INTERNAL DERANGEMENTS OF THE KNEE *

William Darrach, M.D., Sc.D., LL.D.

New York, N. Y.

When a patient complains that his knee slips, catches, locks or gives way, it is no longer wise to make a diagnosis of a loose meniscus, and take it out through a peep-hole incision. There are other conditions which are involved in these attacks of instability, pain and swelling which should be considered and attended to.

The stability and usefulness of the knee joint can be interfered with in more ways than one. It is better not only to make as careful a preoperative diagnosis as possible, but also to make as thorough an exploration as can be done without impairing the joint function. The synovial lining and its subjacent fat pads, the articular cartilage covering the femur, patella and tibia, the lateral and crucial ligaments must be considered as well as the meniscus on each side. In addition to these conditions, loose bodies in the joint and abnormalities in the periarticular structures should be borne in mind.

If a naked femur and a tibia are fitted together, one is impressed by the poor fit of the articular surfaces. With the menisci in place, the cup for the condyles on each side is a little deeper but it still looks pretty unstable. When the collateral and cruciate ligaments are added, it gains a good deal of rigidity. But clinically the knee is only rigid in two positions, extreme extension (the locked position) and extreme flexion. These ligaments are all lax in any other position as can be shown by the distinct amount of rotation and lateral motion which can be obtained in any normal knee if the muscles are relaxed. If it is realized that the only time, in normal use, that the knee is fully extended is when the individual stands with his weight on one leg, the importance of these ligaments in maintaining stability becomes negligible. They check excessive motion but they do not hold the knee rigid. In ordinary walking, running, lifting, sitting or in the various forms of athletic exercise, the knee is never in complete extension or complete flexion. The stability and smooth function of the normal knee depend on the supporting muscles which pass across it. Hence, the importance of maintaining the tone of these muscles when the joint becomes deranged. As the knee is flexed and extended, the point of contact between femur and tibia shifts forward and backward. Coincident with this the menisci move forward and back. This probably is due to the pressure of the approaching articular surfaces in the same way that a watermelon seed can be propelled when squeezed between thumb and finger. Unless the pressure is maintained steadily, however, they can be caught between the opposing surfaces and then become subject to crushing injuries, which split, break or loosen their attachments.

In certain parts of the knee joint, the synovial lining is firmly adherent to

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osteochondritis dissecans. Chondritis lesions undoubtedly give rise to more exaggerated symptoms than when the articular cartilage covering the femoral and tibial condyles and the back of the patella frequently shows evidence of disease. Instead of the bluish white appearance and hard surface it may be distinctly yellow and soft. When a smooth instrument is rubbed over its surface, it feels loosened and can be thrown into little folds. The cartilage may be fissured and frayed so that finger-like processes can be lifted up. The process may go deeper and involve almost the whole depth of the cartilage and large portions may be partly detached with the formation of pedunculated flaps. The more exaggerated picture where large areas several cm. in diameter are more or less completely separated with a portion of underlying bone is less commonly seen. It is believed that only this extreme type deserves the title of osteochondritis dissecans. Chondritis seems a better term for what may be the early stages of the same condition. This condition can quite well be explained by trauma alone, without making use of the embolic theory. The milder lesions are frequently associated with an abnormal meniscus, fat tabs
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and loose bodies, or they may be the only discoverable lesion. When these portions of articular cartilage become entirely separated they form a second type of loose body. A third type of loose body is seen when a portion of the condylar surface is knocked off by direct trauma. Sometimes its former site appears as a concavity in the condyle, the surface of which varies with the time elapsed since the accident. In several cases with rather recent accidents, masses of fibrin were found lying on and adherent to the synovial lining. In one case a strand was found, six cm. in length and attached only at its two ends. These easily might have become detached to form loose bodies.

Seventy-nine per cent of our cases gave a definite history of injury to the knee which usually involved side bending or rotation. It is quite logical to suppose that most meniscus cases start with such an injury which loosens their normal attachment and makes them more likely to become pinched and injured. When such knees are explored soon after the injury, it is often possible to demonstrate tears in the aponeurotic layer, in the lateral ligaments, in the synovial layer and the patellar tendon. In our last 109 cases, 18 per cent showed partial or complete tears of the anterior cruciate ligament and many of these had no instability demonstrable.

The various types of injury to the meniscus are well known. It may become detached at any point in its circumference and split in any direction, or it may only be abnormally loose. In any case it gets caught between the condylar surface and makes trouble. Cysts occur occasionally in the cartilage. We have but one suspected case which refused operation. Occasional new growths are found in the periarticular structures which may interfere with normal joint motion. We had one example of hemangioma invading the region of the knee which had extended into the alar fat pad and become injured. In a number of these cases hypertrophic lipping of the margins of the femoral or patellar articular surface was found. These irregular spurs may be smooth and rounded or may present sharp, jagged edges. The synovial membrane in contact with these projections shows the evidence of repeated irritation. Irregularities in the articular surfaces of either femoral condyle, or tibia, or the dorsal surface of the patella as a result of fracture, sometimes interfere with normal joint function.

The histories of patients with internal derangements of the knee are very similar irrespective of the condition existing in the joint. There are usually repeated attacks of what they describe as slipping, catching, giving way, or locking of the knee, usually accompanied by a sudden, sharp pain and followed by more or less joint swelling. The attacks may be slight in severity and transient in duration, relieved by shaking the leg or kicking it out straight. On the other hand, the joint may be definitely locked with inability to change the position which persists for several days. Some people are able to discover just what motions bring these attacks on and learn to avoid them. One patient is recalled who gave up, one after the other, tennis, golf, swimming and running, but when her knee locked as she turned over in bed, she
agreed to operation. In the large majority of cases, the trouble starts with a definite injury which usually involves abduction or rotation of the leg on the thigh. It is probable that in the meniscus cases, the normal attachments of this cartilage are so torn or loosened as to make it more subject to getting caught between the articular surfaces.

An accurate detailed history together with a thorough examination as to points of tenderness and abnormal mobility, and a careful palpation of the whole region of the knee joint may enable us to differentiate between some of these various forms of derangement. One's diagnostic ability, however, is usually not sufficient to avoid mistaking the main lesion, or in ruling out other associated lesions. In a large majority of cases, therefore, it would appear better surgery, when a knee is operated on for an internal derangement, that it be thoroughly explored. In the last 100 cases we have had, 27 per cent showed a single lesion; 27 per cent showed two lesions; while the remaining 46 per cent showed anywhere from three to 11 abnormal conditions in the joint; 73 per cent showed multiple lesions.

Inasmuch as the stability of the knee depends so largely on the tone of the thigh muscles, too much attention cannot be paid to as rapid a return of them to normal as possible. The best way of developing muscle and maintaining its efficiency is by active movements on the part of the patient. It seems to be a fact that any operation on the knee joint will entirely interrupt the contacts between the central nervous system and the muscles, so that for a while the patient is quite unable to contract his thigh muscles at all, and this varies from a few hours to a week or even longer. It is believed that the period can be shortened materially if the patient practices contracting his thigh muscles before operation. This voluntary control of muscular action should be resumed at the earliest possible moment after the operation, whether the joint is actually bent or not.

Although the old fear of opening knee joints has largely disappeared, the danger of infection still exists and the results of an infected knee joint are still terrifying. The experience of an ankylosis following infection makes one appreciate this. It seems wise, therefore, to exercise every precaution which lies at our disposal to prevent this tragedy. This means thorough skin preparation, complete protection of the wound from skin exposure, and a complete non-touch technic. Many men have advised a long incision with as complete an exposure of the knee joint as possible. We thoroughly agree with this recommendation, and believe this can be done without shortening the convalescence or impairing the after use of the knee. We prefer a parapatellar incision to one which divides the patella vertically. Whether the lower part of the incision returns to the midline or swings out along the joint line seems to be immaterial, but full exposure should be made.

The various pathologic conditions described should be attended to. A loose or injured meniscus should be removed. Hypertrophied fat pads, especially if they contain fibrous nodules in their margins, should be excised. If the articular cartilages are involved, whether softened, frayed, or more or less
detached, the diseased part should be cut away with a sharp gouge or other clean-cutting instrument until normal cartilage is encountered. Sharp hypertrophic spurs should be rounded off. In certain cases, a varying amount of synovial membrane requires excision and of course all foreign bodies encountered should be removed. The stump ends of torn crucial ligaments should be excised if they are apt to be caught between the opposing surfaces. We have not as yet made any attempt to repair these ligaments even when completely torn across as we have not encountered any case where this injury seemed to give any instability. The use of a tourniquet undoubtedly reduces the time of operation materially and since using this, we have had a great decrease in the number of postoperative aspirations.

The majority of our cases have been done under avertin and nitrous oxide anesthesia, with a fair proportion under spinal. As soon as the patient is out of his anesthetic he is urged by everyone who passes his bed to try and contract his thigh muscles and lift his heel off the bed. He is in a chair on the third or fourth day and walking with crutches the day after, increasing the amount of weight bearing as fast as he will. He leaves the hospital between the ninth and fourteenth day and many of them discard crutches and even a cane at the end of two weeks. The resumption of full function depends very largely on the cooperation of the patient. The time at which he resumes full use of the knee varies from one to three months.

During the period 1929-1934 inclusive, the Fracture Service at the Presbyterian Hospital has treated 596 traumatic knees. Four hundred twenty-five have been treated conservatively, 171 have been operated on. Of these, 14 were repairs of fractured patellae. The remaining 157 were operated on for internal derangement of the knee. In the first 48 a small incision was used. In the last 109 a larger incision allowed a more thorough inspection of the joint. There were 117 men and 40 women.

The various age groups were as follows:

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<td>15-20</td>
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<td>Age not stated</td>
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<td><strong>Total</strong></td>
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In 35 cases the synovial membrane was distinctly thickened, in three it was torn, in 11 villi were present and in five adhesions were present. The articular cartilage over the femoral condyles, the patella, or tibia was diseased in 70 cases. The condyles were affected in 55, the patella in 36 and the tibia in six. The alar fat pads were pathologic in 66 cases. The medial meniscus was abnormal in 96 cases, the lateral in 15. In 12 cases the anterior cruciate ligament was completely ruptured and in eight others partially torn. Thirty-two cases showed one or more loose bodies, eight of which were definitely fragments of condylar articular cartilage. In seven cases the pathology was
not sufficient to justify the exploration. In no case was the knee completely normal.

**SUMMARY**

The meniscus is not the only cause of internal derangement of the knee. Many other conditions may give the same clinical picture.

The majority of these knees have more than one lesion.

It is wiser to make an incision which will allow full exploration of at least the anterior portion of the joint.

The thigh muscles are the most important structures in maintaining stability of the knee joint. Maintenance of their tone should be aimed at before operation and resumed as quickly as possible afterwards. This is best accomplished by active use.

**ILLUSTRATIVE CASE REPORTS**

**Case I.**—P. F., 19 years of age. Three and one-half years before admission, the patient jumped down a short distance, kicking his heels up as he did so. Before he reached the ground, he felt a sharp, sudden pain in his right knee. After that, he was unable to put his heel to the ground in walking; that is, there was distinct limitation of extension. Operation was advised but refused, and the patient continued to have an unstable, weak knee.

Three days before admission, while climbing stairs, something snapped in his knee and he was unable to extend it beyond 130°. There were pain and tenderness along the medial aspect of his joint line. He was operated on May 25, 1932, and a “bucket-handle” meniscus was excised. The synovial lining was slightly thickened, but the articular surfaces and other joint structures were normal. He was up on the fourth day, walking on the sixth, and discharged on the eighth. He reported back five months later with a complete return of function and with no pain or disability. He stated that on the fourteenth day after his operation he pitched a full nine innings of baseball and ran bases, too, without subsequent pain or swelling. Two years and three months after his operation he is still rated as completely normal.

**Case II.**—S. D., 20 years of age. Ten days before his admission to the hospital, the patient slipped while working and struck the inner side of his left knee. There was immediate pain, followed soon by swelling. There was limitation of extension with tenderness along the medial aspect of the joint line. Seventy-five cc. of bloody fluid were aspirated and, on the following day, 50 cc. more. As extension was still limited after 12 days, he was admitted for operation which was carried out April 11, 1933.

The joint contained about 30 cc. of serosanguinous fluid. The medial meniscus was partly detached in front, thickened and split, the inner portion being loose and tucked under the lateral portion so that its end was presented as a rounded nub. The ligamentum mucosum and the anterior cruciate ligament were completely torn across. The meniscus and stump of the cruciate were excised and the alar pad sewed up to the front of the joint.

The patient walked with crutches on his ninth day and was discharged on the tenth. At the end of five weeks, he was playing box ball. At three and one-half months his only complaint was slight pain on the inner aspect of his joint. He went back to work in the boiler room at the end of three months. At the end of a year, there was no instability or pain. His movements are complete, but he says that after long walks or playing baseball, he has a slight sense of weakness.

**Case III.**—A. H., 40 years of age. Ten years before his admission to the hospital, a horse fell on his leg, which laid him up for a month. The pain, which began at that
time, increased with gradual swelling three weeks before his first admission and roentgen rays showed the presence of a loose body.

On July 10, 1931, at operation, a pedunculated, loose body was found in the intercondylar notch, and removed through a small incision. The patient started weight bearing on the tenth day and was discharged on the twelfth. He continued to have some pain and a sense of weakness, with a varying amount of fluid in his joint.

Twenty-one months later he had to give up work because of pain and swelling. He was readmitted May 2, 1933. The knee was explored through a longer incision. There were many large hypertrophic spurs along the articular margins of the condyle and patella. The medial meniscus was eroded and the synovia was thickened, purplish and fringed, and the alar fat pad was hypertrophied. The lateral meniscus showed a dentate edge and there was a large eroded area on the femoral condyle. The spurs were removed, and the alar fat pad and lateral meniscus were excised. The eroded area on the condyle was shaved to normal tissue and the greater part of the thickened synovia was excised. The patient could lift his heel from the bed on his fourth day and was up in a chair on the eleventh, walking on the twelfth. A moderate sized hematoma was opened on the fifteenth day which healed slowly without infection, the patient being discharged on the forty-first day. Twelve weeks later his motions were 175°–90° and he was walking four or five blocks. Seven months after the operation, he reported back that he had been working for some time, being on his feet for eleven hours without difficulty.

Case IV.—J. T., 19 years. The patient stated that a year before admission he fell from a tree, landing on both knees. He was laid up for a week with a swollen, painful right knee. Soon after this he noticed a movable lump and since that time there occurred several attacks of pain and swelling with occasional locking. He said he could feel three separate loose bodies. These were evident on radiographic examination and on December 10, 1931, two loose bodies were removed through a small incision.

Ten days later the joint was again opened through a median patella splitting incision and a third loose body was removed. A large, deep, eroded area was found on the medial condyle, and the alar pad was greatly thickened with several fibrous nodules in its margin. The synovia was purple, velvety, and thickened. In addition to removing the third body, a partial synovectomy was done and the margins of the eroded areas were shaved off.

The patient was up on the eighth day, walking on the twelfth, and discharged on the twentieth. Crutches were discarded at the end of four weeks. At the end of 14 weeks he was working as a floorscraper. He reported at the end of 28 weeks with complete return of function, being able to sit on his heels and with no pain or disability. At the end of 20 months, the report is normal; there is painless motion with no disability.

Discussion

Dr. John J. Moorhead recalled having on two occasions shown before the Society a series of knee joint cases. He had, and quite recently, prepared a résumé of these which now number 244. He was almost completely in accord with what Doctor Darrach had said in respect to the methods of diagnosis, in respect to the multiplicity of lesions within the joint, and particularly as to operative treatment and postoperative management. One of the most striking demonstrations he had made was that even in the presence of marked damage to the crucial ligaments, nevertheless, function had been maintained. In a number of these cases there have been plateau fractures in which the spine of the tibia was unquestionably damaged. At Reconstruction Hospital he had not been able to pick up a case in which he could be sure there had been a crucial ligament injury. He was particularly glad to hear Doctor
Darrach say that he is in favor of, and employs, the large incision. He has apparently abandoned the median incision in which the patella was split. The mediolateral incision follows the inner margin of the patella because most lesions are on the inner side. That is a very satisfactory incision and can be made on the outer margin instead, if desired. He was likewise pleased to learn that by the use of tourniquet the postoperative effusions had been lessened. That had been his experience. He was interested, also, in Doctor Darrach's remarks as to the development of osteochondritis dissecans and particularly in hearing him say that a history of trauma can be, and often is, obtainable in these cases. He thought the speaker's emphasis on the ultraaseptic technic most important.

DR. DONALD GORDON thought that to the majority of people who have two good knee joints, Doctor Darrach's presentation would be sufficiently interesting, but to one who has only one it is very pleasant to see the success with which knee joints can be exposed and patients quickly turned out of the hospital without the infections that were held up before us in the old days. The surgical profession should emphasize to the medical profession the importance of these so called minor pinched lesions, or whatever they might be. If they could be taught to get these cases under proper surgical care before they develop relaxation of the muscles, it would be a great step forward.

DR. CLAY RAY MURRAY said prompt recognition of many of these injuries to the knee joint is of the utmost importance. It is early attention to many of them which spares the joint from subsequent secondary degenerative changes. One of the chief obstacles to prompt and adequate care is the frequency of the diagnosis of traumatic synovitis with effusion. It may be almost categorically stated that accumulation of fluid in a knee joint to an appreciable amount in twelve hours or less after a trauma to a previously normal knee never represents a traumatic synovitis, but a hemarthrosis. Any diagnosis made under these circumstances must explain bleeding into the joint cavity. If this is understood there is much less likelihood of passing over derangements of the joint, and much less chance of overlooking pathology on exploration of the joint, and much less satisfaction in the use of an incision inadequate for thorough exploration.

The statement in reference to early fluid accumulation after knee joint injury, often after relatively mild indirect trauma, and hemarthrosis, and incidentally the safety of knee joint aspiration under proper technic, is supported by the results of several hundred aspirations over a period of five years without the occurrence of anything remotely resembling infection, and with, so far as I know in early cases, not a single exception to the rule that early accumulation means hemarthrosis.

DOCTOR DARRACH said in regarding the advantage of getting these knees fairly early, I have completely shifted my point of view. I used to let them
wait until six or seven attacks, that is until the condition seriously interfered with their pleasure. I have seen a lot of those fellows since and many have had their knee joints operated on by someone else, or else the joints are creaky and slippy, or they have given up their tennis or are playing only seven holes of golf. We treat our automobiles better. If we get anything knocking in it, we get it out, and it seems to me when there is a meniscus or a bit of bone being ground up it should be gotten out. I firmly believe that many chondritic cartilages are not embolic, but just plain trauma. We all know that cartilage does not heal very well. It may be replaced by fibrous tissue. When you are satisfied that there is something wrong with a knee joint, you had best go in and attend to it. My impression is that we have had well over 500 aspirations of the knee joint and I don’t believe we have had more than three yellow taps in the whole lot, which is less than 1 percent in knee joints following trauma. They are not yellow taps, but blood, and you can’t get blood unless something tears and gives way; whether it is synovial lining or bone or some part of the joint, these aspirations are bloody.

It took me a long while to come to the free wide incision—about three years ago. That is a long time to wait before profiting by your mistakes. But there are still a lot of peep-hole men.

To persuade patients to move their knees requires a good deal of team work. The patients are talked to beforehand and almost before they come out of the anesthetic. Everyone who goes by—internes, nurses, and others—tells the patient to move his knee. Some patients will do so at once; others will not make a quiver and require four or five days before beginning to contract their muscles. The sooner those muscles begin working together on their own, however, the sooner will you have a recovery. The only way is to make them do it. We do not put them up in plaster.