International Clinical and Medical Case Reports Journal
Case Report (ISSN: 2832-5788)

Surgical Management of Severe Medial Knee Osteoarthritis and Tibial Varus Metaphyseal Deformity in Paget's Disease.

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Citation: Sérgio Rocha Piedade, Ricardo Bastos, Philippe Neyret. Surgical Management of Severe Medial Knee Osteoarthritis and Tibial Varus Metaphyseal Deformity in Paget's Disease. Int Clinc Med Case Rep Jour. 2026;5(2):1-10.

Received Date: 24 February 2026; **Accepted Date:** 27 February 2026; **Published Date:** 01 March 2026

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ABSTRACT

TKA in the setting of severe varus knee osteoarthritis with a large extraarticular deformity of the proximal tibial metaphysis in Paget's disease presents a complex scenario even for experienced surgeons. The pathophysiology of Paget's disease can lead to structural lower-limb deformities, which can pose significant hurdles to the introduction of intramedullary guides, as it can deform the bone and obliterate medullary canals. Moreover, the closer and larger the deformity is to the knee, the greater its importance to the malalignment. All these points triggered the discussion of this case report on the surgical management of a 62-year-old Woman, diagnosed with Paget's disease and under long-term clinical follow-up with a rheumatologist and taking diphosphonate, who developed severe varus knee osteoarthritis, more pronounced in the right knee. This paper addresses the role of preoperative assessment and intraoperative steps in the surgical management of severe varus knee osteoarthritis with a large extraarticular deformity of the proximal tibial metaphysis. It discusses the strategy adopted for a one-stage proximal tibial open-wedge osteotomy with total knee arthroplasty in the right knee in Paget's disease.

Keywords: Genu Varum; Osteitis Deformans; Osteoarthritis, Knee; Osteotomy; Arthroplasty, Replacement, Knee

INTRODUCTION

Sir James Paget first described the chronic skeletal disorder, historically termed osteitis deformans, in 1877, noting the aberrant bony structure and progressive deformities associated with the condition [1,2]. Today, Paget's disease of bone (PDB) is recognized as the second most prevalent metabolic bone disorder worldwide, following osteoporosis, and is characterized by focal areas of accelerated and disorganized bone remodelling [3,4].

While the disease often presents polyostotically, it frequently manifests as a monostotic affection involving a single weight-bearing bone, such as the tibia or femur, without involvement of the adjacent skeletal segments [5,6]. This isolated involvement alters the mechanical axis and joint biomechanics, predisposing patients to secondary

osteoarthritis; indeed, the incidence of osteoarthritis in PDB patients is reported to be 1.7-fold higher than in age-matched controls [1,7].

Surgical intervention in patients with PDB presents distinct challenges attributable to the underlying pathophysiology of the disease. A primary concern is the metabolically active, hypervascular nature of pagetic bone, which significantly increases the risk of excessive intraoperative hemorrhage and potential high-output cardiac failure [2,8]. To mitigate these risks, preoperative optimization with antipagetic pharmacotherapy is essential. The administration of bisphosphonates, such as zoledronic acid, is strongly advocated to suppress bone remodelling, thereby reducing bone turnover and minimizing blood loss during orthopaedic procedures [3,9].

In the setting of total knee arthroplasty (TKA), the structural deformities inherent to PDB pose significant technical hurdles. The disorganized deposition of woven bone frequently results in severe extraarticular bowing deformities in the sagittal or coronal planes, particularly in the femur or tibia [2,6].

These anatomical aberrations often preclude the use of standard intramedullary alignment guides, as the medullary canals may be obliterated or too deformed to accommodate instrumentation [5,9]. Furthermore, monostotic involvement can lead to significant size mismatches between the femoral and tibial components, complicating soft-tissue balancing and implant selection [5].

When severe extraarticular deformity exists alongside end-stage arthritis, intra-articular bone resection alone may be insufficient to restore the mechanical axis of the limb. In such complex scenarios, a corrective osteotomy is often required to realign the limb and ensure the longevity of the prosthesis [2,8]. While often performed as staged procedures, realignment simultaneously with arthroplasty offers the advantage of a single recovery period for the patient. We believe that a combined operation, specifically a simultaneous high tibial osteotomy (HTO) and TKA, represents a viable and effective indication for managing patients presenting with severe osteoarthritis complicated by the extraarticular deformities of monostotic Paget's disease. This case report describes the successful surgical management of severe medial knee osteoarthritis and metaphyseal varus deformity of the tibia in a 62-year-old woman with Paget's disease.

Patient information

A 62-year-old Woman, diagnosed with Paget's disease and under long-term clinical follow-up with a rheumatologist and taking diphosphonate, developed bilateral knee pain, more pronounced in the right knee. The reported pain and discomfort are mechanical in nature, localized primarily on the medial and anterior aspects of the knee joint. Over the years, the patient noticed her legs becoming more bowed, especially the right one. As time goes by, drugs and physiotherapy have proven unsatisfactory, making it difficult to perform her daily activities.

Clinical findings

Physical assessment revealed bilateral knee varus, more pronounced on the right (Figure 1A), with active range of motion of 5° to 120° in the left knee and 10° to 115° in the right knee, with a varus thrust during gait. Moreover, the varus deformity of the right knee showed a partial reducibility, confirming the expected contracted soft tissue of the medial aspect of the right knee.

In contrast, the left knee showed a reducibility of the varus deformity. The patella could easily be moved, and no soft-tissue retraction was observed during passive mobilization.

Diagnostic assessment

The weight-bearing anteroposterior x-ray view of the lower limbs confirmed the varus alignment of the knee in the frontal plane, but also the sagittal curving of the tibia is due to the posterolateral attachment of the fibula and the fact that the tibia is larger than the femur. The right knee showed a markedly bowed leg appearance with severe knee varus of 154°, resulting from a large varus metaphyseal deformity of 18°, which contributed to the left knee having a femorotibial angle of 174°.

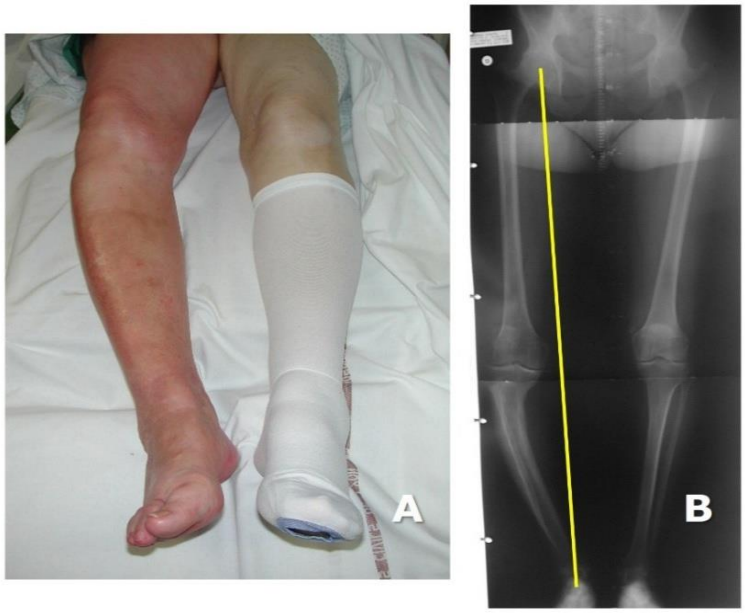

Figure 1: The clinical (A) and radiological (B) images of the varus alignment of both knees. (Neyret P)

Stress radiographs are routinely performed to address the reducibility of the knee alignment deformity. Figure 2A, B, C, and D show partial reducibility and competent collateral ligaments of the right knee of this evaluated patient.

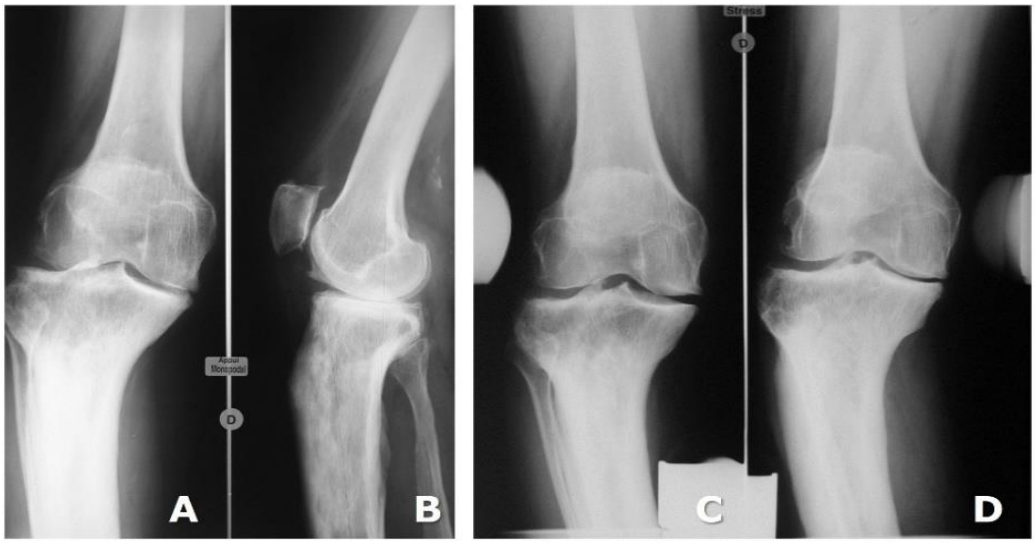

Figure 2: Radiological assessment: (A) anteroposterior, sagittal (B), valgus (C) and varus (D) stress views of the right knee (Neyret P)

Surgical treatment

After the unsuccessful outcome of non-conservative treatment and the patient's complaint, she was submitted to one-stage proximal tibia valgus osteotomy and TKA of the right knee.

Technical points of the surgery

Under spinal anaesthesia and with the tourniquet inflated, the knee was approached via an anteromedial skin incision, followed by a medial patellar arthrotomy and lateral patellar eversion. Then, a minimal medial release on the anteromedial part of the capsule and the deep MCL at the level of the tibia is done to expose the tibial plateau. At the level of the open-wedge high tibial osteotomy, a section of the superficial medial collateral ligament was performed, keeping it attached to the upper part of the tibia.

It is important to state that no radiographic assessment is needed, as the tibial metaphysis can be controlled perioperatively. The site of the osteotomy must be just at the limit of the proximal part of the anterior tibial tubercle, where the patellar tendon inserts. The lateral cortex of the tibia is weakened just above the superior tibiofibular joint. A tibial guide is positioned perpendicularly to the extramedullary rod. The amount of medial opening wedge is made until achieving a symmetric tibial cut, but with wear of the medial tibial plateau. Therefore, there is no need for an X-ray to control the correction. In this case, a 16° open-wedge tibial valgus osteotomy was achieved.

During the fixation of the tibial osteotomy with one Blount staple, it is important to insert the staple so that it does not impinge on the tibial stem of the implant. The space created by the wedge of tibial osteotomy could be filled with bone from the tibia and femoral cuts, and possibly with a piece of cement, as described by Hernigou [10], if needed. After the extraarticular deformity has been corrected by osteotomy, the intramedullary guide for the tibia bone cuts can be introduced with no difficulty.

TKA followed the usual setup using intra-medullary guidance to perform the tibial and femoral cuts, and no ligament balance was performed. The trial components were used to assess and confirm adequate knee stability and range of motion, and the definitive implants were then cemented. The tourniquet was released, careful haemostasis was performed with electrocautery, and the wound was closed with multiple interrupted non-resorbable sutures, the subcutaneous layer with resorbable sutures to close potential dead spaces, and the skin was closed with staples. Drain of Redon for 24 Hours. Regional anaesthesia was used for postoperative pain control.

Postoperative care

Partial weight bearing and crutches for one month; then full weight bearing is allowed using crutches for 45 days. Flexion is limited to 45° during the first two weeks, increased progressively as tolerated, and is not limited thereafter. An extension splint is used for walking until the quadriceps is reactivated and able to lock the knee in extension. Physiotherapy was initiated on the first postoperative day. The patient left the hospital on the third day and was transferred to a rehabilitation centre.

Follow-up and outcomes

The patient was closely reassessed during the first and second postoperative years. She reported regaining her daily activities with no pain or discomfort and was very satisfied with the improvement in her right knee alignment.

DISCUSSION

Performing a combined proximal tibial valgus osteotomy and TKA for treating severe varus knee osteoarthritis is a challenging procedure, mainly when involving patients with Paget's disease; however, a careful preoperative assessment could make it feasible and reproducible to achieve satisfactory results.

It is crucial to note that TKA for treating knee osteoarthritis differs depending on the presence of intra- or extraarticular varus deformity and the severity of the knee deformity [11,12]. In general, knee malalignment resulting from an intra-articular deformity does not pose particular difficulty in performing a standard TKA, as no huge bone deformity is associated. In these cases, no excessive bone cut is expected, and the balance is focused on ligament release, which is clinically and radiologically assessed by performing tensioning stress manoeuvres on the collateral ligaments.

In this reported case, the extraarticular deformity is probably linked to the disruption of the normal cycle of bone renewal observed in patients with Paget's disease, leading to weakened, more fragile bone and, consequently, bone deformities [1,4,5]. The partial reducibility of the varus deformity resulted from the wear of the medial femorotibial compartment. The valgus stress radiograph (Figure 2C) shows that the varus deformity was reducible and that there was no severe medial structure retraction; therefore, no extensive medial release was necessary during surgery.

For severe knee varus extraarticular (medial ligamentous structures) deformities smaller than 6°, the soft tissue release can vary from a unilateral lengthening of the medial collateral ligament (MCL) with no lengthening of the lateral structures, which can be achieved by performing a pie crest procedure on the MCL, to a superficial MCL release on the distal tibia (+/release of the semimembranosus) for addressing knee varus deformities between 6° to 8° [13].

Therefore, it is mandatory to assess the tibial extraarticular deformity, patellar and knee passive range of motion, and quantify the reducibility of the knee varus deformity to neutral alignment, as this could help predict the required soft tissue release and bone resection [14,15].

It is important to emphasize that the closer the deformity to the knee is, the greater its importance. Intra-articular correction of varus deformities produces lateral instability that is better tolerated than medial instability [13]. The presence of a huge extraarticular deformity of the proximal tibial metaphysis, a bowed leg, soft-tissue contractures, and its critical joint malalignment may require a more complex surgical procedure, possibly including the need for an extended surgical exposure. Therefore, huge extraarticular deformities are best treated by extraarticular correction, independent, or total knee arthroplasty [14,15].

In the reported case, the preoperative assessment enabled us to plan a combined proximal tibial valgus osteotomy and TKA performed through a standard knee surgical approach, with the patella laterally everted, thereby achieving adequate joint exposure without compromising the patellar tendon, as confirmed intraoperatively.

In a scenario of varus knees with more than 15° extraarticular deformities, as reported in this case, the surgeon must be aware that the tibial bone cut for TKA implantation may result in excessive and asymmetric bone resection (dotted line), primarily of the lateral plateau (Figure 3A) [14,15]. Therefore, it is important to consider that to compensate for the asymmetrical tibial cut with an excessive tibial resection on the lateral tibial plateau, it will be necessary to use a thicker tibial insert and perform an extensive release of the collateral ligament's insertions to achieve neutral joint alignment, which results in a weakening of the lateral capsule [15,16].

Figure 3B illustrates the effect of an open-wedge tibial valgus osteotomy in reducing the amount of tibial bone resection before performing the bone cuts of the TKA procedure, in a case of severe varus knee with metaphyseal deformity. Besides reducing bone resection (Figures 3B and 3C), associating an open-wedge tibial valgus osteotomy enables symmetric tibial resection.

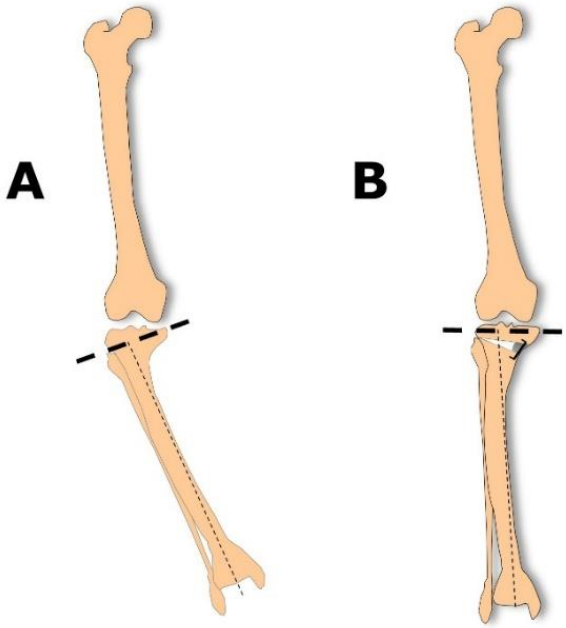

Figure 3: Amount of tibial bone cut in TKA procedure (dotted black lines): no osteotomy procedure (A), combined proximal tibia osteotomy (B) (Piedade SR)

At the time of osteotomy, it is mandatory to perform the bone cut by keeping the saw below the osteotomy pin guides to prevent a lateral tibial plateau fracture. Moreover, the surgeon must ensure that the distance between the osteotomy site and the articular surface of the lateral tibial plateau is large enough to allow a tibial depth of 9mm on the lateral side, while keeping the lateral cortex of the tibia intact. Although an open-wedge osteotomy of more than 15° can be performed, the surgeon must be aware that it can weaken the lateral tibial plateau and make it prone to fracture.

Figure 4A, B, and C show intraoperative views of the effect of the osteotomy in elevating the medial tibial plateau at the level of the medial probe (yellow arrow), the symmetric tibial bone cut, and the final aspect of the tibial plateau after completing the bone cut, which preserves tibial bone stock and reduces the need for additional ligament balancing. Figures 4D, E, and F show the tibial plateau preparation and fixation with cement.

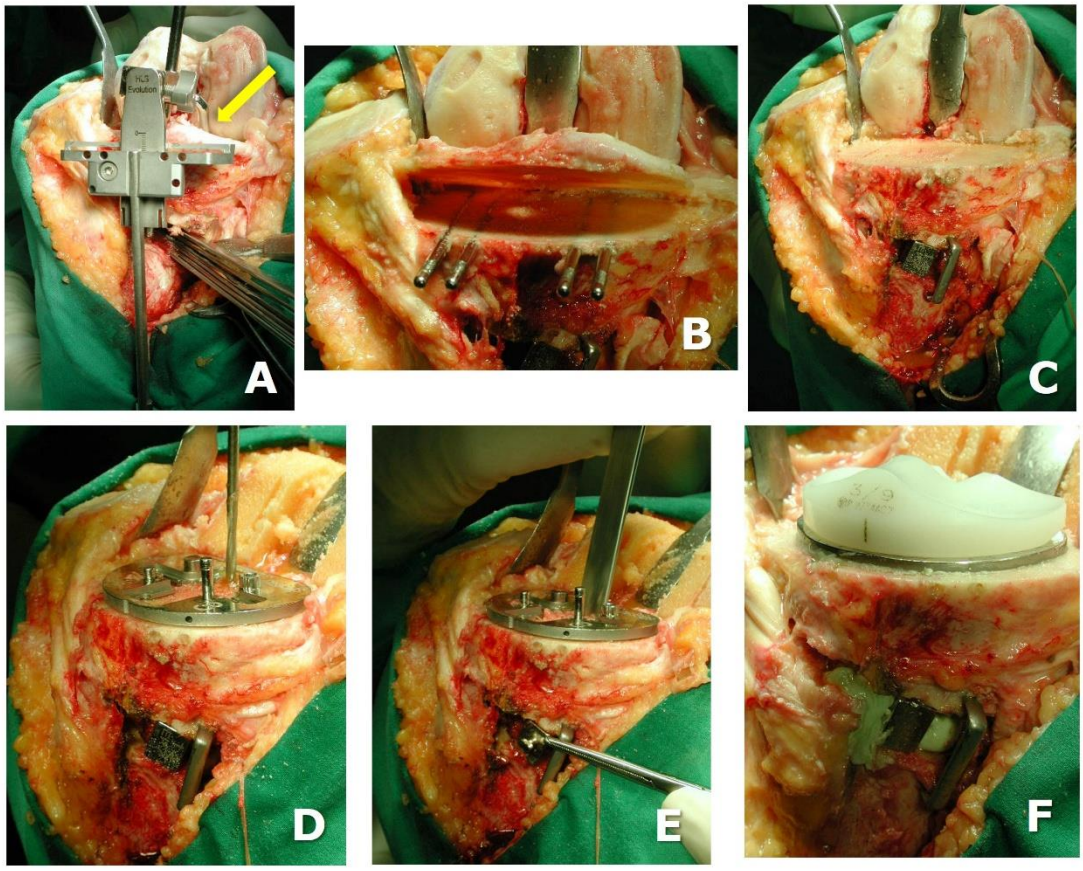

Figure 4: Intraoperative views: proximal tibia valgus osteotomy (A), the symmetric resection of both tibial plateaux (B), Blount fixation of proximal tibial valgus osteotomy and tibial cut (C), preparation of tibial component implantation (D and E), and tibial plateau fixation (F) in the TKA procedure. (Neyret P)

Performing this surgery in a one- or two-stage procedure is also part of this discussion. The severe knee malalignment of 164°, associated with 18° extraarticular deformity of the proximal tibial metaphysis reported in this case, prompted us to perform a proximal tibial osteotomy with a TKA in a one-stage procedure, as we considered it beneficial for the patient.

Although this approach could help lower the patient's psychological distress associated with performing a two-stage procedure, it should be noted that the preoperative assessment, surgeons' experience, and their own learning curve play crucial roles in addressing this question and decision-making regarding staged procedures [11,12,15,16].

Another point of discussion is how to more securely fix the proximal tibia osteotomy performed in conjunction with TKA. Over the years, in our practice, a Blount staple was our primary option for proximal tibia osteotomies; however, we now prefer a locking plate with screws for these combined procedures.

It is important to note that bone healing after a tibial osteotomy in Paget's disease can be challenging, as reported in the literature [10,11,15], and could be an additional factor that may prompt the surgeon to opt for a one-stage procedure. Figure 5 presents the intraoperative view and postoperative anteroposterior, sagittal, and patella axial views

of combined TKA with open-wedge proximal tibial osteotomy. An important reminder is to pay close attention and be careful when preparing the tibia to avoid fractures during the tibial component implantation, particularly if it has wings.

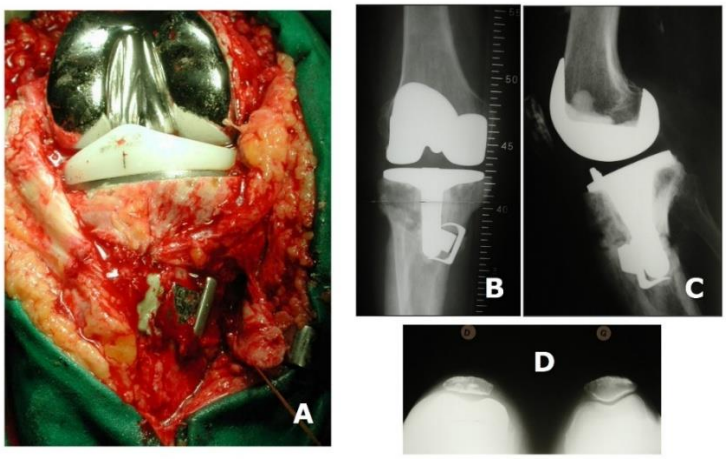

Figure 5: Intraoperative view (A) and postoperative anteroposterior (A), sagittal (B), and patella axial X-rays views (Neyret P)

It should be emphasized that a long-stem tibial component is highly advisable, as it could promote uniform force distribution across the interface bone and the tibial component, enhance TKA fixation, and facilitate healing of tibial osteotomy.

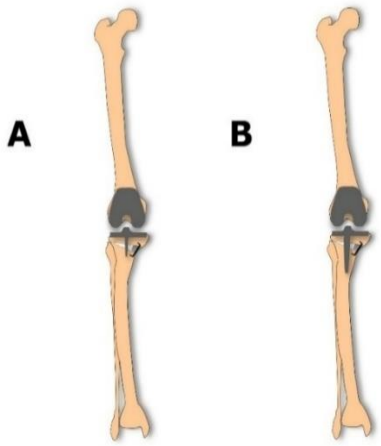

Figure 6: Combined proximal tibial valgus osteotomy and TKA in the right knee using short (A) and long tibial stem (Piedade SR)

Moreover, as the tibial component will be implanted surrounding the site of proximal tibial osteotomy, the length of the tibial stem could also have additional advantages for its fixation in the bone (intramedullary fixation). Although a standard stem had been used in this case, the results were satisfactory knee alignment and clinical knee range of motion (Figure 7).

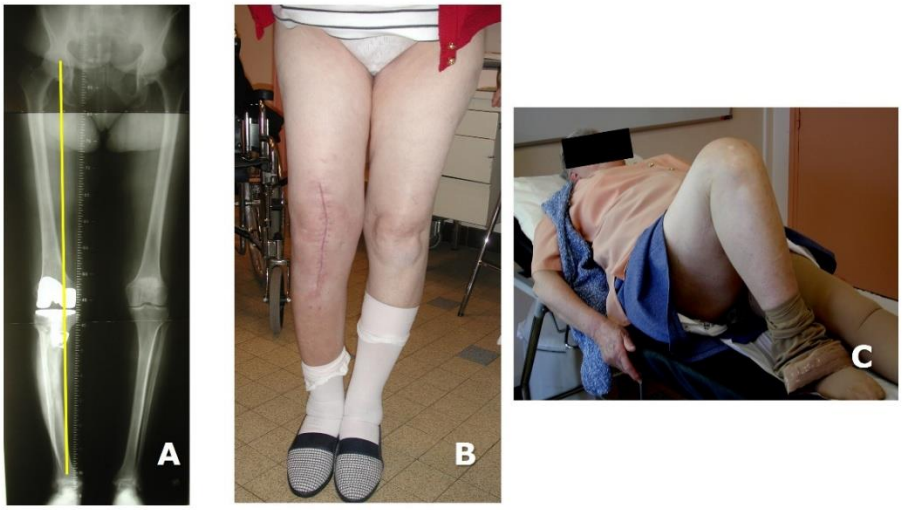

Figure 7: Figure 7: Postoperative knee alignment: (A) standard full-length weight-bearing x-ray of the lower limb, clinical lower limbs alignment (B) and knee flexion (C) (Neyret P)

CONCLUSION

Performing a combined open-wedge proximal tibial valgus osteotomy and TKA for treating severe varus knee osteoarthritis is a challenging yet reliable procedure, particularly when involving patients with Paget's disease; however, careful preoperative assessment can make it feasible and reproducible, enabling satisfactory results.

REFERENCES

1. Popat R, Tsitskaris K, Millington S, Dawson-Bowling S, Hanna SA. Total knee arthroplasty in patients with Paget's disease of bone: A systematic review. World J Orthop. 2018;9(10):229-234.
2. Mamun Al-Rashid, Dipak B Ramkumar, Kevin Raskin, Joseph Schwab, Francis J Hornicek, Santiago A Lozano-Calderón. Paget disease of bone. Orthop Clin N Am. 2015;46(4):577-85.
3. Banaganapalli B, Fallatah I, Alsubhi F, Shetty PJ, Awan Z, Elango R, Shaik NA. Paget's disease: a review of the epidemiology, etiology, genetics, and treatment. Front Genet. 2023;14:1131182.
4. Gennari L, Rendina D, Merlotti D, Cavati G, Mingiano C, Cosso R, et al. Update on the pathogenesis and genetics of Paget's disease of bone. Front Cell Dev Biol. 2022;10:932065.
5. Lee GC, Sanchez-Sotelo J, Berry DJ. Total knee arthroplasty in patients with Paget's disease of bone at the knee. J Arthroplasty. 2005;20:689-693.
6. Lombardi AF, Aihara AY, Fernandes ADRC, Cardoso FN. Imaging of Paget's Disease of Bone. Radiol Clin North Am. 2022;60(4):561-573.
7. Arif M, Makaram NS, Macpherson GJ, Ralston SH. Outcomes following Total Hip and Knee Arthroplasty in Patients Who Have Paget's Disease of Bone: A Systematic Review. J Arthroplasty. 2023;38(7):1400-1408.
8. Kaplan FS. Surgical management of Paget's disease. J Bone Miner Res. 1999;14 Suppl 2:34-8.
9. Sathikumar AS, Jacob G, Varghese J, Mathew V. Total Knee Arthroplasty in Paget's Disease using 3D-Printed Patient-Specific Femoral Jig - A Case Report. J Orthop Case Rep. 2023;13(8):84-88.

10. Hernigou P, Ma W. Open wedge tibial osteotomy with acrylic bone cement as bone substitute. Knee. 2001;8(2):103-10.
11. Wallace SJ, Greenstein MD, Fragomen AT, Reif TJ, Rozbruch SR. Staged Extraarticular Deformity Correction in the Setting of Total Knee Arthroplasty. Arthroplast Today. 2023;24:101247.
12. John R, Sherman K, Sharma H. Surgical principles for complex primary total knee arthroplasty in the presence of extraarticular deformity. J Orthop. 2022;34:295-303.
13. Verdonk PC, Pernin J, Pinaroli A, Ait Si Selmi T, Neyret P. Soft tissue balancing in varus total knee arthroplasty: an algorithmic approach. Knee Surg Sports Traumatol Arthrosc. 2009;17(6):660-6.
14. Wolff AM, Hungerford DS, Pepe CL. The effect of extraarticular varus and valgus deformity on total knee arthroplasty. Clin Orthop Relat Res. 1991;(271):35-51.
15. Madelaine A, Villa V, Yela C, Lording T, Lustig S, Servien E, Neyret P. Results and complications of single-stage total knee arthroplasty and high tibial osteotomy. Int Orthop. 2014;38(10):2091-8.
16. Zanone X, Ait si Selmi, Neyret PH. Prothèse totale du genou e ostéotomie tibiale de correction simultanées pour gonarthrose sur genou varum excessif. Rev Chir Orthop. 1999;85:749-56.