Pneumococcal arthritis

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Pyoarthritis complicating pneumococcal infection is uncommon and contrary to many reports it may be severe and fail to respond promptly to treatment. Three patients observed within 6 months illustrate that the course may be prolonged with resulting bone destruction and residual joint dysfunction.

Case reports

Case 1, a 45-year-old Negro woman, was hospitalized in a mentally confused and disoriented condition on August 7, 1970, with swollen painful knees and right shoulder. She was known to have mild diabetes mellitus, hypertension, and chronic alcoholism. Her joint symptoms were thought to have been present for 5 days.

Examination

The body temperature was 102°F; there was scarring of the left tympanic membrane and hepatomegaly. Both knees and the right shoulder were swollen, warm, erythematous, and exquisitely painful.

Laboratory investigations

Blood leucocyte count 9,300/mm³; haematocrit 37; urine analysis 2+ protein, 2 white blood cells per high-power field and a few granular casts. The synovial fluid was purulent; leukocyte count 362,000/mm³; 98 per cent. polymorphonucleocytes; glucose 13 mg. per cent.

Diplococcus pneumoniae was isolated from the blood and synovial fluid.

Treatment

Penicillin therapy was initiated within 4 hours of admission and 12 m.u. penicillin were administered intravenously each day.

Course

Multiple aspirations of the right shoulder and both knee joints were attempted during the first 4 days; little fluid was obtained in spite of the continued presence of clinical signs of infection. Throughout the first week of hospitalization, the patient remained toxic with a daily temperature of 103–104°F. On the seventh day arthrotomy of each affected joint was performed and drains were inserted. Cultures of the joint fluid were sterile. The clinical course was stormy with persistent fever and swollen, painful joints for 5 weeks.

Result

During the sixth and seventh weeks of hospitalization, however, the temperature abated with improvement in

joint symptoms. The patient was transferred to a hospital for intermediate care where she slowly improved over the next 9 months.

Comments

Roentgenograms taken on admission showed a normal chest, evidence of old trauma in the right shoulder, and soft tissue swelling of the knees. One month later, there was extensive periarticular calcification of the right shoulder (Fig. 1) and each knee joint, and marked bony destruction of the knees (Figs 2a, b, overleaf).

FIG. 1 Case 1. Right shoulder 1 month after onset of pneumococcal arthritis. Note extensive soft tissue calcification

Re-examination after 7 and 9 months revealed a decrease in the soft tissue calcification and improvement in function of the knees and shoulder.

Case 2, a 39-year-old Negro man, re-entered the Baltimore Veterans Administration Hospital on May 13, 1970, because his left knee had been swollen and painful for 3 days. Known to be a chronic alcoholic and on therapy for active pulmonary tuberculosis, he had left the hospital against medical advice 3 days before.

Examination

He was acutely ill, with an oral temperature of 103°F.,

FIG. 2 Case 1(a) Left knee on admission

signs of consolidation at the left lung base, mild hepatomegaly, and a markedly swollen left knee, which was hot, erythematous, and tender to palpation.

Laboratory investigations

The blood leucocyte count was 20,000/mm.³ with a shift to the left. Aspiration of the left knee joint yielded grossly purulent fluid, the leucocyte count being 100,000/mm.³. Cultures of the synovial and pleural fluids obtained on the day of admission yielded *D. pneumoniae*.

Treatment

He was given 20 m.u. aqueous penicillin intravenously daily (the first dose being administered 6 hours after admission), and a chest tube was inserted to drain the empyema fluid. Multiple intraarticular injections of penicillin were administered to the left knee, a total of 20 m.u. being given by this route during 2 weeks.

Course

Inflammation of the right shoulder and left ankle were noted during the first week of hospitalization and aspiration of these joints also revealed purulent fluid. Despite intensive penicillin treatment a low-grade temperature persisted for one month. At this time a repeat culture of synovial fluid from the left knee joint showed *D. pneumoniae*. Penicillin was administered for a full 8 weeks.

Result

There was gradual improvement in joint symptoms.

Comment

On admission a chest x ray showed a left lower lobe pneumoniae with empyema; x rays of the involved joints revealed soft tissue swelling only. One month later, there

FIG. 2 Case 1(b) Left knee 7 weeks later, showing marked bony destruction and peri-articular soft tissue calcification

was a small area of destruction on the lateral tibial condyle; the shoulder was normal except for mild osteoporosis. A repeat examination 4 months later showed extensive calcification of the right shoulder joint (Fig. 3). The left knee was essentially unchanged, and pain and limitation of motion of the knees and shoulder were still present.

FIG. 3 Case 2. Right shoulder 5 months after onset of pneumococcal arthritis, showing extensive soft tissue calcifications (Reproduced from Shawker and Dennis, 1971 (Fig. 2), with permission of the editor of Amer. J. Roentgenol.)

Case 3, a 61-year-old Caucasian man, was hospitalized at the University of Maryland on March 2, 1970, because of back and right shoulder pain. He was a chronic alcoholic with a past history of tuberculosis.

Examination

The right shoulder was tender with erythema and swelling. After 12 hours' observation, the patient complained of headache; he was lethargic, with an oral temperature of 104°F. Examination then showed nuchal rigidity, a mitral systolic murmur, and hepatomegaly.

Laboratory investigations

The cerebrospinal fluid findings were indicative of bacterial meningitis. Spinal fluid and blood cultures positive for *D. pneumoniae*. Blood leucocyte count 7,150/mm³; haematocrit 37 per cent. Urine analysis showed 1 + protein, 15 to 20 white blood cells per high-power field, and a rare hyaline cast.

Treatment

He was given 24 m.u. aqueous penicillin intravenously each day, starting 12 hours after he was first seen.

Course

Within 24 hours the patient was alert and oriented, but 3 days later pain recurred in the right shoulder and the skin overlying the joint was hot, erythematous, and tender to palpation. Joint aspiration produced 10 ml. pus showing a leucocyte count of 125,000/mm³ with 98 per cent. polymorphonuclear leucocytes; glucose 2 mg. per cent. Cultures of the pus were sterile. Repeated aspirations of the shoulder were performed during the next week. The synovial fluid white blood cell count reached 296,000/mm³, with 90 to 95 per cent. polymorphonuclears; synovial fluid glucose 2 mg. per cent.

The patient was persistently febrile until arthrotomy of the right shoulder was performed on the 11th hospital day. Approximately 60 ml. pus was present in the joint. Destruction of the articular cartilage was noted at the time of operation.

Result

The patient was maintained on penicillin therapy for 1 month and gradually improved.

Comment

X rays of the chest and right shoulder were normal on admission; 1 month later mild osteoporosis of the humeral head was noted, but the joint space appeared normal. Examination 7 months after discharge revealed pain on motion of the shoulder joint and limitation of abduction to 45°.

Discussion

Pneumococcal arthritis is classically described as a painful, monarticular arthritis complicating pneumococcal pneumonia (Herrick, 1902; Bunim, 1946; Argen, 1964). The incidence of this complication was very low even in the pre-antibiotic era. Only one in 800–1,000 patients with pneumococcal pneumonia developed a recognized joint infection (Herrick, 1902; Fagge, 1933). The estimated incidence today is even lower. Pneumococcal arthritis is associated with a primary pulmonary infection in 70 to 75 per cent. of cases (Cave, 1901; Bulkley, 1914). Other primary foci include the meninges, middle ear, sinuses, pharynx,

and endocardium (Herrick, 1902). In approximately 15 per cent. of cases, no primary infective site is identified (Bulkley, 1914; Argen, 1964). Bacteraemia occurs in 80 to 90 per cent. of patients with pneumococcal arthritis who have blood cultures taken (Bunim, 1946; Argen, 1964). The knee and shoulder joints are commonly affected (49 per cent. and 24 per cent. respectively in several large series) (Herrick, 1902; Bulkley, 1914; Fagge, 1933). Small joints are rarely affected. Sternoclavicular joint involvement is not unusual, and pneumococci are responsible for approximately 50 per cent. of all septic processes involving that joint (Taleisnik, Peterson, and Martin, 1962). Before antibiotics became available, patients with pneumococcal arthritis were treated with either multiple aspirations or with incision and drainage. Usually there was resolution with minimal or no residual joint damage (Bulkley, 1914; Fagge, 1933). With specific antibiotic therapy, joint destruction rarely occurs (Boger, 1944; Feffer and Hirsh, 1946; Argen, 1964).

Forty cases of pyogenic arthritis (excluding tuberculous arthritis have been observed at our two institutions during the past 5 years. The three current cases represent the only ones caused by *Diplococcus pneumoniae*. These three patients shared many features yet differed from those previously reported. Polyarticular involvement was present in two. Primary sites of infection included the meninges, middle ear, and lung. Usually in pneumococcal arthritis, the primary infection is clinically apparent hours to days before joint involvement appears. By contrast, in our patients, joint symptoms were the 'chief complaint' and other infected areas became apparent only after hospitalization. Knee and shoulder involvement accounted for six of the seven joints affected, which is comparable to the findings in other series. Severe and protracted illness occurred in our patients who had underlying chronic illnesses (*i.e.* chronic alcoholism, diabetes, and tuberculosis). Illness was associated with joint destruction, functional impairment, and periarticular calcification. Argen (1964) recently reported five cases of pneumococcal arthritis. Four of his five patients had chronic underlying diseases (two cirrhosis of the liver, two diabetes mellitus, and one diabetes and severe rheumatoid arthritis). Although hospitalizations were prolonged (ranging from 3 to 7 weeks) all patients had complete recovery of their joint function.

Recent authors (Nelson, 1971; Parker and Schmid, 1971) have noted that therapeutic concentrations of penicillin cross the inflamed synovial membrane when the drug is administered parenterally in adequate dosage. Our patients experienced prolonged febrile illness, complicated by residual joint dysfunction, in spite of the use of appropriate doses of penicillin for an organism known to be sensitive to the antibiotic. In 1967 and 1971, strains of pneumococci

relatively resistant to penicillin were reported (Hansman and Bullen, 1967; Hansman, Glasgow, Sturt, Devitt, and Douglas, 1971), but these organisms have so far been isolated only in Australia. The antibacterial activity of the synovial fluids of our patients with pyoarthritis was not tested. The grossly purulent fluid under increased pressure within the joint space may have prevented adequate bactericidal levels of penicillin from being achieved.

There have been a few descriptions of periarticular calcification following acute pyogenic arthritis (Ferguson, 1949; Markovits, 1949; Shawker and Dennis, 1971). Before antibiotics became available, such calcification was attributed to uncontrolled infection which extended beyond the joint capsule (Ferguson, 1949; Markovits, 1949). Tissue necrosis and increased alkalinity favour the local precipitation of calcium salts. Periarticular calcification was induced within 12 weeks after injection of staphylococci into the knee joints of rabbits. The ultimate radiological appearance of the joint was similar, whether penicillin was given parenterally or directly into the joint or arthrotomy was performed (Bardenheier, Morgan and Stamp, 1966). Among forty patients with pyogenic arthritis reviewed from our institutions, only three developed extensive periarticular calcifications within 3 to 6 weeks from the onset of illness. Lack of appropriate follow-up x-ray studies may account for the low incidence of this finding. The radiological findings of these cases (two with pneumococcal arthritis included in the present report, and one with streptococcal arthritis) have been reported elsewhere (Shawker and Dennis, 1971).

One of the patients with pneumococcal disease developed soft tissue calcification adjacent to the joint capsule of the shoulder. Another developed multiple amorphous calcium deposits around all three involved joints. In this patient, an arthrogram of the knee, performed several months after her illness had resolved, showed calcification in the outer limits of the original joint space; there was also shrinkage of the capsule and diminution of the residual joint space volume. There was partial but incomplete clearing of the periarticular calcification.

Our patients developed septic arthritis which is a complication of pneumococcal infection usually amenable to antibiotic treatment. Open drainage is supposedly unnecessary. Our findings suggest that pneumococcal pyoarthritis is serious and can be protracted in patients who are debilitated by alcoholism or made more susceptible by metabolic disorders such as diabetes mellitus. Under such circumstances early drainage of the septic joint performed in conjunction with antimicrobial treatment may be necessary to preserve joint function.

Summary

Three patients with chronic underlying disease developed pneumococcal bacteraemia and pyogenic arthritis. The course of the illness was protracted and resulted in joint destruction, dysfunction, and extensive periarticular calcification. The severity of this condition is emphasized and the problems of therapy are described, particularly the need for drainage of the joints.

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