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A Clinical Lecture

ON

MODIFICATIONS IN THE MOVEMENTS OF THE KNEE-JOINT DIRECTLY CONSEQUENT UPON INJURY.

DELIVERED AT THE LONDON CLINICAL SCHOOL OF
MEDICINE (SEAMEN'S HOSPITAL).

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[WITH SPECIAL PLATE.]

GENTLEMEN,—The remarks which follow are intended to apply only to cases in which modification of movement at the knee occurs, either immediately upon the receipt of injury, or supervenes after an interval without the intervention of any organic disease of the joint. The primary excessive mobility occasionally met with in complete dislocation and in extensive lacerations is outside my present purpose, and I am not now concerned with impairment of motion from paralysis following upon nerve injury.

I.—MODIFICATION OF MOVEMENT FOLLOWING IMMEDIATELY UPON INJURY.

For clinical purposes this variety may be divided into two types: (a) That in which the joint is completely locked, no movement of any kind being possible; and (b) that in which flexion to a limited degree, which differs in different cases, is possible; the restriction of movement in each case being due either to mechanical obstacle or to pain, as the case may be; in none of these cases is complete voluntary extension possible unless the limitation be due merely to effusion into the joint, a matter to which further reference will be made.

Cases in which Complete Locking of the Joint Occurs.

1. From mechanical obstacle. The commonest cause of this condition, in which the leg is usually fixed at some point between extension and semiflexion, generally nearer to extension than to the other position, is in patients up to 30 or 35 years of age displacement of one or both semilunar cartilages. After that age displacement of the semilunars becomes a less frequent cause, as it gives way to intrusion between the bone ends of hypertrophied synovial fringes, especially in osteo-arthritic subjects.

A certain number of cases may arise from anatomical peculiarity in the arrangement of the tissues behind the ligamentum patellae and in a few instances to the implication of an abnormal flap of synovial membrane, etc., underlying and dependent from the patella. This last condition, which I do not remember having seen mentioned in surgical literature, is well illustrated by the following case: A man 23 years of age who had from time to time noticed a "catch" in the left knee whilst walking, slipped when running and found the knee completely locked in a slightly bent position; in the course of hobbling home the knee suddenly became free. Similar happenings repeated themselves and I finally saw him with

the knee locked. An operation being obviously indicated I opened the knee and found the cause of the trouble to be an apron-like flap of synovial membrane quite normal excepting at its free end, which had been squeezed between the bones. Removal of this flap of course entirely cured the symptoms. The structure removed was clearly a mere abnormality and not a pathological product. I have since noticed in other knee-joints a similar flap but smaller springing from the same situation. In only one case have I seen the knee locked in a position of flexion, the calf of the leg being almost in contact with the thigh. This occurred in a man 50 years of age or thereabouts, the subject of osteo arthritis, who fell down stairs and found the limb fixed in the position indicated; no manipulation with or without anaesthetics availed, and upon opening the joint an irregular loose body as large as an ordinary marble was found wedged in between the tibia and femur, just in front of the point of crossing of the crucial ligaments. The remaining causes are for the most part completely loose bodies ("loose cartilages") or bodies attached by long pedicles.

Other causes are met with, such, for example, as a piece of bone broken off from one of the condyles of the femur acting on a wedge between the bone ends, an example of which was at one time in the museum of St. George's Hospital. Conditions of this kind are, however, so rare as to be of little importance, excepting that they emphasize the value of the use of the *x* rays in the diagnosis of these cases. The causes already mentioned are all intra-articular, and produce mechanical obstacles to movement which may or may not produce great pain.

Fixation of the joint as a consequence of displacement of the tendon of the popliteus muscles is, I believe, sometimes thought to occur, and in two cases at least such a cause has been given by surgeons of repute in cases which have afterwards come under my observation. Although the diagnosis naturally excites admiration, I am compelled to confess that I have never been able to arrive at it myself, nor have I met with anything in the course of operations upon the knee or in the dissected subject which would lead to the conclusion that displacement of the popliteus tendon without displacement of the external semilunar cartilage could provide a mechanical obstacle sufficient to lock the knee.

Locking of the knee-joint, which may in the absence of anaesthesia be apparently complete, may arise from conditions outside the joint, the fixation being due to muscular spasm secondary to pain. The most striking of these which I have seen, the diagnosis having been corroborated by the *x* rays, were oblique fracture of the head of the tibia, fracture of the fibula immediately below the head, and spontaneous detachment of a pedunculated osteoma from the femur, just above the inner condyle. The case of fracture of the fibula below the head is worth a brief notice. The patient was a man 28 years old who in slipping off the kerb felt an acute pain on the outer side of the knee which at once became slightly flexed and could not be moved. I saw him within a few hours of the accident. The knee was somewhat bent; any attempt at movement in the joint was impossible on account of the pain. There was marked tenderness on pressing along the line of the joint just above the head of the tibia, such as is often present in displacement of the external semilunar, no crepitus could be felt, but an *x*-ray examination readily detected the lesion.

With regard to the treatment of these locked cases, it is essential that means should at once be taken to make the diagnosis sure and to rectify the defect. There is no excuse whatever for delay, whether there is great swelling or not. An anaesthetic should be administered as soon as possible; if, when the patient is fully under its influence, the limb drops spontaneously into the extended position, the question of a foreign tissue between the bone ends may be set aside, but if the knee remains bent, no matter how slightly, there is almost certainly something out of place, which must be replaced by manipulation if possible.*

It should be noted that the main part of the limitation of movement in these cases is due to muscular spasm, the amount actually caused by the structure wedged between the bones being often comparatively small. Profound anaesthesia removes the spasm of the muscles and reveals the real amount of limitation produced by the mechanical obstacle. This limitation is at times so little that an inexperienced person may easily be led to think that the obstacle no longer existed, because the limb, unless compared very carefully with that on the opposite side, may seem to be straight. This very careful comparison of the two limbs under the circumstances is especially called for, because extension in its extremest degree is not possible naturally in all subjects—the knees in such persons seeming to be a little bent even when the limb is straightened to the fullest extent so far as they are concerned.

It would seem needless to insist on immediate action in cases of this kind, but it still remains a fact that even in these days there is a tendency with some people to postpone attempts to rectify defects of this kind for insufficient reasons. Whenever available, the x rays should of course be used, and not set aside because it may seem unlikely that they will give any information. Although the spontaneous straightening of the limb to its normal extent under the anaesthetic shows that nothing is wedged between the bones, it by no means proves that the fixation previously existing was not due to impaction of a loose body, because these bodies are notoriously elusive, and very liable to slip back into the joint as the patient becomes unconscious.

Cases in which Restriction of Movement follows immediately upon Injury without Complete Locking of the Joint.

In certain cases in which a foreign body becomes wedged between the bone ends, some amount of movement is possible if the intruded issue is very small or so situated that it exercises its wedge-like influence in certain positions only; but as a rule cases in which movement is limited only, are caused by conditions either outside the joint, or, if intra-articular, are unconnected with structures intruded between the bone ends, such, for example, as may occur when a semilunar cartilage is so completely loosened as to lie in the intercondylar notch, a not altogether rare condition. The commonest, perhaps, of all intra-articular changes, although it is one which has not received much attention, in cases of this kind is, I believe, more or less laceration of one or both crucial ligaments. It is noteworthy that in nearly all the cases in which defective movement of the kind we are considering follows after an interval upon injury, the main difficulty is in flexion, and not in extension, as happens when locking at first has been complete. The injury leading to lesion of the crucial ligaments is generally a violent forcing backwards at the knee-joint. In a case of this kind, in which gangrene followed on account of damage to the popliteal vessels, the anterior crucial ligament was torn three parts across. Injury to these ligaments as a cause of defective movement in the knee is probably commoner than is usually supposed. I shall refer to a notable instance presently.

Beyond the causes already mentioned, the most common are extra-articular, such as laceration of muscle close to the joint, the inner head of the gastrocnemius being, perhaps, the commonest part affected; thrombosis from injury to a vein; the formation or rapid increase of a popliteal bursa in osteo-arthritic subjects with effusion in the knee-joint, in connexion with which a suggestive clinical fact sometimes occurs which is best illustrated by a case. A patient 53 years old, who had long suffered

from osteo-arthritis with effusion in both knees, which were continually painful, whilst under my observation fell heavily with the right knee bent under him; acute pain followed, and when I saw him an hour or two later he was able to bend the knee only very slightly without intense pain; there was no increase of effusion, and extension to the full degree was easy. The popliteal space was full and tender. In the course of a few days the general fullness in the popliteal space had gone, leaving a well-defined bursa easily detectable which had not, I know, been previously perceptible. By degrees flexion became painless, but never so complete as before the injury; the acute pain, however, from which the patient had continually suffered before entirely disappeared. The case affords an excellent illustration of the way in which the formation of a bursa in connexion with an osteo-arthritic condition with effusion will, by relieving tension in the articulation, relieve pain which has resisted all attempts at cure—a fact which, although familiar to those who are much concerned in treating joints of this type, is not often so well demonstrated by injury. The diagnosis of these cases raises one or two practical points. Speaking generally, it will be found that in intra-articular conditions following injury in which defective movement immediately ensues, whether it be complete locking or mere limitation, if the main difficulty is in extension there is a mechanical obstacle of some kind between the bone ends or wedged somewhere in the joint. Exceptions to this occur rarely in the event of loose bodies being caught in the suprapatellar pouch. If extension is free, the question of foreign bodies between the bones may be for practical purposes set aside. In relation to pain upon flexion after injury the effect of effusion into the joint is of moment. In the majority of cases like those which we are discussing, acute effusion occurs in a greater or less degree, and acute effusion unless very trivial always presents an obstacle to flexion, but not to extension unless great tension from an excessive amount of fluid exists. In determining whether pain on flexion under these circumstances is due merely to effusion or to some form of damage to the joint mechanism the principal means of diagnosis lies with the distribution of the pain. If the obstacle to flexion be due to effusion only the pain will be most intense across the joint at about the level of or a little above the upper end of the patella—being caused, in fact, by the tension in the suprapatellar pouch; if, on the other hand, it be due to intra-articular damage it will be felt most acutely along the lateral line of the joint, across the ligamentum patellae or deep in the popliteal space; but loose bodies in the patellar pouch, such as are sometimes met with in osteo-arthritis, may produce pain during flexion like that caused by effusion and for the same reason. The decision as to whether the defect is due to extra-articular damage or not must depend largely upon the evidence of injury to the soft parts, as shown by swelling, bruising, tenderness, and so forth.

II.—MODIFICATION OF MOVEMENT FOLLOWING UPON INJURY AFTER AN INTERVAL.

In this type of case the interval between the receipt of injury and interference with movement may vary from an hour or two, or even less, to weeks, or perhaps months. In the former case the defect may generally be regarded as temporary and readily curable; in the latter the defect is generally permanent unless remediable by some radical measures. When the oncoming is quick the difficulty is generally in effecting extension, flexion being comfortable and easy. In the defect which supervenes after a long interval, with the exception of cases in which improper splinting has led to adhesions, or in which laceration of the crucial ligaments has occurred, the cause is usually extra-articular and often quite remote from the joint, flexion as a rule being the restricted movement. In the cases in which the symptoms follow soon after injury the interval may be so short as to be misleading unless the history of the patient is carefully weighed. As an example of this the following case will serve: A man, 38 years old, who from time to time had for several years suffered from slight pain in the right knee after much exercise, noticed some discomfort in the joint after playing a couple of rounds of golf. He walked home, a distance of a mile and a half, with some inconvenience

* This observation applies only to cases dealt with very soon after the injury: when replacement has not been effected until some days later, temporary slight flexion of the knee may remain after reduction in consequence of swelling about the parts concerned.

and increasing stiffness. He sat down to dinner with a slightly painful knee, and found, on attempting to rise from his chair later on, that the leg was fixed in a bent position, and could not be straightened on account of the pain. He consulted me a few days later. On examination the leg was bent at a position midway between extension and semiflexion. At the inner side of the knee, in connexion with the hamstring tendons, was an extremely tense bursa, which upon any attempt at extension became intensely painful; flexion was easy and comfortable. This was clearly a case of gradual strain of the knee, resulting in the distension of a pre-existing bursa. An interesting and deceptive symptom in the case was a painful and tender area over the external semilunar cartilage, which, had the history been misinterpreted, might easily have led to an impression that the cartilage had been displaced.

In all cases of limitation of movement, especially if it be flexion, supervening at any considerable interval after injury, the liability of the defect being due to lesions remote from the joint is a very important consideration; indeed, in any case of the kind it is essential that a careful examination of the whole limb should be made before a definite line of treatment is decided upon. The following case is an excellent object lesson in this respect: A man, 26 years old, fell across a plank, striking his thigh and damaging the knee. Some swelling of the joint followed which under treatment subsided, and for a time he got about his usual business. A few weeks afterwards, however, he began to feel some pain about the knee and thigh when the leg was acutely flexed, and by degrees he found the bending of the leg more and more difficult, until any bending beyond a right angle became impossible. At this stage the defect caused very little inconvenience in a general way, but after walking more than a mile or two the limb felt heavy and weary, some aching pain being at the same time felt in the thigh. He therefore consulted a bonesetter, who proposed to break down the "adhesion" by forcible flexion, but fortunately before submitting to this treatment he sought further advice, although he said he had already been told by a medical man that if there were adhesions, he did not think they gave enough trouble to justify their being broken down. Upon examination I found the following condition: The patient was a healthy-looking subject, who walked well, and without any suggestion of lameness. Flexion of the leg upon the thigh was abruptly checked at a right angle; there was no pain, and the movements of the joint were perfectly smooth and natural up to the point of locking. Upon examining the thigh its middle third was rather full and very hard, altogether unlike the opposite side. On seizing the quadriceps muscle at this spot it seemed for the most part to consist of a solid mass. I came to the conclusion that the injury to the thigh had led to myositis ossificans of the quadriceps, which accounted for the abrupt arrest of flexion of the leg at a right angle, as I had seen happen in other cases. An x-ray photograph by Mr. Mackenzie Davidson, corroborating the diagnosis, is reproduced in Fig. 1.

Had the breaking-down treatment been adopted and the leg violently flexed upon the thigh, one of two things would have happened—namely, rupture of the quadriceps just above the knee, or fracture of the patella. I was present at a case of a similar kind in which the latter accident occurred. Should no cause remote from the joint be detected some intra-articular condition must be considered. There is little doubt that the most inveterate of intra-articular causes of limitation of movement of the kind under consideration is laceration of the crucial ligaments. A few years ago a case of this kind afforded me one of the few opportunities which have in my experience justified a transpatellar investigation of the knee-joint after injury. The patient was a robust man, whose knee when flexed came to a dead lock at a right angle; there was no pain or other trouble, but, for reasons sufficient for the patient, it was thought absolutely necessary that an attempt should be made to obtain a freely-movable joint at any cost. A transpatellar examination was therefore made. Nothing abnormal was found beyond complete matting together of the crucial ligaments, which had evidently been badly torn in an accident three years previously. An attempt was made by splitting the matted tissues to reproduce something approaching a normal arrangement, but it could hardly be described as successful so

far as the ultimate result was concerned; the patient was, in fact, neither better nor worse for the operation.

In the investigation of cases in which complete extension at the knee-joint is apparently impossible some time after a severe injury it should not be overlooked that the defect may be due not to any lesion in the knee itself but to the union in a faulty position of a fracture in its immediate neighbourhood, a condition well shown in Fig. 3, to which I shall refer again. The most deceptive condition of all in this respect, the mechanism being precisely the same as that seen in Fig. 3, occurs occasionally in young subjects in consequence of overgrowth of the anterior segment of the lower epiphysis of the femur, which leads to a slight turning backwards of the articular surface of the condyles and leaves the leg slightly bent upon the thigh although it is fully extended at the knee joint. This condition of the epiphysis seems to be produced by some trivial injury. The cases which I have seen have been in patients about 12 years old who had been suffering a good deal from "growing pains" in the affected limb. I have in my possession an excellent x-ray photograph of one of the cases, but at this moment I cannot place my hand upon it.

ABNORMAL MOBILITY IN THE KNEE-JOINT AFTER INJURY.

In a certain number of cases of severe injury in the region of the knee-joint excessive mobility, apparent or real, is found either upon removal of splints or other retaining apparatus, or slowly develops in course of time.

In cases where there has been extensive laceration of the capsule or ligaments, notably the posterior, the development of such abnormal mobility should excite no surprise. The unnatural lateral movement associated with almost all displacements of the semilunar cartilages, increasing in degree with each recurrence, is too familiar to require notice here, and there are other causes, with which time does not allow me to deal. In a number of cases of this kind the cause of the apparent abnormality lies altogether outside the joint, and it is to these, the most interesting of all, to which I wish to call your notice, as they have, so far as I know, received too little attention. It more often happens, I think, than is commonly thought that after fracture of the lower end of the femur there is a certain amount of over-extension "in the knee"—that is to say, in extreme extension of the lower limb; the leg, instead of forming a straight line with the thigh, inclines forward at an angle which varies in degree in different cases, sometimes to an extent hardly noticeable, at others to a degree which is not only noticeable, but which completely cripples the patient. The position assumed by the leg in the slighter cases of deformity is sometimes attributed to elongation or relaxation of the posterior ligament, etc., whilst the extreme degrees lead to a condition which might, upon superficial or careless examination, suggest exaggerated genu recurvatum.

As a matter of fact, the knee-joint in these cases is of course not involved at all, the abnormal position being due to the lower femoral fragment having united in a faulty or vicious way. The following is a typical, although exaggerated, example:

A man, 28 years old, sustained a compound fracture of the lower end of the femur from gun-shot wound. Firm bony union followed in due course. When he commenced to walk about he found that "the knee" was inclined to bend backwards, at first, whilst the limb was still stiff, only slightly, but to such an extent when the joint had become supple that it would, unless he was very careful, suddenly "give" in a backward direction and bring him to the ground. With great care, whilst his attention was concentrated on the limb, he could walk fairly well in a rather stilted fashion, but if his attention was withdrawn, back would go "the knee," with the result described. The condition being an impossible one for active purposes, he was sent to me for advice. It was at once obvious that the knee-joint was quite natural in all respects, and that the defect complained of was due to the lower fragment of the femur having united so that the condyles pointed forwards, with the result that when the knee was fully extended the leg was bent forward, as if in a position of hyperextension. When walking, so long as he kept the knee-joint sufficiently flexed to correct the faulty axis of the lower fragment, he got along pretty well, but the moment he was off his guard the leg became automatically

extended at the knee and down to the ground he came. The treatment offered only two alternatives, the rectification by operation of the faulty position of the lower fragment of the femur, or the use of an instrument so constructed as to prevent complete extension of the leg at the knee; the latter course was chosen.

Fig. 2 is an x ray photograph of the case which will explain itself, and should be contrasted with Fig. 3, which shows exactly the reverse condition, the lower fragment having united with the condyles pointing backwards in such a way that when the leg was fully extended at the knee it was still bent upon the thigh. I quote this case particularly in some detail, not because it would be likely to deceive any but a very careless or inexperienced person, but because it demonstrates so well (especially if taken together with that shown in Fig. 3), a condition which if it occurred in a very slight degree might readily be misinterpreted unless the importance were realized of bearing in mind the fact that apparent abnormal movement in the knee-joint may be due to causes outside the articulation, and to show the supreme importance of the use of the x rays in all of these cases.

AN OPERATIVE DEMONSTRATION OF THE OCCASIONAL DIAGNOSTIC ACCURACY OF THE X RAY IN URINARY STONE.

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[WITH SPECIAL PLATE.]

SOME surgeons are rather disposed to undervalue the use of the x ray in the diagnosis of urinary disease, because the method is only occasionally helpful in obscure cases, and because it is only an atom and not the entire molecule of clinical investigation.

Others, again, do not seem to be guided by any rules for the interpretation of the shadows which are shown on the plate, and are quite content to accept the opinion of the radiographer, upon whom no responsibility should rest. No wonder such casualists are disheartened by the mistakes and failures which must necessarily occur. But surely there is a middle course. Let us admit many failures, some fallacies, and very decided limitations for the x ray, but let us employ it routinely when it is possible, and control its findings by operative work. Upon some such sound basis as this let rules of shadow interpretation be framed. If this be done, it will be found that the accuracy of clinical detail occasionally revealed by the shadows will be simply startling. I have given you certain rules which have guided me in my estimation of the character of x-ray shadows, and these are based on 1,000 radiographs of urinary disease. I admit they are merely tentative, but I can give no greater evidence of my dependence on them than by utilizing three or four of them this afternoon to draw for you on the blackboard a rough sketch of the left kidney of the patient who has just been brought into this theatre for operation. I only ask you to remember I cannot do this in every case; it is merely done now in this exceptional instance to show you how valuable the clinical evidence of a radiograph may occasionally prove.

This young man is sent by Mr. Richard Whitlam, of Fulham, with a note that there is probably a stone in the left kidney accompanied by serious destruction of that organ. The patient has but few symptoms. He has had a slight pain in his left loin on and off for ten years, which he ascribes to "wind," but his urine contains $\frac{1}{2}$ to $\frac{1}{4}$ acid pus, which is obviously pyelitic, and on examining the left loin an enlarged but fixed kidney is distinctly to be felt. I will first sketch this kidney on the board, and show the changes in its contour and texture; I then propose to do nephrectomy, which I think will be necessary. If so, the section can be compared with the diagram, and finally I will explain to you the steps by which the clinical assumptions were arrived at.

This radiograph (Fig. 2) was taken by Mr. Harnack, of our radiographic department, and from the negative, for I do not believe in prints, I gather the following facts,

which I illustrate diagrammatically (Fig. 1): The left kidney is dilated by back pressure. This was originally a hydronephrosis, but as much pus has latterly appeared in the urine, I take it the kidney is now in a state of hydro-pyonephrosis. I therefore draw the kidney dilated, and write the diagnosis at the side. *You notice especially that I do not mark a dilated pelvis; there is no pelvis.* Secondly, I know the lower pole of the kidney is transformed into a smooth-surfaced, thin-walled cavity, which is merely a dilated lower calyx, and within it six smooth oxalate of lime stones are lying free. I mark this cavity off and put six little circles to represent the stones in it. To prove to you the thinness of its wall, I shall raise the lower pole in a few minutes to the surface of the wound, and you will see that the cortex will dimple under the slightest touch of the finger. This, of course, indicates thinning. To remind you, I will write "dimpled cortex" opposite this area. Thirdly, higher up on the convex edge of the cortex in the lower middle part of the kidney is an independent projecting cyst. I draw a bulge at this spot and put "cystic cortex." On incising this I shall release a quantity of inodorous pus, and on inserting my finger I shall find another dilated calyx so over-distended as to form a projecting cyst. The mouth of this cyst-forming calyx is blocked by the knob end of an oxalate of lime stone. I mark this stone, drawing two little curved lines from its neck. Fourthly, higher up again the cortex of the kidney may be thicker, but the upper pole is also transformed into a cavity which contains no stones. I cannot say if there is a real cyst at the upper pole or not; I can, however, assure you that it is extremely dilated, so I will just dot the convexity of the pole to denote this. Lastly, an oxalate of lime stone is in the pelvis, and it has a nose or conical projection in front. I know that this nose of the stone has blocked the pelvic outlet and back pressure has resulted. It is, in fact, "a plugging stone," so I write this at the side. I may finally add that the oxalate of lime stone in the pelvis of the kidney is somewhat dumb-belled in shape, so I draw it of this shape; its surface is rough with phosphatic deposit.

The operation was now carried out. The cortex was exposed, and the lower lobe was raised and shown to dimple under the pressure of the forefinger; higher up the projecting cyst was demonstrated, and 6 oz. of inodorous pus and urine were sucked out from it. Nephrectomy being found necessary, the organ was removed. After the wound was closed the kidney was cut lengthwise for demonstration (Fig. 3). The changes in it were proved to be as depicted in the diagram on the board. The kidney was dilated greatly in all parts, the cortex being extremely thin. The lower pole was much hollowed, and contained five instead of six stones, the sixth being found in an adjacent cavity. An oxalate of lime stone was found in the pelvis; it was firmly gripped by the pelvic mucous membrane, its front projection (the nose) blocked the ureter, and the one towards its posterior aspect (a boss) was tightly embraced by the mouth of a deep calyx, and the back pressure exerted by it had created a cyst which projected from the cortex of the lower middle third of the organ. The upper pole of the kidney was much dilated, but there was no true cyst projection, and there were no stones in this portion of the organ.

Now, what clinical and radiographic data gave me such confidence that I could draw exactly beforehand a condition of kidney which was unrecognizable to touch? Permit me to enumerate them.

The shadows in the left loin space of the radiograph are very sharp, and the man is young, therefore they are oxalate of lime stones (Rule 3). There is acid pyuria, hence they will have a slight coating of phosphate of lime (clinical rule).

The six isolated shadows are grouped near the mid-ileo-costal vertical (the mid-vertical line), hence I conclude they are in a calyx (Rule 8*), and as they are seen below the main large shadow, which must be a stone in the pelvis, they must be in a calyx of the lower pole. The shadows are clearly separate, hence there is fluid between them

* Rule 8.—Discrete shadows ranged along the mid-ileo-costal vertical (a line running vertically from the centre of the iliac crest-shadow to the rib, the lamp being mesial) usually denote stones in dilated calyx.

TO ILLUSTRATE SIR WILLIAM BENNETT'S LECTURE ON KNEE-JOINT INJURY.

Fig. 1.—X-ray photograph of the middle third of the thigh, showing myositis ossificans of the deeper portion of the quadriceps extensor femoris, which caused abrupt arrest in flexion of the leg at a right angle, the knee-joint being normal.

Fig. 3.—Faulty union of fracture of the femur immediately above the condyles, showing the mechanism by which extension of the leg upon the thigh would be rendered impossible, in spite of the knee-joint being normal.

Fig. 2.—Faulty union after fracture at the lower end of the femur, causing the leg to assume a position when completely extended suggestive of genu recurvatum.