Recurrent club-foot deformity following previous soft-tissue release

MID-TERM OUTCOME AFTER REVISION SURGERY

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The results of further soft-tissue release of 79 feet in 60 children with recurrent idiopathic congenital talipes equinovarus were evaluated. The mean age of the children at the time of re-operation was 5.8 years (15 months to 14.5 years). Soft-tissue release was performed in all 79 feet and combined with distal calcaneal excision in 52 feet. The mean follow-up was 12 years (4 to 32). At the latest follow-up the result was excellent or good in 61 feet (77%) according to the Ghanem and Seringe scoring system. The results was considered as fair in 14 feet (18%), all of whom had functional problems and eight had anatomical abnormalities. Four feet (5%) were graded as poor on both functional and anatomical grounds.

The results were independent of the age at which revision was undertaken.

The surgical treatment by soft-tissue release of idiopathic congenital talipes equinovarus (CTEV) may lead to a number of complications.1 Post-operative relapse requiring repeat soft-tissue surgery has been reported in 25% of cases.2,3 A variety of further soft-tissue procedures have been described,1,3,4 ranging from a limited posterior release to extensive posteromedial surgery. However, these reports are of small series with no long-term results.

The aim of this study was to review at the end of growth the results of further soft-tissue surgery after relapse of idiopathic CTEV.

Patients and Methods
We reviewed children with relapsed idiopathic CTEV following soft-tissue release who underwent further soft-tissue surgery alone, or combined with other operations, by the senior surgeon (RS) between 1974 and 2001.

There were 60 children (20 girls and 40 boys) with 79 feet. The majority (48 of 60; 80%) were referred following previous surgery elsewhere. The mean age at the time of revision was 5.8 years (15 months to 14.5 years). One previous soft-tissue release had been performed in 70 feet, two in eight feet and three in one. A total of 62 feet (78%) showed at least three components of the deformity (varus, equinus, adductus) and of these, ten had an additional cavus deformity. In 17 feet (22%) two components of the deformity, which occurred in any combination, were present.

Surgical technique. The same basic technique5 was used in all patients including a soft-tissue release through a curvilinear posteromedial incision. Lengthening of the tendo Achillis was performed, followed by a posterolateral release with division of the posterior capsule of the tibiotalar joint, the posterior talofibular and calcaneofibular ligaments, and the superior fibular retinaculum.5,6 Since 1983 the tibialis anterior tendon has been lengthened routinely7 unless this had been done previously. Prior to 1983 a slip transfer of this tendon had been carried out. The medial release included lengthening of the tibial posterior tendon at its insertion onto the navicular. The abductor hallucis longus was freed and elevated from its proximal origin, and the talonavicular joint capsule, the plantar calcaneonavicular ligament, and the calcaneocuboid joint capsule were divided. The subtalar adduction (horizontal rotation of the calcaneopodal block under the talutibiofibular unit8) and midtarsal adduction were then corrected by manipulation; a Kirschner (K)-wire was used to secure the medial column and a second wire placed across the calcaneocuboid joint if required.8 Of the 79 feet, 55 (70%) underwent a complete posterolateral and medial release, but 24 (30%) had only a partial release, depending on the degree of deformity. A plantar release was required in 40 feet (51%) to correct cavus deformity or midtarsal adduction. A distal calcaneal wedge resection9 was performed in 52 feet (66%) to correct residual mid-foot adduction. A subtalar release was carried out in 24 feet (30%) if the rotational deformity of calcaneopodal block was not
corrected adequately. Some feet required additional bony procedures: three navicular osteotomies, two calcaneal osteotomies, two medial cuneiform osteotomies, one cuboid osteotomy and one tarsectomy.

After operation the foot was immobilised in a well-padded above-knee plaster splint if the patient was < four years old, or below-knee if > four years old, with the ankle in slight plantar flexion. One week after revision surgery, the foot was gently manipulated to 0° of dorsiflexion under general anaesthesia and a further cast applied. Excessive valgus angulation or dorsiflexion was avoided. If the radiological correction of equinus was unsatisfactory repeat casting was performed at 14 and, if necessary, 21 days post-operatively. Weight-bearing was not allowed during the first 45 days after operation. A new below-knee walking plaster was then applied. The total period of immobilisation in plaster was three months. Then the plaster and K-wires were removed in the operating room and a below-knee night splint was used for several years to maintain the correction.

The outcome was assessed at the last follow-up using the Ghanem and Seringe scoring system. A recent comparison of a number of widely used evaluation systems for CTEV has shown that they are not comparable. The Ghanem and Seringe scoring system is less liberal than the other systems, such as that of Laaveg and Ponseti. Subjective evaluation accounts for only 32% of the points in the Ghanem and Seringe system, compared to 70% in the Laaveg and Ponseti system. The remaining points are given for assessment of function, radiology and deformity.

Statistical method. The clinical and radiological findings of each patient were statistically analysed using Student’s t-test, where a p-value of 0.05 was considered significant.

Results

The mean follow-up was for 12 years (4 to 32) and the mean age at follow-up 17 years (8.5 to 37).

At the final follow-up, the outcome was considered excellent in 21 feet (26%), good in 40 (51%) (Figs 1 and 2), fair in 14 (18%) and poor in four (5%).

Functional evaluation showed that 72% (57) of feet were free of pain and all wore normal shoes. Children complained of severe and constant pain in only two feet (2.5%) and of occasional mild pain in 20 feet (25%). There was marked insufficiency of the triceps surae muscle in 11 feet (14%) and moderate insufficiency in 18 (23%) using the unilateral jump test on tip-toe. A total of 13 children (22%) were not able to participate in their desired sporting activities.

Clinical examination at final follow-up showed severe subtalar joint stiffness in 52 feet (66%), of which 34 underwent calcaneal wedge resection. Moderate stiffness was found in 20 feet (25%), of which 12 had calcaneal wedge resection. Of these 72 feet, 35 (49%) had stiffness before revision surgery. A total of 24 feet (30%) had an associated subtalar release at revision, but no statistical correlation was found between this procedure and subtalar stiffness at final follow-up (p = 0.45).

Comparison of the pre-operative radiological angles with those at final follow-up showed a significant improvement in all except the dorsoplantar talocalcaneal angle and the lateral calcaneal pitch angle (Table I).

A total of 15 feet (19%) showed dorsal talonavicular subluxation at final follow-up. The tibialis anterior tendon had been lengthened in one-third of these at revision. However, there was no correlation between the lengthening of this tendon and talonavicular subluxation. Nine of these feet had fair or poor results due to poor anatomical and functional problems, but six had good functional results despite poor anatomical realignment. There was a significant negative correlation between dorsal talonavicular subluxation and the final result (p < 0.0001).

Revision was carried out in 11 feet after the age of ten years. Excellent and good results were obtained in nine and two had fair results owing to inadequate anatomical correction and functional limitations. There was no statistically significant correlation between the age at the time of revision and the final result (Student’s t-test, p = 0.699).

Complications. Over-correction into valgus occurred in eight feet (10%). Two had a poor outcome and required triple arthrodesis at skeletal maturity. Two classed as fair underwent further revision surgery by tendon lengthening and osteotomy of the first metatarsal to correct a dorsal bunion. Four had relatively good functional results and further surgery was not indicated. Recurrence occurred in seven feet (9%): one required triple arthrodesis, one tarsectomy and tarsometatarsal arthrodesis, and five no further surgery. A superficial wound infection occurred in one foot which was initially operated on elsewhere through a Cincinnati incision. There were no neurovascular complications.

Discussion

The aim of soft-tissue release in idiopathic CTEV is to obtain anatomical correction and a mobile well-functioning foot. Recurrence requiring revision procedures has been reported in approximately 25% (13% to 50%) of feet. Some detailed algorithms for correction of recurrent CTEV have been described, suggesting that further surgery depends on the severity of the deformity and the age of the patient. There are few reports of further soft-tissue release as the main revision procedure in recurrent idiopathic CTEV, and none of the long-term outcome.

In 1979, Turco described the outcome in feet with resistant CTEV which had failed to respond to non-operative therapy or previous surgical treatment. He used a modified one-stage posteromedial release. The follow-up was between less than two years and 15 years for 202 feet. From 55 feet who had previous surgery, the outcome was excellent or good in 39 (71%). Lehman et al reported 66% excellent and good results after revision surgery (19 of 29 feet), but the average follow-up was only for 30 months. The surgical
method most commonly used for revision in their series was soft-tissue release, either alone or with other procedures, and most of their patients had idiopathic recurrent CTEV. In a second study, Lehman et al reported 81.5% excellent and good results following soft-tissue release and an Evans procedure (22 of 27 feet) after an average follow-up of 5.5 years. Kuo et al performed posteromedial release as revision surgery in recurrent idiopathic CTEV and reported 78% excellent and good outcomes with an average follow-up of 3.25 years. The results of soft-tissue release were favourable in these studies, but the number of feet was generally small and the follow-up short.

Our study is the first to present the mid- to long-term results (4 to 32 years) of further soft-tissue surgery in a large series of children with recurrent idiopathic CTEV. The rate of success in our series compares well with that of previous reports, with excellent and good results in 61 feet (77%). Although soft-tissue release alone has shown good outcomes, additional osteotomies such as the Dwyer, Dillwyn Evans, Lichtblau excision, open wedge osteotomy of the first cuneiform, which may be associated with a closing wedge osteotomy of the cuboid, and metatarsal osteotomies may be needed to complete the correction. Our method of choice in this study was a soft-tissue release, accompanied by a distal calcaneal closing wedge excision as described by Lichtblau for correction of persistent mid-foot adduction when necessary. According to Ghanem et al only 14% of the feet that underwent a Lichtblau procedure developed a rigid or fused calcaneocuboid joint, whereas all the feet that underwent an Evans procedure showed joint fusion. If a wedge resection osteotomy of the cuboid of more than 10° is performed there is a risk of hypertrophy of the base of fifth metatarsal, whereas a wedge excision of the distal calcaneum of up to 30° can be done.

Clinical photographs and a podoscopic view of a six-year-old boy with bilateral idiopathic congenital talipes equinovarus. He had two previous soft-tissue releases on the left foot. a) Lateral and b) posterior view showing equino-cavo-varus adductus deformity of the left foot, c) the podoscopic view shows a bean-shaped left foot.
Release of the subtalar joint was not performed routinely in this series. It has been suggested that there is more stiffness after subtalar release, but most of the feet were stiff before revision and so we were unable to assess this. Release of the subtalar joint has been recommended when the rotational deformity (calcaneopedal block under the talotibiofibular unit) is not adequately corrected.

Dorsal talonavicular subluxation may also increase the chance of a poor outcome.\textsuperscript{19-21} We believe this was due to failure of reduction at the time of revision in almost all feet which presented with such subluxation in this study. Attention should be paid to reduction of the talonavicular joint during pin fixation, which should be performed with the foot in equinus. Lengthening of the tendon of tibialis anterior at the time of first soft-tissue release is said to prevent talonavicular subluxation.\textsuperscript{7} However, there was no statistical correlation between talonavicular subluxation and lengthening or transfer of the tibialis anterior tendon in our
The role of these procedures at the time of revision surgery remains unclear.

Talectomy has been advocated as a salvage procedure for recurrent CTEV to provide a stable, plantigrade and pain-free foot. A long-term study, however, showed 77% fair and poor results requiring further surgery.

Complications such as tibiocalcaneal arthritis, relapse of the deformity, tibiocalcaneal fusion and posterior displacement of the calcaneum occurred in the long term. This technique should be reserved for the persistent rigid CTEV in conditions such as arthrogryposis and myelomeningocele.

The Ilizarov technique may be used as an alternative or an adjunct to further soft-tissue surgery. Correction is achieved through distraction of the soft-tissues alone, associated with soft-tissue release, tendon lengthening or transfer, or with osteotomies and bony distraction. There is no real consensus on this therapeutic option. Satisfactory results have been obtained using the Ilizarov technique associated with soft-tissue release.

However, Freedman, Watts and Otsuka reported 86% fair and poor results using this technique. Many complications have been reported, either in obtaining or maintaining correction by external fixation.

We would advise this method for children with a residual deformity after failed surgery where anatomical correction is not possible by conventional soft-tissue release because of joint stiffness, scarring and the risk of neurovascular complications.

Triple arthrodesis has been suggested as the procedure of choice in children over ten years of age. There is no study that has clarified the results of triple arthrodesis in recurrent idiopathic CTEV. One long-term study of various foot pathologies reported 65% poor results after triple arthrodesis in children with a rigid equinovarus deformity, and an increased risk of the development of arthritis of the ankle and mid- and forefoot in adult life.

Only three feet in this study required triple arthrodesis after skeletal maturity because of over-correction or subsequent relapse. Soft-tissue release was carried out in 11 children over 10 years of age, with 82% excellent and good results in this study. We therefore believe that there is no need for early routine triple arthrodesis, and no age limit should be set for repeat soft-tissue release because the results in this series were independent of the age at the time of revision.

Our findings suggest that revision soft-tissue procedures provide satisfactory anatomical correction and functional improvement following previous failed surgery for idiopathic CTEV. There was a highly significant improvement in most radiological parameters. However, adequate correction did not always relate to the functional outcome. Almost half of the feet graded as fair had poor functional results but good anatomical correction. Joint pain, reduced range of movement and sporting activities, and triceps surae weakness may have affected the functional results. Dorsal talonavicular subluxation is associated with a poor anatomical result.

References