Brown (F. J.)

With Compliments of the Author

THE LIMITATIONS

OF

ELECTROLYSIS

AS A

THERAPEUTIC AGENT IN ORGANIC AND SPASMODIC STRICTURE OF THE URETHRA, WITH CASES . . .

BY

F. TILDEN BROWN, A.M., M.D.

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THE LIMITATION OF ELECTROLYSIS AS A THERAPEUTIC AGENT IN ORGANIC AND SPASMODIC STRICTURE OF THE URETHRA, WITH CASES[1]

BY

F. TILDEN BROWN, A.M., M.D.

MR. CHAIRMAN AND GENTLEMEN:

I FEEL that an apology is due for presenting, before this Section of the Academy, a paper upon a theme, with the status of which, it has long been so well satisfied.

If, before testing it in practice, I had reviewed the literature of the subject as carefully as since, I would have seen that no further evidence was needed to assure the incredulous of its narrow scope, and equally well have recognized the futility of hoping to convince its advocates of any self-deception in the matter.

The therapeutic use of this agent in stricture, was first attempted by Crussel and Wertheimber, who sought by it to relieve the peri-urethral swelling. Their efforts resulted unfavorably. After them, no one found encouragement, until Tripier and Mallez adopted galvanism as a potential cautery for the actual destruction of stricture tissue. In 1867 and 1870 they published forty cases all cured or improved. In 1870 Bautisto Campos recounted a number of successful cases; Couviard and Bruns likewise.

Inspired by the theories and results of these authors, two men of eminence in urethral surgery, Dittel and Keyes dismissed it after a careful trial, and have fortunately given us a detailed account of their experience.

The cure said to follow electrolysis resulted from two causes. Stated briefly as follows:

First.—The destruction by cautery of the constricting tissue, with a subsequent separation and shedding of this portion as a tubular cast.

[1] Read before the Surgical Section of the New York Academy of Medicine.

Second.—The non-retraction of the denuded parts, because of a specific action upon the remaining tissues by the alkaline ions, which temper the nature of the resulting cicatrix by removing that quality of resiliency characteristic of scars produced by acids and the actual cautery.

As the ten cases reported by Keyes in 1871 are so complete as to appear best in a tabulated form at the end of this article, I will here allude only to the closing remarks of his paper. After a complete repudiation of the practice, he says, "Organic stricture may be widened by the passage of the negative current. Recontraction takes place after this as after all other methods. It seems to be utterly inapplicable to strictures at or near the urethral orifice. Symptoms are not relieved rapidly, nor in proportion to the pain of the operation."

Dittel's experience in three cases will be better shown by a description in his own words. "The first case was an ænemic person, æt 30, with a callous stricture at the outer portion of the urethra, and a second one in the membranous part. The case afforded a good opportunity of observing distinctly, with my own eyes, the catalytic action, for it was only necessary to hold apart the lips of the meatus after the operation was completed to see the results. The conductor introduced after the sitting did not however move forwards an iota.

The inner surface of both lips was pale, dull-white, as if scabbed. On the evening of the same day an increase of temperature and pulse rate supervened, but this may have been accidental.

In the second case—a callous stricture of the membranous urethra—electrolysis proved likewise inefficient. The conductor did not move forwards, and the introduction of an ordinary catheter was not rendered more easy. In a third case the electrolytic method was not only unsuccessful, but was followed by a local urethritis."

Except in the Latin countries this evidence of Keyes and Dittel was sufficient to seal the fate of electrolysis when used as a strong potential cautery.

It was left, as an additional source of glorification (?), for America to first discover an hitherto unknown effect of electricity. Namely that of absorption.

This school we will now consider.

Dr. Robert Newman, of this city, claims to have made practicable the use of electrolysis as tried and abandoned by Crussel and Wertheimber. The secret of this success seems to

rest in the motto: "Do not cauterize, only absorb." In numerous articles published since 1874 this author expresses, with slight variation, the same views and results.

One noticeable change is that at first he regarded callous strictures less amenable to electrolysis than the inflammatory congestive variety. He now holds that this method is applicable to strictures of all varieties and situations. It is however, proper to note that strictures of the anterior urethra have really given his school not a little trouble. Newman is the only author I have found who has been able to account for this difficulty; by him, the method is relieved of responsibility, as all such contractions are of syphilitic or chancroidal nature, requiring iodide of potassium. Surely it is to be regretted that strictures resulting from cell proliferations of this nature will not absorb. Newman classifies electrolytic treatment under three heads:

First.—"That by mild currents, used for a short time, at long intervals."

Second.—"The galvano-cautery, which is dangerous and unsuitable."

Third.—"A combination of the first and second, where a passage is forced by the action of a powerful current, with the immediate introduction and retention of a catheter to separate the walls and prevent adhesions."

This third method, that of the French school already alluded to, Newman "practices only when obliged to do so." That this *should* be very seldom may be inferred from his remark. "No one could think of curing stricture by cauterization." "Electrolysis may become caustic in its action, destroying tissues and leaving a denuded surface, which, in the healing process, throws out plastic lymph, fills up the cavity and forms solid and adherent walls."

To describe his view of the action of electrolysis, Newman likes the term "Galvano-chemical-absorption." Absorption he defines as "The process or act of being made passively to disappear in some other substance, through molecular or other invisible means—as absorption of light, of heat, of electricity." This vague suggestion pictures the disappearance of a stricture by either the instrument, the atmosphere, or the tissues absorbing it.

In looking over his tables of 200 cases of stricture "permanently cured" by this means, the great number of deep strictures is noteworthy. He accounts for this by being the

recipient and refuge of the worst class of cases. It is, however, to the probable nature of many of these cases I would refer.

It is generally well-known that idiopathic, if not symptomatic contractions of the neck of the bladder, that is, the region between the vesico-urethral opening and the bulbo-membranous junction, are very easily confounded with organic stricture. In fact, at times, when the smallest instruments are refused, the contraction being so strong and lasting as to completely close the way, the differential diagnosis between organic and spasmodic stricture by this means is impossible. Individually I would not even limit spasmodic strictures to this tract.

Now, in alluding to different kinds of stricture, Newman says: "Spasmodic contractions of the urethra, usually called stricture, is not a real stricture, and has no bearing on, or relation to, the electrolytic treatment." Thus, he wholly ignores what Prince, another advocate of electrolysis, urges as a most important consideration.

Butler, author of that oft-quoted sentence which predicts the early recognition of electrolysis as the acknowledged remedy for organic stricture, sought to make its claims final by the publication, in 1873, of an incomplete report of three cases cured by this means when all other methods had failed.

In articles reporting four cases, Dikeman repeats Newman's rules as his own.

Overall recognizes two forms of stricture to be treated by electrolysis; the one hard and firm, which is easy to treat although the calibre may be almost closed. The other, soft, tender and congested; these latter require preparatory treatment with soft bougies. For the hard, firm variety, strong currents of from eight to twelve volts can be used at once for from ten to fifteen minutes. Two or three treatments generally result in permanent cure.

He believes the irritable stricture, with its gleet, is cured by the mild current, changing the chronic or subacute into an active process. When complete absorption (evidently not Newman's absorption) takes place, cure in the hard variety is effected by the conversion of tissues into their original chemical elements, as well as by subsequent absorption.

Bryce says: "All strictures are amenable to the treatment by electrolysis." "A current which is just positively perceptible to the patient will not burn or cauterize, will not produce pain or inflammation, but will, with positive certainty, reduce the tissues in contact with the negative pole to their

original elements. And what is the result? The stricture is absorbed without pain, without cauterization, but as it were by a chemico-vital process, and the electrode passes readily into the bladder because there is nothing left to obstruct its passage." Bryce's third case evidently had an unrecognized spasmodic element, for at one visit it was apt to refuse a small instrument, and at the next take one several sizes larger. "This demonstrates," *he* says, "what nature does for these cases after an absorption has been started be electrolysis, and the tissues are partly broken down." This sentence has a corollary, "This is true *in all cases;*" then a modification, "*as a general rule*, after a week or ten days patients will return with the calibre of their urethra from one to three sizes larger, than the electrode used at the last seance."

He hints at the difficulty of realizing the elusive compromise of Newman's law when he says: "The problem is to absorb the stricture, not to cauterize."

Anderson's article is noteworthy only from the result secured in his second case, in which, after nine months' treatment, a stricture was enlarged from six to eleven French. He says, "So far, no failures have occurred."

Morton reports a case of stricture complicated by fistulæ, which were caused, seemingly, not by the stricture, but by treatment for a cystitis by fixation of catheter. Fifteen days after electrolysis had been instituted, the stricture was cured and the fistulæ had not only closed, but scarcely any inflammatory thickening about them remained. Alluding to electrolysis, he says, "My own opinion is, that it acts through the trophic nerves, and sets up an increased vital action in the tissues.

Hutchinson is satisfied that he derives marked benefit from the use of electrolysis. He does not attempt any explanation of how it benefits, simply saying, "a powerful stimulus whose rationale or potential no man understands, must, as drugs, in a large proportion of cases, be used empirically.

Except Prince all the advocates speak of electrolysis as a distinct entity in whatever benefit follows its use, wholly ignoring the necessarily associated factor of dilatation. Belfield exemplifies this in saying, "Except for strictures situated within an inch of the meatus, and for strictures of large calibre elsewhere, he considers electrolysis preferable to dilatation and and urethrotomy."

A striking inconsistency in the behavior of galvanism is

shown by contrasting Belfield's experience with Newman's. The former says: "Since cicatricial tissue is but scantily supplied with blood, and is therefore poorly nourished, it yields to a dissolving current which is insufficient to disturb the healthy urethral tissues." The latter says, "Callous strictures are less amenable to electrolysis." * * * "Blood and muscular tissue are good electrolytes, hence the inflammatory strictures yield readily to the electrolytic treatment. If the parts to be acted upon are devoid of water the action will be slow."

Three of Belfield's cases were "Impermeable to urine and impassable to instruments." In each a No. 10 electrode was passed into the bladder in less than twenty minutes, and with weak currents, which, as Belfield asserts, "When properly used the heat is insignificant, the cicatrical tissue is dissolved away, but not cauterized." After this sentence the kindly words of Dittel might be aptly quoted. "If I should ask," he says, "whether any one has ever succeeded by the electrolytic method in removing in the space of a few minutes an old connective tissue formation, the answer could probably justify, in every respect, my doubts as to the utility of the method."

Belfield used the method successfully in thirty-seven cases. He is not prepared to assert that the cures are permenant.

Steavenson, electrician to St. Bartholomew's Hospital, would appear to have an enviable opportunity to clear away much of the mysticism surrounding this subject. He and Bruce Clark claim to have verified in every particular the favorable accounts of electrolysis emanating from this country.

It is unfortunate for the integrity of this system that some of the statements of these authors, although probably perfectly correct, should be so much at variance with those taught here where Newman's electrolysis without chemical cauterization is universally maintained. Almost reconciled to this belief Steavenson bewilders us by saying, "Electricity, on account of its power of splitting up compounds into their chemical elements, can be used as a substitute for ordinary caustics to the human body. The treatment of stricture of the urethra by this method is the most simple and perhaps the most striking in its results."

Although Steavenson does not state the time employed in a single seance, we must infer that it is a long one, for, with mild currents of from 3 to 6 milliamperes, he expects to produce effects resulting in the detachment of a slough or eschar a day or two after the operation. This suggests a combination of the

French and American systems, where the French result is secured by the American means, only with the peculiarity that these weak currents have in his hand a caustic effect. This leads us to the serious mention of a fact too much ignored by writers upon this subject. I mean the relation of time to the effect produced by any given electro-motive force.

Another indication of the caustic power of these weak currents used by Steavenson is shown by the following sentence: "No force is used, but the electricity allowed to do the work. The surgeon has to keep his attention continually applied to the electrode, so as to guide it in the right direction; otherwise a false passage may be dissolved into the side of the urethra."

This same author says of the negative electrode: "Besides its service of applying the same destructive action as is caused by the caustic alkalies, it appears, in addition, to set up an absorptive action, so that cicatricial tissue gradually disappears." As evidence of this he claims that a stricture, after any one treatment, will accept at the next an instrument from one to three sizes larger. There are a number of ways of viewing and explaining such a statement, but, if it is meant as a direct assertion, applicable to the majority of cases, I must say that no experience of mine has lent any support to such a belief.

The claim of Steavenson, just referred to, is so extensively repeated that it suggests a contagious maxim passed from one advocate to the next, and by him fully accepted and repeated before he has had a chance to prove it.

Now, if this happy result does occur in Steavenson's cases, why should not the increased calibre be accounted for by the shedding of an eschar which he expects to follow on electrolytic treatment, or by allaying a spasmodic contraction, as claimed by Reliquet and Prince?

It is this one point, namely, that of subsequent resorption, which is the all-important consideration in this as well as every other method of stricture treatment. If it is favorably influenced by what is called electrolysis then we possess the long looked for specific, and even if some urgent cases should require a preliminary urethrotomy it must be admitted that the usual after treatment would be most speedily conducted by this agent.

When we consider Vollemier's theory of the cure of stricture with ordinary sounds, by what he calls, "Inflammatory

dilatation;" a name he gives to a series of organic phenomena provoked in the urethral walls by the contact of a foreign body, and which leads to atrophy and resorption of the tissues making up the stricture. When, I say, we consider, and probably accept, this theory, it is a very easy and pleasing inference to believe that the additional stimulation of the vital processes by electricity would greatly hasten and so thoroughly accomplish this resorption as to remove all possibility of return. If this happens in deep organic strictures, why should it not in anterior strictures, and those of large calibre, why not in cicatricial formations on the surface of the body? It is not pertinent for the champions of electricity to call in evidence cure of naevi, the shrinkage of fibroids, the consolidation of an aneurism, the obliteration of an hair follicle, for all of these are effects sought for by using electrolysis as it really acts upon tissues, expressed above by the qualifying substantives, and if cited by them is indeed the poorest argument, for the fact that the electric current when so applied has this effect of causing condensation, shrinkage, contraction and inflammatory adhesion affords little reasonable ground for expecting to dispel by it an *existing* tubular contraction. Shrinkage does not take place in a peripheral accumulation at the expense of a central attenuation, but just the reverse. Hence, any gain in the calibre of an organic stricture, following such treatment is due to dilatation by the instrument and in direct opposition to the contracting influence of electrolysis.

Wolff has elaborated Newman's theory by resort to the phenomena of kataphoric action and osmose. Seemingly the mucous membrane of the urethra is to act as the porous diaphragm, unaffected itself by contact with the electrode and the products of decomposition. To express his advanced views I must use his own words. After reviewing the action of electrolysis upon fluids, he says: "If employed on the living tissues the same chemical power of decomposition is observed, with which is associated a new factor, namely, the kataphoric; without this, the chemical action of the electrolysis would be of slight value since it is only owing to this combined action that the destruction of the volume of the young cells peculiar to neoplasms manifests itself, not only through exosmotic destruction of these cells, but also through a solution of the cell walls in consequence of the caustic alkalies accumulating therein."

He goes on to say: The chemical decomposition alone without the kataphoric effect would be a simple cauterization by

alkalies, and this cauterizing effect, could not produce this curative effect, since alkaline caustics were long ago used in such cases without good results, but only favored the return of the stricture by cicatricial tissue formation.

Of all the optimists who urge the advantages of galvanism in the treatment of stricture, no one, it seems to me, has presented the subject in a more practical and reasonable light than Dr. David Prince. He says, when the decomposing agent is used in a moderate degree of intensity the tissues are not at once destroyed but are rendered more yielding, so that, cicatricial tissue, which is ordinarily unyielding, acquires the property of expanding before a moderate force. This happens as the result of what he maintains is a well established fact, namely, that living animal tissues are capable of being softened by the disintegrating influence of hydrogen, so as to offer a diminished resistance to distending forces. In order to get the benefit of this combination, he advises the use of conical sounds and not bulbous instruments, engaging the tip of the sound in the stricture, and having the positive electrode so placed (*i. e.*, under the sacrum), that it will be constantly nearer the point than any other part of the sound.

The same article contains the following: "The galvanic current has another effect, and that is to allay spasmodic action by benumbing nervous sensibility and weakening muscular action. In many cases of moderate stricture the anti-spasmodic element is of great importance in the management of the case. To allay this is to remove one of the difficulties in the treatment by other means."

"It is sometimes found," Prince says, "that though the instrument may fail to pass, the patient finds an improvement in the readiness with which the urine gets away. The relief of the spasmodic element may help to account for this."

Several of Prince's statements corroborate results given in 1872 by Reliquet in an interesting treatise upon the marked benefit to be derived from galvanism in spasms of the bladder, urethra and ureter.

Much that this author asserts has, I believe, a very important bearing upon the cases of genuine cure of stricture by electrolysis. That is, where tight spasmodic strictures have been quite readily overcome and cured by the combined influence of galvanism and dilatation, but where the operator did not recognize the contraction as one of this nature.

One fact mentioned by Reliquet, and verified in my expe-

rience, is to the effect that the relief afforded by galvanism in such cases is only temporary unless the exciting cause is removed.

Dr. Hayes has shown more conservatism than any other advocate. Judging from the frankness which characterizes, in an exceptional manner, his article. I believe a little more experience will prompt him to dismiss the idea of benefiting an organic stricture by electrolysis. He says: "When mild currents only are allowed to act, it would seem probable that a gradual breaking up of fibroid tissues can be effected by a combination of chemical decomposition and vital absorption until but a thin lamella of cicatricial tissue remains to mark the seat of stricture. Much and varied observation will be required before this supposition can be substantiated or negatived." The details of his three cases show that the strictures in all were at, or deeper than, five inches.

Although the author makes no allusion to the possibility of *in*organic stricture, his account of their behavior and ready yielding to dilitation by ordinary sounds after a single preliminary electrolytic treatment, strongly indicate to my mind that their nature was, in great part at least, of this kind.

I could, in the main, agree if, in this sentence of his, he would accept my insertion of the word spasmodic. "With patience and attention to details, many (spasmodic) strictures can be expeditiously and safely rendered permeable, when, in the absence of this agent (electrolysis) urethrotomy might be required and performed."

I thank Dr. Hayes for his very creditable allusion to one failure. "I was invited to try electrolysis," he says, "with a fourth patient, the subject of an extremely tight stricture, impervious to instruments, and complicated by false passages. This stricture, which was in a measure of traumatic nature, did not yield before the electrode; and I have had no opportunity of learning from the gentleman who has charge of the case whether the smallest benefit resulted from our efforts."

Were others as critical of their work, and had they as keen an appreciation of truth, I believe many more just such statements would be made.

I regret that this paper was finished when my friend Dr. Burchard kindly sent me the manuscript of his recent article now about to appear in print. His advocacy of the system is satisfactory evidence that there is a something about it which deserves recognition, but I must take strong exception to his unqualified

approval of the deductions of Belfield and Newman. Did time permit, I would like to review the report of his only two detailed cases, with the purpose of explaining the cures on the basis of my views expressed to-night regarding spasmodic, or the mixed variety of stricture, and try at least to convince him that in accepting the faith of the ultra party he has missed the truth.

My own deductions, regarding my first case, are not at all unlike those of Burchard, where, in concluding his first case he says: "I unhesitatingly declare that the treatment was conducted with less pain and annoyance to the patient and with a better result obtained in a shorter time than I should have expected from the ordinary methods with which I am familiar and am accustomed to employ."

The only indication given by this author of his view respecting the action of electrolysis, is when he says, "The operation aims at producing its results by methods that are purely physiological and not by cauterization or other destructive agencies."

Keyes and Dittel, as well as Newman, have given sufficient evidence, to warrant the dismissal of further discussion as to the unfavorable results of strong currents.

It now remains to consider the negative evidence, in the Newman method. This is not nearly so voluminous as the affirmative; probably for the reason given by one author, who says: "The nature of the question seems not to demand the statistical method. One case carefully observed, if unfavorable, ought to settle the matter." Probably many an one has had this experience and never mentioned it in print.

Marsh says: "We sometimes find it recommended to use a battery, which will secure an electrolytic effect without producing a painful and destructive degree of heat in the living tissues, and that this may be secured by the use of a comparatively mild current. The inevitable law governing the subject is, however, that the electrolytic and thermal effects of the current, other things being equal, are both in the same proportion to the electro-motive force, or strength of the battery. A current which will not evolve heat, will not produce electrolysis." Although unnecessary, I may quote Scoutellen on this point. "The unquestioned calorific action of the electrical current cannot be separated from the chemical, for, if the heat current be reduced, the power, as well as the chemical effects of the battery is likewise diminished."

Returning to Marsh's article, he says: "The idea that the stricture is melted down in cartilaginous or any other stricture

without producing excoriation of the part is a delusion, since the electrolytic action takes place only at the surface of the electrodes, and the effect, when attained, though ever so slowly, must be identical with that of a caustic or red-hot bougie bored through the stricture.

Lest one might infer that Marsh thinks this actually happens let me quote him once more: "No appreciable amount of heat is developed in any metallic electrode imbedded in the living tissue. Even if such were the case the cauterization could be no more destructive or painful than the molecular rending of the part by electrolytic treatment."

The passage of deep stricture, with a mild current, must be due to some other influence, possibly long-continued pressure."

He gives the details of one operation conducted by himself after an original method to determine this point. And, I think, justly adds: "These observations certainly throw some doubt upon the manner in which Belfield states that old cartilaginous strictures in the deep urethra may be opened up by electrolysis."

Berkeley Hill, in discussing the paper of Steavenson and Bruce Clark, says: "The facts related do not lead me to expect that more than a temporary benefit has been afforded, and that was due to the passage of the bougies of increasing sizes which carried the electrode through the stricture; there is no proof that the tissue of the stricture has been absorbed." He details one case in which he operated where the stricture was of such a nature, and so situated, as to permit an operative procedure, which eliminated any reference to dilatation. The result, after several treatments, was a diminution in its calibre of four sizes.

Streeter tried electrolysis in seventeen patients, all of whom had become dissatisfied with dilatation. The calibre of the strictures varied from six to sixteen. The number of applications from six to twelve in each case at intervals of from eight to fourteen days.

He at first used weak currents in all without producing any results, afterwards, in four of these same patients who preferred anything to the knife, he used stronger currents with only bad effects.

All of the cases he afterwards cut with Otis' instrument with immediate benefit, and he believes a permanent cure.

And, finally, I cannot but mention the weighty circumstan-

tial evidence offered by Professor Fenger after the paper and report of cases read by Dr. Belfield.

Thus far the tone of this paper may suggest that I have experimented with electricity for the express purpose of finding it a failure in stricture cases. Any such intention I wish to disprove. Realizing the truth of the late Dr. Bumstead's remark that, "probably no class of affections has more thoroughly taxed the ingenuity of surgeons to discover some steady and effective method of cure, than have strictures," I took up this *new* method without bias, other than any I had imbibed from the teachings of its leading medium whose rules I had prepared myself to follow closely.

The following six cases were treated at my office. Careful records of treatment and its result were noted at each visit. All care was taken to observe every successful point ascribable to the treatment. The monotony of details will be made as short as possible. And four of the cases will be alluded to only in the appended table, which, it will please you to know, is not to be read this evening.

Case 1st.—H. D., æt. 25. Gonorrhœa eight years ago, symptoms of stricture four years later; two and a half years ago had retention, of which he was relieved at a dispensary by passage of a very fine catheter; immediately after, three of the smallest steal sounds were passed. Patient believing the relief was permanent failed to return as advised. Has had no treatment since and when I first saw him, February 11th, he had noticed for several months a gradual decrease in size of stream, which was voided with increasing muscular effort. During day micturition once an hour, not obliged to get up at night. Urine passed before me issues in a very fine and erratic stream.

Examination of Urethra.—Meatus admits 24 Fr. All instruments are refused at four inches until after a half hour's work with two whalebone guides one is passed to the bladder, on this Gouley's grooved sounds up to 8 Fr. then solid sounds to 14 Fr. No pain. No blood.

Next day patient reports intervals of micturition increased to three hours. After a preliminary introduction of the same fine instruments and small sounds. A 15 Fr. bougie-a-boule, shows strictures at four, four and a quarter, four and a half and five inches.

It is fair to infer that the strictures at four, and four and a quarter rest on one base of stricture tissue, but as later investigation reveals, the others are each at times more or less influenced by underlying muscular spasm, if they are not purely spasmodic. I now begin the treatment of these strictures with electrolysis.

Eighteen Fr. bulb negative electrode on straight staff is passed to face of four inch stricture but refused after moderate pressure for ten minutes with five milliamperes, bulb withdrawn, its shoulder covered with white foamy mucus, strongly alkaline in reaction. Now a 16 Fr. bulb is held for eight minutes with five milliamperes, when it passes all but five inch stricture. After passing electrode to and fro over this region a velvety smoothness of the strictures has supplanted the snappy hardness felt before. Without electricity, a 17 and an 18-bulb pass all except at five inches. A No. 15-bulb without electricity now passes five inches.

Patient has felt only a moderate warmth during this treatment. On getting up he voids nine ounces of urine in a stream of such size and force as to suggest an urethra of good calibre, and strongly strengthen the belief in the spasmodic nature of the two deeper strictures.

February 14th.—Three days after operation patient has had no urethral discharge. No pain other than a kind of empty weakness in the bladder after micturition, probably due to rapid and forcible contraction of vesical muscles, now that long existing obstruction is partly removed or allayed.

Examination.—Seventeen-bulb refused at four and a half. No. 15 the same. A 17 Fr. sound is passed after awaiting relaxation. Now 17-bulb, passes all strictures, detecting distinctly one moment and not the next the strictures at four and a half and five inches

February 19th.—One week since first and only treatment with electricity. Patient still notices marked improvement in all his symptoms.

Examination: 18-bulb passes all strictures, tightest at four and a half. Now a 21-bulb after five minutes with five m. amp. moderate pressure passes all strictures; frothy blood on shoulder of bulb.

February 26th.—Excellent condition of urinary organs; micturition only four times a day. Has had daily a moderate chill. Probably urethral treatment has determined an expression of a condition. Patient had malarial chills two years ago.

Examination: 21-bulb refused at four inches.

Now a 22-bulb with four m. amp. held for four minutes goes through with a jump; find no trace of usual four and a half inch stricture.

March 4th.—Had very slight urethral irritation for a day or two after last treatment. Examination: 21-bulb passes all strictures; twenty-two the same.

Now a 24-bulb with two and a half milliamperes passes all strictures in half a minute.

March 11th.—No irritation after last treatment. Examination: 24-bulb refused at four inches; twenty-two the same.

Twenty-one passes; then twenty-two and twenty-four after a minute's pressure.

Galvanic current is now attached to the 24-bulb, and usual treatment with three milliamperes.

March 18th.—Excellent condition. Examination: 24-bulb refused at four and one-half inches. Now three milliamperes of current is turned on. After twenty seconds a sharp spasmodic movement is felt, when the bulb at once jumps through the stricture. Five minutes' treatment, one-half drachm of frothy blood issues with the electrode.

March 25th.—Urethra has been ticklish. Examination: 24-bulb refused at four inches for two and one-half minutes. Three milliamperes of current is turned on. After four minutes a strong muscular contraction throws my hand and electrode upward. As the bulb was gently replaced it passed the stricture at once. Here I must call attention to this strong spasm involving the four-inch organic stricture.

April 1st.—Patient in good condition. Examination: 24 bulb refused at four inches for four minutes, when it slowly passes. The deeper strictures are distinct, but much less resisting.

At this visit I test the urethra with Otis's urethrometer. From five and three-quarters to five inches—forty-five; from five to four inches—twenty-four; from four to three inches—thirty-nine; from three to two and a quarter inches—thirty-four; from two and a quarter to meatus—thirty-three; meatus itself twenty-four.

As the meatus admit only twenty-four, and the strictures will accept this without the galvanic current, the patent is dismissed with the request to report in one month for examination.

On May 6th I examined him. Twenty-four-bulb refused at four inches, eighteen passes readily, twenty-two then quite easily. It detects the four and a half inch stricture. Twenty-four will now pass. It also detects a faint stricture at three and a half, for which I cannot account, unless the contracted meatus has instituted a faint reflex spasm here.

All improvements in the urinary functions had continued despite the fact that during the past month he has been very irregular in his habits.

I feel that the result in this case was most satisfactory. It is not necessary to dwell upon it. Those acquainted with urethral disease will see that muscular spasm was the main cause of this patient's trouble. The case is an excellent example of many which are reported as wholly or almost impassable organic stricture cured by electrolysis.

Case 2d.—J. P., æt. 39. Gonorrhœa eight years ago; patient has noticed more or less discharge since that time, and of late

a diminished stream of urine. No irritation or undue frequency in micturition.

Examination: 18-bulb finds sharp strictures at one, one and one-quarter, one and three-quarters, and at two and one-eighth inches where it is refused. Pass a 17 Fr. sound to bladder. Commence electrolysis with 18-bulb, using from four to seven milliamperes; this No. 18 after thirteen minutes passes the two and a quarter inch stricture, but finds another at two and a half which it passes in six minutes with seven milliamperes.

Treatment for four minutes over these strictures does not dispel their hard and snappy margins. Bulb on withdrawal has dense white frothy mucus. No pain on urination immediately after, in office.

March 4th.—Patient suffered for several nights with chordee, a thing he has never had before. Although no pain at the first micturition, he felt some scalding with succeeding acts the rest of that day. Examination: 17-bulb refused at two and a quarter.

Now 21-bulb with four milliamperes is refused for five minutes at two and a quarter inches, and for the same time with six milliamperes. Twenty one changed for 18-bulb, this with seven milliamperes is also refused at two and a quarter inches. Dismiss patient.

March 11th.—For three days after last treatment severe burning during micturition. No increased frequency.

Examination: unable to pass anything larger than fifteen.

Now 18-bulb with six milliamperes passes two and a quarter after eight minutes, two and a half after five minutes more. The same pressure is maintained as when examinations are made without the electricity.

March 18th.—For twenty-four hours after last treatment, patient suffered great pain on urinating. Moderate urethral discharge has appeared. He notices for past several days that his stream has been smaller.

Examination: eighteen refused at one and three-quarters, same bulb with four milliamperes is refused for four minutes; 15-bulb substituted with three milliamperes, it passes all in one minute. Replace 18-bulb which with five milliamperes passes one and three-quarter inch stricture in six minutes, and a moment later that at two and a quarter. To relieve painful micturition in office inject cocaine solution.

March 25th.—Patient again experienced chordee and burning micturition after last treatment. Patient thinks two more treatments will cure him! Examination: 15-bulb refused at one and three-quarters, fourteen after much opposition passes.

Now the 18-bulb, with four milliamperes and moderate pressure, is refused at one and three-quarters for eight minutes. Change to fifteen, which passes; use eighteen again, which after five minutes passes, causing considerable pain.

The evident tightening of the strictures in this case cause me to discontinue all treatment, and to see after one month what has been effected by vital absorption.

April 22d.—Examination.

One and three-quarter inch stricture refuses No. 12 after smaller ones have been passed.

Two and a quarter inch stricture refuses No. 11 after smaller ones have been passed.

The train of bad results directly attributable to the electrolysis is too manifest to require comment.

This unquestioned case of organic stricture completely refutes all statements to the effect that strictures of this nature gradually enlarge by absorption between treatments so as to later permit the introduction of same or a larger instrument.

It would be proper to review, did time permit, some of the known laws pertaining to the electrolysis of fluids and molten substances, as well the generally accepted theory, that of Grotthuss, explaining these phenomena: in order to contrast the behavior of a similar electro-motive force acting upon living tissues, such an investigation would, I think, at least, show that the action of electrolysis in the latter could not be easily reconciled to the theory of molecular separation and recombination along the whole path of the current as is believed to happen in fluids. Many, Dr. Tilley among them, object to the word electrolysis in this connection, and probably for the reason given. And Steavenson, although finding no fault with the term as applied, is nevertheless so well satisfied that this continuous molecular interchange does not occur in animal tissues, as to furnish him grounds for doubting the correctness of the Grotthuss theory regarding the electrolysis of fluids.

But this ponderous subject we will not dwell upon. Let us rather make a practical test which will convince us all of the truth concerning one point universally maintained by the advocates of electrolysis for stricture.

When we make a thick all-meat sandwich, where in place of the domestic bread and meat, we use meat and connective tissue, after the following fashion; first a slice of fresh beef muscle, then, thin connective tissue, such as Calf's aorta opened and spread flat, and lastly another thick piece of raw beef, care having been taken that the intervening connective tissue shall extend beyond the meat and prevent contact of their surfaces at any point. Now with a long punch made expressly for the purpose, a perfect cylinder of the entire thickness of the sandwich is removed.

This affords us a fair substitute for the urethral canal, having midway in its course an artificial stricture (Belfield may object that it is one of large calibre, since one punch has made the entire canal). Over the canal is set up an open rubber ring on a tripod base to support perpendicularly the straight insulated stem of the negative electrode bulb. The positive electrodes—a pair of platinum needles are thrust into the underlying meat slice. A negative bulb electrode, three sizes (French) larger than the diameter of the punch is now passed through the open ring of the tripod, and its point engaged in the punched out meatus; by its own weight it slowly settles down this meaty canal, until it reaches and rests upon the margin of the connective tissue aperture representing the stricture.

If now we turn on six milliamperes of electricity furnished by a Barrett chloride of silver battery, and maintain this uniform strength of current for one or two hours, at the end of this time we are prepared to note one very important point, namely, that the electrode bulb is just where it was when the electrolytic action was begun. No kataphoric action, chemical absorption, cauterization, osmosis, softening, solution of continuity, melting down or anything else, has advanced the position of the bulb; which now, as before the operation, will with the gentlest touch drop into the canal below. It is this test, gentlemen, which has been going on before you this evening, only, that I have omitted the top slice of beef that the bulb and the galvanic action going on about it might be visible.

You may notice that the milliampere meter still registers six, and that the electrode is just where it was when you entered the room. It is a delicate experiment, and might have proved a false witness in this appellate court. Not that there was the slightest chance of the electrolytic action working a passage, for I have had the same result after using ten and fifteen milliamperes, but, if I have watched the electrode as a Damocles' sword, it was because the difference between the supporting margins of the stricture and the weight of the electrode has been not less alarming than the size of the fabled thread.

To show you how little electrolysis need have done during this long seance, notice the same electrode passing by its weight alone through a piece of pulmonary artery perforated with the same punch, this tissue being a little thinner and more elastic than the aorta of the same animal.

As an excuse for making this experiment before you let me show by a quotation that the claimants have been in the habit

of advancing their doctrine by this means. I especially refer to this lest they should now assume the attitude that no inference can be drawn from what we have seen, because of the dissimilar conditions existing in living and dead tissue. Dikeman says:

"In our text-books on electricity we find many given experiments for the decomposition of various substances by this agent. But we fail to find anything of a simple experiment by which any reference is made to demonstrate the utility of electrolysis in the treatment of organic stricture of the urethra, although much is said in favor of electrolysis in the successful treatment of morbid growths, tumors, chronic inflammations, etc.

I will attempt to demonstrate the principle of electrolysis on animal tissues. Take a small piece of fresh beefsteak and lay it on an insulated surface. Then with the positive electrode placed on the under surface of the beefsteak, and the negative electrode on its upper surface, where the decomposition can be watched, the conducting cords are now connected with six cells of the galvanic battery. By close observation in a few seconds the effects of the electrolysis on the tissues will be seen to take place. By continuing the experiment for a few minutes the results will be distinctly appreciable. Now when we treat stricture of the urethra by electrolysis we have just such an action taking place on the fibrous tissues of which a stricture band is composed. Yet some of the most eminent of our profession say the treatment has failed in their hands, and denounce the operation as unsuccessful."

Is it surprising that an investigator of such acute perceptions should have been unable to detect a single failure in his twenty-eight cases?

What are the gross appearances of these tissues which you have here seen so long in contact with the electrode?

The zone of glazed greenish gray tint surrounding the aperture in the aorta contrasts clearly with the yellow color of the normal tissue beyond. A piece of tumeric paper applied to its centre gives a strong alkaline reaction. You may notice this affected zone is raised slightly above the general surface, this being most marked at the inner free margin of the zone where the electrode was in contact. Notice also the marked slipperiness of this zone when the nail or finger is drawn over it. The odor suggests ammoniacal urine. The puffy, œdmatous infiltration, the alkaline reaction, odor, and the color, all suggest an increased rate of decomposition or putrefaction. I will not delay

to suggest what the equivalents of this would have been in living tissues.

I cannot see that there is any change in the elasticity of the aorta tissue. If the same experiment is done with muscular tissue, where a bulb is used large enough to prevent its settling through the punched canal by gravitation, the gross changes are, briefly, a glazing of the parts as if gelatinized, an alteration in color from pinkish red to purplish red, and finally a condensed rigidity of the canal where the negative electrode has been in contact. Its loss of contractile elasticity being most apparent.

One important effect of the electric current when used upon the urethra in the manner under consideration and to which I have seen no allusion made, is that which it exerts as a self-feeding lubricant. The glands of Littre lining the whole membrane of the urethra whose ducts pass obliquely forward through the membrane, are normally active enough to fulfill their physiological purpose, but the mucus secreted is imperceptible. Under the influence, however, of galvanism, with the negative electrode in the urethra, this outpour of mucus is excessive ; it is this which is seen collected on the shoulder of the bulb when withdrawn, and which Newman says is part of the dissolved stricture. The importance of this action has been overlooked. The marked softening of strictures felt, as the bulb is drawn to and fro over them, is in great part due to it. This mucus is rendered still more efficacious as a lubricant because of its saponification by the associated alkalies. When several strictures exist it is readily seen, that an instrument dipped in oil or smeared with vaseline, is well deprived of its mechanical aid, before the point has even engaged that part where the greatest resistance is to be encountered.

Besides the space thus gained by the emptying of these glands and follicles may be referred to as a slight but actual increment in the equation between the dilatation the part is capable of and the size of the entering wedge.

For argument let us allow that a dense, organic, impassable stricture, wholly uninfluenced by any underlying muscular contraction, has been rendered passable by an instrument under the influence of electricity, used for the same length of time as a similar instrument tried just before but without electricity.

To what is this result ascribable? Shall we say with Burchard, Overall, and others, that vital activity in the stricture itself, or at its distal periphery, has resulted in such rapid

physiological resorption, as to permit this necessary expansion? Can we, in the face of to-night's experiment, say that it is due to a melting down of the free surface of the stricture?

If such a stricture must be admitted passable, I believe it has been due to the mechanical influences of pressure materially aided by the lubrication just spoken of.

If the connective tissue, making up an organic stricture of the deep urethra, is absorbed by physiological processes stimulated by electricity, why should the same agent result in the additional deposit of connective tissue if used on a stricture at the anterior part of the same canal?

I am equally curious to know why a simple stricture of large calibre should be consigned by Belfield to urethrotomy, when, by inference from his statements, one would suppose a single electrolytic treatment should eradicate it. Is it perhaps, because, what little there is of this stricture is genuinely organic?

The majority of deep strictures respond more or less favorably to simple dilatation. They do the same if not better when the identical dilating instruments are used as negative electrodes.

The majority of anterior strictures do not respond so favorably to dilatation, and when electricity is added the results are apt to be unfavorable.

Do these facts point to some selective individuality in connective tissue formations, which prompt them to behave differently in different localities? Or do they afford reason to believe that the nature of these contractions is dissimilar? In other words, where in the deep urethra, we derive benefit from electric treatment, a spasmodic *element*, at least, has existed, whereas in the anterior portion harm has resulted, because we have had a purely organic obstruction.

From my own brief experience with electrolysis in cases of pure organic stricture I incline towards the conviction that this agent, apart from the dilating effect of the instrument by which it is applied, is followed by no benefit.

I believe that a systematically conducted microscopic study of vegetable and animal tissues which have been acted upon by electrolysis, in the manner shown, will furnish facts of importance on this question. I had hoped to submit something of the sort in this article, but the time was insufficient. The inferences, from the hasty examinations I have made, are too vague to permit me to say more than, that, I presume a gradual urinary erosion may enlarge a stricture's calibre after a favorably

adjusted galvanic current has produced a decomposition by chemical cauterization of its superficial layers, providing the same current has not acted upon the deeper parts of the stricture in effecting additional connective tissue deposit, and in a contracting condensation of that already existing. But that there is a vis medicatrix naturæ inherent in stricture tissue, the latent energy of which requires only to be put in motion by electricity when complete resorption goes on, I do not believe.

In fine, then, the only advantages this method can claim are:

1st. That it encourages patience and gentleness.

2d. That it furnishes two aids in overcoming spasmodic strictures, (a) lubrication, (b) an anæsthetizing influence upon the terminal nerves at the irritable point, and possibly earlier relaxation of spasm by muscular exhaustion following overstimulation; or, if the current is strong and long-continued, it may, as the electrode slowly passes, effect a moulding of the muscular envelope of the stricture, destroying its contractile elasticity and sealing this distention until again revivified by natural processes.

3d. A slightly increased rate of exfoliation of hypertrophied epithelial masses.

4th. On theoretical grounds I would try it in cases of deep stricture of doubtful nature with urethral fistulæ.

5th. In certain cases, as a more or less permanent aid in those symptomatic affections, often of obscure origin, frequent and painful micturition.

Names of Operators and References.	No. of Cases.		Previous Treatment of different nature by same Operator for relief of Stricture.	Location of Strictures and Nature of.	Calibre of Strictures.	Sizes and Nature of Negative Electrode	Strength of Current.	Time in passing Strictures at first Operation	No. of Treatments.	Average Time between Treatments.	Calibre of resulting Stricture when Treatment was discontinued.	Result; Subsequent History and Remarks. All cases here reported have been graded to and expressed in the French scale of measurement.
KEYES New York Med. Jour., Vol. xiv, p. 586, 1871....	10	1	With sounds	M. 2½ 5...	23. 21. 16..	.....	10 Cells...	28 Minutes	3....	20 Days.	.....	Good deal of pain. Patient refused to continue treatment or be examined.
		2	No.....	4¾	16.....	.....	16 Cells...	10 Minutes	1....	.....	... .	Frequent micturition. Calibre of urethra increased three sizes.
		3	No.....	M. 3½ 6....	19. 10. 1....	12 Bulb....	12–16 Cells	3 Minutes	4....	16 Days.	.....	Some blood. Patient left hospital.
		4	No.....	M. 2½	12. 8.....	12 Bulb....	6–16 Cells	Impassable	3....	14 Days.	.....	Great pain during operation; twelve days later patient passed a cast of urethra. Refused further treatment and left hospital.
		5	No.....	1¼ —— 6..	29. 22. 20..	24 Bulb....	6–16 Cells	2 Minutes	1....	.....	.....	Some blood. Patient left hospital after a single treatment.
		6	No.....	M. ½ 1¾ 4½..	30. 22. 16. 1	12 Sound..	12 Cells...	1¼ Minutes	1....	.....	.....	Operation without much pain; Orchitis. Patient declared he was no better, refused further treatment or examination.
		7	Yes	From 2 in.. down....	8.....	12 Bulb....	16 Cells...	Impassable	2....	2 Days,	.....	Patient refused further treatment and left.
		8	No	M. ½ 5¼....	27. 24. 18..	24 Bulb....	16 Cells...	14½ Mins.	2....	16 Days.	.....	Stricture at meatus contracted from 27 to 18. Refused further treatment.
		9	No	M. ½ 6	30. 25. 21..	24 Bulb....	16 Cells...	30 Minutes	2...	18 Days	....	Stricture at meatus contracted from 30 to 14 Meatus incised to permit second treatment; condition became steadily worse and urethrotomy was done.
		10	No.....	M. ½ 3½ 5..	29. 24. 17. 9	.....	10–16 Cells	18 Minutes	5....	15 Days	.....	Two deepest strictures yielded to treatment; that at ½ inch became tighter.
FRANK. Med. Record, Vol. ix, p. 62.....	1	1	No.....	M. 2½ 4½...	8. 1. 0.	10.....	9–15 Cells	Impassable	27....	2½ Days.	10.....	Failed to pass 2½ strictures after fifteen minutes; discontinued on account of pain. At second trial passed this in five minutes; discontinued on account of pain at 4¾ stricture; after this patient had daily chill for one week. At fifth treatment electrode was passed to bladder in one hour. Indefinite subsequent treatment with sounds.
BUTLER. N. Y. Medical Times, Vol. x, p. 238	3	1	No.....	M. 1 5½...	9. 6. 6.....	Not stated.	Not stated	Not stated.	4 ...	1 Mth..	32.....	"Permanent cure."
		2	No.....	5½.....	6.....	Not stated.	Not stated	Not stated.	4....	9 Days.	35.....	"Permanent cure." Says he detected this membranous stricture of 6. French with Otis' Urethrometer. This instrument will only close to 14. French.
		3	No.....	M. 3½ 5½...	6. 0	Not stated	Not stated	Not stated.	12....	N't stated....	N't stated....	"Permanent cure."
GLASS. Med. Record, Vol. xxiii, p. 512	9	1	No.....	Not stated	18.....	20 Sound..	10 Cells...	5 Minutes	3 ..	20 Days.	23.....	"23 French represented normal calibre of urethra."
		2	Reported only as duplicate of No. 1									
		3	No.....	Not stated.	20.....	21 Sound..	10 Cells...	6 Minutes	4....	1 Mth..	24.....	
		4	No.....	4½ 5½.....	12.....	14 Sound..	12 Cells...	10 Minutes	9....	22 Days.	23.....	Well marked chill during night; on fifth day cast of urethra was passed; chill followed third treatment.
		5	No.....	5½	14.....	15 Bulb....	10 Cells...	5 Minutes	6...	18 Days.	21.....	
		6	No.....	Pendulous Urethra.	18.....	20 Bulb....	10 Cells...	Not stated.	3 ...	16 Days.	23.....	23 French seems to have been the normal calibre of the urethra in nearly all of these patients, as they were discharged cured when such an instrument could be passed. Believes he is justified in claiming complete and radical cure.
		7	No.....	Pendulous Urethra.	18.....	20 Bulb....	10 Cells...	Not stated.	3....	16 Days	23.....	
		8	No.....	5.....	14.....	15 Bulb....	10 Cells..	Not stated.	5....	20 Days	23.....	
		9	No	2.....	18.....	20 Bulb....	10 Cells...	Not stated.	3....	28 Days	23.....	

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NEWMAN. Jour. of Amer. Med. Asso., Vol. iv, p. 449, '85	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	All remained cured after from three and one-half to eleven years.
NEWMAN. Jour. of Amer. Med. Asso.—ix, 385, '67.....	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	All remained cured after from three months to five years.
DIKEMAN. Med. Record, Vol. xxiii, p. 678	1	No.....	$2\frac{1}{2}$ 5 $5\frac{1}{2}$....	15. 3. 0....	9 Bulb.....	6 Cells....	Impassable	6....	4 days..	22.....	After passing 5 inch stricture in eighteen minutes, he found another at $5\frac{1}{2}$ inches which was impassable; at second operation he passed this stricture after nineteen minutes.
DIKEMAN. Med. Record, Vol. xxv, p. 5...	1	No.....	$1\frac{1}{2}$.....	15.....	19 Bulb....	9 Cells....	.....	3....	1 Week.	28.....	Author says if operation is conducted according to his directions every operator will be rewarded with success. He has treated twenty-eight cases without a single failure.
	2	No.....	2 5	17. 13.....	17 Bulb....	9 Cells....	.....	3....	2 Weeks	26.....	
	3	No.....	2 5.....	28.....	Conical sound....	4-10 Cells.	.....	5. ..	10 Days.	34	
STREETER. Med. Record, Vol xxvi, p. 94..	13	Yes, gradual	... .	6. to 16....	.....	6-8 Cells..	.....	6 to 12	8 to 14 Days.	No benefit to any...	In thirteen cases he used mild current and had no results; in four of these same patients he used strong currents with bad effects. All were afterwards cut with immediate relief.
	4	Dilatation unsatisfactory	.....	6. to 16....	.....	Strong current..	.....	6 to 12	8 to 14 Days.	....	
ANDERSON. Lancet, '85 Vol. ii, p. 1040.....	1	No.....	Not mentioned...	Not mentioned...	17.	Not men.	23 Minutes	1....	.....	N't stated...	This patient had made a false passage with a sound into rectum. Eighteen months after this single treatment he remains cured.
	2	No.....	$1\frac{1}{2}$ 7.....	8. 0.....	14.....	Not men.	.....	2....	3 Weeks	17.....	
	3	No.....	$\frac{1}{4}$.....	6.....	Not mentioned...	Not men.	Impassable	3....	3 Mths..	11... ...	One month after first treatment a No. 5 would not pass. Eight months after treatment was begun a No. 11 French could be passed.
	4	No.....	Not mentioned...	Not mentioned...	9-12.....	7 Cells....	Not mentioned...	2....	1 Month	N't stated....	Author says so far no failures have occurred.
MARSH. Cincin. Lancet Clinic, Vol. xvii, No. 7, p. 184	1	No.....	$1\frac{1}{2}$.....	26.....	Wire ring..	8 Cells....	Impassable	1....	... .	.....	No progress was made after several attempts. Free effervescence at meatus, mostly due to decomposition of mucus. Gleety discharge aggravated. Stricture was subsequently cut.
HAYES. Trans. of Acad. of Med. of Ireland, Vol. iv, p. 185...	1	.....	$5\frac{1}{2}$.....	0. 5.....	Not stated.	18 Cells...	15 Minutes	5....	18 Days.	.....	After initial introductions of electrode ordinary sounds were used.
	2	.....	5.....	.....	"5 Electrode"..	6-12 Cells.	10 Minutes	3. ...	.....	.....	Still under treatment at time of report.
	3	....	6 $6\frac{1}{2}$	.....	"5 Electrode"..	12 Cells...	10 Minutes	2....	.....	.....	Still under treatment at time of report.
	4	Deep traumatic organic	3 $4\frac{1}{2}$... . .	0.....	Not stated.	Not stated	Impassable	1....	.....	....	This patient's stricture was impassable; Author does not know the result of efforts.
MORTON. Brit'h Med. Jour. '87, Vol. ii, p. 711.....	1	Fixation of Catheter..	.....	Not stated.	Not stated.	8-12 Milliam.....	Not stated.	4....	3 Days..	N't stated...	Fifteen days after treatment was begun all fistulæ had closed and the induration surrounding them had been absorbed.

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PRINCE. Trans. of Amer. Surg. Assoc. Vol. iv, p. 334, '86.....	1-	No.....	Not stated.	Impassable by ordinary means	Holt's Dilator	Strong enough to be sharply felt at positive sponge Electrode	2 Hours....	About 20..	1 Week.	.....	After passage of Holt's Dilator the treatment was continued with ordinary sounds used as negative electrodes.
STEAVENSON and BRUCE CLARKE. Proceed. of Royal Med. and Chir. Soc., '86, No. 13 (Vol ii, No. 3)....	6-	Cannot find details,....									
EDWARDS. Ibid.....	1-	Successfully by gradual dilatation then a relapse	1¼ 4 5.....	4..... 19.....	3 Bulb.....	5-8 Milliam,....	Desisted after 25 minutes' trial.....	7....	.....	28 sound	Author says whether this method can effect a cure or not time alone can show.
HILL. Ibid.....	1-	.....	2½.....	A Nodule of cicatricial tissues on one side of Urethra seen by Endoscope.....	A Negative Electrode in form of needle punctured the Nodule..	Guided by sensations of patient	.....	6....	.....	.....	Immediately after first treatment an instrument one millimeter larger could be passed; viz. 20. The stricture finally admitted only a 16, and it was widened by other means.
ALLEN. Boston Med. and Surg. Jour. Vol. 117, p. 621, '87.	4 1	No.....	½ 2 3½...	19. 19. 16 ..	20.....	4 Milliamperes....	20 Minutes	1....	.....	.....	Chill, vomiting, etc., twelve hours later. Had had chills before after passage of sounds.
	2	No.....	1½ 1¾	17.....	18.....	4 Milliamperes, ..	10 Minutes	1....	....	14.....	Malaise and copious discharge. Stricture found to have contracted and treatment abandoned.
	3	No.....	¾ 1½ 2¼....	23. 18. 14...	20.....	4 Milliamperes,...	15 Minutes	5....	18 Days.	22.....	Local irritation; at fifth treatment patient became faint after 25. electrode had been in contact with first stricture for fifteen minutes. Treatment discontinued.
	4	No.....	1¾ 3¾ 5....	25 11. 11...	15	4 Milliamperes ...	Impassable in 20 minutes.....	1....	.....	.....	Treatment abandoned owing to faintness and resorted to gradual dilatation.
WOLFF. New Yorser Med. Presse 1886-7, iii., 121.....	3- 1	Gradual dilatation had no effect....	1½ 5.....	Not stated.	3..... ...	2-5 Elements...	10 Minutes	3....	N't stated....	18.....	After 18. had entered bladder he completed treatment by simple dilatation up to 26. and discharged cured.
	2	Hot baths, Morphine, etc...	2 in. Penile Urethra, 5½.....	Impermeable.....	1.....	5-10 Elements...	15 Minutes	6....	N't stated....	27.....	Has had no return for eleven months; after first electrode was passed, completed treatment with steel sounds.
	3	No.....	Not stated.	Impermeable. ...	Not stated.	Not stated	10 Minutes	3....	1 Week.	26	Patient still under treatment.

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BRYCE. The Southern Clinic, Vol. vii., p. 33, '84.....	3-	1	No.....	5	Not stated.	15.....	Not stated	Not stated.	2....	N't stated....	21.....	"As this is the normal calibre of theure thra, patient discharged cured."
		2	No.....	$4\frac{3}{4}$.....	15.....	17.....	9 Cells..	11 Minutes	4....	N't stated....	21.....	"As this is the normal calibre of the urethra, patient discharged cured."
		3	No.....	4 6	8.....	15.....	Not stated	Impassable	4....	N't stated....	21.....	"As this is the normal calibre of the urethra, patient discharged cured."
BURCHARD The Medical Record, Vol. xxxiii, p. 655, 88..	2-	1	.....	M. 2 $5\frac{1}{3}$....	14. 12. 17..	14.....	6 Cells...	In 15 Min. passed 2 in. stricture.....	10....	1 Week.	.....	Two months later there was no appreciable contraction along the canal.
		2	.....	M. to $5\frac{3}{4}$...	6 will pass all.....	5.....	10 Cells...	8 Minutes	5....	1 Week.	.....	Night after first operation patient had retention. Catheterization was performed with great difficulty. Six months later 29. Bougie-a-boule detects no obstruction.
BROWN.....	6-	1	Yes; Gradual dilation with sounds at the first treatment from 1 to 15 Meatus admits 24...	4 $4\frac{1}{4}$ $4\frac{1}{2}$ 5... Organic and Spasmodic.....	15.....	16	5 Milliamperes....	8 Minutes	7....	1 Week.	24.....	Two months later 22. Bulb passes, detecting very faint trace of any strictures but those at 4 and $4\frac{1}{4}$
		2	No; Meatus admits	1 $1\frac{1}{4}$ $1\frac{3}{4}$ 2 $2\frac{1}{4}$ $2\frac{1}{2}$..... Organic...	18. 18. 18. 16. 18....	18.....	4–7 Milliamperes.	18 Minutes	5....	1 Week.	15.....	Strictures were tighter at each visit; six weeks after all treatment had been discontinued $1\frac{3}{4}$ admits only 11.; $2\frac{1}{4}$ admits only 10.
		3	Meatus admits 24.....	$4\frac{1}{4}$ $6\frac{1}{2}$..... Spasmodic, dependent upon irritable anterior Urethra..	23. 26.....	27 refused.. 24 passes with.....	5 Milliamperes....	3 Minutes	3....	1 Week.	26.....	Marked improvement in functions of bladder and urethra, but no permanent gain in calibre of strictures.
		4	Yes, sounds with temporary benefit to symptoms. Meatus admits 34.....	$4\frac{1}{2}$ 6 7..... Spasmodic, due to pyuria from Nephritis...	30. 28. 28..	32.....	$4\frac{1}{2}$ Milliamperes....	3 Minutes	5....	1 Week.	.....	Relief to symptoms followed first operation, these returned after third treatment, and were not again dissipated by its continuance.
		5	Yes, sounds no gain beyond 23. Meatus admits 26.....	$\frac{1}{2}$ $2\frac{1}{4}$..... Organic...	24. 23.....	24.....	3–5 Milliamperes.	2 Minutes	5....	1 Week.	23.	The same Bulb as that with which treatment was begun can still be passed, but with greater difficulty. An occasional symptom viz., slight involuntary dribbling, was benefited after second treatment, but returned in an aggravated form after the fourth.
		6	Yes, sounds with no benefit. Meatus admits 32.....	$6\frac{1}{4}$ 7..... Spasmodic, due to Cystitis..	19. 18.. ...	21.....	4 Milliamperes....	5 Minutes	3 ...	6 Days..	.....	Treatment very painful; may have been due to bulbous shape of instruments. After first treatment several symptoms benefited, but complete relapse three days later. Pain obliged discontinuance of this method. No gain of calibre during nor long after treatment.

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