# NEONATAL SEPTIC ARTHRITIS

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**Abstract.** Neonatal septic arthritis has always been considered as separate from its counterpart in older children. The condition is uncommon but serious. Affected neonates usually survive, but with permanent skeletal deformities. Ten cases of neonatal septic arthritis were diagnosed between January 1989 and December 1993 in the neonatal intensive care units of two referral hospitals in the state of Kelantan, Malaysia. All except one neonate was born prematurely. The mean age of presentation was 15.6 days. Joint swelling (10/10), increased warmth (7/10) and erythrma of the overlying skin (7/10) were the common presenting signs. Vague constitutional symptoms preceded the definitive signs of septic arthritis in all cases. The total white cell counts were raised with shift to the left. The knee (60%) was not commonly affected, followed by the hip (13%) and ankle (13%). Three neonates had multiple joint involvement. Coexistence of arthritis with osteomyelitis was observed in seven neonates. The commonest organism isolated was methicillin resistant *Staphylococcus aureus* (9/10). Needle aspiration was performed in nine neonates and one had incision with drainage. Follow up data was available for five neonates and two of these had skeletal morbidity. Early diagnosis by frequent examination of the joints, prompt treatment and control of nosocomial infection are important for management.

## INTRODUCTION

Septic arthritis in neonates differs from that in older children because of the absence of systemic manifestations (Clarke, 1958). Diagnosis in neonate is difficult because of the rarity of this condition and paucity of the signs and symptoms. Although the survival of neonates with this condition has improved, the incidence of skeletal morbidity is still high (Fox and Sprunt, 1978; Mok *et al*, 1982; Williamson *et al*, 1990). The aim of the present study is to describe the clinical features, bacteriology, risk factors and follow-up of the neonates with septic arthritis in two tertiary referral neonatal intensive care units in Kelantan, Malaysia.

## MATERIALS AND METHODS

This is retrospective study of the case records and the follow up notes of neonates diagnosed to have septic arthritis in two tertiary referral neonatal intensive care units in Kelantan, a north-eastern state of Malaysia, from December 1991 to December 1993. Neonates (age up to 28 days) with at least any two of the following criteria were included into the study: (1) clinical signs of arthritis like swelling, tenderness, increased warmth and limitation of movements; (2) radiological changes; (3) positive culture from blood or joints or bones; (4) aspiration of pus from bones or joints. Work up, including complete blood counts, culture of blood, urine and pus aspirated from the joints was performed in all these neonates. They were followed up in the clinics at three monthly intervals and evaluated by both orthopedic surgeon and pediatrician. During the follow-up visits, functional evaluation of all joints and radiographs of the affected joints were performed. Those neonates who defaulted on scheduled follow-up dates were contacted through the respective health centers.

## RESULTS

During the study period 10 neonates, six of them, males, met the criteria for diagnosis. All had pus collection in the affected joints. Nine neonates were premature with a mean gestational age of 31.66 (SD 2.06) weeks and a mean birthweight of 1.43 (SD 0.32) kg. Six neonates had umbilical catheterization with an average duration of 5.5 (SD 3) days. Skeletal sepsis was detected after an average period of 10.5 (SD 2.59) days of removal of the catheter. The mean age at presentation was 15.6 days (range 9-18 days). The onset of infection was heralded by vague symptoms followed by definite signs of arthritis in all cases. These vague signs and symptoms include lethargy (40%), feeding intoler-

Table 1

Patient characteristics of ten neonates with septic arthritis.

| Patient characteristics | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | Case 6 | Case 7 | Case 8 | Case 9 | Case 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Mode of delivery | SVD | SVD | SVD | SVD | SVD | SVD | SVD | SVD | SVD | SVD |
| Sex | M | M | F | M | F | F | M | M | F | M |
| Weight (9) | 1,440 | 1,300 | 1,200 | 2,750 | 1,500 | 1,100 | 1,450 | 1,500 | 2,200 | 1,200 |
| Gestation (weeks) | 30 | 30 | 30 | 38 | 33 | 30 | 33 | 30 | 35 | 34 |
| Initial problem | HMD | HMD | HMD | SJ | HMD | HMD | HMD | HMD | HMD | Prematurity |
| Ventilated | Yes | No | No | No | Yes | Yes | Yes | Yes | Yes | No |
| UAC/UVC | UAC | No | No | UVC | UAC | UAC | UAC | UAC | UAC | No |
| Age(days) of presentation | 18 | 9 | 13 | 15 | 17 | 17 | 17 | 18 | 15 | 17 |
| Fever | Yes | No | No | Yes | No | No | No | No | No | No |
| Poor activity | Yes | No | Yes | No | Yes | No | No | No | No | No |
| Feeding intolerance | Yes | No | Yes | No | Yes | No | No | No | No | No |
| Pseudoparalysis | NR | NR | No | NR | No | Yes | NR | No | NR | No |
| Osteomyelitis | Yes | Yes | No | Yes | Yes | Yes | Yes | No | No | Yes |

UAC: Umbilical arterial catheterization; UVC: Umbilical venous catheterization; HMD: Hyaline membrane disease; SVD: Spontaneous vertex delivery; M: male; F: female; SJ: severe jaundice; NR: Not record; P: Prematurity

ance (40%), fever (20%) and hyperglycemia (20%). The average duration of the vague symptoms before the definitive signs of septic arthritis was 2.4 days (range 1-5 days). Swelling of joints was the commonest finding (100%) followed by tenderness (90%), erythematous and warm skin (80%) and limited movement (60%). Pseudoparalysis was noted in only one neonate. No neonate had involvement of the small joints. The knee joint (60%) was commonly affected followed by the ankle (13%) and hip (13%). Three neonates had more than one joint involvement and seven neonates had radiological evidence of adjacent osteomyelitis. At diagnosis the mean total white cell count was 19 × $10^9$/l with a mean polymorphonuclear cell count of 73 (SD 12%). Radiological changes included soft tissue swelling (90%), bone lesions (60%) and periosteal bone formation (10%). One neonate had no ragiological abnormality at presentation. Organisms isolated were *Klebsiella aeruginosa* (1) and methicillin resistant *Staphylococcus aureus* (9). Joint aspirates and blood culture grew the same organism with similar sensitivity to antibiotics in all cases. *Klebsiella aeruginosa* was resistant to cephalosporins and aminoglycosides but sensitive to imipenem. Methicillin resistant *Staphylococcus aureus* was sensitive to fusidic acid, clindamycin, rifampicin and vancomycin. All cases were treated with antibiotics for 2-6 weeks. Joint decompression was done with needle aspiration in nine cases and incision and drainage was done in one neonate. Only one neonate required a second aspiration. Follow up data was available for five neonates. They were followed up for a period ranging from 3 months to 16 months. Two of the five neonates had restricted joint movement and abnormal skeletal growth. The details of the ten neonates with septic arthritis are further shown in Tables 1, 2 and 3.

## DISCUSSION

Septic arthritis and osteomyelitis in the neonate are usually a blood borne infection (Nade, 1983). Ventilatory therapy, invasive procedures, prematurity and respiratory distress syndrome are known predisposing factors (Mok *et al*, 1982; Williamson *et al*, 1990; Ho *et al*, 1989) which were also seen in our series. These are the factors which closely relate to risk of bacteremia. Mok *et al* (1982) suggested that umbilical catheterization irrespective of the maturity place the neonate at a high risk. Prolonged umbilical catheterization and severe illness

Table 2

Signs, bacteriology and radiological findings of ten neonates with septic arthritis.

| Characteristics | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | Case 6 | Case 7 | Case 8 | Case 9 | Case 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Joint swelling | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Warm joint | No | Yes | Yes | Yes | Yes | Yes | No | Yes | No | Yes |
| Erythema of skin over the joint | No | Yes | No | Yes | Yes | Yes | No | Yes | No | Yes |
| Joint tenderness | No | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Limitation of movement | No | No | Yes | Yes | Yes | Yes | No | No | No | No |
| Joint(s) involved | Rt knee | Lt hip Lt knee, Lt ankle | Lt knee | Rt ankle, Lt knee, Lt shoulder | Lt wrist | Lt hip, Lt knee | Rt knee | Rt knee | Lt knee | Lt knee |
| Joint aspirate culture | *Klebsiella aeruginosa* | MRSA | MRSA | MRSA | MRSA | MRSA | MRSA | MRSA | MRSA | MRSA |
| Blood culture | *Klebsiella aeruginosa* | MRSA | MRSA | MRSA | MRSA | MRSA | MRSA | MRSA | MRSA | MRSA |
| X-ray findings at presentation | soft tissue swelling | soft tissue swelling | soft tissue swelling, | soft tissue swelling, bone destruction | soft tissue swelling, bone destruction | soft tissue swelling, bone destruction, joint effussion, fracture femur | soft tissue swelling, bone destruction | No abnormality | soft tissue swelling | soft tissue swelling |

MRSA: Methicillin resistant *Staphylococcus aureus*, Lt: Left; Rt: Right.

Table 3

Management and follow-up of ten neonates with septic arthritis.

| Patient characteristics | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | Case 6 | Case 7 | Case 8 | Case 9 | Case 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Joint decompression | Needle aspiration | Needle aspiration | Needle aspiration | Needle aspiration | Needle aspiration | Needle aspiration | Needle aspiration | Needle aspiration | Needle aspiration | Incision and drainage |
| No. of decompression | Twice | once | once | once | once | once | once | once | once | once |
| Antibiotic therapy | Imipenem | Clindamycin, Fusidic acid | Clindamycin, Fusidic acid | Vancomycin, Rifampicin, Fusidic acid | Rifampicin, Fusidic acid | Vancomycin, Fusidic acid | Vancomycin | Vancomycin | Vancomycin, Fusidic acid | Vancomycin |
| Duration of antibiotic therapy | 4 weeks | 4 weeks | 4 weeks | Vancomycin for 16 days followed by Rifampicin and Fusidic acid for 2 weeks | 5 weeks | 6 weeks | 2 weeks | 6 weeks | 6 weeks | 3 weeks |
| Outcome Follow up | Survived at 3 months normal joint function | Survived at 16 months able to stand and normal growth | Survived lost to follow-up | Survived at 10 months normal joint function | Survived at 9 months abnormal joint growth and function | Survived at 4 months restricted joint movement | Survived defaulted treatment | Survived lost to follow up | Survived lost to follow up | Survived lost to follow up |

in the newborn have been associated with increased risk of bacterial infection. Septic arthritis in a term newborn with severe neonatal jaundice requiring exchange transfusion had also been reported (Lim *et al*, 1977).

The clinical features are usually vague until evidence of joint swelling appears. Although fever has been reported to occur in 50% of cases (Mok *et al*, 1982; Ho *et al*, 1989) it was not a common feature in this series. In contrast to other series most of the preterm neonates in the present series showed little in the way of systemic signs (Williamson *et al*, 1990). All the radiographs at presentation were abnormal. The absence of radiological abnormalities at presentation is known to occur (Mok *et al*, 1982). The presence of radiological abnormalities in our series may indicate a later presentation as compared to other series. In our series none of the neonate had bone scan. The role bone scan in the diagnosis of neonatal septic arthritis is not very clear (Mok *et al*, 1982). in a recent report technetium or gallium bone scan were found to be useful in identifying the silent focus of bone infection (Wong and Isaacs, 1994).

The high incidence of multifocal nature of bone and joint infection is consistent with reported observations (Fox and Sprunt, 1978; Mox *et al*, 1982; Williamson *et al*, 1990; Ho *et al*, 1989). In our series 70% had adjacent osteomyelitis which is high when compared to the other reports (Mok *et al*, 1982; Williamson *et al*, 1990; Ho *et al*, 1989). A plausible explanation could be delay in diagnosis and treatment leading to complication with osteomyelitis. The unique blood supply to the bones and joints in neonates may explain the difference of skeletal infection between neonates and older children. In neonates the epiphyseal circulation is derived from the same periarticular anastomoses as the metaphyseal circulation. This facilitates a rapid spread of infection from the metaphysis to the epiphysis. Destruction of the epiphyseal plate facilitates extension of infection into the joint. This characteristic spread of infection in neonates makes skeletal survey an important investigation, so that bone and joint involvement at other site could be detected even in the absence of signs and symptoms. The rapid spread of infection causes progressive destruction of the bones and joints leading to orthopedic complications. Joint destruction and abnormal bone growth had been estimated to occur in variable frequencies. Even with the availability of effective antibiotics, complication rates are still high (Fox and Sprunt, 1978; Mok *et al*, 1982).

In contrast with other studies which reported positive blood cultures in approximately 70% of cases (Mok *et al*, 1982; Ho *et al*, 1989), all the neonates in our series had positive blood cultures. The microbiological agent causing neonatal septic arthritis depends on whether the infection is hospital or community acquired. In contrast with the most of the reports (Mok *et al*, 1982; Williamson *et al*, 1990), methicillin resistant *Staphylococcus aureus* was the most common organism isolate in our neonates. Only one patient in our series had an infection with *Klebsiella aeruginosa*. Group A beta hemolytic *Streptococcus* which was an etiologic agent in other series (Edwards *et al*, 1978; Baxter and Finnegan, 1988; Knudsen and Hoffman, 1990) was not isolated from any of our neonates. The neonate who was infected with multiresistant *Klebsiella aeruginosa* was treated with parentral imipenam. This neonate did not develop any complication related to imipenam. Neonates with methicillin resistant *Staphylococcus aureus* arthritis were treated with various antibiotics including vancomycin, fusidic acid, clindamycin and rifampicin. Of the two neonates who were treated with a combination fusidic acid and clindamycin, one had normal skeletal function and growth during follow-up at 16 months. Of the two neonates who received rifampicin along with fusidic acid, one developed skeletal deformity during follow up.

Surgical management was done to decompress the affected joints. Controlled studies evaluating the role of surgery and comparion various surgical approaches in the treatment of septic arthritis in neonates are rare. In most series the approaches are taken empirically and frequently gained popularity without any scientific documentation. It has been shown that in joints other than hip and shoulder joint needle aspiration alone is sufficient for decompression (Nade, 1982; Wilson and Paola, 1986). In the absence of any study in neonates, we concur with Wilson and Di Paola (1986) that arthrotomy of the joints may be replaced with repeated joint aspirations. In their series 15 out of 26 hip involvement had a normal outcome with the majority (9) been treated with joint aspiration. Arthrotomy would not be suitable for most of the neonates since they are premature with many associated medical problems. The small joints of these premature neonates make surgical access to the joint technically difficult.

Like Ho *et al* (1989), aspiration of the joint was used for the decompression in our series.

Since prevention measures had been instituted in the form of handwashing, cohort nursing, application of povidone iodine over umbilical cords and using peripheral arterial lines instead of umbilical arterial lines, only two cases were diagnosed in the last two years. The present study reconfirms that neonates on invasive monitors are at risk of septic arthritis and osteomyelitis. The systemic manifestation may be of little help in the diagnosis of this condition.

## REFERENCES

Baxter MP, Finnegan MA. Skeletal infection by group B beta-haemolytic streptococci in neonates. A case report and review of literature. *J Bone Joint Surg* 1988; 70 : 812-4.

Clarke AM. Neonatal osteomyelitis: a disease different from osteomyelitis of older children. *Med J Aust* 1958; 1 : 237-9.

Edwards MS, Baker CJ, Wagner ML, Taber LH, Barrett FF. An aetiological shift in infantile osteomyelitis: the emergence of the group B streptococcus. *J Pediatr* 1978; 93 : 578-83.

Fox L, Sprunt K. Neonatal osteomyelitis. *Pediatrics* 1978; 62 : 535-42.

Ho NK, Low YP, See HF. Septic arthritis in the newborn-A 17 year's clinical experience. *Sing Med J* 1989; 30 : 356-8.

Knudsen CJM, Hoffman EB. Neonatal osteomyelitis. *J Bone Joint Surg* 1990: 72-B : 846-51.

Lim MO, Gresham EL, Franken EA, Leak RD. Osteomyelitis as a complication of umbilical catheterization. *Am J Dis Child* 1977; 131 : 142-4.

Mok PM, Reilly BJ, Ash JM. Osteomyelitis in the neonate. *Radiology* 1982; 145 : 677-82.

Nade S. Acute haematogenous osteomyelitis in infancy and childhood. *J Bone Joint Surg* 1983; 65-B : 109-19.

Williamson JB, Galasko CSB, Robinson MJ. Outcome after acute osteomyelitis in preterm infants. *Arch Dis Child* 1990; 65 : 1060-2.

Wilson NIL, Paola MDI. Acute septic arthritis in infanncy and childhood. 10 year's experience. *J Joint Surg* 1986; 683 : 584-7.

Wong M, Isaacs D. Osteomyelitis in young infants. *J Paediatr Child Health* 1994; 30 : A14.