

therefore, "When the resistance of the circuit is insignificant in comparison with the resistance of the battery, the intensity of the current is not increased by the multiplication of the elements."

Let us now suppose that  $R$  is insignificant, and that  $r$  is colossal, then in our equation  $R$  may be neglected, and we get  $I = \frac{6E}{r}$ . We have thus increased our intensity six times.

Ohm's second rule is therefore, "When the resistance of the battery is insignificant in comparison with that of the circuit, the intensity of the current increases proportionally to the number of the elements."

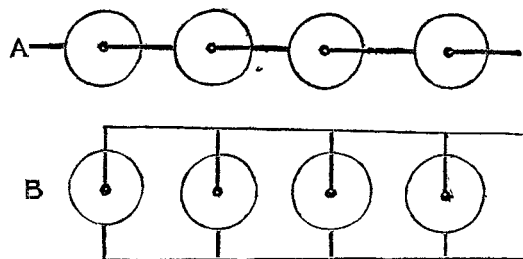
Let us once more suppose  $r$  to be insignificant, and, instead of multiplying our elements by 6, let us increase their area six times. Now, we have said that the resistance of a conductor is inversely as the area of its cut section, so

that our equation becomes  $I = \frac{E}{\frac{R}{6}} = \frac{6E}{R}$ . The third rule, then,

is as follows:—"When the resistance of the circuit is insignificant when compared with the resistance of the battery, the intensity of the current increases in proportion to the surface of the elements."

When  $R$  is insignificant compared with  $r$ , it is obvious that we get a negative result by increasing the surface. Ohm's law, therefore, may be summarised thus:—"When one has to deal with very great resistance in the circuit, the intensity of the current is increased by multiplying the number of elements, without regard to their surface, which may be as small as one likes. If, on the contrary, the resistance in the circuit is very small, then the same end is attained by increasing the surface of each element without increasing their number."

Now, when we unite a number of elements to form a battery, we may do so in two ways, as stated above. When we unite the cells in a sequence, the copper of one being joined to the zinc of the next, as at A (see diagram), we



have an arrangement capable of overcoming external resistance. When, however, we unite all the zincs on one side, and all the coppers on the other (as at B), practically speaking, we enlarge the surface of our elements, and we get an arrangement which is said to furnish a large "quantity" of electricity, but which is of small power for overcoming external resistance.

In the medical batteries the elements are arranged invariably as at A, and their rearrangement is not provided for, so that we are always compelled to use two separate batteries for the galvanic cautery and for electro-therapeutics proper. With big stationary batteries, such as those supplied by Messrs. Elliott, it might be possible to arrange for a double method of uniting the elements, so that one battery should serve two purposes.\*

The *tension* of a current has been defined as the tendency of the electricity accumulated at the poles to free itself and overcome obstacles. Franklinic electricity has a far higher tension than galvanic.

*Density* is another term occasionally used. We stated that the intensity of a current was the same in all parts of the circuit. Now if one part of the circuit be composed of a wire having only half the sectional area of the rest of the circuit, it is evident that the density of the current in that part will be double what it is elsewhere; for we have the same quantity of electricity squeezed, as it were, into half the space.

\* Since this lecture was delivered, Messrs. Mayer and Meltzer have constructed a highly efficient battery for the galvanic cautery, which is composed of carbon and zinc elements of small surface, united in the manner indicated in the diagram B. The exciting liquid consists of bichromate of potash and dilute sulphuric acid. This cautery has great power, is very portable, is easily kept in order, and emits no fumes.

## REPORT OF A CASE OF PHLEGMONOUS ERYSIPELAS OVER THE LEFT GLUTEAL REGION SUCCESSFULLY TREATED BY THE ASPIRATOR.

BY FREDERICK HALL, M.R.C.S.  
(With a Note by Dr. RICHARDSON, F.R.S.)

*History, &c.*—Mrs. B—, aged forty-four years, married and the mother of three children, hitherto enjoying an average share of good health, of active and industrious habits; hair and irides dark-brown, temperament of the nervo-sanguineous type. For eight or nine years this patient says she has, at various times, experienced a dull, aching kind of pain over the sacrum and left gluteal region, which continued for variable periods, and frequently caused her considerable distress. She has sought professional aid to relieve her of this pain on several occasions, but of late she has tried various quack remedies with varying advantage. A few weeks before consulting me she had applied over the hip and upper third of the thigh, on its outer aspect, two or three quack plasters, with, she imagined, some advantage. During the months of October and November of last year her hip was very painful, and she was also at this period much excited and exposed to great maternal anxiety, owing to the serious illness of her children. Late in November she, with her family, visited Devonshire for a change, but while there the youngest child was attacked with pneumonia, which caused her much anxiety and care while nursing the little invalid; and for three days and nights she had but little rest. About this time she again experienced increased discomfort and pain over her left hip, from the plasters having irritated the surface over which they were applied, and "had drawn it very much, causing a free discharge of a yellowish-coloured watery fluid, which, on drying, stained and stiffened the body-linen in contact with the affected hip." She now removed the plasters, and noticed the surface of the hip and thigh, where the plasters had been, to be discoloured and covered with several suppurating papillæ having inflamed and rather firm bases. She applied warm fomentations to the hip occasionally. The child convalescing, she returned to town to her own home and sent for me the day after her arrival (Dec. 3rd, 1873). She was in bed, looking anxious, in pain, and also much depressed, complaining of headache, sleepless nights from her rest being broken by the dull aching pain which constantly remained in her left hip, from which she cannot turn in her bed without much difficulty and pain; and this necessitates her keeping constantly on her back. The left inguinal glands are tender and swollen. She gave me the above history of her case, and thinks her present sufferings are due to the same pains which for the first time occurred nine years ago, after the birth of her first child. The pain she describes as being of a dull, aching, distressingly wearying kind, which extends over the left hip near and around the joint, along the outer and posterior portion of the thigh, down to the popliteal space, involving the knee-joint, and at times reaching to the outer ankle. On examination, I found the left hip to be decidedly larger and rounder than the right one, also to be somewhat tender when compressed—especially is this the case over the course of the great sciatic nerve and about the great trochanter. The general surface is of a dull reddish-brown colour, probably from the effects of the plasters; while some score or so of suppurating papillæ, with inflamed and hardened bases, are scattered over it. No pitting from digital pressure is noticed, neither is there any fluctuation detected, nor is the skin anywhere unusually firm or inelastic. The articulation of the hip is free from tenderness and pain; it can be used freely without any especial difficulty being experienced, except when rotation outwards is fully made—then the patient says she suffers much pain and cries out. Progression is made with a feeling of stiffness and restraint about the joint, external to and within it, so that she readily seeks a resting-place. As night comes on all the worst symptoms are intensified. The menstrual period is just completed.

The tongue is moist and clean; appetite tolerable, thirst slight; pulse 84—90, soft, regular, and steady. Pulmonary and cardiac condition satisfactory.

*Treatment and progress of the case.*—As I regarded the case to be a masked form of sciatica due to rheumatism arising from cold, fatigue, and exposure, I advised her to keep in bed for a day or so, and to apply the following lotion over the sores:—Oxide of zinc, and calamine, of each three drachms; glycerine, four drachms; emulsion of almonds, to four fluid ounces: to be painted freely with a soft brush over the tender parts during the day; whilst at night a warm poultice of linseed-meal was to be applied over the hip. A plain but liberal kind of diet, and this mixture, in one-ounce doses, ordered:—Sulphate of quinine, half a scruple; tincture of perchloride of iron, one drachm and a half; syrup of ginger, one ounce; water to eight ounces.

Dec. 10th.—In some respects she has improved, is more cheerful and strong, being in an easy chair in another room. She occasionally walks about the room to superintend small domestic affairs. The general surface of the gluteal region is more natural in its condition, the papillæ being almost all removed; but the tenderness between the great sciatic notch and great trochanter is more marked. From not sleeping at night, thirty-five grains of hydrate of chloral, in a draught, was given last night, with but small advantage. Continues the mixture and poultices.

20th.—On the 15th, feeling so much easier and stronger, and the weather being unusually mild and dry, she had some carriage exercise, and thinks herself much benefited by the change, although the motion of the vehicle, when passing over the stones, caused increase of pain to the hip. For the first time, she last night experienced distinct rigors; and this morning when she awoke she felt faint, and was damp from a rather profuse kind of perspiration. Slight hysterical symptoms are now present: she is tearful and rather excited. The tongue has an over-clean and glazed appearance; the pulse is full, and from 94 to 96. The urine, formerly pale and clear, is now higher in colour, and rather turbid; on examination, it was found to be acid, of the specific gravity of 1.18, and containing an excessive amount of both the triple and earthy phosphates. The affected hip is now more rounded, its surface over the space above mentioned is distinctly red, while on pressure increased tenderness and an obscure fluctuation are noted. The case is now determined to be one of deep phlegmonous inflammation; and she was accordingly advised to rest more in bed, and to continue the poultices, mixture, &c.

26th.—There is now well-marked œdema of the left foot and ankle, while a dense eczematous rash covers the whole of the dorsum, the burning and itching of which distress the patient exceedingly, especially at night. The dorsum, or wherever the eczema shows itself, is to be occasionally well painted with the lotion ordered on the 3rd. The right ankle is also a little swollen and tender, so that now the recumbent position is imperative. The natural functions are all good; but the patient, who is emaciating, is worn out by nocturnal pains, insomnia, and perspirations. To add twenty minims of dilute phosphoric acid to each dose of the iron and quinine mixture; to induce sleep, forty to sixty grains of chloral hydrate are required, with advantage; and poultices are to be applied over the hip every two hours.

30th.—The character of the patient's condition being advanced, but being very much excited by the proposed use of the lancet or bistoury, I obtained with her ready consent the opinion of Dr. Benjamin W. Richardson, who confirmed my view of the case, and after having, by means of a grooved needle, satisfied ourselves of the presence of pus deeply seated, he advised the continuance of the poultice; and, as the patient is so depressed by the idea of the bistoury being used, he proposes to-morrow to empty the abscess by means of Dufosse's aspirator.

31st.—A circumscribed and distinct fluctuation can be detected over the hip, near to and a little below and to the outside of the great trochanter, in a space about two or three inches in diameter, and, compressing this space rather firmly, a little coloured pus flows from the opening made by the exploring needle. The ether spray was used over this space, so that the patient should be spared all avoidable pain possible, and about an inch of the integument was frozen, when a No. 3 hollow needle was passed through the small existing opening, and forced gently for some two inches downwards, the receiver of the aspirator being pre-

viously exhausted. On turning the tap, and connecting the hollow needle with the receiver, pus, at first sluggishly, afterwards more freely, began to flow from the abscess sac along the connecting-tube into the receiver, which, after being exhausted two or three times more by the pump, was removed, and found to contain six or seven ounces of thick and rust-coloured pus. On removal of the needle, the opening was dressed with carbolised resin ointment spread upon linen, while a fresh warm large poultice was placed over the hip. After the operation—which the patient said was not painful, a sucking kind of feeling being experienced in the part (disagreeable rather than painful)—the hip was flatter, paler, and smaller. From beginning to end the operation did not extend over more than five minutes, and was very clean and efficient, successfully removing all the pus that had formed in the sac. Some little amount of wine was given her at the commencement. To have one drachm of syrup of iodide of iron in water three times a day, with improved diet, including wine. All other medicines discontinued, excepting a chloral hydrate draught at night, if requisite, to promote sleep.

Jan. 3rd, 1874.—A very free escape of pus took place yesterday on the poultices and while dressing the part, some four or five ounces being so removed through the small opening in the skin. To-day this flow continues freely, but in a less amount. The ankles are now of the natural size, and the left leg and thigh of their natural size nearly; the entire limb is also free from pain, and capable of easy motion. The integument of the hip is paler in colour, and possesses a softened and elastic feel. An elastic bandage is now applied from the toes up to and over the upper third of the thigh. The patient is very cheerful, and gets up daily to a sofa in an adjoining room. She is free from pain in any degree distressing, "feeling only a little stiffness and soreness in the skin of the hip." Sleeps well and naturally. She continues to take the drachm of the syrup of iodide of iron in water three times daily. Appetite is good.

7th.—In her sitting-room reading. All poultices discontinued since yesterday, a little carbolised resin ointment on linen being only applied over the hip, which, on standing for some short time, feels weak and tired. She can walk with greater freedom, but refrains from doing so. A few drops of a colourless fluid only flows daily from the closing wound. Continues as before.

13th.—Convalescent. Has taken carriage exercise since the last report, and found the motion agreeable, and not, as formerly was the case, painful to her hip. Since the 8th the lower two-thirds of the thigh has been surrounded by strips of common strapping, while the elastic bandage is carried over from the toes upwards. This treatment of the limb has been a source of comfort to the patient, by affording her a kind of support. Owing to an attack of eczema over the entire surface of the limb, from the foot upwards to the lower portion of the thigh, both the strapping and bandages were removed yesterday, and the calamine and zinc lotion freely painted over the eruption with advantage. She has discontinued the syrup of iodide of iron for a few days, and now takes six grains of carbonate of ammonia in an ounce of decoction of chinchona three times daily. Dr. B. W. Richardson saw this patient again to-day, and was satisfied both with her condition and the result of her treatment. He has advised her going into the country for a week or two to complete the restoration of her health.

From Jan. 17th to the 30th this lady resided at Lewes. She called upon me in February, looking cheerful and in the enjoyment of her usual health. She states that her hip is of no trouble to her now, that she can walk freely and well for a reasonable time, feeling at times only a little stiffness about the seat of the operation. She expressed her pleasure in finding herself so well after what threatened at one time to be a very serious illness. All treatment since January 23rd suspended, and the patient has resumed her usual habits.

Jermyn-street, W.

*Note by DR. RICHARDSON.*

The case related by Mr. Hall is of great practical value. On the old and, taking it all in all, sound principle of surgical practice, that whenever the bistoury can safely reach pent-up purulent matter, it should be brought at once into use, we should a few years ago have made, in this case, a free incision through more than an inch of sound tissue;

should have let air freely into the cavity as we let the purulent fluid out; should have left an extensive surface exposed to air, and to further rapid suppuration;—in a word, we should have turned a closed into an open wound. By the aspirator we may be said to have effected subcutaneously all that was required. We emptied the cavity, and instead of exposing its surface to the air, we brought them close together, and effected at once a rapid radical cure. In using the aspirator, we made an observation which has been omitted by Mr. Hall, but which is of moment—viz., that together with the escape of purulent fluid there was a free escape of gas, so that the fluid itself was charged with bubbles of gas, and the great relief of tension at once experienced was, I am sure, due largely to this escape. In opening large and deep abscesses by free incisions, we do not notice readily this phenomenon of exit of gaseous matter; but I suspect it always occurs, and that, in fact, the force which first distends the tissues, in abscess, is derived from liberation and expansion of gaseous products. It would be easy now, in using the aspirator, to collect the gas that escapes from suppurating cavities and to determine its chemical nature. Considerable simplification is required in the aspirator, in order to make its application ready for the hand of every practitioner in all emergencies. But the advance in principle is so certain that improvement in detail will readily follow.

One other little practical point is of value when ether spray is used for preventing the pain caused by the puncture of the needle. It is this: after freezing thoroughly over the space of a crown-piece, at the point where the puncture is to be made, place the point of the finger in the centre of the frozen part, and thaw at that point completely. When the skin at the spot under the finger is thus rendered quite yielding, the needle can be passed through it still painlessly, if the surrounding part be kept thoroughly frozen. I am indebted to Mr. W. Adams for this suggestion.—B. W. R.

## ON FEIGNED HEMIPLEGIA.

By ALEXANDER DAVIDSON, M.D., M.R.C.P.,  
PHYSICIAN TO THE LIVERPOOL NORTHERN HOSPITAL;  
AND  
CHAUNCEY PUZEY, L.R.C.P. LOND.

THE subject of feigned hemiplegia has been only very cursorily alluded to either in standard works of general medicine or in writings specially devoted to the consideration of feigned diseases. So far as we are aware, no detailed history of any such case has been recorded in medical literature, and we think that the following well-marked example will be both interesting and valuable.

Not long ago, we were requested to visit, on behalf of a railway company, and to report upon the case of a young man who was believed to be suffering from hemiplegia, the result of a railway accident. The history we received was as follows:—

Eight months previously, in a collision, he had received a blow on the left side of the body, which was stated to have been followed by hæmoptysis and the appearance of blood in the urine and motions. For this he was leeches, poulticed, &c., and remained under medical treatment for five weeks, when he was brought to Liverpool. At this time no symptoms existed of any injury to the brain or spinal cord; but two months after the accident, we were informed, he began to complain of pain in the dorsal region of the spine and of numbness of the left leg. He was kept in bed under medical observation; and one night, four months after the accident, he was found doubled up in bed, staring about, struggling and shouting. This attack was stated to have continued for seven hours, and he required several men to hold him still. Similar attacks recurred every night for a week following. After this the left leg became powerless, and weakness of the left arm was noticed; and the symptoms gradually increased until he appeared to have total loss of sensation and of motion on the left side.

We saw the patient in the presence of his medical attendants, and made the following report on his condition:—

We found the patient in bed, lying on his back. His countenance was rather pale, but did not exhibit signs of

serious ill-health. The pulse was somewhat rapid, but regular and of fair strength. The body appeared well nourished. The heart, lungs, &c., were examined and found normal. There was no facial paralysis; the tongue was protruded normally, and articulation was perfect. Memory and intelligence appeared unimpaired, his answers to all questions being ready and sensible. The pupils were normal, and the vision appeared good. His own statement was that he suffered from headache, that his memory was not so good as formerly, and that his vision and hearing on the left side were somewhat impaired. In all these respects, however, he said that improvement had now begun. He admitted that he usually slept well, and said that he occupied a considerable portion of his time in reading. He exhibited signs of much tenderness when the lower dorsal vertebræ were touched, and complained of pain extending from that locality towards the left side; but he said he had no feeling in the skin all over that side of the trunk up to the clavicle, and pricking with a needle failed to elicit signs of pain. When raised in bed, he was able to sit erect with both his hands in front of him, and without assistance. The skin of the back was sound, and there were no bedsores. No paralysis of the bladder or rectum existed. We were told that the bowels acted three times a week, and that on those occasions he went to the closet outside his bedroom, with the assistance of one person.

On proceeding to examine his left leg, which was stated to be completely paralysed both with regard to motion and sensation, we found no difference in appearance between it and the right limb. The muscles on each side were equally firm and well developed, and the measurement of the two legs corresponded in every particular. He professed to be unable to move the left leg to the smallest extent, but when the leg was raised from the bed and bent backwards and forwards, distinct muscular contractions were felt by us. On applying a weak faradaic current, we found the electro-contraction of the muscles perfectly normal. On pricking different parts of the leg with a needle, no sensation appeared to be excited, and no reflex movements were caused by this or by tickling the sole of the foot. On one occasion, however, at a later period of the examination, when his leg was surreptitiously pricked under the bedclothes, his attention being drawn away by a feigned examination of his eyes, a decided jerk of that leg took place; at another time, when pricked unexpectedly on the inner side of the left buttock (as he lay upon his face), he flinched most decidedly; but after this was openly remarked on, and the pricking was repeated in the same spot, no movement occurred.

In order to observe his mode of progression, he was had out of bed by the aid of his brother. He then stood on his right leg, with the left leg slightly bent at the knee, the heel drawn up, and the toes scarcely touching the ground. He then proceeded towards the door, supported by his brother and holding on to the bed. With this help he made a series of steps with the right foot, and at each step we observed that the left leg was jerked up (by muscular action) just as occurs in hopping on one leg. The dragging of real paralysis was wanting. As he was getting into bed again the knee of the affected side was bent almost at a right angle, before it touched the bed.

The paralysis of the left arm was stated to be complete with regard to feeling, but incomplete as to movement. Both arms appeared equal as to size, muscular development, and temperature. On pricking the left arm with a needle, no pain was complained of, and no reflex movements were excited. On being asked to show to what extent he could move that arm, he raised the forearm slightly, but used the help of his right arm to raise it at the shoulder. The muscles contracted well under the faradaic current.

He was again seen by us after a lapse of three months. The general characters of his condition remained, with the following alterations. The left arm was stated to have recovered much of its sensibility, and the power of movement had partially returned. He was also able to move the toes of his left foot to a slight extent, and said he had some feeling in them. He still appeared to be unable to stand or walk. A marked difference, however, was noticed in his manner of progression from what we had previously observed. The heel of the left side was still slightly drawn up as he moved, but now the toes were dragged along the ground, the right knee being also slightly bent. The following circumstances were noted as he lay in bed. On attempting to