

Original Communications.

PATHOLOGICAL AND PRACTICAL RESEARCHES ON THE VARIOUS FORMS OF PARALYSIS.

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PARALYSIS FROM MYELITIS.

THE lesions of sensation and motion which accompany inflammation of the spinal cord vary with the seat, intensity, and period of the disease. If only one side of the cord be affected, the paralysis which results is confined to the corresponding side of the body. When the anterior columns chiefly are the seat of inflammation, the paralysis which follows is that of muscular motion; but of sensation, if the lesion exist in the posterior columns; and, if a careful analysis be made of the several cases in which the grey substance of the cord has been implicated, it will be found that the function of reflex action has been deranged.

During the early stage of inflammation, when the capillaries of the cord are abnormally loaded with red blood, there is a corresponding exaltation of tactile sense and muscular contraction. It is true, death rarely occurs at this first stage of inflammation; but if we may be guided by the analogy of corresponding conditions, superinduced towards the termination of disease of other portions of the nervous centre, the above inference is justified; and a case in point is recorded by M. Ollivier. (*Traité de la Moelle Epinière*, vol. ii, pp. 636-640. Observation 81. Deuxième édition.)

But as the corpuscles of the blood begin to be arrested in the injected vessels, a correlative diminution of the vital properties of the cord ensues; and it is made manifest by the decreasing sensibility or motility of the parts which receive their nerves from the affected part. It is conceivable that the vascular dilatation, when thus carried to an extreme degree, produces injurious pressure on the complex organ, and thereby diminishes its functional activity.

The next stage is that of serous or purulent exudation, in which the consistence and cohesion of the nerve-fibres are destroyed, and a solution of their continuity takes place. The arrest and accumulation of the blood-corpuscles in the distended capillaries impair the quality of the blood, and cause it to behave in the same way as when separated from the living body. It coagulates, in fact; and the liquor sanguinis, together with red and white globules, transude through the delicate tissue of which the capillary walls are formed, and which is known to be favourable to the interchange between their fluid contents and the tissues through which they pass. In this way, as Mr. Lister has satisfactorily shown (*Proceedings of the Royal Society*, June 1857), "these tissues in some degree approximate to the condition of dead matter, and cease to discharge the offices peculiar to them as components of the healthy animal frame."

This disorganisation entails a condition of complete paralysis, more or less extensive, according to the seat and extent of the inflammation. Every part of the body which receives its nerves from the spinal cord below the upper level of the structural lesion is paralysed; consequently, when destructive myelitis extends throughout the cord to the fifth pair of cervical nerves, the upper extremities are palsied, and all those parts which receive their nerve-power from a lower level of the cord are palsied too. If it reach still higher, respiration will be disturbed in consequence of the phrenic nerves becoming involved, whilst the circulation of the blood and

the action of the irides may be affected through the medium of the sympathetic nerves.

But if the paralytic influence do not extend through the entire thickness of the cord, then may the lower extremities preserve their sensation and motion, although the arms hang powerless, owing to the disease having dissected out, as it were, the groups of ganglionic cells which determine the action of certain sets of muscles, whilst the conductors of the will for the movements of the legs pass by unscathed.

An illustrative case, occurring in the practice of M. Broussais, is recorded by Ollivier. The patient was a medical student aged 21, who had, as a result of acute myelitis, complete paralysis of the upper limbs, while the legs, as well as the bladder and rectum, retained their healthy power. He died on the eighth day after the attack. There was some increased vascularity of parts of the encephalon, considerable congestion of the sinuses of the cord with fluid blood, and much sanguineous effusion between the dura mater and the vertebral arches opposite the brachial enlargement of the cord, as well as a considerable quantity of red serum between the pia mater and arachnoid at the lower part. Four minute cartilaginous laminæ were found about the centre of the dorso-lumbar enlargement; and the opposite surfaces of the arachnoid were adherent at several points over the brachial enlargement, which part of the cord, especially the grey substance, was remarkably soft for about two inches. The remaining part of the cord below was somewhat softened.

This case is interesting on more accounts than one, for it illustrates most of the phenomena of myelitis in the cervical region of the cord. The next observation which Ollivier describes (No. 78) is demonstrative of the fact that, when destructive myelitis involves the entire thickness of the cord in the cervical region, there is, as might be expected, complete paralysis of the four extremities.

When the disease occurs in the dorsal region between the two enlargements of the cord, the respiratory muscles which are under the influence of the dorsal spinal nerves, obeying the laws of irritability, are frequently agitated by violent spasms, and the breathing is accomplished by short and painful efforts. If the disease extend to either enlargement, the arms or legs may participate in the spasmodic movements. But, as the work of disorganisation goes on, anaesthesia of the surface and paralysis of the muscles above alluded to follow in the train of symptoms—abdominal respiration, disturbed circulation, embarrassed digestion, difficult defecation, inefficient micturition, and all the consequences of these respective functional disturbances, ensue.

A nervous and imaginative man, with lateral curvature of the spine, is alluded to by Ollivier (vol. ii, pp. 658-667). After an irregular course of life, he experienced at the age of 34 considerable pain and numbness over the curved part between the shoulders; and complete muscular paralysis, with hyperæsthesia of the arms, rapidly ensued. Respiration and expectoration were difficult. He had likewise painful digestion, obstinate constipation, and considerable weakness in the expulsive power of the rectum; but he could void his urine, and retained the muscular power of the lower extremities until he died, at the age of 44.

In this case, the spinal cord did not suffer from compression; but from below the fourth cervical vertebra to the fourth dorsal—about seven inches in extent—the cord was found to be little more than a diffuent mass of greyish red fluid, which fluctuated about with the movements of the body. A few nerve-fibres remained in the situation of the anterior columns; but in the diseased part the anterior roots of the spinal nerves were reduced to their neurilemma only, all the white substance or nervous matter being absent; the posterior roots preserved their integrity.

The solution of continuity of the anterior columns was not complete; hence the case forcibly illustrates the independent function of each individual longitudinal nerve-fibre; and, in considering the change of structure above alluded to, it should be remembered that no part of the animal body changes so rapidly after death as the nervous tissue; so that the decomposed state in which the diseased portion of the cord was found might have resulted from a *post mortem* transformation; and that it was so appeared from the injected condition of the capillary vessels, which were left floating in the fluid mass—a degree of vascularity inconsistent with absolute destruction of both structure and function.

Dr. Nairne has recorded a more acute case in a boy aged 17, who had also an affection of the heart resulting from rheumatism, and in whom chorea existed. He was admitted into St. George's Hospital on the 27th of June, 1849. On the 3rd of July, he died; the convulsive movements having ceased only some hours before his death.

On examining the body twelve hours after death, the spinal veins were found to be greatly congested; and a portion of the spinal marrow—an inch at least in length—opposite the third and fourth dorsal vertebrae, was white and reduced to a semifluid state. In the central part of this softened portion there was fluid; and the remainder was so thoroughly disorganised, that it was thought unnecessary to put any of it under a microscope. (*Medico-Chirurgical Transactions*, vol. xxxiv, p. 37.)

In these cases, where the lesion of the spinal cord is of such a nature as to intercept the transmission of the influence of the will from the brain, convulsive movements are apt to occur in the legs, and to continue for a long time even after the arms have become completely paralysed. These phenomena are doubtless owing to the excitement of disease reflected from the spinal marrow to the motor nerves of the lower extremities. And the same involuntary movements may be produced artificially by tickling the soles of the feet, whose nervous connexion with the brain is cut off by the destruction of a portion of the cord. The influence of the stimulus is transmitted to the spine by the incident nerves, and is reflected back by the motor nerves, thereby producing spasmodic contractions of the limb. Some interesting cases of this description are recorded by Dr. Budd in the twenty-second volume of the *Medico-Chirurgical Transactions*.

But when the disease is confined to the lumbar enlargement of the spinal marrow, the convulsive movements occur at an early period of the disease, and cease *pari passu* with the disorganisation of the cord. And for a time also the electro-muscular contractility is retained;* but eventually this latter property is almost always lost. In the same manner, if there be in the first stage spasmodic contraction of the sphincters of the rectum and bladder, the urine generally becomes alkaline from retention; and priapism not unfrequently results as a reflex action from a distended bladder; but this state soon gives place to a negative condition which is often ushered in by reflex spasms of the legs during defecation and micturition.

The characteristic symptoms of paralysis, as induced by destructive myelitis, are:

1. Pain over that portion of the back which corresponds to the seat of inflammation.
2. Lesions of sensation giving rise to feelings of formication, creeping, pricking, tingling, heat, or cold, to numbness or complete anæsthesia.
3. A gradual and progressive diminution of muscular

power, distinguishing it from the paralysis which the French have denominated "ataxie locomotrice progressive".

4. An equable degree of paralysis in all the muscles which are implicated; for as in health the nerve-force is distributed to whole groups of muscles in an equal degree, so likewise is it annulled when the nervous centre is disorganised.

5. Convulsive and reflex movements of the paralysed muscles.

6. Spasm or paralysis of the rectum and bladder.

7. Alkaline urine. And finally,

8. The loss of electro-muscular contractility.

Be the cause of acute myelitis what it may, whether accidental violence, inordinate muscular exertion, the abuse of venereal pleasure, cold, tubercle, or any other cause, when paralysis has once supervened, there is great reason to fear that the inflamed portion of the cord has passed into a state of disorganisation, and that the disease is incurable. The prognosis, however, will in some degree depend on the precise seat of the disease. If it be in the cervical region, for reasons already stated, the *immediate* danger is greater than when in the dorsal; in this latter, again, the prognosis is more unfavourable than when the lower portion of the spinal marrow is affected; and when the patient retains the command over the motions of the rectum and bladder, and the acid character of the urine remains unchanged, the case is still more hopeful.

But in the dorsal portion of the spinal column there is an exceptional state of things, in consequence of the calibre of the canal, which is narrower and more closely adapted to the volume of its contents than any other part. In the cervical vertebrae, where the extent of motion between vertebrae and vertebrae is greater, the canal is of a triangular form, and large in proportion to the size of the cord. In the lumbar vertebrae, it is also triangular and capacious; and the dura mater is loosely connected with the bony canal. A considerable space, moreover, is left between the opposed surfaces of the arachnoid, so as to allow of a sufficient play of one surface on the other; and thus, at the greatest extent of natural curve, no pressure can take place. Not so, however, with the dorsal vertebrae, the mechanism and articulation of which conspire to limit motion; and there the cord is closely enveloped in its membranes, which more completely fill the canal. This construction of the spine was first described by Mr. Earle (On the Mechanism of the Spine, *Philosophical Transactions*, 1822, part ii, pp. 276-283), to explain a circumstance which had been noticed in diseases affecting the vertebra; namely, "that the symptoms of irritation and inflammation of the spinal marrow are much more early manifested, and are generally more serious in their consequences, when the dorsal vertebrae are affected, than when either the cervical or lumbar are the seat of disease. In the former case, the slightest congestion or effusion is often productive of serious symptoms, from the canal being smaller and more completely filled with the marrow and its membranes; whilst, in the latter description of cases, from the greater capacity of the canal and looseness of the membranes, considerable effusion may exist, without at first producing any marked symptoms, more particularly in the lumbar region"; where, from other circumstances already explained, pressure is less dangerous to life.

In all cases of paralysis dependent on myelitis, both diagnosis and prognosis are greatly assisted by a knowledge of every antecedent and concomitant circumstance connected with the particular instance. In the acute form, every characteristic sign is well marked, and the disease runs a rapid course. M. Ollivier gives, as an average, from three to four days;* but, in some chronic

* To determine the amount of muscular excitability, M. Duchenne of Boulogne places the moistened conductors of his volta-Faradic apparatus on each side of the belly of a muscle, and thus ascertains the amount of electro-muscular or Hallerian irritability which the muscle possesses. (*De l'Électrisation Localisée, etc.*, p. 66.)

* An interesting case of paraplegia from acute myelitis, which was

cases, the pain in the back is sometimes scarcely noticed, notwithstanding that the structural change in the cord may pass through every stage of disorganisation. An example is quoted by Dr. Abercrombie from Professor Bréra.

Such cases, in which a progressive weakness is the only symptom antecedent to complete paralysis, are usually called non-inflammatory; and the morbid result is for the most part a white softening of the spinal cord; but *ramollissement* is very seldom observed where pain has not previously existed; and, in the great majority of cases, I am disposed to think that it depends on an inflammatory origin. Lallemand of Montpellier, whose investigations were in a great degree confined to young and vigorous persons, regarded every case of softening as the result of hyperæmia, extravasation, and endogenous formation of pus; whilst Rostan, whose observations were confined almost exclusively to the aged, maintained that the structural lesion in question might occur without a trace of congestion, infiltration, or morbid secretion; but that it results from a diseased state of the arteries, and, consequently, from an imperfect nutrition of the part to which those arteries are distributed.

It is probable that both views contain the elements of truth, and that softening may depend on inflammation, exudation, and alteration of the connective tissue of the cord; and that it may be produced also by a diseased condition of the arteries and of the coats of the capillaries, whereby the mutual interchange between the blood and the tissues is interrupted.

Fortunately the question is of no great practical importance; for, as a general rule of treatment, it may be stated that as long as the affected muscles are convulsed, rigid, and irritable, the use of antiphlogistics and counterirritants is indicated; but when the means which are calculated to subdue the stage of excitation have failed to arrest the further progress of disease, and paralysis supervenes, stimulants are the only remedies which have the power of restoring to functional activity those nerve-cells and conducting fibres which are not irretrievably destroyed.

And of all stimulants with which we are at present acquainted, electricity and strychnine are unquestionably the most potent and the best.

M. Barbier, of Amiens, first suggested the *secale cornutum* as a remedy possessing the same power as that of strychnine, but in a more manageable form; and M. Payen, of Aix, reasoning on the special action which the secale appears to have on the nervous system,—producing, as it does, feelings of tingling and involuntary spasmodic movements of the legs—tried its effects in paraplegia, and in many cases with the most encouraging result. From repeated and careful observations, he concluded that where neither great pressure, beyond that which simple congestion produces, nor disorganisation of the spinal cord exists, its remedial power is very great. In one case of paraplegia complicated with paralysis of the rectum and bladder, the healthy function of these latter organs was completely restored. At the Bicêtre, M. Guersant has had much experience of its action, and has established the fact of its efficacy as a means of resuscitating muscular contractility of the rectum and bladder, and of assisting the latter organ to expel the remains of calculus left after lithotomy. (*Journal de Chimie Médicale*, June 1839.) The interesting question, however, which suggests itself, from our knowledge of the property of ergot of rye in arresting uterine hæmorrhage is, whether its special agency may not be on the sympathetic system, and consequently on the vaso-motor nerves? The gangrene which it produces points to that particular action, and a distinguished physiologist affirms that

he has seen the diminution in the calibre of blood-vessels of the pia mater of the spinal cord take place in dogs after they had taken large doses of ergot of rye; and that the reflex power of the spinal cord becomes very much diminished under its influence. (*Lectures on the Diagnosis and Treatment of the Principal Forms of Paralysis of the Lower Extremities*. By C. E. Brown-Séquard, M.D. P. 78.) And yet the prolonged use of the ergot produces convulsive affections of the face and hands, and in some cases absolute opisthotonos: results entirely at variance with the growing opinion of the effects produced by a diminished supply of blood to the spinal marrow. But we are not called upon to discard a remedy because we cannot entirely explain its mode of operation; neither should we disregard the experience of men like Guersant, Trousseau, and Brown-Séquard, from whom we have every encouragement to depend on the ergot of rye in chronic myelitis, especially when the pelvic viscera are implicated in the paralytic influence. I have given the æthereal tincture in doses of from ten to twenty drops twice or three times a day, and certainly with advantage; but I have not experienced the relief to reflex convulsions from it which I have been led to expect, and have therefore trusted to prussic acid, digitalis, and belladonna for that purpose.

After the local pain in the back has been subdued by the regular and repeated application of two or three leeches to the painful part, followed by a large warm poultice over the whole length of the spine, and a belladonna plaister of equal length to follow it; or an occasional blister on each side of the spine, together with mild warm purgatives if necessary, I have found no remedy so effectual as strychnia in the dose of one-twentieth of a grain, repeated more or less frequently (twice or three times a day), according to the evidence of its action.

Electricity, after the activity of inflammation has been subdued, is a therapeutic agent of great value; and my own experience has convinced me that the continuous current of galvanic electricity is just as efficacious as the induction or intermittent current.

Whether galvanism or electro-magnetism be employed, no high degree of tension is required for the restoration of muscular power; on the contrary, I suspect that the favourable course of many a case has been retarded by the employment of strong currents, and that Pflüger's experiments may be contemplated with advantage.

But when disorganisation of the spinal cord has become an accomplished fact, the disease is incurable. The exigencies of the patient, however, are not the less pressing on the careful attention of the physician, and in nothing more so than in the protection which is called for against bed-sores, which will sometimes occur in spite of the greatest care.

Spinal congestion and inflammation may result in apoplexy, or the formation of a blood-clot in the cord itself, or on its surface; but paralysis is not an invariable attendant on such extravasation unless it be in the substance of the cord. Such cases are extremely rare, but when they have occurred, the clot has generally been found in the cervical region; and, according to Rokitan-sky, in the grey substance of the cord. Dr. Abercrombie has given a summary of nine cases, in five of which the extravasation existed on the surface, and convulsions, without paralysis, were the principal symptoms. In four others, the cord being more or less implicated, paralysis ensued.

Paralysis may likewise supervene from induration of the spinal marrow, which is not an unfrequent result of chronic myelitis. The preternatural consistence is generally confined to the columns of the cord, and the cervical region is by far the most frequent seat of the affection. This structural change is probably due to a peculiar condition of the blood, or of the extravasated fluid from the blood, which becomes converted into an abnormal fibroid tissue, the deposition of which, in the interstices

caused by the action of cold on the body, and which lasted six days, is reported by Dr. Burrows in the *Medical Times and Gazette*, vol. xxii, p. 331. M. Ollivier records a case of chronic myelitis, the duration of which was fifteen years. (Tome ii, Observation 92, p. 685.)

of the longitudinal nerve-fibres, involves the absorption of the nervous matter, and the resulting induration is called sclerosis. A very remarkable example of paralysis from this cause is recorded by M. Portal. (*Cours d'Anatomie Médicale*, tome 4, pp. 116-17.)

The above, together with two or three other cases of induration of the spinal marrow, are contained in M. Ollivier's work; and in all there is a great analogy of symptoms; but the most remarkable feature in all is the long duration of the disease, notwithstanding the important portion of the nervous centre affected. In neither case was there any muscular contraction, which is so commonly observed in myelitis ending in softening.

A remarkable case of induration and local softening of the spinal cord is also recorded by M. Laboulbène, which has been quoted as suggestive of the exact channel in the cord through which impressions of sensation are transmitted. (*Mémoires de la Société de Biologie*, 1855. Pp. 233-45.)

The iodide of potassium is a remedy which suggests itself to the mind in cases where there is good evidence to believe in the existence of chronic myelitis with induration of the cord. For upwards of ten years I had under my observation a gentleman who, at the age of about 65, began to show symptoms of what I suspected to be induration of the spinal cord. At an early period of the disease he had paroxysms of distressing formication, each of which was the prelude to loss of muscular power. A course of the iodide of potassium always relieved the itching and tingling surface, but on no occasion did it arrest the progress of the general paralysis.

The absence of pain and of spasmodic muscular contraction of muscles in this affection, enjoins much caution in determining the precise moment when the spinal cord is likely to be favourably affected by the energetic excitement which strychnine has the property of communicating to it; therefore its internal administration may be preceded by its external use, together with other stimulants in the form of embrocations over the spine, in this, as in all other varieties of myelitis, when the stage of excitation has been subdued. The same external applications may be employed for the purpose of stimulating paralysed muscles to action through the influence of the sensitive branches of the spinal nerves; and in so doing, the interesting observation of Schroeder Van der Kolk, that "the spinal nerves give their motor branches to the muscles as instruments of motion, and their sensitive branches to the parts moved," should be borne in mind, in deciding on the part to which the embrocation is to be applied.

[To be continued.]

CASES OF PUERPERAL CONVULSIONS TREATED WITH AND WITHOUT BLEEDING.

By R. PROSSER, Esq., Surgeon, Bromsgrove.

CASE I. A. J., first confinement, June 6th, 1860, 4 P.M. She had been in labour four hours. The pains gradually increased, and in an hour became very strong; and she had a violent convulsive fit. She was bled immediately to about twenty-five ounces; in about ten minutes after she was bled, the convulsion ceased; but she remained insensible for a few minutes longer. Whenever the pains came on strong, the fits recurred with equal violence. The fits and pains continued at irregular intervals, and the labour progressed very slowly for some time. After the head had descended upon the perinæum, it seemed to stand; and whenever the pains came on strongly, the fits came on with greater violence. The forceps was applied, and delivery very easily effected. The placenta came away. The uterus contracted, and no

hæmorrhage occurred. There were no fits after delivery. The patient made a good recovery.

CASE II. F. W., third confinement, August 6th, 1860. When the pains put on an expulsive character, she was taken in a violent convulsive fit, which passed into a comatose state. She was immediately bled to about twenty ounces. The fits continued; and the case progressed very slowly. The forceps was applied while she was in a comatose state; and the case terminated without any further difficulty or complication. No fits occurred after delivery; and she made a good recovery.

CASE III. E. W., about eighteen months previous to my attending her, was taken in fits about nine days previously to her delivery. The fits continued about two days. She was bled twice, and had twenty leeches applied to her head. She had no fits during labour. She made a tedious recovery.

On June 4th, 1861, she was in a violent convulsive fit; the breathing stertorous, and face turgid. She sank into a state of quiet unconsciousness, and remained so for about ten minutes. The fits recurred at irregular intervals for the next twelve hours with more or less violence. The kidneys were inactive. A saline diuretic was given; and perfect rest and quietness maintained. The fits gradually became less violent and less frequent, until they ceased. No more fits occurred; and she was naturally delivered eight days afterwards, and made a speedy recovery.

On March 20th last, nine days after confinement, she had a most violent convulsive fit which lasted some hours, or rather a succession of fits. She bit her tongue; her breathing was stertorous, and face turgid. The bowels had not acted for three days; and the kidneys very little. She had large doses of solution of sulphate of magnesia repeated about every three or four hours, until the bowels acted freely. After the bowels had acted, she was without a fit for six hours when a fit came on; and she was no sooner free from one than she was seized with another. The kidneys continuing inactive she had a saline diuretic, and was kept perfectly quiet, and free from all disturbance and restraint. She sank into a deeply comatose state, and continued so for eight hours. When she awoke, she expressed herself much better; but complained of feeling exhausted. No more fits occurred; and in a week she was convalescent.

CASE IV. P. D., about two years previously to my attending her, was taken in labour. She had fits; was bled and delivered; and made a good recovery.

On January 8th, 1862, labour had made considerable progress. The pains became very strong; and she was seized with a violent fit. The limbs were rigid; the breathing stertorous; and the face livid. The fit lasted about ten minutes, but recurred again and again, when the pains came on strongly. The forceps was applied without any difficulty. The placenta immediately followed the birth. The uterus contracted, and no hæmorrhage occurred. There were no fits after delivery; and the patient made a good recovery.

CASE V. E. P., first confinement, March 18th, 1861. She had a "good time"; but next day she had a convulsive fit. As I was not at home, a friend saw her and bled her. No fit occurred until the following day, when she was taken much the same. She had a castor-oil aperient; and made a good recovery.

CASE VI. G. O., in February last, had a natural labour; but a few minutes after the birth, she had a convulsive fit which only lasted about five minutes. Neither bleeding nor any other treatment was adopted. She was kept perfectly free from all disturbance; did not have another fit; and made a good recovery.

REMARKS. The first two cases show that bleeding was tried with no benefit; for the fits continued, and only ceased upon delivery. Cases III and IV were subjected at two different confinements to the two different systems of treatment, and recovered equally well. Case V was