

The Second Hunterian Lecture

ON THE

RESULTS OF THE SURGICAL TREATMENT OF DISPLACED SEMILUNAR CARTILAGES OF THE KNEE.

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BY

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MR. PRESIDENT AND GENTLEMEN,—When I was honoured with the request to give the Hunterian Lecture I accepted the task gladly because it gave me an opportunity of laying a tribute of respect at the feet of John Hunter, the great master to whom every scientific surgeon owes a debt of gratitude which is none the less real because it is somewhat hidden by the lustre which the work of Pasteur and of Lister has shed over our art.

HISTORICAL.

I felt it was desirable to choose a subject which should be at one and the same time Hunterian and yet capable of treatment upon modern lines, and for this reason I chose "Displacement of the Semilunar Cartilages of the Knee and the Results of Surgical Treatment." The subject is a part of the larger question of the diagnosis and treatment of loose bodies in joints, and this question, we know, occupied Hunter's thoughts during the last years of his life. His observations on loose cartilages found in the joints, and more especially in the knee, are set out in a paper by his unworthy brother-in-law, Everard Home, in the *Transactions of a Society for the Improvement of Medical and Surgical Knowledge* (vol. i, p. 229). This communication was made in the year 1793, and John Hunter died on October 16th, 1793, "on the same day, and perhaps hour, that the unfortunate Marie Antoinette, Queen of France, was beheaded in Paris." It is probable, therefore, that Everard Home's paper embodies Hunter's latest thoughts, which we now know to be incorrect because they were based upon an imperfect pathology. "Hunter was led to consider the formation of loose cartilages found in joints," says Home, "in the course of his experiments and observations instituted with a view to establish a living principle in the blood." As a result of his experiments Hunter was led to believe that "extravasated blood, when rendered an organized part of the body, can assume the nature of the parts into which it is effused; and consequently the same coagulum which in the abdomen formed a soft tumour, when situated on a bone or in the neighbourhood of bone forms more commonly a hard one. The cartilages found in the knee-joint, therefore, appeared to him to originate from a deposit of coagulated blood upon the end of one of the bones, which had acquired the nature of cartilage and had afterwards been separated. This opinion was farther confirmed by the examination of joints which had been violently strained or otherwise injured, where the patients had died at different periods after the accident. In some of these there were small projecting parts, preternaturally formed, as hard as cartilage, and so situated as to be readily knocked off by any sudden or violent motion of the joint. This opinion Mr. Hunter maintained for many years in his lectures, and his arguments in favour of it are so consonant to the general laws by which the operations of the animal machine are regulated as scarcely to require further evidence." We know now that Hunter's conclusions are incorrect because his premisses were faulty, but it needed a more perfect microscope and the work of George Rainey (1801-84) at St. Thomas's Hospital before the real pathology was known.

Hunter dealt solely with loose cartilages in joints. His work was carried a step further by William Hey (1736-1819), the great Leeds surgeon, who had been a pupil at St. George's Hospital during the most fruitful period of Hunter's life. Writing in 1803, Hey says: "The existence

of loose cartilaginous substances in the joint of the knee has been noticed by several modern authors. The method of extracting these substances and of treating the patient after the operation has been described by Mr. (William) Bromfield (1712-92), and by Mr. (Edward) Ford in the fifth volume of *Medical Observations and Inquiries*. This operation is considered by those authors as the only method of cure. But, although it has been attended with success, yet, as the late Medical Society has observed, it has sometimes been followed with violent inflammation, fever, and death itself." Hey, therefore, recommended the use of "a well-fitting kneecap," observing—very wisely, if the state of surgery in his time be remembered—"it deserves a trial before the dangerous operation of opening the joint is attempted."

It is clear, therefore, that the question of loose bodies in joints and their treatment was exercising the minds of surgeons in London during the last quarter of the eighteenth century, more especially at St. George's Hospital, where both Hunter and Bromfield were surgeons. But Hey went a step further than those who had taught him. He recognized that there was a condition producing symptoms which resembled those caused by a loose cartilage in the knee-joint. This condition had hitherto remained undescribed, and he speaks of it as an "internal derangement of the knee-joint." Mr. Hey points out that the knee "joint is not infrequently affected with an internal derangement of its component parts; and that, sometimes, in consequence of trifling accidents. The disease is indeed now and then removed as suddenly as it is produced by the natural motions of the joint without surgical assistance, but it may remain for weeks or months and will then become a serious misfortune, as it causes a considerable degree of lameness. I am not acquainted with any author who has described either the disease or the remedy. I shall therefore give such a description as my own experience has furnished me with, and such as will suffice to distinguish a complaint which, when recent, admits of an easy method of cure."

"The disorder may happen either with or without contusion. In the latter case it is readily distinguished. In the former the symptoms are equivocal till the effects of the contusion are removed. When no contusion has happened, or the effects of it are removed, the joint with respect to its shape appears to be uninjured. If there is any difference from the usual appearance, it is that the ligament of the patella appears rather more relaxed than in the sound limb. The leg is readily bent or extended by the hands of the surgeon, and without pain to the patient; at most the degree of uneasiness caused by this flexion and extension is trifling. But the patient himself cannot freely bend nor perfectly extend the limb in walking; he is compelled to walk with an invariable and small degree of flexion. Though the patient is obliged to keep the leg thus stiff in walking, yet in sitting down, the affected joint will move like the other."

"The complaint which I have described may be brought on, I apprehend, by any such alteration in the state of the joint as will prevent the condyles of the os femoris from moving truly in the hollow formed by the semilunar cartilages and articular depressions of the tibia. An unequal tension of the lateral or cross ligaments of the joint, or some slight derangement of the semilunar cartilages may probably be sufficient to bring on the complaint. When the disorder is the effect of contusion, it is most likely that the lateral ligament on one side of the joint may be rendered somewhat more rigid than usual, and hereby prevent that equable motion of the condyles of the os femoris which is necessary for walking with firmness."

Hey then gives a detailed account of five cases which he had seen and treated, of which the first was clearly due to a slipping of the external semilunar cartilage; the second, third, and fourth were examples of simple displacement of the internal semilunar cartilage; whilst the fifth, produced by a fall from a horse, was an instance of a torn cartilage. Each of these cases was treated by manipulation, which is described in the following words: "I placed my patient upon an elevated seat, which had nothing underneath it that could prevent the leg from being pushed backward towards the posterior part of the thigh. I then extended the joint by the assistance of one hand placed just above the knee, while with the other I grasped the leg. During the continuance of the extension I suddenly

moved the leg backwards that it might make as acute an angle with the thigh as possible. This operation I repeated once, and, whatever may be thought of my theory, my practice proved successful."

He never operated upon any patients with displaced cartilage, and he erred in not following up his cases, for it is certain that if he had done so he would have found his treatment insufficient, because the condition is recurrent, and the mere unlocking of the joint when it has become fixed will only cure in a very small proportion of the most simple cases, unless it is assisted by prolonged rest.

Displacement of the semilunar cartilages of the knee did not excite much attention during the Regency and early Victorian periods. Violent athletic exercises were not indulged in when cricket was played in top hats and football had not yet become a science. The wealthier classes hunted and rode; reading men at the universities walked—the constitutional grind—and talked as they did so; the medical student and man about town played billiards and frequented his favourite bar. Young ladies only took a minimum of outdoor exercise and considered that it was indelicate to have an appetite. They lounged and sewed, read novels and fainted on the smallest provocation. Displacement of the semilunar cartilages of the knee, therefore, was of rare occurrence in a race who hardly ever put any severe strain upon their joints. The rapid spread of cricket, football, cycling, and hockey, with the consequent glorification of athleticism in all its forms, has been attended with a large increase in the number of joint injuries, not only in our public schools, but also amongst the class from whom our hospital patients are drawn. Displacement of the semilunar cartilages has formed such a rapidly increasing proportion of these injuries that I have thought it worth while to call your attention to the subject this evening.

FREQUENCY.

The records of St. Bartholomew's Hospital show that the knee-joint has been opened 262 times during the last seventeen years in patients who came complaining that they had experienced painful locking of the joint after an injury; 208 of these patients were men and 54 were women. The number of cases has increased steadily from 6 males in 1892 to 23 males and 6 females in 1907, as is apparent from the following table; and I may here express my thanks for the readiness with which my surgical colleagues at St. Bartholomew's Hospital have allowed me to use the notes of the patients upon whom they had operated.

TABLE OF CASES ADMITTED INTO ST. BARTHOLOMEW'S HOSPITAL DURING THE YEARS 1892-1908 FOR ARTHROTOMY OF THE KNEE.

Year.	Male.	Female.	Total.	Year.	Male.	Female.	Total.
1892	6	0	6	1901	10	2	12
1893	6	1	7	1902	17	5	22
1894	7	2	9	1903	11	1	12
1895	5	5	10	1904	12	4	16
1896	7	4	11	1905	18	3	21
1897	8	2	10	1906	19	5	24
1898	13	3	16	1907	23	6	29
1899	13	4	17	1908	18	2	20
1900	15	5	20	Total	208	54	262

I sent a postcard to each of these patients asking them to reply to the following five questions:

1. Has there been any return of the symptoms for which the operation was performed?
2. Is the knee as strong as the other?
3. Can it be straightened and bent as well as the opposite one?
4. Is there any change in its shape or appearance?
5. Is it ever painful?

Two hundred and sixty-two letters of inquiry were sent out, and 128 postcards were received in reply. Subsequent reference to the ward notes at St. Bartholomew's Hospital showed that 89 of these patients had been operated upon for a loose or torn semilunar cartilage, and 1 had sub-

sequently had his leg amputated for malignant disease, making 90 cases in all.

Seven of the 90 cases had had a displacement or injury to the external semilunar cartilage; the remaining 83 had sustained an injury to the internal cartilage.

Twenty were found to have loose cartilages—*Gelenkmause*—in their knees.

Eight were admitted with the symptoms of internal displacement, but for various reasons were not operated upon.

Six had pieces of thickened synovial membrane removed, the fibro-cartilages appearing healthy.

Two were found to have chronic inflammation of the articular cartilages without any injury to the semilunar cartilages.

Two patients had their knees explored for pain and locking of the joint without the discovery of anything to account for the symptoms.

CAUSES.

An examination of the ward notes of the 90 patients who were found by operation to have suffered some change in the semilunar cartilages shows that the cause was nearly always an injury. One case, however, was idiopathic, and proved to be a pathological curiosity. The specimen is thus described in the Catalogue of the Pathological Museum at St. Bartholomew's Hospital:

No. 569 f.—The half of a left knee-joint showing a sarcoma, apparently originating in the synovial membrane and filling the pouch underneath the quadriceps extensor muscle. The whole joint is surrounded by an envelope of grey friable growth intersected by fibrous septa. Embedded in this tissue on the anterior aspect of the joint lies the shell of the patella. The blue glass rod indicates the line of this extension. The crescentic excavation seen upon the anterior articular surface of the femur represents an area in which the neoplasm has destroyed the bone. A tapering prolongation of the growth passes backwards between the articular surfaces of the femur and tibia, and has practically destroyed the articular surface of the latter. On the outer aspect of the specimen part of the capsule of the joint has been removed to expose the growth beneath it.

Microscopic examination shows that the tumour is a spindle-celled sarcoma.

Removed by amputation from a man aged 31 years. At the age of 22 he was admitted to the hospital on account of a pain in the left knee and occasional locking of the joint, to which he had been subject for seven months. The anterior three-quarters of the left internal semilunar cartilage was removed, but the knee remained stiff. Two months later the knee was wrenched under an anaesthetic, but without benefit. Since the date of this operation—that is, for nine years—the knee had remained stiff and swollen. A second operation was undertaken five years after the first. The scar of the old wound was explored, and some pieces of cartilage were removed from beneath it. For twelve months the patient had noticed a rapid increase in the size of the joint, and suffered much pain in it. A skiagram taken three months before the amputation showed that the patella was pushed forwards but was not involved. A later skiagram showed the excavation of the patella.

The injury is nearly always the result of a sudden movement of rotation whilst the knee is in a state of partial flexion. Football, cycling, and gymnastics appear to be the most common causes of the accident, which is, therefore, most common in young adults. Direct injury to the knee, as in striking it against a gate or falling through the rungs of a ladder, are also given as causes by some of the patients, whilst in a few cases the actual cause has been so slight as to pass unrecognized.

SYMPTOMS.

The injury is followed at once by a painful locking of the joint, which is usually sufficient to bring the patient to the ground. This painful locking may be only temporary, when the patient is able to limp home, or the joint may remain fixed in a state of flexion or extension for several days, or until it is set free by skilled manipulation. There is always some synovitis, and it is characteristic of the lesion that it is recurrent.

DIAGNOSIS.

The diagnosis, therefore, should not be difficult, but an examination of the notes shows that the condition is usually considered and treated as a sprain rather than as an injury to the semilunar cartilages. The patient is put to bed in the more severe cases, and a water dressing is applied, but no attempt is made to reduce the displaced cartilage. The synovitis subsides for a time, but the knee

remains stiff or weak. A back-splint or a plaster-of-Paris case is ordered, and the patient is able to move about in comfort so long as the leg is kept straight, but the symptoms return with greater or less severity when the apparatus is discarded. The patient and his doctor then realize that the injury is more than a sprain, and that some active treatment must be adopted if the limb is to be made useful again. The recurrence of the symptoms, and especially the painful locking of the joint, is a marked sign of a displaced or torn semilunar fibro-cartilage, and the occurrence of these signs is a great help in the diagnosis. A sprain leaves a synovitis and weakness of the joint, but it does not cause repeated immobility with intervals of comparative or perfect freedom of movement. Here are one or two of the cases chosen at random to illustrate these points:

ILLUSTRATIVE CASES.

Case 1.

R. W., aged 28, says that his right knee gave way under him whilst vaulting in a gymnasium; two years ago he was kicked by a horse on his right knee. The knee has locked three times in his sleep since the last accident, and has had to be pulled straight; it then goes into place with a click. On more than one occasion it has let him down in the street, and the leg is then fixed in a state of full extension. Examination of the joint after arthrotomy showed that the anterior portion of the internal semilunar cartilage was loose. It was removed, and four years afterwards the patient replies that he has a perfectly strong and useful joint, which is painless.

Case 2.

T. G. N., aged 19, ricked his knee at a gymnasium eighteen months before admission. He was laid up for one month. The joint has locked about half a dozen times since the accident; on each occasion it has remained flexed for about ten minutes. The internal semilunar cartilage was found to be detached at its anterior end, the loose extremity being doubled backwards into the joint. The loose cartilage was removed. Six years later the patient expressed himself absolutely satisfied with the result.

These cases are satisfactory, and were straightforward from beginning to end. The following are examples of a more rare condition:

Case 3.

E. G., aged 19, was admitted complaining that his right knee had suddenly bent under him and had become locked whilst he was in the act of turning round quickly. He had previously wrenched it on two or three occasions whilst playing football. The joint became locked in September, 1900, and remained bent and immovable until it was reduced under an anaesthetic three days later. A similar accident happened in November, 1900, and an anaesthetic was again necessary, and in June, 1901, chloroform had to be given to release a third attack. Flexion of the joint, as in kneeling, led to fixation of the joint. Examination revealed a tender spot on the inner side of the knee over the head of the tibia, and the joint was in a state of synovitis. At the operation the inner border of the semilunar cartilage was found to be torn away, so that it rested upon the outer edge of the fibro-cartilage. The patient writes in 1910: "Am pleased to say that my knee is as strong as my other one, and is never painful."

The next two cases show that, unless care is taken to examine the semilunar cartilage, it may be insufficiently removed and the symptoms may recur after an operation has been performed:

Case 4.

C. L., aged 22, wrenched his knee at football in September, 1900, and an operation for removal of the internal semilunar cartilage was performed in November, 1900. The knee became troublesome again in February, 1901, and it locked once or twice. A further examination was made on May 18th, and two strips of the internal semilunar cartilage were removed. It is probable, therefore, that the cartilage had been torn horizontally into three strips. I have been unable to obtain further tidings of this patient.

Case 5.

D. J., aged 21, was admitted in January, 1898, on account of a painful locking of his knee, which he had wrenched at football. The joint was examined and a part of the internal semilunar cartilage was removed. The symptoms recurred three months later, and the joint gradually became flexed and could not be straightened. The patient was readmitted to the hospital in December, 1900, and a crescentic piece of the internal semilunar cartilage was removed, showing that the original tear had been circumferential. In 1910 the patient replied that the joint is still painful and not as strong as the other.

MORBID ANATOMY.

Examination of the notes of the cases appears to show that the severity of the injury bears no direct relation to the condition in which the cartilage will be found at the subsequent operation. In the simplest cases the wrench-

ing of the joint may produce a mere slipping of the cartilage due to a tearing of the fibres of the coronary ligament which attaches it to the head of the tibia. The slipping may vary from a simple loosening of the central portion of the cartilage—the extremities remaining attached—to a complete displacement inwards of the entire cartilage. When the ends of the cartilage remain attached the movements of the knee are hampered by a sense of insecurity, but there is no actual locking. A displacement of the cartilage at its anterior extremity without actual tearing may cause a temporary fixation of the joint, which the patient soon learns the trick of relieving for himself. These cases, therefore, do not come under the cognizance of the surgeon, for the patient continues his occupation, only complaining to his friends that he has got a weak knee, which sometimes lets him down.

In other cases the semilunar cartilage may be torn across, the injury usually taking place in the anterior third. The torn ends may lie flat and in good apposition when there is no more inconvenience than if the cartilage had merely slipped. Some day, however, a slight additional wrench leads to a displacement of the ends which had previously lain in apposition, and there is then so much interference with the action of the joint that the aid of the surgeon is soon invoked.

The torn ends of the cartilage are sometimes twisted upon themselves, so that one or other piece lies vertically, instead of horizontally, in the joint. Such a specimen is preserved in the museum of the University College Hospital, and it is the only preparation I know of which shows the *post-mortem* appearances of a torn and displaced semilunar fibro-cartilage in the knee. Mr. Godlee described the specimen in the *Illustrated Medical News* (September, 1888, p. 9) in the following words: "The circumference of the fibro-cartilage has been torn away from its attachment to the capsule of the joint, and it now occupies a vertical position in the intercondyloid fossa. The displacement must have occurred some time before the death of the individual, for the fibro-cartilage remains stiffly in its present position, and appears to have somewhat shrunk from its natural size; it is also obviously flattened by the pressure of the inner part of the condyle. At the same time the inner surface of the capsule is smooth, and it will be observed that the cartilages on the femur and tibia show no signs of alteration, except a little change due to chronic rheumatic arthritis, which, it should be observed, occurs at a point on the tibia which, under ordinary circumstances, would have been protected from friction by the semilunar cartilage." (See figure, p. 64.)

The specimen was obtained by Professor G. D. Thane, F.R.C.S., from the anatomical stores at University College, so that, unfortunately, no history of the clinical symptoms is obtainable. Commenting on the appearances presented by this preparation, Mr. Godlee says: "Looked at from an anatomical point of view, it would seem most likely that the external and not the internal fibro-cartilage should be the one to slip; for it will be remembered that the cartilages are retained in position chiefly by means of their attachment to the capsular ligament of the joint. Now, the shape of the external cartilage being that of a large segment of a small circle, as compared with that of the internal, which forms a small segment of a larger circle, it follows that the anterior and posterior extremities of the external reach a position near the centre of the joint, being attached in fact immediately in front of and behind the two pieces of the spine on the upper surface of the tibia. The external cartilage has thus a much less extensive attachment to the capsule of the joint than the internal, and is consequently much more movable.

"The sheath of the tendon of the popliteus again communicates, often in two places, with the capsule of the joint beneath the external semilunar cartilage, that communication which is constantly found being to the outer side, that which occasionally occurs at the back of the joint. This greatly diminishes the extent to which the cartilage is attached to the capsule. It is also possible that this cartilage is liable to irregular movements from the fact that the tendon of the popliteus muscle has a not inconsiderable attachment to it. But be this as it may, it appears actually to be the internal which most usually suffers displacement—that is, if we are to accept all recorded cases as authenticated, a position I should be

very sorry to occupy when it is remembered how readily loose cartilages in joints, strains, etc., may be mistaken for this not easily diagnosable condition.

"How the accident occurs is very much a matter of conjecture. The most common form of injury appears to have been a blow upon the toes when turned outwards, or a twist inwards of the foot, but it is probably produced in a number of different ways. I would merely point out how comparatively free is the movement of the tibia laterally over the condyles of the femur when the joint is flexed, especially in loose-jointed people, and that this movement of the tibia is more free towards the inner than towards the outer side. Of course, the cartilages move with the tibia, and it seems to me quite comprehensible that when the external cartilage is drawn already well forward towards the inner part of the outer condyle of the femur a sudden jerk or twist might force it still further and cause it to pass actually outside the circumference of the cartilage—that is, either in front of or behind it. This would be very likely to rupture the attachment of the capsule and to drive the cartilage into the position" shown in the specimen.

Mr. Robert Jones¹ has recently made a careful study of derangements of the knee-joint, and he points out that "the displacement or fracture of the internal semilunar cartilage can only take place when the internal lateral ligament is stretched or ruptured. This allows a separation of the joint surfaces and a slipping inwards of the cartilage; as the separate bones snap back the cartilage is nipped and the knee is fixed in a very painful manner. The pain and effusion can be ascribed to injury of the synovial membrane with which the cartilages are covered."

The injuries sustained by the semilunar cartilages, however, are not always simple displacements and laceration, for the cartilage may be torn into so many fragments that it has to be removed piecemeal, or, more remarkable still, it may be literally torn into ribbands, as in the cases whose notes have already been read, and so long as the pieces lie side by side and do not overlap or project, the more complicated injuries do not necessarily give rise to troublesome symptoms.

It has already been pointed out that an examination of the records of many cases shows that the amount of violence causing the displacement is no guide to the condition in which the cartilage will be found. A simple wrench or twist is found in some cases to have produced complicated lacerations, although in theory they should only have led to a simple displacement. The signs, therefore, are of much greater importance to the surgeon who is called upon to decide whether or not an operation is desirable than the history of the accident, although it is often difficult to persuade the patient or his medical adviser that such a trivial accident as a slip on the stairs or on the polished floor of a ballroom can produce a more serious laceration of the semilunar cartilage than a wrench in the football field. It is quite impossible, too, to forecast the amount of pain which

follows upon these injuries. I thought at first that the pain would be most marked when the cartilage was torn so that the edges overlapped, but examination of the notes showed that this is not necessarily the case. The locking of the joint was sometimes quite painless, even when the cartilage was afterwards found to be lying edgewise in the joint, whilst in other cases the pain was excessive when there was only a slight displacement of the cartilage. But pain is wholly subjective, and it is quite possible that a healthy young football-player does not feel pain more acutely than an ardent believer in Christian Science. The limitation of movement is sometimes in flexion and sometimes in extension, the limitation being usually more marked when the cartilage is torn and the edges are displaced than where it has merely slipped.

DIFFERENTIAL DIAGNOSIS.

The mistakes which are likely to be made in diagnosis are well exemplified in the notes of the 128 patients whose cases I have examined, and whose knees had been explored for painful locking of the joint. It should be remembered that each of these patients came under the observation of a highly skilled surgeon, who made his diagnosis carefully and after personal examination of the joint in the presence of numerous medical students. In spite of this 20 of the cases proved at the time of the operation to be suffering from nodules of loose hyaline cartilage, and not from injury to the semilunar fibro-cartilage. I am interested, in reading the notes of these 20 cases, to observe how frequently the patient dated the onset of his symptoms to an injury of the joint on a given day, just as he would have done had he displaced one of his cartilages. It seems, therefore, as if an injury to the joint may sometimes be the starting point of a series of changes in the synovial membrane, which lead ultimately to the formation of a "*Gelenkmaus*." These changes may lead to a multiplication of Rainey's corpuscles in the synovial fringes or to exfoliation of portions of the articular cartilages themselves—sometimes of the femur, more rarely of the patella, most rarely of the tibia. The diagnosis is easy when the loose cartilage can be felt

within the joint, but when it is imperceptible and the patient dates all his symptoms to an accident on a given day it is pardonable to diagnose the condition as being due to a change in the interarticular cartilage. As a general rule, when a semilunar cartilage has been torn the interference with the movements of the joint is well marked from the time of the accident, whilst in loose hyaline cartilages following an accident there is generally an interval during which the joint appears normal after the effects of the sprain have passed off, and the locking only becomes a marked feature at a much later period. In an injured semilunar cartilage there is often a tender point to be elicited by pressure over the head of the tibia on the inner or the outer side, and this is absent in cases of loose nodules of hyaline cartilage.

In like manner an injury to the knee may be followed by a chronic inflammation of one or more of the synovial

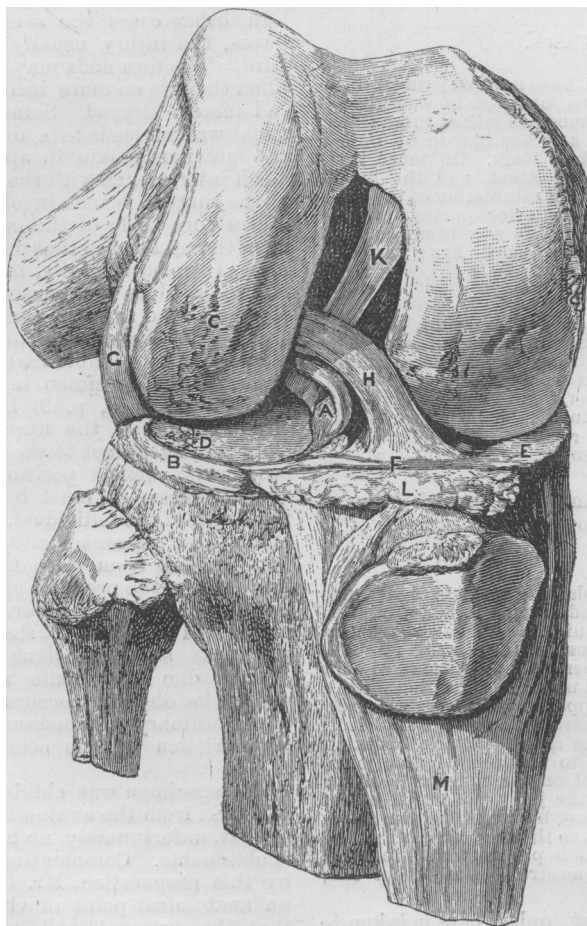


Fig. 1.—Dislocation of external semilunar fibro-cartilage of knee. A, External semilunar cartilage; B, outer part of capsule, from which the cartilage has been torn; C, patch of erosion from chronic rheumatic arthritis on condyles of femur; D, patch of erosion from chronic rheumatic arthritis on that part of the tibia on which the semilunar cartilage originally lay; E, internal semilunar cartilage in the natural position; F, transverse ligaments; G, tendon of popliteus muscle; H, anterior cruciate ligament; K, posterior cruciate ligament; L, infrapatellar mass of fat; M, tendon of triceps extensor cruris. (From a drawing kindly lent by Mr. Rickman J. Godlee, F.R.C.S. Eng.)

fringes. These thickened fringes interfere with the movement of the joint, and thus lead to a diagnosis of slipped cartilage. Such a mistake was made in 6 of the 128 cases, and it is difficult to know how it could have been avoided. An injury leads to an effusion of blood into a synovial fringe, the blood becomes organized, and is replaced by a nodule of fibrous tissue. This nodule becomes pedunculated, and may then cause locking of the joint by slipping between the articular surfaces. I have already given details of a case in which a slipped cartilage was associated with sarcoma of the synovial membrane, and in 2 cases the symptoms of displaced semilunar cartilage were found to be connected with a chronic inflammation of the synovial articular cartilages due, perhaps, to early tuberculous disease. In two cases also the joint was thoroughly explored, only to find that there was nothing to account for the symptoms of which the patient complained.

PROGNOSIS.

When a semilunar cartilage has been displaced in the knee it may become fixed again, just as an injured tissue in any other part of the body may repair itself. It is necessary, however, that the injury should have been of the nature of a displacement of the cartilage or of a tear without displacement of the torn ends. The displaced cartilage must first be replaced accurately in apposition, and the limb must then be kept fixed until time is given for repair. Too often the patient's knee is fixed without any attempt being made to replace the cartilage, and the joint is then left under the same conditions, though in a minor and concealed form, as if there had been an unreduced dislocation.

In these cases and in the more serious injuries the joint remains weak and may become a source of danger on account of the liability to a recurrence of the locking, which occurs suddenly, and may happen when the patient is in a dangerous position, as in crossing a crowded street, getting out of a train before it has stopped, or swimming in deep water. The prolonged displacement of a semilunar cartilage may lead to erosion of the articular cartilage at the point where it rubs, but this is not of frequent occurrence, for many of the notes state expressly that the articular cartilages were healthy, even when there had been repeated attacks of pain with fixation, lasting over several years, before the patient was submitted to an operation.

TREATMENT.

The treatment should be carried out in accordance with the prognosis. It is impossible to tell what injury the joint has suffered directly after the accident. The immediate treatment, therefore, consists in such manipulation of the joint as will restore its perfect freedom of movement to the satisfaction both of the patient and of the medical man. Mr. Robert Jones³ points out that the proper manipulation is "acute flexion, lateral deviation and rotation inwards, and full extension." "Acute flexion is always painful, but it is the only position where internal rotation of the tibia is most free; lateral deviation separates the bones which hold the cartilage, and full extension allows of the readjustment and places the limb in such a position as to permit of accurate union of the internal lateral ligament." The joint is then fixed in a state of full extension until the effusion subsides, after which the patient is allowed to walk, precautions being taken to prevent any lateral strain.

RESULTS OF OPERATION.

I am not especially concerned this evening with the treatment of these cases in the early stage, for they rarely come under the observation of the surgeon, and a considerable proportion are cured. An operation is needed when the recurrent attacks of painful locking are so numerous as to make the patient's life a burden, and when, by reason of his occupation—a cavalryman, an omnibus conductor, or a sailor, for instance—it is impossible for him to earn a livelihood when the movements of his joint are restricted. The operation is not uncommon, as I have already shown, and I thought it would be interesting to know what the results were when the patient had been deprived of a semilunar cartilage for some length of time.

The patients operated upon for removal of the internal or external semilunar cartilage who replied to my ques-

tions numbered 89. Their answers can be tabulated in the following form:

Question 1.—Seventy-three patients replied that they had experienced no return of the symptoms for which the operation was performed; 16 stated there had been a recurrence.

Question 2.—Fifty patients said that the knee from which the cartilage had been removed was as strong as the other; 39 said that it was weaker.

Question 3.—Seventy-seven patients declared that the movement of the joint was perfect; 12 said that the movement was impaired, but in 8 of these cases the movement was only hampered when kneeling, and was free for all other purposes.

Question 4.—Sixty-eight patients reported that the shape of the knee was unchanged, whilst 21 thought that the shape was altered.

Question 5.—In 43 cases the knee was absolutely painless, in 11 cases the knee was only painful at a change of weather, but in 35 cases the joint was said to be painful.

Some valuable information as to the results of the operation can be obtained from these replies. Some of the replies come from patients who were operated upon as far back as 1893 and in no case was the operation more recent than 1908. I wished to know the results when a sufficient time had elapsed to test them thoroughly, and I did not apply for information, therefore, until at least two years had elapsed.

The returns as to recurrence of the symptoms after operation were most satisfactory, since 73 out of 89 patients had been permanently relieved. Of the remaining 16, one, perhaps with some infusion of Irish blood in his veins, writes that he is "not shure" whether he has had any return of a painful locking of the joint; another has "a slight grating in the joint at times"; a third says, "I was nearly fix this year through lifting a box;" a fourth writes that he was "laid up for a fortnight through its slipping out"; a fifth, that "once I twisted it, it swelled up but it gone down." Another replies, "Yes, the cartilage has slipped since then on one or two occasions," and another, "Yes,—on two or three occasions (serious)—often slightly"; and yet another, "Yes, at intervals, but I return it to its position after a few hours." A patient writes that he was "operated upon five years ago, with a return of the symptoms twelve months afterwards." Another complains that "the symptoms recur if he knocks his toes against anything that turns them inwards," and another replies in almost similar words that "if he knocks his toes against anything that turns them outwards the feeling is just the same as if it was coming out again." Both these patients had their internal semilunar cartilages removed.

One patient was frankly dissatisfied with the result, and one lives in dread, for he answers the question, "Has there ever been any return of the symptoms for which you were operated upon?" with, "No, sir; it has not gone out of place yet, but it feels sometimes as if it will." A medical man replies: "No, but the tibia tends to rotate more freely on the femur than normal." The rest of the patients content themselves with saying that there has been no recurrence, but give no details.

The second question was asked to ascertain whether the knee was a useful joint after the semilunar cartilage had been removed. The replies show that a really useful limb was obtained in most cases. One patient replies: "I have to-day swum in the long-distance championship, and felt no trouble from my leg" (the operation was performed in February, 1907), and he further volunteers the statement: "I also play football, cricket, and nearly all other sports." Another patient, operated upon in November, 1899, says: "I have played football every season since." Patient No. 49 writes: "Previous to the operation I could hardly walk with safety, but since then I have continually played football"; and similar testimony to the utility of the joint is borne by the answer: "Can walk ten or twelve miles without getting tired."

The following answers, on the other hand, show that the operation has not been quite so successful, although the patients are satisfied with the results. The answers are given in reply to the question, "Is the knee as strong as the other?" "Yes, for all normal uses," says one. "Yes, for every ordinary purpose; but a slight weakness under a strain—for example, ski-ing," says another. "Yes, as regards walking; not as regards a sideways strain," replies a third.

Some of the patients who felt that the knee was not so strong as the uninjured one say: "It seems to go with a

click if I knock it against anything all of a sudden"; "not so strong after a heavy day's work or an extra exertion at footballing"; "No, at times it seems brittle and ready to snap on pressing back." The same idea expressed in different words is given by another patient, who replies, "No, when bent and the weight of the body is thrown upon it, it feels weak and is unreliable."

The unsuccessful results are told in the following words: "Weak, always have to keep it bandaged"; "The knee is not quite as strong as the other, it gave way badly whilst running a month ago"; "No, it don't seem to have the same power in it." "Is the knee as strong as the other? No, not nearly." And another patient writes: "No, I have not had proper use in it since the operation was performed." I invited this patient to come and see me, as his notes stated that he had left the hospital with a useful knee. He came from a workhouse, and had managed to obtain more beer on the way than was good for him. Examination of the joint showed that he had full flexion and extension, but the joint was the seat of commencing osteo-arthritis.

Question 3 asked whether movement of the joint was interfered with by the operation, and the answers are particularly satisfactory. Nearly all the patients reply without any qualification that the movements of flexion and extension are perfect. With the exception of the patient whose leg was afterwards amputated for sarcoma of the synovial membrane, no patient has had a permanently stiff joint after operation, though one says that he "had a rare job to get proper movement after I left the hospital, the knee being so stiff, but I persevered, with good results, and I can now run, jump, cycle, or play football as well as ever I did, and not feel any inconvenience." Another patient writes, "It never works freely at any time, much worse sometimes than others." It is evident from the replies that flexion is more hampered than extension. Thus one patient writes in reply to the question, "Can the knee be straightened and bent as well as the opposite one?" "Yes, if not bent too suddenly." Others write, "Yes, but I cannot kneel on this knee"; "Cannot bend it quite so much"; "No, not bent so well"; "No, I cannot bend it the same as I can the other one, but it can be straightened as well"; "Yes, if no weight is upon it, but at all times when bent beyond a certain point it 'crackles.'" Only one patient complains that movement is attended with pain, and no one finds any difficulty in straightening the leg.

I expected some interesting replies to Question 4: "Is there any change in the shape or appearance of the knee?" because I thought that removal of the interarticular fibro-cartilage would necessarily be associated with a change in the aspect of the joint, either in the direction of its axis or from secondary and compensatory changes. No such alteration seems to have occurred. Most of the patients reply "No" categorically. One patient says that the knee is inclined to bend inwards, a second that the knee is not much changed, but it seems to be more inward than the other, a third that "the outside of the joint is rather larger," and a fourth that the knee protrudes inwards. Other patients who have noticed some change of shape merely reply that there is some alteration, but give no details. It may be assumed, therefore, that no important change takes place in the appearance of the joint as a result of removing the semilunar cartilage in the knee.

Question 5 has brought out the most unsatisfactory result of the operation. No less than 46 patients out of the 89 whose replies are tabulated state that they have had more or less pain. The pain was slight and of a rheumatic character in 11 of these cases, for it only occurred when the weather changed and the patients made light of it. Indeed, in the majority of the other cases it does not seem to have been very severe, but some of the patients replied as follows: No. 60 says, "There is pain when a strain is put on the knee such as going up steps and at a change of weather." No. 52 says the knee is "very painful at times, especially if it is pressed against anything." No. 25 replies, "Yes, if I attempt to turn round with my foot fixed on the ground." No. 62 answers, "Not unless slightly knocked." Another patient says that his knee is "painful occasionally when tired or after rough walking"; and this is corroborated by another patient who writes, "Yes, lately the knee is very painful when walking and I have to walk very slowly." No. 12 writes that his

"knee is painful two or three times a day," and No. 20 that "it is very painful at times." The drunken reprobate, to whom I have already alluded, wrote, "it is so painful at times that I have to stand on one leg."

The general results are well summed up by a medical man whose internal semilunar cartilage was removed in August, 1905. He is well qualified to give an opinion, as he is the medical officer of a large public school in England. He writes on July 26th, 1910: "(1) I have had one attack of traumatic synovitis since the operation. (2) There is a considerable difference in the strength of the two knees and in their muscular development (the measurement is 1 in. less on the injured side), but I can play at fives and do gymnastics freely. (3) The joint straightens completely, but flexion is incomplete—about 45 degrees—and I cannot kneel on it for any length of time. (4) The osteo-arthritic changes present before the operation have not increased, as I had feared. From time to time I still get creakings on moving the joint, suggesting some thickened synovial tags. (5) I have had one sudden and sharp attack of pain whilst serving at tennis this summer, but it was only momentary, and was not followed by any effusion. I consider the operation has been the greatest boon to me both as regards my work and exercise. . . . I urged the surgeon to operate against his better judgement because I was so sick of being continually laid up, and I was ready to run any risk."

The notes of his case say that he was 32 at the time of the operation, and had injured his knee at football eleven years previously. The injury is described as a severe strain on the inner side of the left knee, which was followed by repeated attacks of pain with effusion. Eighteen months after the injury a small loose body was felt in the upper pouch of the synovial membrane of the joint, and the knee locked repeatedly. The ends of the bone were lipped. At the operation the internal semilunar cartilage was found to be loose. The loose fibro-cartilage, a piece of hyaline cartilage, and several thickened fringes of synovial membrane were removed.

PROGNOSIS OF OPERATION.

The replies to my questions show that the removal of the semilunar fibro-cartilages of the knee is not dangerous to life or limb under the present conditions of surgery. No death followed the operation either immediately or remotely; only one patient had a stiff leg in consequence of it, and in his case the synovial membrane was the seat of malignant disease. The chance of the more severe symptoms recurring—that is to say, a painful locking of the joint—is as 2 to 9. In the nine successful cases the patient may consider that he will have a useful joint for all the ordinary purposes of life, although it may be slightly weaker than the opposite one if the operation has been postponed for a long time and there have been repeated attacks of synovitis. Interference with movement seems to be even a slighter chance than that of recurrence of symptoms, for it is rather less than 1 in 6, and if it should occur the probability is that the limitation of movement will only be felt in extreme flexion of the joint as in kneeling. The joint will not be liable to any increase in the osteo-arthritic changes which may be present; indeed, the removal of a loose or torn cartilage rather tends to prevent the further development of these changes by removing a source of irritation within the joint.

The least satisfactory part about the operation is that it leaves a joint which may be liable to pain of a more or less severe character. This pain is slight in the majority of cases, and only occurs when the joint has been roughly used or has been called upon to do excessive work, and it is, therefore, occasional; in other cases it is rheumatic in character, and the patient only complains in damp weather, but in a few cases it may be severe.

CONCLUSION.

The lines of treatment appear, therefore, to be well defined in cases of internal derangement of the knee-joint due to injury of the semilunar cartilages. When the patient is seen directly after the injury every care should be taken to replace the injured cartilage in position by well-considered manipulation. Rest in an extended position must then be insisted upon until the swelling has subsided and time has been given for repair, massage being em-

ployed during the whole of this period. It must be borne in mind that no satisfactory result will be obtained if the injury be treated simply as a sprain by rest and cooling lotions. It is essential that the cartilage should be replaced, for otherwise it is as useless to rest the joint as it would be to rest an unreduced dislocation. When these methods have failed, or when the original condition has been badly treated, and the patient is left with a chronically inflamed joint, which is insecure, painful, and locking, the sooner an arthrotomy is performed and the interarticular cartilage is removed the better it will be for the patient. As might have been expected *a priori*, my inquiries show that the least satisfactory results are obtained when the patient has been allowed to go about with a damaged fibro-cartilage for months or years, the best results when he has had only a few attacks of painful fixation of a joint. In these latter cases the ligaments have not become stretched, and the joint quickly resumes all its normal functions.

I hope, Mr. President and gentlemen, that in giving you these results I have in some measure fulfilled the object for which this lectureship was founded. I have taken a subject which is frequently met with in practice, which is sometimes improperly treated from ignorance of its pathology, and which the experience of a large hospital is able to shed light upon. These were the subjects with which my master, John Hunter, delighted to deal, and it will be a great pleasure to me if you feel that I have in some manner followed the path pointed out by that great surgeon.

REFERENCES.

- ¹ *Annals of Surgery*, vol. 50, 1909, p. 974. ² *Ibid.*, p. 982.

CONSERVATIVE SURGERY OF THE NOSE.

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MANY of those who have bestowed sufficient attention on the subject of nasal obstruction and diseases of the nose, and observed post-operation results long and carefully enough, must have become fully cognizant of, if they have not severely animadverted upon, the disadvantageous, not to say disastrous, consequences that only too frequently follow much of the present day intranasal surgery. Such consequences are to be largely attributed to and explained by one thing, and one thing only, and that is too great and quite unnecessary sacrifice of the mucous lining of the nose. This wholly unwarrantable and uncalled-for destruction of the invaluable velvety covering of the nasal interior is even oftentimes carried to such an extent that it would be no injustice or exaggeration to stigmatize it as mutilation.

It is now no uncommon occurrence for the rhinologist to meet with patients who have some time previously undergone an intranasal operation or operations complaining of annoying or embarrassing after-effects. This is all the more to be regretted when one realizes that such sequelae are oftener than not but little capable of remedy or amelioration, and might easily have been avoided.

Loss or impairment of the sense of smell, deprivation of the pleasurable sensation received on the inhalation of the cool fresh air along the nasal passages, and consequently inability to detect aerial vitiation; stuffiness of the nose, desiccation and incrustation of the nasal interior, frequent and paroxysmal sneezing, recurrent headache, dryness and soreness of the throat, and chronic or relapsing hoarseness, are some of the most commonly complained of consequences.

There can be little doubt, moreover, that such ruthless and careless injury of the mucous membrane, by wounding it, and thus reducing its protective mechanism against bacterial invasion, lays the victim open to sinus suppuration, and, indeed, supplies a very likely and feasible explanation of the increased prevalence of these chronic sinus suppurative conditions.

It seems to be forgotten by many of those who practise such surgery, resulting in so great a loss of the mucous membrane lining the interior of the nose, that this mem-

brane is covered with a ciliated epithelium, and therefore has very valuable, and, indeed, for the comfort of the individual, both physically and socially, indispensable functions; that the myriads of cilia in the nasal cavities are essential to the proper fulfilment of the duties of the nose as an aerial filter, cleanser, and moistener of the inspired air. It appears to be overlooked, too, how essential is the erectile tissue largely located in certain prescribed positions, such as the posterior half of the nasal septum, on the inferior turbinates, and on the under surface of the middle turbinates, to the carrying out of the special physiological actions of the nose as a warmer and moistener of the inhaled air.

One of the most frequently encountered and most obvious forms of nasal obstruction is alar collapse. This is a condition that is many times missed in hunting for the causes of nasal obstruction, with the result that some redundancy perhaps in the inside of the nose is discovered and operated upon, while the first and real cause—alar collapse—is left undetected and untouched. A simple measure for the correction of this defect at the very entrance to the nose often saves the necessity for more extensive procedures inside the nasal cavity, and so obviates operations that under the circumstances cannot be curative.

The proper surgical treatment of alar collapse becomes, then, a step towards the conservative surgery of the nose by avoiding the necessity of operations farther in the interior of the nasal cavity. Indeed, one may assert that even such operations can never be successful in surmounting the nasal obstruction if the alar collapse is left untreated. The author has had many instances where patients have had the simple operation performed after the method here described on the narrow anterior nares, and where in the face of considerable interior obstruction the respiratory relief has been so great that further and necessary operative measures for a septal displacement have been postponed or refused, even when the obstruction has been of a very pronounced character.

The normal anatomy of the nasal cartilages is very remarkable, and affords an eminent example of a perfect mechanism for the maintenance of a patent and resilient anterior nasal aperture. The chief framework consists of four lateral cartilages—two upper and two lower. The upper plates are flattened and triangular in shape, with their apices above and the bases below. The inner borders of these plates are in apposition and supported by the cartilaginous septum mesially. To the bases are attached the upper convex margins of each of the lower lateral cartilages. The lower lateral cartilages are laterally elongated plates of thin cartilage, with a convex outer surface, and each meets its fellow in the middle line, the pair thus mainly forming the apex of the nose. Each of these lower lateral cartilages has two limbs—an outer, constituting the cartilaginous ala nasi, and an inner, participating in the formation of the central columna nasi. This inner limb only extends half or two-thirds of the length of the columna nasi, and ends in a rounded, pointed portion, which often projects quite visibly from the outer side of the central nasal column. The cartilaginous framework of the nasal entrance is completed by two more groups of structures—namely, the sesamoid, or segmental cartilages, and the mesial end of the nasal septum.

The operation that I have now been performing for some years with entire success in overcoming impeded nasal respiration caused by alar collapse and marked projection of the pointed ends of the inner limb of the lower lateral cartilage consists in excising the protuberance by submucous and subcutaneous resection. A crescent-shaped incision is made, commencing above on the side of the columna nasi, just anterior to the projection of the inner limb of the lower lateral cartilage, and passing alongside of this projection, which can easily be defined by the manipulating fingers of the disengaged hand. The incision ends at the lower angle of the nasal aperture, and is entirely through the skin. A second incision, beginning almost exactly where the first did, is then carried downwards behind the protuberance on the columna nasi nearly to the same position as the first; it may skirt the protuberance, as in the first incision, so as to excise a piece of skin of the width, at the widest part, of $\frac{1}{4}$ in. It may be necessary to remove half as much skin again as this if the protuberance is very large and the skin is redundant. This marked-out