



Diagnosis of septic arthritis and initial antibiotic treatment

Septik artritte tanı ve başlangıç antibiyotik tedavisi

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Amaç: Bu çalışmada, septik artrit çocuklarda ve erişkinlerde klinik, laboratuvar ve radyografik açılarından benzer ve farklı yanlarını ortaya koymak; etken profilini çıkarmak ve gerek başlangıçta gerekse etken üretilmeyen olgularda uygulanabilecek bir antibiyotik tedavi tutumu oluşturmak amaçlandı.

Çalışma planı: Septik artrit öntanısıyla ameliyat edilen 34 hasta çalışmaya alındı. Yaşı 15 gün ile 85 yıl arasında değişen hastalar, çocuk-ergenlik grubu (≤ 15 yaş; 16 hasta) ve erişkin grup (>15 yaş=18 hasta) olarak iki grupta incelendi. Septik artrit klinik ve laboratuvar bulguları ameliyat bulgularıyla karşılaştırıldı. Etken profili ve duyarlılık özellikleri belirlendi.

Sonuçlar: Her iki grupta da tüm olgularda ortak klinik bulgular, tutulan eklemlerde hareket kısıtlılığı ve hassasiyet; laboratuvar bulguları ise yüksek sedimantasyon hızı ve C-reaktif protein, ponksiyon sıvısında polimorf çekirdekli lökosit hakimiyeti idi. Ponksiyon sıvısından yapılan Gram boyama, bakteri açısından çok bilgi verici idi. İki yaşından küçük çocuklarda en sık septik artrit etkeni *H. influenzae* ve *S. pneumoniae*, 2-15 yaşları arasında ve erişkin dönemde stafilokok ve streptokoklar idi. Siprofloksasin ve sulbaktam+ampisilin, her iki grupta da Gram-pozitif mikroorganizmaların çok büyük bir kısmına karşı etkili bulundu.

Çıkarımlar: Septik artrit tanısında en yararlı inceleme eklem ponksiyonu ve materyalin makroskopik ve mikroskopik analizidir. İlk antibiyotik tedavi planlanmasında Gram boyama çok yol göstericidir. İki yaşından büyük hastalarda, stafilokok ve streptokoklara karşı sulbaktam+ampisilin, Gram-negatif bakteriler için amikasin etkili antibiyotiklerdir. İki yaşından küçüklerde Gram-negatif bakteri görüldüğünde öncelikle *H. influenzae* düşünülmeli, tedavide ampisillin yer almalıdır.

Anahtar sözcükler: Antibakteriyel ajan; artrit, enfeksiyöz/tanı/mikrobiyoloji/ilâç tedavisi; çocuk; stafilokok enfeksiyonları/ilâç tedavisi; streptokok enfeksiyonları/ilâç tedavisi.

Objectives: This study was designed to determine the similarities and differences in clinical, laboratory and radiographic presentation of septic arthritis in childhood and at adult ages, to find out its etiological profile, and to establish an antibiotic treatment protocol for the initial period and for patients in whom the causative agent could not be identified.

Methods: Thirty-four patients (age range 15 months to 85 years) who underwent surgery with a diagnosis of septic arthritis were retrospectively studied in two groups, namely, children-adolescents (age ≤ 15 years ; 16 patients) and adults (age >15 years; 18 patients). Clinical and laboratory findings of septic arthritis were compared with operation findings. The etiological profile and sensitivity patterns were investigated.

Results: Unfaltering features in both groups were clinical findings of decreased range of motion and tenderness, laboratory findings of elevated erythrocyte sedimentation rate and C-reactive protein, and domination of polymorphonuclear leukocytes in the joint fluid. Gram staining of the joint fluid was highly informative in terms of probable bacteria. During the first two years of life, the most common bacteria were *H. influenzae* and *S. pneumoniae*, and after two years, staphylococci and streptococci. Ciprofloxacin and sulbactam-ampicillin were found effective against most of the Gram-positive microorganisms isolated in both groups.

Conclusion: The most useful test for septic arthritis is arthrocentesis and macroscopic and microscopic analyses of the material. Gram staining is of great help in the planning of initial antibiotic treatment. For patients older than two years of age, treatment with sulbactam-ampicillin is effective against staphylococci and streptococci, and amikacin against Gram-negative bacteria. Detection of Gram-negative bacteria in patients younger than two years should bring *H. influenzae* in mind, for which ampicillin must be the first choice.

Key words: Anti-bacterial agents; arthritis, infectious/diagnosis/microbiology; child; staphylococcal infections/drug therapy; streptococcal infections/drug therapy.

Staphylococci and streptococci are the most common bacteria seen in the etiology of septic arthritis.^[1] Another bacterium that's common in the very early ages is *Haemophilus influenzae*.^[1,2] It has been reported that septic arthritis due to that bacteria is about to disappear in routinely vaccinated countries.^[3] Even though there are a lot of researches on septic arthritis in childhood, there are only few on the adult ages.^[4] Septic arthritis of the adult ages differentiates in etiology, clinical features, radiographic presentation as well as the secondary factors that play role in the outbreak of the illness.

Septic arthritis is an illness that may cause some severe disabilities especially in the hip unless it gets its sufficient treatment in the right time.^[5-10] In septic arthritis it is very important to start the antibiotic treatment after getting the samples for culture in order to be able to identify the causative agent.^[11] Gram staining of the synovial fluid is one of the most informative tests in early phases of the disease.^[2] However, it is very crucial to choose the antibiotic for beginning the treatment before the results of culture was obtained or sometimes it is the case, the microorganism could not be grown. Besides; it is often not possible to identify the agent in the later phases and also to arrange the appropriate antibiotic treatment protocol because of some factors such as inappropriate and inadequate usage of antibiotics, not being able to identify the agent because of some deficiency of laboratory opportunities, the agent's being a rare one etc. In such conditions, antibiotic treatment is arranged against the probable agent in both childhood and adulthood. However, causative agent and its sensitivity might exhibit some absolute differences due to some predisposing factors and age and also from community to community.^[1,2] In such cases, treatment protocol must be started at once by taking the age of the patient and local epidemiologic data into account.^[12]

This study was designed to determine similarities and differences in clinical, laboratory, and radiographic presentation of septic arthritis in childhood and adulthood, to find out its etiologic profile, to determine whether some differences in the properties of the bacteria occurs in years and to form an approach to antibiotic treatment that can be applied both in the initial period and in terms at which the causative agent could not be identified.

Patients and methods

Thirty-eight patients (age range; 15 days to 85 years) underwent surgery with a diagnosis of septic arthritis between September 1988 and April 2002. Four patients were excluded from the study: one was diagnosed as juvenile rheumatoid arthritis while another as joint tuberculosis in the postoperative examinations, and enough information could not be found out about the last two one in the registries. Remaining 34 patients were classified into two groups: 15 years of age and younger ones were put into childhood and adolescent group (16 patients; nine males, seven females), older than 15 years of age were placed in the adult group (18 patients; eight males, ten females) (Table 1). Child and adolescent group was divided into four subgroups among itself and adult group into two according to their age ranges.

Patient registries and microbiology laboratory results were examined retrospectively. The diagnosis of septic arthritis was assumed by the presence of at least two of these clinical and laboratory findings; high fever, irritability of newborn, pain of the affected joint and a severe decrease in range of motion, purulent joint fluid and microbiologic test findings.

Joint aspiration was applied in all of the patients. Thick ended regular injector needle of 20 ml was used for early childhood and LP needle of number 20 was used for adults in joint aspiration. Gram and Ziehl Nielsen staining of the material and also seeding for culture were made. Material was seeded onto blood agar, chocolate agar and Mac Conkey media. The next day; identified agents were named according to their morphologic and biochemical characteristics. After this stage, antibiotic sensitivity test was applied. Most of the patients who were diagnosed as septic arthritis according to the macroscopic appearance of their aspirated joint fluid, result of the gram staining and clinical and radiographic findings; underwent surgery on the day of their arrival to the hospital or the day after and surgical drainage was applied to all of them. Besides, sample from the joint was taken for culture during the operation. At the final of the operation suction drain was placed into the joint. The drain was kept in the joint as far as it functions. In all of the patients except the ones hav-

Table 1. Distribution of the clinical and laboratory findings according to the age ranges

	Children (≤15 years of age, N= 16)		Adults (>15 years old,) (N= 18)	
	Number	Percent	Number	Percent
Decreased range of motion	16	100.0	18	100.0
Pain and tenderness	16	100.0	18	100.0
Swelling in the joint	10	62.5	15	83.3
Redness in the joint	6	37.5	5	27.8
Fever	9	56.3	10	55.6
WBC elevation	15	93.8	13	72.2
Higher sedimentation rate	16	100.0	18	100.0
CRP elevation	16	100.0	18	100.0
Enlargement of the joint space	9	56.3	4	22.2
Destruction in the joint	1	6.3	3	16.7
Domination of polymorph nuclear cells in the aspirated synovial fluid	16	100.0	18	100.0
Gram stained bacteria in the aspirated fluid	11	68.8	12	66.7
Accompanying disease	1	6.3	4	22.2

ing severe joint destruction or joint instability, early active and passive exercises were started as far as the pain allows.

Planning of the initial antibiotic treatment was made according to the result of the Gram staining of the obtained material from the joint. Or if no organisms are identified, it was made according to the probable agent of the age range (Table 2). Two or three days later after the result of sensitivity test was obtained, the antibiotic treatment was switched to the antibiotic which is the bacteria is highly sensitive and also is most economical, least toxic and has got forms suitable oral treatment. Parenteral antibiotic treatment was continued for 10- 14 days. The effect of treatment was appraised according to

the daily examinations and the controls of fever, intermittent complete blood count, sedimentation rate and C-reactive protein. To switch to oral treatment, the normalizing of the abnormal laboratory findings was taken into account, as well as the disappearing of the systemic infection symptoms. After four to six weeks, treatment was quitted.

Results

The symptoms and findings of septic arthritis disappeared in all of the patients. Clinical profile was estimated in the two different groups.

Children group

Decreased range of motion and pain of the affected joint were the certain findings while applying to

Table 2. Distribution of the sensitivity test according to the age

Microorganism	Number of patients						Total	
	<2	2-5	6-10	11-15	16-40	>40	Number	Percent
MSSA	–	4	–	1	1	4	10	29.4
MRSA	1	–	2	–	1	2	6	17.7
<i>Streptococcus pneumoniae</i>	1	–	–	–	1	1	3	8.8
Haemolytic streptococcus	–	–	–	1	–	–	1	2.9
<i>H. influenzae</i>	1	–	–	–	–	–	1	2.9
<i>Pseudomonas aeriginosa</i>	–	–	–	–	1	–	1	2.9
No growth	1	2	2	–	6	1	12	35.3
Total	4	6	4	2	10	8	34	100.0

the emergency department. Ten patients out of 16 (% 62.5) had swelling of the joint, six (%37.5) had redness in the joint and all were superficial joints such as glenohumeral joint, knee, wrist. Nine patients (%56.3) had fever, 15 patients had leukocytosis (10300 - 24700 / mm³) (% 93.8), all of the patients had high sedimentation rate (40-128 mm/per hour) and CRP (6-45 mg/l). According to the radiographic examinations; nine patients had more or less joint space enlargement (Figure 1), one patient had (% 6.3) bone destruction. In this case who was a neonate, four days had passed from the initiation of symptoms until the patient's applying to the hospital. According to the results of the aspiration of joint fluid; all of the patients had polymorph nuclear leukocytes domination, in 11 patients' material (%68.8) bacteria was determined in Gram stain. One of the patients belonging to this group had jaundice of the neonate accompanying septic arthritis (Table 1).

Adult group

All of the patients had pain, tenderness, and decrease in range of motion. Fifteen patients, out of 18 (% 83.3) had swelling, five (% 27.8) redness in the joint as an initial finding. As same as the other group, swelling and redness were only present in the superficial joints such as knee, elbow and wrist. Ten patients (% 55.6) had high fever, 13 (% 72.2) had leukocytosis (10300-25300 mm³), all of the patients had high sedimentation rate (25-120 mm/per hour) and CRP (51-192 mg/l). In four patients' (% 22.2)



Figure 1. Four years old girl with septic arthritis on right ankle. The joint distance on the right side was enlarged on the comparative ankle AP radiographs

radiographic examination joint space enlargement, in three of them (% 16.7) (two hips, one elbow) destruction in the articular tissue were determined. When we took a look at the microbiological analyses of the synovial fluid material, we establish polymorph nuclear leukocyte domination in all of the patients, and also bacteria were determined in Gram staining of 12 patients (% 66.7). In three patients, diabetes mellitus and in one patient, tuberculosis in another focus was accompanying (Table 1).



Figure 2. AP shoulder radiograph of newborn who had septic arthritis on his right shoulder and applied to the hospital as for 4 days delayed. The distance of joint is enlarged and there are irregularities on the humeral head.

Table 3. Distribution of the microorganism according to antibiotic which was found sensitive*

	MSSA		MRSA		<i>Streptococcus pneumoniae</i>		<i>H. influenzae</i>		Haemolytic streptococcus		<i>Pseud. aeruginosa</i>	
	A	C	A	C	A	C	A	C	A	C	A	C
Amoxicillin + klavulonik acid	1	1	0	1	0	1	0	1	–	–	–	–
Sulbactam + ampicillin	3	2	1	1	1	1	–	–	0	1	–	–
Ampicillin	2	0	–	–	–	–	0	1	–	–	–	–
Cefazolin	2	0	–	–	–	–	0	1	–	–	–	–
Gentamicin	3	1	–	–	–	–	–	–	–	–	–	–
Amikacin	2	0	2	0	–	–	–	–	–	–	1	0
Vancomycin	1	1	1	1	–	–	–	–	0	1	1	0
Teikoplanin	1	1	2	1	–	–	–	–	–	–	–	–
Cephalothin	0	1	0	1	–	–	–	–	–	–	–	–
Sulfamethoxazole-trimethoprim	1	2	–	–	–	–	0	1	0	1	–	–
Cefuroksim	0	1	1	1	–	–	–	–	–	–	–	–
Ciprofloxasin	2	3	2	1	–	–	0	1	–	–	1	0
Ceftriaxone	–	–	–	–	0	1	–	–	0	1	–	–
Fusidik asit	–	–	–	–	1	0	–	–	–	–	–	–

*: Every antibiotic has not been tested for every microorganism. Only sensitive ones have been included to the table.

Two of the bacteria determined in the Gram staining (11 children, 12 adults) were Gram-negative, the others were Gram-positive. One of the Gram-negatives was *H. influenzae* which was determined in a patient younger than two-year old; the other was *Pseudomonas aeruginosa* determined in a patient of adult age.

The most prevalent pathogenic bacteria was *Staphylococcus* which was identified in ten patients out of 34 (% 29.4) as methicillin sensitive, in six (% 17.7) as methicillin resistant *Staphylococcus aureus*. Following agents were *Streptococcus pneumoniae*, which was determined in three cases (% 8.8), *H. influenzae* (% 2.9), α -hemolytic streptococcus and *P. aeruginosa* each determined in one patient. No agent

was determined in 12 cases (% 35.3).

According to the sensitivity test results, Gram-positive bacteria were found sensitive to ciprofloxacin at most in adult group and sulbactam-ampicillin, amikasin and gentamicin followed it in order. On the other hand; this order in childhood was as ciprofloxacin, sulbactam-ampicillin, sulfamethoxazole-trimethoprim and amoxicillin-klavulonik acid. *H. influenzae*, one of the two Gram-negative bacteria, was found sensitive to ampicillin as expected and also cephalosporins, amoxicillin-klavulonik acid; while *P. aeruginosa* was sensitive to amikasin as again expected and also vancomycin and ciprofloxacin (Table 3).

Table 4. Distribution of the anatomic location suffered from septic arthritis according to the age of patients.

Joint	Number of patients						Total	
	<2	2-5	6-10	11-15	16-40	>40	Number	Percent
Shoulder	1	1	–	–	–	–	2	5.9
Elbow	1	–	–	–	2	–	3	8.8
Wrist	–	–	–	–	–	2	2	5.9
Hip	1	1	1	1	2	1	7	20.6
Knee	–	1	3	–	5	5	14	41.2
Ankle	1	3	–	1	1	–	6	17.7
Total	4	6	4	2	10	8	34	100.0

At the age group of younger than 2; hip, shoulder, elbow and wrist were affected with the same frequency but at the age group of 6-10 and older than the age of 15, the most commonly affected region was knee. In general; the most frequently affected joint was the knee in 14 patients out of 34 (% 41.2) and the following regions were hip joint in seven patients (% 20.6) and ankle in six patients (% 17.7). While septic arthritis of shoulder was never seen in childhood, all of the septic arthritis of wrist was seen over the age of 40 (Table 4). When we examined the affected regions according to the accompanying disorders; the affected region in the patient with tuberculosis was the hip, and in two patients with diabetes mellitus the affected region was the knee and in one was the ankle.

Discussion

The diseases that should be taken into account for differential diagnosis of patients with probable septic arthritis are rheumatoid arthritis, traumatic effusion, cellulitis, acute rheumatic fever, acute osteomyelitis, hemophilia, Schönlein-henoch purpura, transient reactive synovitis, Legg-Calvé-Perthes disease and slipped capital femoral epiphysis.^[11,13] It will be very difficult to diagnose the reactive synovitis by only history taking and physical examination. It has been determined by Kocher et al that, children suffering from septic arthritis were usually referred with the presence of the followings; higher fever, not being able to bear weight on the effected extremity, weakness, higher sedimentation rate and white blood cell count.^[14] Even though these findings match with "transient reactive synovitis", we have certainly seen that decreased passive range of motion was more severe in the cases suffering from septic arthritis.^[10,11]

The clinic progress of septic arthritis in adults and children, particularly in early childhood, exhibit differences. The disease may cause much more misleading and uncertain signs in neonates; septicemia may occur.^[15] The most frequent manifestations are lack of appetite and irritability, and also fever and tachycardia may occur.^[13] Generally, signs are not locally severe in affected joints during the disease progress. The patients has tendency to put their joint on certain positions to reduce pain. Reduced joint mobility, pain and tenderness were the signs that every patient had suffered from and so as we experi-

enced in our studies. Glenohumeral septic arthritis has caused destruction in the joint and severe local signs in the only neonate patient in our study, because he applied to hospital when the disease was advanced. Also this patient had jaundice which occurs relatively frequent in the neonates with septic arthritis.^[15] The accompanying disease frequency is higher in adults than neonates. Leslie et al^[4] had determined at least one accompanying disease in all patients except one. Also in our study, the accompanying diseases were more frequent in adult group than child group (Table 1).

Increased sedimentation rate and CRP values was found as invariable findings in patients with septic arthritis, furthermore white blood cell increase has been reported frequently.^[1,4,16] In the present series, increased sedimentation rate and CRP values was constant in both groups and all ages. However while white blood cell elevation were found in all patients of child group except one, 3 out of 4 patients in adults group had elevated white blood cell.

Radiological signs are not much useful in the diagnosis of early stage septic arthritis, because clinical signs and disease become advanced before radiological findings occurred.^[1] Radiological signs, however, may be more significant in children who are not too young than in adults, because the signs of degeneration in joints of elderly people radiographic findings are difficult to interpret and furthermore increase of joint distance may be prevented by tough peri-articular tissues in elderly. Because of the maturation of the bones in very young children is not complete, the radiological evaluation of the disease is difficult. Capsular expansion might sometimes be determined in well taken roentgenograms; however, it usually is impossible to have a good quality radiograph in emergency department. Consequently, the radiological signs are not useful in the diagnosis of the disease during early period, particularly in adults and very young children.^[1]

Joint aspiration is one of the certain diagnostic procedures.^[11,17] The most useful diagnostic procedure is Gram staining with white blood cell count, differentiation and glucose values in the sample taken from the joint.^[11] White blood cell count varies in the range of 25.000 and 250.000 in the patients with septic arthritis, however, shift to the left is determined almost every time.^[12,14] Gram staining of

the fluid sampled via arthrocentesis will possibly be enough for the definition of bacteria. In this study, Gram staining provided information defining 70% of the bacterial agents.

Staphylococcus and streptococcus species are found most frequent bacterial agents in children with septic arthritis who got the microorganism from the outside of hospital and *Haemophilus influenzae* in children under two years old.^[1,2,9,11,13,14,17,18,19] Howard et al^[3] had determined *S. aureus* (39%) as most frequent bacterial agent and secondly *H. influenzae* (33%) before *H. influenzae* vaccine was applied in routine in 1992. They had not determined *H. influenzae* septic arthritis after routine vaccine program.^[3] Also our study comprised an area where a routine vaccine program is not applied; therefore our findings were similar to the literature data. One of the microorganisms, which are determined in the samples taken from the children under two years old, was *H. influenzae*, the other one, *S. pneumoniae*. Staphylococcus and Streptococcus species were determined to be more dominant agent in older children and adults.

On the other hand, defining the agent is not possible in the certain amount of patients with clinically diagnosed septic arthritis. This rate was reported in literature in range of 33.5% and 70%.^[1,2,18,20] In this study, agents could not be defined in 35% of the patients. The fact might be due to antibiotic use before taking sample and also might be due to either laboratory conditions or the variation of the characteristics of bacteria. Authors suggest that, if clinical and laboratory findings support the diagnosis septic arthritis even microorganism could not be defined, the case must be considered and treated as septic arthritis.^[18]

Some authors propose regular punctions through intervals and antibiotic treatment, particularly when the superficial joints affected.^[2] However, Leslie et al^[4] reported that wider joint mobility is obtained by surgical drainage. In the present series, we only used puncture for diagnosis and open drainage was performed immediately in the patients considered to develop septic arthritis. During the surgery, we observed that the infected tissue is hardened in patients whose disease is advanced because of the late applications. We believe that this tissue cannot

be removed by punctures. It is known that one of the reasons of restriction of joint mobility is this necrotic material which occurs in the joint. Early drainage, as it provides clearance of the materials destructing the cartilage, also provides an exact definition of the agent and therefore an effective antibiotic treatment procedure.^[2,7,21]

Early antibiotic treatment is necessary in the cases considered to be septic arthritis; however, treatment should not be administered unless the samples are taken (i.e., the puncture of the affected joint or blood sample) for determining sensitivity.^[11] The fact is significant for an effective treatment, because either agents or the antibiotics effective against the agent vary. In spite of these investigations are carried out before, definition of the agent and determination of the appropriate antibiotic optimistically takes nearly 48 hours. Besides Gram staining, the child's age and the most frequent septic arthritis agent in this age is important for the most probable prediction of agent within this period. Initial antibiotic treatment whatever chosen is commonly agreed upon to be parenteral; however no agreement exists whether the following treatment is administered orally or not. Some of the investigators have reported effective treatments when 5-7 day parenteral treatment was continued by an oral treatment.^[1,11,17,22,23] In this study, we administered oral treatment after the clinic and laboratory findings have reached normal values which took approximately 2 weeks' time. We believe that it increases the compliance to the treatment.

As the well-timed surgery is, choosing the effective antibiotic treatment is also important for an effective septic arthritis treatment. A perfect antibiotic should be effective against the microorganism and furthermore should diffuse into the joint in bactericidal concentrations. Schurman et al^[24] have reported that cephalotin, cefazolin, cefoxitin, amikacin and gentamicin diffused into the synovial fluid in the effective concentrations and reached peak concentrations about 30 min-1 hour. It is reported that penicillins and cephalosporins reaches effective concentrations in the infected bone and cartilage.^[23]

Nelson^[20] proposed an initial treatment with methicillin against Gram-positive bacteria,

kanamycin or gentamicin against Gram-negative bacteria; methicillin and gentamicin combination treatment in the patients that the agent cannot be determined. It is suggested that ampicillin also must be used against *H. influenzae* in children under 18 months' of age.^[12,20] In this study, Gram-positive microorganisms, such as staphylococcus and streptococcus, were found as bacterial agents in all patients except two. In this fact, antibiotic chosen as initial treatment should be effective against staphylococcus and streptococcus species which were the most frequent agents. Many of the staphylococcus and streptococcus species which stained Gram-positive bacteria were determined to be sensitive to ciprofloxacin and ampicillin + sulbactam. Ciprofloxacin usage is not safe in children; furthermore, parenteral formulation is used via infusion and is more difficult to administrate than ampicillin+sulbactam. Therefore, irrelevant to the age, initial ampicillin+sulbactam treatment is also safe and effective in the cases that Gram-positive coccus were determined to be causative agent. In addition, an available oral form lets to continue as oral treatment without changing the drug. Because *H. influenzae* is the most frequent agent in the younger children less than two years of age, ampicillin administration is suitable according to the literature findings and our results. If the patient is over two years old, amikacin, which is effective against the other Gram-negative and some of the Gram-positive bacteria, is appropriate as initial treatment.

A controversy still exists on the period of the antibiotic treatment. In general, in staphylococcus and Gram-negative infections a four weeks' treatment, in *H. influenzae* infection at least two weeks' treatment is suggested.^[2,13,20] Syrogiannopoulos and Nelson^[25] reported that treatment for 3 weeks in septic arthritis of staphylococcus and Gram-negative bacteria and a treatment for 10-14 days in *H. influenzae* infections is adequate if systemic and local signs are disappeared and sedimentation rates reach normal values. In this present series, with oral treatment protocol, antibiotic were given at least for 4 weeks in all. We believe that administration at least for 4 weeks is safer.

An agreement does not exist yet on the subject of immobilization after the surgical treatment. Some of the authors suggested that the fixation of the extrem-

ity prevents the occurrence of further destruction.^[17,19] Paterson^[9] reported that reduce of the joint mobility did not occur if the extremity is immobilized for 6 weeks after surgery. Contrary to this, Salter et al^[26] demonstrated that early passive mobility of the joint is beneficial in rabbits with septic arthritis. Subaşı et al^[16] reported that early passive mobility reduces the destruction of joint. In this series, we administered short time immobilization early after the surgery except the patients with serious damage had already formed in their joint and unless the joint is unstable after drainage. We started passive exercises as quickly as possible. We believe that mobility is necessary for nutrition of the cartilage, after the infection is controlled.

It was reported that the lower extremity is affected most frequently.^[1,9,13] In this series, upper and lower extremities were affected equally by septic arthritis in children younger than two years of age while the main stepping development occurs, but lower extremities were affected most frequently (83%) in the patients older than two years. The fact may be related to the situation of the lower extremity is exposed to the trauma more often after walking began.

Consequently, decreased range of motion in the affected joint and tenderness are the signs which were occurred in all septic arthritis patients. Swelling and redness of the joint are frequent local findings depending on the affected joint and fever is one of the systemic findings. Increase in erythrocyte sedimentation rate and CRP are determined more or less in every case. It is certainly hard to evaluate the radiographic findings in the early phase. The most useful investigations in septic arthritis are arthroscopy and macroscopic analyses of the obtained material. It will avoid the waste of valuable time in the initial phase of the disease, to perform arthroscopy on every patient having the suspicion of septic arthritis. Gram staining is of great help in the planning of the initial antibiotic treatment.

In this study *H. influenzae* and *S. pneumoniae* were the most frequent agents in the first 2 years as stated in the literature, but between 2-15 years of age and adult patients the most frequent agents were Staphylococcus and Streptococcus. Ciprofloxacin and Sulbactam + ampicillin were effective against a great deal of Gram-positive microorganism identi-

fied. Sulbactam + ampicillin, which has both parenteral and oral forms, is an appropriate choice in patients older than 2 years of age in the period till the result of the sensitivity test was obtained or in cases at whom no causative agents were identified. On the other hand, detection of Gram-negative bacteria in patients younger than two years old should bring *H. influenzae* in mind, for which ampicillin must be included in the treatment. Against Gram-negative bacteria identified in elder cases, amikacin must be chosen for the treatment either alone or along with the other antibiotics.

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