ACUTE NONGONOCOCCAL INFECTIOUS ARTHRITIS

Evaluation of Risk Factors, Therapy, and Outcome

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A retrospective analysis of 71 nongonococcal joint infections in 63 patients is reported. *Staphylococcus aureus* was isolated from 59% of the patients. Five patients died as a result of infections. The outcome in Gram-negative joint infections was similar to the overall outcome in the entire series of patients. All 11 joints with infected prostheses ultimately required removal of the prostheses. All patients were treated with appropriate parenteral antibiotics, and surgical intervention was used in 40 joints. Six patients underwent surgical treatment because of inability to sterilize the joint with antibiotics and because of repeated joint aspirations. The outcome with surgical intervention was good only in patients younger than 16 years of age. Medical therapy (parenteral antibiotics and frequent joint aspirations) led to good results in 74% of the patients. Outcome of joint infection was also influenced by factors which contribute to impaired host resistance.

Nongonococcal acute infectious arthritis continues to present a therapeutic challenge, with a poor prognosis in approximately 50% of cases. In some subgroups the mortality rate approaches 20%. During the last 20 years, the incidence appears to have remained essentially constant (1,2). The coagulase positive staphylococcus continues to be the most common infecting organism, accounting for more than 50% of cases in certain studies (3,4) and between 30% and 50% in others (5,6). Other Gram-positive cocci are the next most frequent cause of infection, while the pneumococcus is an infrequent cause of acute infectious arthritis (7).

In recent years, there has been an increased number of reports documenting the occurrences of infectious arthritis caused by Gram-negative organisms (8–18). *Hemophilus influenzae* infectious arthritis is more common in young children, but it also occurs in adults (15). Salmonella infections have been reported less frequently (18). Intravenous drug abusers have a special predilection for Gram-negative infections with a high incidence of involvement of the sternoclavicular joint (8,9,12,13). Almost any joint can be infected with Gram-positive or Gram-negative organisms (19), but the knee and hip remain the most commonly infected joints (1,2).

The current retrospective study was undertaken to determine whether the ability to diagnose and treat nongonococcal infectious arthritis has improved in recent years. Particular attention has been directed to the identification of major factors which influence prognosis and to defining specific subgroups of patients with characteristics that might alter the outcome of the infection.

PATIENTS AND METHODS

The medical records of all patients with a primary or secondary diagnosis of infectious arthritis discharged from

University Hospital between January 1, 1972 and December 31, 1977 were reviewed. Sixty-three cases were found to satisfy one of the following criteria: 1) positive synovial fluid cultures (60 patients); 2) a clinically infected joint with positive blood cultures and negative synovial fluid cultures (2 patients). One additional patient with *H influenzae* meningitis and negative synovial fluid and blood cultures was included, since *H influenzae* antigen was detected by counterimmunoelectrophoresis of synovial fluid obtained from a clinically infected joint. Nine patients diagnosed as having acute infectious arthritis on clinical grounds only have been excluded from this series since blood and synovial fluid cultures were negative. During the same 6-year period, 27 patients with gonococcal arthritis were admitted to University Hospital; these patients were not included in the present study.

Student's *t*-test and chi-square analyses were used to test for statistical significance.

RESULTS

Patient population. There were 32 males and 31 females with a mean age of 35.5 years; 12 patients were less than 4 years old (Table 1). Thirty-three patients were admitted to the Surgery Service, and 30 to the Internal Medicine or Pediatric Services. Fourteen patients were taking oral corticosteroids (greater than 10 mg prednisone/day or equivalent); 3 patients were receiving other immunosuppressive agents. Four had chronic debilitating illnesses (diabetes, alcoholism, or malignancy), and 9 had rheumatoid arthritis. In 9 patients, the infection was superimposed on joints containing prostheses.

A total of 71 joint infections were observed in the 63 patients included in this series (Table 2). Twenty patients were 15 years of age or less. All pediatric patients had monarticular disease; 60% had hip involvement and 35% had knee infections. In the adult age group, there were 2 patients with two joints involved, 2 with three joints involved, and 1 patient with the same joint infected on three separate occasions. The 4 patients with multiple joint infections all had a chronic underlying disease: 3 had rheumatoid arthritis and 1 had systemic

Table 1. Age in years at time of onset of nongonococcal joint infection in 63 patients

Years	Number of patients
0–9	14
10–19	9
20–29	7
30–39	2
40–49	7
50–59	8
60–69	10
70 and over	6

Table 2. Distribution of 71 joints involved with nongonococcal infectious arthritis in 63 patients

Joint	Pediatric (0–15 yrs)	Adult (over 15 yrs)	All ages
Knee	7	25	32
Hip	12	11	23
Ankle	1	3	4
MTP/MCP*	0	3	3
Wrist	0	3	3
Elbow	0	3	3
Sternoclavicular	0	2	2
Shoulder	0	1	1
Totals	20	51	71

* MTP/MCP = metatarsophalangeal/metacarpophalangeal.

lupus erythematosus. Nine patients with prosthetic joints had a total of 11 infections.

The average duration of symptoms before diagnosis was 14 days (range 1–180 days). The mean duration of symptoms in patients with rheumatoid arthritis (excluding patients with prostheses) was 14 days (range 3–30 days) and in those with prosthetic joints 28 days (range 4–90 days). Two patients with infected prostheses had symptoms for 3 months before the diagnosis of joint infection was established.

The presence of warmth of the infected joint was recorded in 13 cases, erythema was noted in 9, swelling in 32, and pain in 48. All four symptoms were present in 6 patients. Fever (oral temperature >100°F) was initially present in 56% of all patients.

Organisms. Eighty-seven different organisms

Table 3. Organisms cultured from infected joints in 63 patients*

Organism	No. joints
Gram-positive cocci (aerobic), 56	
Staphylococcus aureus	40
Staphylococcus epidermidis	6
Aerobic Streptococcus	6
Group D Enterococcus	3
Micrococcus	1
Anaerobes, 8	
Bacteroides species	3
Clostridium species	2
Peptostreptococcus	2
Propionobacterium acnes	1
Gram-negative, 23	
Escherichia coli	9
Proteus species	4
Pseudomonas species	3
Hemophilus influenzae	3
Klebsiella pneumoniae	2
Serratia marcescens	1
Aeromonas hydrophilia	1

* More than one organism was isolated from 11 joints.

were cultured from the 71 infected joints (Table 3). Eleven patients had more than one organism isolated from their joint(s). In 3 cases, the second organism was a coagulase negative Staphylococcus. *Staphylococcus aureus* was isolated from 59% of the patients. Other aerobic Gram-positive cocci isolated were Streptococcus 6, group D Enterococcus 3, and Micrococcus 1. Anaerobes isolated from infected joints were Bacteroides species 3, Clostridium species 2, Peptostreptococcus 2, and *Propionibacterium acnes* 1.

Sixteen patients had joint infections with 23 different Gram-negative organisms. *E coli* was the most frequent isolate (9 patients), followed by Proteus 4, Pseudomonas 3, Hemophilus 3, Klebsiella 2, and Serratia and Aeromonas 1 each.

In the 20 patients in the pediatric age group, coagulase-positive staphylococci were responsible for 14 infections. All three *Hemophilus influenzae* infections were in this age group (1, 3, and 15 years old). There were no other Gram-negative organisms responsible for infection in this group. Streptococcus was the infecting organism in 2 patients and *Propionobacterium acnes* in one. A coagulase-negative Staphylococcus was isolated along with a Streptococcus from one infected joint.

Blood cultures were positive in 13 (34%) of the 38 patients from whom they were obtained.

A primary source for acute infectious arthritis was found in 34 of the 63 patients (54%). The primary source of infection was the genitourinary tract in 6 patients, chronic osteomyelitis in 6 patients, skin abcesses in 4 patients, and intravenous drug abuse in 4 patients. Other sources of infection were intraarticular injections 3, chronic draining sinuses 2 (both from joint prostheses that had drained since surgery), decubiti 2, and abdominal visceral rupture 2. Otitis media, cellulitis, pharyngitis, meningitis, and infected femoral popliteal bypass was the source in one patient each. The most common source of infection in Gram-negative infections was the genitourinary tract (4 patients).

Laboratory data. The average synovial fluid white cell count was 132,400 per mm^3 (range 3,600–905,000). One patient had an initial synovial fluid white count less than 25,000 per mm^3 and had been on antibiotics prior to the development of joint infection. The average peripheral white cell count was 11,000 per mm^3 (range 450–26,700 per mm^3). Twenty-four patients had normal peripheral total white blood cell counts, while 2 patients had leukopenia of less than 3,000 white cells per mm^3. Differential white cell counts demonstrated an increase in immature neutrophils in 21 of 37 patients (58%).

Treatment. Forty joints were treated with parenteral antibiotics and open surgical drainage and/or removal of an infected prosthesis. Thirty-one joints were treated with parenteral antibiotics and repeated aspiration of the joint space to remove purulent material (Table 4). The surgically treated group included 6 patients who were considered medical failures (i.e., the infected joint could not be sterilized after repeated joint aspirations and use of systemic antibiotic therapy). All of these patients had joint aspirations at a minimum of every other day for at least 5 days, combined with high-dose parenteral antibiotics.

Mortality. Five patients died as a direct result of sepsis (Table 5). All the deaths were in patients with severe impairment of host resistance. One neonate was 12 weeks premature and had a patent ductus arteriosus and a bilirubin of over 20 mg/dl. Other fatalities occurred in patients in their sixties who had other chronic underlying disease. One patient died 15 months after diagnosis of acute infectious arthritis as a result of septic shock due to the same organism.

Outcome. Followup data were obtained from 56 of 63 patients who had a total of 64 infected joints. A good outcome was defined as complete recovery and/or the absence of any of the criteria that defined a poor outcome. A poor outcome was defined as: 1) greater than 10% reduction in range of motion of the involved joint compared to the patient's pre-morbid state; 2) infections resulting in a chronically draining abscess; 3) removal of an infected joint prosthesis with a subsequent arthrodesis; 4) recurrent joint infection with the same organism; 5) severe chronic articular pain or an unstable, irritable joint; or 6) death related to the infected joint. Medical therapy consisted of parenteral antibiotics and repeated local joint aspiration. Surgical therapy consisted of parenteral antibiotics and open

Table 4. Treatment of 71 joints involved in nongonococcal infectious arthritis in 63 patients

Joints involved	Medical therapy	Surgical therapy*	Total
Knee	17	15 (7)	32
Hip	5	18 (4)	23
Ankle	2	2	4
MTP/MCP†	3	0	3
Wrist	1	2	3
Elbow	2	1	3
Sternoclavicular	1	1	2
Shoulder	1	0	1
Total	31	40	71

* Numbers in parentheses indicate prosthetic joints.
† Metatarsophalangeal/metacarpophalangeal.

Table 5. Mortality related to nongonococcal infectious arthritis

Patient's age	Organism	Joint	Underlying diseases	Treatment
27 days	S aureus	Knee	12 weeks premature; bilirubin markedly elevated	Medical
66 years	S aureus	Knee	Rheumatoid arthritis for 8 years; on prednisone, 11 mg/day or more for several years	Surgical
64 years	S aureus	Knee	Cerebellar hemangioma; dexamethasone, 12 mg/day for 6 weeks prior to onset of infected joint	Medical
61 years	E coli	Hip	Lymphoma; previous splenectomy; receiving chemotherapy (last course 2 weeks prior to onset of joint infection); leukopenic for 1 week prior to admission	Medical
64 years	E coli	Hip	Gouty arthritis with chronic alcohol abuse; on corticosteroids (dose unknown). Died 15 months after discharge due to E coli septicemia	Medical

surgical drainage (and/or removal of an infected prosthesis).

The clinical outcome of patients in this series is summarized in Table 6. Twelve of the 37 (32%) joint infections treated by open surgical drainage had good results, as defined previously, whereas 25 of 37 (68%) had poor results, as defined previously. When the 11 infected prosthetic joints are excluded, 12 of 26 (46%) had poor outcomes. By comparison, 20 of 27 (74%) patients who were treated with antibiotic therapy and repeated needle aspiration of the joint had good results. Surgically treated patients who had good outcomes all had monarticular infections. Their average age was 5.5 years, and the oldest was 16 years. In contrast, the average age of surgically treated patients with poor outcomes was 45.9 years. This is highly significant ($P <$

Table 6. Clinical outcome related to method of treatment

	Surgical therapy*		Medical therapy†		
	Good	Poor	Good	Poor	Total‡
Knee	2	15 (7)	9	3	29
Hip	9	7 (4)	3	2	21
Ankle	1	1	2	0	4
MTP/MCP§	0	0	3	0	3
Wrist	0	2	0	1	3
Elbow	0	0	2	1	3
Shoulder	0	0	1	0	1
Total	12	25	20	7	64

* Parenteral antibiotics and open drainage. Numbers in parentheses indicate prosthetic joints.
† Parenteral antibiotics and joint aspirations.
‡ Seven patients were lost to followup (5 medically treated, 2 surgically treated).
§ Metatarsophalangeal/metacarpophalangeal.

0.001). The average age of the medically treated groups with good and poor outcomes was 38.9 years and 42 years, respectively.

The mean duration of symptoms in medically treated patients who were classified as having a good outcome was 13.5 days (range 1–60 days); in surgically treated patients with a good outcome, it was 7 days (range 1–21 days). In patients with poor results who were treated medically, the average duration of symptoms was 8.4 days (range 1–21 days). For surgically treated patients with poor outcomes, the average duration of symptoms (excluding infected prostheses) was 18.5 days (range 1–180 days). These differences in pretreatment duration of symptoms were not statistically significant when the single patient with a duration of 180 days is excluded.

All patients were initially treated with appropriate parenteral antibiotics, regardless of other therapy. Surgically managed patients with good results received an average of 19.75 days of parenteral antibiotics; surgically managed patients with poor outcomes received 14.3 days of parenteral antibiotic therapy ($P > 0.05$). Medically managed patients with good outcomes received 21.6 days of parenteral antibiotic therapy compared to 20.8 days for those with poor outcomes. All patients received oral antibiotics after parenteral antibiotics were discontinued. These differences were not significant.

Factors influencing outcome. Age appeared to significantly influence outcome in this series. There were 20 patients in the pediatric age group. Mean followup 2 years following joint infection indicated that good outcomes had occurred in 14 patients, poor out-

comes in 3, and 3 patients had been lost to followup. The 12 cases treated surgically had good outcomes, while 2 of 5 patients treated medically had good outcomes. The 3 medical failures had severe underlying illnesses. One neonate who died is described in Table 5. Another neonate was premature, had respiratory distress syndrome, multiple cutaneous abscesses, and microcephaly. The third patient was a 15-year-old girl with systemic lupus erythematosus who was taking high dose oral steroids and cyclophosphamide. None of the surgically treated patients had a serious underlying illness.

Influence of age was particularly evident in patients with infection of the hip. Followup data were obtained on 21 of 23 such patients. All of the good surgical results occurred in 9 patients under 16 years of age. The one poor outcome in this age group occurred in a 2-day-old infant where surgical drainage was delayed for 11 days following admission. Four of the 6 adults treated surgically had infected prostheses. Five adult patients with hip infections were treated medically; 3 had good outcome, including a 73-year-old man with staphylococcal infection who had normal hip function when examined 6 months after treatment of his infection.

Type of organism. Of the 40 infected joints with only Gram-positive organisms isolated, 22 had good outcomes and 18 had poor outcomes. Of 16 patients with Gram-negative joint infections, followup data were available in 13 patients with 15 infected joints. Good outcomes occurred in 7 of 15 joints; 6 of these 7 joints were treated medically. Only 1 of 5 surgically treated joints had a good outcome. Seven patients had chronic debilitating illnesses (rheumatoid arthritis, chronic osteomyelitis, diabetes, or lymphoma). In addition, 3 patients were taking oral corticosteroids (10–60 mg prednisone/day orally) at the time of joint infection. Two joints were infected with only anaerobic organisms. Both had good outcomes. In 4 cases, there were mixed aerobic-anaerobic infections. All had poor outcomes; 3 of these were in joints with infected prostheses.

Host resistance. Patients suspected of being at increased risk of infection (patients taking oral corticosteroids, patients who were immunologically suppressed, and/or had rheumatoid arthritis) were approximately evenly divided between the medically and surgically treated groups. Seven of 11 such patients treated medically had good outcomes. None of the 10 "high risk" patients treated surgically had a good outcome (Table 7).

Rheumatoid arthritis patients. In this study, there were 9 patients with rheumatoid arthritis who devel-

Table 7. Clinical outcome in specific groups of patients with nongonococcal infectious arthritis

	Surgically treated		Medically treated	
	Good	Poor	Good	Poor
Oral cortico-steroids*	0	4	4	4
Immunosuppressed†	0	3	1	2
Rheumatoid arthritis	0	6	3	0
Infection with Gram-negative organisms	1	5	4	2
Anaerobic infections	0	4	2	0
Total	1	14	9	4

* Greater than 10 mg prednisone (or equivalent) daily.
† Diabetic, alcoholic, cytotoxic drugs, lymphoma, leukemia.

oped acute joint infections. Three patients with 6 infected joints were treated medically and 6 patients with 8 infected joints were treated initially with surgical drainage plus parenteral antibiotic therapy. The latter group included 3 patients with infected joint prostheses. The only good results occurred in patients who were treated medically. Coagulase-positive Staphylococcus was the infecting organism in 6 cases. In the other 3 patients, Bacteroides, Peptostreptococcus, or Klebsiella species were identified as the infecting organism. One patient in this group died as a consequence of joint infection. One patient was receiving oral prednisone, 12 mg/day, and 2 had received intraarticular steroid therapy in the joint that subsequently became infected.

Prosthetic joints. Nine patients had 11 infected prostheses. Three joints were infected with coagulase-positive Staphylococcus. Group D Enterococci, coagulase-negative Staphylococci, and *Clostridium chauvoei* were isolated from 2 patients each. The other organisms involved were *E coli*, *Bacteroides fragalis*, Proteus, Peptostreptococcus, and Micrococcus. There were 2 patients with multiple organisms. Four of 9 patients were initially treated with parenteral antibiotics alone; however, all 4 required removal of the prostheses within 1 year due to persistent infection or pain. All 11 prostheses had poor outcomes (Table 5).

Medical failures. Three of 6 patients who failed to respond to parenteral antibiotics and repeated aspirations, and who subsequently underwent surgical drainage, did well at followup at 4 weeks, 3 months, and 1 year. One patient had a severe decrease in range of motion of the involved joint at 6 weeks. One infant had failure of development of the femoral head at 4½ years

of age, and one patient died secondary to sepsis. Four of the 6 patients had *Staphylococcus aureus* as the infecting organism.

DISCUSSION

The knee and hip were the most common sites of joint infection in this series. This is in agreement with most other series. In this series, medical management of an infected hip in adults had as good an outcome as surgical therapy; however, initial prompt surgical management of an infected hip in children and infants remains the therapy of choice. All of the children so treated in this series had good outcomes.

Morrey, Bianco, and Rhodes (4) studied 103 patients less than 17 years of age who had acute infectious arthritis. They noted one death in their series. Young children were reported to be more susceptible to *Hemophilus influenzae* and streptococcal infectious arthritis; *S epidermidis* was the infecting agent in 5 patients. They noted "few" Gram-negative organisms. *Staphylococcus aureus* was seen in approximately 50%, and *Hemophilus influenzae* in 14% of their patients. Long term followup on 49 pediatric patients by Howard (20) for an average of 4.3 years demonstrated decreased range of joint motion, shortening of the affected limb, and/or deformities of the affected joint in 27%; these sequelae were more common with hip and ankle disease. Physical findings at the time of hospital discharge identified only 31% of the patients who were found to be functionally impaired at a later date. These children with functional impairment usually were sicker for a longer period of time, and drainage was often delayed. In the current series, all children initially treated surgically had good outcomes. Followup at a mean of 2 years did not disclose any change in status from that documented at the time of hospital discharge.

The occurrence of acute infectious arthritis has remained essentially constant during the last several decades. The coagulase-positive Staphylococcus is still the most prevalent nongonococcal organism responsible for joint infection. Most studies indicate that the frequency of gonococcal arthritis is equal to that of all other pyogens combined (21,22). At University Hospital, approximately one-third of patients with acute infectious arthritis have gonococcal infection. This incidence is undoubtedly influenced by the patient population admitted at this institution.

Anaerobic infections were more common in this study (6 patients) than previously reported. This may be due to the fact that 4 of the 8 anaerobes were isolated from 3 infected prostheses; in addition, 1 patient had decubitus ulcers, and 1 patient had rheumatoid arthritis and was receiving oral corticosteroids. Other series (1,4–6) did not include cases with infected prostheses. Ziment and associates (23) have commented upon anaerobic joint infections. In a review of the literature, they found that no organism had been recovered in 16% of patients with presumed infectious arthritis. They commented upon the possibility that in some of these cases, anaerobic microorganisms may have been responsible for the infection. The sternoclavicular joint had a peculiar susceptibility to infection with Gram-negative anaerobic bacilli. These authors felt that an anaerobic infection should be suspected if foul-smelling pus was noted, gas was detected on joint roentgenogram, or if the Gram stain was suggestive of Gram-negative pale staining pleomorphic rods (Bacteroides), or small Gram-positive cocci (which are more often anaerobic than aerobic).

Infectious arthritis in patients with rheumatoid arthritis is an uncommon complication of a common disease. Its incidence in several studies of the rheumatoid population varies from 0.3 to 3% (24–26). Infections have long been recognized as an important cause of morbidity and mortality in patients with rheumatoid arthritis (27). Multiple factors may contribute to increased susceptibility to superimposed infection in patients with rheumatoid arthritis. Neutrophil chemotaxis and phagocytosis have been reported to be decreased in the synovial fluid of patients with rheumatoid arthritis (28,29).

In an early study of infectious arthritis in patients with rheumatoid disease, Kellgren (30) noted that fever and leukocytosis in response to infection were often blunted or absent. However, this has not been borne out by subsequent studies (25,26,31–33). The offending organism was a coagulase-positive Staphylococcus in most cases, and in the current series this microbe accounted for 76% of infections in the rheumatoid patients.

An infected joint in a patient with rheumatoid arthritis is a potentially catastrophic event. The combined death rate in the studies cited above was 18%. There was 1 death in 9 rheumatoid patients included in this study. In addition, only 3 of 12 infected joints in our patients with rheumatoid arthritis had good outcomes.

Eftekhar (34) has stated that aggressive local treatment and use of intravenous antibiotics for 4 to 6 weeks may save approximately 20% of patients with infected hip protheses. This author reported that with a subacute or chronic infection, a conservative approach is justified, and not all infected prosthetic hips require

an immediate decision to remove the artificial device. However, once it has been clinically and radiologically established that the total hip replacement is infected and the patient is symptomatic, the entire implant must be removed. Our population with infected prostheses is too small to state whether there is a 20% salvage rate. All 11 prostheses were removed in this series. Many patients with prosthetic joints are elderly and/or immunosuppressed. The risk of septicemia or metastatic infection in this population would appear to warrant immediate removal of the foreign body in most instances.

Positive blood cultures have been reported to be a poor prognostic sign in patients with acute joint infection (1). In this series, 13 of 38 patients had positive blood cultures. There were followup data for 11 of these individuals, and 5 patients had good outcomes whereas 6 had poor outcomes. However, it is important to note that 3 of the 6 with poor outcomes who had positive blood cultures died.

In the current study, infections with Gram-negative organisms did not significantly alter the outcome, but the presence of an anaerobic joint infection did. Only 2 of 6 patients in this category had good outcomes. Patients in the entire series were more likely to have poor outcomes if they were immunosuppressed, or had rheumatoid arthritis or an infected prosthesis. Outcome was also influenced by duration of symptoms prior to therapy. The average duration of symptoms in all patients who eventually had good outcomes was 9 days, while in those with poor outcomes, it was 20.5 days. This again emphasizes the importance of early diagnosis and treatment of the infected joint. The average duration of symptoms in patients with rheumatoid arthritis was 14 days, while for those with infected prostheses it was 28 days. Outcome was not influenced by the specific joint which was the site of infection.

The current medical literature supports the view that parenteral antibiotics easily reach bacteriocidal concentrations in the synovial fluid (35,36) and that repeated joint aspirations (9,37–40) are the preferred mode of local therapy, unless the pus is too thick, loculated, or the joint is inaccessible to aspiration. If sterilization of the synovial fluid and clinical improvement are not evident in 5 to 7 days, then open drainage should be performed. This differs from the recommendations found in the surgical literature (1,4,34,41) where most authors feel that incision and drainage should be done within the first 1 or 2 days in adults, and immediately in children with hip infections. The reason for recommending immediate surgical drainage in hip infec-

tions in the pediatric patient relates to the anatomy of the joint. The proximal end of the growing bone lies within the joint space, and an increase in intraarticular pressure leads to a rapid compromise of intracapsular blood supply. Morrey, Bianco, and Rhodes (4) suggest that the only indication for aspiration instead of arthrotomy is infection of a joint other than the hip, and a prompt response to antibiotics, both parenteral and intraarticular, within 12 hours. Kelly (41) indicates that the approach to local therapy is not critical if one is able to sterilize the joint with repeated aspirations and systemic antibiotics. In the current series, medically managed adult patients fared substantially better than surgically treated patients. Good results with surgical therapy were limited to children. The lack of good outcome in surgically treated adult patients (excluding those with prostheses), when compared to medically treated patients, cannot be attributed to a significant difference in underlying diseases, duration of antibiotic therapy, or duration of symptoms prior to diagnosis. These results again emphasize that aggressive medical management in the adult is the preferred mode of therapy in most cases.

A high index of suspicion for infectious arthritis must be maintained in all cases of joint inflammation. A suspected infected joint should be cultured for anaerobes as well as aerobes if the patient has a prosthetic joint, is immunosuppressed, has rheumatoid arthritis, or has a distant infection that has a high probability of being anaerobic, such as lung or brain abscess. The lack of systemic symptoms by no means rules out an infected joint. Fever was noted in only 56% of patients in this series at the time of presentation, and the classic signs of local inflammation of the joint were often absent. A primary source of infection must be diligently and repeatedly sought in all cases. Over one-half of our patients had an identifiable primary source of infection. An infected joint prosthesis, especially in an immunosuppressed patient, should be immediately and completely removed.

Based upon this analysis of patients seen during a 6-year period (1972–77), we conclude that initial therapy for an infected joint should consist of aspiration as frequently as necessary (at least daily, initially), and high dosages of parenteral antibiotics. Frequent synovial fluid cell counts, Gram stains, and cultures of the synovial fluid should be obtained, as pointed out by others (31,39,40). Initial antibiotic therapy should be dictated by the results of the initial Gram stain. If no organism is seen on Gram stain, until the results of culture are known the adult patient should be started on a drug

such as nafcillin that is effective against penicillinase-producing organisms, combined with an aminoglycoside if the clinical situation suggests the possibility of a Gram-negative infection or if the patient is immunosuppressed. A child should receive coverage against *Hemophilus influenzae* as well as against penicillinase-producing staphylococci. Parenteral therapy should be continued for a minimum of 2 to 4 weeks in an uncomplicated case, and for at least 4 weeks if the patient is immunosuppressed. If the organism is Pseudomonas, then the aminoglycoside should be combined with carbenicillin. If there is any question regarding the adequacy of medical management, synovial fluid should be tested by the serial tube dilution method and antibiotic concentrations should also be determined. If the patient's joint(s) remain(s) clinically infected, or if the synovial fluid white cell count does not decrease within 5 to 7 days, open surgical drainage may need to be performed. Special consideration must be given to infection of the sternoclavicular joint since it is commonly associated with osteomyelitis or abscess (13,17). In this instance, a more aggressive surgical approach may be justified.

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