

HEMIPLEGIC MUSCULAR ATROPHY OF PERIPHERAL ORIGIN.

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APART from mere functional disturbances, either of exaltation or depression, to which many convulsive and paralytic symptoms may be ascribed, resulting from peripheral lesions of nerves, it is established that lesions of nerves may also induce anatomical changes in the nerve-centres. And the experimental induction of such changes promises to be one of the most reliable methods of determining the position of the various sensory and motor centres and tracts in the brain and spinal cord. It has been shown by the investigations of Dickenson, Vulpian, and others, that as the result of section of nerves, and in cases of long-standing amputation or congenital absence of a limb, certain centres and tracts in the spinal cord and brain undergo atrophic degeneration. In these cases there seems to be mere simple atrophy, without indications of inflammatory action. In the spinal cord the wasting is visible both in the white matter, particularly the posterior columns, and also in the grey substance corresponding to the attachment of the nerves in question. In the cerebral cortex, also, atrophy has been observed in the motor regions, corresponding to those movements which have been long lost.

The effects on the nerve-centres of irritation or inflammation of peripheral nerves are, however, of much greater pathological importance. Under this head come the so-called reflex paralyses, the pathology of which has been the subject of much discussion. It has been found experimentally, and also in man, that in connection with severe injuries of viscera and

traumatic lesions of nerves, paralysis may occur in regions not directly related to the nerves actually injured. These paralyzes come on at once, and subside mostly with the irritation which has induced them. Many such facts have been recorded by Weir-Mitchell, and others. It is obvious in such cases that the paralyzes are of a purely functional nature, as they occur before any organic changes could possibly be induced in the nerve-centres. What is the exact nature of the functional disturbance is a matter more of speculation than actual demonstration, and the theory of vascular spasm of Brown-Séquard, or the theory of exhaustion of Jaccoud, may be regarded as more or less satisfactory.

It is otherwise, however, when the symptoms of morbid affection of the nerve-centres do not show themselves at once, but at some considerable interval after the infliction of the injury. The cases of reflex paraplegia which have been so often seen in connection with affections of the bladder and prostate in man, and the uterus in women, seem to be of a different type from the above; and the views that the paralytic affections in these cases are not merely functional, but due to actual organic changes in the spinal cord, propagated along the nerves of the diseased viscera, have received much support from experimental and pathological investigation of recent years.

Inflammation of peripheral nerves induced in the lower animals by irritants, mechanical lesions and the like, has by some observers been found to be altogether negative as regards propagation to the spinal cord. But others (Hayem, Klemm, Niedieck, &c.) have described both meningeal and myelitic inflammation as the result of such lesions. The resulting neuritis, which, according to Hayem, is both interstitial and parenchymatous, ascends or descends from the primary lesion not in a continuous manner, but interruptedly—*neuritis disseminata vel migrans*—portions of apparently healthy nerve alternating with inflamed portions. In this manner the neuritis reaches the cord, and induces either meningeal inflammation from the direct continuity of the spinal membranes with the neural envelopes and interstitial tissue, or a poliomyelitis with atrophy of the multipolar cells, of greater or less

extent and acuteness, probably through the medium of the posterior roots.

These experimental data render it probable, if it has not been actually demonstrated, that similar processes underlie certain symptoms which are occasionally seen in man in connection with peripheral nerve lesions. It has been found that at more or less distant intervals of time after traumatic lesions of nerves, articular inflammations, and amputation of limbs, atrophic paralysis or muscular atrophy has occurred in regions not directly related to the nerves primarily injured. Thus, after an injury to the ulnar nerve, as in a case reported by Brown-Séquard, muscular atrophy showed itself in the region of distribution of other nerves of the brachial plexus, in a manner which could not be accounted for by mere extension by contiguity. Many other instances are on record of atrophy of a limb from injury of one of the branches of the plexus supplying it.

Not unfrequently, also, atrophic degeneration occurs in the opposite limb, presumably from a transverse extension of the myelitic process; and there are instances, also, which would seem to show that the myelitis may be propagated longitudinally in an ascending or descending manner, so that atrophy occurs in both the limbs on the side of the original lesion.

Cases of this kind have been recorded by Vulpian, Charcot, Leyden, Terrier, and others.¹

In addition to those already recorded, I may mention the following case, which has just come under my observation.

A young man, aged 27, who had left hip-joint disease in childhood, and had recovered with a stiff and atrophied limb, with which, however, he was able to support himself and walk, a few months ago rapidly lost power in this leg, so that now he is unable to support himself with it. A few weeks afterwards he began to experience numbness and weakness in his left hand, and lately he has experienced numbness in the ulnar region of the right hand also.

On examination, the interossei of the left hand were found

¹ See an able summary and review of facts bearing on this question by Ch. Talamon, 'Revue et Mensuelle de Méd. et Chir.,' July 1879, *et seqq.*

to be considerably wasted, the basal phalanges hyper-extended, and the use of the fingers characteristically impaired. The wasted muscles showed well-marked reaction of degeneration.

Though the right lower limb was apparently unaffected, yet there was greatly increased knee-jerk, and tendency to ankle-clonus. The power of retention of urine had also become considerably impaired since the symptoms first developed themselves.

In this case there seems to be both an ascending and transverse myelitis of a subacute form, the starting-point of which is probably the articular inflammation of the left hip, and the atrophic changes in the lumbar region of the spinal cord, which have long remained quiescent. The patient dated his symptoms from the use of a new boot which he had himself constructed, and the use of which in walking seemed to cause unusual fatigue.

A truly hemiplegic form of muscular atrophy has very rarely been observed. Leyden, in his work on 'Diseases of the Spinal Cord,' reports a case of a gunshot injury of the left thigh which was followed by severe pains in the leg, and afterwards in the left arm. Nearly three years after the receipt of the wound the patient became paralysed or paretic on the left side, leg, arm, and face. The acuteness of vision also of the left eye was impaired. Examined by Leyden in Jan. 1874 (the wound having been inflicted in Nov. 1870), the patient was weak on the left side, and complained of a feeling of heaviness in it. The muscles generally on the left side were flaccid and less voluminous than those of the right, and the electric contractility was somewhat diminished, and abnormal.

The following case which I have had under my care shows by its history and progress the recurrence of a truly hemiplegic muscular wasting, with paræsthesia, in connection with neuritis of the stump of an amputation of the left hand at the wrist.

The patient, ætat. 28, is a member of the medical profession; and he thus described his case. While shooting in India one day in June 1877, his gun burst, inflicting a scalp wound, also rupturing the left membrana tympani and

seriously lacerating his left hand. The hand was at once amputated just above the wrist, and in a little more than three weeks he was able to return to duty. The stump had almost entirely healed, and the scalp wound and laceration of the tympanum had quite healed up.

For two years subsequently to the amputation he experienced almost daily pain in the stump. The pain varied in character. He described it as like that caused by tension of the flaps over the face of the stump; as a burning sensation; as if something were contracting and subjecting the ends of the nerves to pressure; as a throbbing sensation.

Later on, this condition of the arm appeared to be greatly influenced by changes in the weather. A hot and dry climate was most agreeable, whereas a sultry and moist atmosphere was always the cause of pain; as also cold and frosty weather.

Soon after the operation he observed wasting of the left arm.

Towards the end of 1878 he began to feel as if a piece of parchment were drawn tightly over the left side of his face, which was so unpleasant that he frequently tried to relieve it by rubbing.

He also felt "unbalanced" or "lop-sided," which was particularly disagreeable. This feeling of "lop-sidedness" grew worse about August 1879, and at this time he observed some wasting of his left leg. Later, he noticed a similar wasting of the left side of his thorax and abdomen.

All these symptoms the patient noticed before they could be recognised by others.

During the attacks of pain in the stump the face always felt more drawn than at other times. One night after his return to England, at the end of 1881, during a severe attack of pain, he felt as if there were a muscular thrill through the left side of his chest. For the last year there have been sensations of pins and needles in the left foot, and fibrillar twitchings in the left leg and thigh. Similar twitchings have also been felt in the left side of the face, thorax and abdomen. He now—January 1882—feels as if there had been a layer cut off the whole of the left side of the body, and complains much of his "unbalanced," "lop-sided" sensation.

The patient was a well-developed, vigorous and healthy-looking man. All the organic viscera and functions were normal. It was plainly evident on examination of the two sides of the body that there was a want of symmetry, but the respective measurements were not determined at this time. The muscles of the left side reacted well to the faradic current, and no very evident difference could be discovered between those of the right and left side.

Sensibility was normal.

The question of re-amputation was discussed, and the patient further consulted Mr. Lister, who advised this at once. The stump was re-amputated by him on January 28, 1882, and the healing of the wound proceeded satisfactorily. A few days after the operation, pain recurred in the stump, accompanied by twitchings of the arm, and tenderness, with hyperæsthesia to cold over the whole of the left side.

After that, the patient ceased to complain of attacks of pain, and the paræsthesia of the left side of the body somewhat diminished. But the feeling of "lop-sidedness" still continued.

On February 22 I made comparative measurements of the two sides of the body.

By stretching a tape-measure between fixed points on the two sides of the face in various diameters, there appeared a difference of one-eighth of an inch in favour of the right side—

			in.			in.
Widest part of thigh	Right	=	21 $\frac{1}{2}$	..	Left	= 20 $\frac{1}{2}$
Four inches above patella	Right	=	15 $\frac{1}{2}$	..	Left	= 14 $\frac{1}{2}$
Calf of leg	Right	=	18 $\frac{1}{2}$	..	Left	= 18 $\frac{1}{2}$
Abdomen—two inches above umbilicus	Right side	=	16 $\frac{1}{2}$	..	Left	= 16 $\frac{1}{2}$

The arms were not strictly comparable for obvious reasons, but the circumference round the acromion and axilla was one inch less on the left side than the right.

There was thus an appreciable difference between the right and left side of the face, trunk and limbs, varying from one-eighth of an inch on the face, to one inch in the limbs.

The patient shortly after this put himself at my advice under the care of Dr. de Watteville for electrical treatment.

This was carried out by him for about six weeks, by his method of galvano-faradisation, which he has recently described in the 'Neurologisches Centralblatt' for June 15, 1882.

Under this treatment the patient gradually improved in all respects, and on my again taking the same measurements on May 23, I found that there was now no appreciable difference between the two sides of the face. The widest part of the right thigh now exceeded that of the left by only one-eighth of an inch; the right calf measured only one-eighth more than the left; and similarly as regards the two sides of the trunk.

The patient ultimately returned to his duties in India, to all appearance perfectly recovered.

The above particulars show an evident causal relationship between the neuralgic stump of the left hand, and the occurrence of the peculiar "lop-sided" paræsthesia of the left side, and actually demonstrable wasting of the face, trunk and limbs on that side, which speedily ceased after re-amputation of the stump, and properly directed electrical treatment.

The condition of the nerves of the stump was examined by Mr. Watson Cheyne, who has furnished me with the following account of his examination.

"Examination of the stump immediately after amputation showed the presence of a firm neuroma, about the size of a small hazel-nut, affecting the divided end of the radial nerve. The nerve itself was thickened, and had a distinctly rosy hue, one or two vessels being also evident in its sheath. The lower end of the ulnar nerve was somewhat expanded, but this expansion did not present the distinct form of the radial neuroma, nor was it so firm. The nerve was of the normal white appearance. The median nerve was apparently quite healthy.

"*Microscopic characters.*—Longitudinal and transverse sections were made both of the neuromata and of the trunks of the radial and ulnar nerves. The neuroma at the end of the radial nerve was found to consist of a large amount of fibrous tissue, enclosing in small alveoli bundles of degenerating

nerve-fibres, in some places indeed the arrangement of the fibrous tissue showed that nerve-bundles had already disappeared. Here and there the fibrous tissue was still almost embryonic. In the trunk of the nerve there was great increase of the fibrous tissue between the bundles of the nerve-fibres which were undergoing degeneration. There was a considerable number of small blood-vessels, some of them surrounded by embryonic cells. This appearance was especially marked towards one side of the nerve, where there was a distinct line of granulation tissue. In the ulnar nerve there was thickening of the fibrous septa to some extent, but not nearly so marked as in the radial; there was no appearance of granulation tissue either in the trunk of the nerve or in the enlargement at its end.

"The appearances indicate chronic inflammation of the radial nerve, both at the divided end and along the trunk. This process was still going on at the time of the operation, as evidenced by the granulation tissue found along one side of the nerve trunk. There was no evidence of continuance of inflammation in the ulnar nerve."

Whether in this case there was any morbid change in the anterior grey column of the spinal cord of the left side capable of histological demonstration, or whether it was merely a so-called functional depression due to the long-standing peripheral irritation, can only be a matter of speculation. The latter view might be considered as the more probable from the fact of recovery on cessation of the irritation, though this would not necessarily follow.

The point of importance is the possibility of a morbid condition of the whole of the grey column of one side of the spinal cord being developed in connection with long-standing peripheral irritation, ascending and descending from the point of primary attachment of the inflamed nerve.