

Lipohemarthrosis of the Knee: A Review of Recent Experiences¹

The radiographs of 268 patients with knee trauma were retrospectively reviewed. In 15 patients with intraarticular fracture, the images demonstrated fat-fluid levels. In 28 other patients with intraarticular fracture, only joint effusion without a fat-fluid level was depicted. The presence of a fat-fluid level in the knee indicated fracture in all patients in whom it was seen. The absence of such a level, however, did not exclude intraarticular fracture.

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TRAUMATIC lipohemarthrosis following intraarticular fracture of the knee joint has been described previously. Lipohemarthrosis can be demonstrated either on a horizontal cross-table lateral view or by depiction of the capsule on a vertical-beam lateral view of the knee joint (1). The first six cases of lipohemarthrosis were described by Kling in 1929, who found fat mixed with aspirated blood in patients with knee joint injury (2). In 1939, Holmgren first demonstrated the fat-fluid level radiologically by horizontal-beam technique (3). The current study was performed to (a) evaluate the frequency of lipohemarthrosis in patients with intraarticular knee fracture, (b) describe the associated fractures, and (c) determine if the absence of such a fat-fluid level could reliably exclude an intraarticular fracture.

PATIENTS AND METHODS

The radiographs of 268 patients with knee joint injury obtained at our institution in the past 5 years were reviewed. All patients had presented to the emergency room with knee pain after injury. Standard anteroposterior (AP) and horizontal cross-table lateral views were available for all patients. The patients were unselected except on the basis of availability of radiographs for review.

RESULTS

Of the 268 patients evaluated, 43 (16%) had intraarticular fractures. Twenty-eight (65%) of these had joint effusion (hemarthrosis) only, while 15 (35%) showed fat-fluid levels (Figs 1-3). Tibial plateau fractures were most frequently associated with fat-fluid levels (Table 1). The distribution of fracture in patients with joint effusion and no fat-fluid level is shown in Table 2. Tibial plateau fractures were noted in 27% of the patients with fat-fluid levels and in 25% of patients without a fat-fluid level.

Patellar fractures were more frequent in patients without a fat-fluid level (36%) than in those with a fat-fluid level (20%). Patients with tibial plateau fractures were more likely to have hemarthrosis (seven of 11, 64%) than lipohemarthrosis (36%). Of 13 patients with patellar fractures, 10 (77%) demonstrated only joint effusion. Conversely, patients with fractures of the tibial spines were more likely to exhibit fat-fluid levels (three of five, 60%) than hemarthrosis (40%).

DISCUSSION

Lipohemarthrosis caused by intraarticular fracture of the knee joint has been well described (1-4). Its appearance is due to a fracture of marrow-containing bone with release of marrow fat. Since fat floats on the accompanying blood, a fat-fluid level is present and may be demonstrated when the image is taken with a horizontal beam. The best method for demonstrating a fat-fluid level is the acquisition of a horizontal cross-table lateral view, now standard procedure in our hospital. Intraarticular fat may also be identified on vertical-beam lateral views by depiction of the knee joint capsule (1). In these cases, the capsule can be seen in profile as a water-density linear structure outlined on each side by fat. This determination is more difficult and almost certainly less sensitive than analysis of the cross-table lateral view. The only drawback to routine acquisition of the cross-table lateral view is the possibility that a small joint effusion may be missed (5). Butt et al suggest that the patient lie in one position for 5 minutes before a horizontal-beam radiograph is obtained, to allow the fat and blood to separate (6).

Familiarity with the appearance of

Abbreviation: AP = anteroposterior.

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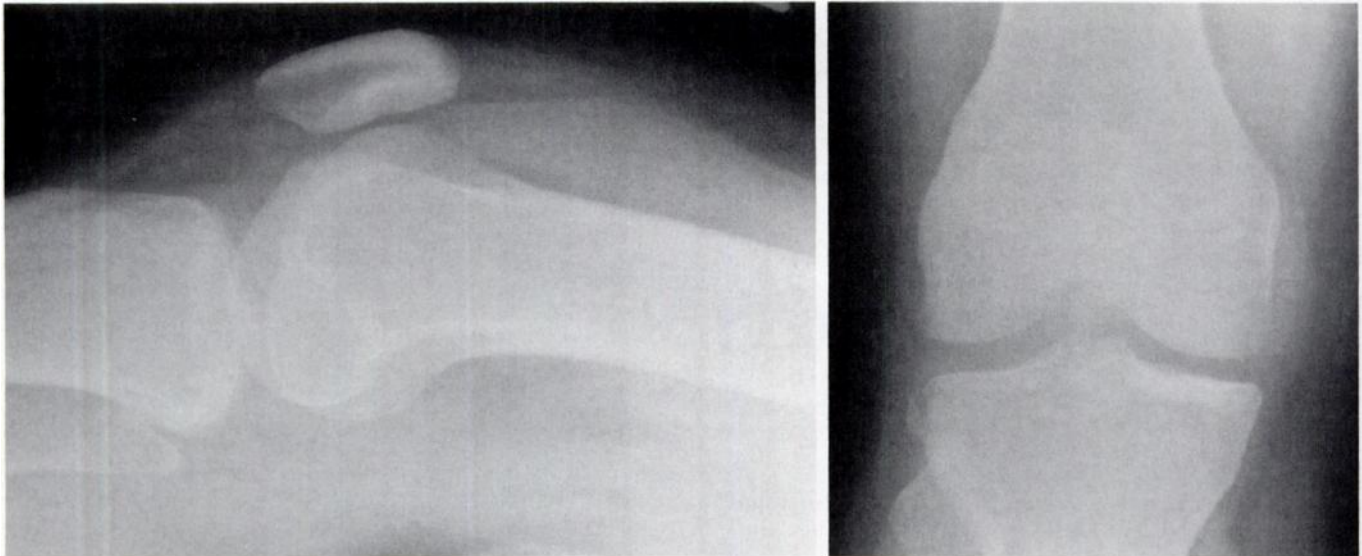
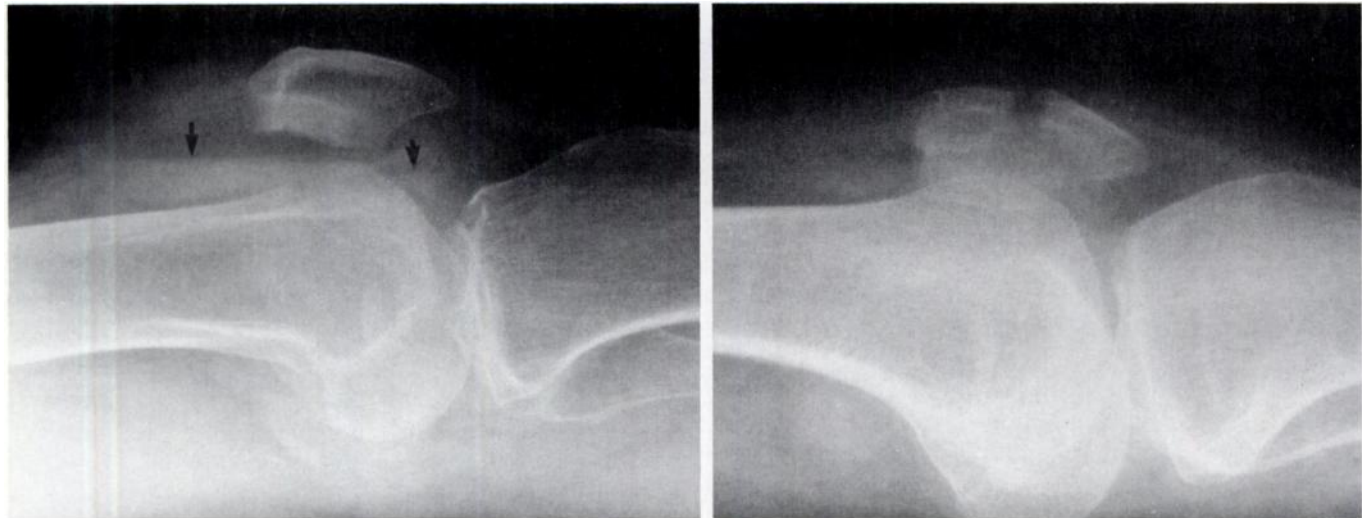


Figure 1. (a) Cross-table lateral radiograph of the knee shows a fat-fluid level in a patient with a Segond fracture. (b) The AP view shows the classic fracture of the lateral tibial margin.



Figures 2, 3. (2) Double fat-fluid levels (arrows) are well demonstrated in the cross-table lateral view of the knee in a patient with a lateral tibial plateau fracture. (3) Fracture of patella with fat-fluid level. There are no other fractures.

the suprapatellar pouch and its relationship to the suprapatellar fat will facilitate differentiation between intraarticular and suprapatellar extraarticular fat. Confirmation of a fat-fluid level can be made if the fat-fluid interface continues under the patella. Interestingly, free fat in the suprapatellar pouch does not outline the patellar cartilage.

Air-fluid levels may be seen after penetrating injury to the knee joint. The greater radiolucency of air in contrast to fat (Fig 4) usually makes the differentiation between the fat-fluid levels and air-fluid levels possible.

The appearance of a fat-fluid level may reflect anatomic variations of

the joint capsule. A double fat-fluid level has been described, for example, in association with a suprapatellar synovial plica (7) or lobulation of the joint capsule. In the present series, three radiographs of intraarticular fracture showed double fat-fluid levels, both in the suprapatellar and intrapatellar regions, probably due to anatomic lobulation of the joint capsule.

To our knowledge, our series is the largest modern evaluation of fat-fluid levels in the knee and confirms the strong association of these levels with intraarticular fracture. All patients with such a level demonstrated a fracture. Tibial plateau fractures and distal femoral fractures were

most often responsible for the finding, although the majority of patients with tibial plateau fractures (64%) actually did not exhibit lipoarthrosis. Our series supports the concept that all patients with a fat-fluid level in the knee have an underlying fracture, and, therefore, additional oblique radiography, tomography, (8) and or computed tomography are suggested if standard radiographs do not reveal the fracture. Most patients with isolated patellar fracture do not exhibit fat-fluid levels. This is in concert with prior reports. In three cases, however, patellar fracture was associated with a fat-fluid level, and no other fracture was identified.

The majority (65%) of intraarticular

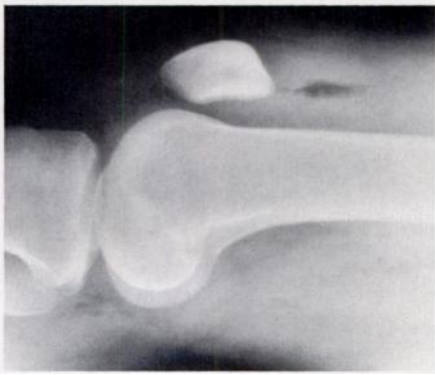


Figure 4. Penetrating injury of the suprapatellar area. Air in the suprapatellar region and soft-tissue swelling are noted. The characteristic density of the air distinguishes it from fat within the joint.

Table 1
Intraarticular Fracture with Fat-Fluid Level

Location of Fracture	No. of Cases*
Lateral tibial plateau	4 (27)
Distal femur	3 (20)
Patella	3 (20)
Tibial spine	3 (20)
Proximal tibia	1 (7)
Proximal fibula	1 (7)
Total	15

* Numbers in parentheses are percentages.

Table 2
Intraarticular Fracture with Joint Effusion and No Fat-Fluid Level

Location of Fracture	No. of Cases*
Tibial plateau	7 (25)
Tibial spine	2 (7)
Patella	10 (36)
Proximal tibia	3 (11)
Proximal fibula	1 (4)
Femur (supracondylar)	2 (7)
Proximal tibia and fibula	1 (4)
Lateral femoral condyle	1 (4)
Medial femoral condyle	1 (4)
Total	28

* Numbers in parentheses are percentages.

fractures in our series were not accompanied by fat-fluid levels and demonstrated only joint effusion. Possible explanations for this are disturbance of the fat-fluid level during movement of the patient, insufficient time for a fat-fluid level to form, rupture of the joint capsule, or inadequate technique (9). We use the cross-table lateral method in all patients and have become quite proficient at it. Still, improper centering could result in failure to detect a level. Although Saxton suggests that 10–20 mL of fat and 80–100 mL of blood are required to form a visible level (10), it is likely that much smaller amounts of fat and fluid are actually necessary. Another possible explanation is alteration in the distribution of marrow fat (11). Visual inspection of magnetic resonance images does, however, show fatty marrow in all these locations, including the patella.

The coincidence of proximal fibular fracture with a fat-fluid level may be explained by the communication that may be present between the tibiofibular joint and the knee joint proper (12).

We conclude that intraarticular fractures are most often accompanied by hemarthrosis (65%), not lipohe-marthrosis. The absence of lipohe-marthrosis, therefore, does not exclude a fracture. The presence of a fat-fluid level in the knee joint is essentially always due to intraarticular fracture. The fractures most often associated with fat-fluid levels are tibial plateau fractures. Most patellar fractures are not accompanied by lipohe-marthrosis, and the highest frequency of a fat-fluid level occurred with tibial spine fractures. ■

References

1. Sacks BA, Rosenthal DI, Hall FM. Capsular visualization in lipohe-marthrosis of the knee. *Radiology* 1977; 122:31–32.
2. Kling DH. Fat in traumatic effusions of the knee joint. *Am J Surg* 1929; 6:71–74.
3. Holmgren BS. Röntgenologisch beobachtete niveaus zwischen blut und fett im kniegelenk bei intraartikulärer fraktur. *Upsala Lakareförenings Forhandlingar* 1939; 139–142.
4. Holmgren BS. Flussiges fett im kniegelenk nach trauma. *Acta Radiol* 1942; 23:131–137.
5. Singer AM, Naimark A, Felson D, Sharpiro JH. Comparison of overhead and cross-table lateral views for detection of knee-joint effusion. *AJR* 1985; 144:973–975.
6. Butt WP, Lederman H, Chuang S. Radiology of the suprapatellar region. *Clin Radiol* 1983; 34:511–522.
7. SanDretto MA, Carrera GF. The double fat-fluid level: lipohe-marthrosis of the knee associated with suprapatellar plica synovialis. *Skeletal Radiol* 1983; 10:30–33.
8. Apple JS, Martinez S, Allen NB, Caldwell DS, Rice JR. Occult fractures of the knee: tomographic evaluation. *Radiology* 1983; 148:383–387.
9. Kusmar V. The shifting level in traumatic lipohe-marthrosis. *Injury* 1971; 3:13–17.
10. Saxton HM. Lipohe-marthrosis. *Br J Radiol* 1962; 35:122–127.
11. Mitchell DG, Vijay MR, Murray D, et al. Hematopoietic and fatty bone marrow distribution in the normal and ischemic hip: new observations with 1.5-T MR imaging. *Radiology* 1986; 161:199–202.
12. Warwick R, Williams PL, eds. *Gray's anatomy of the human body*. 35th British ed. Philadelphia: Saunders, 1973; 453.