A Clinical Lecture ON THE SURGERY OF THE ABDOMINAL WALL.

DELIVERED AT THE MIDDLESEX HOSPITAL,

BY

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GENTLEMEN,—My subject is "The Surgery of the Abdominal Wall." This branch of our art is undoubtedly less important than the surgery of the abdominal contents, by which it has been to a large extent overshadowed, and in which it is a mere incident. There are, however, surgical conditions of the abdominal wall itself which are of great importance, quite apart from their bearing upon the surgery of the contents of the abdomen. Such a condition is hernia, which is a deformity or abnormality of the abdominal wall, and has to be dealt with by surgical procedures on the abdominal wall quite independent of any special treatment of the abdominal contents. Then there are growths of the abdominal wall, which have to be specially dealt with surgically. And there are wounds, ulcers, and abscesses of the abdominal wall which we have to treat. I do not propose this afternoon to say anything about these conditions, but to speak of certain points in connexion with the operations upon the abdominal wall which are merely a step to interferences with the abdominal contents. And I do it for this reason: the interest in all these operations is chiefly centred in what is done within the abdominal cavity, not upon what is done as a means of getting into the abdominal cavity, and therefore we are apt to pass over with insufficient attention what is nevertheless an important part of the operation.

The first points to be determined in any operation upon the abdominal contents are the position and the extent of the incision. About the position I need only say this: that the incision should be, whenever possible and as much as possible, directly over the organ or lesion which has to be dealt with internally. In the earlier days of abdominal surgery surgeons limited themselves to incisions in one or two regions only; they did not think that the whole abdominal wall was a fair field for their activities. As a matter of fact there is no area of the abdominal wall through which the surgeon may not operate when the circumstances demand it. It is a rule which we should apply fairly rigidly, that incisions should be as directly as possible over the organ or lesion to be dealt with. The second observation one should make about the incision is that it should be of sufficient size, but not too large. If the incision is too small, it embarrasses the surgeon in all the deeper and further steps of the operation, and it thereby renders the operation more dangerous, for anything which renders an operation more difficult renders it also more dangerous. Especially is that the case in operations on the deeper viscera of the abdomen and on the vessels and other structures in the posterior part of the abdominal cavity. But, on the other hand, while an incision should be large enough, it should not be too large. Too great a length of incision adds to the danger of the operation by adding to the exposure and manipulation of viscera, and oftentimes it causes prolapse or protrusion of viscera, and adds to the possibilities of infection. It also prolongs the operation, because it takes longer to close than a shorter incision, and it undoubtedly tends to weaken the abdominal wall afterwards. I cannot give you any rule or statement in inches to tell you how long these incisions should be. But one may say the length of the incision should be in proportion to the manipulations required in the interior of the abdomen and to the depth of the organ operated upon. It should also bear some relation to the experience of the surgeon. When you are beginning abdominal surgery do not try to do difficult operations through a keyhole; wait for that until you have learnt to do them through an open door. When you have acquired manipulative dexterity

and a working knowledge of the geography of the abdominal contents, then undoubtedly you can shorten your initial incisions. I remember a time when surgeons took great pride in the shortness of their incisions, and they published lists of cases classified according to the length of the abdominal incision and the mortality met with, as if these facts were closely connected. Happily we have outgrown that, as we have outgrown many other follies in connexion with abdominal surgery.

A great principle to follow in abdominal incisions is so to place them as to interfere as little as possible with the subsequent firmness and function of the abdominal wall.

I wonder what ideas you have of the function and importance of the abdominal wall. Surgically, or rather, anatomically and physiologically, we ought to regard the abdominal wall as a muscular apparatus. True, it is covered on the outer surface by skin and a layer of fat, which varies in thickness very much indeed. And it is lined internally with peritoneum and a little fat between that and the muscle. But the essential part of the abdominal wall is its muscular apparatus. The muscles, of course, have their necessary supply of blood vessels and nerves. The abdominal wall fulfils many functions. It is a protection and a support to the abdominal viscera; it supplements in a very important degree the muscular contraction of the alimentary canal and of the urinary and generative systems; it plays a primary part in the movements of respiration, and aids the circulation; it is the most powerful agent in the movements of flexion and rotation of the trunk, and in addition, by fixing the ribs, sternum, and pelvis, it co-operates in all the more vigorous movements of the limbs. The freedom with which surgeons now invade the sanctity of this great muscular apparatus, and do this as only a step towards the real goal of their operations, might blind you to the extreme importance in our economy of this great muscular apparatus. Always think of the abdominal wall as one of the most important muscles of the body, and remember that the aim of the surgeon in operating through the abdominal wall should be to make such a wound as will not injuriously interfere with this muscular apparatus or will interfere with it as little as possible. That was not at all the first idea of surgeons. The first idea surgeons had was that they must choose for their incisions the least vascular parts of the abdominal wall, and they chose, therefore the middle line in front—the linea alba, or that other less well-marked white line on the outer side of the rectus, the linea semilunaris. And they chose to make their incisions there rather than anywhere else because they were sure of not meeting with blood vessels. That is not a strictly accurate statement at best. Of the linea alba it is fairly true, but in the linea semilunaris there are branches of intercostal arteries anastomosing with the superior epigastric and deep epigastric arteries. Still, it is true that incisions can be made in those two situations with very little haemorrhage indeed. It is amusing to recall that in the early days of ovariectomy surgeons were at great pains to make their incisions precisely in the middle line and to go exactly between the two recti muscles. I have known in our theatre valuable time consumed—first of all in dissecting a little bit on one side and then dissecting a little bit on the other side, because the surgeon had not come down exactly in the middle line between the two recti muscles. It was so important, he thought, to be exactly in that middle line! Now, I want you to think of the linea alba not as the least vascular part of the abdominal wall, but as the great tendon of insertion of the six flat abdominal muscles, the blending of their aponeuroses, an unyielding fibrous band upon the integrity of which much of their successful action depends. Nor is this all, for many of the innermost bundles of the recti muscles are also inserted into the linea alba. You will remember how the aponeurosis of the internal oblique splits to enclose the rectus muscle, the anterior layer uniting with the external oblique and the posterior with the transversalis aponeurosis, and how the two sheaths of each side blend together in the middle line in the linea alba, which can be traced from the xiphoid cartilage above to the symphysis pubis below. The splitting of this aponeurosis is at the outer border of the rectus muscle. Of course it is interesting to remember that that splitting is not

continuous through the whole length of the aponeurosis, but midway between the umbilicus and the pubis all the aponeurosis passes in front of the rectus, and there is an edge left of the posterior sheath of the rectus—the fold of Douglas—over which the deep epigastric artery passes. I wonder why the sheath does not envelop the back of the lower part of the rectus as well as the rest of the rectus! I think it is that the contraction of the lower part of the rectus may act very directly and definitely on the viscera behind it. There is no part of the function of the abdominal viscera that the contraction of the rectus has so much influence upon as on the emptying of the bladder and rectum, and, in certain states, on the emptying of the uterus. And I think it is to give the rectus, as it were, an unfettered power to compress these viscera that we have no sheath behind its lower end. For when the lateral muscles of the abdominal wall contract and pull upon the sheath of the rectus they tend to compress it to a certain extent and a little bit impair the direct pressure of the rectus on the viscera beneath them. But the point I want particularly to draw your attention to is this: The linea alba must be thought of as a continuous fibrous band, with the six lateral muscles and parts of the two recti attached to it. And every part of the aponeurosis which comes into the linea alba makes a pull and strain upon the whole length of the linea alba. We cannot divide the linea alba up into its various constituent fibres or segments and say that one portion of a muscle pulls upon a particular portion of linea alba. Every part of the flat muscles which pass to the aponeuroses or which enter into the linea alba pulls upon the whole of the linea alba. Therefore any weakness of the linea alba is sure to be found out; the great muscular strain which is brought to bear upon it will cause it to yield and become inefficient, and the muscular apparatus of the abdominal wall be made correspondingly ineffective. This is not the case with the sheath of the rectus. Each fibre of that sheath has its own corresponding muscular band attached to it, and no others. And therefore if we weaken a portion of the sheath of the rectus, we undoubtedly weaken the abdominal wall, but we only weaken the attachment of a portion of the muscular fibres of the abdominal wall and not of the whole. The whole muscular abdominal wall pulls upon the linea alba, and upon the integrity of the linea alba, therefore, depends the perfect function of the whole of the abdominal wall. And so anything which weakens the linea alba is liable to cause much more apparent and more serious mischief than that which weakens other parts of the abdominal wall.

When we come to study the linea semilunaris we notice that it is nothing like so thick as the linea alba. It is sometimes said to be composed of the aponeurosis of three muscles blended together; but the external oblique does not really enter into the formation of the linea semilunaris—it is rather a blending of the aponeuroses of the internal oblique and the transversalis, the transversalis being much thinner than the internal oblique. It is purely fibrous tissue, very few blood vessels are distributed through it, and the vitality of it is certainly less than the vitality of the muscular portion of the abdominal wall or of the linea alba. And we find, accordingly, that incisions in the linea semilunaris are apt to form unreliable scars. The scars of incisions there are particularly prone to give way, and some of the worst hernias following operations have been through scars in the linea semilunaris.

But there is something to be said for operating through the linea alba, and it is this: That it is an incision in the middle line of the abdomen. It admits the surgeon to the central region of the abdomen, and it enables him to deal equally well with conditions on the right and left of the middle line. In such an operation as ovariectomy, if the surgeon finds disease of both ovaries he can deal with equal facility with each broad ligament through the central incision, and in hysterectomy he can deal with the uterine artery on either side with equal facility. There is a dictum favoured by some, that the conditions for which surgery is called upon in connexion with abdominal viscera are so varying and oftentimes so misleading, that when operating upon the abdomen the wisest man is he who opens it in the middle line, so that he will be able to reach equally well any of the viscera which may be found to require his interference:

In making abdominal incisions I advise you to observe two great rules—first, do not cut muscles; and, secondly, do not divide motor nerves. The way to preserve a muscle is not to cut it across. If you separate muscular fibres they will lie side by side afterwards, and you will have done the muscle next to no injury. But when you cut a muscle across, its contraction tends to pull asunder the ends of the cut fibres, and if contraction takes place before union is firm it will lengthen and weaken the muscle, and very likely lead to the formation of a ventral hernia—a serious complication. The muscular tissue of the side of the abdomen is soft and easily separated, the rectus muscle has its vertical fibres passing up the front of the belly, and they can be separated easily. There is no question that the safest and best rule to follow in making incisions through the muscular part of the belly wall is to split muscles and never to cut them. Maylard's incision is an apparent exception to this good rule. The rectus muscle is intercepted by tendinous lines, and it has been pointed out that if you plan your incision across the rectus so that it does not divide muscular tissue, but cuts across one of the tendinous intersections, you can subsequently sew it up and get firm union without serious risk of weakening the abdominal wall or of the formation of a ventral hernia. I have not had a large personal experience of the method. A case was in the Queen Ward of the hospital a few months ago in which this particular method of operating was successfully used. The patient was a woman who had been operated upon for gall stones at another hospital. There was the usual vertical scar through the right rectus muscle. I wanted to make a further exploration of the biliary passages, and I used a transverse incision carried carefully through one of the tendinous intersections of the rectus, which I subsequently sutured. The patient was a very fat woman. She recovered with apparently a very strong abdominal wall. After all, this is not a real exception to the statement I made just now. That statement was as to muscular tissue, and not about aponeuroses; surgeons are very unwise to cut across the muscular fibres of the rectus, although they may cut across the tendinous intersections of the rectus muscle. When you want to open the abdomen near the middle line you adopt another plan: make the skin incision 1 in. to right or left of the mid line, divide the front of the sheath of the rectus, draw the inner edge of the rectus outwards, and then divide a part of the posterior sheath of the rectus and enter the peritoneal cavity by dividing fascia, fat, and peritoneum. You get ready access to the cavity of the abdomen if you go an inch to the right or left of the middle line, and you have the advantage of not having interfered with that fundamentally important structure, the linea alba, nor have you materially injured the rectus muscle. The same principle is observed in what is known as Battle's incision for appendicectomy; a vertical incision is made an inch internal to the semilunar line, over the rectus muscle, the front of the sheath of the rectus is divided, and the rectus is drawn inwards, and then the abdominal cavity is opened behind the rectus. When the operation is completed and the wound sutured the rectus is replaced and separates the superficial and deep parts of the wound. Where only a limited incision is required, it is an improvement to divide the sheath of the rectus transversely instead of vertically—the integrity of the aponeurosis is thus thoroughly preserved.

That, again, is making an opening into the abdomen without cutting the muscles and without cutting either the linea alba or the linea semilunaris. Battle's incision is excellent where more room is wanted than can be obtained through McBurney's incision, or where, for any reason, the surgeon wants to get nearer to the centre of the abdomen than the iliac fossa.

An excellent example of the muscle-splitting method is McBurney's "gridiron" incision for appendicectomy. The incision is through the skin and superficial fascia parallel with the fibres of the external oblique; the fibres of that muscle are split and the two parts of it drawn aside; this exposes the internal oblique. That and the transversalis are split too; the fibres of these deeper muscles are separated and held aside by retractors and the peritoneum and subserous fat are divided. The peritoneum is usually opened by an incision parallel to that through the skin. I find it is often better to make it

transversely—there is less tension upon the cut edges of the peritoneum and the wound is sutured more readily. At the close of the operation on the appendix sutures are put in, the previously separated muscular fibres are juxtaposed again, and when they contract the contraction does not tend to separate them, but to approximate them—to close the incision, and you get no interference whatever with the firm muscular structure of the abdominal wall. The same form of incision should be used in the operation of inguinal colotomy—the muscles should be split, not cut—to protect the patient against prolapse and to secure, perhaps, a slight degree of control over the artificial anus.

Similarly in renal surgery, it is well in exposing the kidney not to make a transverse cut regardless of the direction of the fibres of the muscles in the loin. The incision should be oblique, and made parallel with the fibres of the external oblique muscle, and the surgeon should separate the fibres of this muscle, and should be careful not to cut the twelfth dorsal nerve. The internal oblique and transversalis can be similarly treated, and the transversalis fascia divided transversely, and the fatty capsule of the kidney exposed. By this means a much firmer and stronger scar is obtained than if the muscles are cut. I have seen several cases of lumbar hernia after renal operations, and one of the worst and most crippling hernias I have ever seen was in a lady who had had the left kidney removed through an incision in which the muscles had evidently been very freely divided. The operations of exploration of the kidney, lumbar nephrorrhaphy, nephrolithotomy, decapsulation, and some cases of nephrectomy can be carried out without division of muscles; where more room is required, as in the removal of large kidneys, a limited division of the deeper muscles is necessary, but there is never any reason or excuse for division of the fibres of the strong external oblique muscle.

For gastrotomy a vertical incision through the skin should expose the sheath of the rectus; this should be divided transversely, the fibres of the muscle split, and the posterior layer of the sheath, the fascia and peritoneum divided transversely. Through this limited incision the stomach can be found and drawn out, the valvular opening in it made, and the abdominal wound closed very rapidly.

The usual incision for exposing the gall bladder is a vertical one over the right rectus, dividing the anterior part of the sheath, splitting the muscular fibres, dividing the posterior layer of the sheath, and opening the peritoneal cavity in the same vertical line. If more room is wanted, the incision is carried obliquely upwards towards the lower end of the sternum, across the front of the sheath, and the rectus muscle is split still further up, and drawn inwards, the lower end can be prolonged downwards and on wards. This incision has serious drawbacks. One of these is that the peritoneum and transversalis fascia, as well as the posterior layer of the rectus sheath, are in a condition of transverse tension, in the upper region of the abdomen particularly, and therefore there is a great tendency for these structures to withdraw laterally, and there is difficulty in getting them to come accurately and closely together along the whole of the incision. In some cases the peritoneum is neither tough nor elastic, and the needle cuts out, or the suture when drawn upon cuts through. In other cases the deepest sutures are passed through the peritoneum, but fail to include the deep layer of the muscular aponeurosis, and a weak scar results. In fact, the incision transgresses our first rule in that it cuts across the nerves and aponeurosis of the abdominal wall, and it interferes very seriously with their integrity. Recently I have used an incision for the exploration of the gall bladder which conforms to the rules I have given you as to not cutting muscular tissue or motor nerves. I have made an oblique incision, starting over the right ribs and going towards the umbilicus, parallel with the fibres of the external oblique muscle, splitting the fibres of that muscle and having them held aside. I have then separated the bundles of the internal oblique and transversalis muscles, and have carefully preserved the intercostal nerves, and have opened the peritoneal cavity by dividing transversely the transversalis fascia, subserous fat and peritoneum. This incision gives ready access to the gall bladder, and enables one to deal with it quite easily. And it has these advantages, that when one comes to close the wound the peritoneum is easily approximated, and the separated muscles, of course, are

readily closed. The resulting scar is firm, and without any tendency to ventral hernia. This form of incision is not adapted for operations upon the common duct when more room than it gives is required. A similar incision can be used for exposing and operating upon the spleen and the colon, and for any operation in the right or left hypochondriac regions. These incisions seem to me to be quite distinctly preferable to the older incisions in the abdominal wall through the linea alba and linea semilunaris, or directly through the muscular tissue, regardless altogether of the direction of the muscular bundles.

And now a word as to the suture or closure of a surgical wound in the abdominal wall. You must have noticed that there is a great difference in the practice of surgeons in the way in which the abdominal wall is closed. Some pass sutures through all the layers of the abdominal wall in one thread, others close the wound by suturing up the important layers of the abdominal wall one by one. Both measures are successful, and I would not absolutely condemn either of them, but they have their differences, and one must not be blind to them. The method of taking all the structures of the abdominal wall in one loop of suture is the quicker plan, and when, at the end of an operation, the patient is collapsed, and it is important to shorten the operation as much as possible, this method is to be preferred. But we must be very careful in doing it that the sutures do really enclose the peritoneum, because it is all-important that the two peritoneal surfaces should be brought together. It is important because the peritoneum is an exceedingly highly-vitalized structure, and repair takes place in it with remarkable rapidity. The deep portion of the abdominal wall gets shut across and closed in, and the abdominal cavity protected from any leakage through the abdominal wound in a very few hours after the two peritoneal surfaces are brought together. And there is this other, perhaps more important, consideration—that only by so doing can we guard the patient against adhesions between the abdominal contents and the abdominal wall. Whenever the parietal peritoneum is not sutured accurately, and is not fully restored behind the scar, you may be certain that adhesions will form, and it may be that these abdominal adhesions will cause serious trouble in the future. This, therefore, is a matter which should be carefully attended to. The drawbacks to this method of closing the abdominal wound are, that it does not restore the structures of the abdominal wall so completely or so thoroughly as you can restore them by suturing the different layers of the abdominal wall separately. It brings together all the structures—skin, fat, aponeurosis, muscle, peritoneum, in one mass, and they are all welded together in one scar. A second drawback to it is that the suture is liable to be infected from the surface, and as the stitch goes from the skin quite through to the peritoneum, if it gets infected from the surface, the infection is carried by the suture directly down through all the tissues into the peritoneum, and so peritoneal invasion may occur. Such infection has often happened. The other way of suturing the abdomen is by suturing layer by layer and trying to restore the structures as perfectly as you can to their original arrangement. For instance, you put one suture through peritoneum, subserous tissue and the deep layer of the rectus sheath, then a suture through the superficial layer of the sheath, a third through the skin and superficial fat, and a fourth, if you like, through the skin only. A suture like that obviously takes more time. It involves the use of buried sutures, which have their own particular perils; but it secures a far more exact adjustment of the divided structures than can be otherwise effected. Having used both methods, I can say that my preference is decidedly in favour of the more complicated and more troublesome way of closing the abdominal wall. I think that you get better and sounder scars by that means than by the other. That you can get good scars by either method I do not doubt. If you split the abdominal muscles instead of cutting them, it is foolish to enclose the muscles which you have taken care to split and not to divide, in a tight suture, a procedure which will certainly lead to fatty degeneration and wasting of the muscular tissue, and the disappearance of the very structures which your operation has been designed to preserve!

There are two cautions I would give you about these sutures: Do not use catgut; it is dangerous. Catgut may

soften too soon; I have known it do so. I have known it happen that a few hours after an operation the catgut sutures have disappeared and the abdominal viscera have come out through the wound. But what has happened more often is that they have come out underneath the skin, having escaped from the abdominal cavity itself. And that often leads to disaster, always necessitates another operation to close the wound again, and very probably the administration of an anaesthetic a second time and under unfavourable conditions. As a matter of fact the procedure has been attended with many accidents—that is to say, with loss of life. I also advise you not to use a continuous suture. Use interrupted sutures for each of the five layers. It takes longer, I admit, but the advantage is that each suture is self-contained; it does not depend for its efficiency upon what happens to any other part of the thread, whereas in the other case the whole line of suture is dependent upon every individual portion of it. Use interrupted sutures, and then, if by any chance one should happen to get untied or softened or if one should get infected, it is merely a localized failure, a localized injury which has been done, and not one which affects the whole suture. When a continuous suture goes wrong, failure of one spot affects for evil the whole of that suture.

In conclusion, a word about the after-treatment of these cases. The one thing I want you to remember about the surgery of the abdominal wall is that this structure is essentially a great and important muscle. Now an injured muscle should not be subjected to early strain. The tendency, in the rush and hurry of surgical hospital practice, is to get patients up too soon, to hurry them out and to think that when the skin edges are tolerably firm the whole wound is repaired. That is a grave mistake. A very important muscle is involved in every incision through the abdominal wall, and the full and complete repair of it is an extremely important incident in the patient's life, and you must guard this injured muscle against undue strain by keeping the patient in bed a sufficient time, that time being dependent upon the length and character of the incision, the size of the belly, and the general nutritive activity of the patient. You must also take into consideration any special circumstances of the case, such as the strain involved in coughing and in the patient's occupation. Let me repeat, then, that the abdominal wall is one of the most important muscles in the whole body. All surgical interference with it should be thoughtfully and skillfully planned to preserve the integrity of this muscle and its nerves. The closure of the wound should be so conducted as to restore it to its original form with the utmost accuracy, and the after-treatment should aim at protecting the weakened muscle from all undue strain.

THE report of the Surgeon-General of the United States Army issued on September 1st, 1911, shows that the mean strength of officers for 1910 was 4,216. There were 2,515 admissions, 15 deaths, and 119.54 constantly non-effective from all causes, equal to ratios 596.54, 3.40, and 28.35, as compared with ratios of 628.90, 4.20, and 30.27 per 1,000 for 1909. The admission and constantly non-effective, and death rates were lower than for 1909. The principal causes of admission in the order of their respective importance were: Influenza, 51; diarrhoea and enteritis, 40.09; bronchitis, 37; tonsillitis, 28.46; dyspepsia, 26.33; coryza, 24.67; and malarial fevers, 19.21 per 1,000. Thirty-seven officers were retired on account of disability during the year—a rate of 8.38 per 1,000, compared with 11.91 for 1909. The mean strength of enlisted men, white and coloured, for 1910, was 71,534. The total number of "admissions to sick report" was 67,940, equal to an admission-rate of 949.76, as compared with 1,062.99 for the previous year. The deaths from all causes numbered 320, of which 175 were from disease. The death-rate from all causes was 4.46, and 2.44 for disease, as compared with 4.91 and 3.02 respectively for the preceding year. The death-rate from disease is said to be the lowest on record in the office of the Surgeon-General. The discharges for disability numbered 1,007, the rate being 14.02, as compared with 16.84 for 1909. The admission-rate for disease in 1910 was 766.06 per 1,000 of mean strength, for the previous year 865.92, and for the decade 1,248.77. A chart shows that the health of the United States Army has constantly improved since 1899, when the admission-rate for disease alone was 2,125.74.

An Address ON CERTAIN OPERATIVE PROCEDURES IN THE PARALYSIS OF CHILDREN,

WITH SPECIAL REFERENCE TO POLIOMYELITIS.

DELIVERED BEFORE THE
NORTHUMBERLAND AND DURHAM MEDICAL SOCIETY,

BY

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MR. PRESIDENT AND GENTLEMEN,—Before dealing with the operative side in the treatment of poliomyelitis it is necessary that we should understand certain fundamental principles the neglect of which renders either operative or mechanical work ineffective, and ignorance of which leaves us quite unfit to judge as to whether an operation be necessary or not.

SOME PATHOLOGICAL CONSIDERATIONS.

In the first place we must learn to distinguish between a paralysis due to destruction of a motor cell in the anterior cornu, and that due to the mechanical disability of a muscle which remains inactive after the recovery of its governing cell.

We have been taught that a muscle which exhibits the reaction of degeneration is in such a state that it cannot recover voluntary power of response. Many years ago I drew attention to several recoveries in muscles which displayed this reaction, and this has been borne out by many observers, including Hoffa, Konig, Lange, and others, and has been proved both clinically and histologically by Koch.

We may look upon it as a certain and valuable fact that if a muscle reacts to faradism it will recover, but the contrary proposition does not follow. Sherren has certainly shown that, very carefully taken, galvanic reaction will show whether a muscle has been *completely* severed from its motor nerve cell or not, but in practice it is next to impossible to make this observation quite thorough.

Acute poliomyelitis of course often permanently destroys motor cells in the anterior horns of grey matter, and the muscles dependent upon them are for ever useless unless nerve transplantation in the future may come to their rescue. This complete destruction, however, is fortunately the rarer condition, and from the clinical evidence we have of rapid and complete recoveries from complete paralysis, and the very many partial recoveries, it would appear that the cells have generally suffered from temporary injury rather than from destruction.

With the irrecoverable muscle the surgeon has no direct interest; his attention is directed to the cells not actually destroyed, although the muscles governed by these cells may apparently be partially or hopelessly paralysed. It would be highly speculative to discuss the reasons why the recovered cells fail to secure control of their dependent muscles. Something has happened to make the muscle incapable of responding to a motor stimulus. Whether no afferent muscle sense stimulus is sent back to the nerve cell in consequence of this, or whatever be the reason, it is clinically certain that the nerve cells become inactive, though not extinct, and with appropriate treatment of the muscle or group of muscles, functional activity can be reinstated.

Overstretching of Muscles.

When a muscle governed by a live cell fails to act, we may call it a case of functional disability. Now, what is the cause of functional disability in a muscle? The great outstanding cause is overstretching. The surgeon has to find out the difference between a truly paralysed muscle and a muscle overstretched, and herein lies the fundamental principle which should guide us in the treatment of infantile paralysis. If the practitioner from the first disappearance of acute symptoms could prevent the weak muscular groups from being stretched, paralytic disabilities and deformities would be comparatively rare. As it is, too little attention is paid to the posture of the child during