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CASE REPORT

Primary Total Knee Arthroplasty (TKA) with revision Total Stabilizer Prosthesis in a 66-year-old patient with secondary knee osteoarthritis and valgus deformity. Case Report

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Abstract
Knee osteoarthritis (gonarthrosis) is the most prevalent knee pathology encountered nowadays in the third age population, leading to severe disability and reduced life quality. Secondary gonarthrosis may be caused by a traumatic event, which subjects the knee joint to a transitory highly increased mechanical stress, initiating a rapidly progressive degrading process of the articular cartilage and subjacent bone tissue. TKA is intended to replace all the intra-articular components with artificial parts, in order to relieve pain, compensate for ligament instability, correct deformities, and restore proper joint functionality. Semi-constrained, non-hinged implants are usually used for revision TKA, in knees that already had a primary TKA but sustained complications. Nevertheless, here we reported the case of a 66-year-old female patient diagnosed with posttraumatic gonarthrosis who underwent TKA with a revision total stabilizer implant as primary treatment due to severe joint instability and high grade valgus deviation. The outcome of the surgical procedure was positive, with significant pain relief and increased knee stability. The valgus angle was reduced from 37° to 4° and the KSS score increased from 3 to 87 points. Therefore, revision semi-constrained prosthesis may be used as a primary implant with promising result in severe cases.
Keywords: gonarthrosis, TKA, valgus, knee, revision, total stabilizer

Introduction

Osteoarthritis is one of the most common joints disease nowadays and the leading cause of chronic disability in older adults (over 60) [1]. It is a degenerative disorder arising from the breakdown of articular cartilage in the synovial joints. Osteoarthritis involves not only the

articular cartilage but the joint organ entirely, including the subchondral bone and synovium [2].

Due to weight bearing, knee is the most commonly affected joint. This has a significant negative impact on the individual's life quality. In the osteoarthritic knee, also called gonarthrosis, the greatest loss of joint space is commonly seen in the medial tibiofemoral compartment, though the lateral tibiofemoral compartment and patellofemoral compartment may also be affected. Collapse of the medial or lateral compartments may result in varus or valgus deformities, respectively [3].

It can be classified into 2 categories: primary osteoarthritis and secondary osteoarthritis. The triad of symptoms of OA is joint pain, stiffness, and locomotor restriction but patients can also present with muscle weakness and balance issues. The primary one has a polygenic nature and a strong heredity component. On the contrary, secondary osteoarthritis has a specific cause, such as an injury, surgery or inactivity (growing influence of technology in our daily life) [4].

TKA is a surgical procedure used to treat a large spectrum of debilitating arthritic conditions. During a total knee replacement, the damaged cartilage and bone from the surface of the knee joint are removed and replaced with a manufactured surface of metal and plastic.

TKAs are not foolproof. Aseptic or septic loosening, wear and periprosthetic fractures are just a few causes that can lead to their failure. Revision TKA implants are usually used to restore the functionality and relieve the pain in a knee which has already undergone a primary TKA [5]. However, here we described the atypical case of TKA in which the revision prosthesis was used as the primary treatment due to increased valgus instability.

Materials and methods

A 66-year-old female patient came to our department with post-traumatic right knee joint pain, functional impairment, and antalgic gait ("limping") with limited weight bearing on the right leg. The right knee presented with internal joint ligament laxity, marked joint instability and severe valgus deformity. A walking stick aided walking. Pain was present on knee palpation and joint mobilization. Based on this presentation, the patient was diagnosed with secondary gonarthrosis.

The present condition developed following a traumatic event, a 4 meter-high fall off a ladder, which occurred two years before coming to our service. Upon falling, the patient suffered a right knee dislocation that was reduced. During the same accident, the patient suffered an ipsilateral pertrochanteric fracture resolved surgically by a Dynamic Hip Screw (DHS) implant as well as a left hip fracture that underwent a minimally invasive hip replacement. The patient was known with no other condition.

Over a one-year time period, the condition of the right knee worsened, presenting exacerbated joint pain upon extensive joint mobilization, reduced motion range and morning joint stiffness. A stage 3 secondary knee osteoarthritis (Kellegren-Lawrence [6]) was diagnosed as joint space narrowing, osteophyte formation and extensive subchondral sclerosis could be observed on radiography (Fig. 1).

Fig. 1 Right anteroposterior (AP) X-ray of the right knee one year prior to TKA. Space joint narrowing, osteophyte formation, and extensive subchondral sclerosis can be seen, indicating stage 3 knee osteoarthritis

Fig. 2 Right knee before TKA with the severe valgus deformity visible

The patient followed a 3-week-treatment with intra-articular hyaluronic acid injections (viscosupplementation) 6 months prior to admission. There was no positive response as the right knee gonarthrosis progressed to stage 4. Radiographic examination of the knee performed upon hospital admission revealed joint space obliteration with destruction of the lateral femoral condyle and the lateral tibial plateau, the articular surfaces being in a coronal subluxed position (Fig. 2,3). This led to the previously mentioned unilateral valgus deviation, with a tibiofemoral angle of 37° measured on an anteroposterior radiograph in standing position.

Fig. 3 Right knee AP view X-ray on hospital admission (preoperative). Joint space obliteration with destruction of both the lateral femoral condyle and the lateral tibial plateau can be observed, the articular surfaces being in a coronal subluxed position. This led to the previously mentioned unilateral valgus deviation, with a tibiofemoral angle of 37° measured on an anteroposterior radiograph in standing position

Fig. 4 Postoperative knee aspect; a valgus deviation of 4°

Treatment consisted in immediate orthopedic surgery. A total knee arthroplasty (TKA) was performed using a Scorpio TS Revision Implant (Stryker Orthopaedics, Mahwah, NJ). This type of non-hinged semi-constrained prosthesis was chosen because it offers improved ligament, valgus and rotational stability.

A standard medial parapatellar approach was used for its good exposure of the articular surfaces [7]. A longitudinal 15 centimeter-long incision was made on the anterior median line of the completely extended right knee. Joint capsule was incised along the medial margin of the patella, which was subsequently dislocated and flipped laterally. A 90° flexion gave a full exposure to the entire joint. The femoral, tibial and patellar osteophytes were removed and osteotomies were made to the distal femoral diaphysis and the tibial plateau using an oscillating saw and femoral and tibial intramedullary cutting guides. Several successive trial components were inserted and the alignment, movement range, and stability of the right knee joint were carefully assessed. The femoral part of the final prosthesis was composed of a size 5 (10 mm) right TS with a size 5 (10 mm) distal external femoral augmentation block, a 4 mm offset adapter and a cobalt chrome stem of 12 mm diameter and 155 mm length. The tibial part consisted in a size 5 TS tibial tray, a size 5 (10 mm) external half block augment, a 6 mm offset adapter and a cobalt chrome stem of 14 mm diameter and 80 mm in length. A size 5 (16 mm) polyethylene insert was introduced. The dislocated cemented prosthesis was reduced and the incised anatomical planes sutured.

The total operative time was approximately 4 hours.

Results

There was a good postoperative outcome. The Knee Society Score (KSS) [8] improved from 3 points to 87 points, as the pain was markedly reduced and the tibiofemoral angle was corrected to a value of 4° of valgus (Fig. 4). The prosthesis showed proper positioning and fixation on X-ray evaluation, with no detectable radiolucent lines on visual assessment (Fig. 5,6) [9].

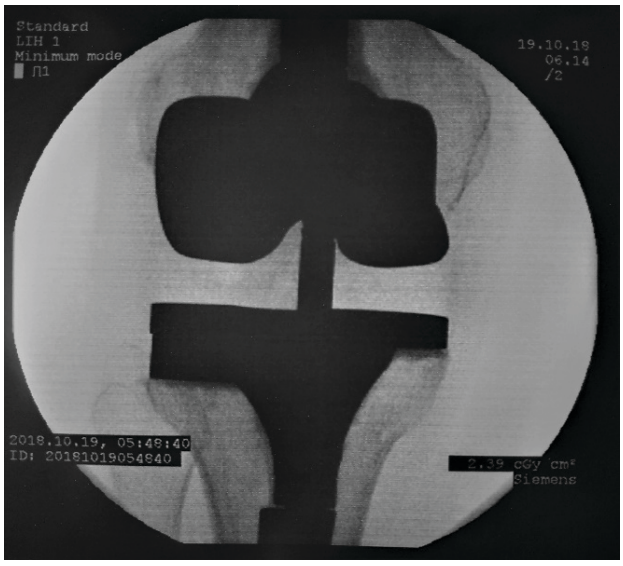

Fig. 5 Postoperative right knee AP view X-ray. The TS prosthesis can be seen in place, with no detectable radiolucent lines

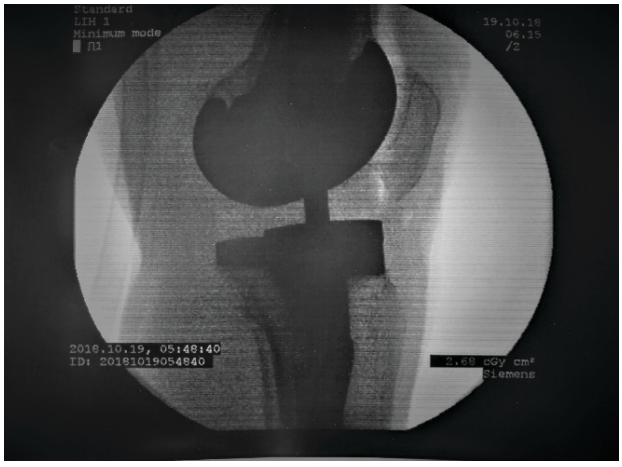

Fig. 6 Postoperative right knee lateral view X-ray

The patient was satisfied and left our service 5 days after the surgery, walking freely and able to perform daily activities with no significant pain. No local or general postoperative complications occurred during the one-month follow-up.

Discussion

The development of TKA began in the early 1970s when tibiofemoral condylar replacements sprouted independently in both the United States and abroad. Numerous surgeons and engineers were involved in this process, as they tried hard to preserve the cruciate ligaments and realize a cemented fixation. Over time, these designs were highly improved leading to a better flexibility and decrease of stiffness of the articulation. Along with this, it has now become a multibillion-dollar industry with millions of knees implanted worldwide. Over 19 companies in the United States distribute total knee implants of three different types:

1. cruciate-preserving (or non-constrained prostheses) - are the most common type; the components are not linked and rely on the patient's own ligaments and muscles for stability;

2. cruciate-substituting (or semi-conservative prostheses) - are used when the ligament retention is not possible or if the surgeon needs to replace an older non-constrained prosthesis with a more stable one during a revision process; these prostheses have a more inherent stability by virtue of a variety of design techniques;

3. constrained (or hinged prostheses) - which have the tibial and femoral components linked together with a hinged mechanism; they are used when the knee is highly unstable and the ligaments will be unable to support other types of prostheses [9,10].

A recent study also proved the necessity of this procedure, as for the past decade, the demand for TKA has highly risen worldwide. The average and median rates of total knee replacement have varied from one country to another, Romania being the one with the lowest percentage and Germany and United States the ones where TKA was performed most often (8.8 and 234 procedures/ 100,000 population for Romania and the United States, respectively) [11].

The main features of a semi-constrained prosthesis are a patellar flange, which allows a smooth painless gliding of the patellar prosthesis during knee movements and two long intramedullary stems, to ensure superior

alignment and fixation of the bones. Exact bone cuts made with intramedullary cutting guides enable precise alignment of the articular faces, which is crucial for joint stability and prosthesis longevity. It also contains a supero-posteriorly oriented linking rod as a result of which the tibia maintains its normal anterior location in relation to the femur during flexion, and stops its retrograde displacement as flexion continues. Thus, a flexion of up to 120° degrees can be achieved. The polyethylene insert is another important component of the semi-constrained prosthesis as it has an adjustable thickness and can compensate bone loss during the primary TKA or arthropathies [12].

Despite its well thought mechanism, there are several complications which can arise. The most common are prosthesis loosening with subsequent instability, dislocation, infection, misalignment, or periprosthetic fracture. Increased biomechanical stress on a misaligned prosthesis can be the main cause for its loosening. This complication is hard to predict as the clinical evidence in its case occurs only after the radiographic signs have started to appear. A migration of one of the prosthesis components, a cement fracture (even without prosthesis movement), or a lucency between the cement and the metal on radiography are signs of loosening. Infection is also hard to detect on plain radiographs and it is usually suspected if a prosthesis loosening is also present. Another sign of infection can be the presence of gas in the intra-articular space. This is resorbable and usually disappears within two weeks after surgery. If the gas fails to absorb or it tends to increase, then the presence of an infection should be taken into account [13].

As a conclusion, this report showed the utility of the semi-constrained total stabilizer implant not only for revision TKA but also as a primary prosthesis when there is marked ligament loosening and instability with severe valgus deviation. There were promising results for our patient during the one-month follow-up as joint pain was significantly reduced and joint stability and functionality were greatly increased with no immediate postoperative complications. The patient will be kept under observation for long-term assessment of this approach to treating severe knee destruction caused by trauma-induced gonarthrosis.

Disclosure

The authors have no conflicts of interest to declare.

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