

Rotating-Hinge Total Knee Arthroplasty for Osteoarthritis with Valgus Deformity and Collateral Ligament Insufficiency in a Post-Poliomyelitis Lower Limb: A Case Report

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Received: 01-05-2026 / Revised: 25-06-2026 / Accepted: 12-07-2026

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Conflict of interest: Nil

Abstract

Total knee arthroplasty (TKA) in post-poliomyelitis limbs is challenging due to residual muscle weakness, deformity, and ligamentous instability. We present a 48-year-old woman with childhood poliomyelitis in the left lower limb presenting with progressive knee pain and difficulty walking for 3 months. Foot drop, reduced left hip and knee strength (MRC 3/5), valgus deformity and medial collateral laxity in the knees were observed. X-rays revealed severe osteoarthritis with valgus deformity that is correctable and insufficiency of the medial collateral ligament. She has had a rotating-hinge TKA with a LINK prosthesis. After implantation, there was restoration of neutral positioning with valgus deformity completely eliminated, and medial collateral laxity was eliminated. Post-operatively, pain levels decreased significantly after surgery, and the ability to flex the knee to 90° was found on day one, with early mobilisation. This case indicates the significance of the correspondence of implant constraint to the instability pattern, where rotating-hinge TKA provides certain stability and early functional progress in select post-polio knees.

Keywords: Post-Poliomyelitis; Rotating-Hinge Total Knee Arthroplasty; Valgus Deformity; Medial Collateral Ligament Insufficiency; Case Report.

DOI: 10.25258/ijcpr.18.7.126

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Introduction

Total knee arthroplasty (TKA) in the limbs with residual poliomyelitis remains a challenging surgery due to the coexistence of advanced degenerative arthritis with abnormal limb positioning, muscle weakness, and instability of the ligaments [1,2]. Neuromuscular imbalance (Over time) changes knee biomechanics, predisposing these patients to progressive deformity and secondary osteoarthritis. Moreover, weakness in the quadriceps and lack of soft-tissue restraints increase instability after arthroplasty [3]. Unlike conventional primary TKA, reconstruction of the post-polio knee requires careful assessment of residual muscle function, deformity pattern, and ligament competence. Valgus or recurvatum deformities, poor neuromuscular control, and collateral ligament insufficiency often make implant selection difficult [1,4]. Although successful outcomes have been reported with different prosthetic designs, the degree of constraint must be individualised. Rotating-hinge prostheses provide additional stability in selected

patients with severe deformity and inadequate ligament support, where less constrained implants may fail [5,6].

Despite advances in implant design, reports on primary rotating-hinge TKA for post-polio residual paresis, particularly in the Indian population, remain limited [7]. We report this case of a poliomyelitis-affected limb with valgus deformity, residual muscle weakness, foot drop, and medial collateral ligament insufficiency managed successfully with rotating-hinge TKA, highlighting the importance of matching implant constraint to the underlying instability to achieve pain relief, deformity correction, and early functional recovery.

Case Report

Presentation and History: A 48-year-old woman presented to the orthopaedic outpatient department with progressively worsening pain in the left knee associated with difficulty in walking and climbing stairs. She had a history of poliomyelitis during

childhood, resulting in residual weakness of the left lower limb with foot drop. She had been ambulatory with difficulty over several years in spite of the deformity. During the 3 months before proceeding, she has experienced increasing knee pain, as well as deterioration in walking capacity, which has limited her ability to live. She was a hypertensive patient and had no history of diabetes mellitus. No concerns of family history or prior surgery on the affected limb.

Clinical Examination: Investigating the patient was haemodynamically stable. The right lower limb was assessed and showed the left upper limb,

left foot drop, and left lower limb wasting (diagnostic) of residual post-polio deformity.

There was a Medical Research Council (MRC) grade 3/5 motor power in the affected knee and hip. There was a visible valgus knee deformity of the left knee on standing (Figure 1).

The patient experienced painful and restricted knee motion with crepitus, indicating severe degenerative alterations. Medial collateral ligament laxity was observed on clinical stress examination, and it is a sign of coronal plane instability.



Figure 1: Pre-clinical photographs of the left lower limb in standing clinical position (both posterior and anterior). The patient in the pose contains a valgus deformity of the left knee and the post-polio wasted, paralytic limb. The patient walked around using a walking aid

Diagnostic Assessment: Routine pre-operative evaluation was performed. Blood investigations were within acceptable limits except for low haemoglobin, for which peri-operative correction was planned. Chest radiograph showed no abnormality. Pre-operative cardiac evaluation with two-dimensional echocardiography demonstrated concentric left ventricular hypertrophy, moderate aortic stenosis with mild aortic regurgitation, and preserved left ventricular ejection fraction of 60%.

Cardiology clearance was obtained prior to surgery. Weight-bearing radiographs of the left knee demonstrated features of advanced osteoarthritis with joint-space narrowing, subchondral sclerosis, and osteophyte formation. Stress radiographs confirmed correctable valgus deformity with medial collateral ligament insufficiency (Figure 2).

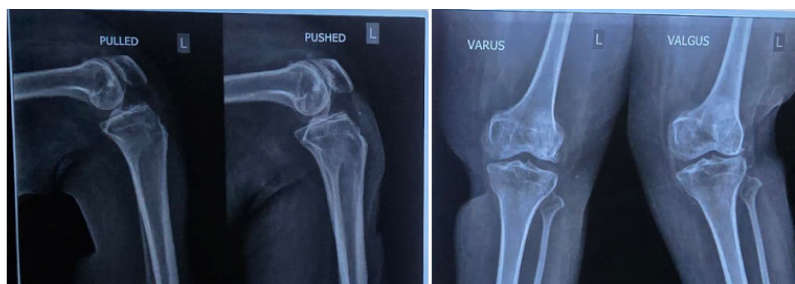


Figure 2: The stress radiographs of the left knee. (a) Pushed and pulled lateral stress radiographs that illustrate the evaluation of the post-polio knee stability in the sagittal plane. (b) Abnormal collateral ligament insufficiency with correctable valgus deformity confirmed with Varus and valgus anteroposterior stress radiographs revealing abnormal joint-line opening. There are also degenerative osteoarthritic changes

Therapeutic Intervention: Considering the advanced osteoarthritis, valgus deformity, residual post-polio muscle weakness, and collateral ligament insufficiency, the patient was planned for rotating-hinge total knee arthroplasty. The patient underwent left rotating-hinge TKA under subarachnoid (spinal) anaesthesia with a conventional midline incision and medial parapatellar incision. It was treated by removal of degenerative osteophytes and the preparation of the femur and tibia using rotating-hinge knee tools. A LINK rotating-hinge knee prosthesis (XS 55mm) was used. This was after implantation, which involved valgus deformity, restoration of neutral mechanical alignment and total elimination of the medial collateral ligament laxity, which was previously noted. The knee demonstrated good stability with no residual medial or lateral laxity.

One unit of packed red blood cells was transfused intra-operatively due to low haemoglobin. The

wound was closed in layers after confirming stable reconstruction.

Follow-up and Outcomes: The post-operative period was uneventful. The patient received routine analgesia, thromboprophylaxis, wound care, and physiotherapy-assisted mobilisation.

On the first post-operative day, she reported marked reduction in pain and achieved 90° of active-assisted knee flexion. A second unit of packed red blood cells was transfused postoperatively for anaemia correction.

The surgical wound remained healthy, and the patient was discharged in a haemodynamically stable condition. Post-operative clinical photographs showed correction of valgus deformity, stable alignment while standing with walker support, and a healthy surgical wound (Figure 3).



Figure 3: Post-operative clinical photographs. When seen in posteriors and anterior standing positions, there is a corrected and well-aligned knee (left knee) where the patient is holding weight on a walker; the supine position presents the clean and covered surgical incision above the left knee

At early follow-up, the correction was maintained with no medial or lateral instability. The patient continued progressive physiotherapy and was able to mobilise with a walking aid, with significant improvement in pain compared with the pre-operative condition.

Complications

No intra-operative or early post-operative complications were encountered. There was no evidence of wound complication, infection, implant instability, or neurovascular deficit during the immediate follow-up period.

Discussion

Total knee arthroplasty in a poliomyelitis-affected limb represents a unique reconstructive challenge, because the surgeon must address both end-stage joint degeneration and the underlying neuromuscular imbalance. Unlike routine primary arthroplasty, these knees frequently show abnormal alignment, weak dynamic muscle control, altered bone morphology and deficient ligamentous

support [1,2]. Achieving a pain-free and stable knee, therefore, depends not only on replacing the arthritic joint but also on selecting an implant that compensates for the existing soft-tissue deficiency.

The principal concern reported in previous series of TKA following poliomyelitis is post-operative instability, most commonly due to quadriceps weakness, genu recurvatum and ligamentous insufficiency [8-10]. Satisfactory pain relief and functional outcome can be obtained when the degree of pain implant constraint is matched to the extent of the neuromuscular compromise [1].

The patients who are not weakened in antigravity quadriceps strength usually have better results since the residual muscle activity is sufficient to meet the post-surgery rehabilitation and mobility [2]. Our patient had residual poliomyelitis with foot drop and lower-limb weakness, but retained hip and knee power (MRC 3/5), which was a favourable functional substrate to support recovery.

One of the significant aspects of this case was the instability, mainly of the coronal-plane character.

Unlike most documented cases of post-polio knees whose deformities include sagittal-plane instability and recurvatum due to quadriceps weakness [10], our patient exhibited a valgus deformity, which was related to laxity of the medial collateral ligament. This trend necessitated keen pre-surgery evaluation, since correcting the deformity and leaving the ligamentous incompetence unattended would have led to incessant instability. The presence of collateral insufficiency directly influenced the decision to select a higher level of prosthetic constraint.

Implant selection remains the most critical step in arthroplasty of the post-polio knee. Conventional implants rely on functional collateral ligaments and adequate muscle control for stability, neither of which is reliable in a paralytic limb. Rotating-hinge prostheses provide intrinsic coronal and sagittal stability while allowing controlled motion, making them suitable for patients with severe deformity or ligamentous deficiency [11,12]. In the present case, the LINK rotating-hinge prosthesis achieved immediate restoration of alignment and stability, with complete correction of the valgus deformity and elimination of the pre-existing medial collateral laxity. The patient achieved 90° of knee flexion on the first post-operative day with significant pain reduction, supporting the appropriateness of the chosen reconstruction.

Although rotating-hinge designs afford excellent stability, their greater constraint transmits higher mechanical stresses to the implant–bone interface. Long-term follow-up is therefore essential to detect complications such as aseptic loosening, infection, extensor-mechanism dysfunction and mechanical failure [1]. In this case, the early outcome was favourable, with stable alignment, absence of residual laxity, satisfactory wound healing and improved mobility; nonetheless, continued clinical and radiological surveillance will be required to confirm durability.

The strength of this report lies in demonstrating the successful management of a relatively uncommon presentation of post-polio knee arthritis, in which valgus deformity and collateral ligament insufficiency rather than the more frequently described recurvatum deformity were the dominant problems [1, 10]. The positive early outcome was achieved due to careful consideration of the instability pattern, correct choice of a rotating-hinge implant and structured rehabilitation. The major weakness is the limited follow-up; more time will be required to assess the survival of the implants and longer functional gains.

Learning Points

1. Sagittal plane instability with recurvatum is the most frequent type; the stress radiographs should be followed by coronal valgus

instability caused by collateral ligament insufficiency, which the stress radiographs should verify.

2. Unconstrained or condylar implants can cause chronic instability in the paralytic knees, but a rotating-hinge prosthesis provides inherent coronal and hyperextension stability in cases where the ligamentous support is insufficient.
3. Preserved antigravity quadriceps power (Medical Research Council grade $\geq 3/5$) is associated with improved functional outcomes, pain relief, and postoperative rehabilitation.
4. Narrow implants in the femoral and tibial can be necessary, and major medical comorbidities (such as severe aortic stenosis) should be formally preoperatively optimised and cardiac cleared.
5. Patients must receive an explanation that the revision rates following total knee arthroplasty with post-polio limbs are higher than those of routine primary arthroplasty, and the necessity of long-term clinical and radiographic follow-ups.

Conclusion

The critical success of total knee arthroplasty in a limb with poliomyelitis will be determined by identifying the underlying pattern of the instability and matching the implant constraint with the deficiency in its functionality. The case indicates that when a patient experiences a valgus knee deformity, laxity of collateral ligaments and persistent residual muscle weakness, a rotating-hinge knee prosthesis is reliable in correcting deformities, stabilizing the knee and providing significant pain relief, with early functional recovery. Careful patient selection, pre-operative planning, and follow-up in the long run are crucial to preserving positive results.

Patient Consent: The patient was informed that data concerning the case would be submitted for publication, and she agreed. All patient-identifying information has been removed from the text, and identifying features have been masked in the images.

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