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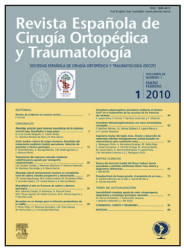

CLINICAL NOTE

Internal tibial plateau fractures following a unicompartmental knee arthroplasty

A. de Prado-López,* M. Román-Torres, J.M. Sotillo-Mármol

Servicio de Cirugía Ortopédica y Traumatología, Hospital Universitario Reina Sofía, Córdoba, Spain

KEYWORDS
UKA complication;
Periprosthetic fracture;
Total knee arthroplasty;
Bone allograft

Abstract The aim of the article is to report the existence of internal tibial plateau fractures as a possible complication in certain circumstances following a unicompartmental knee replacement.

We report a patient who suffered a fracture of the internal tibial plateau after unicompartmental knee arthroplasty (UKA) that required revision surgery with a bone and mesh allograft.

Peri-prosthetic fractures after a unicompartmental knee arthroplasty are rare but with the increasing indications for this procedure in recent years there are more and more cases with complications that can be a challenge for the orthopaedic surgeon.

When there is a periprosthetic fracture in a unicompartmental knee arthroplasty, revision total joint replacement with bone and mesh allograft can provide good results, maintaining the functionality and avoiding long periods of immobilization.

PALABRAS CLAVE
Complicación artroplastia unicompartimental de rodilla;
Fractura periprotésica;
Artroplastia total de rodilla;
Aloinjerto óseo

Fractura de platillo tibial interno tras artroplastia unicompartimental de rodilla

Resumen El objetivo del artículo es comunicar la existencia de fracturas del platillo tibial interno como posible complicación en determinadas circunstancias tras un reemplazo articular unicompartimental de la rodilla.

Presentamos el caso de una paciente, que sufrió una fractura del platillo tibial interno, tras artroplastia unicompartimental de rodilla, y que precisó la cirugía de revisión con aloinjerto óseo y malla.

Las fracturas periprotésicas tras una artroplastia unicompartimental de rodilla son poco frecuentes, aunque con el aumento de indicaciones de este procedimiento en los últimos años, cada vez nos encontramos más casos de solución compleja y que pueden suponer un reto para el cirujano ortopédico.

Tras la aparición de una fractura periprotésica en una rodilla con una artroplastia unicompartimental, la revisión a una artroplastia total con aloinjerto óseo y malla puede aportar buenos resultados, preservando la funcionalidad y evitando largos períodos de inmovilización.

*Corresponding author.
E-mail: antoniodeprado@hotmail.com (A. de Prado-López).

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Introduction

Unicompartmental knee arthroplasty began to be an alternative to proximal tibial osteotomy in patients under 65 year of age with degenerative joint disease in only one knee compartment.[1] Currently, new implant designs and minimally invasive surgical techniques offer results comparable to those obtained with total knee arthroplasty. This accounts for its recent surge in popularity throughout the world.

Although unicompartmental arthroplasty has proven to be a feasible treatment solution in certain cases of osteoarthritis of the knee, it is not free of complications.[3] Peri-prosthetic fracture of the tibial plateau is one such complication, though it is considered an infrequent event following this surgery. Typically, it is associated with cortical defects during implantation in procedures performed by surgeons with little experience. The majority of these fractures are caused by technical errors during preparation of the tibial surface that result in weakening or overloading of the proximal end of the tibia. This is why they usually appear during the procedure or within a few weeks after the joint replacement surgery.[3] Possible treatments range from plaster immobilization to replacement of the prosthesis.

The objective of this article is to present a case of peri-prosthetic tibial fracture following unicompartmental knee arthroplasty, to discuss the possible causes of failure of this arthroplasty, and to present a treatment alternative consisting of rescue surgery for it.

Clinical case

A 72-year-old woman with history of arterial hypertension, type 2 diabetes mellitus, hypercholesterolemia, and type II central obesity with a BMI of 37.46 (weight 87.69 kg, height 1.53 m) was seen in the Traumatology Outpatient Clinic, reporting pain of a mechanical nature in the left knee for about 2 years that severely limited her in activities of daily living.

Upon examination, no major deformity was appreciated in static standing position, although she reported tenderness to palpation at the inner aspect of the knee, which impaired her gait and made it difficult to actively move the knee, limiting flexion to 90°. The knee was stable in the anterior-posterior axis, with less than 5 mm of travel, and no varus or valgus instability was noted. Patient had an extension deficit of about 5°, a varus deviation of 5°-10°, and a KSS of 48.

After x-rays were taken, patient was diagnosed with medial knee compartment osteoarthritis (fig. 1). Because the lateral compartment was in excellent condition on x-ray and there were no significant changes in the axis, unicompartmental replacement surgery was proposed to the patient (fig. 2).

The patient underwent this surgery in April of 2008 with an Oxford-type unicompartmental knee arthroplasty implant. Vancomycin was given for antibiotic prophylaxis, and ischemia prevention was used with a duration of 82 minutes. There were no adverse events intra-operatively,

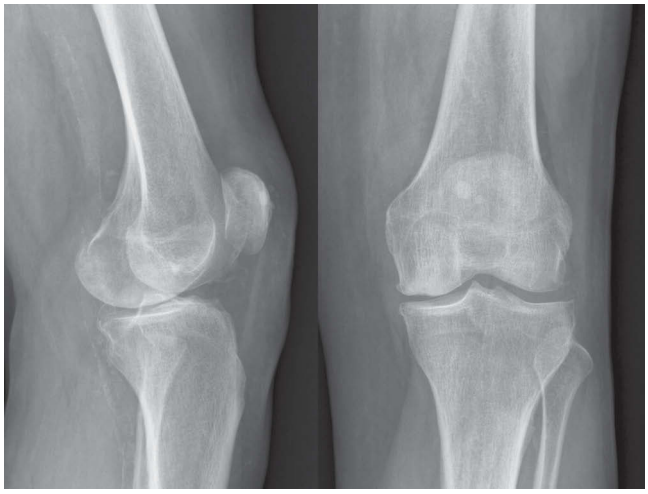

Figure 1 Pre-operative x-rays of the medial knee osteoarthritis.

and the post-operative period was also normal. Patient began ambulation 3 days after surgery and was discharged at 5 days to be seen in outpatient clinic 2 weeks after surgery.

At 3 weeks after the procedure, patient went to Urgent Care for sudden onset of pain in the inner aspect of the operated knee, exacerbated over the last 2 days, that made it impossible for her to walk without assistance. On the stat x-ray taken, collapse of the tibial component of the unicompartmental prosthesis was appreciated, as well as the metaphyseal extension of a fracture line (fig. 3). On physical examination, swelling and induration of the skin and subcutaneous tissues were noted in the affected area.

The patient underwent surgery again for removal of the unicompartmental prosthesis and fixation of the tibial fragment using a mesh with screws and bone allograft to fill the defect. Subsequently, a total knee prosthesis was implanted with tibial rod (fig. 4). The skin over the fracture area was infiltrated and taut due to the hematoma, which made it a difficult closure, and because it remained under

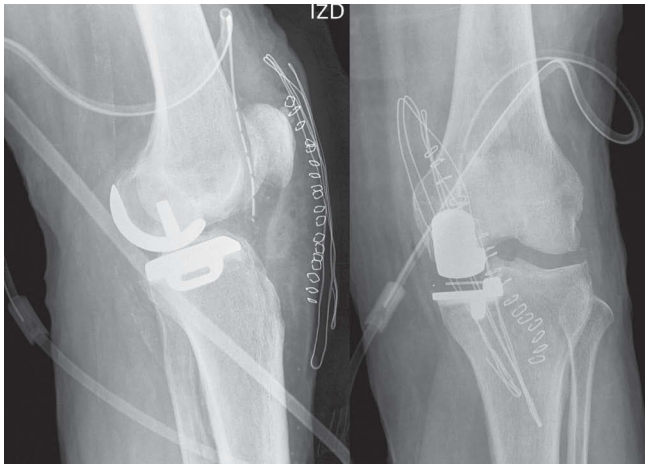

Figure 2 Post-operative x-rays of the unicompartmental prosthesis.

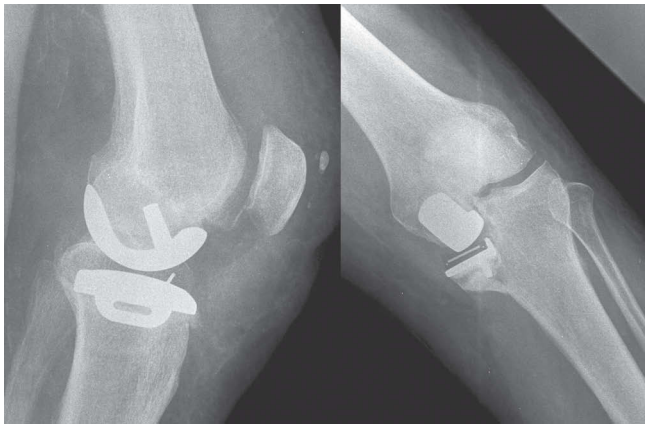

Figure 3 X-rays of the peri-prosthetic fracture with medial collapse.

tension, a central necrosis developed that the Plastic Surgery Service treated on a deferred basis via debridement and coverage with an internal gemellus muscle flap.

At discharge, the patient was ambulating with a walker, with an articular balance of 5°-90° in the knee and pain she rated as tolerable, not requiring that she take analgesics, and a KSS of 81.

At the subsequent outpatient check-ups, patient was progressing satisfactorily, able to carry out her activities of daily living and ambulate without the walker, though at 18 months after the surgery she was using a crutch sporadically (figs. 5 and 6). Follow-up labs, examinations, and x-rays ruled out any infection.

Discussion

Unicompartmental knee replacement surgery is a very demanding procedure, technically, with a steep learning curve. This type of arthroplasty is recommended in many

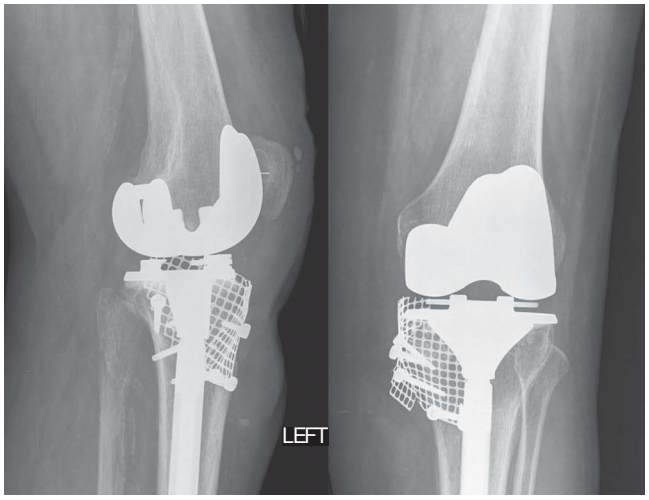

Figure 4 X-rays of the revision total knee prosthesis with mesh and tibial rod.

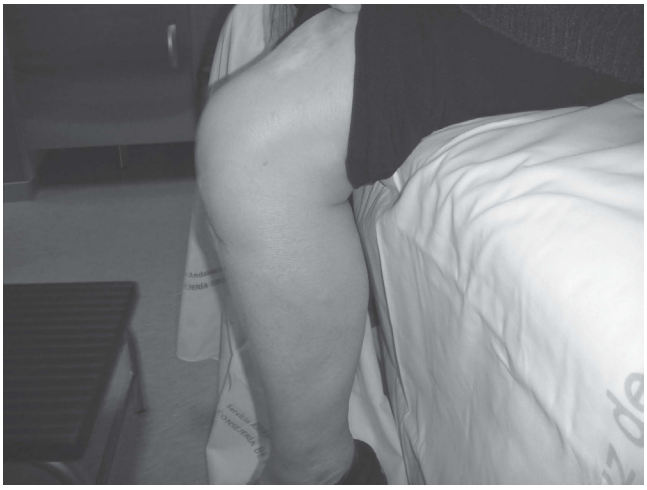

Figure 5 Lateral image of the flexed right knee at 9 months post-operative.

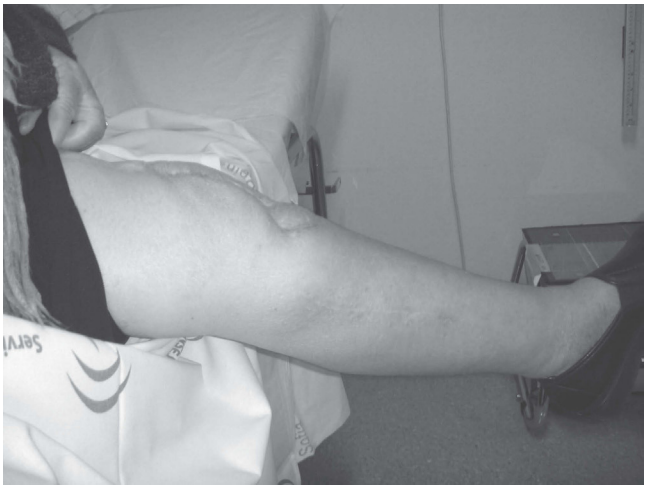

Figure 6 Lateral image of the extended knee at 9 months post-operative.

publications because it is associated with lower surgical morbidity, reduced blood loss, shorter rehabilitation, less pain, shorter hospitalisation, better function with preservation of normal knee kinematics, and a lower incidence of post-operative venous thromboembolism and infection in comparison with total knee arthroplasty.[2] The indications and contraindications for this surgery are well known,[4] although there is controversy with regard to obesity. Böhler asserts that patients weighing more than 80 kg are not good candidates for unicompartmental arthroplasty,[5] and Bert has determined that the patient must not be obese.[6] Kozinn and Scott[7] initially limited this procedure to patients weighing less than 90 kg, and a weight of more than 124.5 kg[8] or a BMI greater than 45[9] have recently been described as contraindications.

The causes of its failure and subsequent revision are wearing or luxation of the polyethylene, loosening, infection, and progression of the osteoarthritis to other knee compartments. Breakage of the femoral component of

these prostheses due to fatigue has also been described.[10] The incidence of revision following partial joint replacement is twice that of revision following total knee replacement, owing to femoral or tibial loosening, peri-prosthetic fractures, and pain.[2] The latest analyses of Oxford unicompartmental prosthesis survival show a survival of 97% at 10 years—results similar to those described for a total knee prosthesis[11]—and greater than 95% at 15 years.

Nowadays, development of a peri-prosthetic fracture is not a common cause of prosthetic revision, although the increase in the number of unicompartmental prostheses in recent years has been accompanied by an increase in the incidence of this type of fracture (0.2%–5%), which may occur in the internal femoral condyle or the internal tibial plateau. In a series of more than 1,000 cases, Pandit[12] obtained a fracture incidence of less than 1%. Peri-prosthetic fractures have also been described in implants inserted through minimally invasive surgery under navigation control.[13] Among the factors involved in their etiopathogenesis are errors in surgical technique (breach of the posterior cortex, excessive bone resection, inadequate preparation of the groove for the keel, overly energetic impaction of the components), trauma, low bone mineral density, and poor alignment. Hanssen believes that there are specific risk factors for these tibial fractures, such as using tibial components with keels, pins, or slender rods—for these may result in pressures being concentrated around the orifices or cavities where the arthroplasty is inserted.[14] Van Loon et al[15] emphasize the importance of calculating the tibial implant size correctly to prevent stress fractures due to loads not being transmitted properly between the tibial component and the proximal tibial plateau. The area may also be weakened if the vertical cut made for the tibial component is extended too far distally[16] or a sagittal saw cut is too extensive, which may weaken the posterior tibial cortex.[12]

In the case presented here, we believe the patient's excess weight and low bone mineral density were the 2 most significant factors in the fracture developing, since the procedure was performed by an expert surgeon and no particular technical difficulties were encountered during the procedure. Besides, the patient did not report having suffered any trauma prior to the onset of symptoms.

Surgical treatment of a displaced peri-prosthetic fracture of the tibia is difficult—given the associated implant loosening and fracture comminution—depending on the patient's symptomatology, at what point the fracture is diagnosed, the degree of displacement, whether or not the implant is loosened, and the angle of varus deformity.[12]

It may be treated either conservatively (brace), if the diagnosis is made intra-operatively or within the first 3 weeks and there is no displacement, or via internal fixation with screws or a support plate,[16] if the displacement is unacceptable (varus deformity greater than 5°). If symptoms persist more than 3 months after the fracture due to pseudarthrosis or loosening and distal migration of the tibial component with progressive collapse of the medial compartment, revision to total knee prosthesis will be indicated, with semi-restricted components and a long rod for optimal stability.[15]

Bone defects may be filled with cement, allograft, or autograft. Thicker metallic or polyethylene supplements are also effective. Backstein recommends the use of structural allografts or tumour prostheses if defects larger than 3 cm are found, which may affect the stability of the prosthesis,[17] although complications such as pseudarthrosis and bone graft resorption may develop.

In our case, we opted for surgical revision to total arthroplasty with metallic support mesh and tibial rod, since the fracture had developed 2 weeks before and consisted of various fragments less than 1 cm that were difficult to synthesize.

In conclusion, we believe that proper patient selection and meticulous surgical technique are absolutely necessary to prevent this type of complication with implantation of a unicompartmental knee arthroplasty—using particular caution with an overweight patient and with the degree of posterior inclination of the tibial prosthetic component. Revision to total knee arthroplasty with supporting mesh and tibial rod is a quite feasible alternative in treating comminuted peri-prosthetic fractures.

Evidence level

Evidence Level IV.

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