Septic arthritis of the shoulder in children in Malawi

A RANDOMISED, PROSPECTIVE STUDY OF ASPIRATION VERSUS ARTHROTOMY AND WASHOUT

From Queen Elizabeth Hospital, Blantyre, Malawi

We undertook a prospective study of 61 children in Malawi with septic arthritis of the shoulder. They were randomised into two groups, treated by aspiration (group 1, 31 patients) or arthrotomy (group 2, 30 patients). Both received antibiotics for six weeks. We studied the results of blood tests, microbiology, and the clinical and radiological outcome one year after diagnosis. Only one patient was sickle-cell positive and three were HIV-positive. Non-typhoidal *Salmonella* species accounted for 86% (19/22) of the positive joint cultures in group 1 and 73% (16/22) in group 2. Of the 33 radiographs available for review at follow-up at six months, 23 (70%) showed evidence of glenohumeral damage. There was no statistical difference in radiological outcome for the two groups. We devised and validated a scoring system, the Blantyre Septic Joint Score, for the assessment of joints based upon swelling, tenderness, function and range of movement. Despite the radiological changes only one of the 24 joints examined at one year had any deficit in these parameters. There was no statistical difference in the clinical outcome for the two treatment groups at any stage during the period of follow-up.

Received 11 December 2001; Accepted after revision 22 April 2002

Septic arthritis of the shoulder is rare in the developed world but relatively common in young children in sub-Saharan Africa. Although Schmidt, Mubarak and Gelberman described it as “a disease of infancy” it is sometimes seen in adults when it is usually associated with serious underlying disease. While all authors recognise that it is an emergency requiring urgent treatment, the management itself is controversial, and may depend on whether the admitting team is medical or surgical. The need for appropriate antibiotics and drainage of the joint is universally agreed, but the method of drainage ranges from simple aspiration to arthrotomy and debridement, with the insertion of antibiotic-impregnated beads and drainage systems. We therefore undertook a prospective, randomised study of septic arthritis of the shoulder in children in Malawi to determine the clinical features, microbiology and the clinical and radiological outcome after treatment with antibiotics and either aspiration or arthrotomy and washout.

Patients and Methods

Between 1999 and August 2000, all patients under 16 years of age attending Queen Elizabeth Hospital, Blantyre, Malawi, with a diagnosis of septic arthritis were treated by either simple aspiration of the affected joint or by arthroscopy and lavage. There were 61 patients, 31 in the aspiration group and 30 in the lavage group. All parents had signed consent for participation in the study, which had the approval of the local Ethics Committee. Table I gives the details of the two groups. They were well matched for age, gender and expected weights.

Each patient underwent a full clinical examination and blood tests including a full blood count (with differential white cell count), ESR, sickle-cell and HIV testing, and plain radiographs were taken of the affected shoulder. Any patient with evidence of osteomyelitis on the initial radiographs was excluded from the study. Full counselling was carried out before testing for HIV. The treatment for the patients was decided in the operating theatre using random numbers in sealed envelopes. In the aspiration group the joint was aspirated using a widebore needle (14 G) and an anterior approach until no more pus could be removed. If no pus was obtained on aspiration, arthrotomy was carried out and the patient considered a failure of aspiration. If the joint was found to be free from pus in either group, the patient was excluded from the study.
on the grounds that the diagnosis of septic arthritis was unlikely. This occurred in two patients. After drainage of the joint, both groups received a course of antibiotics for six weeks, parenterally for the first 48 hours and then orally if the temperature was normal. If necessary, the antibiotics were changed according to the results of culture and sensitivity. The Blantyre Septic Joint Score (BSJS) was devised for the assessment of septic joints (Table II). Patients with a persistent pyrexia and no improvement in their BSJS underwent further intervention. Patients in the arthrotomy group who did not settle had a further arthrotomy and washout. Those in the aspiration group who had a subsequent reaccumulation of pus had a further aspiration; any reaccumulation thereafter was treated by arthrotomy and washout. Patients were discharged when they were apyrexial, the swelling had settled and they were using the joint comfortably.

They were then reviewed at two, six, 12, 24 and 52 weeks when blood tests and radiographic examination were repeated. The follow-up was 100% at two and six weeks, 95% (58/61) at 12 weeks, 59% (36/61) at 24 weeks and 41% (25/61) at 52 weeks. Thirty-three patients (54%) had radiographs available for review with a follow-up of at least six months (6 to 21).

Results

There were no initial ‘dry taps’ in the aspiration group. Three patients required a second aspiration. One of the arthrotomy group required a further washout. There was a seasonal variation in admissions (Fig. 1), with an increase during the rainy season. The patients in both groups were generally anaemic (mean haemoglobin 8.4 g/dl) with a leucocytosis (mean white cell count 14 300/ml) and a raised ESR (mean 52 mm/hr) on admission, but these improved during the first six weeks of treatment.

Microbiological findings. The pus from each joint was sent for culture and sensitivity. There was a positive culture in 72% of patients. Non-typhoidal Salmonella species, Salmonella enteridis and Salmonella typhimurium, made up 86%

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Aspiration group</th>
<th>Arthrotomy group</th>
<th>Combined total</th>
<th>Percentage of all cultures</th>
<th>Percentage of positive cultures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmonella typhimurium</td>
<td>15</td>
<td>12</td>
<td>27</td>
<td>44</td>
<td>61</td>
</tr>
<tr>
<td>Salmonella enteridis</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Type-B Haemophilus</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Group-A Streptococcus</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Streptococcus pneumonia</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Klebsiella</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>No growth</td>
<td>9</td>
<td>8</td>
<td>17</td>
<td>28</td>
<td>-</td>
</tr>
</tbody>
</table>

Table I. Details of the 61 children treated for septic arthritis of the shoulder by either aspiration or arthrotomy and washout

<table>
<thead>
<tr>
<th></th>
<th>Aspiration</th>
<th>Arthrotomy and washout</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>31</td>
<td>30</td>
<td>61</td>
</tr>
<tr>
<td>Median age (months)</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>M:F</td>
<td>2.9:1</td>
<td>1.7:1</td>
<td>2.2:1</td>
</tr>
<tr>
<td>Treatment delay (days)*</td>
<td>7.0</td>
<td>7.5</td>
<td>7.3</td>
</tr>
<tr>
<td>BSJS on admission†</td>
<td>4.0</td>
<td>3.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Percentage of expected weight‡</td>
<td>89</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>HIV positive</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Sickle-cell disease</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

* time from onset of symptoms to drainage
† weight when expressed as a percentage of the expected weight for a child of the same age using the standard ‘Malawi Road to Health Charts’
(19/22) of positive cultures in the aspiration group and 73% (16/22) in the arthrotomy group (Table III).

**Clinical findings.** The mean BSJS on admission was 3.0 in the aspiration group and 2.7 in the arthrotomy group. The overall mean temperature on admission was 37.7°C. The mean time for the patient to become apyrexial was 1.4 days in the aspiration group and 1.6 days in the arthrotomy group. Follow-up at six weeks showed that the scores had dramatically improved in both groups with only one shoulder scoring less than 12/12 in each. This improvement was maintained over one year for both groups (two-tailed Mann-Whitney U test).

Despite the normal values of the BSJS at follow-up at one year, a proportion of the shoulders showed clinical signs of glenohumeral damage. These included crepitus and a slight sulcus just lateral to the acromion. Although most shoulders appeared to have a full range of movement, some of this was secondary to a compensatory increase in scapular rotation. If the inferior angle of the scapula was immobilised, the total amount of abduction of the shoulder was reduced. Conversely, if the scapula was not immobilised, the inferior angle would protrude into the axilla; we called this the ‘scapular sign’.

**Radiological results.** Radiographs in 33 of 61 patients for at least six months were available for review at follow-up; 22 (70%) of these showed evidence of damage to the glenohumeral joint. Although the odds of having radiological changes were more than 1.5 times greater in the arthrotomy than in the aspiration group (odds ratio 1.56) this difference was not statistically significant (p = 0.44). Of the shoulder radiographs which were abnormal 64% (9/14) were in the aspiration group and 74% (14/19) in those having an arthrotomy. Overall, the epiphyses showed radiological sequelae of sepsis in 61% (20/33) of patients ranging from a small epiphysis with or without areas of radiolucency to an absent epiphysis in one-third of patients (11/33). Radiological evidence of metaphyseal changes was present in 45% (15/33) and almost half (7) showed a characteristic appearance of ‘medial beaking’. Only one patient had evidence of glenoid damage on plain radiographs.

There was a pattern to the progression of radiological changes when they occurred. In the metaphysis a lucent area developed during the first two weeks, often with an overlying periosteal reaction (Fig. 3). During the following months the metaphysis widened, with a cupped appearance of the epiphyseal plate (Fig. 4) and subsequent ‘medial beaking’ (Fig. 5). The appearance of the humeral epiphysis was often delayed by several months, and once formed had areas of lucency (Fig. 6). These lucencies progressed until there was no radiological evidence of an epiphysis in one-third of patients (Fig. 7). The remaining ‘absent epiphyses’ were in patients in whom the epiphysis had not been seen on plain radiographs and this probably represented marked delay in re-ossification. The ossification centre of the humeral head usually appears at between four and six months of age, and although they were young, all the patients were older than six months at radiological review.

**Discussion**

Septic arthritis of the shoulder affects very young children and infants. In a literature review of 471 children with septic arthritis by Jackson and Nelson only 4% (18/471) had involvement of the shoulder. Gillespie found a similar percentage (3%) in his series of 102 children. Our experience in Malawi is that septic arthritis of the shoulder accounts for a much larger percentage of the total number of cases in children with septic arthritis. Molyneux and French found that shoulders made up 28% of cases of septic arthritis in their study of 100 children in Malawi, and postulated that the high incidence of involvement of the shoulder may have been related to the African habit of swinging the child onto the mother’s back by holding it’s arm, causing repeated minor injury to the joint. The literature suggests that septic arthritis is more common in boys,
and our findings support this. There is no obvious reason to account for this gender difference, although it may be that boys are more likely to sustain repeated minor injury to the shoulder.

An organism was grown from the cultures of synovial fluid in 44 shoulders (72%). This was a slightly higher rate of positive culture than in most previously published series. Of these positive cultures 79% (35/44) were non-typhoidal *Salmonella* species. In the scientific literature from the developed world, non-typhoidal *Salmonella* accounts for only about 1% of all cases of septic arthritis. It is, however, the commonest cause of bacteraemia and septicaemia in children in tropical Africa, and the most frequently reported cause of septic arthritis in infants in Kenya, Zambia and Malawi. The peak age for non-typhoidal *Salmonella* bacteraemia is between ten and 14 months of age and it is strongly associated with anaemia, poor nutritional status and malaria. In Malawi, the highest incidence of malnutrition and anaemia is at the end of the rainy season, and this may explain the high frequency...
of admissions in May and June (Fig. 2). Although there is a
definite association between non-typhoidal Salmonella and
HIV disease,30,31 which is common in Malawi, only three
patients in our study were HIV-positive. Sickle-cell anaemia
and schistosomiasis are also important risk factors for sal-
monellosis, but tend to be seen in association with non-
typhoidal Salmonella infection in older children and
adults.32-37 Only one patient in our study was sickle-cell
positive. Schistosomiasis is endemic in the Lakeside areas
of Malawi but is much less common in the Blantyre region.
It seems likely that the predominance of non-typhoidal Sal-
monella in our study was due to the high numbers of young,
malnourished, anaemic children in a part of Africa where
non-typhoidal Salmonella and malaria are endemic.

The progression of radiological changes in our patients
was very similar to that described by Schmidt et al2 and
Lejman et al.7 Two-thirds showed radiological evidence of
glomerular damage at follow-up at six to 21 months. Whether this will influence the clinical outcome in the
longer term remains to be seen. Despite the relative fre-
cency of septic arthritis of the shoulder in Malawi, in our
experience it is extremely rare for adult patients to present
with symptoms in the shoulder after having septic arthritis
as a child.

The aim of treatment in septic arthritis is to avoid poten-
tially devastating damage to the joint by prescribing anti-
biotics to control infection, to drain the joint to remove
destructive proteolytic enzymes, inflammatory cells and
mediators, and to decompress the joint.38 Most authors
agree that antibiotics should be given parenterally initially
and then orally once the signs and symptoms of infection
start to resolve.3,4,39-41 The recommended duration of anti-
bacterial treatment varies from two weeks to more than
three months although most authors favour six weeks.23,42

The method of drainage of a septic joint remains contro-
versial. Arthrotomy allows thorough debridement with the
removal of debris and breakdown of loculations, but carries
the morbidity of open surgery and general anaesthesia.
Aspiration carries minimal morbidity and may not require
general anaesthesia in the older child. It may, however, pro-
vide less satisfactory drainage of the joint. Arthroscopic
washout is another alternative with some potential advan-
tages and is being used increasingly, particularly in the
knee. Nord et al43 in an experimental study using the knunes of goats infected with Staphylococcus aureus, found no dif-
ference in damage to the articular cartilage between antibi-
otics alone, antibiotics and arthroscopy, antibiotics and
arthrotomy, antibiotics and aspiration, and antibiotics,
arthroscopy and debridement.

Most authors agree that in the septic hip which is deep-
seated, difficult to aspirate, and in which the sequelae of
sepsis can be devastating, arthrotomy and washout are the
best method of treatment.15,22,44-50 Many authors, however,
are divided on the best way to drain the shoulder in children.
Some recommend aspiration for all septic shoulders and
some arthrotomy.2,6-11 Schmidt et al2 considered that septic
arthrosis of the shoulder in children should be treated by drain-
age of the bicipital recess and drilling of the metaphysis.

In this randomised, prospective, study in which our
patients were treated either by simple aspiration or by
arthrotomy and wash-out, there was no significant differ-
ence between the two groups on either clinical (p = 0.32) or
radiological assessment (p = 0.44) at follow-up at one year.
Although we await the results of longer-term follow-up in
these patients, our preliminary findings suggest that both
aspiration and arthroscopy and washout are equally effective
methods of drainage in children with septic arthritis of the
shoulder.

No benefits in any form have been received or will be received from a com-
mercial party related directly or indirectly to the subject of this article.

References

3. Leslie BM, Harris J, Driscoll D. Septic arthritis of the shoulder
4. Gelberman RH, Menon J, Austenlitz M, Weisman M. Pyogenic ar-
3.
6. Lavy CB, Lavy VR, Anderson I. Salmonella septic arthritis of the
7. Lejman T, Strong M, Michno P, Hayman M. Septic arthritis of the
shoulder during the first 18 months of life. J Pediatr Orthop 1995;15:
172-5.
9. Wilson NIL, DiPaola M. Acute septic arthritis in infancy and
7.
10. Goldenberg DL, Brandt KD, Cohen AS, Cathcart ES. Treatment of
septic arthritis: comparison of needle aspiration and surgery as initial