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Case Report

The Use of Ultrasonography in Suspected Tibia Plateau Fracture with Lipohemarthrosis: A Case Report

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Knee pain is a common complaint in rehabilitation outpatient clinics. Plain radiography is typically used to detect knee pain and trauma. However, a slight depression plateau fracture could be easily overlooked on plain radiography. This is a case report of a 57-year-old woman with left knee pain who visited the outpatient clinic for help. Ultrasonography showed fat-fluid level, but plain radiography did not reveal any fracture. Magnetic resonance examination confirmed the depression fracture of the tibial plateau and the lipohemarthrosis. Lipohemarthrosis is a highly sensitive predictor of intra-articular surface fractures. Ultrasound is a convenient and reliable tool to detect lipohemarthroses of the knee, implying further evaluation, especially if plain radiography is negative or uncertain. (Tw J Phys Med Rehabil 2022; 50(2): 145 - 151)

Key Words: lipohemarthrosis, tibial plateau fracture, ultrasonography

INTRODUCTION

Knee pain is a common complaint after trauma. Ultrasonography (US) is routinely performed as the initial examination to rule out effusion. In some circumstances, bone contours may be nicely demonstrated by US, allowing diagnosis of cortical irregularities. In the case presented here, the location of the depressed fracture (type III Schatzker’s classification) would not permit its detection by US. However, the presence of lipohemarthrosis, easily demonstrated by US, should conduct the radiologist for further examination, either by computed tomography (CT) or by magnetic resonance imaging (MRI). If lipohemarthrosis is identified by high-resolution ultrasonography, then intra-articular fractures are highly suspected. Lipohemarthrosis is defined as the presence of blood and fat in the joint cavity. It is present in 35%-41% of intra-articular fractures in the knees. There are many tools that can detect lipohemarthrosis, including plain radiography, CT, MRI and ultrasound. The cross-table lateral view of plain radiography is the most sensitive method for detecting intra-articular lipohemarthrosis at the knee in the past. Plain radiography distinguishes the fluid levels based on radiodensity. The double fluid-fluid level is more specific for lipohemarthrosis. However, when a simple fluid-fluid level is present, hemarthrosis should also be considered. CT and MRI are both gold standard imaging modalities for the detection of lipohemarthrosis. MRI was selected to further evaluate this case in
order to avoid radiation exposure. It can reveal fluid-fluid levels due to differences in tissue relaxation.[7]

**CASE REPORT**

A 57-year-old woman with a medical history of hypothyroidism and coronary heart disease presented to the rehabilitation outpatient clinic with dull pain and swelling in her left knee. She reported that she experienced left knee pain after jumping from a height of 50 cm (about two steps of stairs) in the morning prior to consultation. She could not elevate her left knee or walk because of worsening pain. Therefore, she visited the outpatient clinic for further assessment and management. At the outpatient clinic, a palpable mass approximately 7cm × 2cm on the left suprapatellar recess was found on physical examination. It was associated with swelling, pain, and tenderness on the left knee. After discussion with the patient, we arranged for further evaluation. Ultrasound examinations were arranged initially. The patient was placed in a supine position with the knee extended for evaluation. The linear transducer used was a Logiq S7 Expert R3 Ultrasound Machine with 8.0 MHz (General Electric Ultrasound Korea, Ltd., Seongnam-si, Gyeonggi-do, Korea). Ultrasoundography revealed multiple areas of hypoechoic lesions on the vastus lateralis. A 1.46 cm thick gray hyperechoic mass was found near the patella insertion area, between the prefemoral and suprapatellar fat pads (Figure 1). The transverse view of the left knee showed a hyperechoic mass lesion with fluid-fluid levels (Figure 2). Effusion of the medial and lateral joint lines was also noted. Plain radiography examinations were performed to assess the possible skeletal injury.

Left knee x-ray examinations were performed. Anteroposterior radiographs of the knee did not show any apparent fracture. However, a hyperdense mass was found in the suprapatellar recess. The effusion was visible on the lateral X ray view behind the patellar tendon. Discontinuity of posterior tibia plateau was also revealed by lateral view of the knee (Figure 3a). MRI was performed under the suspicion of knee effusion related to occult fracture.

The MRI showed a fracture of the lateral tibial plateau with slight depression (Figure 3b). Focal bone marrow edema in the distal femur and lateral tibial plateau was also observed. Moderate lipohemarthrosis of the left knee joint with three-layered joint effusion and synovial enhancement were noted (Figure 4). After knee plastic orthosis treatment, she visited our outpatient clinic for follow-up two months later. The left knee ultrasound was performed again. The effusion significantly improved. The patient can ambulate as usual without knee pain.

![Figure 1. Longitudinal ultrasonography of the left knee under Doppler window shows marked distension of the suprapatellar pouch with echogenic fluid. Fluid-fluid level(arrow) ±:Thickness of about 1.46 cm.](image)
Figure 2. Transverse ultrasonography of the left knee showed floating fat and fluid-fluid level (arrow). The serum level and cellular level margin are blurred (arrow head). It may be related to the time of injury.

Figure 3. Lateral view of the left knee (Figure 3a). A hyperdense effusion is found on suprapatellar pouch area (hollow arrow). Blurred margin of posterior tibia plateau was seen by the radiography (arrow). T2 sagittal (Figure 3b). The effusion is visible in the same position compared to the lateral view (hollow arrow). Slight depression and focal bone marrow edema (arrow) in the lateral posterior tibial plateau are noted. A double fluid-fluid level (arrowhead) and the plica separate (curved arrow) are also found.
DISCUSSION

Traumatic knee pain with effusion is common among patients seen in outpatient rehabilitation clinics. The most common traumatic causes of knee effusion are ligamentous, osseous, meniscal, and overuse syndromes.\(^1\) Plain radiography is the most common examination for the initial evaluation of traumatic knee pain due to its availability, low cost, and short examination time.\(^9,10\) High-quality radiographs can easily detect fractures around the knee. However, some fractures such as tibial plateau fractures, segond fractures, stress fractures, and fibular head fractures may be difficult to detect even with optimal images.\(^11\)

This case report is an example of a type of knee fracture (type III Schatzker’s classification) that was difficult to detect initially through ultrasound. However, high-resolution ultrasonography is a reliable and accurate method for the evaluation of lipohemarthrosis, which is an indicator of intra-articular fractures.\(^1\)

Ultrasonography (Figures 1 and 2) show floating fat levels in the upper part of the patellar bursa. However, the unclear margin of the serum and cellular levels are not definitive of the diagnosis when the patient is immobilized for a few minutes only. Timing of ultrasound examinations may be the most important aspect of this diagnostic dilemma. A previous study of six patients examined by ultrasonography showed a single fluid-fluid level appearance of a joint effusion after few minutes of immobilization. A superior echogenic layer made of fat and an inferior hypoechogenic layer filled with blood was found. However, double fluid-fluid level of joint effusion representing fat (superior hyperechogenic), serum (intermediate anechoic), and blood cells (inferior hypoechogenic) were found after patients was immobilized for 3 h.\(^12\) The greater duration of immobility prior to MRI may explain the definitive presence of double fluid-fluid level, as compared with ultrasonography that may be done immediately after the injury. A single fluid-fluid level in post-traumatic knee joints does not necessarily represent lipohemarthrosis. A double fluid-fluid level would mean the presence of lipohemarthrosis.\(^5\)

The patient was scheduled for MRI on the same day. The hypointense change in the posterolateral part of the tibial plateau revealed bone marrow edema and fracture with slight depression (Figure 3b). The MRI findings were then compared with the radiography results (Figure 3a) that also showed blurred and irregular cortex lines on the posterior tibial plateau. Furthermore, there were two different horizontal levels seen in the axial view (Figure 4); this may be related to the plica synovial fluid that sepa-
rates the fluid into two compartments.\(^{[13]}\)

It is difficult to find direct signs of fracture such as cortical disruption in the intra-articular fracture due to the limitation of ultrasound penetration. However, some small joints, such as the elbow, especially in children, are useful tools for detecting occult fractures with normal plain radiographs.\(^{[14]}\) Indirect signs such as lipohemarthrosis and the posterior fat pad sign are used to diagnose fractures in elbow trauma in children.\(^{[15,16]}\)

Therefore, ultrasonography may also imply an intra-articular fracture of the knee.

Some rare mechanisms such as traumatic rupture of synovial membranes, capsuloligamentous structures, and intra-capsular fat pad injury should be considered as possible etiologies of the release of intra-articular fat in the patellar bursa. However, the most common mechanism of lipohemarthrosis is intra-articular fracture.\(^{[17]}\)

Ultrasound is a convenient and reliable modality not only to evaluate for lipohemarthrosis but also to guide the needle aspiration.\(^{[18]}\) It is important that the patients have a quick diagnose immediately by using ultrasound and corresponding treatment, in comparison to MRI and CT.

Here, we highlighted this case of lipohemarthrosis and successfully diagnosed by ultrasonography.

## CONCLUSION

The ultrasound provides an effective, easy-availability evaluation for initial patient of acute knee trauma and avoid radiation. The fat-fluid level sign of knee joint effusion is visible under ultrasonography, providing promising diagnostic measure for physiatrist and considering the most common etiology is intra-articular fracture, and the tibial plateau fracture should be considered.

## REFERENCES


Ultrasonography in Suspected Tibia Plateau Fracture with Lipohemarthrosis

Hsiao, W. N., Chen, P. H., & Tsai, S. W.

A 57-year-old female patient presented with left knee pain. Ultrasonography showed multiple layers of joint effusion, but X-ray did not reveal a clear fracture. MRI diagnosed tibial plateau fracture with joint effusion and fat. Joint effusion and fat are often indicative of a fracture in the joint cavity. When ultrasonography shows joint effusion and fat, but X-ray does not show a clear fracture, further tests should be arranged.

Keywords: joint effusion and fat (lipohemarthrosis), tibial plateau fracture (tibial plateau fracture), ultrasonography (ultrasonography)