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Application for Indexation in PubMed

Dr. Ernesto Bersusky
RAAOT Editor

To the users of our journal—readers, authors, and reviewers—we would like to share some thoughts on the important transformation our journal (RAAOT) has undergone over the past 10 years. This transformation has been significant, as evidenced by the recognition we have achieved through various indexations: **SciELO, Latindex, Dialnet, DOAJ, REDIB, AmeliCA, JournalTOCs, and EBSCO**. RAAOT is also part of the Basic Nucleus of Scientific Journals of CAICYT-CONICET. Additionally, it is included in the catalogs of **Sheffield Hallam University - Library Gateway, WorldCat, Sudoc, Latindex, Harvard Library, Internet Archive, Zeitschriften Datenbank, OpenAlex, LOCKSS Repositories, BASE (Bielefeld Academic Search Engine), Wikidata, ROAD, and Google Scholar.**

This means that, immediately after publication, articles are available for consultation, ensuring wide dissemination. This is confirmed by the metrics presented with each article, offering authors the assurance that their work reaches a broad audience.

Given the editorial and scientific standards we have reached, we consulted CAICYT to determine whether we were in a position to apply for indexation in PubMed. After several inquiries, CAICYT confirmed that RAAOT met the necessary requirements, and we proceeded to submit the application.

Unfortunately, our journal was not accepted for indexing in PubMed. However, this was not a definitive rejection; we were informed that the journal will be re-evaluated in two years. The stated reason for the rejection was vague, citing "poor scientific and editorial quality."

We are aware that Latin American, institutional, and open access journals are often subject to more rigorous scrutiny. When accepted, it is usually only after several rounds of submission. The *National Library of Medicine* explicitly states that non-U.S. journals—especially those that are regional or institutional—will be evaluated more selectively. In contrast, journals from major international publishers benefit from substantial resources, specialized staff dedicated to managing indexation applications, larger budgets, and a higher volume of submissions. Authors often prefer these publishers due to the visibility they offer.

As editors—and also as readers and authors who have published in PubMed-indexed journals—we believe that the scientific quality of our published articles is not inferior to that of already indexed journals.

In light of this situation, we will continue to work with the guidance of CAICYT-CONICET, which includes us in the Basic Nucleus of Scientific Publications (NBPC). It is worth noting that our journal is one of 52 medical and health sciences journals included in the NBPC.

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CAICYT has sent us a report suggesting only minor changes to the journal's general description and certain specific items. As communication standards evolve and new tools emerge in our field, any that affect editorial flow or quality must be reflected in our portal and editorial policies. For example, the rise of Artificial Intelligence prompted us early on to establish clear guidelines for its use, which were added to our Publication Regulations. Addressing this required careful consideration and decision-making. Each change in the portal is not a simple task, as it involves a series of technical processes within platforms like OJS, which present their own complexities.

We have shared our disappointment with editors of other journals. Their words of encouragement were: "No journal is indexed in PubMed on the first application."

We now have two years before we can apply again. In the meantime, we reaffirm our commitment to continue working—more diligently than ever—toward achieving our goal, with the unwavering support of our authors and reviewers.

Tibiotalocalcaneal Arthrodesis with Retrograde Intramedullary Nail in Patients with Charcot Neuroarthropathy of the Ankle and Hindfoot

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ABSTRACT

Introduction: Tibiotalocalcaneal (TTC) arthrodesis is the treatment of choice for the surgical management of Charcot neuroarthropathy (CN) affecting the ankle. The primary goal is to avoid major amputation and restore a functional lower limb suitable for ambulation, thereby improving patients' quality of life. **Objective:** To describe the clinical and radiological characteristics and evolution of patients with diabetes mellitus and Charcot neuroarthropathy who underwent TTC arthrodesis using a straight retrograde intramedullary compression nail. **Materials and Methods:** This retrospective case series included consecutive patients with CN of the ankle and hindfoot and diabetes mellitus who underwent TTC arthrodesis with a retrograde intramedullary nail. Radiographic union, complications, reoperations, limb salvage, and preoperative metabolic parameters (serum albumin and HbA1c) were evaluated. **Results:** Eight patients were included, with a median follow-up of 58 months (IQR 40.75–75.5). The median preoperative HbA1c was 6.6% (IQR 5.7–7), and the median serum albumin level was 3.41 g/dL (IQR 3.05–3.71). Three patients required revision surgery. Radiographic union was achieved in seven patients; two developed stable fibrous union, and one patient remains under follow-up. No patient required amputation. **Conclusions:** TTC arthrodesis with a retrograde intramedullary nail is a viable surgical option for diabetic patients with Charcot neuroarthropathy involving the ankle. Optimizing preoperative metabolic status and comorbidities, along with appropriate management of osteomyelitis, is essential to reduce complications and promote bone healing.

Keywords: Charcot neuroarthropathy; ankle; hindfoot; diabetes mellitus; tibiotalocalcaneal arthrodesis; retrograde intramedullary nail.

Level of Evidence: IV

Artrodesis tibio-talo-calcánea con clavo endomedular retrógrado en pacientes con neuro-osteoartropatía de Charcot de tobillo y retropié

RESUMEN

Introducción: La artrodesis tibio-talo-calcánea es el tratamiento de elección para la corrección quirúrgica de la neuro-osteoartropatía de Charcot que compromete el tobillo. El objetivo es evitar la amputación mayor y lograr un miembro inferior apto para la deambulación y así mejorar la calidad de vida. **Objetivo:** Describir las características y la evolución clínica y radiológica de los pacientes con diabetes mellitus y neuro-osteoartropatía de Charcot que se sometieron a una artrodesis tibio-talo-calcánea con un clavo endomedular retrógrado recto con compresión. **Materiales y Métodos:** Serie de casos retrospectiva de pacientes consecutivos con neuro-osteoartropatía de Charcot del tobillo y retropié, y diabetes, sometidos a una artrodesis tibio-talo-calcánea con un clavo endomedular retrógrado. Se evaluaron la consolidación radiológica, las complicaciones y reoperaciones, el salvataje del miembro y los parámetros metabólicos preoperatorios (albúmina sérica y HbA1c). **Resultados:** Se incluyó a 8 pacientes con un seguimiento de 58 meses (RIC 40.75-75.5). La HbA1c preoperatoria fue del 6,6% (RIC 5,7-7) y la albúmina, de 3,41 g/dl (RIC 3,05-3,71). Tres requirieron una cirugía de revisión. En 7 pacientes, se observó la consolidación, dos de ellos desarrollaron una consolidación fibrosa estable y uno continúa en seguimiento. Ninguno requirió una amputación. **Conclusiones:** La artrodesis tibio-talo-calcánea con clavo endomedular retrógrado es una opción válida en pacientes con diabetes y neuro-osteoartropatía de Charcot que compromete el tobillo. La optimización de los parámetros metabólicos preoperatorios y las comorbilidades, y el tratamiento de la osteomielitis son necesarios para disminuir las complicaciones y favorecer la consolidación.

Palabras clave: Neuro-osteoartropatía de Charcot; retropié; tobillo; diabetes mellitus; artrodesis tibio-talo-calcánea; clavo endomedular retrógrado.

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INTRODUCTION

Charcot neuroarthropathy (CN) is a rare but serious and debilitating complication of diabetes mellitus (DM), typically occurring in patients with peripheral neuropathy. It is a progressive, non-infectious inflammatory process that predominantly affects the foot and ankle. CN affects approximately 0.1% to 5% of individuals with DM and may present bilaterally in 5.9% to 39.3% of cases.[1]

The midfoot is the most commonly affected site, followed by the hindfoot (34%). Involvement of the ankle is less frequent (11%), but it is often associated with joint instability and progressive deformity, which frequently lead to ulceration.[2] The primary treatment during the acute phase of CN consists of immobilization and offloading. For cases involving the ankle and hindfoot, conservative management may require prolonged immobilization until the disease becomes inactive; however, residual instability often persists.[3,4] Misalignment, bony prominences, and protrusion of the malleoli can interfere with footwear and support surfaces, increasing the risk of ulceration, osteomyelitis, and eventual amputation.[5]

Tibiotalocalcaneal (TTC) arthrodesis is the preferred surgical treatment for correcting Charcot neuroarthropathy of the ankle. Several internal and external fixation techniques have been described.[2,6] The objectives of surgical reconstruction in these patients include preventing major amputation (i.e., amputation proximal to the ankle), achieving a functional, weight-bearing limb suitable for ambulation and proper footwear, preventing ulceration and infection, and ultimately improving quality of life.[2,3]

The aim of this study was to describe the clinical and radiological characteristics and postoperative outcomes of patients with DM and Charcot arthropathy of the hindfoot and ankle who underwent TTC arthrodesis using a straight retrograde intramedullary nail with compression.

MATERIALS AND METHODS

A retrospective case series was conducted, including patients with diabetes mellitus (DM) and Charcot neuroarthropathy (CN) of the ankle and hindfoot who underwent tibiotalocalcaneal (TTC) arthrodesis with a straight retrograde intramedullary nail with compression, between January 2011 and December 2021.

This study was approved by the institution's Ethics Committee and complies with the principles of the Declaration of Helsinki and Good Clinical Practice guidelines. Data confidentiality was maintained in accordance with Argentine Personal Data Protection Law No. 25,326.

Inclusion criteria were: patients over 18 years of age, with a diagnosis of DM and unstable hindfoot and ankle CN (types 2, 3a, and 4 according to the Brodsky-Trepman classification), and a minimum postoperative follow-up of 2 years. Exclusion criteria included incomplete medical records and TTC arthrodesis performed for acute traumatic fractures.

Preoperative evaluation included anteroposterior and lateral foot and ankle radiographs, as well as computed tomography (CT) scans. Demographic characteristics and data related to DM diagnosis were recorded. All patients were assessed preoperatively by an interdisciplinary team to optimize metabolic and clinical conditions. Peripheral neuropathy was assessed using the Semmes-Weinstein monofilament test. Vascular status was evaluated via arterial Doppler ultrasound with measurement of the ankle-brachial index, complemented by a clinical examination by the Cardiovascular Surgery team.

Preoperative laboratory parameters included serum albumin levels (as a nutritional marker) and glycated hemoglobin (HbA1c) levels (as a metabolic control marker).

To determine the disease stage at the time of surgery, the Eichenholtz and Shibata classifications were used. Resolution of the acute resorptive phase was defined clinically by the absence of local signs of inflammation, such as erythema and elevated skin temperature compared to the contralateral foot and ankle.[7] The anatomical location of CN was classified according to the Brodsky-Trepman system.[8]

Additionally, the use of structural bone grafts or bioactive crystals during the procedure was recorded.

Postoperative systemic and local complications were evaluated. Local complications were categorized as infectious and non-infectious. A superficial infection was defined as one managed with local wound care and oral antibiotics, without hospitalization. A deep infection required hospitalization, intravenous antibiotics, and surgical debridement. Non-infectious complications included nonunion, symptomatic hardware removal, and periprosthetic fractures.[9] Re-ulceration events were also documented.

Radiological healing was considered to be the continuity of the bony fabric through the arthrodesis foci in the anteroposterior and laterolateral views, or in the computed tomography in the three planes of at least 50% of the

fusion surface.[9] Nonunion was defined as failure to achieve fusion at the 12-month follow-up or the presence of catastrophic implant failure.[9] Fibrous union[10] was considered when there was no radiographic healing but no clinical or radiological signs of instability, and no revision surgery was required at the end of follow-up.

Surgical Technique

The procedure was performed under regional anesthetic block combined with general anesthesia. Patients were positioned in lateral decubitus, and a thigh tourniquet was applied. A lateral approach to the ankle and hindfoot was used. The distal fibula (5–10 cm) was resected, and debridement was carried out to remove fibrous tissue, articular debris, and loose fragments. The remaining tibiotalar and subtalar joint surfaces were prepared for fusion. Proper alignment of the tibia, talus, and calcaneus was ensured to maximize bony contact and achieve a plantigrade foot. In cases with significant bone defects, bone bank grafts (femoral head) or bioactive crystals were used. If the resected fibula presented good bone quality and additional bone was needed at the fusion site, it was ground and added as graft material. The target foot position was 0° dorsiflexion, 5° valgus, and 5–10° external rotation.

The patient was then repositioned to dorsal decubitus. A plantar incision was made for insertion of a guide pin, and its correct position was verified in all planes. The intramedullary canal was prepared with progressively larger drills. A straight retrograde intramedullary nail (Panta®, Integra LifeSciences, Plainsboro, NJ, USA) was inserted, and two distal locking screws were placed in the calcaneus. Compression was applied at the arthrodesis sites, followed by the placement of two proximal locking screws. A cast boot was then applied.

Postoperatively, antibiotic prophylaxis, analgesia, and thromboprophylaxis were administered. Patients were typically discharged 48 hours after surgery.

One week postoperatively, the initial cast was removed, surgical wounds were evaluated and dressed, and a new non-weight-bearing cast boot was applied. At 45 days postoperatively, the cast was replaced by a removable Charcot Restraint Orthotic Walker (CROW) boot, if available, and the patient remained non-weight-bearing. Immobilization and offloading durations were individualized, often prolonged due to the nature of the disease. Approximately 8 weeks after surgery, if clinical and radiological progress was favorable, patients began partial weight-bearing using a progressive boot. Full weight-bearing in custom-made footwear with orthotic support was allowed upon confirmation of bone healing. Patients unable to perform partial weight-bearing continued with complete offloading until clinical and radiological signs of healing were observed. In cases of intolerance to weight-bearing, progression was postponed. Follow-up assessments were conducted at 1 and 4 weeks postoperatively, and then monthly. At each visit, anteroposterior and lateral radiographs were obtained until healing was confirmed. If radiographs were insufficient, CT imaging was used. Once healing was confirmed, weight-bearing anteroposterior, lateral, and panoramic radiographs of the lower limbs were obtained.

Postoperative evaluation and follow-up were performed by an interdisciplinary team.

Statistical Analysis

Categorical variables are presented as absolute frequencies and percentages. Continuous variables with a normal distribution are expressed as mean and standard deviation, while those not meeting normality assumptions are reported as median and interquartile range (IQR). Statistical analyses were performed using Stata 17® Version 2021 (StataCorp LLC).

RESULTS

Eight patients (five men) were included in the study. The median age was 52.5 years (IQR 25-75%: 50–56), and the median duration from diabetes mellitus (DM) diagnosis to surgical intervention was 25.5 years (IQR 25-75%: 18.75–30). The median follow-up period was 58 months (IQR 25-75%: 40.75–75.5). Six patients had a history of foot ulcers at the arthrodesis site, all of which had healed by the time of surgery. None had a diagnosis of osteomyelitis at the time of the procedure. Six procedures required bone bank grafts, and one utilized bioactive crystals. The median preoperative HbA1c was 6.6% (IQR 25-75%: 5.7–7), and the median preoperative serum albumin was 3.41 g/dL (IQR 25-75%: 3.05–3.71). No patients presented with significant vasculopathy prior to surgery. According to the Eichenholtz classification, seven of the eight patients underwent surgery during stage III and one during stage II. Additional demographic characteristics are provided in Table 1.

Table 1. Demographic data.

	n = 8
Age, years, median (IQR)	52.5 (50-60)
Male sex, n (%)	5 (62.5)
Kidney failure, n (%)	1 (12.5)
Dialysis, n (%)	0 (0)
Kidney transplant, n (%)	1 (12.5)
Pancreas transplant, n (%)	1 (12.5)
Insulin-dependent, n (%)	3 (37.5)
Peripheral neuropathy, n (%)	8 (100)
Cardiopathy, n (%)	2 (25)
Retinopathy, n (%)	3 (37.5)
Obesity, n (%)	5 (62.5)
Smoking, n (%)	1 (12.5)
Dyslipidemia, n (%)	5 (62.5)
Hypothyroidism, n (%)	1 (12.5)
Previous amputation, n (%)	1 (12.5)
Time since diagnosis of diabetes, years, median (IQR)	25.5 (18.75-30)
Pre-operative glycated hemoglobin, median (IQR), %	6.6 (5.7-7)
Pre-surgical albumin, median (IQR), g/dl	3.41 (3.05-3.71)

IQR = interquartile range.

Three patients required revision arthrodesis: one due to implant failure following a fall and two due to nonunion (Figures 1 and 2). Revision procedures involved implant removal, debridement of the arthrodesis site, and re-arthrodesis using a new nail. All revision surgeries were preceded by optimization of metabolic parameters and comorbidities.

At the end of follow-up, seven patients had achieved stable healing of the TTC arthrodesis (Figures 3 and 4). Two developed fibrous healing, which allowed ambulation with orthotic support. One patient required a delayed revision and remains under follow-up. The median time to radiographic healing was 8.6 months (IQR 25-75%: 4.7–8.6).

Figure 1. Preoperative anteroposterior (**A**) and lateral (**B**) radiographs of the foot and ankle showing Charcot neuroarthropathy of the ankle.

Figure 2. Postoperative radiographs of the foot and ankle. **A.** Anteroposterior view showing nonunion with implant failure. **B.** Lateral view showing nonunion with implant failure. **C.** Anteroposterior view following revision arthrodesis showing signs of healing. **D.** Lateral view following revision arthrodesis showing signs of healing.

Figure 3. Preoperative anteroposterior (**A**) and lateral (**B**) radiographs of the foot and ankle. Marked bone destruction is observed, particularly involving the talus (hindfoot).

Figure 4. Anteroposterior (**A**) and lateral (**B**) radiographs of the foot and ankle taken four years postoperatively. Bone healing is evident, with breakage of the distal locking screw during the healing process.

Complications are detailed in Table 2. Six patients experienced some form of complication requiring additional surgical intervention: three required re-arthrodesis, four underwent surgical debridement, and three required implant removal. In cases of deep infection, the implant was removed and targeted antibiotic therapy was administered according to sensitivity testing. All such patients showed favorable clinical and radiographic evolution of inflammatory parameters, and no recurrences were recorded. No patient required limb amputation during the follow-up period.

Table 2. Complications

Superficial infection	2
Deep infection	3
Rupture of the osteosynthesis material	1
Reulceration	2
Nonunion	2

DISCUSSION

This is the first published series in our country of patients diagnosed with diabetes mellitus (DM) and neuroarthropathy (CN) undergoing tibiotalocalcaneal (TTC) arthrodesis using a compressive retrograde intramedullary nail (Brodsky-Trepman types 2 and 3).

Patients with DM typically present with comorbidities and target organ damage, placing them at higher risk for postoperative complications and impaired bone healing. In our series, both preoperative and postoperative follow-up were conducted in an interdisciplinary manner; however, several postoperative complications and secondary surgeries were recorded. Nevertheless, by the end of follow-up, outcomes were satisfactory: 7 of 8 patients achieved stable healing and a plantigrade foot, and none required amputation.

Several studies have reported on patients with DM and CN treated with TTC arthrodesis using retrograde intramedullary nails. Limb salvage rates range between 77.8% and 100%[5,11-13] with average healing times of up to 12 months in this population.[14] Delayed union or nonunion occurs in approximately 22% of TTC arthrodeses, particularly in high-risk patients.[12,14] Additionally, rates of stable nonunion or fibrous union allowing ambulation—considered satisfactory outcomes—range from 4.4% to 22.2%.[3,5,11,12] In our study, primary radiographic healing was achieved in 3 patients, while 3 others required revision arthrodesis (1 due to a fall and 2 due to nonunion). At the end of follow-up, 7 patients had stable healing (5 with complete union and 2 with fibrous union allowing ambulation with bracing). One patient remains under follow-up. All limbs were salvaged.

Although 6 of the 8 patients experienced postoperative complications, all recovered favorably following appropriate treatment. Multiple studies have demonstrated higher complication rates in patients with DM undergoing ankle or hindfoot arthrodesis.[4,7,15] Patients with complicated DM are ten times more likely to develop surgical site infections compared to those without DM, and six times more likely than patients with uncomplicated DM.[16] DM, peripheral neuropathy, peripheral vascular disease, HbA1c >7%, and tobacco use are associated with increased postoperative infection rates. Similarly, DM, preoperative blood glucose >200 mg/dL, smoking, and solid organ transplantation are associated with a higher risk of non-infectious complications.[15] In one series, all patients who developed complications had preexisting ulcers of more than 6 months' duration.[12] In our series, the two patients without a history of ulceration experienced postoperative complications, while two patients with prior ulcers did not, suggesting that larger series are needed for statistically significant conclusions. For patients with a history of ulceration or infection, active infection should be ruled out prior to reconstructive surgery.[4]

Richman et al. reported 11 revision surgeries in 14 patients with CN treated with intramedullary nailing.[17] Caravaggi et al. documented 14 reoperations among 45 patients, including major amputations.[11] Regauer et al., in their series of midfoot and hindfoot CN reconstructions, reported a complication rate of 89% and a revision surgery rate of 46%.[18] In our study, 3 revision arthrodeses, 4 surgical debridements, and 3 implant removals were performed during follow-up; nevertheless, as in other similar series, limb salvage rates remained high at final follow-up.[11,17]

Individualized treatment selection and preoperative optimization of metabolic parameters and comorbidities are essential to minimizing the risk of complications.[19]

Major amputation rates of up to 20% have been reported following TTC arthrodesis with retrograde intramedullary nailing.[12,13] DM has been identified as a risk factor for amputation,[13] and uncontrolled DM as a predictor of TTC arthrodesis failure.[20] Preoperative assessment, inpatient management, and follow-up should all be conducted by an interdisciplinary team. Surgical indications should be individualized based on metabolic status, comorbidities, vascular health, and bone stock, in order to determine the feasibility of reconstruction and fixation method. Patients should be fully informed regarding surgical risks, recovery timelines, and the need for offloading strategies in the postoperative period.

Long-term glycemic control appears to be a modifiable risk factor for reducing postoperative complications. Although the relationship between HbA1c levels and bone healing remains inconclusive, values >7% have been associated with impaired bone healing.[21] Additionally, perioperative HbA1c >7.5% has been identified as a significant risk factor for surgical site infections.[22] Although our case series is too small for statistically significant conclusions, we consider HbA1c an important factor in preoperative planning and recommend individualized, interdisciplinary assessment. The median preoperative HbA1c in our series was 6.6% (range: 5.7–7). One of the three patients who progressed to nonunion had a preoperative HbA1c >8%. Following metabolic optimization, this patient's HbA1c decreased to 6.9% prior to revision surgery, after which healing was achieved without further complications.

Some authors have used serum albumin as a marker of nutritional status in orthopedic patients. Albumin levels <3.5 g/dL have been associated with increased postoperative complications,[23] and levels <2.5 g/dL with a higher risk of wound complications in patients with DM.[24] The median preoperative albumin level in our series was 3.41 g/dL. Notably, 2 of the 3 patients requiring revision arthrodesis had albumin levels <3.5 g/dL. The evidence remains inconclusive and is largely based on retrospective studies. Further research is warranted to assess nutritional status as a potential factor influencing postoperative outcomes in patients with DM undergoing foot and ankle surgery.

Traditionally, surgical reconstruction in CN was deferred until the inactive phase—characterized by resolution of soft tissue edema, temperature normalization, and cessation of bone destruction—to reduce postoperative complications. However, this paradigm is being reexamined. Wukich et al. suggest that delaying surgery until severe deformities or bone loss occur may not be necessary; instead, they advocate treating active CN similarly to intra-articular fractures or dislocations in selected patients.[25] This strategy is viable when supported by interdisciplinary care that enables better metabolic and comorbidity control, reduces complications and reinterventions, improves healing rates and timelines, shortens recovery, and enhances quality of life—ultimately lowering the socioeconomic burden of CN treatment.

A limitation of our study is its retrospective design and small sample size. Nevertheless, one strength is the inclusion of consecutive cases managed by the same interdisciplinary team at a single institution, with outcomes comparable to those in international series. Moreover, given the limited regional literature on this topic, understanding the characteristics and outcomes of our patient population is essential for improving treatment strategies. Another strength is the incorporation of serum albumin measurement as a preoperative nutritional assessment parameter.

CONCLUSIONS

Tibiotalocalcaneal (TTC) arthrodesis using a retrograde intramedullary nail with compression is a viable surgical option for limb salvage in patients with DM and CN of the ankle and hindfoot who are at risk for major amputation.

This patient population is characterized by a high incidence of complications, reoperations, and delayed or difficult healing, often resulting in a prolonged postoperative course requiring continuous monitoring and care. Nevertheless, the long-term limb salvage rate remains high. Optimization of metabolic parameters and comorbidities—both preoperatively and throughout follow-up—may help reduce complication rates. Additionally, it is critical to rule out osteomyelitis in patients with a history of ulceration.

Comparative, multicenter studies with larger patient cohorts are needed to obtain statistically significant results.

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

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Arthroscopic Treatment of Large and Massive Osteochondral Lesions of the Talus: A Prospective Cohort Study

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ABSTRACT

Introduction: The treatment of talar osteochondral lesions remains challenging, particularly in cases of large or massive defects, due to the limited intrinsic capacity of articular hyaline cartilage for repair or regeneration. **Objective:** To evaluate clinical outcomes and physical activity levels two years after surgery in patients with large or massive talar osteochondral lesions treated arthroscopically with debridement and microfracture of the subchondral bone. **Materials and Methods:** A short-term prospective descriptive cohort study was conducted, including 14 symptomatic patients with large or massive osteochondral lesions of the talus. All patients underwent anterior ankle arthroscopy involving debridement of devitalized cartilage and microfracture of the subchondral bone. At the two-year follow-up, clinical outcomes were assessed using the Foot and Ankle Ability Measure (FAAM), patient satisfaction, and the ability to perform physical activity. **Results:** The mean FAAM score for activities of daily living was 89% (range: 50–100%), and for sports activities, 78.8% (range: 43.7–100%). Thirteen patients reported being satisfied with the surgical outcome. No statistically significant association was found between FAAM scores and lesion size, volume, or location within the talus. **Conclusions:** Arthroscopic treatment of large and massive talar osteochondral lesions using debridement and microfracture of the subchondral bone yields high patient satisfaction and favorable clinical outcomes, with low complication rates at two years postoperatively.

Keywords: Osteochondral lesion; talus; debridement; microfracture; arthroscopy.
Level of Evidence: II

Tratamiento artroscópico de lesiones osteocondrales grandes y masivas del astrágalo. Estudio prospectivo de cohortes

RESUMEN

Introducción: El tratamiento de las lesiones osteocondrales astragalinas representa un desafío, especialmente el de las lesiones grandes y masivas, a causa de la pobre capacidad intrínseca de reparación o regeneración del cartílago hialino articular. **Objetivo:** Evaluar los resultados clínicos y la capacidad de realizar actividad física a los 2 años de la cirugía en pacientes con lesiones osteocondrales astragalinas grandes y masivas sometidos a un desbridamiento y microperforaciones del hueso subcondral por vía artroscópica. **Materiales y Métodos:** Se realizó un estudio descriptivo prospectivo de cohortes a corto plazo, que incluyó a 14 pacientes sintomáticos con lesiones osteocondrales astragalinas grandes o masivas sometidos a una artroscopia anterior de tobillo para realizar un desbridamiento del cartílago desvitalizado y microperforación del hueso subcondral. A los 2 años, se determinaron la evolución clínica mediante el FAAM, la satisfacción del paciente y la capacidad de realizar actividad física. **Resultados:** La media del FAAM fue del 89% para las actividades de la vida diaria y del 78,8% para la actividad deportiva. Los 13 pacientes refirieron estar satisfechos con el resultado de la cirugía. No se encontró una asociación estadísticamente significativa entre los resultados del FAAM y el área, el volumen y la localización de las lesiones en el astrágalo. **Conclusiones:** El tratamiento artroscópico de las lesiones osteocondrales astragalinas grandes y masivas mediante el desbridamiento del cartílago desvitalizado y las microperforaciones logra una elevada satisfacción y buenos resultados clínicos, con bajas complicaciones a los 2 años de la cirugía.

Palabras clave: Lesión osteocondral; astrágalo; desbridamiento; microperforaciones; artroscopia.
Nivel de Evidencia: II

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INTRODUCTION

Osteochondral lesions (OCLs) are defined as articular cartilage defects involving the underlying subchondral bone. They may be caused by multiple factors, including embolisms, defects in ossification, endocrine disorders, genetic predisposition, avascular necrosis, and others; however, trauma—either repetitive microtrauma or acute indirect trauma to the ankle—is currently the most widely accepted etiology.

Kappis first described OCLs in 1922,[1] and Berndt and Harty classified them in 1959.[2] In 2001, Scranton and McDermott[3] added a stage to the Berndt and Harty classification (stage 4), characterized by a large cyst beneath the articular surface.

OCLs can also be classified by size as small, large, or massive.

Chuckpaiwong et al.[4] proposed a cutoff of 15 mm in diameter based on lesion evolution after debridement and microfracture. Accordingly, lesions <15 mm in diameter are classified as small, and those >15 mm as large. A category for massive OCLs is reserved for lesions >3000 mm³, as defined by Raikin. Raikin[5] proposed that these massive OCLs >3000 mm³ be designated stage 6 of the Berndt and Harty classification. In a 2016 systematic review, Ramponi et al. lowered the cutoff from 15 mm to 10 mm.

Regarding OCL localization, Raikin et al.[6] divided the talar dome into 9 zones or "grids" to facilitate therapeutic analysis and to identify behavioral patterns of these lesions (Figure 1).

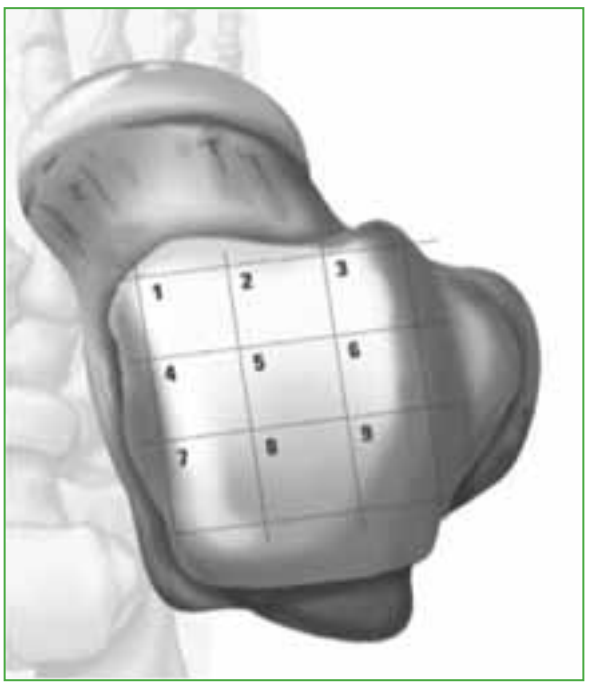

Figure 1. Raikin grid (division of the talar dome into 9 zones).

Treatment of OCLs remains a challenge due to the poor intrinsic capacity of articular hyaline cartilage to repair or regenerate. Several factors hinder repair, including the tissue's hypocellularity and the fact that chondrocytes are "imprisoned" in an extracellular matrix.[7] According to Brittberg and Winalski,[8] following articular cartilage injury, chondrocytes initiate a reparative response marked by cellular proliferation and increased proteoglycan synthesis. The repair obtained stimulates type I collagen, which produces fibrocartilage. This is important to mention because fibrocartilage does not have the same biomechanical properties as hyaline cartilage and, therefore, increases friction and induces greater wear.

In general, treatment selection depends on local factors (lesion location, size, and chronicity) as well as systemic factors (patient age, activity level, comorbidities, and hindfoot alignment).

Although conservative treatment is initially attempted with some success, approximately 50% of skeletally mature individuals remain symptomatic, at which point surgical intervention is considered.

Surgical treatment options are categorized as follows: palliative (debridement of devitalized cartilage), reparative (osteochondral stimulation procedures, such as microfracture of the subchondral bone following debridement) and replacement (implantation of autologous chondrocyte cultures or osteochondral grafts (autografts or allografts)).[9]

For OCLs measuring <15 mm in diameter, arthroscopic debridement and microfracture are the procedures of choice prior to considering more invasive techniques such as osteochondral autografting, allografting, or autologous chondrocyte implantation. Collagen, hyaluronic acid, or fibrin-based scaffolds are also used in conjunction with cultured chondrocytes or following subchondral bone stimulation to enhance the stability of transplanted or migrating cells. However, no comparative studies exist evaluating the efficacy of the various scaffolds or membranes used.

In large or voluminous OCLs, treatment remains controversial. On one hand, several authors—including Chuckpaiwong et al.[4] (105 cases), Choi (120 cases), and Ramponi et al.[10] (systematic review)—conclude that debridement and microfracture are ineffective for lesions exceeding 15 mm in diameter, 150 mm^2 in surface area, or 10.2 mm in diameter, respectively.

On the other hand, recent research has failed to demonstrate a significant correlation between lesion size and clinical outcome after debridement and microfracture. For instance, van Bergen et al.[11] reported no difference in clinical outcomes between OCLs <11 mm and >11 mm in diameter. Similarly, Kuni et al.[12] found no association between poor outcomes on the *American Orthopaedic Foot and Ankle Society* (AOFAS) score and lesion volume in a series of 22 patients with OCLs averaging 377 mm^3.

An additional confounding factor is the wide variability in lesion measurement methods. There is no standardized protocol. Some studies use computed tomography, others rely on magnetic resonance imaging, and some assess lesions arthroscopically, despite the known low interobserver reliability of this method. There is also variation in the timing of measurement—some authors assess lesion size before debridement, while others do so afterward. Furthermore, the mathematical formulas used to calculate lesion area differ among studies.

All of this highlights the lack of robust evidence supporting the current therapeutic algorithms based primarily on lesion size.

OBJECTIVE

The main objective of this study was to evaluate clinical outcomes and the ability to engage in physical activity two years after surgery in patients with large and massive osteochondral lesions (OCLs) of the talus who underwent arthroscopic debridement and microperforation of the subchondral bone.

The hypothesis was that, after two years, patients would be able to resume physical activity following surgery.

MATERIALS AND METHODS

Prior to initiation, the study protocol was submitted for review and approved by the hospital's Department of Academic Development and Ethics Committee. All patients provided written informed consent preoperatively.

This study adhered to the STROBE guidelines. The STROBE checklist includes essential elements to be addressed in reports of the three main types of analytic epidemiologic studies: cohort, case-control, and cross-sectional designs.[13]

A prospective, descriptive, short-term cohort study was conducted on patients consecutively treated between June 2019 and November 2021 using a standardized surgical technique. During this period, 14 symptomatic patients with chronic large or massive talar OCLs were included.

All patients underwent anterior ankle arthroscopy involving debridement of devitalized cartilage followed by microperforation of the subchondral bone.

Inclusion criteria were: Skeletally mature patients with chronic ankle pain secondary to an OCL >15 mm in diameter; patients treated with arthroscopic debridement and subchondral bone microperforation; patients who had previously undergone surgery for the same condition using the same surgical technique; patients with concurrent ankle pathologies associated with talar OCLs, such as anterior impingement or chronic ankle instability.

Exclusion criteria included: Skeletally immature patients, patients with acute traumatic injuries, patients with OCLs <15 mm in diameter.

All OCLs were preoperatively classified using computed tomography (CT) according to their location based on the Raikin grid.[6] Lesion size was measured by determining the maximum dimensions in the anterior-posterior and medial-lateral planes, while depth was calculated using CT slices in the axial, sagittal, and coronal views. Lesion volume was calculated by multiplying the three dimensions, and lesion area was calculated using the ellipsoid correction formula (area = $\pi \times$ [coronal diameter / 2] $\times$ [sagittal diameter / 2]).

All procedures were performed by the same surgeon, a specialist in foot, ankle, and lower limb arthroscopy, using the same surgical technique in every case.

Surgical Technique

Anterior ankle arthroscopy was performed via anteromedial and anterolateral portals. Debridement of the osteochondral lesion (OCL) was carried out using a curette and shaver until a stable base was achieved. Any loose fragments or unstable cartilage were removed. Microperforation of the lesion base was then performed using a 1.8 mm diameter conical arthroscopic microfracture punch. The punch was inserted to a depth of at least 3 mm per pass, with perforations spaced 3–4 mm apart to avoid coalescence of the holes. The depth was verified until subchondral bone bleeding was visualized, indicative of bone marrow access and the potential for fibrocartilage formation. In large and massive cystic lesions, devitalized subchondral bone was resected with a curette until healthy bone was reached, where microperforations were then performed. Associated procedures were performed as indicated, such as lateral ligament repair or treatment of bone and soft tissue impingement. The pneumatic tourniquet was deflated before the end of surgery to confirm bleeding from the base of the lesion.

All OCL treatments and associated procedures were performed arthroscopically.

The postoperative regimen included a two-week period of non-weight-bearing, during which active and passive ankle mobility was permitted. Sutures were removed at two weeks, and weight-bearing was initiated. One month postoperatively, patients were allowed to walk without limitations on time or distance. At two months, they were permitted to resume running and engage in pre-injury physical activities. For those requiring ligament repair, a 90° cast boot was used for two weeks with non-weight-bearing, followed by a Walker boot for one month to allow ambulation. Physical activity was resumed at three months postoperatively in this group.

All patients followed the same clinical follow-up schedule: every two weeks during the first postoperative month, monthly until six months postoperatively, and a final evaluation at two years.

Clinical evolution and surgical complications were recorded. At two years postoperatively, patients completed the *Foot and Ankle Ability Measure* (FAAM), a validated self-reported outcome instrument for assessing musculoskeletal conditions of the lower limb. The FAAM includes 29 items across two subscales: 21 items for *Activities of Daily Living* (ADL) and 8 for *Sports*. Each item is scored on a 5-point scale (0 = unable to do; 4 = no difficulty). Maximum scores are 84 for ADL and 32 for Sports. A percentage is obtained from this score. Higher percentages indicate better functional status, with 100% representing no dysfunction.

Patient satisfaction with the surgical procedure at the two-year follow-up was assessed using a 5-point Likert scale: 5 = very satisfied; 4 = satisfied; 3 = neutral; 2 = dissatisfied; 1 = very dissatisfied. Patients were also asked to report their ability to participate in sports prior to surgery and at the two-year follow-up.

To minimize biases, the FAAM, satisfaction, and physical activity questionnaires were sent via email and completed by the patients independently, without the presence of medical personnel.

The mean patient age at the time of surgery was 38 years (range: 24–54). Of the 13 patients, 11 were male and 2 female. Eight OCLs involved the right ankle and five the left. No patients underwent bilateral surgery.

Five patients underwent additional arthroscopic procedures along with OCL treatment: three for anterior impingement, one for lateral ligament repair, and one for both.

Only one patient had previously undergone a similar surgical procedure for an OCL at another center by a different surgeon. In this case, arthroscopic debridement and microperforation were again performed. The remaining patients had no history of prior surgery of the affected ankle.

All data were recorded and managed using REDCap.[14] REDCap is a metadata-driven electronic data capture platform widely used in clinical and translational research.

Statistical Analysis

All statistical analyses were conducted using R software (R Core Team, 2022; R Foundation for Statistical Computing, Vienna, Austria) and RStudio (Posit Team, 2024; Boston, MA, USA).

Continuous variables are presented as mean (standard deviation [SD]) or median (interquartile range [IQR]), depending on the distribution. Categorical variables are reported as frequency and percentage (n [%]) (Table 1).

Table 1. Variables evaluated.

Variable*	(n = 13)
Age	39 [27, 48]
Volume	1584 [784, 2100]
Area	170 [144, 224]
Side	5 (38.5)
Associated procedures	5 (38.5)
Complications	1 (7.7)
Satisfaction = 5	7 (53.8)
Would recommend = yes	13 (100.0)
Sport before surgery	4 (30.8)
Sport after surgery	10 (76.9)
FAAM Activities of daily living	92.80 [85.70, 98.80]
FAAM Sport	78.10 [56.20, 96.80]
Overall, how would you rate your current level of function?	
1	5 (38.5)
2	5 (38.5)
3	3 (23.1)
Level of function in activities of daily living	90 [80, 95]
Level of function during sport	85 [60, 95]
Change in sports activities	
I do sports now	6 (46.2)
I have never done sports	3 (23.1)
I have always done sports	4 (30.8)
Number of Raikin zones affected per patient	
1	2 (15.38)
2	9 (69.24)
3	2 (15.38)
Raikin zone (n = 26)(*) (*)	
1	2 (7.7)
3	1 (3.8)
4	9 (34.6)
6	4 (15.4)
7	7 (26.9)
9	3 (11.5)

*Categorical variables are expressed as n (%) and continuous variables as mean (SD) or median (interquartile range) according to the distribution.
**The total number of affected zones of all patients is considered.
FAAM = *Foot and Ankle Ability Measure*.

Linear mixed-effects regression models were considered, with the patient included as a random effects variable, to assess the association between the FAAM Activities of Daily Living (ADL) and FAAM Sport scores and each predictive variable (age, lesion area, lesion volume, and pre-injury sports participation). However, due to the small sample size, fitting a reliable regression model was not feasible. Therefore, bivariate associations are presented graphically.

Scatter plots were generated to visualize the relationships between FAAM ADL and FAAM Sport scores with lesion area and volume. Box plots were used to assess the association between Raikin zone and FAAM ADL and Sport scores.

RESULTS

Of the 14 patients who underwent surgery, 13 completed the 2-year follow-up. One patient could not be contacted for evaluation at the 2-year mark.

Nine lesions were located in the medial region of the talus: 2 affected only zone 4; 5 involved zones 4 and 7; and 2 extended across zones 1, 4, and 7. The remaining 4 lesions were lateral: 3 affected zones 6 and 9, and 1 involved zones 3 and 6.

Two patients presented with massive OCLs, with volumes of 6000 mm^3 and 7140 mm^3, respectively. The remaining cases involved large lesions, each with a diameter >15 mm.

The mean lesion area was 197 mm^2 (range: 108–420), and the mean lesion volume was 2136 mm^3 (range: 432–7140) (Table 2).

Table 2. Data of the 13 patients included in the study.

Patient	Date of surgery	Age (years)	Lesion size (mm)	Volume (mm^3)	Area (mm^2)	Raikin zones	Side
1	Jun 5, 2019	33	17 x 14 x 10	2380	238	6 and 9	Right
2	Jul 10, 2019	41	16 x 14 x 8	1792	224	4 and 7	Right
3	Nov 13, 2019	54	20 x 8 x 7	1120	160	1, 4 and 7	Left
4	Jan 29, 2020	24	18 x 11 x 8	1584	198	4	Right
5	Jul 29, 2020	52	16 x 7 x 7	784	112	4	Right
6	Sep 26, 2020	25	16 x 10 x 6	960	160	3 and 6	Right
7	Oct 21, 2020	24	18 x 6 x 4	432	108	4 and 7	Right
8	Apr 28, 2021	48	17 x 10 x 12	2040	170	4 and 7	Left
9	Oct 20, 2021	49	10 x 21 x 10	2100	210	6 and 9	Left
10	Oct 30, 2021	43	20 x 21 x 17	7140	420	1, 4 and 7	Left
11	Oct 14, 2021	39	16 x 9 x 5	720	144	6 and 9	Left
12	Oct 13, 2021	36	15 x 8 x 6	720	120	4 and 7	Right
13	Nov 17, 2021	27	25 x 12 x 20	6000	300	4 and 7	Right

No intraoperative complications occurred. One patient developed neuralgia in the territory of the superficial fibular nerve during the immediate postoperative period, which resolved spontaneously within 6 months without the need for reoperation or medications beyond the standard postoperative pain protocol.

Only one patient required revision surgery within the 2-year follow-up period. At 18 months postoperatively, he developed anterior impingement-related pain and underwent a repeat anterior ankle arthroscopy for impingement resection and removal of an intra-articular loose body (Figure 2).

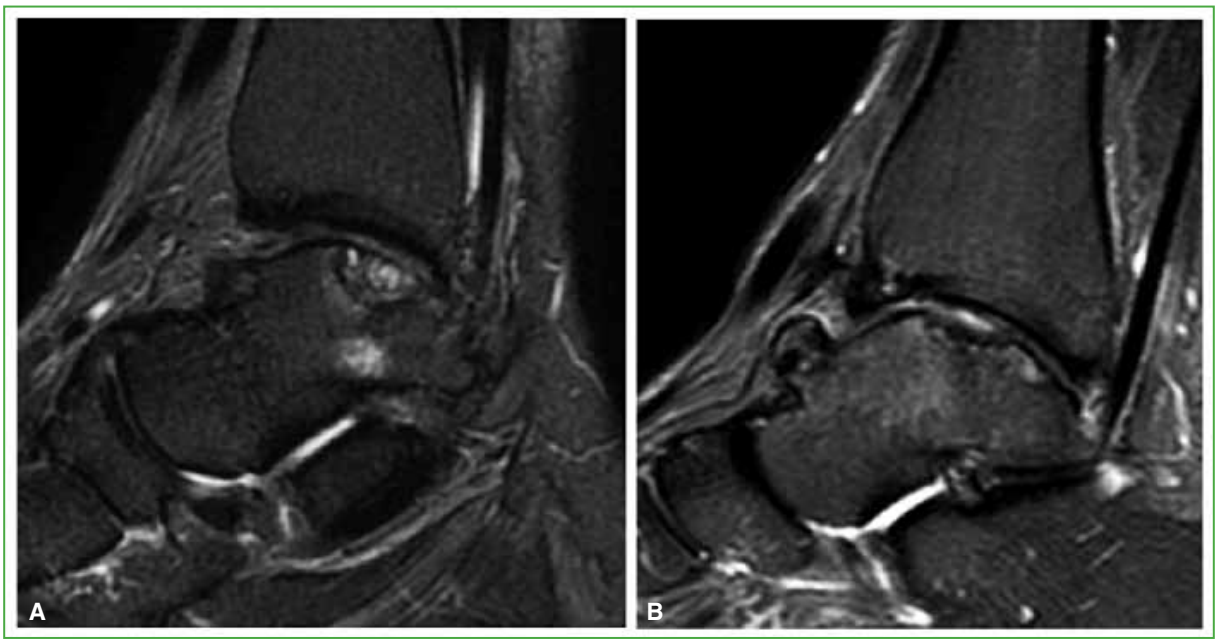

Figure 2. Magnetic resonance imaging of the ankle, sagittal view. **A.** Large osteochondral lesion in the talar dome, involving Raikin zones 4 and 7. **B.** Irregular fibrocartilage defect in the region of the previous lesion and development of symptomatic anterior bony impingement. Revision arthroscopy was performed to treat the impingement.

Nine of the 13 patients were unable to engage in physical activity prior to surgery due to pain during exertion. Of these, 6 resumed and maintained physical activity 2 years postoperatively, while 3 continued to experience pain or discomfort during activity. The 4 patients who were active preoperatively remained active after surgery.

All 13 patients reported satisfaction with the surgical outcome and indicated that they would recommend the same procedure to others with the same condition. The mean satisfaction score was 4.53 out of 5. Seven patients reported being very satisfied, and six were satisfied.

The mean FAAM ADL score was 89% (range: 50–100%), and the median score was 93.4% (Figure 3). When asked to subjectively rate their level of function in daily activities, the mean reported score was 83% (range: 50–100%).

Regarding specific ADLs, 84.6% of patients reported no difficulty performing housework, while 15.4% reported moderate difficulty (Figure 4). The most challenging ADL was walking uphill: 53.8% reported no difficulty, 38.5% reported slight difficulty, and 7.7% reported moderate difficulty (Figure 5).

The mean FAAM Sport score was 78.8% (range: 43.7–100%), and the median score was 84% (Figure 6).

When asked to assess their functional level during sports activities, the mean score was 80.4% (range: 50–100%). The most difficult sport-related task was starting and stopping quickly (Figure 7).

No statistically significant associations were observed between FAAM scores and lesion area, volume, or location. As illustrated in Figures 8-13, scatter plots revealed flat regression lines, indicating no meaningful correlations.

Patients were also asked to self-rate their current level of function as normal, almost normal, abnormal, or severely abnormal. Five patients rated their function as normal, five as almost normal, and three as abnormal (Figure 14).

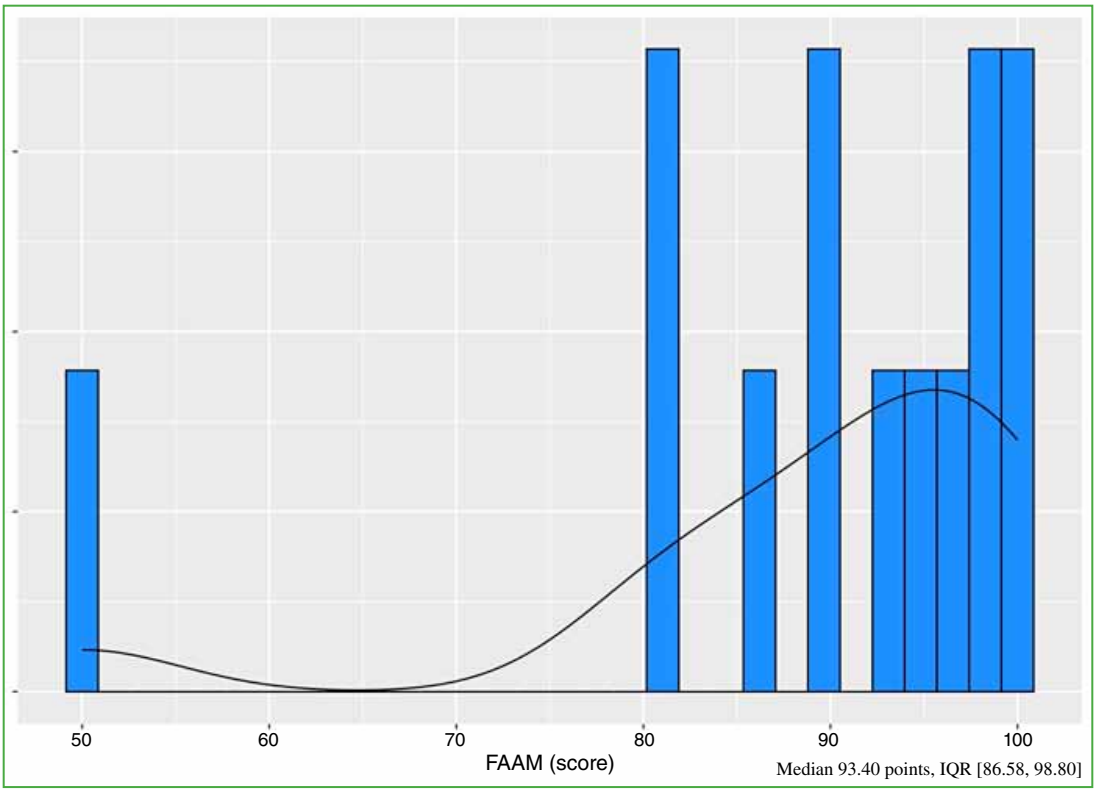

Figure 3. *Foot and Ankle Ability Measure* (FAAM) *Activities of Daily Living* (ADL) scores of the 13 patients evaluated 2 years postoperatively.

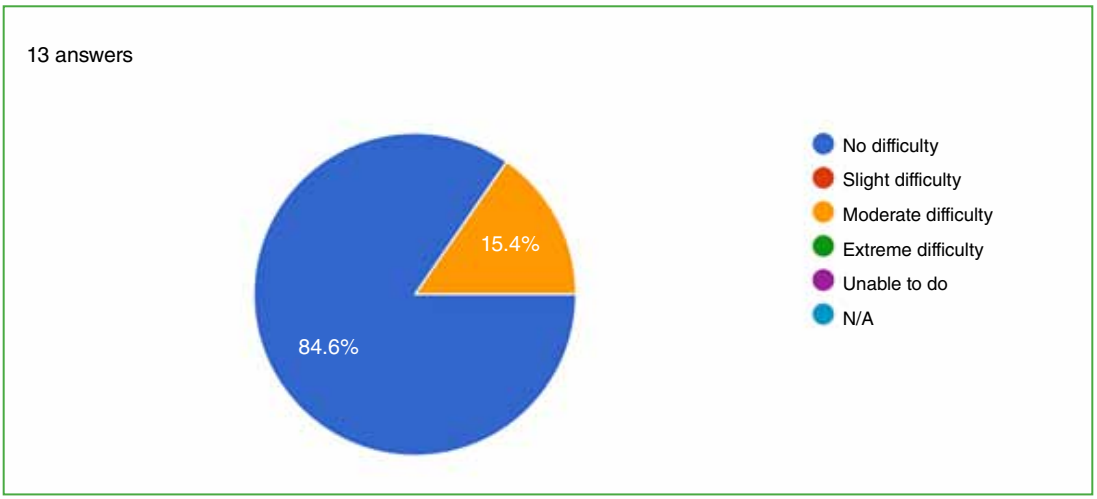

Figure 4. Difficulty performing household chores.

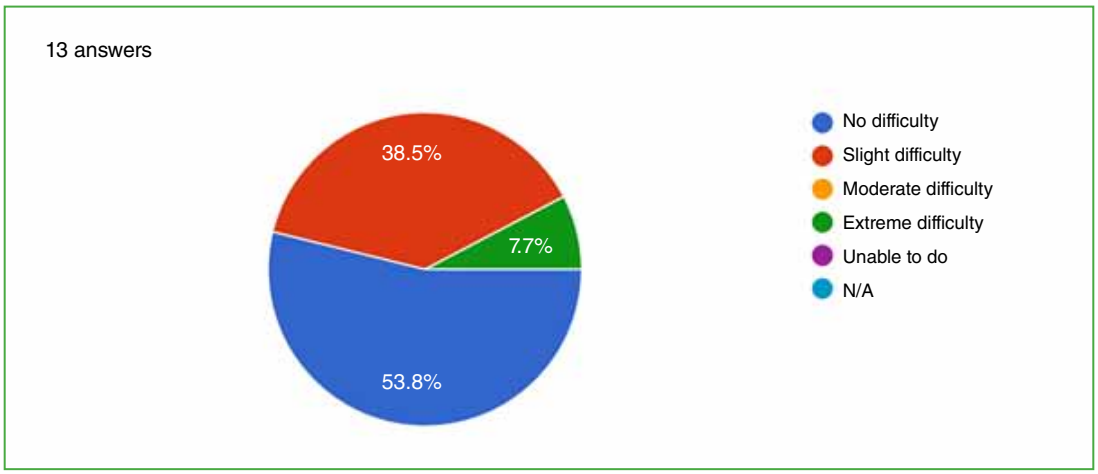

Figure 5. Difficulty walking uphill.

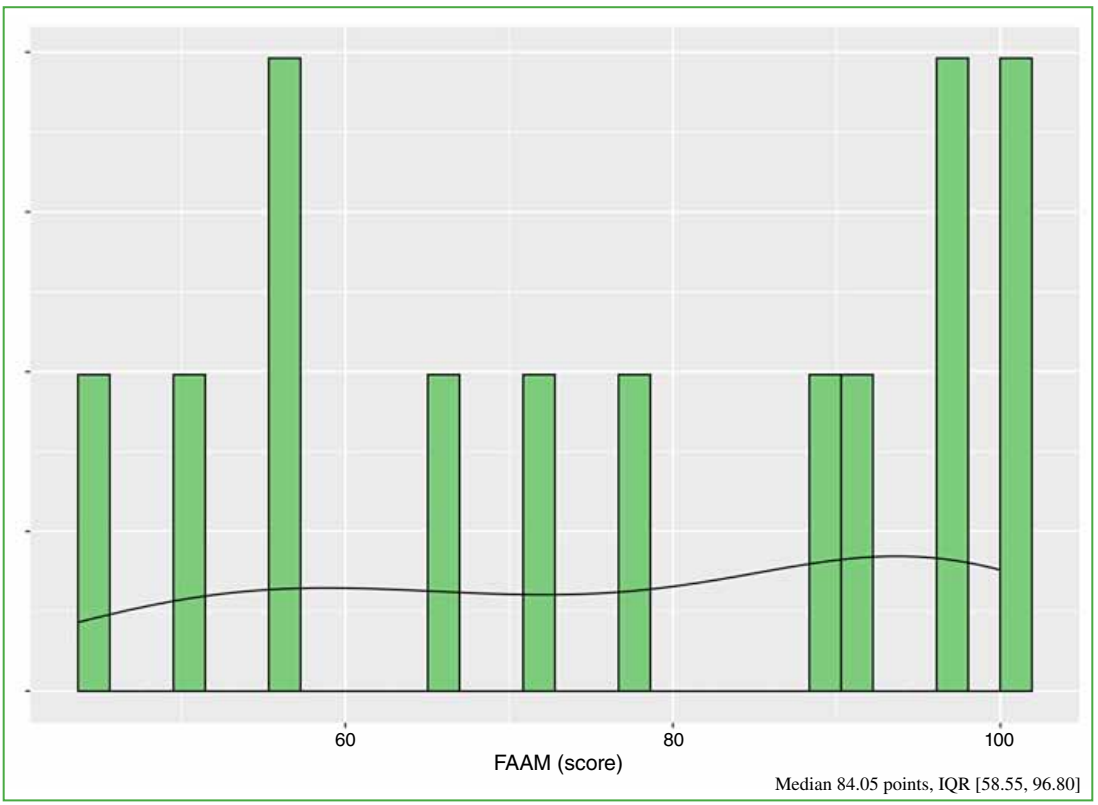

Figure 6. FAAM Sport scores of the 13 patients evaluated 2 years after surgery.

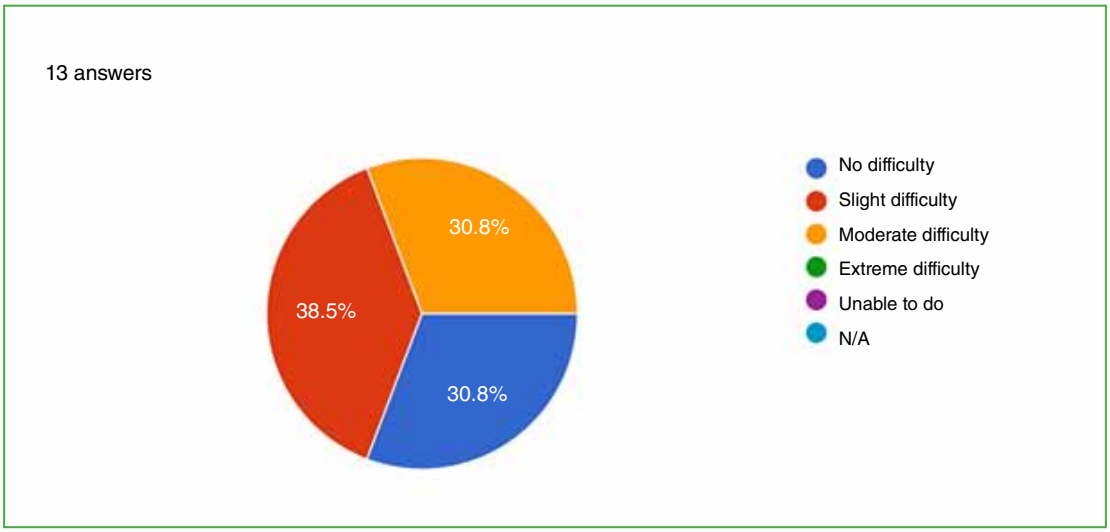

Figure 7. Difficulty in starting and stopping quickly.

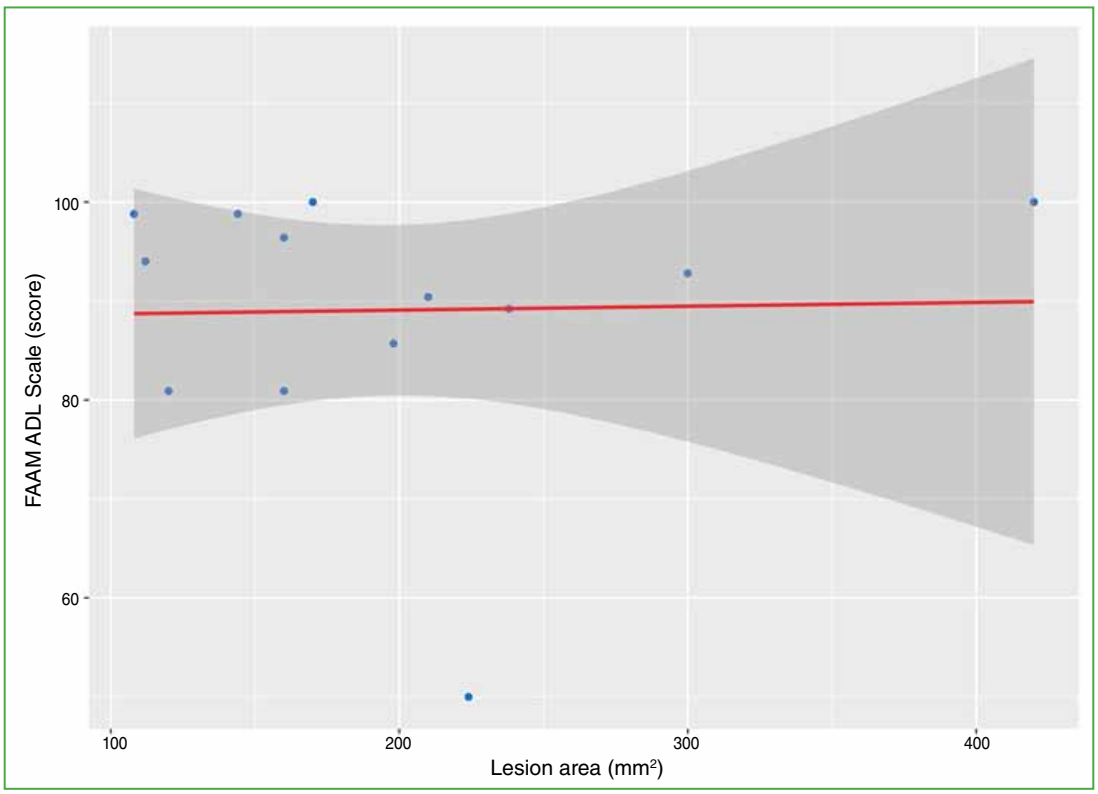

Figure 8. Scatter plot of the relationship between the FAAM Activities of Daily Living score and lesion area.

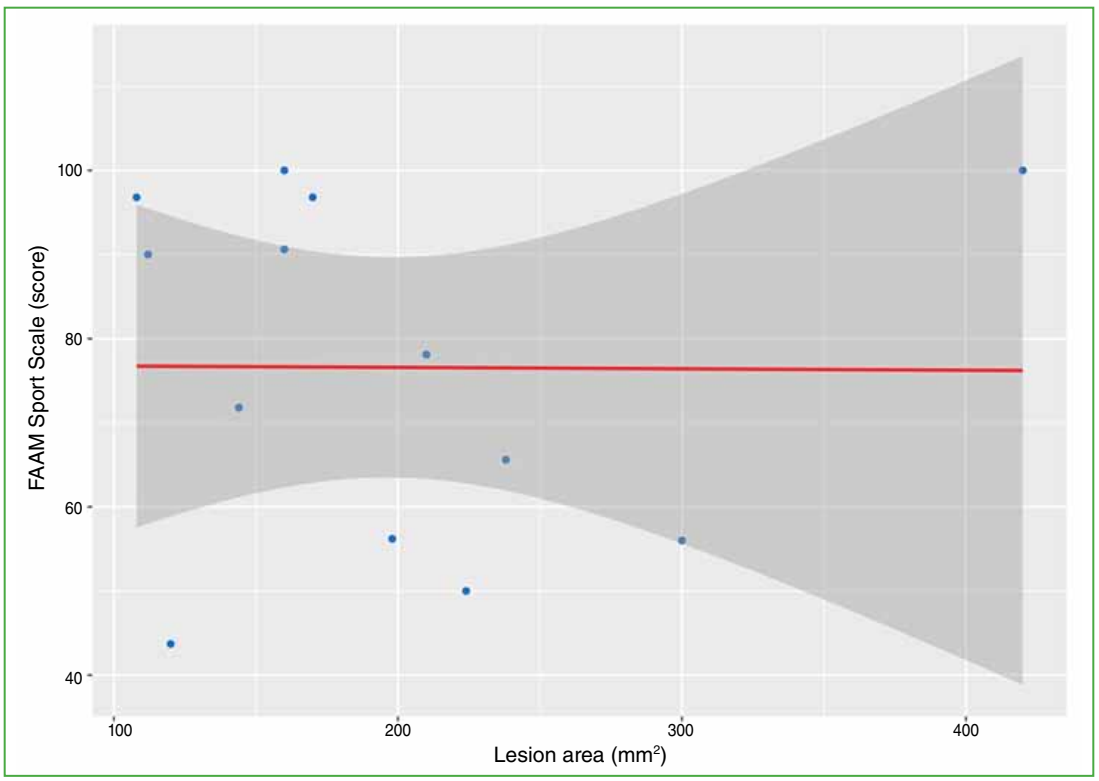

Figure 9. Scatter plot of the relationship between the FAAM Sport score and lesion area.

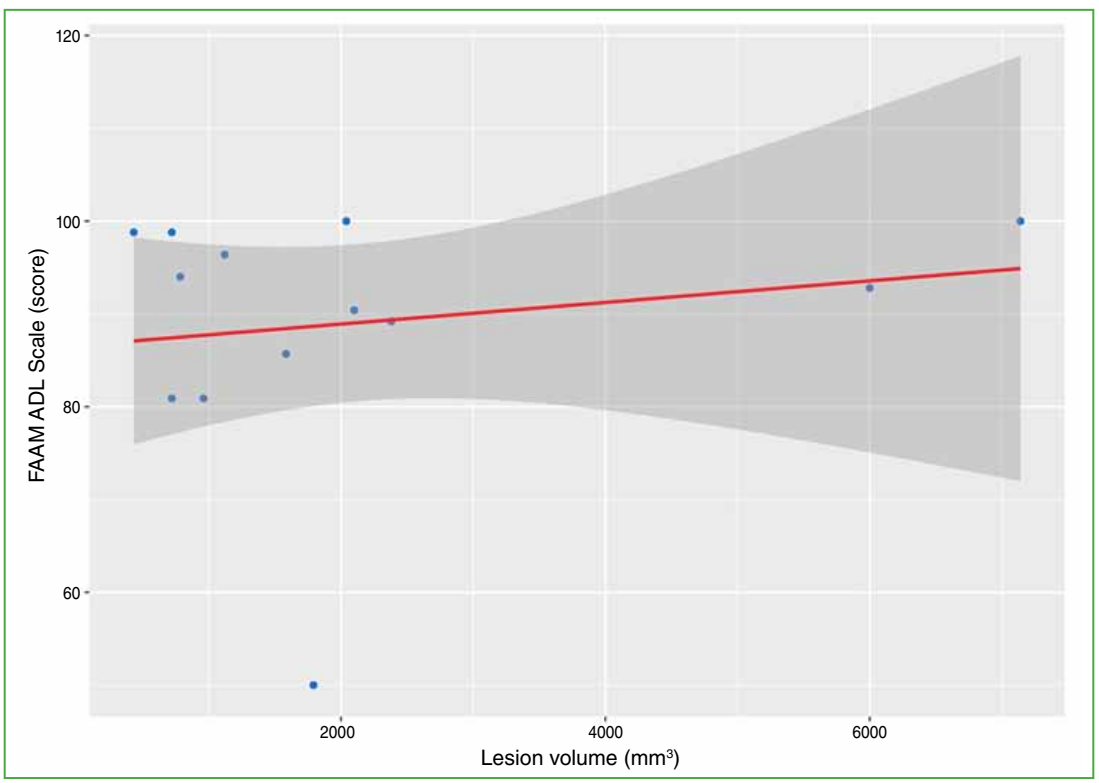

Figure 10. Scatter plot of the relationship between the FAAM Activities of Daily Living score and lesion volume.

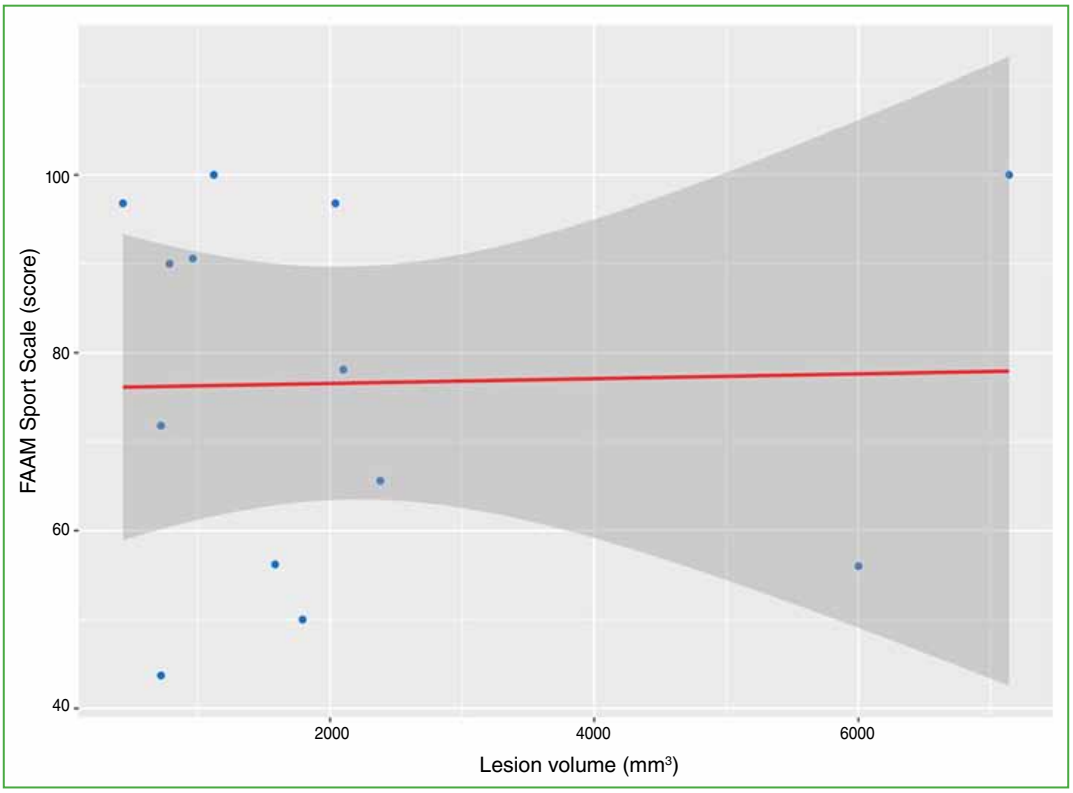

Figure 11. Scatter plot of the relationship between FAAM Sport score and lesion volume.

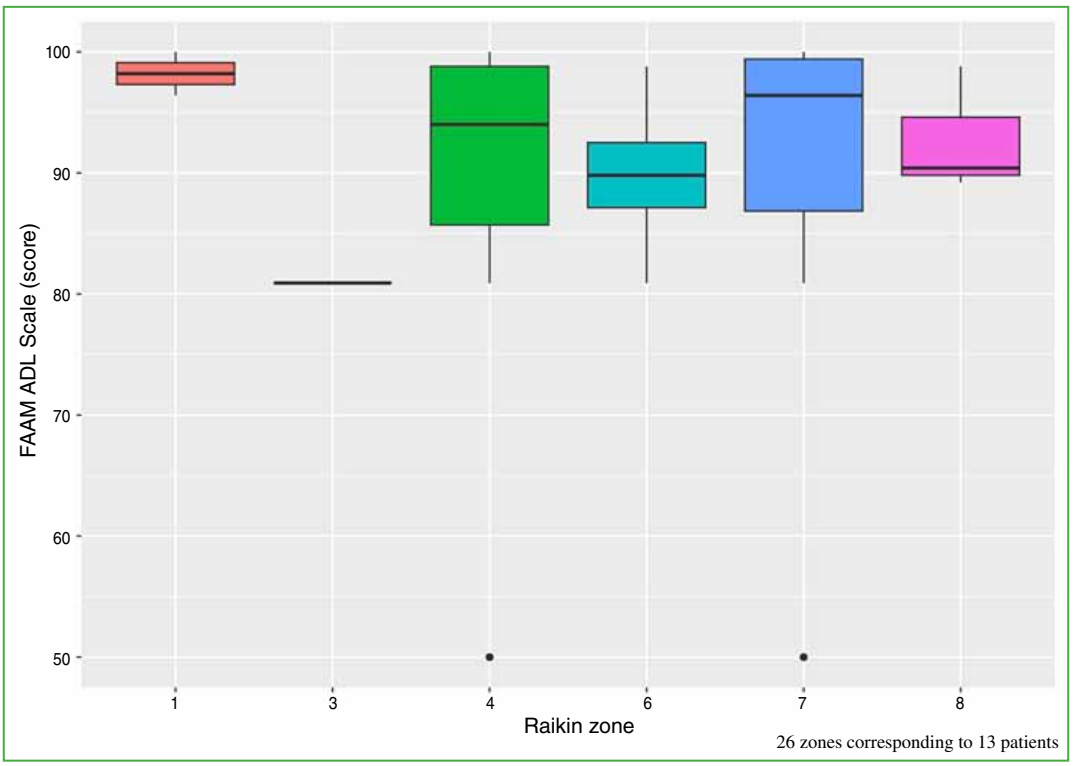

Figure 12. Box plot: FAAM ADL score by Raikin zone.

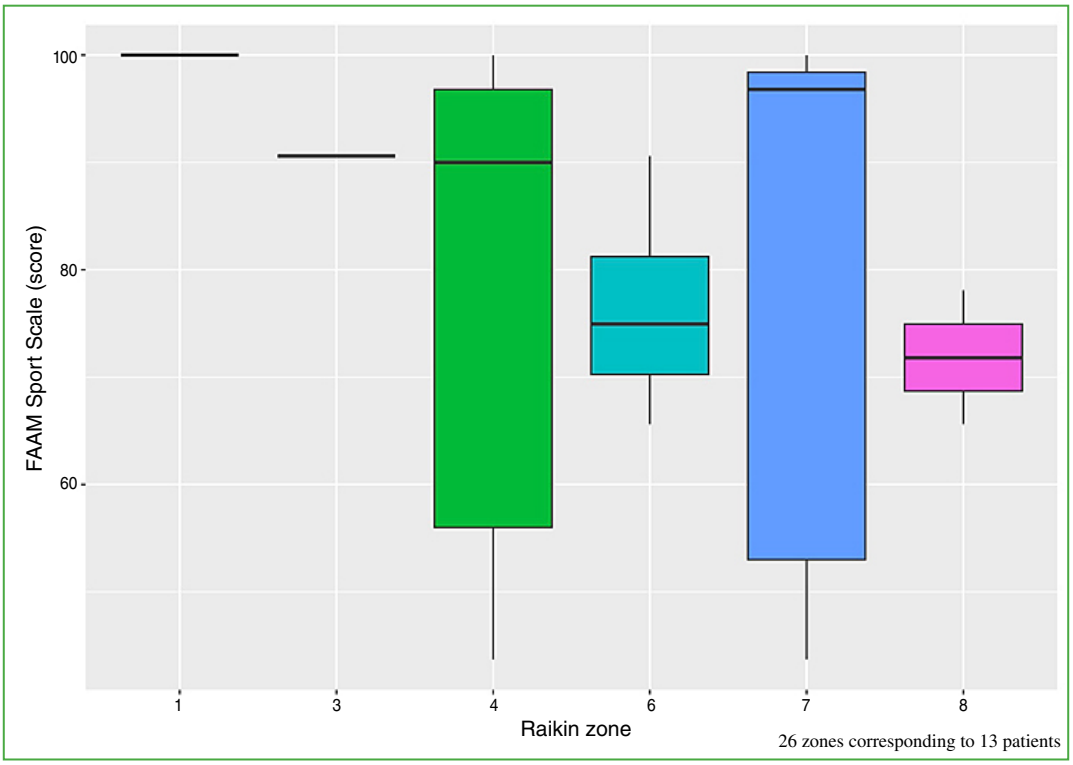

Figure 13. Box plot: FAAM Sport score by Raikin zone.

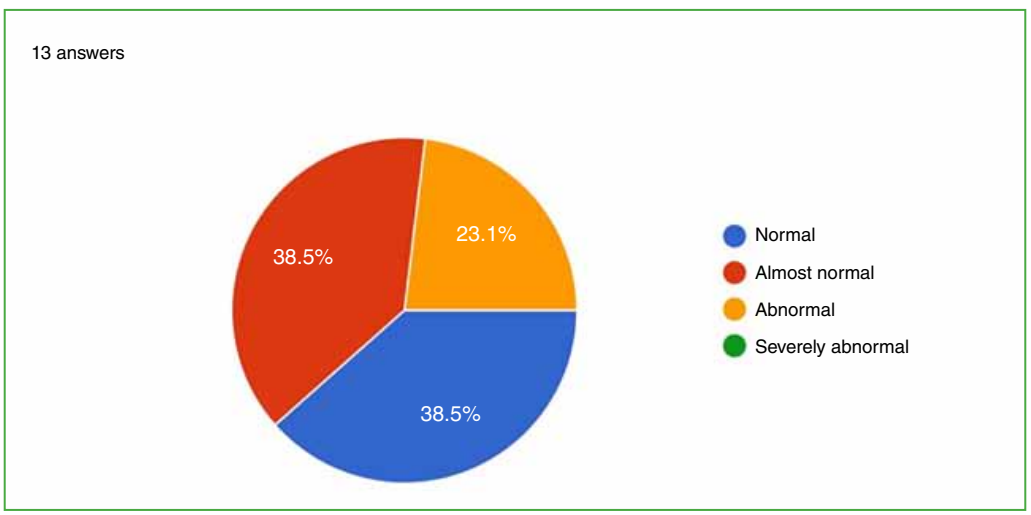

Figure 14. Patient-reported classification of current functional level.

DISCUSSION

Our experience in treating large and massive OCLs with frozen cadaveric osteochondral grafts has been positive. In our previously published series of 8 patients, the average improvement in the AOFAS score was 34.5 points, with a mean follow-up of 47 months.[15]

For large defects, osteochondral allografts offer advantages, as they allow filling of lesions of various sizes and shapes without donor site morbidity in other regions of the patient. However, this type of surgery requires a prolonged non-weight-bearing postoperative period, during which patients are unable to participate in sports or work activities for extended durations. In daily practice, this is a common reason for patients to decline surgery. These individuals often live with pain that prevents them from engaging in sports but still allows them to work with the help of analgesics.

Given the inability—or refusal—of some patients to undergo procedures with extended recovery times, we sought less invasive alternatives with quicker rehabilitation to address pain. For this reason, we opted for an arthroscopic approach involving OCL debridement and subchondral bone microperforation, similar to the protocol used for OCLs <15 mm in diameter, aiming to relieve pain and restore physical activity until definitive treatment could be pursued.

Microperforation treatment seeks to stimulate the subchondral bone to induce fibroblast recruitment and generate fibrocartilage repair. It has been reported that 75% of cases achieve good outcomes at 3 years, with significant pain relief. In certain studies, neofibrocartilage survival has been reported at 95% at 4 years and 92% at 7 years in non-massive OCLs.[16,17]

Although lesion size has traditionally been the main criterion for indicating this procedure, a systematic review by Ramponi et al.[10] highlights the considerable variability in lesion measurement methods. This variability complicates comparisons between studies and limits the validity of treatment guidelines based on lesion size. Standardization of OCL measurement techniques would enhance the statistical reliability of correlating lesion size with treatment outcomes.

Repair of OCLs by microperforation generates a fibrocartilage layer covering the subchondral bone. This fibrocartilage is primarily composed of type I collagen with few chondrocytes, unlike native hyaline cartilage, which contains predominantly type II collagen and more chondrocytes. Type I collagen fibrocartilage is structurally and biomechanically inferior to natural hyaline cartilage. This has been demonstrated in knee OCLs,[18] where long-term studies of femoral condyle microfractures show increasing failure rates after 5 years and 39% of patients requiring further surgery by year 12.[19]

However, the literature on talar lesions shows more favorable results. Becher et al.[20] reported good to excellent outcomes and high satisfaction at 6 years, and van Bergen et al.[11] demonstrated similar outcomes at 12 years. Nonetheless, some studies note surgeon hesitation to use this technique due to concerns about declining functional scores over time, inadequate lesion filling, and failure to return to pre-injury levels of sports participation.

In response to these concerns, biologic adjuvant therapies have been proposed for cartilage repair, including hyaluronic acid, platelet-rich plasma (PRP), and pluripotent stem cells. Unfortunately, there is a lack of medium-term (>5 years) and long-term (>10 years) outcome data in the literature; most studies report only short-term results. In a randomized study, Guney et al.[21] compared isolated microfracture with microfracture plus PRP, and found no significant differences in FAAM or AOFAS scores at 4 years. Hannon et al.[22]and Karnovsky et al.[23] evaluated microfractures combined with autologous bone marrow concentrate stimulation and similarly reported no differences in outcomes at 3 and 6 years.

Conversely, Görmeli et al.[24] observed better AOFAS and visual analog scale scores in patients treated with microperforations plus PRP compared to those treated with microperforations alone or microperforations plus hyaluronic acid in OCLs <15 mm.

The additional cost of adjuvant therapies must also be considered, especially given the lack of consistent long-term outcome data and the variability of these costs depending on the technique used.

Despite these limitations, the concept of biological augmentation for OCLs is supported by the *International Consensus Meeting on Cartilage Repair of the Ankle*,[25] where experts unanimously agreed that biological augmentation may be beneficial for lesions treated with microperforation.

Biologic adjuvants may improve long-term outcomes of microperforation procedures, but larger, long-term studies are required to justify their use and associated costs.

Currently, there is no validated scoring system specifically for OCLs. Most studies assess clinical outcomes using the AOFAS score. In this study, we employed the FAAM instrument, a validated, patient-reported outcome measure for musculoskeletal conditions of the leg, ankle, and foot.

The limitations of this study include the small sample size—although we found no national or international literature presenting large series of large or massive OCLs—the short duration of follow-up, and the absence of a control group. We did not request postoperative imaging studies. While some might consider this a limitation, the purpose of this study was to focus on patient-reported outcomes and satisfaction. Previous research has shown a poor correlation between clinical outcomes and postoperative radiographic findings in the ankle.[26]

CONCLUSIONS

Arthroscopic treatment of large and massive talar osteochondral lesions (OCLs) by debridement of devitalized cartilage and microperforation of the subchondral bone provides good clinical outcomes in terms of activities of daily living and sports performance, with a low complication rate and high patient satisfaction at 2-year follow-up.

Further studies with a larger sample size are needed to rule out small sample size as the reason for the lack of statistically significant associations between the studied variables. Continued follow-up of patients is also necessary to compare short-term clinical outcomes with medium- and long-term results, as well as to evaluate outcomes with the addition of biological adjuvant treatments.

This study may serve as a foundation for comparison with future cases of OCLs treated using this technique, both with and without biological augmentation.

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

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Difficulties in the Initial Management of Spinal Trauma: A Survey of On-Call Trauma Surgeons in Argentina

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ABSTRACT

Introduction: This study aims to assess the difficulties encountered during the initial management of patients with spinal trauma, based on the experiences of on-call trauma surgeons in Argentina. **Materials and Methods:** We conducted a cross-sectional observational study of traumatologists working in emergency departments across Argentina. The objective was to identify challenges in the initial management of spinal trauma as perceived by these professionals. Data were collected using an online questionnaire distributed between March 1 and May 1, 2024. **Results:** A total of 261 professionals responded, the majority of whom were male (n = 210; 80.5%), with a mean age of 39.3 years (SD = 8.4; range: 26–68 years). Of the respondents, 67.4% were board-certified specialists. Responses were received from 22 of Argentina's 23 provinces, with the majority coming from the province of Buenos Aires (n = 171; 65.5%), particularly the metropolitan area (n = 134; 51.3%). Over 70% of respondents reported encountering difficulties in various aspects of managing patients with spinal trauma. **Conclusions:** The experience reported by traumatologists working in emergency departments throughout Argentina reveals that more than 70% face significant and recurrent challenges in the care of patients with spinal trauma. Most respondents reported multiple difficulties, particularly regarding initial assessment, diagnostic evaluation, treatment, and timely referral.

Keywords: Spinal trauma; traumatologist; emergency care; challenges; spine.
Level of Evidence: IV

Dificultades en la atención inicial del paciente con trauma vertebromedular: encuesta a traumatólogos de Guardia de la Argentina

RESUMEN

Introducción: Nuestro objetivo es estimar las dificultades en la atención inicial del paciente con trauma vertebromedular según la experiencia de médicos traumatólogos de la Argentina. **Materiales y Métodos:** Se realizó un estudio observacional y transversal de médicos que se desempeñan en Guardias de Ortopedia y Traumatología de la Argentina, con el fin de estimar las dificultades en la atención inicial del trauma vertebromedular, según su experiencia. Los médicos fueron evaluados mediante un cuestionario digital entre el 1 de marzo y el 1 de mayo de 2024. **Resultados:** Se obtuvo una muestra de 261 médicos, en la que predominaron los hombres (n = 210; 80,5%), la edad promedio fue de 39.3 años (DE = 8.4; rango 26-68), el 67,4% eran médicos especialistas certificados. Se recibieron respuestas de médicos de 22 de las 23 provincias de la Argentina. Predominaron las respuestas de la provincia de Buenos Aires (n = 171; 65,5%), en especial, del área metropolitana (n = 134; 51,3%). Más del 70% de la muestra experimentó dificultades con la atención de este grupo de pacientes en diferentes áreas. **Conclusiones:** La experiencia docu-

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mentada de traumatólogos que se desempeñan en Guardias de Ortopedia y Traumatología de la Argentina describe dificultades frecuentes en la atención del trauma vertebromedular en más del 70% de los médicos encuestados, quienes, en su mayoría, manifestaron individualmente tener múltiples dificultades relacionadas con la atención inicial, la evaluación diagnóstica, el tratamiento y la derivación oportuna.
Palabras clave: Trauma vertebromedular; traumatólogo; guardia; dificultades; columna vertebral.
Nivel de Evidencia: IV

INTRODUCTION

Spinal trauma (ST) is a sudden and critical event that can disrupt neuraxial function and threaten the physical, psychological, and social well-being of the patient.[1-3] The global incidence of traumatic spinal injury is variable, and there are no formal records in our country or in Latin America.[4,5] In the United States, the annual incidence is 54 cases per million inhabitants.[6,7] Motor vehicle accidents and falls from height are the two most common causes, followed by violent incidents such as gunshot wounds and sports or recreational activities.[7]

International guidelines recommend early decompression and stabilization within the first 24 hours after ST. Our actions are guided by the principle that "time is spine."[8] However, applying these clinical guideline recommendations is a complex process that depends on each region's resources and the organization of its healthcare system.

Trauma physicians play a key role in the interdisciplinary team responsible for the initial care of patients with ST in emergency departments.[9] ST is an essential component of the clinical expertise required in our training.[10] We are involved in both diagnostic evaluation and treatment, including initial and definitive management.

The aim of this study was to assess the difficulties encountered in the initial care of patients with ST, based on the experiences of trauma physicians in Argentina.

MATERIALS AND METHODS

An observational, cross-sectional study was conducted among physicians working in Orthopedics and Traumatology Emergency Departments across Argentina to estimate the challenges encountered during the initial care of patients with ST. Physicians were surveyed using a digital questionnaire administered between March 1 and May 1, 2024.

A non-probabilistic sample was obtained using a snowball sampling method. The questionnaire was initially distributed via email and messaging applications to members of the Argentine Association of Orthopedics and Traumatology (AAOT) and the Argentine Society of Spine Pathology (SAPCV).

A desired sample size of 362 participants was calculated from a finite population of 6,136 AAOT member traumatologists, using a 95% confidence interval and a 5% margin of error.

Inclusion criteria were physicians of any sex and age working in Orthopedics and Traumatology Emergency Departments in Argentina, including certified specialists and those in training (residents, fellows, or concurrent physicians). Blank or incomplete questionnaires (defined as those with fewer than 50% of responses completed) were excluded.

The primary outcome measure was the identification of difficulties in the care of patients with acute traumatic spinal injury, defined as patients with a presumptive or confirmed diagnosis (clinical and imaging correlation) of acute traumatic spinal cord injury, with or without associated vertebral fractures.

Acute spinal cord injury is defined as sudden-onset damage or trauma to the spinal cord, resulting in loss of tissue integrity and potentially leading to functional impairment, reduced mobility, or sensory deficits.[11,12] A "difficulty" was defined as any abnormal situation that creates a barrier or obstacle to the timely diagnosis and treatment of such patients.

A self-administered digital questionnaire was developed using Google Forms. The content was generated through interactive consensus among the research group members, who are experienced ST specialists and members of various scientific societies and institutions. Relevant clinical practice guidelines were used as reference documents during the design of the survey.[11,12] A pre-test was conducted to assess item clarity and response rate.

The questionnaire was divided into six sections: A) Sociodemographic variables; B) Initial care; C) Imaging studies; D) Treatment; E) Referral; F) Human resources training. The questionnaire included closed and semi-closed questions. Questions aimed at measuring frequency used Likert-type scales to assess the respondents' level of agreement or disagreement. The survey is available at: https://drive.google.com/file/d/1P2V_Tqa9PL-rqUJ6NXyMYosSj43rrw6h/view?usp=sharing

This study was conducted in accordance with the principles of the Declaration of Helsinki, ensuring the anonymity and confidentiality of data. All participants gave their consent to complete the questionnaire.

RESULTS

A total of 313 questionnaires were received. Of these, 48 were from physicians not working on call, and 2 were from foreign respondents; all were excluded. Additionally, 2 blank questionnaires were discarded, resulting in a 99% response rate. The final sample consisted of 261 physicians, predominantly male [male sex: 210 (80.5%), female sex: 48 (18.4%), prefer not to answer: 3 (1.1%)], with a mean age of 39.3 years (SD = 8.4; range 26–68). A total of 176 participants (67.4%) were certified specialist physicians. Respondents represented 22 of the 23 provinces of Argentina (Figure 1).

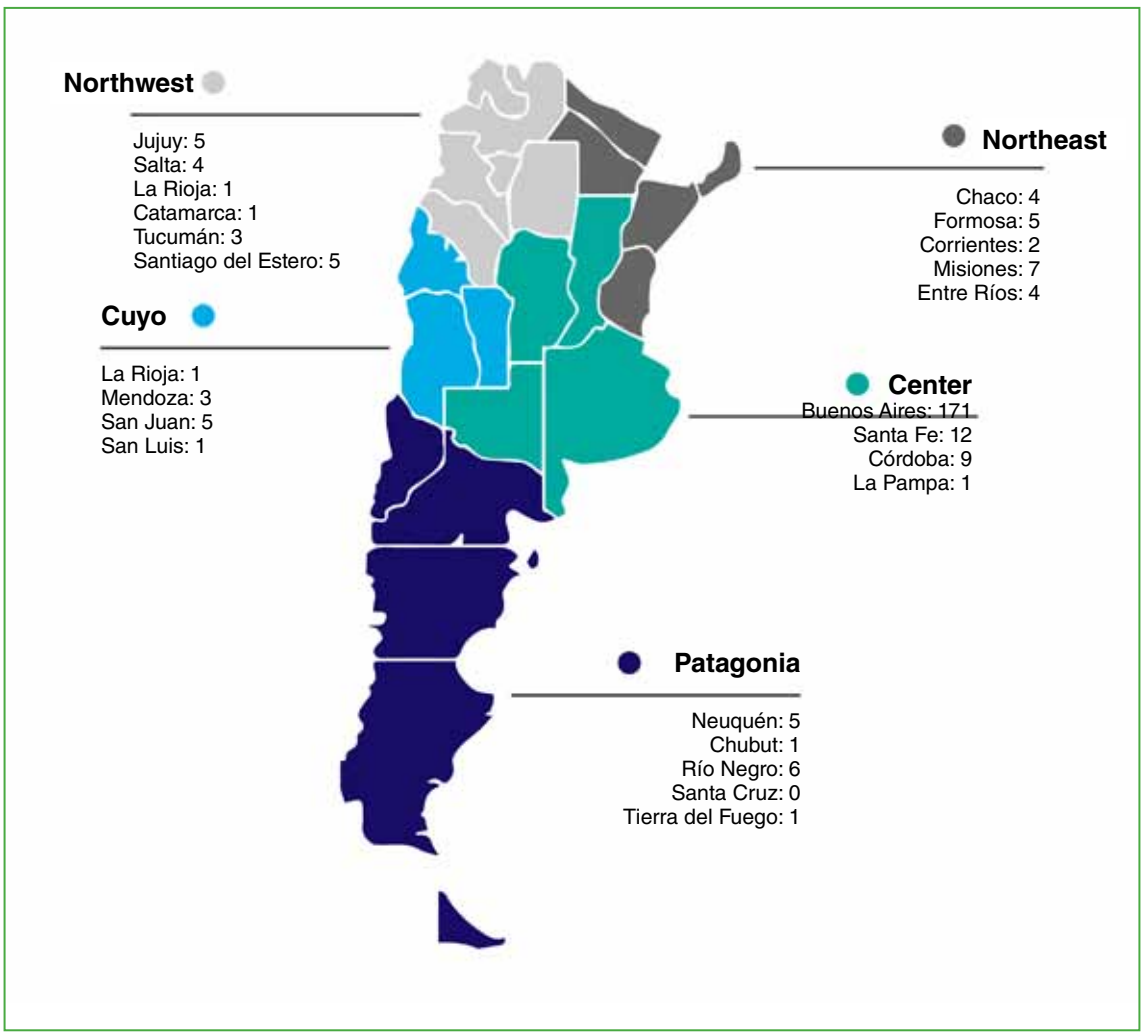

Figure 1. Distribution of respondents by region and province in Argentina (n = 261; missing data, n = 5).

Responses from the Province of Buenos Aires (n = 171; 65.5%) and its metropolitan area (n = 134; 51.3%) predominated. Sociodemographic characteristics are presented in Tables 1 and 2.

Table 1. Characteristics of the sample.

Variable	Results (n= 262)	
Age; mean (SD; range)	39.3	(8.4; 26-68)
Sex; n (%)		
Male	210	(80.5)
Female	48	(18.4)
Prefer not to say	3	(1.1)
Position; n (%)		
Specialist	176	(67.4)
Resident	80	(30.7)
Other	5	(1.9)
Experience; n (%)		
0 to 5 years	140	(54.7)
5 to 10 years	42	(16.4)
10 to 20 years	44	(17.2)
>20 years	30	(11.7)
Type of institution; n (%)		
Public	197	(75.5)
Private	64	(24.5)
On-call hours; n (%)		
12 hours	39	(15.0)
24 hours	221	(85.0)
On-call day; n (%)		
Monday-Friday	154	(59.0)
Saturday-Sunday	107	(41.0)
Frequency ST/year; n (%)		
<10 cases	157	(60.4)
10 to 30 cases	77	(29.6)
30 to 50 cases	17	(6.5)
>50 cases	9	(3.5%)

SD = standard deviation; ST/year = spinal trauma cases per year.

Table 2. Comparison between traumatologists according to difficulties in the care of patients with spinal trauma in the Metropolitan Area of Buenos Aires.

Variables		Difficulties in the care of patients with ST			
		No (n= 35)		Yes (n =99)	
Age; mean (SD)		39,7	(9.7)	38.8	(7.7)
Sex; n (%)	Male	32	(91.4)	79	(79.8)
	Female	3	(8.6)	18	(18.2)
	Prefer not to say	0	(0.0)	2	(2.0)
Position; n (%)	Specialist	24	(68.6)	62	(62.6)
	Resident	11	(31.4)	33	(33.3)
	Other	0	(0.0)	4	(4.0)
Years of experience; n (%)	0-5 years	20	(58.8)	58	(59.8)
	5-10 years	5	(14.7)	15	(15.5)
	10-20 years	3	(8.8)	15	(15.5)
	>20 years	6	(17.6)	9	(9.3)
Type of institution; n (%)	Public	22	(62.9)	79	(79.8)
	Private	13	(37.1)	20	(20.2)
City; n (%)	CABA	26	(74.3)	64	(64.6)
	AMBA	9	(25.7)	35	(35.4)
ST/year; n (%)	<10 cases/year	21	(60.0)	56	(56.6)
	>10 cases/year	14	(40.0)	43	(43.4)
Surgical delay <24 h; n (%)		13	(37.1)	15	(15.1)

SD= standard deviation; ST/year = spinal trauma cases per year; CABA = Autonomous City of Buenos Aires; AMBA = Buenos Aires Metropolitan Area.

Difficulties in the Care of Patients with ST

A total of 72.4% (n = 189) of surveyed physicians reported difficulties in the care of patients with ST. Among them, more than 80% (n = 152) cited multiple difficulties. Specific challenges were most frequently related to imaging evaluation (n = 130; 49.8%), followed by definitive treatment (n = 118; 45.2%), patient referral (n = 93; 35.6%), initial care (n = 87; 33.3%), and human resource training (n = 87; 33.3%) (Figure 2).

Initial Care

The initial care of patients with ST is guided by on-call trauma physicians in the majority of surveyed institutions (n = 165; 63.2%). Fewer than 5% of respondents indicated that emergency medicine physicians (n = 5; 1.9%) or on-call general clinicians (n = 6; 2.3%) are responsible for the care of these patients in their institutions (Figure 3).

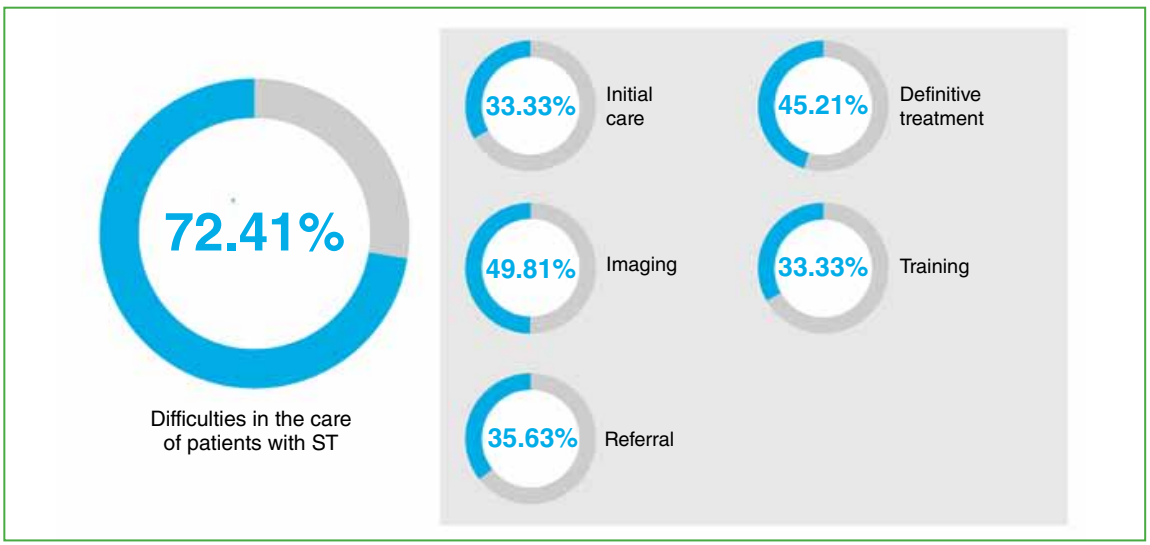

Figure 2. Pie charts showing the distribution of difficulties in the initial care of patients with spinal trauma. Specific types of difficulties are detailed in the gray box.

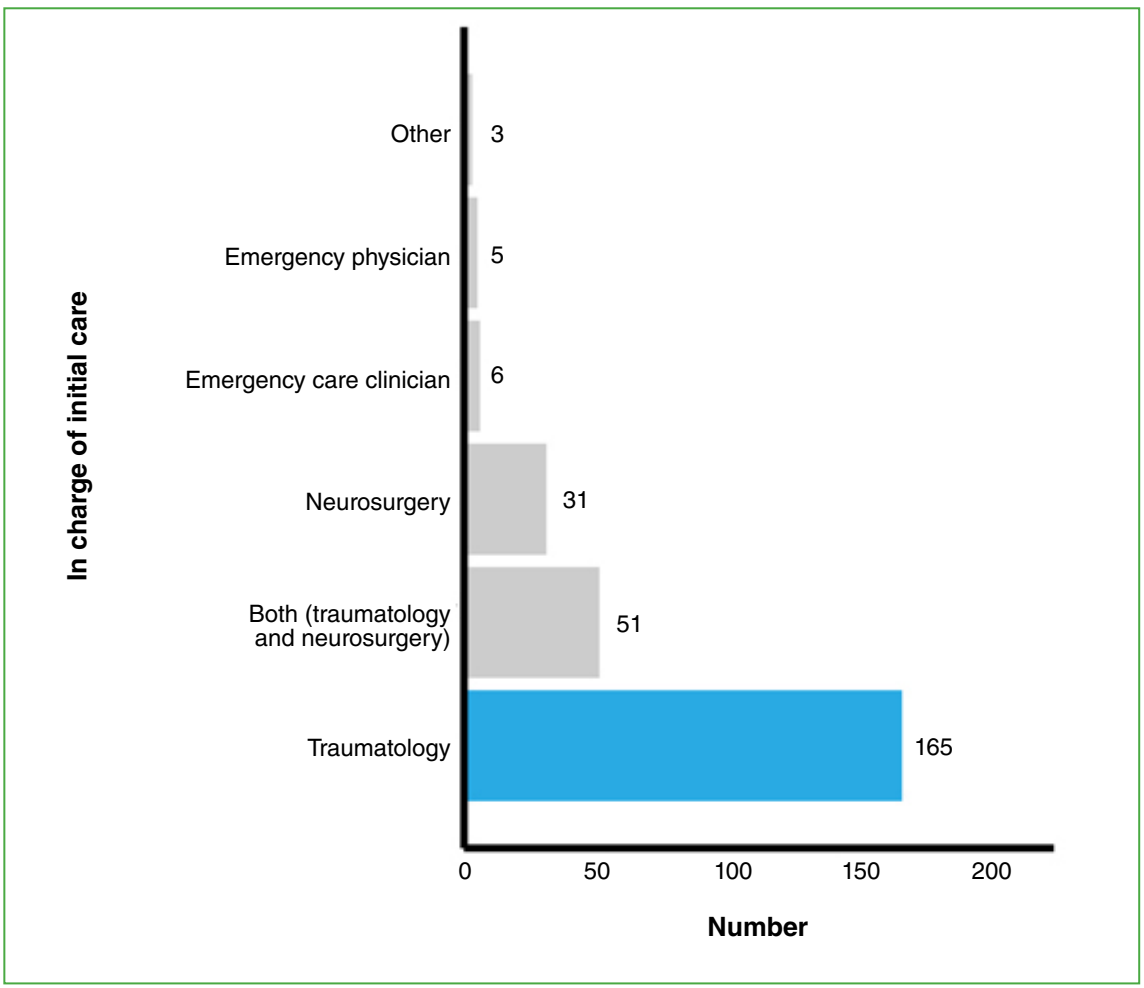

Figure 3. Bar graph illustrating the distribution of medical specialties responsible for guiding the care of patients with spinal trauma.

Most respondents work in institutions with an active spine team (n = 173; 63.3%), allowing for effective interconsultation during on-call shifts (n = 151; 87%). Interconsultation within 12 hours was significantly more frequent among physicians working in institutions with an internal spine team compared to those relying on external consultants [delay < 12 h with institutional spine team: n = 138 (80%); delay < 12 h with extra-institutional spine team: n = 42 (48%); $p < 0.001$].

A total of 54.8% (n = 143) reported that their institutions do not have a formal protocol for the management of ST patients in the emergency department. However, 59.4% (n = 155) indicated that they use classification systems to document these cases. The American Spinal Injury Association (ASIA) Impairment Scale was the most commonly used classification tool (n = 164; 62.8%), followed by the AOSpine classification system (n = 115; 44.1%).

Imaging Studies

More than 90% of respondents reported the availability of radiographs (n = 259; 99.6%; missing data = 1) and computed tomography (CT) (n = 239; 91.6%) at their institutions. In contrast, only 36% (n = 96) indicated access to magnetic resonance imaging (MRI). Most reported challenges related to the quality of radiographs (n = 185; 70.9%), incomplete imaging (n = 129; 49.4%), suboptimal technique (n = 129; 49.4%), and delays in obtaining timely radiographs in the shock room setting (n = 111; 42.5%). Nearly 90% of respondents reported that a spinal CT scan was obtained within 6 hours of admission, whereas fewer than one-third reported obtaining spinal MRI within the same timeframe (Figure 4).

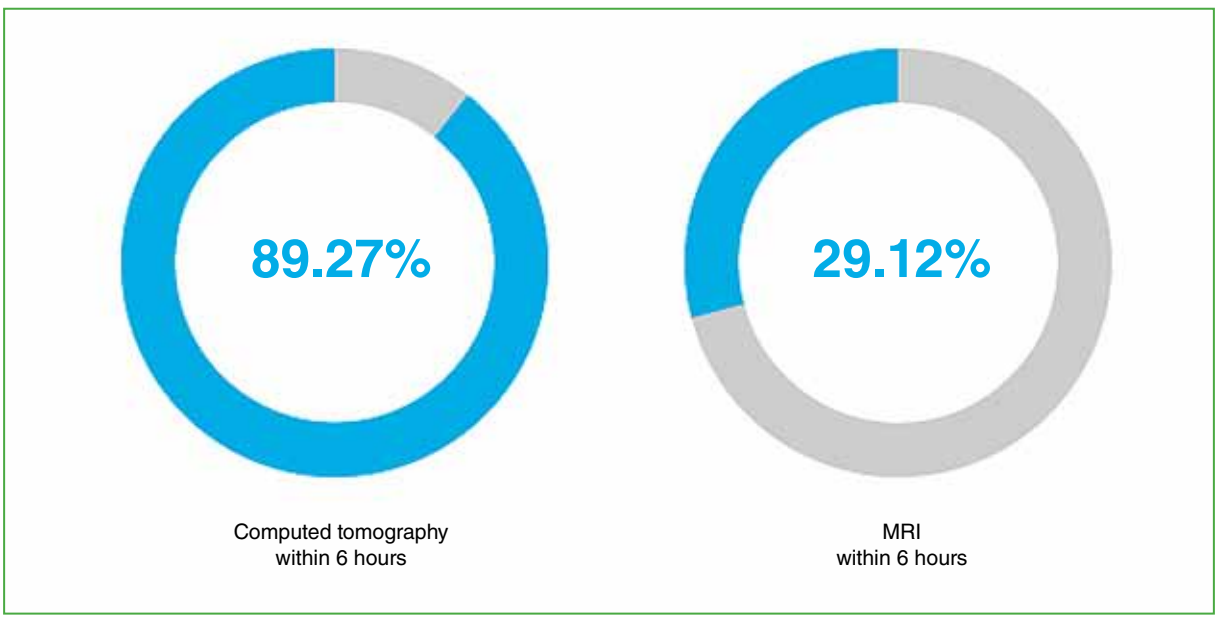

Figure 4. Pie chart: access to CT and MRI within 6 hours of patient admission.

Treatment

According to respondents, patients with ST are admitted directly to the intensive care unit (ICU) (n = 127; 48.7%) or to the emergency area of the general ward (n = 86; 33%). Approximately half reported experiencing difficulties with patient admission at least occasionally (cumulative percentage of the categories Occasionally/Frequently/Very frequently: 47.4%; n = 123), and similar difficulties were noted for initial clinical management (cumulative percentage of the categories Occasionally/Frequently/Very frequently: 61.6%; n = 161). A total of 51.3% (n = 134) reported administering methylprednisolone to patients with neurological injury, and more than 50% reported frequent or very frequent issues with its availability in the emergency department (cumulative percentage of the categories Frequently/Very frequently: 53.6%; n = 140).

Eighty-one percent of respondents included cervical traction in their therapeutic algorithm; however, only 32.6% (n = 85) reported having the necessary equipment to perform it in the Emergency Department. Most respondents indicated that definitive treatment is provided at their own institution (n = 190; 72.8%) and is carried out either exclusively by traumatology (n = 105; 40.2%) or in collaboration with neurosurgery (n = 61; 23.4%). Only 18.8% (n = 49) reported neurosurgery as the primary specialty responsible for managing spinal trauma (ST). The majority reported a typical delay of more than 24 hours from admission to spinal decompression and stabilization (n = 206; 78.9%). Additionally, 12% (n = 32) considered laminectomy without instrumentation as part of their management strategy (Figure 5).

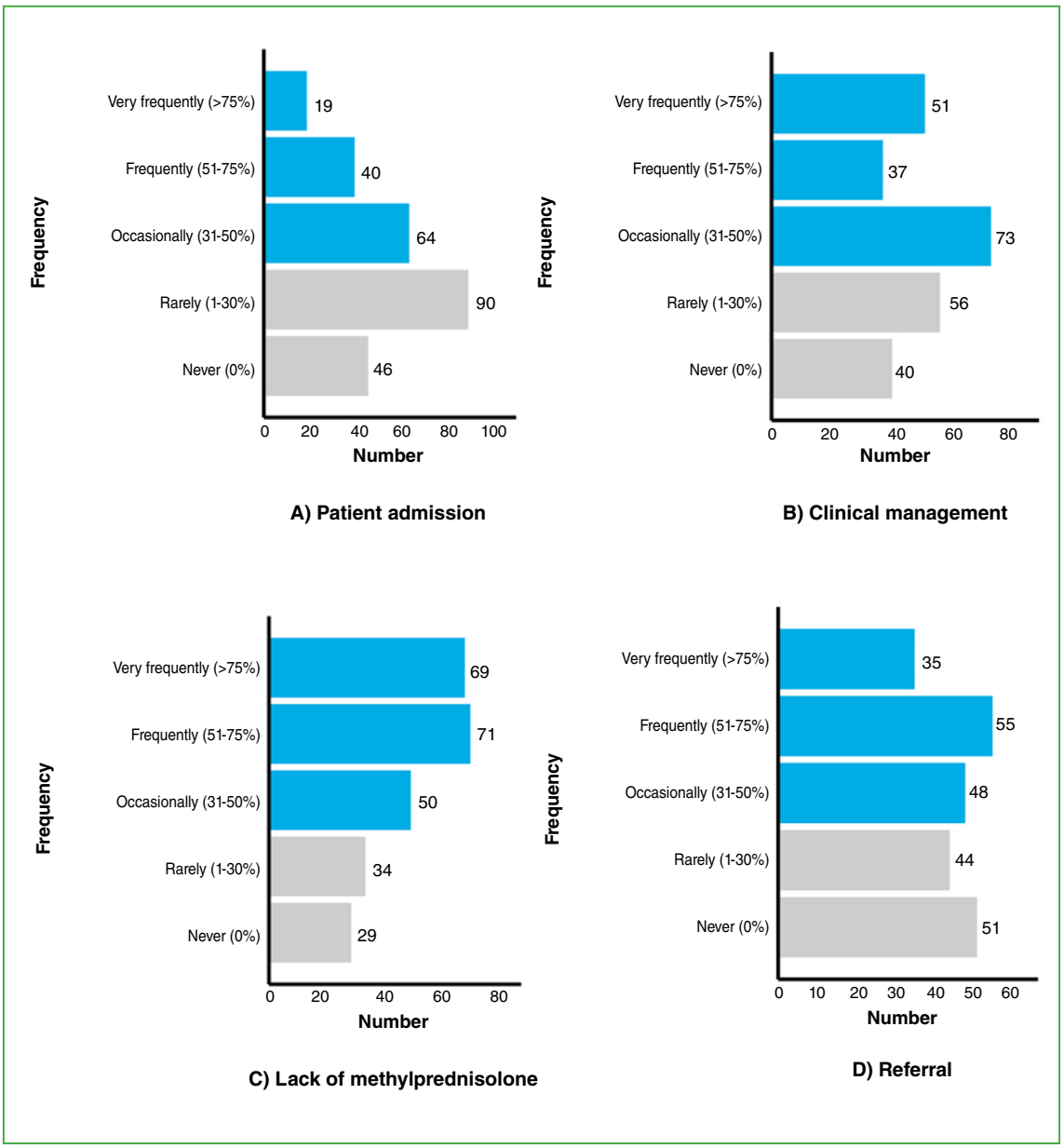

Figure 5. Bar graphs: A) Frequency of reported difficulties upon admission of patients with spinal trauma B) Frequency of reported difficulties upon initial clinical management C) Frequency of reported difficulties regarding vailability of methylprednisolone in the ward D) Frequency of reported difficulties regarding patient referral.

Referral

More than 50% of traumatologists reported experiencing difficulties with patient referral at least occasionally (cumulative percentage for the categories Occasionally/Frequently/Very frequently: 52.8%; n = 138). According to 46.7% (n = 122), the usual referral delay was greater than 12 hours, and according to 30% (n = 78), it exceeded 24 hours. The most commonly reported barriers were issues related to the patient's type of medical coverage (n = 138; 52.9%) and transfer delays (n = 114; 43.7%), followed by poor communication with the receiving center (n = 87; 33.3%), delays in obtaining imaging (n = 32; 12.3%), and other causes (n = 2; 0.8%) (Figure 5).

Training and Quality of Training During Residency

When assessing the perceived level of training of the on-call physicians included in the survey, the categories grouped as "Moderately" or "Highly" trained accounted for 67.4% (n = 115).

Finally, regarding training in spinal trauma (ST) care during residency, only 25% of respondents rated its quality as "incomplete" or "very incomplete" (n = 66; 25.3%).

Comparison Between Traumatologists According to Difficulties in the Care of Patients With ST

This comparison was conducted exclusively among traumatologists from the Buenos Aires Metropolitan Area, who comprised 51.3% (n = 134) of the respondents, in order to avoid bias from underrepresented cities or provinces.

When comparing the characteristics of surveyed physicians in relation to difficulties encountered in the care of ST patients, the variables "type of institution (private vs. public)" and "surgical delay <24 h" showed statistically significant differences. A higher proportion of private institutions (37% vs. 20%; p = 0.046) and a greater frequency of early surgical intervention (37% vs. 15%; p = 0.003) were observed among traumatologists who reported no difficulties in the care of ST patients (Table 2).

DISCUSSION

In recent decades, multiple efforts and scientific advances have been made to optimize the initial care and limit the sequelae in patients with spinal trauma (ST).[11] Early surgical decompression and adequate hemodynamic management play a crucial role in improving outcomes.[11,12] The growing body of available evidence has led to an increase in both the level of evidence (from low to moderate) and the strength of recommendation (now strong) in support of surgical decompression within the first 24 hours following injury.[12] However, the effective implementation of clinical guideline recommendations faces "real-life" challenges, where the gap between the ideal and the possible varies geographically.[11,13-17]

Our study describes a cross-sectional cohort of physicians working in emergency departments across the country. More than 70% of the sample reported difficulties in the care of this patient group across various domains.

There is general consensus that patients with acute ST should be admitted to the intensive care unit (ICU), or at least to an area where continuous hemodynamic monitoring is possible.[18] In our survey, most physicians reported that patients with ST are admitted directly to the ICU (n = 127; 48.7%) or to the emergency area of the ward (n = 86; 33%). Approximately half of the respondents reported challenges related to patient admission and initial clinical management. Notably, fewer than 5% indicated that emergency medicine physicians (n = 5; 1.9%) or on-call clinicians (n = 6; 2.3%) are in charge of guiding care for ST patients.

Our cohort reported relatively easy access to radiography and computed tomography. However, over 70% noted difficulties in radiographic evaluation due to incomplete studies or suboptimal technique. Importantly, most surgeons indicated that their institutions lack access to magnetic resonance imaging (MRI), and only one-third reported access to spinal MRI within 6 hours.

Previous studies have assessed surgical delays in spinal trauma patients in our region. Guiroy et al. retrospectively evaluated time to surgery in patients with unstable thoracolumbar fractures and found that more than half of the cases experienced delays exceeding 72 hours, and in approximately one-quarter, surgery was delayed more than a week.[17] The main reasons for surgical delay reported in previous studies were clinical instability and lack of financial resources. In our study, only 21% of traumatologists indicated that spine decompression and stabilization procedures are usually performed within the first 24 hours at their institutions. Notably, when comparing physicians from the Buenos Aires Metropolitan Area based on reported difficulties in ST patient care, the variable "type of institution" showed statistically significant differences, with a higher proportion of traumatologists from private institutions in the group that reported no difficulties.

Additional factors associated with limited resources for the initial management of ST patients were also documented. These include the availability of skeletal traction equipment, the presence of methylprednisolone in the emergency department, delays in transfers for referral, and limited or delayed access to a specialized spine team.

The timely referral of ST patients to centers with adequate infrastructure and specialized personnel is essential.[11,12] However, 46.7% of respondents reported referral delays greater than 12 hours. For those working in institutions without an active spine team, this delay is compounded by the time required for external consultations. The complexity of our healthcare system undermines the promptness that this condition demands. Contributing factors include heterogeneous insurance coverage, delays in patient transfers, and prolonged intervals from injury to definitive diagnosis using appropriate imaging modalities—all of which were cited as challenges by the surveyed orthopedic surgeons.

This study has several limitations, such as its cross-sectional design, potential recall bias among respondents, and underrepresentation of some provinces. Nevertheless, the findings provide valuable local insight and highlight a critical issue due to its clinical relevance and associated morbidity and mortality in our specialty. These results may serve as a foundation for the future development of local protocols aimed at aligning with the recommendations of international guidelines and current scientific evidence.

CONCLUSIONS

The experience reported by orthopedic surgeons in Argentina reveals that more than 70% face frequent challenges in the care of patients with spinal trauma (ST). These difficulties span across initial clinical management, diagnostic evaluation, treatment, and timely referral.

There is a clear need for prospective, multicenter studies at the national level to establish a reliable registry that reflects our current clinical reality. Such data are essential to inform decision-making and guide the development of strategies aimed at improving the effectiveness and timeliness of spinal trauma care in Argentina.

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

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Clinical and Demographic Characteristics of Workers with Unspecified Low Back Pain

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ABSTRACT

Objective: To describe the clinical and demographic characteristics of workers with unspecified low back pain treated at a primary care facility. **Materials and Methods:** This was a descriptive, cross-sectional study involving workers diagnosed with unspecified low back pain (ICD-10 M54.50) at a primary care facility. The sample included 269 patients selected through consecutive random sampling. The patient profile was analyzed across nine dimensions: demographic, physical, nutritional, health-related behaviors, occupational, etiological, duration of symptoms, clinical manifestations, and management. Statistical analysis included percentages, means, and 95% confidence intervals for both. **Results:** The majority of patients were female (53.7%; 95% CI: 47.8–59.6), with a mean age of 41 years (95% CI: 40–43). Obesity was present in 37.8% of patients (95% CI: 32.0–43.6). Most patients engaged in moderate physical labor (58.5%; 95% CI: 52.6–64.4). In 22.6% of cases (95% CI: 17.6–27.6), the onset of low back pain followed physical exertion. Limited lumbar mobility was observed in 31.9% (95% CI: 26.3–37.5), and 42.6% (95% CI: 36.7–48.5) were unable to work due to the condition. **Conclusions:** Workers with unspecified low back pain treated in primary care were predominantly women in their forties, with high rates of obesity, low physical activity, and moderate occupational physical demands. In most cases, the underlying cause was not identified, the duration of symptoms was typically under three weeks, and clinical manifestations included motor symptoms, muscle contracture, and work-related disability.

Keywords: Low back pain; clinical characteristics; workers.
Level of Evidence: IV

Perfil epidemiológico del paciente con lumbago no especificado

RESUMEN

Objetivo: Identificar el perfil epidemiológico del trabajador con lumbago no especificado, atendido en una unidad de medicina familiar. **Materiales y Métodos:** Estudio transversal descriptivo en trabajadores con lumbago no especificado (CIE 10 M54.5), atendidos en una unidad médica de primer nivel. El tamaño de la muestra fue de 269, la técnica muestral fue aleatoria por casos consecutivos. El perfil epidemiológico se integró en 9 dimensiones: perfil demográfico, perfil físico, perfil nutricional, perfil de salud y hábitos, perfil laboral, perfil etiológico, perfil del tiempo de evolución, perfil de manifestaciones clínicas y perfil de manejo. El análisis estadístico incluyó porcentajes, promedios e intervalos de confianza para porcentajes y promedios. **Resultados:** Predominó el sexo femenino (53,7%; IC95% 47,8-59,6), la edad promedio era de 41 años (IC95% 40-43), el 37,8% tenía obesidad (IC95% 32,0-43,6), la actividad laboral predominante fue el trabajo moderado (58,5%; IC95% 52,6-64,4), el origen de la lumbalgia después de un esfuerzo representó el 22,6% (IC95% 17,6-27,6), el 31,9% (IC95% 26,3-37,5) tenía una movilidad lumbar limitada, y el 42,6% (IC95% 36,7-48,5), incapacidad laboral. **Conclusiones:** El perfil epidemiológico del trabajador con lumbago asistido en el primer nivel de atención contempla la cuarta década de la vida, el sexo femenino, la obesidad, la escasa actividad física, la actividad laboral moderada; y no identifica la etiología, la evolución inferior a semanas, los síntomas motores, la contractura muscular y la incapacidad para la actividad laboral.

Palabras clave: Lumbago; perfil; trabajador.
Nivel de Evidencia: IV

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INTRODUCTION

Low back pain is a globally prevalent musculoskeletal condition, characterized by acute or chronic pain and attributed to various causes, including poor posture, excessive physical load, or inadequate movements. Additionally, individual physical condition—particularly overweight and obesity—has been identified as a contributing factor.[2,3]

This condition is recognized as a public health problem due to its impact on individuals, the strain it places on healthcare services, and the associated costs of care. It is estimated that approximately 80% of individuals will experience low back pain at least once in their lifetime.[4-7]

Prevalence rates reported in the literature vary widely, ranging from 6% to 13%,[8,9] with some studies indicating a prevalence as high as 42% among working populations.[10]

Describing the characteristics of low back pain involves the concept of an epidemiological profile, which encompasses population-specific attributes. Although a universal definition does not exist, this profile generally includes clinical features, etiology, healthcare-seeking behaviors, and personal habits.[11-14]

Identifying the epidemiological profile of low back pain may offer clinical insights; however, its primary value lies in generating knowledge to better understand and characterize affected populations.

In this context, the objective of the present study was to identify the epidemiological profile of workers with unspecified low back pain treated at a family medicine unit.

MATERIALS AND METHODS

A descriptive, cross-sectional study was conducted using clinical records of workers diagnosed with unspecified low back pain (ICD-10: M54.5)[15] at a family medicine unit in the city of Oaxaca, Mexico. The study period spanned from September 2021 to August 2022.

Inclusion criteria comprised clinical records of active workers over 18 years of age, engaged in any form of employment, and with complete medical documentation. Exclusion criteria included patients with a history of lumbar spine surgery, cauda equina syndrome, terminal illness, or pregnancy.

The sample size was determined using the formula for an infinite population with a 95% confidence interval (CI) for a critical region with $Z_{alpha} = 1.64$. Assuming a prevalence of 50% for Skill level 1 (p = 0.50%) and a margin of error of 5% (d = 0.05), the calculated sample size was 269 participants.

A non-randomized consecutive sampling technique was employed. The sampling frame was derived from the list of patients diagnosed with unspecified lumbago maintained by the statistics department of the medical unit.

The epidemiological profile of low back pain was structured into the following nine dimensions:

- Demographic profile (age and sex).
- Physical profile (weight, height, and body mass index (BMI)).
- Nutritional profile (underweight, normal weight, overweight, or obesity).
- Health/Habits profile (presence of chronic diseases and physical activity (defined as ≥30 minutes/day, 5 days/week)).
- Occupational profile: Based on the *International Standard Classification of Occupations* (ISCO-88):[16] Skill Level 1, Simple, routine physical or manual tasks; Skill Level 2, Tasks involving operation and repair of electronic/manual machinery or data processing; Skill Level 3, Specialized technical tasks requiring skills and procedures in a specific field; Skill Level 4, Complex problem-solving and decision-making based on extensive theoretical knowledge.
- Background profile (strain, trauma, postural factors (e.g., heavy lifting, static postures, repetitive work, frequent flexion), or no apparent cause).[17]
- Evolution profile (duration of illness (in weeks) and time from symptom onset to seeking medical attention (in days)).
- Clinical manifestations profile (accompanying symptoms, sensory and motor signs (e.g., mobility limitation due to pain), genitourinary symptoms, radiating pain, restricted lumbar ROM, radiculopathy, and muscle contracture).
- Management profile (medical-administrative procedures and support services).

After obtaining authorization from the research committee, data collection was carried out at the statistics department of the medical unit. All records with a diagnosis of unspecified low back pain between September 2021 and August 2022 were identified. Subsequently, the family medicine information system was accessed, and data were extracted from records that met the selection criteria. Throughout the process, patient confidentiality and anonymity were strictly maintained.

The statistical analysis included the calculation of percentages with corresponding confidence intervals (CI), as well as means with their respective confidence intervals.

RESULTS

Demographic, Physical, Nutritional, and Health/Habits Profiles

Among the studied population, women represented the majority (53.7%; 95%CI: 47.8–59.6). The mean age was 41 years (95%CI: 40–43), and the mean weight was 73.38 kg (95%CI: 71.68–75.08). Based on body mass index (BMI), 44.4% (95%CI: 38.5–50.3) were classified as overweight (BMI 25–29.99 kg/m²). The prevalence of arterial hypertension was 12.2% (95%CI: 8.3–16.1), and 24.4% (95%CI: 19.3–29.5) reported engaging in regular physical activity. These variables are detailed in Table 1.

Table 1. Demographic profile, physical profile, nutritional profile and health/habits profile of patients with unspecified low back pain.

Characteristics	Average % (n = 269)	95%CI	
		Lower	Upper
Demographic profile			
Age (years)	41.61	40.22	43.01
Sex (female)	53.7	47.8	59.6
Physical profile			
Weight (kg)	73.38	71.68	75.08
Height (m)	1.59	1.58	1.61
BMI (kg/m^2)	28.60	28.07	29.13
Nutritional profile			
Underweight	2.2	0.5	3.9
Normal weight	15.6	11.3	19.9
Overweight	44.4	38.5	50.3
Obesity	37.8	32.0	43.6
Health/Habits profile			
Comorbidities			
Diabetes mellitus*	3.0	1.0	5.0
Arterial hypertension**	12.2	8.3	16.1
Diabetes mellitus/arterial hypertension***	2.2	0.5	3.9
None	82.6	78.1	87.1
Habits			
Physical activity (30 min per day, 5 days per week)	24.4	19.3	29.5

*Prevalence of diabetes, regardless of whether the patient has hypertension or not.
**Prevalence of hypertension, regardless of whether the patient has diabetes or not.
***Prevalence of both diabetes and hypertension.
BMI = body mass index; 95%CI = 95% confidence interval.

Occupational Profile

According to the ISCO-88 classification, 42.6% (95%CI: 36.7–48.5) of participants performed tasks associated with Skill Level 1. Further occupational characteristics are presented in Table 2.

Table 2. Occupational profile in patients with unspecified low back pain.

Characteristics	% (n = 269)	95%CI	
		Lower	Upper
Job position			
Skill level 1	42.6	36.7	48.5
Skill level 2	38.9	33.1	44.7
Skill level 3	15.9	11.5	20.3
Skill level 4	2.6	0.7	4.5

95%CI = 95% confidence interval.

Background Profile

A history of strain was reported in 22.6% (95%CI: 17.6–27.6) of cases. The remaining antecedents are shown in Table 3.

Table 3. Background profile of low back pain in patients with unspecified low back pain.

Background of low back pain	% (n = 269)	95%CI	
		Lower	Upper
Strain	22.6	17.6	27.6
Trauma	21.5	16.6	26.4
Posture	7.4	4.3	10.5
No apparent cause	48.5	42.5	54.5

95%CI = 95% confidence interval.

Evolution and Clinical Manifestations Profiles

Limited lumbar range of motion was documented in 31.9% (95%CI: 26.3–37.5) of patients. The predominant time of evolution was less than 6 weeks in 70.4% (95%CI: 65.0–75.8) of cases. These data are summarized in Table 4.

Management Profile

Work incapacity was reported in 42.6% (95%CI: 36.7–48.5) of patients. The mean number of days of work leave for the entire population was 1.26 days (95%CI: 1.05–1.47). Detailed information on medical-administrative management and the use of support services is provided in Table 5.

DISCUSSION

It has been reported that the likelihood of experiencing low back pain increases with age.[10] However, this finding contrasts with the results of the present study, where the mean age was approximately 40 years—corresponding to a younger population. This discrepancy can be attributed to the nature of the sample, composed exclusively of working individuals, primarily within the young adult demographic. This characteristic inherently influences the age at presentation of low back pain in this study.

Table 4. Profiles of time of evolution and clinical manifestations in patients with unspecified low back pain.

Characteristics	% (n = 269)	95%CI	
		Lower	Upper
Profile of time of evolution			
Time of disease evolution			
Less than 6 weeks	70.4	65.0	75.8
6 to 12 weeks	4.1	1.7	6.5
More than 12 weeks	25.6	20.4	30.8
Onset of symptoms and request for care			
1 to 7 days	56.7	50.8	62.6
1 week to 1 month	17.0	12.5	21.5
More than 1 month	26.3	21.0	31.6
Profile of clinical manifestations			
Accompanying symptoms			
Sensitive	25.6	20.4	30.8
Motor	71.5	66.1	76.9
Genitourinary and gastrointestinal	3.0	1.0	5.0
Irradiation of pain	22.2	17.2	27.2
Lumbar range of motion			
Limited	31.9	26.3	37.5
Radiculopathy	13.7	9.6	17.8
Muscle contracture	67.8	62.2	73.4

95%CI = 95% confidence interval.

Table 5. Management profile of the patient with unspecified low back pain

Characteristics	%/Average (n = 269)	95%CI	
		Lower	Upper
Medical-administrative management			
Analgesics (exclusively)	16.7	12.2	21.2
Posture hygiene	40.7	34.8	46.6
Work incapacity	42.6	36.7	48.5
Leave (days, all patients)	1.26	1.05	1.47
Support services			
Orthopedics and Traumatology	7.8	4.6	11
Rehabilitation	5.6	2.9	8.3
Emergencies	0.4	0.4	1.2

95%CI = 95% confidence interval.

Overweight and obesity are also well-documented components of the epidemiological profile of low back pain. The rationale for this association is twofold: first, abdominal prominence in overweight individuals promotes lumbar hyperlordosis, leading to increased tension in the lumbar musculature. Second, excess body weight increases the mechanical load on vertebral structures, accelerating degenerative processes.[3,18,19] This relationship is compounded by physical inactivity—another prevalent trait within the study population—which may further contribute to the development of low back pain.

In terms of occupational classification, skill levels 1 and 2—representing physically demanding jobs—were the most prevalent. In contrast, occupations requiring complex decision-making (skill levels 3 and 4) were less represented. This distribution suggests that the sample primarily comprises manual laborers rather than knowledge-based workers. While these findings do not allow us to infer a higher prevalence of low back pain among manual laborers per se, they do highlight the specific job profile of the population studied. Notably, training in spinal care has been consistently recommended for physically active workers to mitigate the risk of musculoskeletal disorders.[16]

The observed prevalence rates for diabetes mellitus and arterial hypertension were lower than those reported in the general population, which is consistent with the younger age profile of the cohort. Previous research has shown that the prevalence of these conditions increases with age. Among the two, hypertension tends to appear earlier than diabetes, explaining its relatively higher frequency in this group.[20-22]

Although the low prevalence of regular physical activity may contribute to the risk of low back pain, this study did not investigate causality or association between these variables. Thus, physical activity is reported here as a descriptive characteristic of the study population.

Finally, although nearly half of the patients required medical leave due to their condition, the average number of days of leave was low. This may suggest that medical leave was primarily intended to manage acute symptoms. Moreover, the short duration of leave could be influenced by the potential economic consequences of extended work absence.

CONCLUSIONS

The epidemiological profile of low back pain among workers treated in a primary care setting is characterized by individuals in their fourth decade of life, with a high prevalence of obesity, low levels of physical activity, and employment involving physical exertion. The condition commonly presents with symptom evolution of less than six weeks, associated muscle contracture, and work incapacity.

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Which Should Be Operated on First—The Spine or the Hip?
A Survey-Based Study on Treatment Order in Patients with Concurrent Degenerative Disorders of the Hip and Spine

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ABSTRACT

Introduction: In patients presenting with both hip osteoarthritis (OA) and spinal pathology, and where symptoms from both conditions are severe enough to warrant surgical intervention, determining the optimal order of treatment can be challenging. **Objective:** To identify surgeons' preferences and the rationale behind the treatment order in patients with hip OA and five different lumbar spine disorders. **Materials and Methods:** A survey-based study was conducted among hip and spine specialists. Respondents were asked which condition they would operate on first in five clinical scenarios involving hip OA combined with: 1) lumbar spinal stenosis with neurogenic claudication, 2) low-grade lumbar spondylolisthesis with radicular pain, 3) lumbar disc herniation with muscle weakness, 4) degenerative lumbar scoliosis with sagittal imbalance, and 5) thoracolumbar disc herniation with myelopathy. **Results:** The percentage of hip specialists who recommended addressing the hip first was: 45% for scenario 1, 61% for scenario 2, 20% for scenario 3, 71% for scenario 4, and 26% for scenario 5. Among spine specialists, those percentages were: 56%, 69%, 9%, 77%, and 16%, respectively. There was no consistent agreement between specialists from different fields—or even within the same specialty—as indicated by a low kappa concordance index across all scenarios. **Conclusions:** Given the low level of agreement among both hip and spine surgeons, interdisciplinary discussions are essential when managing complex cases. An individualized treatment plan should be developed for each patient, particularly when the spinal pathology is more complex.

Keywords: Spine; hip; survey.
Level of Evidence: IIb

¿Qué debería operar primero? ¿La columna o la cadera? Estudio basado en encuestas sobre el orden del tratamiento para pacientes con trastornos degenerativos concurrentes de la cadera y la columna

RESUMEN

Introducción: Cuando los pacientes tienen osteoartritis de cadera y enfermedad de la columna vertebral, y los síntomas de ambos cuadros son lo suficientemente graves como para justificar la cirugía, puede ser difícil decidir el orden óptimo de tratamiento. **Objetivo:** Determinar la preferencia y la justificación del orden del tratamiento en pacientes con artrosis de cadera y 5 trastornos lumbares diferentes. **Materiales y Métodos:** Estudio basado en encuestas a especialistas de cadera y de columna sobre qué cuadro operar primero en 5 escenarios clínicos de osteoartritis de cadera y 1) canal estrecho lumbar con claudicación neurológica; 2) espondilolistesis lumbar de bajo grado con dolor radicular; 3) hernia de disco lumbar con pérdida de la fuerza muscular; 4) escoliosis lumbar degenerativa con desequilibrio sagital; 5) hernia de disco toracolumbar con mielopatía. **Resultados:** El porcentaje de especialistas en cadera que recomendaron operar la cadera primero fue del 45% para el escenario 1; 61% para el escenario 2; 20% para el escenario 3; 71% para el escenario 4; 26% para el escenario 5. No hubo acuerdo entre los cirujanos de ambas especialidades, ni siquiera entre los de la misma especialidad, con un índice de concordancia kappa bajo en todos los

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casos. **Conclusiones:** Como la concordancia dentro de cada especialidad es baja, en casos individuales complejos, los cirujanos de columna y de cadera deben entablar una discusión interdisciplinaria y desarrollar un concepto de terapia individualizada para cada paciente, sobre todo cuando la enfermedad de columna es más compleja.

Palabras clave: Columna; cadera; encuesta.

Nivel de Evidencia: IIb

INTRODUCTION

Patients with symptomatic osteoarthritis of the hip often present with concomitant lumbar or thoracolumbar spine disorders.[1,2] In these patients, treatment priority is usually determined by the severity and location of symptoms, impact on activities of daily living, and patient preference. However, when the symptoms of both conditions are severe enough to warrant surgical intervention, determining the optimal order of treatment can be challenging. Patients with lumbar symptoms or prior lumbar fusion are known to experience more complications—such as dislocation—and report lower satisfaction following total hip arthroplasty (THA).[2,3] Conversely, one study suggested that patients with lumbar symptoms and simultaneous hip osteoarthritis may experience partial relief of back symptoms after THA and may subsequently not require spine surgery.[4]

The primary objective of this study was to assess the preference and rationale for the order of treatment in patients with hip osteoarthritis and five distinct lumbar spine disorders. The hypothesis was that surgeons specializing in THA would differ in their preferred treatment sequence from those specializing in spine surgery.

MATERIALS AND METHODS

In collaboration with the *Argentine Society of Spine Pathology* (SAPCV) and the *Argentine Association for the Study of the Hip and Knee* (ACARO), an electronic survey was distributed to 480 members of SAPCV and 370 members of ACARO. A total of 167 responses were received (response rate: 20% overall; 23% for ACARO and 15% for SAPCV). The survey can be accessed at: https://docs.google.com/forms/d/e/1FAIpQLSe7YxWA_oVQ-Io50WsDpEAhTkgd4u46ZkjQHx52TnazJdL5wEw/viewform?usp=sf_link.

A survey-based study was conducted using five clinical scenarios involving concurrent hip osteoarthritis and common lumbar spine disorders. The goal was to obtain professional opinions on the preferred order of surgical treatment. The clinical scenarios presented were as follows:

Case 1: Hip osteoarthritis and lumbar spinal stenosis with neurogenic claudication.

Case 2: Hip osteoarthritis and low-grade lumbar spondylolisthesis with radicular pain.

Case 3: Hip osteoarthritis and lumbar disc herniation with muscle weakness.

Case 4: Hip osteoarthritis and degenerative lumbar scoliosis with sagittal imbalance.

Case 5: Hip osteoarthritis and thoracolumbar disc herniation with myelopathy.

Responses to the five scenarios were compared using percentage distribution and the kappa concordance index to evaluate inter-rater agreement (scale: 0.1–0.2 = poor; 0.21–0.4 = acceptable; 0.41–0.6 = moderate; 0.61–0.8 = good; 0.81–1 = very good). The aim was to assess consistency between responses and to identify patterns leading to new insights.

Descriptive statistics (frequency, central tendency, and variability) were calculated. Excel and InfoStat statistical software were used to georeference participating surgeons. Data were recorded in contingency tables. Data consistency was evaluated by correlating studied variables, and the results were illustrated using bar and pie charts to facilitate interpretation and enhance clarity.

RESULTS

A total of 850 professionals were surveyed, and 167 responded: 88 specialized in arthroplasty and 79 in spine surgery. Sixty-three respondents practice in the Autonomous City of Buenos Aires and the Province of Buenos Aires, while the remainder are distributed throughout Argentina. The overall mean number of years in practice was 18 (range 1 to >40 years) (Figure 1).

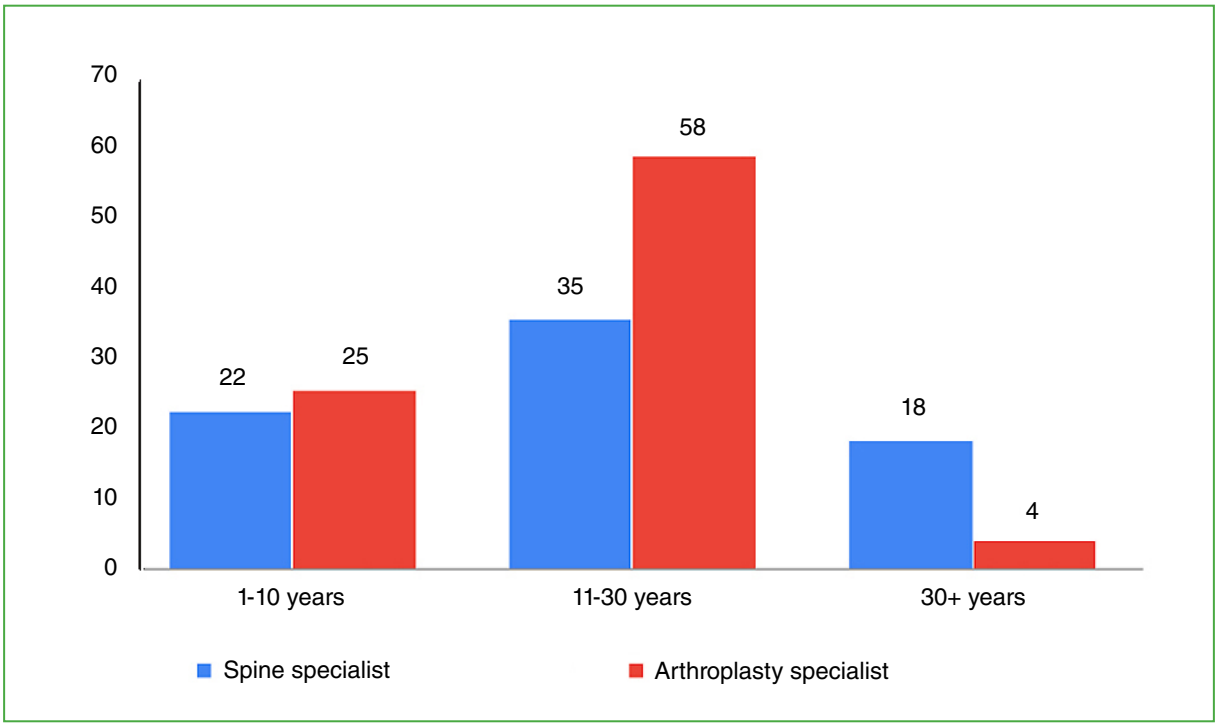

Figure 1. Years of experience according to specialty.

When assessing which surgery should be performed first in each clinical scenario, inter-specialty agreement was low, as demonstrated by the kappa concordance index (Table, Figure 2).

Table. Which surgery should be performed first, according to the different scenarios.

	Hip surgeons	Spine surgeons	Kappa
Scenario 1 Osteoarthritis plus lumbar spinal stenosis	55% Spine first	56% Hip first	0.136
	45% Hip first	40% Spine first	
Scenario 2 Osteoarthritis plus spondylolisthesis	61% Hip first	69% Hip first	0.070
	30% Spine first	24% Spine first	
Scenario 3 Osteoarthritis plus lumbar disc herniation	79% Spine first	89% Spine first	0.097
	20% Hip first	9% Hip first	
Scenario 4 Osteoarthritis plus degenerative lumbar scoliosis	71% Hip first	77% Hip first	0.047
	25% Spine first	21% Spine first	
Scenario 5 Osteoarthritis plus thoracolumbar disc herniation with myelopathy	72% Spine first	84% Spine first	0.103
	26% Hip first	16% Hip first	

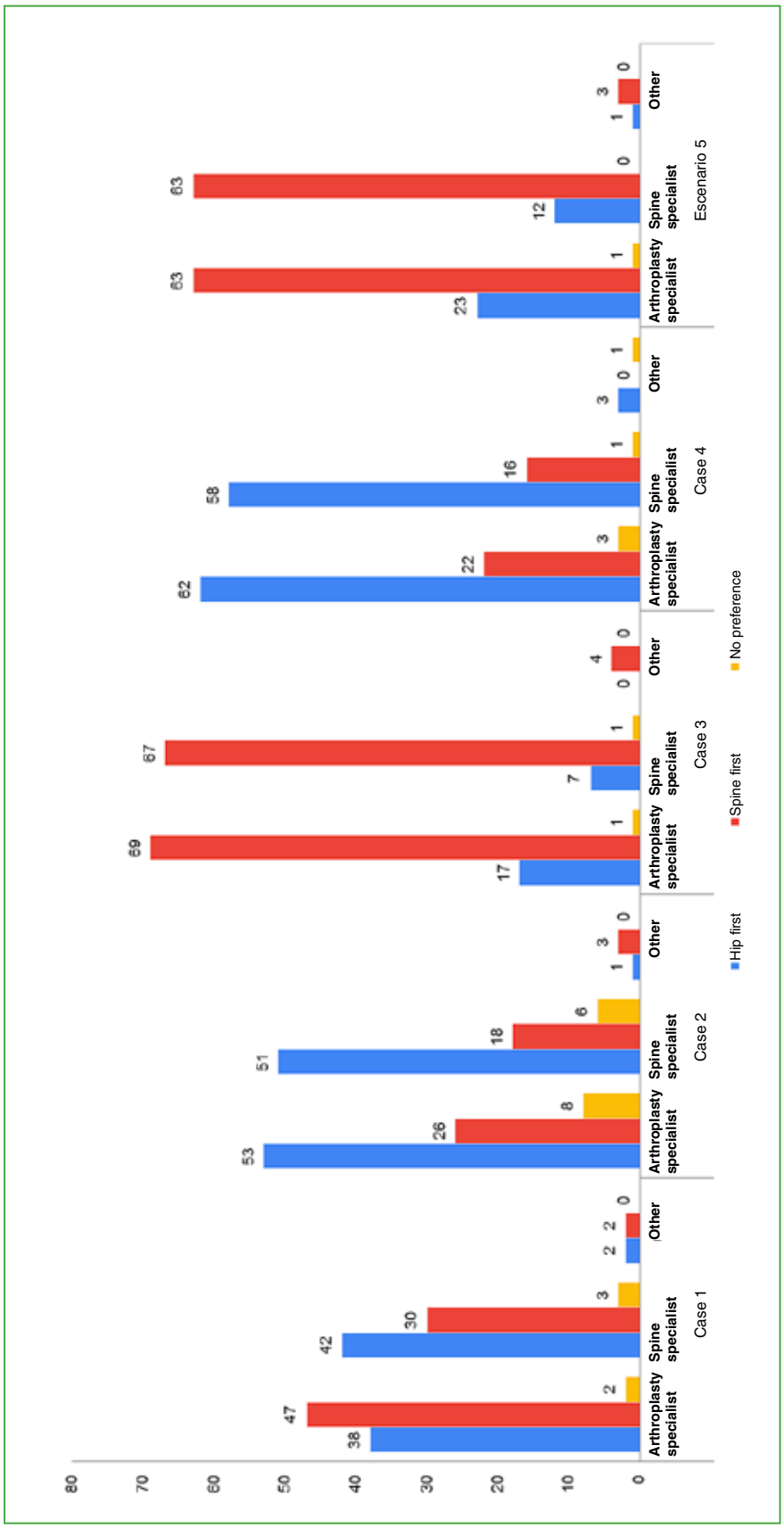

Figure 2. Type of surgery chosen according to specialty, distributed by scenario.

Among arthroplasty surgeons, the percentage recommending "hip first" surgery varied significantly across scenarios. The highest percentage was observed in Scenario 4 (hip osteoarthritis plus degenerative lumbar scoliosis, 71.3%), while the lowest was in Scenario 3 (hip osteoarthritis plus lumbar disc herniation, 20%). Conversely, spine surgeons most frequently recommended "spine first" surgery in Scenario 3 (89%) and least frequently in Scenario 4 (21%).

Overall, the variation in treatment preference among specialists recommending "hip first" across the five scenarios was statistically significant, as confirmed by concordance index analysis. However, in Scenarios 2 and 4, the concordance index indicated particularly low agreement between specialties and treatment preferences (Figure 3).

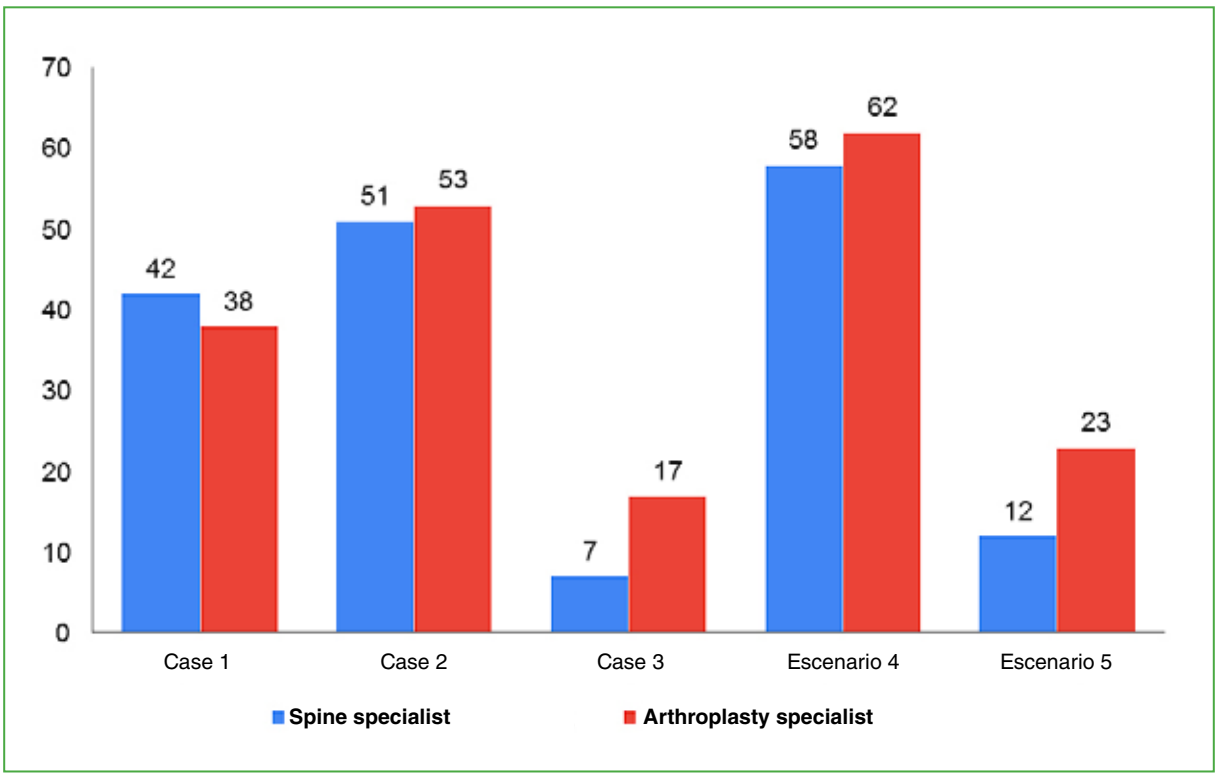

Figure 3. Choice of "hip first" surgery.

When comparing both groups of specialists across scenarios, greater concordance was observed in recommending "spine first" surgery in Scenarios 3 and 5, with more variability in the remaining scenarios (Figure 4). In some cases, there was no clear preference between operating on the spine or the hip first.

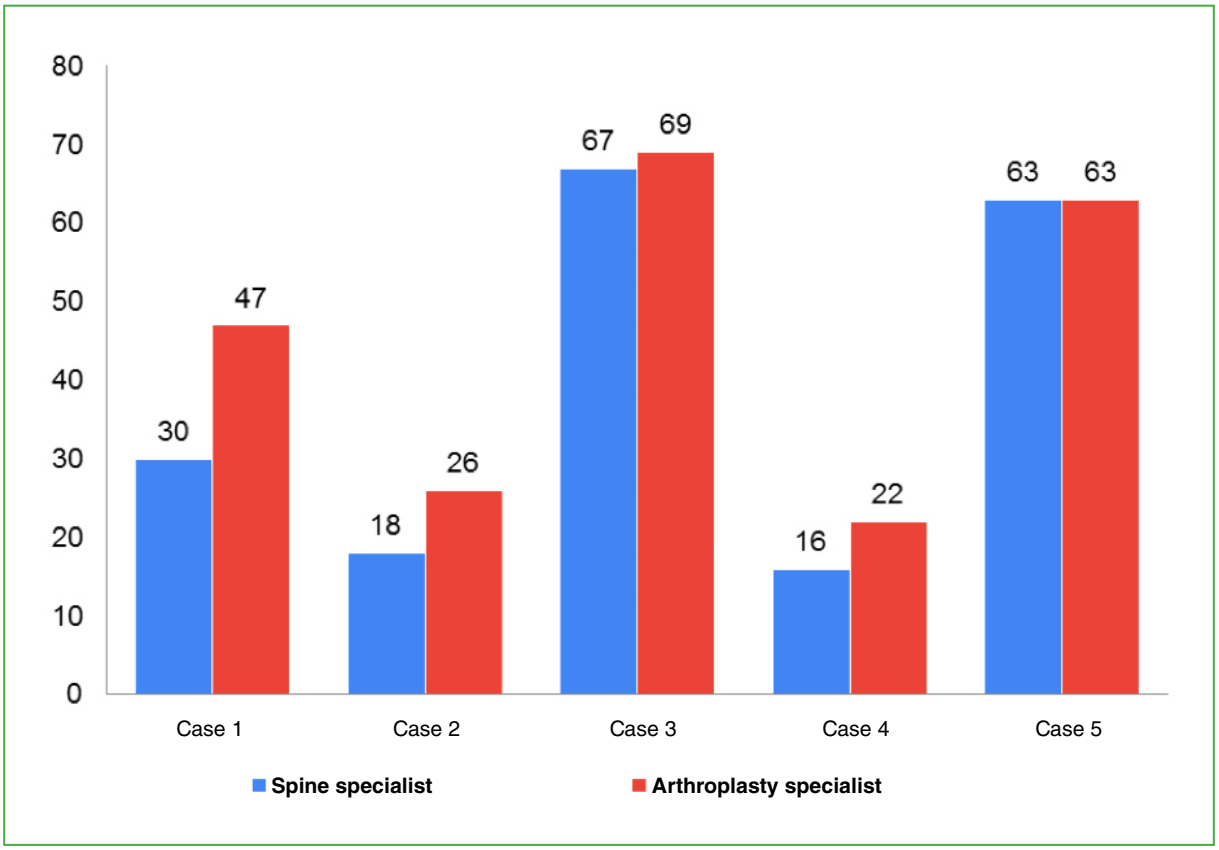

Figure 4. Choice of "spine first" surgery.

Scenario 1 was unique in that there was not only a lack of intra-specialty consensus, but also a reversal of inter-specialty preferences: 55% of hip specialists recommended "spine first," whereas 56% of spine specialists recommended "hip first."

Prosthesis selection also varied by specialty and clinical scenario. Among arthroplasty surgeons, notable differences were observed in prosthesis choice depending on the case. Similar variability was found among spine specialists. In Scenarios 2, 3, and 5, the most frequently chosen prosthesis was the cementless primary prosthesis (61%, 66%, and 43%, respectively). In Scenarios 1 and 4, the dual mobility prosthesis was the most commonly selected (45% and 55%, respectively) (Figure 5).

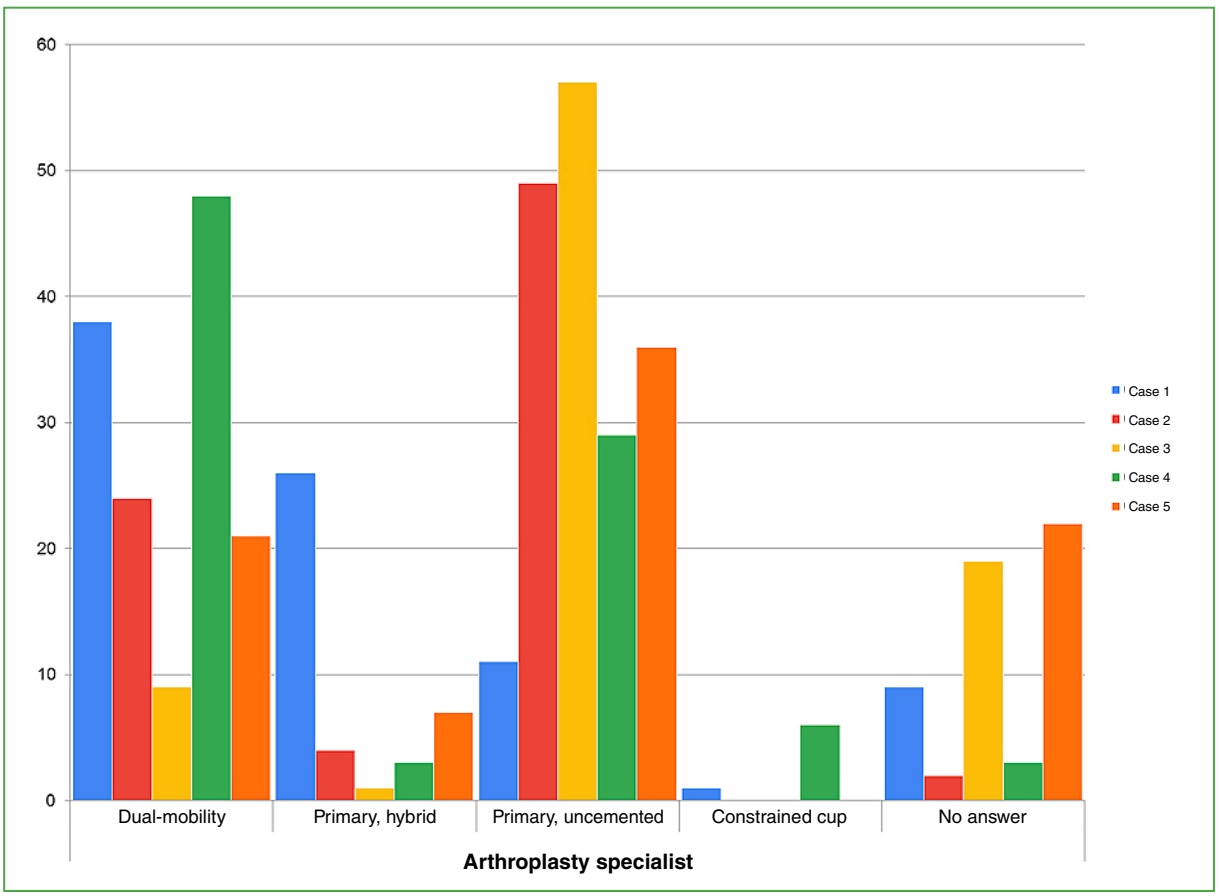

Figure 5. Choice of prosthesis type by arthroplasty specialists.

DISCUSSION

Total hip arthroplasty (THA) is considered the most successful operation in orthopedics and has been described as "the surgery of the century"[5] because it reliably meets patients' expectations.

This procedure effectively reduces or eliminates pain and improves joint mobility, thereby enhancing quality of life. However, recent studies show that up to 40% of patients with symptomatic hip osteoarthritis also suffer from degenerative lumbar spine disease,[1,2,6] and up to 4.5% undergo lumbar spine surgery following THA.[2] This association is linked to lower patient satisfaction and diminished quality of life. Furthermore, several studies report a 16-fold increase in THA dislocation rates and a 10-fold increase in revision rates when THA is performed after lumbar fusion.[7,8] Given this complex interaction between the two conditions, it remains controversial whether—and in which cases—THA can relieve spinal symptoms.

In a prospective study of 25 patients with hip osteoarthritis and lumbar spine symptoms, THA reduced low back pain intensity and Oswestry Disability Index scores[9] by 35% and 34%, respectively.[10] These findings highlight the need to establish a consensus on the order of surgical treatment in patients with coexisting symptoms in both anatomical regions. Resolution of one condition may lead to symptom improvement in the other, making it essential to pay close attention to clinical signs in the medical records, physical examination, and complementary studies.

This study was based on an electronic survey sent to members of two scientific societies involved in the treatment of both pathologies to determine treatment preferences across five clinical scenarios involving concurrent hip and spine disease. The design was modeled after the study by Liu et al.,[11] and reproduced in the Argentine orthopedic population.

Liu et al. received 88 responses, half the number obtained in our study (167). The average years of experience among respondents in Liu's study was 30.8 years, compared to 18 years in ours. Liu et al. reported that the majority of surgeons in both specialties preferred to operate on the hip first in Scenario 2 (hip osteoarthritis and low-grade lumbar spondylolisthesis with radicular pain), and on the spine first in Scenario 5 (hip osteoarthritis and thoracolumbar disc herniation with myelopathy). In Scenario 3, they found statistically significant discrepancies: 19% of spine specialists and 47% of hip specialists chose "hip first."

Similarly, in Scenario 4, 78% of spine specialists and 47% of hip specialists selected "hip first," a statistically significant difference. In Scenario 1, 59% of hip specialists and 49% of spine specialists preferred "hip first." Statistical analysis in that study was conducted using the χ^2 test. However, when we applied the same test, we did not find significant differences; thus, we used the kappa index, which adjusts for random agreement. Using this method, we observed a low concordance index both between and within specialties. For example, in Scenario 1, half of the hip surgeons chose "hip first," while the other half opted for "spine first," indicating no clear consensus even within the same subspecialty.

Analysis of responses across scenarios reveals trends within each specialty. When spinal disease was associated with neurological deficits or spinal cord involvement—such as in Scenarios 3 and 5—both specialties more frequently opted for spine surgery first. There is general agreement that patients with hip osteoarthritis and a progressive neurological deficit should undergo urgent spine surgery. However, the treatment order is less clear when neurological deficits are chronic and non-progressive, as seen in Scenario 1 (narrow lumbar canal with lower limb weakness) and Scenario 2 (chronic lumbar radiculopathy).

In Scenario 1, the tendency of hip surgeons to recommend spine surgery first may be due to unfamiliarity with lumbar disease management and the assumption that any neurologic symptom warrants urgent intervention, regardless of severity. Conversely, spine specialists may favor "hip first" due to the belief that improved hip mobility can enhance lumbopelvic biomechanics, potentially eliminating the need for spine surgery.

In Scenario 4 (hip osteoarthritis with degenerative lumbar scoliosis and sagittal imbalance), both specialties tended to recommend "hip first." This preference may be due in part to the perception that THA is a safer, more reliable procedure with faster recovery and more predictable outcomes compared to adult scoliosis surgery. However, it is important to note that sagittal imbalance poses an increased risk of instability.[12-14]

Regarding prosthesis selection, consistent with Liu et al., hip surgeons tended to select dual-mobility implants in scenarios involving increased concern for instability due to spinal stiffness or spinopelvic imbalance.[12,15] In scenarios with no apparent elevated risk of dislocation, the preferred choice was cementless primary arthroplasty. However, the survey did not inquire about bearing surface types or femoral head sizes, which may influence prosthesis choice.

When either hip or spine symptoms are severe and one of them clearly predominates, determining the order of treatment is relatively straightforward. However, when symptoms are equally severe or when the pathologic or radiologic findings in one region influence the surgical management of the other, decision-making becomes more complex. Preoperative planning would benefit greatly from consensus between hip and spine surgeons regarding optimal treatment sequencing.

Hip surgeons should prioritize accurate component positioning, restoration of hip anatomy, leg length equality, and appropriate soft tissue tensioning. They should also consider the use of large femoral heads or dual-mobility implants in patients at elevated risk of dislocation. In complex cases, we recommend close collaboration between arthroplasty and spine surgeons to formulate individualized treatment plans.

A limitation of this study is the response rate of approximately 20%, which, while relatively low, is comparable to that reported in other published surveys.

CONCLUSIONS

This survey generated considerable interest among participants with extensive experience in hip and spine surgery. Responses were more consistent in scenarios involving disc disease, whereas greater variability was observed in cases with more complex spinal conditions. Given the low level of concordance within each specialty, interdisciplinary discussions between spine and hip surgeons are essential in complex cases. A personalized treatment strategy should be developed for each patient based on individual clinical presentation.

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Changes in Patient Preferences When Choosing a Surgeon and Hospital for Elective Hip Surgery: Ten Years Later

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ABSTRACT

Introduction: Total hip arthroplasty is one of the most successful procedures in modern medicine. Globalization, increased access to information, and the diversity of healthcare systems have driven greater public engagement in health-related decisions. Patients are increasingly seeking detailed information before undergoing arthroplasty. **Objective:** To identify and analyze the factors influencing the selection of a surgeon and hospital for elective hip replacement, and how these preferences have changed over the past ten years. **Materials and Methods:** Anonymous surveys were conducted among 100 patients who underwent hip replacement for osteoarthritis between 2011 and 2013. Their responses were analyzed and compared with those of 100 patients who underwent the same procedure between 2021 and 2023. **Results:** In terms of surgeon selection, patient recommendations have become the most influential factor, surpassing the surgeon's professional reputation. While the popularity of the healthcare institution remains a secondary consideration, the surgeon's recommendation continues to be the key determinant in selecting the facility for surgery. **Conclusions:** This study provides valuable insights into evolving trends in patient decision-making, within a landscape increasingly influenced by digital connectivity and technological access. Understanding these changes is essential for healthcare professionals aiming to adapt their communication strategies and foster trust in an era where shared experiences play a critical role in the decision-making process.

Keywords: Elective total hip replacement; surgeon selection; hospital selection; social media.
Level of Evidence: IIIB

Cambios en las preferencias de los pacientes al elegir un cirujano y un hospital para una cirugía programada de cadera. 10 años después

RESUMEN

Introducción: El reemplazo articular de cadera es una de las cirugías más exitosas de la medicina actual. La globalización, el acceso a la información y la diversidad de sistemas asistenciales han impulsado un mayor interés de la población en el cuidado de su salud, que demanda cada vez más información antes de someterse a una artroplastia. **Objetivos:** Identificar y analizar los factores que influyen en la selección del cirujano y del hospital, y su variación en los últimos 10 años. **Materiales y Métodos:** Se realizaron encuestas anónimas a 100 pacientes sometidos a un reemplazo de cadera por artrosis, entre 2011 y 2013. Estas encuestas fueron analizadas y comparadas con las de otros 100 pacientes operados por el mismo cuadro, entre 2021 y 2023. **Resultados:** En cuanto a los determinantes en la preferencia del especialista, actualmente, la recomendación de otro paciente pasó a ocupar el primer puesto, por sobre la reputación del cirujano. La popularidad del centro de salud continúa teniendo una importancia secundaria respecto a la sugerencia del especialista, la cual es el factor determinante al elegir dónde operarse. **Conclusiones:** Este estudio aporta valiosa información sobre las tendencias emergentes en la toma de decisiones de los pacientes en un contexto cada vez más influido por la tecnología y la conexión digital. Comprender estos cambios es esencial para que los profesionales de la salud adapten sus estrategias de comunicación y refuercen la confianza en una era donde las experiencias compartidas tienen un peso terminante en el proceso de elección.

Palabras clave: Reemplazo total de cadera programado; elección del cirujano; elección del hospital; redes sociales.
Nivel de Evidencia: IIIB

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INTRODUCTION

Hip joint replacement is one of the most successful procedures in modern medicine. Since the 1960s, advances in technology and surgical techniques have significantly improved the effectiveness of this operation.[1] Patient satisfaction rates are high, and quality of life is greatly enhanced following surgery. In recent decades, increased life expectancy has been accompanied by a rise in the prevalence of degenerative joint diseases and, consequently, a growing number of arthroplasties performed.[2]

Globalization, widespread access to information, and the broad range of available healthcare systems have also sparked a greater interest among the population in managing their health. Currently, there is a growing demand from patients for information when undergoing joint replacement surgery.

Several studies have investigated how patients choose their physicians and care centers. According to McGlone et al., the most influential factors in the initial selection include reputation, manners, location, qualifications, office environment, insurance coverage, and patient reviews.[3] Meanwhile, Faber et al., in a review of 14 randomized controlled trials, concluded that presenting information clearly, in an easy-to-read and explanatory format, plays a critical role in patients' selection of both physicians and healthcare facilities.[4] In our country, there is a lack of literature on the factors patients consider when choosing specialists and hospitals.

The objectives of our study were to identify the factors that patients consider when selecting a surgeon and hospital for elective hip replacement surgery, and to analyze whether these preferences have changed over the past decade—particularly in light of the growing influence of social media, online reviews, and online ratings.

MATERIALS AND METHODS

We included 100 consecutive patients in Group 1. Inclusion criteria were a diagnosis of primary hip osteoarthritis and a scheduled total hip replacement. This first cohort was treated between 2011 and 2013. The series was analyzed and subsequently compared with a new cohort of 100 patients (Group 2), who underwent arthroplasty between 2021 and 2023. All procedures were performed by a staff surgeon from the Orthopedics and Traumatology Service team or by a resident physician under direct supervision, at the *Centro de Educación Médica e Investigaciones Clínicas "Norberto Quirno"* (CEMIC). Patients in both groups had the option to choose between two surgeons. Patients undergoing revision surgeries, those with hip fractures, and individuals affiliated with the hospital's internal health insurance system were excluded, as they did not have the option to choose a different healthcare center.

All patients completed a survey ranking, in order of importance, the factors they considered in selecting both the surgeon and the hospital. Surveys were completed either during hospitalization or at the first postoperative follow-up visit.

The survey was divided into two forms (Appendix). Form 1 assessed factors influencing the choice of surgeon and included five main categories, each subdivided into five subcategories: 1) Surgeon's reputation (information obtained via the internet, provided by the institution, disseminated by scientific societies, or through other means); 2) Patient recommendation (from another patient operated on by the same surgeon, seen but not operated on, seen by another member of the Orthopedics and Traumatology Service, or treated within the institution); 3) Professional recommendation (from the patient's primary care physician, another orthopedic physician from the same or another institution, or non-medical institutional staff); 4) Hospital reputation (information sourced online, from the institution itself, through external channels, or from patients previously treated at the same hospital); 5) Doctor-patient relationship established during the initial consultation (clarity of information about the condition, the surgeon's appearance and demeanor, trust conveyed, and the support/interest demonstrated by the professional).

Form 2 assessed the factors influencing hospital choice, also subdivided into five main categories: 1) Hospital reputation (e.g., level of medical staff, scientific achievements, university affiliation, or lack of knowledge about the institution's reputation); 2) Hospital proximity (≤30 blocks, 30 blocks to 10 km, 10 km to 100 km, or >100 km); 3) Hospital accommodation (precarious but adequate, inadequate/insufficient, adequate and comfortable, or irrelevant); 4) Recommendation to choose the hospital (from the operating surgeon, primary care physician,

another professional, or another patient); 5) Satisfaction with prior care (experience in the emergency department, orthopedic outpatient clinic, another professional's office, or reported by another patient).

At the beginning of each form, participants were instructed to rank each factor according to the level of importance attributed to it in their decision-making, using the Likert scale.[5-7] This psychometric tool is used to assess degrees of agreement or importance across a range of statements, offering more nuanced responses than simple binary (yes/no) options.

A 1-to-5 scale was used to rank the factors influencing the choice of surgeon and hospital. Additionally, respondents were asked to mark with an X the specific breakdown of factors previously explained.

RESULTS

The results of the comparative analysis between two groups of patients who underwent total hip replacement during different periods are presented. Group 1 consisted of patients treated between 2011 and 2013, and Group 2 of those treated between 2021 and 2023. The objective of the comparison was to identify the factors influencing the selection of hospital and surgeon in each group, highlighting how patient preferences have evolved over the past decade.

Surgeon Choice

In Group 1, the surgeon's reputation was the most highly weighted factor (Likert mean score: 3.9), followed by recommendation from another professional (3.5) and the doctor-patient relationship (3.4). In contrast, in Group 2, recommendations from other patients emerged as the most influential factor (Likert 4.8), displacing surgeon reputation to second place (Likert 4.4) (Table 1).

Table 1. Comparative mean Likert scores for factors influencing surgeon selection

Factors of importance in the choice of surgeon	Mean Likert score (2011-2013)	Mean Likert score (2021-2023)
Surgeon's reputation	3.9	4.4
Recommendation from another patient	3.5	4.8
Doctor-patient relationship established during the first consultation	3.4	3.9
Reputation of the hospital where the surgeon operates	2.2	3.4
Recommendation from another professional	2.1	2.8

Fifty-one percent of patients in Group 1 discovered their surgeon via the institution's website, while only 12% did so through social media platforms. In Group 2, there was a notable increase in the use of social media platforms (35%) and medical portals (45%) as primary sources of information (Figure 1).

Professional recommendations showed no significant difference over time in terms of their influence on surgeon choice (Figure 2).

Unlike ten years ago, when the choice of surgeon was primarily based on trust (81%) stemming from reputation or professional recommendations, patients today place greater importance on interpersonal factors—particularly emotional support, interest shown by the doctor (46%), and the overall quality of the doctor-patient relationship (Figure 3).

For Group 1, most patients obtained information through the institutional website (49%) or from patients previously treated at the hospital (38%). In contrast, 56% of patients in Group 2 received information via recommendations from other patients, indicating a growing influence of shared personal experiences (Figure 4).

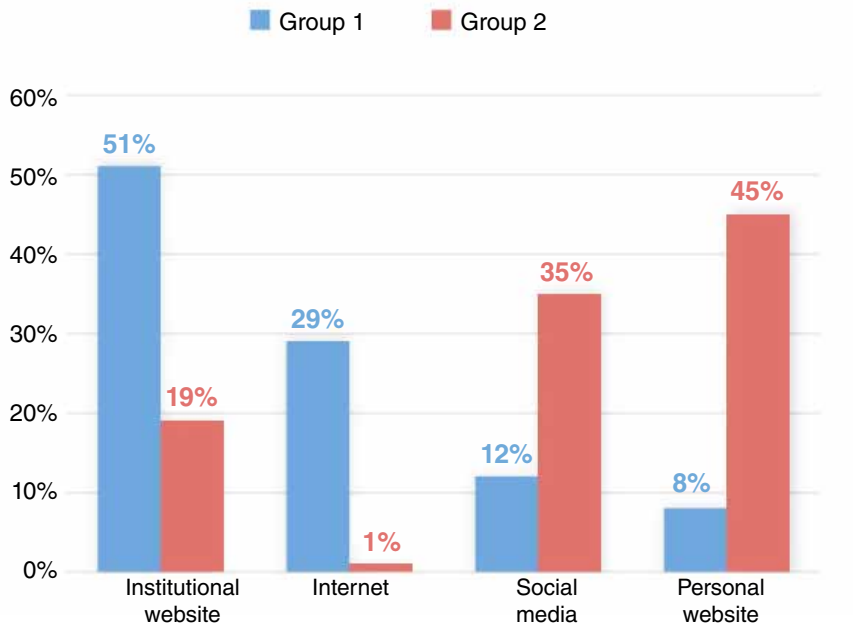

Figure 1. Choice of surgeon – Surgeon's reputation.

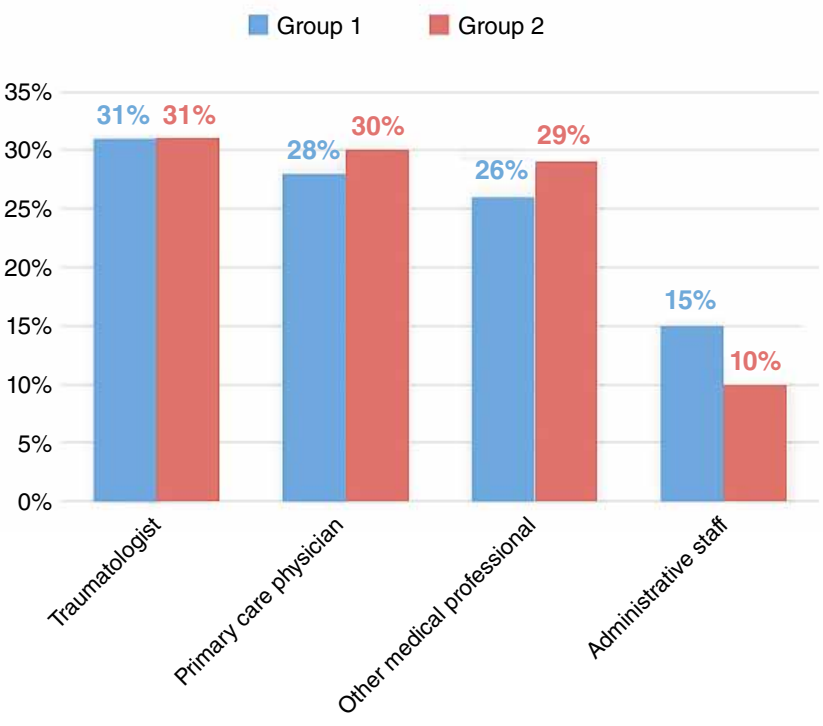

Figure 2. Choice of surgeon - Doctor recommendation.

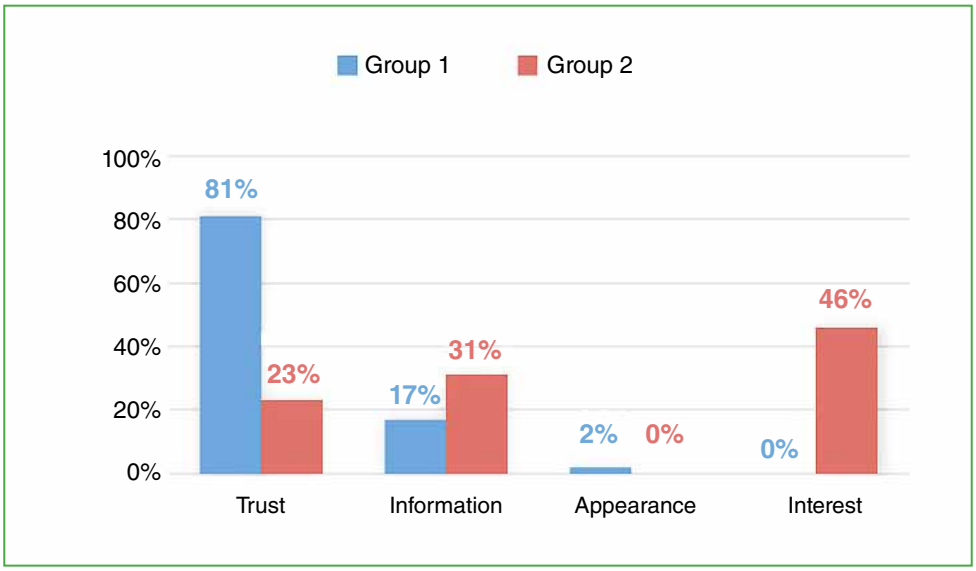

Figure 3. Surgeon's choice - Doctor-patient relationship.

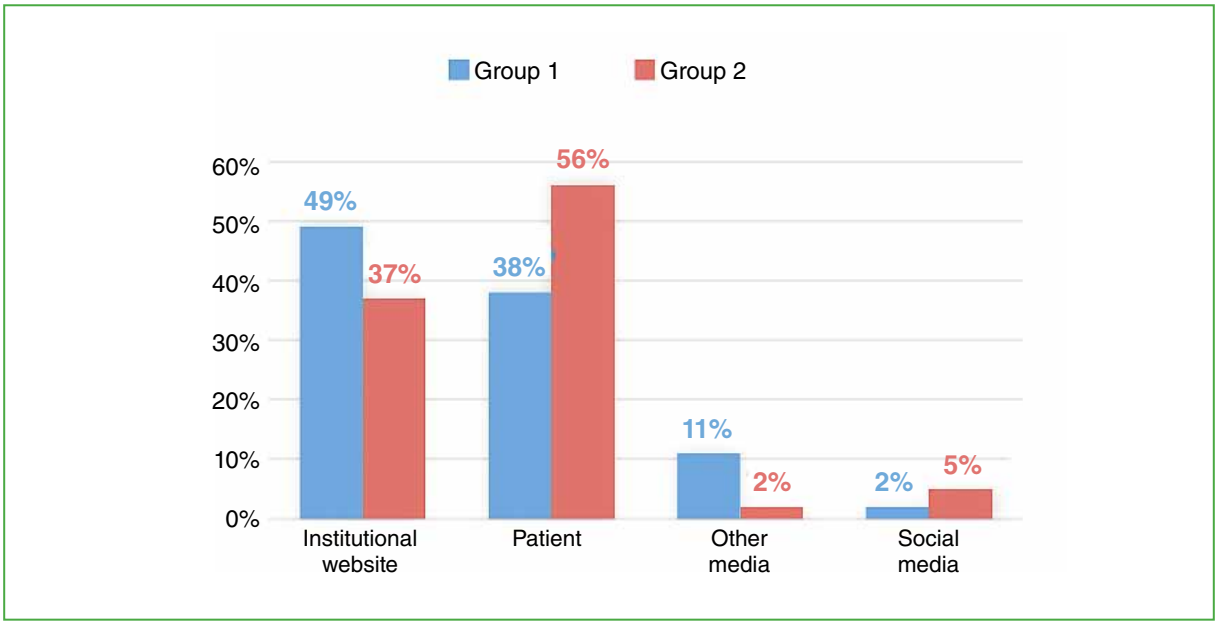

Figure 4. Surgeon Choice - Hospital Reputation.

Eighty-nine percent of Group 1 were referred by patients previously seen by the same surgeon, 59% of whom had undergone surgery, and 30% had only attended consultations. In Group 2, 99% of patients were referred by individuals previously seen by the same surgeon (Figure 5).

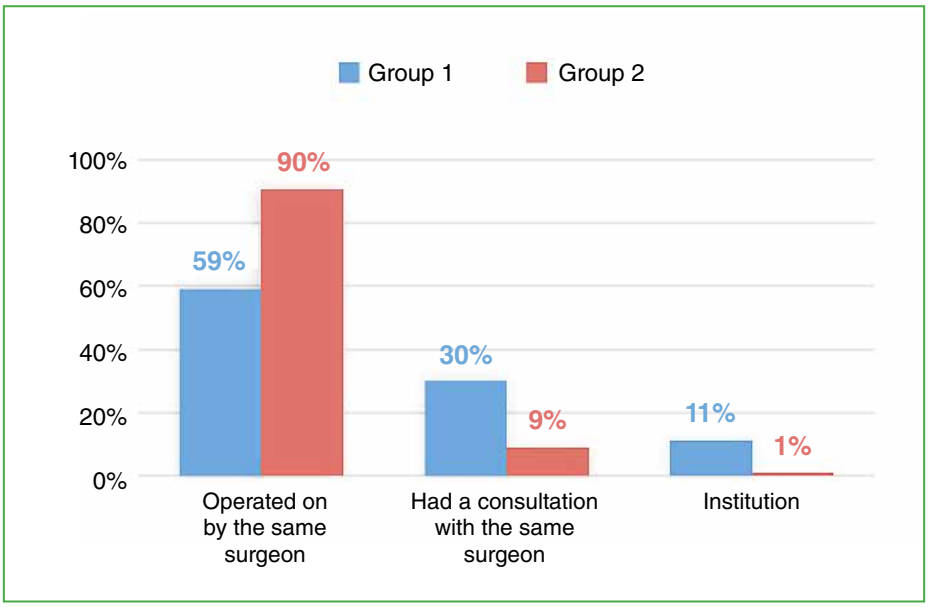

Figure 5. Surgeon choice - Patient recommendation.

Choice of Hospital

With respect to hospital selection, in Group 1, the surgeon's recommendation was the most decisive factor (Likert 4.8). Although still important in Group 2, its weight decreased (Likert 4.5). In this group, other factors such as hospital reputation (Likert 4.0) and satisfaction with previous care (Likert 3.5) gained greater relevance compared to Group 1 (Table 2).

Table 2. Comparative mean Likert scores for factors influencing hospital selection.

Factors of importance in the choice of hospital	Mean Likert score 2011-2013	Mean Likert score 2021-2023
Surgeon recommendation	4.8	4.5
Hospital reputation	4.5	4.0
Satisfaction with prior care	4.2	3.5
Hospital proximity	2.4	3.0
Hospitality/accommodation	1.8	1.7

In Group 1, the surgeon's recommendation was the leading factor in hospital choice (83%), followed by recommendations from other professionals (11%) and from other patients (6%). In Group 2, although the hierarchy remained the same, 60% selected the hospital based on the surgeon's advice, while 20% did so based on recommendations from another physician or patient (Figure 6).

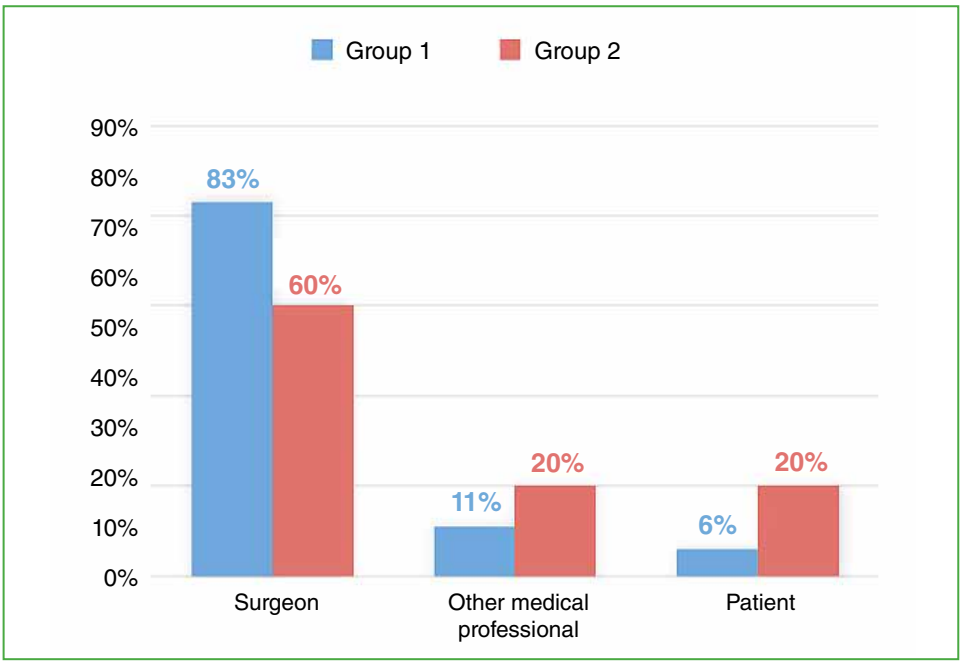

Figure 6. Choice of hospital - Surgeon recommendation.

Regarding institutional prestige, the high level of the medical staff was cited as the most critical factor in both groups (71% and 70%, respectively) (Figure 7).

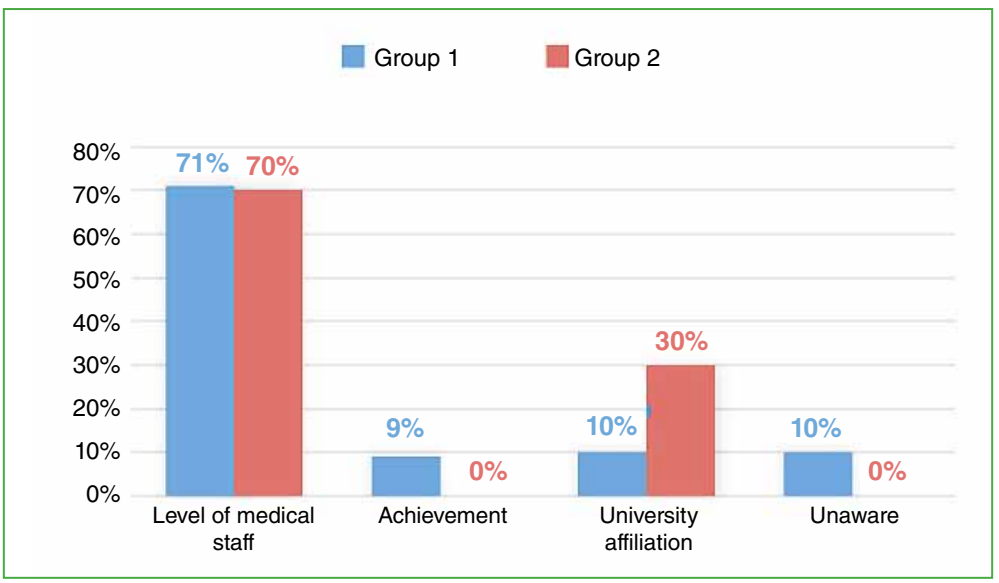

Figure 7. Hospital Choice - Hospital Reputation.

Satisfaction with previous care in the Orthopedics and Traumatology outpatient clinic was high in both groups (57%). However, 27% of patients in Group 2 highlighted their experience in the emergency department, indicating the rising influence of post-pandemic emergency care in hospital selection (Figure 8).

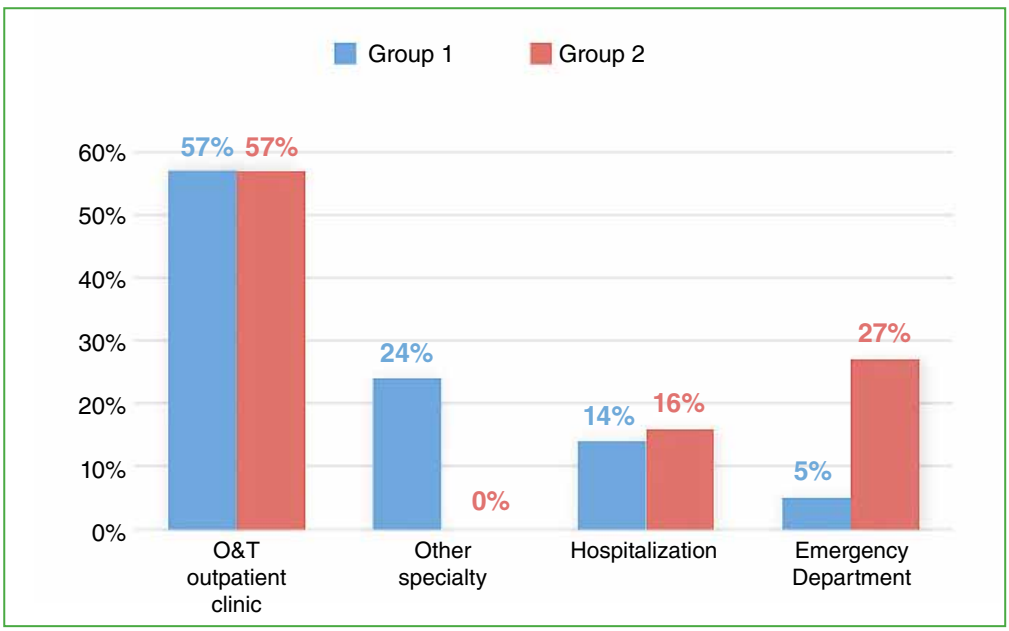

Figure 8. Choice of hospital - Satisfactory previous care.

There were no significant differences between the groups regarding hospital proximity (Figure 9).

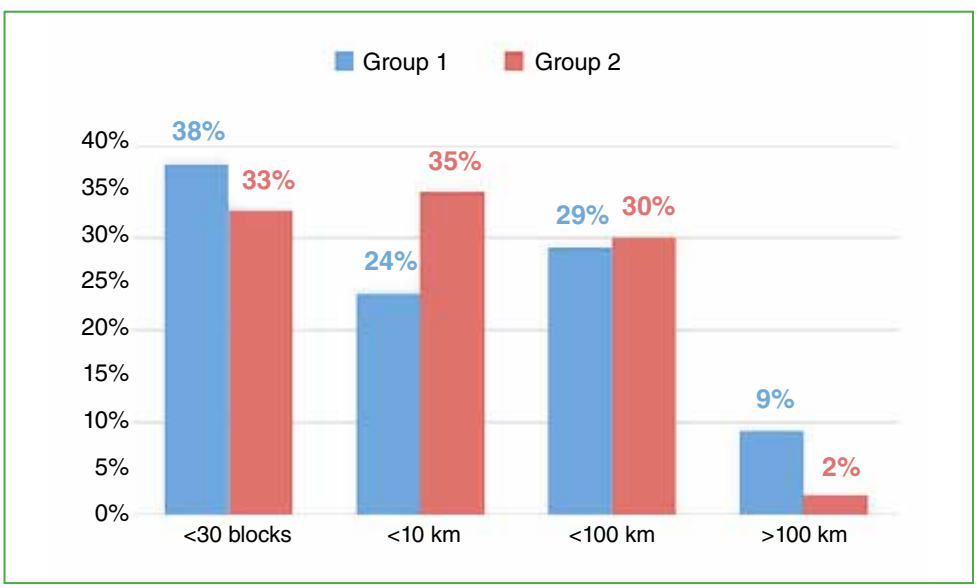

Figure 9. Choice of hospital - Proximity.

Seventy-five percent of Group 2 rated the hospital's accommodation as adequate and comfortable, compared to only 30% in Group 1—suggesting a substantial improvement in hospital facilities over the past decade (Figure 10).

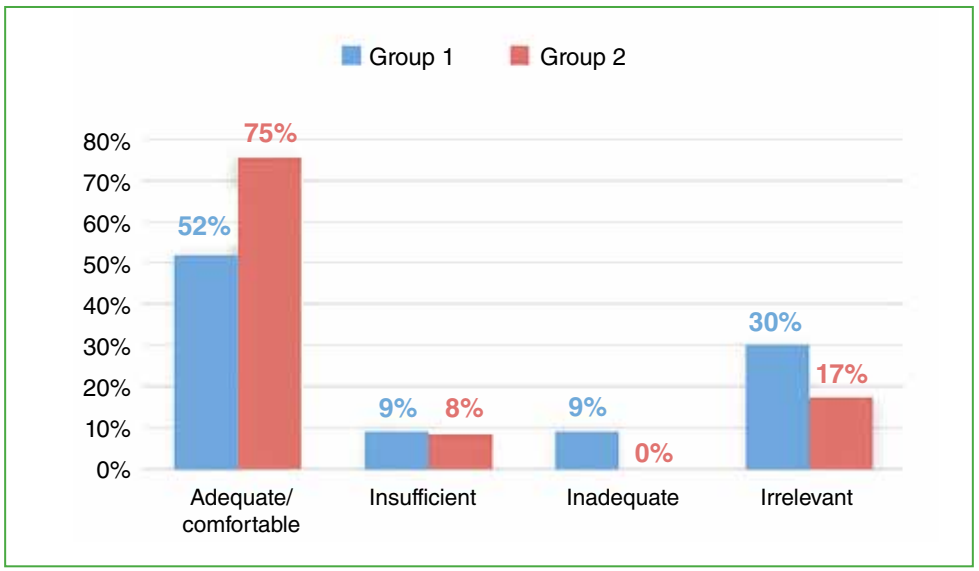

Figure 10. Hospital Choice – Hospitality/acommodation.

DISCUSSION

Currently, there is greater demand for and accessibility to information among patients regarding their disease, therapeutic alternatives, institutions, and healthcare professionals. Accordingly, the objective of our study was to identify changes over the last 10 years in the factors influencing the choice of surgeon and hospital for hip joint replacement surgery.

Regarding the determining factors in specialist selection, recommendations from other patients have overtaken the surgeon's reputation as the most influential factor, while the remaining factors maintained their relative positions.

Shared experience plays a crucial role in healthcare decision-making, as patients tend to place trust in the empathy and authenticity perceived in others who have undergone similar situations. In their cross-sectional observational study, Entwistle et al.[8] described how subjective experiences and personal narratives help to reduce uncertainty and establish an emotional connection that is often lacking in technical or academic information.

Broom[9] similarly emphasized how shared experiences through online forums and social media influence patients' confidence, as these narratives are perceived as more genuine and relatable than the clinical information delivered during medical consultations.

Through semi-structured interviews, Iglesias et al. found that personal recommendation was the most important factor in selecting a surgeon—ranked above the surgeon's experience, hospital reputation, and individual attributes such as surgical expertise and communication skills. Variables such as sex, ethnicity, publication history, and treatment cost were deemed less relevant.[10]

Conversely, Marshall et al. surveyed 422 patients and reported that surgeon reputation remained the most significant factor, with patients willing to wait up to seven months for a consultation with a referred specialist in cases of severe pain, rather than seeking a different physician.[11] In their analysis of 538 surveys, Fabrizio et al. concluded that patients most often choose specialists based on referrals from other physicians, over factors such as reputation, insurance coverage, or academic training. They also emphasized the weight of professional credentials within the medical community in attracting referrals.[12] Manning et al, in a study of 382 patients, reinforced this finding, stating that referrals outweigh the influence of mass media advertising—including radio, television, or internet sources.[13]

Digital platforms such as social media and healthcare review websites have significantly transformed how patients perceive and select healthcare professionals. These platforms provide access to others' personal experiences, which often carry greater perceived value than formal medical credentials. Furthermore, these digital environments foster ongoing interaction and community-building, thereby reinforcing trust in patient-generated reviews.[14]

It is also important to mention that, in recent years, there has been a growing distrust of medical authority, particularly due to patient experiences characterized by a lack of empathy or perceived conflicts of interest within the healthcare system.[15] This distrust prompts patients to seek alternative sources of information and to place greater trust in their peers, whom they perceive as free from such conflicts of interest.

In parallel, there has been exponential growth in the influence of social media personalities who share personal experiences related to their health and treatments. These influencers present themselves as accessible and relatable figures, fostering a sense of community and emotional connection with their followers. As a result, patients may place more trust in their recommendations than in traditional sources. By translating complex medical information into easy-to-understand, visually appealing content, influencers have effectively become a new form of advertising for healthcare professionals or institutions. However, their influence often lacks ethical oversight, increasing the risk of disseminating erroneous or misleading information.[16]

This reflects a broader shift toward increased reliance on peer opinions, driven by factors such as trust in shared experience, the emotional resonance of personal narratives, the persuasive power of digital platforms, and, in some cases, skepticism toward the medical establishment.

Regarding the preference for healthcare institutions, this remains secondary to the surgeon's recommendation, which continues to be the primary determinant—albeit to a lesser degree than a decade ago. Our findings are consistent with those of Moser et al.,[17] who conducted a qualitative descriptive study in Europe, and with Al-Faifi et al.,[18] who conducted a nationwide cross-sectional survey in the Middle East. Proximity was not a determining factor in hospital selection. Notably, while there was a marked improvement in perceived hospital accommodation—likely due to the relocation of services—this was not a decisive factor in patients' hospital choice.

As described, there is a growing body of literature seeking to evaluate how patients choose their surgeon and healthcare facility. However, there is a notable absence of research within our local context on the decision-making process for elective surgeries and how it has evolved over the past decade.

Our study has several limitations. First, respondents evaluated only a specific group of surgeons within a single institution. Second, due to the design of our survey, patients could only select one option per item (beyond the initial Likert-scale rankings), which limited their ability to express multiple or nuanced preferences. Third, all participants had health coverage through private insurance plans or public systems, which inherently restricts the range of available healthcare facilities. Lastly, the population studied had a mean age close to 70 years—an age group that is not among the highest users of the Internet or social media. We can reasonably hypothesize that younger patients might place even greater importance on these digital sources when making healthcare decisions.[19]As a strength, we believe this study contributes to a better understanding of evolving patient behavior in the context of users of health insurance. We recognize that good outcomes from prior surgeries, combined with a cordial relationship, are key factors in the selection of a surgeon. At the same time, trust and support in the doctor-patient relationship, as well as the professional's reputation, are values developed over the long term and sustained beyond the act of surgery itself. Nevertheless, we must acknowledge that the rise of digital tools—websites, online reviews, social media, and influencer-driven content—now plays an emerging, active, and prominent role in shaping patients' decision-making processes.[20]

CONCLUSIONS

This study highlights significant changes in the factors influencing surgeon selection for total hip replacement over the past decade. The recommendation of another patient has emerged as the most important determinant. This shift suggests that shared experience and patient empathy have overtaken the traditional emphasis on the specialist's reputation as the primary factor in decision-making. The increasing accessibility of digital platforms and social media has transformed how patients gather and value information, giving greater weight to the opinions and experiences of other users.

Furthermore, technical credentials and professional distinctions have become less relevant, while trust based on personal experience and perceived authenticity has gained prominence. Confidence in the online community and the influence of social media figures have introduced new dynamics—creating alternative information sources that often complement, and in some cases compete with, traditional medical authority.

With regard to hospital selection, although still a factor, its influence has declined relative to that of the surgeon. Elements such as proximity or infrastructure now play a secondary role in the decision-making process.

Despite its limitations, this study provides valuable insight into emerging trends in patient behavior in a healthcare context increasingly shaped by digital interconnectedness. Understanding these evolving dynamics is essential for healthcare professionals to adapt communication strategies and reinforce trust in an era where shared experience plays a decisive role in patients' choices.

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APPENDIX

Form 1

Please rank the following factors from 1 to 5 according to their importance in your choice of surgeon (1 = most important). Do not repeat numbers.

- Reputation of the surgeon.
- Recommendation from another patient.
- Recommendation of another professional.
- Reputation of the hospital where the surgeon operates.
- Doctor-patient relationship established during the first consultation.

Please mark with a cross the most applicable option for each of the following items. Select only one option per item.

Reputation of the surgeon

- I learned about the surgeon through:
  - √ Personal website
  - √ Institutional website
  - √ Professional information portals (LinkedIn, TopDoctors, AAOT, ANM)
  - √ Social media platforms (Instagram, Facebook, TikTok)

Recommendation from another patient.

- The surgeon was recommended by:
  - √ A patient operated on by the same surgeon
  - √ A patient seen (but not operated on) by the same surgeon
  - √ A patient seen by another member of the O&T team
  - √ A patient treated at the same institution

Recommendation from another professional.

- The surgeon was recommended by:
  - √ My primary care physician
  - √ Another physician from the Orthopedics and Traumatology Service
  - √ A physician from another institution
  - √ Non-medical staff from the institution

Reputation of the hospital

- I learned about the hospital through:
  - √ The institutional website
  - √ Direct information from the institution
  - √ Other media (magazines, TV, radio)
  - √ Recommendations from previous hospital patients
  - √ Social media platforms (Instagram, Facebook, TikTok)

Doctor-patient relationship in the first consultation

- What I valued most in the first encounter:
  - √ Information provided about my condition
  - √ The surgeon's demeanor and appearance
  - √ Trust and confidence conveyed
  - √ Support and interest shown by the professional

Form 2

Please rank the following factors from 1 to 6 according to their importance in your choice of hospital (1 = most important). Do not repeat numbers.

- Reputation of the hospital
- Proximity to the hospital
- Hospitality
- Recommendation of the surgeon
- Satisfaction with prior care
- Referral from another source

Please mark with a cross the most applicable option for each of the following items. Select only one option per item.

Hospital reputation

- I consider the hospital reputable based on:
  - √ High level of medical staff
  - √ Scientific achievements
  - √ Being a university-affiliated center
  - √ I am not aware of the hospital's reputation

Proximity

- Distance from my home:
  - √ < 30 blocks.
  - √ 30 blocks to 10 km.
  - √ 10 km to 100 km.
  - √ More than 100 km.

Hospitality/accommodation

- I would describe the hospital's accommodation as:
  - √ Precarious but sufficient
  - √ Inadequate and insufficient
  - √ Adequate and comfortable
  - √ Irrelevant to my decision

Recommendation source

- The hospital was recommended by:
  - √ The surgeon
  - √ My primary care physician
  - √ Another healthcare professional
  - √ Another patient

Satisfaction with previous care

- I base my hospital preference on prior care received in:
  - √ Emergency Department
  - √ Orthopedics and Traumatology outpatient clinic
  - √ Another specialty outpatient clinic
  - √ Previous hospitalization

Pharmacological Management of Bone Loss in Patients with Spondylodiscitis: A Systematic Review

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ABSTRACT

Introduction: Lytic bone defects are a common and devastating consequence of spondylodiscitis, often leading to vertebral collapse and spinal instability. Currently, there are no established guidelines for pharmacological management of this condition in conjunction with antibiotic therapy. **Objective:** To review the existing scientific evidence on the pharmacological treatment of bone loss secondary to spondylodiscitis. **Materials and Methods:** A systematic search was conducted in major medical databases to identify studies evaluating the use of teriparatide, romosozumab, or denosumab in patients with lytic bone defects associated with pyogenic spondylodiscitis or Pott's disease. **Results:** Two studies reported improved bone mineral density and enhanced osteoblastic activity following the use of teriparatide in patients with bone loss or osteoporosis associated with vertebral infection. Adverse reactions were minimal, and no interactions with antibiotic therapy were observed. In one of the studies, treatment was supplemented with romosozumab. A third study demonstrated improved outcomes in infected osteoblasts. Conversely, the use of bisphosphonates and denosumab was associated with poor outcomes and worsening of the infection. **Conclusions:** Anabolic agents such as teriparatide and romosozumab appear to be promising options for managing bone loss and severe osteoporosis in the context of vertebral infections, with a favorable safety profile. However, clinical trials are needed to confirm their efficacy.

Keywords: Discitis; spondylodiscitis; bone loss; tuberculosis; teriparatide; bisphosphonates; denosumab.

Level of Evidence: III

Manejo farmacológico de la pérdida ósea en pacientes con espondilodiscitis. Revisión sistemática

RESUMEN

Introducción: El defecto óseo lítico es una consecuencia devastadora y muy frecuente del paciente con espondilodiscitis, y es responsable del colapso y la inestabilidad. En la actualidad, no existe una pauta para el manejo farmacológico. **Objetivo:** Revisar la evidencia científica publicada sobre el tratamiento farmacológico de la perdida ósea secundaria a espondilodiscitis. **Materiales y Métodos:** Se realizó una búsqueda sistemática en bases de datos de referencia médica para hallar estudios sobre el uso de teriparatida, romosozumab o denosumab en pacientes con defecto lítico asociado a espondilodiscitis piógena, tuberculosis vertebral. **Resultados:** En dos artículos, se comunicó la mejoría de la densidad mineral y la formación osteoblástica con el uso de teriparatida en pacientes con defecto óseo u osteoporosis asociada a infección vertebral; las reacciones adversas fueron escasas, no hubo interacción con los antibióticos, y uno de ellos cuando se complementó con romosozumab. Un tercer artículo informó mejoría en los osteoblastos infectados. Asimismo, los bifosfonatos y el denosumab provocaron malos resultados y empeoraron la infección. **Conclusiones:** El uso de fármacos anabólicos, como teriparatida y romosozumab, promete ser una excelente opción para el tratamiento de la pérdida ósea y la osteoporosis severa en casos de infección vertebral, con escasas reacciones adversas. Se requieren estudios clínicos para verificarlo.

Palabras clave: Discitis; espondilodiscitis; pérdida ósea; tuberculosis; teriparatida; bifosfonatos; denosumab.

Nivel de Evidencia: III

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INTRODUCTION

Spondylodiscitis is an infection affecting the intervertebral disc and adjacent vertebrae, which can result in significant bone loss and, secondarily, spinal instability.[1] Its incidence, although low (0.2–2.4/100,000 inhabitants in Western countries), has increased over the last 20 years due to prolonged life expectancy and a rise in comorbidities, leading to devastating consequences for patients, the healthcare system, and even mortality.[2]

Infectious involvement is associated with advanced osteolysis, vertebral destruction, instability, pain, severe disability, and, in some cases, serious neurological disorders.[3-5]

To date, various treatments have been implemented for spondylodiscitis, including bed rest, antibiotic therapy, and surgical intervention in cases of spinal instability or neurological compromise. However, no pharmacological treatment currently exists for vertebral destruction and bone defects.[6] Moreover, a significant number of patients with spinal infection also present with untreated subclinical osteoporosis—an association that has not yet been thoroughly studied.[2] Although the gold standard for diagnosing osteoporosis is bone mineral density measurement via DXA scanning, it is now possible to assess bone quality by quantifying Hounsfield units (HU) through computed tomography.[7-10]

Teriparatide, a parathyroid hormone analogue (PTH 1–34), is an anabolic agent that stimulates osteoblastic proliferation and currently plays a key role not only in the treatment of osteoporosis, but also in the prevention of complications and planning of spinal surgeries.[11-20] For this reason, it appears to be a promising agent in the management of bone defects associated with spinal infections.

The aim of this study was to review the current scientific evidence on the use of anabolic drugs and monoclonal antibodies in patients with spondylodiscitis, in order to determine whether they should be recommended for those presenting with bone loss or osteoporosis associated with the infection.

MATERIALS AND METHODS

This study was conducted in accordance with the PRISMA 2020 (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*) guidelines.

Sources and Data Search

A systematic literature search in English was performed from January 2009 to March 2023 in the PubMed, Cochrane, LILACS, and SciELO databases using the MeSH terms: (((teriparatide) OR (romosozumab)) AND (((spine) OR (infection)) OR (spondylodiscitis))) AND ((bone defect) OR (bone loss))).

Filters were applied by year, text availability, article characteristics, article type, and publication date.

Inclusion Criteria

Analytical studies, randomized clinical trials, systematic reviews, narrative reviews, and case reports were included. The inclusion criteria comprised studies evaluating the use of teriparatide, romosozumab, or denosumab for treating bone defects associated with spinal infections in both human and animal models, as well as studies analyzing the relationship between osteoporosis and spondylodiscitis.

Exclusion criteria

Articles addressing osteoporosis or bone defects not associated with spondylodiscitis or involving vertebral tuberculosis were excluded. Also excluded were studies involving patients with osteoporosis secondary to other causes, such as chronic kidney disease, rheumatoid arthritis, and other metabolic, endocrine, or immunological conditions. Duplicates, unpublished studies, books, letters, and other documents were also discarded.

RESULTS

The initial search yielded 396 articles between 2009 and 2023 in PubMed, and 0 in Cochrane, SciELO, and LILACS. Continuing the selection process in PubMed, 375 articles were available in full text and written in English. Books, conference papers, abstracts, duplicate articles, unpublished studies, editorials, technical reports, and citations were excluded. This left a total of 207 studies. A second screening was conducted by reviewing the titles and abstracts. 199 studies were excluded for not being relevant to the research topic, as they included patients with osteoporosis secondary to endocrine, autoimmune, renal, or metabolic diseases, or patients receiving anabolic or antiresorptive drugs outside the context of vertebral infection.

Eight articles were identified that related osteomyelitis or spondylodiscitis to osteoporosis or bone loss. Of these, one was excluded because it did not address spondylodiscitis; another because it linked denosumab to infection risk in patients with low bone mineral density, but not with spondylodiscitis; a third because it was a review article on surgical site infection; and another because it focused solely on osteonecrosis management due to antiresorptive drugs and proinflammatory cytokines. Ultimately, four articles were selected for analysis: Two that associated anabolic agents with bone defects in patients with spondylodiscitis, one that evaluated the response of teriparatide to isoniazid and rifampicin, and one on the diagnosis of osteoporosis in patients with spondylodiscitis (Table).

Table. Selected articles meeting the inclusion criteria.

Author (Year)	Sample size	Objective	Dose/Interval	Germ	Interactions with antibiotics	Adverse events	Control		LE
							Imaging	Time	
Ohnishi et al. (2021)	1 patient	Literature review	Not specified	Not specified	None	Exanthem, surgical site infection	CT	3 wk, 6 wk, 2 m	III
Shinohara et al. (2014)	1 patient	To evaluate bone mineral density after teriparatide administration in patients with spondylodiscitis, bone destruction and a history of osteoporosis.	56.5 µg weekly, for 3 months	Not specified	None	Headache, nausea, vomiting	DXA	3 wk, 6 wk, 3 m	IV
Lee et al. (2022)	1 patient	To evaluate the use of teriparatide vs. antituberculosis drugs.	400 ng/ml, every 48 h, for 7 days	*M. tuberculosis*	None	None	No	1 wk, 4 wk	II

CT = computed tomography; DXA = bone density scan. LE = level of evidence.

Data Analysis

The review demonstrated that the available literature on this topic is limited. No randomized clinical trials or high-level evidence studies were identified.

The earliest study dates to 2014, in which Shinohara et al. administered 56.5 µg/week of teriparatide to a 78-year-old diabetic patient with spondylodiscitis and secondary bone destruction at T11. Bone mineral density (BMD) was assessed via DXA scan at 3, 6, and 12 weeks, showing a 17.6% increase in BMD as early as the third week, along with better resolution of the infection at 8 weeks. Reported adverse effects included nausea and headache. The authors recommended teriparatide administration in these patients.[6]

In 2020, Bettag et al. retrospectively analyzed 200 patients with spondylodiscitis treated surgically via posterior instrumentation and followed up for one year. Only 5% had a prior osteoporosis diagnosis and received pharmacological treatment. When bone density was assessed using Hounsfield units (HU) via computed tomography, 41% (81 patients) were found to have undiagnosed osteoporosis. Patients with HU <110 had a significantly higher rate of revision surgery and implant loosening. The authors recommended HU quantification in patients with spondylodiscitis and associated osteoporosis, and early initiation of anabolic treatment, such as teriparatide, due to the high risk of complications including fractures and implant loosening.[2]

In 2021, Ohnishi et al. administered teriparatide to a patient with spondylodiscitis, severe osteolysis, and an L3 fracture. Anabolic treatment was initiated but discontinued due to a rash. The patient subsequently underwent fixation from T12 to L5. A surgical site infection occurred 6 weeks after discontinuing teriparatide, accompanied by worsening osteolysis. Romosozumab was then initiated, resulting in a favorable response with bone bridging at 6 weeks and complete resolution of the infection.[1]

Finally, Lee et al. (2022) observed a 705% increase in alkaline phosphatase levels and osteoblastic activity at day 28 ($p < 0.0031$) after administering teriparatide at 400 ng/mL every 48 hours for 7 days, alongside isoniazid and rifampicin, against MG-63 cells infected with spinal tuberculosis. Infection was eradicated by day 7. There were no adverse reactions and no reduction in antibiotic efficacy.[21]

DISCUSSION

The bone defects and low mineral density associated with spinal infections pose a significant challenge for spinal surgeons due to irreparable structural loss, functional impairment, pain, and the frequent need for additional surgical interventions—all of which have a considerable economic impact.[1] The infectious process often leads to rapid and severe bone lysis and accelerated destruction.[22]

Molecular studies have shown that infection suppresses osteoblastogenesis and increases osteoclastic activity through the release of proinflammatory cytokines—such as tumor necrosis factor-alpha, interleukin-1β, and interleukin-6—by macrophages and lymphocytes. These cytokines bind to the receptor activator of nuclear factor kappa-B ligand (RANKL), which activates osteoclastogenesis via its receptor RANK.[23-28] Moreover, bone loss is further exacerbated by prolonged bed rest and lack of physical activity.[29]

Currently, there is no established consensus regarding the use of osteoanabolic drugs in the context of infection.[1] These agents have been used for managing osteoporosis in patients with osteomyelitis—not only in the spine, but also in other locations such as the femur and tibia—with the aim of preventing osteoclastic resorption and thereby minimizing structural damage.[30] Two major categories of bone-active drugs have been studied in the laboratory: anabolic agents (mainly teriparatide and romosozumab) and antiresorptives (bisphosphonates and denosumab).

Teriparatide, an analog of parathyroid hormone, exhibits anabolic effects by inhibiting osteoclast activity while simultaneously promoting bone formation—an advantage over antiresorptive agents, which inhibit resorption but also suppress osteogenesis and bone turnover.[1]

There is increasing evidence linking osteonecrosis of the jaw to infection as an early histological manifestation.[31,32] Various infections have been reported in association with antiresorptive therapy. Interestingly, teriparatide has emerged as the treatment of choice in such cases, owing to its bone-forming properties.[33,34] However, data on its use in patients with bone defects secondary to infection remain scarce, only a few case reports. However, there have been reports of its successful application in infected hip arthroplasty, septic arthritis of the elbow, and infected tibial nonunion—all without exacerbation of the infectious process.[35-37]

Romosozumab, a monoclonal antibody, inhibits sclerostin binding to low-density lipoprotein receptors (LRP-5 and LRP-6), leading to increased β-catenin levels in the osteoclast. This results in suppressed bone resorption and enhanced osteogenesis.[38]

Among antiresorptives, denosumab is a monoclonal antibody that inhibits the precursor of osteoclasts in mature cells by blocking RANKL. Although effective in managing osteoporosis,[39] several clinical trials have reported an increased incidence of infections such as cellulitis, erysipelas, surgical site infections, and urinary or gastrointestinal infections.[40,41] In a meta-analysis of 20,470 patients across 24 controlled trials, Catton et al. observed a statistically significant increase in the overall infection rate in patients treated with denosumab (relative risk: 1.11; 95% CI: 1.02–1.20; $p = 0.02$).[42] These findings suggest that denosumab may not be an ideal option for patients with spondylodiscitis, as it could potentially aggravate the infectious process. Further research is necessary to clarify this association.

Bisphosphonates, which are pyrophosphate analogs that bind to hydroxyapatite on the bone surface, are categorized into nitrogen-containing and non-nitrogen-containing types. The former are associated with osteoclast apoptosis and are more commonly used in the treatment of bone loss.[43] However, the nitrogen-containing molecule has also been found to enhance bacterial adhesion to the bone surface, potentially worsening infection. Additionally, they have been linked to inflammatory complications, including the development of osteomyelitis. As a result, bisphosphonates are not recommended in cases of vertebral osteomyelitis, as their potential to worsen infection outweighs their benefits in reducing bone resorption.[44,45]

The first line of management for spondylodiscitis is conservative treatment with antibiotics and analgesics. From the outset, the infection presents a lytic component that progresses to bone defects, vertebral destruction, and instability, with neurological repercussions in some patients.[1,6,21] In these cases, surgery offers the best alternative for management; however, it is often doomed to failure due to the progression of osteolysis and implant failure in patients who do not receive osteoforming therapy. This results in surgical reinterventions that pose life-threatening risks and are not favorable for the healthcare system.

For this reason, it is also recommended to quantify Hounsfield Units (HU) by computed tomography during spinal planning in order to reduce complications.[2]

Regarding adverse reactions, Shinohara et al. and Onishi et al., in their case series, recorded mild events such as rash, headache, nausea, and vomiting caused by anabolic agents. These were easily managed and did not interfere with antibiotic therapy, resolution of the infection, or the patients' overall health status. On the contrary, they observed signs of early bone formation around the third week.[1,6]

In addition to pyogenic spondylodiscitis, Lee et al. confirmed the osteoforming effect of teriparatide in a case of tuberculous spondylodiscitis with vertebral destruction, reporting no adverse reactions or drug-drug interactions.[21]

One of the most commonly used antibiotics in the treatment of spinal infections is vancomycin, which has demonstrated cytotoxic effects on osteoblasts.[46]

Tsuji et al. highlighted the protective effect of teriparatide after administering 7.5 µg over 24 hours to cultured bovine serum cells infected with spinal pathogens, successfully reducing vancomycin-induced cytotoxicity.[47]

The optimal dosage and administration interval of these anabolic agents have not yet been established. However, it is clear that treatment was initiated during the acute phase of infection, with signs of accelerated osteoformation observed within the first three weeks. This effect increased at six weeks and at three months in the reported cases,[1,6,21] and with a dose of 56 µg weekly in the study by Shinohara et al.[6]

Limitations of this study include the absence of controlled clinical trials to determine appropriate dosing and administration intervals for teriparatide and romosozumab; small patient sample sizes; insufficient evaluation of the cost-effectiveness of these agents; lack of standardized HU measurement by computed tomography in clinical practice; and the absence of a multidisciplinary approach integrating infectious disease and endocrinology specialists.

CONCLUSIONS

According to the limited available literature, teriparatide and romosozumab appear to be promising options in the management of bone defects and severe osteoporosis in patients with spondylodiscitis. They are associated with few adverse reactions and no drug-drug interactions. The use of antiresorptive agents is not recommended due to the potential risk of infection exacerbation.

Further clinical studies and stronger evidence are needed before these therapies can be routinely recommended in clinical practice.

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Stress Fractures of the Lumbar Spine: Pediculolysis as an Unusual Presentation Variant. Case Report

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ABSTRACT
In 1990, Gunzburg and Fraser introduced the term pediculolysis to describe stress fractures of the vertebral pedicles, a rare clinical presentation. Repetitive microtrauma associated with lumbar spine hyperextension and rotational movements is considered a key risk factor for this type of lesion. We report the case of a 22-year-old professional rugby player with a history of left-sided spondylolysis who presented with an episode of disabling acute low back pain. Radiographic studies revealed a right pedicle fracture of the fifth lumbar vertebra (L5) and contralateral spondylolysis. Magnetic resonance imaging (MRI) showed signs of edema in the left pedicle. Conservative orthopedic management was indicated, with a favorable clinical outcome and return to full sports activity.
Keywords: Stress fracture; lumbar spine; pediculolysis.
Level of Evidence: IV

Fracturas por estrés de columna lumbar. Pediculólisis como variante de presentación inusual. Reporte de un caso

RESUMEN
En 1990, Gunzburg y Fraser introducen el término pediculólisis para describir las fracturas por estrés de pedículos vertebrales. Representan formas clínicas de presentación inusual. Los microtraumas a repetición asociados a los movimientos de hiperextensión y rotación son factores de riesgo en este tipo de lesiones. Presentamos a un paciente de 22 años, jugador de *rugby* profesional, con antecedente de espondilólisis izquierda, que sufrió un episodio de lumbalgia aguda invalidante. Los estudios radiológicos revelaron una fractura del pedículo derecho en la 5.ª vértebra lumbar y espondilólisis contralateral. La resonancia magnética mostró signos de edema en el pedículo izquierdo. Se indicó un tratamiento ortopédico conservador; la evolución clínica fue favorable y pudo retornar a su actividad deportiva habitual.
Palabras clave: Fractura por estrés; columna lumbar; pediculólisis.
Nivel de Evidencia: IV

INTRODUCTION

Stress injuries of the posterior vertebral arch are a common cause of low back pain in young patients and athletes. In general, they occur at the fourth or fifth lumbar vertebra. Depending on the vertebral structure involved, they are classified as spondylolysis, laminolysis, or pediculolysis, with spondylolysis being the most frequent presentation. Although the development of this condition has been attributed to genetic factors, the most widely accepted theory attributes it to repetitive microtrauma during sports activity.[1-3]

In 1990, Gunzburg and Fraser introduced the term pediculolysis when they described three cases of pedicle stress fractures in the lumbar spine.[4] The low prevalence of this type of lesion, among other factors, has contributed to its limited representation in the literature.

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The aim of this article is to report the case of a young athlete with a lumbar pedicle fracture associated with contralateral spondylolysis.

CLINICAL CASE

A 22-year-old male rugby player, with no history of trauma or prior low back pain, presented with intense, non-radiating low back pain of approximately two weeks' duration.

Physical examination revealed pain on palpation in the right lumbar paravertebral region and limited lumbar flexion-extension, with no neurological deficit.

Anteroposterior, lateral, and oblique radiographs of the lumbar spine showed sclerosis of the right pedicle and left-sided spondylolysis at the level of the fifth lumbar vertebra. CT scan revealed, in addition to the findings mentioned above, a discontinuity in the right pedicle, with sclerotic and hypertrophic margins (Figures 1 and 2). Magnetic resonance imaging demonstrated edema in the lumbar pedicle (Figures 3 and 4).

Figure 1. Computed tomography of the lumbar spine, sagittal view. There is a fracture of the right pedicle of L5.

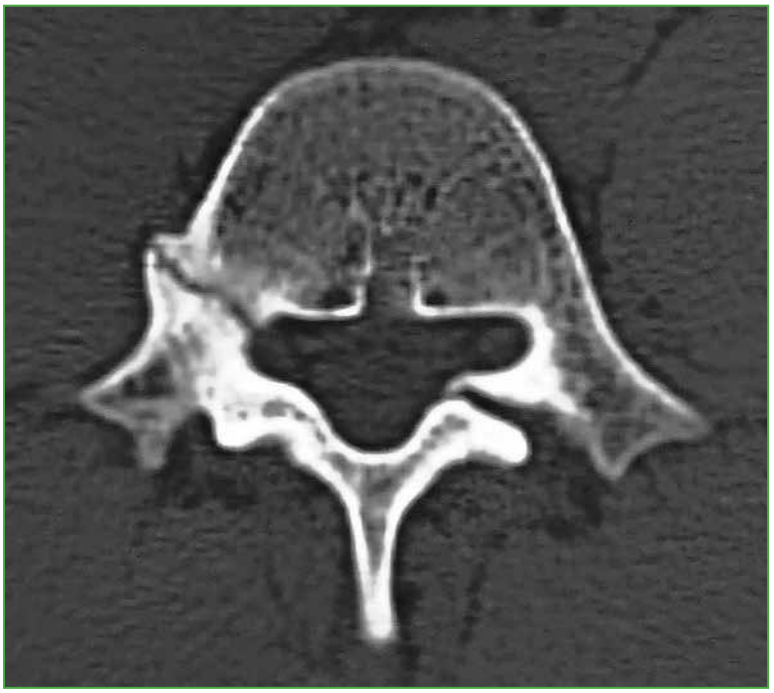

Figure 2. Computed tomography of the lumbar spine, axial view. A fracture of the right pedicle and left spondylolysis of L5 are visualized.

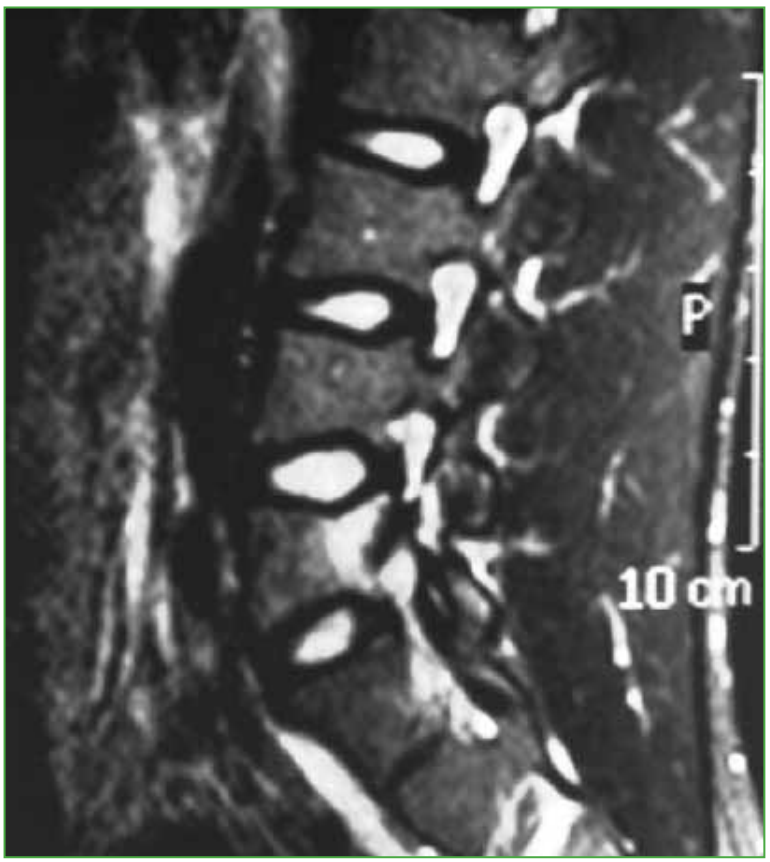

Figure 3. MRI of the lumbar spine, sagittal view. Edema of the right pedicle of L5 is observed.

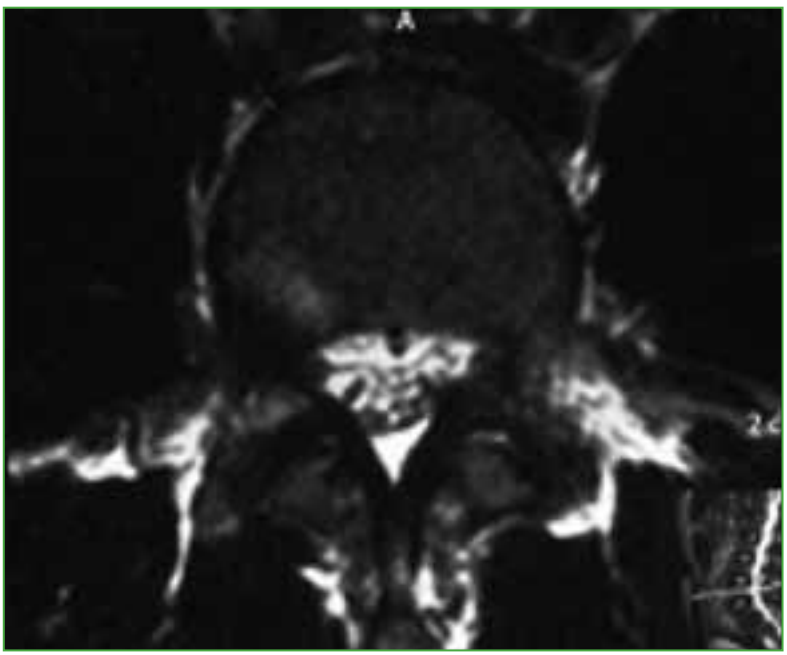

Figure 4. MRI of the lumbar spine, axial view. The edema of the right pedicle of L5 is visualized.

The patient underwent conservative treatment consisting of sports rest and the use of a lumbosacral orthosis. After two months, he began an adapted and progressive rehabilitation program. At five months of follow-up, he had returned to his usual sports activity without limitations or recurrence of low back pain.

DISCUSSION

The physical demands of certain sports activities undoubtedly predispose individuals to various types of injuries. In this regard, case reports of lumbar pedicle stress fractures have been associated, among other causes, with sports such as gymnastics, baseball, and cricket.[5-7] These sports are characterized by requiring hyperextension and rotational movements of the lumbar spine. The repetitive microtraumas generated by these movements may explain the origin of these lesions in the lumbar pedicle. However, our patient practiced a contact sport in which such movements do not predominate.

Among the anatomical structures that make up the posterior vertebral arch, the pedicle—after the pars interarticularis—is considered the site of greatest biomechanical vulnerability. Additionally, Sairyo et al. observed that young athletes with a history of unilateral spondylolysis developed an overload of forces on the contralateral pedicle.[7,8]

A common feature of pediculolysis is sclerosis of the pedicle, although it remains unclear whether this represents an adaptive phenomenon prior to the fracture or a consequence of it.[9] This unilateral sclerosis gives the vertebra an asymmetric appearance on radiological imaging. Computed tomography (CT) undoubtedly allows for better assessment of the lesion, differential diagnosis, monitoring of progression, and, in some cases, therapeutic planning. Characteristic CT findings include a radiolucent line of discontinuity with sclerotic and hypertrophic margins.[4] Magnetic resonance imaging (MRI) has high sensitivity for diagnosing these lesions. While it may or may not reveal the fracture line at the pedicle level, it does demonstrate associated edema, which appears hypointense on T1-weighted sequences and hyperintense on T2-weighted sequences.[3,4]

Regarding treatment, various authors recommend conservative management using lumbar immobilization orthoses along with a rehabilitation program tailored to the patient's needs.[10,11]

Gunzburg and Fraser, as well as Weatherley et al., noted that in cases where conservative treatment fails—primarily indicated by persistent low back pain—patients benefit from surgical intervention. This typically involves repair of the pars interarticularis using the Buck technique and screw osteosynthesis of the affected pedicle.[4,7] Araki et al. repaired the pars interarticularis and the pedicle of the fourth lumbar vertebra using Herberg screws and performed posterolateral arthrodesis of L4–L5 due to a history of degenerative disc disease at that level.[6]

In the case presented, the patient underwent conservative treatment and experienced a favorable clinical course, allowing him to return to his usual sports activities without any limitations. Consequently, surgical alternatives were not considered necessary.

CONCLUSIONS

Pediculolysis is a very rare clinical presentation. A history of spondylolysis—particularly in young patients and athletes—may represent a risk factor for the development of this condition. In this context, persistent mechanical low back pain may serve as a warning sign that, in conjunction with imaging studies, facilitates diagnosis.

In general, the response to conservative treatment is favorable. However, in cases of treatment failure, various surgical techniques are available.

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Aneurysmal Bone Cyst with Neurological Involvement in the Spine: Report of Two Cases and Literature Review

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ABSTRACT

An aneurysmal bone cyst (ABC) is a benign, vascularized bone lesion with an expansile growth pattern. Its presentation with neurological involvement is rare and presents a therapeutic challenge. This article describes two clinical cases of ABC located in the thoracic spine, both with acute neurological compromise. The patients were treated with staged surgical approaches and followed for 24 months. Both achieved complete neurological recovery. Early decompression and spinal stabilization, combined with selective embolization, are highlighted as key components of effective management.

Keywords: Aneurysmal bone cyst; thoracic spine; neurological compromise; embolization; spinal surgery; tumor.

Level of Evidence: IV

Quiste óseo aneurismático con compromiso neurológico en la columna: reporte de dos casos y revisión bibliográfica

RESUMEN

El quiste óseo aneurismático es una lesión benigna y vascularizada de comportamiento expansivo. Su presentación con compromiso neurológico es infrecuente y representa un desafío terapéutico. Este artículo tiene como objetivo describir dos casos clínicos de quiste óseo aneurismático en la columna torácica con compromiso neurológico agudo, tratados mediante abordajes quirúrgicos en dos tiempos y con un seguimiento de 24 meses. Ambos pacientes tuvieron una recuperación neurológica completa. La descompresión precoz y la estabilización, junto con la embolización selectiva, se destacan como pilares del tratamiento.

Palabras clave: Quiste óseo aneurismático; columna torácica; compromiso neurológico; embolización; cirugía espinal; tumor.

Nivel de Evidencia: IV

INTRODUCTION

Aneurysmal bone cyst (ABC) is a rare, benign, hemorrhagic, hyperemic tumor-like disease that infrequently causes neurological involvement.[1]

The first published description found by the authors corresponds to Lichtenstein in 1950, who reported two clinical cases and referred to this condition as a benign pseudotumoral pathology commonly confused with giant cell tumor and occasionally with hemangiomas and osteogenic sarcomas.[2]

At present, the neoplastic origin of this disease and the genetic translocation that causes it are well established.[3]

ABC accounts for approximately 1% of all primary bone tumors and predominantly affects females (2:1).[4] Most ABCs occur before the age of 20 years and can involve any bone segment. The metaphysis of long bones is the most commonly affected region. Between 10–30% of these tumors occur in the mobile spine and account for 15% of all primary spinal tumors.[5] Many are asymptomatic and, therefore, underdiagnosed; spontaneous regression has also been observed.

Enneking classifies them from grade 1 to 3 according to their aggressiveness: grade 1, latent; grade 2, active; and grade 3, aggressive.[6]

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The most frequent clinical presentation includes pain and local edema. Rarely, the initial manifestation may be a pathological fracture. Patients typically report a history of pain that does not respond to medical treatment. These are highly vascularized lesions with expansive growth, and given their lytic nature, they are prone to cause mechanical instability.[7]

In the spine, their distribution is as follows: lumbar spine 40%, cervical spine 30%, thoracic spine 20%, and sacral spine 10%.[8] The usual topographic location in the vertebra is the posterior arch.[3]

Radiography, computed tomography (CT), and magnetic resonance imaging (MRI) are the complementary studies that aid in diagnosis. Radiographs reveal an osteolytic, expansile cavity. CT and MRI typically show characteristic fluid-fluid levels.[8]

The treatment of ABC varies depending on location and aggressiveness. Available surgical treatments include curettage or partial resection; intralesional therapies with autologous bone grafts; and, in some cases, medical therapy or radiotherapy. Complete resection with safe margins is associated with the lowest local recurrence rates and is therefore considered the treatment of choice whenever feasible.

We did not find a clear management protocol in the literature for cases presenting with progressive and disabling neurological compromise.[9]

The aim of this article is to describe and analyze two cases of ABC in the thoracic spine with neurological involvement.

A descriptive and retrospective study was conducted on a series of patients (2015-2022) operated on by the same surgical team at a general hospital serving as the head of a regional health network. The patients who participated in the study provided written informed consent.

Both patients were monitored for at least 24 months following surgical treatment. Follow-up consisted of interviews with the treating team 15 days after hospital discharge, at 1 month, 2 months, and then every 6 months up to 24 months. Complementary imaging studies were performed during the immediate postoperative period and every 6 months thereafter (radiographs and MRI).

Neither patient had received prior treatment for the tumor, so both cases were considered primary (Table).

Table. Peri- and post-surgical demographic data.

Age	Sex	Location	Staging (WBB)	Staging (Enneking)	Initial Frankel	Embolization	Treated levels	Final Frankel
9	F	C7/T1/T2	Zone 4 – 7 D	G3 benign aggressive	C	YES	C5 / T5	E
8	F	T4	Zone 1 – 12 D	G3 benign aggressive	C	YES	T2 / T6	E

F = female; M = male, WBB = Weinstein-Boriani-Biagini Classification.

CLINICAL CASE 1

A 9-year-old girl presented with chronic pain (>2 years) in the lower cervical and interscapular region. She denied any relevant personal or family medical history. On questioning, she reported upper back pain that did not respond to pharmacological or physical therapy.

Physical examination revealed gait disturbance with a widened base of support, bilateral patellar hyperreflexia, and paresis corresponding to the right C7 nerve root. This was manifested as weakness in the right triceps muscle (grade 4/5), as well as in the wrist flexors and extensors on the right side (grade 4/5), according to the Medical Research Council (MRC) muscle strength scale (Figure 1).[10]

An initial anteroposterior radiograph showed an alteration in the physiological coronal axis (Figure 2).

Figure 1. Lateral view of the patient. An antalgic posture with cervical spine anteposition is observed.

Figure 2. Initial anteroposterior radiograph of the proximal cervical and thoracic spine. Alteration of the physiological coronal axis is noted.

Complementary imaging revealed extensive vertebral involvement: at C7 (posterior arch), zones 4–7 and levels III and IV of the Weinstein-Boriani-Biagini (WBB) classification; at T1 (vertebral body), zones 10–3 and levels III and IV; and at T2 (right pedicle and posterior arch), zones 3–7 and levels III and IV.[11] The lesions had an expansile cystic appearance (Figures 3 and 4). Due to the expansile nature of the lesion, a vertebral hemangioma was ruled out. The lesion was interpreted as an Enneking grade 3 ABC.

The therapeutic plan aimed to reduce bleeding risk, decompress the lesion, and stabilize the spine.

Angiography revealed multiple feeding arteries arising from the paraspinal trunk. Several of these were embolized during the same procedure, although no dominant feeding artery was identified.

Forty-eight hours after embolization, the first surgical stage was performed. This involved posterior pedicle instrumentation from C5 to T5, decompression of C7, T1, and T2 (Figure 5), and tumor mass resection. Intraoperative bleeding was <500 mL.

Five days later, the second surgical stage was performed via an anterior approach, including T1 corpectomy with autologous bone graft placement.

The patient's neurological deficit began to improve 48 hours after surgery. She currently has a normal gait without sequelae and remains under routine postoperative follow-up, with no reported complications. Histopathological examination confirmed the diagnosis and showed tumor-free surgical margins.

Figure 3. Coronal computed tomography of the cervical and proximal thoracic spine. Expansive cystic lesions are visible in the posterior elements of T1.

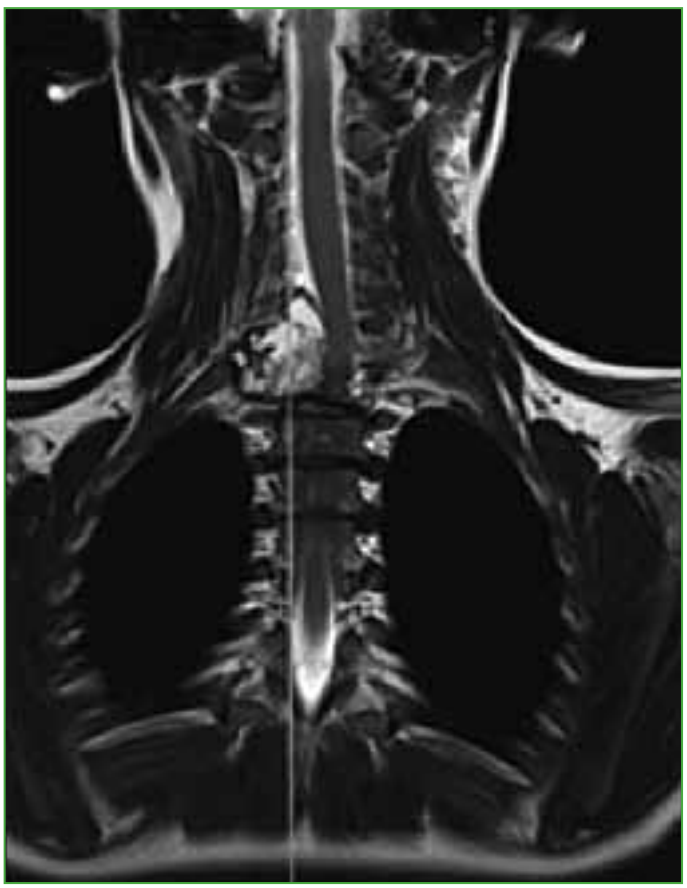

Figure 4. Coronal MRI of the cervical and proximal thoracic spine. An expansive cystic lesion with characteristic fluid–fluid levels is visualized.

Figure 5. Postoperative lateral radiograph of the cervical and proximal thoracic spine. Posterior and anterior fixation elements from C5 to T5 are visible.

CLINICAL CASE 2

An 8-year-old girl presented with weakness in the lower limbs (grade 3/5 on the MRC muscle strength scale). She reported sudden symptom onset (<72 hours) and denied any significant personal or family medical history.

On admission, anteroposterior radiography revealed absence of the pedicle image in the affected vertebra, a radiographic sign known as the "owl's wink" (Figure 6).[12]

The lesion involved zones 3-6 and levels III and IV of the Weinstein-Boriani-Biagini classification.[11] Complementary imaging studies showed multiple septated cysts with fluid-fluid levels. A simple bone cyst with expansile and compressive features was ruled out, as was vertebral hemangioma (Figures 7 and 8). This case was also interpreted as an Enneking grade 3 ABC.[13]

The therapeutic plan involved urgent spinal decompression and stabilization in the first surgical stage, followed by selective embolization to reduce bleeding risk, and then a second stage of stabilization and arthrodesis.

The first surgical stage was performed within 24 hours and consisted of spinal canal decompression by resection of the T4 posterior arch, followed by a costotransversectomy corpectomy using an eggshell technique to preserve the cortical rim.[14] The spine was stabilized with pedicle fixation from T2 to T6.

Within the next 48 hours, angiography and embolization of the tumor's vascular pedicle were performed.

In the second surgical stage, a titanium spacer filled with autologous bone graft was placed (Figure 9).

The neurological deficit resolved within the first month postoperatively. No recurrence has been observed to date. Histopathological analysis confirmed the diagnosis of ABC and clear surgical margins.

Figure 6. Anteroposterior radiograph of the cervical and proximal thoracic spine on admission. The "owl's wink" sign is visible at T4, indicating absence of the pedicle.

Figure 7. Sagittal computed tomography of the thoracic spine. An expansive lytic lesion involving the vertebral body of T4 and the posterior elements is observed.

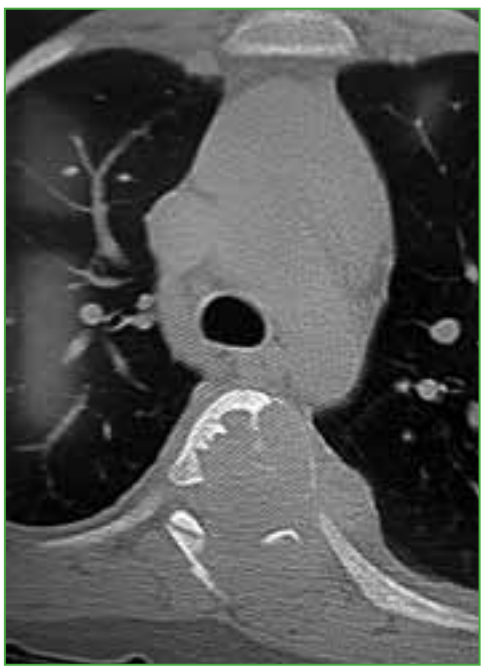

Figure 8. Axial computed tomography of the thoracic spine. Multiple fluid–fluid levels are identified within the cystic lesion.

Figure 9. Postoperative anteroposterior radiograph of the cervical and proximal thoracic spine. Pedicle fixation from T2 to T6 and placement of a titanium interbody cage with bone graft are seen.

DISCUSSION

The primary goal of treatment in both cases was to improve neurological status and confirm the preoperative diagnosis.

Given the neurological involvement, early spinal cord decompression was essential. Secondary objectives of the surgical intervention included minimizing the number of involved spinal segments and preventing future deformities or pathological fractures.

When an ABC is suspected, the initial step should be a needle biopsy to confirm the diagnosis. Subsequent treatment options vary and may include observation—given reports of spontaneous resolution post-biopsy—pharmacological therapy (e.g., denosumab or bisphosphonates), radiotherapy, percutaneous sclerotherapy with agents such as phenol, liquid nitrogen, doxycycline, argon, bone graft, or bone substitutes, selective vascular embolization, intralesional curettage and filling, or en bloc resection with oncologic margins.[3,9]

In the presence of neurological compromise, we considered decompression and stabilization—either in a single or staged approach—as imperative.

In both cases, preoperative biopsy was not feasible due to the urgency of the clinical presentation. In Case 2, selective embolization was deferred because of rapidly progressing neurological deficits; treatment was later completed with an anterior corpectomy to reconstruct the anterior column. Selective embolization followed by complete tumor resection is a recommended strategy whenever feasible.

Case 1 posed a particular challenge due to the lesion spanning three vertebral levels.

We propose that surgical intervention is indicated in cases with neurological deficit or risk of pathological fracture. Non-surgical treatments are reserved for lesions that do not compromise spinal stability and, in asymptomatic cases, percutaneous sclerotherapy with agents such as calcitonin may be preferred.

A limitation of this report is the small number of cases. However, our team plans to present a larger series of patients with ABC and neurological involvement in the near future.

CONCLUSIONS

ABC with neurological involvement requires urgent surgical intervention. Early spinal cord decompression is critical for neurological recovery. Preoperative selective embolization is useful in reducing intraoperative bleeding and recurrence.

A two-stage complete resection is a feasible and effective strategy. Further studies with larger patient cohorts are needed to establish evidence-based therapeutic guidelines and treatment consensus.

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Meniscal Preservation Surgery and Genu Valgum Correction through Guided Growth in Patients with Discoid Meniscus

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ABSTRACT
The discoid meniscus and genu valgum can combine to cause significant joint dysfunction in the knees of pediatric patients. This paper presents a surgical technique that simultaneously addresses discoid meniscus preservation and genu valgum correction through guided growth (GG). The meniscal preservation technique aims to conserve functional meniscal tissue, improving joint biomechanics in the long term. At the same time, GG is used to realign the mechanical axis of the limb. This combined approach could optimize meniscal function and improve long-term outcomes in skeletally immature patients with a discoid meniscus.
Keywords: Meniscus; discoid; children; meniscal preservation; guided growth.
Level of Evidence: IV

Cirugía de preservación meniscal y corrección del genu valgo mediante el crecimiento guiado en pacientes con menisco discoideo

RESUMEN
El menisco discoideo y el genu valgo pueden combinarse para causar una disfunción articular importante en la rodilla de los niños. En este artículo, se presenta una técnica quirúrgica que aborda simultáneamente la preservación del menisco discoideo y la corrección del genu valgo mediante el crecimiento guiado. La técnica de preservación meniscal busca conservar tejido funcional y mejorar la biomecánica articular a largo plazo. Al mismo tiempo, se utiliza el crecimiento guiado para realinear el eje mecánico de la extremidad. Este abordaje combinado podría optimizar la función meniscal y mejorar los resultados a largo plazo en pacientes esqueléticamente inmaduros con menisco discoideo.
Palabras clave: Menisco discoideo; niños; preservación meniscal; crecimiento guiado.
Nivel de Evidencia: IV

INTRODUCTION

The discoid meniscus is a congenital variant of the meniscus, most commonly found in the lateral compartment, with a prevalence of 3-5% in the general population.[1] Its abnormal histological composition and absence of normal peripheral insertions may predispose patients to tears and other biomechanical issues that increase the risk of long-term osteoarthritis.

Over the years, advancements in arthroscopic surgical techniques have enabled surgeons to more effectively address the pathologies associated with discoid meniscus, thereby reducing the risk of progressive joint deterioration. However, despite these improvements, the postoperative revision rate remains high,[2,3] suggesting a need for further innovations to enhance long-term outcomes in these patients.

Guided growth via transient inhibition of a portion of the physis is an established technique for the correction of angular deformities in children, and it has progressively replaced more invasive osteotomies.[4] This method has

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proven to be a versatile tool with multiple applications in pediatric sports medicine, including patellofemoral instability, osteochondritis dissecans, and anterior cruciate ligament injuries.[5,6] This approach has been successfully used to correct angular deformities and may offer a promising strategy to optimize joint loading in patients with discoid meniscus. The application of guided growth techniques in the treatment of discoid meniscus may reduce compartmental overload and thereby decrease the risk of re-tears.

In this article, we present a surgical technique combining arthroscopic meniscal preservation surgery with guided growth in patients with open physes, which may optimize meniscal function and improve long-term outcomes in patients with discoid meniscus.

SURGICAL TECHNIQUE

Indications

The authors' current indications for discoid meniscus preservation surgery combined with guided growth in patients with open physes are: 1) Complete or incomplete symptomatic discoid meniscus, with or without peripheral instability; and 2) Genu valgum, with the mechanical axis positioned in the lateral compartment (normally just medial to the center of the knee) and a lateral distal femoral angle ≤84°.

Description of the procedure

The patient is placed in the supine position following the administration of spinal anesthesia. A leg support is positioned to allow sufficient space for meniscal repair. A single dose of 1 g of cefazolin is administered prior to the start of the procedure. Asepsis and antisepsis are performed, and the surgical fields are prepared according to standard technique. After exsanguinating the affected limb using an Esmarch bandage, a hemostatic cuff is applied to the thigh and inflated to 250 mmHg. Prior to arthroscopy, anatomical landmarks are marked with a sterile marker, including the planned arthroscopic portals and the incisions for the inside-out sutures, to ensure precise placement—since these could be distorted following joint insufflation. The anterolateral portal is established to perform the initial diagnostic arthroscopy of the knee. All intra-articular structures are explored, and a second anteromedial arthroscopic portal is created. A probe is introduced through this portal to evaluate the characteristics of the discoid meniscus and to assess for tears or peripheral instability. A hook probe, approximately 5 mm in diameter, is used as a rough guide to measure the peripheral meniscal segment to be preserved after saucerization.

The tear pattern of the discoid meniscus is assessed using the hook probe, with particular attention to identifying peripheral instability. The hook is placed in the popliteal hiatus to apply traction to the posterior horn and confirm the degree of instability. If the tear site is easily accessible, meniscal repair is performed before saucerization to more precisely identify the areas of the meniscus that require resection. This approach is typically employed when there is anterior or posterior meniscal migration (Figure 1). If access is hindered due to the bulk of the discoid meniscus, which obstructs visualization of the lesion or area of instability, a limited central resection may be carried out first to improve exposure.

Saucerization begins with an arthroscopic scalpel to resect the most anterior portion of the meniscus. Resection of the central portion is completed using arthroscopic punch forceps of various diameters and a shaver, shaping the meniscus into a half-moon shape to improve congruency while preserving a 10–15 mm peripheral rim. After saucerization, meniscal stability is re-evaluated.

Meniscal stabilization is performed using inside-out, outside-in, or all-inside techniques, depending on the tear pattern. For posterior horn lesions, inside-out sutures are preferred and are combined with a posterolateral approach to expose the interval between the posterior capsule. A medium-sized speculum is used as a meniscal retractor to facilitate suture retrieval and protect posterior neurovascular structures. With the arthroscope in the anterolateral portal, a posterior-specific cannula is inserted through the anteromedial portal. The assistant introduces vertical meniscal suture needles through this cannula, starting at the posterior horn and progressing toward the meniscal body at 3–5 mm intervals, securing the meniscus to the posterior capsule. Sutures are retrieved through the lateral incision and tied over the capsule.

For anterior horn lesions, outside-in sutures are primarily used, or combined with inside-out techniques if the tear extends into the meniscal body. Discoid menisci often exhibit central degeneration and horizontal tears, which become evident during saucerization. These horizontal lesions can be repaired using an all-inside tech-

nique with the Knee Scorpion™ Suture Passer (Arthrex®, Naples, FL, USA) or the FirstPass Mini (Smith & Nephew, Memphis, TN, USA; London, England). After completing the repair, a microfracture punch is used at the intercondylar notch to release bone marrow elements into the joint space, promoting a healing environment.[7]

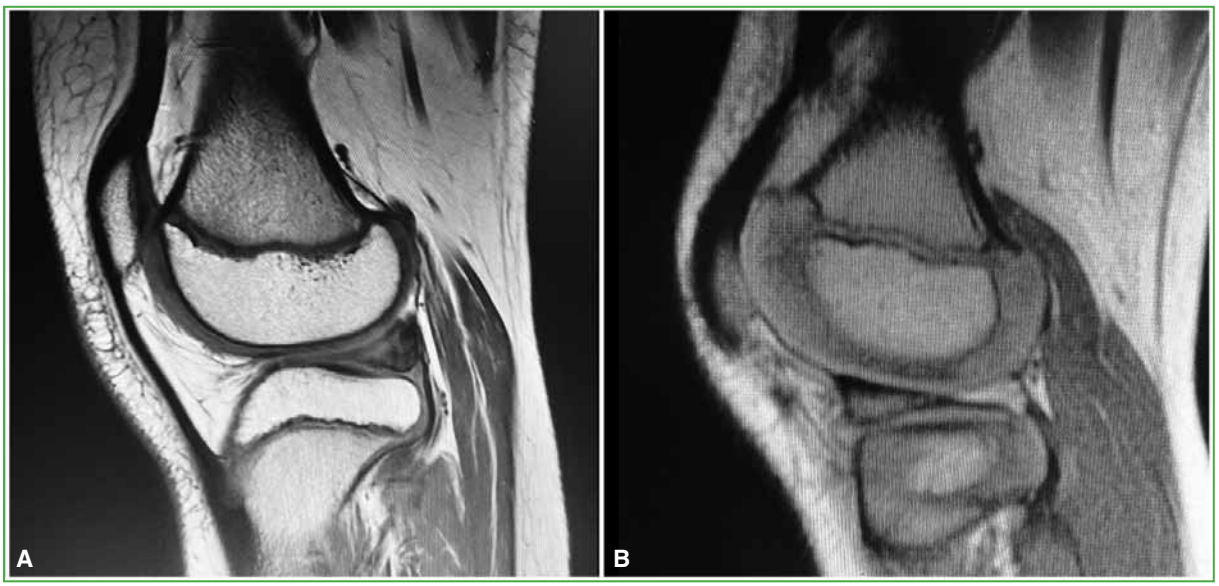

Figure 1. Knee MRI of a patient with anterior instability (**A**) and posterior instability (**B**). Note the direction of meniscal migration and the absence of the anterior (**A**) or posterior (**B**) horns.

After the arthroscopic procedure, guided growth is performed. If the estimated remaining growth exceeds two years, tension band plates are used;[8] if less growth remains, transphyseal screws are employed (Figure 2).[9]

Figure 2. Surgical technique of guided growth with tension band plates (**A**) and transphyseal screw (**B**).

Skeletal maturity is calculated with the FELS method.[10] Tension band plates are placed under fluoroscopic guidance. A 1.6 mm guide pin is inserted into the epiphyseal region of the distal femur, approximately 6–8 mm distal to the physis (the distance between the proximal and distal holes of a 12 or 16 mm plate). The plate is then advanced along the guidewire into the subcutaneous tissue to allow placement of the second guide pin proximally into the metaphysis in a divergent orientation. Proper positioning is verified fluoroscopically. The trial plate is removed, and a skin incision (typically 2–3 mm) is made between the two guide pins, extending as needed. The plate is then dissected down to the periosteum, positioned in place, and 4.5 mm cannulated screws are inserted over both guide pins using standard technique. For transphyseal screws, a guide pin is placed obliquely from distal to proximal under fluoroscopic control.

After confirming position, the tract is reamed from proximal to distal, and a 7.0 mm fully threaded cannulated screw is inserted percutaneously. Screw length is selected to ensure at least three threads engage the epiphysis. A washer is used to facilitate future removal. Finally, all incisions are closed in layers, and a sterile dressing is applied to the surgical wounds.

Postoperative Management

Patients undergoing saucerization combined with guided growth only are allowed full weight-bearing immediately, with no restriction in the range of motion. At 2 weeks postoperatively, sutures are removed, and physical therapy is initiated, continuing until knee swelling subsides and full range of motion and strength comparable to the contralateral leg are achieved.

For patients who underwent saucerization with meniscal repair and guided growth, a knee immobilizer and crutches are prescribed. Non-weight-bearing is maintained for 4 weeks. During this period, the immobilizer may be removed intermittently, and passive motion from 0° to 60° is allowed.

Between weeks 4 and 6, progressive partial weight-bearing (approximately 50%) is introduced, along with a range of motion from 0° to 90°. Physical therapy is initiated, focusing on strengthening the knee. From week 6 onward, patients are allowed full weight-bearing and gradual progression to full range of motion. Finally, return to sports is authorized after 6 months.

The mechanical axis is assessed at follow-up visits every 3 months. Once a slight overcorrection is achieved (Stevens zone -1),[11] removal of the hardware is scheduled. One year after removal, a telemetric assessment is performed to rule out a rebound effect (loss of axis correction due to remaining skeletal growth) (Figure 3).

Figure 3. A. 12-year-old patient with right unstable discoid meniscus and homolateral genu valgum. **B.** Saucerization, peripheral repair of anterior instability and guided growth with tension band plate. **C.** Mechanical axis one year after material removal.

DISCUSSION

This article provides information on the surgical technique used by the authors for discoid meniscus preservation surgery in combination with guided growth in patients with open physes. The surgical technique described involves saucerization of the external discoid meniscus, its repair in the presence of injury or peripheral instability, as well as the incorporation of guided growth during the same surgical procedure, using either tension band plates or transphyseal screws.

Surgical treatment of the discoid meniscus has evolved significantly. Prior to the advent of arthroscopy, subtotal or total meniscectomy was the treatment of choice for symptomatic patients. However, medium-term outcomes were often poor. With the development and refinement of arthroscopic techniques, meniscal preservation through saucerization (resection of the central portion of the discoid meniscus) has improved outcomes by preserving more meniscal tissue. Nonetheless, some patients exhibit peripheral instability due to capsulomeniscal insertions or tears. Arthroscopic repair techniques have addressed the instability associated with the discoid meniscus, demonstrating excellent short-term results and a low complication rate. However, medium- and long-term studies have shown that results tend to deteriorate over time, with a high reoperation rate. This trend is exemplified in the study by Lins et al., in which patients reported favorable outcomes following preservation surgery, although 44% required a second surgery on the ipsilateral limb during a mean follow-up of 19.5 years (range, 16-27 years).[2]

Genu valgum is an angular deformity that may initially present in association with a discoid meniscus or may develop following surgical treatment of this condition. Several studies have observed a significant increase in knee valgus following partial resection of the external discoid meniscus in patients with otherwise normal lower limb alignment.[12-14] A greater increase in the angle of deviation appears to correlate with the extent of meniscus resected, suggesting increased load distribution in the lateral compartment.[9] The effect of lower limb alignment on the risk of developing osteoarthritis has been studied and identified as an independent long-term risk factor.[15] Overloading of the lateral compartment increases stress on joint structures, which may accelerate articular degeneration and contribute to symptom recurrence. In the context of discoid meniscus—an abnormally shaped meniscus with histological alterations that predispose it to injury—[16]induced or aggravated genu valgum following surgery not only compromises normal knee biomechanics but may also contribute to surgical failure. Therefore, correction of lower limb alignment may be important for improving postoperative outcomes and reducing the reintervention rate.

Historically, angular limb deformities have been corrected by osteotomy. Although effective, osteotomy is an invasive procedure requiring prolonged recovery and carrying risks of complications such as infection, delayed bone healing, and the need for postoperative immobilization.[17] In recent decades, the development of guided growth techniques has revolutionized the management of these deformities in patients with open physes. Techniques such as the use of extraphyseal tension band plates[18]or transphyseal screws[9] allow the natural growth of the limb to be modulated, gradually guiding it into correct alignment. Unlike osteotomy, guided growth is minimally invasive, reducing recovery time, postoperative discomfort, and the risk of complications. Consequently, guided growth has become the treatment of choice for angular deformities in the pediatric population, minimizing the need for invasive interventions and offering a safe and effective alternative.[4]

In summary, this article discusses the current indications and technical aspects of arthroscopic discoid meniscus preservation surgery combined with guided growth for coronal axis realignment in patients with open physes.

We consider the combination of both techniques to be a promising and useful option; however, further studies are required to validate the clinical outcomes and assess potential complications in this patient group.

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

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Jean F. Dubousset (1936-2025)

Professor Emeritus of the Université René Descartes, Paris
Member of the Académie Nationale de Médecine, France
Member of the Académie de Chirurgie, France

It is with deep sorrow that we announce the passing of Dr. Jean F. Dubousset, an eminent professor of Orthopedics and Traumatology, who died on May 4, 2025, in Paris, France, at the age of 88, surrounded by his beloved family and friends. His professional legacy, human warmth, and unwavering commitment to his patients made him an unforgettable figure and a role model in the field of medicine.

Born in Montferrand, Auvergne, France, on November 16, 1936, Dr. Dubousset dedicated his life to medicine, specializing in orthopedic surgery. He was widely recognized for his exceptional technical skill and profound knowledge. He gained acclaim for revolutionizing the treatment of spinal deformities in children and adolescents, developing innovative techniques that not only improved clinical outcomes but also brought hope to countless young patients and their families.

I had the honor of working alongside Dr. Dubousset at Saint-Vincent-de-Paul Hospital in Paris from 1982 to 1990. That period transformed my understanding of orthopedics. I learned not only from his remarkable surgical expertise but also from his unique ability to connect with each patient. His holistic approach—combining technique with compassion—was a lasting source of inspiration.

Together with Professor Yves Cotrel, Dr. Dubousset earned global recognition for his work on scoliosis and other spinal deformities. His pioneering surgical techniques went beyond correcting deformities; they prioritized restoring the quality of life for young patients. His innovative thinking and steadfast dedication to research helped countless children and adolescents regain their health—and often, their self-esteem.

Beyond the operating room, Dr. Dubousset was a devoted teacher who shared his vast knowledge with generations of physicians around the world. He instilled in his students not only a passion for orthopedics but also a profound understanding of the importance of compassionate care. His commitment to teaching left a lasting impact, encouraging many to follow the path of integrity and dedication he exemplified.

He spent a year in the United States, working in Miami and Texas, where he contributed his expertise in pediatric orthopedics and neuroorthopedics.

Dr. Dubousset was a great friend of our country, which he visited several times. His curious and adventurous spirit even led him to Patagonia to explore why penguins do not develop scoliosis.

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A tireless advocate for research, he actively participated in numerous scientific conferences and publications. His contributions significantly advanced the treatment of skeletal deformities, and many of his insights continue to shape current medical practices.

His *curriculum vitae* is so vast that it cannot be fully captured in this tribute.

Beyond his professional achievements, Dr. Dubousset was an extraordinary human being. His kindness, generosity, and empathy extended far beyond the medical sphere. Always ready to listen and to help, he left a deep and lasting impression on all who had the privilege of knowing him.

Dr. Jean F. Dubousset leaves behind a legacy of dedication, a profound love for medicine, and an unwavering respect for human dignity. His influence lives on in the lives of those who, thanks to his work, found a path to healing. His memory will continue to inspire all who were touched by his life and work.

Rest in peace, dear Jean. Your legacy endures in the medical community, in orthopedic surgeons across the world, in your patients, and in every life you helped transform.

Dr. Armando E. Orellano
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