intradural lipomata are more curious, in that they contain tracts of striped muscle fibre. A specimen of this nature has been placed on record by Gowers.²⁷

Recklinghausen described a fatty tumour in a man lodged within the dural sheath. In this case the cord, instead of ending at the level of the second lumbar vertebra, extended to the middle of the sacrum, and was imbedded in fatty tissue containing striated muscle fibre. Recklinghausen remarked that the muscle resembled the short fasciculi of the special muscles of the spine. Each fasciculus was a muscle in miniature, and had terminal tendons. The man was the subject of spina bifida occulta in the lumbo-sacral region.

Obré²⁸ described a specimen found in the spinal canal at the level of the seventh clavicle and first dorsal nerve.

The occurrence of an intradural lipoma is not surprising, for the loose connective tissue between the cord and the dura mater is in many mammals, especially in young lions, bears, and tigers, occupied by fat often in large quantity.

Many congenital tumours have been described as lipomata which have occurred in connection with the spine, and in a few instances where surgeons have been rash enough to meddle, the tumours have been found to pass deeply, and to be connected with the dura. In the majority of instances these were examples of spina bifida in which the sac had become surrounded by an unusual quantity of fat.

In this account of fatty tumours I have intentionally avoided considering those which arise from fatty changes in nævi.

FOUR YEARS' EXPERIENCE OF CASES OF STRICTURE OF THE URETHRA TREATED BY ELECTROLYSIS, WITH A RECORD OF FIFTY CASES.¹

By W. BRUCE CLARKE, M.B.Oxon., F.R.C.S.,
Assistant-Surgeon to St. Bartholomew's Hospital.

It is more than four years since Dr. Steavenson and I first published a note in the JOURNAL on the treatment of strictures of the urethra by electrolysis. This was supplemented by our paper before the British Medical Association a year later, and also by a contribution of my own in the *Practitioner* of the same year. The plan of treatment laid down in these papers by Dr. Steavenson and myself has been in the main adhered to, being modified only in a few details.

The cases referred to in the following paper comprise those which were recorded in my paper in the *Practitioner*, as well as others which have since come under my care. I am anxious to take the present opportunity of tendering my best thanks to Dr. Steavenson and his various assistants in the electrical department at St. Bartholomew's for the help I have so often received at their hands.

During the past four years I have had special opportunities of testing this method of treatment, and propose in the ensuing paper to give some accounts of what results may be expected from it, and I am the more induced to do so because I have received a large number of letters from others who are interested in the same subject, and who have requested me to furnish them with some details of the management of these cases.

In addition to this, a large amount of correspondence has taken place in the various medical papers, particularly during the past year, tending to throw a certain amount of discredit upon this method of treatment. I am, however, convinced that anyone who takes up the subject, if he will, before doing so, master the details of the electrical apparatus which he proposes to employ, and if he will carefully attend to his battery and to the other instruments which he employs, will not be disappointed by the result which he obtains; nay, more than that, the success which will attend his efforts will be quite as great as that which will attend treatment of nævi by this method, or in any other of the various conditions for which electricity has been so largely employed in recent years.

In addition to discussing the best method of carrying out elec-

trollysis, I am anxious in this paper to give as far as it lies in my power the subsequent history of fifty cases of stricture of the urethra treated by this method, with the results, temporary and permanent, which this plan has yielded. With regard to the question of permanency, I am quite aware that it may be urged that even four years is not a sufficient length of time to enable one to ascertain with accuracy what the ultimate result may prove to be; but a somewhat extended experience of these cases leads me confidently to assert that, though four years' immunity from urinary trouble may not be an absolute safeguard against relapse in all cases, yet in the great majority of instances such a period of freedom from symptoms may be regarded as practically constituting a cure.

Before passing on to consider more in detail the various modifications of the electrolysis treatment which I have adopted or the various kinds of stricture to which this kind of treatment is applicable, I will give a brief summary of the changes in the urethra which can be produced by this plan of treatment. As I stated in the account which I gave both in the JOURNAL and also in the *Practitioner* between three and four years ago, an employment of a galvanic current to effect changes in the normal and diseased parts of the body is no new idea, nor is its application in some form or other to the treatment of urethral stricture by any means a recent innovation. Mallez and Tripiér gave a full account of their attempts in this direction in the *Comptes Rendus*. Apparently, from their description they failed to distinguish between the galvano-caustic and electrolytic action of the current which they were employing. The reintroduction of this plan of treatment is largely owing to Newman in America, though my experience does not by any means dispose me to agree with him in all particulars, yet it is only due to him to state that he was, as far as I can learn, the first distinctly to point out that the change to be effected in the tissues must be one of gradual alteration (electrolytic action), and that the tissues must not be destroyed wholesale by the galvano-cautery.

Caustics had been employed early in this century by Sir Everard Home, and he gives in his writings a most graphic account of his success in at length passing a stricture, after some hundreds of sittings. Sir Henry Thompson has alluded to this subject in his account of stricture, and that plan needs only now to be mentioned to be universally condemned.

The method which is now known by the name of electrolysis is as essentially different in its results from those which are produced by the galvano-cautery as from the treatment point of view to be in no sense comparable with it and when the weaker electrolytic currents are employed, the changes which are effected in the tissues by them are of so slight a nature, and give rise to such an entire absence of anything like destruction, that they cannot in reality be compared to a destructive process. Every one has observed the changes that go on in a recent scar, after it has been skinned over, how the tissue undergoes alteration, and eventually the firm, hard cicatrix, with which we are so well acquainted, is the result. That which is effected by electrolysis is really an action upon the tissues, promoting and softening of this cicatricial tissue, and to be efficient must be very gradually and carefully produced. And this is no mere theory, for we have frequent opportunities of witnessing what takes place in those tissues which are submitted to electrolysis, and which are at the same time under the observation of the naked eye. It seems as if the action of a current through the tissues gave rise to increased activity in them and thus produced, in many instances, a rapidity of tissue change which could not under ordinary circumstances be effected without some considerable lapse of time, and in many instances would not have taken place at all. Thus, for example, I have on more than one occasion witnessed the effect of galvanism on two legs which were the seat of a considerable amount of oedema, the result of plugging of the veins. If the one be galvanised, the positive pole being placed over the region of the sacrum and the negative over the affected part, the leg which is so treated will recover its normal condition some time sooner than the one which is left to Nature; and, to effect this purpose, the same battery, almost the same electrodes, the same galvanometer and almost the same current strength may be employed, as if it were the urethra we were operating on. Use the same battery and the same instruments, replacing electrodes which were used in the previous case by sharp pointed needles, and we can effect such change upon nævoid tissue as will promote a healthy action in the parts, coagulate the blood in the blood vessels, and convert the vascular into fibrous tissue.

²⁷ Loc. cit., vol. xvii, p. 19.

²⁸ Path. Soc. Trans., vol. iii, p. 248.

¹ Read before the Medical Society of London.

The only difference between this and the previous instance is to be found in the increase in the strength of the current. It is at the same time perfectly true that if a stronger current still be employed, or the positive pole of the battery in place of the negative be used to destroy the nœvus, a much more rapid action will take place, and a considerable sloughing and loss of substance will ensue. In the case of a nœvus, we can utilise this process because we can carry it on under our immediate eyes. In the case of a stricture it is totally inadmissible, and, if employed, will lead to the most disastrous results. It is most necessary thus to illustrate the subject, and also to insist on the operator being thoroughly well acquainted with the instruments which he employs, with the method of employing them, and with the exact results which he expects to produce. To attempt to operate without these precautions and without this knowledge is to court disaster, and is about as likely to yield a successful result as if an ordinary surgical operation were performed by someone who was not conversant with the instruments which he proposed to use, or with the result which he was desirous of achieving.

Electrolysis consists in the chemical decomposition of some compound, by which one component is liberated at one pole of the battery and one component at the other. The simplest instance of this process is perhaps furnished by the familiar example of the chemical decomposition of water into its two component gases oxygen and hydrogen. But it must not be imagined that the decomposition which takes place within the human body is of so simple a nature as the above. So long as the exact chemical composition of the tissues of the human body is unknown we must be content to remain in ignorance of the exact chemical change which takes place when they are electrolysed. We may assume, we may imagine, and we may infer, but we cannot know, and we must be content to gauge the efficacy of the process by the results which it yields, and which can only be fully appreciated when patients have been under our observation for some considerable length of time. It is to these results, therefore, that I appeal as a testimony of the value of the procedure.

When a solution of any salt in water is decomposed by electricity, the positive pole (anode) liberates the acid, and the negative (cathode) the alkalies or the bases. It has long been known that this law was equally exemplified in the human body, and advantage has been taken of it in the treatment of various diseased conditions; but as I have already stated, we must be careful to recall the fact that the two poles of the battery differ widely in their action, and therefore produce very different results. When undertaking the treatment of urethral stricture by this means, it is absolutely essential that the negative pole alone should be employed. If the current be reversed during the process even for a few seconds, the acid which is then liberated gives rise to considerable pain, corrodes the electrode which is being employed, and often causes bleeding from the urethra, none of which phenomena are ever observable if care be taken to make use only of the negative pole and to employ weak currents.

A galvanometer should always be employed in order to register the strength of the current. The sensations of the patient, or the number of cells, may form a fair substitute where no better means are at hand, but there is no excuse for employing them when a galvanometer is readily obtainable, which will do away with all possible sources of error. It should be obtained graduated in milliampères, which may, for all practical purposes, be regarded as measures of changes in current strength, just as the degrees on a thermometer denote changes in the temperature.

At the commencement of the sitting a current strength of from three to five milliampères may be employed, which should be gradually increased, if the patient's sensations admit of it, to from seven to ten milliampères, but this latter limit should never be exceeded. In order to carry out these arrangements properly it is most essential that the galvanometer should be employed, for one cannot too often emphasise the fact that a cell which is capable of giving a definite strength of current one day may generate a totally different strength the next, from the fact that it has been weakened by continued use. So too the tissues of the patient may offer a greater or less resistance to the passage of the current on different occasions, owing to conditions of moisture, etc., which we have no means of accurately gauging, but by the deflections of the galvanometer. In fact it is usual for the galvanometer to indicate that the current strength has increased within, say, five minutes after the sitting has begun, which is owing to the skin becoming moister from the wet pad of the electrode, which is in con-

tact with the back, and thus a less number of cells suffice to complete the remainder of the sitting.

The thickness and therefore the conductivity² of the skin varies in different individuals and in different parts of the same individual, and without a galvanometer the operator will remain in complete ignorance of these numerous sources of error.

It is hardly necessary to state that the cells of one battery differ in strength and size from those of another, hence a comparison by cells is not only useless but misleading. At the same time of course it goes without saying that if an operator is thoroughly familiar with his own battery, and has tested it under different conditions, and on many occasions with a galvanometer, he can pretty well gauge its strength, and may work it with success in the absence of his galvanometer. It is, however, never desirable to do so, for on more than one occasion it has happened to me, that a patient in the middle of a sitting has slightly shifted his position, and had it not been for the galvanometer, I should perhaps never have detected the fact that he had dislodged his pad, and that the current had ceased to pass through the body.

The exact kind of battery is of no particular moment provided that it is readily under control, and is of so simple a nature that the operator can readily set it right if anything goes wrong during the sitting. It should consist of some twenty-five or thirty cells of average size, certainly of not less than twelve or fourteen, each of which, when freshly charged, is capable of exerting an electromotive force of from one to two volts.

In my hospital practice I have generally employed a Stöhrer's battery, consisting of a series of zinc-carbon elements, but a series of Daniell, Grove, or Bunsen cells would answer equally well. In my own house I employ a battery consisting of thirty-six Leclanché cells (quart size), which though largely in excess of anything that I am likely to require, is at the same time useful as affording a most efficient safeguard against any chance of a breakdown, besides being useful in the electrolysis of nœvi, for which a much higher current strength is required. The cells possess the additional merit of being perfectly free from smell, and being readily accessible to inspection in case anything should go wrong in the connections, etc. The only attention or trouble they have demanded during more than three years has been that the cells require to be filled up about every six months with water.

Such a battery is of course not portable, and where portability is an object, either a small Leclanché cell battery or a Stöhrer will be best employed, but at the same time it must be born in mind that these small batteries are much more liable to get out of order. For the purpose of electrolysis, if the battery is to work economically, the cells should be so arranged that each zinc plate is coupled to its corresponding carbon, whilst for the purposes of galvanocautery where a "quantity current," as it is called, is required, the battery should consist of a few large cells. At the same time the surgeon must bear in mind that a battery arranged for electrolysis is quite capable, if too many cells are employed, of producing a caustic effect.

It may not perhaps be out of place to mention at this point that a battery usually fails to work because its connections (that is, the places where the wires are joined either to the electrodes or to the battery) are either rusty, or dirty, or in some way imperfect. The surgeon who makes use of them should so far master their construction as to enable him to repair any of the simple mishaps he is sure to be constantly meeting with.

The instruments which I have been in the habit of employing are of three different kinds.

No. 1 is practically a stiff catheter to which a black (Brodie) handle is attached. Its tip, *M*, is made of metal (copper or zinc) which is nickel-plated, and is connected by a copper wire, *C*, passing up the centre of the catheter with a binding screw, *A*, by means of which it is attached to the negative pole of the battery.

No. 2 is similar to No. 1 in construction, except that a small guide bougie, *W*, is screwed on to its point, exactly as it is in a Teevan's urethrotome. The guide bougie in the drawing is rather shorter than it should be.

No. 3 differs from the other two instruments in being tunnelled like a railroad catheter, so that a catgut or small bougie, *B*, may pass through it. The connection between the metal tip, *M*, and the binding screw is in this case effected by a ribbon of copper or tin, which is wound round the inside of the instrument, instead of by means of a copper wire passing up its centre.

² These terms are not identical, though they are used so here, for practical illustration.

For most purposes, a series of bougies of No. 1 pattern will be sufficient, and the small sizes are not so essential as the larger, for in some instances I have rapidly dilated the stricture first to No. 5 or 6 English, and then used electrolysis subsequently. The bougies can be made stiff and unyielding or thoroughly flexible so that they can be bent into any shape the operator may prefer. Number 2 instrument is a most useful form, but it has this disadvantage, that the current acts to a slight extent on the whip bougie (W) where it is screwed into the metal, and if it is not carefully examined from time to time, there is no doubt some slight risk of its being left behind in the bladder. At one time I deemed this objection to be a more serious one than it really is. I am, however, confident, from a somewhat extensive use of this form of instrument, that with the most ordinary care this accident is impossible.

(To be continued.)

TWO CASES OF ACUTE INTESTINAL OBSTRUCTION, ASSOCIATED WITH ENORMOUS SECRETION OF PERITONEAL FLUID: ABDOMINAL SECTION AND RECOVERY IN EACH.

By J. GREIG SMITH, M.A., F.R.S.E.,

Surgeon to the Bristol Royal Infirmary; Joint Lecturer on Surgery, Bristol Medical School.

CASE I.—D. D., aged 14, was seen, in consultation with Mr. Firmin Cuthbert and Dr. Edis, at Gloucester on April 18th, 1889, and operated on on that day.

The following notes were kindly supplied by Mr. Firmin Cuthbert: "With the exception of sluggish bowels, the lad had been quite well until April 11th at 10 A.M., when he was seized with pain in the epigastrium, which lasted till 3 P.M., when he was sick and had relief from pain. At 5 P.M. the pain came on again, and lasted till 8 P.M. He went to bed at 8 P.M., and, at 10 the pain returned and lasted all night, increasing in severity. When I saw him for the first time, at 9 A.M. on April 12th, he was in such great pain that I gave him a hypodermic injection of one-sixth of a grain of morphine. This relieved him slightly, but, in about three hours, a similar dose had to be administered. During the previous night he had had a dose of salts and an enema to move his bowels (without effect); I therefore gave him belladonna and opium in pill (quarter grain of each) every two hours.

"On examining the abdomen, I could feel nothing abnormal. The sickness ceased, but the general aspect of the patient and the continued pain indicated acute obstruction from some cause or other. No blood was passed *per anum*. An enema, administered by myself, brought away some fæces, but increased the pain. During the night he had no pain, and slept well. His tongue in the morning was coated, and there had been no action of the bowels. In the afternoon the pain returned; another injection of morphine (one-sixth of a grain) was given, an enema administered, and the abdominal parietes were painted with a mixture of glycerine and belladonna. On the 14th the pain was less; on the 15th it was worse, and his condition was so serious that operation was proposed, but rejected. On the 16th and 17th the boy got steadily worse, the sickness increasing and abdominal distension becoming more marked. On the 18th I telegraphed to Mr. Greig Smith with a view to the performance of abdominal section."

The lad when I saw him had the well-known appearance and symptoms of a patient entering the later stages of acute intestinal obstruction. It was evident enough that, if unrelieved, he could scarcely live over another day. The abdomen was greatly distended, the parietes being tense and brawny. There was dullness in both flanks and in the hypogastrium up to the level of the pubes. Examination of the rectum and abdomen revealed nothing.

It was clear that the patient would not bear a prolonged operation; in fact, the administration of an anæsthetic was not free from risk. An incision large enough to admit two fingers was made at the upper level of the dull area just below the umbilicus, and large quantities of clear serous fluid ran out—perhaps about three or four pints in all. The lower abdomen was almost free of intestine, but high up under the diaphragm the intestines were crowded together in an apparently inextricable mass. A little manipulation with the two fingers released something, and coils of bowel at once fell downwards towards the pelvis. I could now feel an agglomerated lump composed of intestinal coils comparatively empty, which I unravelled, pulled down, and spread out in the lower abdomen. Gas could be felt rushing into the liberated coils; and, being satisfied that the cause of the obstruction was overcome, I did nothing more, but at once inserted a drainage tube and closed the wound. A rounded, hard nodule felt in the mesentery was pulled to the surface and examined; it looked like tubercle, but almost certainly was not.

The after history of the case, as reported by Mr. Firm'n Cuthbert, who treated him, is devoid of interest. Pain and sickness passed off; the bowels acted the same night, and with regularity every day following with a few exceptions, on which small enemata were employed. The tube was removed after four days, very little fluid having come away through it—not more than an ounce in all. The temperature was normal throughout the pro-