

SEPTIC ARTHRITIS

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The incidence of septic arthritis is no less today than in the pre-antibiotic era, but that of chronic arthritis is less.² In the pre-antibiotic era the development of a painless, ankylosed joint was considered a good result. Very few retained a fully functional painless joint. Destruction of the joint, pathological dislocation and a painful fibrous ankylosis were common sequelae.

Today two-thirds of cases have a satisfactory outcome with simple measures such as rest and antibiotics.¹ In the other cases the infection becomes suppressed by the antibiotics and a subacute arthritis develops which may flare up into an acute attack as soon as antibiotic therapy is discontinued. The causative organisms eventually tend to become insensitive to the antibiotics used.

In an attempt to avoid this long drawn-out course with frequent exacerbations, a number of procedures have been used. The joint may be aspirated. This relieves tension on the joint ligaments and hence reduces pain. It also enables one to culture the causative organism and to ascertain its antibiotic sensitivity. At the same time one may instil antibiotics, usually penicillin, into the joint. It has been shown that most antibiotics, with the exception of crystalline

penicillin, do not cross the normal or traumatized joint lining.³ As the causative organism is lying within the joint's synovial fluid, it is exposed to a much higher concentration of antibiotics by direct instillation into the joint.

Soto-Hall *et al.*⁴ have shown that increasing the intra-articular pressure in the hip, possibly because of its rather unique arterial blood supply, may cause an avascular necrosis of the head of the femur. Aspiration will relieve the tension in the affected joint and hence avoid this possible complication.

Repeated aspirations, with or without simultaneous instillation of antibiotics, have also been used, especially if the effusion tends to recur. Jergeson and Jawitz² insert a tube via a trocar into the affected joint and then instil antibiotics 12-hourly into the joint. This is left undisturbed for 3 hours and then the tube is connected to suction drainage until the next instillation.

Watkins⁵ prefers open operation and incision and drainage of the affected joint. If there is a lot of purulent fluid present, he finds no contraindications to maintaining an intra-articular drain for up to 4-7 days.

In the past few months we have used continuous perfusion of joints in 3 cases, all 3 affecting the knee, with very gratifying results.

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TECHNIQUE

This may be carried out under local anaesthesia. The joint is aspirated and if the fluid obtained looks perfectly normal, perfusion is not carried out. If it looks at all purulent, 2 large venecaths are inserted into the joint.

The needle is inserted into the joint, the polythene tube threaded through the needle and the needle withdrawn. A second tube is inserted in the same manner. The tubes are strapped to the skin to prevent them from slipping or from being pulled out. One of the tubes is connected to the inflow bottle, a vacolitre of saline containing usually 1 G of chloramphenicol, and the joint is perfused with 3 litres every 24 hours. The second tube is connected to a sterile drainage bottle, and the aspirated fluid is sent off for culture, sensitivity and guinea-pig inoculation tests.

The limb is placed at rest, either in a Thomas' splint with skin traction or in a plaster-of-paris cast. If the latter, a window is cut in the plaster through which the tubes can be connected to the bottles and through which the joint can be examined frequently.

CASE REPORTS

Case 1

A 6-year-old boy was admitted to hospital with pain in the right knee of 2 weeks' duration. On the day before admission, the pain had become increasingly severe and he was unable to walk. No other joint was involved.

On examination he was obviously in severe pain, with a temperature of 100°F and a pulse rate of 100 per minute. His right knee was hot, swollen and tender and a large effusion was present. Pain and muscle spasm restricted its movements completely. No other joints were involved and there was no inguinal lymphadenitis. The white cell count was 10,000 with 80% neutrophils and he had an ESR of 28 mm. in 1 hour (Wintrobe).

He was treated with systemic cloxacillin and erythromycin and the joint was aspirated under local anaesthesia. Forty ml. of a purulent fluid were aspirated and one million units of penicillin were instilled. Postoperatively, skin traction was applied to the limb. Gram-positive cocci and a moderate number of polymorphonuclear leucocytes were found in smears of the aspirated fluid, but the culture was negative.

Forty-eight hours later the knee was again swollen, hot and painful and his temperature was 100°F. The knee was again aspirated, a blood-stained purulent fluid withdrawn and penicillin and streptomycin instilled into the joint.

Two days later the knee had again become swollen and still the patient showed no signs of improvement. At this stage two large venecaths were introduced into the knee and the joint continuously perfused for the following 96 hours. Three litres were perfused per 24 hours, each litre containing one million units of penicillin and 1 G of streptomycin. During this period skin traction was maintained.

Four days later the tubes were removed. The joint was not tender, no effusion was present and the patient could flex his knee to 50° without pain. His temperature was 99°F.

At 16 days he had a full pain-free range of movement and skin traction was removed, and 10 days later he was allowed up. However it took another fortnight before his white cell count and ESR returned to normal. He was discharged at this stage on oral antibiotics and these were discontinued 8 weeks after his admission to hospital. He has been seen repeatedly for the past 11 months, and has remained well.

Case 2

A 19-year-old male was admitted to hospital complaining of pain and swelling of his right knee for 2 days. The pain had been increasing in severity and had prevented him from walking on the day before his admission. He had had rigors for the 24 hours before admission. On examination, the patient was pyrexial (99.8°F) and his pulse rate was 100/min. His right knee was warm, red, tender and swollen. A large effusion was present and he could flex the knee from 5 to 25° only.

Attempts at further flexion caused a great deal of pain and muscle spasm. Radiographs of the knee were normal. His white cell count was 14,700 with a 78% neutrophilia, and he had an ESR of 17 mm. in 1 hour.

The patient was placed on oral tetracycline and cloxacillin. The knee was aspirated under local anaesthesia and 100 ml. of purulent fluid obtained. Microscopic examination of a stained smear showed the presence of Gram-positive cocci and numerous polymorphonuclear leucocytes. Culture of the fluid was however negative. Skin traction was applied to the limb. Forty-eight hours later the patient had not responded to treatment. He was still pyrexial and in pain and his right knee was still as inflamed.

The knee was again aspirated and 2 venecaths introduced: 135 ml. of a purulent fluid were obtained and again multiple neutrophils and Gram-positive cocci were seen but the culture was negative. For the following 96 hours, the patient's knee was perfused with 3 l. of saline per 24 hours, each litre containing 1 G of chloramphenicol.

Within 36 hours of the commencement of the perfusion, the patient was afebrile. Three days after the removal of the tubes he could flex his knee to 90° without any pain. Nine days later the skin traction was removed, and he could flex his knee to 110°. Three days later, he was allowed up, but had a mild relapse, in that the knee became warm and his white cell count rose to 14,300 with 58% neutrophils. He was again put to bed and allowed up after 3 days and this time had no further recurrence. He was discharged 2½ weeks later, still on antibiotics. These were discontinued 3 weeks later. He has a fully functional normal knee and has remained well for 11 months.

Case 3

A 19-year-old male was admitted to hospital complaining of pain and swelling of his right knee for 2 days. He was unable to walk because of the pain. His pulse rate was 88/min. and his temperature was 100°F. His right knee was warm, red, tender and swollen. A moderate effusion was present. Flexion was limited to 5-20°. His white cell count was 14,300 with a 73% neutrophilia and his ESR was 5 mm. in 1 hour.

It was decided that the patient had an early septic arthritis, and under local anaesthesia the joint was aspirated. 80 ml. of a somewhat purulent fluid were obtained. Two large venecaths were then inserted into the joint and the limb was placed in a plaster-of-paris cylinder with a window cut to expose the knee. His knee was perfused with 3 litres of saline per 24 hours, each litre containing 1 G of chloramphenicol. Gram staining of the aspirated fluid showed the presence of multiple polymorphonuclear leucocytes but no organisms. Culture was negative. The patient was also given systemic antibiotics.

By the third day the patient was afebrile and after 96 hours the tubes were removed. The knee was not tender and no effusion was present. He was allowed up on the 15th day and discharged on oral antibiotics 24 hours later.

Two weeks later his ESR had fallen to 2 mm. in 1 hour, and the plaster cylinder was removed. Three weeks later the antibiotics were discontinued. The patient has remained well for 10 months and he has a fully functional joint.

During his stay in hospital, a full battery of investigations for gout, rheumatic fever, rheumatoid arthritis, other collagen diseases, gonococcal arthritis, etc., were carried out and proved to be negative. In view of the fact that organisms were not demonstrated in the joint fluid, the diagnosis might be questioned in this case. However negative results on direct microscopy and culture are not uncommon² and in view of the clinical picture, monoarticular arthritis, leucocytosis, polymorphonuclear leucocyte loading of his joint fluid, negative battery of investigations and dramatic response to antibiotic treatment, a diagnosis of septic arthritis was confidently made.

DISCUSSION

In the straightforward case the diagnosis of septic arthritis is seldom in doubt. The infection may arise by haematogenous infection, by a direct spread from a nearby osteomyelitis or from a penetrating wound, operation or an intra-articular injection.

The diagnosis is made on the clinical picture, leucytosis, raised ESR and on the demonstration of organisms in the joint fluid. A negative culture is not uncommon, and even direct microscopic examination may be negative.⁵ Early in the disease process, the synovial fluid may still have an inhibiting effect on the organism's growth, the organism may still be localized to the synovium, or incomplete antibiotic exposure may interfere with the culture of the organism, but not inhibit the process of the disease itself.

In all cases radiographs were normal. This is not surprising as it takes 2-3 weeks for diffuse rarefaction, loss of joint space and possibly bony destruction to appear.

The difficulty arises in differentiating the milder case from osteomyelitis and acute rheumatic fever. In osteomyelitis the bony metaphysis is affected and particularly if the metaphysis is intra-articular, a septic arthritis may develop. In the absence of this complication, a sympathetic joint effusion develops and the patient presents with swelling of the joint and pain. On examination, however, the site of maximal tenderness is over the bone and not the joint, and although an effusion may be present, a fair range of joint movement remains and normal synovial fluid is aspirated.

With acute rheumatic fever, a flitting polyarthralgia is usual. The involved joints may be tender, but no effusion is present and if aspirated only a few ml. of normal synovial fluid are obtained.

The treatment of the condition is based on 3 firm pillars, viz., rest, antibiotics and release of intra-articular tension. Rest may be supplied in the form of traction or of a plaster cast. Theoretically traction also tends to distract the joint surfaces, but the weights that one normally employs seem to be inadequate to serve this function. If the limb is encased in plaster, it should be windowed to allow frequent inspection of the joint. Bed rest is also essential, especially if the joint involved is a weight-bearing one. The position of the joint in traction or plaster is important, especially in relation to the hip.

Soto-Hall *et al.*⁴ have shown that if the intra-articular pressure of the hip joint rises above the articular pressure, the intracapsular blood-vessels supplying the head of the femur may be compressed and avascular necrosis result. The increased intra-articular pressure may be relieved by aspiration, open incision and drainage, or continuous perfusion and drainage. This diminishes the tension on the capsule and ligaments and hence relieves the pain and also avoids the possible sequelae of a raised intra-articular pressure.

Antibiotics may be administered by a number of routes. They may be given orally or parenterally, as a single instillation, as multiple instillations with or without aspirations or via continuous perfusion. The latter method has several advantages. The antibiotic is placed directly into the joint and does not have to cross the joint lining. The concentration in the joint is maintained continuously and the antibiotic is being continuously replaced. Fluid is available at all times for direct microscopy, culture and sensitivity tests and animal inoculation. By repeated microscopy and culture of the effluent fluid, one is able to study the efficacy of the treatment. With repeated sensitivity tests, one is able to change the antibiotics as required. The joint is constantly being flushed out, and

debris, fibrin clots, etc., which may predispose to future adhesion formation and ankylosis, are removed. The procedure is atraumatic and is performed under local anaesthesia. The patient in his toxic condition is not exposed to the risks of a general anaesthetic and no surgical scar is required.

These 3 cases illustrate the effectiveness of this form of treatment. Case 1 had been treated for 120 hours with rest, traction and high doses of systemic antibiotics. He had had 2 aspirations and instillations of antibiotics into his affected joint with no improvement in his clinical condition. After 96 hours of continuous perfusion with no other change in the therapeutic regime, he showed a dramatic response. He could flex his knee to 50°, it was no longer tender and no effusion was present. At the time of preparing this paper, it was 11 months since the termination of therapy and the patient has a fully functional joint.

Case 2 had been hospitalized for 48 hours. He again had had rest and traction, high doses of systemic antibiotics, one aspiration and antibiotic instillation, with no improvement. After only 36 hours perfusion he was afebrile and after 96 hours he could flex his knee to 90° without pain.

Case 3 again showed a dramatic response, but in his case the perfusion was started *ab initio*. He may have responded to antibiotics alone as the organisms were possibly still localized to the synovial membrane, but at the time of the commencement of treatment, this was not known.

SUMMARY AND CONCLUSION

Septic arthritis is a serious disease which has severe sequelae. Simple means such as rest and antibiotics have a 50-66% satisfactory result. To prevent complications and to avoid a chronic and a long drawn-out arthritis with frequent exacerbations, a more vigorous approach is required.

The therapeutic regime suggested, is that if, on admission, the diagnosis of septic arthritis is suspected, the joint should be aspirated and placed at rest and the patient given systemic antibiotics. If the joint fluid is at all purulent, immediate perfusion of the joint should be carried out, but not for longer than 96 hours.

Three litres of saline are usually perfused every 24 hours, each litre of fluid containing either 1 G of chloramphenicol, or one million units of penicillin with 1 G of streptomycin.

When the temperature, clinical condition of the joint, white cell count and ESR have settled, traction, if used, should be discontinued. If the disease does not flare up after a few days, the patient should be allowed up, and again if the disease process remains quiescent, the patient is discharged several days later, but still on his antibiotics. These are discontinued after approximately 8-12 weeks, depending on the rapidity with which the infection settles. If the condition relapses, the patient is readmitted immediately and the full therapeutic regime recommenced.

If the joint is placed at rest in a plaster cast, the patient is usually discharged with his cast, and this is removed later as an outpatient.

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REFERENCES

1. Alicandri, F. P. (1964): *Med. Tms (N.Y.)*, **92**, 767.
2. Jergeson, F. and Jawitz, E. (1963): *Amer. J. Surg.*, **106**, 152.
3. Joeson, C. T. (1955): *J. Bone Jt Surg.*, **37-A**, 107.
4. Soto-Hall, R., Johnson, L. H. and Johnson, R. A. (1964): *Ibid.*, **46-A**, 509.
5. Truman, J., Connolly, J. P., Mills, J. A. and Swartz, M. F. (1963): *Clin. Pediat.*, **2**, 572.
6. Watkins, M. B. (1965): *J. Bone Jt Surg.*, **47-A**, 428.