A NEW OPERATION FOR CONGENITAL ABSENCE OF THE FIBULA

Preliminary Report

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The treatment of congenital absence of the fibula is difficult, because of the complexity of the deformity. This syndrome in its classic form consists of: 1) complete or partial absence of the fibula; 2) congenital shortening of the extremity; 3) anterior bowing of the middle and lower parts of the tibia; 4) deformity of the foot (plano-valgus or equino-valgus position of the foot, with complete or partial dislocation of the talo-tibial joint, associated with the absence of the lateral malleolus). Other features that are often observed include primary or secondary bony fusion between the talus and calcaneus (Lapasset and Cahuzac 1935), deformity or even total absence of the talus or of the cuboid bone, or absence of one, two or even three lateral metatarsals with the corresponding toes.

Deformity of the foot increases with age, on account of: 1) a fibrous or cartilagino-fibrous strip, which replaces the fibula (Thompson, Straub and Arnold 1957); 2) shortened peroneal muscles which frequently adhere abnormally to the lateral side of the tuber calcanei; and 3) lateral transposition of the tendons of the long extensor of the toes and of the great toe, caused by valgus deformity of the foot (Gruca 1959).

The posterior and lateral parts of the lower epiphysis of the tibia may also be undeveloped (Harmon and Fahey 1937, Ambros 1948, Dubost-Perret 1950, Badgley, Connor and Kudner 1952) or may undergo atrophy because of the asymmetrical loading (Gruca 1959).

The deformity becomes fixed during the second and third years of life by capsular, ligamentous and muscular contractures. The disappearance of the supporting function of the extremity, caused by marked deformity, enhances the primary underdevelopment and shortening of the limb, which develop most rapidly between the first and the sixth years of life.

TREATMENT

The author believes that treatment of primary absence of the fibula must have three objects: 1) to get the foot into normal position in line with the longitudinal axis of the tibia, and to restore the shape and muscular equilibrium of the foot; 2) to reconstruct the lateral malleolus; and 3) to correct the anterior bowing of the tibia and reduce the shortening of the limb.

There is no possibility of achieving these objects by means of conservative treatment, although such treatment may be useful during the first year of life as a preparation for operation. In this period massage, manipulations and splints are used. Single cases are described in which this treatment checks the development of deformity (Tavernier 1937, Stracker 1942, Dubost-Perret 1950).

The restoration of normal position of the foot in line with the axis of the tibia may be achieved between the second and fifth years by operation on the soft tissues. The operative procedures developed by Freund (1936), Harmon and Fahey (1937), Guilleminet and Dubost-Perret (1950), Coventry and Johnson (1952), Thompson, Straub and Arnold (1957) consist of the division of the posterior and lateral parts of the capsule of the talo-tibial and subtalar joints. Gruca (1959) advised that this procedure should be combined with transposition of the long and short peroneal muscles into the tuber calcanei.

Operations on soft tissues are usually ineffective after the seventh year of life. Where there is subluxation or pronation of the calcaneus a wedge resection of the talo-calcaneal
joint (Dubost-Perret 1950) or calcaneal osteotomy (Mau 1927) are indicated. The author considers takedown, recommended by Froelich (1923) and Nové-Josserand (quoted by Dubost-Perret 1950) to be ineffective. The problem of fixation of the foot in line with the axis of the tibia in growing individuals has not as yet been completely solved. Arthrodesis of the talotibial or subtalar joints is recommended by Braun (1887), Franke (1905), Haas (1929), Putti (1929), Branciforti, Franz and Goidanich (1955), Kruckenberg (1928). This procedure seems to the author to be undesirable, because it causes marked disturbance of the power and in the adaptive capacity of the foot.

Operations for reconstruction of the lateral malleolus by means of grafts taken from healthy tibia (Albee 1919, Froelich 1923), from the affected tibia (Kruckenberg 1928, Haas 1929, Stracker 1942, Gruca 1959), from the calcaneus (Rivarola 1929) or from a rib (Gruca 1959), seem to be indicated in adults. Before the completion of the growth these operations are insufficient, because the transplanted bone stops growing and becomes inadequate in course of time. Reconstruction of the lateral malleolus by means of autogenous grafting with bone containing viable epiphyseal cartilage (Küttner 1913, Guilleminet and Dubost-Perret 1950) is of questionable value, because the transplanted cartilage does not retain its proliferative properties (Rehn and Wakabayashi 1912, Lexer 1931, Fohl (quoted by Ambros 1948), Gruca 1959).

The reconstructive operation recommended by Bardenheuer (1894), consisting of splitting the lower epiphysis of the tibia and transplanting the troclear part of the talus into the space thus formed, is according to Watermann (1925) ineffective, because this procedure may cause retardation of growth and stiffness of the talo-tibial joint.

To solve the problem of keeping the foot in line with the longitudinal axis of the tibia, a method of reconstructive operation has been developed, according to the suggestions of Gruca, at the Clinic of Orthopaedic Surgery of the Medical Academy in Warsaw. This new operation serves the following purposes: 1) creation of a lateral malleolus containing a viable epiphyseal cartilage that can grow along with the lower tibial epiphysis; 2) stabilisation.
of the talo-tibial joint and prevention of lateral subluxation and valgus deformity of the foot by reconstruction of the fork-like shape of the talo-tibial joint; and 3) preservation of movement in the new ankle joint.

**TECHNIQUE OF OPERATION**

A vertical midline incision is made, extending from a point seven centimetres above the line of the ankle joint to the neck of the talus. The tendon of the long extensor of the toes together with the corresponding vascular bundle are bluntly dissected and transposed medially with the tendon of the long extensor of the great toe. The periosteum and the capsule of the joint are cut longitudinally between the lateral and middle thirds of the tibia. The periosteum on the lateral and postero-lateral surface of the tibia must be left undisturbed. The tibia is cut obliquely in the vertical plane, beginning from a point situated between the lateral and middle thirds of the articular surface of the lower epiphysis of the tibia and running upwards obliquely from the inferior and lateral side to the superior and medial one (Fig. 1). This mobilised fragment consists of two-thirds of the articular surface, of two-thirds of the epiphyseal cartilage and of half the epiphysis of the tibia. It is transposed upwards and medially for about 1.5 centimetres. The gap between both fragments above the epiphyseal cartilage is filled with a graft taken from the tibiae just below their tuberosity (Fig. 2). All fragments are united firmly by a Kirschner wire or by one or two screws but without separating or disturbing the adjacent soft tissues (Fig. 3).

The viability of the two fragments is not impaired, because the attachments of the soft tissues are preserved and the linear section of the epiphyseal cartilage does not disturb its function. The blood supply remains sufficient.

The anatomical axis of the talus and of the calcaneus become shifted towards the midline in relation to the anatomical axis of tibia. This is an additional factor, which prevents the valgus deformity of the foot.
Case 2. Figure 6—Appearance before operation, at the age of 8 years. Figure 7—One year after bifurcation operation. The talus is in good position and the new lateral malleolus has a growing epiphysis.

Case 3. Figure 8—Appearance before operation, at the age of 8 years. There is equinus deformity and lateral subluxation of the talo-tibial joint. Figure 9—One year after bifurcation operation. Good position of talus and foot and preservation of epiphysial cartilage. Note the increased density of the epiphysis of the new malleolus.
This reconstructive operation has been performed in three children aged four, eight and eight years. The periods of observation after operation were from seventeen to twenty-seven months.

CASE REPORTS

Case 1—A child aged three years and eight months was brought because of congenital absence of the right fibula. Treatment by manipulations, plaster and splints had been started when the child was three. There was lateral subluxation of the foot with a valgus deformity of 90 degrees, a pronation deformity of 60 degrees and an equinus deformity of 125 degrees. Weight was borne on the head of the talus (Fig. 4).

Operations—Capsulotomy of the talo-tibial, talo-calcanear and calcaneo-cuboid joints was done. At the same time the peroneus longus was transferred to the tibialis posterior and the peroneus brevis was inserted into the tuber calcanei. At first the deformity was corrected, but it recurred, and seven months later the new operation was done.

Twenty-seven months after this the shape and position of the foot were found to be satisfactory. There had been no increase in the disparity (5-5 centimetres). The epiphyseal cartilage of the lower end of the tibia and of the new lateral malleolus remained active, and there was a range of movement of 40 degrees in the talo-tibial joint (Fig. 5).

Case 2—A child aged eight years was brought because of congenital absence of the left fibula. Treatment had been started when the child was three, but had been limited to the provision of apparatus to make up for the disparity of 10 centimetres. There was lateral subluxation of the foot, with a pronation deformity of 40 degrees. The talus was fused with the calcaneus (Fig. 6).

Operation—Postero-lateral capsulotomy of the talo-tibial and subtalar joints with excision of the fibrous strip representing the fibula was combined with transposition of the peroneal muscles and bifurcation of the lower end of the tibia.

Eighteen months after operation the foot was stable and in line with the long axis of the tibia. There was a range of movement of the ankle of 30 degrees, and there was no evidence of premature closure across the epiphyseal cartilages. There had been no increase in the amount of shortening (Fig. 7).

Case 3—A child aged eight years was brought with congenital absence of the right fibula (Fig. 8). Treatment had been started when the child was six months old, and had consisted of manipulation, plasters and splints. There was shortening of 10 centimetres, with 20 degrees of valgus deformity of the foot and subluxation of the talo-tibial joint.

Operations—At first a new lateral malleolus was fashioned from a rib graft, but this broke after six months, and the bifurcation operation was done twelve months later.

Eighteen months after the second operation the foot remains in satisfactory position and the amount of shortening has not increased. There is no evidence of premature closure across the epiphyseal cartilages, but the epiphysis of the new lateral malleolus shows some evidence of necrosis (Fig. 9). There may have been damage to vessels in this area during the first operation.

DISCUSSION

Stabilisation of the foot seems to have been achieved in all three cases. Measurements made from the radiographs show that the new malleolus grows at the same rate as does the remaining part of the tibial epiphysis. The range of movement of the ankle increases steadily, after mobilisation is begun. Curvatures of the tibia not exceeding 50 degrees seem to correct themselves spontaneously without the necessity of osteotomy.

Severe shortening presents a serious problem. The reconstruction of the lateral malleolus shortens the limb further by some 1-5 centimetres. The author believes that this is insignificant in comparison with the considerable advantages of the operation. Hyperaemia during the healing period after removal of the tibial graft should stimulate the growth of the upper epiphyseal cartilage. In the cases described we are planning to elongate the tibiae by the insertion of cylindrical bone grafts combined with Trueta's (quoted by Gruca 1959) operation.

CONCLUSIONS

1. In congenital absence of the fibula, the fibrous strip that replaces the bone, abnormal insertions of fibular muscles, and disturbances in the formation and growth of the tarsal
bones all go to cause the valgus deformity of the foot and the complete or partial dislocation of the talo-tibial joint.

2. Conservative treatment is justified only for children less than a year old and then only as preparation for operation.

3. Between the second and seventh year of life operations upon the soft tissues are indicated, to eliminate the contractures occurring on the posterior and lateral sides, to restore the proper position of the foot in line with the axis of the tibia, and to restore the normal shape of the foot and muscular equilibrium. At the same time favourable conditions are created for operative reconstruction of the lateral malleolus.

4. Arthrodesis of the talo-tibial joint or reconstruction of the lateral malleolus by a bone graft with the aim of stabilising the foot in the axis of the tibia is not advisable in the growing limb.

5. The results obtained in three cases described support the conclusion that the bifurcation operation recommended by Gruca produces a new lateral malleolus with an epiphysis that grows at the same rate as the remainder of the lower epiphysis of the tibia, does not affect the rate of growth of the tibial epiphysis, prevents the recurrence of the deformity, and preserves the mobility of the talo-tibial joint.

6. In early cases this reconstructive operation may be done at the same time as soft-tissue deformities are corrected and subluxation reduced.

7. It is probable that the bifurcation operation should be done on children aged between two and seven years in order to give the limb the best chance to develop normally.

REFERENCES


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