

Cases of paraplegia / by T. Grainger Stewart.

Contributors

Stewart Thomas Grainger, Sir, 1837-1900.
Royal College of Physicians of Edinburgh

Publication/Creation

Edinburgh : Oliver and Boyd, 1876.

Persistent URL

<https://wellcomecollection.org/works/u3e5ykjn>

Provider

Royal College of Physicians Edinburgh

License and attribution

This material has been provided by This material has been provided by the Royal College of Physicians of Edinburgh. The original may be consulted at the Royal College of Physicians of Edinburgh. where the originals may be consulted.

This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

CASES OF PARAPLEGIA.

BY

T. GRAINGER STEWART, M.D., F.R.C.P.E.,

PHYSICIAN TO THE ROYAL INFIRMARY, AND LECTURER ON CLINICAL MEDICINE
AND ON THE PRACTICE OF PHYSIC, EDINBURGH.

Read before the Medico-Chirurgical Society of Edinburgh, 7th June.



EDINBURGH: OLIVER AND BOYD, TWEEDDALE COURT.

MDCCCLXXVI.

REPRINTED FROM THE EDINBURGH MEDICAL JOURNAL FOR JULY, AUGUST,
AND SEPTEMBER 1876.

R51539

CASES OF PARAPLEGIA.

NOTWITHSTANDING the attention which has been devoted to the study of paraplegia, cases frequently occur which are not readily referable to any of the recognised types of the disease. As such cases cannot be expected to recur very frequently in the practice of any one physician, it seems desirable to record even isolated examples, with a view to the ultimate elucidation of their nature by comparison with others. Moreover, there is reason to fear that cases, even of the well-recognised types, are sometimes allowed to go on without proper treatment until they become hopeless, and that, on the other hand, treatment is sometimes abandoned in despair while yet it might be applied with success. It therefore seems important that the results of treatment should be laid before the profession, in order that the knowledge of the most successful methods may become more widely diffused. Influenced by these considerations, I purpose to bring under the notice of the Society a group of cases which are interesting for one or other of the reasons indicated.

CASE I. *Paraplegia from Pott's Disease of the Vertebrae. Treatment by Rest, Mechanical Supports, and Tonics. Recovery. Relapse after prolonged violent exertions. Treatment as before. Recovery.*

In the summer of 1870 Thomas Smith, a sailor, 28 years of age, began to feel pain about the seventh or eighth dorsal vertebra, with stiffness in the back and unfitness for active exertion, but he contrived to follow his occupation till October, when he was necessitated to remain on shore, by reason of the severity of the pain and of loss of power in the legs. These symptoms gradually increased, and were attended by jerking of the limbs, but not by any marked affection of the bladder or bowel, until, on the 9th of March 1871, he was carried into my wards in the Royal Infirmary. He was a fair-complexioned, wiry-looking man, free from fever. He complained of pain extending from just below the eighth dorsal vertebra, round to the front of the body, but most severe in the epigastrium. This pain, though generally dull and constricting, was sometimes sharp and lancinating, especially when he moved, when he assumed the erect position, or when the

weather was cold and damp. The legs felt cold, but were free from pain, formication, or numbness. The sensibility to all kinds of impressions was normal. The reflex action produced by tickling the feet was rather exaggerated. Voluntary motion was impaired in the legs, especially in the right one. When lying in bed some slight and feeble movements could be accomplished, but when he attempted to stand the power gradually passed away, and in a few seconds he fell. It was impossible for him to walk. The muscles of the legs were fairly nourished. Their electro-contractility was normal, but they were frequently disturbed by involuntary spasmodic jerkings. There was an acute curvature of the spine at the level of the seventh or eighth dorsal vertebra; but there was no sign of abscess in connexion with it, and the patient was free from fever.

The diagnosis in this case was obvious, viz., paraplegia, due to pressure exerted upon the anterior columns of the cord by the bag of debris resulting from the destruction of the bodies of the vertebræ.

The treatment adopted was rest, which was obtained by remaining in bed, and by using a mechanical support whenever the patient assumed the erect posture; the administration of cod-liver oil and of iron; and the regular faradization of the nerves and muscles of the legs. The instrument for support was constructed by Mr Gardner, and was designed to take the weight of the shoulders and head off the spine. It consisted of a firm girdle base, resting upon the sacrum and the iliac bones; from each side there arose a steel rod, terminating in a crutch, which reached the axilla. By this means the weight of the shoulders was conveyed directly to the pelvis. From the centre of the sacral part there sprang a rod which curved forwards at its upper extremity, so as to support the head by means of a strap which passed below the chin. Whenever the instrument was put on, the patient felt some relief of the pain in the back, and some increase of power in the limbs.

He gradually improved, and by the middle of June not only walked about the ward, but made his way down to the green; and by November he was quite well, excepting that an anchylosed curvature existed in the back.

After thus recovering his health he went to sea, and remained steadily at work until about Christmas 1874, when his ship was overtaken by a storm and dismasted. He was then obliged, like the rest of the crew, to make great exertions to prevent the rise of water in the hold, and to work hard at the pumps for fifty-two hours with very little intermission. The ship was saved, but his spinal pains returned, and paraplegia speedily supervened. He was treated in hospital at Wexford for a fortnight; was then transferred to another infirmary, where his symptoms gradually increased, until, in the month of April, he was dismissed as incurable. He then returned to Edinburgh on 24th April 1875, was readmitted to my wards, and examined. It was then found that the girdle pain was

very severe. There was a cold feeling in the legs, particularly the right, and some formication in the back of the trunk. Sensibility to touch, temperature, tickling, and pain was greatly impaired in the right leg, though it was natural in the left. The muscular sense was greatly impaired in the left leg, though natural in the right. He was unable either to walk or to stand, and even in bed, while the right leg could be moved about with some freedom, the left was totally paralyzed. It was clear that there was more disease than formerly, that mere pressure would no longer account for the phenomena, which must be due to local changes in the cord; but as these grave changes were due to the causes which were active during the former illness, the same treatment was adopted, and it was followed with like good results. In August the girdle pain had disappeared from one side, and the paralysis was much diminished. It was found that on the left side, the side affected with motor paralysis, the sensibility of the skin of the abdomen, up to the level of the umbilicus, was unnaturally acute. The patient continued to improve during the succeeding months, and in January left the Infirmary cured. He is at present employed as a sailor in the Baltic trade.

It is just a hundred years since Percivall Pott¹ described, with great accuracy, the form of disease of the vertebræ from which this patient suffered, and the form of paraplegia which it is apt to induce. It is now² known that Pott's disease may originate either in a strumous affection of the bodies of the vertebræ or in disease of the articular structures, and that in whichever seat it may commence, there is ultimately crumbling down of the bone, resulting in the formation of an acute curvature, and perhaps abscess. I am inclined to think, considering the patient's age, his constitution, and occupation, the absence of suppuration, the presence of nocturnal exacerbations of pain, and the subsequent progress of the case, that the disease originated in the cartilages.

Pott³ recognised the great features of this kind of paraplegia. He says,—“It should be observed that, notwithstanding the lower limbs be rendered almost or totally useless, yet there are some essential circumstances in which this affection differs from a common nervous palsy, when legs and thighs are rendered unfit for the purposes of locomotion, and do also lose much of their natural sensibility; but, notwithstanding this, they have neither the flabby feel which a truly paralytic limb has, nor have they that seeming looseness at the joints, nor that total incapacity of resistance which allows the latter to be twisted up in almost all directions. On the contrary, the joints have frequently a considerable degree of stiff-

¹ Remarks on that kind of palsy of the lower limbs, which is frequently found to accompany a curvature of the spine, and is supposed to be caused by it. The Chirurgical Works of Percivall Pott, F.R.S., vol. iii. p. 393.

² See Leyden, Rückenmarks' Krankheiten, vol. i. p. 217. Shaw, in Holmes's System of Surgery, 2d edit., vol. iv. p. 103.

³ *Op. cit.*, p. 400.

ness, particularly the ankles, by which stiffness the feet of the children are generally pointed downward, and they are prevented from setting them flat on the ground."

The clinical history has been more minutely described by subsequent observers.¹ The earliest symptoms are generally an abnormal attitude of the trunk, difficulty of bending and straightening the spine, and tendency to be easily fatigued; to which are subsequently added pain in the back, girdle pain, and paralysis. The paralysis is generally characterized by well-marked loss of motor power and slight diminution of sensory, with exaggeration of reflex excitability. According to the portion of the cord which is affected, special symptoms arise; for example, alterations of the action of the bladder, the irides, the circulatory, respiratory, or digestive systems.

The nervous symptoms resulting from disease of the vertebræ may be produced by affections of the nerves, the membranes, or the cord itself, each of which may be either simply compressed or structurally altered. While all three may be affected in common, each of them has its own characteristics. Thus, when the nerves are the seat of disease, seeing that either the conjoint trunk or its two roots are invariably involved, sensation and motion are affected in the district supplied by the particular nerves, and, of course, the parts of the body supplied by nerves leaving the cord lower down are free. But, as in our patient the legs were paralyzed, and sensation was affected in one, motion in the other, it is clear that his symptoms were not referable to lesion of the nerves merely. When, again, the symptoms are due to affection of the membranes, anatomical changes are necessarily presupposed. These changes consist mainly of inflammatory thickening of the dura mater, so considerable as to compress the cord or the nerves as they pass out. Beginning at one spot, the process gradually extends, and sometimes even reaches round so as to encircle the cord.² The characteristic symptom of this condition is severe pain of a darting and radiating character, extending along the nerves, and aggravated by movement of the trunk. It is very probable that in our patient this lesion existed to some extent, but, considering the prominence of the motor paralysis, and the absence of any but girdle pain, it is apparent that a further cause must be sought for. Lastly, when the cord itself is at fault, either from pressure or from nutritional changes in its substance, there is interference with the function of the segment involved, and of the whole cord below it. It must not be forgotten that the lesion may be so

¹ See Leyden, *loc. cit.* Bouchard, Dictionnaire Encyclopédique des Sciences Médicales, vol. viii. p. 664. Shaw, in Holmes's System of Surgery. Charcot, Leçons sur les Maladies du Système Nerveux, cinquième leçon. Erb, Krankheiten des Rückenmarks, in Ziemssen's Handbuch, p. 318.

² These processes have been minutely described by M. Michaud in his work, "Sur la Meningite et la Myelite dans le Mal Vertébral." Paris, 1871.

localized as to involve only a single column or a lateral half of the organ; and that when this is the case corresponding varieties of symptoms are manifested.

Now, during the first period of his residence in the Infirmary, our patient had, as has been shown, merely pressure upon the cord. This was made evident by his comparative freedom from palsy when lying down, the rapid increase of the palsy when he assumed the upright position, and the relief experienced whenever the weight of the shoulders and head was taken off the spine; and the gradual advance of the symptoms indicated that neither the bursting of an abscess nor partial dislocation, rendered possible by destruction of bone, could be regarded as the cause; while all the facts corresponded with the phenomena which should result from the pressure of a sort of bag of disintegrated tissue, representing the bodies of the vertebræ. The result of treatment was arrest of the progress of disease of the bone, ankylosis of the affected vertebræ, and complete relief from pressure on the cord.

But during the second period of his residence in the Infirmary, it was no longer possible to ascribe the symptoms to simple pressure. It is admitted, indeed, that such a paralysis may arise from mere pressure; but, considering, on the one hand, that change of attitude made no difference, the patient being as completely paralyzed in the recumbent as in the erect position, and, on the other, the long duration and intensity of the paralysis, we are warranted in believing that chronic inflammatory changes had occurred in the substance of the cord itself; whilst the distribution of the symptoms, paralysis of motion on one side, with loss of sensibility on the other, indicated an affection of one half of the cord, involving both the antero-lateral and posterior columns.

Assuming the correctness of this view, there are three points of considerable physiological interest to which I would direct attention, viz. :—

1. The confirmation which the case afforded of the discovery of Brown-Séguard,¹ that while the motor fibres decussate in the upper part of the spinal cord, the sensory fibres decussate near their point of entrance into the cord, so that section of one lateral half of the cord induces motor paralysis on that side, sensory on the other.

2. The confirmation of Brown-Séguard's statement, that while the fibres for touch, temperature, tickling, and pain, decussate near their point of entrance, those for the muscular sense do so at the upper part of the cord. The muscular sense, it will be remembered, was lost on the side which had the motor paralysis—not the sensory.

3. The confirmation of Brown-Séguard's observation, that section or injury of one lateral half of the cord at the level of the tenth dorsal vertebra leads to hyperæsthesia on the side on which motor

¹ Brown-Séguard, *Journal de la Physiologie de l'Homme et des Animaux*, Jan., Apr., and Oct. 1863. *Radcliff, Lancet*, 27th May 1865.

paralysis exists. This exaltation of function was not recognised in the leg, but was distinctly made out in the lower part of the abdomen.

With regard to the treatment, it will be observed that although the pathological conditions during the two illnesses differed, the plan of treatment adopted was the same. The explanation is, that although during the second illness the cord itself had become affected, the primary lesion was the same at both periods. *Mechanical support* was the first essential. Various forms have been suggested, but the results I have obtained in a considerable number of cases by that which I have described have been very satisfactory. The patient who wears such a support is able to get up and move about, and has a much better chance of recovering strength than one who is kept constantly lying in bed. But rest in bed is also of great value, some authorities indeed regarding it as preferable to mechanical support. Its disadvantage is the want of exercise, the failure of appetite, depression of spirits, and lowering of general tone.

As to *internal treatment*, our patient derived most benefit from the use of iron. Unfortunately he could not continue cod-liver oil, but his general nutrition was carefully attended to by liberal dieting. Tonic remedies are as a rule of great importance, and, on the whole, iron, and quinine and iron, are the most suitable. During the process of recovery, benefit appears sometimes to be derived from the use of nitrate of silver. Strychnia, even in small doses, is apt unduly to increase the irritability of the cord; and although its use is sometimes desirable in this form of paraplegia, it must always be employed with great caution. Cod-liver oil is eminently beneficial when the stomach will bear it. Leudet,¹ in his paper upon an interesting case of recovery from several successive attacks of paraplegia, insists upon the value of general internal treatment, and shows that by means of iron, antiscorbutics, tonics, and cod-liver oil, he has obtained excellent results, without local counter-irritation or other special treatment.

Electrization of paralyzed parts was in our case perseveringly employed. Faradization was as usual most useful, keeping up the activity of the nerves and muscles, their nutrition, and the circulation in the limbs. I did not employ a plan of treatment which is warmly advocated by Erb,² the local galvanization of the affected part of the cord. He places one electrode above, the other below, the diseased part, and passes a weak constant current, first in the one and then in the other direction for two to three minutes (in all) daily.

Counter-irritation over the seat of disease did not appear needful in this case. It was Pott's favourite treatment, and certainly the

¹ Recherches Cliniques sur la Curabilité des Accidents Paralytiques consecutifs au Mal Vertébral de Pott. Mémoires de la Société de Biologie. 1863. P. 100.

² Die Krankheiten des Rückenmarks, Ziemssen, Handbuch Speciellen Pathologie und Therapie, B. xi. part 2, p. 342.

results obtained in many of his cases were very remarkable. He formed issues, kept them open with peas, and irritated the surface from time to time with powder of cantharides. It appears probable that counter-irritation is of use in different ways, viz., in relieving pain, in checking inflammatory action in the articular form of spine disease, and in diminishing inflammation of the membranes and substance of the cord. The experience of Charcot is much in favour of it. He employs the actual cautery. Of the benefits to be obtained by blisters and setons, we have an example in a case recorded by Dr James Young¹ about twenty years ago; while the application of compound tincture of iodine is recommended by Mr Shaw,² writing in Holmes's System of Surgery.

The results obtained by our treatment in the first illness have been already referred to. What were the results obtained during the second period? The spine became once more ankylosed; the membranes and the cord were restored almost to their natural condition, and the occurrence of important secondary changes (consecutive sclerosis) was prevented. That recovery of wounded or injured spinal cord may take place, was proved by the observation of Van Kempen, Flourens,³ Brown-Séguard,⁴ Masius and Vanlair.⁵ The last-named authorities proved not only that simple section of the cord of the frog, or other animal, may be recovered from, but that a considerable loss of substance may be made up for, and voluntary motion completely restored. The details of the pathological process, as described by these writers, are full of interest. Leyden⁶ states that experiments have been made by Paul Dentan, which show that this power of recovery exists in dogs as well as in cold-blooded animals. Such observations render it probable that, even in man, there may be restoration of structure as well as function where lesions have been produced by injury or disease; and, unless I am mistaken, this actually occurred in our patient. Recovery from the local affection being obtained before much time had elapsed, he was saved from the development of secondary sclerosis.

CASE II. *Paraplegia with anæsthesia, intense neuralgia, and wasting of muscles, following upon fatigue, exposure to cold, and malarious poisoning. Treatment by Opiates and Quinine. Recovery.*

Mr A. B. first consulted me on 28th October 1874. He was then twenty-four years of age, had always been healthy, but led a somewhat intemperate life as he grew into manhood. He married before he was twenty, and went to America, where he entered upon practice as a veterinary surgeon.

¹ Edinburgh Medical Journal, 1856, p. 1021.

² Holmes's System of Surgery, 2d edition, vol. iv. p. 158.

³ Annales des Sciences Naturelles, t. 13, p. 128.

⁴ Med. Exam., 1852, p. 379.

⁵ Recherches Experimentelles sur la Régénération Anatomique et Fonctionnelle de la Moelle Epinière. Quoted by Leyden.

⁶ Leyden, *op. cit.*, vol. i. p. 84.

In September 1873 he was wrecked in one of the large American lakes, was about forty-five minutes in the water before he was rescued, and thereafter was obliged to remain in his wet clothes for some hours. During the succeeding days he was exposed to malarious poison, and ague came on within a week. This malady recurred from time to time until the winter, and then, in consequence of a severe epizootic affecting horses, he was very hard worked, had to go about on foot instead of driving, and often slept in his wet clothes. In April 1874 he began to suffer from pain in the toes of the left foot, soon afterwards in those of the right also. And he noticed that when his feet touched the ground he felt it very hard and painful, while at the same time if a needle were driven into his calf he did not feel it at all. The pain gradually extended up to the knee, then to the front of the thighs. It was constant, but was occasionally greatly aggravated and of a lancinating character. These exacerbations were not periodic. From July onwards he had a feeling of numbness in the legs, with the sensation of "pins and needles," and in that month he noticed that his sight was impaired. During the earlier months of the illness he could walk about, but he felt his muscular power diminishing, and noticed that the legs were wasting. In walking he had to swing his leg round in the arc of a circle. In July he lost power altogether, and was almost confined to bed. As he experienced no benefit from the treatment by means of strychnia, Easton's syrup, iron, bromide of potassium, and blisters, which were tried in America, he resolved to return to Scotland. During his voyage he suffered greatly, and he thought his symptoms were aggravated by the use of chloral, which was freely administered.

On his arrival in this country I was asked to see him. I found him pale and emaciated, but free from any disease except occasional attacks of ague, and the following nervous symptoms:—He complained of almost constant intense pain in all the nerves of the legs, aggravated by movement, either active or passive, or by touching the skin. He had no pain in the trunk, but frequently felt it cold when there was no real lowering of temperature. He had pain in both arms, especially the right. Sensibility to touch was lost in the toes and feet, gradually improved towards the trunk, where it was normal. In the hands it was normal. Sensibility to heat and cold, and to tickling, was lost in the feet. The special senses were, and muscular sense appeared to be, natural. Reflex action was abolished in the feet, diminished in the hands. There was no alteration of the functions of the bladder. The bowels were constipated. He was unable to walk, or even to stand. When lying down, he could perform, although very feebly, flexion and extension, abduction and adduction of the thighs; could still more feebly move the legs on the thighs; could make a slight movement of the left ankle-joint, none of the right; and he could not move his toes at all. There was no loss of power in

the trunk, nor in the arms above the elbows; but while pronation and supination of the forearm were normally performed, flexion and extension of the wrists were impaired, and the fingers and thumbs could only be slightly used. The right hand was worse than the left. There was no spontaneous fibrillary twitching or jerking of the muscles, but some twitching was observed on voluntary effort. All the muscles were diminished in bulk proportionately to the diminution of power. There was no tendency to sloughing of the skin. The cerebral and mental functions were normal, excepting in respect of sleeplessness, due to the intense pain. There was no peculiarity of the cranium or spine.

The treatment adopted at first was careful dieting, complete rest, the administration of iodide of potassium, with opiates for the relief of pain. The last-named afforded temporary relief, but the iodide proved useless. *Liquor strychniæ* was then given in doses of 5 minims three times a day, but without benefit. The amount of opium required was very large, 8 grains being sometimes taken in the course of a night. Hoping to relieve the pain, I ordered, early in November, full doses of quinine, and for many weeks from 20 to 30 grains were taken daily. Soon after it had been begun, improvement set in; and on the 18th of December the following report was taken: Pain has disappeared from the thighs, but continues in the legs and feet, and occasionally there is severe neuralgia of the head. The feet feel less cold, but very heavy, and they are still numb, and sometimes have a twitching sensation. Sensibility is still diminished. Movement and touch are less painful. Tickling the right sole is felt painful. Reflex movements have reappeared in the legs, and voluntary movement is paralyzed in the same groups of muscles as before, but in a less degree. The movements of the hands are greatly better. The nutrition of the muscles is everywhere improved. The opiates had now become less necessary, but the quinine was perseveringly employed.

In the beginning of February 1875, the pains had disappeared from all parts except the feet, and were only occasionally felt there. He still complained of coldness of toes, and occasional formication. The sensibility was almost natural, although impressions were conducted slowly. The sensitiveness to movement and contact was greatly diminished, but warmth was felt as pain. Reflex action was almost natural. Voluntary motion in the hands and arms was almost perfect. The muscles of the thighs were normal; those of the knees were perfect. Flexion, extension, eversion, and inversion of the foot were still all somewhat feeble. The left foot was better than the right. He could, however, stand without support, and walk with the aid of crutches. The nutrition of his muscles was greatly better. He could sleep without any opiate, being almost free from pain.

He steadily progressed from this time, and in the month of April of the present year I met him driving a gig on Corstorphine Hill. He

laid aside the reins, jumped down from his place, in order, as he said, to show me his paces on the road. They were almost perfect.

On first taking charge of this case I regarded it as a very grave one, and did not venture to hope for the speedy recovery which actually occurred; yet I could not refer it to any of the well-known types of spinal disease. It seemed grave because of the intensity of the pain, the completeness of the paralysis, sensory and motor, but, most of all, because of the atrophy of the muscles. Notwithstanding the intensity of the radiating pains, it was evidently not a case of meningitis, as was shown by its mode of development, by the marked paralysis, and by the absence of rigidity of the spine, and of aggravation of pain on movement of the back. It was also certainly not myelitis, although the rapid wasting of the muscles suggested that disease, for there was no marked affection of the sphincters, no tendency to sloughing of the skin of the affected parts; and while the radiating pains in the limbs were more severe and continuous than in myelitis, there was no local spinal pain, and no girdle pain, no spinal tenderness, nor special sensitiveness to the hot sponge. It was also not a result of congestion of the cord or its membranes, or of both, because the anæsthesia was so well marked, the pains were so intense, and so intensely aggravated by movement of the limbs, the paralysis of the muscles was so complete, and their nutrition so distinctly impaired. It certainly was also not to be referred to spinal anæmia, there being nothing to account for such a condition in the patient, and the group of symptoms being much too pronounced. There was, of course, no possibility that sudden extravasation had been the cause; and careful inquiry showed that neither diphtheria, nor any other disease usually recognised as a cause of paraplegia, had preceded the attack.

It is difficult to arrive at a positive conclusion as to the seat of the pathological change in this case. It might be in the nerve-centres, or in the nerves themselves. Were we to hold that it was located in the nerve-centres, it must be assumed that it was widely distributed, involving all the columns of the cord and a great part of its extent. That all the columns were involved, must be assumed, seeing that sensation, motion, reflex action, and muscular nutrition were all affected. That a great part of the cord must be held to have been diseased, was shown by the affection both of the legs and the arms. But there is much difficulty in the way of accepting this hypothesis, in consequence of the absence of other spinal symptoms. If the whole thickness of the cord were to so large an extent diseased, we should certainly expect to find in the spine some tenderness on pressure, or some pain on movement, or sensitiveness to heat or cold, some affection of the bladder, the bowels, the digestive organs, the respiration, the circulation, or the pupils; but all of these were unaffected.

On the other hand, it may be held that the nerves themselves

were the seat of the morbid process. The distribution of the symptoms affecting both the upper and lower extremities, and increasing in intensity as it passed down the limb, taken along with the order of development, both pain and weakness having first appeared at the periphery and spread towards the centre, may be regarded as supporting this view. Some authorities regard these as important evidences of the peripheral seat of a lesion, and I am inclined to agree with them, notwithstanding the consideration advanced by Dr Handfield Jones.¹ He says that such an extension of disease from periphery to centre by no means implies that the extremities of the nerves are first affected, and that the morbid action advances centrad to the cord. It really means that one set of nerves is affected after another, leaving it entirely an open question whether the nerve-roots or the distal extremities are the seat of the disorder. It is clear, says he, that the same phenomena would ensue, if we suppose the morbid action to be located in the cord, and to proceed gradually upward from below. I am not aware of any anatomical facts as to origins and distributions of the individual nerves of limbs which would bear out this statement. While it might be true enough in the case of a paralysis spreading up the trunk, and involving one intercostal nerve after another, it is surely not so in the case of an affection of a nerve of a limb. There is, for example, no reason to think that the utmost peripheral branches of the sciatic take origin in the lowest segment of the cord from which that nerve derives its fibres. Such considerations as these, taken along with the results of clinical observations, forbid my accepting the view of Dr Jones.

Again, the sensations experienced by the patient resembled those resulting from pressure on the nerve-trunks when the limbs are in the condition popularly termed "asleep." There was the same anæsthesia, the same motor paralysis, the same painful feeling when a muscular movement was made, or when the leg was touched, only the pain was far more severe. This, however, shows that a condition analogous to that of our patient, although of a passing kind, may be produced by temporary influences acting merely on the nerves; but one sometimes sees corresponding symptoms result from the pressure of tumours, such as aneurisms, upon nerve-trunks. Aneurism of the innominate artery, for example, may lead to very similar changes in the arm by pressure on its nerves.

Assuming, then, that, so far as our present knowledge goes, it is reasonable to conclude that the nerves were the seat of the lesion, the question suggests itself, What was its nature? Of this we can say nothing certain; but I shall quote a sentence or two from the valuable work of Dr Handfield Jones.² Speaking of the nature of paresis, he says:—"It may be somewhat elucidated by reflecting on the condition of a nerve such as the median or

¹ Functional Nervous Disorders, 2d edit., p. 145.

² *Op. cit.*, p. 138.

ulnar when affected by severe neuralgia. The function of the nerve is temporarily abolished, the skin which it supplies is utterly anæsthetic, and the muscles palsied. Under the influence of quinine, and perhaps galvanism, the sensory and motor power is restored. It is certain that these remedies would not amend a state of neuritis; and I can see no other view to adopt than that, owing probably to some minute molecular derangement of tissue depending upon impaired nutrition, the nerve-fibres are no longer capable of conveying centrad and peripherad the impressions they normally transmit." It obviously implies but little to say that probably minute molecular changes take place in such a condition, but the statement may help some minds to form a conception of the kind of change which may be supposed to exist in nerves affected as were those of our patient.

Whatever may have been the nature of the morbid process, it is manifestly of the utmost importance to inquire into the causes which induced it. Various factors probably played a part in its production. Among the circumstances preceding the attack, there were three, which are well recognised as causes of paraplegia, viz., wetting, fatigue, and exposure to cold. But the accident on the lake preceded the illness by seven months, and the special fatigue and frequent wettings occurred during the winter, and certainly were not immediately followed by the paralysis or the pain. The question then arises, Whether the malarious poison could have had any share, or even a leading share, in its production?

Eisenmann¹ remarks that malaria, like cold, is capable of producing not only febrile, but all kinds of non-febrile affections of the nervous system, and it may be added that all parts of the nervous system may be affected. With the view of getting light upon this case, I have searched such authorities as I have had access to, and, while I have not succeeded in finding any example of malarious nervous affection exactly corresponding to the one we are considering, I have found many cases which in some measure bear upon it.

The mental functions have long been known to be occasionally influenced by malaria. Sydenham² recognised the fact that a peculiar form of mania in some instances follows long-continued agues, that it sometimes results in fatuity, and terminates only with the life of the patient. Bucknill and Tuke³ recognised the same fact; and Griesinger,⁴ entering more minutely into the subject, describes one kind of case in which mania takes the place of an ague fit, the proper ague fit never occurring; another, in which the regular ague paroxysms, having existed for a time, disappear, and are replaced by maniacal attacks, these attacks frequently assuming a remittent or continuous type, and becoming chronic;

¹ Die Bewegungs-Ataxie, Wien, 1863, p. 191.

² Sydenham's Works. Sydenham Society's edition, vol. i. p. 93.

³ Psychological Medicine, 2d edit., p. 287.

⁴ Griesinger on Mental Diseases. Syd. Soc. transl., p. 184.

and a third form, which is a uniform persistent chronic affection, often coming on after the cessation of the ague.

That the sensory functions are often affected by malaria is well known, for all physicians concur in recognising malarious neuralgia as a very common affection. Such neuralgiæ are, however, generally local; but Dr Fonssagrives,¹ of Brest, records two examples of general neuralgia due to malarious poison, cases which present numerous points of analogy to that under consideration, but differ from it in respect that there was distinct periodicity of the symptoms, and less muscular palsy.

The motor functions, again, are frequently affected. Romberg² states that various old authors record examples of intermittent paralysis. He himself met with one case in 1830. A woman, sixty-four years of age, who had been quite well the day before, was suddenly seized with paralysis of the legs, attended by involuntary escape of urine and fæces. When lifted out of bed she could neither walk nor stand, but fell down all of a heap. Sensibility and consciousness were unimpaired. Temperature was cool, pulse quiet, breathing normal. She made no complaint of pain in the back. In the absence of any other indication, he ordered 16 cupping-glasses to be applied to the dorsal, and a blister to the lumbar region, and some arnica and ammonia to be given internally; at the same time, warning the patient's friends that death was the termination to be expected. Next day he was surprised at the change of condition, for the patient came led by her daughter. She complained only of weakness of the limbs, but was all right in respect of the bladder. Next morning, however, damped the ardour of his satisfaction at the speedy effect of his remedies, for all the symptoms had recurred at the same hour as they had come on two days before. There was then no doubt as to the nature of the illness, and the presence of other indications of intermittent fever made it the more certain. Still, to make quite sure, he waited for a third attack. It came duly, and then, under quinine, the patient rapidly recovered. This case is the classical example of malarious paraplegia, but others are on record, thus:—Handfield Jones³ tells us that M. Bailly describes how, during his stay at Rome, when he was evidently under the influence of malarious infection, he experienced every day, about three or four P.M., an extraordinary weakness of the legs, so that he could hardly get along, and was obliged to use his arms, which were unaffected, to pull himself by the banisters up stairs. He was cured of this symptom by quinine. The same authority relates a case, of which the history was communicated to him by a friend:—“H., æt. 42, labourer, was seized, 9th July, while at work, with violent pain across the loins, and with numb-

¹ Archives Générales de Médecine, 1856, i. p. 277.

² Nervenkrankheiten, Dritte Auflage, 1857, p. 752.

³ *Op. cit.*, p. 83.

ness running down the legs. The urine was retained, so that he could not pass it, and there was involuntary discharge of fæces. When first seen he was lying on his back at full length, the toes pointing straight out, the skin cold, the legs paralyzed and insensible, even when pinched with the nail. He was quite unable to stir. No pain or disorder elsewhere. He was quite conscious. Ordered an enema of turpentine with aloes, and calomel, gr. v., and pulv. jalap. co. gr. x. After the enema and purge had acted freely the limbs still remained powerless; the pain continued, but was relieved by a croton-oil liniment. 11th July, Quin. disulph. gr. x. ter die. The next day sensation returned, and the next he could sit up in bed. In a week he walked to the dispensary, and soon after was quite well."

It is, of course, unnecessary to bring forward any proof that the vaso-motor function is affected by the ague poison, the ordinary phenomena of the paroxysm affording sufficient evidence. Among other affections of nerves arising from malaria may be mentioned spasmodic cough, asthma, megrim, hiccup, and insomnia.¹ It is thus certain that all the chief functions of the nervous system may be interfered with by the action of this poison, so that we may safely conclude that it is capable of producing alterations in any part of the system, and has no exclusive affinity for any part.

The chief difficulty which stands in the way of accepting the hypothesis that our case belongs to the group of malarious affections is the absence of a periodic or even a markedly paroxysmal character. But this consideration is, in my opinion, outweighed by the admitted possibility of malaria inducing a great variety of nervous symptoms, the certainty that these symptoms are not invariably periodic, the history of exposure to the poison, the existence of the tendency to ague before, during, and after the paraplegia, and, above all, by the remarkable and speedy improvement which followed the administration of quinine. I quite admit that this view is one which cannot be held to be absolutely demonstrated, but I am unable to suggest any better explanation of the case.

The remaining cases of this series are less important than the preceding, and may be dismissed after much more brief consideration.

CASE III. *Paraplegia with pain, anæsthesia, and œdema of legs. Treatment with Quinine, Strychnia, and Iron. Recovery.*

In May 1874, A. H., fifty-six years of age, applied for admission to the Royal Infirmary on account of weakness and swelling of the limbs. He said that he had always been healthy till within two months of his admission, and then he noticed nothing wrong, excepting swelling of the feet and legs, with muscular debility. The swelling first attracted his attention, and it was attended by a redness of the skin at first, as well as by numbness and insensibility. On admission, the most careful examination revealed no evidence of

¹ Trousseau's Clinical Medicine. Syd. Soc. transl., vol. v. p. 29.

disease of heart, liver, kidneys, nor of any anæmia ; but the patient suffered from severe pains darting occasionally down the legs, a feeling of coldness of the feet, of formication, and of prickling. The ground felt soft under his feet, and the sensibility to touch was impaired nearly to the knee. Sensibility to pain, heat, and tickling was diminished. Reflex action was greatly diminished in the legs. Voluntary movement was natural everywhere, except in the legs below the knees ; but these parts were so palsied that he could not walk and could scarcely stand. Electro-sensibility and contractility were both much diminished. The weakened muscles were flabby, somewhat wasted. There was no tendency to jerking, nor to rigidity of the muscles. The feet and legs were swollen. The treatment adopted was rest, good diet, local faradization of the limbs, and quinine, strychnia, and iron. Under this he gradually and steadily improved, and in the middle of August, about three months after his admission, he was dismissed quite well.

This case afforded an example of functional¹ paraplegia, probably of peripheral origin, and requires little comment. It was not due to any of the important lesions of the cord, neither was it a result of the diphtheritic or any other constitutional morbid process ; and it was happily not an example of that distressing and disappointing paralytic affection which sometimes ushers in locomotor ataxia, and which, by its speedy subsidence, makes the physician hope that his patient is safe until the occurrence of the characteristic symptoms reveals his hopeless condition. In this case the recovery was complete, and seemed to be due to the treatment adopted.

The chief point of interest in this case was the congestion and œdema of the feet and legs, which after careful examination I satisfied myself were not accounted for by the condition of the kidneys, the heart, or the blood, but were clearly of nervous origin. At the very commencement of his illness these symptoms began, for almost the first change he noticed was the redness of the skin. It is well known that such a redness may result from nerve influence. Erb² remarks that while much obscurity still hangs over the changes produced by the nerves in the vascular system, certain facts are well established, and among them may be recognised local congestion, and increased redness along with elevation of temperature in the affected (generally paralyzed) parts. This often exists merely temporarily, and is sometimes succeeded by pallor and coldness. As to the way in which it arises, it is certain that it may be produced by section of the cord, and that (as shown by the experiments of Goltz), when such a section has healed, the symptoms disappear. Pathological processes evidently act in a corresponding way, slight and passing injury of the cord leading to temporary redness, more serious lesions, such as

¹ Compare Jaccoud's Classification, *Les Paraplegies et l'Ataxie du Mouvement*.

² *Krankheiten des Rückenmarks*, in Ziemssen's *Handbuch der Speciellen Pathologie und Therapie*, p. 111. See also Leyden's *Klinik der Rückenmarks' Krankheiten*, vol. i. p. 150.

occur in spinal hæmorrhage, producing more prolonged congestion. It is, of course, clear that other changes besides such formidable spinal lesions must be capable of producing the condition, though we are not at present able to demonstrate the facts. Although it was from this kind of congestion that our patient suffered, reference may be made to the fact that there is another kind sometimes met with, in which the affected parts are cold, markedly livid, and cyanotic, from extreme atony of the vessels. This may exist without paralysis, and may be attended in a more or less marked degree by the condition known as "glossy skin." Then, also, there occasionally occurs extreme coldness, with remarkable pallor of skin, due to spasmodic contraction of the vessels, arising from irritation of the vasomotor nerves either direct or reflex. In our case, we have no means of determining the exact explanation of the fact, although it evidently belonged to the first of the three groups.

But the congestion was attended and succeeded by dropsy of the paralyzed parts. This symptom continued very distinct for several weeks. It is to Dr Laycock¹ that the profession is indebted for the clear indication of the influence of the nervous system in the production and prevention of dropsies. After a long series of clinical observations, he concluded—"1. That the nervous system as a whole, or else some special division of it, has a direct influence both on the production and prevention of anasarca. 2. That anasarca is produced when innervation is defective. 3. That anasarca is prevented being manifested locally when the general causes are in operation, by more vigorous, because more healthy, innervation of the exempted tissues." There are other very interesting inferences, but it is unnecessary at present to adduce more than these. This case was one of many in which I have had occasion to verify Dr Laycock's conclusions. I rather think—although my notes do not mention the fact—that the case also illustrated a point made out by Dr Handfield Jones,² viz., that the dropsical swelling got worse during the night when the patient was in bed, and rather improved during the day when he was up.

CASE IV. *Paraplegia, with numbness, hyperæsthesia, muscular paralysis, and twitching; probably due to exposure and damp. Treatment with Ergot, afterwards with Strychnia. Recovery.*

R. S. was admitted to the Royal Infirmary, 17th August 1874, complaining of want of power in the legs. He was a stout, full-bodied man, a blacksmith by trade, and about 45 years of age. He stated he had enjoyed perfect health until a week before admission; had had no sore throat nor other illness. He had been rather intemperate at times, but ascribed his illness to his having slept several successive nights in a damp bed.

¹ Clinical Inquiries into the Influence of the Nervous System on the Production and Prevention of Dropsies.—*Edinburgh Medical Journal*, 1866, p. 775.

² Functional Diseases of the Nervous System, 2d ed., p. 128.

On the 10th of August he went to his workshop as usual, but found that he was unable to do any work, because he could not control the muscles of his arm so as to wield the hammer, and his legs were weak and tremulous. He left his work after an hour and a half, and sauntered about the town. During the week he became worse day by day, and was soon unable to walk, while a feeling of numbness in hands and feet increased, *pari passu*, with the muscular debility.

On admission he had sensation of numbness and cold in the hands and feet, and in these parts there was some excess of sensibility to different kinds of impressions. The special senses, the muscular sense, and electric sensibility, were natural. The reflex actions produced by tickling the soles of the feet were excessive. Voluntary motion was fair in the hands, but greatly impaired in the legs. He was unable to walk or stand, the knees giving way under him, though, when in the recumbent position, he could kick out pretty well. The muscles were well nourished, but they twitched on the slightest irritation. There was no affection of the bladder or rectum. The legs, although feeling cold to himself, were warm. There was no trophic change. The cerebral and mental functions were normal, excepting that sleep was disturbed.

On his admission he got four doses of 20 minims of liquid extract of ergot, which was followed by marked and rapid increase of the symptoms. The medicine was then stopped, and liquor strychniæ given instead. Under it rapid and steady improvement took place, and within two months of the commencement of his illness the patient was quite well.

The first point worthy of comment in this case is the cause of the attack. The patient ascribed his illness to the fact that he had been led, by domestic circumstances, to occupy for several successive nights a damp bed. Of the efficiency of cold and damp as a cause of spinal disease there can be no doubt. Cases frequently come under observation in which the malady is due to such exposure, the patient having fallen into water, or slept in damp clothes or on wet ground, or worked in snow or rain; but of the precise way in which cold acts we know nothing. While it is true that Feinberg has (as quoted by Leyden)¹ proved, experimentally, that myelitis may be artificially produced by greatly lowering the temperature of the cord; it is obvious that such a lowering cannot exist in all the cases in which cold induces spinal symptoms. It is probable that it produces its effects through the peripheral nerves, in a manner akin to that in which the beneficial effects of the cautery are brought about. But we certainly have no means of explaining either the fact that, in one case the membranes, in another the cord, in one case the anterior, in another the posterior columns, are the seat of the change, nor that in one case the functions are exalted, in another they are depressed. For the diseases of the cord ascribed to cold are very various, including, according to Erb,² spinal meningitis, myelitis, loco-

¹ *Op. cit.*, vol. i. p. 171.

² *Op. cit.*, p. 151.

motor ataxia, infantile paralysis, and tetanus, and, doubtless, along with them, many less formidable affections.

The symptoms presented by our patient were very peculiar, combining, as they did, evidences of excess with evidences of defect of function. For while there was feeling of numbness in the affected parts, there was also hyperæsthesia; and while there was want of motor power, the muscles jerked on the slightest irritation. The whole history indicated that the case must, like the last, be referred to the functional group; but, in the present state of our knowledge, it would be unsatisfactory to speculate as to the actual condition of the nervous system. Certainly the results of the treatment were very satisfactory, and of considerable practical interest. There seemed distinct enough indications for the employment of ergot, in accordance with the rules laid down by Brown-Séquard.¹ He says—*1st*, Ergot must be employed in paraplegia in cases attended with irritation of motor, sensitive, or vasomotor nerves, viz., in congestion or inflammation of the spinal cord, or its meninges. *2d*, Ergot must be avoided as an agent only able to increase the paralysis in cases of paraplegia without symptoms of irritation, such as cases of reflex paraplegia, or of non-inflammatory softening of the spinal cord. With such signs of irritation as our patient presented, one would certainly have concluded, according to these rules, that the ergot should have been useful. But it proved quite otherwise; and, after a few doses, had to be discontinued, as it was manifestly proving injurious. Turning, again, to the rules laid down by the same distinguished authority for the use of strychnia, it appears that that remedy should have been most unsuitable. For strychnia, says he, should, *1st*, be employed in those cases of paraplegia in which there is no sign of irritation or of increase of the vital properties of the spinal cord, such as cases of reflex paraplegia and white softening. *2d*, It ought to be avoided as a most dangerous poison in those cases of paraplegia in which there are signs of congestion or inflammation of the spinal cord or its membranes. In these cases strychnia can only increase the cause of the paralysis. In our case therefore this remedy might have seemed contra-indicated. But experience shows that ergot of rye and the preparations of nux vomica suit opposite classes of cases; and it was therefore right to try the latter when the former had aggravated the symptoms. Its beneficial effects were alike powerful and speedy, and the result shows that strychnia may prove eminently beneficial, even in some cases where irritative symptoms exist.

¹ Paralysis of the Lower Extremities, p. 111.