STAPHYLOCOCCUS AUREUS INFECTION OF THE LONG BONES IN THE NEWLY BORN

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In a study of the clinical picture and effects of various infections in the new-born there have occurred three cases of staphylococcal infection of the long bones. These are here reported and discussed because so little has been written on the subject, and also because they illustrate how this disease process, like many others, differs in its clinical picture and results in infancy from a similar process in later childhood.

In 1935 Dilliehunt made some observations on osteomyelitis in infancy, and pointed out that the condition is locally relatively benign in infants under two years of age. He reported two cases in which the onset had been before the age of one month. In one case there was a staphylococcus aureus infection of ten days' duration of the lower end of the femur. The temperature was 102° F. on admission, but, judging from the photograph, the child was not wasted or ill. In the other case a streptococcal infection of the patella was present. The temperature was 102° on admission and the child was markedly malnourished, with a dry skin, after ten days' illness. Both cases were treated with simple incision down to the abscess, and recovery was rapid and complete. There was no evidence of disease five weeks after operation.

In the same year Green stressed the differences between osteomyelitis as it occurs in infancy and in older children. He attributed the rapid healing of the bones and the absence of sequestra in infancy to the thinness of the cortex and loose attachment of the periosteum at this age, the pus thereby escaping easily and rapidly from the medulla into the soft tissues without causing any necrosis of the cortex. For this reason he advocated treatment of the infant first and of the local condition later, and suggested that the less done at operation the better. He stated that by giving the infant fluids and immobilizing the affected limb until the general condition was satisfactory, and then making a simple incision down to the pus without disturbing the bone, he had treated thirty consecutive cases under two years of age with only two deaths, both of which were in infants under two months of age with diffuse sepsis.

In 1933 Dunham reported thirty-nine cases of septicaemia in the new-born, in four of which osteomyelitis was present. One was a fatal case of staphylococcal infection with multiple bony lesions in addition to peritonitis, pneumonia, meningitis and multiple skin abscesses. One was a case of staphylococcal osteomyelitis of the femur in which the general condition was satisfactory at first, but open operation was followed by erysipelas-like lesions around the wound, streptococcal septicaemia, and death. A case of bacillus coli infection of the upper end of the humerus was treated without operation and recovered. A case of mixed bacillus pyocyaneus and staphylococcus aureus infection of the clavicle and sternoclavicular joint died without operation.

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Mount (1935) reported a case of haemolytic staphylococcal septicaemia with suppuration in the left elbow joint and around the lower end of the left humerus, and pneumonia. Death occurred at the age of fourteen days after only two days' illness.

Case reports

Case 1. R. C. : This was a male child born at term in a maternity hospital on September 10, 1937. Birth weight was 7 pounds 14 ounces. The delivery and puerperium were normal and the child was not known to have been in contact with any infection. The child was breast fed for ten days and then weaned. The mother stated that the umbilicus was a little moist at the tenth day. Slight redness of the left knee was noticed a few days later, and rapidly

FIG. 1.—Case 1. R. C. X-ray of left knee. October 22, 1937, showing osteitis of lower end of left femur.

FIG. 2.—Case 1. R. C. X-ray of left knee. November 12, 1937, showing osteitis of lower end of femur healing with deformity of articular surface.

increasing swelling of the knee was noticed at one month of age. The child took its feeds well throughout. There was no gastro-intestinal disturbance and the child was not ill at any time. The child was sent to hospital when four and a half weeks old because of the swelling of the knee. At this time he was sturdy, vigorous, had a good colour and weighed 8 pounds 5 ounces. He was happy and free from pain unless the left leg was moved. There was a tense red swelling around the left knee-joint and a hard gland about the size of a walnut in the left groin. The left sternoclavicular joint also was swollen, red and tender. The child was admitted to hospital. Prontosil $2\frac{1}{2}$ grains was given three-hourly for four doses without apparent effect. The knee joint was aspirated four times in the first ten days after admission, a total of $2\frac{1}{2}$ ounces of pus being withdrawn. *Staphylococcus aureus* was isolated from the pus. After the last aspiration gentle extension was applied to the leg, and about ten days later the leg was put up in plaster of Paris with the knee extended as completely as possible—at about 160° . The sternoclavicular joint subsided without aspiration. While in hospital the child was apyrexial, apart from a rise of temperature between 99° F. and 101° F. for three days during the first

week. There was no fresh manifestation of sepsis except for a few pus cells in the urine on one occasion. The stools were usually normal, but occasionally relaxed. The child took its feeds well throughout, and his general condition never caused any anxiety. He was discharged at the age of seven and a half weeks weighing 9 pound 6 ounces. X-ray examination (Dr. Whately Davidson) two weeks after the onset of the swelling showed periosteal thickening of the distal half of the left femur and rarefaction and excavation of the distal end. A week later the condition had improved and fresh calcification had occurred at the distal end. Five weeks after the onset healing was advanced (see fig. 1 and 2). The condition was shown radiologically to be healed three months after the onset, but there was residual deformity and widening of the femoral epiphysis, and this has persisted. At the age of one year nine months the child's general condition was excellent, but there was considerable valgus deformity of the left knee joint which necessitated an iron support to the limb.

BLOOD COUNTS.—On admission, October 12, 1937, at one month of age : haemoglobin 75 per cent. ; white blood cells 23,000 per c.mm. ; polymorphs 67 per cent.

October 27, 1937 : haemoglobin 55 per cent. ; white blood cells 17,000.

November 11, 1937 : haemoglobin 70 per cent.

December 30, 1937 : haemoglobin 90 per cent. ; white blood cells 13,000 : polymorphs 39 per cent.

Case 2. M. A. : This was a female child born at term on December 28, 1938, in a maternity hospital. Birth weight was 6 pounds 2 ounces. The mother had albuminuria during pregnancy, but the delivery and puerperium were normal and the child was not known to have had any contact with infection. The child was breast fed for ten days and then weaned. The first abnormal signs were swellings of both parotid glands and the right thumb at two weeks. A week later a swelling appeared over the right sternoclavicular joint. A few days later there was a purulent discharge from the left ear. The child was not ill at any time and there was no gastro-intestinal disturbance. She was admitted

FIG. 3.—Case 2. M. A. X-ray right hand, February 14, 1939, showing osteitis of first metacarpal and proximal phalanx with erosion of bones.

FIG. 4.—Case 2. M. A. X-ray right hand, March 21, 1939, showing healing osteitis with shortening and displacement of bones.

to hospital at one month of age. Her general condition was quite good and she weighed 6 pounds 10 ounces. She was happy and vigorous and took her feeds well. There was a fluctuating swelling over each parotid gland. The mouth and throat appeared clean and healthy. Red fluctuating swellings were present over the right sternoclavicular joints and the right first metacarpal bone. Four days after admission a swelling appeared around the right knee and a day or two later a tender red fluctuating swelling developed in the left hip region. The swelling at the base of the right thumb was incised and the

FIG. 5.—Case 2. M. A. X-ray right knee, January 27, 1939, showing marked periosteal thickening over lower end of femur.

swellings over the sternoclavicular and left hip joints were aspirated, the latter repeatedly. *Staphylococcus aureus* was isolated in pure culture from the sternoclavicular and left hip joints and from the discharge from the left ear. Three weeks after admission there was oedema of the labia and a vaginal swab gave a growth of *staphylococcus aureus* and *b. coli*. The parotid swellings subsided rapidly and the aural discharge cleared up in about six weeks. The temperature ranged between 98° and 100.2° F. during the first four weeks after admission and then fell to normal. The stools were relaxed during the first three weeks. The child's appetite was good throughout and her condition was never serious. X-ray examination (Dr. Whately Davidson) showed osteitis with considerable thickening in the lower end of the right femur and the upper end of the left femur, and osteitis of the adjacent ends of the first right metacarpal bone and proximal phalanx with considerable erosion of the joint surfaces (see figs. 3, 4, 5 and 6). Healing occurred rapidly in both femora without deformity. The child was discharged at the age of ten weeks weighing 8 pounds 2 ounces. When seen at the age of six months her general condition was excellent and no deformity could be detected

except for shortening of the right thumb. The movements of the thumb were full and free.

BLOOD COUNTS, February 13, 1939 (at the age of six weeks) : haemoglobin 58 per cent. ; red blood cells 2.8 millions per c.mm. ; colour index 1.03 ; white blood cells 22,500 per c.mm. ; polymorphs 33 per cent.

March 21, 1939 : haemoglobin 66 per cent. ; red blood cells 4.14 millions per c.mm. ; colour index 0.8 ; white blood cells 9,900 per c.mm.

April 18, 1939 : haemoglobin 62 per cent. ; red blood cells 4.2 millions per c.mm. ; colour index 0.74 ; white blood cells 9,000 per c.mm.

Case 3. Baby B. : This child was seen privately by Dr. A. G. Ogilvie, who has kindly supplied the notes. It was a female child born three weeks prematurely. Birth weight was 5½ pounds. Delivery and puerperium were normal. The child was breast fed, but there was difficulty with the feeding, possibly owing to prematurity. The child thrived fairly well. The cord did not separate until three weeks after birth, and left the umbilicus moist. At two weeks the left foot became puffy, but this subsided in a few days. At three weeks a swelling appeared over the left sternoclavicular joint. During the fourth week the legs became swollen, and the right knee and right shoulder

became red and swollen. When seen at one month of age the child was thin and looked like a premature child, but was fairly vigorous and had a strong cry. She was hungry for feeds and had no gastro-intestinal disturbance. The umbilicus had a small slough in one corner with some moistness around it. There was gross oedema of both legs involving the labia. The right knee, shoulder and sternoclavicular joints were swollen, red and fluctuating. The sternoclavicular joint was aspirated and thick pus which yielded staphylococcus aureus on culture was obtained. M and B 693, $\frac{1}{4}$ tablet, was given four times a day without apparent effect. During the next two months several fresh joints were affected and aspirated, but no incisions were made. The child recovered.

FIG. 6.—Case 2. M. A. X-ray of both femora and knee joints, March 21, 1939, showing healing of both femora with marked periosteal thickening, but no apparent deformity of the bones at the left hip or right knee joints.

Discussion

The cases here reported not only support the statements of Green and Dilliehunt that osteomyelitis of the long bones in infants is locally relatively benign, but also show that in uncomplicated staphylococcal osteomyelitis in the newly born there is practically no systemic disturbance. In these cases the mothers sought advice because of the swellings and not because the children

seemed ill. The infants slept and behaved normally and appeared to have no pain unless the affected bones or joints were moved. They took their feeds well throughout, and although there were occasional loose stools there were no serious gastro-intestinal disturbances. The pyrexia was slight in view of the suppuration and the conservative treatment adopted. Neither of the infants seen at the Babies' Hospital lost weight or appeared wasted at any time during the illness. Both gained eight ounces during the first month of life and about one pound during the second month. The first child, R. C., did not thrive normally between the second and sixth months and had recurrent attacks of gastro-enteritis, but after the sixth month he thrived steadily. The second child, M. A., has gained weight steadily since one month of age. There was moderate anaemia at about two months of age in each case. This improved as soon as the signs of active sepsis had cleared, but the child, M. A., developed hypochromic anaemia later. It is not clear from the reported cases if the prognosis is equally good in osteomyelitis in the newborn due to organisms other than the staphylococcus, but it is clear that if in a purely staphylococcal infection there is no infection of the lungs, peritoneum, meninges or skin, the prognosis, apart from the risk of deformity, is good. The parotitis and otitis present in the case M. A. did not apparently affect the prognosis adversely. There is evidently no urgency for operative treatment on account of either the local or the general condition. When the epiphyseal line is intracapsular there is a marked tendency to early infection of the joints because of the rapid escape of the pus through the cortex, but surprisingly little deformity or disability follows this joint infection. The only permanent deformities in the cases R. C. and M. A. have been due to erosion and shortening of the articular ends of the bones, and not to adhesions in the joints. These deformities occurred in one case following incision of the abscess and in one case following repeated aspiration. The advantage of repeated aspiration of the pus rather than open drainage is the avoidance of the risk of secondary infection of the wound, which was apparently the cause of death in one of the cases reported by Dunham.

Summary

Three cases of staphylococcus aureus infection of the long bones in the newborn are reported and discussed. The condition is found to be compatible with good general condition and good ultimate prognosis, apart from the risk of deformity, if the infection is unmixed and the lungs, skin, peritoneum and meninges are not involved. Repeated aspiration without open drainage gave good results and the lesions healed rapidly without sequestrum formation.

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