



REVIEW / *Musculoskeletal imaging*

Acute traumatic knee radiographs: Beware of lesions of little expression but of great significance



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Abstract Knee radiographs are the first imaging modality performed in acute knee trauma, and in most of cases, the findings are obvious. Nevertheless, sometimes, only subtle clues can indicate a potentially more severe underlying abnormality, such as ligamentous, tendinous or meniscal tears. Knowledge of the origin of such signs and of the related underlying injury mechanism, might lead to additional imaging investigation, which may facilitate appropriate patient work-up and prevent consequences of delayed treatment.

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Knee radiographs, including frontal (antero-posterior) and lateral views, are the first imaging modality performed in acute knee trauma, its prescription being guided by two main validated clinical decision rules, which are the Ottawa knee rules and the Pittsburg decision rules [1,2] (Boxed text 1 and Boxed text 2). Plain radiographic findings in the acutely injured knee are most of the time obvious, however, sometimes only subtle clues indicate an underlying abnormality, which can be potentially severe [3]. Knowledge of normal knee anatomy and of a few key anatomic sites refines the detection of less apparent signs of some fractures, avulsion fractures, musculotendinous and ligamentous injury (Fig. 1). Early recognition of knee injuries both facilitates appropriate patient work-up and prevents long-term consequences of delayed treatment [4].

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Boxed text 1 Ottawa decision rules.

Radiograph of the knee indicated if one of the following is present:

- age > 55;
- tenderness of the head of the fibula;
- isolated tenderness of the patella;
- inability to flex at 90°;
- inability to bear weight in ED (4 steps).

Boxed text 2 Pittsburgh decision rules.

Radiograph of the knee indicated if one of the following is present:

- mechanism: blunt trauma or fall;
- age < 12;
- age > 50;
- inability to bear weight in ED (4 steps).

Lipohemarthrosis

Lipohemarthrosis refers to the presence of fat and blood in a joint and is a definite proof of an intra-articular fracture, even though the fracture may be radiographically occult. Lipohemarthrosis occurs in approximately 40% of all the intra-articular fractures of the knee joint and appears within 3 h after the trauma [5]. A fat fluid level (characteristic double fluid–fluid layer) in the supra-patellar pouch and in Hoffa's fat pouch, seen on a lateral knee radiograph, reveals the intra-articular fracture, as fat and blood enter the joint from a marrow space through an osteochondral defect at the articular surface of the joint (Fig. 2). Three bands can usually be distinguished in typical cases: the top one consisting of fat, the one just below in serum and serous joint effusion and the lowest consists of the cellular part of the blood, due to the loculation of the supra-patellar space. It should be mentioned that a conventional lateral view radiograph is sometimes not capable of depicting the fluid–fluid

level. A horizontal radiograph is needed to distinguish fat from serum.

Hemarthrosis

An immediate post-traumatic knee effusion indicates an intra-capsular injury, such as a ligament tear, but not necessarily a fracture [6]. On lateral radiograph, the effusion appears as soft tissue opacity. This is due to hemorrhage or hematoma around the patellar tendon and associated increased opacity of the retropatellar fat pad (Fig. 3). The normal sharp soft tissue-fat interface between the patellar tendon and the retropatellar fat pad is obliterated. In subtle effusion, a variable amount of fluid can be seen in the supra patella pouch and in Hoffa's triangle while, in large effusion, the patella can be displaced anteriorly and angled due to the pressure exerted by the fluid in the supra-patellar pouch.

Cruciate ligaments avulsion of the tibia eminence

Most avulsion injuries of the anterior or posterior cruciate ligaments occur distally, on their insertion on the anterior or posterior tibial eminence, rather than on their insertion site on the lateral and medial femoral condyles [7]. Avulsion of the tibial eminence can be associated with other injuries, including collateral ligament and meniscal tears and focal bone contusions. Diagnosis at radiography can be difficult and often requires additional tunnel-view and oblique imaging. CT and MR imaging can display the fracture site to greater advantage; MRI enables visualization of associated ligament and meniscal tears [8].

Fracture fragments near the anterior tibial eminence, particularly with the involvement of the tibial spines may suggest anterior cruciate ligament injury or avulsion. In this case, an antero-posterior radiograph may show a bony fragment projecting in the intercondylar notch with cortical irregularity of the adjacent tibial eminence, and the

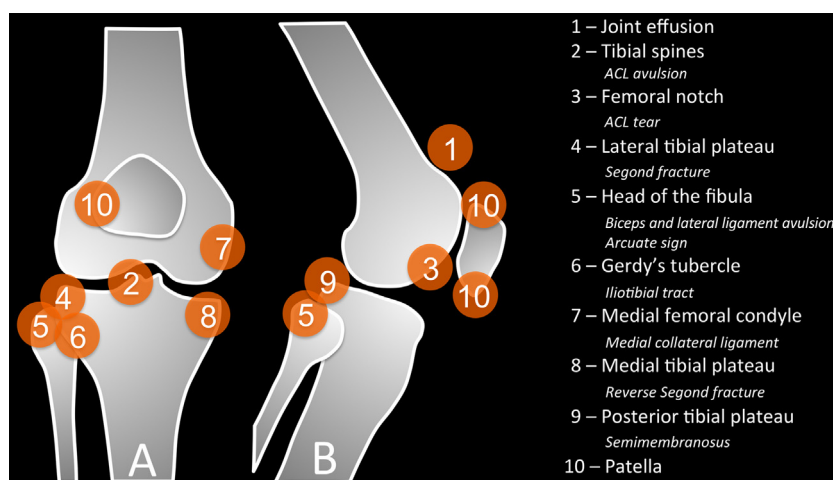


Figure 1. Schematic representation of the knee (frontal view in A, lateral view in B) demonstrating the different keys sites to be checked on traumatic knee radiograph.

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