OSTEOTOMY OF THE NECK OF THE FIRST METATARSAL IN THE TREATMENT OF HALLUX VALGUS

A Follow-up Study of Eighty-two Feet

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Osteotomy of the neck of the first metatarsal bone has been practised for many years in the treatment of hallux valgus. Although various techniques have been described (Hohmann 1948; Mitchell, Fleming, Allen, Glenney and Sanford 1958), we are aware of only one detailed report of results (Mitchell et al. 1958).

This paper presents the results of osteotomy in eighty-two feet, and attempts to define its place in the treatment of hallux valgus.

TECHNIQUE

Metatarsal neck osteotomy has been carried out occasionally over many years at the Royal National Orthopaedic Hospital. The technique at first resembled that described by Hohmann (1948), but modifications have been introduced by several surgeons, notably J. A. Cholmeley, and in recent years the operation has been more frequently performed using the standardised technique now to be outlined.

Through a longitudinal dorsi-medial incision the neck of the first metatarsal bone is exposed subperiosteally and divided with an osteotome or Gigli saw just proximal to the joint capsule, along the line indicated in Figure 1; the cortex of the proximal fragment is trimmed so as to leave a stout lateral spike about three-eighths of an inch long and nearer the plantar surface than the dorsal. The metatarsal head is then impacted on to the spike with the toe in neutral position, and this may be facilitated by boring a small hole in the distal fragment. The metatarsal head is thus displaced laterally and a little towards the sole. After closure of the incision a padded below-knee plaster is applied, including the great toe.

All the patients reported here have been operated on by this technique. In six feet the medial capsule of the joint was also tightened by reefing sutures, but this made no difference to the results.
THE PATIENTS

This operation was performed on 128 feet in eighty patients, of whom all but two were female; fifty-two (eighty-two feet) were available for review. The age at operation ranged from twelve to fifty-five, with an average of thirty years. The longest period after operation was six years, the average two and a half years. This is a fairly short interval, but as the results changed little during the period of post-operative observation a provisional assessment is now possible.

FIG. 2
Case 1—Pre-operative and post-operative radiographs of a patient with a good result on both sides.

METHOD OF ASSESSMENT

The patients' complaints before and after operation were the most important factors studied. These were of four types: 1) pain over the medial side of the first metatarsal head; 2) pain under the second, or the second and third, metatarsal heads; 3) difficulty in obtaining comfortable shoes; and 4) the appearance of the foot. The first three will be referred to as exostosis pain, metatarsalgia, and shoe difficulty respectively. The anatomical factors studied
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included 1) correction of the deformity of the great toe, 2) preservation of mobility of the joint, and 3) reduction of the width of the forefoot. Results were classified as follows: 

**Good**—Completely free of symptoms; deformity fully corrected as judged by both patient and surgeon; normal mobility of the joint. 

**Satisfactory**—Symptoms absent or so reduced as to cause no inconvenience; deformity considered by the patient to be fully corrected. 

**Poor**—If any post-operative symptoms were troublesome or so little improved that the patient considered the operation valueless. 

**Bad**—If the patient thought the foot was worse after operation than before.

**RESULTS**

The results in eighty-two feet (Table I) show that four out of five were either good or satisfactory (Figs. 2 and 3).
ANALYSIS OF FAILURES

The seven patients with bad results had clear reasons for regretting the operation. One had non-union, treated by a graft, which resulted in painful hallux rigidus. The other six all developed metatarsalgia which gave them more discomfort than their pre-operative symptoms; in addition three of these had unrelieved exostosis pain.

The post-operative complaints in the nine poor results were a medley of incomplete relief of exostosis pain, mild metatarsalgia, shoe difficulty and uncorrected deformity; no particular symptom predominated.

The following factors in selection and in operative and post-operative technique have been analysed in an attempt to detect the reasons for unsatisfactory results:

TABLE 1
RESULTS OF OPERATION IN EIGHTY-TWO FEET

<table>
<thead>
<tr>
<th>Result</th>
<th>Number</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>21</td>
<td>25.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80.5</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td>Poor</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19.5</td>
</tr>
<tr>
<td>Bad</td>
<td>7</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Selection of cases. Age—Age had no effect on the result, but the selection of cases for operation excluded the common type of older patient with severe deformity or degenerative arthritis. Degree of subluxation—We found some evidence that a good result is less likely after severe subluxation has occurred, though the number of observations is too small for this statement to be conclusive. Although in this series osteotomy has seldom been performed in the presence of gross deformity, in twenty-one feet the subluxation was such that more than one-third of the articular surface of the metatarsal head was exposed. Out of these twenty-one there were four bad results, whereas in the remaining sixty-one feet, in which subluxation was minimal, there were only three bad results.

Presence of metatarsalgia—This operation would not be expected to relieve metatarsalgia, and of twenty-five feet which gave rise to this symptom before operation, twenty continued to do
so afterwards. Although 80 per cent of these patients were satisfied because they had been relieved of the exostosis pain which had been their major complaint, osteotomy should not be performed when metatarsalgia is pronounced.

**Technical errors. Dorsal angulation of distal fragment**—This was assessed by lateral radiography of the weight-bearing foot (Fig. 4). We agree with Mitchell *et al.* (1958) that it is the most important cause of a bad result. Dorsal angulation, by displacing the first metatarsal head from its normal weight-bearing position, throws excessive strain on the heads of the lesser metatarsals, especially the second, and may thus produce metatarsalgia. With the exception of the patient with non-union, all patients with bad results had dorsal angulation of the distal fragment and developed metatarsalgia. By comparison, angulation (though not necessarily pain) was present in 55 per cent of patients with poor results and in 25 per cent of the remainder. Expressed another way, metatarsalgia was four times as frequent in cases with angulation as in those without.

The danger of dorsal angulation was recognised by Hohmann (1948), and it has been customary to avoid weight bearing for at least three weeks after operation to reduce this risk. But since angulation has been observed radiographically during the first week after operation, before weight bearing was allowed, we suspect that it is usually produced at the time of operation and that early weight bearing is irrelevant. For various reasons sixteen of our patients were allowed to take weight within a few days of operation, and they showed no increased incidence of dorsal angulation.

**Inadequate lateral displacement of distal fragment**—Lateral displacement, producing narrowing of the forefoot, is an essential feature of the operation, the subsequent relief from shoe pressure being one of the main factors contributing to a successful result. In three of our seven bad results there was persistent exostosis pain, and in two of these there had been complete failure to displace the metatarsal head laterally; on the other hand, maximal lateral displacement (Fig. 1) always resulted in complete relief of this symptom.

**Post-operative management**—This varied but little and such variations as there were did not affect the result. The usual programme entailed eight weeks in a below-knee plaster, during the first three of which weight bearing was not permitted, but in sixteen cases the non weight bearing period was less than one week. The results in these sixteen did not differ significantly from those in the remainder, and in particular there was no increased incidence of dorsal tilting of the metatarsal head. It would be unwise to assume from this experience that a period of non weight bearing is unnecessary, but we suggest that when firm fixation of the metatarsal head has been obtained and an early post-operative radiograph confirms its stability, then the patient may be allowed to start walking in the plaster.

**COMPLICATIONS**

**Early displacement of the metatarsal head**—Radiographs were always taken during the first week after operation, and in nine feet (11 per cent) they showed an unsatisfactory position—either incorrect angulation or actual displacement of the metatarsal head off an inadequate spike. This was corrected in five feet by manipulation under anaesthesia and in the remaining four by open realignment, without apparent impairment of the result. We believe that this displacement usually occurs during closure of the wound and application of the plaster. Its high incidence is not a criticism of the operation itself, but an indication that meticulous attention to detail is required throughout.

**Non-union**—The only major complication was non-union, which occurred twice. In one case, in which the patient had persistent pain on weight bearing, treatment was by an iliac bail-graft; this produced sound union, but painful hallux rigidus developed and the result was bad. In the other case non-union was a surprising radiological finding at review fourteen months after operation; there was dorsal angulation of the distal fragment associated with mild metatarsalgia,
and the result was poor. The cause of non-union in these two cases is unknown; the operative technique was not unusual in any way, and the periods of non-weight-bearing and immobilisation after operation were rather longer than average.

**Loss of mobility at the first metatarso-phalangeal joint**—In many cases there was slight loss of mobility after operation, but, apart from the one case of hallux rigidus after a grafting operation for non-union, an adequate painless range of movement with normal voluntary control was always preserved.

**Shortening of the first metatarsal**—Some shortening of the first metatarsal is inevitable and averaged six millimetres as measured radiologically. Unsatisfactory results were not related to excessive shortening; recession of the great toe was rarely obvious, and in no case did the patient complain of it. Fear of shortening the first metatarsal should therefore not deter the surgeon from fashioning a spike adequate for secure fixation.

**DISCUSSION**

Operations for hallux valgus are either corrective, with the aim of restoring the foot to approximate normality, or palliative, with the aim merely of abolishing the most painful features of the deformity. Both types have their place, and we believe that the best results will be achieved not by rigid adherence to any particular technique, but by careful choice of operation for the individual foot. This discussion therefore will be concerned mainly with the *modus operandi* of metatarsal neck osteotomy and its place in the treatment of hallux valgus in general, and only briefly with such technical details as are essential to a successful result.

**Modus operandi**—The principal effect of this operation is to narrow the forefoot without deranging the first metatarso-phalangeal joint. In addition to this the lateral shift and slight proximal displacement of the distal fragment relax the conjoined tendon of adductor hallucis and the lateral head of flexor hallucis brevis, thus permitting realignment of the great toe. Fifty-one of the eighty-two feet had some degree of subluxation before operation and in thirty-one of these it was reduced and remained so throughout the period of follow-up. This complete restitution is, however, a bonus and not the chief aim of the operation, for when subluxation has been present for several years it is questionable whether anything is gained by abolishing it.

**Selection of cases**—There are two main contra-indications to osteotomy: degenerative arthritis in the great toe joint and troublesome metatarsalgia. Osteotomy will not relieve the latter, and if inaccurately performed may make it worse. It is most valuable where there is moderate deformity, no arthritis, and symptoms are entirely due to the width of the forefoot (exostosis pain and shoe difficulty). This type of foot is most commonly seen in young adults and adolescents, but when it is encountered in middle age and later we still consider it suitable for osteotomy.

Should osteotomy of the metatarsal neck be practised in the adolescent or young adult with deformity but without symptoms? There has been natural reluctance to advise any operation for this type of case, because there has been no method of forecasting which foot would become troublesome later, and because the results of operation have been uncertain. It has been shown (Piggott 1960) that in these young patients there are three prognostic groups. 1) The joint surfaces are in normal relationship and the valgus is caused by exaggeration of the normal angles between them and the long axes of their supporting bones; this is not a true deformity and does not progress. 2) The proximal phalanx is deviated to the lateral limit of the metatarsal head, but is not subluxated; this may remain stationary or progress to 3) subluxation. When this is present deformity is likely to be progressive. It may therefore be justifiable in the presence of subluxation to undertake prophylactic surgery if consistently good results can be assured. This is a formidable proviso, but since nearly all the bad results reported here were due to faulty selection or technique we believe that osteotomy of the metatarsal neck, properly applied, is a reliable operation. So far we have little knowledge of the long-term
results, but no case of severe relapse after satisfactory initial correction has been seen up to five years and ten months after operation.

Correction by tendon transfer and capsulotomy of the McBride type (McBride 1928) should also be considered in this connection. When subluxation has been present for only a short time and the articular surfaces are still fully compatible, this type of operation may prove to be better than osteotomy. These matters can be settled only after much more experience has been accumulated, but we suggest that prophylactic surgery should now be given a trial, limited to those potentially bad feet which show subluxation at an early stage.

Operative technique—No claim is made that the spike technique of osteotomy described in this paper is superior to those of Hohmann (1948), Mitchell et al. (1958) and others. If the principles of the operation are understood and the technique is precise the manner in which the required displacement of the metatarsal head is achieved matters but little. Adequate lateral displacement is essential, and to achieve this the osteotomy must be as far distal as possible, in the broadest part of the neck. It is most important to avoid dorsal angulation of the metatarsal head; thus the spike on the proximal fragment must be towards the plantar aspect and the great toe must be immobilised in slight plantar flexion.

SUMMARY

1. Correction of hallux valgus by spike osteotomy of the neck of the first metatarsal is described, and the results in eighty-two feet are presented.
2. A high proportion of satisfactory results can be obtained, but great care is needed in both selection and technique.
3. The ideal case is one of moderate deformity, without degenerative arthritis, and with symptoms referable to increased width of the forefoot; the operation should not be performed in cases with obvious degenerative change, nor when metatarsalgia is a prominent symptom.
4. It is important to displace the metatarsal head as far laterally as possible, and vital to avoid dorsal angulation or displacement.
5. It is suggested that enough is now known about the natural evolution of hallux valgus and the results of some operations for prophylactic surgery to be undertaken in carefully selected cases.

It is a pleasant duty to express our thanks to the surgical staff of the Royal National Orthopaedic Hospital for permission to examine their patients, and in particular to Mr A. T. Fripp and Mr J. A. Cholmeley, at whose suggestion this study was undertaken: and to the staffs of the Medical Records and Radiographic Departments of the Royal National Orthopaedic Hospital and of the Photographic Department of the Institute of Orthopaedics for their untiring assistance.

REFERENCES