CERTAIN INJURIES OF THE KNEE-JOINT*

BY

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The injuries and strains sustained by the knee-joint are legion, and their signs and symptoms are often so indefinite that a diagnosis is made with the very greatest difficulty, and with no great confidence. Indeed, it is because of the medical man's want of confidence in his knowledge that in many cases the patient turns away from the qualified and seeks the unqualified practitioner. There is no doubt that we of the medical profession are very largely to blame for this loss of confidence on the part of many members of the general public. Instruction in joint surgery is not given the prominence it deserves in our medical education. Our surgical teachers have for the most part stressed the great advances in abdominal surgery, and the newly qualified doctor is allowed to find out for himself what he considers the best methods of dealing with joint lesions. Fortunately there has been a great improvement in this branch of teaching during the past ten years, but much more is necessary before we cease to hear what was told me by two patients during the last fortnight. They stated they had been to unqualified practitioners, but added in explanation: "Of course, my doctor acknowledges he does not know anything about bones and joints."

We must not be content with this one-sided knowledge of the human body and its ailments; we must not only recognize the lesion which is present, but must know the best method of correcting it. It is only when we have a sure knowledge of ourselves that we are able to convince our patients of our ability to give them the correct form of treatment, and so wipe away this slur from our profession.

I now propose to discuss in turn the different types of lesions to which the knee is subject.

CRUCIAL LIGAMENTS

These ligaments, which may be taken as the sole representative of the normal bony interlocking in a large weight-bearing joint, are usually injured only as a result of very severe trauma, and such an injury is diagnosed by the possibility of an abnormal amount of active or passive gliding of the tibia on the femur. In no other lesion of the knee-joint is speed so essential in making a correct diagnosis and starting treatment, because the prognosis depends largely upon the time which elapses between the accident and the commencement of treatment. When the knee is flexed to an angle of 45 degrees both anterior and posterior crucial ligaments are relaxed, and a partial or complete rupture of either crucial ligament is best treated by prolonged immobilization of the knee at this angle for a period of three or four months.

If the ligament is completely torn and the ends separated from each other this method of immobilization is bound to fail, but fortunately in the great majority of cases the rupture is not complete, and in my personal experience there have been several cases of clinically complete rupture in which this treatment has resulted in a sound joint with no sign of ligamentous weakness. There are other cases, however, for which adequate treatment has not been adopted, or in which it has failed, and the problem arises whether any operative measures can be employed to suture or replace the injured ligament with other structures.

Many ingenious operations have been devised to deal with the condition. These have varied from the suture of the ruptured ligament *in situ* with catgut, silk, or even wire, but the end-results in every case have been disappointing. When catgut has been used the result has usually been a slow absorption of the gut and reappearance of the primary laxity. When silk or wire has been used the result has been even more unsatisfactory, because the presence of these foreign bodies has led to the formation of a definite osteo-arthritis and an increase of disability. Hey Groves devised an ingenious operation by which, through drill holes in the femur and tibia, a portion of the ilio-tibial band—which had been rolled into a cord—was used to replace the injured ligament, but unfortunately this new ligament gradually stretched, and after twelve months or so the laxity again appeared. In fact no satisfactory and reliable operative measure has been devised by which we can replace the action of either crucial ligament after a complete rupture. We are left, then, with the problem of an unstable knee in which at any moment the tibia may shoot forwards on the femur. This instability may be somewhat relieved by the wearing of a knee cage, which will prevent the shooting forwards, but the wearing of this inevitably leads to wasting of the important muscle groups surrounding and governing the joint. It is far better to attack the instability by developing these muscles by voluntary exercises and carefully regulated massage, which usually results in an astonishingly sound and useful knee-joint. When, however, both crucials are divided, or for any reason it is impossible to produce a sound muscular control, the problem of arthrodesis of the joint has to be considered very carefully.

INTERNAL LATERAL LIGAMENT

When any ligament is strained or ruptured the lesion usually occurs, not in the middle of its course, but near one or other of its bony attachments. This is a point of the very greatest clinical importance, for after a strain or tear of the internal lateral ligament the area of tenderness is found at the femoral or tibial insertion, more often the former.

Strains or tears of the ligament should be treated by complete rest for a period of fourteen to twenty-one days, during which the newly forming scar tissue is allowed to consolidate, but after that time complete fixation and want of use are inadvisable. In other words, the patient should then be allowed to walk and exercise the leg, but with the proviso that the injured ligament is protected from all strain. The increased circulation caused by use is helpful in strengthening the union and in the prevention of adhesions round the injured area. While this line of treatment is quite satisfactory in those cases where the injury of the ligament is only partial, it will fail when the rupture is complete. Just as in the instance of rupture of the crucials, simple suture of the divided ligament usually leads to a disappointing result. In such a case the ruptured ligament may be reinforced by the tendons of the neighbouring semitendinosus or gracilis muscle, which are freed from the fascia holding them to the posterior aspect of the internal condyle, and one or both are implanted into a deep groove cut into the internal condyle of the femur. In this manner the muscles become inserted into the femur and not into the tibia, their lower portions being sutured to the substance of the injured ligament and reinforcing this structure. There are, however, cases in which, after a strain of the knee, tenderness is found over the middle of the internal lateral ligament about the level of the knee-joint. These are not true cases of strain of the ligament, but strain of the attachment of the internal semilunar cartilage to the deep aspect of the ligament, and they should be treated for this lesion.

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We can say, then, that in any recent injury of the internal lateral ligament, in addition to the instability of the joint, there is tenderness, either at the insertion of the ligament into the femur or into the tibia. Later, when the inflammatory reaction has disappeared, this tenderness will also disappear, and only a greater or less amount of laxity is left to indicate the previous lesion.

EXTERNAL LATERAL LIGAMENT

Injuries and tears of this ligament are much rarer than those of the internal, probably because in most people there is a slight tendency to knock-knee, and because the external lateral ligament is protected by the powerful ilio-tibial band of fascia lata and the strong tendon of the biceps femoris. These, of themselves, are almost capable of supporting the outer side of the joint without the help of the external lateral ligament. If, however, the ligament is strained the tenderness is not usually so marked, and this absence of tenderness is probably more apparent than real, owing to the difficulty of finding the tender spot which lies under the cover of these protecting structures. Just as in the case of the internal lateral ligament, a strain or tear is accompanied by tenderness at the insertion of the ligament into the femur or the fibula, the latter being the usual site of the lesion. Strains of the internal lateral ligament are frequently accompanied by strains, or displacements, or even tears of the internal semilunar cartilage, because of the close association of the two structures, but similar injuries of the external lateral ligament are not generally associated with any lesion of the underlying meniscus, because there is no definite connexion between the two structures.

SEMILUNAR CARTILAGES

By far the commonest derangements of the knee-joint are injuries or displacements of one or both of the semilunar cartilages. These two fibro-cartilaginous bodies are placed between the articular margins of the femur and tibia, apparently in order to deepen the surface of the tibia on which the femur articulates. They are both firmly attached to the upper surface of the tibia, firstly by the very firm attachments of their anterior and posterior horns to the upper surface of the bone, and secondly, along their periphery to the non-articulating circumference of the tibia by short fibrous bands known as ligamenta coronaria. In addition, the internal cartilage has the accessory attachment to the deep surface of the internal lateral ligament already mentioned, and the external cartilage sends some fibres into the posterior crucial ligament.

The two cartilages follow very closely all the movements of the head of the tibia, but there is also permitted a slight gliding movement of both cartilages on the upper surface of the bone. In the normal knee-joint this movement is very slight, but where there has been repeated effusion into the joint, and there is a generalized ligamentous laxity, the movement may be very definitely increased.

We know certain facts regarding the mechanism of cartilage injury, but there are many points on which we cannot at present dogmatize. Twists or strains of the joint may cause injury of a cartilage, usually the one on the side towards which the strain has been directed. Thus, if the knee is strained on the inner side the internal cartilage may be injured, and similarly the external cartilage may be injured by a strain applied to the outer side of the joint. Such a displacement or injury of the cartilage never occurs, however, unless the knee-joint is flexed at the time of receiving the strain. The reason for this is obvious—the cartilages are so firmly fixed to the head of the tibia that they follow that bone in all its

movements. If, however, the knee-joint is bent at the time of receiving the strain, then a lateral or rotary strain on the joint may easily displace the cartilage from its attachment to the tibia, or may cause a definite bursting strain of the cartilaginous fibres. A close study of the histories of patients suffering from lesions of the semilunar cartilages will soon convince us that these injuries always occur when the knee-joint is in a position of flexion.

DISPLACEMENT OF INTERNAL CARTILAGE

Let us take a textbook description of a displacement of the internal semilunar cartilage, which is by far the commonest lesion.

The story is that whilst the knee was in a position of flexion the foot was suddenly twisted outwards, or the femur twisted inwards, and the patient felt a sudden acute pain in the antero-internal aspect of the joint, so that he was unable to bear his weight on the leg, and fell down. On attempting to rise, straightening of the knee may or may not have been possible, according to whether the cartilage had in the meantime remained displaced or had gone back into its normal position. This trauma was followed in a few hours by swelling of the joint, which gradually disappeared in the course of a week. At the end of that time the joint appeared normal, except, possibly, for some tenderness on pressure over the antero-internal aspect, just to the inner side of the ligamentum patellae and post-patellar pad. This displacement may only have occurred once, but usually the primary injury was the precursor of many more of a similar nature, each one occurring with slightly less cause than the last and being followed by less reaction in the joint, as indicated by the swelling. In the intervals between the occurrences no gross abnormality can be found in the joint. There may be tenderness on pressure over the antero-internal aspect, but there is no sign apart from the fact that the patient usually says the joint feels unstable and likely to give way on any similar twist.

Here the diagnosis must rest on the history, on the localized tenderness, and possibly, if we are lucky, on seeing the patient directly after one of these displacements has occurred.

DISPLACEMENT OF EXTERNAL CARTILAGE

The story of a displacement or injury of the external cartilage varies very little from that of an internal, except that the knee—again in flexion—has been twisted in the opposite direction, so that the tibia is rotated inwards, or the femur outwards, with the result that the knee is useless and there is pain on the outer side at the joint level. The subsequent story, however, is different. "Locking"—by which we mean the impossibility of straightening the joint—is extremely rare, and subsequent displacements cause a "uselessness," or feeling of extra weakness of the joint rather than the painful locking seen in the case of the internal cartilage. Sometimes there is, in the case of the external cartilage, an additional sign of "clicking," which is of the greatest help in diagnosis. This is a definite and loud click, which can be felt, or even heard, when the joint is straightened. There are two important points to be noted in regard to this diagnostic click: (1) it always occurs at the same angle of flexion of the joint, and (2) this angle is usually the last 10 degrees of full active extension.

DIAGNOSIS OF CARTILAGE LESIONS

I have deliberately gone over these signs at length because they are the only indications of cartilage trouble which are given in our textbooks, and apparently without their presence we are supposed to consider there can be no cartilage lesion.

Let us consider these signs in detail. The only way in which we can mechanically reproduce the series of signs and symptoms of a displaced internal cartilage is

by having the whole or part of the anterior end of the cartilage bent backwards and reduplicated, so that it acts as a wedge between the femur and the tibia when an effort is made to extend the leg. From this we must deduce that either a lesion of the internal cartilage never occurs behind the level of the internal lateral ligament, or if, as we know, such does occur, then its diagnosis without inspection *in situ* is impossible. In regard to the click, or cluck, sometimes caused by the abnormal external cartilage, this can only—on mechanical grounds—be due to the sudden squeezing outwards from between the extending bones of a cartilage with abnormally lax attachments. I have had the opportunity of examining the mechanism of its production on many occasions at operations, and in my experience the method of production has always been the same.

We are left, then, in a very unsatisfactory state. A lesion of the middle or posterior end of the internal cartilage, or a tear of the external cartilage, will certainly not give these classic signs and symptoms; but, nevertheless, they have an equally definite series of signs and symptoms which we must know and appreciate before we can consider ourselves capable of dealing with the various derangements of the joint. The site of a lesion in a cartilage depends, to some extent, upon the angle of flexion of the joint at the time of the occurrence of the original injury. Thus, if the joint is slightly flexed the lesion is usually towards the anterior end, while the more flexion present in the joint the further back is the site of the lesion. This rule is not invariable, but at least it is roughly reliable. Splits of the cartilage may occur at any spot. They start from the inner sharp edge of the cartilage and extend longitudinally, and as the cartilage itself is entirely avascular there is no chance for such a broken piece to join with the rest of the cartilage, no matter how long the joint is kept at rest after the original injury. Each twist of the joint leads to a further splitting of the cartilage, so that the pedunculated mass gradually becomes larger and the disability caused by it more definite. It is not usually large enough to cause locking, whether it is situated in the anterior or posterior section of the joint, but when it is nipped between the femur and tibia it does cause pain, discomfort, and a transitory weakness frequently followed by a synovitis. Similarly, a "bucket-handle" split may occur in either cartilage, and the inner portion may not be sufficiently thick to produce a definite locking of the joint, or, indeed, it may be displaced so far to the middle line that it lies between the condyles of the femur and so allows the movements of the joint to occur in an almost normal manner.

ELICITATION OF A SPECIAL SIGN

The problem before us is whether it is possible to diagnose these injuries to the cartilage, both as to their nature and site, and whether this differential diagnosis is possible at any time, and not only on the occasions when the locking or sudden spasms of pain give us some indication as to the nature of the lesion. In answering these questions we have certain facts to go upon. The first is that each time the torn or broken portion of cartilage is nipped between the femur and tibia a considerable amount of pain is caused to the patient, who can always say whether the spasm or pain was similar to that which occurred previously. If, then, it were possible so to manipulate the joint that the injured cartilage, or portion of cartilage, was nipped between the bones, and pain was caused similar to that usually experienced, it is probable that the same mechanical disturbance had occurred in each case. Such a manipulation can be carried out comparatively easily if we remember the mechanics of the joint.

If the knee-joint is first fully flexed so that the heel is placed almost on the buttock, then abduction of the leg and external rotation of the foot will bring to bear on the internal cartilage the exact same strain as occurs in the ordinary accident when an internal cartilage is displaced or torn. With the foot and leg held in this relation to the thigh, the knee is then slowly extended. If there is a lesion of the internal cartilage at any spot from the level of the attachment of the internal lateral ligament backward, a distinct click will be produced when the femur passes over the site of injury in the cartilage.

This manipulation can also be carried out in the diagnosis of lesions in front of the middle of the cartilage, but for obvious mechanical reasons the test is not so reliable in this situation, and is, in fact, not often necessary because the history and clinical signs are so much more definite and clear. Similarly, lesions of the external cartilage may be examined in almost the same way; after full flexion the joint is straightened with the leg adducted and internally rotated.

There are certain provisos to be remembered in carrying out this test: (1) in the knee of a child a click may frequently be produced in a perfectly normal knee-joint; (2) this may also be possible in some adults in whom there is ligamentous laxity without any other lesion of the cartilage; but if a definite, painful click can be produced on several occasions with the knee at the same angle of flexion, then it is more than likely there is a lesion of that particular cartilage at that spot. Once learnt, the test can easily be carried out, but it requires a considerable amount of "knack" before satisfactory results can be obtained, and practice is the only way in which one can become proficient. It is necessary to note the exact angle of the joint at which the clicking occurs, and whether it occurs at one or two angles—the latter usually indicating the "bucket-handle" type of lesion.

TYPICAL AND ATYPICAL CASES

The test is of little or no value in the typical case in which there is a lesion of the anterior end of the cartilage. The story here is so clear: the patient describes so definitely the site of pain, there is the usual area of tenderness, and there has been the usual history of locking and unlocking. But these classical cases do not make up the whole field of cartilage troubles. At least one patient in three comes with the story that as he is walking along something suddenly gives way in his knee; there is pain, and he either falls or saves himself with an effort. On close questioning he states that the pain occurs somewhere inside the joint. When asked to localize the spot he places both hands over the joint and again says, "It is somewhere inside." No tenderness can be found, and probably very little swelling, while usually there is never any locking of the joint. This is the type of case which seems to me to present the greatest difficulty. Nothing can be found by the ordinary methods of examination—*x* rays, etc. Are we then to say the man probably has an internal derangement of the joint, possibly a cartilage, and advise an exploratory arthrotomy, or else condemn him to the massage department?

If there is a lesion of the posterior end of either cartilage an exploratory arthrotomy cannot possibly do any good, because it is impossible to see the posterior ends of the cartilage *in situ* from any incision on the anterior aspect of the joint. In my experience an exploratory arthrotomy is never advisable as a method of diagnosis in lesions of either cartilage. As far as the massage department is concerned, it is already far too well patronized. We find hidden in its soothing care many types of case more suitable for active surgical treatment, and there seems little object in adding to their number. If there is a definite cartilage tear or

displacement massage cannot cure it, and its practice can only postpone the form of treatment likely to benefit the patient.

GENERAL INDICATIONS OF TREATMENT

To me the greatest difficulty in the treatment of knee-joint injuries is the diagnosis. Once this has been settled satisfactorily the carrying out of treatment is comparatively easy. Let us take a simple illustration. A patient has a lesion confined to the posterior end of either cartilage, and on opening the joint in one of the usual positions on the anterior aspect it is seen that the cartilage is apparently normal and undamaged. This is the time when certainty of diagnosis is essential, as without it we are groping in the dark and probably doing more harm than good. Diagnosis should be made before and not after opening the joint. In fact, unless it is made beforehand, opening of the joint will, in all probability, only add to our confusion. A careful examination of the story, good x-ray photographs, and an examination for localized tenderness will help us, but if these are not sufficient a careful manipulation of the joint will nearly always enable us to clinch the diagnosis.

LOOSE BODIES

There are certain errors into which we may fall, and the first of these is in regard to loose bodies. These masses of cartilage, or cartilage and bone, or calcified cartilages, are derived from a variety of sources. They may come from the edge of the articular surface, as a result of a direct blow; or from the substance of the articular surface, as a result of osteochondritis dissecans; or from the development of fibrotic changes and calcium deposition in hypertrophied synovial fringes. In whatever way they are developed they may cause signs and symptoms very much like those of a broken or displaced semilunar cartilage. There is the same unexpected acute pain in one or other side of the joint. There is the same "locking" of the joint, followed by unlocking and usually synovitis; but there is one definite difference. If the body causing these symptoms is really loose then the locking may occur on either side of the joint. If the locking always occurs at one spot then the "loose" body is not really loose but pedunculated, and may be found where the signs and symptoms indicate its presence.

ADHESIONS

A damaged or loose semilunar cartilage may be diagnosed in error when the disability is really due to the presence of adhesions in the capsule or round the attachment of the cartilage. When the capsule of the joint or the attachment of the cartilage to the upper surface of the tibia is stretched beyond its normal capacity there usually follows a considerable amount of inflammatory reaction, either localized to the injured tissues or generalized in the joint as a synovitis. When this inflammatory reaction disappears the distended tissues gradually fall together and may become adherent to each other. In this way, owing to binding together of capsule or synovial membrane, the usual range of movement in the joint is limited. Attempts to carry out the normal range of movements may pull on these adhesions and cause symptoms and signs very much like those of a lesion of the subjacent cartilage. When the adhesions are present over the antero-internal aspect of the joint, rotation of the leg outwards may cause symptoms exactly like those of a displacement of the anterior end of the internal cartilage. There is the sudden acute pain, and on account of the tenderness and pain the patient cannot extend the leg, so that the joint is apparently "locked." There may be a little synovitis, although this is never present

to any great extent, and a similar twist may produce the same symptoms on subsequent occasions. There is, however, one definite point of difference in the story. Although there is the sudden apparent locking, this is never followed by a sudden unlocking and freedom of the joint, as we find in cases of lesion of the semilunar cartilage. In cases of adhesions straightening always comes slowly, as the inflammation diminishes.

It is essential for us to appreciate these different conditions, because in the case of a recurrent displacement of a loose or broken cartilage only removal of the cartilage is really satisfactory. In the case of adhesions a gentle manipulation, under anaesthesia, is usually all that is required to produce normal function in the joint, and for the sake of our reputations we must be able to diagnose those cases which are likely to be a success in the hands of a manipulator, qualified or unqualified.

OPERATIVE APPROACH

The prognosis in regard to knee-joint lesions depends upon the general condition of the joint. If there is no trace of osteo-arthritis, if there is no abnormal ligamentous laxity, and if there is no long-standing chronic synovitis, then excision of an abnormal cartilage will leave a joint which is little removed from the normal. In this removal of the offending cartilage many points are raised as regards the technique and the extent of operation to be carried out. There are certain points on which we are all agreed. First, the incision must be so planned that none of the important ligaments round the joint are injured, and for this reason we use an incision on the anterior aspect between the patella and the internal or external lateral ligament. Secondly, we must consider the length of the incision. There are two schools of thought—those who believe in a large incision through which the operative field can be widely inspected, and through which any other abnormality in the joint can be examined, and those who use the smallest incision which is compatible with free access to the field of operation. I myself am a firm adherent of the latter school of thought, because a very long incision does not necessarily give any better view of the operative field, and the most important feature of the incision is not the length but the site. The reason why, in my opinion, a long incision into the capsule of the joint is detrimental is because such an incision is in many instances followed by synovitis, which recurs again and again as a result of the most trivial strains.

An illustration of this is the case of a footballer I saw recently. He had had a broken internal semilunar cartilage removed in its entirety through a long incision, and during the past year he had been trying to get fit to return to football. Each time he began to train the knee swelled up afterwards, in spite of the fact that the muscle development had been restored to its pre-accident condition. There was no suggestion that a piece of the cartilage had been left in, or that there was any other intra-articular lesion, but only that the long wide scar on the capsule and the synovial membrane had led to a laxity and a loss of the normal absorptive process of the synovial membrane, so preventing the full restoration of function in the joint.

The next question is whether, when the cartilage is found at operation to be broken, we should remove only the broken portion or the cartilage in its entirety. I think this is the point on which I have heard the greatest diversity of opinion. One group of surgeons is quite definite that in at least some cases it is unnecessary to remove the whole of the cartilage, and they often justify this opinion by saying that they never see those cases again in which a partial removal of the cartilage has been done. There is the other group equally definitely of the opinion that in any lesion of the cartilage the

whole cartilage, and not only the broken portion, should be removed at the time of operation. I am a very firm believer in the necessity of removing all of the offending cartilage. During the past fifteen years I have been obliged to remove many posterior ends of cartilages which have been left at the primary operation.

In regard to after-treatment, my practice is to keep the patient in bed with the knee fixed at an angle of slight flexion for ten days. After this time the stitches are removed and he is allowed to walk about with the leg still fixed on a splint for another ten days, during which time he is persuaded to exercise the quadriceps muscle. The splint is then removed and replaced by a bandage round the joint, and exercises and gentle massage are given to the quadriceps until this group of muscles is equal to those of the other leg. I have never found any difficulty from stiffness following this splint fixation, and I believe it is necessary to allow the wound of the joint to become soundly healed before strain is put on it by flexing the knee.

A CASE OF TYPE IV PNEUMOCOCCAL SEPTICAEMIA

BY

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The following case may be worthy of record, both on account of its rarity and of its successful conclusion. The diagnosis was only made after many investigations, and the blood culture on which it depends was repeated, at an interval of two days, with the same results.

CASE HISTORY

The patient, a widow aged 34 years, was admitted to hospital complaining of attacks of shivering and pain in the epigastric and lumbar regions for two weeks. There was nothing outstanding in her past history; she had had no serious illnesses, and she had never been abroad. She had no children. As regards her present condition, the pain was not severe and the shivering attacks did not upset her, although they were sometimes followed by vomiting. Her bowels were regular and the motions normal. She had no urinary symptoms, and no menstrual disturbance or vaginal discharge.

Examination of the abdomen elicited slight tenderness and rigidity in the epigastrium and right hypochondrium. There was nothing abnormal palpable. Rectal and vaginal examination revealed no abnormality. Her heart and lungs were normal. Her throat was clean and the teeth healthy. There was no nasal or oral discharge. She was running a swinging temperature from 99° to 104° F., but showed very little general disturbance. The investigations made, the patient's progress, and her treatment can best be considered together, with reference to her temperature charts.

First Week

Pathological investigations revealed a moderately severe anaemia: red cells, 3,600,000 per c.mm.; haemoglobin, 44 per cent. There was a polymorphonuclear leucocytosis of 13,000 per c.mm. Agglutination reactions for *B. typhosus* and *B. paratyphosus* A, B, and C, the Salmonella group, and for *Brucella abortus* were all negative. Urine was normal, except for a trace of bile.

Second Week

An x-ray photograph of the gall-bladder showed no abnormal shadows. On blood culture there was a heavy growth of a short-chain coccus, which was identified as a Type IV pneumococcus. This was repeated two days later, with the same result. The blood sedimentation rate was 50 per cent. (one hour reading). The patient's general condition was worse, although she still felt fairly well. She was given a single intravenous injection of 5 c.cm. of collosol argentum.

CHART 1.

Third Week

Two injections of 10 c.cm. of Pané's polyvalent anti-pneumococcal serum were given. Although a third blood culture at this time was negative, there was no improvement in the patient's general condition. The blood sedimentation rate had risen to 61 per cent., and the leucocyte count had fallen to 9,000 per c.mm. There was an acute cardiac dilatation, the apex beat being in the mid-axillary line. The patient complained of pain in the right side of her chest, and a small patch of pleurisy and impaired resonance was found. X-ray examination of the chest confirmed the cardiac enlargement, but showed no abnormal shadows in the lungs. A course of injections of S.U.P. 36 and nucleinic acid, 1 c.cm. of each daily, was started.

CHART 2.

Fourth Week

For five days the patient had no rigors, but remained very ill. The pulse was persistently over 100, and sometimes up to 140. The anaemia was very severe, the red cells being only 850,000 per c.mm. and haemoglobin 24 per cent.

Fifth Week

A blood transfusion of 750 c.cm. was given, with an immediate improvement in the general condition. In two days the pulse had settled to about 90; although the rigors

CHART 3.