OBSERVATIONS ON INFANTILE COXA VARA

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Understanding of coxa vara in young children is improved by accepting a congenital group of cases associated with bowing or shortening of the femur and an "infantile" group in which the head has moved infero-posteriorly on the neck. Evidence is produced in this paper that this second group is due to trauma and occurs either in a normal or a weakened femoral neck.

HISTORY

In 1907 Elmslie suggested that in some cases of congenital coxa vara without other abnormalities injury at birth might perhaps be one factor. He described accurately the cervical breach in infantile coxa vara with the typical metaphyseal wedge included in the proximal fragment, and pointed out that there was often a clear history of injury. In 1913 he described thirty-four cases of the infantile or cervical type out of a total of seventy-seven cases of coxa vara. He believed that trauma, or gradual slipping, accounted for the pathological changes. His description of radiographs of three children aged five is of a downward displacement of the head of the femur, carrying with it the adjoining part of the base of the neck. He said that "this displacement, whether occurring as a result of a sudden accident, or by a process of gradual slipping, exactly accounts for the appearances seen in the radiographs."

Fairbank (1928) accurately described the lesion under discussion and separated clearly the congenital group from the group which he called "infantile or cervical coxa vara." The characteristics of this second group were the later onset of signs and symptoms, the smaller amount of shortening and a characteristic radiological feature, which he described as "the presence of a clear line through the neck of the femur other than the epiphysial line, the two lines forming an inverted V and enclosing between them a triangular piece of bone." Fairbank could not accept trauma as the cause because the lesion was often bilateral, and he argued that a developmental error was the explanation. Babb, Ghormley and Chatterton (1949) agreed, and on the basis of fifteen cases concluded that the responsible developmental lesion was probably vascular and of congenital origin. Amstutz and Wilson (1962) admitted the confusion of names and entitled their paper "dysgenesis of the proximal femur." They described the Fairbank type but called it "congenital," pointing out, however, that their seventeen cases of this type showed no other congenital disorders. The diagnosis was delayed until weight-bearing began and progressive deformity was invariable. They concluded that the responsible lesion was "faulty maturation of the neck and irregular ossification." These writers described coxa vara associated with a generalised bone disease, as had Fairbank (1928), Le Mesurier (1948) and Almond (1956). In Fairbank's case this was cranio-cleido-dysostosis, and the coexistence led him to the conviction that as this disease was developmental, then so was infantile coxa vara. Morgan and Somerville (1960) described a congenital type due to intra-uterine injury and attempted thereafter to explain all coxa vara in infants on the basis of a lesion causing interruption of ossification of the femoral neck. They believed that if this lesion, which they inferred was vascular (as had Nilsonne in 1928), was distal to the trochanter congenital coxa vara with short femur would result, whereas if the lesion was proximal to the trochanter infantile coxa vara would develop.
HYPOTHESIS

All writers agree that the lesion described by Fairbank is not present at birth; so it cannot be congenital. Amstutz and Wilson (1962), Almond (1956) and the author have all reproduced radiographs showing an apparently normal hip which later developed coxa vara.

The striking feature of many published radiographs is that half or more of the femoral neck is naked and the shaft looks laterally rotated. This appearance could be produced by the capital epiphysis with its epiphysial plate and triangular fragment of metaphysis sliding distally until the superior aspect of the head abuts on the inferior surface of the proximal part of the neck. The line of cleavage remains visible and the displacement is the width of the femoral neck. When the deformity reaches this stage, symptoms and signs are severe enough for advice to be sought and radiographs taken. Figure 1 is a copy of a radiograph of a boy of six and a half from Fairbank's essay, showing as he says "all the essential features" of the condition under discussion. These changes could have arisen in the way described.

![Figure 1](image)

"All the essential features of infantile coxa vara." A copy of Figure 1 from Fairbank's essay showing bilateral abnormality in a boy aged 6½.
(By kind permission of Oxford University Press.)

Illustrations in the papers of Amstutz and Wilson (1962, Fig. 12a), Le Mesurier (1948, Fig. 15) and Morgan and Somerville (1960, Fig. 9) are very similar. This movement distally of the head—infantile slipped epiphysis—will take a triangular fragment of bone with it, an invariable finding in slipping of epiphyses of tubular bones, thus accounting for the ossicle considered pathognomonic by Fairbank.

Familiarity with the battered baby syndrome teaches us that a history of trauma is often unobtainable when changes cannot be explained on other than a traumatic basis. The hypothesis suggests that severe trauma in normal infants, often unadmitted, or the shearing produced by normal walking in a weakened femoral neck, is sufficient to produce the changes.

CASE REPORTS

Case 1—A girl aged five months attended in 1954 with a painful swelling of the right thigh and of the clavicular region. Radiographs of the femur showed a normal hip, but there was a metaphysial flake fracture of the lower end, highly suggestive of battered baby syndrome (Fig. 2). She attended again two years later with a fracture of the neck of the femur (Fig. 3). Five years later the radiograph showed changes usually ascribed to infantile coxa vara (Fig. 4).
Case 2—A girl aged five years complained of pain in the left hip for two days. We were told that she had been involved in a fight. She had been in hospital twice before, once at the age of two years with a subdural haematoma which required drainage, and again at the age of four with a burn and an occipital haematoma. She had been maltreated. Radiographs showed a fracture of the femoral neck and a triangular metaphysial fragment (Fig. 5). She was treated
by abduction osteotomy. One year later radiographs showed union of the osteotomy but no bony union of the fracture; the appearance resembled that of infantile coxa vara treated by osteotomy (Fig. 6).

![Fig. 7](image1)
![Fig. 8](image2)

Case 3. Figure 7—Radiograph of the right hip of a girl aged 5, three months after a fall. Figure 8—Radiograph of the same hip six years later, showing union at 11.

![Fig. 9](image3)
![Fig. 10](image4)
![Fig. 11](image5)

Case 4. Figure 9—Radiographs of the left hip of a girl of 4. Figure 10—The same hip five years later, showing movement of the head. Figure 11—The same hip at 11, showing complete displacement of a pathological fracture. The disorder was bilateral.

Case 3—A girl aged five years attended in 1959 with a limp. She had fallen three months before, injuring her right hip, and had been unable to stand or walk for two weeks thereafter. There was shortening of the right leg by 2 centimetres and there was no abduction at the hip.
It was known for certain that she was clinically normal before the fall. Radiographs showed the femoral head in apposition to the medial surface of the femoral neck—an appearance again closely similar to that of infantile coxa vara (Fig. 7). Six years later union had occurred (Fig. 8).

Case 4—A girl aged four attended in 1956 with mental retardation and obesity. A radiograph of the hips was normal (Fig. 9). At the age of nine she began to limp and developed a rolling gait. Radiographs showed developing coxa vara (Fig. 10). At the age of eleven a further radiograph showed symmetrical bilateral fractures of the neck of the femur (Fig. 11). All other bones appeared normal on radiography, but the obesity, mental retardation, facies and unexplained femoral neck changes suggested atypical chondrodystrophy.

DISCUSSION

McDougall (1961) showed that after untreated fracture of the neck of the femur in children, union of the proximal fragment to the base of the neck of the femur or even to the upper medial part of the shaft can occur. He found progressive coxa vara in thirteen out of twenty-four treated fractures. This shows that a vertical fracture line will defeat union because of shearing strain for a time, but ultimately a stable state is reached and union can occur. The outcome in infantile coxa vara is the same and, whereas the vertical fissure line which I believe to be a fracture is visible for many years, it has not been described in adults. Radiographs of late cases of infantile coxa vara—as for instance those illustrated by Morgan and Somerville (1960) and by Babb, Ghormley and Chatterton (1949)—are identical to those of late malunited fracture of the femoral neck in children. The similarity between Fairbank's radiograph (Fig. 1) is so close to that in Figure 4 as to suggest the same etiology.

It has been stated repeatedly that the vertical fissure in the neck, a diagnostic prerequisite of infantile coxa vara (Fairbank 1928), is distinct from the epiphysial line, but no published radiograph shows this distinction and it is far more likely that the slip occurs at the metaphysial side of the epiphysial plate, only breaking away from this plate at its distal end to separate off a flake of metaphysis. This area was said by Morgan and Somerville, quoting Trueta (1957), to have a separate blood supply.

In spite of complete ignorance as to the nature of the softening lesion at the epiphysial plate in some infants, we know from Case 4 here reported and others that such a process does occur. This gives us two proven ways in which radiological changes of infantile coxa vara can arise. One by severe trauma to normal bone as in the battered baby syndrome, and one by shearing strain in pathological tissue. Without further evidence, we should resist acceptance of any others. In spite of a voluminous literature in the last fifty-five years, the evidence suggests that Elmslie's accounts published in 1907 and 1913 cannot be faulted.

SUMMARY

1. Congenital coxa vara and infantile coxa vara must be separated as distinct entities.
2. Infantile coxa vara is likely to be due to distal movement of the head fragment relative to the shaft and neck. This can result either from severe trauma in normal bone or from shearing stress on an abnormal femoral neck.
3. There is no justification for considering infantile coxa vara as congenital, developmental or due to interruption of ossification. The nature of the pathological lesion at the epiphysial line in some children is unknown.

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REFERENCES


