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Traumatic hip joint tamponade

Two cases with femoral head ischaemia

Two elderly patients had pain after hip trauma with no radiographic evidence of fracture. Computed tomography demonstrated capsular haematoma. Scintimetry revealed femoral head ischaemia. Intracapsular hip joint pressure in extension was 240 and 176 mm Hg, respectively, in neutral position and 280 and 360 mm Hg in internal rotation. The hip joints were aspirated for 8 ml and 5 ml of blood, respectively, leading to pain relief and regained radiotracer uptake in the femoral head. It is concluded that traumatic hip joint tamponade may cause femoral head ischaemia which may be reversed by aspiration.

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The possibility of hip joint tamponade as a causal factor in the development of avascular femoral head necrosis has been proposed by several investigators (Soto-Hall et al. 1964, Calandruccio & Anderson 1980, Deyerle 1980). This hypothesis has been confirmed in animal studies (Woodhouse 1964, Tachdjian & Grana 1968, Launder et al. 1981) but not in man; the immediate effect on femoral head vascularization of hip joint tamponade could not be demonstrated before the era of radionuclide scintimetry.

We present two cases of traumatic hip joint effusion with high intracapsular pressures and femoral head ischaemia. After joint aspiration, the femoral head ischaemia was reversed.

Case reports

Case 1

A 75-year-old man, with no previous history of arthropathy and in good physical condition, fell 0.5 m from a ladder, sustaining a trauma to his right hip. He had severe pain at rest and was unable to walk. Conventional radiographs of the hips in AP and lateral views did not reveal any fracture or other pathological findings. ^{99m}Tc-MDP-scintimetry was performed 2 days after the trauma (Figure 1 A) and evaluated as described by Strömqvist (1983), i.e. regions of interest were selected over the femoral head and trochanter bilaterally and uptake ratios injured/intact side determined. The femoral head ratio was 0.56, i.e. a 44 per cent reduction on the trauma side, indicating reduced blood flow. The trochanteric ratio was 1.60, indicating the possibility of an infraction not demonstrated on conventional radiographs.

Three days later, computed tomography (Toshiba TCT 80 A) performed in a transverse plane across both hip joints showed an intracapsular haematoma (Figure 2) distending the capsule of the symptomatic hip. On the same day the hip joint was aspirated under local anaesthesia with image intensifier guidance antero-laterally over the neck of the femur. A 1.4 mm epidural needle was used, connected via a saline-filled closed system to a piezo-electric transducer. Pressure data were recorded graphically and digitally. The intracapsular pressure was recorded at 240 mm Hg with the patient supine and the hip in extension and neutral position. In extension and inward rotation the pressure rose to 280 mm Hg; in extension and outward rotation, it was 175 mm Hg; in 10° of flexion it was 120 mm Hg; whereas in 45° of flexion the pressure was reduced to 30 mm Hg. Eight ml of blood with some free fat droplets were aspirated, reducing intracapsular pressure in neutral position to 0 mm Hg (Table 1).

Immediately after aspiration, the patient was markedly relieved from pain with an increase in active and passive range of motion.

Follow-up scintimetry 24 h later (Figure 2) showed restitution of isotope uptake in the head of the fe-

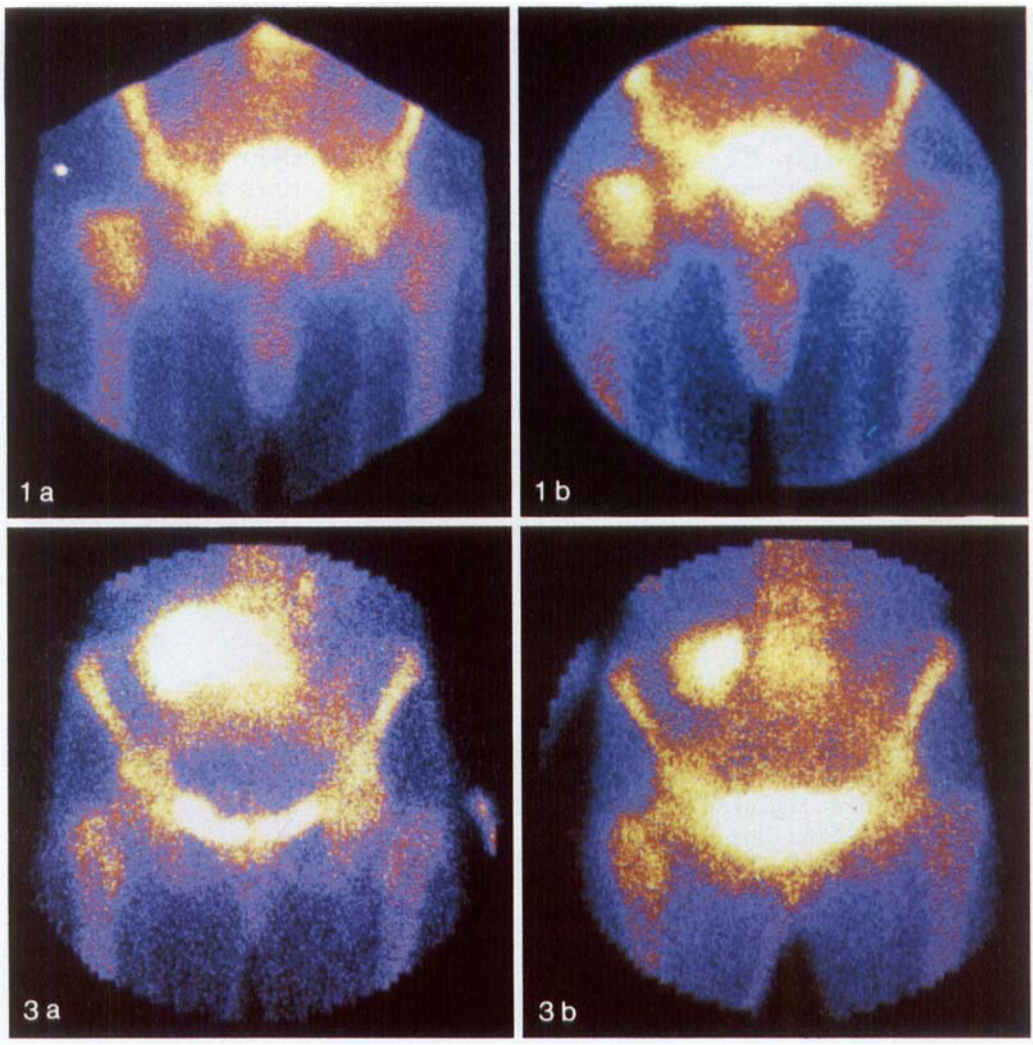


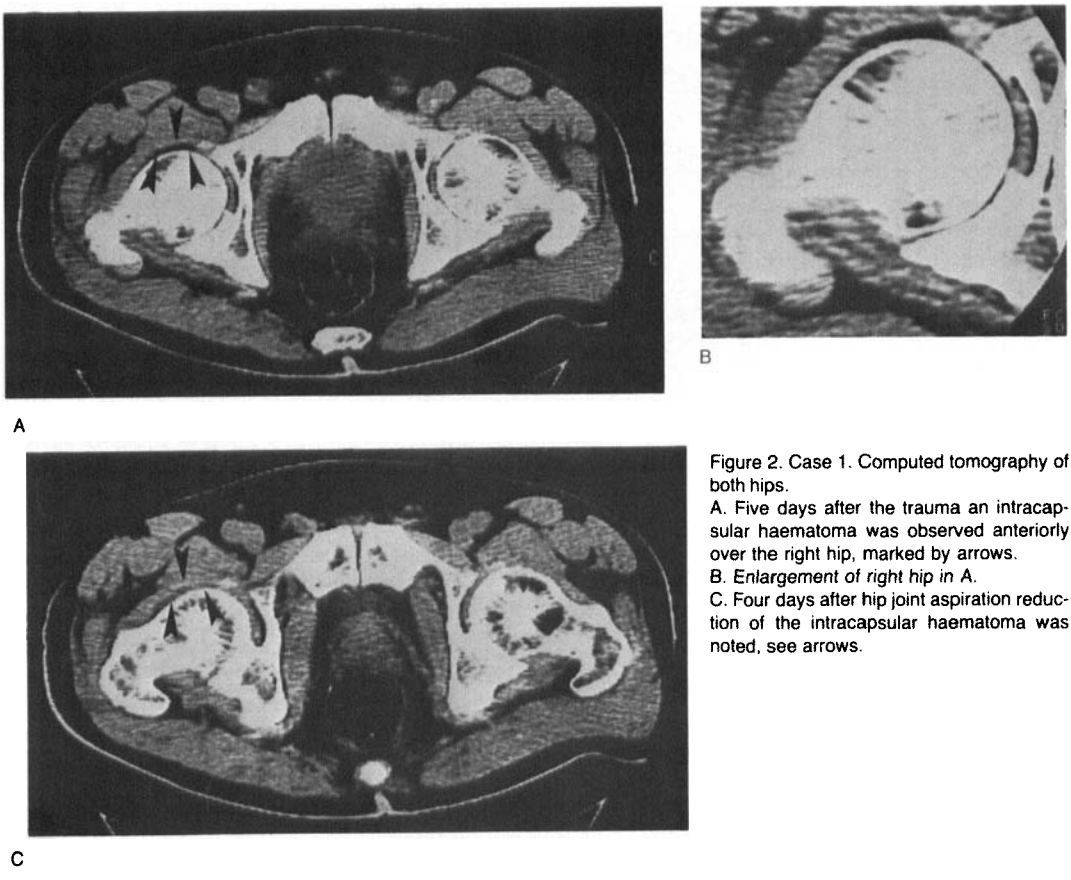
Figure 1. Case 1. ^{99m}Tc-scintimetry of both hips. A. Two days after the trauma there was uptake deficiency over the right femoral head, ratio right/left 0.56. B. The day after hip joint aspiration the isotope uptake over the femoral head was normal, ratio right/left 1.01.

Figure 3. Case 2. ^{99m}Tc-MDP-scintimetry of both hips. A. On the day after the trauma, a moderate uptake reduction was seen over the right femoral head, ratio right/left 0.78. B. Twelve hours after hip joint aspiration the femoral head isotope uptake on the right side had increased, giving a ratio right/left side of 1.15.

mur, with the ratio 1.01. Three days later, computed tomography (Figure 2) showed markedly reduced intracapsular distension. The patient was mobilized and underwent a second follow-up scintimetry 17 days after the accident, revealing the same pattern of uptake restitution as in the postaspiration examination. The patient was then discharged, walking with minimal discomfort.

Case 2

An 82-year-old woman with cardiosclerosis and pulmonary emphysema fell on her right hip when tripping over a carpet. She had no previous history of hip disorder. Due to pain on weight bearing, she was unable to walk, but conventional AP and lateral radiographs the same day were normal. ^{99m}Tc-MDP-scintimetry 24 h after the accident (Figure 3) did not reveal evidence of cervical fracture; the femoral head



A

B

C

Figure 2. Case 1. Computed tomography of both hips.
A. Five days after the trauma an intracapsular haematoma was observed anteriorly over the right hip, marked by arrows.
B. Enlargement of right hip in A.
C. Four days after hip joint aspiration reduction of the intracapsular haematoma was noted, see arrows.

of the symptomatic hip showed a reduced radiotracer uptake, ratio 0.78, while the trochanteric uptake was increased, ratio 1.40, raising the suspicion of infraction. Computed tomography on the same day (Figure 4) showed an intracapsular haematoma in the symptomatic hip.

The intracapsular pressure was 176 mm Hg with the patient supine and the hip in a neutral, extended position; in extension and inward rotation pressure was 360 mm Hg; in extension and outward rotation pressure was 160 mm Hg; whereas in 45° of flexion it was reduced to 9 mm Hg. Aspiration of 5 ml of blood with some free fat reduced the intracapsular pressure in neutral position to 0 mm Hg (Table 1). Immediately after aspiration, the patient was markedly relieved from pain and an increased active as well as passive range of motion was noted. Follow-up scintimetry 12 h after aspiration showed restored isotope uptake in the femoral head (ratio 1.15) (Figure 3). The patient was able to walk with little discomfort 2 weeks after the trauma, and a second follow-up scintimetry at this time was unchanged as compared to the postaspiration examination.

Table 1. Intracapsular pressures recorded in two cases of traumatic hip joint tamponade

	Case 1		Case 2	
	mm Hg	kPa	mm Hg	kPa
Position of the hip				
Extension, neutral	240	32.0	176	23.5
Extension, inward rotation	280	37.3	360	48.0
Extension, outward rotation	175	23.3	160	21.3
Flexion 10°	120	16.0	105	14.0
Flexion 45°	30	4.0	9	1.2
Amount of aspirate (ml)	8		5	
Pressure after aspiration	0	0	0	0

Discussion

In both cases the joint pressure recorded with the hip in neutral position exceeded the arteriolar pressure of previous investigations (Howell 1955, Ashton 1975) and may thus be held responsible for the femoral head ischaemia shown by scintimetry prior to aspiration. Hip joint pressure in neutral position after femoral

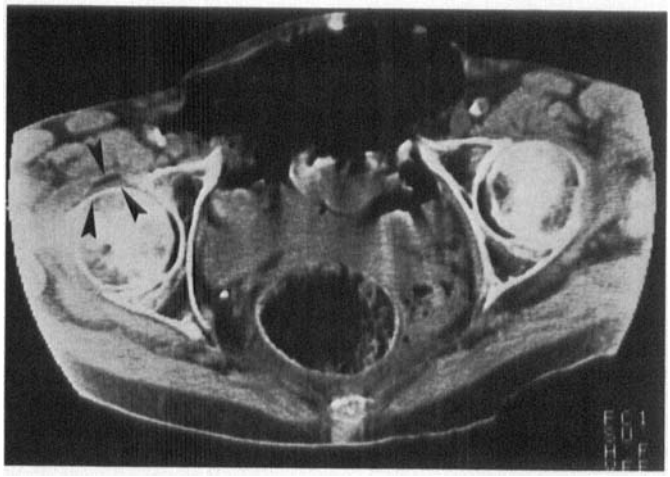


Figure 4. Case 2. Computed tomography of both hips. On the day after the trauma an intracapsular haematoma was seen ventrally over the right hip (marked with arrows).

neck fracture has been registered between 0 and 20 mm Hg previously (Soto-Hall et al. 1964, Körner et al. 1981); possibly the hip in most fracture cases is drained through a capsular rupture or through the fracture, a possibility that did not exist in the two cases presented here.

Hip joint effusion has been considered a contributory aetiologic mechanism in necrosis of the femoral head after cervical fracture (Soto-Hall et al. 1964, Calandruccio & Anderson 1980, Deyerle 1980) and also in the development of Legge-Calvé-Perthe's disease (Kloiber et al. 1983, Wingstrand et al. 1984). In this development, the time factor must be of considerable importance. In animal studies, the cells of the femoral head seem to tolerate complete anoxia for no longer than 6–12 h (Woodhouse 1964, Henard & Calandruccio 1971, Launder et al. 1981), and there is no reason to expect a higher tolerance in elderly humans. On the other hand, different degrees of subtotal hypoxia may exist, depending also on variation in the position of the hip adopted by the patient. In flexion, intracapsular pressure falls markedly.

Scintimetry and computed tomography have in our report demonstrated for the first time that hip joint aspiration may improve the metabolic status of the femoral head. This may make it possible to evaluate the effect of aspiration in femoral neck fracture both in the short term regarding vascularization and in the long term regarding avascular necrosis. Restored femoral head vascularization after femoral neck fracture reduction has been demonstrated in some cases by oxygen tension measurement (Woodhouse 1962) and arteriography (Müssbichler 1970). On the other hand, the possibility of a negative effect on femoral head vascularization by the procedure of osteosynthesis was proposed by Linton (1944) and has recently been proven (Strömqvist 1983, Strömqvist et al. 1984). Femoral head vitality prior to as well as after femoral neck fracture surgery, thus, seems to depend on several interacting factors. "Idiopathic" femoral head necrosis may in some cases be preceded by months or years by "subclinical" fractures with transient hip joint haemarthrosis; this theory could also explain why idiopathic femoral head necrosis is common in alcoholics as they often sustain repeated traumata without seeking medical care. This would add to the risk of metabolic changes induced in alcoholics.

In transient synovitis of the hip in children, hip joint effusion *per se* could cause ischaemia of the proximal femoral epiphysis, the vascular supply of which is completely dependent on capsular vessels from the medial circumflex artery. This mechanism has been suggested as a possible aetiological factor in the development of Legg-Calvé-Perthes disease. In some cases of transient synovitis there is ischaemia of the proximal femoral epiphysis either spontaneously recovering (Wingstrand et al. 1984) or following joint aspiration (Kloiber et al. 1983). Intracapsular pressures in these cases are de-

pendent on the position of the hip and amount to 57–130 mm Hg in extension in neutral position (Wingstrand et al. 1985), which would be enough to compromise blood flow to the proximal femoral epiphysis. The position of extension should thus be avoided in these cases and possibly also after fresh femoral neck fracture.

In conclusion, the cases reported here have, for the first time, demonstrated to us by computed tomography a hip joint haematoma and its disappearance after aspiration as well as a scintimetric femoral head uptake defect, reversed after joint aspiration.

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