ANNOTATIONS ON THE ETIOLOGY AND TREATMENT OF TIBIA VARA

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Tibia vara was first reported by Erlacher (1922) and later fully described by Blount (1937), after whom the disorder is usually named. Only about 150 cases in all have been reported in the literature. The disease is therefore relatively uncommon and it seems to have a geographic distribution, occurring chiefly in and around the Caribbean.

The condition consists essentially in the development in a child of progressive varus and medial torsion of the tibia. Blount described two principal groups of patients: the infantile variety in which the deformity becomes manifest in the first three years of life, and the adolescent variety in which it first becomes obvious at about the age of eight years. The infantile variety is the more common, the more severe and the more certainly progressive form of the disorder. Usually both legs are affected, but the condition may be unilateral.

FIG. 1

FIG. 2

Figure 1—Radiographs showing an undisplaced greenstick fracture through the upper right tibial metaphysis of an 18-month-old girl. Figure 2—Radiograph of the same patient showing development of genu valgum fifteen months after injury.

ETIOLOGY

The condition is generally considered to arise from a disorder at the postero-medial aspect of the growth plate of the proximal tibial epiphysis, where in later cases the radiographic

changes are obvious. In early cases, however, the differential diagnosis between physiological bowing of the knees and tibia vara is very difficult, and sometimes impossible, the one merging into the other. Radiographic changes become evident only after progression for a year or more.

Theoretically it is possible to explain both the varus and the medial torsion deformities by a simple differential growth in length between tibia and fibula.

Increase in length of a long bone in a child after injury has been known for over a century. It was certainly known and described by Ollier (1867) and more recently in the experimental work and clinical observations of several workers, notably Bisgard (1936), and Compere and Adams (1937). Further development of our ideas on increase in the length of bones is due to Trueta's work on the blood supply of bone and its possible clinical implications (1953). In a child increase of growth takes place for at least six months after injury, and the greatest gain in length is in the first few months (Bisgard 1936).

The effect of overgrowth of the tibia—It is well known that overgrowth of the tibia in a child caused by stimulation by injury or disease may produce knock-knee deformity. This genu valgum from stimulation of the proximal tibial metaphysis while the fibula exerts a tethering effect, was described by Taylor (1963) in seventy-two of 103 cases which he studied. The deformity developed within five months and the degree of deformity, as might be expected, depended on the skeletal age. The observation of a similar case of our own gave rise to the idea that such differential growth might be used in an analysis and consequently in the treatment of tibia vara.

FIG. 3

FIG. 4

Figure 3—Tracing of lateral view of right tibia (Frazer 1933). Figure 4—The superior tibio-fibular joint lies posterior to the inferior tibio-fibular joint.

CASE REPORT

A girl aged eighteen months suffered an undisplaced minor greenstick fracture through the upper right tibial metaphysis (Fig. 1). This was treated in plaster and after a few weeks the leg was normal. Nine months later the child was developing unilateral knock-knee and fifteen months after the fracture she had developed a right genu valgum of 25 degrees with a 6.25 centimetre intermalleolar gap (Fig. 2). The left leg remained straight. This was an example of the well known overgrowth of the tibia after fracture in a young child, causing late knock-knee deformity.

The effect of delayed growth of the tibia—If one considers a reversal of this differential growth in length—that is, if the tibia lags behind the fibula—one might assume that tibia vara would occur. However, one has to account for the simultaneous torsion of the tibia in Blount's disease.

FIG. 5

Theoretical calculation based on a simplified model to show the expected rotation of the tibia caused by relative increase of growth of the fibula, which lies at an angle of 6 degrees relative to tibia. (It does not take into account the simultaneous varus deformity of the tibia.) (Mr W. E. Liversage, M.Sc.)

An examination of the precise anatomical relations of tibia and fibula provides a possible explanation of this: the superior and inferior tibio-fibular joints do not lie in the same coronal plane: the upper joint lies posterior to the lower joint. In a tracing from Frazer (1933) the upper joint lies about 6 degrees behind the lower joint (Fig. 3).

Such an isolated measurement is, of course, full of pitfalls, but other examinations of skeletons and of normal subjects seemed to confirm that the upper joint lies posterior to the lower joint, the angle from the vertical being approximately 6 degrees or slightly less (Fig. 4). This vertical offset of the fibula on the tibia could cause the fibula to act as a camshaft if there were differential growth between the two bones. Such differential growth would, therefore, lead not only to a simple varus or valgus deformity, but would also produce simultaneous rotation of the tibia. Calculations show that with a 6 degree offset action of the fibula only very slight differential in growth between tibia and fibula would be required to produce surprisingly large degrees of rotation. The infant tibia grows 5 centimetres in

FIG. 6

FIG. 7

FIGS. 6 AND 7

Effect of fibular lengthening shown by a model. The tibia has been cast in vinyl and a turnbuckle introduced into the shaft of the fibula. Figure 6—The two markers are lined up, one attached to the lower end of the tibia, the other unattached below it. Figure 7—As the fibula is lengthened, varus and medial torsion of the tibia occur.

length from birth to the age of three years (Maresh 1943), and as little as 5 millimetres lag in growth of the tibia while the fibula grows normally, might produce medial rotation of the tibia by as much as 30 degrees (Fig. 5).

A model was assembled in which the tibia was cast in vinyl, a plastic of rubber consistency,

FIG. 8

FIG. 9

FIG. 10

FIG. 11

Case 1. Figures 8 and 9—Photograph and radiographs before operation. Figures 10 and 11—One year after operation.

and part of the fibula was replaced by a turnbuckle. Elongation of the fibula with the turnbuckle caused both varus and medial torsion of the tibia in the model (Figs. 6 and 7).

The most important fact in the etiology of Blount's disease is its geographic distribution. Since all children are born with radiographic varus which later converts to valgus (Bateson

1966, 1968) early weight-bearing would be expected to play a key role in the conversion of physiological bow leg to true tibia vara. It has been clearly shown that more Jamaican children walk for longer on physiologically bowed legs than do British children (Golding, Bateson and

FIG. 12

FIG. 13

FIG. 14

FIG. 15

Case 2. Figures 12 and 13—Photograph and radiographs before operation. Figures 14 and 15—One year after operation.

McNeil-Smith, quoted by Rang 1969). Arkin and Katz (1956) showed that growth on the compressed side of an epiphysial plate tended to slow down, and on the other side relatively to quicken. It is probable that the basic disorder of tibia vara is a simple differential growth in length because of early weight-bearing on the tibia. The tibia—in particular its medial

side—grows relatively less than the fibula, because of early weight-bearing on physiologically bowed legs. Once this has started, static forces will cause further disorder and ultimately disorganisation of the postero-medial aspect of the upper tibial growth epiphysis, thereby compounding the deformity. If tibial growth were stimulated early the otherwise inevitably progressive deformity might be halted and reversed.

TREATMENT

The above hypothesis on the possible mechanism of the development of tibia vara, combined with the known facts concerning stimulation of longitudinal growth of long bones in children, lead to the idea of a new and much simplified form of treatment for early cases of infantile tibia vara, and this was tested in two clinical cases.

CASE REPORTS

Case 1—A girl born in August 1964 in Britain of West Indian parents was first seen at the age of two years and nine months with bilateral tibia vara. The gap between the upper tibiae was 6.25 centimetres and there was marked torsion of both tibiae (Figs. 8 and 9).

Upper tibial forage was carried out on both sides. Seventeen months later the legs were almost completely straight (Figs. 10 and 11).

It may be argued that all the criteria for a diagnosis of Blount's disease were not present in this case. Nevertheless, the result was sufficiently encouraging for the method to be tried in an undoubted case of Blount's disease.

Case 2—A girl born in October 1965 in Britain of West Indian parents was brought at the age of two years and two months with marked deformity of the left leg. The distance between the upper tibiae was 6.25 centimetres. The deformity seemed to be entirely unilateral (Figs. 12 and 13). All the criteria of Blount's disease, almost entirely confined to the left side, were present. Operation was done one month after the radiographs and photographs were taken. The periosteum at the upper end of the tibia was stripped from the bone and the cancellous bone distal to the growth plate was removed through a small trapdoor in the tibial cortex. One year after operation the legs were virtually normal (Figs. 14 and 15).

If experience shows that this operation consistently gives similar results the treatment of the condition will greatly be simplified. All authors are agreed that infantile tibia vara is progressive unless surgical treatment is undertaken (Gailey 1956, Golding and McNeil-Smith 1963, Langenskiöld and Riska 1964). It is, therefore, extremely unlikely that the rapid improvement in the two patients described was the result of spontaneous regression. It is reasonable to ascribe it to stimulation of growth of the tibia by simple forage, with consequent correction of both the longitudinal and the rotation deformities of tibia vara.

SUMMARY

1. It is suggested that early weight-bearing on physiologically bowed legs in infants leads to slowing of growth of the tibia and consequent increase of the differential length between fibula and tibia.
2. Such differential growth can produce both varus and medial rotation, leading to established tibia vara or Blount's disease.
3. Stimulation of tibial growth by simple metaphyseal forage can correct this deformity if performed at an early age.

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