

NEONATAL OSTEOMYELITIS

C.R. STAALMAN and B.H. TANIA¹

Abstract

The authors describe five cases of neonatal osteomyelitis encountered during the last five years. Their findings are compared with those of the current literature. The striking contrast between the often unreliable or unspecific clinical symptoms of neonatal osteomyelitis, and the sometimes extensive and/or multiple skeletal lesions seen at roentgenographic examination, is stressed. Attention is given to the possible differences in the roentgenographic findings in relation to the kind of bacteria cultured.

The possible helpfulness of the estimation of the erythrocyte sedimentation rate in the assessment of the infectious nature of the disease, and in the evaluation of its response to therapy, is underlined.

Key-words: Bones, infection — Infant, newborn, skeleton — Soft tissue, Abscess — Osteomyelitis, newborn, skeleton, staphylococcal infection.

Neonatal osteomyelitis is a well known though relatively rare disease.

Most frequently the metaphyseal ends of the tubular bones are affected (1); epiphyseal involvement and joint effusion are often observed (2). Delayed and/or inadequate treatment may, therefore, cause growth disturbances, resulting in shortening of the limb and impaired mobility of the adjacent joint.

Neonatal osteomyelitis often presents with unreliable or unspecific clinical signs despite multiple sites of involvement (3). Therefore, roentgenographic detection of the skeletal lesions, and awareness of the radiologist of their clinical impact in view of possibly severe sequelae of the disease, is of great importance.

Material and methods

During the last five years we encountered five children with osteomyelitis occurring within the first two months of live. There were one male and four females.

In all patients sequential radiographs were taken; in one of them also a nuclear study was performed.

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1. Departments of Radiology of the Emma Children's Hospital and the Academical Hospital at the University of Amsterdam, Amsterdam, the Netherlands.

Case 1

L.T. was born on 14.12.78 by means of caesarean section. She was a 1110 g dysmature and premature baby girl. Soon after birth the patient developed a staphylococcal sepsis (proven by blood culture), and a swollen left knee. Both legs were swollen with pitting edema.

Roentgenographic examination showed an osteolytic defect in the left proximal tibia (not represented). At the age of 1 week the knee abscess was surgically drained and staphylococcus aureus was cultured from the aspirate. Antibiotic treatment was started with intravenous administration of cloxacillin during the following three weeks. In the meantime a red swelling was noted on the left wrist.

Roentgenographic examination (fig. 1) revealed an area of irregular osteolysis at the distal metaphysis of the radius. The aspect of the lesion was highly suspicious of osteomyelitis.

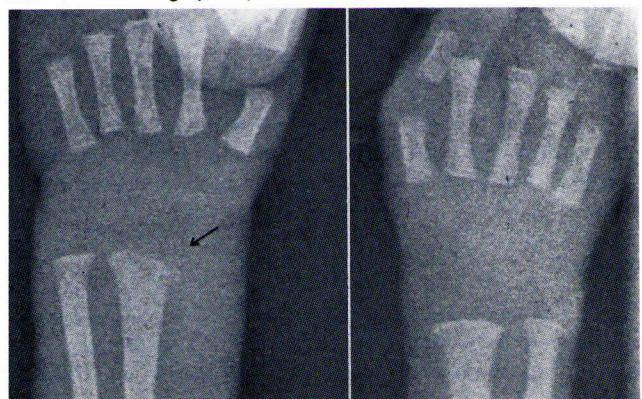


Fig. 1. — Case 1. Newborn with staphylococcal sepsis, before treatment. Small defect at the distal metaphysis of the left radius (arrow) with marked soft tissue swelling. The right wrist is normal.



Fig. 2. — Case 1. Left wrist 4 weeks after therapy. There is a deformity of the distal radial metaphysis.

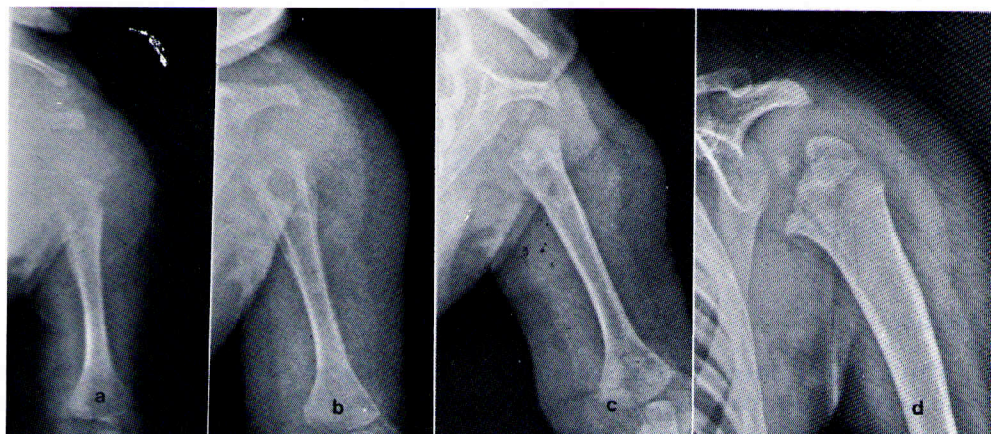


Fig. 3. — Case 2. a) left shoulder 3 weeks after initial complaints; b) 2 weeks later; c) after 2 months; d) after 8 months.

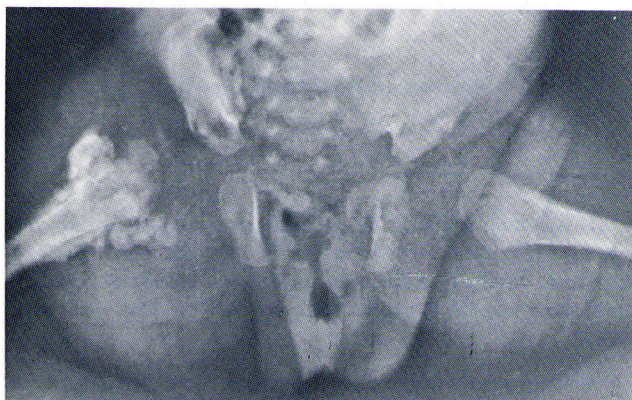


Fig. 4. — Case 3. Pelvis film 3 weeks after onset of symptoms. Irregular metaphysis of the right femur, with abundant periosteal reaction and callus formation.

Hypoproteinemia was demonstrated. Albumin and plasma were given intravenously and subsequently the pretibial edema disappeared.

Repeat radiographs at the age of four weeks showed still a small defect in the proximal tibial metaphysis (not represented) and a marked deformity of the distal radial metaphysis (fig. 2).

At the age of 6 weeks the patient was dismissed in a good general condition. Her body weight had increased to 1720 g. Control examination at the age of 21 months revealed no residual abnormalities.

Case 2

L.E., a full term baby girl, was born on 17.7.79, after an uncomplicated pregnancy and delivery. At the age of 1 month the mother noted a lack of spontaneous movement of the left arm. Passive movement of the arm was painful. The baby was presented to the surgeon, who found no local signs of disease. Radiographs showed no abnormalities. The neurologist could not find any explanation for the symptoms.

One week later the situation was unchanged, without any local sign of disease.

On 5.8.79 the patient was still in good general condition. Locally, a slight swelling of the left shoulder was noted. A repeat radiograph (fig. 3a) revealed a large area of destruction in the left proximal humeral metaphysis, with marked periosteal reaction. Catecholamin values in a 10-hours-portion of urin were just beyond upper limits. A presumptive diagnosis of neuroblastoma metastasis was made and the patient was subsequently admitted to the pediatric oncological centre. The consulted surgeon found the baby in good general condition with a body temperature of 37.3°C. The left arm was hypotonic. There was a marked swelling of the left shoulder, with enlarged axillary lymphnodes. The erythrocyte sedimentation rate (ESR) was 130 mm. Blood culture: staphylococcus albus.

A diagnosis of osteomyelitis was made and antibiotics were given intravenously. Within 2 weeks, the paresis of the left arm and the swelling of the left shoulder disappeared. On 28.9.79 the patient was dismissed, continuing her erythromycin orally for 4 weeks. The ESR had fallen to 22 mm.

Follow-up radiographs (fig. 3b, c and d) showed a gradual improvement. The further course was uneventful.

Case 3

F.M., a full term 3450 g baby girl, was born on 23.4.81, after an uncomplicated pregnancy and delivery. She was the third child of healthy parents.

Two weeks after birth the patient developed local abscesses at the right hand, fourth left finger, and left ankle. Also an erythema appeared over the whole body. The patient was admitted to the hospital. There, the baby was found to be in a good general condition. Body temperature 38.4°C. ESR 65 mm. Leucocyte count 23 000. In addition to the above mentioned localizations abscesses were found in the right buttock and right shoulder.

Roentgenographic examination revealed an area of lytic destruction with a huge periosteal reaction at the proximal metaphysis of the right femur (fig. 4). The right shoulder showed a large soft tissue swelling and subluxation of the left hip, due to joint effusion.

The abscesses were punctured and cultures of the aspirate revealed staphylococcus aureus. An immune deficiency was ruled out by

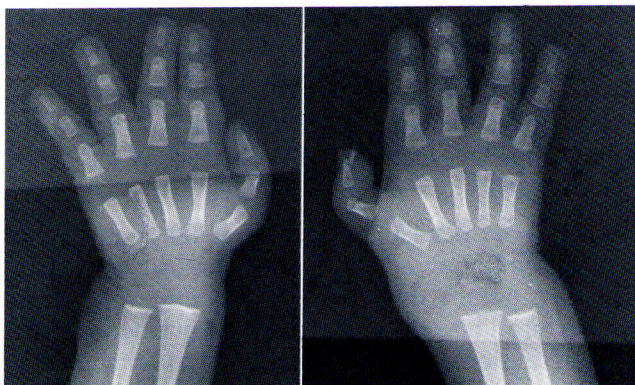


Fig. 5. — Case 4. The right wrist shows marked soft tissue swelling at the radial side with increased distance between radius/ulna and metacarpals. The left wrist is normal.

examination of the granulocyte and lymphocyte functions. According to the sensitivity of the bacteria cloxacillin was given intravenously. Subsequently, body temperature and ESR fell down to almost normal values. The lesions improved gradually; except the left hip which showed a subluxation. After a bloody reposition relaxation occurred, which has to be corrected in the future.

Case 4

J.S., a 2 140 g premature baby boy, was born on 18.9.81 by means of caesarean section. Apgar scores 9 and 10 after 1 and 5 minutes. His mother had juvenile diabetes since her fourth year. She was admitted to the hospital because of a slight toxicosis and a growth retardation of 2 weeks.

The first 1½ day of his life the baby was fed intravenously with a 10% glucose solution. The 2nd and 3rd day he underwent phototherapy because of hyperbilirubinemia. Afterwards he developed well.

At the age of 3 weeks he was in good general condition apart from a rhinitis. Two weeks later the rhinitis was still present. The

patient's temperatures were raised (37.8-38.5°C) and soft tissue swellings developed on the right hand, and left hip and upper leg. Laboratory findings included anemia, leucocytosis and hypalbuminemia. A presumptive diagnosis of neonatal subcutaneous fat necrosis was made.

The roentgenographic images, however, were compatible with septic arthritis of the left hip and right wrist (fig. 5). Cultures of several aspirates revealed staphylococcus aureus. Subsequently, antibiotics (ampicillin and cloxacillin) were administered.

On 26.11.81 the patient was dismissed in a good general condition. The arthritis of the left hip had resulted in shortening and subluxation, but good function. The other localizations healed completely.

Case 5

M.K., a full term baby girl, was born on 16.9.82 after an uncomplicated pregnancy and delivery. Four weeks later the mother noted decreased activity of the right arm. Till then the baby had been completely healthy, and had had no intravenous injections or other procedures with increased risk on infection.

On 28.10.82 the patient was admitted to the hospital. A marked swelling of the right shoulder was found, the skin being somewhat warmer than on the left side. Active movements of the right arm were almost absent. Passive movements were possible, though painful. Laboratory findings included an elevated ESR (80 mm) and a slight leucocytosis (15 600) with normal differentiation. The body temperature was 37.4°C. Roentgenographic examination revealed a large osteolytic defect in the proximal metaphysis of the right humerus, with some periosteal reaction. The epiphysis was smaller than the left one. The distance between epiphysis and glenoid fossa was increased (fig. 6). A diagnosis of osteomyelitis with joint effusion was made. A skeletal survey showed no other sites of disease.

On 29.10.82 the right shoulder joint was punctured. Group B hemolytic streptococci were cultured from the aspirate. Subsequently, the patient was treated with penicillin G intravenously.

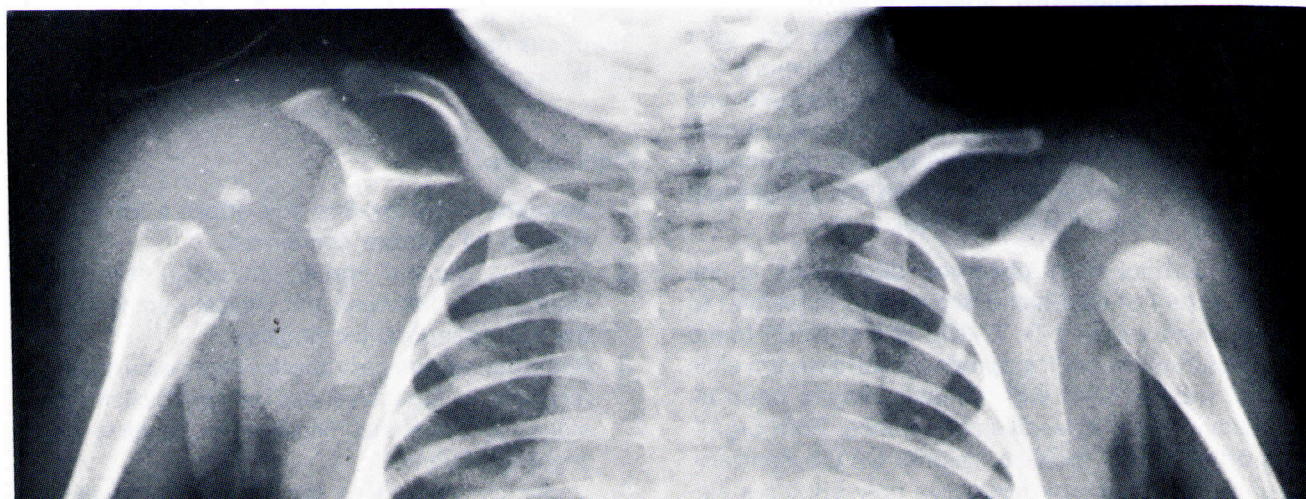


Fig. 6. — Case 5. Lytic defect in the right proximal humeral metaphysis with slight periosteal reaction. Joint space widening. Soft tissue swelling.

On 22.11.82 the ESR and leucocyte count were turned to normal. The local swelling was diminished. On the radiograph the lytic defect was decreased in size. Marked periosteal reaction was noted. The baby was dismissed, continuing her antibiotics orally.

Discussion

In spite of good care and modern antibiotics neonatal osteomyelitis still offers a lot of problems to all doctors concerned.

This is especially due to the paucity of clinical signs causing delay (4) in detection and treatment, and to the risk of severe sequelae.

Initially, limited mobility of a limb may draw the mother's attention and then may lead to the detection of a soft tissue swelling (5). Additionally erythema and regional adenopathy may be found (6). Elevation of the erythrocyte sedimentation rate and leucocytosis are frequently found (6). Roentgenographic findings include metaphyseal osteolytic lesions, joint space widening, soft tissue swelling (1, 7) and often abundant periosteal reaction (8).

Blood culture and/or needle aspiration are the final step in establishing the diagnosis (6, 9).

The major causative organisms are staphylococcus aureus (2, 3, 6, 10) and Group B streptococcus hemolyticus (6, 7, 10, 11). Others, including *Candida albicans* (2, 3, 9), *E. coli* (6, 10), and *Salmonella typhi* (2, 12) are less frequently found. These organisms preferably affect the metaphysis (1, 3, 7, 12) of the tubular bones by hematogenic spread and can be cultured from the blood and from local aspirate (9). Also facial (5) and vertebral (3) involvement may occur.

During the first year of life particular vessels persist from the embryonal period, connecting metaphyseal and epiphyseal arterial branches. These transphyseal vessels facilitate epiphyseal and joint involvement (8, 13), which are, therefore, more frequently found in osteomyelitis of the neonate and young infant (5, 6). Epiphyseal and joint involvement are responsible for the possible residua of neonatal osteomyelitis: shortening of the limb and impairment of mobility of the joint involved (5).

Some authors have observed differences in the clinical picture of neonatal osteomyelitis in relation to the organism cultured (3, 7, 10). Brill et al. (3) found bone destruction with staphylococcal osteomyelitis is more marked than with *Candida*, where bone lesions have a less aggressive appearance. Both organisms often exhibit multiple lesions. On the contrary, Group B hemolytic streptococcus only effects a single bone (7, 10) (most often the proximal humerus (10) with very few exceptions (11)). *Staphylococcus aureus*

usually affects children with neonatal problems, and often gives rise to severe residua (3, 6); the opposite is true for Group B streptococcus.

Our limited experience corresponds with these observations, as is clear from the histories of our cases 1, 3, 4, and 5.

In a recent publication Mok et al. (2) suggest that patients with neonatal osteomyelitis can be divided into two groups depending on severity of disease. They state that premature infants requiring umbilical catheterization and severely ill full term infants constitute a high risk group for osteomyelitis. Multifocal infection and joint involvement are more frequent, and severe skeletal deformities more common than in the low risk group. *Staphylococcus aureus* was the dominant organism in their series.

As is clear from our case histories 1 and 3 our data disagree with this proposition.

There is general agreement in the literature about the essential role of radiography for initial diagnosis and subsequent follow-up of neonatal osteomyelitis (2, 14). In any infant with osteomyelitis at one site a skeletal survey is indicated to look for other, silent, lesions (3).

The place of nuclear studies in the assessment of neonatal osteomyelitis is still a matter of discussion (2, 8, 15, 16). Probably according to the nature of the process the scans are often negative or equivocal (15). Sometimes a "cold" lesion is found on the basis of vascular occlusion (6, 9).

Some authors (7) stress the importance of the erythrocyte sedimentation rate in the evaluation of the process and to monitor progress. Mok et al. (2), however, do not mention the ESR at all. In our "low risk" patients (cases 2, 3 and 5) the ESR was of great help to the clinician in the recognition of the infectious nature of the disease, and in the evaluation of its response to therapy.

Conclusions

1. Neonatal osteomyelitis still offers a lot of problems to all doctors concerned.
2. There is general agreement about the striking discrepancy between the clinical symptoms and the roentgenographic findings.
3. Roentgenographically there seem to be some differences in aggressiveness and multiplicity of lesions, and residual findings, in relation to the organism cultured.
4. Under circumstances the estimation of the erythrocyte sedimentation rate can play a role both in initial diagnosis and subsequent follow-up.

Résumé

Les auteurs décrivent 5 cas d'ostéomyélite néonatale rencontrés par eux au cours des cinq dernières années. La place particulière qu'occupe l'ostéomyélite néonatale est évoquée, de même que la cause de celle-ci, à savoir la survenance, au cours des premiers mois de la vie, de vaisseaux sanguins à circulation transphyséale. L'accent est mis sur le contraste frappant qui existe entre les symptômes cliniques souvent vagues ou aspécifiques et les anomalies radiographiques du squelette, parfois étendues et/ou multiples, caractérisant l'ostéomyélite néonatale. Les différences d'aspect radiographique d'un patient à l'autre dues aux micro-organismes qui s'y sont développées sont également considérées. Dans certains cas, la détermination de la vitesse de sédimentation semble utile tant pour l'établissement de la nature infectieuse de l'affection que pour l'évaluation de l'effet thérapeutique.

Samenvatting

De auteurs beschrijven 5 gevallen van neonatale osteomyelitis die zij de laatste vijf jaren zijn tegengekomen. Besproken wordt de aparte plaats welke de neonatale osteomyelitis inneemt en de oorzaak daarvan, nl. het voorkomen in de eerste levensmaanden van transphyseaal verlopende bloedvaten. Benadrukt wordt de opvallende tegenstelling welke er bestaat tussen de vaak onduidelijke of aspecifieke klinische symptomen en de soms uitgebreide en/of multiple röntgenologische skeletafwijkingen bij neonatale osteomyelitis. Tevens wordt aandacht geschonken aan de verschillen in de röntgenologische beelden bij verschillende patienten in relatie tot de bij hen gekweekte micro-organismen. In sommige gevallen lijkt de BSE-bepaling van nut, zowel voor het vaststellen van de infectieuze aard van de aandoening, als ook voor het evalueren van de reactie op therapie.

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Address reprint requests to: Dr C. R. Staalman
Department of Radiology
Academical Medical Centre
Meibergdreef 9, 1105 HZ Amsterdam (Nederland).