BONE PEG ARTHRODESIS OF THE FIRST
METATARSO-PHALANGEAL JOINT

By G. S. Tupman, M.B., F.R.C.S.
Senior Orthopaedic Registrar, Bath Clinical Area

This paper is a review of 33 cases of metatarso-
phalangeal fusion of the hallux, using an intra-
medullary beef bone peg as a graft, the indications
for adopting the operation, its technique and the
results derived therefrom. This operation has
been performed in Bath, since the beginning of
1955, and is presented as one of simplicity, free
from complication and with a high degree of
success.

In 1952 Duncan McKeever described a method
of arthrodesing this joint, by means of a screw
inserted across the excised joint, the head of the
screw lying under the proximal phalanx, the screw
itself occupying the whole of the medulla of the
metatarsal shaft. He appeared to be wholly
satisfied with the results, but patients who have
had this type of fusion have, on occasion, com-
plained of pain over the screw head on walking,
with loss of the efficient functioning of the long
flexor of the toe, an all-important factor in
securing a satisfactory gait. In addition, the
presence of the metallic foreign body in the
metatarsal shaft has on one occasion provoked a
bony reaction with periosteal new bone formation,
and cavitation of the metatarsal, accompanied by
severe pain.

These complications have necessitated removal
of the screw, a task which is not always simple
and which subjects the patient to a second opera-
tive procedure.

The method of fusion to be described obviates
these complications.

Indications for Arthrodesis

There has been described in orthopaedic
literature a multitude of operative procedures for
arthritic conditions of the first metatarso-
phalangeal joint. Among these have been attempts
to correct, by osteotomy, the direction of the first
metatarsal in metatarsus primus varus in young
adults, the basic deformity of this age. Various
operations described by Keller, Mayo and Girdle-
stone have been adopted to correct hallux valgus
in the adult group, and of these, Keller’s operation
appears to have stood the test of time. A review,
however, by Holden at Guy’s Hospital of 72 cases
of hallus valgus treated in this way showed
25 per cent. good results with 25 per cent. poor,
the other 50 per cent. showing only some im-
provement. There is a certain group of cases of
hallux valgus in which Keller’s operation gives
unsatisfactory results, and these may be classified
under the heading of splaying of the forefoot,
especially when associated with a short elevated
first metatarsal. Examination of the foot reveals
the presence of callosities under the second and

Fig. 1.—X-ray showing osteitis of the first metatarsal
on the right side. (Two years after operation.)
third metatarsal heads, with clawing of the toes and even subluxation of the proximal joints of the toes.

Due to intrinsic muscle weakness, the metatarsal arch becomes flattened and widened with accompanying incompetence of the medial segment of the foot. To weaken and lessen the stability of this segment by shortening the hallux and establishing a pseudoarthrosis at the site of the metatarso-phalangeal joint is to increase the burden thrown on the already overtaxed metatarsal arch. By the correction of gross deformity of the hallux, and its maintenance by arthrodesis, not only is the shape of the foot restored but added stability and preservation of the length of the medial segment is achieved.

The results of Keller's operation for hallux rigidus, whether secondary to metatarsus elevatus or trauma, have not been universally satisfactory, and many surgeons have preferred arthrodesis of the joint as a procedure carrying greater success.

Other conditions of this joint which have been found to benefit from fusion include the failed Keller's in which a painful pseudoarthrosis is present, often accompanied by the inability of the flexor hallucis longus to adequately control the false joint during walking.

The grossly deformed and valgus toes found in many cases of rheumatoid arthritis, where particularly the intrinsic muscles of the foot are almost non-existent, have given gratifying results from fusion, and have facilitated the fitting of suitable surgical footwear.

In certain distributions of paralysis in poliomyelitis a flail metatarso-phalangeal joint may present some difficulty, when the patient attempts to put the shoe on; fusion of the joint facilitates this manoeuvre.

In summing up the indications for this operation it is to be emphasized that arthrodesis is in no way offered as a substitute for Keller's operation, but is adopted where pre-operative assessment leads one to believe that the latter would be followed by increasing forefoot pain. In addition, it must be emphasized that the interphalangeal joint of the hallux must be fully mobile and free...
from clinical and radiological evidence of arthritic change.

Position of the Arthrodesis

In planning the operation the optimum position in which to fuse the joint should be carefully considered, and in this one should be guided by the type of footwear which the patient has been accustomed to wearing. The higher the heel, the less obtuse must be the angle of fusion to facilitate the donning of the shoe, and to maintain the 'take off' position of the toe in walking. The most satisfactory angle of fusion varies from 15 to 30 degrees of the phalanx on the metatarsal, the greater angle (30 degrees) being most favoured by women.

Technique of Operation

The operation is performed with the aid of a thigh tourniquet, the incision being curved on the dorso medial aspect of the toe, its centre opposite the metatarso-phalangeal joint. Soft tissue dissection lays bare the capsule of the joint and any adventitious bursae are excised. Bone levers are used to embrace the metatarsal neck, the long extensor tendon then falling laterally out of danger. The joint is then opened from the dorsal surface, flexing the toe to facilitate this manoeuvre. Remnants of the capsule are removed from the bone edges and an osteotome used to trim down the metatarsal head, to give as near a straight medial border as possible. Any dorsal exostoses are also removed. The joint surfaces are denuded of cartilage, the metatarsal being shaped to set the correct angle of arthrodesis, great care being taken to preserve the integrity of the flexor tendon, sesamoids and the adductor of the toe. Drill holes, the same size as the bone peg, are made to the depth of 1 inch into the metatarsal shaft and ½ inch into the phalanx. The drill should not be of greater diameter than the peg as the latter tends to pass too far into the shaft of the bone. A beef bone peg is then introduced into the metatarsal and trimmed down to leave ½ inch or less of peg projecting. The phalanx is then impaled on the peg, and the bone surfaces apposed. No force is necessary in this procedure and impaction can be effected by a screwing movement. The tension of the soft tissues exerts almost a compressing effect, and the arthrodesis feels quite stable from the outset. After closure of the soft tissues a padded split-below-knee plaster cast is applied with a hood over the hallux, and the tourniquet removed. Sutures are removed at three weeks and a walking plaster applied for a further six to eight weeks. During the post-operative period it is important that the patient should be encouraged to practise exercises to effect the efficient flexion of the terminal joint of the hallux.

Analysis of Results

There were no immediate post-operative complications in this series and sepsis was nil; 33 arthrodeses have been performed on 30 patients, of whom 26 were women and four were men.

Bony arthrodesis has been sound both clinically and radiologically in 30 cases (90 per cent.), with satisfactory walking and a painless foot of good shape. There was no difficulty with shoes, many of the women patients being able to wear shoes which had been denied them for years. One woman patient was employed by the post office, delivering letters, an occupation which she was forced to abandon until her operation. She now walks 8 miles a day. All the women were able to walk the long distances entailed by a day's shopping. Established non-union, or union of doubt, occurred in three cases (10 per cent.), and one of these was entirely satisfied with the result. Failure of union on investigation was found to be due to too early resumption of unprotected weight bearing, as X-ray showed that these patients had broken their bone pegs and had been released from plaster at between six and eight weeks.

Two of the men were farmers and were able to negotiate rough ground without trouble. The feet of some of the women suffering from rheumatoid arthritis appeared at first sight to be beyond salvage.

The length of time of immobilization should be a minimum of ten weeks, which is a considerable time, but on questioning patients at review they expressed no regrets and were well satisfied with the results.

Summary

A review of 33 cases of arthrodesis of the first metatarso-phalangeal joint by intramedullary bone peg is presented.
The indications for operation and its technique are described.

Sound bony arthrodesis was achieved in 90 per cent. of cases.

The length of time of immobilization is justified by the general satisfaction of the patients.

Bone pegs used in this operation were obtained from Down Bros. and Mayer & Phelps Ltd., Mitcham, Surrey.

BIBLIOGRAPHY

HOLDEN, N. T. (1954), Guy's Hospital Report, 103, 274.


CARDIAC DISEASE

Price 4s. 0d. post free

INTRODUCTION
Walter Somerville, M.D., M.R.C.P.

ANGIOGRAPHY

BEDSIDE DIAGNOSIS OF CONGENITAL HEART DISEASE
Walter Somerville, M.D., M.R.C.P.

SURGICAL TREATMENT OF CONGENITAL HEART DISEASE
W. P. Cleland, M.R.C.P., F.R.C.S.

PREGNANCY AND RHEUMATIC HEART DISEASE
Samuel Oram, M.D., F.R.C.P.

DRUG TREATMENT OF HYPERTENSION
E. G. McQueen, M.B., M.R.C.P., and F. H. Smirk, M.D., F.R.C.P.

TREATMENT OF BACTERIAL ENDOCARDITIS

THE MANAGEMENT OF COR PULMONALE
J. F. Goodwin, M.D., M.R.C.P.

THE CARDIAC RISK IN ANAESTHESIA AND SURGERY
Graham W. Hayward, M.D., F.R.C.P.

Published by
THE FELLOWSHIP OF POSTGRADUATE MEDICINE
60, Portland Place, London, W.1

RUTHIN CASTLE, NORTH WALES

A Clinic for the diagnosis and treatment of Internal Diseases (except Mental or Infectious Diseases). The Clinic is provided with a staff of doctors, nurses, technicians, modern Radiological and Physiotherapy departments.

The surroundings are beautiful. The climate is mild. There is central heating throughout. The annual rainfall is 30.5 inches, that is less than the average for England.

The Fees are inclusive and vary according to the room occupied.

For particulars apply to THE SECRETARY, Ruthin Castle, North Wales.

Telegrams: Castle, Ruthin
Telephone: Ruthin 66