On the nature and treatment of talipes equino-varus or club-foot / by Bernard E. Brodhurst.

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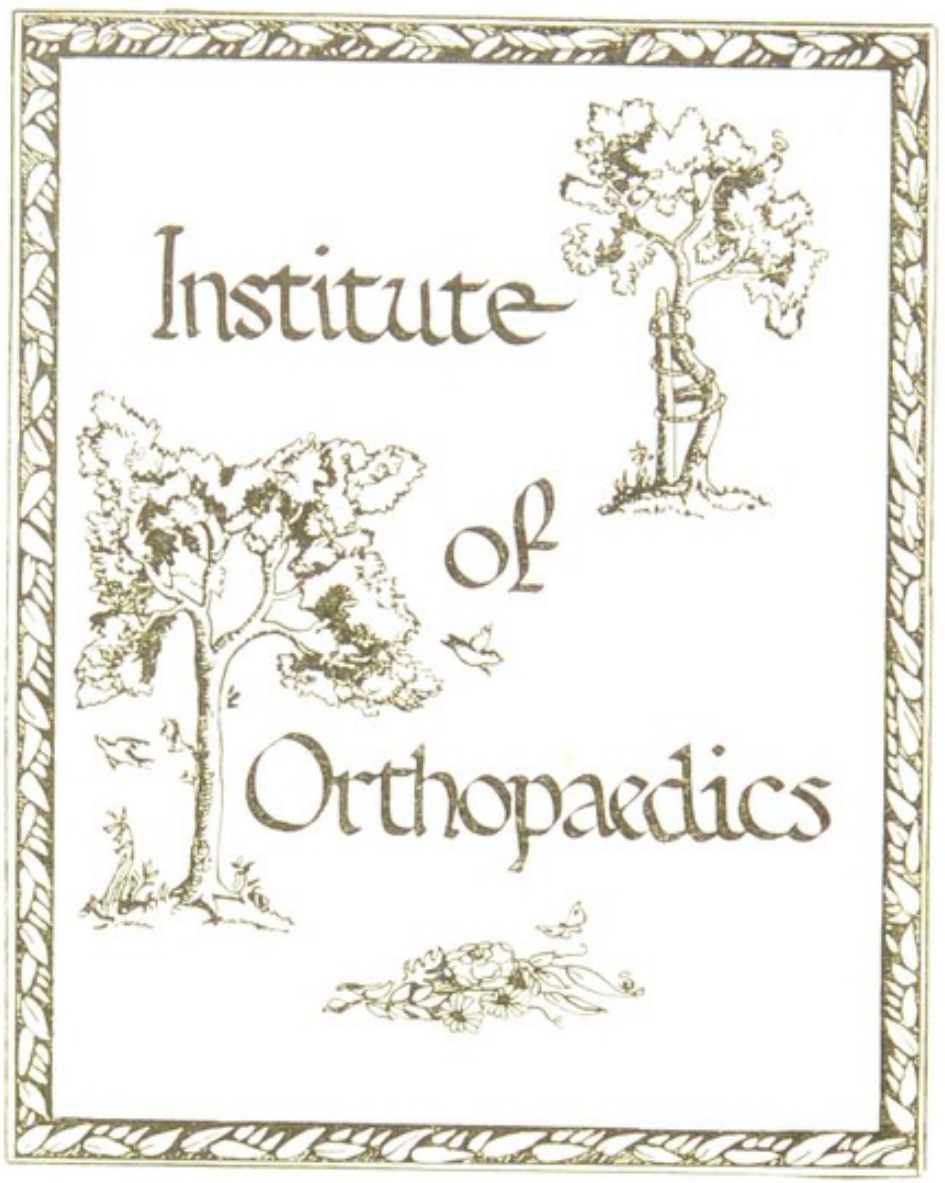
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NATURE AND TREATMENT

OF

TALIPES EQUINO-VARUS

OR

CLUB-FOOT

ON THE NATURE AND TREATMENT OF TALIPES EQUINO-VARUS OR CLUB-FOOT

BY

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LONDON
J. & A. CHURCHILL
11, NEW BURLINGTON STREET
1893

PREFACE

This treatise on talipes equino-varus was published, together with other papers, in 1856, and again in 1876. Some additions and rectifications have now been made, together with remarks on osteotomy, and especially on osteotomies in childhood.

Grosvenor Street,
London, W.

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ON

TALIPES EQUINO-VARUS

CHAPTER I

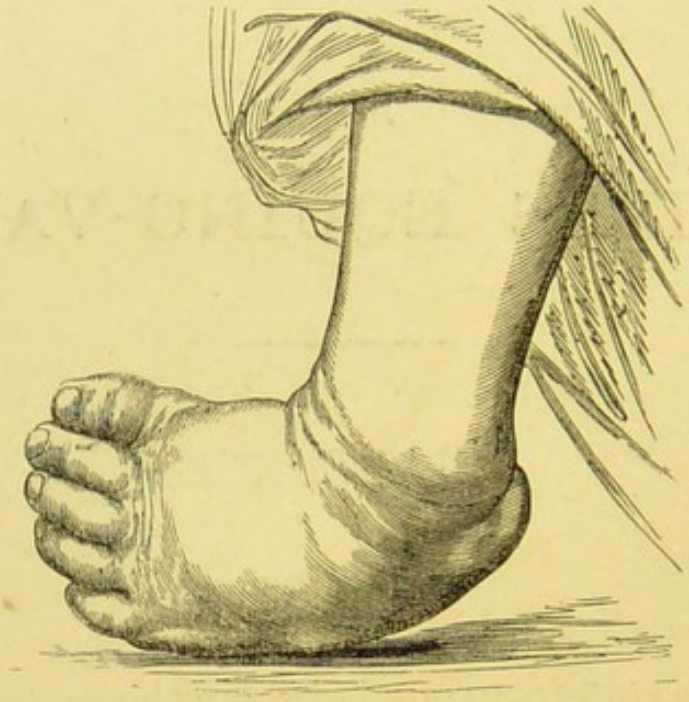
ANATOMY

TALIPES EQUINO-VARUS is by far the most common form of congenital deformity with which we are acquainted. One or both feet may be affected, but both feet are more commonly distorted at birth than one only. When one foot alone is deformed, the right is that which is the most frequently affected.

The essential character of varus is, of course, inversion—that is to say, the anterior portion of the foot is directed inwards; and this may exist, although it is rare, without either extension or rotation. But, for the most part, the foot undergoes a threefold alteration in position in its relation to the leg, viz. adduction, rotation, and extension. Thus the anterior portion of the foot is inverted, whilst its inner margin is raised, and the heel is raised. This, then, is the ordinary

form—the type, so to speak, of congenital equino-varus. It is represented in Fig. 1.

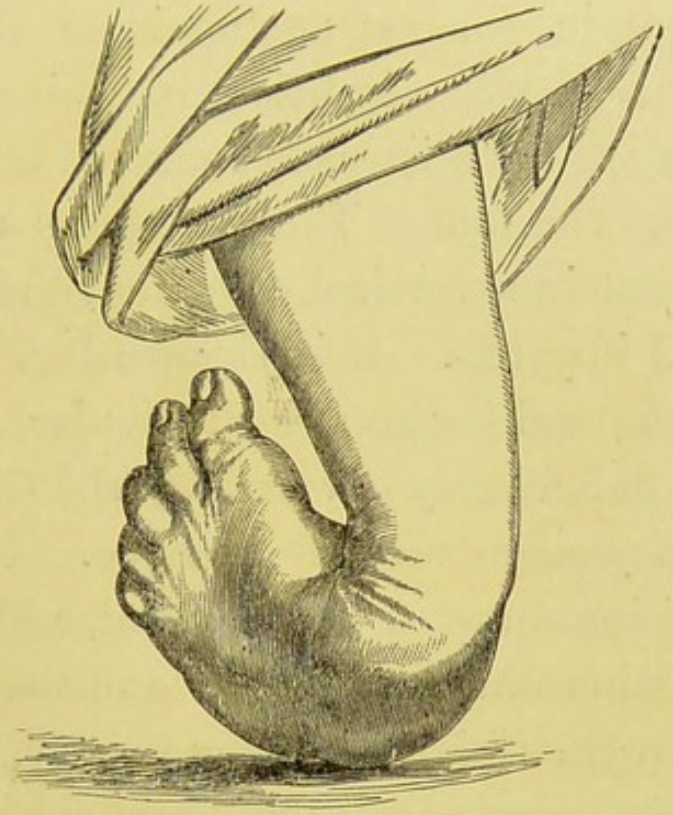
Fig. 1.



Other degrees of deformity are met with, which are usually described as grades. Thus the tibialis anticus muscle may be alone retracted, causing inversion of the anterior portion of the foot, to which may probably be added contraction of the plantar fascia, through which the sole is shortened. This variety is rare. Or, again, the front of the foot is inverted, the inner edge is raised, and the heel is raised; but to a smaller degree than is shown in Fig. 1. And that which is usually described as the fourth grade is the most severe form of congenital equino-varus, and it is only rarely seen. In this variety the inner margin of the foot is in contact with the side of the leg; the toes present

upwards, or they are bent backwards; the dorsum is directed downwards and forwards, and the heel is strongly drawn upwards, as is shown in Fig. 2.

Fig. 2.



The muscles which are principally concerned in producing these several grades of equino-varus are the tibial muscles, the flexor longus digitorum, and those in the calf of the leg; but in the last-mentioned grade all those muscles to which reference has been made are rigidly retracted, so that the tendo Achillis is deflected from its ordinary position, and lies immediately above the posterior tibial vessels; the plantar fascia is shortened, and the muscles in the sole of the foot are retracted; while, on the other hand, the peronei and the extensor longus digitorum are weak and attenuated.

In an ordinary case of equino-varus, such as is represented in Fig. 1, there is no material change in the shapes of the tarsal bones at birth; and in such a case as that represented in Fig. 2 the change in the astragalus is so slight that during the plastic condition of this bone any irregularity of form is easily removed by pressure in everting the foot. The astragalus undergoes displacement in a vertical direction, and the neck is inclined inwards. It is thrown forward on to the dorsum, and its superior articular surface is therefore imperfectly covered by the tibia. The calcaneum remains normal in shape. It is raised into a position more or less vertical, and it undergoes a certain rotation inwards; and the scaphoid, acted on by the tibialis posticus muscle, is rotated inwards and upwards. The scaphoid is the first of the tarsal bones to undergo displacement, whether varus is produced by impeded development and structural shortening of the muscle or by spasmodic action.

In the anencephalous fœtus changes from the normal condition of the bones are found, which through impeded development approach closely to simian forms. Especially the astragalus is found occasionally not unlike that bone in the higher apes. This is interesting with a view to comparative anatomy; but in treating of the anatomy and surgery of the human infant it is not necessary

to consider the bones of the anencephalous monster nor those of the ape.

The tarsal bones, then, at birth in the infant with an ordinary form of varus may be said to be unchanged in form, and to retain their normal characters; and in extreme varus, such as is rarely met with, the tarsal bones being plastic are readily moulded and brought into shape in treating the foot. But even in the anencephalous fœtus the calcaneum is often found to be normal, and even the astragalus may scarcely show any deviation in form. Certain rotations of these tarsal bones occur, which are due to muscular retraction, and these vary as muscular retraction itself varies. The os calcis is rotated on its axis by the combined action of the extensors, and of the adductors on the bone itself and on the scaphoid, and through traction on the calcaneo-scaphoid ligament. Also the astragalus is necessarily rotated with the os calcis, and through the action of the extensors upon the latter it is thrust forward on to the dorsum, and thus it gains an oblique direction between the malleoli.

Thus, in an extreme degree of varus the tarsal bones are not only rotated on their axes, but they may be wanting in development and also be malformed. But, as has already been said, these malformations occur only in the most severe forms of congenital varus. In such cases the internal

malleolus is small, and the deltoid ligament is short. It is this ligament which constitutes the chief impediment after the tendons have been divided to the extension and rotation of the foot. Also the patella is sometimes retracted, and it may be found drawn up on the outer side of the thigh to the extent of two or three inches above its usual position. Occasionally it is small, and perhaps scarcely more than one fourth or even one eighth of its normal size. Together with this state there is usually a spastic condition of the extensors, through which the limbs may be forcibly flexed upon the abdomen.

When, however, the weight of the body begins to be borne upon the feet, important changes take place; for the weight is then transmitted, not, as in the normal condition, through the tarsal arches, but through the outer margin. The metatarsal bones become folded into the sole, and thus a broader surface is gained; and a cushion composed of fat and cellular tissue is formed, through which the superincumbent weight is transmitted. This pad renders it as easy to bear the weight of the body as when it is received on the heel. This cushion is seldom developed in non-congenital varus, and walking is therefore in such cases painful. Inflammation is easily excited in it through over-use or through exposure to cold, when sloughing may probably occur. This cushion

is gradually absorbed when pressure is removed—when the sole is placed on the ground.

Thus not only the fifth, but also the fourth metatarsal bone is folded into the sole, and the weight of the body is no longer transmitted through the outer margin of the foot, but through the dorsum, as is shown in Figs. 3 and 4. The

Fig. 3.

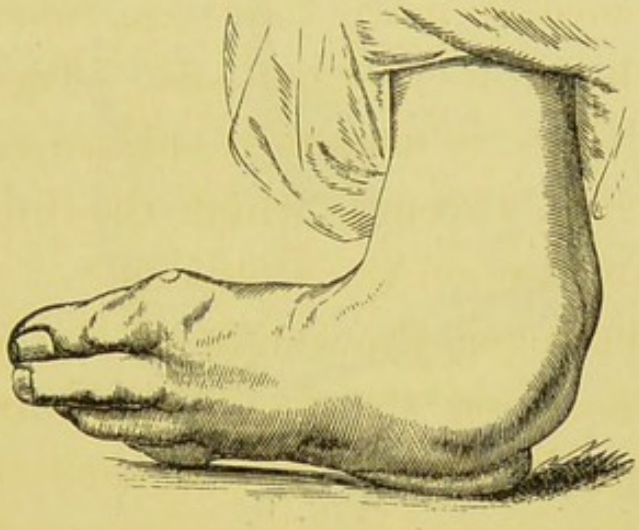
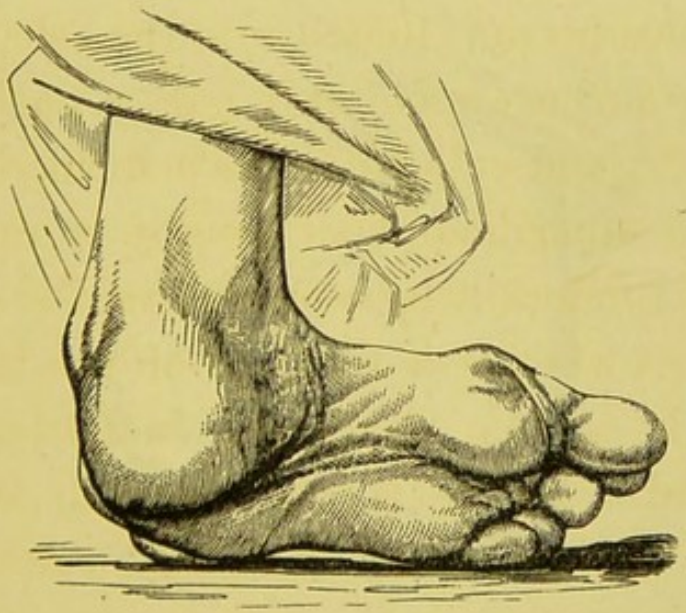


Fig. 4.

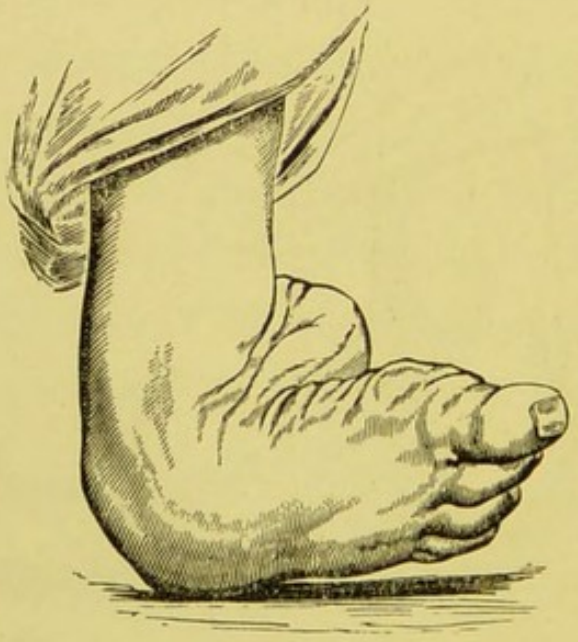


transverse arch, which hitherto was unaffected,

becomes compressed, and even it may be obliterated. This rotation of the foot is occasionally seen to be so complete that the weight is borne mainly on the astragalus in walking, as is shown in Figs. 5 and 6.

FIG. 5.

FIG. 6.



In the adult, every structure which enters into

the composition of the limb undergoes structural change, the bones become light and the tarsal bones through pressure are altered in shape.

These changes are incident to age, and to wear and tear. As the result of inflammatory action excrescences may form on the astragalus, and ankylosis more or less complete may take place between various tarsal bones.

These changes in the bones necessarily involve the ligaments, especially the deltoid, the calcaneo-scaphoid, and the astragalo-scaphoid.

CHAPTER II

ETIOLOGY

Various opinions have been entertained with regard to the causation of congenital talipes. Thus Walther and Geoffroy Saint-Hilaire taught that a varus position was a natural development in the embryo; whilst Camper, Glisson, Blumenbach, Naumberg, Wanzel, and Tourtual thought that it was induced by deficiency, abnormality, or displacement of the astragalus or other of the tarsal bones. And Scarpa, and later Hüter, wrote that the tarsal bones being deformed and twisted on their axes, the muscles became shortened through the altered positions of the bones. Delpech wrote that the muscles were the cause of deformity; and Maisonnabe insisted that the plantar fascia being contracted was the cause of talipes varus. Others again, such as Boyer, Cruveilhier, Martin, Chaussier, Breschet, concluded that malposition *in utero* was the cause of congenital deformities. Cruveilhier reasoned thus: —Club-foot and club-hand are analogous affections; and as club-hand ceases at birth, it is evi-

dent that it is caused by a cramped position *in utero*. These affections of the hand and the foot, he urged, are of the same nature and own a common cause. Therefore pressure *in utero* is the cause of club-foot. But his premisses were false. Club-hand does not cease at birth, but it continues for months, and in many cases for years. And Wagner ascribes congenital equino-varus to arrest of development whilst the feet of the embryo are still inverted. It is probable that calcaneus is occasioned by pressure *in utero*, for this is produced much later in intra-uterine life than is varus, and the condition is altogether different from that which is found in varus, valgus, and equinus.

The foot at this period becomes flexed, just as in the earlier months of fœtal life it is inverted. The normal position of the feet at an early period of embryonic life is that of inversion, and if during this early period anything should occur to render this position permanent—should evolution through any cause be impeded—shortening of the muscles ensues, growth being arrested, and this, the natural position of the fœtus *in utero*, becomes deformity at birth. It is probable also that impeded evolution may occasion talipes valgus somewhat after the same manner as with varus; and that shortening of the muscles is produced whilst growth is impeded. Thus arrest

of development or obstructed development whilst growth elsewhere proceeds in a normal manner becomes at birth deformity. Up to the fourth or the fifth month or even later the embryo presents a club-footed appearance. If at this period from whatever cause evolution should be impeded, so that, for instance, the adductors of the foot cease to be developed whilst growth elsewhere proceeds in a normal manner, the feet remain unfolded—clubbed, as in the embryo. Thus, direct pressure *in utero* may give rise to talipes calcaneus, and impeded evolution will cause talipes varus and valgus. This theory of "obstruction in the normal development of the feet, during some period of intra-uterine life," has been admirably stated by Dr. H. W. Berg.* Also, the same opinion has been further elaborated by Mr. R. W. Parker and Mr S. G. Shattock.† Again, bands of lymph, perhaps binding the limbs and preventing movements, movements which are essential to the development of the fœtus are not uncommon.

It is thought by some that intra-uterine pressure may produce congenital deformities. It should be remembered, however, that at an early period of gestation the embryo floats in the liquor amnii, and that as utero-gestation advances, and

* Seguin's 'Archives of Medicine,' 1882.

† 'Path. Trans.,' 1884.

the fœtus becomes bent upon itself, this fluid prevents injurious pressure of the uterus, and enables those movements to take place which, indeed, become stronger and more marked until the period of gestation is completed. But, also, deficiency of the liquor amnii does not entail deformity. In its passive state, and until labour commences, the uterus exercises no pressure on the fœtus, but yields to every movement from within; and it is only when this passive condition is exchanged for one of action, to expel its contents, that the uterus exercises direct pressure on the fœtus. It is, therefore, impossible that under ordinary circumstances the uterus should produce such pressure upon the fœtus during gestation as to induce deformity. As Professor Louis Bauer says, truly enough that, if intra-uterine pressure were a cause of club-foot, every child should be club-footed, for the foot is naturally inverted *in utero*.*

Doubtless the cause of club-foot must be sought elsewhere than in the muscles or the bones, or in any extrinsic cause; for considering the manner in which the fœtus is packed in the uterus, the head being bent upon the breast, the neck and back curved forward, the thighs flexed upon the trunk, the legs upon the thighs, and the feet inverted, the arms folded on to the thorax,

* 'Lectures on Orthopædic Surgery.'

and the fingers into the palm, and such being the normal position of the *fœtus in utero*, if position were an element occasioning distortion, club-foot and every other form of muscular retraction would not be the exception, but the rule. Besides every known deformity is met with in the fœtus where there is some deficiency or any change from the normal state, whether in the brain or in the spinal cord. As Rudolphi wrote, club-hand and club-foot arise through morbid influence on the muscular system.* In the anencephalous fœtus, for instance, there is found every known form of muscular retraction, such as scoliosis, torticollis, strabismus, talipes, and luxations of every kind, complete and incomplete, of the patella, the knee, the femur, the jaw, the shoulder, the elbow, &c. In these various forms of deformity, muscular retraction exists in a degree equal to the amount of distortion. The spine may be curved laterally to so great an extent as to diminish by one third or more the height of the trunk. And when the muscles of the back of both sides are simultaneously retracted, the occiput may be drawn down to approach the sacrum. Or, again, the extensors may cause the leg to be bent forward upon the thigh; and, in the same manner, retraction of the triceps may draw the fore-arm backwards upon

* 'Grundriss der Physiologie.'

the arm. And, together with these distortions, talipes will probably be found to exist in some severe form.

Cause and effect in these cases, then, are demonstrable.

Again, a second series exists, in which are included hydrocephalic and hydrorachitic fœtuses, where a similar result is observed as in the last-mentioned category; namely, luxations and subluxations, with muscular retraction in every form.

And, again, similar distortions are found with traces only of cerebral and spinal disease, the degree of distortion, and its extent, bearing some relation to the amount of disease present.

Except in those instances in which distortion is very slight, nutrition is imperfect. The full period of gestation is seldom reached, but it is terminated at the seventh or the eighth month. This defect of nutrition is perhaps due to spastic action and to the cause giving rise to it, namely, irritation or disease of the nervous centres.

Mental emotion, whether fear, anger, intense joy, or grief, may give rise to spasmodic contraction of the *fœtus in utero*. The changes which are induced in the blood and secretions of the fœtus, by emotion in the mother, or through any continued derangement in the system of the mother, are causes inducing convulsive action in the embryo. Of this there are many examples on

record, and it can scarcely be doubted that a slight cause will in the fœtus induce abnormal action.

I have known so many instances in which emotion has been the cause of derangement in the system of the fœtus, where cause and effect have been recognised and acknowledged in some at the time of their occurrence, and without waiting for demonstration of the effect until the termination of gestation, that it is impossible to doubt its influence.

The following case was under care at the Orthopædic Hospital:

"During the sixth month of pregnancy, a robust woman fell, in the dusk of the evening, into an opening which had been left uncovered in the road. She was much alarmed and somewhat hurt by the fall. The child was born at the eighth month, with the hands and feet as shown in the accompanying engravings."

I could mention many cases in which the mother remembered to have been particularly struck by the appearance of a club-foot during her pregnancy, and which she believed, from the impressions it had occasioned, to be the cause of deformity in her own child. The following is a remarkable case in point. A lady was serenaded by the local band on the anniversary of her marriage, the leader of which had club-feet; and this circumstance so impressed her—she being at the time somewhat far advanced in pregnancy—that she

immediately became faint and ill. The sensation which had been produced remained more or less with her until her child was born. She was

Fig. 7.

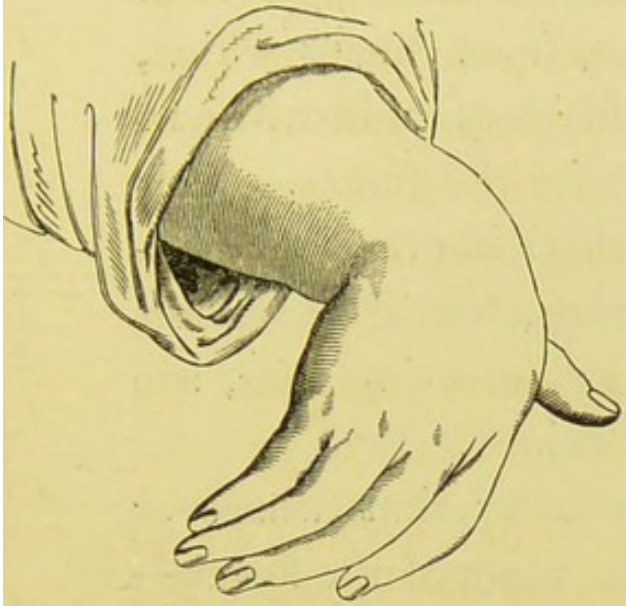


Fig. 8.

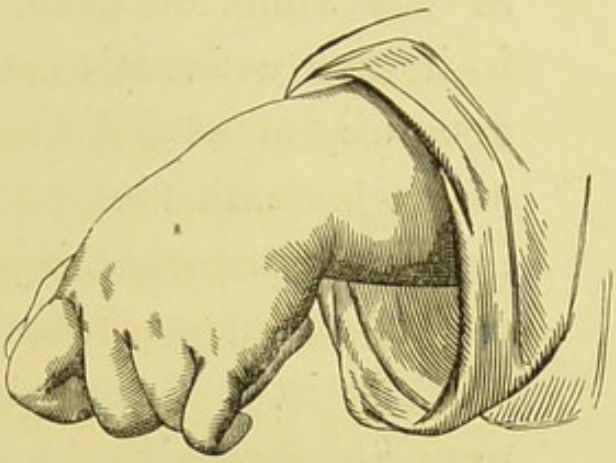
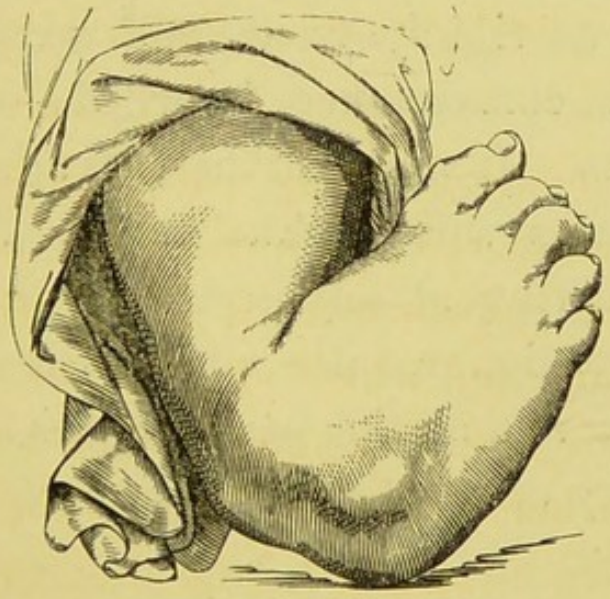


Fig. 9.



persuaded that it would be deformed in the same manner as the leader of the band, and so expressed herself to her husband and her friends. The

child was born at the termination of the seventh month, and both feet were violently contracted into equino-varus. Otherwise the child was healthy and well formed.

But, also, cases of deformity occur in hysterical and highly sensitive persons, from causes which, in others more robust, would be quite insufficient to induce convulsive action in the fœtus. It is generally accorded that mental impressions, unrestrained and violent passions, brutal treatment involving personal injury and creating fear, are common causes of these affections.

Thus it is reasonable to infer that whatever may interfere with the development of the fœtus—with those changes of position which are essential to evolution, and without which the limbs become more or less rigidly fixed, and growth of the muscles in consequence impeded—will cause equino-varus. It may, further, be admitted that various causes will produce varied effects; and that these acting at any period of intra-uterine life will occasion results which will vary as the cause varies and as the period varies, and as the susceptibility or mental impression of the parent varies.

Congenital deformities are hereditary. Thus, I know five boys in one family who have suffered with congenital talipes equino-varus, their father, uncle, and paternal grandfather having likewise

suffered from similar forms of distortion. In each generation females were added to this family, but none of them were deformed at birth. I have lately also seen another family of four children, two boys and two girls, all of whom were club-footed at birth; their mother also was club-footed. But besides these cases many others somewhat similar have come under my notice.

Dr Little, speaking of talipes varus, says:—"I have traced it on the paternal side even through four generations—namely, the male infant, the father, the grandfather, and the great-grandfather."*

Duval mentions a somewhat similar example, where three boys were born with club-foot, and whose maternal grandmother was also similarly affected. Also he cites another case in which two girls in one family were born with club-foot, whose paternal grandfather was also afflicted with congenital varus.†

Held also relates the case of a family of six children, all of whom were born with club-foot; and one of the parents was also similarly affected.‡

And Mr H. Lockwood relates a remarkable history to show the hereditary character of deformities.‖

* Article "Orthopædic Surgery," in 'Holmes' System of Surgery.'

† 'Traité pratique du Pied-bot.'

‡ 'Diss. sur le Pied-bot.'

‖ The 'Lancet,' 1885.

Dr. Little says:

"It may be remarked, as a contribution to the etiology of congenital distortions, that the parents of children born with varus, for example, often present uncommon convexity of tarsus without contraction of leg muscles, and without appreciable deformity, or they, and their fathers before them, have been particularly accustomed to turn in their toes. They have what may be considered a small element of calcaneo-varus or of varus; viz. unusual concavity of sole, probably due to some unusual tension of plantar muscles, or some undue tension of posterior leg muscles. But in accordance with the observed law in physiological pathology, that parental derangement is reproduced in the progeny in increased intensity, unless counteracted by another law which regulates the union of the sexes, but which it is unnecessary to enter upon here, the child is born not simply with an affection dependent upon slight undue tension of plantar or other muscles (as in the parent), but presents increased disorder of nervous and muscular system, severely involving muscles of the leg, as well as of the sole, and consequent varus."*

Children who are born with these deformities are particularly subject to convulsive disorders. I have seen equino-varus recur, having been entirely removed, whilst the child was convulsed, and at the moment of an epileptic seizure, and during teething.

Guérin has recorded an example of the recurrance of distortion after cerebral excitement. He says:

"I had to treat twins who were affected with double congenital varus. I entirely removed the deformity, and the

* 'On the Deformities of the Human Frame,' p. 308.

treatment had been concluded six months when one of them was seized with a cerebral affection which brought back the club-feet, so that in three days they were just as they had been before the treatment was commenced. I again treated and cured them; and, as though further to prove the relation of cause and effect, one year later the same child was seized with convulsions, less violent than previously, and one foot again became clubbed—that one, namely, in which there had been the greatest deformity. On this occasion the foot was less distorted than previously. At these three periods, viz. at birth, and after the first and second cerebral attacks, the foot presented the same form and anatomical peculiarities. At birth these children appeared perfectly healthy, and this distortion of the feet was the only trace of the intra-uterine affection which had occasioned it."*

Slight congenital deformities are at times overcome during sleep, the limb then regaining its normal position. The distortion recurs at the moment of waking, and the limb is again seen contracted as before. Further, relaxation of the retracted muscles occurs to some extent, and in some cases to a very considerable extent, under the influence of chloroform. And this may be so considerable as to interfere materially with the section of tendons.

Thus it may be said that development being impeded and growth arrested, the clubbed condition of the feet, which is normal in embryonic life, continues, and at birth, evolution not being

* 'Mémoire sur l'Étiologie générale des Pieds-bots congénitaux.'

concluded, the clubbed condition remains. And further, it may be stated that deformity is occasioned by obstruction rather than by pressure, and that thus evolution is retarded. Material obstruction may occur *in utero*, and it may also be caused by abnormal nervous influence. Growth is consequently irregular and impeded.

CHAPTER III

NON-CONGENITAL TALIPES EQUINO-VARUS

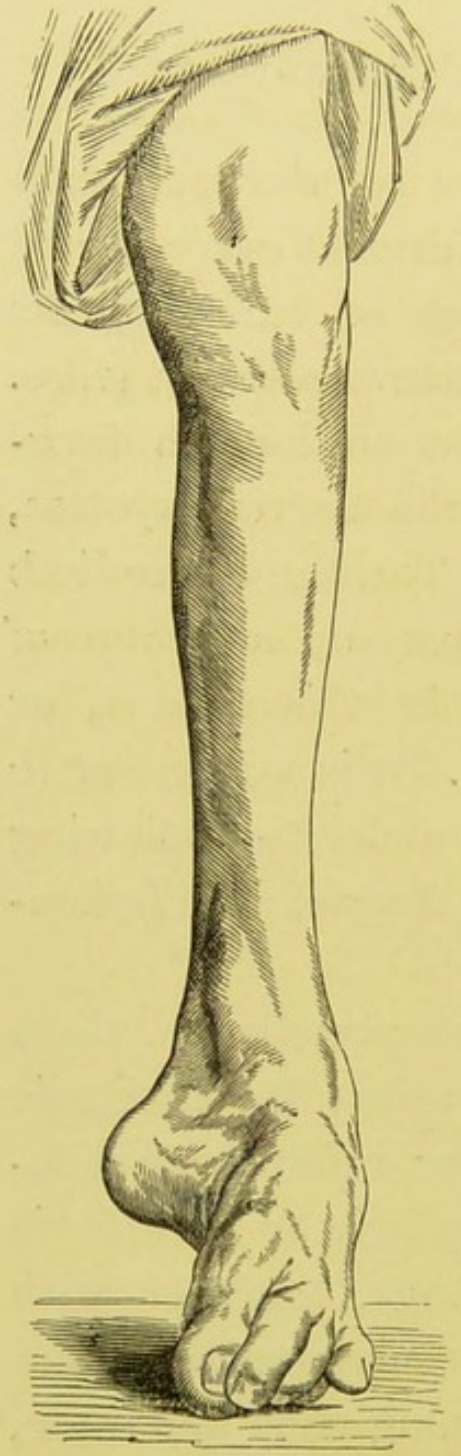
This form of talipes occurs for the most part during infancy; yet it may occur at every period of life: after the first years of existence its occurrence is, however, comparatively rare. This deformity is due to structural or to functional change in portions of the nervous system, and to local inflammation. Thus an entire limb may be more or less affected, or a group of muscles may be implicated in this change, or perhaps only a single muscle. It is convenient to treat of these various causes under the following headings, namely, *Paralysis*, *Spasm*, and *Inflammation*.

Paralysis presents itself especially in three forms; namely, that which arises from organic change in the nervous centres; infantile or rheumatic, and traumatic. Hemiplegia or paraplegia may result from organic change, together with flaccid muscles, the muscles remaining loose and flabby; and these again becoming rigid and tense, produce contractions of the limbs. Again, rigidity may obtain from the commencement. Such loss

of power occurs both in the weak and in the florid and robust.

Myogenic paralysis rarely occurs except during infancy, and it is therefore known as the *essential paralysis of infants*. It usually occurs under two years of age. It is sudden in its access, and is induced by exposure to cold, such as a draught of cold air whilst the body is heated. Loss of power is for the most part preceded by pain, more or less acute: often it is very acute. The duration of pain may be for two or three days, when it terminates in loss of power in certain muscles. During this period the sensibility of the limb is, in the words of Dr Kennedy, "wonderfully increased," and the child will not allow the limb to be touched. Subsidence of pain is immediately followed by partial or complete loss of motor power in the affected muscles; and the limb is drawn by the opponent

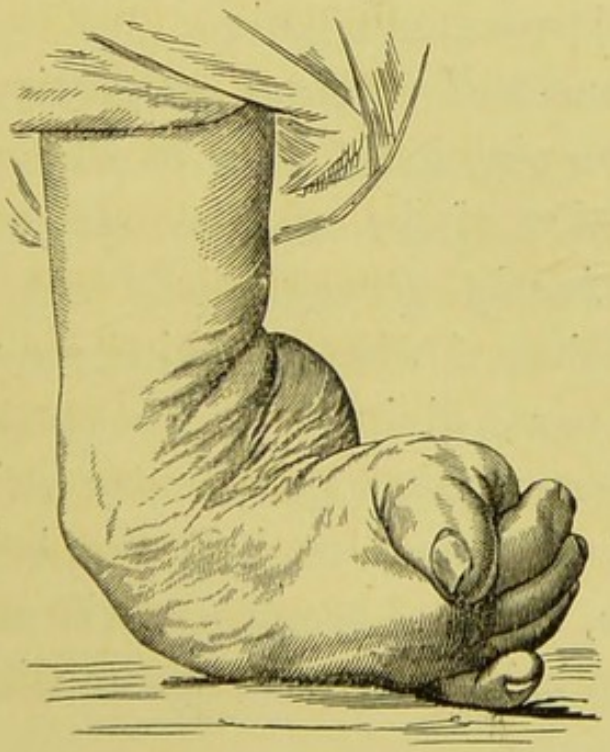
Fig. 10.



muscles gradually into a distorted position, as is shown in Fig. 10.

Paralysis is by far the most common cause of non-congenital talipes. Every form of talipes may result from this cause, but the forms most frequently met with are equinus and equino-varus. The form which the foot assumes after years of contraction, resembles closely that of congenital equino-varus; but there are distinctive characters which render confusion impossible. In such cases the form is irregular, and there is less rigidity than in congenital deformities; the temperature is ill maintained, and the cushion on which the foot rests is absent, or only slightly developed. Such limbs inflame on exposure to cold; ulceration takes place, and sores form which are difficult to heal. See Fig. 11.

Fig. 11.



It is especially the muscles on the outer side of the leg, namely, the peronei and extensor longus digitorum, which are primarily affected in these cases, and secondarily the flexors.

Spasm and paralysis frequently co-exist—spasm of the flexors and the adductors of the limb, while their opponents are perhaps paralysed.

Thus the thighs may be flexed upon the trunk, the knees crossed one over the other, so that they cannot be separated, and the feet are extended and inverted.

Children in the earliest years of life are particularly liable to convulsive disorders. The vascular excitement of the gums and of the alveolar processes during the period of dentition induce cerebral excitement and spasmodic action. And gastro-intestinal irritation, induced by disordered secretions, is also a fertile source of infantile convulsion and spasmodic action.

Other causes of cerebral congestion and spasmodic action also exist, such as whooping-cough, the incubation of the exanthemata, constipation, an insufficiently strangulated nævus, or, indeed, irritation of whatever kind may act as the exciting cause, giving rise to congestion and spasm. Carpo-pedal spasm may exist without cerebral disturbance, but irritation being allowed to continue, cerebral symptoms will ensue.

Irritation being removed, spasm will cease, and

it may not recur. But after long continuance of irritation and spasmodic action, the affected muscles may not resume their normal condition, but they remain contracted.

Spasmodic action is sometimes caused by pressure upon the head of the infant during birth. The deformities which arise from this cause are doubtless frequently not distinguished from those which have been previously alluded to as congenital distortions; but tonic rigidity of a limb or of a pair of limbs (for the most part the lower limbs) or of the entire voluntary muscular system may result from some injury at birth, such as is sustained by the brain and the brain-case, or by the vertebræ and the spinal cord, through too much force in the application of instruments or, indeed, without instrumental interference, when undue violence is used. This may occur together with or even without deformity and contraction of the pelvis. In these cases the flexors and the adductors of the thighs, the flexors of the legs, and the extensors of the feet are for the most part affected. The upper limbs are usually less affected than the lower, yet the elbows will also probably be found partially flexed, the forearms pronated, and the fingers wanting in power. The muscles of the neck are also in these cases deficient in power, and unable to support the head; so that the head rolls from side to side, and falls

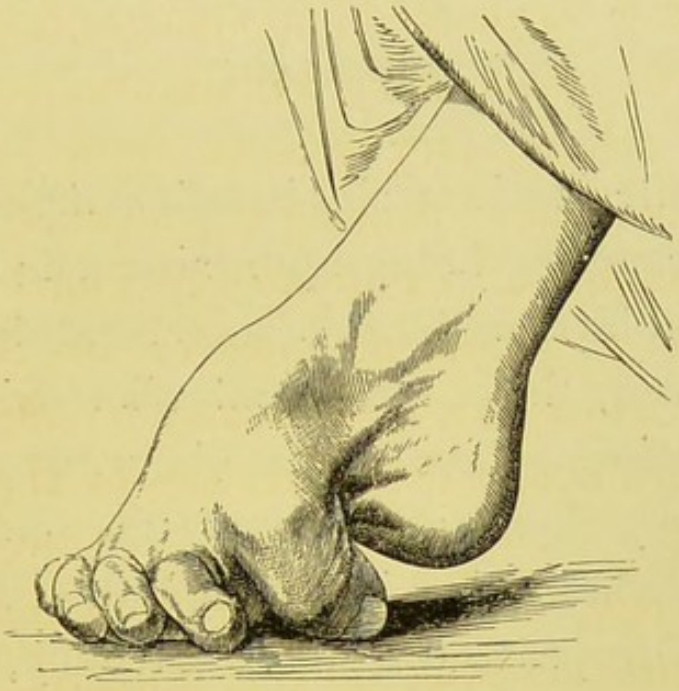
on to the breast or backwards. In the same manner the muscles of the trunk participate in the general weakness, and the child is in consequence unable to sit upright. In children thus affected there is also occasional or constant strabismus, and the muscles of speech are also not infrequently implicated: in some a cry only can be uttered, in others a syllable or two; while again in others, and this is more commonly observed, violent stuttering is provoked by a very slight amount of excitement. Thus, a single muscle or a group of muscles or the entire voluntary muscular system may be affected, and endless varieties of deformity are in this manner produced.

Such, then, are the forms in which spastic contractions are seen during infancy. And together with these spastic conditions of the arms and legs, there will probably also be found abnormal conditions of the feet and hands: indeed, every known form of talipes and cheirismus is to be found together with these rigid limbs.

Again, similar effects are produced by local causes, such as burns, gun-shot wounds, and especially by lacerated wounds, strumous abscesses, and other like causes. Such cases are difficult to treat, both on account of the solutions of continuity which have occurred and also from

the tendency to relapse into deformity. Fig. 12 represents a case of traumatic varus which was induced through destruction of the soft structures in the sole of the foot. Cicatrices formed which contracted more and more, drawing the

FIG. 12.



anterior portion of the foot inwards. And similar effects may be produced by erysipelas, and by deep-seated inflammation and abscess occasioned by contusion.

CHAPTER IV

PATHOLOGY

The contracted muscles in talipes are shortened, their extremities being approximated; but they have not at birth undergone structural shortening: nor, indeed, does structural shortening occur until inaction, or some other abnormal condition, has destroyed the power of the muscle. If structural shortening is ever found at birth, it is so rare as to prove the rule. Atrophy, or structural change induced by inflammation or other cause, always precedes structural shortening; and degeneration follows rapidly on inaction. At birth the muscles which are affected in equino-varus are in a normal condition and perfectly healthy. Microscopic examination reveals only healthy structure. Degeneration may occur even before birth; but whether it occur before or after birth, those muscles which are extended are first affected, and later those which are contracted.

An instance is recorded by Mr. Adams of this form of degeneration at birth in a severe form of

equino-varus where some of the muscles "might almost be said to be absent as far as their muscular fibres were concerned."* The child to which reference is now made died some few hours after birth.

This case is cited not as an example of the condition of the muscles in talipes varus at birth, but as the exception to the rule, for the muscles at this time are perfectly healthy. It might be supposed on reading the 'Transactions' that this case represented the ordinary condition of the muscles at birth in equino-varus, whereas it is most rare and exceptional.

After birth, structural change is occasionally rapid. In the course of a few weeks (a fortnight, says Sir James Paget) the colour of the muscle may have undergone considerable change. When structural change is occasioned by inaction the muscle wastes, it becomes pale, is stained with yellowish or fawn-coloured patches, which coalesce, and the entire muscle perhaps assumes an uniform fawn-colour; the transverse striæ disappear, the muscular fibre becomes disintegrated, and at length it is totally lost. The muscles are then transformed into yellowish or whitish fat, and their forms are no longer traceable, but they coalesce into a mass not bearing a trace, perhaps, of the distinctive characters of muscle. The skin

* 'Transactions of the Pathological Society,' vol. iii.

then loses its softness and elasticity, and becomes rough and scaly; the nerves become atrophied, and reduced as though to their neurilemma; the ligaments are softened and lose their elasticity, and the bones degenerate with the rest of the limb; the tendons are diminished in size, and the blood-vessels in their calibre. In some instances these changes are met with to a very remarkable extent; and in cases of foot deformity muscular fibre in the leg may be almost or entirely absent, so complete is the fatty change which has been induced. Such an example is to be seen in the museum of the College of Surgeons, Path. Series, No. 9 B.

In a paralysed limb, the nerves passing to the affected muscles are always atrophied after some duration of paralysis; and the spinal cord, corresponding to the paralytic lesion, undergoes atrophy. The bones become light, and their walls thin; and the cancelli are increased in size, and are filled with oily matter.

When paralysis of the flexors of the foot, for instance, occurs, so that the foot dangles loosely, and the anterior portion of the foot drops, the limb is rendered comparatively useless until retraction of the extensors of the foot takes place; then the limb is, so to say, *braced up,* and talipes equinus or equino-varus is produced. By this provision a certain amount of power is restored to the limb. Retraction increases in proportion to the amount of

paralysis until the heel is uplifted, and the anterior portion of the foot is alone in contact with the ground.

Under these circumstances atrophy commences in the flexors of the foot; and when the heel is fully elevated, the muscles of the calf of the leg also undergo a certain amount of atrophy through inaction: the calf appears to be situated higher on the leg than usual, and the length of the tendo Achillis appears to be increased. At length the tibio-tarsal joint becomes fixed, motion is lost, structural shortening ensues, and, ultimately, fatty degeneration takes place.

CHAPTER V

SECTION AND REPAIR OF TENDONS

Various attempts have been made to remove deformities by the section of tendons. Thus, Thilenius, in the year 1784, divided the tendo Achillis, and Sartorius, in 1806, performed a similar operation. Michaelis followed in 1809, and operated on various occasions. He did not, however, cut the tendon across, as was done by Thilenius and Sartorius, but, having divided the tendon in part, he ruptured the remaining portion. This also was the manner, and the only manner, in which, so far as I know, the tendo Achillis was divided in this country in 1843. This I witnessed more than once, and the result was satisfactory. Delpech, in 1816, divided the Achilles tendon subcutaneously; and he subsequently wrote the following rules which are admirable, and may be said to be still recognised for the division of tendons:

"1st. The tendon to be divided should not be exposed; but its section should be made by inserting the knife at a distance from the tendon,

and not by making an incision in the skin parallel to it. There is danger of exfoliation of the tendon unless this precaution be taken.

"2nd. Immediately after division of the tendon, the divided extremities should be brought into contact, and so be held by a suitable apparatus until re-union is accomplished.

"3rd. As re-union can only take place by an intermediate fibrous substance (*organisation inodulaire*), gradual and careful extension should be made, to give the required length to the shortened muscles, before solidification takes place.

"4th. Extension being complete, the limb should be fixed in this position, and be so retained until the new substance has acquired that firmness of which it is susceptible."*

The author of these rules may well be said to be the originator of subcutaneous tenotomy.

Fifteen years after the operation by Delpech, and three years after the publication of his work on the subject, Stromeyer first divided the tendo Achillis.

Stromeyer published his 'Contributions to Operative Orthopædic Surgery'† in 1838, in which the following occur as his rules for the performance of subcutaneous operations:

"When it can be done, the tendons of the resisting muscles must be divided, but when the

* 'De l'Orthomorphie,' tome ii, p. 330, 1828.

† 'Beiträge zur Operativen Orthopädik,' Hanover, 1838.

tendons can be reached only with great difficulty, then the muscles themselves should be divided. The section should be made beneath the skin, when this is possible, and the skin itself should not be divided. Small instruments of different shapes are to be chosen for this purpose: generally a moderately curved, sharp-pointed knife is the most useful. The limb should be so held that the tendon to be divided may be made to stand prominently forward; and the knife being passed behind the tendon, and the point of the knife having reached the opposite side, the resisting tendon is to be divided rather by pressure against the edge of the knife, than by an onward movement of the blade. The yielding skin follows on the blade of the knife, so that the two small wounds are only of the same breadth as the blade. I have very often divided the tendo Achillis with a single puncture of the skin; but this is unimportant, for the two small punctures heal as quickly as one only. Usually a peculiar cracking noise is heard at the moment when the tendon is divided. Section of the tendon with the point of the knife is not always safe, partly because the point is not sufficiently strong, but also because other structures may be wounded should the patient not remain quiet. Probe-pointed knives are quite useless. . . . . When there are many tendons to be divided the sections should, if

possible, be made at the same time, for extension is then accomplished with greater facility than when the operation has to be repeated."*

Stromeyer thus established the division of tendons on a secure and permanent basis, and ensured its reception as a standard operation in the art of surgery.

In the year 1836 Dr Little, who from childhood had suffered from equino-varus, visited Stromeyer in Hanover, and was operated on by him. In his work† Dieffenbach gives an account of Dr Little's return to Berlin after he had been operated on by Stromeyer, in the following words:

"A month had elapsed," writes Dieffenbach, "since Dr Little had taken a letter from me to Dr Stromeyer, in Hanover, when suddenly my door was opened, and the individual who had left me a cripple, entered with a vigorous and rapid step. I can scarcely tell which was greatest, my astonishment or my pleasure. I immediately examined his foot, and found the shape normal, the sole in contact with the ground, the arch of the foot diminished; the calf of the leg had begun to be developed, and the entire lower extremity had gained its normal length. A miracle could not have struck me more forcibly, and I confess

* Op. cit., p. 18.

† 'Ueber die Durchschneidung der Sehnen und Muskeln,' 1841.

I was never more taken by surprise in the whole course of my life at the successful result of a surgical operation than by this, and I esteemed Stromeyer, who had performed the operation, even more fortunate than Little, who had benefited by it."

In connection with the treatment of deformities, numerous experiments have been made to determine the mode of re-union after division of tendons. Some of the earliest of these were made by von Ammon, who published an elaborate work on the subject with highly coloured and over-wrought plates, which, however, contained much excellent and truthful material.* He was followed by Jules Guérin, Bouvier, Duval, Pirogoff, and others. Our own countryman, Herbert Mayo, had previously given the results of his experiments on animals. He did not operate, however, subcutaneously. Sir James Paget subsequently recorded a series of subcutaneous sections, and his record,† which is very precise, is of much value. The microscopical characters relating to the reparative process are given in considerable detail, and his representions are truthful records of the anatomical appearances which are presented. Gerstäcker and Boner about the same

* 'De Physiologia Tenotomiæ experimentis illustrata,' 1837.

† 'Lectures on Surgical Pathology,' vol. i, 1853.

time also recorded a series of experiments of a similar kind, and Thierfelder made a like series of experiments with most carefully detailed results, together with the microscopical appearances which were presented in thirteen instances, of the reparative process and of the structural changes which were observed between the first and the fifty-sixth day.

There were some points, however, which had not been clearly made out in the sections which had been made, and therefore I determined to repeat to a certain extent what had already been done, and to observe the results of division and the structural changes which take place during the process of re-union when the limb is placed under similar conditions to those which are observed in man. The results of my investigations were communicated to the Royal Society, together with the anatomical specimens themselves, as well as the drawings which were made from them. The mode of conducting these investigations differed from that adopted by others, in this respect, that instead of allowing the limb to be moved after the section had been made, it was kept at rest. The results which were obtained were intended to show, in the first place, the manner in which immediate re-union of the divided tendon is effected; and secondly, how re-union takes place when gradual extension of the uniting

medium is made. This mode of experimenting had not previously been adopted, and it had not been ascertained what was the condition of the new structure under these circumstances.

Mr Adams also made some sections of tendons about the same time. He followed the plan which had previously been adopted of dividing the tendon and allowing free movements of the limb. But the result of this mode of treatment is not satisfactory in its application to surgery. When this operation is performed in man, a splint is accurately bound to the limb, to prevent movements.

Thus my experiments were made as in man, and they were divided into three series to show—

1st. That when a tendon has been divided and the limb is held perfectly at rest it may reunite without leaving a permanent cicatrix.

2nd. That the new material may be extended to any required length.

3rd. That the new material does not impair the power of the muscle, except when it is so elongated as to prevent in any measure the action of the muscle.

RESULTS OF EXPERIMENTS

1. The tendon was divided one inch from its insertion, and the limb was then extended so as to approximate the divided ends of the tendon, and it was so held until re-union and consolidation had taken place. Two months having elapsed, the tendon was removed. A cicatrix was not observable externally upon the tendon. On making a longitudinal section of the tendon, however, a cupped depression was seen where the tendon had been cut across. After a more considerable lapse of time, namely, from three to four months, this depression had also disappeared.

2. When gradual extension after section of the tendon was made, as is done in man for the removal of deformity, the new material was drawn out to any required length. During consolidation contraction of the new material was always found to take place to a greater or less extent. When, however, extension of the uniting medium has been made the new material remains as a permanent structure.

3. When the new material, which is deposited between the divided extremities of the tendon, is extended slowly and gradually it may equal in diameter and strength the original tendon. It differs, however, in colour from the original

structure for, instead of the uniform arrangement of fibres and the pearly lustre of normal tendon, it presents a greyish, translucent appearance.

The process of re-union after the subcutaneous division of a tendon is as follows—

Immediately after the section of the tendon has been made, the muscle retracts, somewhat in proportion to the power of the muscle. Thus in the case of the tendo Achillis the upper portion of the tendon is retracted together with the muscle away from the wound, while the lower portion of the tendon remains opposite to the puncture. A clot or two of blood may be found in or about the sheath of the tendon, and especially in the immediate vicinity of the wound. The inflammatory product is usually of small amount, and the exudation ceases after twenty-four hours. The external puncture is closed by adhesion in from twelve to twenty-four hours.

On the second day there was found a film of blood in the sheath of the tendon, and a small quantity of lymph was attached to the divided ends. On the third day the space between the divided ends of the tendon was equal to from three fourths of an inch to one inch; the sheath was thickened and its vessels were injected; soft greyish lymph was attached to both extremities of the tendon, but especially to the upper divided

end. On the fourth day this constituted a soft bond of union between the divided ends, and the lymph was more or less blotched with blood. On the sixth day the ends of the tendon were more closely approximated, the intervening substance not being more than half an inch in length; it was well defined, firm, and ruddy, being streaked with blood. At this time the uniting medium was distinctly fibrous. The ends of the tendon, especially the upper end, were enveloped in this new material to the extent of one fourth of an inch; they were also somewhat swollen, softened, and succulent. Occasionally an elongated clot of blood was found imbedded in this new material as an accidental product, which did not, however, appreciably hinder the healing process. On the tenth day the uniting medium had contracted to one fourth of an inch in length; it was softer, paler, and thicker than the normal tendon, but it was not less well defined, and it was at this time capable of very considerable resistance. The Achilles tendon of a rabbit, for instance, supported a weight of eighty pounds.

The reparative process appears to proceed equally well whether the sheath of the tendon be entirely or in part only divided; yet the sheath is doubtless important in giving definition to the new product. In these sections slight adhesions to the sheath were sometimes found to exist. In

numerous instances, however, the tendon was free in its sheath. It was found that when the sheath was entirely divided it did not contract with the muscle, but it was always afterwards adherent. Each day added to the strength and perfection of the intermediate substance.

If the limb be retained for a long period in a position to favour perfect re-union, contraction of the new material continues to take place until a bulbous enlargement alone marks the point of section. This, also, at length disappears, and no outward trace of the passage of the knife across the tendon itself remains. On making a longitudinal section of the tendon, however, a slight central depression may be observed, which marks the point where the tendon was divided. This depression is at length also removed, so that the condition as it is described by Sir James Paget is obtained, namely, no trace of the division can be discerned even with microscopic aid. Such, then, is the mode in which re-union takes place when the limb has been kept entirely at rest.

When, however, extension has been made—as for the removal of deformity—or when the section of a tendon has been made and the limb has not been kept at rest, the new material becomes elongated, either according to the desire of the surgeon or, whilst in its soft extensible condition, through the unrestrained motions of the limb.

And should these movements be excessive, and especially if they occur soon after the division of the tendon, re-union may be wholly prevented.

While the new material remains soft and extensible it may be drawn out to any desired length, and thus become the means of restoring the proportions of a limb when structural shortening has taken place. But that this new material may be formed of the required length and of equable dimensions extension must be made gradually. Otherwise re-union will probably be imperfect, or the soft material may be drawn out to an inordinate length, as when extension is made too rapidly. Then paralysis or weakness of a previously healthy muscle will be induced. This is a point of considerable importance in the treatment especially of non-congenital deformities, and those occasioned by inflammation and local injury. I have known the divided ends of the Achilles tendon to be so widely separated after section of the tendon that re-union was prevented: the sheath of the tendon became thickened, but talipes calcaneus resulted.

Thus it is shown that re-union may take place under favorable circumstances without leaving a permanent cicatrix, while, on the other hand, it may take place through the formation of new tissue, which will remain as an added structure.

This new material may be extended to the

required length without impairing the strength of the tendon, if extension be made gradually and while the substance is still soft, but when extension is made too rapidly the new material will be lengthened inordinately, and remain unfitted for the purposes of the muscle. It then becomes only a slender uniting medium, which by its length impairs the power of the muscle.

CHAPTER VI

TREATMENT

The time usually selected for the treatment of congenital varus is from six weeks to two months after birth; and it is best to treat every case, however slight, by division of tendons. The tendons to be divided are those of the tibialis posticus and anticus muscles, and of the flexor longus digitorum, and the tendo Achillis. The plantar fascia also may require to be divided.

Equino-varus being a compound distortion, its removal is to be undertaken by stages. First, inversion is to be overcome, after the section of the tibial tendons and that of the flexor longus digitorum. Secondly, the plantar fascia is to be divided, and the anterior portion of the foot is to be flexed. And, lastly, the tendo Achillis will be divided, the heel will be lowered, and the entire foot will be flexed upon the leg.

The tendons of the tibialis posticus and the flexor longus are those which should be first divided; and unless these tendons are completely severed, the radical treatment of equino-varus is

hopeless. The tenotome will be introduced at about one inch above the malleolus and passed on to the edge of the tibia, and the sheath of the tendon is to be freely opened, without, however, enlarging the external puncture. The round-ended tenotome will then be passed well beneath the tendons, and the edge being turned towards them, they will be divided on extending the foot.

In the adult the sharp-pointed knife may safely be employed in dividing these tendons, but it is safer in the infant to use the blunt-pointed knife.

The tendon of the tibialis anticus muscle is to be divided immediately after that of the tibialis posticus, by passing the knife beneath the tendon as it passes over the ankle-joint from without inwards, and between the artery and the tendon. Sometimes this is more tense than that of the posterior tibial, and it should in this case be divided first. Otherwise, on dividing the posterior tibial the jerk may be only indistinctly felt.

For the first two or three days the foot is to be kept in the same position as before the operation; but so soon as the punctures have healed, a splint extending from the knee is to be bound on to the outer side of the leg and foot. With this, slight traction is made upon the foot, and this is to be continued until rotation is overcome, and the foot is fully everted. To succeed in

overcoming rotation, this movement must be gradual. But rotation cannot be overcome except after the division of these tendons; and therefore there must always remain a false position of the tarsal bones if the tendons have been imperfectly divided—transfixed and partially divided; or when the foot is forcibly placed in position, and so retained in plaster of Paris. Under such circumstances relapse into varus will surely take place. For a successful issue the varus position must not be overcome quickly. In ordinary cases rotation is readily enough overcome after tenotomy by means of the straight metal splint. And even when the tarsal bones are somewhat bent, or abnormal in shape, being soft—almost cartilaginous during the first few months of life—they are easily moulded into shape, through gentle, but continued traction and pressure. But, because in severe cases the astragalus is deflected inwards as well as the calcaneum, and the deltoid ligament is short, haste in removing the varus position will lock the bones still more, and will remove all chance of unfolding the foot and replacing the bones in position.

After the foot has been fully everted the tendo Achillis is to be divided. The knife is to be passed from the outer to the inner side of the tendon, and care must be taken not to puncture the posterior tibial artery. This is the last

tendon to be divided; and it is of the last importance that the foot shall be fully everted before this tendon is severed, for it fixes the heel; and after dividing the Achilles tendon, the power to bring the tarsal bones into position is lost, nor can the arches of the foot then be unfolded. It is therefore most important fully to evert the foot before the fixed condition of the os calcis is destroyed. Thus, it is only after inversion has been overcome, and the arches have been unfolded, that the Achilles tendon may be divided.

The plantar fascia, when contracted, should be divided before the support of the Achilles tendon is removed from the os calcis, whether in infantile or in adult varus; otherwise the longitudinal arch of the foot cannot be fully expanded. It is rare, however, that this fascia requires to be divided in the infant; yet the central portion may require division, or the inner band of fascia may alone be contracted. In either case the contracted portions should be fully divided. In the adult the plantar fascia offers a serious impediment to the restoration of the shape of the foot, and requires to be freely divided.

In dividing the plantar fascia the point of the knife should be held in close proximity to the contracted fibres. After these have been freely divided, extension is still to be continued and

increased between the heel and the ball of the great toe, when other contracted fibres will probably be observed, which also must in turn be divided. And whether it be contracted fascia or tendon, the tenotome should be held in close proximity to the contracted structure: there will then be no danger of dividing blood-vessels or nerves.

The unfolding of the foot in equino-varus demands the greatest patience and some tact. Fortified with these essentials, there are few cases indeed in which deformity may not be overcome. In a very large experience spread over many years, and numbering very nearly four thousand cases, those which were not amenable to tenotomy and the gradual unfolding of the foot, have probably not amounted to twenty.

It is certain that the treatment of such cases demands special knowledge—surgical, anatomical, and mechanical. Some never attain to it: even after the experience of years they seldom divide the tendons, and the after-treatment is an utter bewilderment to them And yet such an one will probably perform any operation in a hospital theatre in the most approved style. Names, as examples, could be added with ease; and they would certainly be recognised.

Thus there are cases which do not yield to tenotomy alone. In these, it is well to divide

the deltoid ligament. This almost invariably enables the operator to evert the foot fully. Such cases may even occur in early childhood. I have always taught that the ligaments rather than the bones, after division of tendons, interfere with the removal of deformity; and of the ligaments the deltoid or internal lateral interferes the most. The subcutaneous section of this ligament, and especially the anterior portion, removes in many cases the most formidable resistance. Then, again, the calcaneo-scaphoid and the astragalo-scaphoid interfere far more than do the tarsal bones in the rectification of the foot. According to my experience, however, these ligaments only need to be divided in later life.

Some few weeks after birth the after-treatment may quite well be conducted with a flexible metal splint only, and without special apparatus. But should there be difficulty in retaining a splint for flexion, then the best apparatus is that mentioned and figured by my colleague, Mr Baker, in his volume on 'Deformities.'* And in later life the best instrument in use—a modification of Scarpa's shoe, is made by Mr Gümpel, of Newman Street.

When distortion has been removed, active and passive exercises of the limb, together with fric-

* 'Treatment of Deformities,' p. 23.

tion, galvanism, bathing, and other like means must be employed, until easy if not complete power of motion is gained; for if the shape of the foot alone is restored, and the power to move it is overlooked, the patient will walk, but without elasticity and without motion at the ankle-joint; and then contraction, to a slight extent at least, will probably recur. These passive exercises and manipulative movements should be practised by those who are properly instructed, not only with regard to the force to be employed, but also as to the direction in which it should be used. This is an art which appears very simple when it is learnt, as many others do, but these manipulations require considerable practice if they are to be performed successfully. The restoration of function very largely depends on these exercises, and they should be continued three or four times or more daily until the complete ankle movements are gained. Thus the treatment of talipes varus consists, in the first place, of the removal of deformity; and secondly, of the restoration of the functions of the limb.

It is not possible to conclude this chapter without making some reference to proceedings which have of late years been forced upon the profession, with regard to tarsotomy and tarsectomy. I would say of these operations, with my colleague Mr Reeves, that "any form of osteotomy in infants

and young children is utterly indefensible and unjustifiable."* Even it would be justifiable to use harsher language. The truth is that after the tendons have been properly divided there is rarely difficulty in restoring the shape of the foot.

The difficulty lies in the division of the tendons. But unless these are divided it is impossible to overcome rotation. It is easy to say that tenotomy has fulfilled its purpose, and that now more drastic measures should be taken. But why? With the help of tenotomy the most admirable cures have been made,—such perfect restorations that it would be impossible for anyone to say that equino-varus had ever existed. And yet this system is to be changed, forsooth, for another which is thus described by an advocate for tarsectomy:— "I have always taught," says Mr Walsham, "that though I firmly believe these intractable grades of the deformity can only be cured by tarsectomy, *at the best it is but a bad job*."†

But to cut through the tarsal arch at six weeks after birth, whilst the bones remain soft and pliable, is a very great abuse of power placed in the hands of the surgeon. Yet such cases are recorded. In this early and plastic stage osteotomies are entirely unjustifiable.

* 'Bodily Deformities,' p. 178.

† 'The Lancet,' Dec 10th, 1892.

Again, Dr Ogston, who is in favour of osteotomy in general, alludes as follows to these operations. He says, "Tarsotomy by subcutaneous puncture and chain-saw passed round the foot was done five times, *but was now given up*. Excision of the wedge of the tarsus was done three times, and, *though it looked pretty, was not useful*."*

Doubtless tenotomy and the after-treatment, to bring about a good result, demand much skill and a great deal of patience; whereas osteotomy requires none. But then how different is the result which is obtained! After tenotomy a limb is produced equal to the best, but after osteotomy only "*a bad job*."

The question of amputation in relation to congenital talipes ought never to arise. Yet it is heard of, especially after osteotomy, and apparently it is thought to be justifiable, even where little or no adequate attempt has been made to correct deformity. I saw in consultation, some years ago, a boy, aged twelve, with congenital equino-varus. It was said that everything had been tried, but no impression was made on the deformity. I remarked that the tibialis posticus tendon had not been divided, for the fact is easily recognised whether this tendon has been divided or missed; and I recognised immediately that

* 'The Lancet,' 1888.

it had been missed. I recommended that it should be divided; but, instead of this, both feet were amputated. And whether a foot be amputated, or whether it be mutilated and rendered useless, there is this difference: in the one case an artificial leg is provided which can be used; in the other a foot which cannot be used. But, so far as I know, it is only to the poor, the ignorant, and the helpless that these disadvantages are rendered. These osteotomies demand no skill; they are quickly done; there is no trouble, and the result is good so far as appearances go. It has with much truth been said that they rank among the surgical atrocities of the age. Surely no one with such mutilated feet could be expected to stand and much less to walk even for eight hours in the day. How much better it would be to leave the foot untouched! It is at least in its deformed condition useful.

These osteotomies are too frequently performed. Success is constantly being recorded; but it is not meant that a patient can walk after such an operation, but that amputation has not been had recourse to, and that the patient is still living. If, as Dr Ogston says, "*it looks pretty, but it is not useful*," this is sufficient condemnation, and it is certain that such an operation ought not to be performed. It can only be a success where the utility of the limb is increased.

There are, however, certain cases, and among the thousands that I have treated, perhaps as many as could be counted on the fingers of one hand might be found, where it would be permissible to remove the astragalus. These are neglected cases where the limb has been greatly used, and where consequently material changes have taken place in the bones. But when I can tell of cases of congenital equino-varus operated on at seventy-three years of age, and perfectly restored after tenotomy only, so that no vestige of deformity remained; and of a member of the profession who, at fifty-two years of age, submitted to operation, having one of the most severe forms of congenital equino-varus that I ever saw, and who was so far relieved that he could walk well with the sole flat on the ground, and with free ankle motion, I may perhaps be excused if I doubt the frequent necessity of osteotomy in equino-varus. It is not, however, of such cases that I would speak. When people have arrived at such years, it is their own fault if they submit to osteotomy. But it is for the sake of the children that I would protest against these practices; for through these operations they are incapacitated for every-day work, and they are unfitted to gain their living. Besides, relapse after tarsectomy frequently occurs, so that it is not unusual to perform two or even three opera-

tions of this kind on the same foot in succession.

The latest description of these operations is thus given: The operation "consists in dividing every resisting structure which is encountered in a free vertical passing from the dorsum of the foot into the depths of the sole over the head of the astragalus, the tendon of Achilles having been first cut. The improved position of the foot is thus obtained by lengthening the inner border of the foot, rather than by shortening the external border, as is usually accomplished in tarsectomy. It consists in inserting a broad wedge of space into the astragalo-scaphoid joint. This space is duly filled up with granulation tissue, which is eventually converted into a strong and trustworthy cicatricial band between the anterior and posterior segments of the foot."

Thus the fabric of the foot is cut through, that there may be inserted *a broad wedge of space into the astragalo-scaphoid joint.* And this is done because, "operating [subcutaneously] comparatively in anatomical darkness, the surgeon cannot know for certain what structures he is dividing, nor can he be sure of severing certain important bands, deeply placed in the sole, perhaps, which chiefly prevent his obtaining the perfect and easy rectification of the foot. Moreover, in a severe case of congenital club-foot, the

skin itself offers a most serious impediment to a correction of the deformity."*

Because the surgeon uses not only the eye, but the ear and the sense of touch, he can do his subcutaneous operations in the "anatomical darkness" of the urethra, the bladder, and the kidney. I have witnessed instances where "anatomical darkness" was so dense that neither could the bladder be reached to discover the stone, nor could the femoral artery be found in an operation for aneurism. But in dividing tendons we have the great advantage that the eye comes to assist the finger, so that the tendon of a retracted muscle is not only most distinctly felt, but it can be drawn into view. And if, under such circumstances, the surgeon does not know what structures he is dividing, clearly his education has been neglected, or he has mistaken his vocation. There is no band that he has to divide to which he has not a certain guide; nor is the skin an impediment to the correction of deformity. Therefore the necessity of cutting through the arch of the foot to insert a broad wedge of space, whatever that may be, is perhaps not so clearly made out that subcutaneous operations will cease to be performed. But these osteotomies, followed at times by amputation, and even by death, may make it desirable to acquire such knowledge

* 'Proc. Roy. Med. and Chir. Soc.,' 1892.

as is necessary to perform subcutaneous tenotomy.

Thus it may be concluded:—*First*, that the tarsal bones being at birth normal in shape, deformity is easily removable after tenotomy. *Secondly*, that even should there be any abnormal form, the bones at this time being plastic are reducible—readily moulded and brought into shape. *Thirdly*, because equino-varus can be perfectly removed after tenotomy, it is unjustifiable to cut through the arch of the foot, thus producing a mained limb and one which, if not entirely unserviceable, is at least of diminished utility. *Fourthly*, it is rash to separate widely the divided ends of the tendon, as is done when the limb is encased in plaster of Paris, for thus re-union is prevented, and permanent weakness is produced.

And, therefore, the treatment which has been hitherto practised, and which is here recommended, namely, tenotomy and gradual extension, is not only the safest, but also it is that which conduces to the freest and the strongest use of the limb, and to the restoration both of form and function.

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TALIPES EQUINO-VARUS

PRINTED BY ADLARD AND SON,
BARTHOLOMEW CLOSE, E.C., AND 20, HANOVER SQUARE, W.