

**Total Knee Replacement (TKR): A Clinico-radiological Review for  
Orthopaedic Surgeons and Radiologists**

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**Abstract**

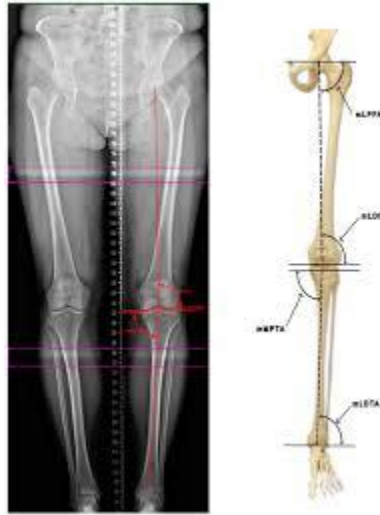
Total knee replacement (TKR) is one of the most commonly performed orthopaedic procedures for end-stage knee arthritis. Successful outcomes depend on appropriate patient selection, precise surgical technique, and accurate postoperative assessment. Imaging plays a critical role throughout the perioperative period, from preoperative planning and alignment assessment to postoperative evaluation and diagnosis of complications. This combined clinico-radiological review integrates orthopaedic and radiological perspectives on implant design, alignment concepts, surgical techniques, and multimodality imaging following TKR.

**Introduction**

TKR has proven to be a highly effective intervention for relieving pain and restoring function in patients with advanced knee arthritis. However, persistent pain or dissatisfaction is reported in a subset of patients, necessitating close collaboration between orthopaedic surgeons and radiologists.

**Preoperative Evaluation**

Clinical evaluation focuses on deformity, ligament status, and functional impairment. Imaging with weight-bearing radiographs and long-leg alignment views is essential for surgical planning.



Bilateral lower limb radiograph AP View -For bone length

### Implant Design and Alignment Concepts

Implant selection and alignment philosophy influence long-term outcomes. Mechanical, kinematic, and functional alignment strategies are increasingly evaluated using imaging correlation.

### Postoperative Imaging Protocols

Standard radiographs form the cornerstone of postoperative assessment. Structured reporting improves communication and decision-making.



Radiographic determination of coronal alignment in total knee arthroplasty. Coronal tibiofemoral (left), femoral (middle), and tibial (right) measurements are shown.

### **Advanced Imaging**

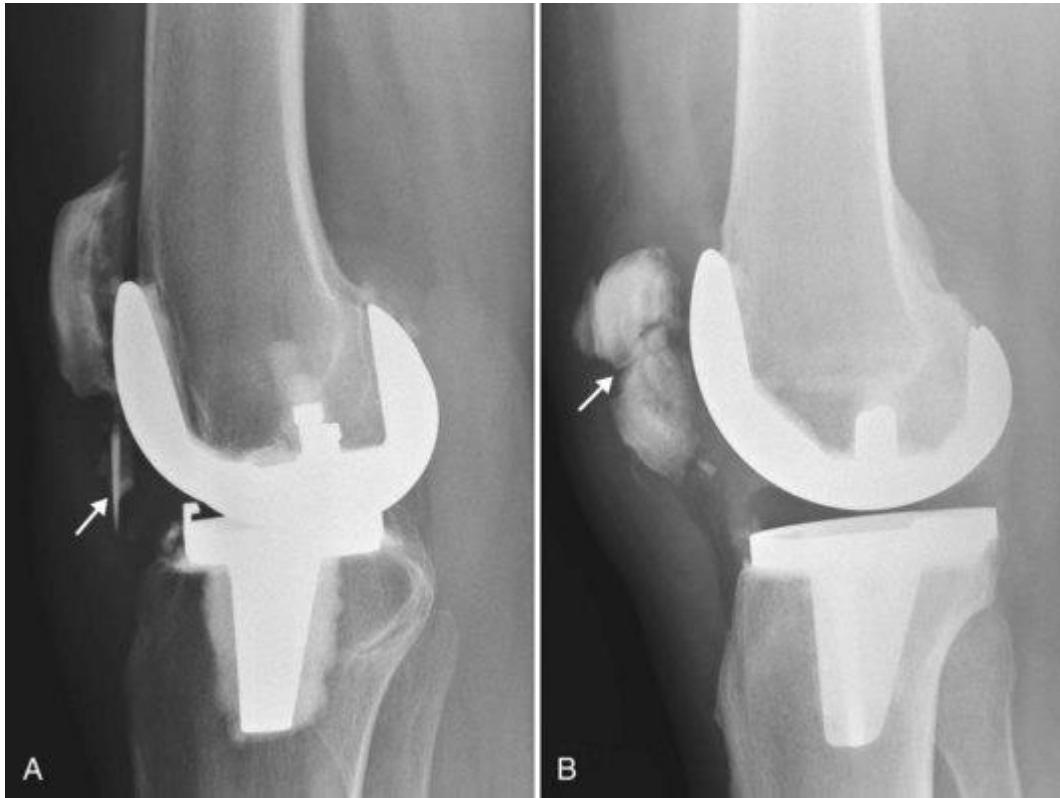
CT is useful for evaluating component rotation and fractures. MRI with metal artifact reduction techniques allows soft-tissue assessment. Nuclear medicine aids in differentiation of infection from aseptic loosening.

### **Complications of TKR**

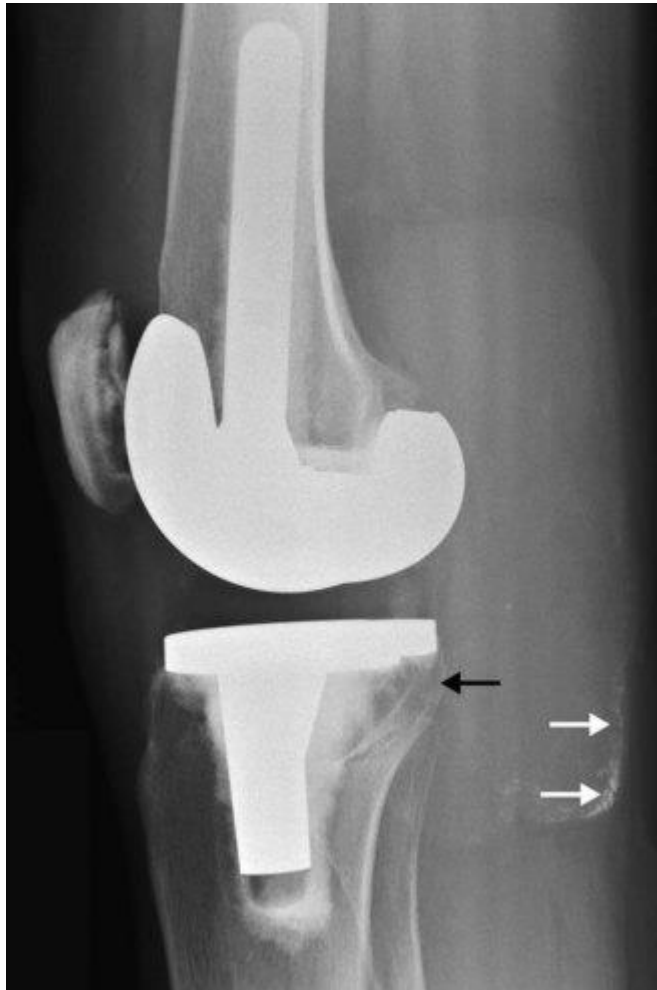
Common complications include aseptic loosening, periprosthetic joint infection, instability, polyethylene wear, arthrofibrosis, and periprosthetic fractures. Imaging findings guide management strategies.



Anterior tibiofemoral dislocation of total knee arthroplasty.



Patellar complications. A, Lateral radiograph shows the displaced polyethylene component (*arrow*) to lie caudal to the patella. B, Lateral radiograph in another patient shows a patellar fracture (*arrow*). Increased density of the fragments suggests osteonecrosis.



Metal synovitis. Lateral radiograph following revision of a total knee arthroplasty demonstrates a dense line outlining a distended popliteal cyst (metal line sign, *white arrows*), which is diagnostic of metal synovitis. Osteolysis is also seen at the posterior tibial baseplate (*black arrow*), along with loosening of the patellar component.



**Loosening.** A, Lateral radiograph shows radiolucent lines (*arrows*) along the femoral component (Ewald zones 1, 2, and 5). This component was proven to be loose at the time of revision surgery. B, Weight-bearing view in another patient demonstrates radiolucent lines greater than 2 mm along the tibial baseplate (*arrows*) and subsidence of the tibial component, indicating loosening.



Staged Knee replacement revision for prosthetic joint infection.

**Future Directions**

Robotic surgery, artificial intelligence, and advanced imaging techniques are shaping the future of TKR management.

**Conclusion**

A multidisciplinary approach combining clinical and imaging expertise is essential for optimizing outcomes after total knee replacement.

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