

not enough to induce them to have it relieved by operation. There are occasional examples of prolapse of the uterus to the vulva, in which there is no defect of perineum and no cystocele. In the treatment of these, ventro-suspension alone is required. Anterior and posterior colporrhaphy was done in most of the remaining 16 cases. An elongated cervix was amputated in one case. In several instances curetting and drainage of the uterus seemed necessary, and was done in addition to the plastic vaginal operations.

In brief, whatever operations upon vagina or uterus the condition of each patient seemed to require, were done first; then the uterus attached to the abdominal wall at the same sitting.

The after-progress of all these patients to recovery was rapid and uneventful. In no instance were there any of those disturbances that we now and then see after abdominal sections for other and graver affections. The contents of the abdomen are so little exposed and so little is done within the abdominal cavity, that there is no danger except from septic infection, which, with our care of to-day in this operation, is practically an eliminated factor of danger.

The recorded results in large numbers of cases by others, confirm this statement. Ventro-suspension, in addition to the ordinary plastic operations done for prolapse, did not in any way alter or retard the patient's progress to recovery. These cases have been operated on so recently that I do not know whether there will be any remote sequelæ that will detract from the value or final success of the operation. But its after-results so far have been so satisfactory to myself and so gratifying to the patients, that in all cases of prolapse of the uterus to the vulva, ventro-suspension will be done with the consent of the patient; and in view of the complete cure that can be promised, that consent will rarely be withheld.

As applied to the correction of complete prolapse, ventral suspension cannot be advised so confidently. Although it has been entirely successful so far as my own small experience goes, still there are several recorded cases of failure. Some of these are undoubtedly due to the fact that hysterorrhaphy alone, without the auxiliary plastic operations, was relied upon.

We have, then, to compare ventral suspension, supplemented, of course, with the necessary plastic work, with other operative procedures that may be chosen for the treatment of the affection. Vaginal hysterectomy has given, in many cases, very satisfactory results, but it is often followed by an intractable cystocele.

The character of the operation is such that this sequel cannot be prevented nor cured when it has once occurred. Ventro-suspension, even if it is followed by an occasional relapse, is by far the preferable operation.

The choice of operation, then, lies between hysterorrhaphy and abdominal hysterectomy. Baldy reports eight cases of supra-vaginal hysterectomy for prolapse, and describes the technique followed, which in the first part, is the ordinary operation (Baer's). Then he raises and attaches the cervix to the broad-ligament pedicles that contain ovarian arteries and sound ligaments. He thus utilizes the remaining portion of the cervix to draw up and anchor the stretched-out vagina. The advantages of this procedure over complete abdominal hysterectomy are at once apparent.

In one case Baldy¹ attached the cervix to the anterior abdominal wall.

Noble² also reports a case in which hysterorrhaphy had failed, and in which he did hysterectomy and attached the cervix to the abdominal wall.

These cases all gave satisfactory results.

The single advantage of hysterectomy over ventro-suspension is that it would probably eliminate the rare failures that might follow the latter operation. A very movable uterus can be removed with great facility and with very little danger, still the mortality of the operation is necessarily larger than that of ventro-suspension. When it is done for prolapse, the patient must submit, two or three weeks later, to additional plastic operations, and is confined in bed six weeks. When ventro-suspension is done the patient is consciously disturbed by only one operation, for the others that are required are done at the same time, and she recovers in three weeks. At the present time, my own choice of operation will be ventro-suspension with women of child-bearing age, and those quite advanced in years, for example, sixty-five and older, and in ordinary cases of complete prolapse. Should prolapse recur, the failure is not irremediable, for hysterectomy can then be done. However, in that class of cases in which the uterus has become greatly enlarged or its structure much changed from long-continued exposure, I believe that hysterectomy with all its disadvantages will give better results.

ANATOMY OF CONGENITAL EQUINO-VARUS.¹

FROM THE SEARS PATHOLOGICAL LABORATORY OF THE HARVARD MEDICAL SCHOOL.

BY EDWARD H. NICHOLS, M.D., *Assistant in Pathology.*

THE two specimens of equino-varus illustrated in this article are the feet of a still-born child, delivered at term, in the Out-patient Clinic of the Boston Lying-in Hospital.

Besides the double club-foot there was a failure to close of the posterior wall of the neural canal in the occipital and dorsal regions, "partial cranio-rachischisis"; a lack of development of the right side of the heart, and a fetal mesentery.

The left foot was carefully dissected. The right foot was frozen, and cut in parallel sections in a plane corresponding to that of the malleoli. This method, so far as the writer knows, is a new one, and gives an accurate view of the relations of the parts, without the artifacts necessarily associated with any dissection of the deep structures.

THE NORMAL FOOT.

In the normal foot the astragalus lies tightly wedged between the tibia and fibula, with which its upper surface articulates, and this joint permits motion only in flexion and extension. In front of this joint the neck of the astragalus extends forward and slightly inwards, and terminates in an articular facet or head, which articulates with the scaphoid. The plane of this joint is practically at right angles to the long axis of the foot. The astragalus rests upon the os calcis, a little to its inner side, and the plane of the articular

¹ Read before the Boston Society for Medical Improvement, November 30, 1896.

² American Journal of Obstetrics, April, 1866.

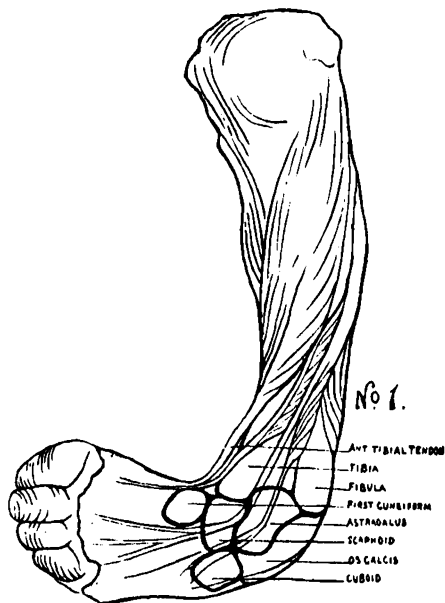
² American Gynecological and Obstetrical Journal, May, 1896.

surface between the astragalus and os calcis is practically a horizontal one, at right angles to the long axis of the leg.

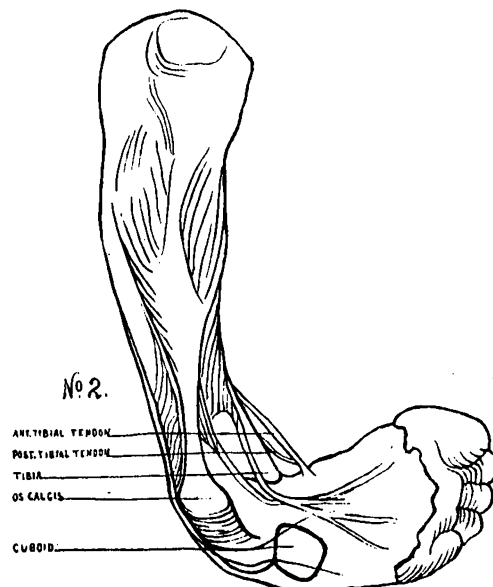
The os calcis lies below, and a little to the outer side of the astragalus, to which it is firmly attached by the interosseus ligament. The long axis of the os calcis runs forwards and slightly inwards. The anterior end extends nearly to the plane of the joint between the astragalus and the scaphoid, and articulates with the cuboid. The plane of this joint is also practically at right angles to the long axis of the foot. The two articulations, between the astragalus and the scaphoid on the inner side of the foot, and the os calcis and cuboid on the outer side of the foot, together constitute the "mid-tarsal" joint. This joint

calcis posteriorly, and the scaphoid and cuboid anteriorly. The deformity is best understood by studying the changes in the individual bones, ligaments and tendons. The following description of the abnormalities, especially of the relations of the bones, is based upon an examination of the two feet illustrated in this article, and of several dissections and preparations in the Warren Museum. For descriptions of individual bones various works were consulted, especially the admirable description of Walsham and Hughes.

The astragalus is deviated slightly inward at the ankle-joint, the neck is somewhat elongated, and curves inward and downward so that the facet which should articulate with the scaphoid, points inward. The whole astragalus is tipped forwards so that the ante-



Congenital Equino-Varus. View of anterior surface of left foot. Shows inward deviations of neck of astragalus, and of os calcis, with resulting obliquity of mid-tarsal joint; altered relations of scaphoid, cuboid and internal cuneiform; and direction of anterior tibial tendon. Line-drawing from photograph of dissected foot.



Congenital Equino-Varus. View of plantar surface of left foot. Shows convexity of os calcis; altered relation of cuboid; and direction of posterior tibial tendon. Line-drawing from photograph of dissected foot.

allows limited motion in all directions, and is the joint chiefly concerned in the deformity of club-foot.

EQUINO-VARUS.

The gross changes in club-foot are obvious. The heel is small and elevated. In front of the leg the dorsum of the foot is prominent; the toes point inward nearly at right angles to the line of the leg, and the outer edge of the foot rests upon the ground, while the inner border is raised; the dorsum of the foot looks forward, while the plantar surface looks backward. The sole of the foot is contracted. The deformity is due to an inward and upward rotation of the whole foot, caused by a change in the shape of all the bones of the foot, accompanied by a contraction of the internal, and a lengthening of the external, ligaments, and by shortening of certain muscles and tendons, and by peculiarities in the course of vessels and nerves.

The greatest and most important abnormalities are the obliquity of the facets, and the change in shape of the bones which enter into the formation of the "mid-tarsal" joint, that is, the astragalus and os

terior half or two-thirds of the superior articular facet is not covered by the ankle-joint, and appears as a prominence on the dorsum of the foot. The inner surface is compressed, so that on cross-section the bone appears wedge-shaped, with the apex of the wedge on the inner side of the foot.

The os calcis is generally small. The posterior end is raised, the anterior end is depressed, while the bone, as a whole, is rotated inward beneath the astragalus, with the interosseous ligament as the axis. Moreover, the whole bone is convex externally and concave internally, and is directed downward, forward and inward, so that the anterior facet looks down and inward.

The scaphoid is somewhat flattened, is drawn inward and upward, and slightly rotated on its antero-posterior axis, so that its internal surface looks somewhat upward. It articulates with a facet on the inner side of the head of the astragalus, and may also articulate with the internal malleolus.

The cuboid is somewhat altered in shape, is drawn inward and upward, and is somewhat rotated on its antero-posterior axis, so that its internal surface faces

upward; it may be drawn entirely to the inside of the os calcis. It articulates with the obliquely placed anterior facet of the os calcis.

The cuneiforms are slightly changed in shape, the facets being obliquely placed to correspond with their altered position. They are adducted and rotated inward, so that their plantar surfaces look backward and inward.

The metatarsals are adducted and rotated to correspond with the altered positions of the cuneiforms and cuboid, but are only slightly altered in shape.

The internal ligaments are contracted, especially those which bind the scaphoid in its position. The external ligaments are lengthened. The plantar fascia is very much contracted.

The anterior tibial muscle is displaced inward, and shortened, and is an important factor in maintaining the varus position of the foot. The posterior tibial

that part of the foot in front of the mid-tarsal joint. The rotation of the anterior part of the foot causes the outer edge of the foot to bear upon the ground, and the dorsal surface to look forward. The shortened ligaments and tendons, especially those of the tendo-Achillis, tibialis anticus, and tibialis posticus, retain the foot in its abnormal position, while the shortened plantar fascia causes the contraction of the sole of the foot. Of these changes the most essential, and the one which offers the greatest resistance to correction of the deformity, is the obliquity of the mid-tarsal joint.

In patients who have walked upon uncorrected club-feet, all of these deformities are increased and accentuated. The muscles atrophy. The cartilaginous

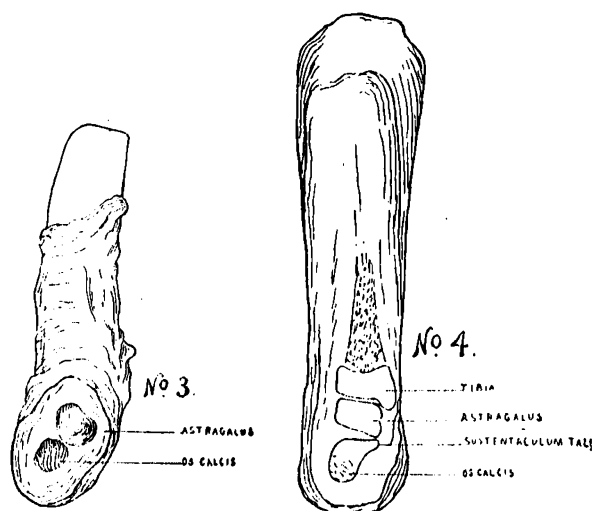


FIG. 3. Congenital Equino-Varus. Frozen section through mid-tarsal joint of normal foot at birth. Shows articular facets of astragalus and os calcis, with plane of articulation at right angles to the long axis of the foot.

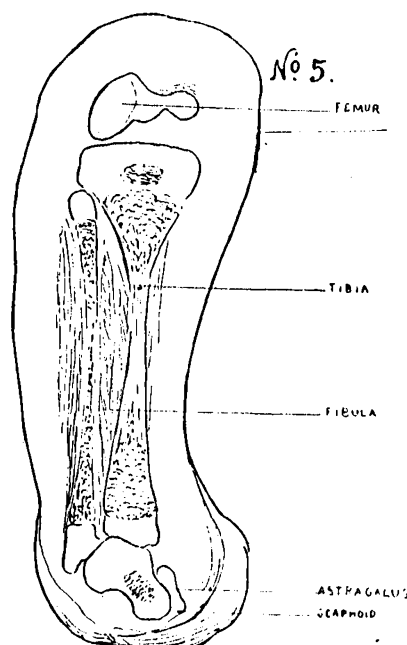
FIG. 4. Congenital Equino-Varus. Frozen section of normal foot, in long axis of the leg in the plane of the malleoli. Shows the nearly vertical position of astragalus and os calcis beneath the tibia. The section passed just in front of the fibula.

is shortened, and extends directly forward to its attachment to the scaphoid. The tendo-Achillis is shortened, and elevates the posterior end of the os calcis.

The anterior tibial artery is displaced inward, but is separated from the anterior tibial tendon by the long extensor of the great toe. The posterior tibial artery lies to the outer side of the posterior tibial tendon, although in close proximity.

The posterior tibial nerve is closely approximated to the posterior tibial artery.

Hence it appears that the deformity of the foot in cases of congenital equino-varus is due essentially to an alteration in the shape of all the bones of the foot. The tilting forward of the astragalus, carrying with it the os calcis, produces a plantar flexion of the foot at the ankle-joint. The inward twist of the neck of the os calcis and of the astragalus, causing an inward deviation of the anterior articular facets of the mid-tarsal joint, combined with the adduction and rotation of the scaphoid and cuboid, produces the varus position of



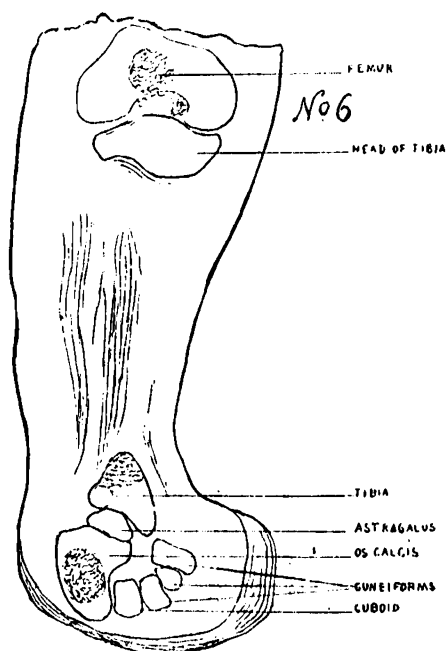
Congenital Equino-Varus. Frozen section, vertical, in the plane of the malleoli at about the level of the mid-tarsal joint, through a right congenital club-foot at birth. Shows the length and inward deviation of the neck of the astragalus, and the articulation of the scaphoid with the inner side of the neck of the astragalus.

surfaces of the os calcis and astragalus, which are uncovered and fail to articulate with the proper bones, lose their cartilage, which may be replaced by fibrous tissue or bone. This renders late reposition of the foot difficult. The ligaments bind the anterior tarsal bones more firmly in their abnormal positions. The marked inward direction of the anterior facet of the astragalus prevents forcible correction of the scaphoid or tends to cause recurrence of the deformity, if reposition is possible. The inward direction of the anterior facet of the os calcis prevents reduction of the cuboid, or tends to cause recurrence if reduction is possible. The contraction of the plantar fascia is more marked and the contraction of the anterior and posterior tibial tendon is extreme. Firm ligaments bind the scaphoid to the internal malleolus, the cuboid to the inner side of the os calcis, and the posterior surface of the astragalus to the external malleolus. The skin over the point of pressure of the foot upon the ground thickens, and large bursæ may form.

REDUCTION OF THE DEFORMITY.

To reduce the deformity it is evident that each step of the deformity must be corrected, that is, the contraction of the sole of the foot, the inward rotary deviation of the anterior part of the foot at the mid-tarsal joint; the inward obliquity of the mid-tarsal joint, the inward deviation of the astragalus and os calcis, and the plantar-flexion of the foot at the ankle-joint.

In infantile and non-resistant cases division of the plantar fascia will correct the contraction of the sole. Forcible reposition, with, if necessary, division of the anterior and posterior tibial tendons, and of the calcaneo-scaphoid and calcaneo-cuboid ligaments, will cor-



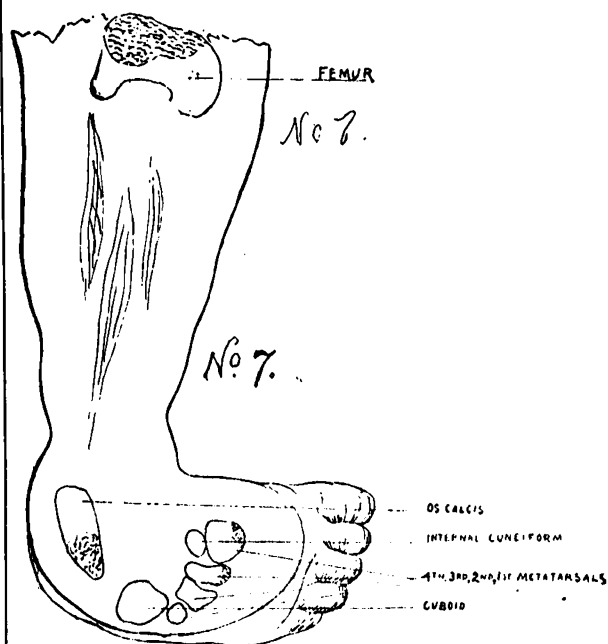
Congenital Equino-Varus. Frozen section, vertical, in the plane of the malleoli, about one-quarter of an inch posterior to the section in Fig. 5. Shows the compression of the astragalus; the obliquity of the os calcis; the altered position inward of the cuboid; and the relations of the cuneiforms.

rect the rotation and varus. Division of the tendo-Achillis and forcible reposition will correct the plantar flexion and inward deviation of the astragalus and os calcis. On account of the cartilaginous, yielding structure of the bones, division of tendons, forcible reposition of the foot, and retention of the foot in an overcorrected position will generally suffice, because the distorted bones conform to the corrected position.

In adult and resistant cases the bones are hard, no longer cartilaginous; the ligaments are very firm; and all steps of the deformity are accentuated. To correct these obstinate cases many operations have been recommended; for example, removal of the cuboid; of the astragalus; of the astragalus, cuboid and scaphoid; of the astragalus and external malleolus; division of all internal soft parts down to the bone; wedge-shaped osteotomy of the outer side of the os calcis; and, finally, osteotomy of the neck of the astragalus and of the neck of the os cal-

cis. From the anatomy it is evident that an operation which neglects to correct the inward obliquity of the mid-tarsal joint and the inward deviation of the astragalus and os calcis must be faulty, and liable to be followed by a recurrence of the deformity. A correction of the deformity of the anterior part of the foot alone will leave a re-entrant angle between the head of the os calcis and the cuboid, and is tolerably certain to be followed by a relapse.

The rational treatment of the deformity must depend upon a recognition of the essential changes that produce it. Division of the plantar fascia will correct the contraction of the sole. Division of the anterior tibial tendon, the calcaneo-scaphoid ligament, the calcaneo-cuboid ligament, possibly the posterior tibial



Congenital Equino-Varus. Frozen section, vertical, in the plane of the malleoli, about one-quarter of an inch posterior to the section in Fig. 6. Shows the os calcis cut obliquely; the altered position inward of the cuboid; the internal cuneiform; and the heads of four metatarsals.

tendon, with osteotomy of the neck of the astragalus, and of the neck of the os calcis, followed by forcible reposition, will correct the varus and rotation at the mid-tarsal joint. Division of the tendo-Achillis, with forcible reposition, will correct the plantar flexion at the ankle-joint, and the inward deviation of the astragalus and os calcis.

SUMMARY.

The deformity in cases of congenital club-foot is due to alterations in the shape of all the bones of the foot, accompanied by contraction of certain tendons and ligaments. The chief deformity is at the "mid-tarsal" joint, and is due to an inward deviation of the anterior articular facets of the os calcis and astragalus. A failure to correct this obliquity is a failure to correct the deformity. In resistant cases the obliquity can be corrected best by an osteotomy of the neck of the os calcis and of the astragalus, followed by forcible reposition of the foot.