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ORIGINAL ARTICLE

Arthrodesis without bone fusion with an intramedullary modular nail for revision of infected total knee arthroplasty☆

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KEYWORDS
Total knee arthroplasty;
Arthrodesis;
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Abstract
Objective: To evaluate the outcome of knee fixation without bone fusion using an intramedullary modular nail and interposed cement.
Materials and methods: Retrospective study of 29 infected total knee arthroplasties with prospective data collection and a mean follow-up of 4.2 years (3–5).
Results: Complications included 2 recurrent infections, 1 peri-implant fracture, and 1 cortical erosion due to the tip of the femoral component. All of these were revised with successful results. The mean limb length discrepancy was 0.8 cm, with 24 < 1 cm. Twenty-five patients reported no pain. The mean WOMAC-pain was 86.9, WOMAC-function 56.4, SF12-physical 45.1, and SF12-mental 53.7. Four patients needed a walking frame, and only two were dependent for daily activities.
Conclusions: The Endo-Model Link nail is an effective method for knee fixation that restores the anatomical alignment of the limb with adequate leg length.

PALABRAS CLAVE
Artroplastia total de rodilla;
Artrodesis;
Enclavado intramedular

Artrodesis sin fusión ósea con clavo modular intramedular para revisión de prótesis total de rodilla infectada

Resumen
Objetivo: Evaluar los resultados de la fijación de rodilla sin fusión ósea, con clavo intramedular e interposición de cemento.
Material y métodos: Estudio retrospectivo de 29 prótesis total de rodilla infectadas con datos recogidos prospectivamente y seguimiento medio de 4,2 años (3-5).

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Resultados: Las complicaciones fueron 2 infecciones recurrentes, una fractura periimplante y una erosión cortical en la punta del componente femoral, siendo todas revisadas con buen resultado. La dismetría media fue 0,8 cm, con 24 < 1 cm. Veinticinco pacientes no referían dolor. El valor medio de WOMAC-dolor fue 86,9, WOMAC-función 56,4, SF12-físico 45,1, y SF12-mental 53,7. Cuatro pacientes precisaron andador y solo 2 eran dependientes para actividades diarias.
Conclusiones: El clavo Endo-Model Link® es un efectivo método de fijación de rodilla, restaurando la alineación del miembro y adecuada longitud del mismo.

Introduction

Arthrodesis following failure of total knee arthroplasty (TKA) is a widely accepted technique for limb rescue when the implantation of another prosthesis is not possible or recommended.[1] At present the indication of arthrodesis is infrequent,[2] with most cases being due to recurrent infection which cannot be controlled through surgical revisions or extensor apparatus lesion. For this reason, the literature is scarce and practically all studies involve short series, with very few works describing more than 30 cases,[2] with the exception of that by Mabry et al.,[3] which contained 85 cases. Also, due to this low prevalence, all studies up to the present are retrospective assessments.

The objective of conventional arthrodesis is to achieve knee stability without pain through femorotibial bone fusion. At present, the most commonly used methods are external fixation and intramedullary nailing.[2] In general, the results described with external fixation have been inferior compared to those obtained through intramedullary nailing[3,4] due to a longer time required to achieve bone fusion and a greater rate of complications. Both methods have the potential disadvantage of producing an excessive shortening of the limb in most cases,[2] as well as difficulty in obtaining bone fusion in a previously septic environment.[5] Another type of permanent knee fixation can be permanent knee stabilization without bone fusion[5] through fixation with intramedullary nailing and interposition of a cement block to maintain the length of the limb, such as that obtained with the Endo-Model Link® nail. We have only found 5 studies in relation to this model of nail,[7–11] of which only 2 did not carry out femorotibial bone fusion.

The objective of this study is to analyze the functional results obtained in knee fixation without bone fusion by means of the Endo-Model Link® arthrodesis nail, during revision of infected TKA.

Materials and methods

This was a retrospective study conducted with prospectively collected data. Our database of arthroplasties included all those implanted at our department, with preoperative and postoperative radiographic and clinical data, collected prospectively in a protocolized manner and with a systematized follow-up. The inclusion criteria described consecutive patients treated between 2001 and 2010 with knee arthrodesis due to an infected TKA. There were no exclusion criteria. We identified 29 cases and in all of them the arthrodesis was conducted through surgical revision in 2 stages, using the Endo-Model Link® (Waldermar Link, Hamburg, Germany) intramedullary, modular nail. The relevant characteristics and surgical technique of this device have been described previously.[7,10]

All revisions were conducted in 2 stages and 5 intraoperative samples for culture were obtained during each intervention. The first stage consisted in prosthesis explantation, surgical cleaning and placement of a non-standardized cement spacer with gentamicin. Infection was treated with specific antibiotic therapy, intravenously for 1 month and orally up to 3 months. Infection was considered cured by normalization of C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) values, along with at least 2 negative cultures obtained by joint puncture (culture and cell count) during the following 3 months. Thus, the interval for the second surgical stage was at least 6 months. Bone scintigraphy scans with marked leukocytes were only carried out in case of diagnostic doubt. The second stage consisted of reimplantation of the TKA if the extensor apparatus had not been damaged or an arthrodesis nail if it had. In cases where the infection recurred after reimplantation, a new surgical revision for arthrodesis was conducted.

The arthrodesis was carried out in a second surgical stage, once the infection was considered cured. We took 5 intraoperative samples for culture. Subsequently, we started specific, intravenous antibiotic therapy according to the results of the previous cultures, during 2 weeks if the new cultures were negative. The arthrodesis nail consisted of 2 chromium-cobalt components of varying lengths, femoral and tibial, which were joined and screwed on each other at the level of the knee, providing a very robust connection with a fixed femorotibial angle of 5° in valgus in the frontal plane and 5° in flexion in the sagittal plane. The stems were introduced after drilling the medullary canals, in a retrograde direction in the femur and in an anterograde direction in the tibia, applying cement only in the metaphyseal portions. Given the technical difficulty of cementing the entire length of the nails, we ensured that an adequate cement filling of the metaphyseal portion was performed and at least 10 cm diaphyseally in each component. After attaching both components, the joint space was filled with a cement block with 80 mg of gentamicin (Cerafixgenta, Ceraver, France). Specific antibiotic and antithrombotic prophylaxis was applied, and load with a walking frame was permitted after the second postoperative day if pain allowed it.

The series consisted of 25 females and 4 males, with a mean age of 74.6 years (range: 59–83 years) at the time of the arthrodesis. The mean body mass index (BMI) was 32.3 kg/m^2, with 22 patients (75.8%) presenting a BMI $\geq$ 30,