SUB-CAPITAL COXA VALGA AFTER VARUS OSTEOTOMY FOR CONGENITAL DISLOCATION OF THE HIP

A REPORT OF SIX CASES WITH A MINIMUM FOLLOW-UP OF NINE YEARS

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Coxa valga may sometimes occur as a complication of varus osteotomy for congenital dislocation of the hip. Six such cases are described with a minimum follow-up of nine years. In three cases the varus osteotomy had been performed on only one side; in one case it was done on both sides and coxa valga developed bilaterally; and in two further bilateral cases coxa valga developed on one side only. In each case the coxa valga was sub-capital. Detailed radiographic analysis included measurements of neck-shaft angle, acetabular angle and C.E. angle. The epiphysis-shaft angle is described; it is an index of the constant tendency of the capital epiphysis to assume a horizontal position. The cause remains unknown, but damage to the trochanteric growth plate or to the lateral part of the capital growth plate could not be identified as aetiological factors. Poor acetabular cover was considered a possible factor. All the patients in this series had functionally excellent hips, but the long-term prognosis of the hips with partly uncovered femoral heads is doubtful.

Upper femoral rotation osteotomy is a well-established procedure in the management of congenital dislocation of the hip (Somerville and Scott 1957). Trevor (1958) described varus osteotomy as a logical addition to rotation when there is a valgus position of the femoral neck. Chuinard and Logan (1963) noted improved results in patients accidentally fixed in a varus position at the time of rotation osteotomy. Whereas in most patients the varus is corrected spontaneously (Mau 1961; Chuinard and Logan 1963; Lloyd-Roberts and Swann 1966; Eyre-Brook 1968), it is possible for overcorrection into a valgus position to occur (Mau 1961; Scaglietti and Calandriello

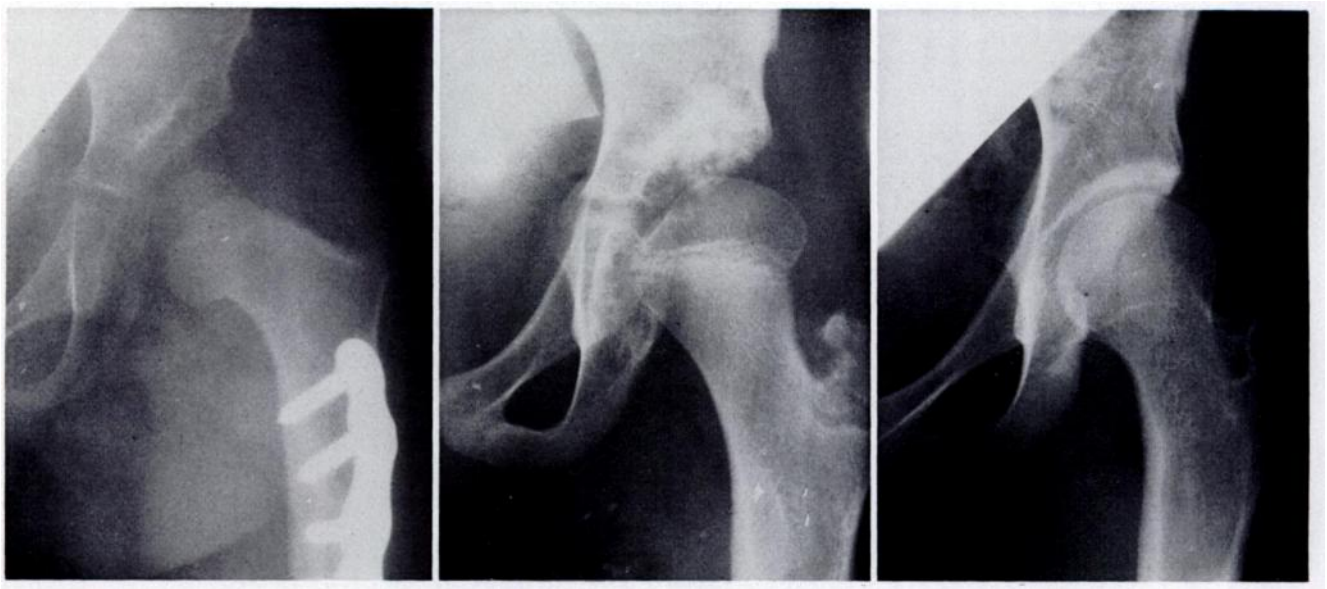

FIG. 1 FIG. 2 FIG. 3

Case 1. Figure 1—Radiograph four months after varus osteotomy at the age of 3 years 4 months. Figure 2—Four and a half years after osteotomy at the age of 7 years 10 months. Note the coxa valga with a neck-shaft angle of 149 degrees. Figure 3—Eight years later (aged 13½ years). The femoral head is partly uncovered.

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1962; Somerville 1967; Harris and Wilson 1970). Although Eyre-Brook (1968) expressed concern over the possible harmful effects of coxa valga, there has been no detailed description of the complication. The purpose of the present paper is to draw attention to sub-capital coxa valga and to present the findings in a detailed analysis of six cases followed up for a minimum of nine years.

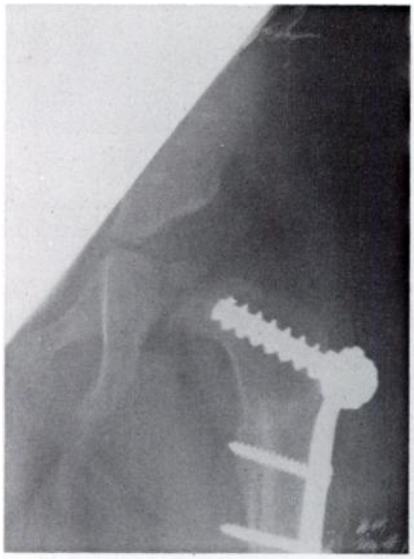

FIG. 4

FIG. 5

Case 2. Figure 4—A radiograph seven weeks after varus osteotomy which was done at the age of 8 months. Figure 5 shows coxa valga with a horizontal capital epiphysial plate seven years later at the age of 7 years and 6 months.

FIG. 6

FIG. 7

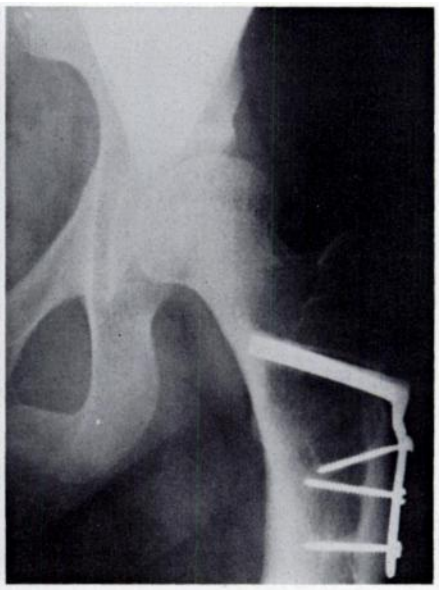

FIG. 8

Case 3. Figure 6—A radiograph three and a half years after the first osteotomy. Figure 7 is the radiograph immediately after the second osteotomy, sixteen months later. Figure 8 shows the coxa valga which developed nine years after the second osteotomy. There is incomplete cover of the femoral head.

CLINICAL MATERIAL

Six cases of coxa valga following varus osteotomy have been noted out of a total of forty-seven patients in whom this procedure was carried out in the management of congenital dislocation of the hip in this centre between 1954 and 1965. In three of the six cases the operations were bilateral. The cases are subdivided into three groups: Group A comprised three cases in which the varus osteotomy was done on one side only; Group B was composed of one case in which both hips had been operated upon and both developed coxa valga; Group C comprised two patients in whom both hips had been operated upon but in whom coxa valga occurred on one side only.

FIG. 9

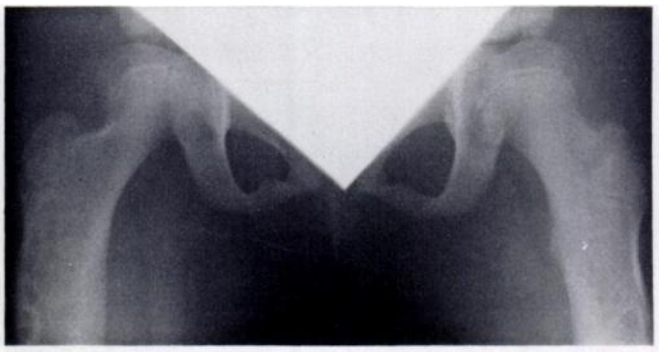

FIG. 10

FIG. 11

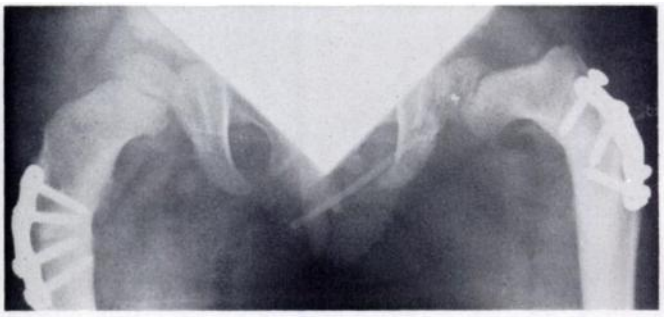

FIG. 12

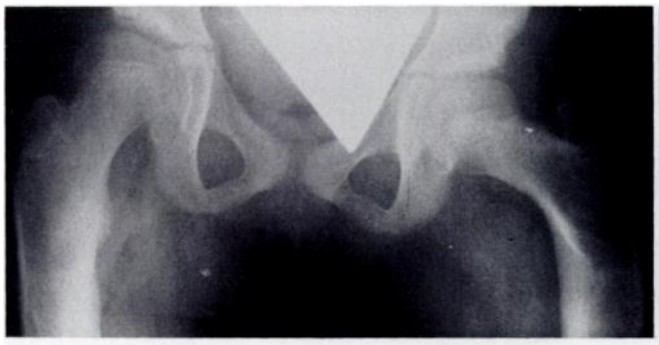

FIG. 13

FIG. 14

Case 4. Figure 9—A radiograph two months after osteotomy. Figure 10 shows the bilateral coxa valga five years later; there is marked narrowing of the femoral neck in the radiograph on the left. Figure 11—Three years later at the age of 13 shows that a large proportion of the capital epiphysis is lying outside acetabular cover. Case 5. Figure 12 shows the radiograph nine months after osteotomy at the age of 3 years and 11 months. Figure 13 shows the coxa valga on the right side, when the child was 9 years and 8 months old. Figure 14 shows the appearance at the age of 16. Note the femoral head on the right side.

The cases in Group C provided an opportunity to analyse factors present on one side and not on the other in the same patient, and they are therefore of particular importance in a discussion of the possible aetiology and prevention of this complication.

CASE REPORTS

Group A

Case 1—A girl aged two years nine months presented with an abnormality of gait and was noted to have congenital dislocation of the left hip. After open reduction a rotation and varus osteotomy was carried out. Clinical progress was excellent. Radiologically, however, coxa valga developed (149 degrees neck-shaft angle), and the femoral head was incompletely covered at the age of thirteen and a half years (Figs. 1 to 3). The patient has no symptoms and shows a full range of hip movements.

Case 2—This girl was treated from birth for congenital dislocation of the left hip. Because of instability following closed reduction, rotation and varus osteotomy was carried out (in June 1966) at age eight months. Figures 4 and 5 show the radiological changes between seven weeks and seven and a half years after operation. Clinical progress was excellent, the patient being free from symptoms and having a full range of movement.

Case 3—A girl came under treatment at the age of one year and three months because of a limp on starting to walk. A congenital dislocation of the left hip was diagnosed in May 1960. Initially the management was conservative, but because of a tendency to subluxation in lateral rotation, a rotation varus osteotomy was done two and a half years later in January 1963. In the subsequent three years, during which

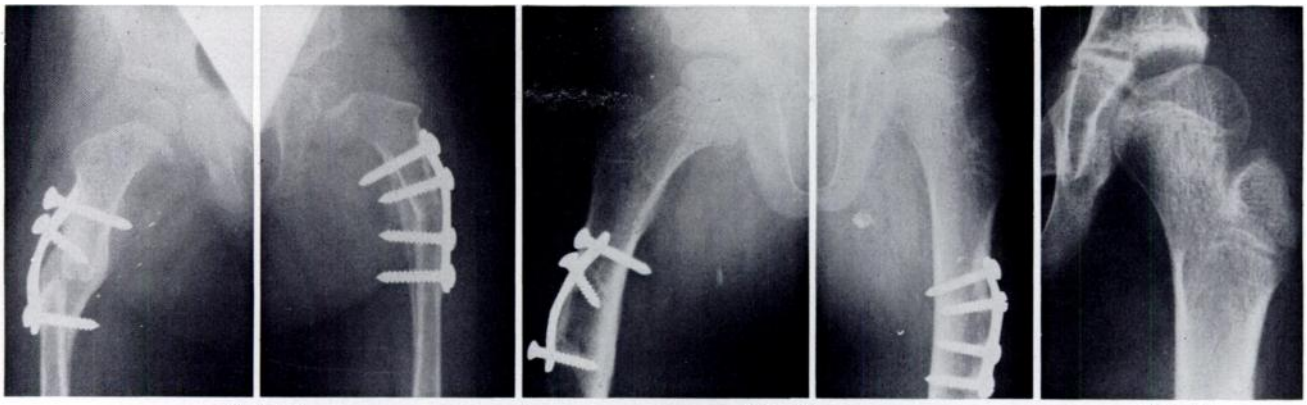

FIG. 15 FIG. 16 FIG. 17

Case 6. Figure 15—A radiograph four months after osteotomy at the age of 2 years and 2 months. Figure 16 shows the appearance six years later. Figure 17 shows the coxa valga and the poor cover of the femoral head after a further three years.

time there were no clinical problems, the varus corrected (Fig. 6) and a further osteotomy was done in September 1966. The radiographs showed that possibly the growth plate of the greater trochanter had been damaged by the nail plate (Fig. 7). At the end of a further nine years the clinical progress had been excellent and the child had no symptoms and a full range of hip movements. Radiologically, however, she had coxa valga with a portion of the femoral head uncovered (Fig. 8).

Note: In the three cases described, the unaffected hip developed normally and there was no tendency to coxa valga.

Group B

Case 4—A girl presented with a limp at the age of two and a half years, having been walking for five months. Bilateral congenital dislocation of the hip was diagnosed and treated initially by closed reduction. At the age of four and a half years bilateral varus rotation osteotomies were done (Fig. 9). Clinical progress was excellent but radiologically coxa valga developed, with striking "swanning" of the right femoral neck (Fig. 10). At the age of thirteen the patient was clinically excellent, with no symptoms and full range of movement, but the radiographs show incomplete cover of the femoral heads (Fig. 11); tracings of the radiographs illustrate this and are shown in Figure 22.

Group C

Case 5—A girl presented in June 1960 with a gait abnormality at the age of sixteen months, having been walking for six months. Closed reduction was carried out with ease, and was followed by varus and rotation osteotomy on both sides nearly two years later. More varus was created on the left side (neck-shaft angle 77 degrees) than on the right (neck-shaft angle 105 degrees) (Fig. 12). Despite excellent clinical progress the radiographs taken at nine and three quarters years and at thirteen years (Figs. 13 and 14), show the development of coxa valga on the right with incomplete cover of the femoral head. At the time of review the patient was free from symptoms, showed a full range of movement and was able to enjoy normal activity.

Case 6—A girl noted to be limping at one year and eight months was found to have bilateral congenital dislocation of the hip. After initial traction, open reduction was necessary on the left side and bilateral varus and rotation osteotomies were performed at the age of two years (Fig. 15). Clinical progress was good but concern was expressed regarding the degree of cover of the left femoral head, and a Pemberton acetabuloplasty was carried out four years after the osteotomy. A valgus inclination of the femoral neck developed at the age of eleven years (Figs. 16 and 17). A varus shortening osteotomy was carried out to reduce the amount of uncovered femoral head. The clinical state remains satisfactory.

RADIOGRAPHIC MEASUREMENTS

The following measurements were made: the neck-shaft angle; the C.E. angle in adolescence; the acetabular angle in infancy; and the shaft-epiphysis angle.

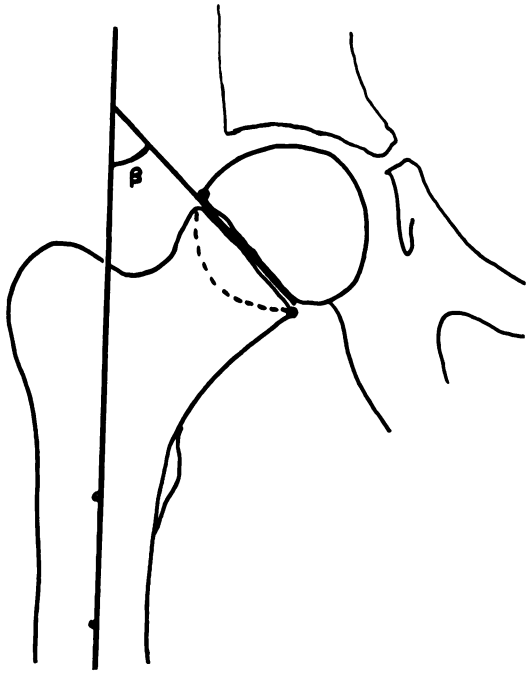

FIG. 18
The shaft-epiphysis angle (β).

The shaft-epiphysis angle (Fig. 18) is an index of the orientation of the capital growth plate, which in all the cases described assumed a horizontal position. It is defined as the angle between the axis of the shaft of the femur and the axis of the capital epiphysial plate in the antero-posterior radiograph. The angle closely parallels

the neck-shaft angle (Fig. 19) but is a much more sensitive index of the orientation of the growth plate.

The variation in the neck-shaft angle with rotation was investigated by taking radiographs of an isolated femur in various degrees of rotation (Figs. 20 and 21).

medial side of the sub-capital growth plate at the expense of the lateral side. This is supported by a study of the tracings of the radiographs in this series (Figs. 22 and 25).

It has been assumed that the cause is damage to the trochanteric growth plate at the time of operation (Mau

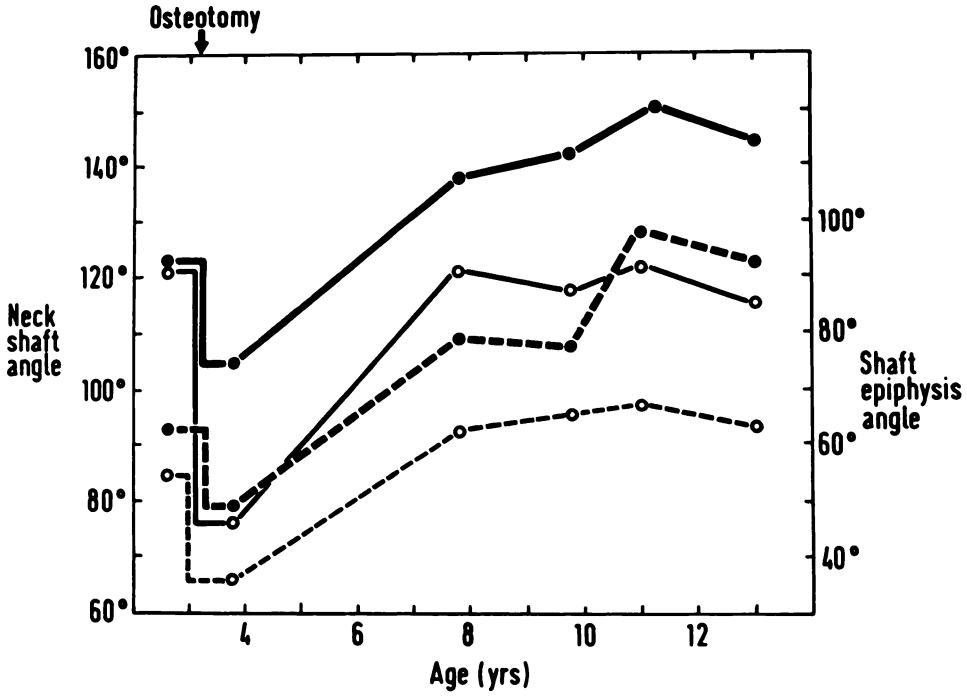

FIG. 19

A graph to show the changes in the neck-shaft angle (as demonstrated by the continuous line) and the shaft-epiphysis angle (as demonstrated by the broken line) in Case 5. The thick lines represent the right hip and the thin lines represent the left hip. The shaft epiphysis angle closely follows the neck-shaft angle and the correction is very similar on the left and right sides despite the initial difference in the degree of varus obtained at osteotomy.

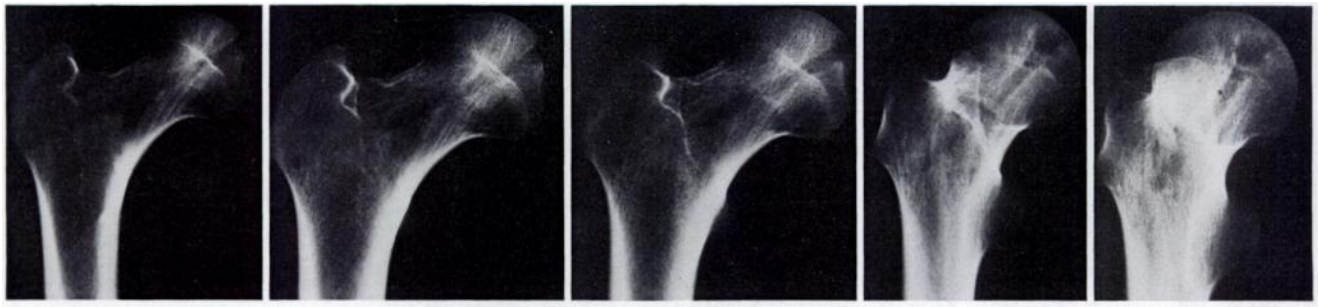

FIG. 20

A series of radiographs of a femur in various degrees of rotation (the particular femur used had a considerable degree of anteversion).

When the upper end of the femur is in a medially rotated position (as it is after rotation osteotomy) the effect of rotation of the neck-shaft angle is negligible.

DISCUSSION

It is clear that coxa valga can occur after varus osteotomy. The appearances are unlike the other forms of coxa valga (Figs. 23 and 24), and the term sub-capital coxa valga is appropriate. It is believed that the mechanism of development is a relatively increased activity at the

1961). While it is accepted that this may theoretically be a cause it was not identified as such in this series. The evidence against damage to the trochanteric and lateral part of the sub-capital growth plate is as follows. Firstly, in four of the six cases the osteotomy was at the upper end of the femoral shaft and thus not in the field of the trochanteric growth plate. Secondly, the post-operative radiographs and also the surgeon's notes indicate that there had been no interference with the growth plate (except in Case 3). Other aetiological factors must therefore be considered.

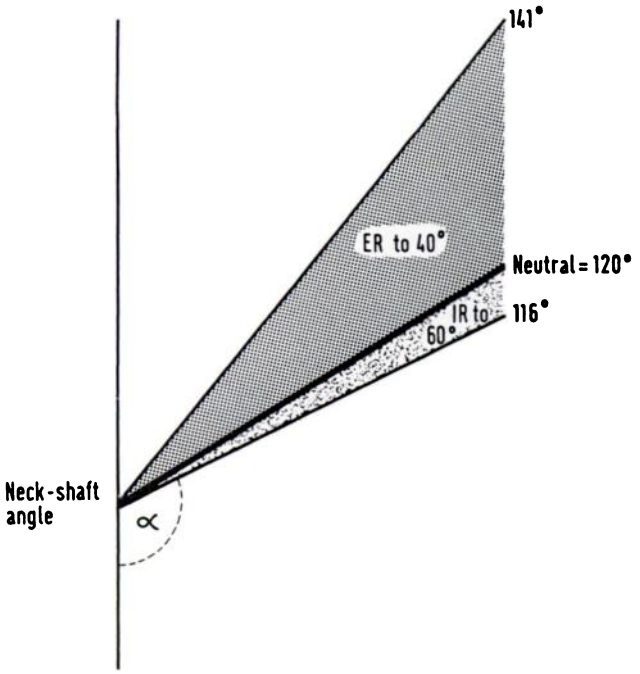

FIG. 21

This diagram illustrates that the neck-shaft angle (α) increases considerably in lateral rotation but decreases only slightly in medial rotation. The measurements were taken from the radiographs in Figure 20.

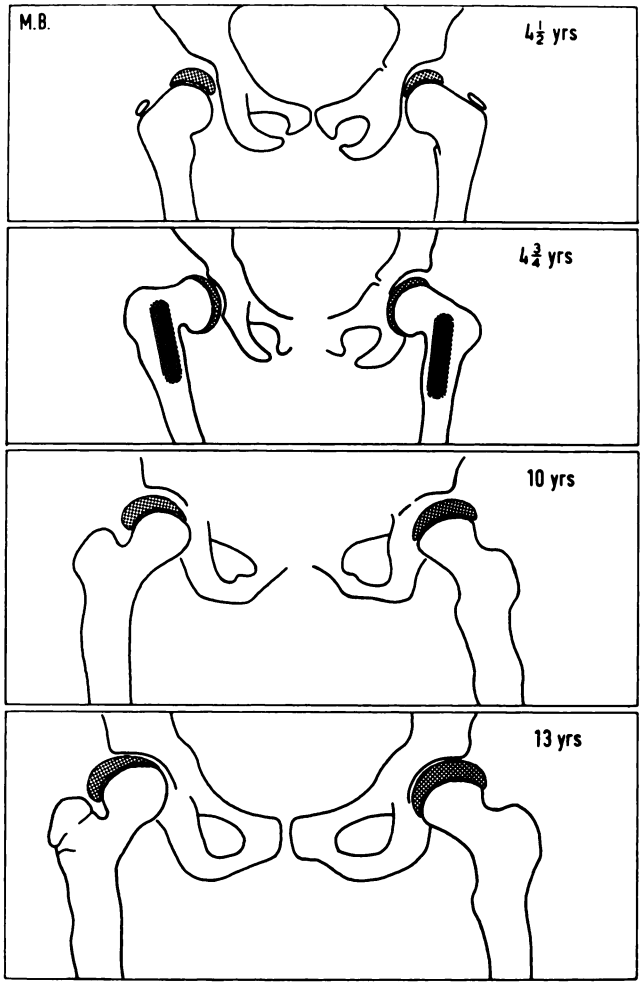

FIG. 22

Tracings of the radiographs of Case 4. The apparent migration of the femoral capital epiphysis is demonstrated.

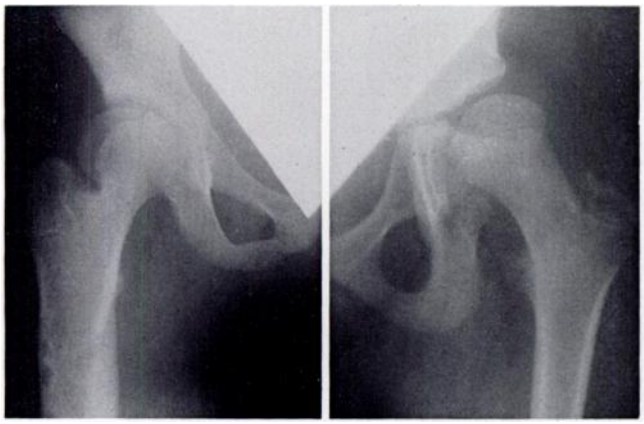

FIG. 23

FIG. 24

Figure 23 is the radiograph from Case 4 to show the features of subcapital coxa valga, which are to be compared to the radiograph in Figure 24 which shows the hip of a patient with a myelomeningocele with the coxa valga of abductor paralysis. The different appearance of the two types of coxa valga is evident.

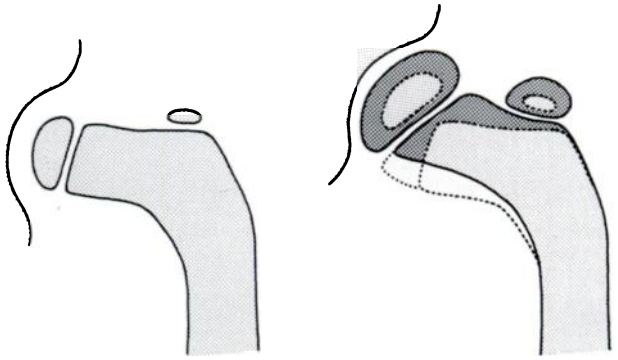

FIG. 25

A diagram constructed from the tracings of the radiographs of Case 5. Note how the epiphysial plate has assumed a more horizontal position and how bone appears to have been laid down superiorly on the neck and to have been resorbed inferiorly.

Scaglietti and Calandriello (1962) speculated that the adequacy of the roof of the acetabulum and the obliquity of the femoral neck influence one another. In this study the relationship of the acetabular cover to the development of coxa valga was investigated, and the results are shown in Figure 26. From this histogram it is clear that there is at least an association between poor acetabular cover and coxa valga.

Although concentric reduction and functional congruity were obtained in these cases before the age of four and a half years, the acetabula did not develop normally. Initially this seems at variance with the conclusions of

Harris, Lloyd-Roberts and Gallien (1975). However, it may be said that the development of coxa valga acts against the maintenance of a congruous joint during the growth period.

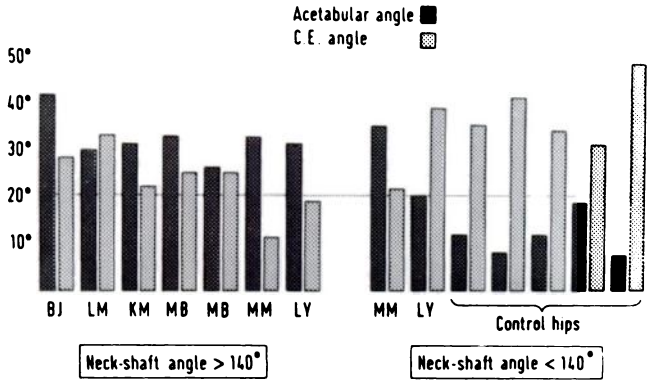

FIG. 26

Each double column represents one hip. The hips which went into coxa valga are collected on the left side of the histogram whereas the right side of the histogram demonstrates the hips of the two cases from Group C which did not go into coxa valga (MM and LY). The control hips consist of unoperated hips of patients in this series and both hips of another similar bilateral case. Note the tendency to a high acetabular angle and low C.E. angle (with poor acetabular cover) in patients with coxa valga, whereas the reverse is the case in the control series.

From the measurements made it is evident that the addition of excessive varus at the time of osteotomy does not prevent the development of coxa valga (Figs. 9 to 11). However, most of the cases in this series had only a moderate amount of varus applied, and in the bilateral cases it was the hip which had a greater amount of varus that did not go into coxa valga (Figs. 12 to 17 and 19).

In the six cases described the final radiograph demonstrates a deficiency in the cover of the femoral head (Figs. 3, 5, 8, 11, 14 and 17). Despite the fact that these cases were clinically excellent at the time of review, the radiological picture leads to speculation on the possibility of later subluxation and early denegerative change. Because it is the aim of treatment to prevent such late complications, coxa valga must be considered a potentially serious long-term complication of the operation of varus osteotomy as well as nullifying its purpose.

CONCLUSIONS

1. Coxa valga occurred in six out of forty-six hips undergoing varus osteotomy in the treatment of congenital dislocation of the hip.
2. The femoral capital growth plate assumes the horizontal position and the rate at which it does so may indicate the development of coxa valga. The epiphysis-shaft angle is described as an index of this development.
3. The term sub-capital coxa valga has been used to indicate the difference in radiological appearance from other types of coxa valga.
4. The cause is still unknown; damage to the trochanteric epiphysial plate and the lateral part of the capital growth plate did not occur in this series. The condition is also associated with, and may be caused by, poor acetabular cover.
5. It leads to a partially uncovered femoral head in adolescence and must therefore be regarded as a serious long-term complication.

I wish to express my thanks to Mr A. L. Eyre-Brook for his help and encouragement in this study. I would also like to thank Mr A. H. C. Ratliff for kindly reading the script. Mr P. J. Witherow and Mr R. A. J. Baily allowed me to examine their cases and kindly read the script. The illustrations were prepared by the Department of Medical Illustration, Bristol Royal Infirmary, and the script was typed by Mrs C. A. Calder.

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