

# Changing epidemiology of neonatal septic arthritis

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## ABSTRACT

**Purpose.** To study the changing epidemiological pattern of micro-organisms as an aetiology of septic arthritis, and to correlate the pattern with the outcome of neonatal septic arthritis, in terms of joint function and morphology.

**Methods.** 15 consecutive cases of neonatal septic arthritis of hip admitted between 1999 and 2002 were studied. Diagnosis of septic arthritis was made on the basis of Morrey's criteria. All patients were treated by arthrotomy after aspiration of purulent fluid from the joint. Patients were followed up for a mean period of 2.4 years. Clinical and radiological examinations were performed at follow-up.

**Results.** The mean age of the 15 patients was 20.35 days. 13 (87%) patients had primary septic arthritis, while only 2 (13%) had associated osteomyelitis. Culture reports revealed that the spectrum consisted of 33% gram-negative organisms, 7% fungal, and only 20% gram-positive organisms—*Staphylococcus aureus*

in 3 patients, *Klebsiella* in 2 patients, one each of *Proteus*, *Candida*, *Escherichia coli*, and *Enterobacter*. Six patients were pus-cell positive with negative culture. No organism was found in 6 (40%) cases. Investigations showed leukocytosis, raised C-reactive protein and erythrocyte sedimentation rate in all 15 patients. 12 patients had normal clinical and radiological parameters at follow-up. Three patients had delayed surgical drainage of more than 72 hours due to late presentation, and showed various radiological sequelae with terminal restriction of joint movements.

**Conclusion.** There are more cases of primary septic arthritis than secondary septic arthritis. Clinicians should be alert of the aetiology shift to gram-negative organisms, in addition to fungal and gram-positive ones. Arthrotomy to drain pus from the joint should not be delayed. Better long-term results can be achieved by early surgical drainage and immediate antibiotic coverage.

**Key words:** arthritis, infectious; epidemiology; infant, newborn

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## INTRODUCTION

Septic arthritis is one of the diseases which can have crippling sequelae. These sequelae can be prevented by early identification of suspects and prompt initiation of definitive treatment. Initial diagnosis and treatment depend on clinical suspicion, as well as haematological and radiological findings. Factors affecting the prognosis include age, duration between onset of symptoms and surgical intervention, and the type of micro-organisms.

The microbiological spectrum of neonatal septic arthritis has been typically dominated by gram-positive cocci.<sup>1-5</sup> There have been reports of a shift in the microbiological spectrum<sup>6</sup> and epidemiology. We conducted a prospective study at a single institution to assess the changing spectrum of bacteria, associated risk factors, time between onset of symptoms and surgical intervention, and the relationship of these factors with the patient outcome.

## MATERIALS AND METHODS

We conducted a prospective study of septic arthritis of the hip joint in 15 consecutive patients, who were in the neonatal age-group (age range, 1-31 days). All patients were admitted to the neonatal intensive care unit of our hospital from 1999 to 2002. These patients had been primarily admitted for their associated clinical conditions such as neonatal asphyxia, sepsis, prematurity, and low birth weight.

All 15 patients presented with very subtle signs of septic arthritis of hip initially. Haematological investigations such as C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), leukocyte count, blood culture, and urine culture were performed. Ultrasonographies (USG) of the hip were also performed in all patients.

Diagnosis of septic arthritis was made on the basis of the clinical criteria of Morrey et al.<sup>7</sup> supported by raised CRP values, USG of the hip, and results of the bacterial and fungal culture of the aspirated joint fluid.

All patients in this series were treated by arthrotomy by anterolateral approach after aspiration of purulent joint fluid. A postoperative drain was kept for 24 hours. All patients were protected in a hip spica. They were followed up for a mean period of 2.4 years (range, 2-4 years). Clinical assessment included range of motion of the joint, pain associated with function, and instability and shortening of the lower limbs. Patients were also assessed radiologically

for morphological changes in capital femoral epiphysis and acetabulum.

## RESULTS

The mean age of the patients was 20.35 days. 13 (87%) patients had primary septic arthritis, while 2 (13%) had associated bony lesions in the femoral metaphysis, suggestive of osteomyelitis. 11 (73%) patients had problems of prematurity and low birth weight.

All 15 patients had nosocomial infections. They showed raised CRP (mean, 86 mg/L) and ESR (mean, 56 mm/h). 13 (87%) patients had leukocytosis with increased polymorphs.

Positive blood culture was revealed in 7 (47%) patients. The distribution of organisms was gram-negative in 4 (57%) patients, pseudomonas in one (14%) patient, and gram-positive in 2 (29%) patients.

Joint culture was positive in 9 (60%) patients, while 6 patients were pus-cell positive with negative culture. The causative organisms were *Staphylococcus aureus* in 3 patients, *Klebsiella* in 2 patients, one each of *Enterobacter*, *Proteus*, *Escherichia coli*, and *Candida*. Thus the microbiological spectrum of infection was 20% for gram-positive, 33% for gram-negative, and 7% for fungal, whereas the remaining 40% were of negative culture. Joint fluid culture and blood culture correlated well only in 42.8% of the patients.

Of the 15 patients, 3 were operated on after 72 hours due to late presentation. The remaining 80% were operated on as early as possible, mostly within 48 hours. 12 (80%) patients had better clinical outcome after early arthrotomy i.e. within 48 hours. 12 (80%) patients showed excellent joint function without any pain, instability, or shortening. These patients were revealed to have normal joints upon radiological examinations.

Radiological sequelae were seen in the 3 patients who had arthrotomy after 72 hours. The sequelae were delayed calcification of head of femur, fragmentation of head, and lateral avascular necrosis; but there were no acetabular changes. Clinically these 3 patients had restricted range of motion, especially rotation, associated with pain at extremes of flexion and internal rotation range but without any instability or shortening.

## DISCUSSION

Septic arthritis of hip in neonates is a disease with severe long-term disability if not treated promptly. Prematurity and low birth weight<sup>8</sup> predispose the

child to frequent bacteraemia and hence septic arthritis. The epidemiology and natural history of neonatal septic arthritis are changing due to early recognition and intervention.

Primary septic arthritis, in contrast to that secondary to osteomyelitis, is on the rise. We had only 2 patients with osteomyelitic lesion in the femoral metaphysis, although the literature<sup>3,4,8-10</sup> shows that septic arthritis is often associated with osteomyelitis. Such a change is possibly because of the early attention given to the child; and thus increases the likelihood of earlier detection of subtle signs.

In this series, 73% (n=11) of the patients were premature and had low birth weight. Because more and more premature children can survive with special care, a multitude of procedures is required to help them grow. These children with underdeveloped haemato-lympho-reticular system acquire bacteraemia often during hospital stay and implementation of procedures, which subsequently lead to septic arthritis. This probably explains why 80% of our patients had nosocomial infection. The chronic indwelling catheters, intravenous accesses, and long hospital stay play a significant role in causing bacteraemia.

CRP and ESR were raised in all patients. CRP is time-sensitive and is a disease process indicator. It is raised immediately after infection and also reduces in value as the infection responds to antibiotics and settles down. It shows a downward trend as early as the third day after arthrotomy. On the other hand, it takes 6 to 7 days for the ESR to show a fall, which may stretch over a long period of time. So CRP is more helpful as an indicator to monitor the patient's response to treatment. This is well supported by Tachdjian.<sup>8</sup>

Some studies<sup>1,8</sup> show that 40% of the patients had positive blood culture except Lyon<sup>11</sup> who reported positive culture in only 21% of the patients. 47% (n=7) of the patients had positive culture in our series. The microbiological spectrum was dominated by gram-negative septicaemia, followed by gram-positive ones. The joint fluid culture had results different from that of the blood culture in 4 patients. But the blood culture result correlated well with the type of infection in 3 patients. Hence in patients with negative joint fluid culture, the blood culture organism and its antibiotic sensitivity have a definite role to play in identifying the aetiology.

Previous studies showed the dominance of gram-positive cocci in causing infection.<sup>1-5,9,12,13</sup> Tachdjian<sup>8</sup> finds that *Staphylococcus aureus* is the most common organism in all age groups, whereas in neonates *Streptococcus* is the second most common organism. Lyon and Evanich<sup>11</sup> reported 80% of patients had

gram-positive infection. Edwards et al.<sup>6</sup> reported that prior to 1940, haemolytic streptococci was a common cause of neonatal osteomyelitis, and that in the period between 1940 and 1970, *Staphylococcus aureus* was the major cause.<sup>14</sup> After 1970, group B *Streptococcus* has become a significant cause of neonatal septicaemia, meningitis, and osteomyelitis.

This microbial epidemiology is, however, changing. In this series, joint fluid culture showed 33% gram negative, 20% gram positive, and 7% fungal. We had different gram-negative organisms such as *Klebsiella*, *Proteus*, *Enterobacter*, and *Escherichia coli*. One should always try to remember the current epidemiological trend since this has significant implications for antibiotic selection and early empirical coverage of the spectrum. Early effective antibiotic therapy will be of help in the prevention of further damage of the joint and hence guarantees a maximum preservation of joint morphology. In this series, 3 patients had significant radiological sequelae following late arthrotomy. Of these 3 patients, 2 had gram-negative organisms in blood culture and in joint fluid culture. One had gram-positive organisms in joint culture. Though literature has reported that gram-positive cocci are more destructive because of their production of kinases<sup>15</sup> and proteases enzymes, the gram-negative organisms are also capable of causing significant long-term sequelae, as substantiated by this series. Therefore, one should cover gram-negative organisms in the choice of antibiotics and try to search for them in culture.

Previous studies show that the incidence of culture-negative septic arthritis is between 18% and 48%. These figures are compatible with that in this series. Lyon and Evanich,<sup>11</sup> however, reported a much higher figure: 70% of their patients were culture-negative. We think that the indiscriminate use of antibiotic before taking a sample for culture may mask the result.

In this series, 3 patients were operated on after 72 hours due to late presentation and they all had radiological changes and restriction of joint function. This is in contrast to reports by Paterson,<sup>3,4</sup> and Wilson and Di Paola,<sup>5</sup> who envisage that one can wait for at least 4 days with interim intravenous antibiotics and aspiration, before a decision of arthrotomy is made. We suggest that the time of arthrotomy should be as early as possible, especially on an emergency basis.

## CONCLUSION

The disastrous consequences of septic arthritis in neonates can be prevented by early recognition and

immediate arthrotomy of the hip joint. The changing epidemiology of septic arthritis should be kept in mind to reduce the rate of disability. We conclude from this series that:

1. Higher incidence of primary than secondary septic arthritis mandates the identification of a septic process even in the absence of bony lesion on X-ray.
2. Aetiology shift to gram-negative organisms, in addition to fungal and gram-positive ones, should always be kept in mind for antibiotic selection and culture methods.
3. Immediate arthrotomy to drain pus from the joint in cases with strong clinical suspicion, instead of waiting for more than 72 hours, is advised.
4. Better long-term results can be achieved by early surgical drainage and immediate antibiotic coverage.

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