In limbs affected by poliomyelitis, total knee arthroplasty results in satisfactory pain relief. However, the risk of failure is high, especially if the preoperative quadriceps power is low. Therefore, treating osteoarthritis in the current patient represented a challenging procedure. A 66-year-old man presented with tricompartmental osteoarthritis of both knees, with valgus deformity of 14° on the left knee and 11° on the right knee. He walked with a bilateral knee recurvatum of 30° and a grade 1 quadriceps power. The authors treated both knees with cemented custom-fit hinged total knee arthroplasty with 30° of recurvatum in the tibial keel. Clinical scores showed good results 1 year postoperatively, especially on the subjective data of quality of life and function. At follow-up, radiographs showed good total knee arthroplasty positioning on the right side and a small mechanical loosening at the end of the tibial keel on the left side. Only 5 studies (Patterson and Insall; Moran; Giori and Lewallen; Jordan et al; and Tigani et al) have reported total knee arthroplasty results in patients with poliomyelitis. This study reports an original case of bilateral custom-fit hinged total knee arthroplasty in a patient with poliomyelitis. To the authors’ knowledge, this is the first report of this type of procedure in the literature. The key point is the degree of recurvatum that is needed to allow walking, avoiding excessive constraints on the implants that can lead to early mechanical failure.
The incidence of poliomyelitis has declined in many Western countries as a result of the widespread use of poliovirus vaccine. Nevertheless, although polio has been eradicated in France, there are still 40,000 to 55,000 individuals with polio sequelae, with a mean age of 55 to 60 years.1 Deformities caused by this disease are responsible for degenerative joint damage. Some studies2-6 have reported the results of total knee arthroplasty (TKA) in patients with poliomyelitis. The authors report an original case of bilateral custom-fit hinged TKA in a patient with a history of poliomyelitis.

**Case Report**

A 66-year-old man consulted the authors because of bilateral chronic knee pain. He had poliomyelitis since childhood. He reported pain as 6 of 10 on a visual analog scale. The patient walked with crutches and had no history of trauma or infection.

On physical examination, the patient was lean, measuring 173 cm in height and weighing 68 kg. He had bilateral, uncorrectable valgus deformities and walked with bilateral knee recurvatum of 30°. The quadriceps were atrophic, and he had grade 1 strength bilaterally, with no effective muscle contractions. Hamstring strength was normal. Findings on ankle examination were also normal.

Radiographs showed tricompartmental grade 4 osteoarthritis of both knees, with valgus deformity of 14° on the left knee and 11° on the right knee (Figure 1).

Surgery was performed on both knees 8 months apart, with cemented custom-fit hinged total knee arthroplasty with 30° of recurvatum in the tibial keel (Figure 2). Preoperative planning was used, especially for the tibial cut, to anticipate the bone cut (Figure 3). The authors used a classic anteromedial approach, with large medial and lateral soft tissue release. Tibial tubercle osteotomy was not necessary to expose the knee. The tibial cut was performed first using a custom cutting block with an inverse tibial slope of 30° to obtain the desired recurvatum. For tibial bone preparation, the authors used a posterior point of entry to allow intramedullary guide and tibial keel passages. For the femoral cut, an intramedullary guiding rod was used.

Postoperative rehabilitation occurred according to the standard protocol, but with preservation of the native recurvatum, with normal progression from frame to crutches.

At 1-year and 1.5-year follow-up for the right and left sides, respectively, the patient had good pain relief when walking, with good functional improvement. He reported no instability on either side. His only complaint was of posterior pain on the left side after prolonged standing. He could walk at least 1 km on uneven ground with 2 crutches. On physical examination, he had a small effusion on the left side. He still had a valgus deformity. Passive range of motion was 35° of recurvatum and 90° of flexion on the left side and 30° of recurvatum and 95° of flexion on the right side. Postoperative clinical data were evaluated with the International Knee Society score and the Knee Injury
and Osteoarthritis Outcome Score. Clinical score results are shown in the Table.

At follow-up, radiographs showed good TKA positioning on the right side. However, on the left side, they showed evidence of mechanical loosening at the end of the tibial keel, with a radiolucent zone at the cement-bone interface (Figure 4). Bone scintigraphy showed enhanced uptake around the tibial component of the left side (Figure 5).

**DISCUSSION**

In general, TKA in limbs with poliomyelitis results in satisfactory pain relief, but the risk of failure as a result of recurrent instability and functional deterioration is high, especially if the preoperative quadriceps power is low. Patients with poliomyelitis and weak quadriceps rely on locking of the knee in hyperextension to walk. Therefore, treating osteoarthritis in this patient represented a challenging procedure. The authors chose to respect his native recurvatum deformity to maintain walking function and avoid falls, which are more frequent in these patients than in the general population.

The authors performed bilateral custom-fit hinged TKA that maintained the patient’s preoperative recurvatum to allow for walking. To the authors’ knowledge, this is the first report of such a procedure in the literature.

From a technical point of view, the authors opted for a classic anteromedial approach in spite of the genu valgum because the use of a hinged TKA allowed wide soft tissue release with compromise in exposure. Although the authors anticipated this situation, it was not necessary to use a tibial tubercle osteotomy that could have been deleterious for this patient, given his weak quadriceps. The key point of this surgery was the tibial cut. The authors had to anticipate the height and the orientation of the cut preoperatively through careful planning (Figure 3). During surgery, the authors used a custom cutting block fixed on an intramedullary guide to obtain the 30° recurvatum in the sagittal plane and avoid an oblique cut in the frontal plane. Femoral and patellar preparations were performed in a standard fashion.

At the last follow-up, radiographs of the left TKA showed a radiolucent zone at the cement-bone interface at the end of the tibial keel. Clinical scores were worse on the left side, with mild pain and an effusion, probably related to bone loss at the bone cement-implant interface. The authors also performed bone scintigraphy that showed increased uptake under the tibial component and at the end of the tibial keel (Figure 5) that confirmed the radiograph findings of component loosening. The loosening of the tibial component on the left side could be caused by the high constraints when loading with recurvatum. In an effort to preserve the re-

<table>
<thead>
<tr>
<th>Knee</th>
<th>Preop</th>
<th>Postop</th>
<th>ROM (Recurvatum/Flexion)</th>
<th>Subj IKDC Score</th>
<th>KOOS</th>
<th>IKS Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>8°</td>
<td>4°</td>
<td>30/120</td>
<td>30/95</td>
<td>65</td>
<td>79</td>
</tr>
<tr>
<td>Left</td>
<td>14°</td>
<td>10°</td>
<td>30/120</td>
<td>35/90</td>
<td>58</td>
<td>79</td>
</tr>
</tbody>
</table>

**Table:** Preoperative and Postoperative Data for Both Knees

*Abbreviations: IKS, International Knee Society; KOOS, Knee Injury and Osteoarthritis Outcome Score; Preop, preoperative; Postop, postoperative; ROM, range of motion; Subj IKDC, subjective International Knee Documentation Committee.*
curvatum, the authors opted for a hinged TKA with intrinsic stability to avoid recurrence of knee instability, which is otherwise common in these cases.\textsuperscript{9} Excessive recurvatum can stretch the posterior soft tissue and lead to residual pain; here, the function of the hinge is to absorb constraints and avoid this posterior stress. Despite the use of a long stem extension to better distribute stress at the bone-cement interface, constrained TKA implants can lead to high stress transfer, particularly at the distal tibial stem.\textsuperscript{10} This stress can lead to early mechanical failure of the prosthesis.\textsuperscript{6}

Tigani et al.\textsuperscript{6} in a retrospective series of TKA in 10 patients with poliomyelitis, reported 7 rotating hinge prostheses. At 2-year follow-up, they found no sign of prosthetic loosening, possibly because of the rotating hinge, which allowed more physiologic movement of the prosthesis.\textsuperscript{11} Jordan et al.\textsuperscript{5} reported no complications at 3-year follow-up of a hinged prosthesis. However, in both series, the hinged TKA allowed only slight hyperextension (about 3°), thereby reducing stress transfer on the prosthesis. A mild degree of hyperextension confers stability to the knee because of an anatomic self-locking mechanism.\textsuperscript{12} This stability is essential for walking, especially when the quadriceps is weak. Consequently, knee recurvatum must be respected up to 10°.\textsuperscript{13} When TKA is performed in a patient with polio sequelae, the intrinsic degree of recurvatum must be preserved. The important decision is whether to keep the preoperative recurvatum and risk early loosening or keep only a slight recurvatum and risk disturbing the patient’s gait. Determining the ideal trade-off between stability and constraint is difficult, with little support from the literature. Hosalkar et al.\textsuperscript{14} performed TKA in 3 postpolio patients with knee recurvatum and weak quadriceps. They restored normal anatomic axes, correcting the recurvatum deformity to save energy during stance. These patients had good functional outcomes, but they needed knee-ankle-foot orthoses to walk. The authors believe that the goal of TKA in such patients is to improve quality of life as well as to remove external orthoses. Finally, clinical scores showed good results 1 year postoperatively, especially with regard to subjective data, quality of life, and function. These results are consistent with those of other series.\textsuperscript{5,6} The current patient regained the autonomy that he had lost because of his initial pain. Unfortunately, signs of early aseptic loosening are visible on the left side and warrant further treatment. Aseptic loosening is a well-known complication after hinged TKA,\textsuperscript{10,15,16} even with normal lower-limb axes. The rigidity of the hinge increased stress transfer to the bone from the prosthesis through the locked hinge. In this case, the authors attempted to find a trade-off between respecting the recurvatum to maintain the patient’s ambulatory capacity and providing acceptable constraints on the prosthesis. With hindsight, 30° of recurvatum appears excessive for the left side. The philosophy of maintain-
ing a large native recurvatum for TKA in a patient with weak quadriceps is a novel one. Patients with sequelae of polio make for technically challenging TKA, with a heterogeneous array of preoperative considerations. The appropriate recurvatum level is probably between the previously described 3° and the current description of 30°. Further assessment is necessary to find the right recurvatum required to walk with weak quadriceps.

**References**