

with (1) the apoplectic attack itself; (2) the anatomical changes which are produced in the brain by the hæmorrhage; (3) the focal symptoms, the paralysis (or paresis) of one side; and, in general, all motor and sensory disturbances referable to the attack.

(a) The treatment of the attack itself varies according as we have to deal with a suddenly or gradually developing apoplexy. In the former case we may assume that the hæmorrhage has already stopped when we first see the patient, whereas in the second case the presumption that the bleeding is still going on is justifiable, and hence all measures which tend to arrest the hæmorrhage are strenuously indicated at once. One of these is venesection, which produces a fall in the blood pressure, and should always be resorted to in cases in which, after (or during or perhaps before) a hæmorrhage, the carotids are found throbbing, the action of the heart is tumultuous, and the face red and congested. The success is sometimes surprising. The patient, who just before was comatose and motionless, with stertorous breathing, immediately after a free bleeding begins to breathe more quietly, and evidently with greater ease. He stirs, opens his eyes, and becomes conscious. In such a case venesection was the only measure indicated; it could not have been replaced by anything else—in short, it has saved the patient's life. The compression of the carotid artery, which Spencer and Horsley recommend as a result of their experiments upon animals, will probably be resorted to only in rare instances (*Brit. Med. Journ.*, March 2, 1889). If the pulse is small, the face pale, and the heart sounds are weak, no one will ever think of taking away blood. Then the administration of stimulants will be found useful; of course, they have to be given with great caution, and be selected carefully. Vinegar enemata, sinapisms, and ether injections may be tried. Changes in the blood pressure of the brain ought to be avoided most carefully; they may be produced by turning the patient in bed, by shouting at him frequently, and by other attempts to wake him from his coma. The physician will have to warn the friends against doing this, and do his best to have the patient left quiet and undisturbed. If the face is congested, he will order his head to be placed high and have him kept in one position. Local bleeding from the head is, if not directly harmful, absolutely useless. If bleeding is indicated at all, we shall choose venesection; cupping and leeching are matters of

so much detail and are so slow in their action that they can not be recommended.

Immediately after the attack has passed off and the patient has regained consciousness the chief task of the physician is to see that he has absolute rest. Even more than any other sudden illness, apoplexy produces the greatest excitement and consternation in a family, and it can hardly be wondered at that this gives place to the greatest joy when the patient, who has already been given up, is seen to return to life, and that each member of the family is anxious to express his feeling of satisfaction. All such outbursts may be very harmful to the patient, and these demonstrations must be crushed by the physician with iron firmness in order to avoid any emotion on the part of the patient; besides, he should give directions as to a proper bed which will answer all the therapeutic and hygienic requirements of the case, and, above all, from the very first due precautions against bed-sores ought to be taken. Proper arrangements should be made for the reception of the stools and the urine. The head ought to be covered with thin compresses, cooled with ice-water or with a light ice-bag that will exert no pressure. The application of cold must not, however, be carried too far, since by a contraction of the peripheral vessels we run a risk of producing an increase in the intracranial blood pressure, which would be the opposite of what we are attempting to do. Any simple medicine which contains acids or cream of tartar or tartar. boraxat. and the like, is sufficient for the first few days, during which the patient ought to be fed upon a light, nourishing, but unstimulating diet.

(b) The treatment of the focal lesion in the brain—that is, of the place where the hæmorrhage has occurred—should not be begun until a considerable time has elapsed after the general symptoms have abated. This will usually be from about four to six weeks after the attack. Whether it is actually necessary to wait so long we do not know, but, as a matter of fact, we are afraid to undertake any active measures at an earlier moment, and certainly if a physician should go contrary to tradition, and if accidentally another hæmorrhage should occur, he would lay himself open to severe censure on the part of the family.

On the other hand, it seems more than doubtful whether we are able to influence the disease-focus in any way by treat-

ment or succeed in hastening the absorption which we desire. It is, however, supposed that this can be accomplished in two ways: namely, by internal and external remedies, by potassium iodide and mercury, and by galvanic treatment respectively. The iodide treatment is based on the supposed absorbent properties of the drug. Whether it possesses such a power to any great degree is doubtful, and the fact that it so frequently fails to give good results seems to speak very much against it. On the other hand, there is no question but that iodide, if used for any long period of time, acts deleteriously on the stomach, and spoils the appetite and may lead to symptoms of intoxication. An unprejudiced practitioner who does not administer medicine in a routine way will therefore always first ask himself which of the two is the lesser evil—whether he should renounce such help as is supposed to be derived from the remedy in the process of absorption and keep the patient's appetite in a good condition, or whether he should depend upon the more than doubtful action of the drug and at the same time ruin the patient's digestion. But if we have once decided to administer iodide of potassium, let it be done boldly, and let 2.0, 3.0, 5.0 (30, 45 to 75 grains) a day in one or two doses be given in hot milk. Given in this way the administration of the drug is less likely to be followed by unpleasant effects than if we order a tablespoonful three times a day of a solution of iodide, 4.0 to 8.0; water, 200 (ʒj-ʒij to ʒvj). The mercurial inunctions to the portion of the skull corresponding to the focus are not harmful if any symptoms of intoxication are watched for and salivation is at once treated energetically; but their success is in no way greater than that obtained with potassium iodide.

With regard to the galvanic treatment, it must first of all be absolutely admitted that it is possible to act upon the brain with the galvanic current. The peculiar phenomena which occur during galvanization of the head—vertigo, seeing of sparks, etc., the cerebral nature of which can not be doubted—speak strongly in favor of such a possibility, and the experiments of Loewenfeld on animals seem to indicate that these are due to an influence on the circulation in the brain. Whether, however, the galvanic current possesses, besides this undoubted action on the vaso-motor nerves, definite catalytic properties, and, if so, in a measure sufficient to enable us with its help to influence the disease-focus, nobody knows. We will suppose this and hope that it is so, because it is the only weapon upon

which we have to depend. The best and most reliable electrotherapeutists, Erb at their head, with his unusually wide experience, admit the scarcity of positive results from such a treatment, and acknowledge that in by far the greater number of cases they are negative (Erb, *Handbuch der Electrotherapie*, page 320, Leipzig, 1882). Yet cases may occur where the physician is forced to resort to galvanization of the head—"the electrical treatment of the brain." He should therefore be familiar with the mode of application. Only large electrodes ought to be used. Fig. 73 represents the head electrode of Erb. The anode being placed on the forehead, the cathode on the neck, weak currents without make or break should be al-

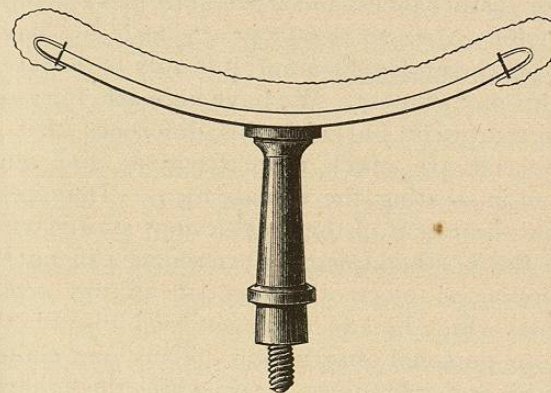


FIG. 73.—THE LARGE HEAD ELECTRODE (COVERED WITH SPONGE) OF ERB.

lowed to pass through the head of the patient for from one minute and a half to two minutes. Transverse and oblique currents may also be tried. (Details are to be found in Hirt, *Lehrbuch*, *loc. cit.*, page 165.)

(c) The treatment of the hemiplegia and the posthemiplegic motor disturbances demands, if any success is to be expected, much perseverance on the part of the patient as well as of the physician. If we can not familiarize ourselves with the idea that for weeks and months the same procedures and manipulations have to be gone through in exactly the same way, we should not begin the treatment at all nor order it to be undertaken. We shall then at least spare ourselves the disappointment of a failure; yet with patience, and where the necessary means are not wanting, it should be undertaken. The cases in which a systematic treatment for a long time has benefited the patient very materially are numerous enough, and they

would undoubtedly be met with more frequently if a fair trial were given it more often than is unfortunately the case. Grossmann has shown that suggestion plays a prominent part in the results of this treatment (*Die Erfolge des Suggestionstherapie bei nicht-hysterischen Lähmungen*, Berlin, 1892). Since there can be no question of regenerating destroyed brain tissue, his aim is to produce an improvement in the general cerebral energy. To this point we shall return later.

From internal medicines absolutely no effect on the hemiplegia is to be expected, and even the most sanguine therapeutists, whose faith in drugs is unbounded, abstain here from fruitless attempts. The same may be said about the posthemiplegic motor disturbances, and if we here make mention of the use of veratrine (0.002 to 0.003 [gr. $\frac{1}{30}$ to $\frac{1}{20}$] a day in pills) against the posthemiplegic tremor, it is only to declare the utter futility of this medicament. We have here also to resort chiefly to electrical treatment, but with this difference, that the good results observed are much more frequent and much more marked than in treating the disease-focus. Definite rules for the electrical treatment of the focal lesions as well as the hemiplegic and the posthemiplegic phenomena can not be given. Every experienced electrotherapeutist follows certain rules and principles which he has found out for himself in the course of years from personal observation. Thus one claims only to accomplish his end with quite weak, while the other has seen better results from the use of strong currents. The one uses galvanism, the other by preference the faradic current. Every one adduces reasons for his own method, which, as a rule, are strongly combated by other writers who claim to possess infinitely more experience.

Above all, the wishes of the patient should guide us in deciding which mode of electrization should be chosen. One man will have a genuine idiosyncrasy against the faradic current, and more especially against the faradic brush. Another can not stand strong galvanic currents; they excite him, make him nervous, and disturb his sleep. In a very general way we may lay down the rule that in paralytic conditions most is accomplished by the galvanic current, with frequent makes and breaks, so as to produce contractions of the muscles. In conditions of irritation, especially contractures, on the other hand, most is accomplished by local faradization. We hardly need to insist that the greatest attention must be given to the

groups of muscles most severely affected—for instance, in the upper extremities, to the extensors. The faradic treatment may, especially if contractures are threatening, be begun earlier than is allowed by our rule given above, even twelve to fourteen days after the cessation of the general symptoms, without any danger to the patient.

Patients in good circumstances expect their physician to send them to a watering place every year, as a stay there is a pleasant change from the monotonous electrical treatment, and we can not blame anybody for putting great faith in it. Unfortunately, these hopes are not by any means justified, and by a course of treatment at Oeynhausen, Wildbad, Gastein, and Ragatz, where, by the way, the temperature of the baths ought not to exceed 93° F., painfully little is accomplished, certainly a great deal less than by electrization or this alternated with massage. The latter ought to be carried out only by well-trained masseurs, and only with the greatest care. From the cold-water treatment we also have seen little success on the whole, although it is decidedly to be preferred to the simple hot baths and the like. This also must be administered carefully, and must be adapted to the idiosyncrasies of the patient, a rule which is unfortunately not always observed. Hydrotherapeutics can not be learned in the clinics, where only an occasional remark is made about it, but deserves and demands a practical study in establishments where this treatment is intelligently and carefully conducted. The reason why it is not esteemed everywhere as highly as it ought to be is because it is frequently not understood. Those who wish to acquire the theory of this treatment thoroughly I would refer, among other works, to the excellent text-book of Winternitz.

While we have seen, then, how helpless therapeutics is against cerebral hæmorrhage and its consequences, we have, on the other hand, the satisfaction of knowing that so much success is promised by a timely and appropriate prophylaxis, that we must recommend it most earnestly to all individuals of a so-called apoplectic habit, all who are inclined to cerebral congestion, all patients with a heart hypertrophy, and, finally, all those with hereditary tendencies. They should try to avoid putting on too much flesh, and shun everything which would conduce to the production of an undue increase in the blood pressure. Among the most important rules upon which we must insist are moderation in eating, regulation of the bowels,

frequent exercise in the open air, systematic gymnastics indoors—for instance, on the “ergostat” of Dr. Gärtner, of Vienna, a small apparatus which can easily be kept in the room and on which a large amount of work, measured by kilogramme-metres, can be done (the work can be prescribed in kilogramme-metres). This apparatus I can highly recommend, as I have very often seen good results from its use. To avoid increase in the blood pressure, the use of alcohol, coffee, and other stimulants, finally, all excitement, be it sexual or of any other kind, should be interdicted. Unfortunately, these warnings of the physician are not listened to until it is already too late, and men who will protect themselves in time and give up some pet habit—the customary nap after dinner, or the like—in order to avoid a danger that only threatens, are few and far between.

2. *Embolism and Thrombosis of the Cerebral Arteries.*
Encephalomalacia.

Pathological Anatomy.—We have already adverted to the fact that the arteries of the cortex anastomose among themselves, while those of the basal ganglia are what we call terminal arteries; from this it is evident that the embolus has quite a different significance where it plugs up an artery of the former type to that which it possesses when the obstructed vessel is a terminal artery, and no collateral circulation is possible. In the first case the collateral circulation compensates for the damage, while in the second case we are bound to have a necrosis in the areas supplied by the obstructed artery, a “focus of softening.” It is unnecessary to dwell much upon the important bearing of this fact; suffice it to say that the arteries usually concerned are the main branches and, above all, the middle cerebral. The reason why embolic processes are more frequent on the left than on the right side has already been explained. Brain emboli originate in the same manner as emboli in other organs; among the causes are diseases of the left heart—chronic endocarditis, mitral disease, and weak heart—aortic aneurisms, more rarely diseases in the pulmonary circulation. Thus in certain cases purulent particles may pass from the lungs into the pulmonary vein (in ulcerative bronchitis, gangrene of the lungs, etc.), and be carried into the systemic circulation. In a case reported by Dähnhardt a doubled-up echinococcus vesicle was the cause

of embolism in the left art. fossæ Sylvii, the left art. prof. cerebri, and the arter. basilaris (Neurol. Centralbl., 1890, No. 19). Pölchen (cf. lit.) has also shown that certain poisons, especially carbon monoxide, appear to sometimes produce softening of the brain substance. According to him, the CO while circulating in the blood acts injuriously on the nutrition of the vessels, and brings about fatty degeneration and calcification in them. Hence there finally results a necrosis of the tissue. It is possible that phosphorus acts in a similar way. Age plays a still less important rôle in the ætiology of embolism than in that of hæmorrhage, whereas the influence of sex can not be denied, as it is well known that by far more women are attacked by cerebral embolism than men; it is possible that this is the case, owing to the greater frequency with which we find articular rheumatism with its accompanying heart lesions in the female sex, especially in its younger members. The puerperal state may also have something to do with it.

Thrombosis of the cerebral arteries is either produced by an atheromatous process which narrows the lumen of the vessel, and by slowing the blood current gives rise to coagulation, or by an abnormal proneness of the blood to coagulate. The first happens frequently in old people, and we can fairly say that atheroma is just as often the cause of senile softening as miliary aneurisms are the cause of cerebral hæmorrhage. The abnormal tendency to coagulate (hyperinosis), which the blood presents in the puerperal state, in pneumonia, etc., is rarely or never the only cause of coagulation. It can not be said to do more than favor it, and hence we need not go further into the question. Considerable general increase in the intracranial pressure may give rise to thrombosis (compression thrombosis), as also the pressure exerted on the vessels which occurs sometimes in basilar meningitis. If, in addition, the arterial walls are diseased—for instance, by tuberculosis or syphilis—the conditions are still more favorable for the formation of thrombosis. According to Gerhardt, the hemiplegias which occur in the course of basilar meningitis are due to thrombosis with secondary softening.

Finally, we should remember that traumatism—a fall or a blow upon the head—may produce a disease in the arteries which long after may give rise to thrombosis.

The necrosis of the brain tissue which follows the cutting off of the arterial blood supply is called softening, encephalo-

malacia, and we speak, according to the special ætiological factor, of a traumatic, an embolic or thrombotic, and an atheromatous (senile) softening. The process is as follows (Wernicke): The vessels in the area from which the blood supply is cut off collapse, the lymph spaces dilate and through aspiration become filled with cerebro-spinal fluid, so that the whole tissue appears soaked, and the recent focus of softening shows a decided increase in volume; the nerve fibres and nerve cells then become macerated in the fluid, and soon undergo destruction. With the microscope we detect varicosities of the nerve fibres, myelin drops, and the neuroglia and the connective tissue appear œdematous. If many red corpuscles are present, the coloring matter coming from them gives to the whole focus a yellowish tint; such a discoloration is especially seen in the cortex (*plaques jaunes*, Charcot); the white matter which lies beneath is usually of a lighter tint. If then no sufficient collateral blood supply is established, which, as seems not impossible in a recent focus, might produce complete regeneration, there commences to develop in from thirty-six to forty-eight hours a fatty retrograde metamorphosis of the necrotic tissue. Polynuclear leucocytes emigrate from the dilated blood-vessels and invade the necrotic tissue; they take up the fatty particles, and some reach the blood current again through the lymph channels as compound granular corpuscles. The latter, which are invariably present in foci of softening more than two days old, on account of their infiltration with fat granules, are larger than the normal leucocytes. A part of them seem to undergo fatty degeneration, others seem to be transformed into myelin drops, especially in old foci. A quite gradual absorption of the dead and disintegrated brain tissue takes place, and a so-called cyst is formed, which can not be distinguished from that following a brain hæmorrhage; more rarely we find a cicatrix of connective tissue, which becomes as hard as cartilage, and grates under the knife. Softenings, which from the onset take a chronic course, have frequently been found to form sclerotic cicatrices, so that the softening can eventually become a sclerosis (Wernicke).

In softening of the cortex quite considerable areas may become deficient, which are partly replaced by serous fluid, partly by thickened pia. The convolutions, which sometimes remain, present a yellowish discoloration, appear atrophic, and are of a firm sclerotic consistence.

Symptoms and Diagnosis.—Just as in hæmorrhage, we may in embolism have symptoms which have to be regarded as premonitory of the regular attack. They resemble very closely those above described, and chiefly consist of vertigo, headache, an occasional feeling as of pins and needles in the limbs, etc. The headache may be especially prominent; it may persist for weeks with undiminished intensity, and then disappear, or be followed by a distinct deficiency in memory or beginning mental decline.

The attack proper, which occurs at the moment the lumen of the vessel is completely obstructed by the embolus, may simulate the apoplectic attack so closely that it may be absolutely impossible to distinguish the one from the other. All the above-described differences in the nature and degree of disturbance of consciousness may be met with here also, and though it is true that at times the attack sets in with more violent epileptiform convulsions, that the face is less congested and respiration less disturbed, these points are by no means sufficient for a differential diagnosis. It is supposed that complete loss of consciousness speaks more against embolism and for hæmorrhage, and the early disappearance of the paralytic symptoms present point rather to embolism. Gerhardt considers (Berl. klin. Wochenschr., May 2 and 9, 1877) a well-pronounced aphasia to be in favor of embolism in doubtful cases.

In embolism the attack is not evoked by an increase in the blood pressure, as in apoplexy, but by a "negative pressure." "Since the vessels lying to the peripheral side of the embolus suddenly collapse, and the blood contained in the capillaries flows into the veins owing to the *vis a tergo* exerted by the contraction of the vessels, a vacuum is suddenly formed in the tissue, and hence a negative blood pressure is produced" (Wernicke, *loc. cit.*, p. 133). In its efforts to fill up the empty space, the brain parenchyma is bound to be subjected to a more or less considerable traction from all sides, which may sometimes lead to disintegration. If only a very small area is affected by the embolus, a regular attack may not take place and consciousness not be lost; if it is very large, various indirect symptoms may appear, and indeed even the non-affected hemisphere be implicated. But even after a severe stroke and after consciousness has been lost for quite a long time, a favorable event is by no means impossible, because the tissue does