

BIFURCATION OF THE DISTAL FEMUR

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Bifurcation of the femur has previously been reported in the literature in only 12 cases. Two more cases are added, and the etiology of this congenital anomaly is discussed.

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Bifurcation of the distal femur is a rare congenital anomaly. It has been described only in conjunction with an ipsilateral absence of the tibia.

CASE REPORTS

Case 1 is a 33-year-old male patient (P.H.) who was admitted to our hospital for the first time when he was 4 weeks old. His parents had noted an extreme shortening of the right lower leg at birth. An X-ray examination showed complete absence of the tibia and fibula, and hypoplasia of the femur.

In the area of the femoral condyles, the X-rays (Figure 1) revealed laterally a narrow, dense, band-like structure with a separate center of ossification. In contrast to the normal left side, the right hind foot showed only one center of ossification. There was also absence of the fibular ray of the right foot with simultaneous hypoplasia of the third metatarsal.

Clinically and radiologically this was a complete paraxial hemimelia with aplasia of tibia and fibula, but with the tibial ray of the foot present.

Follow-up at age 12 showed only a slight growth retardation of the right femur in comparison with the normal left leg. Radiologically (Figure 2), there is a bifurcation of the distal femur and presence of a dysplastic patella. Distal to the femoral condyles a compact bone is visible on the X-rays. This bone fragment could be palpated clinically. The patellar ligament

could actively extend it. In accordance with its topographic location and function, this can only be the dysplastic tibia. The bony elements of the hind foot consist of a y-shaped ossicle, the cuboid, the navicular, and the first cuneiform.

No attempt was made at surgical correction. The patient was fitted with a femoral prosthesis. On his last visit at the age of 33 the right thigh was only slightly shorter and thinner than the left. Immediately below the knee joint the foot was placed in extreme equinus and had a slight external rotation. The range of motion of the foot was limited to 20 degrees dorsiflexion from an extreme equinus position. The lateral femoral condyle was smaller than the medial. A bony prominence was palpable in the popliteal fossa. The patella, much smaller than on the left side, was freely movable. The knee joint was slightly rotated externally. When the quadriceps contracted, the patella could be elevated and the foot could be extended 20 degrees, deviating slightly to the lateral side.

The X-ray demonstrates a hypoplasia of the medial femoral condyle (Figure 3). Distal to the lateral condyle is a bony structure with an oblique direction towards medial. The bones of the hind foot which have become fused are located medially to this bony structure (Figures 4 a and b). There is an articulation between the hind foot and the fore foot. The first cuneiform has fused to the navicular. The first, second, and fourth toes appear almost normal. The third metatarsal is short and small, and the fifth toe is missing. It cannot be determined whether the aplasia affects the fourth or fifth ray.



Figure 1. Case 1 (P.H.), at four weeks old: Hypoplasia of the femur, absence of the bones in the lower leg, band-like bony density lateral in the area of the femoral condyles with a separate center of ossification.

On the lateral X-ray there is an exostotic thickening of the distal femur at the level of the popliteal fossa. The X-rays at the age of 12 show that this exostosis used to possess its own growth center.

Case 2 is a Turkish boy (V.M.) who was first examined at our hospital at the age of three.

Clinically, the left thigh showed a club-like enlargement of the lower third (Figures 5 a and b). The lower leg was shortened and hypoplastic with a fixed deformity of 90 degrees in relation to the thigh. The foot was hypoplastic as well, with the fourth and fifth rays missing. The patella was absent, but the fibula was present. The lateral malleolus could be felt through the skin, the medial malleolus was missing. Proximal to the crural joint a club-like structure was found, and distal to this bony structure there was a palpable thickening which clinically seemed to be the tibia.

X-ray examination revealed a bifurcation of the femur at the junction between middle and

distal third (Figures 6 a and b). The lateral segment is in alignment with the axis of the femur and articulates with the fibula. The medial segment deviates in a mediodorsal direc-



Figure 2. Case 1 (P.H.), at 12 years old, lateral X-ray of "knee-joint" complex.

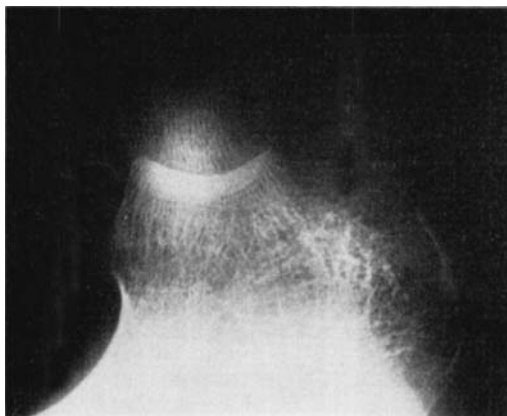
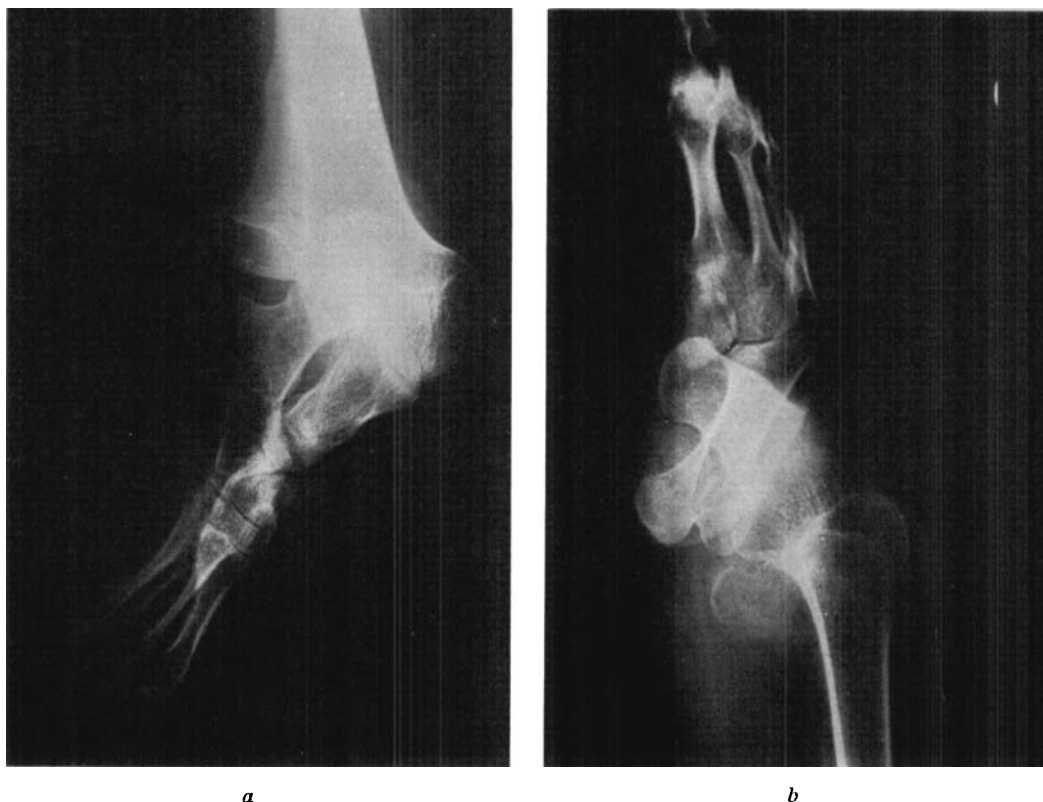


Figure 3. Case 1 (P.H.), at 33 years old, sky-line view of right patella with hypoplasia of the medial femoral condyle.



Figures 4 a and b. Case 1 (P.H.), at 33 years old, (a) a.p. and (b) lateral X-rays of the right femur, knee-joint complex, and foot.

tion. This segment has a growth plate while the lateral does not. The fibula lacks a growth plate in its proximal part and there is no tibial growth plate. The skeleton of the foot contains the osseous nuclei of talus, calcaneus, and cuboid. The three lateral digital rays are present.

Both cases were treated conservatively. The first patient is well adjusted to his femoral prosthesis. The active mobility of the "knee-joint" complex enables good function and an acceptable gait. The patient has a sedentary occupation.

The second case was treated with a Thomas' splint to enable an upright gait. We await further development of the malformation. By resection of the useless part of the bifurcation and the lower leg we will then have better conditions for proper treatment with a prosthesis.

DISCUSSION

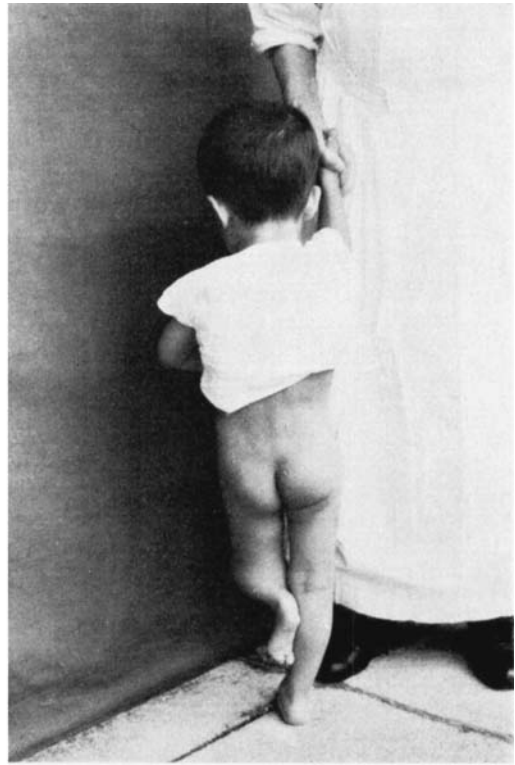
During the past 100 years, occasional reports have been made about bifurca-

tion of the femur, usually in connection with aplasia of the tibia. The first case of bilateral femoral bifurcation was reported by Ehrlich (1885). Liepman (1906) was the first to present X-rays of this deformity with reference to a case observed by Hildemann (1882). The following authors have each contributed one case: Rodriguez & Escardo (1924), Nigst (1927), Cornah & Dangerfield (1974) and Ogden (1976). The largest series was collected by Aletter (1932) with 5 cases.

In 1960, Salzer reported the case of a patient who had a femoral exostosis at the same location as our first case. In contrast to our patient, this patient lacked the patella. Thirteen of the 183 cases of aplasia of the tibia collected by Salzer showed such a femoral exostosis.



a



b

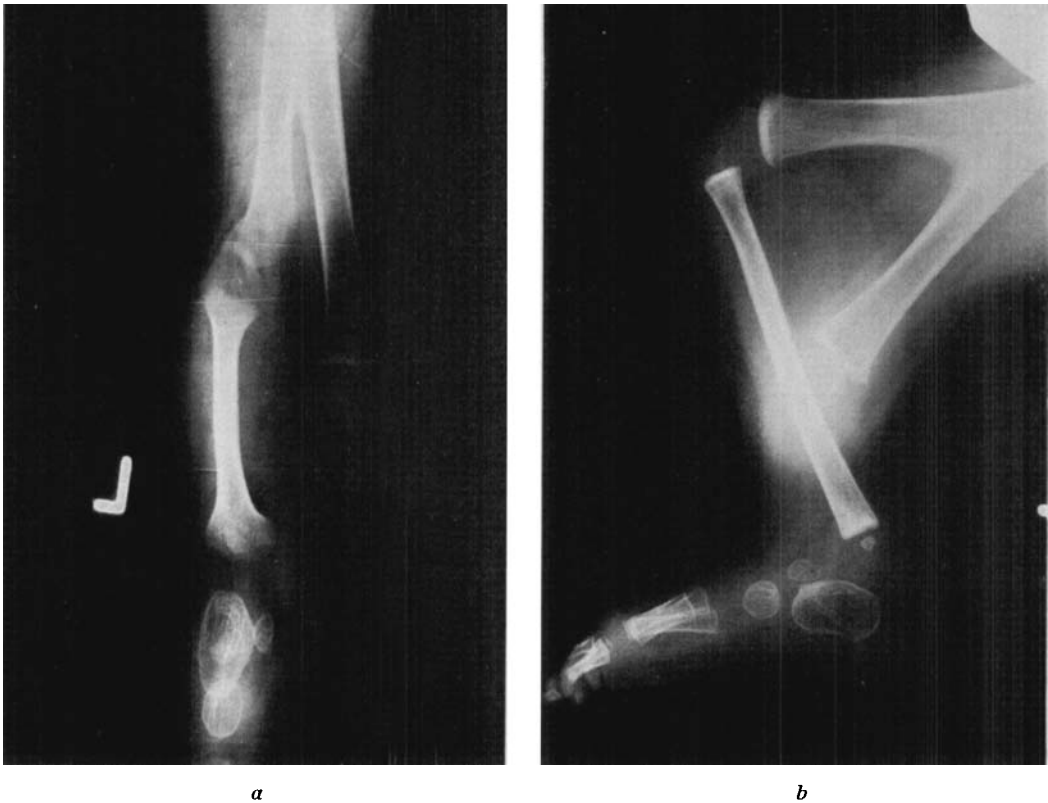
Figures 5 a and b. Case 2 (V.M.), at 3 years old, clinical pictures of left extremity malformation.

He concluded that this was an ectopic anlage of the tibia since a femoral exostosis in this location had never been described with a partial tibial defect. Ehrlich (1885) had offered the same explanation after dissection of a bilateral femoral bifurcation. The specimen contained no patella and the insertions of gracilis, sartorius, semimembranosus, and semitendinosus muscles led to one of the shafts of the femoral bifurcation. Ehrlich considered that this was therefore a heterotopic development of the tibia.

In contrast, our first case has a patella and a patellar ligament enabling an active dorsiflexion of the foot in the knee joint. This, together with the orthograde position of the foot, gives rise to the thought that there must be a hypoplastic tibia (Figures 5 a and b).

The second case has a striking resemblance to the most recently reported case by Ogden (1976). The femur shows a bifurcation rather than a reduplication as described in the case of Cornah & Dangerfield (1974). The singular bone of the lower leg definitely represents the fibula. Radiologically, we are therefore dealing with a complete tibial aplasia. This, however, is not in accordance with the clinical picture of an orthograde position of the foot: in cases of aplasia of the tibia, the foot should be in an equinus position. The only possible explanation is that the foot has been held in an orthograde position by a cartilaginous tibial anlage not visible on X-ray.

From our two observations, we conclude that bifurcation of the femur cannot be considered an ectopic tibial anlage. Femoral bifurcation appears only in



Figures 6 a and b. Case 2 (V.M.), at 3 years old, (a) a.p. and (b) lateral X-rays of left lower extremity.

conjunction with malformation or aplasia of one of the bones of the lower leg.

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