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The surgical treatment of partial tibial deficiency and ankle diastasis

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Abstract

Partial tibial absence and congenital ankle diastasis are described together with a surgical regime for their reconstruction.

Introduction

Operations performed on the foot and the lower leg in cases of tibial malformations require a comprehensive and detailed knowledge of the morphology of these most complex and variable deformities. The major morphological details are therefore described first.

The clinical appearance is, above all, characterised by a severe foot deformity, i.e. an equinovarus foot, as well as shortening and instability of the leg, along with a dysplasia of the knee joint (Fig. 1).

Partial tibial aplasia

The distal tibial epiphysis, metaphysis and the adjacent diaphysary section are missing. The diaphysis ends in the middle, sometimes in the lower third, of a thin and often pointed stump which may in addition also show a slight axial deviation. Sometimes, the skin in this region is scarred along with pitting, and the condition may be associated with polydactyly.

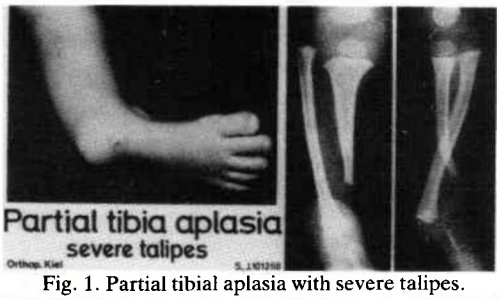

Fig. 1. Partial tibial aplasia with severe talipes.

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Lower leg diastasis

In lower leg diastasis, the tibial end is hypoplastic and does not articulate with the talus. It is even possible that the two lower leg bones override (Fig. 2). Parts of the tibia may be missing (Fig. 3), as already specified for the partial aplasia.

Interestingly enough, in these kinds of deformities the distal end of the tibia, provided with a soft tissue covering, my protrude from the residual lower leg, and there are similarities to the formation of clefts in hands and feet.

Foot

In both deformities the foot shows a distinct varus position. In some cases the sole points to the face. The talus is "suspended" at the distal fibular end in a tight capsulo-ligamentous interconnection. Feet in extreme equinus are predominantly seen in diastases of the lower leg. Tarsal synostoses, oligodactyly and even monodactyly are also found.

Editors Note:

The treatment of total tibial deficiency, first described by Otto in 1841, is either knee disarticulation or reconstruction. The former course is simple, requiring only one surgical procedure and allows the child to undergo straightforward prosthetic rehabilitation.

Reconstruction which seems an attractive option may require multiple surgical procedures and seldom obviates the need for an orthoprosthesis. It consists of transferring the upper end of the fibula to the intercondylar notch of the femur, and correcting the equinovarus deformity of the ankle by centralising the fibula into the talus. Furthermore it may be necessary to ablate the foot, so that the child becomes a below-knee amputee whose knee joint needs external support.

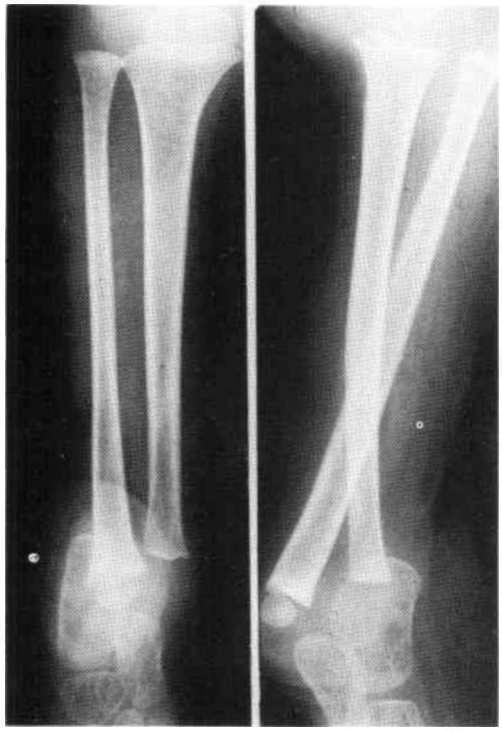


Fig. 2. Tibial hypoplasia with overriding bones in the lower leg.

Knee joint

An impaired knee joint development is evident with dysplasia of the articular components and patella, raised position of the fibular head and instability of the ligaments.

Indication for surgical treatment

Surgical treatment is indicated for all forms of tibial hypoplasia and partial aplasia, when it will provide consistently improved function of the deformed limb, allowing at the same time easier and better orthotic fitting.

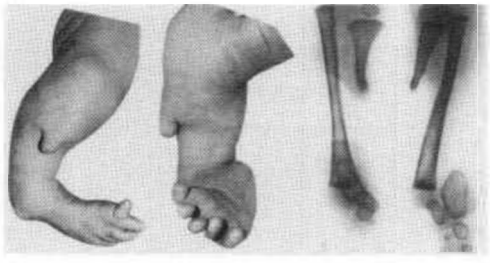


Fig. 3. Partial tibial aplasia.
Note: Distal end of the tibia contained in "skin bag", severe equinus foot deformity.

Surgery has two primary objectives:
- the correction of the foot deformity,
- replacement of missing tibial sections by the fibula.

Only after a stable and solid interconnection of foot and knee joint has been obtained is it possible to consider lengthening procedures. The authors usually proceed first to correct the deformed foot.

Surgical technique

In the early 60's the authors started to develop the so called foot realignment, with the hind foot being placed below the distal fibular end. The talus is then resected, with the fibula being placed in a recess in the calcaneus. The fibular epiphysis has to be prepared very carefully in order to preserve to the greatest possible extent the vascular supply of the growth line.

The foot is held in its position with Kirschner wires and a plaster cast. Immobilisation is required at least 8–10 weeks, although it is possible to remove the wire after 3–4 weeks.

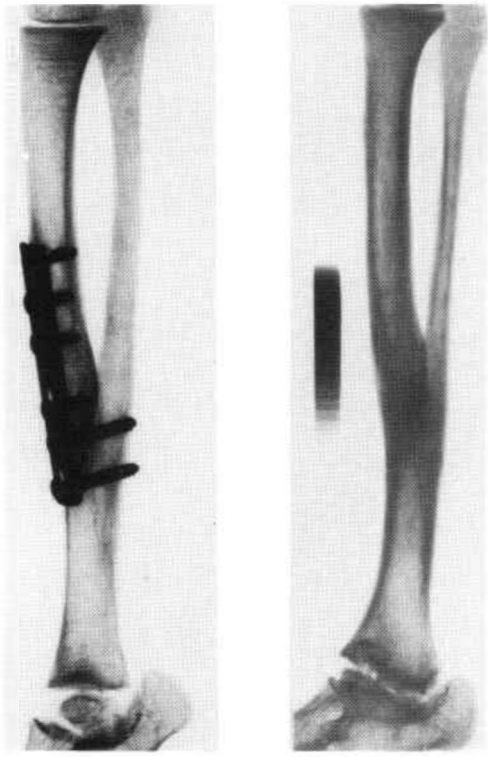
If the malformation of the foot is unilateral and it is certain from the beginning that lengthening of the leg is not recommended, the foot is brought into an equinus position, so as to allow proper fitting of a shoe or extension prosthesis.

The fusion of the tibia and the distal fibular section is performed about 3–4 months later. The distal tibial end is exposed and prepared. The fibular diaphysis is sectioned at the predetermined level. A space is then created, which is as large as possible, in the soft tissue between the two lower leg bones, for moving the distal fibular fragment to the tibial fragment. The bones are then fixed in their position by a selfcompressing plate.

Case reports

Figure 1 shows a partial tibial aplasia, with a severe deformity of the foot. Repositioning of the foot was completed at the age of 3 years, with fibula/tibia fusion being performed 1 year later. Figure 4 clearly demonstrates the recess in the calcaneus. There are no signs of damage to the large epiphyseal plate.

Meanwhile, the epiphysis is tightly fused with the residual talus and calcaneus, with the epiphyseal plate beginning to ossify. The hypertrophy of the distal tibial sections is



(a) (b)

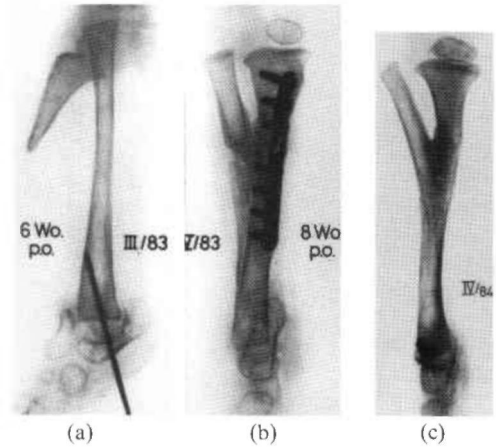
Fig. 4
a). Repositioning the foot at the age of 3, fusion completed 1 year later.

b). 10 years after repositioning the foot and 9 years after fibula/tibia fusion.

clearly demonstrated, showing a good example of functional correction of the foot (Fig. 4).

In another patient, the tibial stump was contained in a sort of skin bag (Fig. 5). The foot was repositioned at the age of 1 year, and the fibula/tibia fusion completed 8 weeks later. Due to the significant difference in the length of the legs, the foot was put in equinus. Initially, ortho-prosthetic fitting was rather difficult because of the laterally extending proximal fibula. However, with progressive growth of the leg, containment of the entire lower leg is no longer required, so the fibular head is no longer enclosed.

The authors apply this technique also in cases of diastases of the lower leg. The initial findings are demonstrated in Figure 6. This patient had on the right side a cleft foot, and on the left a lower leg diastasis. The distal tibia, contained in a skin bag, protruded from the lower leg.



(a) (b) (c)

Fig. 5.
a) After repositioning the foot
b) After fibula/tibia fusion.
c) 1 year after repositioning the foot and operative fusion.

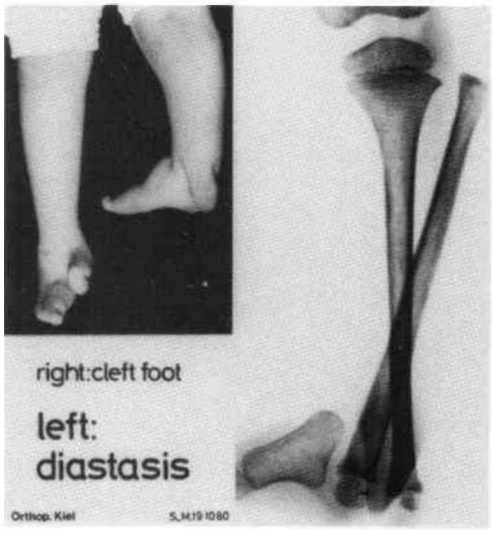
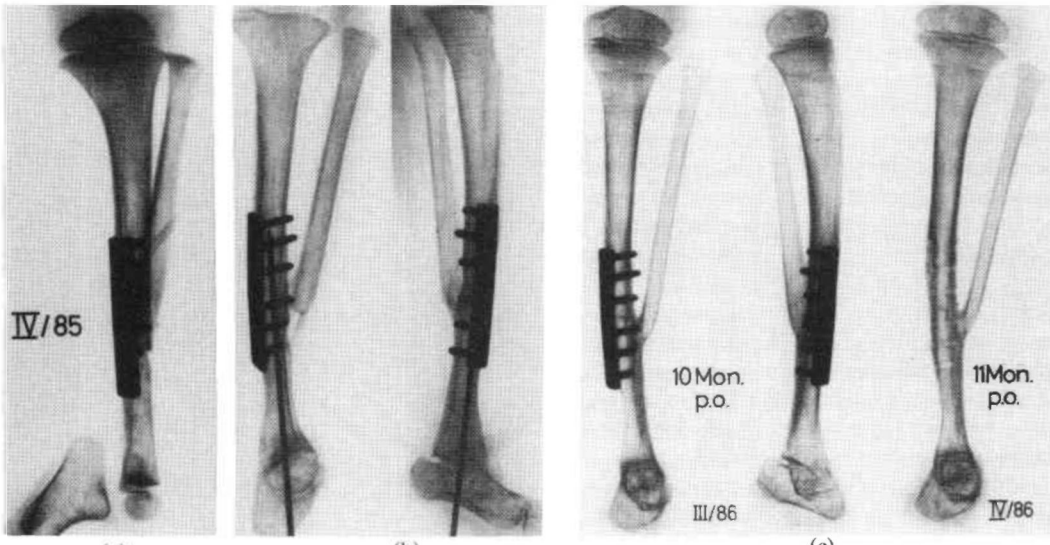


Fig. 6. Diastasis of the lower leg.

The tibia/fibula fusion was performed at a first operation and the foot was repositioned on a second occasion. Because of monodactyly, weight bearing was only possible via the repositioned calcaneus, and so the toe was amputated in a third procedure. The final state corresponds to a Pirogoff-Günter amputation. Ten weeks after the last operation the patient received the definite prosthesis (Fig. 7).

Summary

In cases of congenital partial tibial aplasia or



(a) (b) (c)

Fig 7.
a) Fibula/tibia fusion.
b) After repositioning the foot.
c) After operative fusion, repositioning of the foot and amputation of the forefoot.

so-called diastases of the lower leg, very good results are to be expected from tibia/fibula fusion in association with a repositioning of the foot. Form and function of the limb are significantly improved, with ortho-prosthetic fitting being considerably facilitated.

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