Observations

ON

THE TREATMENT OF FRACTURES INVOLVING
THE ANKLE-JOINT.*

BY

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SINCE the days of Pott and Dupuytren fractures involving the ankle-joint have received much consideration, though not too much, in view of the disabilities which may follow in their train. Apart from the classical fractures, as usually described, the great importance of the anterior and posterior marginal fractures of the tibia was emphasized by Cotton in 1915,¹ and more recently by Ashurst.² It should always be remembered, however, that Astley Cooper described the posterior marginal fracture in 1822.

TYPES OF ANKLE FRACTURE.

Three years ago the British Orthopaedic Association, at its meeting in Manchester, discussed ankle fractures at some length, and I fear that it is not possible for anyone to break much new ground to-day. In considering my contribution to this discussion it seemed to me that an outline of the treatment adopted and the results obtained in a series of my own cases would be of most use. Beyond this, I propose to review a number of isolated cases which have offered more than the usual difficulties in their treatment. The incidence of the various types of fractures at the ankle is shown by the following summary of 100 cases radiographed at Salford Royal Hospital between December, 1927, and November, 1928.

Summary of 100 Consecutive Cases (Radiographic Findings) at Salford Royal Hospital, December 12th, 1927, to November 30th, 1928.

External malleolus	44
Internal malleolus	14
Fibula and internal malleolus and tibial epiphysis...	15
Both malleoli	12
Tibia and external malleolus	2
Posterior margin fractures (with malleoli)	7
Anterior margin fractures (alone 1; with external malleolus 1)	2
Astragalus with malleolus (internal 1, external 2) ...	3
Cuboid with malleolus (external)	1
Total	100

You will notice the large percentage of the simpler type of isolated fracture of the external malleolus. In this connexion I would like to refer for a moment to a point in the mechanism of production of fractures of the ankle. Although, as each one of us can testify, the most usual direction for the foot to turn in an ankle "twist" is towards a varus, or inverted, position, we find that not more than 3 or 4 per cent. of fractures occur which can be described as having been brought about by a forced inversion. What is the reason? Why are 90 per cent. or more of our ankle fractures due to an abduction, or valgus, twist? I believe that many a man avoids a serious fracture because, when his ankle turns into a sudden inversion, he follows it with his body, as the wrestler is taught to do, and so takes the strain. He gives way with the force, and the strain is distributed. In the reverse position it is not possible to give way similarly, and the full straining force falls on the ankle mortise.

The proportion of external malleolus fractures in this list is very close to that shown by an earlier series of 100 fractures, collected prior to the end of 1925 in order to allow us to estimate the ultimate results. As many of you know, it is a matter of some difficulty to trace end-results in hospital cases. The poorer classes are apt

to change their residences frequently and so become lost; others are too careless or too illiterate to reply to the answers on the questionnaire with accuracy. The registrar's office sent out 100 circulars to the consecutive cases prior to December 31st, 1925, and about 65 replies were received. Further cases, continuing the series, were then approached, and, after writing to about 150 patients, complete replies from 100 were obtained, and investigated. The following table embodies, therefore, not strictly a consecutive 100 fractures, but 100 consecutive replies. The proportions, however, fall closely into line with most other series, and I give them as representing our results.

End-results in 100 Consecutive Cases of Ankle Fracture prior to the End of 1925.

	Cases.
External malleolus	42
Returned to former work	39
Average time off work eight weeks.	
Internal malleolus	8
Returned to former work	8
Average time off work eleven weeks.	
Both malleoli, fibula and internal malleolus	35
Returned to former work	30
Average time off work nineteen weeks.	
Marginal fractures	12
Returned to former work	9
Average time off work twenty-six weeks.	
Fibula with dislocation astragalus	1
Returned to former work	1
Away from work twenty-three weeks.	
Fibula, internal malleolus, and astragalus	2
Returned to former work	2
Away from work seventeen and eighteen weeks.	
Total	100

Out of 100 cases, all varieties, there returned to original work 89 per cent. Average time off work fourteen weeks.

In our discussion in 1925, to which I have already referred, one of the speakers reported end-results and provided a series of 60 cases. These were further subdivided into Pott's fractures 20, external malleolus 14, both malleoli 8, various others 18. The first group included all cases which had a fracture of the fibula near the lower end, with displacement of the foot outwards, and some definite sign of injury to the inner ankle. The speaker found that out of his 14 cases of external malleolus fracture 14 had returned to work. A computation of 100 per cent. returns to work in this type of fracture was therefore made. Nothing approaching this recovery rate had ever been hoped for, and the speaker's conclusion was, of course, fallacious. There is no greater error than to calculate percentages on fewer than 100 cases. No one could say what would be the end of the other 86 cases still needed to complete the 100. In series of fewer than 100 only the actual figures can be accepted.

TREATMENT OF FRACTURE AT THE ANKLE.

On arriving at hospital the limb should be placed on a temporary splint for transport to the radiological department. At least two views of the fracture must be taken, lateral and antero-posterior, and the result carefully scrutinized for the less obvious displacements. The gross fractures and dislocations are easily seen, but the lesser degrees of departure from the normal must not be overlooked. With this in mind, I would like to show the radiograms of a fracture which I was asked to see recently. The patient had stumbled and twisted the foot, at the same time plantar-flexing the ankle. The practitioner in charge sent the patient for radiological examination, and with the pictures came the report: "Fracture of external malleolus. There is no displacement."

On the strength of this report the foot was not subjected to any manipulation, but was left to rest on a pillow, and massage was commenced. The ankle became more painful, and refused to allow any movement at all in the direction of dorsiflexion. I was asked to see it, and found the foot plantar-flexed, with some prominence of the

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astragalus in front. The radiogram showed quite a definite displacement forwards of the astragalus (Fig. 1). There is no doubt that had the ankle been left as it

FIG. 1.

FIG. 1.—Abduction fracture of external malleolus; subluxation forwards of foot at ankle-joint.

FIG. 2.

FIG. 2.—Same case as Fig. 1; subluxation reduced.

was there would have been a very tedious recovery and probably some permanent loss of ankle movement. Under gas anaesthesia I dorsiflexed the foot, with the result shown in Fig. 2. At the end of forty-eight hours the patient himself was able to perform a reasonable degree of dorsiflexion. I would therefore ask radiologists to be especially careful in their reading of the radiograms of injuries before reporting "no displacement," and particularly so if the patient is going home under the care of his general practitioner, who may be relying very largely on the radiologist's report for guidance in treatment.

Reduction of Displacement.

When displacements are revealed by the radiograms, those usually to be overcome are: (1) eversion of the foot; (2) backward displacement of the foot; (3) some degree of equinus; (4) separation of the tibia and fibula. As good an anatomical reduction as possible must be aimed at. It is true that good functional results are seen in which the anatomical result is imperfect, but, on the other hand, there are extremely few poor functional results where a correct anatomical reduction has been obtained. It does occasionally happen that, despite the best of treatment and the most careful reduction, the ankle remains painful. The reason is the development of a traumatic osteo-arthritis. In such a case further treatment, to which I shall refer later, will probably be required.

The displacement having been determined, a general anaesthetic is given and the calf muscles are fully relaxed by flexing the knee. The heel is grasped firmly and drawn forwards whilst the other hand fixes the lower leg. The backward displacement is completely overcome, and the ankle is then dorsiflexed with the foot inverted to approximate the astragalus and internal malleolus (Figs. 3 to 8).

Methods of Fixation.

Our most useful method of fixation is undoubtedly a plaster-of-Paris cast. In the simpler injuries, such as those of the external malleolus only, with no tendency to redisplacement, a plaster strip, as advocated by Kellogg Speed, is sufficient, alone or reinforced with a bandage circularly applied. The ambulatory plaster splint described by Delbet in 1916, consisting of two laterally placed plaster splints fixed by transverse strips to the sides of the leg at the malleoli and below the knee, is easily applied, and is much used in some hospitals. The splint was originally intended for fractures of the leg bones. The apparatus allows movement of both ankle- and knee-joints, and after a week or ten days the patients are encouraged to walk in the plaster splint. Delbet also advised its employment in ankle injuries, and reported 53 good results in 55 cases. My own experience of Delbet's splint is small but increasing, and I am sure that it is a most useful appliance. I have observed that not infrequently more than one plaster is required, and Delbet himself found that of 123 cases in which the splint had been used, 68 cases needed a second

cast, 28 needed a third cast, 3 needed even a fourth cast, and only 20 cases got through on one splint.

The plaster splint which I have chiefly used extends from the toes to below the knee. It is, of course, completely unnecessary to fix the knee-joint in a fracture so low down as an ankle fracture. The cast is split laterally along both sides, so as to permit constant inspection and early massage. All the fractures of the external malleolus alone, and others which show no tendency to displacement, are given massage almost at once and are encouraged to commence active ankle movement after two or three days. The fractures which have shown a tendency to redisplacement are retained in the position of reduction for a longer period, varying with the individual case, but always a minimal one. In some few cases of severe marginal fracture with backward displacement of the foot there is difficulty in maintaining even the

FIG. 3.

FIG. 3.—Posterior marginal fracture of tibia; fracture of external malleolus; backward displacement of foot.

FIG. 4.

FIG. 4.—Same case as Fig. 3; displacement reduced.

FIG. 5.

FIG. 5.—Fracture of internal malleolus and astragalus.

FIG. 6.

FIG. 6.—Same case reduced.

FIG. 7.—Lateral view of Fig. 5.

FIG. 8.—Same after reduction.

smallest degree of dorsiflexion after reduction. The tendo Achillis becomes tightened and the obliquity of the line of fracture allows the tibia to slip forwards again. In these circumstances a tenotomy of the tendo Achillis is an

advantage, and I do not hesitate to perform it. In cases of severe comminution at the ankle, sometimes also further complicated by a compound wound, Steinmann's pin and direct traction on a Thomas knee splint are very valuable. After union has occurred all our ankle fractures, except those in children or a few of the more simple fractures in adults, are fitted with a wedged boot and an outside brace to prevent any tendency to valgus when weight-bearing starts.

The question as to the form of splint, however, is of small importance compared with the ability of the individual to use his appliances properly. For anyone to say that this or that splint is the only proper one to use is a mere conceit. Each one should learn to use an apparatus with which he can produce an efficient result, and strive to make his technique with his apparatus as perfect as possible.

Operative Measures.

Operative measures, in recent cases, should be adopted only if the displacement cannot be reduced satisfactorily, or if it cannot be maintained by the usual routine methods. Many have pointed out, and with good reason, the danger of using screws, plates, or other foreign bodies in the presence of a wound, but in several cases of severe displacement, with the tibia fragment projecting through the skin over the internal malleolus, I have fixed the fibula with a plate and screws, merely as a temporary measure.

FIG. 9.

FIG. 10.

FIG. 9.—Very oblique fracture of tibia, almost compound.
FIG. 10.—Fixation by pin.

The tibial wound is cleaned or extirpated and the fibular wound kept completely shut off. After a short time the plate is removed, usually in two to three weeks. On other occasions, in similar fractures which have stopped short of becoming compound, I have used a screw running from side to side across the lower end of the tibia. (Figs. 9 and 10.)

With severe dislocation of the astragalus, and especially if it should be rotated on a vertical axis, open operation will almost certainly be required. In one of my cases there was a rotation of 90 degrees, the astragalus lying transversely across the fractured mortise. On exposure it was found that all its ligaments, save a few shreds, were torn across. The bone was replaced in position, and although it had no blood supply, and must for a period have survived by means of the synovial fluid, lymph, and blood serum surrounding it, there was a very complete recovery and a range of movement hardly limited at all.

OLD-STANDING CASES OF INCOMPLETE REDUCTION.

This is a group of cases where considerable disability has resulted from an incomplete reduction, usually a failure to correct valgus or to reduce a backward dislocation of the foot. Almost every case in this group requires operative treatment. Every one has to be considered individually, and it is impossible to generalize. I know of no cases requiring greater judgement or more resource; they are among the most difficult cases in the surgery of the extremities. The operative measures decided upon

must be most thoughtfully conceived and carefully carried out in every detail, and I would not advise any surgeon who is not familiar with this class of work to experiment with it. I have illustrations of four such cases.

The first case is that of a young man of 25 years, who had a bad eversion fracture ten years before I was asked to see him.

FIG. 11.

FIG. 12.

FIG. 11.—Old posterior marginal fracture, unreduced.
FIG. 12.—The same, reduced and fixed by ivory pin.

There was a much-everted foot and considerable pain. I performed a cuneiform osteotomy of the tibia and a linear of the fibula. The foot was forced over into varus. The tibia united, but a year later the fibula had not united, and was giving pain. I placed an inlay bone graft in it, and since it has united the foot has become strong, so that he has now been back at heavy labouring work for two years. His range of ankle flexion and extension is from 75 to 120 degrees.

The next case was that of a middle-aged woman who suffered from an unreduced posterior marginal fracture, which occurred two years before. Walking was impossible. The fracture was reconstructed, and the displacement reduced. An ivory pin was driven from back to front of the tibia, and the use of the ankle, whilst not normal, is greatly improved, and walking has become comfortable. (Figs. 11 and 12.)

It happens in some instances that an ankle is so painful that weight-bearing is impossible, and with or without operative treatment, reconstructive or otherwise, the patient gets no relief. I do not hesitate, in such a case, to recommend an arthrodesis of the ankle-joint. There is no doubt that a well-arthrodesed ankle is infinitely superior to one in which a moderate result has been obtained by means of a reconstruction operation.

The last case to which I wish to refer is that of a young man who had suffered in childhood from a separation of the lower tibial

FIG. 13.

FIG. 14.

Result of old separation of tibial epiphysis.

epiphysis, and in whose ankle, as growth had been interfered with, there resulted a gross deformity, which had become so bad that it was with much difficulty that he hobbled along. The appearance was as shown in the cast. (Figs. 13 and 14.) Radiograms showed a varus deformity, the fibula being curved to fit round the varus and the ankle-joint deflected more than half a right angle.

(Fig. 15.) A wedge was removed from the fibula; the tibia was divided transversely and opened out, and the gap filled up as far as possible by the piece of fibula and by shavings from the side of the tibia. Union is good, and a useful foot has been obtained. The appearance and function are now excellent. (Figs. 16 and 17.)

FIG. 15.—Pre-operative radiogram.

FIG. 16.—After osteotomies and graft.

FIG. 17.—Present appearance.

In conclusion, I would emphasize that function is the ultimate test of treatment, and I know of no better evidence of restoration of function than a return of the individual to his pre-accident work. I stress "pre-accident" because in some estimates of end-results a return to "work" has been accepted. The 1908 article of Clinton Dent, which has been so often quoted, stated: "I can hardly recall a case of Pott's or Dupuytren's fracture where recovery has been good enough to permit a man to return to police work. Among the Metropolitan Police 30 per cent. of all ankle injuries failed to recover for work."

This was a very serious state of affairs, and I hope that I have shown that some progress has been made since that time. Many causes have brought about this improvement, but none, I think, so much as the treatment of the fractures by one department. If you will permit me, I would like to quote the substance of two paragraphs in an article which I wrote for the *British Medical Journal* in 1921. The article was headed "The hospital treatment of fractures."

In order to ensure the most perfect functional result which is possible it is desirable that the same surgeon should supervise the case from start to finish. He should be entirely responsible for the case whilst in the wards; he should supervise its manipulation and splinting, its early massage and, on discharge, its progress through the out-patient and physio-therapeutic departments. In hospitals which have no special department for orthopaedics a member, or members, of the surgical staff should be selected to take charge of the fractures. The number of beds which should be allotted to them for this purpose will, in an industrial area, be about 10 per cent. of the total surgical beds of the hospital.

This arrangement, by which the continual supervision is under one control, has been responsible more than any other single factor for the improvement which may have been obtained in our fracture results.

CONCLUSIONS.

1. Reduction of all displacements should be carried out as thoroughly and as early as possible.
2. A suitable splint which will permit constant inspection, early massage, and active movements at the earliest time should be applied.
3. Open operation in recent cases should be reserved for those in which the displacement cannot be satisfactorily reduced or maintained.
4. In old cases of mal-union operation is indicated.
5. In compiling statistics of end-results percentages should not be calculated on less than 100 cases, and "return to work" should mean the pre-accident work.
6. In the present series 89 per cent. of ankle fractures, of all types, returned to pre-accident work.
7. A fracture case, from the time of its arrival at hospital to the time of its discharge to work, should be under the supervision of one surgeon.

REFERENCES.

- ¹ Cotton, F. J.: *Journ. Amer. Med. Assoc.*, 1915. ² Ashurst and Brower: *Arch. of Surg.*, 1922. ³ Ollerenshaw, R.: *British Medical Journal*, April 16th, 1921, p. 559.

THE TREATMENT OF ACUTE DIVERTICULITIS.*

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DIVERTICULITIS, like appendicitis, is, as regards our knowledge of it, a comparatively new disease, and is still considered by many doctors a very rare condition. It was not known to the last generation of surgeons, and cases of the condition were described as "pericolitis sinistra," iliac abscess, etc., and the underlying cause of such states remained unrecognized until recently. It is now a fairly well-recognized condition, although it has hardly found its way yet into the ordinary medical textbooks of the time. Nevertheless, it is by no means an uncommon condition, and is accountable for quite a considerable number of deaths and a still larger number of chronic invalids each year.

SYMPTOMS.

The symptoms are fairly characteristic and, if recognized, are not easily mistaken for anything else. The patient is practically always over 45 years of age, and usually rather stout; for some unexplained reason the condition appears to be quite uncommon in thin persons. The main symptoms are pain in the lower part of the abdomen, tenderness in the left iliac fossa, or just above the pubes, and raised temperature, often accompanied by shivering and mild rigors. The pain is not very acute as a rule, but is distressing, and prevents the patient from moving about freely. The tenderness, if looked for, is very definite and quite characteristic of the condition. Any pressure in the lower left side of the abdomen causes the patient to flinch, and as a rule the area of acute tenderness is very well localized to a certain spot. The temperature is seldom high; usually it ranges from 100° to 101° F. rather than higher. Quite high temperatures are sometimes seen, but are exceptional, except at the onset of an acute perforation, and in this respect it differs from appendicitis, where high temperatures are the rule. Also vomiting, though occasionally a symptom, is a rare one, whereas it is a common symptom at the onset of appendicitis.

Not infrequently a definite resistance or tumour may be felt deep in the pelvis on the left side, and it may be possible to feel this bimanually, either by the rectum or vagina. It need hardly be pointed out that very gentle handling of such a tumour is advisable, or serious consequences may result. Such a swelling can, as a rule, be easily distinguished from a carcinoma of the colon by the fact that it is very definitely tender and that there are obvious symptoms of inflammation present.

The bowels may, or may not, be constipated; on the other hand, there may be a mild diarrhoea from irritation of the colon. In some cases frequency of micturition is a well-marked feature of the case, and when this is present it almost invariably means that the bladder is adherent to the diseased colon and that a perforation from the colon into that organ is threatened. Just as in the case of appendicitis, a dose of castor oil will often precipitate acute symptoms and should on no account be administered.

These symptoms apply, of course, in the main to cases of diverticulitis of the pelvic colon, by far the commonest site, and are considerably modified when the affected portion of the colon is elsewhere. The diagnosis is often extremely difficult when either the ascending or transverse colon is involved, as the symptoms then imitate several other conditions, such as appendicitis, perforated duodenal or gastric ulcer, and cholecystitis.

The acute symptoms may arise from several different causes. Most commonly one or, possibly, two diverticula have become acutely inflamed and caused a small local abscess in the bowel wall, generally just beneath the peritoneum. The inflamed area has become adherent to other structures, such as the bladder, the small intestine, the uterus, or a tube, or sometimes to the abdominal wall. Sometimes a direct perforation into the abdominal cavity is the first symptom, and in such cases a general peritonitis will occur, the exact cause of which may easily be

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