Hip septic arthritis in children: Assessment of treatment using needle aspiration/irrigation


Department of Pediatric Orthopaedic Surgery, Nancy Teaching Hospital Center, Children Hospital, 5, allée du Morvan, 54511 Vandœuvre, France

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Summary
Introduction: This retrospective series evaluated the surgical treatment of hip arthritis in children by needle aspiration-irrigation alone.

Patients and methods: Forty-three cases of septic hip arthritis were treated by needle aspiration-irrigation under general anesthesia associated with intravenous then oral administration of antibiotics. Clinical and biological criteria at admission, during hospitalization and at final follow-up were studied to identify any criteria carrying a predictive value for unsuccessful needle aspiration-irrigation.

Results: Thirty-eight hips had a favorable outcome in this series, while secondary open arthrotomy was required in five hips for further irrigation. Common criteria found in the group requiring open arthrotomy were a diagnosis delay of at least 6 days between initial clinical symptoms and treatment as well as markedly abnormal biological results at admission. A threshold for the predictive value of certain variables was identified including C-reactive protein above 100, white polynuclear blood count above 15000, and sedimentation rate above 25 in the first hour and 50 in the second hour.

Discussion: Treatment modalities for septic arthritis of the hip remain controversial in children and various techniques have been shown to be effective in the literature. Needle aspiration-drainage, the least invasive of these, has been shown to have good results, even in the hip, even though this is a deep, tight, joint which is known to be difficult to drain. Prognostic criteria are difficult to identify, however all authors agree that delayed treatment makes evacuation of intra-articular debris especially difficult.

Conclusion: Needle aspiration-irrigation is effective in septic arthritis of the hip, as long as basic principles are followed. Delayed treatment and certain biological criteria should be taken into account when selecting a treatment, since negative predictive criteria identified in this series were present in the five hips requiring secondary arthrotomy.

Level of evidence: Level IV. Retrospective study.

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Introduction

Although there is general agreement that it is urgent to treat septic arthritis in children, the method for draining and lavage differs from one team to another [1,2]. Puncture drainage, needle aspiration-lavage and draining by arthroscopy or arthrotomy are the most frequently described techniques [3,4]. Nevertheless, most authors recommend open or instrumental drainage as first line treatment for the hip, because this joint is deep and tight making it inaccessible to needle aspiration-lavage [4,5].

We analysed the results of needle aspiration-lavage to determine its efficacy as a first line treatment of septic arthritis of the hip and to better understand its indications. We also tried to identify any positive predictive factors for this technique, or whether certain clinical or biological criteria supported an open surgical approach as a first line treatment.

Patients and methods

A retrospective study of all files of children with septic arthritis of the hip between 1996 and 2005 who received needle aspiration-drainage as first line treatment were reviewed. The Waldvogel criteria were used to confirm the diagnosis of septic arthritis and osteomyelitis [6]:

- clinical signs of articular pain with fever;
- positive bacteriological culture from blood culture or local samples;
- presence of radiological signs suggesting septic arthritis such as soft tissue edema, synovial effusion or even a periosteal reaction or bone degeneration;
- draining of purulent liquid during the surgical procedure.

Children who underwent open arthrotomy as a first line treatment without prior needle-aspiration were excluded from the study, as well as all children whose diagnosis was later found to be inflammatory or reactive arthritis. The presence of radiological bone lesions at presentation was also a criterion for exclusion, because only simple arthritis was evaluated without associated bone lesions.

Thus 43 hips were evaluated in 40 children (bilateral hips in three children). There were 29 boys and 11 girls, mean age 5 years and 3 months old (3 days—14 years) with a mean follow-up of 16 months (1—78 months). Patient management and the treatment protocol were standardized: after clinical examination and a standard AP view X-ray and a Lauenstein view of the hip had been performed with the child in the supine position, peripheral biological tests were performed. This included a full blood count with differential, C-reactive protein dosing, sedimentation rate and part was saved for direct analysis and seeding in a bacteriological laboratory on an enriched culture medium. Once local bacteriological cultures had been obtained, intravenous antibiotics were begun while the patient was still anesthetized. Peripheral or central intravenous lines could be used depending on the age of the child and the condition of his/her veins. A central catheter was placed at that time if necessary. If the child was under 2, an association of cefotaxime and fosfomycin was administered while methicillin-gentamycin was chosen for older children (gentamycin was only administered for 3—5 days depending on the case and bacteriological results). Intravenous treatment was continued for a mean 11.4 days (4—32 days), followed by a mean 6.8 weeks of oral antibiotics (2—24 weeks).

Clinical data were noted on admission, including the delay between the first clinical signs and treatment (0—15 days), the temperature, and the Blantyre septic joint score [1] when it could be determined from the file. The Blantyre septic joint score is a total of 12 points based on four items each with a score of 3. It rates pain, passive articular range of motion, articular function, and the presence of swelling around the joint. Finally effusion was measured in millimeters on ultrasound (Table 1).

Biological data were collected at admission as well as at follow-up during the hospital stay. Parameters evaluated at D0 then D10 were leucocytosis, neutrophil polynucleosis, C-reactive protein and SR (sedimentation rate) in the first and second hour. Table 2 shows the changes in biological criteria in the 10 days following initial needle aspiration-lavage.

Stat Plus® Professional 2008 software was used for the statistical evaluation. Comparison of groups according to the different parameters was performed by the Student t-test. P < 0.05 was considered to be significant.

Results

The outcome of 38 of the 43 hips treated by needle aspiration-lavage as first line therapy was favorable during hospitalization, with pain relief, apyrexia and normalization of biological criteria, requiring no additional surgical treatment. On the other hand the clinical condition and/or biological results worsened in five cases and secondary arthrotomy was required. Arthrotomy was performed two days after initial needle aspiration-drainage in one case, on the 5th day in two cases and then on the 9th and 13th day respectively for the two other cases. Secondary arthrotomy resulted in a clinical and biological cure in all cases.

Thus the clinical and biological results (D0 and D10) and bacteriological results of these two groups (group 1: needle aspiration-drainage alone, group 2: secondary arthrotomy) were analysed separately, and all items were evaluated statistically to identify any possible predictive factors.

Clinical criteria

There was no statistically significant difference between group 1 and group 2 at presentation for age (mean 5.3 years and 5.9 years respectively) (p = 0.6), body temperature or the Blantyre Joint Score whose values for each item in the two groups are shown in Table 3. There was a difference in
Treatment of septic arthritis of the hip in children by needle aspiration-irrigation

Table 1  Clinical data at admission.

<table>
<thead>
<tr>
<th></th>
<th>No. of hips evaluated</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay to treatment</td>
<td>43</td>
<td>4.09</td>
<td>0</td>
<td>15</td>
<td>4.54</td>
</tr>
<tr>
<td>Temperature at admission</td>
<td>43</td>
<td>37.8</td>
<td>36</td>
<td>40</td>
<td>0.89</td>
</tr>
<tr>
<td>Blantyre joint score /12</td>
<td>43</td>
<td>5.02</td>
<td>0</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Effusion at initial US mm</td>
<td>43</td>
<td>5.72</td>
<td>0</td>
<td>10</td>
<td>2.16</td>
</tr>
</tbody>
</table>

Table 2  Progression of biological data at D10.

<table>
<thead>
<tr>
<th></th>
<th>No. of hips</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leucocytes at admission</td>
<td>43</td>
<td>12781.16</td>
<td>5100</td>
<td>25000</td>
<td>4510.31</td>
</tr>
<tr>
<td>Neutrophiles at admission</td>
<td>43</td>
<td>8669.51</td>
<td>1326</td>
<td>20450</td>
<td>4043.93</td>
</tr>
<tr>
<td>CRP at admission in mg</td>
<td>43</td>
<td>59.56</td>
<td>2.5</td>
<td>336</td>
<td>72.66</td>
</tr>
<tr>
<td>SR 1st hour at admission</td>
<td>37</td>
<td>33.11</td>
<td>2</td>
<td>136</td>
<td>27.17</td>
</tr>
<tr>
<td>SR 2nd hour at admission</td>
<td>35</td>
<td>56.63</td>
<td>4</td>
<td>140</td>
<td>32.95</td>
</tr>
<tr>
<td>Leucocytes at D10</td>
<td>43</td>
<td>6974.37</td>
<td>1110</td>
<td>12300</td>
<td>2114.58</td>
</tr>
<tr>
<td>Neutrophiles at D10</td>
<td>43</td>
<td>4227.19</td>
<td>674</td>
<td>11200</td>
<td>2471.19</td>
</tr>
<tr>
<td>CRP at D10</td>
<td>26</td>
<td>27.3</td>
<td>0.6</td>
<td>232</td>
<td>47.5</td>
</tr>
<tr>
<td>SR 1st hour at admission</td>
<td>24</td>
<td>31.1</td>
<td>2</td>
<td>73.11</td>
<td>14.9</td>
</tr>
<tr>
<td>SR 2nd hour at admission</td>
<td>24</td>
<td>55.21</td>
<td>5</td>
<td>109</td>
<td>32.41</td>
</tr>
</tbody>
</table>

Table 3  Comparison of clinical data between the two groups.

<table>
<thead>
<tr>
<th></th>
<th>Aspirated hips n = 38</th>
<th>Hips with arthrotomy n = 5</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>5.334</td>
<td>5.984</td>
<td>0.672</td>
</tr>
<tr>
<td>Temperature</td>
<td>37.6</td>
<td>38.2</td>
<td>0.185</td>
</tr>
<tr>
<td>Blantyre Joint Score</td>
<td>4.82</td>
<td>6.6</td>
<td>0.216</td>
</tr>
<tr>
<td>Delay to treatment</td>
<td>3.82</td>
<td>6.2</td>
<td>0.275</td>
</tr>
</tbody>
</table>

the delay between the first clinical symptoms and treatment between group 1 and group 2 (a mean 3 and 6 days respectively) but this was not statistically significant (p=0.2).

Biological criteria

There was no significant difference in leucocytosis values, neutrophil polynucleosis, C-reactive protein or sedimentation rate between the two groups (Table 4). Nevertheless, because mean C-reactive protein levels were twice as high at presentation in group 2 (102 mg) than in group 1 (53 mg), we investigated the levels of significance for each of the biological criteria. Only a sedimentation rate above 25 mm at admission was statistically significant (p=0.03) (Table 5).

Radiographic criteria

Although ultrasound confirmed the presence of effusion, the quantity did not provide additional information: a mean 5.6 mm for the group 1 and 6.7 for group 2 (p=0.3).

Bacteriological criteria

Bacteriological samples were positive in 41.86% of cases or in 18/43 hips (including five positive blood cultures). Distribution of bacterial flora showed a majority of methicillin sensitive Staphylococcus aureus (seven cases), followed by staphylococcus epidermidis (four cases), then Streptococcus and Kingella kingae (two cases each), as well as less common Staphylococcus. There was no difference between

Table 4  Comparison of biological data between the two groups.

<table>
<thead>
<tr>
<th></th>
<th>Aspirated hips n = 38</th>
<th>Hip arthrotomies n = 5</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leucocytosis</td>
<td>12459</td>
<td>15224</td>
<td>0.201</td>
</tr>
<tr>
<td>Polynuclear neutrophiles</td>
<td>8435</td>
<td>10444</td>
<td>0.302</td>
</tr>
<tr>
<td>SR 1st hour</td>
<td>31.59</td>
<td>42.8</td>
<td>0.399</td>
</tr>
<tr>
<td>SR 2nd hour</td>
<td>53.68</td>
<td>79.5</td>
<td>0.143</td>
</tr>
<tr>
<td>C-reactive protein</td>
<td>53.95</td>
<td>102.6</td>
<td>0.166</td>
</tr>
</tbody>
</table>
the groups for type of germ or for the way it was identified (blood culture or synovial fluid culture).

Complications

Open arthroscopy was considered to be a complication and the hips were separated into two groups based on this. Moreover, X-rays were evaluated in the two groups at the last follow-up when this was sufficient (more than 6 months, 42/43 hips) to monitor any secondary bone lesions. Two bone lesions were identified during follow-up in group two hips but this did not affect the clinical or final radiological outcome. Three bone lesions were identified in group 2 (two in the acetabulum, one in the femur) immediately before or after arthroscopy. Nevertheless, the only permanent complication in this group was moderate impingement of the joint space, which developed at 5 months of follow-up in one hip with an acetabular lesion, but without functional impairment.

Discussion

Among the different associated modalities used in the treatment of septic arthritis in children, three have been the subject of much debate with radically different options proposed in certain cases: techniques for the drainage and lavage of articular fluid, the route of administration and duration of antibiotics, and immobilization of the affected joint. It is difficult to compare the different series in the literature because of the many heterogenous factors making interpretation of results unreliable [2]. As a result, we voluntarily limited our series to septic arthritis in one joint to evaluate one of the surgical treatments proposed in the literature. This represents a bias in our series because arthritis in other locations was not taken into account, however, our sample is homogenous for one joint.

Although our study is limited to septic arthritis of the hip, the epidemiological data in this series are comparable to those in literature for children all locations combined, with a majority of boys, mean age for the peak occurrence of between 3–5 years old [7–9]. The three most common locations are the hips usually with a similar proportion of cases as in the knees, then the ankles [9]. Nevertheless, several authors have specifically investigated acute arthritis of hip to determine the factors of a poor prognosis and progression, although no clear recommendations have been provided on the type of treatment depending on the case [7–10].

Clinical presentation

We used the Blantyre joint score recommended by Smith [3], however these clinical signs are mainly used for diagnostic rather than prognostic factors. This score seemed interesting because it rates subjective clinical symptoms such as pain and objective signs such as joint range of motion on an arithmetic scale. On the other hand, swelling is difficult to evaluate in the hip because it is a deep joint.

We did not find any significant difference between the groups for these clinical criteria. This was also confirmed by Eich et al. [11] and Sultan and Hughes [12] who used clinical criteria for the differential diagnosis of transitory acute synovitis or joint effusion from other causes, but not for the prognosis.

Thus, there do not seem to be any clinical criteria to suggest more severe injury that could justify arthrotomy as a first line therapy.

Biological tests

Klein et al. [13] do not consider the inflammatory syndrome to be a diagnostic tool and the values that are provided (in particular for the sedimentation rate which is given a value of 45 mm in the first hour) are diagnostic and not prognostic thresholds. The sedimentation rate was found to be a reliable marker, even as a prognostic indicator and we found a significantly different threshold between the groups. Thus, a sedimentation rate above 25 mm in the first hour and 50 in the second hour after admission were criteria for a poor prognosis.

The leucocytosis value is important for certain authors, but always for its diagnostic and not its prognostic value (threshold 13200 for Del Beccaro et al. [14] to differentiate septic arthritis from transitory acute synovitis). However, like in the literature, our results did not show this item to have significant prognostic value.

On the other hand, opinions are divided about C-reactive protein. Indeed, although this parameter was always elevated in our series with a clear arithmetical difference between the two groups that did not reach significance, the CRP was not constantly elevated in the series by Bonhoeffer et al. [8] and this parameter was less useful than the sedimentation rate in the diagnosis of acute arthritis. That study could not explain why this parameter was normal despite the confirmed diagnosis. Kaback also supports this, stating that an initially elevated CRP is not sufficient to confirm the diagnosis and should be associated with clinical criteria [1]. On the other hand that study states that a persistently elevated CRP (without defining the value) after 3 or 4 days of treatment is a good indication of complications or at least an unfavorable outcome.

Bacteriology

Our bacteriological results were not different from those in the literature [15]: a majority of S. aureus, then Streptococ-
Treatment of septic arthritis of the hip in children by needle aspiration-irrigation

Bonhoeffer et al. [8] who clearly recommend searching for septic arthritis of the hip. This has also been suggested by authors as a sign of severity or poor outcome [18—20]. Three of the four out of five hips requiring arthrotomy in our series had visible radiological bone lesions. While for Rutz and Brunner [20] visible radiological bone lesions are an indication for arthrotomy.

Associated bone lesions

This is a fundamental point, which is emphasized by all authors as a sign of severity or poor outcome [18—20]. Three out of five of the hips requiring arthrotomy in our series had a secondary bone lesion. This suggests that it may be necessary to systematically search for bone lesions in all cases of septic arthritis of the hip. This has also been suggested by Bonhoeffer et al. [8] who clearly recommend searching for bone lesions in the early stages of the disease, ideally by MRI. For that author the presence of a bone lesion does not mean that arthrotomy will be systematic, while for Rutz and Brunner [20] visible radiological bone lesions are an indication for arthrotomy.

Antibiotic treatment

There are no specific recommendations for the duration of antibiotic treatment whatever the route of administration although there is a tendency to reduce the duration of intravenous treatment [21]. For Gandini [5] a mean 8 days of intravenous treatment should be followed by 3 weeks of oral treatment. The duration of treatment does not seem to affect the final result because our patients all received equivalent treatment with no difference at the final follow-up. Vinod et al. [22] compared the results in two groups of children, one with a long-term 5-week protocol of antibiotic treatment, and the other for 3.5 weeks with no difference in results. Kim et al. [23], in a similar manner, proposed oral antibiotics immediately following the disappearance of clinical symptoms, which usually resulted in less than 7 days of intravenous administration. This was confirmed by Jagodziński in a prospective study showing that 3—5 days of intravenous administration was effective followed by only 3 weeks of oral treatment [24].

Thus the type of antibiotic treatment cannot be considered a factor influencing the outcome of this disease.

Surgical drainage

The choice of technique has long been controversial. Even 1979, Lunseth and Heiple [17] did not find any difference in results between arthrosis treated by arthrotomy or simple aspiration. There is general agreement that treatment must include draining the joint sufficiently to mechanically eliminate a maximum of fungal debris followed by antibiotic treatment. Opinions vary on the choice of technique, in particular for the hip because this joint is deep and tight. Needle aspiration-lavage is the simplest, least invasive technique but it is also accused of being less effective because of the difficulty of removing voluminous debris such as pseudomembranes, and numerous authors prefer systematic arthrotomy for debridement of all remaining septic tissue [25, 26]. At the same time there is a tendency to prefer less invasive drainage-lavage techniques because of the significant risks associated with open surgery. Thus arthroscopy was developed with satisfactory results that are perfectly comparable to those obtained by open arthrotomy [4]. However this technique is still somewhat more difficult to perform in the hip than another looser joint, such as the knee, especially in young children.

We chose the least invasive technique in our study in the absence of clear arguments in the series in the literature supporting the efficacy of different surgical draining methods. Like Nord et al. [27] and Smith et al. [28], who found no difference between the drainage-lavage techniques (aspiration, arthroscopy or arthrotomy), our satisfactory results support the use of simple needle aspiration of purulent fluid as the first line treatment. Whether the anterior or obturator internus approach was used, the results of needle aspiration-drainage were perfectly satisfactory in most cases in our series. Nevertheless, it is essential to follow basic principles: aspiration should remove an amount of pus that corresponds to what would be expected based on ultrasound results. Lavage should be continued until a clear fluid is obtained. Any difficulty in draining the synovial fluid suggests the presence of pseudomembranes, which cannot be removed by needle aspiration. In this case, or if recovery is slow, another method of lavage — either arthroscopy or arthrotomy — should be performed depending on the surgical team [29].

Conclusion

Management of septic arthritis is evolving. New diagnostic methods such as molecular biology techniques have been developed and there is a tendency to limit the invasiveness of antibiotic and surgical treatments without affecting treatment efficacy. Our series in septic arthritis in one location seems to support this. Needle aspiration-lavage for septic arthritis of the hip was immediately effective in more than 85% of the cases in our series and the drainage-lavage technique did not seem to be the cause of surgical revision. It was difficult to isolate statistically significant factors for a poor prognosis in patients who underwent secondary arthrotomy in our series, even if the initial degree of

biological inflammatory syndrome was clearly higher in this group.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References


