Case report

Traumatic chylous knee effusion

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SUMMARY A 47-year-old patient presented with a chylous knee effusion and traumatic infected skin lacerations. The diagnosis of septic arthritis was considered because of purulent looking joint fluid, spuriously high synovial fluid white cell count, and signs of acute knee synovitis. Synovial fluid lipid analysis showed increased total lipids due to high concentration of neutral lipids, mainly triglycerides, and repeated knee radiographs showed a small fracture of the tibial spine. Joint trauma with subchondral fracture can be associated with frank chylous effusion, which may mimic acute septic arthritis.

Key words: trauma, fat.

Chylous or milky joint effusions have been described in association with longstanding rheumatoid arthritis, systemic lupus erythematosus, and as a consequence of lymphatic obstruction in chronic filariasis.¹⁻³

This report describes a unique patient with a chylous knee effusion that developed acutely after trauma. There was an associated small subchondral fracture of the tibial spine, which was not recognised on the initial radiographic study. Joint trauma or subchondral fractures have not been previously reported as causes of chylous synovial effusions. The synovial fluid lipid profile in this case showed increased amounts of total lipids due to high concentrations of neutral lipids in the form of triglycerides.

Case report

A 47-year-old black man presented to the hospital of the University of Pennsylvania with left knee pain and swelling associated with fever. Ten days earlier he had been assaulted with a baseball bat and had sustained superficial lacerations of the scalp and

distal third of the left anterior pretibial region. Three days before admission he experienced fever and chills. Owing to increased swelling and discomfort of his left knee, he was admitted to the hospital. There was no previous history of arthritis or other illnesses.

On physical examination the temperature was 39.5°C. Positive findings were confined to the left lower extremity, where there was diffuse erythema, warmth, tenderness, and mild oedema extending from the lower mid-calf to just below the knee. Two fluctuant wounds draining purulent material were noted on the distal third of the anterior pretibial region. The left knee was swollen with a large effusion, diffusely tender on palpation, and showed mild limitation of range of motion.

Roentgenograms of the left knee, tibia, and fibula were reported to be normal, except for soft tissue swelling. Laboratory studies showed a packed cell volume of 48% and white cell count of 17 000/mm³ ($17 \times 10^9/l$), with 85% polymorphonuclear leucocytes. Wound drainage showed abundant bacteria, which subsequently were identified as *Streptococcus pyogenes* and *Enterobacter cloacae*. Aspiration of the left knee joint yielded 15 ml of thick, creamy pink synovial fluid (Fig. 1a). After centrifugation of this fluid a distinct creamy lipid layer formed as supernatant (Fig. 1b). The automated white cell count was reported to be too numerous to count, but

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(a)

(b)

Fig. 1 Cloudy haemorrhagic synovial fluid aspirated from the left knee (a), which after centrifugation (b) separated into a creamy supernatant fat layer and red cells at the bottom.

(a)

(b)

Fig. 2 Fresh smear of synovial fluid. (a) Unstained specimen showing abundant non-birefringent fat globules. ($\times 10$). (b) Oil red stain showing numerous positively stained fat droplets. ($\times 30$).

Table 1 Percentage of lipids* present in synovial fluid of a patient with traumatic chylous effusion

Synovial fluid	Triglyceride (%)	Diglycerides (%)	Free fatty acids (%)	Free and esterified cholesterol (%)	Total neutral lipids (%)	Total phospholipids (%)	Total lipids (mg/100 ml)
Normal synovial fluid†	15.7±2.1	2.5±1.0	1.7±0.7	47.1±5.3	65.5±5.1	32.5±3.7	5±0.8
Patient	83.37	1.85	1.39	11.35	97.96	2.04	1227

*Values are mean±SD.

†Pooled.

SI conversion: mg/100 ml×0.01=g/l.

one was greater than 100 000 cells/mm³ ($100\times 10^9/l$). A fresh drop preparation showed that the specimen contained red blood cells and innumerable fat globules, which stained deep red with oil red S stain (Fig. 2b). Some of these fat globules had been ingested by synovial cells and had the appearance of lipid-laden mononuclear cells on Wright's stain. The white cell count was 500 cells/mm³ ($0.5\times 10^9/l$), with 80% large, foamy mononuclear cells in this preparation. No bone marrow elements or crystals could be identified. Three subsequent synovial fluid aspirations yielded the same results, but cultures for bacteria were negative. Serum lipids, amylase, and lipase were normal. Because of the persistent presence of fat in the synovial fluid, left knee roentgenograms were repeated. They showed a small avulsion fracture of the anterior tibial spine.

The patient was treated with bed rest and a course of cephazolin and gentamycin for his skin infection. He made an uneventful recovery, with complete resolution of the knee effusion in 10 days.

SYNOVIAL FLUID LIPID ANALYSIS

5 ml of chylous synovial fluid was centrifuged for five minutes at 100 g. Total lipids, neutral lipids, and phospholipids were measured in accordance with techniques previously reported by one of the authors in a study of lipid composition of synovial fluid.⁴ (Values for total neutral lipids, neutral fat, and phospholipids from pooled normal synovial fluid from that study were used as a control.) The synovial fluid lipid profile showed increased total lipids up to 1227 mg/100 ml (12.27 g/l) due to the presence of neutral lipids, with 83.37% of them in the form of triglycerides (Table 1).

Discussion

Synovial effusions that appear milky or creamy have been described as chylous or chyliform when they contain a lipid concentration greater than 800 mg/100 ml (8 g/l).³ Chylous material has been found in joints, bursae, and tendon sheaths of patients with longstanding rheumatoid arthritis,^{1,5,6} as unique occurrences in the ankle joint of a patient with systemic lupus erythematosus, and in the knee joint of 25 patients with filariasis.³ In our review of the literature direct joint trauma or subchondral fracture have not been described as a cause of chylous effusion.⁷

The articular cavity is surrounded by abundant subsynovial fatty tissue.⁷ Any conditions which may induce fat necrosis, such as trauma, ischaemia or increased pancreatic enzyme activity, can produce the appearance of increased amounts of fat in the joint.⁸⁻¹¹ Increased intra-articular lipid synthesis as a

result of chronic intra-articular inflammation and damage of synovial lymphatic vessels with decreased articular lipid clearance are the other two factors that also may increase intra-articular lipid concentration.^{1,3}

Joint trauma with or without acute internal derangement or subchondral fracture can be associated with fat necrosis and with damage in blood vessels and lymphatics of the synovial membrane.⁸ Intra-articular fat release is assayed in the synovial fluid of the patient discussed here by increased concentration of neutral lipids and triglycerides, which ordinarily make up 90% of the lipids found in the synovial membrane, intra-articular fat pad, and bone marrow.⁴ This finding suggests that fat released by trauma from the bone marrow or intra-articular fat pad was the leading cause of this chylous effusion.

Although areas of cellulitis were present on the distal third of the leg, no signs of lymphangitis were observed, which may also account for the abnormal lymphatic flow. In some patients chronic haemarthrosis, with subsequent lysis of red blood cell membranes, may be a contributing factor by increasing phospholipid concentration,¹² but in our patient synovial fluid phospholipid levels were lower than normal (Table 1).

The arthritis observed in patients with exocrine pancreatic disease and raised serum pancreatic enzymes may also be associated with intra-articular fat necrosis and creamy synovial fluid.¹⁰ Synovial fluid lipid analysis in these cases showed raised levels of triglycerides and marked increase in free fatty acids due to increased lipolytic activity. In our case no clinical symptoms suggestive of pancreatic disease were observed (serum pancreatic enzymes and synovial fluid free fatty acids were within normal limits) (Table 1).

Chylous effusions may also be due to increased lipid synthesis by chronically inflamed synovium, bursae, or tendon sheaths. Newcombe *et al*^{1,5,6} described the synovial fluid lipid profile of a patient with rheumatoid arthritis containing cholesterol crystals.¹ Cholesterol and phospholipid levels were significantly higher than those obtained in the sera and in non-chylous effusions from other patients with rheumatoid arthritis.¹ Isotopic studies with ¹⁴C-labelled acetate indicated an early high radioactive uptake in the chylous synovial fluid when compared with the serum. These findings suggested a local increased synthesis of cholesterol and phospholipids by rheumatoid synovium.

Lipid analysis of a chylous effusion of a patient with systemic lupus erythematosus complicated by nephrotic syndrome and hyperlipidaemia showed increased synovial fluid concentrations of chole-

sterol, phospholipids, and chylomicrons when compared with serum levels, suggesting also increased local synthesis.²

The largest series of patients with chylous effusions has been described by Das and Sen.³ They studied 25 patients with filariasis who had chylous arthritis with signs of acute knee inflammation simulating septic arthritis but with sterile effusion of a self limited course similar to the patient discussed here. Synovial fluid total lipid means value was 1240 ± 288 (SD) mg/100 ml (12.4 ± 2.88 g/l) but not individual lipid analysis or synovial fluid cytology were reported. However, synovial biopsies in patients showed inflammatory changes with polymorphonuclear infiltrates, and lymphangiogram performed in five patients showed periarticular lymphangiectasia, varicosities of the popliteal system, and blind channel ending into the knee joint. These changes suggested that a lymphatic fistula in the joint cavity or a lymphatic obstruction, or both, could be pathogenic factors involved in the chylous effusion of filariasis.

The chylous effusion presented here, the one associated with systemic lupus erythematosus, and those observed in filariasis mimicked a septic arthritis. A spuriously raised synovial fluid leucocyte count by automated Coulter counter technique may further confuse the clinician.¹³ Different lipids such as free fatty acids, triglycerides, and cholesterol, have been shown to evoke localised inflammatory reaction on subcutaneous implants and after intra-articular injections, which may account in part for the inflammation associated with chylous effusions.^{10,14,15}

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