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ON THE TREATMENT OF PROGRESSIVE LOCOMOTOR ATAXIA WITH RAREFIED AIR, AFTER THE METHOD OF JUNOD.

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IN the issue of *The Medical Record* for September 30th, 1882, pp. 373-4, I reported a case of progressive locomotor ataxia which seemed to have been improved by rest and vigorous application of dry cups. Briefly stated, the history was as follows:

D—, a private soldier in the army, but free from all venereal taint, when about twenty-three years of age, was obliged to lie out one wet night, during the cold spring weather in 1865. This caused a pain in the back, with other symptoms of sufficient severity to drive him for a number of days into the hospital. No definite conclusion relative to the nature of the disorder appeared to have been reached by the medical attendant, and he finally returned to duty, to be discharged from the service soon afterwards at the close of the war.

With the exception of some pain and weakness in the lumbar region, he enjoyed good health for several years, and became actively engaged in mercantile pursuits. He was severely overtaken during the period of confusion following the great Chicago fire, in 1871, and began to suffer with lancinating pains and with paroxysms of pain-

ful micturition which were in no way relieved by active treatment for a supposed spasmodic stricture of the urethra. Notwithstanding these recurring pains, he presented the appearance of excellent health, and continued his usual avocations. During the year 1879, he became alarmed by an increasing unsteadiness in his gait, especially in the dark. I now saw him for the first time, and found present the ordinary phenomena of progressive locomotor ataxia: lightning pains, anæsthetic, paræsthetic, and analgesic patches upon the surface of the limbs, paroxysms of hyperæsthesia affecting the mucous surfaces of the mouth and pharynx, absence of the patellar reflex, ataxic gait, diminished power of co-ordinating the muscles of the upper extremities, cracking of the joints, unequally contracted pupils, with loss of the pupillary reflex, progressive atrophy of the optic discs, and failure of sexual appetite.

Treatment with galvanism, nitrate of silver, iodide of potassium, and bichloride of mercury did no good. The patient continued actively engaged in his business, travelling from California to New York and elsewhere: and finally, in October, 1880, was married, though compelled to keep his bed, without the slightest desire or ability to consummate the marriage.

About the same time, Mr. D—— found himself suddenly deprived of the means of support by the failure of the mercantile house with which he had been connected. The effect of this disaster was decisive. "Eyesight began to fail, ataxia increased, the muscles of the lower extremities began to dwindle, lightning pains were frequent and agonizing. The rectum became anæsthetic and uncertain in its retention of fæces. The feet were cold and numb." Walking was almost impossible.

While in this condition, D—— was persuaded to make trial of Junod's boot, applied daily to the lower extremities, along with vigorous dry-cupping of the spine. This mode of treatment produced a gradual improvement in the condition of the patient, so that, when he again came under my observation, during the summer of 1882, I was able to record his condition, as follows:

“There is still some degree of ataxia manifested in the movement of the feet, especially when excited or weary. The upper extremities are perfectly manageable. Anæsthesia has disappeared from the regions where it was formerly manifested, but the tendinous reflexes are still absent. The patient walks easily and rapidly without a cane, turning sharply around without difficulty, but he is unsteady on his feet with his eyes shut, and he is unwilling to trust himself in the dark. The eyeballs move perfectly, but the pupils are contracted, and do not respond readily to changes of light, though they move somewhat in accommodation. There is considerable atrophy of the optic discs. Difficulty is apparent in recalling proper names, but otherwise the intellectual processes are intact. Appetite, digestion, and sleep are perfectly natural. The patient no longer feels that excessive sensibility to changes of temperature which formerly troubled him. Erections take place as often and as completely as ever. Amatory feelings have revived, and sexual intercourse has been performed several times without much subsequent lassitude, but for prudential reasons has been discontinued. The patient feels competent to resume business, but is wise enough to see that his disease is not cured. He still continues the use of the cupping apparatus every other day, and is positive in his conviction that his improvement, though gradual, is progressive.”

Thus far the course of the disease at the date of my report in 1882. Since then, I have had opportunities, at intervals of a few months, for noting its further evolution. During the last five years, there has been a complete development of the second stage of the disease, and a partial entrance upon its final, paralytic stage. The patient has lived in various parts of the country, and has taken very little medicine, but has made constant use of the cupping apparatus with which he had furnished himself six years ago. He has usually applied the boots to the lower limbs as often as every other day. It is to the effect of this treatment that I now desire to call especial attention.

So far as the onward march of the spinal disease is concerned, the treatment has produced no appreciable result. This is true of this case as it is, also, of every other case of genuine tabes dorsalis in which I have seen it tried. If employed during the first and second stages of the disease, when the characteristic fulgurant pains form a prominent feature, great relief is sometimes experienced, but no other immediate result can be discovered. It is important in this connection to avoid the error of mistaking the natural subsidence of pain in advanced stages of the disease for the effect of treatment. But, when the paralytic stadium is imminent, my observation of this patient leads me to believe that considerable benefit may be derived from treatment of the limbs with rarefied air. When this treatment was commenced, six years ago, the muscles of the lower limbs of my patient were becoming incapable of supporting the weight of the body, and the circulation of blood in the extremities was insufficient to maintain their natural color and temperature. Daily application of the boots, with rarefied air, produced a gradual improvement until the patient was again able to stand, and to walk as well as before the collapse of his limbs. At the present time he is able to walk, though with the usual ataxic gait, and the muscles of the legs are firm and solid. Above the knees the muscles of the thighs present the same condition as high as the middle of the upper third of the thigh—that is, as high as the boots can reach when applied to the limbs. Above this point, the abrupt transition in the continuity of the muscles from a full and natural volume to the thin and flaccid structure of atrophy is very remarkable. The muscles of the hips exhibit the same progressive atrophy, and it is probably invading the muscles of the trunk. Only those regions which have been subjected to the action of rarefied air have escaped; and the line of demarcation is too well defined to admit of any doubt in the premises.

The question that now arises has reference to the manner in which the use of the cupping apparatus operates to hinder muscular atrophy. Obviously this is accomplished

by a reinforcement of the processes of circulation. Is this result brought about indirectly, through reflex influences, or is it a direct effect of local changes consequent upon dilatation of the muscular vessels during the application of the boots? Probably, it follows both of these methods of modifying nutrition. The value of counter-irritation applied to the lower extremities in cases of locomotor ataxia has been lately emphasized by M. Brown-Séquard, in his recent remarks before the Society of Biology, in Paris. He is reported to have said (*Lancet*, June 4th, 1887, p. 1,161) "that it was important to apply revulsive treatment, not to the back, as was generally done, but to the lower extremities. The cord is acted upon in this way by all the sensory nerves, and the effect greatly increased. He quoted the case of a medical man, who was cured of locomotor ataxy by circular blisters around the leg and thigh." But, in the experience of my patient, it is evident that the general effect of counter-irritation has been insufficient to prevent atrophy in those parts of the limbs which had not been included within the receiver of the cupping apparatus, though its direct effect upon the included portions has been very beneficial. It is not improbable that the cases in which revulsives are most productive of good will prove to be examples of peripheral neuritis, in which it is well known that reflex influences produce a most salutary effect.

It is hardly possible, at present, to give a thoroughly satisfactory explanation of the manner in which rarefied air acts upon a given portion of the body, to improve its nutrition. When the whole person is immersed in highly rarefied air, the results are very deleterious (Landois and Stirling's *Physiology*, 2d ed., p. 229). How, then, can a partial immersion become useful? We learn from the experiments of Bernard ("Dic. Encyc. Sci. Med.," Art. *Musculaire*, p. 662) and others, that, if the nerve leading to a muscle be divided, the blood that returns through the muscular vein exhibits less than the ordinary venous appearance; it has not surrendered its full quota of oxygen in exchange for carbon dioxide, etc., generated in the

muscle. The same thing, only proceeding after a more tardy fashion, occurs when the anterior nerve roots in the spinal cord are invaded by disease. Oxygen starvation supervenes, and this produces a granulo-fatty degeneration; hence, the characteristic muscular atrophy and paralysis that mark the later stage of progressive locomotor ataxia. Electricity, massage, cupping, and other similar expedients serve to replace the nervous influences that are lacking, and are thus useful in delaying the advance of muscular atrophy. But the experience of my patient indicates that something more than mere increase of the circulation is needful to secure the adequate nutrition of the muscular fibre. Those muscles and portions of muscles which were left to the action of electricity and manipulation have become atrophied in the usual way; while the muscles that have been treated with rarefied air have retained a great share of their normal firmness and functional vigor. There must, therefore, be a local process set up through rarefaction of the air surrounding a muscle, to which process the conservation of nutrition must be ascribed. This local change implies something more than mere acceleration of the blood current—in fact, it is doubtful whether the circulation is materially quickened by the act of cupping. Blood is drawn into the limb, but it is also detained in the part. It is probable that the nerve-endings in the muscles may be considerably stimulated by this operation; but it is not easy to understand how this can be any more beneficial than excitation with electricity or by manipulation. If a diminution of atmospheric pressure over a portion of the body exerts the same effect upon the interchange of elements in its tissues that is observed when the whole body is thus relieved from pressure, it is impossible to infer that the good results of the operation are due to an improved respiration of the tissues; for, when the entire surface of the body is subjected to the action of rarefied air (Landois and Stirling's *Physiology*, loc. cit.), the oxygen in the blood is diminished, carbon dioxide is imperfectly removed, and oxidation within the body is lessened. It, therefore, seems probable that when

the limbs alone are subjected to a reduction of atmospheric pressure while the trunk remains free, the conditions are sufficiently different to account for the observed fact of improved nutrition. Under such conditions the blood is sucked out of the deeper tissues of the limb, and is forced out of the member, where it cannot be effectually aërated, into the general circulation of the body, where aëration proceeds under normal conditions. The nutrition of muscles which have been thus artificially defecated must be favorably affected by such treatment.

But, after all, this leaves still unexplained the fact that such improvement is confined to the parts that have been directly exposed to the action of rarefied air. We are, therefore, compelled to conclude that the process consists in an artificial dilatation of the muscular fibre, thereby facilitating that intussusception of nutriment through which the bulk and vigor of the muscle are sustained.

From these considerations we may conclude:

I. That progressive locomotor ataxia cannot be cured by dry cupping.

II. That the painful sensations which accompany the evolution of the disease may sometimes be relieved by this method of treatment.

III. That the principal advantage resulting from the use of Junod's cupping apparatus consists in the improved nutrition of the muscles of the limbs which are subjected to its action.

IV. That the delay of muscular atrophy thus procured is due to the local action of rarefied air upon all the structures of the affected parts, and is limited to the tissues which are actually inclosed within the exhausted receiver.

V. That the improvement of nutrition is, therefore, principally accomplished by direct action, rather than by reflex influences exerted through the spinal cord.

VI. That in the use of rarefied air we employ an agent which is competent to fill a subordinate and limited, yet often serviceable position in the treatment of cases that are characterized by a tendency to muscular degeneration.

This, probably, is also true in other diseases besides progressive locomotor ataxia.