Validity of an oblique posterior condylar radiographic view for revision total knee arthroplasty

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We have previously developed a radiographic technique, the oblique posterior condylar view, for assessment of the posterior aspect of the femoral condyles after total knee arthroplasty. The purpose of this study was to confirm the validity of this radiographic view based upon intra-operative findings at revision total knee arthroplasty. Lateral and oblique posterior condylar views were performed for 11 knees prior to revision total knee arthroplasty, and radiolucent lines or osteolysis of the posterior aspect of the femoral condyles were identified. These findings were compared with the intra-operative appearance of the posterior aspects of the femoral condyles. Statistical analysis showed that sensitivity and efficacy were significantly better for the oblique posterior condylar than the lateral view. This method can, therefore, be considered as suitable for routine follow-up radiographs of the femoral component and in the pre-operative planning of revision surgery.

Osteolysis is a well-described complication of total hip arthroplasty and is increasingly recognised after total knee arthroplasty (TKA).1,2 Fehring et al3 showed early failure of TKA because of osteolysis. Although, osteolysis commonly occurs in the posterior part of the femoral condyles,4 this is an area which is often difficult to evaluate on a true-lateral radiograph; an abnormality in one condyle may be obscured by the other. Moreover, even if an abnormality is detected, it can be difficult to determine which condyle is affected. We have performed several revision procedures in which the lateral radiograph appeared normal pre-operatively, but in which an augmentation block was necessary because of massive bone resorption of the posterior aspect of a femoral condyle.

We developed an oblique posterior condylar radiographic view for evaluation of the posterior femoral condyles after TKA. With this view, the medial and lateral condyles can be observed separately. We have already reported the efficacy and reproducibility of this view in detecting abnormalities of the posterior aspect of the femoral condyles.5 However, it is still unclear whether these radiographic changes reflect true local bony abnormalities.

The purpose of this study, therefore, was to confirm the validity of the oblique posterior condylar view based on intra-operative findings at revision TKA. We focused specifically on the detection of bony deficiency in the posterior condyles rather than the detection of radiolucent lines.

Patients and Methods

We selected 11 consecutive revision TKAs (ten patients) which had been performed at our hospitals between 2001 and 2004. There were two men and eight women with a mean age of 78.6 years (60 to 88) at the time of revision surgery. The mean interval between the primary and revision procedures was 112.5 months (63 to 198). Lateral and oblique posterior condylar views were obtained pre-operatively for all patients, with any osteolytic or bony defects of the posterior aspect of the femoral condyles being regarded as abnormal. The oblique posterior condylar view was obtained with the patient sitting with the knee flexed to 90°. The x-ray beam was directed horizontally, and bilateral oblique views of the knee (45° to 50°) were obtained. The radiographic findings for both the lateral and oblique posterior condylar views were then related to the state of the posterior aspect of the femoral condyles during revision TKA after removal of the femoral component. As the lateral radiographic view does not permit an assessment of the medial and lateral condyles separately, only one judgment for each knee was possible. In contrast, the oblique posterior condylar view allowed an assessment of both condyles, so
two judgments for each knee were possible. In order to validate the lateral view, the intra-operative findings were considered normal only if both condyles were normal. In the oblique posterior condylar view, the radiographic findings for both the medial and lateral condyles were compared with the intra-operative situation. Sensitivity, specificity, and efficacy were calculated for both the lateral and oblique posterior condylar views. Statistical analysis was performed using Fisher’s exact probability test with values for p < 0.01 being regarded as significant.

Results
On the lateral view, ten of the 11 knees were regarded as normal with only one condyle being judged abnormal; this showed massive osteolysis intra-operatively. However, eight knees showed bony defects in the femoral condyle intra-operatively. On the oblique posterior condylar view, 22 radiographs were evaluated. From these, 11 condyles were regarded as abnormal, all of which showed bony defects in a femoral condyle intra-operatively. Typically, no abnormalities were seen in the posterior aspect of the femoral condyles on the lateral view (Fig. 1). However, the
oblique posterior condylar view clearly showed osteolysis of the lateral femoral condyle (Fig. 2) which was confirmed intra-operatively. We assessed 11 knees as normal on the oblique posterior condylar view. Two of these, however, had bony defects intra-operatively. In one the radiographic assessment of the posterior femoral condyle was difficult because of severe metallosis.

The sensitivity of the lateral and oblique posterior condylar radiographic views was 0.111 and 0.846, respectively, while specificity was 1.00 for both and efficacy was 0.273 and 0.909, respectively. Statistical analysis showed that sensitivity and efficacy were significantly better for the oblique posterior condylar than the lateral radiographic view ($p < 0.002$ and $p < 0.005$, respectively).

**Discussion**

Rodriguez et al\(^6\) reported that the majority of osteolytic lesions seen in a posterior-stabilised TKA are on the femoral side. Huang et al\(^4\) also described osteolysis in the distal femur, most commonly in the posterior part of the femoral condyles. However, the lateral radiographic view cannot reliably demonstrate radiolucency of the posterior femoral condyles after TKA. Rotation of the X-ray beam by a few degrees does not necessarily reveal a radiolucency adjacent to the component.\(^7-9\) Even with a true lateral radiograph, abnormal findings in one condyle may be obscured by the other. Furthermore, determination of the side of the abnormality is difficult. Particularly in a posterior-stabilised TKA, visualisation of the posterior aspects of the femoral condyles a) lateral and b, c) oblique posterior condylar.
condyles may be blocked by the cam mechanism of the femoral component. Consequently, routine radiographs usually underestimate the presence and extent of osteolysis found at revision surgery and this has been highlighted by Van Loon et al.\textsuperscript{10} Nadaud, Fehring and Fehring\textsuperscript{11} recommended oblique radiographs in order to identify femoral osteolysis around a posterior-stabilised implant. Their method may be useful for massive osteolysis, but cannot show the interface between the posterior flange and the posterior part of the femoral condyle.

In contrast, the oblique posterior condylar view is technically easy, and allows the lateral and medial femoral condyles to be assessed separately. It is reproducible and significantly more accurate than the lateral radiographic view.\textsuperscript{5} Intra- and inter-observer agreement for the oblique posterior condylar view was excellent (kappa mean of intra-observer agreement 0.888 (0.82 to 1.00); kappa mean of inter-observer agreement 0.793 (0.74 to 0.82)).\textsuperscript{5} Even in posterior-stabilised knees, it is possible to see the posterior femoral condyles (Fig. 3) and we found intra- and inter-observer agreement to be excellent. For revision TKA, in particular we have found the oblique posterior condylar radiographic view to be useful for judging the need for augmentation or bone graft.

There are some drawbacks to the oblique posterior condylar view. First, it has a blind spot at the interface between the posterior aspect of the femoral condyles and the posterior flange. Secondly, it cannot be performed in patients with severe limitation of flexion angle of the knee, because the tibial component would block the femoral condyle. Thirdly, in patients with severe metallosis, assessment of the posterior aspect of the femoral condyles may be difficult.

Despite these problems, the oblique posterior condylar radiographic view is an easy and accurate procedure for evaluating radiolucencies of the posterior femoral condyles after TKA. It may be considered as suitable for routine follow-up radiographs of the femoral component and in pre-operative planning for revision surgery.

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References