A prospective 2-year study of 75 patients with adult-onset septic arthritis

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Abstract

Aims and methods. To assess the clinical features of septic arthritis and characterize therapeutic strategies and outcome in a prospective study of 75 patients selected by positive synovial fluid culture.

Results. Underlying joint disease was present in 46 patients, 25 of whom had rheumatoid arthritis and 15 osteoarthritis. Eleven patients were i.v. drug abusers. Fifty-six per cent of cases involved the knee, 15% involved two or more joints, and staphylococci and streptococci were cultured in >90%. Seventy-eight per cent of patients lived in areas of high social deprivation. Fever was present in 64% and the white cell count (WCC) was normal in 38%. The C-reactive protein was elevated in 98%. Leg ulcers were present in 11% of all patients but in 38% of patients who died ($P < 0.006$). Median duration of antibiotic therapy was 15 days i.v. with subsequent oral treatment for 21 days. Thirty-seven per cent of cases required surgical intervention. Mortality was 11%. A raised WCC at presentation ($P < 0.02$) and the development of abnormal renal function ($P < 0.015$) were predictors of poor prognosis.

Key words: Septic arthritis, Clinical characteristics, Risk factors, Treatment, Outcome.

Septic arthritis (SA) is a rheumatological emergency that can lead to rapid joint destruction and irreversible loss of function. Patients with SA have previously been classified [1] into three categories: (i) those in whom bacteria can be cultured from infected synovial fluid (SF); (ii) those in whom organisms can be isolated from elsewhere; and (iii) patients in whom no organism can be identified but clinical examination and investigations support the diagnosis. Despite improvements in antibiotic therapy for SA, mortality and morbidity has not improved significantly over the last two decades [2–9].

Most recent studies are retrospective, with the inherent problems of ascertainment. They have analysed all patients with clinical features of SA irrespective of bacterial culture from synovial fluid. Nevertheless, older age at diagnosis, polyarticular involvement and confusion have been identified as predictors of poor outcome [4, 9]. Chronic alcohol abuse has also been implicated in one study [8]. However, the role of open surgical drainage of the infected joint remains controversial, one study showing this to be detrimental [9] and another beneficial [5].

In prospective studies, again investigating patients with clinically diagnosed SA [6, 10], irrespective of SF bacterial culture, major risk factors included skin infection, joint surgery, lower limb joint prosthesis, rheumatoid arthritis (RA), diabetes mellitus and older age (>80 yr). To date there is no information regarding the role of social deprivation and i.v. drug abuse in SA, and little prospective data on antibiotic use and longer-term outcome.

We have therefore undertaken a multicentre prospective study to identify hospital in-patients in Scotland with SA selected by the presence of bacteria cultured from SF. We have specifically excluded patients in whom bacteria cannot be identified on SF culture to investigate a cohort of patients in whom diagnostic homogeneity can be maintained and to enable future comparisons with patients fulfilling Newman Grade B and C criteria for SA. Clinical features, serological indices and potential risk factors were evaluated at presentation. We have identified current therapeutic strategies, antibiotic use and systemic complications and evaluated outcome in this highly selected cohort of 75 patients recruited over the past 2 yr.

Methods

Study design
We undertook a prospective investigation of SA over a 24-month period between August 1997 and July 1999. This was part of an ongoing multicentre study incorporating 11 teaching and district general hospitals serving a combined population of 2.3 million people in the central belt of Scotland. Adult patients (over 16 yr of age) with a clinical diagnosis of SA were identified
weekly by telephone contact with rheumatologists and orthopaedic surgeons in participating hospitals, and were followed up until death or discharge. At no point did this analysis alter the practice of the individual physician or surgeon in patient management. For the purposes of this study only patients fulfilling the criterion for Newman Grade A (bacteria present on synovial fluid culture) were eligible for inclusion [1].

**Patient data**

Demographic data, socio-economic status (Carstairs index [11]), the duration and nature of symptoms before admission, details of comorbid conditions (including primary joint disease), drug therapy at diagnosis and recent surgical procedures were noted.

Body temperature, white cell count (WCC), C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were noted, as were sites of infection and the organisms that were cultured. Details were recorded of antibiotic therapy, surgical intervention, complications attributable to acute SA and the need for central venous catheterization, artificial feeding, dialysis and intensive therapy unit (ITU) admission. Mortality rates were calculated.

**Synovial fluid culture**

SF was aspirated with an aseptic technique on the ward except in the case of infected hips and prosthetic joints, when aspiration was undertaken in operating theatres. Culture of SF was done on the day of admission using routine methods as described previously [12]. Blood culture bottles were not used for this purpose.

**Statistical analysis**

Data were analysed using the Mann–Whitney U-test with 95% confidence intervals or the χ² test. P values less than 0.05 were accepted as significant.

**Results**

**Patient demography**

Seventy-five patients in whom bacteria were cultured from SF (Newman Grade A) were identified. Median age was 63 yr [interquartile range (IQR) 45–74 yr]. Forty-six (61%) patients with SA had primary joint disease. Twenty-six patients (33%) fulfilled the ARA (American Rheumatism Association) criteria for RA [13]. The median duration of disease was 18 yr (IQR 11–27 yr). The sex ratio in patients with RA was 3:1 in favour of females. In those without RA the sex ratio was equal. Fifteen patients (20%) had radiological evidence of osteoarthritis [14], three (4%) had a previously identified crystal arthropathy (two had pseudogout, one had gout), two (3%) fulfilled the New York criteria for ankylosing spondylitis [15] and one (1%) had a seronegative arthropathy associated with psoriasis.

Seven patients (9%) had suffered a previous episode of SA, in all patients except one involving the same joint. However, in two patients, on the second occasion the infection not only affected the index joint but was polyarticular. In one of these two patients the initial infection was in one knee prosthesis and the second infection involved the other knee replacement.

**Symptoms, signs and investigations at presentation**

Pain was the most frequent presenting symptom (85%), usually being present on movement and at rest. New joint swelling was present in 58 patients (77%). Fever was described in only 33 (44%), and sweats and rigors in only 31 and 16% of patients respectively. The median time to admission after symptom onset was 7 days (IQR 4–22 days). Overall, the median temperature was 37.5°C (IQR 36.1–40°C), but 30% of non-RA patients and 57% of RA patients were afebrile.

Table 1 shows the results of the biochemical and haematological investigations at presentation. Only one patient had a normal CRP; the ESR was elevated in all cases. The WCC was normal in 28 patients with SA (33% of non-RA and 50% of RA patients). There were no differences in these variables between the RA and non-RA patients.

**Coexistent conditions**

A number of coexistent conditions were identified (Table 2). Twenty-one patients (28%) had infected prosthctic joints and 11 (15%) were regular i.v. drug-abusers (IVDAs). Local causes for infection (including recent joint injection, arthroscopy and joint replacement within 6 months) were identified in 10 patients (13%), and distant sites of infection (including leg ulcers, chest

<table>
<thead>
<tr>
<th>Indicator of inflammation</th>
<th>All patients with SA (n = 75)</th>
<th>RA patients with SA (n = 25)</th>
<th>Non-RA patients with SA (n = 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRP (g/l)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (range)</td>
<td>185 (6–460)</td>
<td>184 (16–422)</td>
<td>191 (6–460)</td>
</tr>
<tr>
<td>IQR</td>
<td>101–256</td>
<td>137–233</td>
<td>94–281</td>
</tr>
<tr>
<td>ESR (mm/h)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (range)</td>
<td>80 (10–197)</td>
<td>103 (27–135)</td>
<td>72 (10–197)</td>
</tr>
<tr>
<td>IQR</td>
<td>43–105</td>
<td>70–117</td>
<td>39–94</td>
</tr>
<tr>
<td>WCC (10⁹/l)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (range)</td>
<td>13.1 (5.5–40.5)</td>
<td>10.2 (5.7–40.5)</td>
<td>14.4 (5.5–32.2)</td>
</tr>
<tr>
<td>IQR</td>
<td>9.3–18.1</td>
<td>8.0–16.7</td>
<td>10.2–18.5</td>
</tr>
</tbody>
</table>
infections, cellulitis, cholangitis, pharyngitis and IVDA) in 40 (53%). Interestingly, three patients developed SA within 2 weeks of insertion of a permanent pacemaker.

**Use of disease-modifying anti-rheumatic drugs and immunosuppressants**

In the RA group, five patients (21%) were taking prednisolone (2–10 mg daily) and five were prescribed methotrexate (5–15 mg weekly) (Table 3). Seven patients (28%) were taking standard disease-modifying anti-rheumatic drug (DMARD) therapy (gold salts, hydroxychloroquine, sulphasalazine or penicillamine). However, nine RA patients (38%) were not on any DMARD on admission. Of the three patients with seronegative arthropathy, one was taking methotrexate (5 mg weekly) and two were not on DMARD therapy.

### Table 2. Potential risk factors for septic arthritis

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>No. of patients with RA (n = 25)</th>
<th>No. of patients without RA (n = 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distant sites of infection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVDA</td>
<td>0</td>
<td>11†</td>
</tr>
<tr>
<td>Leg ulceration</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Chest infection</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Pharyngitis</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Pacemaker insertion</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cholangitis</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Others⁵</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Local factors in infection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prosthetic joint</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Blunt trauma</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Primary peri-articular abscess</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Recent joint surgery</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Previous septic arthritis</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Recent intra-articular injection</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Recent arthroscopy</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Systemic diseases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Alcoholic liver disease</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

aWithin the preceding 2 weeks.
bOne patient each with urinary tract infection, chest wall abscess or bronchectasis.
cOne patient each with IVDA for 4 yr. Two patients were hepatitis C-positive. None was HIV-positive.

dTwo patients taking prednisolone were also taking either methotrexate or hydroxychloroquine. Another patient had received i.v. cyclophosphamide 3 months earlier.

One patient in the non-RA group was taking prednisolone (5 mg daily) for autoimmune nephritis.

**Social deprivation**

Socio-economic status was assessed using the Carstairs index, a composite score derived by postcode and calculated on the basis of social class, male unemployment, overcrowding and car ownership [11]. Those in group 1 are the most privileged and group 7 comprises the most deprived. Patients with SA resided in the more socially deprived areas, 39 of the 50 non-RA patients with SA (78%) being in Carstairs categories 5–7 compared with 44% of the normal population (n = 2.3 million, P < 0.0001). Furthermore, 62% were in the most severely deprived groups (6 and 7) compared with only 27% of the normal population (P < 0.0001) (Table 4). Eleven patients were IVDAs and fell into groups 5–7. After removal of these patients from the calculations, there were still more SA patients in groups 5–7 (64% vs 44% of the control population P < 0.001). Similarly, when compared with a cohort of 374 RA patients [16] attending the Centre for Rheumatic Diseases, Glasgow, 64% of the RA patients with SA fell into categories 5–7 vs 49% of these RA patients without SA.

**Bacteriological investigations**

Fig. 1 shows the sites of infection after SF culture, undertaken as described previously [12]. The knee (56%) was the commonest site, followed by the hip (16%). In 11 cases (15%), two or more joints were involved. Infection occurred in a prosthesis joint in 28% of cases. Median time from joint replacement to the development of SA was 6 months (IQR 3 months to 2 yr). Blood culture was undertaken in 56 patients, and this was determined by the practice of the individual unit. In 26 (46%) of the patients tested, bacteria were cultured from both blood and SF.

Staphylococci and streptococci were implicated in 91% of cases, staphylococci (71%) being the commonest pathogens (Table 5). *Staphylococcus epidermidis* was more common in prosthetic than native joint infections (19 vs 6%), but this difference was not statistically significant. Gram-negative bacteria were present in seven cases (9%). Multiply resistant *Staphylococcus aureus* (MRSA) was implicated in 9% of *Staphylococcus aureus* infections (5% of all infections). In three patients (4%), two organisms were isolated from the infected joint, and in one case three organisms were identified. The organisms were cultured in all cases despite 11 patients (15%) having received antibiotics in the preceding week. In this adult study there were no infections with *Haemophilus influenzae*, mycobacteria or gonococci.

**Antibiotic therapy**

The median duration of i.v. antibiotic therapy was 15 days (IQR 10–42 days) and oral antibiotics 21 days (IQR 10–42 days). There were no differences in prescription at presentation for RA and non-RA patients; formal characterization of the bacteria present defined later antibiotic use. Five patients received oral
Table 4. Social deprivation in 75 patients with septic arthritis as assessed by the Carstairs index

<table>
<thead>
<tr>
<th>Carstairs index</th>
<th>No. (%) of non-RA patients (n = 50)</th>
<th>No. (%) of West of Scotland controls (n = 2.3 x 10^6)</th>
<th>No. (%) of RA patients (n = 25)</th>
<th>No. (%) of RA controls(a) (n = 374)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 (2%)</td>
<td>1.8 x 10^5 (8%)</td>
<td>3 (12%)</td>
<td>21 (6%)</td>
</tr>
<tr>
<td>2</td>
<td>1 (2%)</td>
<td>2.3 x 10^5 (10%)</td>
<td>2 (8%)</td>
<td>23 (6%)</td>
</tr>
<tr>
<td>3</td>
<td>4 (8%)</td>
<td>4.1 x 10^3 (18%)</td>
<td>1 (4%)</td>
<td>41 (11%)</td>
</tr>
<tr>
<td>4</td>
<td>5 (10%)</td>
<td>4.6 x 10^2 (20%)</td>
<td>3 (12%)</td>
<td>74 (20%)</td>
</tr>
<tr>
<td>5</td>
<td>8 (16%)</td>
<td>3.9 x 10^1 (17%)</td>
<td>7 (28%)</td>
<td>39 (10%)</td>
</tr>
<tr>
<td>6</td>
<td>14 (28%)</td>
<td>3.9 x 10^1 (17%)</td>
<td>6 (24%)</td>
<td>82 (22%)</td>
</tr>
<tr>
<td>7</td>
<td>17 (34%)</td>
<td>2.3 x 10^5 (10%)</td>
<td>3 (12%)</td>
<td>61 (16%)</td>
</tr>
</tbody>
</table>

\(a\)Missing values in 9% of RA population [15].

Site of Infection

![Site of Infection](image)

Fig. 1. Site of infection in 75 patients with acute SA. ■ Prosthetic, □ native.

antibiotics indefinitely because of physical frailty and the presence of multiple prosthetic joints.

All 21 patients presenting with prosthetic joint infection were initially treated with i.v. antibiotics. Nine (43%) were commenced on single antibiotics: four on vancomycin, three on fluoxacinil and one each on cefuroxime and amoxycillin. The remaining 12 patients received combination antibiotic therapy. The commonest antibiotics used at presentation, before the availability of bacterial sensitivities, were fluoxacinil (11 patients), gentamicin (seven patients), vancomycin (six patients) and fusidic acid (four patients). The commonest combinations included fluoxacinil with gentamicin or fusidic acid (six patients) and vancomycin with gentamicin or fusidic acid (three patients).

Of the 54 patients receiving antibiotics for native joint infection, most were commenced on i.v. treatment. Twelve (22%) were prescribed single antibiotics with fluoxacinil (five patients), ceftriaxone (three patients), amoxycillin or vancomycin (two patients each). Thirty-one patients (59%) received two antibiotics in combination and 10 (19%) were given triple therapy. One patient received a combination of four antibiotics. Of the 34 patients receiving combination therapy with fluoxacinil, 17 (50%) were also prescribed gentamicin. None of the antibiotic combinations included vancomycin.

MRSA has not previously been a common pathogen in SA, but our four cases reflect the general increase in MRSA infections. Three cases were in RA patients (one knee replacement, one hip prosthesis). In two patients, MRSA infection had been identified previously from other sites and appropriate antibiotics prescribed. In the remaining two, antibiotic therapy was amended to either vancomycin or teicoplanin after confirmation of sensitivity.

Three of the 11 IVDA patients presented difficulties with venous access. In one, fluoxacinil and rifampicin were administered orally with i.m. gentamicin. Oral treatment alone was prescribed for two others, one of whom, taking oral fluoxacinil and amoxycillin, discharged himself from the accident and emergency department. In one further in-patient, oral cephalaxin and clindamycin were given, but vancomycin therapy was subsequently necessary because of failure to respond to treatment.

Surgical treatment

Twenty-eight patients (37%) underwent surgical intervention. Arthoscopic washout was performed in seven cases and open synovial lavage in 13 patients. There were no obvious differences in patients treated after lavage compared with recurrent aspiration during the course of admission. One patient who had had partial treatment for SA of the knee whilst on holiday abroad and another with a persistent knee effusion despite
conventional therapy underwent surgical synovectomy on the advice of the orthopaedic surgeons, with a good functional result. Seven of 21 infected prosthetic joints were removed, anticipating replacement at a later date in five patients. One infected knee joint was fused and a Girdlestone hip arthroplasty was performed in the remaining patient. In one patient with a native hip infection, a Girdlestone arthroplasty was fashioned because of extensive joint destruction. Patients with prosthetic joints or those on orthopaedic surgical wards were more likely to undergo surgery. Overall, 48% of patients were on orthopaedic wards and 52% on rheumatology or medical wards, but 83% of those having surgical treatment were orthopaedic patients, compared with only 17% on non-surgical wards ($P < 0.001$).

**Outcome**

Median in-patient stay was 25 days (IQR 17–46 days). Three patients required admission to the ITU with septicaemic shock. One patient with knee infection with *Streptococcus pneumoniae* developed a cerebral abscess and another with polyarticular *Staphylococcus aureus* infection developed cervical spine osteomyelitis requiring stabilization. Twenty-one patients suffered acute tubular necrosis, and two of them required dialysis.

Eight (11%) patients, three of whom were male, died as a result of acute SA. The median interval from admission to death was 39 days (range 8–140 days). Four patients had RA and one had pseudogout. Two of the RA patients were receiving prednisolone (10 and 5 mg daily, respectively) in combination with either methotrexate (7.5 mg weekly) or recent i.v. cyclophosphamide for a vasculitic leg ulcer.

Two patients had infected prosthetic joints and one had polyarticular infection. Three patients had *Staphylococcus aureus* infection (including one patient with MRSA), three had streptococcal infection, and Gram-negative bacteria were detected in two cases; two of these eight patients had positive blood cultures as well as bacteria growing in SF. All eight patients had a high WCC at presentation (range 13–38 $\times 10^9/l$), higher than the cohort as a whole ($P < 0.02$), and each had comorbid conditions. In particular, three patients (38%) also had infected leg ulcers, significantly more than in the SA population who survived ($P < 0.0006$). Impaired renal function was detected in seven of the eight patients (88%), compared with only 21% of the survivors ($P < 0.015$). Two patients also developed liver abnormalities before death. Four patients required central venous access, three needed artificial feeding and two required admission to the ITU.

**Discussion**

This prospective 2-yr study of adult patients with SA specifically included only those who fulfilled Newman Grade A criteria (in which a diagnosis of SA is made based on positive SF culture). Nevertheless, we identified 75 proven cases of SA. As such, this study is the first UK prospective study to examine and characterize the features of SA in which each case has been confirmed in this way.

This study shows an annual incidence of culture-proven SA of 1 in 62,500. Because one hospital had no rheumatologist and some patients would have come through the accident and emergency departments to other units, it is likely that we did not have access to every case, thus making the overall incidence higher. Telephone contact with microbiologists in participating hospitals suggested that we had collected nearly 80% of the potential number of cases, based on our inclusion criteria. Nevertheless, we show a frequency of SA similar to that reported in England [9, 18] and Australia [5]. Taking into account the deliberate exclusion of patients with suspected SA (Newman grades B and C), which our preliminary results showed to be just as prevalent as culture-proven SA [17], the annual incidence in the West of Scotland may be higher than estimated in this study.

We have found that a high number (61%) of SA patients had underlying joint disease (RA, 33%; ostearthritis, 26%), as in the other prospective hospital-based study [6]. Retrospective analyses [5, 8, 9, 18] may not have the opportunity to evaluate all symptoms and investigations, and may therefore underestimate pre-existing joint damage. Ten patients had a probable local portal for entry of infection, including intra-articular treatment and joint replacement. The presence of prosthetic joints in 21 patients supports the hypothesis that abnormal bone structure and synovial damage are factors which encourage bacterial seeding and growth [19, 20]. The polyarticular infection rate of 15% may be an underestimate because joints other than the index joint may be less severely affected, and therefore aspiration may not be attempted. However, this limitation is a feature of all analyses.

This study highlights the previously identified problem of IVDA [21] in the development of SA in the urban community, although this was not supported by recent European studies [6, 9]. In our investigation, 11 patients were abusers of i.v. drugs, and of the seven patients with previously documented SA, three had failed to modify their risk behaviour before the second episode. A Spanish study during the 1980s [22] demonstrated that over 50% of proven SA patients fell into this category. The prevalence of i.v. drug abuse fell during the 1990s, which perhaps explains the lower frequency in our analysis. Nonetheless, 7000 people in the Glasgow area are estimated to be regular abusers of i.v. drugs [23]. This implies an annual incidence of 0.1%, which approaches the 0.3% incidence of SA reported in RA patients [6]. More importantly, if the drug abuse problem persists, these patients will continue to be at risk of SA with a concomitant strain on resources.

Poverty increases the risk of infection, and we have shown that social deprivation is relevant in SA. This was implied in a recent study in which Aborigines were shown to have a three-fold higher rate of SA than non-indigenous Australians [5]. Our SA patients from both populations showed skewing towards the higher deprivation scores, but this did not reach statistical
significance in the RA patients, possibly because our uninfected RA patients were already more deprived [16]. Nevertheless, our data unequivocally show that, even after excluding i.v. drug-abusers, SA patients are more disadvantaged than the local population. It remains to be shown whether these individuals are at risk of SA because of significant comorbidity.

Of the 25 RA patients in our study, 10 were taking prednisolone or methotrexate (either alone or in combination). Therapy with immunosuppressive drugs has been implicated as a possible cause of impaired immune system function in SA [6, 9]. However, because this was a multicentre study, we cannot clarify whether these drugs were used more frequently in SA patients than in uninfected RA patients in the West of Scotland. Nevertheless, nine RA patients and two with seronegative spondyloarthropathy were taking no DMARD at the time of diagnosis, which supports the theory that autoimmune disease may be sufficient to predispose to SA in its own right. Furthermore, two of the four RA patients who died were not taking any DMARD.

RA is a risk factor for joint sepsis, but this study has shown that RA patients are likely to have a normal body temperature and WCC at presentation, indicating that a high degree of clinical suspicion of SA is necessary in this group. The fact that blood cultures were positive in nearly 50% of cases confirms that this investigation is warranted even in apyreal patients with a normal WCC.

The infecting pathogen, the needs of the patient and the preferences of the physician and microbiologist will all influence the choice and duration of antibiotic treatment, but therapy should be immediate [24–29]. There are no guidelines for antibiotic treatment in SA, but most authors agree that i.v. antibiotics should be given for at least 1 week and subsequent oral antibiotics for at least 2 weeks. This practice was adhered to in most cases, with a median duration of i.v. antibiotics of 15 days and subsequent oral therapy for 21 days in the present study. Although 42 patients (57%) were prescribed two antibiotics, in eleven (15%) patients three or more antibiotics were given. The combination included fluoxacillin, gentamicin or vancomycin in 85% of cases. As staphylococci and streptococci are implicated in over 90% of cases of SA, and in keeping with published suggestions for therapy [30], this practice would seem appropriate. The common use of rifampicin and fusidic acid is an indication of their more effective bone penetration. Gentamicin is a favoured combination antibiotic in many units in the West of Scotland, until sensitivities have been fully established, because it offers broad-spectrum Gram-positive and Gram-negative cover. In the present study, the use of vancomycin as a first-choice antibiotic reflected evidence of previous infection with Staphylococcus epidermidis or MRSA in some cases. In other patients there was a high suspicion of these infections (after joint injection or surgery), but in two cases it was used because of the presence of SA in association with multiple joint replacements.

The 11% mortality in this study is similar to the rates in previous studies [6, 9, 18] and shows little improvement in prognosis despite optimal therapy. However, it is no different from the mortality from other community-acquired infections, such as pneumonia [31]. At presentation, all eight patients who died during the acute infective episode had a leukocytosis (range 13–38 × 10^9/l), which could be useful in identifying those at greatest risk. Leg ulceration was seen in three patients and was notable as a possible predictor of poor prognosis. The aetiology of leg ulcers in RA is recognized to be multifactorial, but in one case the patient had received treatment for vasculitis. It remains to be seen whether the extra-articular features of RA, including vasculitis, are of major importance in the development of SA or in the subsequent outcome. As in other severe infections, renal function became impaired before death in seven of the eight patients who died, and in two of these patients liver abnormalities also developed.

In conclusion, our experience indicates that all patients with suspected SA should have both SF and blood culture analysis, irrespective of body temperature and inflammatory indices. Although other local practices may vary, the combination of fluoxacillin (or a macrolide if the patient is allergic to penicillin) plus gentamicin offers broad-spectrum cover for most organisms isolated in SA, but if MRSA or Staphylococcus epidermidis are suspected, vancomycin should be used. If bone involvement is thought likely, the addition of fusidic acid or rifampicin would be appropriate. In most cases, parenteral treatment for at least 2 weeks followed by oral therapy for a minimum of 3 weeks is desirable.

SA is clearly a significant problem in the West of Scotland. Socio-economic factors are important, and IVDA is a potential predisposing factor to SA in urban communities. In addition, we have shown in a prospective study of SA patients in whom bacteria had been identified on SF culture that the use of antibiotics is appropriate. This analysis of patients fulfilling Newman Grade A criteria will facilitate comparisons with patients in the other two Newman groups in whom bacteria cannot be identified on SF culture but in whom the diagnosis is suspected clinically.

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References