Original Articles.

OPERATIVE TREATMENT OF RESISTANT CLUB-FOOT.¹

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IN presenting this paper written on the subject of the treatment of resistant club-foot by means of radical operation, the statement should be made at the outset that it is not intended to advocate operative interference, even tenotomy, in all cases of club-foot, even of the congenital form. One of the most successful cases of congenital club-foot I am able to report was treated without any operative measures, even tenotomy. The result may be shown by the accompanying foot-print (Fig. 1). The drawings from photographs have already been shown;² but the foot-imprint is even more convincing than the photograph, and warrants the assertion that the feet are now perfectly normal in a child fifteen years of age treated without tenotomy when a year old. This can be seen by a comparison with the imprint of a normal foot (Fig. 2).

In this article investigation will be limited to those cases which, either through previous neglect or bad treatment or the obstinate nature of the deformity, have developed into the most persistent type of the distortion, resisting the simpler measures of treatment. In the 160 cases I have treated there has been no hesitation to perform more radical operations, such as wedge-shaped excision of the tarsus, though this method, as will be seen later, is at present not advocated. While it is readily admitted that the successes of Drs. Taylor, Judson, and Shaffer have shown conclusively that club-foot can be in many instances satisfactorily corrected by means of mechanical treatment alone, in advocating operative measures for the persistent cases, the claim, however, is made that in the severest and most resistant cases cure can be effected more speedily, certainly and safely by proper radical operative measures than by simpler means. As Dr. Morton has well said, some cases of congenital club-foot are corrected without great difficulty and permanently cured, while in others the deformity is resistant, and there is a tendency to relapse; and in treating of club-foot, in some instances time is of importance, and also the inefficiency or poverty of the parents has to be considered. Many resistant cases could be treated by mechanical means alone, provided the parents had sufficient persistency to continue the treatment for six months or a year or longer with daily or frequent visits; but where persistency and attention cannot be commanded, mechanical treatment becomes impossible, and these cases remain doomed to deformity unless some means can be devised which will enable the surgeon to cure in a short time. It is for this reason that operations on the bone, radical in character, are sometimes demanded which otherwise might have been avoided. The choice

is between such methods as involve the least mutilation and give the best results in the speediest time.

Of these methods three deserve careful consideration: (1) Forceful correction, preceded by thorough division of the ligaments and tendons; (2) Removal of the astragalus, an operation frequently performed on the European continent, and advocated lately by Dr. Morton, of Philadelphia³; (3) Osteotomy of the neck of the os calcis and of the astragalus, preceded by careful division of the soft parts of the inner side of the foot.

It is not proposed to consider the claims of wedge-shaped resection of the tarsus, although this method has given good results. But any one who has had experience with it will know that an unnecessary amount of bone is sacrificed where this method is relied upon.

Forceful correction, combined with division of the shortened soft tissues accessible to the knife, will be

FIG. 1. Imprint of foot of a child sixteen years old, treated when one year old for congenital club-foot.

FIG. 2. Imprint of normal foot.

found to be a method which in a large majority even of the most resistant cases will prove entirely satisfactory. It has the advantage of avoiding any unnecessary sacrifice of bony tissue, and has given excellent results.

The accompanying illustrations will serve to show the fact that in cases of the severest type, the method is capable of giving satisfactory results without any sacrifice of bony tissue (Figs. 3, 4, 5, 6).

This case has already been reported in the *Revue d'Orthopédie*, March 1, 1892.

The foot-imprint represents the ultimate result three years after operation, and shows a sole of a foot entirely flat in walking, which three years before had been of the severest type of deformity in a woman thirty-five years of age. A lever wrench was used in correction previous to tenotomy having been done. Two sittings were required as the skin tore on the inner side of the foot at the first, and it was thought advisable to delay complete rectification until a fortnight had passed after the first sitting. The patient was en-

¹ Read before the American Orthopedic Association.

² Transactions American Orthopedic Association, vol. 1.

³ Transactions of American Surgical Association, vol. viii, 1890, p. 71.

abled to walk about with crutches two weeks after the second operation, and a splint was applied one month later. The patient began to walk with the splint and a cane about this time, and she is now able to walk

subcutaneous division of the soft parts preceding forcible correction, in a majority of cases I have employed the subcutaneous method, using a section of the insertion of the anterior and posterior tibialis

FIG. 3. Drawn from photograph of foot of a woman thirty-five years old, suffering from congenital club-foot.

about freely without any appliance. It is now four years after the operation.

She suffered somewhat a year after the operation from the pain of flat-foot, the foot having been over-

FIG. 4. The foot one year after forcible correction.

corrected and the woman being a stout and heavy one. The cure may be considered a complete and permanent one.

In regard to a choice between open incision and

FIG. 5. Foot one year after forcible correction.

anticus tendon and of the scapho-astragaleal ligaments, according to the method recommended by Drs. Parker and Shattock. After some practice with these methods, it has hitherto seemed to me that I have been able, in a majority of cases to satisfactorily divide all of the soft tissues by subcutaneous division. The plantar fascia is divided first: the tenotome is then in-

FIG. 6. Sole-imprint of the same foot three years after forcible correction.

serted on the inner edge of the foot, at a short distance below the internal malleolus, directly towards the scaphoid; it is then passed directly under the sole of the foot, hugging the bone, and drawn inwards and

forwards, keeping close to the edge of the scaphoid as it joins the astragalus. The tenotome is then inserted on the outer side of the foot at the junction between the cuboid and the os calcis. After this, the foot is forcibly corrected, such fibres as have not been thoroughly divided being stretched, and the tendo-Achillis is divided with the tenotome.

FIG. 7.

Fig. 7. Congenital club-foot in a boy six years of age, drawn from a photograph.

FIG. 8.

Fig. 8. After forcible correction.

But in many cases during the past year I have operated by means of an open incision introduced by Dr. Phelps; and I must frankly admit that the readiness with which everything is exposed and the certainty

one. In one case I have seen over-correction in a flat-foot follow too extensive section, but this can be avoided by proper judgment.

FIG. 9.

Fig. 9. Plaster-of-Paris imprint from a boy of eleven, after excision of astragalus for resistant club-foot.

FIG. 10.

Fig. 10. Drawn from photograph of foot of a boy of eleven, after osteotomy of neck of astragalus for club-foot.

FIG. 11. Sore-imprint after removal of astragalus for club-foot.

FIG. 12. Drawn from photograph after removal of astragalus of left foot for club-foot.

FIG. 13. Drawn from photograph after removal of astragalus of left foot.

with which everything can be divided has led me to believe that, contrary to my previous opinion, the latter method is more thorough, and is to be preferred in resistant cases. There is one disadvantage, however, namely, the greater time needed for healing, as compared with that after subcutaneous division. The resulting scar is also an objection, though not a great

The case of forcible correction mentioned well represents what can be done in a great many club-feet of the severely resistant type by this method; but in some instances such perfection cannot be attained in this way; either the deformity is so great or the undivided interosseous ligaments resist, that it is impossible to thoroughly over-correct. Repeated operation

will in time stretch the contracted ligaments, but in some instances a satisfactory result is not gained. Example of this will be seen in the accompanying photographs (Figs. 7, 8). The deformity was of a very severe type; one foot was entirely over-corrected; the left foot, however, was nearly corrected, but not enough to prevent a relapse.⁴ In this instance a great deal of force was used, and two sittings were given;

I am unable to state in how large a percentage of cases complete correction by means of force is possible. In a large number of cases this is true, but experience has shown me, in the 160 cases which have come under my care, that in five, relapses have occurred after satisfactory over-correction by force, as in the case just mentioned. In most of the cases the feet were small, the children being very young. I

FIG. 14. Drawn from photograph after removal of astragalus.

FIG. 15. Sole imprint of a case of club-foot corrected by tenotomy with inversion of the foot without contraction.

but what appeared to be resistance at the joint between the cuboid and the os calcis was sufficiently strong to prevent bringing of the cuboid into an over-corrected position. The distortion at the astragalo-scapoid

FIG. 16. Drawn from specimen of adult club-foot.

articulation was satisfactorily corrected, but when the attempt was made to raise the outer edge of the foot at the same time that the front of the foot was turned up and brought up, an amount of resistance was encountered which could not be corrected by force. It formerly appeared to me that this was due to the strength of ligamentous bands uniting the important tarsal bones, and that if sufficient force were applied the difficulty could be overcome.

⁴ The patient died of diphtheria before an operation for complete correction of the left foot could be undertaken.

had explained this on the supposition that owing to the elasticity of the bones in the feet of children, the force could not be applied in such a way as to rupture or stretch the contracted ligaments. It also seemed probable that in some instances deformity of bone was the impediment; and for this reason I have in the last year excised the astragalus in five cases, in the belief that the astragalus was the bone chiefly affected, and because excellent results were reported as following this operation, especially in the interesting article by Dr. Morton. The results in five cases operated upon by me in this way are given below. The operation is itself a simple one. An Esmarch bandage is applied, and an incision made on the outer side of the foot, beginning a little above the external malleolus, and curving forward and reaching to slightly beyond the head of the metatarsal. After dissecting back the flaps by cross incisions, the astragalus is separated from the scaphoid, the tibia and fibula, and, after forcibly twisting the foot, from the os calcis. Some difficulty is often encountered in dividing the strong ligament between the astragalus and os calcis, but after the use of some care this ligament is divided, and also the astragalus is removed. A counter opening is sometimes made on the inner side of the foot; the wound through the skin is stitched; and after removal of the Esmarch bandage, the wound is dressed aseptically and the foot placed in a corrected position and fixed by means of a plaster bandage applied over a large aseptic dressing. The foot can, after operation, be placed without difficulty in the proper position and

if proper care is used in asepsis, no evil effects follow the operation and the wound should heal well. After three weeks the plaster bandage is removed, an appliance put on, and later the patient allowed to walk. The result is a useful and often an excellent foot, and correcting appliances are not required after the ankle regains strength, that is, in from two to three months.

The results after this operation are shown in the

FIG. 17. Imprint left foot, congenital club-foot, before operation.

accompanying pictures. It will not be found, however, that the results are entirely perfect, and it must be admitted that the removal of so large and important a bone as the astragalus, is in itself a mutilation which it is desirable to avoid if as good result can be obtained in other ways. An examination of the imprints of the sole in all the cases showed that a slight inversion still remains. This gives a result which, although

FIG. 19. Imprint left foot after operation.

satisfactory in that the resulting feet are not noticeably deformed and are useful, cannot be regarded as perfect, and perfection is what should be aimed at. This may be seen in the tracing of the feet shown in the accompanying illustrations. If the sole of a normal foot be examined, it will be noticed that a line drawn through the middle of the sole is a straight one. In the cases of club-foot after removal of the astragalus, it will often be seen that the median line in front of the medio-tarsal articulation forms an angle with the median line posterior to that articulation. This, which is not to be seen in a normal foot, is evidently due to the obliquity

of the anterior facet of the os calcis, normally at right angles to the long axis of the foot, as it is well known from pathological specimens that this obliquity exists in a certain number of cases. A picture of the sole of what may be termed a perfect result is seen in the accompanying photograph (Fig. 10).

In two of the five cases of excision of the astragalus I have done, the deformity was in both feet; in the

FIG. 18. Imprint right foot before operation.

others the deformity was of one. In all the cases the deformity was congenital, and had been treated with care before. Two of the cases had been treated by me, and had relapsed later; and they were earlier cases where the details of treatment were not as thoroughly understood by myself as later experience has taught. One was a boy of twelve; the second was a

FIG. 20. Imprint right foot after operation—osteotomy of neck of astragalus and os calcis.

boy of ten, double deformity; the third, a boy of six; the fourth, a boy of ten; and the fifth, a girl of ten. The results were satisfactory.

In all of these cases the slight obliquity inward of the anterior portion of the feet was noticed, marring the perfection of the result; though in no way preventing the usefulness of the foot or the activity of the child. This is indicated by the sole-impression of the imprint of the foot of Case 2 (Fig. 11). In Case 5, some twisting of the foot remains, as is seen by the illustrations (Figs. 12, 13). The astragalus was removed without difficulty. The wound healed; and the patient

was soon able to walk about freely, with motion at her new ankle-joint. Judging from external appearances and the history of the case, it is evident that some internal and anterior obliquity at the articulation of the os calcis must be present, for after removal of the as-

fascia or in any part of the foot. The foot can be placed readily in an over-corrected position. The child walks about without apparatus, which has been discarded for several years. There is a tendency, however, for the child to toe in, especially when running,

FIG. 21. Drawn from photograph, before operation in boy of twelve.

FIG. 22. From photograph after operation in boy of twelve — osteotomy of neck of astragalus and os calcis.

FIG. 23. Drawn from photograph after operation.

tragalus the inward inversion of the front of the foot should disappear, unless some other cause than the distortion of the astragalus was present (Fig. 14).

If the removal of the astragalus is not sufficient for complete correction it is evident that the deformity exists also elsewhere and the obliquity in the facet of the head of the os calcis suggests itself as a cause of the

and the foot-print indicates that the anterior part of the foot turns to the inside. This appears to be due to the obliquity in the articulation of the facet of the os calcis. The same condition is seen in the photograph from the dissection in the Warren Museum (Fig. 16), and even better in a specimen of adult congenital club-foot, prepared by Dr. Goldthwait.

FIG. 24. Drawn from casts before operation in a boy of ten with congenital club-foot.

continuance of the distortion. This obliquity of the os calcis is demonstrated by the accompanying foot-print, which shows the foot-print of a case of congenital club-foot, treated by mechanical stretching and tenotomy of the tendo-Achillis (Fig. 15). The deformity is entirely corrected, as far as can be demonstrated, by complete flexibility and excellence in gait. There are at present no contractions either in the tendo-Achillis, plantar-

FIG. 25. Drawn from photograph after operation — double osteotomy of neck of astragalus and os calcis.

On examination of this specimen, it will be clearly seen that the obstacles to the correction of this deformity do not lie alone in the distortion of the astragalus, nor in the ligamentous tissues which bind the scaphoid to the astragalus. After these may be removed, there remain evidences of distortion in the os calcis at its junction with the cuboid. The articulated surface of the os calcis, as it lies in contact with the cuboid, is

oblique relative to the axis of the foot, rather than at right angles to this axis. It is manifest that in this individual case it would be impossible to entirely replace the cuboid in the proper position in relation to the os calcis simply by a division of the soft parts on the inner side of the foot and also that after removal of the astragalus all the osseous obstacle to correction is not removed.

The method of procedure for attacking the projection of the os calcis is a simple one. An incision should be made, starting below the external malleolus with convexity upward reaching to the projecting head of the astragalus and passing downwards toward the outer side of the foot towards the sole. This flap should be drawn down by means of hooks, and the neck of the os calcis laid bare. An osteotome can be inserted a short distance from the line of the cartilage,

FIG. 26. Sole-imprint after osteotomy of neck of os calcis and astragalus.

and the wedge-shaped piece of bone removed from the neck. The foot can be forcibly corrected with but little force if the contractions of the soft parts on the inside of the foot have been stretched or divided. If, however, there is, as there often is, also resistance at the astragalus, the upper portion of the skin above the incision can be retracted, and the neck of the astragalus easily seen, an osteotome inserted, and either the astragalus divided by a linear osteotomy or a wedge-shape piece removed. The operation can be done very readily and with but little mutilation of the foot.

I have operated in this way in three cases of double congenital club-foot with satisfactory results in the past year. The accompanying photographs and imprints indicate the results. They were taken (Figs. 17, 18, 19, 20, 21, 22, 23,) some time after the operation, proving the ultimate result to be satisfactory. Nothing of particular interest in the history of either case is to be recorded, except that in the first case, open incision was done on one foot and osteotomy of the neck of the os calcis and the astragalus were done upon the other foot with tenotomy but without open incision on the inner side of the foot. The result, as indicated by the tracing, would appear to show that the open incision without osteotomy gave a more satisfactory result than osteotomy following subcutaneous tenotomy. This is

perhaps due to the fact that the foot on which osteotomy was done was the most severely deformed of the two. But it may suggest also the fact, which I have found in other instances, that subcutaneous incision does not divide as thoroughly as an open incision. In several instances I have divided by means of subcutaneous tenotomy as thoroughly as I was able to do, and I have subsequently cut down by an open incision to see if I had left any tissues undivided; and I have satisfied myself that with the tenotome in the foot, fibres may be left undivided by subcutaneous division, which can be only discovered by open incision, as is the case in subcutaneous division of the insertion of the sterno-cleido mastoid.

In the second case (Figs. 24, 25), the result was entirely satisfactory, and both were operated upon by osteotomy of the neck of the astragalus and of the os calcis. In previous cases I have attempted to osteotomize the neck of the os calcis, without thorough division of the plantar fascia in inner ligaments. They were earlier cases, and the operation was not done with precision or with the carrying out of the details already mentioned; and they may be fairly considered experimental cases. Although the deformity was corrected satisfactorily and useful feet resulted, yet the greatest possible perfection was not gained, as is shown in the accompanying foot-imprint, (Fig. 26), which, it will be seen, though that of a useful foot and in result to be compared with that after enucleation of the astragalus, yet is not so excellent as in the best cases.

In conclusion it can be said that not only is club-foot of the most persistent variety entirely and completely curable, but also that in many cases the milder means are sufficient. It is, however, demonstrable that in a certain number of cases osseous deformity of the neck of the astragalus and os calcis exists; and where this exists, the perfect correction can be made with but little mutilation of the bone, by either a linear osteotomy of the neck of the os calcis, and of the astragalus, or the removal from the neck of either or both a small wedge of bone, if this is preceded by thorough division or stretching of the contracted soft parts. Thorough lengthening of the contracted ligaments and fascias, as well as tendons, either by stretching or tenotomy or open incision, is essential for a perfect result; if this is not done a less perfect result is obtained.

CASES OF CHOLECYSTOTOMY, WITH SOME REMARKS UPON THE TECHNIQUE OF THE OPERATION.¹

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LAST year I reported two cases of cholecystotomy; and my reason for bringing the subject forward again this autumn is, that there are one or two points in technique which I have learned during this summer's work, which, it seems to me, make the operation easier of execution and somewhat safer.

I have opened the gall-bladder six times during the past summer, and have removed gall-stones in four of these cases; in one case the stoppage of the common duct was due apparently to malignant disease, and in the other, although no stones were found in the gall-

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