TREATMENT AND PROGNOSIS IN CONGENITAL CLUB FOOT

A. J. HARROLD†, C. J. WALKER

From St Mary's Hospital, Harrow Road, London

One hundred and twenty-nine unselected club feet were classified at birth into three grades of severity; 123 were followed up. The results of primary treatment were analysed and it is shown that the bad feet did worst. Serial splinting in plaster achieved lasting correction in nine in ten mild club feet, in half of the moderately deformed, but in only one in ten of the severely affected. Surgical correction succeeded in two out of three of the resistant feet, but had to be repeated in the others.

In the primary treatment of congenital talipes equino-varus, information on the method of choice and on the results to be expected is still incomplete. The application of corrective splints conflicts with the need to allow the developing foot to be freely exercised and its function explored and expanded. Excessive external force risks irrecoverable damage to cartilage in particular (Trueta and Trias 1961) and surgical division of muscles and ligaments may exact an unanticipated penalty at maturity. Comparison of the methods of primary treatment is made difficult by the lack of definition of the populations under review, for some club feet are notoriously more resistant than others. The deformity involves the skeletal elements from the beginning (Iranian and Sherman 1963; Ippolito and Ponseti 1980), long before term and long before the surgeon can normally expect to be able to begin treatment (Figs 1 and 2). Appreciation of the pathological anatomy induces surprise, not at the frequency of recurrent deformity but at the plasticity of bones that can be persuaded by treatment to grow to normal or near normal shapes.

This paper reports experience of treatment by serial plaster-of-Paris splints and attempts to identify prognostic factors evident at birth. We report on a cohort of unselected children with club feet, all those born in one maternity department over 18 years. All patients in whom the deformity was recognised at birth are included but patients referred from elsewhere have not been added.

MATERIAL AND METHODS

During the 18 years from 1961 to 1978 there were 37402 live births at St Mary’s Hospital, Harrow Road. Of these, 86 children were regarded as suffering from talipes equinovarus, an incidence of 2.30 per thousand, or 1 in 435. In just half the children the deformity was bilateral, making a total of 129 club feet. Of the whole series 50 (58 per cent) were boys.

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* C 1983 British Editorial Society of Bone and Joint Surgery 0301-620X/83/1003-0008 $2.00

THE JOURNAL OF BONE AND JOINT SURGERY

Fig. 1

Fig. 2

Case 1. Postmortem specimens from a girl with a left club foot who was born 14 weeks prematurely and died aged 10 days. Figure 1—The upper aspects of the left and right talus: the left talus is small and its long axis is deviated medially. Figure 2—The upper aspects of the calcanei: the left calcaneus is smaller and is convex laterally.
TREATMENT AND PROGNOSIS IN CONGENITAL CLUB FOOT

Table 1. Grading of club feet at birth

<table>
<thead>
<tr>
<th></th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>18</td>
<td>21</td>
<td>34</td>
<td>73</td>
</tr>
<tr>
<td>Girls</td>
<td>31</td>
<td>11</td>
<td>14</td>
<td>56</td>
</tr>
<tr>
<td>TOTAL</td>
<td>49</td>
<td>32*</td>
<td>48*</td>
<td>129</td>
</tr>
</tbody>
</table>

* Review was not possible in four Grade 2 and two Grade 3 feet

Treatment. In a few of the mildest of the club feet treatment was begun by teaching the mother to stretch the foot repeatedly into dorsiflexion and eversion. For most of the patients, however, treatment was by serial plaster-of-Paris splints. With the foot held by the surgeon firmly towards the position of correction, the plaster is applied over wool from the tips of the toes to the upper thigh. The knee must be at a right angle.

No actual manipulation or stretching is used. The plasters are all applied with the co-operation and assistance of the mother, who supports and diverts the child. When the plaster is changed, a week later, the tissues are found to have yielded through the child's own activities in the splint, and further correction is possible. The varus is corrected before the equinus. The plasters are changed weekly for six to eight weeks and then every two weeks, continuing for two to four months. If a position of full dorsiflexion and eversion is not reached after six or eight weeks this is regarded as a failure of the plaster technique and prompt operative treatment is indicated. At the end of plaster treatment the feet are left free. Night splints are not used. Subsequent relapse to the neutral position or worse requires further measures, either conservative or operative.

Resistant deformity was corrected, between the ages of three days and three months, by a posterior and usually also medial release with formal elongation of the calcaneal tendon and the tibialis posterior tendon, posterior capsulotomy of the ankle and wide capsulotomy of the heel. After three months' treatment in plasters there have been good results for six years with no relapse.

Case 2. Grade 1 or mild club foot. Figure 3—At birth the deformity of the left foot was less severe than the right. Figure 4—Both corrected to the neutral position. After three months treatment in plasters there have been good results for six years with no relapse.

Case 3. Grade 2 or moderate club foot. On each side the deformity (Fig. 5) corrected to just short of neutral (Fig. 6). Relapse after treatment in plaster led to soft-tissue releases at 16 months. The feet were plantigrade and mobile at 13 years old.

Case 4. Grade 3 or severe club foot. Fixed equinus was 45 degrees (Fig. 7) and fixed varus 50 degrees (Fig. 8) on each side. Soft-tissue releases on the third day achieved correction which is still satisfactory 11 years later.
the talonavicular joint with, when necessary, division without suture of the long toe flexors. The leg was then immobilised in plaster for six to eight weeks. When faced with persistently recurrent deformity, an attempt was made to develop corrective forces by transfer of the tibialis posterior tendon, or less often of the tibialis anterior, or by valgus osteotomy of the heel (Dwyer 1963).

RESULTS

In six children (six feet, four Grade 2, two Grade 3) review was not possible. Two died within a few weeks of birth, three left the district immediately, and in one the case notes have been lost. There were therefore 80 children (123 feet) left for review.

Primary care

Manipulation only. Eighteen feet with mild Grade 1 deformity were treated at first by passive manipulation only. Four of these feet (two children) still lacked full movement at six weeks and were then treated by serial plasters without subsequent relapse.

Treatment by serial plasters was applied to 103 feet. In 12 the method failed to produce correction of the deformity and early operative treatment was advised. Of the 91 feet apparently responding favourably to treatment with serial plasters, 43 relapsed and required further procedures. The plasters achieved apparently lasting success in 89 per cent of Grade 1 feet but only 10 per cent success with severely deformed Grade 3 feet (Table II).

Table II. Results of treatment by serial plasters

<table>
<thead>
<tr>
<th>Grade of deformity</th>
<th>Number of feet treated</th>
<th>Apparent success</th>
<th>Mean follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number</td>
<td>Per cent</td>
</tr>
<tr>
<td>Grade 1</td>
<td>35</td>
<td>31</td>
<td>89</td>
</tr>
<tr>
<td>Grade 2</td>
<td>28</td>
<td>13</td>
<td>46</td>
</tr>
<tr>
<td>Grade 3</td>
<td>40</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>103</td>
<td>48</td>
<td></td>
</tr>
</tbody>
</table>

Early operative treatment (before the age of three months), advised for 18 feet, was applied to 15 as one child moved away and one died. In 12 feet it was indicated by the failure of the plaster treatment to achieve correction, and in six others operation was advised for very severe deformity. Sixteen of the feet were initially graded severe and two moderate. In eight of the 15 operated upon no further treatment has been required during a mean follow-up of 85 months, but in the other seven further measures have been considered necessary, in five before the age of two years.

Relapse and later management

There were 43 feet in which, after an initially favourable response to serial plasters, enough deformity returned to need more treatment. In 35 of the 43 the need for this treatment was apparent before the age of three years. A second course of serial plasters was tried on 22 but failed to correct the deformity in 12. In the other 10 correction was obtained, but a subsequent second relapse called for surgical treatment in six. Thus a second course of serial plasters appeared to have had lasting value in only four feet and even of these, three have been followed for only 17 months since the latest plaster, too soon to claim lasting success. In 38 feet operation was advised for relapse after primary treatment with plasters, but was applied to only 33; two children (four feet) left the district and one had multiple defects. The operations were all done after six months of age, the mean age being 26 months; 25 of the 33 were operated on before the age of three years. In five the follow-up is inadequate. In five others more surgical treatment has later been needed at a mean age of 32 months, while 23 feet have remained satisfactory followed to a mean age of nine years.

Results in relation to the initial grade of the deformity

Grade 1. Of the 49 feet with a mild initial deformity, 14 responded to treatment by simple manipulation of the foot by the mother, 31 were treated by plasters from the beginning and four by plasters after the failure of earlier manipulative treatment (Table II). Of these 35 only four needed any further care. In three this took the form of soft-tissue release with satisfactory results and one responded well to a second course of serial plasters.

Grade 2. There were 32 moderately deformed feet, but only 28 were available for review. Of these, 13 responded adequately to one course of serial plasters and showed no relapse during an average follow-up of 65 months. Three more required a second course of plasters, and in 12 operative treatment was judged necessary, in eight before the age of three years. Two of these 12 were lost to follow-up, one needed more treatment, and nine followed to a mean age of 13 years have shown no relapse.

Grade 3. Serial plasters were applied to 40 severely deformed feet. There were 10 feet in which the plasters failed to correct the deformity. In 26 the deformity corrected but relapsed to the extent of needing later surgical treatment. In only four, followed for an average of 81 months, have no further measures been required. In addition there were the six feet with so severe an initial deformity that plaster treatment was not attempted but early operation advised. Thus conservative measures were successful in only four out of forty-six of these severely deformed feet. The results of surgical treatment could be studied in 34 Grade 3 feet. In 11 relapse called for more treatment at a mean age of 33 months, in eight before the third birthday. In 23 nothing more has been needed when followed to a mean age of 70 months, although eight of these had not reached three years when last seen. Of the 13 feet operated on before three months of age, six needed more treatment later. Of the 12 operated on between four and 12 months of age, more treatment was needed in four, and of the nine operated upon over one year of age only one came to more treatment.
Other prognostic factors

Family history. There were 10 children (18 club feet) with a family history; in nine, siblings were affected. The deformity, often bilateral, was also relatively severe, 10 feet being Grade 3, five Grade 2 and three Grade 1. There were no identical twins in this series, but in three of five sets of non-identical twins both twins showed the deformity. Only two feet in this group showed a repeated tendency to relapse.

Bilateral versus unilateral deformity. There was no gross difference in the distribution of the three grades between the children with bilateral and those with unilateral club foot (Table III). Nor did the bilateral cases show any greater tendency to relapse.

Table III. Bilateral versus unilateral deformity

<table>
<thead>
<tr>
<th>Grade</th>
<th>Bilateral Feet</th>
<th>Per cent</th>
<th>Unilateral Feet</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36</td>
<td>42</td>
<td>13</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>21</td>
<td>14</td>
<td>33</td>
</tr>
<tr>
<td>3</td>
<td>32</td>
<td>37</td>
<td>16</td>
<td>37</td>
</tr>
<tr>
<td>TOTAL</td>
<td>86</td>
<td></td>
<td>43</td>
<td></td>
</tr>
</tbody>
</table>

Table IV. Status of the opposite foot

<table>
<thead>
<tr>
<th>Grade</th>
<th>Left foot</th>
<th>Right foot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade 1</td>
<td>Grade 2</td>
</tr>
<tr>
<td>Grade 1</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>Grade 2</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Grade 3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Status of the opposite foot. Although the presence of a normal opposite foot did not appear to confer any protection against severe deformity, in bilateral cases like grades tended to go together (Table IV).

Arthrogyrosis. There were three children with multiple joint deformities. One, with a Grade 2 foot, responded to treatment by plasters only and was satisfactory, although the foot was rather short and cavus 11 years later. One of the two children with severely deformed feet slowly relapsed after plaster treatment and required operative release four years later; while the other relapsed within a few months.

Complications of plaster treatment

Spurious correction of the equinus by dorsiflexion at the midtarsal joint produces a convex sole and can easily occur in a resistant foot if the plaster is moulded to press upwards distal to the midtarsal region. Swelling and pain are warning signs. The diagnosis is confirmed by radiographs showing persistent equinus of the calcaneus. This complication was recognised in 16 feet, 11 of which eventually had a soft-tissue operation. However, in five feet—two followed to the age of four, two to the age of eight and one until 11 years—the problem resolved spontaneously.

DISCUSSION

Denham (1967) classified club feet at birth and found that all of the mild cases, but only 60 per cent of the severe, did well. The results given here show, in more detail, how the prognosis of a club foot at birth can be deduced from the severity of the original deformity. Though serial plaster splints often failed with the severer deformities, surgical release of the tight soft-tissues was no panacea. Even when done within the first three months, in about half the feet further treatment was needed. It must also be noted that in later childhood the children who had had an extensive soft-tissue division, although often presenting mobile plantigrade feet, frequently lacked agility and had difficulty in walking on tiptoe and hopping.

Those feet that relapsed after surgical treatment, the crux of the club foot problem, constituted about 10 per cent of the total. Of the 12 feet in this category in this series, seven achieved a tolerable shape and mobility with persistent treatment, including repeated surgical procedures. Although tarsal movements were lost in the remainder, a plantigrade foot was always obtained.

It is a pleasure to acknowledge the help of Sisters M. Wellbeloved and T. Miller who applied most of the plasters.

REFERENCES