ON PARALYSIS OF THE BLADDER, AND ITS TREATMENT BY THE CONSTANT GALVANIC CURRENT.*

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It is a well-known fact that, while some diseases of the bladder, such as inflammation and stone, have received a full share of pathological inquiry and therapeutical attention, other affections of the same organ have been unduly neglected, both as far as pathology and treatment are concerned. To this latter class of diseases belongs the affection known as paralysis of the bladder, which is generally, in text-books on the practice of medicine and surgery, and even in special treatises on diseases of the urinary organs, dismissed with a few cursory and superficial remarks; while in practice patients suffering from this disorder are given over to the use of the catheter for the rest of their lives, and only imperfect endeavours are made to cure a very annoying and troublesome complaint, which almost always, if left to itself, exerts a depressing influence upon nutrition and assimilation throughout the system, and likewise causes considerable mental despondency, with all its attendant evils.

The term "paralysis of the bladder" is often loosely applied to cases in which there is difficult micturition, but where the bladder is not really paralysed. Patients in whom this organ has lost its function of acting as a reservoir for the accumulated urine, are said to suffer from incontinence or paralysis of the sphincter of the bladder; and again, cases in which some mechanical obstruction, such as hypertrophied prostate, offers an impediment to the discharge of the urine, are frequently put down as such of paralysis of the bladder. It can, however, be no matter of surprise that pathological terms relating to disordered micturition should have been vague and inaccurate, if we consider that until quite lately the physiology of that important function has been in a most unsatisfactory condition. Only little was known about the mode in which the motor and sentient nervous supply is conveyed to the bladder, and even less about the muscular forces by which the urine is retained in, and expelled from, that viscus. Before, therefore, proceeding to the immediate subject of this paper, I will give you as concisely as possible the results of some very important investigations into the physiology of micturition, which have recently been made by Professor Budge of Greifswald, and with which, although they have been made known in Germany for some years past, I believe the profession in this country are as yet unacquainted.

Budge made his experiments chiefly on dogs, in which the nervous centres and the bladder were laid bare. It being impossible to determine the course of nervous fibrils from the central organs towards the viscus, by means of dissection or chemical or mechanical tests, the only way to arrive at a satisfactory conclusion respecting the origin of its nervous supply was to observe the physiological effects of electrical stimulation. Now it was found that by faradising the cerebral hemispheres, the corpora striata, and thalami optici, no effect was produced on the bladder; nor did any action become perceptible when the cerebellum was faradised. As soon, however, as the pedunculus cerebri and the restiform bodies were touched by the electrodes, the viscus was seen to contract, and urine was voided. Thus it was made evident that nervous fibrils exist at a certain definite point in the upper portion of the cerebro-spinal axis, which have a special relation to the movements of the bladder.

It now became necessary to determine the course which these fibrils take in order to reach the viscus, and which might lead either through the pneumogastric, the sympathetic nerve, or the spinal cord. Both the pneumogastric and sympathetic were divided without altering the phenomena previously observed; but, after section of the cord, faradisation of the parts just mentioned proved ineffectual. Further experiments showed that these motor fibres of the bladder proceed from the pedunculus and the restiform bodies through the anterior columns of the cord to the anterior roots of the third and fourth sacral nerves, and that their function may be excited both by cerebral influence and by reflex action, the latter through the intermediate agency of the posterior roots of the sacral nerves.

Besides the one just mentioned, there is another nervous centre for the bladder in the lower portion of the lumbar cord, faradisation of which causes well-marked movements of the viscus, and the excitability of which, after death, persists longer than that of any other portion of the cord in relation to the bladder. Motor nervous fibres proceed from

this, independently of those first described, through the hypogastric plexus on their way to the bladder.

Another important result of Budge's researches has been, that the muscle hitherto described by anatomists as *sphincter of the bladder*, is really no sphincter at all, physiologically speaking; and that the longitudinal as well as the circular unstriated muscular fibres of the bladder—that is, the muscles known as detrusor urinæ and sphincter vesicæ—serve exclusively for expelling the urine, without having the least effect in closing up the orifice of the viscus. Faradisation of any portion of the bladder causes urine to be voided; and when Budge caused a column of water to flow in an uninterrupted stream out of the bladder, faradisation of the anatomical sphincter had no influence in arresting the flow. This was, however, immediately checked when the electrodes were directed to the membranous portion of the urethra, acting upon the constrictor urethræ and bulbo-cavernosus muscles. The nerves animating these muscles originate in the pedunculus cerebri, and emerge from the cord between the third and fifth sacral nerves, being enclosed in the sheath of the pudendal nerve. The muscles mentioned habitually close the bladder by means of their reflectory tone—a special arrangement to that effect existing between the posterior roots of the third, fourth, and fifth sacral nerves, the lower part of the spinal cord, and the anterior roots of the same sacral nerves.

The female bladder has, likewise, no sphincter, properly speaking; but the constrictor vaginæ takes in females the place of the constrictor urethræ and bulbo-cavernosus muscles in males. It is, therefore, best to drop the term "sphincter of the bladder" altogether, and to call the dense mass of unstriated circular fibres near the opening of the urethra into the bladder the "annulus circularis".

Being guided by the results of these physiological researches, we can experience little or no difficulty in satisfactorily explaining the phenomena of micturition, both in their normal state and when they are pathologically altered.

1. The urine is *allowed to accumulate* in the bladder by the reflectory tone of the constrictor urethræ and bulbo-cavernosus muscles. When their tone is considerably increased, as is the case during erection, any passage of urine from the bladder becomes impossible; but if it be lost, there will be incontinence—that is to say, the urine will dribble off as fast as it is secreted. This, however, it would be incorrect to call "paralysis of the bladder". Artificial incontinence may be produced by section of any of the parts concerned in keeping up the reflectory tone of the urethral muscles. Thus the urine is seen constantly to dribble away in dogs after section of the *anterior* roots of the three sacral nerves previously mentioned, whereby the *motor* fibres animating the urethral muscles are deprived of their energy; and the same takes place if the *posterior* roots of these nerves be divided, in consequence of which the influence of the sentient nerve-fibres is withdrawn. Either of these operations destroys the reflectory arrangement just described, and, therefore, the tone of the urethral muscles. On the other hand, division of the spinal cord at some place *above* the sacral nerves increases the reflectory tone of all parts below, and, amongst others, of the urethral muscles. In this instance, therefore, the result of the operation is not incontinence, but paralysis of the bladder; the latter being due partly to an increased reflectory tone of the urethral muscles, whose function it is to close the orifice of the viscus, and partly to true paralysis of the motor nerves of the bladder itself.

2. The urine is *voided* in the normal condition by concurrent relaxation of the constrictor urethræ and bulbo-cavernosus, and contraction of the longitudinal and circular unstriated muscular fibres of the bladder. This occurs either by cerebral impulse, or by sentient influence and consequent reflex action. Thus we generally make a point of passing urine just before starting on a railway journey, not because there is any desire to do so, but because we know from experience that for some time to come we shall have no opportunity of satisfying any call of nature. The sentient influence comes into play when the bladder is full and becoming distended, thus causing a peculiar impression on the sentient nerves which imparts to us the desire to empty the viscus. If both cerebral impulse and sentient influence be dulled, as is the case during sleep, no urine is passed; but if they be increased from any cause whatever, unusually frequent calls are the consequence. Thus a general state of excitement and nervousness, which frequently causes diarrhoea, will also cause frequent micturition; and exalted local sensibility of the sentient nerves of the bladder, owing to inflammation of the mucous membrane or the presence of a foreign body, will produce the same result.

Paralysis of the bladder—that is to say, inability to pass urine in the natural way from loss of motor nervous influence—may therefore ensue in the following circumstances.

1. When the conduction of nervous influence from the *pedunculus cerebri* to the bladder is interrupted. This occurs in certain cerebral diseases, in hysteria, in typhoid fever.

* Read before the Medical Section at the Annual Meeting of the British Medical Association in Plymouth, August 1871.

2. When the influence of the *lumbar portion of the spinal cord* is removed, as in chronic myelitis, certain injuries of the spine, and in atony of the cord. The inability to pass urine is here due partly to paralysis of the motor nerves of the bladder, and partly to an increased reflexory tone of the urethral muscles, which close up the orifice of the bladder and do not allow the urine to escape.

3. When the normal excitability of the *motor or sentient nerves of the bladder* is pathologically altered, without any central affection being present. Most cases of this kind originate in affections of the sentient, not of the motor, nerves of the bladder, and should, therefore, be looked upon as instances of reflex or inhibitory paralysis. This occurs after instrumental interference—such as the operation of lithotomy; after any operation for piles, but chiefly where the actual cautery is used; and after childbirth, owing to the pressure of the head on its passage through the pelvis. Local paralysis of the bladder is also observed after the use of certain drugs which have a special influence upon the nerves of the viscus, such as belladonna and hyoscyamus.

It will be observed that I do not include under the heading of "paralysis of the bladder" cases of *atony* of the viscus from overdistension. The pathology of such cases is quite different. They occur either in consequence of some organic obstruction—such as stricture or hypertrophied prostate, preventing the complete emptying of the bladder; or in people who, on a single occasion, or habitually, for some reason or another, suppress the desire to pass urine. In such cases, the muscular fibres of the bladder become overstretched and lose their tone, but there is not necessarily any failure of nervous power combined with this; and it is, therefore, preferable to avoid the term "paralysis" for cases of this kind.

The treatment of paralysis of the bladder has hitherto, on the whole, been unsatisfactory, more especially that of the first two forms of the disease, where the affection is owing to cerebral or spinal mischief. The remedies most usually recommended and employed are strychnia, ergot of rye, cantharides, arsenic, iron, and faradisation. These remedies have, no doubt, succeeded in curing or improving a number of cases, more especially of the third class; but they have, to my personal knowledge, often remained ineffectual even in such patients, and rarely, if ever, do any good in the cerebral and spinal varieties of the disease. It is especially well known of faradisation, that it has little or no therapeutic influence in diseases of the nervous centres; and, if employed at all in paralysis of the bladder, it should only be used in the local and reflex or inhibitory form of the disease. Under these circumstances it is certainly a matter of congratulation that we possess in the constant galvanic current a remedy which, if properly applied, appears always to be able to restore the influence of volition over the bladder, unless actual destruction of the nervous matter involved should have taken place. From what I have seen of its effects in a number of, at first sight, unpromising cases, I have no hesitation in asserting that, both in efficacy and quickness of action, it is infinitely superior to all other remedies which are generally used for this affection; and that, where there is a physiological possibility of restoring the voluntary action of the viscus, we shall be able to effect it by the aid of the constant current.

The mode of using this agent is of considerable importance. Experience has shown me that it is neither necessary nor expedient to apply the current directly to the tissue of the bladder itself, as we might do by means of an insulated sound, with a free metallic knob, introduced into that organ. Direct galvanisation of the *full* bladder is objectionable, because a powerful chemical decomposition of the urine is the consequence of such a proceeding, giving rise to symptoms of fainting, owing to the sudden distension of the viscus by the gases which are set free; while direct galvanisation of the *empty* bladder appears to produce an irritating effect upon its mucous membrane. External galvanisation produces none of these inconveniences, and is thoroughly effective, so that it should in all cases be employed in lieu of direct internal galvanisation.

The position of the electrodes should vary according to the seat of the affection. Where we have reason to believe that it is due to disease involving the pedunculus cerebri, one director connected with the negative pole should be placed to the back of the head, and another connected with the positive pole above the os pubis. The latter electrode should have a large surface. In cases of disease of the lumbar portion of the spinal cord, the negative pole is placed to the lower part of the lumbar spine, and the positive in the same position as above. Finally, in local paralysis of the bladder, we may either use the same arrangement of the electrodes as in spinal disease, or both directors may be placed above the os pubis.

How long should the application of the current be continued? and should it be intermittent or continuative? The intermittent application, according to my experience, is far superior to the continuative—a fact which is in perfect consonance with the results obtained by the same

method in other forms of paralysis. Fifty or sixty intermittences of the current are sufficient for one application. I am in the habit of leaving the positive pole *in situ*, and of removing the negative every three or four seconds, putting it on again immediately afterwards. The whole time of application in such cases, therefore, does not exceed three or four minutes.

The current used must have a certain tension; for, if it be feeble, no result is produced. I have in most cases used fifty or sixty cells of Daniell's or Smee's battery; but, in the cerebral form of the disease, less power may be employed.

I now proceed to narrate a few cases illustrative of the different varieties of paralysis of the bladder, and their treatment by the constant galvanic current.

CASE I. *Paralysis of the Bladder from Syphilitic Disease of the Pedunculus Cerebri*.—W. S., aged 29, unmarried, a clerk out of employment, was admitted as an out-patient at the Infirmary for Epilepsy and Paralysis, under my care, in April 1870. He had been in good health until three years ago, when he contracted a chancre, and had sore-throat and roseola about a month afterwards. He underwent a course of mercurial treatment, under the influence of which he apparently quite recovered. About Easter 1869, however, cerebral symptoms began to make their appearance. His memory became very bad; he frequently suffered from headache, and sensations of giddiness and dizziness; he felt irritable and desponding, and had some difficulty in expressing himself. At the same time, he entirely lost the relish for his work, and found sustained application impossible. He was now put on a course of iodide of potassium, under which he improved. Early in 1870, however, he had a fainting fit, and lost his speech for two days. He was now obliged to give up his employment altogether. About a month before I first saw him, he was suddenly affected with ptosis of the right eyelid; and, a few days after this had come on, with difficulty of micturition. This latter increased rapidly, so that he was only able, with great efforts, to pass about two tablespoonfuls of urine at a time. He was then, by his medical attendant, instructed in the use of the catheter, which he now introduced three times daily. He applied for relief at the Infirmary, chiefly with regard to a galvanic treatment of the ptosis, which troubled him more than his other ailments.

On examination, the patient appeared to be of sallow complexion, and spare habit. He had a childish and half-idiotic expression. He answered questions rationally, but in a sluggish and hesitating manner, and occasionally burst out laughing. The saliva was seen to dribble away from the corners of the mouth. There were complete ptosis of the right eyelid, and paralysis of the rectus internus muscle of the same eye. The sense of smell was diminished; the patient complained of nocturnal headaches and sleeplessness. The gait was rather staggering, but the patient could walk two or three miles without much fatigue. The heart and lungs were perfectly healthy. The tongue was fissured, and digestion was much impaired. The action of the bowels was torpid; and he never passed his urine now in the natural way, although he could by much straining pass a small quantity. The urine contained an enormous excess of phosphates, but was otherwise healthy. As the patient had taken large doses of iodide of potassium during the last twelve months, and his general nutrition was rapidly failing, he was put on iron and cod-liver oil; and galvanisation, by the constant current of Daniell's battery, of the paralysed muscles of the eye and eyelid, and of the bladder, in connexion with the medulla oblongata, was at the same time resorted to. There was soon considerable improvement perceptible in both affections. The patient passed about four ounces of urine in the natural way after the second application; after three more, he had entirely recovered the control over his bladder. The ptosis improved *pari passu*. Soon afterwards, he was lost sight of; but I heard lately that, although his general condition had become rather worse, and more especially his intellect was fast failing, there had been no return of the ptosis, nor of the paralysis of the bladder.

CASE II. *Hysterical Paralysis of the Bladder*.—A married lady, aged 32, of highly nervous constitution, who had lived much in the tropics, was sent to me by Dr. Frank in July 1870. She had been very delicate as a child, and her mother had died of phthisis. Family troubles thoroughly upset a system naturally predisposed to nervous disturbances, and in which only some powerful exciting cause was required for the full development of hysteria. Early in 1870, when she was under the care of Dr. Siordet, of Mentone, the patient had cataleptiform seizures, and convulsive attacks resembling opisthotonos. She soon after lost her voice, and the power of walking and of voiding the urine. From March 6th, until the time she came under my care, the catheter had to be introduced twice daily. This was a cause of great annoyance, for it became necessary that the patient should, even in her travels, merely on account of this symptom, be constantly accompanied by a medical man

able to give relief to the bladder. The urine in this case was quite normal.

Galvanisation of the cervical sympathetic and the spinal cord was resorted to in this patient for producing a beneficial modification of the constitution of the nervous system. A current of fifty cells was also applied to the bladder on two several occasions (July 30th and 31st). After the first such application, the patient passed her urine in a feeble stream, and with a certain amount of pain and straining; after the second application, she could pass it freely, and had fully retained the power of doing so when I last heard of her, ten months later (May 1871).

CASE III. *Paralysis of the Bladder from Disease of the Lumbar Portion of the Spinal Cord.*—A gentleman, aged 46, married, of spare habit, and without regular occupation, was in his usual health in summer 1870, when he went for change of air to Blankenberghe, near Ostend. He took a most active part in all the gaieties which were going on there, and, amongst other things, danced all the dances every night at the casino, which he had not done for many years past. After this kind of life had gone on for about a month, he suddenly lost the power over the bladder, being altogether unable to void his urine, so that the use of the catheter became necessary. Soon after, he also lost to a great extent the power over the lower extremities, so that he was unable to walk for more than a few minutes at a time; and he began to suffer from obstinate constipation. Symptoms of catarrh of the bladder now likewise made their appearance. The patient consulted a number of eminent physicians and surgeons, both in Germany and England, who treated him with iron, nux vomica, arsenic, ergot of rye, and various other medicines, but without beneficial result; and he came under my care in March 1871.

The symptoms had, on the whole, not varied much since their first appearance, but the catarrh of the bladder was now rather worse than before. The specific gravity of the urine was 1.025; it had a very feebly acid reaction, and readily turned ammoniacal on standing; it contained a large quantity of muco-pus. There were occasional attacks of great irritability of the bladder, attended with chilliness, chiefly at night. He introduced the catheter three times daily, and, when the bladder was irritable, as many as six times; and he never passed his urine in the natural way. Digestion was impaired, flatulency complained of, and the action of the bowels was sluggish and uncomfortable. The patient was in a most desponding state of mind, and almost despaired of recovery. He was treated with galvanisation of the lumbar spine, and of the bladder. After the second application, he could pass his urine freely by himself, and only introduced the catheter at bedtime, in order to make sure that the bladder was completely emptied. At first, he generally found about eight ounces of urine in the bladder; but, as the treatment proceeded, the quantity drawn off at night became reduced to two or three ounces, showing that the expulsive power of the viscus became more and more strengthened. The patient likewise underwent medicinal treatment for the catarrh of the bladder, and peripheral galvanisation was used for the lower extremities and the rectum; but it would be foreign to the purpose of this paper to enter at length into these matters. Suffice it to say that, when he discontinued the treatment in June last, the expulsive power of the bladder was all that could be desired; that the action of the bowels was much easier, and that he could walk some miles at a time without fatigue. The urine still contained muco-pus, but not nearly as much as before, and its reaction was now strongly acid.

The foregoing cases are sufficient to show the marked and rapidly beneficial effects which galvanisation of the bladder will produce in paralysis of that viscus, even if produced by constitutional causes, as in the first case, and by disease of the nervous centres, as in the last. If it be, at the same time, considered that the treatment is painless and devoid of inconvenience for the patient, it will, I hope, be conceded that a new and really valuable means for the relief of that troublesome affection has been added to our therapeutical store.

DONATIONS, BEQUESTS, ETC.—Mrs. F. K. H. N. has given £1,000 to the Royal Isle of Wight Infirmary, Ryde.—The Misses Steven, of Polmadie and Bellahouston, have, in accordance with the wishes of their brother, Moses Steven, expressed shortly before his death, distributed £2,000 between various charities, among which are £200 to the Glasgow Royal Infirmary, and £100 each to the Glasgow Western Infirmary, the West of Scotland Convalescent Home, the Glasgow Convalescent Homes, the Glasgow Royal Asylum for Lunatics, and the Glasgow Eye Infirmary.—The Malvern Rural Infirmary has received £100 under the will of Mr. Oliver Mason.—The Leicester Infirmary has received £500 under the will of the Rev. W. G. Sawyer.

CLINICAL MEMORANDA.

PUNCTURE OF THE INTESTINE FOR THE RELIEF OF TYMPANITES.

AMONG the various interesting communications which have appeared in recent numbers of the JOURNAL on "Punctures of the Colon for the Relief of Tympanites", no reference has been made to medical authorities who in the last century not only discussed the operation from a theoretical point of view, but successfully relieved by surgical interference the intense pain from which their patients suffered. I trust that a brief reference to these writers may not be devoid of interest to those members of our profession who are concerned in the revival of the operation.

It has occurred to me that the operation might have been first suggested by the practice, which was advocated by the older surgeons, of pricking with round or triangular needles the gut distended with air, in the course of the operation for hernia. Pare, Corneille de Soelingen, and Pierre Dionis, among others, recommended the practice. Heister, in his work on *Surgery* (Eng. ed., p. 74, 1750), suggests that in pneumatocele, or "hernia flatulenta", if ordinary remedies fail, the scrotum should be perforated with a trocar, and its contents thereby discharged, "which will demonstrate whether it was wind or water." In the same work, Heister expresses doubts of the success of the operation of paracentesis in tympanites. According to Sprengler, in his *Histoire de la Médecine*, vol. ix, p. 181, François de Paule Combalusier was the first who successfully employed the trocar in tympanites. (Combalusier, *Pneumatopathologia*, a French edition of which appeared in 1754, *Traité des Maladies Venteuses*, traduit du Latin, par Jault, vol. ii, in 12.) Benjamin Bell, having observed that this operation was attended with but slight danger in the lower animals, advised that the intestine should be punctured in tympanites. Callisen, who used Petit's trocar, states that paracentesis may be useful as a palliative (*Syst. Chir. Med.*, Pars ii, p. 52). Charles Bell, in his *System of Operative Surgery*, vol. ii, p. 186, does not regard with much favour the practice of piercing the gut with the trocar in intestinal tympanites. C. B. Zang gives very precise directions for the performance of the operation. He plunges a long and fine trocar in the middle of a line drawn from the anterior extremity of the second left false rib to the anterior superior extremity of the ilium of the same side, to the depth of four or five inches. In this way the instrument strikes the descending colon without piercing the mesentery. (Zang's *Operat. Th.*, iii, p. 289.) Zang states that the operation is as devoid of danger as ordinary simple puncture, because, after the withdrawal of the cannula, the wound in the intestine does not exceed half a line in extent. In the *Dictionnaire de Médecine et de Chirurgie*, ed. 1835, L. Ch. Roche, in his article on "Tympanite", after recommending the ordinary remedies and attempts to draw off the gas with a syringe, states that, as a last resort, the abdominal walls may be punctured; and, although he considers the operation to be attended with grave danger, states that it has been practised a certain number of times with success. Among more modern works on surgery, Chelius gives similar instructions for the operation of paracentesis in distension of the alimentary canal with air, when the ailment is idiopathic, and not a symptom of any other disease. (South's edition, vol. ii, p. 495.) Olivier operated on twenty patients in Bolivia, South America, of whom eight recovered in three weeks; the others died, probably from not having been subjected to treatment till too late. The cause of the disease was attributed to overloading the stomach with half-cooked vegetable food, and drinking badly fermented liquid prepared from maize. (*Vide New Sydenham Society's Year-Book*, 1861; and Schmidt's *Fahrbücher*, vol. iii, p. 308.)

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MALIGNANT DISEASE OF THE LUNGS SIMULATING PHTHISIS: ENCEPHALOID DEPOSITS IN THE KIDNEYS.

PRIVATE JAMES C., aged 30, belonging to the 2nd Battalion Coldstream Guards, was in hospital for thirty-four days in 1860, for a simple venereal sore, which was followed by a bubo; and in 1868 for twenty-six days with bronchitis. He had been twelve years in the service. He was and always has been a strong, muscular-made man, and a good soldier.

He was admitted into hospital July 15th, 1870, for an attack of hæmoptysis, stating that he "spat up" a little blood on the 4th, and that on the night before admission he lost a pint in a similar way. He did not