**Introduction**

Congenital clubfoot (talipes equinovarus) occurs in about 1 in 1000 live births in Caucasians [1]. The incidence differs geographically, being higher in the county of Uppsala, Sweden, than in a county in Alabama, USA [2]. In the past few decades, conventional radiography has been the standard method for the assessment of clubfoot and it is still widely used in most hospitals all over the world, as the required apparatus is easily available and inexpensive. However, this method is associated with several disadvantages: (a) in practice, it is difficult to find correct and reproducible projections when taking radiographs, (b) it is unreliable to assess the deformity only from small detectable ossification centres, which are often isometric to their cartilaginous anlages in cases of clubfoot [3] and (c) the hazards of ionising radiation should be considered seriously in this age group. The value of arthographic assessment of clubfoot through the talocrural and talonavicular joints was investigated in the 1970s [4], but the procedure was traumatic and the complicated manoeuvre required limited its clinical application. Computed tomographic (CT) studies of clubfoot have until recently rarely been reported [5].

Magnetic resonance imaging (MRI) is known for its safety, superb soft tissue resolution and visualisation of cartilage and hence provides a promising imaging modality for clubfoot. Downey et al. [6] undertook a pilot MRI study of clubfoot in 1992, when the potential of the method was demonstrated. More recent studies have shown that MRI is valuable for unravelling this complex malformation [7, 8]. In the present study, a new approach for clubfoot evaluation by using MRI with the multiplanar reconstruction (MPR) technique is described, and the preliminary results are reported.

**Abstract**  
Background. Magnetic resonance imaging (MRI) has been shown to be a useful tool in the evaluation of the complex deformities which are present in congenital talipes equinovarus (clubfoot).

Objective. To evaluate MRI with the multiplanar reconstruction (MPR) technique as a new method for assessment of clubfoot.

Materials and methods. Seven infants with 11 clubfeet were studied by using three-dimensional gradient-echo MR sequences. MPR was performed from the acquired image data in orthogonal, single and double oblique planes to demonstrate the complex deformities in clubfoot. Three angles (talar body-neck angle, talocalcaneal left-right angle and the talocalcaneal superior-inferior angle) were defined for measuring the medial angulation of the talar neck and the rotation of the calcaneus in relation to the talus.

Results. The method clearly demonstrated the pathological anatomy of the clubfoot, especially the talonavicular articulations. Dislocation of the navicular bone was observed in 9 of the 11 feet. The angle measurements were easily conducted with MPR, and these angles differed considerably among the patients.

Conclusions. The information provided by this method is useful for classification of the severity of clubfoot deformities.
Materials and methods

Patient population

Seven patients with 11 clubfeet, 4 bilateral and 3 unilateral, were investigated. These included all patients referred to Uppsala University Hospital in the period from August 1993 to December 1995. Congenital clubfoot was defined as a foot born with equinus varus, adductus and supination, which could not be redressed to normal position without casting or operation. All patients were below 1 year of age (range 3–8 months) and, except for the youngest patient, all had undergone serial casting for clubfoot correction. MRI was performed 1–3 weeks before surgery in 6 patients (the 3-month-old patient was operated on after 2 months).

MRI

The patients were imaged with a 0.5-T or 1.5-T superconductive imager. A knee coil (Ø = 18 cm, length 20 cm, operating in quadrature mode) was usually used. In two cases, the feet were too severely adducted to fit in the knee coil, and a head coil, 28 cm in diameter, was used instead. The patients were scanned with the feet in their habitual position except one, in whom a pair of specially made plastic cradles was applied to hold the extremities in a relatively ‘normal’ position. Both feet of all patients, with either bilateral or unilateral involvement, were scanned simultaneously. Sedation was achieved by chloral hydrate enema before imaging.

For each patient, 1–4 three-dimensional (3D) gradient echo (GE) sequences were obtained. The sequences differed in their repetition time (TR) and echo time (TE), which ranged from 26 to 66 ms and from 9 to 20 ms, respectively; the flip angles were between 10° and 60°, producing images with T1-weighted (T1-W), proton density (PD) weighted or T2-weighted (T2-W) appearance. A fat-suppression technique, spectral presaturation inversion recovery (SPIR), was applied in one case. The images were acquired with a 256 × 256 matrix and 14–18-cm field of view; 1.2–1.5-mm slice thickness was used for the original image datasets, with about 50 slices in the sagittal plane to cover the imaging area. The acqui-