THE FLEXOR-EXTENSOR TRANSPLANT OPERATION FOR CLAW TOES

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Clawing of the toes, like that of the fingers, is the result that one would predict from paralysis of the intrinsic muscles. Nevertheless it has not been possible in most cases of claw toes to demonstrate any actual paralysis or atrophy of these muscles (Taylor 1951).

Strong action of the interossei and lumbricals was considered to be of the highest importance in the function of the foot by both Lambrinudi (1938) and Girdlestone (1947), each of whom devised an operation to restore or replace this action when, as in the case of claw toes, it is seemingly lost. In both operations the power of the long flexors, which in claw toes becomes a deforming force, is put to work to perform the function of the "lost" intrinsics.

In the Lambrinudi operation, by arthrodesis of the interphalangeal joints, the long flexors are persuaded to exert all their action on the metatarso-phalangeal joints. The Lambrinudi procedure is too often regarded as a mere "toe-straightening operation"; but far from simply correcting a static deformity it produces a dynamic redistribution of power which restores function as well as improving appearance. Nevertheless, to fuse healthy joints in the absence of true paralysis is a step that does not commend itself to everybody, and for that reason the Girdlestone operation may appear theoretically more acceptable. There is, however, considerable difference of opinion about the practical merits of the operation, and this uncertainty has prompted the present study of the results of the flexor-extensor transplant.

It would be most instructive to compare the results from the two types of operation but this is not possible unless comparable cases are treated. Here, as elsewhere, it has been customary to confine the tendon transplant operation to cases of mobile clawing of the toes and to perform multiple arthrodeses only when the toes are rigidly clawed. This paper therefore does not purport to discuss the relative merits of the two operations, but merely to review the results of the Girdlestone procedure in those patients in whom it appeared to be the treatment of choice.

MATERIAL

In the records of the Orthopaedic Department of the Royal Victoria Hospital, Belfast, for the ten years 1947-56, information was available on thirty-five patients subjected to the Girdlestone flexor-extensor transplant. Twenty-three of these patients attended for review, and since seventeen had had both feet operated upon there were forty feet in which the result could be assessed subjectively and objectively. The records of the twelve patients who could not be traced were not detailed enough to permit reliable assessment except in three cases. The objective assessment previously made in these three cases (two bilateral, one unilateral) brought the total of feet assessed objectively to forty-five.

Of the total number of twenty-six patients thus included in the study, thirteen were male and thirteen female. Ages ranged from thirteen to fifty-five years, but most of the patients were in their late teens or early twenties.

METHOD

The operation was carried out as described in detail by Taylor (loc. cit.) with only two minor variations: 1) division of the extensor tendons and the posterior capsule of the metatarso-phalangeal joints was carried out as a part of the set operation and not as a preliminary procedure; and 2) the Lambrinudi splint was not used because of the danger of sepsis and ischaemic complications from the necessary stay sutures. It was found that the
toes could be equally well controlled with an extended plaster applied with strong upward pressure beneath the metatarsal heads and with the toes held in flexion at the metatarso-phalangeal joints (Fig. 1).

Each patient was questioned about his complaints before the operation and about the nature and degree of his residual symptoms, if any, at the time of review. Each patient was also asked to give his general assessment of the result of operation. So that these "subjective assessments" might be classified the patients were shown a card (Table I) from which to choose one of five alternative descriptions of the result.

In the objective assessment the following factors were considered: 1) the presence of symptoms, their type and degree; 2) the shape of the toes; 3) the mobility of the toes; 4) the functional efficacy of the transplant as judged from the presence, range and power of active plantarflexion at the metatarso-phalangeal joints; 5) the presence or absence of callosities over the proximal interphalangeal joints and under the metatarsal heads; and 6) other phenomena present only in certain cases.

On these criteria, the result was assessed as excellent, good, fair, poor or bad.

RESULTS

On the whole the patients had a somewhat better opinion of the operation than had the examiner. Table I shows the proportion of feet in each category of result as determined by the patient. Worthwhile improvement (shown in the first two categories) constituted 60 per cent.

Table II shows the result as determined by the examiner (by personal examination in forty feet, from adequate notes in five). Here the first two categories together accounted for only 51 per cent of the feet. This is perhaps surprising because other abnormalities besides
claw toes were frequently present in the feet operated on (most often pes cavus and hallux valgus; occasionally pes valgus and tight tendo calcaneus) and were, of course, uninfluenced by the operation. It was recognised, however, that persistence of these abnormalities would

tend to lower the patients' estimate of the value of operation, and care was taken to explain that their opinion was required of the result only so far as the forefoot was concerned. Even so, a few patients were less satisfied with the result than an objective appraisal warranted. In particular, a youth with "gorilloid" feet, in whom the objective result in the small toes was

regarded as excellent, rated the result in category 4 ("no improvement") because of the unaltered appearance of the abducted hallux. In most of the other cases the rating given by the patient corresponded closely to that allotted by the examiner.

**TABLE I**

<table>
<thead>
<tr>
<th>Group</th>
<th>Description of result</th>
<th>Number of feet</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Complete success</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Marked improvement</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>Slight improvement</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>No change</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Worse than before</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**TABLE II**

<table>
<thead>
<tr>
<th>Result</th>
<th>Number of feet</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Good</td>
<td>18</td>
<td>40</td>
</tr>
<tr>
<td>Fair</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>Poor</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td>Bad</td>
<td>4</td>
<td>9</td>
</tr>
</tbody>
</table>

**FIG. 2**

Case 1—The extensor tendons have regenerated after operation, with consequent recurrence of the deformity.
FIG. 3
Case 2—Left foot before operation.

FIG. 4
Case 2—Appearance of foot after operation. There is a marked improvement in the shape of the toes, and the callosities over the interphalangeal joints are much less obvious.
One other case deserves special mention: that of a patient with marked neurological disturbance of the legs, associated with congenital abnormalities of the spine. This patient classed the result under the category "no change," and the objective assessment was "bad." The patient subsequently had all the toes of both feet amputated. It seems clear that this case was never a suitable one for operation and might justifiably be excluded from the series.

Fig. 5
Case 3—Photographs showing the range of active extension and flexion of the toes after operation. There is a good range of movement at the metatarso-phalangeal joints, but note the poor movement at the interphalangeal joints.

DISCUSSION

The operation cannot be regarded as universally successful. Three causes of imperfect results demand further consideration.

Metatarsal pain and callosities—In no case in which these had been prominent before operation was there significant improvement. Both the pain and the callosities under the metatarsal heads persisted in only slightly diminished degree, even when the transplant appeared to be functioning well.

Stiffness of the interphalangeal joints—This was a common finding. Although passive movement of the metatarso-phalangeal joints was nearly always free, and active flexion of the metatarso-phalangeal joints was good in over half the cases, the interphalangeal joints were stiff as regards both active and passive movement in 60 per cent. whether or not the shape of the toes was satisfactory. Although this may impair the objective result it may not detract from the functional result, as will be mentioned later.

Regeneration of extensor tendons and recurrence of deformity—This was noted in almost 20 per cent of cases. The tendons seem to reattach themselves in a way that makes it appear as if the operation had never been done. In the case illustrated (Fig. 3) there is no doubt that the extensor tendons and the posterior capsule of the metatarso-phalangeal joints were divided. Strange to say, similar regeneration has not occurred in the opposite foot, which was dealt with by an exactly similar technique, and by the same surgeon. I have been unable to find any satisfactory explanation for this perverse and capricious behaviour of the extensor tendons.

Advantages—Despite the drawbacks that have been mentioned the operation has several advantages.

Shape of the toes—This was often markedly improved (Fig. 4), with consequent easier fitting with comfortable shoes. A frequent complaint before operation, especially among women, was the great difficulty in "getting shoes to fit." To many the solution of this problem alone made the operation well worth while.
CORNS—Although metatarsal callosities were generally little relieved by the operation, corns over the interphalangeal joints often disappeared. Even when they persisted they generally became painless.

Walking—This was improved in many instances. The improvement is attributed to the restoration of "intrinsic muscle" action in the toes—that is, active flexion of the metatarso-phalangeal joints (Fig. 5). The improved function of the foot reduces fatigue.

CONCLUSIONS

The forty-five feet here reviewed were operated upon by five different surgeons with only minor variations in technique. Good and poor results were more or less evenly distributed; so the poor results cannot be attributed to any individual errors of technique. Indeed it was not uncommon to find distinct differences in result in the right and left foot of the same patient, both feet having been treated by the same surgeon by exactly the same technique. One can only conclude that the operation is somewhat unpredictable in outcome, and is on the whole far from being an unqualified success.

One conclusion emerged clearly: that the best results were obtained in the patients with the mildest symptoms. Dissatisfaction with the shape of the toes, difficulty in obtaining shoes, and corns on the toes, were all symptoms that could usually be relieved by operation. On the other hand, marked cocking-up of the toes, severe metatarsal discomfort, or painful callosities under the metatarsal heads were but little relieved by operation.

An interesting finding was the stiffness that so often develops in the interphalangeal joints, probably from scarring. This loss of interphalangeal movement, though unforeseen and at first sight undesirable, may not be wholly disadvantageous; indeed it may even contribute to the success of the operation by converting the flexed jointed toe into a rigid lever, thereby enabling the long flexors to act strongly on the metatarso-phalangeal joints as in the Lambrinudi operation. It is thus possible that the successful Girdlestone operation works (at least partly) on the Lambrinudi principle. But this fortuitous stiffness is inferior to that produced by deliberate arthrodesis because the toe may become stiff in flexion. Although a true comparison is not possible here it seems likely that the Lambrinudi operation is in that respect the more satisfactory, and it is the operation of choice when the flexor-extensor transplant operation has failed.

SUMMARY

1. Patients subjected to the flexor-extensor transplant have been reviewed. The results in forty feet were assessed by direct questioning and examination, and the results of a further five operations were assessed from the records.
2. Worthwhile improvement was gained in a little over half the cases. The chances of success are greatest when the symptoms are mildest.
3. The operation appears to be inadequate in certain respects and it seems doubtful whether it has any advantage over the multiple arthrodesis (Lambrinudi) operation.

I wish to thank Mr R. J. W. Withers, Mr N. S. Martin and Mr R. I. Wilson for permission to study their patients and for allowing me the privilege of operating on many of them. I am indebted to Mr R. G. Wood for most of the photographs.

REFERENCES