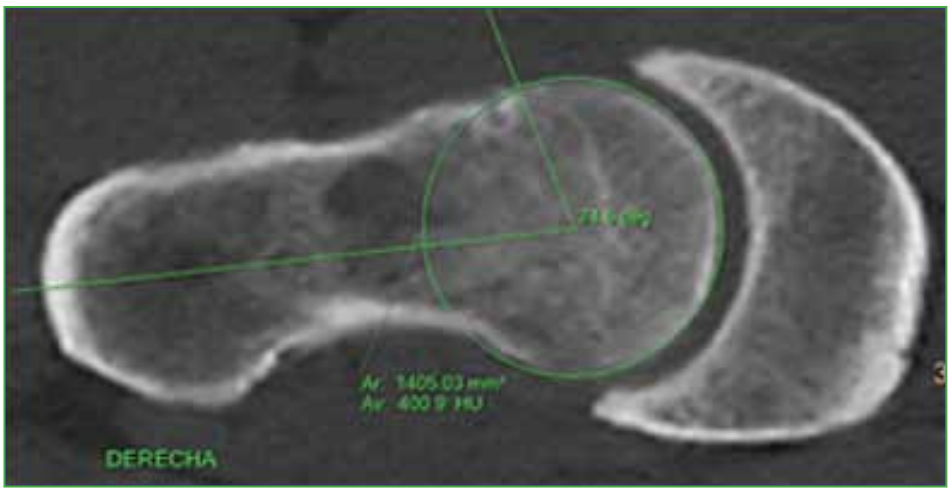

Figure 2. Alpha angle measurement.

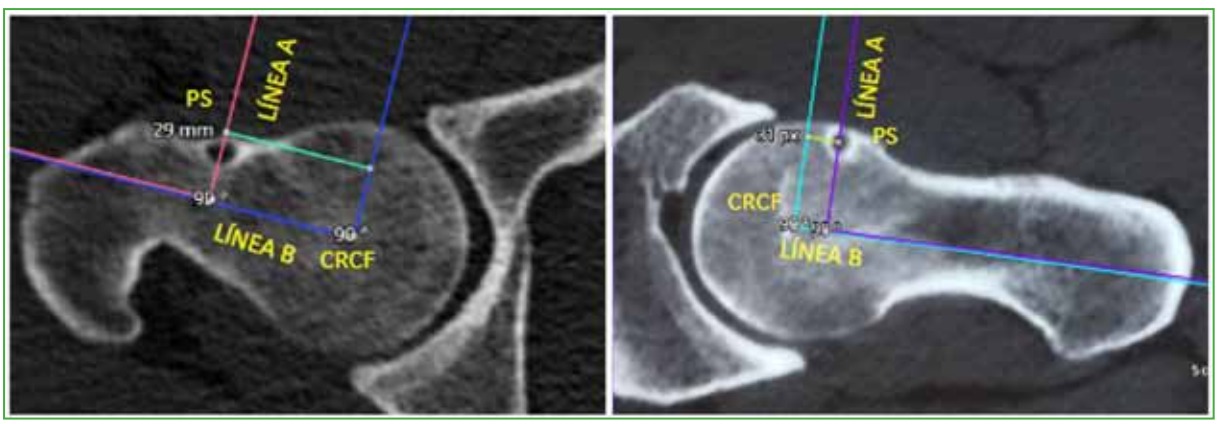

Figure 3. Analysis and location of the SP (distance from the center of rotation of the femoral head to the femoral pit).

SP morphology: The following parameters were analyzed on axial oblique CT or arthro-MRI slices: 1) measured by a tangent from the anterior femoral cortex to the deepest point of the SP (Figure 4); 2) measured by a tangent from the proximal femoral border to the most distal point of the SP (Figure 5); 3) Shape: round, oval, or multilobulated; and 4) Rim: complete (cyst) or incomplete (notched).

Symptom duration and sports activity: Measured from symptom onset to surgery; sports activity was recorded as frequency and type.

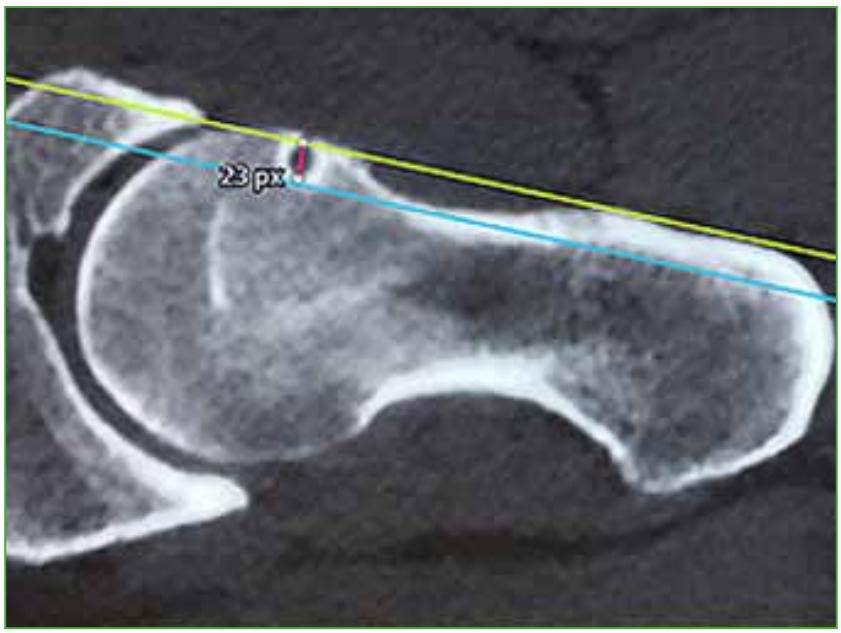

Figure 4. Depth of the synovial pit.

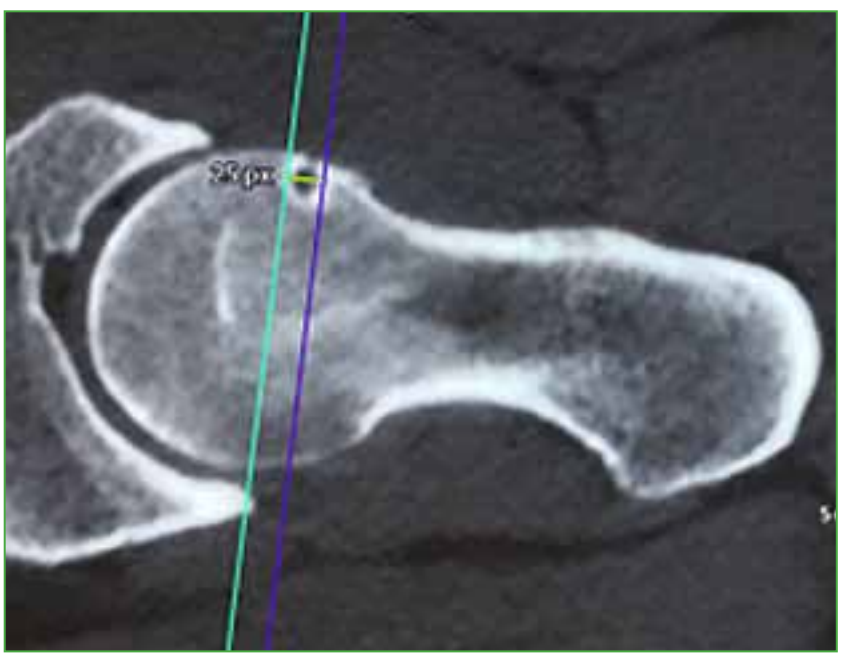

Figure 5. Femoral pit diameter.

RESULTS

In all statistical analyses, confidence intervals (CI) were calculated at 95%.

The type of morphological abnormality was analyzed: 85.71% had a mixed-type deformity (24 cases); 3.57% had a Cam-type deformity (1 case); and 10.71% had a Pincer-type deformity (3 cases). With regard to femoral disorder, the mean alpha angle was 60.6° (range, 45–76), mean Wiberg angle 33.6° (range, 24–46), and mean acetabular inclination (Tönnis angle) 3.5° (range, 0–10).

The mean distance from the SP to the femoral head center was 12.5 mm (range, 6–28); mean depth 6.3 mm (range, 2–14); and mean diameter 6 mm (range, 2–12). Eighty-two point one percent of SPs had complete rims, and 17.9% incomplete rims. The shape was round in 78.6% (22 cases), oval in 10.7% (3 cases), and multilobulated in 10.7% (3 cases).

The mean femoral head diameter was 45.1 mm. Seventy-five percent of patients had Tönnis grade 0 osteoarthritis and 25% grade 1; none had advanced OA (grades 2–3).

The mean duration from symptom onset to surgery was 13 months (range, 5–24). Seventy-two percent were active athletes (>3 sessions per week). The most frequent sport was soccer (44%), followed by functional training or gymnastics (35%); the remainder practiced other sports less frequently.

Statistical analyses are shown in Tables 2-4.

Table 2. Simple general statistical analysis

Simple statistics						
Variable	**n**	**Mean**	**Standard deviation**	**Median**	**Minimum**	**Maximum**
Alpha angle	25	62.28000	6.64279	61.00000	53.00000	76.00000
Distance between center of rotation and synovial pit	25	11.80000	4.69929	11.0000	6.00000	28.00000

Table 3. Analysis of Spearman's overall correlation coefficient

Spearman correlation coefficients, n = 25 Prob > |r| assuming H0: Rho = 0		
	Alpha angle	**Distance between center of rotation and synovial pit**
Alpha angle	1.00000	-0.21705 0.2973
Distance between center of rotation and synovial pit	-0.21705 0.2973	1.00000

Table 4. Analysis of Kendall's overall tau correlation coefficient.

Kendall's tau correlation coefficients b. n = 25 Prob > |tau| assuming H0: Tau = 0		
	Alpha angle	**Distance between center of rotation and synovial pit**
Alpha angle	1.00000	-0.17864 0.2290
Distance between center of rotation and synovial pit	-0.17864 0.2290	1.0000

Correlation between alpha angle (Cam-type) and distance from the femoral head center was evaluated using Spearman and Kendall tests (Spearman = –0.21; 95% CI -0.54-0.19; Kendall = -0.17), showing a trend toward shorter distances with greater deformity, without statistical significance (Tables 5-7).

Table 5. Simple statistical analysis in patients with Cam-type disorder.

Variable	n	Mean	Standard deviation	Median	Minimum	Maximum
Wiberg angle	27	33.74074	5.52333	33.00000	24.00000	43.00000
Tönnis angle	27	3.40741	3.00332	3.00000	0	10.00000
Distance between center of rotation and synovial pit	27	12.48148	5.50787	11.00000	6.00000	29.00000

Table 6. Analysis of the overall Spearman correlation coefficient in patients with Cam-type disorder

Spearman correlation coefficients, n = 27 Prob > |r| assuming H0: Rho = 0			
	Wiberg's angle	Tönnis angle	Distance between center of rotation and synovial pit
Wiberg angle	1.00000	-0.86986 <0.0001	0.37267 0.0556
Tönnis angle	-0.86986 <0.0001	1.00000	-0.49373 0.0089
Distance between center of rotation and synovial pit	0.37267 0.0556	-0.49373 0.0089	1.00000

Table 7. Kendall's tau correlation coefficient analysis in patients with Cam-type disorder

Kendall's tau correlation coefficients b, n = 27 Prob > |tau| assuming HO: Tau = 0			
	Wiberg angle	Tönnis angle	Distance between center of rotation and synovial pit
Wiberg angle	1.00000	-0.73900 <0.0001	0.25564 0.0734
Tönnis angle	-0.73900 <0.0001	1.00000	-0.36264 0.0139
Distance between center of rotation and synovial pit	0.25564 0.0734	-0.36264 0.0139	1.00000

For Pincer-type deformities, Wiberg (Spearman = 0.37; 95% CI 0.00-0.66) and Tönnis angles (Spearman = -0.49; 95% CI -0.73 to -0.11) were correlated with distance from the femoral head center (Tables 8 and 9), suggesting that larger Wiberg angles correspond to greater distances and higher Tönnis angles to shorter distances (Table 3).

Table 8. Statistical analysis in patients with Pincer-type disorder.

Variable	n	Mean	Standard deviation	Sum	Minimum	Maximum
Alpha angle	28	60.80714	7.98303	1697	45.00000	76.00000
Depth	28	6.25000	2.68914	175.00000	2.00000	14.00000
Diameter	28	6.00000	2.76218	188.00000	2.00000	12.00000
Femoral head diameter	28	45.14286	2.87665	1264	40.00000	53.00000
Wiberg angle	28	33.60714	5.46598	941.00000	24.00000	43.00000
Tönnis angle	28	3.46420	2.96251	97.00000	0	10.00000

Table 9. Pearson's statistical analysis in patients with Pincer-type disorder.

Pearson correlation coefficients, n = 28 Prob > |r| assuming HO: Rho = 0						
	Alpha angle	Depth	Diameter	Femoral head diameter	Wiberg angle	Tönnis angle
Alpha angle	1.00000	0.12551 0.5245	0.02855 0.8853	0.32348 0.0931	-0.08176 0.6792	0.10040 0.6112
Depth	0.12551 0.5245	1,00000	0.62826 0.0003	-0.05267 0.7901	0.15055 0.4444	-0.21502 0.2719
Diameter	0.02855 0.8853	0.62826 0.0003	1.00000	0.0652600.7415	0.07850 0.6913	-0.22178 0.2567
Femoral head diameter	0.32348 0.0931	-0.05267 0.7901	0.06526 0.7415	1.00000	-0.05047 0.7987	0.05712 0.7728
Wiberg angle	-0.08176 0.6792	0.15055 0.4444	0.07850 0.6913	-0.05047 0.7987	1.00000	-0.08785 <0.0001
Tönnis angle	0.10040 0.6112	-0.21502 0.2719	-0.22178 0.2567	0.05712 0.7728	-0.08806 <0.0001	1.00000

The correlations between the alpha angle, the Wiberg angle, and the Tönnis angle and the FS diameter and depth were analyzed, and a χ^2 test was applied to assess independence between rim type and FS imaging characteristics (Table 10). Specifically, there was no correlation between the alpha angle and diameter (p = 0.8853), between the Wiberg angle and diameter (p = 0.6913), or between the Tönnis angle and diameter (p = 0.2567). Likewise, no correlations were found between the alpha angle and depth (p = 0.5245), between the Wiberg angle and depth (p = 0.4444), or between the Tönnis angle and depth (p = 0.2719). By contrast, a significant association was observed between FS diameter and depth (Spearman = 0.63; 95% CI, 0.33-0.82; p = 0.0003), indicating that larger diameters were accompanied by greater depths, and vice versa (Table 11).

Table 10. Simple statistical analysis of the correlation between the alpha angle, Wiberg angle, and Tönnis angle with the diameter and depth of the synovial pit.

Simple statistics						
Variable	**n**	**Mean**	**Standard deviation**	**Sum**	**Minimum**	**Maximum**
Symptoms	28	12.67857	4.73015	355.00000	5.00000	24.00000
Diameter	28	6.00000	2.76218	168.00000	2.00000	12.00000
Femoral head diameter	28	45.14286	2.87665	1264	53.00000	53.00000
Depth	28	6.25000	2.68914	175.00000	14.00000	14.00000

Table 11. Analysis of Pearson correlation coefficients between the alpha angle, Wiberg angle, and Tönnis angle with the diameter and depth of the synovial pit.

Pearson correlation coefficients n = 28 Prob > |r| assuming H0: Rho = 0				
	Symptoms	**Diameter**	**Femoral head diameter**	**Depth**
Symptoms	1.00000	-0.03969 0.8411	0.00350 0.9859	0.08226 0.6773
Diameter	-0.03969 0.8411	1.00000	0.06526 0.7415	0.62826 0.0003
Femoral head diameter	0.00350 0.9859	0.06526 0.7415	1.00000	-0.05267 0.7901
Depth	0.08226 0.6773	0.62826 0.0003	-0.05267 0.7901	1.00000

The correlation between symptom duration (in months) and SP diameter was analyzed, as well as between symptom duration and depth, using the χ^2 test between the median number of months with symptoms and the rim type, and between the median number of months with symptoms and the morphological characteristics of the SP (Table 12). It was concluded that the null hypothesis could not be rejected, meaning that there is no correlation between the duration of symptoms and SP diameter ($p = 0.8411$), nor between the duration of symptoms and SP depth ($p = 0.6773$). The null hypothesis of independence between the median number of months of symptoms and the rim characteristics was also tested and not rejected ($p = 0.2283$); therefore, both variables were considered independent (Table 13). Likewise, the null hypothesis of independence between symptom duration and the imaging characteristics of the SP was not rejected ($p = 0.2854$), indicating that these variables were also independent.

Table 12. Analysis of the correlation between symptoms (months) and diameter and between symptoms (months) and depth.

Fisher's exact test	
Cell (1,1) Frequency (F)	15
Left aligned Pr ≤ F	0.9382
Right-aligned Pr ≥ F	0.2901
Probability table (P)	0.2283
Two-tailed Pr ≤ P	0.3531

Table 13. Hypothesis of independence between the median of the months of symptoms and the characteristics of the rims.

Fisher's exact test	
Cell (1,1) Frequency (F)	1
Left aligned Pr ≤ F	0.3358
Right-aligned Pr ≥ F	0.9496
Probability table (P)	0.2854
Two-tailed Pr ≤ P	0.5433

DISCUSSION

In the early 1980s, Allen H. described a depression in the superolateral femoral neck ("Allen's cervical depression") associated with a local inflammatory reaction. Angel had previously referred to it as a "reaction area" in 1964.[7]

The reaction area hypothesis proposed a mechanical origin due to capsular contact.[8] The lesion was thought to result from mechanical and abrasive forces exerted by the thick joint capsule and the lateral band of the iliofemoral ligament, mainly during hip extension, causing synovial tissue herniation into cortical defects of the femoral neck.[9]

Years later, Leunig et al. retrospectively compared 117 hips from 101 consecutive patients with FAI against 132 hips from 105 consecutive patients with acquired dysplasia without impingement. They found SPs in 33% of the FAI group and in none of the dysplasia group, demonstrating a clear association.[5]

Therefore, SPs likely result from repetitive trauma and femoral neck impingement rather than being incidental findings, as initially believed. Leunig et al. also proposed that they represent juxta-articular fibrocystic changes rather than true synovial herniations. On radiographs, they appear as small (<10 mm) round or oval radiolucent lesions with sclerotic margins; on MRI, they show homogeneous or heterogeneous hyperintensity depending on content. Differential diagnoses include intraosseous ganglion, osteoid osteoma, and degenerative cyst. Few studies have analyzed the imaging features of SPs. Wang et al. evaluated 21 SPs in 18 patients, 17 of which were round (2 oval, 2 figure-eight shaped), and only 2 measured >10 mm.[4]

The question remains: what is the clinical usefulness of understanding their specific characteristics?

FAI syndrome is a complex, multifactorial, and dynamic condition, and any information that improves understanding of its pathogenesis and correction is valuable.

Recent technological advances have led to the development of preoperative and intraoperative tools such as *Stryker HipMap* (a patient-specific preoperative 3D analysis to support surgical planning) and *Stryker HipCheck* (an intraoperative guidance system to help localize and treat impingement precisely). It would be appealing to consider SP characteristics as potential guides for decision-making using conventional imaging, without the need for additional complex tools.

In our series, the incidence of SP was 7.2% among all hip arthroscopies (including dysplasia cases), explaining the lower rate compared to Leunig et al.[5]

According to our statistical analysis, when the Cam-type deformity predominates, impingement occurs more proximally; hence, the SP tends to appear in that region. Conversely, in Pincer-dominant cases, the conflict occurs more distally. Other variables (symptoms and imaging features) were not statistically significant. Larger-scale studies are required to confirm these findings.

Study limitations include the small sample size, the relatively low incidence of SPs in FAI patients, and potential selection bias. Participants may have been selected in a way that is not representative of the general population, limiting generalizability to broader populations or settings due to the specific characteristics of the sample or the setting in which the study was conducted.

CONCLUSION

The identification and characterization of SPs on preoperative imaging and during hip arthroscopy may provide additional insights into the mechanics of femoroacetabular impingement and the specific biomechanical environment of the hip joint.

Conflicts of interest: The authors declare no conflicts of interest.

A. O. Perea ORCID ID: https://orcid.org/0000-0002-7011-8966
R. Munafó Dauccia ORCID ID: https://orcid.org/0000-0003-0300-7841

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Prophylactic Technique to Reduce the Risk of Interprosthetic Femoral Fractures

Belisario Segura, Pablo Maletti, Martín Aguilera, Marcos Torres, Bruno Schmir, Deoclecio Segura, Raúl Silvano
Hip and Knee Service, Otamed, Mendoza, Argentina

ABSTRACT

Introduction: With increasing life expectancy and patient longevity, the number of hip and knee arthroplasties has risen, leading to more ipsilateral joint replacements and, consequently, a higher risk of interprosthetic femoral fractures (IFF). The objectives of this study were to evaluate fracture-free survival in patients with ipsilateral hip and knee arthroplasties who had risk factors for IFF and to assess their functional outcomes. **Materials and Methods:** Six patients with ipsilateral hip and knee arthroplasties were evaluated, all operated on by the same surgical team. The mean follow-up was 46.5 months. Risk factors for interprosthetic fractures included stemmed prostheses, advanced age, osteoporosis, distance between stems <8 cm, revision surgery, and obesity. At the time of arthroplasty, minimally invasive osteosynthesis with a locking plate was performed as a prophylactic measure. **Results:** No cases of interprosthetic fracture, infection, loosening, or revision were observed. The rehabilitation protocol was not modified. **Conclusion:** Although few studies have addressed interprosthetic fractures, and their results are heterogeneous, they consistently highlight the same risk factors. We believe that prophylactic osteosynthesis entails low intraoperative morbidity and mortality and provides satisfactory short-term outcomes.

Keywords: Interprosthetic fracture; femoral fracture; prophylaxis.
Level of Evidence: IV

Método profiláctico para disminuir el riesgo de fracturas interprotésicas femorales

RESUMEN

Introducción: Como consecuencia de la mayor expectativa de vida y la longevidad de los pacientes, han aumentado las artroplastias de rodilla y cadera y, por lo tanto, el número de artroplastias ipsilaterales. Esto determina un mayor riesgo de sufrir una fractura interprotésica. Los objetivos de este estudio fueron evaluar la supervivencia libre de fractura interprotésica femoral en pacientes sometidos a artroplastias ipsilaterales de cadera y rodilla, y con factores de riesgo, y analizar su evolución funcional. **Materiales y Métodos:** Se evaluó a 6 pacientes con artroplastias ipsilaterales de cadera y rodilla. El seguimiento promedio fue de 46.5 meses. Los factores de riesgo de fracturas interprotésicas eran: prótesis con vástagos, edad avanzada, osteoporosis, distancia entre vástagos <8 cm, revisiones y obesidad. Se les realizó una osteosíntesis mínimamente invasiva con placa bloqueada en el momento de colocar la prótesis. **Resultados:** No hubo casos de fracturas interprotésicas, infección, aflojamiento o revisión. No se modificó el protocolo de rehabilitación. **Conclusiones:** Hay pocos artículos sobre fracturas interprotésicas y los resultados son dispares, pero coinciden respecto de los factores de riesgo para que se produzcan. Creemos que la técnica de profilaxis con osteosíntesis supone una baja morbimortalidad en el acto intraoperatorio y logra resultados satisfactorios a corto plazo.

Palabras clave: Fractura interprotésica; fractura femoral; profilaxis.
Nivel de Evidencia: IV

INTRODUCTION

Interprosthetic femoral fractures (IFFs) occur in the femoral segment located between a total knee arthroplasty and a total hip arthroplasty. This type of fracture was first described by Dave et al. in 1995.[1] Owing to the excellent results achieved with hip and knee arthroplasties, the number of IFFs has increased notably. In the United States, more than 700,000 total knee arthroplasties and 300,000 total hip arthroplasties are performed annually, and the reported incidence of IFFs ranges from 2.5% to 5.5%.[2,3]

Received on June 4th, 2023. Accepted after evaluation on August 25th, 2025 • Dr. BELISARIO SEGURA • belisariosegura1@gmail.com https://orcid.org/0000-0002-0741-0307

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Published risk factors include advanced age, revision arthroplasty, uncemented stems, rheumatoid arthritis, distance between stems <11 cm, osteoporosis, obesity, and female sex.[4] These fractures are classified according to the Pires and Platzer system.[5-7]

Different treatment algorithms have been established for periprosthetic femoral fractures, but there is no specific predetermined treatment for IFFs.[8] Various studies have shown that IFFs are a devastating complication in patients with ipsilateral arthroplasties. Neitzke et al. reported a 24% reoperation rate and a 71% reintervention-free survival at 2 years, underscoring the clinical impact of this entity.[9]

The lack of a treatment standard, together with poor outcomes, prompted the search for a prophylactic method to reduce fracture risk and improve the prognosis of this complex condition. Placement of an osteosynthesis construct at the zone of highest stress has been described as a prophylactic method to decrease fracture incidence.

The objectives of this study were to evaluate IFF-free survival in patients with ipsilateral hip and knee arthroplasties and risk factors, and to analyze their functional course.

MATERIALS AND METHODS

In this retrospective study, six patients who had undergone ipsilateral hip and knee arthroplasties were evaluated. Four were men and two were women. Mean age was 76.8 years (range, 63–86). Inclusion criteria were ipsilateral hip and knee arthroplasties plus at least two of the following risk factors: age >70 years, diagnosed osteoporosis, distance between stems <8 cm, prior prosthetic revision, obesity (body mass index >30), and uncemented stems. Exclusion criteria were prior fractures of the ipsilateral femur, active infection, or follow-up <12 months.

At the time of prosthesis placement, minimally invasive prophylactic osteosynthesis was performed using a fixed-angle locking plate, secured with bicortical screws, unicortical locking screws, and wire cerclage. In two cases, a second medial support plate was added. All patients were operated on by the same team; mean follow-up was 46.5 months (range, 27–70).

Patients were assessed at 2, 6, and 12 weeks; 6 months; 1 year; and 2 years. Panoramic femoral radiographs were obtained for follow-up. Function was assessed with *the Harris Hip Score* (HHS) in cases whose latest implant was a hip arthroplasty and with the *Knee Society Score* (KSS) for patients who underwent knee arthroplasty (Table 1).

Table 1. Risk factors for interprosthetic fracture

Patient	Gender	Age (years)	Osteoporosis	Distance between stems (cm)	History of revision prosthesis	BMI (kg/m^2)
1	F	83	Yes	12	Hinged TKA	32
2	M	80	No	10	Hinged TKA	38
3	M	86	No	3	Revision TKA	28
4	M	81	No	4	Revision THA Cemented stem	35
5	F	63	Yes	0	Revision THA Distal fixation stem	30
6	M	68	No	8	Revision THA Distal fixation stem	33

F = female; M = male; BMI = body mass index; TKA = total knee arthroplasty; THA = total hip arthroplasty.

RESULTS

Three patients had undergone total hip arthroplasty: two with a primary hybrid prosthesis and one with a revision prosthesis with a cemented stem; all had ipsilateral knee implants with cemented stems (Figures 1 and 2). In addition to the hip implant, a prophylactic lateral osteosynthesis plate was placed in all three. Preoperative HHS was 45 (range, 42–48) and postoperative HHS was 80.33 (range, 79–82).

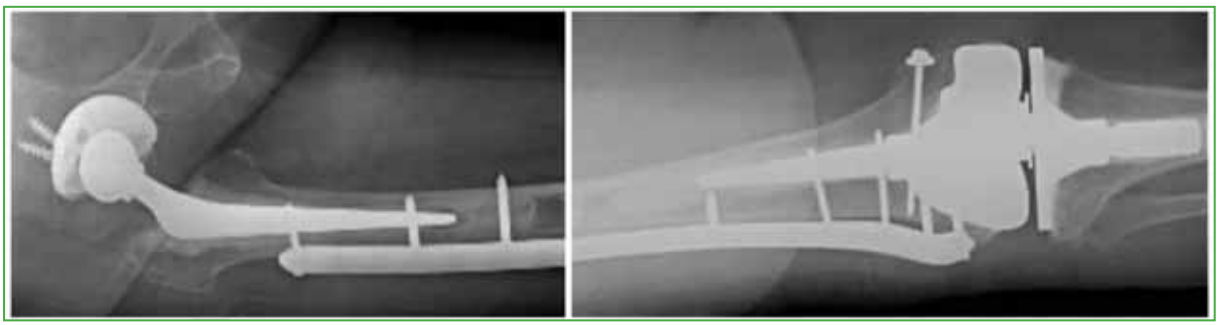

Figure 1. Eighty-year-old patient who underwent a hybrid total hip replacement for osteoarthritis, with a prior ipsilateral hinged total knee replacement, and prophylactic lateral plate placement.

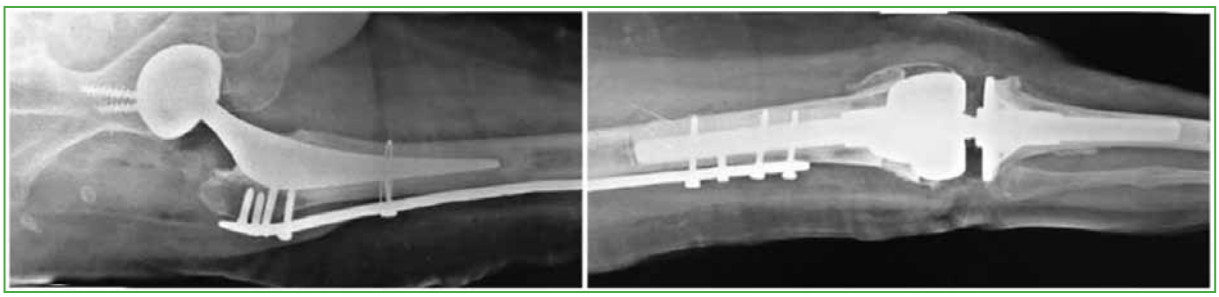

Figure 2. Eighty-three-year-old patient with osteoporosis, treated in the same manner as the patient in Figure 1.

The remaining three patients underwent knee prosthesis revision: two with a hinged prosthesis with cemented stems and one with an posterior-stabilized prosthesis with cemented stems. These patients already had ipsilateral hip implants at the time of knee revision; all were hip revisions, one with a cemented stem and two with uncemented, distally fixing stems. In two patients, a double prophylactic plate (lateral and a medial support plate) was placed during the same knee revision procedure (Figure 3).

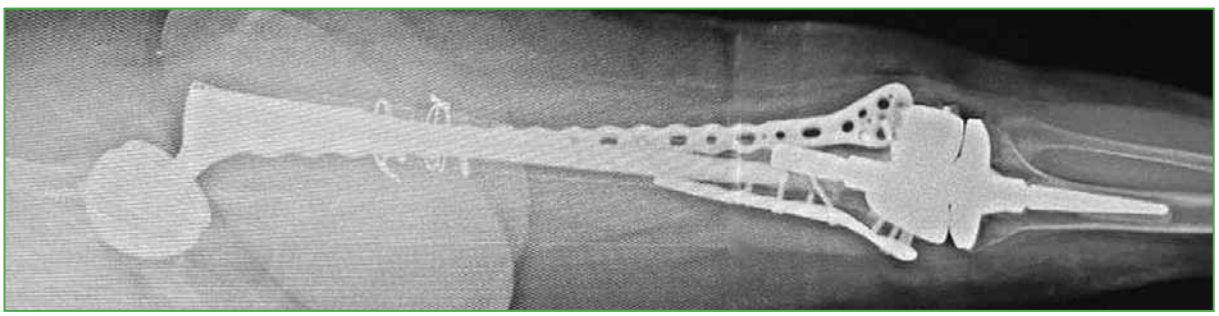

Figure 3. Sixty-three-year-old patient with a right hip revision using a distally fixing stem who underwent an ipsilateral knee revision with a hinged prosthesis and double prophylactic plating (lateral and medial).

In the remaining patient, only a lateral plate was placed. Preoperative KSS was 44.66 (range, 40–48) and postoperative KSS was 82.33 (range, 77–87) (Table 2).

No patient experienced complications and, notably, no interprosthetic fractures were recorded. One patient died at 37 months of follow-up from causes unrelated to the surgery.

Table 2. Results

Patient	Treatment	Prophylactic plate	Preoperative HHS	Postoperative HHS	Preoperative KSS	Postoperative KSS	Follow-up (months)	Interprosthetic fracture
1	Hybrid THA	Yes Lateral	42	80	N/A	N/A	70	No
2	Hybrid THA	Yes Lateral	48	82	N/A	N/A	48	No
3	Revision THA Cemented stem	Yes Lateral	45	79	N/A	N/A	45	No
4	Hinged revision TKA	Yes Double plate	N/A	N/A	40	87	52	No
5	Hinged revision TKA	Yes Double plate	N/A	N/A	46	77	37	No
6	Revision TKA	Yes Lateral	N/A	N/A	48	83	27	No

HHS = *Harris Hip Score*; KSS = *Knee Society Score*; THA = total hip arthroplasty; TKR = total knee arthroplasty; N/A = not applicable.

DISCUSSION

Despite growing interest in the epidemiology, management, and outcomes of interprosthetic fractures, the literature remains limited. Interprosthetic fractures are uncommon; consequently, publications on this condition are scarce. They typically occur in older adults, are more frequent in women, and almost always result from low-energy mechanisms.[10,11] They are associated with the presence of hip and knee implants and, in some series, occur more often at the supracondylar level, a pattern linked to constrained implants.[12] More than 20 years ago, Kenny et al. noted that IFFs are difficult to treat.[13,14] Currently, treatment is associated with multiple potential complications arising from poor bone quality, prosthetic obstacles, residual bone defects, or prosthesis loosening. In at-risk patients, outcomes range from poor to catastrophic.[15] In recent years, locking plates have gained popularity because of biomechanical and biological advantages over nonlocking constructs.[16,17] Angular stable plates provide better fixation than conventional plates in osteoporotic bone. Some authors also advocate intramedullary nailing.[18]

Among the risk factors described, the distance between implants alone does not fully predict fracture risk; shorter distances increase stress-zone fracture risk, whereas overlap between implants has been associated with reduced fracture rates.[19,20]

Multiple biomechanical studies have shown that femoral cortical thickness is a predominant and independent risk factor for IFFs, even more so than the interstem distance. Weiser et al. evaluated human cadaveric femurs and found a significant correlation between cortical thickness and bone strength ($r = 0.804$, $p < 0.001$), with neither interprosthetic distance nor bone mineral density exerting a relevant influence on fracture occurrence.[21] Likewise, Mühling et al. confirmed via physical and computational simulations that thin cortices generate sig-

nificantly higher stress peaks, increasing fracture risk, whereas thick cortices mitigate the effect of close implant proximity.[22] These findings reinforce the need to consider cortical thickness as a key parameter in surgical planning and in preventing interprosthetic fractures.

Although this is an infrequent complication with high morbidity and mortality, we found no references in the literature to preventive methods specifically for IFFs.[23] Options include using short hip stems to increase the interstem gap; inserting cement between stems (long stems in a "kissing" configuration with interposed cement), although cement retainers may form and mark a zone of weakness; or placing a structural cortical onlay allograft, which we consider valid but which requires a larger exposure for placement and fixation, further devitalizes soft tissues, and carries a risk of bone resorption.[24,25]

By contrast, placing a long plate fixed with locking screws, cortical screws, and/or cerclage wire is a method with which we are very familiar. It does not substantially prolong operative time or increase comorbidities, avoids severe complications, and does not alter the usual rehabilitation protocol after conventional arthroplasty.

Using proximal cables increases fixation without interfering with prosthesis placement; creating femoral loops does not cause periosteal injury because contact points are discrete.[26,27] Moreover, angular locking systems do not require intimate plate-bone contact; periosteal injury and subplate bone resorption are therefore clearly reduced. Kampshoff et al. showed that using either unicortical or bicortical screws in the presence of cement does not compromise prosthesis fixation and that bicortical screws achieve better fixation.[28]

Unlike Neitzke et al., for whom treatment of IFFs involved complex operations with high rates of infection and nonunion, our series proposes a preventive strategy (prophylactic osteosynthesis) in patients with defined risk factors. With this minimally invasive intervention, we achieved 100% fracture-free survival over follow-up, with no surgical or functional complications. Both studies identify the presence of stems and interprosthetic distance as critical biomechanical factors; however, whereas Neitzke et al. address established fractures, our approach seeks to prevent their occurrence through early intervention.[9]

With this technique we achieved excellent results: a reduced incidence of fractures in at-risk patients, minimal soft-tissue insult, and a stable construct that allows early weight bearing. A study with greater statistical power is needed to evaluate the protective effect of the procedure.

Limitations of this study include the small sample size, its retrospective design with prospective data collection, and the absence of a control group. Strengths include the paucity of literature on prevention of this fracture pattern—making this an original contribution—and that all patients were operated on by the same surgical team.

This preliminary study suggests that prophylactic osteosynthesis using a locking plate in patients with ipsilateral hip and knee arthroplasties and risk factors for IFFs may be an effective strategy to reduce the incidence of this complication.

CONCLUSIONS

In our cohort, IFF-free survival was 100% during follow-up; no surgical complications occurred and the rehabilitation protocol was not altered. In addition, functional outcomes assessed with HHS (hip) and KSS (knee) were satisfactory, with clinical improvement in all cases.

Complementing these findings, current publications highlight femoral cortical thickness as a predominant and independent risk factor, even above interstem distance. This reinforces the need to incorporate bone structural parameters into surgical planning, especially in patients with multiple implants and compromised bone. While acknowledging this study's weaknesses, we consider that it provides original evidence on a reproducible, low-morbidity preventive technique with potential to improve prognosis in high-risk patients. Multicenter studies with greater statistical power are required to validate these results and establish universal recommendations.

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P. Maletti ORCID ID: https://orcid.org/0000-0001-5065-9880
M. Aguilera ORCID ID: https://orcid.org/0009-0003-6515-3083
M. Torres ORCID ID: https://orcid.org/0009-0002-7442-0422
B. Schmir ORCID ID: https://orcid.org/0009-0005-1054-6765
D. Segura ORCID ID: https://orcid.org/0000-0001-8760-6328
R. Silvano ORCID ID: https://orcid.org/0000-0003-2920-937X

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Impact of Total Hip Arthroplasty on Sexual Activity and Life Satisfaction: An Underexplored Aspect

Ezequiel Lulkin, Sebastián Pereira, Fernando Bidolegui
Orthopedics and Traumatology Service, Hospital Sirio Libanés, Autonomous City of Buenos Aires, Argentina

ABSTRACT
Introduction: Sexual activity and life satisfaction are important outcomes for patients undergoing total hip arthroplasty (THA), yet they remain underexplored in routine assessments. **Materials and Methods:** Retrospective study with paired pre- and postoperative evaluations in 40 adults (20 women, 20 men). Variables analyzed included sexual activity (yes/no), hip pain limiting sexual activity (yes/no), pain during sexual activity (frequency), and sexual satisfaction (5-point scale). **Results:** The proportion of sexually active patients increased from 60% (24/40) to 75% (30/40), an absolute change of +15 percentage points. Patients reporting hip pain that limited sexual activity decreased from 12 (30%) to 6 (15%) (p = 0.031). Among the 30 patients who were sexually active postoperatively, 13.3% reported pain during sexual activity ("often"). High sexual satisfaction (scores 4–5) increased from 12.5% to 62.5%. Of the 10 patients (25%) who remained inactive after surgery, 7 attributed it to lack of desire or absence of a partner, and 3 to concern or fear. **Conclusions:** Total hip arthroplasty was associated with increased sexual activity, reduced limiting pain, and a marked improvement in reported sexual satisfaction. Prospective studies are needed to confirm these findings.
Keywords: Total hip arthroplasty; sexual activity; sexual satisfaction; pain; quality of life.
Level of Evidence: III

Impacto del reemplazo total de cadera en la actividad sexual y satisfacción de vida: un aspecto poco explorado

RESUMEN
Introducción: La actividad sexual y la satisfacción de vida son dimensiones relevantes para los pacientes sometidos a un reemplazo total de cadera; su evaluación específica sigue poco explorada. **Materiales y Métodos:** Estudio retrospectivo con mediciones pre y posoperatorias en 40 pacientes adultos (20 mujeres, 20 hombres). Se analizaron las siguientes variables: actividad sexual (sí/no), dolor de cadera limitante para la actividad sexual (sí/no), dolor durante la actividad sexual (frecuencia) y satisfacción sexual (escala 1-5). **Resultados:** La proporción de pacientes activos sexualmente aumentó del 60% al 75%, un cambio absoluto +15 puntos porcentuales. La cantidad de pacientes con dolor de cadera limitante para la actividad sexual disminuyó de 12 (30%) a 6 (15%) (p = 0,031). El 13,3% de los 30 pacientes activos después de la cirugía refirió dolor durante la actividad sexual ("a menudo"). La satisfacción sexual "alta" (niveles 4 y 5) aumentó del 12,5% al 62,5% de los pacientes. De los 10 (25%) que permanecieron inactivos después de la cirugía, 7 lo atribuyeron a la falta de deseo o a la ausencia de pareja y 3, a preocupación/miedo. **Conclusiones:** El reemplazo total de cadera se asoció con una mayor actividad sexual y menos dolor limitante, y un incremento marcado de la satisfacción sexual reportada. Se requieren estudios prospectivos para confirmar estos hallazgos.
Palabras clave: Reemplazo total de cadera; actividad sexual; satisfacción sexual; dolor; calidad de vida.
Nivel de Evidencia: III

INTRODUCTION

Total hip arthroplasty (THA) is a fundamental procedure in the treatment of degenerative joint diseases that significantly affect patients' quality of life. The main objectives of this surgery are to improve joint function and reduce pain, but other aspects of patients' daily lives also deserve attention, including sexual activity.[1,2]

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Sexual activity is a vital component of physical and emotional health, and its alteration can have significant consequences on overall well-being. In the scientific literature, the relationship between THA and sexual activity has been only marginally addressed, leaving a gap in understanding the postoperative impact on patients' lives.[3,4]

This retrospective study focused on evaluating how THA influences sexual activity and overall life satisfaction. Through the implementation of pre- and postoperative questionnaires, we sought to identify changes in the frequency of sexual activity, pain during sexual activity, and levels of sexual and overall satisfaction, thereby obtaining a broader perspective of surgical outcomes beyond improvements in joint function. The study aims to shed light on a little-explored topic.

MATERIALS AND METHODS

A retrospective study was conducted to evaluate the influence of THA on patients' sexual activity and overall life satisfaction. The research was based on standardized questionnaires that included a preoperative section answered by patient recall and a postoperative section (Appendix).

The study was approved by the Ethics Committee of Hospital Sirio Libanés before the surveys were administered.

Forty patients (20 men and 20 women), aged 60–75 years (mean age 70), were included. Inclusion criteria were a diagnosis of hip osteoarthritis and clinical indication for THA. Patients with previous hip surgery or medical conditions preventing participation in sexual activity were excluded. The sample was formed by stratified random sampling by sex (20 men and 20 women).

Two questionnaires were designed to collect data on sexual activity and overall satisfaction. The instruments were developed from the literature and clinical practice but lack formal psychometric validation. The sexual satisfaction scale was administered to all participants, regardless of their sexual activity, to assess satisfaction, desire, and expectations.

The preoperative questionnaire assessed sexual activity before surgery, frequency of pain during sexual activity, and level of sexual satisfaction. The postoperative questionnaire collected information on resumption of sexual activity, pain during sexual activity, and ratings of sexual and overall satisfaction after surgery.

Statistical Analysis

A descriptive analysis of quantitative and qualitative variables was performed. Continuous variables are expressed as mean and standard deviation, and categorical variables as frequency and percentage. Appropriate statistical tests were used to compare pre- and postoperative responses (paired design). Likert scales were treated as quasi-interval variables, applying the paired Student's t-test as an approximation and, where appropriate, the Wilcoxon test. Dichotomous variables (sexual activity and limiting pain) were analyzed using the exact two-tailed McNemar test. Two-tailed p-values and 95% confidence intervals are reported. A p-value <0.05 was considered statistically significant.

No comparisons between men and women were performed; this analysis will be considered in future studies. For sexual satisfaction (ordinal scale), a descriptive preoperative–postoperative transition matrix is presented.

RESULTS

The distribution by sex was equal (20 men and 20 women). Before surgery, 24 patients (60%) reported being sexually active. Of the 16 who were not active, 12 attributed their inactivity to hip pain or discomfort, and 4 to other reasons (e.g., lack of desire or absence of a partner). All 40 participants responded regarding preoperative sexual satisfaction: 10 (25%) reported low satisfaction (levels 1–2); 25 (62.5%) reported moderate satisfaction (level 3); and 5 (12.5%) reported high satisfaction (levels 4-5).

After surgery, 30 of the 40 patients (75%) reported being sexually active. Among the 10 (25%) who did not resume activity, the main reasons were lack of desire or not having a partner (70% of inactive patients; 17.5% of the total) and concerns or fear (30% of inactive patients; 7.5% of the total). Four of the 30 active patients

(13.3%) reported pain during sexual activity after surgery, all describing it as occurring "often." In this group, 27 (90%) rated their sex life as "improved," and 3 (10%) as "unchanged." Twenty-five of the 40 (62.5%) rated postoperative sexual satisfaction as "high" (levels 4–5) (Figures 1 and 2, Tables 1-3).

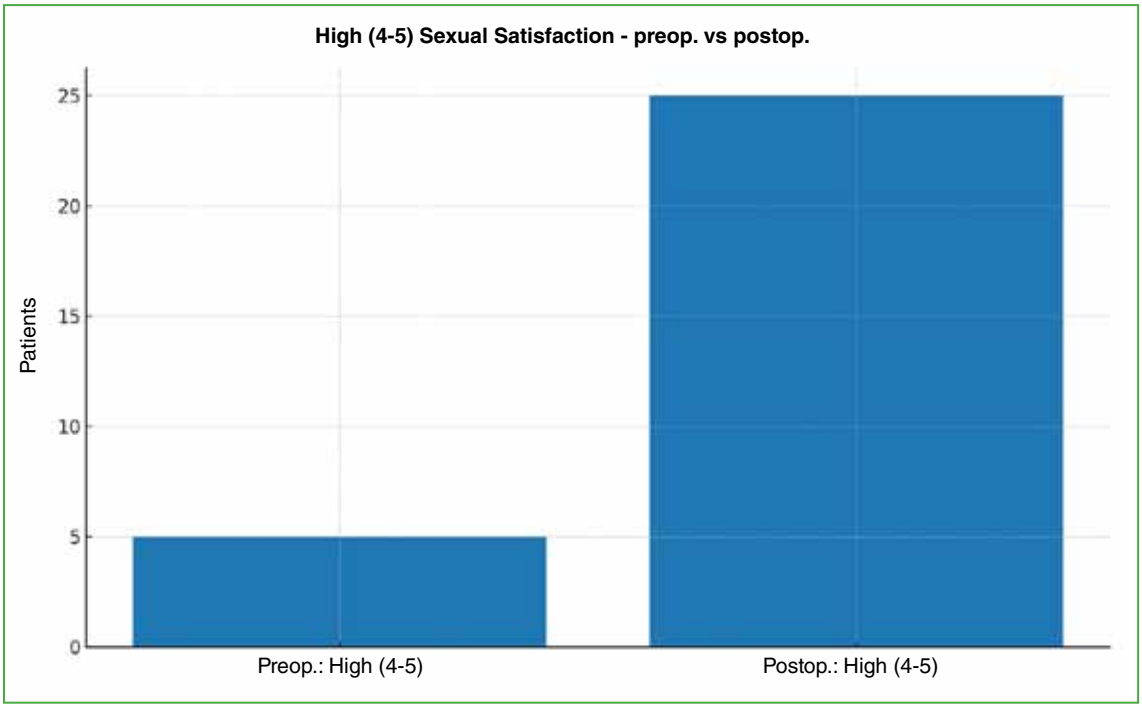

Figure 1. High sexual satisfaction (levels 4-5) pre vs. post (n = 40).

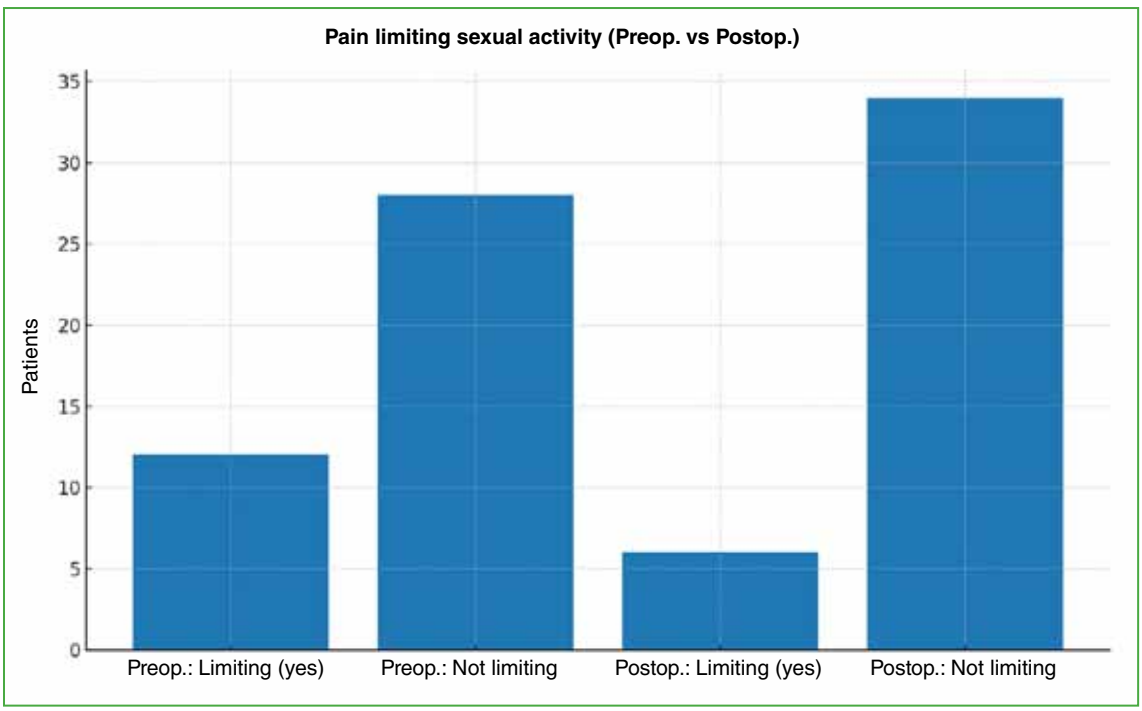

Figure 2. Pain limiting sexual activity (pre vs. post; n = 40). Exact McNemar test (two-tailed): p = 0.031.

Table 1. Preoperative and postoperative transitions in sexual activity (yes/no) (n = 40)

	Postop. active	Postop. inactive	Total
Preop. active	24 (60%)	0 (0%)	24 (60%)
Preop. inactive	6 (15%)	10 (25%)	16 (40%)
Total	30 (75%)	10 (25%)	40 (100%)

Values n (%), calculated for each row. n = 40. Paired contrast with McNemar test (exact, two-tailed): p = 0.031.

Table 2. Preoperative and postoperative transitions of pain limiting sexual activity (yes/no) (n = 40)

	Postop. non-limiting	Postop. limiting	Total
Preop. non-limiting	28 (70%)	0 (0%)	28 (70%)
Preop. limiting	6 (15%)	6 (15%)	12 (30%)
Total	34 (85%)	6 (15%)	40 (100%)

Same analysis scheme as Table 1 and same discordant pattern, exact McNemar test: p = 0.031.

Table 3. Preoperative and postoperative transitions in sexual satisfaction (levels 1-2, 3, and 4-5)

	Postop. Low (levels 1 and 2)	Postop. Moderate (level 3)	Postop. High (levels 4 and 5)
Preop. Low (levels 1 and 2) (n = 10)	10	0	0
Preop. Moderate (level 3) (n = 25)	0	5	20
Preop. High (levels 4 and 5) (n = 5)	0	0	5

3 x 3 paired matrix of preoperative →postoperative transitions. n = 40. Descriptive presentation.

DISCUSSION

The results of this retrospective study demonstrate improvements in sexual activity and overall life satisfaction after THA. Other studies have also examined the implications of THA on patients' sexual activity. In particular, Turhan and Buyuk[3] found that sexual quality of life improved significantly after bilateral THA, supporting our findings of improved postoperative sexual satisfaction. Yoon et al.,[4] in a study of Korean patients, also reported improvements in sexual activity and satisfaction after this surgery. However, they highlighted the insufficient patient education regarding the resumption of sexual activity, an aspect not specifically addressed in our study, but potentially relevant for future research and clinical practice.

Galloway et al.[5] studied sexual function and return to sexual activity in young adults after THA and reported significant improvement in sexual function, consistent with our findings of increased satisfaction and decreased pain. Similarly, Yang et al.,[6] in a study of young Chinese patients, reported improved sexual satisfaction scores in both men and women after THA, reinforcing our findings of postoperative improvement.

A systematic review by Neonakis et al.[7] confirmed that THA improves sexual satisfaction and reduces physical barriers limiting sexual activity. This strongly supports our observation that sexual activity is a major concern for patients and that THA is associated with improved outcomes. Bonilla et al.[8] investigated the impact of THA on women's sexual satisfaction and found significant postoperative improvements. However, they identified the need for more effective communication and counseling, an aspect also suggested by our finding that a small proportion of patients did not resume sexual activity due to concerns or fear.

Similarly, Wall et al.[9] emphasized the importance of addressing sexual activity both before and after THA. Their study found that 77% of patients believed their hip disease limited their sex life and considered resumption of sexual activity important. However, many felt they did not receive enough information about postoperative sexual activity, consistent with our observation of the need for better communication between patients and surgeons. Wall et al.[9] also highlighted that most surgeons fail to adequately discuss sexual activity with patients due to the sensitivity of the subject and the lack of standardized measures to evaluate sexual function after THA.

Our study confirmed the positive effect of THA on sexual activity and overall life satisfaction.

Unlike previous studies, we found that a small percentage of patients did not resume sexual activity after surgery due to concerns or fear, underscoring the need for healthcare professionals to provide more effective communication and counseling. Future research should address this gap in patient education to improve overall recovery and quality of life after surgery. In addition, the inclusion of validated outcome measures that incorporate sexual activity should be considered, to facilitate discussion of this sensitive issue between patient and surgeon.

Despite the limitations inherent in its retrospective design and sample size, the results obtained are statistically significant and provide a solid foundation for future research. Prospective studies with larger and more diverse samples are recommended to confirm these findings and to further explore the impact of THA on intimate relationships and body image.

CONCLUSIONS

This study provides evidence that THA not only improves mobility and relieves pain, but also has a positive effect on sexual activity and overall life satisfaction, which are fundamental aspects of comprehensive patient recovery.

Statement on generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the authors used AI to improve readability, language, and review statistical consistency. After using this tool, the authors reviewed and edited the content as necessary and assume full responsibility for the content of the publication.

Conflicts of interest: The authors declare no conflicts of interest.

S. Pereira ORCID ID: https://orcid.org/0000-0001-9475-3158
F. Bidolegui ORCID ID: https://orcid.org/0000-0002-0502-2300

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APPENDIX

Preoperative Questionnaire:

Were you sexually active before surgery?
[ ] Yes
[ ] No

If you were not sexually active, was it due to hip pain or discomfort?
[ ] Yes
[ ] No

If you experienced hip pain during sexual activity, how often did it occur?
[ ] Always
[ ] Often
[ ] Sometimes
[ ] Rarely

Did pain affect your desire for sexual activity?
[ ] Yes
[ ] No

On a scale from 1 to 5, how would you rate your sexual satisfaction before surgery? (1 = not satisfied at all, 5 = very satisfied)
[ ] 1
[ ] 2
[ ] 3
[ ] 4
[ ] 5

Postoperative Questionnaire:

After surgery, did you resume sexual activity?
[ ] Yes
[ ] No

If you have not resumed sexual activity, what is the main reason?
[ ] Pain or discomfort
[ ] Concern about damaging the prosthesis
[ ] Lack of desire
[ ] Medical advice
[ ] Relationship issues
[ ] Other reasons (please specify):_____

After surgery, have you experienced hip pain during sexual activity?
[ ] Yes
[ ] No

If you answered yes to pain, how often does it occur?
[ ] Always
[ ] Often
[ ] Sometimes
[ ] Rarely

Compared with before surgery, how would you rate your sex life?
[ ] Better
[ ] The same
[ ] Worse

On a scale from 1 to 5, how would you rate your sexual satisfaction after surgery?
[ ] 1
[ ] 2
[ ] 3
[ ] 4
[ ] 5

On a scale from 1 to 5, how would you rate your overall satisfaction with your quality of life after surgery?
[ ] 1
[ ] 2
[ ] 3
[ ] 4
[ ] 5

Selective Arterial Embolization

Hernán G. Bertoni,[*] Victoria Bertoni,[**] Carlos M. Autorino,[#] Federico Manfrin[##]
[*]*Interventional Oncology Department, Instituto Alexander Fleming, Autonomous City of Buenos Aires, Argentina*
[**]*Diagnostic Imaging, Hospital Italiano de Buenos Aires, Autonomous City of Buenos Aires, Argentina*
[#]*Orthopedics and Traumatology Service, Hospital Universitario Austral, Buenos Aires, Argentina*
[##]*Hip and Knee Reconstructive Surgery Unit, Sanatorio Anchorena-Itoiz, Avellaneda, Buenos Aires, Argentina*

ABSTRACT
Knee osteoarthritis is the most prevalent degenerative arthropathy and one of the leading causes of chronic pain and disability. Its pathophysiology involves chondral wear, synovial inflammation, pathological angiogenesis, and sensory neoinnervation. Treatment options range from conservative measures to arthroplasty; a subset of patients who are not yet surgical candidates would benefit from minimally invasive alternatives. Genicular artery embolization has emerged as a promising option by reducing neovascularization and, consequently, pain. Clinical improvements greater than 70% and a favorable safety profile have been reported. Its indications have also been extended to persistent pain after arthroplasty and to other chronic musculoskeletal entities (e.g., adhesive capsulitis), with encouraging results. Despite this promising early evidence, controlled trials and long-term follow-up are needed to define its role in the management of osteoarthritis and other musculoskeletal diseases and, in turn, to support its inclusion in treatment guidelines.
Keywords: Embolotherapy; selective arterial embolization; genicular artery embolization; osteoarthritis; knee osteoarthritis; painful total knee arthroplasty; adhesive capsulitis.
Level of Evidence: IV

Embolización arterial selectiva

RESUMEN
La osteoartritis de rodilla es la artropatía degenerativa más prevalente y una de las causas principales de dolor crónico y discapacidad. Su fisiopatología involucra desgaste condral, inflamación sinovial, angiogénesis patológica y neoinervación sensorial. El tratamiento varía desde medidas conservadoras hasta la artroplastia. un grupo de pacientes aún no candidatos quirúrgicos se beneficiarían de opciones mínimamente invasivas. La embolización arterial genicular surge como una alternativa prometedora al reducir la neovascularización y, de este modo, el dolor. Se han comunicado mejoras clínicas superiores al 70% y un perfil de seguridad favorable. Su indicación se ha extendido al dolor persistente después de una artroplastia y a otras entidades nosológicas musculoesqueléticas crónicas (capsulitis adhesiva), con resultados alentadores. Pese a la evidencia inicial prometedora, se necesitan ensayos controlados y un seguimiento prolongado para definir su rol en el manejo de la osteoartritis y otras enfermedades musculoesqueléticas y, de esta manera, poder incluirla en guías de tratamiento.
Palabras clave: Emboloterapia; embolización arterial selectiva; embolización de arterias geniculares; osteoartritis; gonartrosis; reemplazo total de rodilla doloroso; capsulitis adhesiva.
Nivel de Evidencia: IV

INTRODUCTION

Osteoarthritis is the most common degenerative joint disease worldwide and represents one of the leading causes of chronic pain and disability, especially among older adults. The knee is the most frequently affected joint in people from developed countries. This condition increasingly impacts healthcare systems due to population aging and the sustained rise in obesity.[1,2]

Traditionally, osteoarthritis was considered a purely degenerative disease, attributed to the progressive "wear and tear" of the articular cartilage. However, in recent decades, it has been recognized that chronic inflammation, particularly of the synovial membrane, plays a central role in its pathophysiology. Mechanical damage triggers a

Received on September 23rd, 2025. Accepted after evaluation on September 25th, 2025 • Dr. HERNÁN G. BERTONI • hernangbertoni11@gmail.com https://orcid.org/0000-0002-0821-413X
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synovial inflammatory response that stimulates pathological angiogenesis and fosters a persistent inflammatory microenvironment, accelerating joint degeneration. Added to this process is sensory neoinnervation associated with neovascularization, which contributes to the persistent pain characteristic of the disease.[3,4]

Therapeutic strategies range from conservative measures, such as lifestyle modification, physical therapy, analgesics, anti-inflammatory agents, and intra-articular treatments (hyaluronic acid, corticosteroids, or platelet-rich plasma), to surgical procedures. Among these, total knee arthroplasty remains the treatment of choice for advanced, refractory cases.

However, in patients with mild to moderate osteoarthritis who do not adequately respond to conservative management but are not yet surgical candidates, a significant therapeutic gap persists, prompting the search for minimally invasive alternatives.

Case of Symptomatic Knee Osteoarthritis

A 68-year-old male surgeon presented with degenerative joint disease and symptomatic genu varum (Figure 1). Recently, he had to increase his analgesic medication and limit walking.

Figure 1. Weight-bearing radiographs of both knees showing grade II/III knee osteoarthritis according to the Alhbäck classification.

In previous consultations, intra-articular hyaluronic acid injection and prosthetic arthroplasty had been proposed.

At the time of evaluation, the patient reported having declined both options: a) he refused injection therapy because of progressive malalignment of the knee, and b) he was not yet willing to undergo prosthetic arthroplasty, as he did not perceive a significant limitation in his daily or professional activities.

Selective arterial embolization was therefore proposed (Figure 2).

Figure 2. A. Access to the inferomedial genicular artery. **B.** Digital subtraction angiography showing focal inflammatory "blush" (arrows). **C.** Post-embolization control showing resolution of the inflammatory focus (circle).

The patient reported marked symptomatic relief following embolization (Figure 3).

Thanks to a better understanding of the pathophysiological mechanisms of osteoarthritis, strategies aimed at modulating inflammation and synovial neoangiogenesis have been developed in recent years. Within this context, the hypothesis has emerged that embolization of synovial neovessels could reduce pain by interrupting pathological blood flow and the associated sensory stimulation. Moreover, interruption of the inflammatory cycle might delay the structural progression of the disease.[5-12]

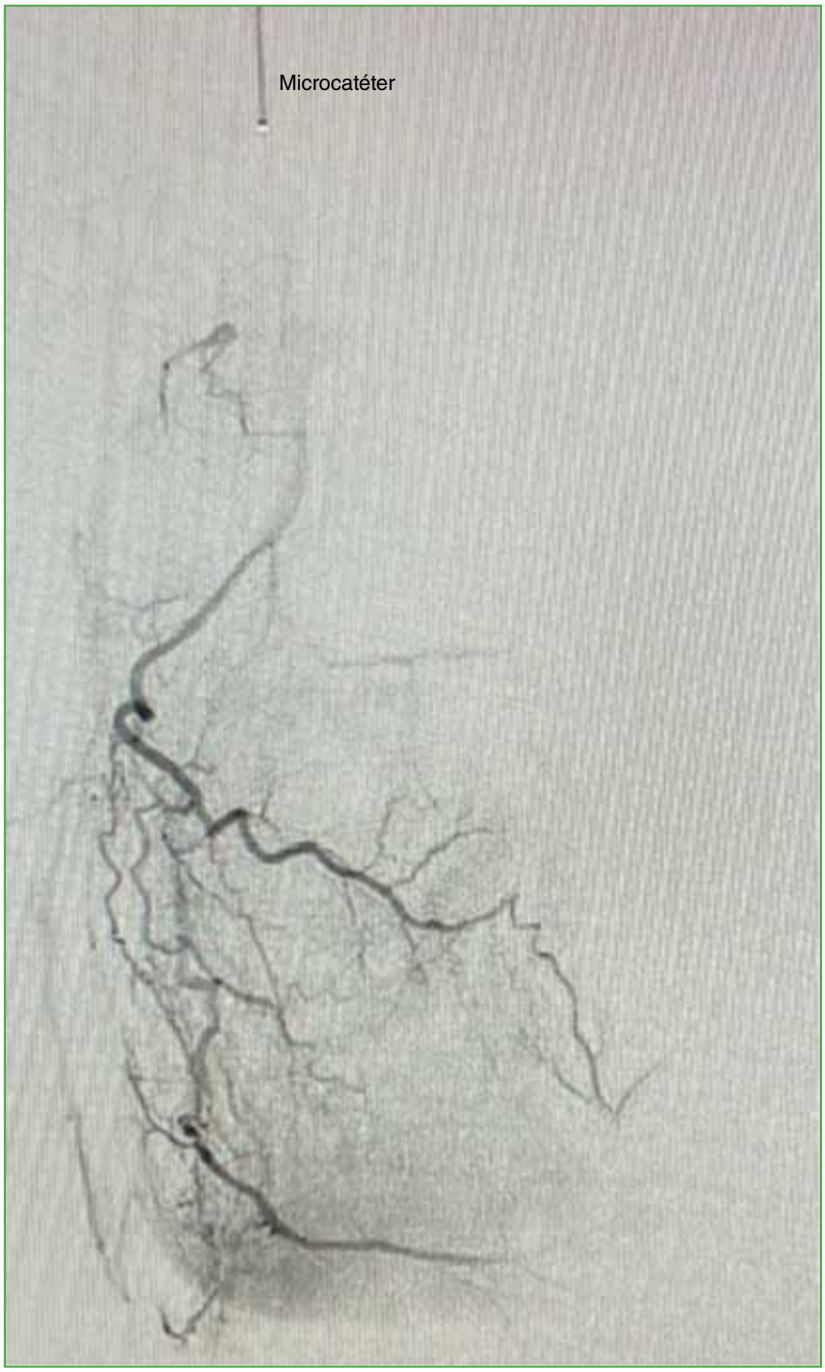

Figure 3. Selective embolization (genicular artery embolization) performed to achieve symptomatic relief. Pre-embolization image showing inflammatory focus characterized by neovascularization (“blush”).

GENICULAR ARTERY EMBOLIZATION

Genicular artery embolization has emerged as a minimally invasive therapeutic alternative for patients with symptomatic osteoarthritis who do not respond to conventional treatment but are not immediate candidates for prosthetic surgery.

The technique consists of superselective embolization of genicular arterial branches supplying areas of synovial neoangiogenesis, seeking a controlled reduction—though not complete occlusion—of flow to the pathological vessels, in order to decrease inflammation and pain while minimizing the risk of ischemia in adjacent tissues (Figure 4).[13]

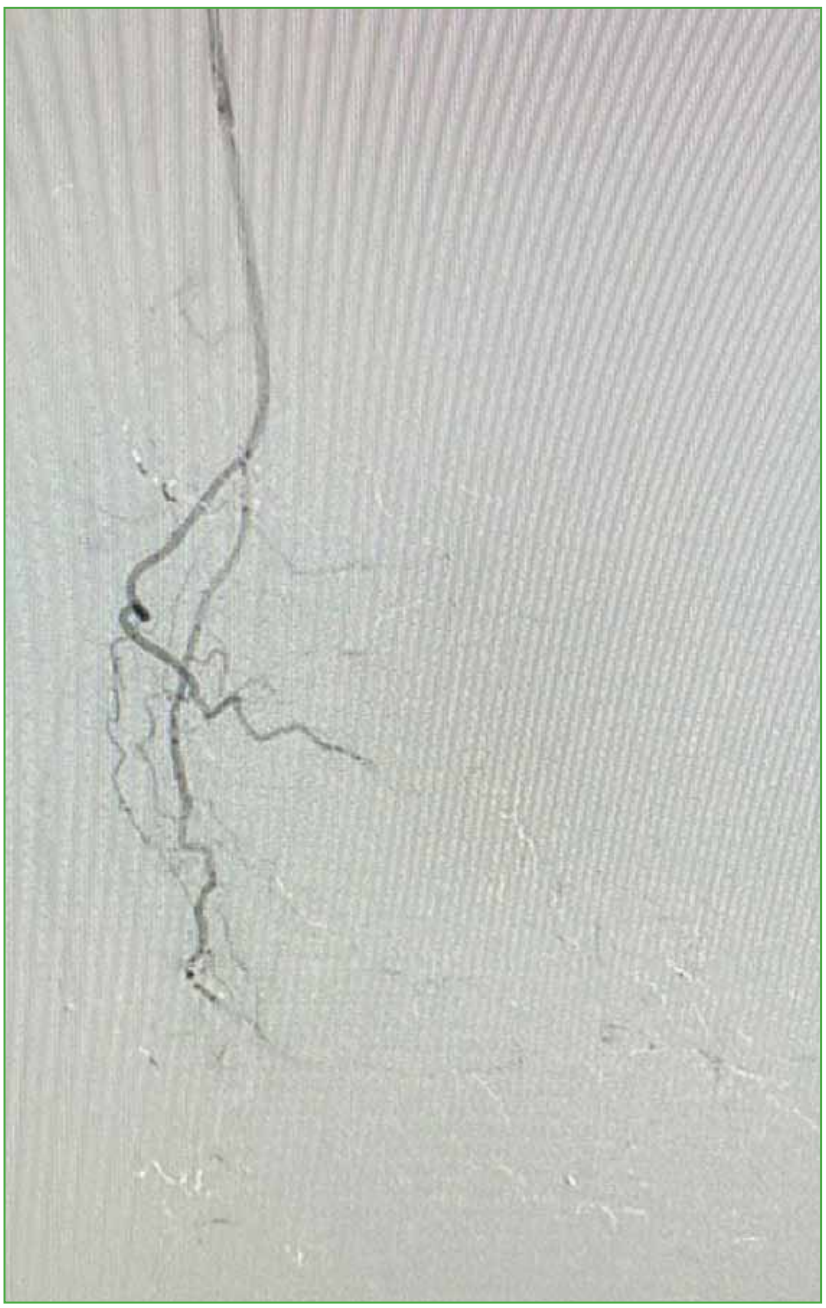

Figure 4. Post-embolization image. The "cotton-like" blush has disappeared, with preservation of collateral branches.

Okuno et al.[5,6] were pioneers in the clinical implementation of this technique. Over the past decade, they have published several case series and prospective studies documenting significant improvements in pain and function at short- and mid-term follow-up. Based on these initial experiences, genicular artery embolization has been progressively adopted by multiple international centers, consolidating its position as a promising therapeutic option.

Several subsequent studies have confirmed its efficacy, reporting clinical improvement rates exceeding 70%, along with consistent reductions in pain scales, such as the Visual Analog Scale, and in functional questionnaires, including the *Western Ontario and McMaster Universities Osteoarthritis Index.*[7,8]

In recent years, genicular artery embolization has also been used to treat: a) persistent pain after total knee arthroplasty, once mechanical and infectious causes have been ruled out as sources of symptoms,[14-20] and b) recurrent hemarthrosis, after excluding specific clinical conditions such as coagulopathies or hemorrhagic synovial disorders.[21-23]

Case of Recurrent Hemarthrosis

A 52-year-old man underwent a two-stage revision arthroplasty for periprosthetic joint infection, reconstructed with a rotating-hinge implant. He presented with recurrent hemarthrosis caused by impingement of a synovial fold (Figure 5).

Although current evidence in this context is still limited, available studies suggest that the procedure can achieve significant pain reduction and substantial improvements in quality of life, maintaining a favorable safety profile and short recovery times.

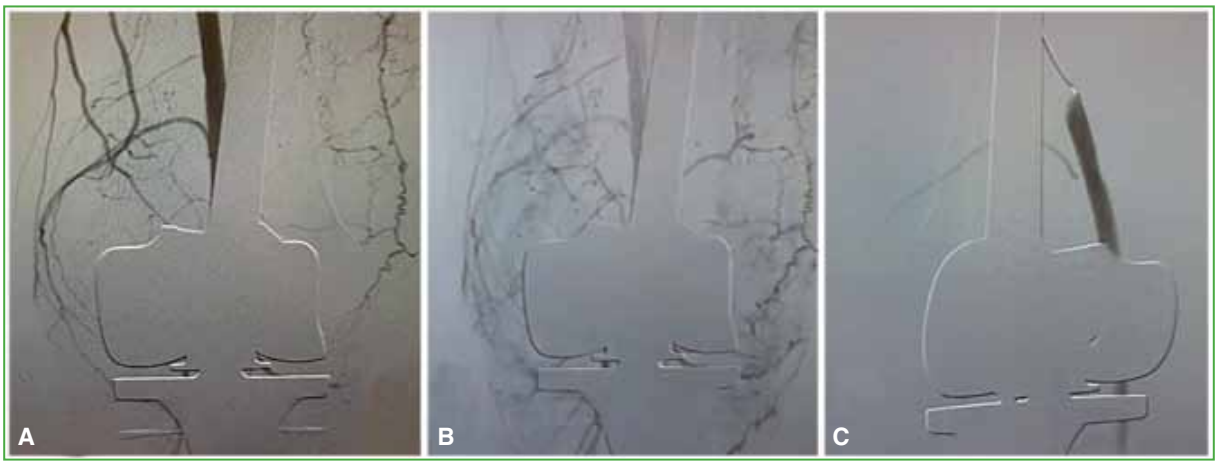

Figure 5. A and B. Synovial vascular proliferation with a "cotton-like," cumulonimbus-type appearance. **C.** Selective arterial embolization showing disappearance of the cloudy image. The recurrent hemarthrosis resolved clinically.

In terms of safety, most adverse events reported have been mild and self-limited. The most common is mild, transient post-procedural pain, which usually resolves with symptomatic management. In rare cases, superficial skin ulcerations have been observed, related to non-target embolization of cutaneous branches; these typically heal favorably with conservative local measures. Such events have been associated with the use of permanent embolic agents. These findings support the favorable safety profile of genicular artery embolization when performed using a superselective technique and with appropriate embolic material selection. Furthermore, operator experience plays a crucial role in minimizing risks and optimizing clinical outcomes.[18]

While most of the accumulated experience pertains to knee osteoarthritis, the technique is now being explored for other musculoskeletal conditions associated with pathological neovascularization and chronic pain, such as rotator cuff tendinopathy, lateral epicondylitis, Achilles tendinopathy, and plantar fasciitis. In these entities, peritendinous neovascularization is often accompanied by sensory neoinnervation, perpetuating pain and functional limitation.

Preliminary pilot studies and case series have shown that selective embolization of these abnormal vessels may lead to pain relief and functional improvement in patients unresponsive to conservative therapies, with a safety profile comparable to that observed in the knee.[24-34]

Despite these encouraging results, the current evidence presents limitations: small numbers of randomized controlled trials, heterogeneous patient selection criteria, variability in embolization technique and embolic materials used, and relatively short follow-up periods in most studies. These constraints preclude definitive conclusions regarding durability of the effect and need for repeat interventions. Therefore, larger-scale prospective studies with longer follow-up are required to more precisely define the efficacy, safety, and role of genicular artery embolization in the therapeutic algorithm for knee osteoarthritis and other musculoskeletal disorders.

Initial experience suggests that selective embolization, whether genicular or targeting other musculoskeletal sites, represents a minimally invasive, safe, and effective procedure within the multidisciplinary management of chronic pain conditions characterized by neovascularization and inflammatory foci that impact pain sensitivity.

Conflicts of interest: The authors declare no conflicts of interest.

V. Bertoni ORCID ID: https://orcid.org/0009-0003-6519-4053
C. M. Autorino ORCID ID: https://orcid.org/0000-0001-6410-3816
F. Manfrin ORCID ID: https://orcid.org/0009-0000-0234-5684

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Traumatic Anterior Hip Dislocation in a 7-Year-Old Pediatric Patient

Gustavo E. Dávila-Godínez,[*] Pedro Jorba-Elguero,[**] Mauricio Zárate-de la Torre,[*] Miguel Ángel Dorantes-Díez,[*] José A. Fernández-Gutiérrez,[*] Natasha Osorio-Gómez[*]

[*]*Orthopedics and Traumatology Service, Hospital Español de México, Mexico City, Mexico*

[**]*Orthopedics and Traumatology Service, Hospital Pediátrico de Legaria, Mexico City, Mexico*

ABSTRACT

Traumatic hip dislocation in children is extremely rare, and the anterior type is exceptional. It is considered an emergency due to the high risk of complications, the most serious being avascular necrosis of the femoral head. We report the case of a 7-year-old child who sustained a fall from a height of five meters, resulting in an anterior hip dislocation. The diagnosis was confirmed with computed tomography, and closed reduction was performed eight hours after the accident. Radiographic follow-up at three and six months showed no signs of avascular necrosis; however, given the risk of its occurrence, continued monitoring is warranted.

Keywords: Pediatric hip dislocation; avascular necrosis of the femoral head; traumatic dislocation; anterior hip dislocation.

Level of Evidence: IV

Luxación anterior traumática de cadera en un niño de 7 años

RESUMEN

La luxación traumática de cadera en la edad pediátrica es un cuadro sumamente infrecuente, y la luxación anterior es una lesión excepcional. Se considera una urgencia debido al alto riesgo de complicaciones, la más importante es la necrosis avascular de la cabeza femoral. Se presenta el caso de un niño que sufrió una caída de 5 m de altura que le provocó una luxación anterior de cadera. Se diagnosticó mediante una tomografía computarizada simple, y se la trató, de manera cerrada, a las 8 h del accidente. En el control radiográfico a los 3 y 6 meses, no se observaron signos de desarrollo de necrosis avascular; sin embargo, ante la posibilidad de este cuadro, es necesario continuar con un protocolo de seguimiento.

Palabras clave: Luxación de cadera; pediatría; necrosis avascular de la cabeza femoral; luxación traumática; luxación anterior de cadera.

Nivel de Evidencia: IV

INTRODUCTION

Traumatic hip dislocation is rare in children, accounting for 2-5% of all dislocations in this age group.[1] The incidence increases with age, yet it is up to 25 times less frequent than in adults.[2,3] This is attributed to anatomical factors such as skeletal immaturity and ligamentous laxity, which compromise joint stability.[1,4]

In children under 6 years of age, dislocation occurs after low-energy accidents as a result of limited joint contact from cartilaginous acetabular coverage and ligamentous hyperlaxity.[4] In those over 6 years of age, it is associated with high-energy mechanisms,[4] which can cause life-threatening injuries; therefore, a standardized initial clinical assessment is essential to rule out severe systemic and orthopedic injury.[5]

The most common presentation is posterior dislocation (95%); anterior dislocations account for only 5% and are subdivided into pubic (superior) and obturator (inferior).[6] Another classification considers soft-tissue integrity; closed dislocations are more common, whereas open dislocations require high-energy mechanisms.[7]

Received on January 7th, 2025. Accepted after evaluation on May 22nd, 2025 • Dr. GUSTAVO E. DÁVILA-GODÍNEZ • gustavodavilag01@gmail.com https://orcid.org/0009-0000-7987-7566

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Clinically, posterior dislocations present with the limb in adduction, flexion, internal rotation, and shortening; anterior dislocations present with abduction, external rotation, flexion, and also shortening.[8] The mechanism of anterior dislocation is not fully defined, but a force vector in external rotation and abduction with flexion has been proposed for the obturator type, and with extension for the pubic type.[6]

Diagnosis requires pelvic radiographs supplemented with computed tomography (CT) and magnetic resonance imaging (MRI) to evaluate osseous and soft-tissue structures.[7,8] The standard treatment is closed reduction under sedation within the first 6 hours.[5]

Complications include associated fractures (40%), neurovascular injuries (25%), and articular cartilage injuries (6%).[7] The most important complication is avascular necrosis of the femoral head (AVN), detected in 8% of patients at 12 months. [9,10]

CLINICAL CASE

A 7-year-old boy with normal neurological and psychomotor development for his age and no relevant medical history suffered a fall from a height of 5 m, with an apparent injury mechanism involving traction, external rotation, and abduction of the right hip, as well as traumatic brain injury.

He was stabilized by a mobile medical unit and transferred to the emergency department 6.5 hours after the accident. On admission, his Glasgow Coma Scale score was 8, and the right lower limb was in flexion, abduction, and external rotation (Figure 1).

Figure 1. Clinical presentation with flexion, abduction, and external rotation of the right lower limb.

Orotracheal intubation was performed. A cranial CT scan showed an epidural hematoma and a frontotemporal fracture without surgical indication. Initial pelvic CT revealed right hip joint incongruity consistent with an anterior dislocation of obturator type (Figure 2); associated injuries were ruled out.

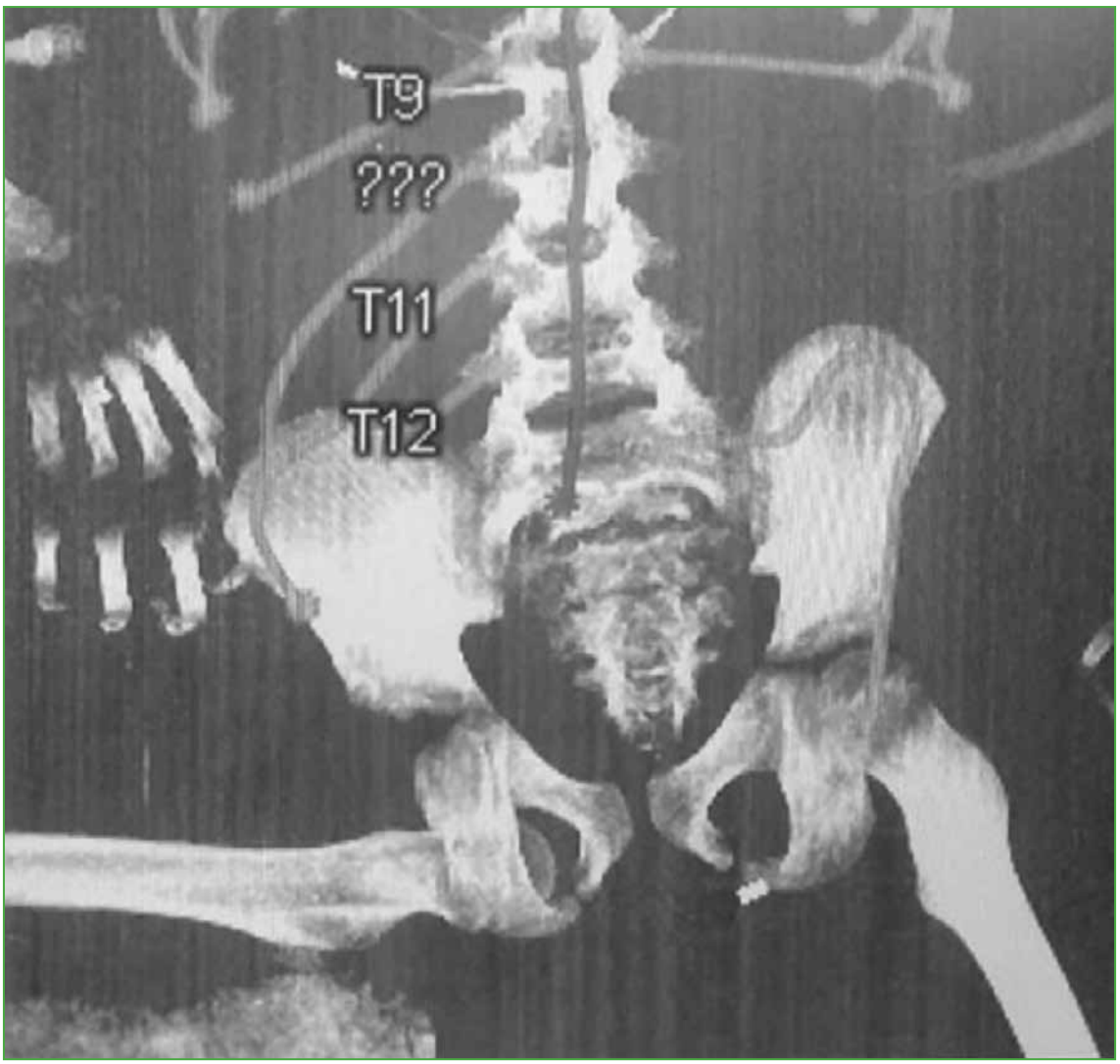

Figure 2. 3D CT of the pelvis. Anterior dislocation of the right hip, obturator type.

After stabilization, closed reduction under sedation was performed 8 hours after the accident. With the child in the supine position and the knee flexed at 90°, longitudinal traction was applied; simultaneously, the proximal femur was displaced laterally using a strap and external rotation, achieving successful clinical reduction. Stability maneuvers were positive, and reduction was confirmed by fluoroscopy (Figure 3).

Figure 3. Fluoroscopic confirmation of closed reduction of the right hip.

The patient was admitted to the intensive care unit for observation and monitoring. A cranial CT at 48 hours revealed no changes. At three weeks, progressive neurological improvement was noted. He was discharged from intensive care with instructions for close follow-up.

Follow-up radiographs at 3 (Figure 4) and 6 months (Figure 5) showed no evidence of AVN, and other musculoskeletal complications associated with traumatic dislocation were also ruled out.

Figure 4. Anteroposterior pelvic radiograph at 3 months of follow-up.

Figure 5. Anteroposterior pelvic radiograph at 6 months of follow-up.

DISCUSSION

Traumatic hip dislocation has an incidence of 0.8 cases per million in the pediatric population.[3,11] Our patient, a 7-year-old boy, falls within the most frequent age range, according to Mehlman et al., who reported a mean age of 9 years and 10 months.[12] In addition, this injury is 3 to 4 times more common in males.[13]

In this case, the child sustained an anterior dislocation, the less frequent type, as 95% of dislocations are posterior.[12] Baumann et al. reported a prevalence of 2.8% for anterior dislocations involving the obturator foramen.[11]

CT was useful to confirm the dislocation direction, although it is not ideal for detecting acetabular fractures in children due to unossified cartilage; MRI would be more appropriate,[8] but was not performed. This case corresponded to an isolated dislocation (grade I),[10] without associated injuries, which is common in children under 8 years of age, in whom acetabular fractures are rare.[14] Chondral and osseous injuries increase with age.[3]

Closed reduction was performed 8 hours after the accident. A delay greater than 6 hours increases the risk of AVN up to 20-fold.[15] MRI is indicated if soft-tissue interposition is suspected after reduction.[8] Immobilization was not indicated after reduction due to the patient's neurological status. In children under 10 years of age, immobilization with a spica cast for 4 weeks and a rehabilitation protocol are recommended,[10] but authors such as Sahin et al. report that neither immobilization nor time to weight bearing significantly influences functional outcomes.[16]

Reported complications include coxa magna, sciatic nerve palsy, paresthesias, and AVN of the femoral head.[10] In patients under 18 years of age, the incidence after isolated dislocation ranges from 3% to 15%,[17] and is higher if reduction is delayed.[18] Therefore, imaging follow-up is essential. Although there is no consensus on ideal timing, in this case, check-ups were performed at 3 and 6 months, and no radiographic evidence of AVN was detected.

MRI is the diagnostic gold standard, with specificity and sensitivity greater than 99%,[19] but it could not be obtained due to socioeconomic and infrastructure limitations in our setting. Plain radiographs were chosen which, although less sensitive in early stages, can be an acceptable alternative when MRI is unavailable, as noted by Manenti et al.[19-21]

Follow-up radiographs showed no signs suggestive of AVN (sclerosis, collapse, cysts, joint-space narrowing, etc.).[22] These findings may take 2 to 6 months to become visible on radiographs,[20] so the follow-up schedule was appropriate.

Finally, beyond time to reduction, factors such as age, trauma severity, and concomitant intra-articular fractures also influence outcomes. In our patient, young age, absence of an intracapsular fracture, and no prior coxa vara were protective factors.[23,24]

Despite the absence of radiological signs of AVN up to 6 months, continued imaging follow-up is necessary to detect potential development of AVN, which may take up to 2 years to manifest.[25]

CONCLUSIONS

Traumatic anterior hip dislocation in children is uncommon. Diagnostic and therapeutic management must be timely. Closed reduction within the first 6 hours after injury is essential to reduce the risk of complications such as AVN of the femoral head, which leads to early joint degeneration, limits therapeutic options, and compromises the likelihood of a favorable outcome.

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P. Jorba-Elguero ORCID ID: https://orcid.org/0000-0002-1948-4290
M. Zárate-de la Torre ORCID ID: https://orcid.org/0009-0001-2786-8163
M. Á. Dorantes-Díez ORCID ID: https://orcid.org/0000-0003-0145-4269
J. A. Fernández-Gutiérrez ORCID ID: https://orcid.org/0000-0002-9036-4312
N. Osorio-Gómez ORCID ID: https://orcid.org/0009-0001-4477-3190

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Medial Discoid Meniscus: A Rare Condition. Case Report and Treatment Considerations

Hugo Vasquez Diaz, Diego Toledo, Marco Gutierrez Gonzalez, Pedro Valdecantos
Pediatric Traumatology Service, Clínica Dávila, Santiago de Chile, Chile

ABSTRACT
Medial discoid meniscus is an extremely rare condition, with a reported incidence of 0.12-0.3%. It results from early developmental abnormalities that produce a thickened meniscus, compromising function and stability and predisposing to injury. Magnetic resonance imaging (MRI) is the main diagnostic tool, while arthroscopy is considered the gold standard for confirmation. Treatment depends on clinical symptoms and associated injuries, and may be conservative or surgical, with an emphasis on preserving as much meniscal tissue as possible. We report the case of a 14-year-old patient with left knee pain. MRI findings confirmed the diagnosis of medial discoid meniscus. The patient underwent arthroscopic saucerization with a favorable postoperative outcome.
Keywords: Knee; meniscus; arthroscopy.
Level of Evidence: IV

Menisco discoide medial: un cuadro infrecuente. Presentación de un caso y consideraciones sobre el tratamiento

RESUMEN
El menisco discoide medial es un cuadro extremadamente raro, tiene una incidencia del 0,12-0,3%. Se relaciona con trastornos en períodos tempranos del desarrollo, que generan un menisco de mayor grosor que afecta la función y la estabilidad, y predispone a las lesiones. Se puede diagnosticar mediante una resonancia magnética y la artroscopia es el procedimiento quirúrgico de elección. El tratamiento se basa en los signos y síntomas, y las lesiones asociadas, y puede ser conservador o quirúrgico, siempre tratando de preservar la mayor cantidad de menisco. Se presenta el caso de un paciente de 14 años con gonalgia izquierda. Los hallazgos en una resonancia magnética permitieron llegar al diagnóstico. El paciente fue sometido a una saucerización artroscópica y la evolución fue buena.
Palabras clave: Rodilla; menisco; artroscopia.
Nivel de Evidencia: IV

INTRODUCTION

The menisci are two fibrocartilaginous structures located between the medial and lateral femorotibial articular surfaces. Their morphology (C-shaped and semicircular, respectively), together with their viscoelastic properties, contributes to balance and load distribution, energy absorption, and provides stability, lubrication, and proprioception.[1]

A discoid meniscus (DM) is a congenital anomaly caused by failure of apoptosis and resorption of central tissue during development.[2] It is characterized by thickening of the meniscus over the tibial plateau, formation of disorganized hypertrophic tissue, and meniscocapsular alterations. This, combined with poor vascularization, increases mechanical stress and predisposition to injury. The incidence of DM ranges from 0.4% to 17% and is highest in Asian populations.[3] In 97-99% of patients, the lateral DM is affected, and up to 25% of cases are bilateral.[4] Discoid medial meniscus (DMM) is extremely rare, accounting for 0.12%-0.3% of patients with DM.[5] Its relevance lies in its location within a direct load-bearing zone which, in theory, entails a higher risk of injury and long-term degeneration.[2]

Received on October 9th, 2024. Accepted after evaluation on August 24th, 2025 • Dr. MARCO GUTIERREZ GONZALEZ • marcotuliogutierrez23@gmail.com https://orcid.org/0009-0006-1089-6164
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Characteristic clinical findings include pain, joint effusion, locking, audible clicking, and limited range of motion during childhood or adolescence.[6] The onset of symptoms and signs depends on the intrinsic abnormalities of the DM, activity level, or associated trauma. In many cases, it may be asymptomatic and go undiagnosed or only be detected in adulthood.[3]

Evaluation begins with radiographs, which help narrow the diagnosis and rule out differential diagnoses. Reported findings include increased femorotibial joint space, loss of lateral femoral condyle convexity, tibial plateau concavity, and the condylar cut-off sign (posterior cortical break of the lateral femoral condyle on the sagittal plane).[4] Magnetic resonance imaging has a sensitivity of 61.7%-78.2% and a specificity of 90.2%-95.5% for confirming the diagnosis.[6] Described findings include increased meniscal thickness, degenerative morphological alterations on axial images, and the bow-tie sign (three or more consecutive 5-mm sagittal slices showing continuity of both horns).[4] Arthroscopy is the diagnostic procedure of choice, although it does not allow characterization of certain degenerative or intrasubstance lesions.[6]

Multiple classifications use morphological variables (complete vs incomplete), stability, and type of displacement, and relate these to prognosis and treatment options; however, all were developed for lateral DM, and there are no classifications specific to medial DM. The most widely used systems are those of Watanabe (1969), Klingele (2004), Good et al. (2007), and Ahn (2009).[7] The latter is a findings-based classification.[8]

Treatment is determined by symptoms and meniscal characteristics. Conservative management is reserved for asymptomatic patients or those with mild symptoms. Surgery is indicated when there are disabling symptoms, functional limitation, locking, and signs of instability. Surgical options include saucerization for stable lesions (partial resection leaving a minimum meniscal remnant of 6-8 mm),[9] partial meniscectomy for extensive tears or significant degeneration, or meniscal repair if associated tears are present.[6]

The prognosis is favorable, with pain relief and functional improvement; however, degenerative joint deterioration cannot be predicted, so tissue preservation is the most important protective factor during treatment.[9]

The aim of this report is to describe the clinical, radiological, and arthroscopic findings in a patient with a DMM, an extremely rare condition for which current management evidence is limited.

CLINICAL CASE

A 14-year-old male, with asthma and active in sports, presented to the Emergency Department with a two-week history of left knee pain sustained during soccer training. He had persistent pain associated with limping and intermittent locking. After initial evaluation and radiographs (Figure 1), outpatient management was chosen under the suspicion of a sprain. Symptoms decreased slightly, and locking ceased.

He was referred to an orthopedic subspecialist. Physical examination revealed tenderness on palpation of the medial joint line, painful flexion-extension with full range of motion (0-130°), and a positive medial McMurray test; the remainder of the exam was normal. Given these findings, an MRI of the left knee was requested (Figure 2). Imaging showed an enlarged medial meniscus (incomplete) without displacement, with intrameniscal degeneration.

Conservative management was indicated: rest from sports, nonsteroidal anti-inflammatory drugs, and physical therapy (20 sessions). At the end of treatment, the patient still reported pain and had functional limitations preventing competitive sports, so surgery was indicated.

Knee arthroscopy was performed through two portals (anterolateral and anteromedial). An incomplete, stable DMM was confirmed, covering approximately 80% of the medial tibial plateau; no associated lesions were detected (Figure 3). Using a shaver and arthroscopic forceps, saucerization of the central segment was performed, leaving an 8-mm circumferential, stable meniscal remnant. The portals were closed, and the procedure concluded uneventfully.

The patient was discharged with the knee immobilized in full extension for 2 weeks and a range-of-motion progression of 30° every 2 weeks to complete 8 weeks, along with physical therapy.

At subsequent follow-ups, significant improvement was noted, and he was cleared to return to sports 4 months after surgery, with annual follow-up thereafter.

Figure 1. Comparative anteroposterior and lateral knee radiographs. No signs suggestive of a meniscal defect are observed.

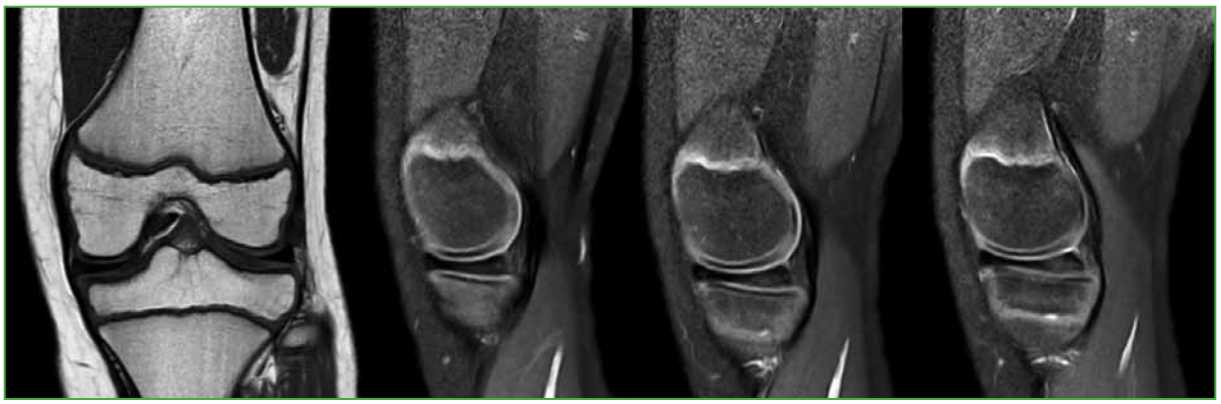

Figure 2. MRI of the left knee (T1 and DP sequences). Subtle meniscal thickening in the medial compartment with intrasubstance degeneration; no tears or other associated lesions.

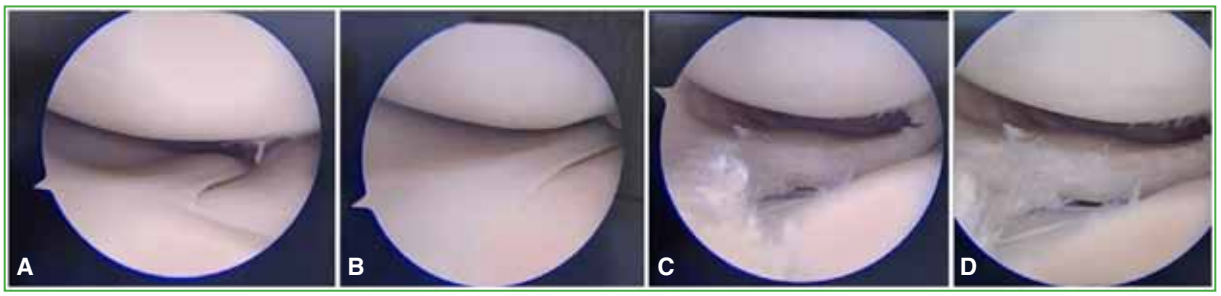

Figure 3. Diagnostic and therapeutic arthroscopy of the left knee. **A, B**: Medial discoid meniscus with partial involvement of the tibial plateau; no associated lesions. **C, D**: Disorganized fibers and saucerization of the medial discoid meniscus with a stable 8-mm remnant.

DISCUSSION

DMM is an extremely rare congenital anomaly. Its uniqueness stems not only from its low incidence but also from the biomechanical complexity of the medial compartment. Currently, there is no clear consensus on management, and evidence from lateral DM often must be extrapolated. However, important differences make management of medial lesions debatable.

In a study by Kim et al., saucerization of symptomatic DMM effectively relieved pain and improved joint function; however, there was a significant risk of progression to joint degeneration due to resection of meniscal tissue in a weight-bearing zone such as the medial compartment.[8] Similarly, Lee et al. reported favorable short-term functional outcomes with saucerization but cautioned about the risk of long-term complications, including osteoarthritis.[9] In a comparative study by Yamasaki et al., patients who underwent more extensive resections of DMM progressed more rapidly to osteoarthritis than those treated for lateral DM, underscoring the importance of minimizing resection in these cases.[10]

These authors emphasize that meniscal preservation is essential, given the constant exposure of the medial compartment to the load axis, which makes it more susceptible to long-term degenerative changes. Nonetheless, these are observational studies with limited statistical strength and do not yet provide valid recommendations for a definitive cutoff for the meniscal remnant.

Despite limited evidence, prior patient expectations and function must be considered. In the present case, given a stable DMM without associated lesions, conservative treatment was initially offered; however, due to persistent symptoms and functional loss (previous competitive activity), surgery was performed while preserving as much meniscal tissue as possible. Short-term results were favorable, and the patient fully resumed activities. Continuous follow-up is essential to detect potential long-term complications.

CONCLUSIONS

Management of DMM remains an area of uncertainty and debate in orthopedics. The rarity of this condition, coupled with the inherent risks of treating a key structure within a load-bearing compartment, demands careful consideration of therapeutic options. As more case reports are published and appropriate follow-up is carried out, evidence will emerge to guide safe treatment. Until then, management should prioritize preservation of as much meniscal tissue as possible.

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H. Vasquez Diaz ORCID ID: https://orcid.org/0000-0003-4851-6738
D. Toledo ORCID ID: https://orcid.org/0009-0000-8621-1690
P. Valdecantos ORCID ID: https://orcid.org/0009-0008-9159-4903

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Surgery in the Age of Artificial Intelligence: The Art That Only Human Hands Can Learn

Gabriel Vindver,[*] Carlos M. Lucero[**]

[*]*Orthopedics and Traumatology Service, Hospital Sirio Libanés, Autonomous City of Buenos Aires, Argentina*

[**]*Orthopedics and Traumatology Service, Hospital Italiano de Buenos Aires, Autonomous City of Buenos Aires, Argentina*

ABSTRACT

In the age of artificial intelligence, orthopedic surgery faces the challenge of integrating technology without losing its human essence. This article reflects on the importance of practice, manual dexterity, and continuous surgical training as irreplaceable pillars of our specialty. Based on the experience of courses and workshops organized by ACARO and AAOT, it emphasizes that the surgeon's precision and judgment remain the true driving forces of the surgical act.

Keywords: Artificial intelligence; surgical dexterity; continuing medical education.

Level of Evidence: V

La destreza quirúrgica en tiempos de la inteligencia artificial: el arte que la inteligencia artificial no puede aprender

RESUMEN

En la era de la inteligencia artificial, la cirugía ortopédica enfrenta el desafío de integrar la tecnología sin perder su esencia humana. Este artículo reflexiona sobre la importancia de la práctica, la destreza manual y la formación quirúrgica continua como pilares insustituibles de nuestra especialidad. A partir de la experiencia de cursos y talleres organizados por la ACARO y la AAOT, se destaca que la precisión y la decisión del cirujano siguen siendo el verdadero motor del acto quirúrgico.

Palabras clave: Inteligencia artificial; destreza quirúrgica; formación médica continua.

Nivel de Evidencia: V

In recent years, we have heard more and more about artificial intelligence, algorithms, and digital tools that promise to transform medicine. Orthopedics is no exception: prosthesis planning, image analysis, outcome prediction, all of these are useful and hold tremendous potential. Yet, amid the enthusiasm, it is important not to lose sight of something simple: no patient recovers their life through an algorithm. Surgery is resolved in the operating room, through the surgeon's practice, experience, and ongoing training.

In 2025, this was evident in every hands-on course organized by ACARO and AAOT: stations with instruments, bone models, prostheses, and colleagues sharing techniques and experience. The same occurred at the Congress, where hundreds of surgeons donned gloves, practiced maneuvers, fine-tuned details, and confirmed once again that orthopedics is transmitted live, from mentor to apprentice, from colleague to colleague (Figures 1-4). No screen or software can replace that experience.

Received on October 7th, 2025. Accepted after evaluation on October 7th, 2025 • Dr. CARLOS M. LUCERO • lucero.raaot@gmail.com https://orcid.org/0000-0002-0833-7818

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Figure 1. AAOT Surgical Skills Teaching Coordination Committee.

Figure 2. Practical course on knee arthroplasty. Participants performing ligament alignment and balance exercises on an anatomical model – ACARO 2025.

Figure 3. Advanced University Course in Hip and Knee Surgery – ACARO and Maimónides University. Advanced training for surgeons in surgical technique.

Figure 4. Teaching team of the Advanced University Course in Hip and Knee Surgery – ACARO and Maimónides University 2025.

Artificial intelligence can enhance our diagnostic accuracy or assist in planning an osteotomy, but it will never feel the resistance of a ligament, the balance of a knee prosthesis, or the satisfaction of watching a patient walk again. That kind of learning comes only through practice, trial and error, courses, and real surgical training. And therein lies the true strength of our community: we never stop training, sharing, and teaching.

For this reason, we believe the message for this issue is clear: let us celebrate technological progress, adopt what is useful, but never forget that the heart of orthopedics remains in our hands. Let us keep practicing, learning, and defending those spaces of practical teaching, because that is where the future of our specialty is truly built.

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G. Vindver ORCID ID: https://orcid.org/0000-0003-3858-6687