usual in such cases, that the little blood in the anterior chamber did not make any progress towards absorption; and this inactive condition caused me to suspect that there must be a foreign body lodged in the interior of the eye. Now the test for detecting the presence of a foreign body in the eye is touch. When the eyeball is gently touched in every direction, if the patient start as if pricked, you may assume with certainty that a foreign body is there; if he be passive, then it is possible that a foreign body may be embedded in the lens-substance, in such a manner as not to cause pain on pressure: this is likely to be the case when the tear in the cornea is small; but when the tear is large, marking the existence of a large surface, the possibility of such a substance lodging there quiescent must be excluded. Reasoning, therefore, from these premises, I came to the conclusion that a foreign body of sufficient size to inflict such a tear could not lodge in the lens-substance without indicating its existence by causing starting on pressure. Yet, when watching the behaviour of the anterior chamber, the dryness of the iris, and inactivity of the aqueous humour, I became suspicious that a foreign body must be lodged there. Indeed, by-and-by, when examining the eye by oblique illumination, I noticed a small black speck at the margin of the iris, which was at first taken to be a pigment-spot; but I came to the conclusion that this must be the offending body. I opened the cornea at the original wound with a needle, and touched the spot, which I found to be a foreign body. I drew it forwards, and, in withdrawing the instrument, I enlarged the corneal opening. I then, with the toothed forceps, seized and removed a piece of iron, of the shape and size represented in the figure (6), weighing $1\frac{1}{2}$ gr.; but to this

Fig. 6.—Piece of Iron.

moment I am perfectly at a loss to explain how such an angular body could be lodged in the lens without betraying its existence on pressure. Three weeks later, I extracted the lens; and you can satisfy yourselves that the patient enjoys good sight. He reads No. 10 of Jäger. From the form of his pupil, you would never suspect that the eye had such a narrow escape.

In cases like this, the line that divides the region of safety from the necessity of sacrificing the eye is so faint, that it requires great watchfulness on your part to lay hold of the phenomena, and judgment to balance the conflicting evidence on each side, in order to arrive at a satisfactory conclusion.

RESPIRATORY TROUBLES IN SYPHILITIC AFFECTIONS OF THE LARYNX.—In a paper reprinted from the *Annales des Maladies de l'Oreille et du Larynx*, 1879, Dr. Krishaber describes the following syphilitic accidents: 1. The consecutive and secondary lesions; 2. Those which result from the more profound changes which are produced later on, and known as tertiary. Both give rise to dyspnoea, hoarseness, and sometimes progressive or rapid asphyxia, calling for energetic interference. The narrowing of the larynx in the second period is due to oedema of the glottis; and this oedema is variously constituted, according as the lesion which has given rise to it itself occupies the vestibule of the larynx, the aryteno-epiglottic folds, or the vocal cords. In any case, the nearer these lesions are to the bronchi, the more serious they are. Lesions of the vocal cord are more serious than those of the vestibule, and those of the trachea are still more grave than those of the vocal cords. The narrowing of the larynx, and the symptoms of asphyxia to which it gives rise, may be so complete as to necessitate tracheotomy. Usually, however, it is less sudden and severe; and, when the specific nature of the lesions is ascertained, the immediate application of energetic antisyphilitic treatment may suddenly suppress the accidents and avoid tracheotomy. Mercurials and iodide of potassium are often very useful in such cases; and Dr. Krishaber thinks it useful to consider most non-tuberculous individuals attacked with acute oedema of the larynx as suspected of syphilis. Finally, it must be remembered that the so-called secondary lesions of laryngeal syphilis may be produced at a period relatively distant from the outset of the disease; and this consideration is the more important, as the respiratory symptoms of tardy laryngeal disease are very exceptionally determined by oedema of the glottis; and, on the other hand, the treatment which can be opposed to them, in spite of the slowness of the symptoms, must be much more radical. The ravages of the destructive processes at this period of profound syphilis leave after them gaps to be filled up; and their cicatrization, with the contraction to which it gives rise, is the only advantage which can be expected from the treatment. But, if this retraction have a tendency to obliteration of the larynx, that obliteration will take place, whatever may be done to prevent it. In such a case, it is necessary to open the trachea, and to keep the cannula in it indefinitely, under pain of serious relapse.

CLINICAL LECTURES ON NERVOUS DISEASES.

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LECTURE III (concluded from page 163).

ELECTRICITY AS A METHOD OF PHYSICAL DIAGNOSIS IN DISEASES OF THE NERVOUS SYSTEM.

III. The Employment of Faradism and Galvanism as Diagnostic Agents.—From a consideration of the action of electricity in health and disease, we may draw inferences which are sometimes valuable in forming a diagnosis; at the same time, it must be admitted that alone we cannot place exclusive dependence upon it. Like all other methods of physical research for investigating disease, its use must be combined with a careful consideration of the case in all its bearings; and although it may thus assist, and valuably assist, our reflections in estimating the nature of nervous affections, by itself it does not claim to demonstrate the existence of any individual lesion. On this account, its help is not to be despised, any more than that of the stethoscope or the thermometer, neither of which diagnoses any morbid state, but simply acts as an exact instrument for scientific research, for aiding and improving our senses, and for enabling us to measure and record physical conditions with accuracy. It has been said that electricity tells us nothing that cannot be ascertained by other means. This is only partially true, and the same argument equally applies to all other methods of clinical inquiry. For example, we feel that the skin is hot, but trusting to our unaided senses is uncertain and inexact, individuals having different notions as to the extent of the symptom. By the thermometer, we demonstrate and record with exactitude the precise degree of temperature, thus avoiding all vague statements and individual impressions. It is true that, in well marked instances, we can see muscular atrophy and guess at nervous degeneration, but by electricity we are enabled to prove and measure these with some degree of accuracy; and, although the science has not yet advanced sufficiently to permit us to do so with absolute precision, there is enough to warrant us in employing that agent for practical purposes. It is by the encouragement of such physical methods of inquiry that our hopes are to be realised of making medicine as much as possible an exact science.

What, then, does electricity actually prove? It demonstrates the functional activity of nerve and muscle, and in consequence their histological condition, a knowledge of which, in many nervous diseases, combined with the other circumstances of the case, often enables us to arrive at a diagnosis.

From the preceding observations on the effects of electricity on different morbid states, it will be seen that much useful information is gained, that we can definitely ascertain the extent of the excitability of nerve and muscle, and can infer with great accuracy the stage of histological degeneration which exists. A diagram, as it were, of such pathological changes is thus physically displayed. Although it is a general knowledge of the relations which the electrical reactions bear to the various anatomical changes in nerve and muscle which take place in disease that we depend upon to assist us in diagnosis, we shall mention a few of the special phenomena which appear to be of practical clinical value.

1. Normal Electrical Reactions in Disease.—In abnormal states, such as paralysis, the presence of healthy electrical reactions is by itself of diagnostic value. It may be stated that, as a general rule, in paralysis from brain-disease, the nerves and muscles are normal to both faradism and galvanism. In doubtful cases, such knowledge may prove of great assistance in determining whether a given palsy is due to disease of the brain, as opposed to lesion of the cord, nerve, or muscle. For example, if in chronic paralysis of the face, the electrical reactions be normal, the symptom is due to disease of the higher centre. The same applies to paresis of any other set of muscles in the body.

In many diseases of the spinal cord, especially when the posterior roots and the posterior and antero-lateral columns only are affected,

the electrical reactions to nerve and muscle are normal, as is seen in locomotor ataxy, lateral sclerosis, etc. This may be the means of diagnosing these diseases in their early stages from those of a more extensive distribution. So long as the grey matter is not extensively affected, and the anterior cornua and roots are intact, there are no characteristic alterations of electric excitability. If, therefore, in a case of spinal paralysis the reactions be everywhere normal, we may infer that these portions of the cord are not seriously involved.

In some cases of paraplegia, obviously from disease of the grey matter of the cord, the electrical reactions of the lower limbs may be normal. This shows that the portion of the cord from which the nerves to the lower extremities take their origin is healthy. Careful examination of the muscles higher up, would probably end in the discovery of some point where abnormal electrical changes were found, and according to their extent we would infer the limits of the lesion.

In certain instances of slight peripheral paralysis, there are no abnormal reactions which indicate that the disease, although capable of causing diminution of voluntary motion, has not induced anatomical changes in the motor nerve-fibres. This is sometimes seen in cases of rheumatic facial palsy.

The whole class of so-called functional paralyses are, as a rule, also accompanied by negative electrical reactions. For example, in a chronic case of hysterical paraplegia, the responses to the faradic and galvanic currents would be everywhere normal in both nerve and muscle. In organic spinal disease of the same standing, there would most probably be evidences of degeneration of nerve or muscle.

In cases of malingering, electricity is occasionally of service. Apart from the emotional and sensational effects, evidence of degeneration of nerve or muscle is proof of the reality of disease. In claims for compensation after accident, and in other such circumstances, electricity may sometimes be utilised with great effect, as a demonstration of fact is always more convincing than individual opinion. Absence of abnormal reactions does not, however, prove that no disease exists. In such a negative position, the diagnosis must be made from the other general circumstances of the case.

There are certain nervous and other conditions in which persons may be mistaken for dead. It is said that people have, under such circumstances, been buried alive. Electricity furnishes us with an absolutely certain method of determining life from death. As soon as the heart ceases to pulsate, there is an immediate diminution in the electric muscular contractility, which rapidly progresses, so that, in from half an hour to two hours, the muscles have completely lost their excitability. Hence if all the muscles, on application of faradism, show no traces of contractility, the patient is dead, as there is no disease in which this could occur. If, on the other hand, they all contract freely, and this continue for more than a few hours, the patient is certainly alive, or was when the observation was begun. In medico-legal practice, this may be important, for if, after death, any muscular contractions remain, it can be certified that the individual died within three hours.

2. *Abnormal Electrical Reactions in Disease.*—*a. Simple increase* of electric excitability, if slight, uniform, and temporary, at the outset of the disease, is in favour of its cerebral origin; and if the increase be considerable, there is probably some irritating lesion. Moderate increase, lasting a long time, indicates usually a spinal affection, and more particularly disease of the lateral columns, in which the inhibitory fibres from the brain appear to run. Increase of excitability accompanying paralysis in the lower part of the body, with normal reactions above, evidences localised disease of the spinal cord, and if excessive, is in favour of an irritating lesion. Excess of action in any particular nerve or set of muscles supplied by it, is also due to local irritation of its fibres, and, if very temporary, may be the result of sudden and complete section. Increased response of muscular fibre to the slowly interrupted galvanic current, especially if associated with diminished reaction to nerve, indicates commencing degeneration of muscle.

b. Simple diminution of electric excitability demonstrates loss of functional activity in the nerve or muscles. It is rare in paralysis from cerebral disease, but, if it occur at an early stage, it is probably due to affection of the crus or of the origins of the cranial nerves. In paralysis from brain-disease of long standing, diminution in nerve and muscle may arise from two causes, namely, simple disuse and secondary degeneration. The first may readily be distinguished by applying faradism for a few days to the paralysed limbs, after which the normal reactions to both nerve and muscle return, without change in motility. In the latter case, they retain their abnormal reactions, and are probably associated with qualitative changes, thus indicating permanent organic disease of the cord, nerve, or muscle. Diminution of electrical response occurs in many diseases of the cord, especially if chronic. This, taking place in a case of paralysis without any qualitative changes, would indicate that, although the central tracks were interrupted, the

anterior roots and the cornua of the grey matter were not involved. Simple diminished reactions to nerve or muscle serve to show that, although their motor functional activity is impaired, there are no serious disturbances of their nutrition or anatomical structure.

c. Qualitative changes are always accompanied by the quantitative disturbances of increase or diminution of electrical excitability, but chiefly the latter. If these be present, cerebral affections as their cause may be excluded; so also diseases of the white columns of the cord. They always occur in extensive disease of the grey matter of the cord, especially its anterior cornua and anterior roots, and in all serious affections of peripheral motor nerves.

If, therefore, in a case of spinal paralysis there be found loss of excitability to all the nerves and muscles, with the reaction of degeneration in the latter, we may conclude that the whole of the grey matter of the cord is diseased, and certainly its anterior cornua. If the upper limbs present these abnormal reactions, and, although paralysed, the lower extremities have normal or increased excitability, we conclude that the grey matter of the cord in the upper dorsal region is disorganised in a limited area, and that the cord below is healthy.

From the extent of the signs of degeneration, we can, therefore, infer the amount of spinal disease, the two bearing a constant relation to one another. The completeness of the electrical reactions will also, to a certain extent, indicate the stage of the lesion. If there be complete loss of excitability of nerve, with atrophy and well developed reaction of degeneration of muscle, the centres are probably entirely disorganised. If the abnormal responses, on the other hand, be not fully displayed, the disease is only partial.

In certain cases of spinal disease, there is no paralysis proper, but there is atrophy of muscle, with corresponding motor weakness, due, it is supposed, to a modification of the nutrient centres of the muscle in the spinal cord. Such is indicated electrically by the muscles contracting under direct faradic irritation according to their bulk, and exhibiting reactions of degeneration to galvanism, while at the same time the nerves are healthy to both forms of the current. This is seen in progressive muscular atrophy, thus distinguishing it from paralysis due to disease of the motor centres, such as infantile paralysis. The electrical reactions are here the same as in amyotrophic lateral sclerosis; the clinical distinction between the two being that, in the latter, owing to the affection of the lateral columns, paralysis is the main feature of the case, and it precedes the atrophy. In the former, the wasting appears before the altered movements, and is the cause of them.

Paralysis on one side of the body from disease of one half of the spinal cord would be distinguished electrically from hemiplegia as a result of brain-disease, by the fact that, if the grey matter were involved in the former case, there would be signs of nervous or muscular degeneration, while in the latter the reactions would be normal.

To distinguish between paralysis from disease of the cord, as opposed to that of nerve, is not possible by electrical tests alone; other circumstances must be considered, which, combined with them, may help us to arrive at a true diagnosis. Reactions of degeneration on both sides of the body would be, as a rule, in favour of central disease. If confined to one nerve and the muscles supplied by it, there is likelihood of its being of peripheral origin; and if to this we find that the nerve and muscle supplied by a branch from above the seat of paralysis are normal, this is made almost certain. In peripheral paralysis, the abnormal electrical reactions in both nerve and muscle are usually more complete than when it is the result of spinal disease.

Loss of response by the nerve to both currents, faradism and galvanism applied directly to the muscle being followed by normal reactions, indicates that the trunk of the nerve is alone diseased, its peripheral portion and the muscle being healthy. This occurs in commencing rheumatic and other local paralyses of nerve.

Loss of response by nerve to both currents—faradism applied directly to the muscle producing no results, galvanism to the muscle being followed by normal reactions—indicates that the trunk of the nerve, with its peripheral intramuscular branches, is paralysed; and that the muscular fibres are intact. This is seen in nervous paralysis from cold, and also in the earlier stages of disease in the grey matter of the cord.

Loss of response by the trunk of the nerve to both currents—faradism applied directly to the muscle producing no results, quantitative and qualitative changes on direct galvanism to muscle—indicates disease of the entire nerve, and also muscular degeneration. This occurs in cases of traumatic section of nerve, in the late stages of infantile paralysis, etc.

If, on irritating the nerve, the muscular contractions be normal to both currents; if faradism applied directly to the muscle induce no action; and if galvanism, when also thus applied, be followed by quantitative and qualitative changes,—these indicate that the trunk of the

nerve is healthy, but that its peripheral branches, with the muscles, are disorganised, as may be seen in some cases of lead-poisoning.

If the nerve act normally to both currents while faradism, when applied directly to the muscle, excites contraction according to its bulk, but galvanism is followed by the reaction of degeneration—these signs show that the nerve is healthy in its whole extent, and that the muscle alone is diseased, which is seen in progressive muscular atrophy, pseudo-hypertrophic paralysis, etc.

If the nerve act normally to both currents, faradism applied directly to the muscle produce no result, and galvanism to the muscle be followed by normal reactions—these indicate that the trunk of the nerve and the muscles are healthy, but that the peripheral intramuscular branches are paralysed. This is seen in some forms of facial paralysis from exposure to cold.

In peripheral paralysis, all the elements of the nerve-structures are not always equally affected. If the nerve and muscles show perfectly normal electrical reactions, it is evidence that the voluntary motor fibres have been altered only in function, and not in structure, as seen in the slight forms of rheumatic facial paralysis. If the nerve exhibit great diminution or loss of electrical response, the nutritive influences to its motor fibres must be involved; and, if there be degenerative reactions of muscle, it shows that, in addition to the motor fibres, the trophic conductors to the muscles are involved; either of which may be seen in the middle form of facial paralysis. Finally, both nerve and muscle may exhibit abnormal reactions, demonstrating that the whole nerve, including the motor conductors and the trophic fibres to nerve and muscle, is degenerated, as instanced by the severe form of facial paralysis.

In many doubtful cases, electricity may decide our diagnosis before there are other symptoms sufficiently definite. For example, in an incipient case of lead-poisoning, the bulk of the muscles and their voluntary power may be apparently normal. On testing with the faradic current, diminished nerve-excitability may be found; and with the galvanic, commencing degeneration in muscles may be demonstrated—thus confirming our suspicions; for, in this disease, the histological changes precede apparent impairment of function.

In estimating the condition of sensation, electricity is of great service, and delicate shades of increased or diminished sensibility may thus be detected. The faradic current is indispensable for determining muscular sensibility, and galvanism applied to the tongue is the best method for testing the sense of taste.

Many instances might be given to show how electricity practically assists diagnosis. Of these, we shall only mention three as illustrations.

A young woman had, among other symptoms, almost complete paralysis of the left leg, from which she had suffered for many months. Electrical tests failed to elicit abnormal reactions in any part of the body. This greatly assisted in the diagnosis of cortical cerebral disease, which was confirmed after death by the discovery of a tumour in the right hemisphere, in the posterior parietal region.

A man, previously in good health, fell on a pitchfork, a prong of which passed through his upper arm. After the wound healed, the limb was weak, and, a month after the accident, had greatly lost power; and the muscles of the hand had wasted. The diagnosis of his physician was local injury to the nerves, with corresponding loss of function. Tested electrically, the nerves were found perfectly normal. With faradism, the muscles contracted according to their bulk; and those which were atrophied exhibited with galvanism the reaction of degeneration. On investigating the muscles of the apparently normal arm, precisely the same conditions were found, only not so definitely marked. Here, then, was a case, not of injury to the nerve from an accident, but an instance, probably, of commencing progressive muscular atrophy; the fall being a coincidence, and merely attracting the patient's attention to his right hand.

A house-painter entered the hospital suffering from general debility and vague dyspeptic symptoms. The question arose, Is this man suffering from lead-poisoning? There were no symptoms except those stated above; no colic; no blue line on the gums; and he had never observed any weakness or wasting of the muscles of the arms. Electricity applied to the extensors of the wrist demonstrated slight but distinct reactions of degeneration, which, under the circumstances, definitely confirmed an otherwise doubtful diagnosis.

These are three examples in which the diagnosis of a lesion respectively of the brain, spinal cord, and peripheral nerves and muscles, was practically established by electrical tests. Others similar might be multiplied, which brevity compels us to omit. It is, however, to be hoped that, in the foregoing discussion, enough has been said to show that our knowledge of electricity, although as yet imperfect, is even now sufficiently advanced to afford us valuable assistance in the diagnosis of nervous diseases.

MR SPENCE ON SURGICAL STATISTICS.

By JOSEPH LISTER, F.R.S.,

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MR. SPENCE's article on Surgical Statistics, which appeared in the JOURNAL of the 24th ult., consists of two elements; one tending to disparage my character as a surgeon; the other calculated to diminish the effect of the statistics which I lately adduced in favour of antiseptic surgery. The former of these elements I shall take leave to dismiss without further notice than the remark that, as Mr. Spence never did me the honour to witness the practice which he criticises, so that his knowledge of it, beyond my brief descriptions of the cases, must have been derived entirely from hearsay, the exercise of a little charity towards a late colleague might have induced him, in every one of the points to which he refers, to accord a more generous and at the same time a more just interpretation.

But, in direct proportion as Mr. Spence succeeds in persuading the readers of the JOURNAL of his own superiority and of my inferiority as a surgeon, must his argument tell in favour of antiseptic surgery; for if, in spite of such disadvantages, I am enabled, by the application of a new principle, to obtain results superior to his, the fact must speak volumes in favour of the principle.

First, then, of amputations; Mr. Spence produces a table of excellent results from his own practice. But I have first to remark that they are not derived from the period during which mine occurred, but from a time long antecedent. What is the reason for this selection? We can hardly suppose that Mr. Spence took his illustrations from the practice of many years ago because he thought his method of treating wounds then superior to that which he employs at present. We are, therefore, forced to the conclusion that he has selected a set of cases in which good fortune came greatly in aid of good surgery.

Next, I have to observe that the cases which he compares with mine are not similar to them in kind; for he omits primary amputations, which are by far the most dangerous class, and which are included in my numbers. And the manner in which his statement is made is somewhat apt to mislead, although, I am sure, without any such intention on his part. After the mention of my general results of nine deaths in eighty major amputations, he proceeds to make what I venture to regard as a lame apology for the selection of a different period from mine, and then gives his own figures in a tabular form calculated to strike the eye; and it requires a somewhat close reading of the text to notice that these cases are only amputations for disease, and therefore not fairly comparable with mine. In order to institute a just comparison, I must deduct the primary amputations from my own list. These were sixteen in number, with four deaths, leaving sixty-four amputations for disease and secondary amputations for injury, with five deaths; and thus my percentage of mortality is at once reduced from 11.2 to 7.8. But here I must repeat the observations which I made on these cases in the discussion at St. Thomas's. Of the five deaths, two were after amputation at the hip-joint, followed by death within twenty-four hours after the operation; and, whether Mr. Spence be correct or not in his idea that the patients might perhaps have been saved by better surgery, these cases have no bearing whatsoever upon the question under discussion, which is the relative safety of different modes of dressing. Both succumbed from the immediate effects of the operation. Those two cases, therefore, should be excluded as irrelevant. But I cannot take leave of them without raising a protest against the view which Mr. Spence must be supposed from his remarks to entertain, that every case of myeloid disease of the lower end of the femur should be summarily treated by formal amputation at the hip-joint. We know how greatly these cases differ among themselves as to the degree in which the bone is implicated beyond the obvious tumour; and many a man would be deprived of life unnecessarily, and many another would lose the advantage of an useful stump, if such a doctrine were allowed to prevail.

My other deaths arose from accidental causes wholly unconnected with the operation. One took place in a woman who presented herself with a swelling of no large size under the right deltoid, so extremely soft that I was unable to satisfy myself whether it was a collection of fluid in the bursa or a solid of jelly-like consistence, without an exploratory puncture, which was made antiseptically; a malignant tumour was diagnosed, and the patient was requested to submit to amputation. This, however, she refused to do, and one day tore off the antiseptic dressings, with the result of causing putrefaction in the tumour and an aggravation of both local and general