Prospective, Randomized Trial of 10 Days versus 30 Days of Antimicrobial Treatment, Including a Short-Term Course of Parenteral Therapy, for Childhood Septic Arthritis

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(See the editorial commentary by Bradley, on pages 1211–2)

Background. The standard treatment for septic arthritis in children is antimicrobials for several weeks (initially administered intravenously) and arthrotomy (at least for the hip and shoulder joints). No sufficiently powered study has examined the true need for these treatments.

Methods. In a randomized, multicenter prospective trial in Finland, children aged 3 months to 15 years who had culture-positive septic arthritis were randomized to receive clindamycin or a first-generation cephalosporin for 10 days or 30 days (intravenously for the first 2–4 days). The number of surgical procedures was kept to a minimum. Illness was monitored with preset criteria. Antimicrobial therapy was discontinued when the clinical response was good and the C-reactive protein level decreased to ≤20 mg/L. The primary end point was full recovery without need for further administration of antimicrobial therapy because of an osteoarticular indication during the 12 months after therapy.

Results. Of the total 130 cases, 88% were caused by Staphylococcus aureus, Haemophilus influenzae, or Streptococcus pyogenes; 63 patients were in the short-term treatment group, and 67 were in the long-term treatment group. The median durations of antimicrobial treatment were 10 days and 30 days, respectively. Surgical procedures that were more extensive than percutaneous joint aspiration were performed for 12% of patients, with no preponderance to hip or shoulder arthritis. Two late-onset infections occurred in 1 child in the long-term treatment group; however, all patients recovered without sequelae.

Conclusions. Large doses of well-absorbed antimicrobials for ≤2 weeks (initially administered intravenously) and only 1 joint aspiration are sufficient for treatment of most cases of childhood septic arthritis, regardless of the infecting pathogen or anatomical site, if the clinical response is good and the C-reactive protein level normalizes shortly after initiation of treatment.

No consensus prevails on the duration of antimicrobial therapy for childhood septic arthritis (SA). The lack of sufficiently powered studies [1–5] is surprising, because the duration of treatment is equally as important as the choice of agent [6]. Recommendations, based on personal experience and retrospective case analyses, reiterate that after an intravenous treatment phase of ∼1 week [6–8], oral treatment may be possible [1–4, 9] if serum bactericidal activity is assayed [10] and treatment compliance is guaranteed. The total treatment course should last weeks, depending on patient age, causative agent, and localization of the infection [5, 11, 12]. The role of surgery is underlined by many clinicians, especially if the shoulder or hip joint is involved.

Data showing that many severe infections can be treated safely with short-term, mostly oral regimens [13, 14] are proof against long-term hospital stays and bacterial resistance and provide a way to reduce the overall cost of treatment. By conducting a large comparative trial in Finland, we sought to determine
whether the treatment of SA could be simplified by shortening the duration of treatment and maintaining strict criteria for surgical procedures. Because SA in Scandinavia is rare (incidence among persons aged 0–14 years, <5 cases per 100,000 persons per year [15, 16]), long-term enrollment was expected. However, we believe that the goal was reached; most cases of childhood SA responded to relatively uncomplicated treatment.

**METHODS**

**Study design.** This randomized, multicenter, open-label, parallel-group, noninferiority trial was performed at 7 referral hospitals in Finland during 1983–2005. The study protocol was approved by the relevant ethical committees, and the inclusion of a child required the consent of a legal guardian. The trial was designed, conducted, and analyzed independently of any medical companies or manufacturers. Only previously healthy children were included. The study is registered as International Standard Randomized Controlled Trial ISRCTN38832979.

When acute SA (marked by fever, painful and swollen joint without trauma, restriction of motion, and often tenderness and warmth [11]) was suspected in a child aged 3 months to 15 years, the clinician contacted (by telephone) a special ward of the Children’s Hospital (Helsinki, Finland) 24 h/day. Each patient obtained a computer-generated number that randomized him or her to receive antimicrobial treatment for 10 or 30 days; the information was immediately recorded in the chart. If involvement of an adjacent bone was detected during the first few days of treatment, the case was deemed to be a combination of SA and osteomyelitis. These cases were excluded from this analysis, which focused only on SA.

**Treatment.** Because SA in industrialized countries is most frequently caused by gram-positive agents [2, 5–7, 11, 12, 15, 17], clindamycin [1, 18–20] (40 mg/kg per day every 6 h) [4, 20] or a first-generation cephalosporin (see below; 150 mg/kg per day every 6 h) [4, 21] was used. This randomization was performed by birthday (odd or even). Because *Haemophilus influenzae* type b was previously the second-most common causative agent of SA [15, 22], ampicillin or amoxicillin (both 200 mg/kg per day every 6 h [4]) was also given to children aged 0–4 years until the causative pathogen was identified; the treatment course was completed with only 1 antimicrobial. After vaccination eliminated the *H. influenzae* type b etiology in 1997, ampicillin and amoxicillin were no longer used for treatment of SA [22].

Of the first-generation cephalosporins, cephadrine [4, 23–25] was our first choice, because it was available for parenteral and oral use. Later, withdrawal of cephadrine from Scandinavia forced a change to intravenous cephalothin and oral cephalaxin [3, 21] or cephadroxil (all administered in the same manner as cephadrine). The switch was not deemed critical for the study, because the properties of all first-generation cephalosporins are very similar [26].

Antimicrobial treatment was instituted intravenously for 2–4 days, and the course was then completed orally with the same high doses. Serum or joint fluid concentrations were not assayed, and adjuvant dexamethasone [27] was not used. Instead, nonsteroidal antiinflammatory drugs were given at the discretion of the attending clinician (a pediatrician or a pediatric or orthopedic surgeon).

**Identification of the causative agent, role of surgery, and monitoring of patients.** Blood cultures were performed invariably. The only recommended surgical procedure was needle aspiration to obtain a representative sample for bacterial culture; otherwise, the number of surgical procedures was kept to a minimum. Repeated aspirations or routine arthrotomy with or without lavage were not recommended even for shoulder or hip arthritis, unless the clinical response was unsatisfactory or the orthopedic surgeon felt that such an operation was mandatory.

The preset laboratory and radiographic investigations comprised plain radiograph at hospital admission and on days 10 and 19 and basic blood analysis at presentation and on days 5 and 10. Serum C-reactive protein (CRP) level and erythrocyte sedimentation rate (ESR) were measured sequentially [28, 29] during the entire follow-up period (figures 1 and 2). A CRP level $\geq 20$ mg/L and an ESR $\geq 20$ mm/h were considered to be increased. CT and MRI were performed only on demand. Special forms were used for recording. All data were then computerized and analyzed in Helsinki with use of Statview (SAS Institute). A researchers’ meeting was held yearly.

**Discontinuation of antimicrobial therapy, management of special problems, and control visits.** Antimicrobial therapy was discontinued when the patient was clinically recovering (i.e., when fever was improving and the majority of local symptoms and signs were subsiding) and the CRP level had decreased to <20 mg/L, regardless of the ESR. If the clinical signs were still prominent or the CRP level remained elevated or notably increased again, therapy was continued until 2 normal CRP levels were obtained. In cases of likely drug allergy, the medication was switched to an alternative drug.

Because osteoarticular infections have some tendency to reoccur [5, 30] and long-term sequelae may develop slowly [31], control visits were scheduled at 2 weeks, 3 months, and $\geq 1$ year after hospitalization. The liaison performed all investigations, paying special attention to potential sequelae. Radiographs were performed, and ESRs and CRP levels were checked routinely.

**Outcome measures and statistical analysis.** To maximize the reliability of results, only culture-positive cases were included. The primary end point was full recovery (i.e., having no symptoms or signs of SA at the end of the follow-up period, with no readministration of antimicrobial therapy for an os-
Simplified Treatment of Septic Arthritis

Figure 1. Serum C-reactive protein (CRP) level (\(\pm\) SEM) and erythrocyte sedimentation rate (ESR; \(\pm\) SEM) in 16 children who underwent arthrotomy or joint lavage by arthroscopy or with needles, compared with those in the 110 children who underwent diagnostic aspiration only. Data from 2 weeks, 3 months, and 1 year were collected after hospitalization.

Results

Participants. SA was diagnosed in 200 children (figure 3), 154 of whom had an organism isolated. Adjacent bone was affected in 23 cases (excluded), but of importance, this was never a consequence of short-term treatment. Because 1 child refused follow-up, 130 cases of SA (table 1) were analyzed.

All age groups were affected; however, children aged \(<2\) years preponderated (figure 4). The mean age was 6.5 years (median, 5.7 years). Medical attention was sought within 3 days after the onset of symptoms by 85 patients (65\%) and within 6 days by 121 (93\%). No association prevailed between the duration of time from symptom onset to presentation and the presenting status. The lower extremities were most frequently affected: the hip was affected in 48 patients (37\%), the knee was affected in 32 (25\%), and the ankle (tibiotalar joint) was affected in 30 (23\%). With the exception of the hip and knee, among which the affects of SA were distributed somewhat unevenly (although nonsignificantly) between groups, the distribution of the affects of SA among joints was similar.

Bacteria grew on cultures of synovial fluid and blood specimens from 41 patients (32\%; only synovial fluid specimens from 60 patients [46\%] and only blood specimens from 29 patients [22\%]). \textit{Staphylococcus aureus} (all methicillin susceptible) caused 76 cases, \textit{H. influenzae} type b caused 23 cases, \textit{Streptococcus pyogenes} caused 16 cases, \textit{Streptococcus pneumoniae} caused 11 cases, and other agents caused 4 cases (table 1, figure 4). Sixty-three children (48\%) were randomized to the 10-day treatment group, and 67 (52\%) were randomized to the 30-day treatment group. Clindamycin was administered to 43 children, cephalosporin was administered to 26 children, and ampicillin or amoxicillin was administered to 20 children; the other children received medication preferred by the attending physician.
Figure 2. Serum C-reactive protein (CRP) level (± SEM), erythrocyte sedimentation rate (ESR), and WBC count in the 67 patients in the 30-day treatment group, compared with those in the 63 patients in the 10-day treatment group. Data from 2 weeks, 3 months, and 1 year were collected after hospitalization.

The initial mean CRP level was slightly higher in the 10-day treatment group than in the 30-day treatment group (93 mg/L vs. 83 mg/L) (table 1). The mean ESR was similar between groups (54 mm/h vs. 56 mm/h).

Treatment. Antimicrobial therapy was given intravenously for a mean duration of 3 days. The median duration of the entire medication was 10 days (interquartile range, 10–15 days) in the short-term treatment group and 30 days (with no deviation) in the long-term treatment group. Treatment was prolonged only if there was a slow decrease in CRP level or if the attending physician deemed the response to be suboptimal. Adjacent osteomyelitis was suspected in 1 patient but was not confirmed later.

Four children did not undergo a surgical procedure. Percutaneous aspiration was performed for 110 patients; needle lavage was performed for 7 of these patients (2 with hip involvement, 2 with knee involvement, and 1 each with ankle, elbow, and shoulder involvement). Knee arthroscopy was per-
formed for 1 patient. Arthrotomy, occasionally with drilling of adjacent bone, was performed for 15 patients (12% overall). Hip arthrotomy was performed 3 times in the short-term treatment group and 4 times in the long-term treatment group, whereas operations on the shoulder (6 cases) were never performed. As shown in figure 1, CRP levels and the ESR normalized more slowly in the children who underwent surgical procedures than in the children who did not undergo surgical procedures (the curves for CRP level joined on day 12, and the curves for ESR joined on day 19).

**Outcomes.** Most patients recovered quickly, and there were no statistically significant differences between the groups with regard to any follow-up index. Figure 2 shows a comparison of the CRP levels, ESRs, and blood leukocyte counts in the short-term and long-term treatment groups. Of importance, no marker in the 10-day treatment group deviated after discontinuation of antimicrobial treatment.

Two weeks after hospitalization, 10 children in the short-term treatment group and 21 in the long-term treatment group were still recovering; the most common complaints were joint swelling, restricted mobility, and pain. Soft-tissue swelling was found by radiography in 5 children.

At 3 months, 3 patients had minor joint symptoms; a 9-year-old boy still had a swollen knee, a 6-year-old boy recovering from hip arthritis complained of groin pain, and a 15-year-old boy had local pain during exercise after having had sacroiliac arthritis. At 1 year, these children had no symptoms, whereas an 11-year-old boy with perinatal Erb palsy and left elbow arthritis showed mild extension deficit, likely related to previous palsy. A 14-year-old boy with hip arthritis showed a 1-cm limb shortening; this normalized within 12 months. Radiography detected mild coxa magna in a 2-year-old boy and narrow hip joint space in a 5-year-old boy.

**Problem cases and adverse events.** Treatment was changed for 8 children (table 2), all of whom recovered without further problems. A 10-year-old boy in the 30-day treatment group experienced 2 late recurrences of infection. Initially, *S. aureus* arthritis of the ankle responded to cephaladine so well that treatment was discontinued on day 28. Seventeen months later, the same joint was affected, *S. aureus* was isolated, and cepha-

dine treatment was administered again. This time, suboptimal clinical response led to a change to clindamycin for 30 days. Recovery seemed uneventful; however, of surprise, the same ankle was affected again 8 months later, and coagulase-negative staphylococci were identified. Clindamycin therapy for 30 days led to full recovery. Since 1990, the child has remained symptomless. No surgical procedure other than aspiration was performed, and scintigram findings were normal. Immunodeficiency and bacterial resistance were not found.

Four children developed rash, likely caused by medication (2 during amoxicillin therapy and 1 during cephradine or clindamycin therapy). Change of the agent led to full recovery without prolonged treatment. Loose stools were reported in 7% of the children who received cephalosporin and in 1% of patients who received clindamycin, but a causal association was disputable.

**Final outcomes.** One hundred fifteen (88%; 86% from the 10-day treatment group and 91% from the 30-day treatment group) of the 130 children attended the 1-year follow-up visit. One child in the 10-day treatment group was documented as fully recovered 7 months after hospitalization. The remaining patients refused additional follow-up visits after full recovery at 3 months. With the exception of the patient who had late recurrences of infection (table 2), none of the patients experienced relapse, recrudescence, residual dysfunction, growth disturbance, or other clinically significant sequelae.

**DISCUSSION**

Although SA is no longer associated with significant mortality [32], deaths still occur [9, 33]. Therefore, there is an abundance of advice on how aggressive the treatment should be, both medically and surgically. The relevance of those recommendations has been questioned; however, studies have found that clinicians continue to use long durations of therapy (25–29 days in the United States [8, 34] and 31 days in Australia [35]). A recent guideline [36] states that empirical therapy comprises administration of antimicrobials for 4–6 weeks, starting intravenously for at least 3–4 weeks. To our knowledge, our study is the first sufficiently powered randomized trial to document the efficacy and safety of a considerably shorter duration of treatment. Because all of our cases were culture positive, many interpretation problems (e.g., the case definition) were avoided.

Most children presented within a week after symptom onset in our study, similar to other studies [5, 33, 34]. Differences prevail between countries [5–9, 15, 17, 37–39], but we believe that our series is representative of SA in the industrialized world. Whether our results apply to the developing countries, such as those where *Salmonella* arthritis is common [37, 38], remains to be shown, but we expect at least some relevance. If so, our data should also be good news for those settings.

We used high doses of antimicrobials, as has been previously
<table>
<thead>
<tr>
<th>Variable</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All (n = 130)</td>
</tr>
<tr>
<td>Sex, M:F</td>
<td>75:55</td>
</tr>
<tr>
<td>Age, median years (IQR)</td>
<td>6.2 (2.0–10.2)</td>
</tr>
<tr>
<td>Time from symptom onset to presentation, median days (IQR)</td>
<td>2.0 (1.0–4.0)</td>
</tr>
<tr>
<td>Localization of SA</td>
<td></td>
</tr>
<tr>
<td>Hip</td>
<td>48</td>
</tr>
<tr>
<td>Knee</td>
<td>32</td>
</tr>
<tr>
<td>Ankle (tibiotalar)</td>
<td>30</td>
</tr>
<tr>
<td>Elbow</td>
<td>8</td>
</tr>
<tr>
<td>Shoulder</td>
<td>6</td>
</tr>
<tr>
<td>Sacroiliac joint</td>
<td>2</td>
</tr>
<tr>
<td>Multiple joint involvement</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
</tr>
<tr>
<td>Causative agent</td>
<td></td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>76</td>
</tr>
<tr>
<td><em>Haemophilus influenzae</em> type b</td>
<td>23</td>
</tr>
<tr>
<td><em>Streptococcus pyogenes</em></td>
<td>16</td>
</tr>
<tr>
<td><em>Streptococcus pneumoniae</em></td>
<td>11</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
</tr>
<tr>
<td>Site from which the pathogen was cultured</td>
<td></td>
</tr>
<tr>
<td>Joint only</td>
<td>60</td>
</tr>
<tr>
<td>Joint and blood</td>
<td>41</td>
</tr>
<tr>
<td>Blood only</td>
<td>29</td>
</tr>
<tr>
<td>Initial laboratory value</td>
<td></td>
</tr>
<tr>
<td>CRP level, mean mg/L ± SEM</td>
<td>88 ± 5</td>
</tr>
<tr>
<td>ESR, mean mm/h ± SEM</td>
<td>55 ± 3</td>
</tr>
<tr>
<td>WBC count, mean cells/mm² ± SEM</td>
<td>14,100 ± 600</td>
</tr>
<tr>
<td>Duration of antimicrobial therapy, median days (IQR)</td>
<td>25 (10–30)</td>
</tr>
<tr>
<td>Relapse</td>
<td>0</td>
</tr>
<tr>
<td>Late-onset reinfection</td>
<td>2</td>
</tr>
<tr>
<td>Full recovery at last follow-up visit</td>
<td>130 (100)</td>
</tr>
</tbody>
</table>

**NOTE.** Data are no. or no. (%) of patients, unless otherwise indicated. CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; IQR, interquartile range.

- The metatarsophalangeal joint was affected.
- One infection each was caused by *Neisseria meningitidis* group W135, β-hemolytic streptococcus type G, and *Streptococcus viridans*.
- Infection was caused by *Neisseria meningitidis* group B.
- Includes all patients with compatible symptoms and signs of acute SA and objective documentation of joint involvement.
- No deviation.
- One patient who initially received cephradine experienced reinfection twice, with 17 and 8 months between infections.

The risk of reoccurrence is not known. Among 168 US cases [5], there were no reoccurrences of infection, whereas 1 child in our study experienced 2 reoccurrences of infection. Second episodes of osteomyelitis caused by different strains were recently reported in 3 patients [30]. Obviously, a previously infected site remains a focus of diminished resistance to infection; an analogy to endocarditis is evident. However, these aberrations from the usual pattern should not dictate the general treatment guidelines, which are determined only from large randomized trials such as ours. We are confident in the effectiveness of our short-term treatment regimen, without claiming that it works in 100% of cases. In clinical medicine, exceptions always exist.
Figure 4. Age distribution (top) and localization and proportional distribution of the causative agents (bottom) among the 130 children with acute septic arthritis. Hib, Haemophilus influenzae type b; GAS, group A streptococcus (Streptococcus pyogenes); Pnc, pneumococcus (Streptococcus pneumoniae).

mer alternative; thus, the enrollment time was long. However, the data were not significantly biased for this reason, because the researchers’ yearly meetings kept standards the same. Withdrawal of cephradine from Scandinavia was unwelcome news but did not significantly skew the results, because all first-generation cephalosporins perform almost identically [26].

There were, however, also limitations in our study. The protocol advised how to cope with problem cases; however, we could not always understand why treatment was prolonged or another agent was used. On the other hand, a responsible clinician makes the final decision, and this ethical view has few counterarguments. Despite these deviations from protocol, we believe that the goal of the study was achieved.

Although 12% of the patients did not have a 1-year follow-up visit, undetected reoccurrences almost certainly did not exist. Patient care in Finland is virtually free of cost, and the doorstone to revisit a health care facility is low if any problems during convalescence from such a serious disease as SA arise. We are convinced that the nonattendees also recovered entirely.

Five lessons were learned. First, pyogenic arthritis can often be treated with antimicrobials for ~10 days without notable risk of recrudescence or sequelae. Some cases might have improved with an even shorter course of treatment; however, because our treatment relied on the normalization of CRP level, we cannot comment further on this likely possibility (except that, currently, we do not necessarily wait for the CRP level to decrease to <20 mg/L if recovery seems otherwise likely). It is evident that the antimicrobial has to be well chosen and that large doses are probably needed [40]. Clindamycin and first-generation cephalosporins (and ampicillin or amoxicillin) worked well in our study. Methicillin resistance was not a problem, but fortunately, methicillin-resistant staphylococci usually retain their susceptibility to clindamycin [42].

Second, intravenous therapy (if needed at all) can be administered for only a few days. When shifting to the oral route, serum assays are not mandatory [34], but compliance should be guaranteed. Oral administration is gaining a footing for several community-acquired infections, including severe pneumonia [13, 14], and a swift switch to the oral route simplifies the treatment in many respects. Oral antimicrobials (except vancomycin) are also considerably cheaper than their parenteral forms.

Third, routine joint decompression and debridement are usually not indicated for treatment of SA, at least not childhood SA. In fact, most patients in our study recovered uneventfully after having only the diagnostic joint aspiration performed. Our results are in good accordance with prospective [39] and retrospective studies [1, 33, 35, 43, 44] that suggest that aggressive surgery sometimes worsens the outcome [43, 44]. We cannot exclude the possibility that the children who underwent surgical procedures were more ill, but no prospectively recorded data supported this assumption. Because the initial CRP levels were also essentially the same in the children who underwent surgical procedures and in those who did not, we view that surgical interventions, per se, provoked greater inflammatory reactions, and for this reason, CRP levels and ESRs decreased more slowly when arthroty or arthroscopy was performed. The CRP curve joined at 14 days, which is approximately the same duration of antimicrobial therapy that the short-term treatment group received, whereas the ESR curve joined 1–2 weeks after that. Extinction of inflammation (whatever the cause) was thus shown sooner by CRP level.

Fourth, sequential CRP measurements proved to be very useful in the diagnosis and monitoring of the course of illness. For decades [28, 29, 45–47], we have learned to rely on this simple, quick, easy-to-perform [48], and inexpensive parameter, which at the present time, can be performed bedside [49, 50]. We use nephelometry or turbidmetry [48], but whatever the methodology, CRP can be exploited effectively only if it is measured quantitatively and the results arrive quickly (our results are available in a few hours or within 20 min if requested). Normalization of the CRP level is a good sign of recovery not only in a SA, but also in many invasive bacterial infections [28, 45, 47, 49, 50]. During the follow-up period, an ESR [29, 45, 51] adds nothing to a CRP level [46, 52], except that it may lead to an unnecessarily long course of therapy.

Fifth, staphylococcal disease, which was responsible for the majority of cases in our series, does not require an approach that is different from that against infection caused by other
### Table 2. Patients for whom the treatment regimen was changed.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex</th>
<th>Age, years</th>
<th>Localization</th>
<th>Event</th>
<th>Intended duration of treatment, days</th>
<th>Treatment regimen</th>
<th>Infecting pathogen</th>
<th>Surgical procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>12.0</td>
<td>Knee</td>
<td>Slow CRP level decrease on day 10</td>
<td>Total 20 days: cephalothin (3 days) and cephadroxil (17 days)</td>
<td><em>Staphylococcus aureus</em></td>
<td></td>
<td>Aspiration</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>7.0</td>
<td>Hip</td>
<td>Slow CRP level decrease on day 10</td>
<td>Total 20 days: cephalothin (3 days) and cephadroxil (17 days)</td>
<td><em>S. aureus</em></td>
<td></td>
<td>Arthrotomy</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>10.5</td>
<td>Hip</td>
<td>Slow CRP level decrease on day 10</td>
<td>Clindamycin (17 days; 4 days IV and 13 days orally)</td>
<td><em>Streptococcus pyogenes</em></td>
<td></td>
<td>Aspiration and lavation</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>11.0</td>
<td>Hip</td>
<td>Fever during first 13 days of treatment</td>
<td>Clindamycin (19 days)</td>
<td><em>S. aureus</em></td>
<td></td>
<td>Aspiration</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>4.9</td>
<td>Hip</td>
<td>Slow CRP level decrease on day 10</td>
<td>Total 21 days: clindamycin (1 day) and amoxicillin (20 days)</td>
<td><em>Haemophilus influenzae type b</em></td>
<td></td>
<td>Arthrotomy</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>1.3</td>
<td>Hip</td>
<td>Slow CRP level decrease on day 88</td>
<td>Total 88 days: cefuroxime plus penicillin G (3 days) and amoxicillin (85 days)</td>
<td><em>H. influenzae type b</em></td>
<td></td>
<td>Arthrotomy</td>
</tr>
<tr>
<td>7</td>
<td>F</td>
<td>0.6</td>
<td>Hip</td>
<td>Radiological suspicion of osteomyelitis (not confirmed) at 1 month</td>
<td>Total 58 days: IV cefuroxime plus oral cephalixin</td>
<td><em>H. influenzae type b</em></td>
<td></td>
<td>Aspiration</td>
</tr>
<tr>
<td>8</td>
<td>F</td>
<td>6.1</td>
<td>Hip</td>
<td>Elevation of CRP level and ESR on day 30</td>
<td>Total 37 days: cephalothin (2 days) and clindamycin (35 days)</td>
<td><em>S. pyogenes</em></td>
<td></td>
<td>Aspiration</td>
</tr>
<tr>
<td>Late reinfection: 9</td>
<td>M</td>
<td>10.7</td>
<td>Ankle (tibiotalar)</td>
<td>2 reinfections at intervals of 17 and 8 months</td>
<td>For the first infection, cephradine (27 days); for the second infection, cephradine (6 days) and clindamycin (30 days); for the third infection, clindamycin (30 days)</td>
<td>First and second infections, <em>S. aureus</em>; third infection, coagulase-negative staphylococci</td>
<td>Aspiration</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE.** CRP, C-reactive protein; ESR, erythrocyte sedimentation rate.
gram-positive organisms or \textit{H. influenzae} type b. \textit{Salmonella} arthritis might be different \cite{37, 38}. From Thailand, we have learned that \textit{Salmonella} meningitis requires a long treatment course \cite{53}.

In summary, treatment with large doses of well-absorbed antimicrobials for \textasciitilde{}10 days (started intravenously for a few days only) is not less effective as a 30-day treatment course for childhood SA, provided that the clinical response is good and the CRP level normalizes quickly. Staphylococcal or hip or shoulder arthritis do not warrant a special approach. With interest, we read about shortened intravenous treatment (7 days) of osteoarticular infections in Iran \cite{54}. We hope that this information hints toward further studies on this potentially severe infection elsewhere.

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