

# Varus and valgus deformities of the foot in cerebral palsy (1982)

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Another in our series of commentaries on notable papers from the DMCN archives. The full paper is available at [www.mackeith.co.uk](http://www.mackeith.co.uk).

Bennet GC, Rang M, Jones D. Varus and valgus deformities of the foot in cerebral palsy. *Dev Med Child Neurol* 1982; 24: 499–503.

Deformities of the foot and ankle are common among patients with cerebral palsy. Equinus due to contracture of the gastrocnemius-soleus muscle is the most common: it has been estimated that some 20 to 25 per cent of all children with cerebral palsy will require surgery for this deformity and the results are predictably good. Varus and valgus deformities are less easily corrected surgically, and it is also less easy to explain their development.

An equinovarus deformity usually is attributed to overactivity of tibialis anterior or tibialis posterior in the presence of equinus. Equinovalgus is explained by the 'bowstring' theory, which states that: 'in the presence of an equinus contracture the hind-foot is forced into the valgus position when the forefoot touches the ground. This occurs because of the bowstring effect of the triceps surae on the ankle and subtalar joints. The calcaneum then rotates under the talus, which then drops into a more vertical position on losing the support of the sustentaculum tali.' Two objections can be raised against this theory. (1) equinovalgus deformities are seen in children who have never walked; and (2) hemiplegic children who are fully mobile seldom develop a valgus deformity, in spite of equinus commonly being present.

From clinical observations we have noted that whereas hemiplegia typically produces an equinovarus deformity, diplegia and quadriplegia are characterised by an equinovarus foot. This was confirmed in a retrospective study of 230 children who had had foot surgery at the Hospital for Sick Children, Toronto.

If either varus or valgus deformity was present, 94 per cent of affected hemiplegic patients were in varus, whereas for those with diplegia and quadriplegia, 64 per cent were in valgus.

We also noted that hemiplegic children often show signs of tibialis overpull, whereas those with diplegia or quadriplegia seldom do. This suggests a possible reason for the different pattern of deformity in the two groups; it seemed to us that the fundamental difference lay not in muscle contractures or mobility, but in the function of tibialis posterior.

## Commentary

To understand the significance of this paper it is important to put it in its historical context.

In the early 1980s, orthopaedic surgeons were only just starting to come to grips with the concept of dynamic assessment of cerebral palsy (CP). A generation of surgeons brought up on a neuromuscular diet of polio and myelodysplasia were struggling with the effects of spasticity on gait. Many were operating on an empirical and piecemeal basis, with results that might kindly be termed variable. Orthopaedic surgery was getting a bad reputation among parents and physiotherapists.

Some were beginning to realize that CP behaved very differently from these other conditions, and in particular that there was often a marked difference between the conventional static clinical examination and the findings when the child started to stand and walk. Some of us were starting to put together our own primitive gait analysis units in an attempt to understand what happens when a child with CP walks.

Into this confused world came this paper from Toronto by George Bennet, Mercer Rang, and Derek Jones. In clear and simple terms that even an orthopaedic surgeon could understand, it addressed the question of why some children with equinus went into varus while others developed a valgus posture. With simple gait analysis, including electromyography, they elegantly demonstrated that varus feet were always associated with abnormally sustained firing of the tibialis posterior muscle throughout the gait cycle, whereas valgus feet were usually characterized by absent tibialis posterior activity.

This paper probably seems a somewhat slight contribution in today's world of sophisticated gait analysis and single event multilevel surgery. True, the numbers are small and the discussion a little speculative. There is also a mistake in the Introduction which escaped the editor's eagle eye; see if you can spot it.\* However, at the time it was published, for paediatric orthopaedic surgeons struggling to try to understand what on earth was going on in the foot and ankle in hemiplegia and diplegia, its impact was considerable. I believe that it represented one of the first attempts to bring a little science and logical thinking to an area of orthopaedic surgery clouded by empiricism and anecdotal practice.

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\*The second 'equinovarus' in the first sentence of the third paragraph of the Introduction should of course be 'equinovalgus'.