

APPLICATIONS AND ADVANTAGES OF STABLE GALVANISM

By DR. HAROLD THOM.

TO-DAY it seems to be for several reasons particularly appropriate to draw attention to a physiotherapeutical medium of prime importance, namely to the simple direct current. Particularly so since electrotherapy—we refer here only to the direct application of the electric current—like perhaps no other method is in the unfortunate predicament of losing its rightful position in physiotherapy as a result of incorrect use and insufficient knowledge of methods and indications. However, due to the introduction of modern low-frequency therapy, its great success and advancement above all in the treatment of paralyses, the danger of letting fall into oblivion a method known and approved for almost two hundred years has by no means become smaller.

Moreover, knowledge of the biological effects of the direct current constitutes the basis for the understanding of the entire low-frequency therapy since the modified and interrupted (no matter in which way) direct current being the starting-form for all stimulating currents used today can eventually always be traced back to the constant direct current. Knowledge of its effects is accordingly an absolute necessity for all further understanding. Finally the constant (or also simple surging) current has a wide, therapeutic range in ionic and iontophoresis which we shall later treat in detail. Combined with histamine, bee-poison, etc. this method has an excellent influence on the various forms of rheumatism, on neuralgiae, arthroses, circulatory disturbances, etc.

The use of the galvanic current for electrolysis has been in the main replaced by cold cauterization (high-frequency surgery). It is however still used frequently for the removal of hairs, warts, etc. as well as for electropuncture (surgical galvanization).

As against the continuous galvanization current the interrupted direct current has additional, completely different effects upon the human body, especially on all contractile tissues. Here it is used chiefly for electrogymnastics and diagnostics by means of its stimulating effect resulting from the make and break of the current. However we shall discuss only the effects of an evenly flowing, non-interrupted direct current with fixed electrodes, in short the effects of stable galvanization.

Generally the term "stable galvanization" denotes merely the use of fixed electrodes. It does not apply to a "stability" of the current. In our case, however, stable galvanization shall mean also the use of a continuous direct current.—On the other hand, a "non-stable galvanisation" designates the use of mobile electrodes, e.g. rollers or brushes. Here usually "faradic" currents are applied, since with this technique mostly a nonspecific exciting effect is intended.

The reasons for the diverse effects of the electric current are to be found in its capacity of causing changes in the electrochemical concentration of the tissues. For explanation of the processes taking place hereby the theory first expressed by Nernst at the beginning of this century can essentially still be applied. It constitutes even today the basis for understanding the physiological and therapeutical effects of the electric current.

Since the human (and animal) tissue from the viewpoint of physics represents a semi-conductor, transport of the

electric current through the tissues is taken over by ions (migrating ions); as against the metals, first-class conductors, where accordingly the transport is taking place by electron flow. These electrically charged atoms resp. groups of atoms (ions) are created by electrolytes splitting into negatively and positively charged particles when the current is led through. Thereby the moment the circuit is closed all positively charged electrolyte components (cations) start moving towards the cathode and all negatively charged components (anions) towards the anode. Thus there is not only a flow from the so-called plus to the minus pole—as is assumed for the sake of easier comprehension—but also in the opposite direction. In addition to the transport of charged particles a certain part is played also by the transport of uncharged particles. However we shall not enter here into the particulars of these partly very complicated processes paraphrased by terms like electroosmosis, cataphoresis, electrophoresis, etc.

The migration of ions, taking place hereby, effects in the main a change in the chemical concentration, and that in the cell substance (protoplasm) as well as in the tissue fluid. On account of variable conditions of permeability these changes of concentration occur chiefly on the cellular limiting surfaces resp. wherever two media of a different kind border on each other. Since for instance the hydrogen ions due to their smaller molecular size possess a considerably higher migration velocity than the organic anions, therapeutically useful effects result, for owing to evacuation of sour inflammatory products a favourable influence on the foci of inflammation is achieved. Furthermore, by the extensive migration of ions as well as by the change in the chemical concentration resulting thereby all metabolism and biological processes are intensively stimulated. Thus countless halogen and mineral ions are activated and mobilized without administration of alien substances, whereby this physiological process is additionally aided by a likewise effected longlasting hyperemia.

The vasomotor and trophic effects of the galvanic current are no less significant; they can be readily observed by examining after galvanization, especially under the electrodes, the flushed and warm skin. It could be demonstrated by thermoelectrical measurements that hereby the skin temperature is increased by more than 2 to 3° C. The circulatory increase caused by the galvanic current is far higher than the one attainable by massage or even by short wave therapy. However, the hyperemia is not limited to the skin, but extends also to the more deep-seated tissue layers.

A further advantage of the hyperemia produced by galvanization is its very long duration. Even after days an increased tendency towards vasodilation can often be shown. If one or two days after a galvanization a patient is treated for instance with hot-air, the skin area which was covered by the electrodes used for the galvanization stands out distinctly against its surroundings by its deeper redness. This longlasting increased circulation has in many respects a favourable effect on the pathological process, not at last also on the improvement of the trophicity of the tissues which is nearly always affected as a result of paralyses, especially poliomyelitis, and of circulatory disturbances.

In addition to the favourable influence on circulation and trophicity as well as the stimulation of all processes of metabolism, the sedative and analgesic effect of the galvanic current, taking place predominantly under the anode, is playing an important part therapeutically. This soothing effect is not limited to all peripheral (sensory) nerves, but can also be demonstrated on the central nervous system.

Thus, if certain low animals, e.g. fishes, are exposed to an electric current in such a manner that the anode is at their head and the cathode at their tail, they fall after a short time into a kind of narcosis. When the direction of the current is suddenly reversed however, the animals wake up immediately and in violent agitation change their position so long until—with their head turned again towards the positive pole they relapse into narcosis. This process, observed for the first time in low animals and termed electrotropism, applies in a certain way also to the central nervous system of higher animals and of human beings.

If we apply for therapeutical purposes the plus pole to the head and the minus pole in the region of the os sacrum ("descending galvanization"), a reduction of the reflex excitability can be demonstrated. This methodology used for the first time by Scheminzy is favoured even today in the treatment of all spastic paralytics, hemiplegics and others, and there is hardly another type of physiotherapy which in these cases would be superior to the simple galvanic current. Unfortunately it happens again and again that such spastics are treated with faradic surging currents and possibly even with the faradic roller. Such thoughtless therapy is already bordering on what is customarily called malpractice.

An additional field of application of the constant direct current to which much too little attention has been given is the therapy of paralyses. Here it is able to achieve excellent results as a supporting and preparatory measure for subsequently applied electrogymnastics with selectively acting stimulating currents. Since a constantly flowing direct current—at therapeutical amperages—does not cause any muscle contractions, it was formerly taken for granted that no usefulness could be attributed to it in the treatment of paralyses. However, ample experimental studies are available by a large number of authors where the beneficial effect of the constant galvanic current on paralyzed and atrophic musculature was proven unequivocally. The first tests of this kind were carried out as early as 1848, when Reid was experimenting with frogs which he paralysed on their hind legs by cutting through the respective roots of the spinal nerves and which he then galvanized only on one side. After two months the muscles of the treated side could still be well excited electrically and shew no decrease in volume, whereas the musculature of the other untreated side was atrophic and had shrunk. In 1875 Déjerine repeated these experiments on guinea-pigs whereby he obtained the same favourable result. Later Götze and Piontkowski carried out similar tests on dogs and rabbits with equally good result. They were, moreover, able to prove histologically that regeneration in the treated muscles was more rapid. Kosaka and Izwa as well as Lenoche obtained the same result. As can be inferred already from these few citations, not all therapeutic methods in use are based on such an abundance of experimental studies as well as clinical experiences as precisely galvanization.

The beneficial influence of the galvanic current on paralyses is not least due to its effect on vasomotricity and trophicity, manifested by a hyperemia of long duration. This is especially true for all paralyses caused by poliomyelitis which as a rule represent the largest contingent of the cases coming up for treatment, since the combating of vasomotor and trophic disturbances manifesting themselves above all in cyanosis, paleness and coldness of the skin, is playing an important part here. However, the hyperemia produced by galvanization is not limited to the skin but

extends also to the more deep-seated tissues, as could be proven by Strauch by means of plethysmographic examinations. An effect of no lesser importance for the therapy of atrophic paralyses is the reduction of the rheobase, appearing—particularly under the negative electrode—as a result of galvanization. It is expressed by a more easy excitability of the affected nerve-muscle systems concerning not only electrical impulses (reduction of the chronaxy, etc.), but also for instance purely mechanical impulses (examination of tendon reflexes). However, not only will musculature pretreated with constant galvanization show an increased response to subsequently applied pulsing or surging current therapy, but above all the patient will respond better to voluntary impulses originating in himself. Therefore after each treatment the patient is made to carry out active exercises, which undoubtedly represent the aim of all our therapeutic efforts in the treatment of paralyses.

Forms of application of galvanization.

Best suited for carrying out a stable galvanization are plain metal plates of zinc or lead which are available in various sizes or which can be cut from a big sheet in the desired shape. Between the skin and the electrode plates an intermediate layer of fabric, as thick as possible, is placed—Kowarschik recommends terry cloth folded eight times—which should somewhat surpass the rim of the metal plates. In no case should the electrode itself or a not insulated connecting terminal (crocodile terminal) be in direct contact with the skin, since otherwise cauterizations will be the inevitable result. The intermediate fabric layer has to be well soaked with water (warm if possible) in order to render it electrically sufficiently conductive. (Adding salt to the water increases the conductivity, but is superfluous, especially in modern units which keep the current intensity constant independently from the resistance). Water is for many purposes of galvanization the ideal electrode. This can be applied either in form of a two or a four-cell bath or in form of a hydroelectric full bath, e.g. the Stanger bath.

The four-cell bath according to Schnee consists of two nonconductive tubs for the arms and the feet containing metal or carbon electrodes protected against direct contact. By means of a special arrangement it is possible to adjust various current directions and combinations of the individual tubs. The great advantage of this bath as against the electric full bath is on one hand the fact that the patient does not need to undress, and on the other hand that the currents indicated on the milliammeter are really traversing the body at full intensity whereby the current density is indeed greatest on the extremities. The four-cell bath can naturally be used also as three, two or one-cell bath. In the latter case a conventional electrode with underlaid fabric constitutes the second pole. As a rule the one or two-cell bath is used for the treatment of single extremities, while the four-cell bath is applied for having the current flow through the entire body.

The hydroelectric full bath is suited particularly for general treatment. Due to the good conductivity of the water a large part of the current by-passes the body of the patient unless membranes of a suitable insulating substance stopping the current are used. Concerning the dosage one is for the most part dependent on the sensation subjectively experienced by the patient.

The Stanger bath is a special form of the hydroelectric bath whereby certain substances are added to the water (tannin).

Owing to an ingenious arrangement of numerous protected electrodes selective treatment can be given to various parts of the body. The effect of the electric full baths is supported additionally by the soothing and relaxing influence of the warm water (34 to 37°C.). For rheumatic diseases a hot bath of about 40°C is recommended.

Otherwise the size of the electrodes is selected according to the purpose. Since in stable galvanization it is intended to have the current flow evenly through the body or individual parts of the body without giving preference to either one of the poles, as a rule two electrodes of equal size are chosen.

If particularly intensive treatment is desired as for instance in the therapy of ischialgiae, the so-called transversal galvanization recommended by Kowarschik—as against the usual longitudinal galvanization—can be advantageously applied. Hereby about 25 inches long and 3 inches wide electrodes are used which are applied to the flexor and extensor side of the leg (cathode below). Care has to be taken in each type of transversal galvanization that the electrode width should not be more than a quarter of the circumference of the extremities, since otherwise at the points of contact of the two electrodes an undesirable increase of current density can result, the so-called fringe effect.

The duration of a galvanic treatment is as a rule 10 to 15 minutes. In excitable and sensitive patients one begins with shorter treatments and increases the periods gradually in the course of the therapy. For the treatment of severe neuralgiae in particular, like sciatica or facial neuralgiae, it is recommended to extend the treatment to one half or three-quarters of an hour.

Finally it has to be mentioned that adjusting the desired amperage may never be done suddenly. The current has to be increased gradually, it has to "creep in" as we usually say. In this manner considerably higher amperages can be applied than if the intensity is increased rapidly. Accordingly breaking the circuit also has to be done slowly. This applies especially to excitable patients as well as to treatments of the head, since otherwise dizziness and other disagreeable sensations may easily occur. Just as the current may not be suddenly interrupted during treatment it may not be reversed either. If a change of the current direction is intended, one first has to creep out slowly and only after having changed the direction of the current creep in again slowly.

Among the chief indications of stable galvanization are neuralgiae and every type of neuritis including trigeminus neuralgia as well as occupational neuralgiae. Further myalgiae (lumbago, wry-neck, muscle cramps and spasms, atrophic and spastic paralyses, tremor, paralysis agitans, postencephalitic conditions and migraine.

Hydroelectric full baths as well as four-cell baths are applied above all in general stages of excitation, spastic diseases of various kinds, paralyses of sections of the spinal cord, multiple sclerosis, insomnia as well as angiospastic diseases (Raynaud intermittent claudication) and circulatory disturbances of different genesis.

There is no doubt that the field of indication of hydroelectric baths and that of ultrasonics are to a great extent overlapping. Whether to use hydroelectric baths, ultrasonics or mud-bath will have to be decided individually from case to case according to the given circumstances and with doctor and patient in agreement. In certain cases also a combination or an alternating use of various methods will be of advantage. In chronic rheumatic diseases, chronic deforming articular diseases as well as in chronic inflammatory diseases of the adnexa generally a mud-bath treatment is preferred.

Generation of direct current.

A review of the value of the galvanic current would not be complete without briefly mentioning something about its generation. Besides, handling alternately the most different types of apparatus makes an understanding of the basic principles desirable in order to facilitate effortless manipulation of different models. In principle, the direct current necessary for galvanization can be obtained either by means

of the usual galvanic cells resp. batteries or by connecting the units to the mains. In the latter case this is done by interposing motor converters (in direct current supply)—as in the Multostat or the old Motor-Pantostat—or transformers and rectifiers (in alternating current supply). The battery operated units which, since they do not require any maintenance, are used almost exclusively with dry cells have—as against mains operated units—undoubtedly the advantage of supplying independently from the fluctuations in the mains an absolutely constant current, while the current supplied by way of a motor convertor is always subjected to small fluctuations. Such apparatus were therefore favoured for carrying out most precise diagnostic examinations. In the course of time the battery operated units were almost all replaced by units which can be connected to the mains. Today there is no difficulty any more in converting, by means of so-called filters connected in series, the ripple current obtained from half-wave or full-wave rectifiers into an entirely smooth, i.e. entirely constant direct current. Since the majority of our mains supply alternating current and as a rule the mechanical work resulting from using a motor converter—as in the former Motor-Pantostat—can be dispensed with, for some time already apparatus have been produced where, after interposing a transformer for isolation from the mains and for reduction of the mains voltage, the alternating current is rectified by means of a valve rectifier or a barrier-layer.

All apparatus for galvanization have in addition to a make and break switch terminals for picking up the current (plus and minus pole) as well as a current reverser which makes it possible to reverse the flow direction of the current as often as desired without having to change the electrodes.

All apparatus have an intensity control for adjusting the amperage. Since many apparatus are used for both, galvanization and faradization, they are also equipped with a selector switch for adjusting the desired kind of current, if need be also for constant or surging galvanic or faradic current as well as for the combination of both kinds of currents.

Deliverance . . .

*from pain . . . the humanitarian function of
of the practitioner . . . now accomplished
with greater speed, more economy and with a
higher degree of safety than ever before.*

Full details and clinical notes on
the use of

RENOTIN

in the treatment of Migraine,
Neuritis, Lumbago, Sprains and
Myalgia may be obtained from

Exclusive Distributors for Southern Africa

Protea PHARMACEUTICALS LTD.

P.O. BOX 7793

JOHANNESBURG