TRAUMATIC SUBPERIOSTEAL HAEMATOMA OF THE FEMUR IN THE NEWBORN

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Subperiosteal haemorrhage usually accompanies fracture of a long bone at birth. The occurrence at birth of a subperiosteal haematoma without fracture was not widely recognized until attention was drawn to the condition by Snedecor, Knapp and Wilson (1935), who called it 'traumatic ossifying periostitis'. A few other reports of this type of birth injury were subsequently published under such titles as periosteal stripping (Burman and Langsam, 1939), neonatal contusion (Caffey, 1945) and ossifying haematoma (Brailsford, 1948), and the subject was later reviewed by Snedecor and Wilson (1949). The number of reported cases is small, and no pathological studies have yet been published; we therefore present two cases, one of which was examined at necropsy.

Case Reports

Case 1 (M.H. 52/343). A first-born female child was born at term, her weight being 7 lb. 10 oz. (3·5 Kg.). She presented as a frank breech in the left sacro-anterior position. To effect delivery the left leg was brought down with some difficulty, the right following more easily. The baby appeared normal at birth but on the third day it was noted that she was not moving the left leg as freely as the right and that there was slight pitting oedema of the left foot. On the following day the distal end of the left femoral shaft was tender and felt thicker than normal. The infant's general condition was good and radiographic examination of the affected femur revealed no abnormality. (Fig. 1). At one week the thickening of the femur was more pronounced and there was radiological evidence of subperiosteal 'ossification' around the shaft which gradually increased (Figs. 2 to 5). The infant's general progress was quite satisfactory and she was discharged from hospital on the thirteenth day. At the age of 16 months radiological examination of the femur showed no abnormality (Fig. 6).

Case 2 (D.R.I. 54/274). A female infant weighing 8 lb. (3·6 Kg.) was born at term, the pregnancy being the mother's eighth. The mother was admitted in labour, with the infant presenting as a transverse lie, the arm having prolapsed into the vagina. Internal version was carried out with some difficulty and was followed by breech extraction. Following delivery the infant's condition was poor and she was kept in oxygen for 24 hours. During the first few days she was lethargic and fed slowly. It was noted that she was not moving her legs, and examination indicated that there had been severe injury to the spinal cord: there was slight costal indrawing, a patulous anus through which meconium constantly dribbled, and flaccid paralysis of both legs, though strong stimulation resulted in a withdrawal reflex. Radiological examination of the legs on the fourth day showed no evidence of injury to the bones (Fig. 7).

Towards the end of the first week pitting oedema of both legs developed and on the eighth day she was admitted to a paediatric ward in Dundee Royal Infirmary where the clinical findings were confirmed. By the end of the second week the oedema had diminished and there was now slight thickening of the distal end of the right femoral shaft. Radiological examination showed an opacity round the cortex of the femur, and this subsequently increased in size and density (Figs. 8 to 10). The oedema of the legs had completely disappeared when the infant was 3 weeks old although there was no appreciable diminution of the paralysis. Despite the severity of the birth injuries the infant fed well and seemed contented. An unexplained pyrexia developed at the age of 3 weeks. It was not associated with a leucocytosis and the blood was sterile on culture; radiological examination showed a small patch of atelectasis at the apex of the right lung. Intermittent pyrexia up to 105° F. continued for five weeks despite treatment with streptomycin and chlorotetracycline, but the infant gained weight steadily, began to take notice and made slight spontaneous movements of the legs. The intermittent pyrexia subsided at the age of 8 weeks, but in the meantime costal indrawing had increased, and 10 days later the infant suddenly died from respiratory failure.

Summary of Necropsy. The spinal cord showed gross destruction from approximately C 7 to T 3. The damaged segments were shrunken and stained with altered blood pigment. The lungs showed hyostatic congestion and oedema; the major intra-pulmonary bronchi contained mucopus and much of the right lung was collapsed. The other organs showed no abnormality.
Figures 1 to 6. Serial radiographs of the left knee in Case 1.

Fig. 1.—No abnormality visible on fourth day after birth.

Figs. 2-5.—Appearance and subsequent increase of subperiosteal ossification round lower end of femur.

Fig. 6.—At 16 months the ossified haematoma has disappeared completely and femur appears normal.

on macroscopic and histological examination. The right femur which showed no gross abnormality was removed and examined histologically.

Histology of Right Femur. Transverse sections of the distal part of the shaft (Figs. 11 and 12) showed that part of the surface was covered by a layer of new subperiosteal bone which was less sclerotic than the original cortex. The new bone enclosed a relatively large space, surrounded by scar tissue and filled with degenerated blood and fibrin and fragments of dead bone but these had not excited any osteoclastic activity. The scar tissue contained many histiocytes laden with haemosiderin but showed no evidence of pyogenic inflammation. The cortex of the original shaft appeared to be thinner beneath the new layer than it was elsewhere but showed no other abnormality.

Discussion

Clinical Features. Subperiosteal haematoma of a long bone in a newborn infant is almost invariably the result of trauma during birth. It should be suspected when there is a history of difficult delivery, particularly if internal version has been performed, and there is limitation of movement of a limb, possibly pain on passive movement, and swelling of soft tissue. Careful palpation will usually reveal tender thickening around the affected bone. At this stage, radiological examination may show the soft tissue swelling but will probably reveal no bony abnormality. However, the diagnosis will be confirmed by the radiological changes which appear after the first week (Figs. 1-10). In the absence of clinical signs of injury, minor degrees of subperiosteal haemorrhage may easily be overlooked: thus, Snedecor and Wilson (1949) found evidence of the condition in no less than three of 50 consecutive breech deliveries when routine radiographs of the limbs were taken on the 7th day of life. In their experience the distal end of the femur is most commonly involved although the proximal end and the tibia may be affected. Involvement of the humerus has also been reported, usually when delivery has been by the vertex (Scaglietti, 1938).

Injury to the epiphysis is quite commonly associated with subperiosteal haematoma but was not present in either of our cases. Both lesions occurred together in two of the 11 cases of injury to the long bones at birth reported by Snedecor and Wilson (1949) while four had epiphyseal damage alone.

Pathogenesis. Subperiosteal haemorrhage is probably produced by manual traction on a limb combined with torsion (Snedecor et al., 1935) and hence
is most likely to occur in a difficult internal version and in an assisted breech delivery.

Stripping of the periosteum from the shaft of a long bone is believed to occur much more easily in the foetus and newborn than in the adult (Macewen, 1912; Caffey, 1945). This impression appears to have been confirmed by investigation at necropsy (Barmeyer, Alderson and Cox, 1951) and it is therefore reasonable to assume that forcible periosteal stripping during delivery injures or tears the numerous blood vessels that are known to enter the bony cortex from the periosteal layer (Ham, 1953) giving rise to a subperiosteal haematoma which is presumably followed by the formation of callus and new subperiosteal bone. This belief is supported by the histological findings in Case 2, particularly by the evidence that bleeding had occurred at the site of the new subperiosteal bone. However, the presence of fragments of dead bone within this new subperiosteal layer indicates that bone injury, albeit of minor degree, has accompanied periosteal stripping and various possible explanations for this have obviously to be considered. A gross fracture of the shaft can reasonably be excluded, and we believe that direct manual compression during obstetrical manipulation is unlikely to cause necrosis of the dense cortical bone of the femoral shaft in a mature infant, though it might crush the more delicate trabeculae, many of them radially arranged (Ham, 1953), of immature cortical bone. The most probable explanation is that periosteal stripping was accompanied by avulsion of fragments of cortical bone as well as by subperiosteal haemorrhage, for our investigations at necropsy in the newborn have shown that the periosteum of the femur, though easily stripped from most of the shaft, is more firmly attached to the metaphysis and is inseparable from the bone and its muscle attachments along the linea aspera. It is also possible, of course, that devitalization of cortical bone follows injury to its blood supply from the periosteum (Ham, 1953). Avulsion of bone appears to have been regarded by Caffey (1956) as the explanation of ‘chip fractures’ accompanying new subperiosteal bone formation in relation to the tibia of an infant aged 3 weeks.

Differential Diagnosis. A presumptive diagnosis of subperiosteal haematoma may reasonably be made when clinical evidence of injury to a long bone is found after a difficult delivery, and is followed by the appearance and subsequent regression of the characteristic radiological changes. When these changes are slight, they may be confused with the double contour of the long bones that is sometimes seen in normal infants; the latter, however, is seldom visible during the first month of life and occurs...
most frequently in small premature infants, usually after a normal birth (Glaser, 1949; Hancox, Hay, Holden, Moss and Whitehead, 1951). Infantile cortical hyperostosis also gives a somewhat similar radiological picture and at one time Smyth, Potter and Silverman (1946) even doubted the existence of ossifying subperiosteal haematoma as a separate entity, believing that the cases so diagnosed were really examples of infantile cortical hyperostosis. In the latter condition, however, there is considerable systemic disturbance with pronounced irritability, loss of weight and fever, several of the long bones are usually involved throughout their entire length, and, characteristically, the mandible and clavicles are affected (Fairbank, 1952). Furthermore, infantile cortical hyperostosis rarely occurs during the first 2 weeks of life although Kitchin (1951) has reported one rather atypical case in a newborn infant, and the condition has been diagnosed radiologically in utero (Barba and Freriks, 1953; Bennett and Nelson, 1953). In the second of our two cases of subperiosteal haematoma, prolonged fever suggested yet another possibility, namely, osteomyelitis, but this diagnosis was rejected because ossification preceded the onset of fever, and study of the femur at necropsy showed no evidence of pyogenic inflammation.

When an ossifying subperiosteal haematoma is discovered some weeks or even months after birth, it may be mistaken for a sarcoma or for a manifestation of scurvy (Brailsford, 1948, 1953). Although scurvy may produce an indistinguishable radiological picture, it is usually accompanied by other signs of vitamin C deficiency, and in the absence of these a history of a difficult breech delivery will suggest a presumptive diagnosis of traumatic subperiosteal haemorrhage. It is theoretically possible, of course, that vitamin C deficiency might be a contributory factor in the pathogenesis of subperiosteal haemorrhage following birth trauma, but the mere fact that the haematoma undergoes 'complete resolution' when vitamin C is administered is not proof, as Brailsford (1953) avers, that scurvy has been partly responsible. Neither of the infants we have described showed any sign of vitamin C deficiency and, in the absence of corroborative evidence, it seems unnecessary to invoke scurvy as an additional aetiological factor in the neonatal period. Neither hypervitaminosis A nor syphilis is likely to be confused with subperiosteal haematoma, and both should readily be differentiated by the history and by full clinical investigation. Finally, subperiosteal haematomata may follow comparatiively minor injuries in postnatal life and again this is presumably because the periosteum is more loosely attached to the bones than it is in adult life (Barmeyer, Alderson and Cox, 1951; Silverman, 1953; Bakwin, 1956).

**Treatment.** Subperiosteal haematoma of the newborn requires no treatment. As the bone
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Increases in diameter the subperiosteal layer becomes incorporated in the shaft and the bone eventually assumes its normal contour, though residual thickening may be visible radiologically for many months (Caffey, 1945). However, when there is an associated injury of the epiphysis, orthopaedic treatment may be necessary to prevent permanent disability.

Summary

The clinical and radiological features of traumatic subperiosteal haematoma of the femur in two newborn infants have been described.

In both cases there was a history of difficult breech delivery, with strong manual traction on one of the legs.

Necropsy was performed on one of the infants and examination of the femur showed a layer of new subperiosteal bone enclosing fragments of dead bone and some altered blood.

It is suggested that the subperiosteal haemorrhage was produced by a combination of manual traction and torsion of the limb and that cortical bone was probably avulsed as the periosteum was stripped off the femoral shaft.

The differential diagnosis and treatment have been discussed.

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