A COURSE OF
LECTURES ON SURGERY,

DELIVERED IN THE
MEDICAL SCHOOL OF CAMBRIDGE.

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LECTURE XVIII.

ATROPHY CONTINUED.

An increase of the irritability of muscular fibres is associated with, and in some measure dependent on, atrophy; examples of this afforded by the facility with which weakened and paralyzed muscles are excited to contraction; this is compatible with only a certain amount of atrophy; startings of diseased joints explained by this theory; also rolling movements of eyes; circumstances under which these movements occur, they generally indicate incurable disease, but not always; there is a condition of nervous system corresponding with this state of increased irritability of muscles, and often associated with it, observed in chorea, paralysis agitans, and other similar affections; nerves and parts of nervous centres are affected in like manner; in all these cases power is lost and replaced by increase of susceptibility.

Clonic contraction, pathological effects of, circumstances under which it occurs, and its effect in causing contraction of diseased joints, the force of the flexors generally preponderating; permanent shortening of the muscles and corresponding changes in fasciæ and ligaments; difficulty of restoring a limb thus bent to its proper position; use of chloroform in some cases; the same thing observed in paralytic limbs; pathology of club-foot and analogous distortions; pathology of strabismus; circumstances under which it occurs; connection of diverging strabismus with amaurosis.

At the conclusion of the last lecture, gentlemen, your attention was directed to certain spasmodic contractions which are apt to take place in muscles reduced to a state of atrophy, or rather of partial atrophy, in consequence of disease in a neighbouring joint. I then did no more than briefly allude to the fact; it is, however, a circumstance of much interest, suggesting reflections of physiological no less than of pathological importance, and deserving a more careful consideration; we will, therefore, devote a few minutes to it, in the hope that you may be enabled to attain a clearer comprehension of some curious phenomena which have, no doubt, often attracted your notice in the examination of patients, and have, probably, already furnished some food for your meditation.

Physiologists are in the habit of expressing by the term "irritability," the peculiar property resident in muscular fibres of being excited to contract when they are subjected to a stimulus, such as nervous influence, electricity, or any other. We will not, at the present time, stop to discuss the question as to the particular share which the several components of a muscle re-

spectively take in the performance of this function; whether, for instance, it is the result of some property inherent in the ultimate fibres, or of some peculiar influence extended to them from the nervous system. Let us assume the former of these views to be correct, because it accords best with the carefully conducted experiments of recent observers, and because it seems, on the whole, to be the most probable, and to correspond most fully with the pathological phenomena we are about to consider.

Supposing, then, this irritability to be a quality resident in the ultimate fibres of muscle, you would expect the degree in which it is manifested to vary with certain conditions of those fibres; but you will probably be a little surprised to find that it is less quickly and easily evidenced in the plump, strong, well nourished muscle, than in the pale, weak, relaxed organ. Such, however, appears very frequently to be the case; and a great number of experiments made upon animals in reference to this point, together with numerous illustrations afforded by different states of the human body, agree in showing that, up to a certain point, the irritability of muscular fibres is commensurate with their weakness. Thus it is found, that if the nerves of a limb be divided, the muscles on that side may be induced to contract by an electric current of strength insufficient to affect the opposite sound extremity. The weak, thin, atrophied heart responds most readily to the pressure of the blood within its walls, and is most easily excited to rapid palpitating action by slight exertion, excitement, or nervous impression of any kind. Convulsive twitchings of muscles are most frequently observed, and proceed to the greatest extent in enfeebled persons; and many troublesome affections of this kind admit of relief by measures calculated to invigorate the system. Most of you have been subject to twitching movements of the eyelids and other muscles of the face when you have been out of health; and every one has experienced startings and other convulsive movements, on falling asleep, in consequence of the relaxed and enfeebled state in which the body then is. These startings are felt most particularly when persons have been much fatigued by muscular exertion during the day. In like manner painful crampy contractions of the muscles are most likely to occur during sleep when the system is depressed or exhausted, also in any part of the body which has been over-exercised; in the legs, for instance, after dancing.

Very similar to these spasmodic movements are the local muscular contractions observed by Dr. Stokes to be excited in phthisical subjects, and in emaciated persons generally, by a smart rap with the fingers upon the front of the chest, or in other parts of the body. The stimulus thus directly communicated to the muscular fibres is sufficient to excite their action in these feeble patients, so that you may see them drawn into knots under the skin at the part struck.

Peculiar tremulous movements may often be observed in muscles which are relaxed and impaired in their nutrition, in consequence of the suspension of a proper volitional controul over them, as in paralysis, more par-

ticularly paralysis resulting from cerebral disease. The greater susceptibility of palsied limbs to the influence of a stimulus, such as strychnia and electricity, has been repeatedly noticed. In cases of paraplegia the excitability is sometimes so great that an irritation applied to a distant region—the skin of the abdomen, for instance, or even the upper extremity, will be followed by convulsive movements of the lower limbs, although it may not be productive of the slightest apparent muscular change in the immediate neighbourhood of the part touched.

It very generally happens that the sufferers under paraplegia, who are deprived of sensation as well as volition, acquire a consciousness of the distended state of the bladder, or the passage of fæces, only by the contractions in the muscles of the lower extremities induced through the medium of the reflex property of the spinal cord. I remember a case of this kind where the patient had been some time confined to bed, and the susceptibility of the muscular as well as of the spinal system was so great, that the tickling or nipping one leg was followed by convulsive movements of all the extremities, and occasionally also of the face. The paralysis in this man was caused by disease in the middle of the vertebral column, and there was some remnant of sensation in the lower limbs.

You are probably aware that palsied limbs, and limbs diseased from other causes, are more easily excited by emotional influences than those over which volition holds and exercises its sway. Our great naval hero presented in his own person a well known illustration of this fact; it is related that the movements of his stump indicated the existence of strong emotions, which might otherwise have passed unnoticed.

An amusing instance of the emotional susceptibility of weakened muscles is sometimes afforded by paralysis of the facial nerve. A gentleman suffered this affection from exposure of the face to a cold wind, and though he has nearly recovered the use of the part, he is still unable to controul the emotional movements of the muscles, so that the unruly members often betray him to be enjoying a joke, when he would fain preserve a serious countenance.

This emotional susceptibility is, no doubt, sometimes dependent on the particular region of the nervous system which is the seat of disease causing the paralysis. Thus the tract of the cerebral hemispheres presiding over volition may be disturbed, while that ministering to the emotions remains intact, in which case the emotions must predominate, being uncontrolled by the will. But in the case of facial paralysis just mentioned, and in others of the same kind, such an explanation cannot hold good, because the paralysis was there the result of some change in the nerves. It is on the whole most probable, that the phenomena in question are due to an augmentation of irritability in the muscles themselves.

So constant, indeed, is this increase of irritability in muscles deprived of volitional influence, that it has been attributed by Dr. Marshall Hall to the suspension of such influence as its direct cause. According to his theory the spinal cord is the great source of muscular

irritability, and volition acting through the medium of the brain is its exhaustor; hence the suspension of volition is thought to be followed by an accumulation, as it were, of irritability in the muscles. This view is sufficient only to meet the cases of cerebral paralysis, and affords no explanation of those numerous instances in which limbs, weakened by disease, or various local causes, are found to possess an exalted sensibility to emotional and other impressions. In all these cases the increase of irritability is associated with a weakened or atrophied state of the muscles; it seems therefore more reasonable to regard that as its cause. We may still suppose that the suspension of volitional influence is instrumental in producing the same effect, but that it does so only by inducing an enfeebled state of the muscles concerned.

In thus asserting the coincidence of increased irritability with diminished functional activity, and a partially atrophied condition in muscles, more particularly in referring the former of these to the latter as its direct cause, I may seem to be making statements at variance with the well-known and almost unexceptional law in the animal economy, that vital properties are produced and maintained only in proportion to the degree in which they are required, and that they are found in a state of perfection corresponding with that of the structure wherein they are originated. It must be confessed that at first sight these statements do not seem to coincide with one's preconceived notions; still let it be remembered, that an augmentation of irritability, similar to that now contended for in muscular fibre, is generally found to co-exist with the diminution of structural and functional vigour in other parts of the frame. Common observation tells us that patients become more irritable, that is more susceptible of various impressions, as they lose strength; and the phenomena just described are but examples of the manifestation in muscles of that which almost invariably occurs in other parts of the system. Moreover, they are not commonly regular well-defined contractions that result from this increased irritability in the muscles, but rather ill-marked irregular flickering movements, possessed of very little force, and exercising scarce any influence upon the nutrition of the organs concerned.

It may be well to remind you that this increase of irritability in muscles is only compatible with a certain amount of atrophy; for if the latter proceed to any great extent, or have been long continued, the fibres become nearly or altogether insensible to nervous, electrical, and other stimulus, being then, as we have seen, completely altered in structure, and losing all trace of contractile power. There is at the present time in the hospital, a man, who some months ago was treated for popliteal aneurism by compression of the femoral artery, successfully so far as the tumour was concerned; but so rapid had been the swelling and so severe its effects upon the popliteal nerve, that he has since suffered complete paralysis of the limb below the knee. He is now under treatment by electricity, and some benefit has been derived from it; but I mention the case to you as an illustration of the

insensible state to which muscles that have been long out of use may be reduced. The moistened sponges of the machine were applied alternately upon both lower extremities, and we found that an amount of electric stimulus sufficient to excite strong contractions in the sound leg failed to produce any perceptible effect upon the muscles of the paralyzed limb.

Any other disease or injury besides paralysis, which impairs a limb and prevents the action of its muscles is likely to be attended with spasmodic movements in consequence of the wasting and increased irritability of the muscles so engendered. Hence it is that patients suffering under ulceration of the cartilages of a joint are greatly troubled by convulsive twichings and startings of the part which occur more particularly when they are going to sleep and aggravate their sufferings in no slight degree. You will understand that these involuntary movements to which your attention has been so often directed in the wards of the hospital, have no more direct connection with the ulceration of the cartilages than a dependance upon the muscular atrophy induced thereby. It is probable that they accompany some other affections of the joints, and are overlooked, because the suffering occasioned by them is less severe.

In dissecting limbs immediately after amputation on account of some disease in a joint, you may have noticed the great irritability of the muscles, giving rise to a series of contractions when their fibres are touched with the scalpel. I have found this take place more especially in cases where muscular movements had been in great measure prevented by severe ulceration in the cartilages, by ankylosis, or other cause, for a considerable length of time before the operation. This struck me much in several instances, and I was at a loss to explain it till the foregoing reflections occurred. I now regard it as affording another and a good example of the association of atrophy with increased irritability.

The irritability of the muscles generally, and of the intestinal canal and bladder in particular, is remarkably increased by faintness, fright, or other depressing cause; hence the frequent evacuation of feces and urine under such circumstances. It is by the stimulus of the first meal following the long fast of the night that the action of the bowels is generally induced, and constipation may be sometimes obviated by lengthening the period of that fast, whereby a more feeble and consequently more irritable state of the intestines is brought about. A long walk or fatigue occasioned in any way will often answer the same purpose.

One of the most interesting and remarkable instances of involuntary muscular contractions induced by the loss of function in an organ, is furnished by the peculiar rotatory movements to which an eyeball is subject when vision is destroyed or greatly impaired. I am not aware that any satisfactory explanation of this phenomenon has been offered, further than that it is supposed to result from a want of the habitual volitional direction of the eye to particular objects, consequent on the loss of vision. Now the foregoing remarks seem to suggest an easy solution of this difficulty; it is

simply this, that the recti and obliqui muscles losing their natural exercise become atrophied and also the subjects of excessive irritability; hence they are incessantly moving and jerking the eyeball in various directions. This effect of blindness is most commonly observed to commence in infancy or early childhood. It may occur in one or both eyes and may result from any disease destroying the utility of the organ, whether it be seated in the cornea, iris, lens or retina. We have seen it accompany a malignant tumour of the eyeball in the case which terminated fatally not long ago. It takes place not unfrequently when vision is only partially lost, as in the lad with cataract and in other cases now in the hospital. You may have observed also, a great unsteadiness and difficulty of fixing the eyes upon particular objects in persons who are troubled with excessive shortsightedness, partial amaurosis, or imperfect sight from other causes.

The direction of the movements under these circumstances is very various; sometimes the eyes are rolled about in every possible way; at others the eyeball is rotated on its axis by the alternating action of the obliqui. The affection generally commences in the external and internal recti; when existing in its slightest degree the latter may be observed to roll the eye inwards by a slight jerking motion, till the external rectus, roused as it were to activity by the stretching inflicted on it, suddenly contracts and restores the organ to its natural position, from which it is again gradually turned by the opponent muscle.

As a general rule it may be stated that any disease of the eye will be found incurable upon which this rolling motion has supervened: not necessarily so, however, for in congenital cataract, when the operation is performed early and the retina is brought into use before it has faded away for want of exercise, the patient may in course of time acquire proper control over the organ. If the operation be delayed till the retina is atrophied and the flickering movements have become habitual there is great probability that they will never be overcome. Such has been the result in the majority of cases operated on after the age of five years.

There is a condition of the nervous system corresponding in all important particulars with this irritability of the muscles, and like it associated with an enfeebled and partially atrophied state of the organs concerned. In some persons this is evidenced by an exceeding sensitiveness to pain, light, sound, or impressions of any kind, which may be so acute that the individual with weak nerves, as it is called, receives a shock from influences that would scarcely be perceived by the sthenic and well-balanced system. These and other effects of the like kind are indications of preternatural susceptibility in the recipient part of the nervous organism, and they are for the most part, as we well know, connected with an enfeebled state of the body.

That the excitator or efferent department of the nervous system may partake of the same irritability under similar circumstances is shown by the too great rapidity with which it sometimes responds to impressions made upon it, and the slight causes that are

sufficient to excite emotional or convulsive movements in various parts of the body. The hysteric laughter, sobbings, and other outbreaks of the like kind, are instances of this preternatural excitability in the efferent nervous tracts, just in the same manner that the hysteric pain is the result of too great sensibility in the recipient tracts of the same. The spasmodic twitchings in chorea, and a variety of strange irregular movements, rythmical or otherwise, are also in great measure dependent upon excessive irritability associated with debility. The treatment which is found to be on the whole most successful in these cases accords with this view, for as you well know, it consists in the employment of shower baths, tonic medicines, nutritious diet, and other means calculated to invigorate the body generally, and the nervous system in particular.

This preternatural nervous susceptibility is often associated in the same individual with the like condition of the muscles, rendering it difficult or impossible to decide the degree in which each is to blame for the effects produced. Indeed the muscular and nervous systems are so intimately leagued together and dependent upon each other, that the one cannot suffer much derangement in function or nutrition, without in some measure involving the other. To revert, for example, to the particular affection of the eye we have been just considering, when the organ ceases to be directed in a fixed steady manner, from a want of the perception of external objects, the muscles begin to suffer in their nutrition, but at the same time a corresponding loss of function is sustained by the nerves and nervous centres connected with those muscles; and this again is followed by defective nutrition and undue sensibility to impressions; so that the rolling movements to which the eye becomes subject may be referable in part to the atrophy and excitability of the nerves, though it is probably connected, as before explained, most intimately with increased irritability of the muscles.

You will often observe a tremulous state of the limbs when the bodily powers are reduced by age, infirmity, or intemperate habits. This condition sometimes amounts merely to an unsteadiness of the hand, or a twitching of the facial muscles; it may be so severe as to constitute a real disease bearing the name of "paralysis agitans," which signifies at once the shaking of the limbs and the inability of the patient to controul it. You must have seen modifications of this affection repeatedly in elderly persons, or in persons prematurely aged by late hours, hard work, and more particularly in dram drinkers. It is felt most in the morning; many men being in consequence of it, unfit to enter upon their daily avocations till they have been fortified by their customary libations, which give a temporary tone to the system and enable these sufferers to assume the command over their features and their limbs. The movements in paralysis agitans are a kind of vibratory tremor, unattended with any sense of weariness, and apparently exercising no influence upon the nutrition of the muscles; they are probably dependent upon weakness and undue excitability of the nervous, as well as of the muscular, system.

A shaking of similar nature accompanied with chattering of the teeth is often induced by the depressing effects of extreme cold, by the early stage of ague, by the preliminary chill which foreruns an inflammatory attack, by a fright, or by the shock of an injury. A very slight impression such as that produced by emptying the bladder is sufficient to produce a general shudder in some states of the system, when the body is much fatigued, reduced, or enfeebled in any way.

In delirium tremens the state of the cerebral hemispheres corresponds in many respects very closely with that of the muscles in paralysis agitans: the frightened wandering delusions in the one answering to the tremors in the other; both are traceable pretty much to the same cause and require nearly the same treatment for their removal.

Again, when any part of the nervous system has been partially deprived of its proper functions, its sensitiveness is increased, just as we found to be the case with unemployed muscles. The intolerance of light occasioned by a temporary exclusion from the retina of its natural stimulus is an instance of this; so likewise, in all probability, is the great irritability of the spinal cord evincing itself by involuntary movements of the extremities when the cerebral influence upon it is suspended, whereby one half at least of its functions is lost. These remarks apply only to the *partial* abolition of function, for if any nerves or portion of a nervous centre be rendered altogether useless their structure will become completely altered or atrophied and they will cease to respond in any way to the impressions made upon them.

The above mentioned examples are enough to show that an augmentation of nervous sensibility, corresponding to the increase of muscular irritability, is, to a certain extent, commensurate with and dependent upon an atrophied condition of the parts concerned. This takes place, as I mentioned when endeavouring to reconcile the seeming anomaly in the case of the muscular fibres, without any real increase of power, for both the contractile strength of the muscle in the one instance and the *vis nervosa* in the other are actually diminished, and are replaced by too great susceptibility to impressions of various kinds, rendering the organs liable to be excited by agents which in the natural state would be able to exert scarce any influence upon them. It appears to be a result of the same law, operating in a like manner, which renders the enfeebled frame highly susceptible of impressions, so that a short exposure in the cold is followed by a chill, and a slight amount of stimulus is sufficient to light up an inflammation or excite a fever.

We will now turn our attention to another remarkable property of muscles, the effects of which we have the most frequent opportunities of observing when the muscles are in a state of atrophy from disease. I mean the property most commonly called clonic or tonic contraction; that is a power of slow steady contraction, inherent in muscular fibres, resulting from the mere quality of their tissue, and independent of nervous

influence or other stimulus. Quite distinct from the sudden forcible movements which result from the application of stimulus, occurring in a small portion of a fibre at a time, and enduring at each spot only for a moment, this clonic contraction affects the whole muscle in a uniform manner, and for a considerable length of time, and seems to be of the same nature with the shrinking of the fibrin in a clot of blood. It is the cause of the rigor mortis, and then displays itself in all muscles, voluntary and involuntary alike.

Now the effects of this clonic or inherent contractile force in muscles is observed only when the proper stimuli to their action, of which volition is the chief, have been withdrawn. They are seen, therefore, under much the same circumstances as the tremulous movements we have been considering. Rather, I should say, they occur at a subsequent period, as the result of more complete suspension of function. You have often seen limbs gradually and forcibly bent, and in course of time fixed in that position, after having been subject to the convulsive twitchings and startings which accompany disease of the articular cartilages. This change takes place most frequently, or rather in the most marked manner, at the knee during the progress of some acute affection, and occasionally during its subsidence. The joint is sometimes bent much beyond a right angle, so firmly as to require a dangerous power to extend it.

Now it appears that, in all or the greater number of these cases, the contraction is owing to a partial loss of volition, and the consequent operation of the inherent contractile tendency in the muscles; and you remark that these muscles are at the same time more or less atrophied, and they perhaps are or have been subject to tremulous movements. It is not on that account to be inferred that there is any necessary relation between the atrophy and the contraction as cause and effect, but simply that they are both referable to the same source—a loss of the influence of volition—and are on that account, often associated together. The bent position is no doubt assumed because of the greater force of the flexor muscles overcoming that of the extensors, when volition, or the power which usually maintains a proper balance between the two, has been removed. It is owing to the same cause that the fingers are bent and the limbs curled up during sleep, and that they are usually fixed in a semiflexed position by the rigor mortis. Again, the toes, those members over which so little influence of volition is permitted among civilized nations, are generally bent so that the phalanges form a half circle, instead of being spread out and planted in their whole length along the ground, as we find to be the case with Indians and untutored but less tortured tribes.

This same contraction of the limb is an attendant upon severe synovial disease of a joint almost as frequently as when the cartilages are affected. In cases of inflammation of the hip-joint, the thigh, often at a very early period, becomes adducted and the pelvis tilted by the elevation of the affected side, giving rise to apparent shortening of the limb, it may be to the extent

of an inch or more. It seems probable that both this adduction and tilting are a consequence of the clonic contraction in the principal muscles lying between the lower part of the pelvis and the femur, which are not counterbalanced by any proportionate force acting in the opposite direction. The careful observation of many cases of diseased hip has convinced me that the alteration in the position of the limb has no direct relation to any particular changes going on in the joint, because it takes place under such a great variety of circumstances; and I could not account for the distortion, which is so very common an event, till the explanation just suggested occurred to me.

When once the contraction has fairly taken possession of a limb it is exceedingly difficult to overcome. It proceeds to a certain point and then ceases; but the flexor muscles do not relax, on the contrary they become gradually adapted to their altered length, growing shorter in fact, so that the distortion is thereby rendered permanent. Probably some corresponding change takes place in the sarcolemma and cellular investments of the fibres. The extensor muscles are also suited to the stretching in the same manner that the flexors are adapted to their shortened condition; hence, even if the original disease be cured, the patient is generally quite unable to move the joint; indeed, after it has been for some time contracted, it is impossible to extend it without using such force as would be likely to occasion serious injury to the limb.

Not only do the muscles and their immediate cellular investments become shortened in these cases but the fasciæ and ligaments also undergo the same change. If you endeavour to extend a knee thus contracted you will find the popliteal fascia to be tense as well as the hamstrings on either side. In a case which I dissected, where forcible extension had been practised, the popliteal fascia was rent across the middle, the tendons and ligaments were torn from their attachments, dragging the periosteum and even fragments of the bone with them, but the muscles had not yielded in the slightest degree.

I have known contraction to occur in some of those cases of painful affection of the joints, unaccompanied by real organic disease, to which your attention has been several times directed, and have tried extension of the limb while the patient was under the influence of chloroform, with great success in one instance, the treatment being instituted before sufficient time had elapsed for the muscles and other structures to undergo any real alteration of length.

Of the application of tenotomy to these cases, and the subsequent employment of extension, I can say nothing from personal experience. Successful cases have been reported in the practice of other surgeons, but there must be many difficulties to overcome, because the dissection of these limbs tells us that shortened ligaments and fasciæ, adherent and deformed articular surfaces will, no less than the contracted muscles, offer formidable impediments to such a mode of treatment.

Since the difficulty of rectifying this state is so great when once it has taken place and been allowed to con-

tinue, it is scarcely necessary to suggest the importance of endeavouring to prevent it in cases where it is likely to occur. Much may be sometimes done by the careful use of splints and bandages; unfortunately, however, the pain and inconvenience attending these appliances is generally so great that we are obliged to discontinue them, and are compelled to allow the muscles to do their worst without being able to offer any effectual opposition. I am sure that in slight cases the confinement of the patient to bed often induces this contraction, by placing the limb at rest, and in a measure suspending the influence of volition upon it. This is no improbable view when we reflect that in a great majority of bedridden persons the comparative cessation of voluntary motion in the lower extremities, attendant on long confinement in one position, is followed by more or less contraction of them; the knees soon become bent, and after a time can be extended only with the greatest difficulty. Since, then, rest in bed is alone sufficient to induce the distortion, there can be little doubt of its accelerating the same in the case of a joint already predisposed to it by disease.

It may have occurred to you as an objection to the above mode of accounting for the forced flexion of diseased joints, that the extensor muscles, which are placed under the same circumstances with the flexors in regard to the suspension of function and the atrophy consequent thereon, should in like manner be subject to the effects of passive contraction, and should be rendered tense if not shortened; but this is not generally the case. The explanation of the apparent anomaly is probably to be found in the fact that the extensor muscles are kept on the stretch by the superior slowly acting force of the flexors; for it would appear that stretching is one of the most effectual means of preventing the gradual process of stiffening or contraction, as well as of destroying it when it has taken place. It is on this account probably, in part, that the straight position is found to answer so well in most instances of fracture of the thigh and leg, and to be followed by much less stiffness of the knee than the bent posture formerly adopted; the powerful flexors are thus kept on the stretch and are little or not at all affected by clonic contraction and shortening, whereby the patient is saved much pain and trouble in recovering the use of his limb.

The effects of this inherent contractile tendency in muscles are witnessed in paralytic limbs no less than in the cases we have been just considering. If you observe a patient who has long been crippled by hemiplegia you will generally find that the palsied arm is drawn to the side, the elbow is a little bent, the forearm pronated, the thumb pressed against the fingers, and the latter flexed upon the palm, so that you can scarcely straighten them. The attempt to restore them to a natural position throws the flexor tendons, as well, perhaps, as the segments of the palmar fascia into strong relief, showing how much they or the muscles connected with them have become shortened. The same thing may occur in the lower extremity, but it does so less frequently, because the paralysis is for the

most part less complete there. It is more common in the foot than in the knee or thigh, which depends, no doubt, upon the fact that volition is seldom entirely lost in the latter region, while the weight of the bed-clothes and of the limb, the patient usually lying on his back, would have some influence in preventing the flexure of the knees.

It forms, however, no uncommon sequence of the paralytic seizures which so often affect the lower extremities of children, occurring in teething and under a variety of circumstances, and leading not unfrequently to the partial or total loss of motor power over the leg or foot. The limbs thus circumstanced have a withered appearance, are defective in growth, being shorter than natural, and they are generally contracted.

The deformities in the lower extremities, included under the general name of "clubfoot," are a result of this infantile paralysis. Congenital clubfoot is so, most probably; and I am sure that the affection occurring after birth is, in by far the greater number of cases, to be referred to a paralytic seizure which has been followed by the clonic contraction of the flexor muscles, elevating the heel, turning the sole up, and increasing the plantar arch. The foot becomes fixed in that position by the alteration in the muscles, and the shortening of the fasciæ and ligaments, just as in other instances of the like kind; so that, although volition or nervous influence may be restored to the muscles, the child is able to move the foot in a limited range only. If we wish to reduce the part to a proper shape, with any chance of its being retained, we find it necessary not merely to divide the tendons of the more important muscles, but also to stretch the fasciæ and ligaments. This, indeed, constitutes the chief difficulty in the treatment of such cases, requiring much perseverance, and the careful employment of extension for weeks or even months.

It is to be remarked in clubfoot, that the extensor muscles of the great toe and of the other toes, are often contracted, drawing the phalanges back upon the metatarsus, at the same time that the other joints of the toes are preternaturally flexed.

This infantile paralysis and its attendant deformity are by no means always confined to the foot, though they are generally manifested there in the greatest degree. Sometimes the voluntary power is imperfect over the whole of one or both lower extremities, in which case the knees are forcibly flexed, and the thighs adducted, with much tension of the hamstrings and popliteal fascia, and also of the adductor muscles. You may remember, some little time ago, a girl in the hospital, whose upper extremities were weak, and the lower limbs so feeble as to be quite unable to bear the weight of the body; they doubled under her when we attempted to place her upon her feet—indeed she could scarcely move them. In that case, besides slight talipes, the knees were contracted, and the thighs adducted, so that they could be separated very little, the legs being crossed. There was such a total want of power in these limbs, that we agreed in the inutility of subjecting the child to the pain of tenotomy and the annoyance

of wearing instruments. Those measures have since been tried in another institution, without success.

It generally happens, when the tendons have been divided, and the proper position of the limb attained, that the muscles, if they be not completely paralyzed, gain strength, and the patient may in time be able to walk very well. Sometimes, even when we have not that hope, it is worth while to divide the tendons, and extend the foot, with a view of enabling the patient to bear more comfortably upon it.

You have already heard that the growth of these paralyzed limbs is often imperfect—that they are short as well as wasted. You are not on that account to suppose that the abnormal position of the foot is a consequence, a compensation as it were for the deficiency of length in the extremity, because the same thing sometimes occurs in both extremities, or in one without there being any inequality of length. I should not have thought it necessary to allude to such an idea, did I not know that it is entertained by some persons whose opinions may have weight with you.

A condition very much like that of clubfoot is often induced in adults by chronic ulcers upon the legs, more particularly when they occur in the neighbourhood of the internal malleolus. You may have observed that in most persons who have been long afflicted in this way the heel is drawn up, so that they cannot place it upon the ground, the sole is contracted, and the toes are bent back upon the metatarsus; sometimes the foot is twisted, and the outside of the instep is placed upon the ground when the patient endeavours to walk; all which is probably caused, as in clubfoot, by the inaction and consequent shortening of the flexor muscles of the foot and leg.

Another affection, in some respects similar both in its pathology and treatment to clubfoot, is strabismus. A child has a convulsive attack, occasioned, perhaps, by the irritation of teething; the attack passes off, but leaves one of the muscles of the eye, generally the external rectus, paralyzed, the eye is in consequence rolled inwards by the unopposed action of the internal rectus, which in course of time becomes shortened after the manner I have described when muscles are under the influence of clonic contraction; so that, although the paralyzed muscle may resume its function, it is not able to stretch its antagonist sufficiently to bring the eye again to proper position. When by an operation the internal rectus has been divided, the external muscle being free to act, rolls the eye outwards to an extent proportionate to the force it has re-acquired; this sometimes exceeds, at others falls short of, the desired point.

You see that squinting differs from clubfoot, inasmuch as the latter results from a paralysis of all the muscles alike, and the distorted position is assumed in consequence of the superior clonic power exerted by some of them; whereas squinting seems to be occasioned by a loss of the balance that should exist between the antagonising muscles, from some imperfection in the nervous influence acting upon one or more. The chance of cure by operation depends upon the force remaining in

the enfeebled muscle; this may be tested with some accuracy by desiring the patient to close the sound eye, when the influence of volition which is now directed more fully upon the squinting organ should enable it to assume its proper position; the power thus temporarily acquired ceases, and the strabismus returns as soon as the other eye is opened, and brought into use again.

You should know that squinting often depends upon some imperfection in the eye, such as an opacity in one part of the cornea, or a want of sensibility in a circumscribed region of the retina, the eye being under these circumstances habitually rolled into such a position as affords the best opportunity for vision. It is worthy of remark, that the strabismus so commonly associated with amaurotic affections, is almost invariably of the diverging kind. This again I believe is explained by the abstraction of volition from the unsound organ; for the direction of the eyes with converging axes usually maintained, is a forced position dependent on the continuance of a semi-voluntary effort, and changing as soon as that is removed. No wonder, therefore, if this effort ceases when one of the eyes has become useless, or comparatively useless, and that the organ then reverts to the position which is most easily preserved.

The diverging strabismus is an important symptom in amaurosis; it indicates that the organ has ceased to be employed in ordinary vision, and the prognosis in such cases is very unfavourable. The eye which has thus, as it were, confessed an incapacity to assist and co-operate with its fellow, and has in consequence retired from the axis of vision, is very seldom restored.

Although our time has been occupied this morning in considering these two subjects, (the increase of irritability and the effects of the clonic contraction of muscles,) occurring as pathological phenomena, you must not think that we have by any means exhausted either of them. There still remain many interesting points in connection with both, which time will not allow me to enter upon. I have thought it worth while to say thus much upon them because they have an important relation to certain diseases which are of frequent occurrence, and because they are themselves the cause of various affections and distortions requiring surgical treatment. Their relation to an atrophied or weakened state of the parts concerned is so constant (though they may not always depend upon it as a direct cause,) that the present seemed to be the most favourable opportunity for speaking to you respecting them.

STATISTICS OF BLINDNESS.

By AUGUSTIN PRICHARD, Esq., M.R.C.S.,
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(Read before the Quarterly Meeting of the Bath and Bristol Branch of the Provincial Medical and Surgical Association, December 21, 1849.)

THE following brief account of the causes of blindness is drawn up from the examination of 100 cases, taken in order as they have fallen under my notice, as surgeon to the Asylum for the Blind in this city.

I have arranged the causes under five heads,—viz.,