Pathological plain-film findings related to patellar resurfacing in total knee replacement

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Learning objectives

To describe and illustrate the spectrum of pathological findings related to patellar resurfacing on plain-film X-rays in patients with total knee arthroplasty, regardless of whether the outcome of knee arthroplasty was favorable.

To familiarize radiologists with uncommon and often forgotten complications of patellar resurfacing in total knee arthroplasty.

Background

In some knee replacements, the patella is unaltered, and the artificial implant is shaped to glide easily beneath it. But in another approach, called patellar resurfacing, the surgeon attaches a separate piece to the back of the patella to fit smoothly with the implant, resurfacing the patella (Figure 01).

Patellar resurfacing is performed in about 45% of patients undergoing total knee arthroplasty. Resurfacing is a good option for obese patients, those with patella baja, and those at risk for anterior knee pain. Isolated patellar resurfacing procedures are sometimes done in younger patients; however, the results are variable, and many of these procedures are converted to total knee replacements.

Complications of patellar resurfacing following knee arthroplasty are often underestimated or forgotten, but it is important for radiologists to recognize them. Very few references to complications patellar resurfacing appear in the literature, and practically all of these concern complications that arise from total knee arthroplasty itself. We retrospectively reviewed 648 consecutive patients who underwent total knee arthroplasty with patellar resurfacing in the last five years; 22 (3.39%) patients (14 women and 8 men; mean age, 71 y; range, 59-85 y) presented complications related to patellar resurfacing.

Images for this section:
Fig. 1: NORMAL FINDINGS AFTER PATELLAR RESURFACING. 65-year-old woman, five years after total knee replacement. Axial radiograph (Merchant view) shows onlay patellar resurfacing with cemented multiple pegs (arrow).
Imaging findings OR Procedure Details

Plain-film X-rays of the knees are standard in the presurgical evaluation of candidates for patellar resurfacing with or without total knee arthroplasty. Baseline postsurgical plain films 3 weeks after the procedure and plain films every 1 or 2 years during long-term follow-up are considered appropriate. Knee plain films are one means of surveillance for possible complications in routine postsurgical follow-up.

Routine views of the knee are the anteroposterior, lateral, and tangential axial (Merchant) views.

Radiological findings in complications of the patellar button are not very different from those seen in painful knee or hip arthroplasties. Complications of patellar prostheses are usually independent of those that can emerge in knee arthroplasties. Complications of patellar prostheses are infrequent, but may have a dramatic impact on the patient's quality of life. Single or multiple cemented or uncemented non-metallic pegs used for patellar resurfacing in total knee arthroplasty must not be mistaken for reactive osteolysis between the button prosthesis's fixation devices (Figure 02). The most common complications related to patella resurfacing were aseptic loosening and/or osteolytic patellar lesions, instability, dislocation or luxation and rupture of the prosthetic patellar component, and osteonecrosis. The mean interval from total knee replacement to patellar complication was 3 years and 7 months (range, 11 months-10 years).

ASEPTIC LOOSENING

When aseptic loosening appeared, it occurred predominantly around the patellar button prosthesis. This is the most frequent complication that affects the patellar button. Mechanical loosening is the most common indication for revision. Patients are usually symptomatic.

The radiological signs of aseptic loosening are the same as those described in knee and hip arthroplasties: a thin radiolucent line between bone and cemented prostheses less than 2 mm in width is a normal finding and is usually stable over the time. Definitions of loosening may vary, but loosening is probable when the radiolucent zone is greater than 2 mm wide (Figure 03). Depending on the type of patellar resurfacing, this zone can involve the interface between the prosthesis and bone, between cement and bone, or between cement and prosthesis. In general, comparison with previous radiographs is the most helpful method to detect loosening.
It is important to remember that a cortical defect in the lateral patellar facet adjacent to the button prosthesis may be a normal variant that persists into adulthood.

**PATELLAR INSTABILITY**

An axial view of the knee is important for assessing patellofemoral alignment, and it should be performed at a standard degree of flexion, usually 30°-45°. On an axial view, the prosthetic patellar component should be centered over the middle of the trochlea of the femoral component. On a lateral view, the joint line (distance from the tibial tubercle to the tibial component) should not be altered more than 8 mm, and the patella height (distance from the inferior edge of the patellar component to the tibial articular surface) should be 10 mm-30 mm. To avoid stress on the extensor mechanism, the combined anteroposterior thickness of the patella and polyethylene component should not exceed that of the native patella.

Patellar resurfacing instability may present as dislocation (Figure 04) or luxation of the patella. Luxation can occur in a lateral (Figure 05) or cranial or caudal direction (Figure 06). It can be caused by patient factors (poor muscle tone or trauma), positional factors (such as limb malalignment) or component malposition. This complication is more common in revision total knee arthroplasties. Comparison with previous radiographs is always helpful.

**OSTEOLYTIC LESIONS**

These occur as a result of macrophage reaction on the prosthetic side of the patellar button, as has also been described in knee or hip arthroplasties. Aggressive granulomatosis in the resurfaced patella is uncommon and can present as areas of radiolucency around the prosthesis (Figure 07). Friction with the total knee prosthesis may produce an osteolysis in the lateral facet of the patella adjacent to the button prosthesis (Figure 08).

Infection, which often has more aggressive features, is the main differential diagnosis. Even with large areas of osteolysis, the prosthesis may be stable.

**OSTEONECROSIS**

Patellar fragmentation and sclerosis of the fragments are presumed to represent osteonecrosis (Figure 09). Generally, patellar resurfacing is not the direct cause of
the necrosis, but the vascular network of the patella can be affected during total knee replacement surgery. Median parapatellar arthrotomy, fat pad removal, and lateral release all contribute to patellar devascularization.

**LOOSENING OR RUPTURE OF THE PATELLAR PROSTHETIC BUTTON**

As mentioned earlier, a patellar prosthetic button (patellar component of the total knee arthroplasty) is added to about half of all total knee replacements. Like all joint prostheses (such as hip, knee, and small joints), the patellar button may loosen or rupture (Figure 10), resulting in the same or similar characteristic radiological signs as in the other joints.

**Images for this section:**

![Fig. 2: NORMAL PATELLAR RESURFACING IN THE CONTEXT OF LATE COMPlications OF TOTAL KNEE ARTHROPlasty. 73-year-old woman, ten years after total knee replacement. Lateral radiograph reveals normal cemented patellar resurfacing with multiple pegs (arrow), simulating reactive osteolysis in a patient with](image-url)
patellar displacement and rotation with clinical suspicion of quadriceps tendon tear. Sonogram confirmed a disrupted quadriceps tendon (not shown).

**Fig. 3:** PROSTHETIC PATELLAR BUTTON LOOSENING. 73-year-old woman, four years after total knee replacement. Axial radiograph (Merchant view) shows a lucent line surrounding the prosthetic patellar button (arrows), indicating loosening.
Fig. 4: PROSTHETIC PATELLAR BUTTON INSTABILY. 69-year-old woman, six years after total knee replacement. Axial radiograph (Merchant view) shows patellar tilting with loosening and non-displaced rupture of the prosthetic button (arrow).
Fig. 5: PATELLA WITH CEMENTED PROSTHETIC BUTTON: LATERAL LUXATION. 87-year-old woman, four years after total knee replacement. Axial radiograph (Merchant view) of the knee prosthesis with cemented prosthetic button demonstrates lateral patellar displacement on flexion (arrow).
Fig. 6: PATELLA WITH CEMENTED PROSTHETIC BUTTON: CAUDAL LUXATION. 78-year-old woman, eleven years after total knee replacement. Lateral radiograph of the knee prosthesis shows caudal displacement (arrow) of the patella with cemented prosthetic button.
Fig. 7: PATELLAR OSTEOLYSIS. 75-year-old woman, twelve years after total knee replacement. Axial radiograph (Merchant view) shows osteolysis of the lateral facet of the patella (arrow) after surgery to remove the loosened prosthetic button.
Fig. 8: PROSTHETIC PATELLAR BUTTON WITH OSTEOCHONDRAL LESION. 76-year-old man, six years after total knee replacement. Axial radiograph (Merchant view) shows osteolysis of the lateral facet of the patella (arrow) with a single-peg cemented prosthetic button due to friction with the total knee prosthesis.
**Fig. 9:** PATELLAR SURFACING NECROSIS. 72-year-old woman, nine years after total knee replacement. Axial radiograph (Merchant view) of the knee prosthesis shows bony sclerosis with partial bone collapse in the lateral part of the patella resurfacing (arrow), with signs of loosening.
Fig. 10: RUPTURE OF THE PROSTHETIC PATELLAR BUTTON. 68-year-old woman, four years after total knee replacement. Sagittal radiograph shows rupture of the patellar prosthetic button (arrow) with caudal displacement.
Conclusion

Complications of patellar resurfacing following total knee arthroplasty are rare, but often clinically significant. Plain films are essential for the evaluation of patellar resurfacing complications and should be the initial imaging study. Careful attention to initial prosthesis placement and comparison of follow-up images will allow subtle abnormalities to be detected. This information may influence treatment strategy and surgical planning. Radiologists need to be able to recognize these uncommon and often forgotten complications.

References


Personal Information