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A NEW METHOD
OF
TREATING
MALIGNANT TUMORS

BY

Electrolyzing the Base.

BY

Pres. by the Author

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THE very great and increasing interest that is now felt in Electro-Therapeutics—medical and surgical—and in the study of Nervous Diseases, makes it desirable that those who are giving special attention to these branches should have a medium of communication with each other, and with the profession at large, through which it shall be possible to discuss the various questions that arise in these complex and rapidly expanding sciences with greater elaborateness and detail than would be appropriate in a journal of general medicine.

The aim will be to make the ARCHIVES OF ELECTROLOGY AND NEUROLOGY both *scientific* and *practical*.

Each number will contain not merely long essays that appeal only to a limited body of specialists, but rather a variety of *short* articles, some of which will be of general interest.

The plan of the Journal will be as follows :

- 1.—Papers on important questions in Electrology, including Electro-Physics, Electro-Physiology, Electro-Pathology, and Electro-Therapeutics—Medical and Surgical.
- 2.—Reports of interesting and suggestive cases treated by Electricity, including operations by *Electrolysis* and *Galvano-Cautery*.
- 3.—Papers on important questions in Neurology, including Neuro-Physiology, Neuro-Pathology, and the Diagnosis and Therapeutics of Diseases of the Nervous System.
- 4.—Papers on important questions in Psychology, Insanity, Mental Hygiene, and Medical Jurisprudence.
- 5.—Descriptions of new and improved Electric Apparatus for medical use.
- 6.—Abstracts of papers published in home and foreign journals.
- 7.—Reviews of Books.
- 8.—Miscellaneous Notes.

It is the desire of the editor that the ARCHIVES may be distinguished by candor and fairness, that its impartiality may be absolute, and that, especially in the reports of cases, the love of truth may be always conspicuous.

Already a large number of the highest living authorities in the general and special branches of Electrology and Neurology have promised to contribute to this journal. In this list of actual and prospective contributors are the names of ALTHAUS, of London; BENEDICT, of Vienna; HITZIG and EULENBERG, of Berlin; ERB, of Heidelberg; VÄTER, of Prague; ONIMUS and TRIPIER, of Paris; and in this country nearly all the best known writers on these themes, not only in New-York and Brooklyn, but in all the great medical centres.

It is expected that the next number of the ARCHIVES, which will appear in the early Autumn, will contain important articles by two or three European observers, besides a variety of papers from able and eminent authorities at home. In the same number the editor will begin a series of Lectures, entitled

"THE ELEMENTS OF ELECTRO-THERAPEUTICS,"

the aim of which will be to present clearly and concisely those primary facts and principles of Electro-Physics, Electro-Physiology, Electro-Pathology, and Electro-Therapeutics, of which beginners in the art of Electro-Therapeutics feel a constant need.

The next, and the succeeding numbers of the ARCHIVES, will contain papers by different writers on the following subjects:

Further Experimental Researches in the Physiology of the Brain.

Chronic Alcoholism.

Hysteria and Allied Affections.

Description of Latest Improvements in Galvano-Cautery Apparatus.

Treatment of Whooping-Cough and Debility in Children by Electricity.

Cases Illustrating the Morbid Anatomy and Pathology of various Nervous Diseases.

A NEW METHOD
OF
TREATING MALIGNANT TUMORS
BY
ELECTROLYZING THE BASE.

BY
GEORGE M. BEARD, M.D.

DURING the past three years, I have treated malignant tumors of various kinds by a method of electrolysis, which I have termed *working up the base*, or *electrolysis of the base*.

Ordinary Method of Electrolysis.—In the ordinary method of electrolysis of tumors, the needles, insulated or non-insulated, are plunged directly into the body of the tumor. This method, which was introduced to the profession by Dr. Althaus, of London, is very satisfactory in the treatment of certain benign growths, as erectile and cystic tumors, and goitres, and in many cases its advantages over the knife are very great.

In erectile tumors, the ordinary method of electrolysis causes the formation of a clot, which is slowly and gradually absorbed, and thus a cure is accomplished with little or no pain, and with little or no cicatrix.

In benign cystic tumors, the ordinary method of electrolysis causes decomposition of the fluid contents, stimulates absorption, causes more or less atrophy of the walls, and this way approximately or perfectly cures.

* A very condensed abstract of this paper was presented to the N. Y. State Medical Society, February, 1874.

I have treated quite a number of cases of superficial and subcutaneous erectile tumors and of benign cystics by this method, and with results that have been most agreeable. In some cases, it is necessary to repeat the operation once or twice before the cure is perfected; but the pain in many cases is but slight, or can be readily controlled by local anaesthesia, and hence the operations are but little dreaded. Many of these benign tumors occur in localities where it is highly desirable to avoid a scar. Many of them also occur in patients who dread any ordinary operation with the knife, ligature, cautery, or hot needles.

In some of these cases, the results of the ordinary method of electrolysis are not only satisfactory, but really brilliant, and there is no question that the method will become a permanent part of the surgery of the future.

But for *malignant* tumors, this method of electrolysis does not suffice. It will relieve the pain, but relief of pain can be obtained by simple external galvanization without any needles. It will cause a certain reduction in size, but this reduction is almost always limited, rarely exceeding ten or twenty-five per cent. In some cases, not the slightest perceptible reduction is caused, even by the most persevering use of mild electrolysis. When powerful currents are used, there must, of course, result more or less destruction of tissue near the point where the needles are inserted, and by successive operations the entire growth may be broken down, or may slough away after the operations are discontinued, and it is possible to extend the operations far into the base and surrounding tissues. Some of my first cases were treated in this way; but it is to the last degree awkward, tedious, and involves a great waste of time and force. The time thus spent on the body of the tumor is wasted time.

Method of Operating.—The patient must first be fully etherized. The method of operating on a *small* tumor is to first insert the needle connected with the positive needle underneath the tumor and near the border. A similar needle connected with the negative pole is inserted also underneath the tumor, and, if possible, at some distance below the base of the growth, so that the point emerges on the opposite side. The current is now gradually let on, and the strength increased until the

electrolysis becomes active, as will be indicated by the yellowish form that appears at the negative pole, which becomes gradually loosened. As the action increases, the negative pole may be slowly worked from side to side, with a slight cutting motion, so as to undermine the tumor. The positive meanwhile remains *in situ*; it becomes firmly adherent through oxidation, and need not be removed until the close of the operation.

After the tumor falls off, through the thorough undermining of its base, the base itself can be worked up in all directions with the needles, or with a harrow electrode that I have devised for this purpose. After the removal of the growth, it is well to change the position of the poles in working up the base, so that all parts of the surface may get the benefit of the action peculiar to both poles.

If the tumor is a large one, as an extensive epithelioma, or scirrhus, it is better to have it first removed by the knife. The base can then be worked up in the manner just described.

The cavity after the operation has a charred appearance.

The time required in an operation of this kind ranges between ten minutes and a half or three quarters of an hour.

Little or no pain follows the operation, although the charred appearance of the cavity that has been thoroughly electrolyzed suggests terrible agonies.

Instruments required.—For this method of working up the base, I have devised needles, or electrodes, that are quite different from those employed in the ordinary method of electrolysis. The needles are long, spear-shaped, double-edged, and tolerably sharp, so that a slight cutting action may be combined with the purely electrolytic action. These needles are not insulated, except in that portion that is grasped by the hand in operating. In nearly all of these operations, I have used the zinc-carbon batteries of sixteen or thirty-two cells, and usually those of the Galvano-Faradic Manufacturing Company; and when a good deal of work is to be done in a short time, as in important electrolytic operations, no batteries are better than these. The various modifications of Daniell cells, which

are so excellent in central galvanization, are not well adapted for powerful electrolysis.*

Theoretical Arguments in favor of the Method.—The theoretical considerations that bear on this subject are both interesting and important. The theory of the pathology of malignant tumors and the theory of the nature of electricity are both to be considered. My own view of the general pathology of malignant growths is, that the tendency to develop them under the necessary exciting causes—the *diathesis*—is constitutional; and, like all other constitutional tendencies, the tuberculosis or the gouty, for example, is subject to the laws of hereditary descent, with all the exceptions and variations. But diathesis is one thing, disease is another. In order that diathesis may develop into positive local disease, it is necessary that there should be some irritating or exciting cause. The great exciting causes of malignant tumors appear to be injuries of some kind, and very likely cold and dampness. It is probable that not only the injuries that come from blows and falls, but the irritation of bad food in the alimentary tract may excite the disease; and in this way, we may perhaps explain the primary cancers of the stomach, liver, and intestines. The majority of cases of epithelioma of the lip, tongue, and face, and of scirrhus of the breast that I have seen trace their disease quite directly to some local injury, as blows or falls. In one patient, an epithelioma of the face developed in an old scar; in another patient, from a slight cut made by a razor. A man who worked in a carriage manufactory, and who kept tacks in his mouth much of the time, died of epithelioma of the tongue. A cystic of the breast in one case rapidly and directly followed a fall against a corner of a bedpost; in another case, the irritation of the corsets was the assigned cause. Dr. Stephen Smith tells me that he saw a case where scirrhus of the breast was pretty directly traceable to a blow that a lady received on her breast from her husband's elbow while turning in bed. Dr. S. T. Hubbard says that he has seen cases of scirrhus that appeared to be excited by abscesses of the breast. All such statements of patients must, of course, be

* The reasons for this I have explained in detail in my recently published pamphlet on *Ohm's Law, and its Practical Applications to Electro-Therapeutics*.

received with much allowance for error and for careless observations, and yet it seems scarcely possible that so many intelligent patients—most of whom have no theory on the subject—should agree in tracing the origin of the different forms of external cancer to local irritation. Cancers of the rectum, uterus, and vagina could easily be explained on this theory, for these parts are subject to almost constant irritation; and in confirmation of this view, it has been shown by statistics that the very great majority of cases of cancer of the uterus begin in the neck, and not in the body of the organ. Cases of external cancer that are not traceable to any special injury may very likely be excited by exposure to wet or cold, and, in confirmation of this view, Professor E. Andrews, of Chicago, has shown by statistics gathered from the United States statistical returns for twenty years, that the proportion of deaths from cancer diminish pretty regularly as we go West or South—away from the seacoast and toward warm latitudes. Making all allowance for errors in diagnosis (and when a patient dies of external cancer, at least, there is little chance for blunder), and taking into consideration, also, the facts that the stronger people go West, and there lead less confined and artificial lives than the residents of the East, it seems necessary to accept the conclusion that cold and dampness may act as exciting causes of cancer, just as they unquestionably act as exciting causes of consumption.

The analogy of consumption is quite an advantage here. The tendency to consumption—the *tuberculous diathesis*—is constitutional, and subject to the laws of hereditary descent. The disease is local, and is, in some cases at least, excited by local irritation. But the tuberculous diathesis is very different from tuberculous disease. Thousands of people with the tuberculous diathesis go through life without ever becoming tuberculous; they either escape the exciting causes, or successfully resist them. Just so we may suppose that thousands of people can go through life with the cancerous diathesis without ever developing cancer. A dozen women, we will suppose, fall against a bedpost and injure their breasts; three of the twelve develop scirrhus in the injured breasts, and the other nine, perhaps, never think of the matter afterward. The three who

develop scirrhus have the cancerous diathesis; the nine who do not develop scirrhus have not the cancerous diathesis. If these three had not been injured in that way, or in some other way, they would not have had cancer; the diathesis alone was powerless to develop the disease, just as coal is powerless to make a fire until it is lighted.

The most recent pathological investigations seem to point pretty clearly to the view that cancer is a local disease, and affects the adjacent parts and the general system by actual transfer of the cancer-cells.* The disease spreads like a fire on a prairie, in various directions, seizing those tissues on which it can best feed, and sending out patches of morbid substance far in advance of the border of the tumor. Thus it happens that cancer cells are found not only in and around a cancer, but, at a distance from it, little islands of cancer-cells appear, surrounded on all sides by healthy tissue.

We must, therefore, fight cancer as we fight a great fire, not by useless efforts to save the part already destroyed, but by drawing a cordon around it, between it and the healthy tissue, and cutting off its communication even at the expense of the healthy tissue.

If we accept these views, we must also accept the view that *cancer, whatever constitutional treatment we adopt, should be treated locally, and by some method of local treatment that acts not only on the body of the tumor, but also and especially on the surrounding tissue, and that the earlier such treatment is used, the better the prognosis.*

If we accept these views, we must also accept the view that the present method of removing the body of the tumor with the knife, and then closing the wound so that it may heal by the first intention, is precisely the method that would be adopted if it were desired to have the tumor recur. The battle-ground on which is to be fought out the question whether a cancer is to recur is not in the tumor itself,

* See "A Lecture on the Structure of Cancerous Tumors, and the Mode in which Adjacent Parts are Invaded," by Dr. Woodward, Assistant-Surgeon, U.S.A. The Toner Lectures of the Smithsonian Institute, Washington, November, 1873. See also the recent and admirable discussion of the subject by Drs. De Morgan, Hutchison, Paget, and others, in the *Lancet* for March and April, 1874.

but in the surrounding tissue, and at a considerable distance from the main body of the tumor. The knife only removes the hopelessly diseased tissues that are most apparent to the senses and most accessible. But around the tumor itself, and perhaps on every side, there is an areola of morbid and semi-morbid tissue mingled with or inclosed by healthy tissue; there are tissues that are gradually and imperceptibly shading off into morbid tissues. When now we remove the tumor and close up the wound, we leave the areola mostly untouched, and shut up the cancer-cells in a soil best of all adapted to nourish them. Hence we need not wonder that the disease recurs either immediately in or near the place of removal, or that the cells wander to some distant part where another tumor appears after months or years.

The morbid or semi-morbid tissues that surround malignant tumors have been treated in various ways by caustics, in substance, by caustic needles, and by the actual and galvanocautery. So far as I can learn from the experience of surgeons who have faithfully tried any one or all of these methods, the results are more satisfactory than the results of ordinary treatment by the knife or ligature. Dr. Stephen Smith informs me that he experimented some years ago quite extensively with the caustic needles. These were made of chloride of zinc, and thrust into the tissue around the tumor. Their effect was to destroy not only the tissues immediately around each needle, but also the tissue between them and at some distance from them. The results of this treatment were, in his opinion, which is based on quite a number of cases, more satisfactory than the ordinary treatment.

The theoretical arguments that electrolysis of the base would produce more radical results than the use of caustics are based necessarily on our ideas of the nature of the electric force and of the process of electrolysis. When electrodes connected with the two poles of a galvanic battery are inserted into the animal tissue, the vibrations of the electric force not only pass between the electrodes, but extend at a considerable distance in all directions from them. While most of the vibrations appear at the poles, very many extend at a distance from them, varying with the strength of the current and the conductivity of the tissues, and thus the nutrition of the surround-

ing tissues is more or less modified. In this way, it is possible that the degeneration of healthy into morbid tissue may be prevented, at some distance from the electrodes and from the median line between them.

Besides this general modification of nutrition through the chemical and other action of the current, there are two other effects that are to be considered. These effects are cauterization and destruction of tissue. Just how much these effects contribute to the results of this method of treatment, I am not yet able to determine. In a protracted operation with strong currents, the cauterization is so great as to make the base worked over present the appearance of a charcoal-pit. The hemorrhage, excepting that which comes from large arteries, is of course stopped. The destruction of tissue that takes place during the operation is not great, but after the operation, it appears in the form of sloughing, which sometimes is quite extensive.

The destruction of tissue that takes place during the operation is the result in part of the electrolysis and in part of the cauterization, but is mainly due to the former. It should be kept constantly in mind that this chemical effect—the electrolysis—is the effect that is specially sought for in the method of working up the base, and it is probably by virtue of this mainly, though not entirely, that the permanency of the results are due.

PRACTICAL VALUE OF THE ORDINARY METHOD OF ELECTROLYSIS.

Although the ordinary methods of electrolysis and the processes of external electrization with moistened electrodes fail to cure malignant tumors, they are yet of a certain palliative efficacy, and may be adopted in those cases where the method of working up the base is impracticable, or when any attempt at radical cure is inadvisable.

1. The majority of cases that are attended with pain are relieved of this pain more or less permanently by the galvanic current, whether applied externally, by sponges, cloths, or metals (catalyzation), or subcutaneously by needles (electrolysis).

In some cases, the relief of pain appears during the application: in others, some time after the close of the sitting. It may

last for several hours, or for several days. The galvanic current seems the more efficacious for this purpose than the faradic. A strong current is not required; indeed, may sometimes enhance the pain already in the tumor, and in some cases a too prolonged sitting may do harm. There are cases, however, where the current may be used for hours.

The power of ordinary electrolysis to relieve the pain of hopeless cases of cancer was well shown in a case of scirrhus of the breast, that was referred to me by Dr. Skene. I could not prevent the extension of the disease; but, from the application of the current, through all the experiences of several operations, she suffered but little pain, and in gratitude for that, she allowed me to experiment with her as much as I wished.

Two years ago, I was called to Bridgeport, to see, in consultation with Dr. T. G. Lewis, a case of malignant tumor of the abdomen, for which I advised prolonged galvanization. For several hours a day the current was allowed to run through the tumor, and the pain and distress were very greatly relieved thereby. When the patient died, a colloid, weighing 15 pounds, was found in the abdomen.

In two cases of recession of cancer of the breast to the axilla, the pain was not relieved.

In a case of epithelioma of the tongue—a patient of Dr. Burge—there was immediate, though temporary and limited, relief of the pain by the application of the galvanic current. The relief, after some of the applications, would last for several hours, and even one or two days. The patient has died of the disease, but lived long enough to demonstrate the power of the galvanic current to relieve somewhat a most serious phase of disease, and that, too, in a locality where only very mild currents can be borne.

2. The electrical treatment, both external and subcutaneous, causes more or less diminution of size in morbid growths, and, in occasional instances, tumors may entirely disappear under external electrization alone.

The cases of entire disappearance are, as we have seen, exceptional; but they are facts, none the less, and must be considered in giving a *résumé* of the present state of this department of electro-surgery.

Under either current, a tumor may go down all the way from one quarter to one half. In some cases, this retreat of the disease before the current is temporary; in the course of months or years, the morbid forces recover their courage, and again advance, but in other cases the result is quite permanent. Goitres, especially of the cystic variety, and old goitres that are not too large and too dense, can by this method be greatly reduced in size, and in some cases are entirely cured. Similarly, fibroids of the uterus can be reduced in size, and many of the unpleasant symptoms which they cause can be mitigated.

The explanation which I have to offer for the reduction of tumors under electricity is the following:

First. Stimulation of the absorbents, so that morbid matters are taken up into the circulation.

This result may be attained by external electrization with either current. The faradic current by its mechanical influence undoubtedly stimulates the absorbents, and thus causes reduction in the size of growths. A certain percentage of cases have been known where, under faradization alone, morbid growths of some size have entirely disappeared, and a moderate and limited subsidence of such growths, under the exclusive use of the faradic current, is a matter of frequent observation.

Secondly. The electro-chemical decomposition of the fluid constituents of the growths. Not only the water of the blood, but the saline solutions of all the tissues are, under the galvanic current especially, subjected to the chemical changes, acids and oxygen going to the positive, and alkalies and hydrogen going to the negative pole. The elements thus decomposed are, we may suppose, partly absorbed, and partly escape to the surface.

These chemical changes are, of course, most marked when the needles are used—electrolyzation; but there is every probability that they occur during external galvanization. When we consider that the human body is mostly fluid, we can readily enough understand why this decomposing power of the current should be an important factor in causing the reduction of tumors.

Thirdly. Coagulation of the albuminous constituents. Blood is coagulated by the galvanic current at both poles, and especially at the positive, as I have repeatedly demonstrated by a

variety of experiments on animals, and we may believe that in a similar way the albuminous portions of the tissues are coagulated in the region near where the needles are inserted.

Fourthly. Actual destruction of tissue by the thermic or heating power of the current. Cauterization is not the leading factor, as many suppose, in the treatment by galvano-puncture; it is merely an incidental effect of the passage of the current through the poorly conducting human tissues, and of the chemical action evolved by the current, and is not the effect that is specially desired, and only plays an important part in those cases where very strong currents are used with prolonged applications.

ADVANTAGES OF THE METHOD OF ELECTROLYZING THE BASE.

1. Less liability to recurrence.

I have kept close watch of a majority of the cases that have been treated in this way during the past three years. In the list of cases are found several epithelioma of the lips and face, and one case of malignant cystic of the neck. But one of the cases of epithelioma of the lips and face has yet recurred; although the time that has elapsed since the treatment varies all the way between three years and four months. The case of malignant cystic has not yet recurred. It is yet too early to arrange any statistics on this subject, for, as every surgeon knows, some cases of epithelioma are permanently cured by the knife, and their prognosis under ordinary surgical treatment is better than that of scirrhus of the breast, or indeed scirrhus anywhere. It is a fact of high encouragement for this method of working up the base, that the case of malignant cystic tumor, and one of the cases of epithelioma had previously been operated on by various other methods, as the knife or the ligature, and in each case there had been rapid recurrence. If the experience of the future shall confirm the experience of the past, if a larger induction shall show as satisfactory results in proportion to the cases I have thus far treated, then the question will in time be settled beyond dispute.

Some hopeless cases—notably a case of scirrhus of the rectum, and epithelioma of the vagina—I have treated by this method in order to palliate the symptoms and prolong life, and with most interesting and remarkable results. Indeed, I have

been as much encouraged by the palliative effects obtained in these hopeless forms of malignant disease as by the apparently radical cures of milder cases.

It follows, from the theoretical considerations above given, and experience confirms this view, that the results of this method of working up the base will depend entirely on the *thoroughness with which the operation is performed*. If the base be but half electrolyzed, if patches of morbid tissue be allowed to remain, then there will be a recurrence in all probability, just as after other modes of operating. I have tested this in cases in which, for anatomical reasons, it was impossible to thoroughly electrolyze the base, and in all cases there was a recurrence. Better not use the method at all than use it timidly or imperfectly. The operation should not cease until the whole base of the tumor and the surrounding tissue for a considerable distance have been completely worked up, and any enlarged glands should be treated in the same way; for although more or less sloughing follows the operation, and in that process more or less morbid tissue may be removed, yet it is not safe to trust to that, as I have found by fair trial.

If the theory of cancer on which this method of treatment is based be sound, then it is not right to assume that when a person who has been operated on for cancer develops another cancer months or years afterward, that the second growth has any direct relation to the first; it may have arisen independently, under some form of local irritation, and might have occurred even though the first one had never existed. The question may arise quite frequently whether a cancer that follows a removal—whatever method of operating be adopted—is a secondary or an independent growth.

During the past winter, a lady was brought to me by Dr. A. N. Dougherty, of Newark, with a large and rapidly-growing tumor of the scalp. Two and a half years before, Dr. Dougherty had removed a scirrhus from the breast. A German pathologist thinks he has seen the ameboid movements of the cancer-cell, and it is possible that the remains of the tumor may have traveled from the breast to the vertex; but it is, to say the least, just as probable that constant irritation of the heavy comb which the patient used had acted as an exciting cause of

a separate and independent cancer, that would have appeared even if the cancer of the breast had never existed.

In regard to the prognosis of malignant tumors under this method of treatment, then these three facts are worthy of consideration :

Firstly. Some forms of malignant tumors are disposed to extend much more rapidly than others. Thus scirrhus spreads more rapidly than epithelioma.

Secondly. The rapidity with which a malignant tumor extends is very much modified by the structure of the part in which it occurs. In glandular and in soft and mucous tissues, a malignant tumor extends more rapidly than in the skin or in hard tissues. In making the prognosis, therefore, it is even more necessary to consider the *locality* of a malignant growth than its precise nature. An epithelioma of the tongue or vagina has a far more rapid course than a similar tumor of the face. A scirrhus of the womb has a worse prognosis than an external scirrhus. All this is explained by and is in harmony with the theory of cancer above given. In soft tissues, the cancer-cells travel easier, and thus more rapidly affect the surrounding parts.

Thirdly. Tissues whose organization is low, or which are in a condition of degeneration, are specially disposed to take on cancerous degeneration. Thus, the breast and the womb at change of life are more disposed to cancer than earlier in life. Cicatricial tissue always invites cancerous degeneration.

2. Less hemorrhage than other methods of operating. The reason for this has already been explained—electrolysis coagulates the blood, constricts the tissues, and slightly cauterizes them. Ordinary parenchymatous hemorrhage is thus controlled in the most satisfactory manner, so that if a strong current is used, neither sponges nor styptics are required. This power of electrolysis to prevent ordinary hemorrhage in operations, I have shown in treating cases of growths of exceeding malignity.

The cauterizing and coagulating power of electrolysis is not usually sufficient to check the hemorrhage when an artery of any size has been ruptured, as I have found out by actual experience in two cases where I was operating with Dr. A. B. Crosby. I made little attempt to check the hemorrhage by the needles, preferring that Dr. Crosby should tie it, which he did.

3. Less liability to shock. I form this judgment from protracted operations made on patients in various stages of debility, and in the extremes of life, infancy and old age. I have not yet seen any effect at all suggestive of shock, after very long sittings under strong currents, even where sensitive localities were operated on. The electric current would indeed appear to be one of the very best *antidotes* to shock, and for a long time it has been known and used as a means of resuscitation.

4. It is followed by a more satisfactory healing than other operations. This fact has been observed markedly in several severe and hopeless cases, and has attracted the attention of all the surgeons who have seen the cases. (In illustration, see the case reported by Dr. Crosby, in the May number of the ARCHIVES OF ELECTROLOGY AND NEUROLOGY, pp. 98-103.)

5. There is reason for the belief that the future will show that septicemia and pyemia are less likely to follow electrolysis than other surgical operations. It is more than probable that electrolyzation, like cauterization, constricts the absorbents so that they can not as easily take up pus with the circulation. I am well enough aware that years must elapse before this question can be statistically demonstrated, but it is certain that in the very many operations in the vagina, rectum, and in localities that would invite pyemia, no such result has followed. Dr. Byrne tells me that in all his operations with the galvano-cautery, no case of pyemia has occurred, and that excellent healing usually follows. Dr. Livingston, of New-York, who has had much experience with the galvano-cautery, gives me the same testimony.

6. To all these facts must be added the consideration that many patients dread the knife—without reason it may be, and without common-sense; but patients are not expected to exercise reason or common-sense—and such persons are willing to submit to electricity, however employed.

The advantages of working up the base by electrolysis, as compared with working up the base by caustic, the actual cautery, or the galvano-cautery, are worthy of study. Some of the advantages claimed for electrolysis of the base quite as truly belong, in a certain degree at least, to galvano and actual cautery and the caustic needles. All these methods

tend to constrict the absorbents, and thus prevent pyemia. All of these are followed by sloughing, with whatever benefits may come from loss of tissue. Any one of these would seem to be better for a malignant tumor than the knife or ligature, when used alone. It is hardly probable, however, for the reasons above given, that the prospects of radical cure after cauterization will be as good as after electrolysis.

An extended experimental comparison of their effects, in this regard, has not yet been made.

DISADVANTAGES OF THE METHOD.

Against the advantages of electricity, must be set these disadvantages.

1. It requires apparatus more or less bulky, and that require more or less experience in their management. Simple external applications may be made with currents from comparatively small batteries, but powerful electrolyzation requires from 15 to 30 or 40 cells of reasonable size. Batteries for electrolysis can be made portable, or at least transportable, so that they may be taken from house to house, and moved through the different wards of a hospital.

2. Electrolytic operations frequently require more time than operations with the knife or ligature, and in some cases, the operation must be repeated.

If electrolysis produced shock, this element of time might, perhaps, be a serious one; but, inasmuch as it appears to act as an antidote to shock, and as the stimulus of the current allows us to prolong anæsthesia with safety, and, as in many of the cases where electrolysis is used, treatment by knife or ligature is contra-indicated, this objection need not deter us from resorting to it.

3. The irritative fever that follows powerful and prolonged electrolytic operations is sometimes quite severe. This fever rises to its highest the second and third day after the operation, and then gradually subsides. The parts around the tumor operated on become more or less swollen, but are not usually painful, and this swelling also soon subsides.

4. When great sloughing ensues, in very vascular growths, there may be secondary hemorrhage from blood-vessels that become involved.

There is usually no difficulty in ascertaining whether there is probability of secondary hemorrhage, either from our knowledge of the vascularity of the parts, or from tentative operations with the needles.

Looking now at the general subject of the electrical treatment of tumors, I conclude that this method of working up the base, as an addition and supplement to other means, is entitled to consideration among the surgical procedures of the future. It will not be used recklessly nor indiscriminately, nor with overweening confidence; but its indications and contra-indications will be understood both by surgeons and electro-theraputists, and the result may be a positive advance in the art of healing—not so complete a victory as we would wish, but yet an important and consolatory something; and this, in time, may prepare the way, we may hope, for further and better victories by other agents, in the generations to come.

Before closing, it is proper to state that the ordinary method of electrolysis, if thoroughly used and repeated a sufficient number of times, may run into this method of working up the base, and in epithelioma, at least, may accomplish good results. The body of the tumor may be gradually broken and destroyed; and then, in successive operations, the needles may be made to work up the base and surrounding tissue. Groh,* of Vienna, has used this method with success in quite a number of cases of epithelioma, as well as of sarcomatous growths. I have used the same method in epithelioma, and with success. The method has, however, the sufficiently serious objection that it first wastes the time and strength of the patient on unnecessary treatment of the tumor, and is only successful in proportion as it falls back on the method of working up the base and surrounding tissue.

* *Die Electrolysis in der Chirurgie*, Vienna, 1871. Groh has also treated sarcomatous growths by very prolonged electrolysis, with mild currents. This method seems to have greater inconveniences, without any compensating advantages.

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