Skeletal Radiology

Tibiotalar Tilt – A New Slant

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Abstract. Classically tibiotalar tilt (TTT) is associated with four conditions: Fairbanks disease, hemophilia, sickle-cell anemia and juvenile rheumatoid arthritis. We have found it to be present in at least 20 other conditions including other dysplasias, developmental conditions such as fibrous dysplasia and a variety of other acquired disorders including various metabolic diseases and following previous trauma. The pathogenesis is controversial, but the most probable cause is related to stress and the blood supply of the distal tibial epiphysis. The differentiation of TTT from pseudotibiotalar tilt is also discussed.

Key words: Tibiotalar Tilt – Metabolic disorders – Dysplasias – Arthritis.

However it is also necessary to consider the problem of pseudo-tibiotalar tilt before we begin the discussion of TTT proper.

Pseudo-Tibiotalar Tilt

Bigongiari [1] described a common positioning artifact produced by flexing the knee and placing the foot into external rotation while taking an anteroposterior (AP) view of the ankle which simulates true TTT (Fig. 2). As far as possible in our review, we have excluded all cases of pseudo-tibiotalar tilt.

Tibiotalar tilt or tibiotalar slant (TTT) was originally described as occurring in four conditions: epiphyseal dysplasia multiplex (Fairbanks’s disease), hemophilia, sickle cell anemia, and in juvenile rheumatoid arthritis (JRA) [3, 4, 6]. It is caused by asymmetrical growth of the distal tibial epiphysis and hence it appears curious that TTT has not been described in other conditions or disorders involving the distal tibial physeal plate. A recent case of neurofibromatosis with tibiotalar tilt (Fig. 1) stimulated a search of the teaching file and the authors’ memories of similar recent cases for other examples of diseases which cause TTT. We have now seen TTT in over 20 other conditions which may be conveniently subdivided into congenital, developmental, and acquired causes (Table 1).

Fig. 1. Neurofibromatosis. This child came in for corrective surgery to her right ankle. The abnormality of the distal fibula is obvious and the tibiotalar tilt appears to be due to a growth abnormality of the lateral aspect of the distal tibial epiphysis.
Table 1. Conditions in which tibiotalar tilt has been seen

**Congenital**
1. Epiphyseal dysplasia multiplex (Fairbank's disease)
2. Nail-patella syndrome
3. Van Buchem's disease
4. Spondyloepiphyseal dysplasia
5. Metaphyseal dysostosis
6. Mandibulo-acral dysplasia

**Developmental**
7. Fibrous dysplasia
8. Neurofibromatosis
9. Multiple exostoses
10. Ollier's disease

**Acquired**
11. Hemophilia and other similar blood disorders
12. Inflammatory arthritis: JRA
13. Sickle cell anemia
14. Poliomyelitis
15. Rickets
16. Adult cretinism
17. Hypophosphatasia
18. Primary hypoparathyroidism
19. Chronic renal failure with avascular necrosis
20. Blount's disease
21. Femoral bowing
22. Leukemia
23. Fractured femur with abnormal stresses
24. Post-trauma, Salter III or IV fracture of distal tibia
25. Old osteomyelitis of tibia

Table 2. Theories of pathogenesis

1. Episodic increase in intracapsular pressure may occlude epiphyseal vessels with resultant avascular necrosis of epiphysis [9]
2. Irregular overgrowth and early fusion of the tibial epiphysis caused by hyperemia of the medial malleolus [5]
3. Chronic hemarthrosis and soft tissue hyperemia leading to asymmetrical overgrowth with eccentric and premature epiphyseal fusion [8]
4. Long-standing articular and periarticular inflammation resulting in epiphyseal overgrowth as is seen in JRA [8]
5. Chronic hyperemia as is seen in sickle cell anemia [8]
6. Eccentric segmental premature fusion of the epiphysis [2]
7. Deficiency of lateral portion of distal tibial ossification center [6]

The Pathogenesis of Tibiotalar Tilt

Many different theories as to the cause of abnormal epiphyseal growth which may result in TTT have been proposed (Table 2): ranging from Trueta's theory [9] on episodic increase in capsular pressure which may occlude the epiphyseal vessels and produce avascular necrosis of part of the epiphysis, to various theories suggesting that hyperemia or long-standing periarticular inflammation such as is seen in JRA may be the cause [5, 8]. In the dysplasia, TTT may be due

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**Fig. 2.** Pseudo-tibiotalar tilt. In this series of views of a normal ankle, the effect of external rotation of the foot and flexion of the knee can be seen.

**Fig. 6.** Fibrous Dysplasia. This patient had classical fibrous dysplasia involving his pelvis, left femur, and left tibia. The tibiotalar tilt was an incidental finding and was not present in his right ankle.

**Fig. 7.** Old Salter Type IV Fracture. This 22-year-old man was admitted for corrective surgery because of the deformity of his right ankle caused by a Salter IV fracture sustained 12 years previously. The abnormality of his tibiotalar joint is noted although the "tilt" in this case appears angled medially.

**Fig. 8.** Poliomyelitis. There is marked distortion of the left ankle with tibiotalar tilt in this patient who has paralysis of the left leg as a result of polio. The gracile bones and loss of soft tissues as well as disuse osteoporosis are apparent.