fortunately obtained, and revealed in the upper part of the large intestine a number of transverse scars of recently healed amœbic ulcers, but no active lesions. The lower half of the gut showed the characteristic lesions of an acute bacillary dysentery, Shiga's organism being obtained on culture, while no amœbæ could be found with the microscope.

These two cases are most instructive, for without necropsies I should have had to regard both as probably relapses of amœbic dysentery, and consequently evidence of the failure of emetine to bring about a complete cure; whereas they now afford the strongest proof that three days of emetine injections can bring about rapid and complete healing of both very acute amœbic lesions, destroying extensive areas of the mucous and muscular coats of the bowel (although not able to restore the destroyed tissues), and also of a very chronic and relapsing form of the disease, and to bring about the encystment of a small liver abscess. Much further experience is needed to furnish absolute proof that the new treatment will always destroy the whole of the pathogenic amœbæ throughout the human body, but all the evidence at present available points to such being actually the case. If this is eventually found to be so it will constitute the most remarkable therapeutic success yet achieved.

Calcutta.

INJURIES TO THE SEMILUNAR CARTILAGES :

A PERSONAL EXPERIENCE OF 449 CASES OF OPERATION.¹

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DURING the past 10 or 11 years I have been much interested in the subject of injuries to the semilunar cartilages, and, inasmuch as this class of case is extremely common in the northern counties of England, I have had ample opportunity of studying it.

On looking through the notes of both my hospital and private patients I find that, during the period between the end of the year 1900 and the end of the year 1911, I have operated upon 449 cases (413 hospital and 36 private) diagnosed as suffering from injury to the semilunar cartilages. All the patients made good recoveries, and in no case was there any resulting joint infection, or any interference with the after stability of the joint. In a few cases—and this applied particularly to those in which no definite pathology was found at the operation—complaint was made that the symptoms had not been relieved; otherwise the results were all that could be desired.

One of the commonest industries in Northumberland and Durham, if not the commonest, is coal mining, and this industry far outnumbers all the rest in the district in supplying the vast majority of sufferers from this accident. The reason why this is so is not far to seek. The coal-miner, owing to the lowness of the seam at which he is hewing, performs his work with his knees more or less flexed. In this position, owing to relaxation of the internal, posterior and anterior crucial ligaments, a certain amount of rotation and lateral mobility between the upper end of the tibia and the lower end of the femur is permitted; and it therefore follows that if, while the knee is in the flexed position, a forcible twist or wrench takes place—such, for instance, as might happen in swinging coal while in a squatting position, when the body is swung round too far—one or other knee is twisted, and the cartilage may be torn. Where the accident does happen the cartilage, nipped between the condyle of the femur and the upper end of the tibia, is forcibly dragged towards the centre of the joint, and either split more or less in a longitudinal manner, or its free edge torn or frayed.

I have been unable to satisfy myself that there is ever a true detachment, as in every case observed, even where the split is very near the attached margin, a narrow rim of cartilage still retains its normal position. I would here wish to emphasise that where a proper diagnosis has been made the injury is always in the nature of a tear or split, and where such is not found the probability is that a wrong

diagnosis has been made, some other structure having been injured, probably the internal lateral ligament. In the present series of cases 95·5 per cent. of them showed definite splits or tears, so that only in 4·5 per cent. was there no definite pathology. These latter, I presume, are what are termed "loose" in the various text-books.

As I have before stated, coal-miners are the most frequent sufferers from torn semilunar cartilage, and in the present series, out of 449 cases 282 occurred in miners while following their employment. This gives a percentage of 62·8.

Football players are also very liable to the accident, and when we remember that in football the running is, as a rule, not straightaway, but consists rather of dodging, twisting, and swerving, one is not altogether surprised. I am also inclined to think that the long leather studs in the boots, fixing the foot in the ground during swerving or dodging, while the body momentum goes on, are often the primary cause. Out of my 449 cases the accident occurred, in the first instance, while playing football 81 times. This gives a percentage of 18. It will be noted, therefore, that the mining occupation and football playing are responsible for 80·8 per cent. of the injury. Other forms of sport supply 2 per cent.

The internal semilunar cartilage is very much more often injured than the external. In the present series of cases the former shows a percentage of 92, while the latter shows a percentage of 8. For a long time I was under the impression that the reason the internal semilunar cartilage was more often torn than the external was the nature of the accident. It seemed to me that an inward twist, where the femur is rotated inwards and separation of the joint surfaces takes place at the inner side, was the factor which would cause tearing of the internal semilunar cartilage. I found, however, that this was not always so, a great many of the patients being positive in asserting that the knee was twisted outwards. I am, therefore, driven to the conclusion that both an inward and an outward twist will cause rupture of the inner cartilage. Perhaps the reason is to be found in the anatomical conditions. We know that while the internal semilunar cartilage has a close connexion with the capsule and internal lateral ligament, the attachment of the external semilunar cartilage to the capsule is looser, and it has no connexion with the external lateral ligament. Under these conditions, supposing the external semilunar cartilage was nipped between the external condyle and the upper surface of the external tuberosity of the tibia, and thrust towards the centre of the joint, and bearing in mind the limited lateral excursion of the femur which would be permitted, a tear of the cartilage would not be likely to take place, but rather, in the majority of cases, at the most, stretching of its connexions. On the other hand, if the internal cartilage be nipped between the internal condyle and inner tuberosity of the tibia, and dragged towards the centre of the joint, considering its much closer connexion, a split or tear would often result.

The right knee is slightly more frequently affected than the left, the percentage of the one being 53·3 and of the other 46·7. In the case of six patients both internal cartilages were removed, in one case at the same operation, and

List of Special Cases.

No. 49	...	...	Both internal cartilages removed at same operation.
Nos. 86 and 361	...	"	" " " " 5½ years' interval.
" 123	" 146	...	" " " " 9 months' "
" 210	" 366	...	" " " " 2 years' "
" 374	" 449	...	" " " " 9 months' "
" 424	" 438	...	" " " " 6 weeks' "
" 62	" 70	...	" external " " 1 year's "
" 22	" 343	...	" cartilages in one knee " at same operation.
" 113	" 266	...	" " " " " " with interval of 3 yrs.
" 184	" 195	...	" " " " " " " " 8 mos.
" 294	" 346	...	" " " " " " " " 11 "
" 110	" 142	...	Same cartilage operated upon twice.
No. 196	...	...	Patient developed gangrenous appendicitis after 1st Op.
" 428	...	...	" acute lobar pneumonia " "
" —	...	...	" whitlow.

in the others with an interval of from six weeks to five and a half years. In one patient both external cartilages were removed with an interval of one year. In two cases, in both of which the internal semilunar cartilage was diagnosed as torn, on operation these were found normal. An incision

¹ A paper read before the Surgical Section of the Royal Society of Medicine on Oct. 8th, 1912.

was therefore made on the outer side of the joint, and the external cartilages, much torn and mutilated, were removed. These two cases show that sometimes it is impossible to diagnose whether, in the case of an injured knee, the internal or the external semilunar cartilage is at fault. In three cases from the same knee both semilunar cartilages were removed, in the first with three years', in the second with eight months', and in the third with 11 months' interval between the operations. In two cases where, after operation for injury to the internal semilunar cartilage, the symptoms were not relieved the joint was again opened. The portion of cartilage left behind after the previous operation was found to be torn and so was removed with complete relief of symptoms.

Many types of torn semilunar cartilage are met with, and examples of these I will show you. In the first place there is the simple longitudinal split, varying as regards its position to its attached border, being sometimes quite close to this and sometimes quite near to the free edge. When the accident is recent the edges of the tear show roughness and are often blood-stained, while the joint cavity itself contains blood-stained synovial fluid. Where the primary accident occurred some weeks or months previously the edges of the split are rounded and smooth, and in some cases at the ends of the split some cicatrization may be noticed. The split does not extend straight through the substance of the cartilage, but rather in an oblique manner from near its circumferential attachment downwards and towards the centre of the joint, so that on the upper surface of the cartilage the tear is near the outer circumference; on the under surface it shows nearer the free edge.

In some cases, on opening the joint the detached portion is seen lying in its normal position, and if a careful search be not made it might easily be overlooked. Again, in other joints the detached piece will be found curled up between the condyles, and practically only attached by its anterior and posterior ends. Sometimes the split is in the posterior part, and cannot be demonstrated until the anterior attachment of the semilunar cartilage is divided and strongly pulled upon, when the detached portion snaps forward. In one case, after a long search I found the detached portion lying stretched round the condyle.

In another type the tear extends from some point in the free border, across the breadth of the cartilage for a variable distance, and then either forwards or backwards. In the former case the detached portion may form a pedunculated piece, which, previous to operation, may be felt moving in front of the internal condyle. In another type the free border is the part that has been torn, forming a small pedunculated disc with rounded edges, and in some of these showing where it hinges over the free margin of the still attached cartilage. This pedunculated disc may form one of the varieties of loose bodies, in consequence of becoming completely separated as a result of being frequently ground between the joint surfaces. In still another type there is a more or less horizontal split through the thickness of the cartilage, the undermost piece being liable to engage between the joint surfaces and so cause symptoms. This type may be combined with the simple longitudinal split. In a minority of cases the injured cartilage is mutilated beyond all recognition.

The bulk of the sufferers from torn semilunar cartilage give a very typical history, and I would here emphasise that in the majority of cases we have to diagnose the condition from what we are told. It may be that when you first see the patient the primary tear occurred months or years previously, and the subsequent attacks of "something going wrong with the joint" have been comparatively slight, consisting, perhaps, of little more than experiencing a click or a snap at the inner side of the knee with pain in the same situation. He then finds that momentarily the joint locks—i.e., he is unable to extend it completely; then suddenly, after moving his knee himself or somebody moving it for him, another click or snap is experienced, and full power of movement is again regained. Attacks such as these occur more or less frequently and at various intervals after the primary tear, and are often followed by no effusion, the only symptom remaining being a tender point at the inner or outer side of the patella somewhere in the line of the articulation, according as it is the internal or external cartilage that is injured. These subsequent attacks are often determined by very slight causes, such as catching the bed-clothes

with the toes, stepping on irregular ground, or rising from the squatting position. When, however, they do occur they render the limb perfectly helpless for a time and may happen at very awkward moments, as, for example, when crossing in front of a tram or motor-car. One of my patients sustained a severe punctured wound of his palm in consequence of spiking his hand on some iron rails which he had attempted to grasp in order to prevent himself falling.

When the primary tear takes place the symptoms are much more severe, and are often as follows. In consequence of a severe wrench or twist the patient is suddenly seized with severe pain. The pain is at first often felt over the whole joint, later becoming localised at the inner or outer side, and is frequently so bad as to cause faintness and vomiting. At the same time a click or snap is felt, or a feeling of something slipping. If running, he falls to the ground, and finds he is unable to completely extend the knee. Often some witness of the accident at once practises flexion and extension movements, another click or slip is felt, and the joint is then found to be capable of complete extension. In a few hours swelling occurs, the result of effusion in the joint, and this, in consequence of rest, disappears in the course of two or three weeks. In some cases the inability to extend persists for a week or more, and in others only disappears when an anæsthetic is given and certain manipulative procedures carried out or the offending cartilage is removed. For some weeks after the accident, and after all swelling has disappeared, a tender point persists at the inner or outer side of the patella according as the internal or external cartilage has been torn.

In deciding upon a line of treatment the question arises as to whether it is necessary for the patient to have a perfectly sound joint or not. If he is engaged in manual labour the answer must be in the affirmative, and in the absence of any contra-indication, such as intercurrent disease, operation is demanded. This decision must also apply to active men and women who are still wishful to spend their leisure in open-air sports such as football, cricket, hockey, shooting, and riding. I am aware, of course, that in some of these cases the application of a knee splint, which, while permitting flexion and extension, prevents rotary and lateral movements, may prevent the joint "going wrong," but for such a splint to be really effective it must be somewhat heavy and cumbersome, and this the patients will not wear as a rule, or at any rate discard it after using it for a short time. I am afraid I am very sceptical as regards the result of treatment by prolonged rest, in the case of a primary tear, bringing about a cure, in view of the conditions found in operated cases.

Where the inability to completely extend the joint persists operation is certainly demanded. Even where it is hoped that reduction under an anæsthetic may occur, this procedure should not be attempted unless the joint has been thoroughly prepared, so that in the event of failure open operation may be performed. If operation be decided upon, the question next arises as to which is the best time to operate. Personally, I see no objection against doing this after the first week or 10 days following the primary accident. I choose this time because I judge the devitalising effect of the trauma will by then have passed away and attempts at repair have started. Where operation is decided upon in consequence of repeated attacks of locking, it does not matter when the operation is performed (although personally I again prefer to wait until a week or 10 days has passed), as the effects of the last attack will probably be so slight as not to lower the joint resistance.

Previous to and during operation the most rigid antiseptic precautions are called for. For 36 hours I keep the patient in bed, and at the beginning of this period the skin of the thigh and leg is shaved, thoroughly washed with spirit soap and water, then with turpentine, and finally with methylated spirit. A compress wrung out of 1 in 1000 perchloride of mercury solution is then applied around the limb, extending from the middle of the thigh to the middle of the leg. This is covered with mackintosh and secured by a bandage. The same procedure is carried out 24 hours later, and then, when the patient is on the operating table, and after a tourniquet is applied round the thigh, the knee is strongly flexed and kept in this position by my assistant. Before making the incision the operation area is thoroughly washed with a solution of 1 in 20 carbolic acid.

The incision I use is a transverse one, extending, in the

case of the internal cartilage, from the inner border of the patellar tendon, backwards for about two inches in the line of the articulation. This incision, I consider, gives the best exposure, and if the internal lateral ligament be not cut across there is no interference with the after stability of the joint. After the skin is divided a strong aponeurosis is exposed, and is also divided in the length of the incision. The capsule with underlying synovial membrane is then opened, and the interior of the joint exposed. Then, in the great majority of cases, the tear or split will be quickly recognised, especially where it involves the anterior part of the cartilage or where there is marked displacement of the torn portion. If after careful scrutiny nothing pathological is discovered, I divide the anterior attachment of the semilunar cartilage, seize it with strong-toothed forceps, and drag it forwards. If there be a posterior split the detached portion will suddenly snap forwards between the condyles and tuberosity. This snapping forwards is what actually happens during an attack, and if witnessed it can be readily appreciated what a shock it will be to the patient. In every case I remove not only the detached piece, but endeavour to ablate the portion still retaining its normal attachment, and since doing this have had no patient returning with recurrence of symptoms. After the cartilage is removed the capsule and synovial membrane are sutured in one layer with catgut. The aponeurosis is similarly dealt with, and the skin incision is closed with a subcuticular suture of silkworm gut. An antiseptic dressing is then applied, with a thick layer of wood-wool wadding, and secured by a domette bandage firmly applied. No splint is used, and the patient is told to commence to move his knee as soon as he can.

After the operation a rise in temperature for the first two nights to 99° or 100° F. is commonly met with, but this need cause no alarm. Again, for the first 48 hours a great deal of pain may be complained of, necessitating one or two hypodermic injections of morphia. Otherwise the convalescence of the patient is perfectly straightforward, and at the end of a week the subcuticular suture is removed. After this is done a light dry dressing is applied, and my infirm patients are discharged as a rule on the tenth day, being then able to carry out full movements of the joint. In the case of one patient convalescence was disturbed by an attack of acute gangrenous appendicitis, for which operation was promptly performed 11 days after the cartilage had been removed, with a successful result. Another was seized with acute lobar pneumonia (pneumococcal), but made a good recovery; while a third contracted a whitlow a few days following his operation, but this did not in any way affect his recovery.

As regards the after-history of my patients I can only say that I have seen them at periods varying from seven years to a few weeks after their operation, and, except in a very few instances, they have been quite satisfied and have told me that the joint was as strong as ever. In part proof of this I would refer you to the cases in which after the semilunar cartilage in one knee has been removed, the patients have returned to have a torn cartilage removed from the other, or in one or two cases the other cartilage of the same knee. They would not have done this if the first operation had not been successful. Again, where I have operated in the case of both amateur and professional football players, they have all played again, and many of them are still playing. One Monday morning, a week or two ago, I noticed in the column of the *Daily Telegraph* devoted to the account of Association matches played the previous Saturday, that a player in an important Second League match, from whose left knee I removed both semilunar cartilages at the same operation on March 16th, 1910, had not only played well, but scored the only goal of the match.

Where a man is engaged in manual labour I allow him to return to work in 10 or 12 weeks after the operation, but in many cases—and this, of course, applies to sufferers who have sustained the accident at football (other than professional), and so are not entitled to workmen's compensation—they have returned to work as early as six or seven weeks after, and with no bad result.

I am afraid my remarks and conclusions have been, perhaps, based too much on personal experience, but inasmuch as so little has been authoritatively written about

injuries to the semilunar cartilages in text-books and elsewhere, this was unavoidable. I trust my small contribution to the subject may be of some value, and would add, in conclusion, that I have always thought these accidents, which claim as their victims a goodly number of those engaged in the important industry of coal mining, have not received the attention they deserved.

Newcastle-on-Tyne.

ON THE CHANGES INDUCED IN BLOOD BY FEEDING: A STUDY IN CELLULAR PHYSIOLOGY.

By GUSTAV MANN

AND

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(WITH COLOURED PLATE.)

THE experiments detailed below were undertaken with the view of ascertaining whether feeding would produce changes in the blood which could be demonstrated microscopically, apart from the increase in number of white blood corpuscles which we know to occur.

Lily Huie,¹ working in Edinburgh and Oxford under Mann's direction, was able to show marked changes in the nuclei of the gland cells of the insectivorous plant *Drosera* after feeding the same with egg albumin, albumoses, peptones, &c. The rapidity with which the nuclear changes could be produced depended on the amount of predigestion of the protein food substances. Subsequently, H. G. Butterfield, working with Mann in Oxford, succeeded in demonstrating that if newts are starved in the summer time for a fortnight, and if each newt is fed with a worm of the size of a wooden match, all the nuclei of the most diverse animal tissues, excepting only the nuclei of the nerve cells, would stain much more deeply in the fed newts than in the control animals.

In the present instance blood was chosen for the subject of inquiry to ascertain whether metabolism in the nucleated blood cells during the ingestion of food is likewise accompanied by a definite increase in the nucleo-proteins. Secondly, to determine, if possible, the function of the granules in both leucocytes and lymphocytes. Thirdly, to see whether the increased alkalinity of the blood during gastric digestion would show itself by an increased affinity for free acid dyes, as in Mylius's reaction. And fourthly, to reinvestigate the problem whether a deposit of stored material, such as glycogen or fat, occurs in the blood cells or platelets after a liberal meal.

Our experiments were made on men and frogs. We started our investigation on six medical students, who volunteered to act as subjects, and the following procedure was adopted. After eating the usual breakfast, which included at least two eggs and one glass of milk, no food of any kind and no liquid, except water, was ingested until noon of the next day; thus the men fasted for about 30 hours. Immediately before the breakfast, and after breakfast at two-hour intervals, each student made four blood films, except from 12 o'clock midnight until 8 A.M. the following morning. The last blood films were made two, four, six, and eight hours following the first meal after the fast.

The films were air-dried, wrapped in tissue paper, marked, and turned in to us at the end of the period. The slides on which the students made the blood films were cleaned by us to remove all traces of sodium silicate, because the alkalinity of the latter would have interfered with the Mylius-Ehrlich reaction.² The slides were placed in Mann's cleaning fluid of chromic and sulphuric acids² for two to four hours, rinsed in several changes of distilled water, and finally rinsed again, one at a time, in distilled water, dried with tissue paper, and wrapped in packets of four, care being taken to avoid touching the surface of the slides.

¹ Huie, Lily: Changes in the Cell Organs of *Drosera Rotundifolia*, produced by Feeding with Egg Albumin, *Quarterly Journal of Microscopical Sciences*, vol. xxxix., N.S. (1896-97). Further Study of Cytological Changes produced in *Drosera*, *ibid.*, vol. xlii. (1899).

² Consult Mann's *Physiological Histology*, Clarendon Press, 1902.