CLINICAL LECTURES ON ORTHOPAEDIC SURGERY, DELIVERED AT THE PHILADELPHIA HOSPITAL; NOS. I-II

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THE ETIOLOGY, MORBID ANATOMY, VARIETIES, AND TREATMENT OF CLUB-FOOT.

LECTURE I.

GENTLEMEN: Every observant person, whether within or without the profession of medicine, must be impressed with the prevalence of various deformities in individuals of the human family, and their very existence must cause him to reflect upon the nature of their being, their chronic and progressive character, and the apparent difficulty of arresting them. Much of this has been due to lack of knowledge of the mechanical factors which enter into their etiology, and the very general neglect the subject of malformations has received, from an educational standpoint, in our medical schools. Though twenty-five years have elapsed since the establishment of orthopædic surgery as a legitimate special branch of surgical art, its science and practice, noticeably in this city, are permitted to occupy a very subordinate position, and its principles practically are untaught. In this clinic, which will initiate the course of lectures upon orthopædic surgery in the Philadelphia Hospital, which it will be my privilege to deliver before you this Spring, no better subject could be chosen than one descriptive of *club-foot*, a condition which you will frequently meet in practice, and of which many examples may be constantly observed in the nervous, obstetrical and surgical wards of this hospital.

We may define club-foot, or talipes, which latter designation was first employed, about thirty years ago, by William J. Little, of London, as a deformity of the foot, caused by paralysis, permanent spasm, or structural shortening of the

muscles, contractions of fasciæ or ligaments, and resulting in an alteration of the normal relations of the tibio-astragaloid articulation, or between the bones of the tarsus proper. Under the generic term club-foot, or talipes, we include all deformities of the foot which occur on an antero-posterior or transverse plane, and which are characterized by flexion, extension, inversion or eversion.

To obtain a clear conception of the deformities under consideration, it is best to divide the foot into an anterior and a posterior portion, the former, the "*pes*," or foot proper, and the latter, the "*talus*," or ankle. These portions articulate at Chopart's joint, which is formed by the astragalus and os calcis behind, and the scaphoid and cuboid in front. For purposes of clinical study, club-foot is most conveniently separated into two classes, composed of the simple and the compound forms. Of the former there are four varieties, two between the tibia and foot, namely, *equinus*, in which the heel is raised, the foot being held in the extended position, the patient walking upon the ball of the foot; and *calcaneus*, its opposite, in which the patient walks upon the heel, the foot being drawn into the position of flexion. There are also two lateral deformities: *varus*, in which the internal border of the foot is elevated, the sole directed inward, and the anterior portion of the foot adducted; and *valgus*, its opposite, in which the outer side of the foot is raised, and the sole everted. Any combination of these simple varieties will present compound forms, such as *talipes equino-varus*, *equino-valgus*, *calcaneo-valgus*, etc.; some authors have added others: for instance, *talipes cavus*, in which the arch of the foot is increased, and *talipes planus*, or spurious valgus, in which the foot is flattened, the arch resting upon the ground. Recently, Shaffer, of New York, under the title *non-deforming club-foot*, has described a class of cases in which there is little or no deformity, but which are very important on account of the inconvenience they occasion the sufferer, and the results to which they give rise, coupled with the liability of being over-

looked, unless care be taken in the examination of the patient.

The varieties of club-foot may be classified as follows:—

TABLE NO. I.

- Varieties
  - Simple, ...
    - Antero-posterior
      - Equinus.
      - Calcaneus.
    - Lateral . . . .
      - Varus.
      - Valgus.
  - Compound, . .
    - Equino- . . .
      - Varus.
      - Valgus.
    - Calcaneo- . . .
      - Varus.
      - Valgus.
  - Other forms, . .
    - Cavus.
    - Planus.
    - Non-deforming.

As previously mentioned, these simple forms, or their combinations, constitute the deformities which you will meet with, and a knowledge of their relative frequency is of interest and importance. Much difficulty is experienced in the investigation of this subject, owing to the difference in nomenclature employed by various authors, similar conditions being spoken of under different names. Duval has recorded 1000 cases, of which 574 were congenital; 364 of these were in males, and 210 in females. His statistics as to relative frequency are valuable, and are as follows:—

TABLE NO. II.

	Cases.	Boys.	Girls.
Equinus and equino-varus, ...	417	215	202
Varus, ...	532	302	230
Valgus, ...	22	14	8
Calcaneus, ...	9	6	3
Extreme calcaneus, ...	20	13	7
Totals, ...	1000	550	450

I have compiled the following statistics, shown in Table No. III, from the records of the New York Orthopædic Hospital, and the Orthopædic Dispensary of the University of Pennsylvania:—

TABLE NO. III.

	Congenital.	Acquired.
Equinus,	5	87
Calcaneus,	3	31
Varus,	78	66
Valgus,	29	286
Equino-varus,	95	68
Equino-valgus,	3	9
Calcaneo-varus,	0	2
Calcaneo-valgus,	5	34
Totals,	213	533

Lannelongue has collected the statistics of the Maternity Hospital (Paris), covering a period of ten years, from 1858 to 1867, inclusive. In 15,229 births, 8 children were born with club-foot, a proportion of about 1 case in 1963 births.

The condition may be present as a congenital or an acquired deformity, and the relative frequency of the two forms may be seen by reference to Table No. III, from the cases treated in the New York Orthopædic Hospital, and the Orthopædic Dispensary of the University of Pennsylvania, in which are recorded 746 cases, of which 213 were congenital, and 533 acquired. Tamplin's deductions, shown in Table No. IV, covering 764 cases of congenital talipes, show the relative frequency to be as follows:—

TABLE NO. IV.

CONGENITAL.

Talipes varus,	688	cases.
" valgus,	42	"
" calcaneus,	19	"
" varus of one foot and valgus of the other,	15	"
Total,	764	"

ACQUIRED.

Talipes equinus,	401	"
" valgus,	181	"
" equino-varus,	162	"
" calc. and calc.-valgus,	110	"
" equino-valgus,	80	"
" varus,	60	"
" varus of one foot and valgus of the other,	5	"
Total,	999	"

Adams states the proportion between the congenital and acquired forms to be as 2 : 3, and the tables already referred to show the large preponderance of cases in which the deformity has been acquired. Giving due weight to the statistics which have been alluded to, we may conclude that club-foot occurs more frequently in males than in females; that cases in which inversion and adduction of the foot, either accompanied or not by elevation of the heel, or the varus types, are oftener met with, and that the right foot is more frequently deformed than the left, but that many more cases of double club-foot occur than of single; and that the primitive forms, pure equinus, calcaneus, varus or valgus, are rare.

The etiology of congenital talipes is veiled in obscurity. The difficulty of studying pathological changes occurring during intrauterine life is self-evident, as the fœtus cannot be subjected to any direct scientific method of investigation. Comparative physiology, embryology, and the changes and diseases which occur subsequently to birth, give us data of comparative value, but all such investigations have resulted in much speculation, many theories, and but few facts. The theory that diseases which produce the acquired forms have their prototypes during intrauterine existence has its supporters, notably Little. But microscopical research has not yet shown the existence of changes in the fœtal brain and spinal cord analagous to those found in cases of the acquired paralytic forms. Voluntary muscular control is retained in congenital cases, while it is lost in the acquired varieties referred to, and the electrical reactions are markedly different; so that this theory has no foundation to rest upon, except the similarity in the appearance of the deformities.

Hereditary influence, with its transmission of peculiarities of face and form, of various tendencies, of traits of character, etc., has some weight as an etiological factor.

Another theory of causation is that of arrest of development, and although cases occur in which co-existing deformi-

ties, such as spina bifida, harelip, cleft palate, etc., are also present, the feet show no evidence of arrest of development, the only alteration being that of the direction of the planes of the feet which is characteristic of the deformity. Adams and Hüter, it is true, have described changes in the bones involved, consisting of alteration of form and relative position of articulating facets, but these changes are by no means constant, and whether they be causative or secondary to the altered relation of the bones, is a matter regarding which there is much difference of opinion. Personally, I incline to the latter view, although the theory has many eminent supporters, including A. Lücke.

The theory which has, perhaps, the greatest number of votaries, is that which ascribes to abnormal intrauterine pressure, and deficiency of amniotic fluid, the influence productive of club-foot; the foot being permanently fixed in the abnormal position during intrauterine life. Although numbering among its supporters such names as Volkmann, Kocher, Banga and Parker, I do not think the assumption tenable, for the following reasons: Were this deformity the result of pressure, it is reasonable to believe that in many cases deformity of other members would co-exist, having been exposed to the same pressure-influence; such, however, is not the case, combinations of this kind being of rare occurrence. Again, in children who have been born with club-foot, and in which the mother had previously given birth to several healthy children, no appreciable difference in the quantity of amniotic fluid discharged during the various labors can be made out. Further, I have recently seen a case of double equino-varus in a twin, the other child showing no deformity whatever.

Dr. H. W. Berg, of New York, in a series of investigations which are commendable for their originality, ascribes congenital equino-varus to a failure of rotation during intrauterine existence. In his studies at the New York Hospital and Wood's Museum at Bellevue Hospital, he has followed the changes which occur in the position of the lower extremi-

ties at different periods of fœtal life. At first, the entire leg is rotated outward, and the feet are in a position of marked varus, and, subsequently, of equino-varus. Later, rotation inward takes place, gradually diminishing the amount of varus; but even after this rotation has been completed some varus remains, and, in a very slight degree, is the normal position of the foot in the newborn. Dr. Berg found, in some instances, equinus to be present in fœtuses of two, three and four months, the condition disappearing in the process of normal growth, and he reaches the conclusion, that in early fœtal life equino-varus or varus is physiological, and that its disappearance is coincident, and keeps pace with the normal rotation of the limb. When, from any cause, rotation is retarded or arrested, club-foot results.

To summarize the theories to which I have alluded, and which constitute the principal ones advanced in explanation of the causes of congenital talipes, I have reduced them to the following: that which would ascribe club-foot to pathological changes occurring in the fœtus, similar to post-natal diseases; that which assumes, as a cause, the action of mechanical forces upon the child in utero; then the theory of heredity, with its influences but little understood; the theory of arrest of development; and, lastly, the theory promulgated by Dr. Berg, which would make club-foot dependent upon the absence or retardation of rotation. The last mentioned possesses the merit of being demonstrable by embryological research, and in the present state of our knowledge it has, in my opinion, greater claims to recognition than those which are based upon similarity of post-natal conditions, or those which rest upon even a more fanciful basis.

Turning our attention now to the consideration of the etiology of acquired talipes, we do not find the path of investigation beset with the difficulties we met with in the study of the causation of the congenital types. We may divide the causes into six groups: 1st. Infantile spinal paralysis. 2d. Spastic contractions due to an irritative lesion of the spinal