Remarks

ON

LOOSE BODIES IN JOINTS.

BY

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It is reasonable to believe that loose bodies in joints must have been familiar to the ancients, for from time immemorial the limbs of man have been subject to injuries of unchanging type. But there is no record of an attempt to remove a loose body by operation until we reach the Middle Ages, when the incomparable Ambroise Paré¹ (1558) extracted a typical specimen from a cystic swelling which communicated with the knee-joint.

In more modern times considerable attention has been directed towards the elucidation of the pathogenesis of loose bodies, and the subject is now endowed with a literature of formidable proportions. A brief review of this historical phase will serve as an introduction to this communication, which will deal more especially with certain practical aspects relating to the diagnosis and operative treatment of loose bodies in the knee-joint.

In 1875 Volkmann² presented a broad classification in which loose bodies were divided into two main groups; this is still in use. Group I included the bodies found in diseased joints, and Group II those found in otherwise healthy joints. The distinction between the two is in some respects artificial, but the outstanding contrast is emphasized in proper perspective.

A third group, which does not entirely conform to the requirements of the classical schema, is sometimes recognized. In this are included the loose bodies which develop primarily as synovial chondromata, a process which is little understood, but which merits recognition as a pathological entity.

PATHOGENESIS.

Group I.—Diseased Joints.

There is no mystery in the origin of the loose bodies which make their appearance in joints which are frankly diseased. They result simply from the separation of small portions of the changed articular surfaces. Thus, in osteoarthritis, marginal osteophytes may sometimes become detached, either spontaneously or after a trivial injury. We must recognize, however, that in a certain proportion of joints which show comparatively mild osteo-arthritis changes accompanied by one or more loose bodies the arthritis is really a secondary development. On the whole, in osteo-arthritis loose-body formation is not very common. In neuropathic arthritis—for example, the familiar Charcot's joint of tabes—the somewhat bizarre hypertrophic and degenerative changes offer an ideal background for the wholesale exfoliation of articular fragments. Under such conditions loose bodies are usually of minor pathological and surgical importance.

In this group of diseased joints the majority of the patients are past middle age, and the loose bodies are almost invariably multiple.

Group II.—Otherwise Healthy Joints.

The pathogenesis of the bodies which form in joints apparently sound to ordinary clinical tests cannot be expounded in so simple a fashion. The essential clinical features have long been defined, the more important being: (1) the comparative youth of the patients (15 to 25 being the age of choice); (2) the high incidence in the male sex; (3) the predilection for the knee-joint—with the exception of the elbow, loose bodies are extremely rare in other joints; (4) the bodies are more commonly single than multiple.

It was obvious to the earliest observers that this type of loose body also was derived from the articular surface (Monro, 1762³), and when the patient gave a history of antecedent trauma the method of production seemed to be

clear. But when, as not infrequently happened, there was no record of injury a different explanation was demanded.

Among the first to suggest an alternative hypothesis was Sir James Paget.⁴ In 1870 he removed a loose body from the knee-joint of a Harrow schoolboy. Histological examination of the specimen showed that it had been detached from one of the femoral condyles. In the origin of this body Paget saw yet another example of a process for which he had coined the term "quiet necrosis." In his view a trivial unnoticed injury had produced on the femoral surface a limited zone of necrosis. In due course a cartilaginous flake had become separated, and after a time had assumed the typical round, smooth appearance of the mature loose body. It was not until 1888 that Koenig⁵ introduced the term "osteochondritis dissecans" to describe the exfoliation of fragments from the articular surfaces of the knee-joint. But Koenig himself did not accept trauma as the first stage in the sequence of events which culminated in the development of such loose bodies.

In the later work of the German school there has been an attempt to extend Koenig's thesis by providing an explanation of quiet exfoliation without invoking trauma as a necessary preliminary. Considerable emphasis has been laid on the observation that osteochondritis dissecans has a favourite site in the knee-joint.

This is a small area on the lateral aspect of the mesial femoral condyle, just in front of the attachment of the posterior crucial ligament (Fig. 1). The area is supplied by a special vessel—the arteria genu media—which in the injection experiments of Ludloff⁶ appeared to be an end artery. The position of this vessel at once suggested its vulnerability, and it was concluded that thrombosis might easily be produced, either by injury or after the lodgement of a tiny embolus. In this way a zone of "quiet necrosis" would be determined. Unfortunately for the further exposition of such a thesis, the more recent injection experiments of Nüssbaum⁷ show that the arteria genu media anastomoses freely with the vascular supply of surrounding areas.

Axhausen⁸ (1920) has also supported the quiet necrosis theory from the experimental side. In his conception, the first stage in loose-body formation is the occurrence of a small embolic infarct, which includes a wedge-shaped area of subchondral bone. Later the infarct becomes shut off from the living bone by the ingrowth of granulation tissue. Detachment does not occur for some little time, but finally the fragment is extruded into the joint cavity and enters on its career as an independent loose body. But Phemister⁹ has obtained very different results after the experimental production of localized foci of aseptic necrosis on joint surfaces, for he finds that the necrotic areas are not exfoliated. In spite of much conflicting evidence at the present time it is generally agreed that trauma plays a dominant part in the production of the ordinary loose body in the so-called normal joint. In the knee-joint a considerable area of both femoral condyles is repeatedly exposed to the risk of direct impact, and it is conceivable that a localized infraction of the joint surface may be induced by comparatively trivial violence. Such an injury may be followed by complete healing or, on the other hand, by an immediate, or delayed, separation of an articular fragment. It is also probable that traction exerted through the medium of the posterior crucial ligament may tear off a flake in the intercondylar region. Freiberg¹⁰ believes that an unusually long internal tubercle of the tibial spine may impinge on the crucial ligament when the knee is flexed and externally rotated. It has also been suggested that the tibial spine itself may come into contact with the mesial condyle and thus act as the prime detaching force (Roessner¹¹).

Although attention has been focused on the vulnerable intercondylar region, it must be realized that a considerable proportion of loose bodies in the knee do not originate from this site. Indeed, it is probable that the majority represent detachments from other parts of the condylar

FIG. 1.—Interior of knee-joint, showing vulnerable area on internal condyle supplied by arteria genu media.

* A paper read before a conjoint meeting of the Manchester and Liverpool Medical Societies at the Liverpool Medical Institution.

surface. Patches of early erosion are not infrequently seen in exploratory operations on the knee for the removal of injured semilunar cartilages.

Group III. Synovial Chondromata.

As long ago as 1834 Benjamin Brodie¹² surmised that certain types of loose body originated in the synovial membrane. These are now separately classified under the term "synovial chondromata," and are believed to develop from small nests of cartilage cells commonly found in normal synovial villi. Little is known of the conditions which determine such a change, but it is probable that the bodies are actual tumours. Although small isolated synovial chondromata may be found in osteo-arthritis joints, or in joints presumed to be healthy, the loose bodies which fall into this group are generally present in considerable profusion. Where the synovial membrane is invaded widely, the condition has been termed "osteo-chondromatosis" (Henderson¹³). Many of the synovial chondromata remain attached for an indefinite period, the number of free loose bodies being small.

Changes in Loose Bodies during and after Separation.

It is well recognized that, irrespective of their mode of origin, many loose bodies do not become completely detached for some considerable time. During this intermediate stage both the cartilaginous and bone elements undergo changes which are characteristic of living tissue; but after the body has broken away from its vascular pedicle the bone cells die. The cartilage cells, however, continue to live and proliferate, nourished by the joint fluid (Fisher¹⁴). The original hyaline cartilage may be replaced by fibro-cartilage (Phemister, loc. cit.). After a sojourn in the joint cavity the loose bodies tend to increase in size and take on a uniform shape and appearance.

A loose body may acquire a secondary attachment to the synovial membrane, and so for a time its migratory habits are suspended. In somewhat similar fashion a group of bodies may accumulate in a pocket which ultimately becomes shut off from the joint cavity proper. An occasional hiding place for a solitary body in the knee-joint is a pouch connected with the coronary attachment of the semilunar cartilages.

LOOSE BODIES IN THE KNEE-JOINT.

A full description of the symptomatology of loose bodies in the knee-joint lies outside the scope of this paper. It is sufficient to state quite broadly that the clinical picture is embodied in the familiar syndrome of "internal derangement" of this joint. In the so-called normal knee this syndrome is usually presented in clear-cut fashion; in a diseased joint other long-standing symptoms may obscure the signs which the loose bodies themselves evoke.

There are, of course, many points of clinical interest which distinguish loose bodies from other more common causes of internal derangement—for example, injuries of the semilunar cartilages. Where the loose body has been actually palpated the problem is solved; but in the majority of instances the differential diagnosis must rest on the radiographic findings.

Once the presence of a loose body has been established, apart from certain reservations as to age, economic circumstances, and the existence of advanced joint disease, operative removal is indicated. But before the knee-joint is opened the surgeon should be in possession of information which enables him to define both the exact number of loose bodies and their distribution in the joint cavity. This means that as a routine the knee should be radiographed from many angles, and in the position of flexion as well as extension. In addition, stereoscopic views are often invaluable.

Such requirements raise the important question of the interpretation of the radiographic appearances of loose bodies in various phases of their development.

RADIOGRAPHIC DIAGNOSIS.

1. The Loose Body before Separation—Osteochondritis Dissecans.

We have already referred to the stage when the developing loose body is still attached by a pedicle. In certain positions of the joint the fragment lies snugly in its fossa.

At other times it flaps about on its hinge, but, although its range of movement is small, it may give rise to the characteristic symptoms of internal derangement. There is a danger that a pedicled fragment, unless temporarily displaced from its bed, may be overlooked in conventional radiograms; but that the radiographic evidence of osteochondritis dissecans may be clear-cut is well exemplified in the following case.

Some four years ago I saw a public school boy, aged 15½, with a typical history of recurring attacks of transitory "locking" of the knee, following a direct contusion sustained at football two years before. The boy's family doctor had felt a loose body on the outer aspect of the knee during two of the attacks, but when I examined the joint it was "silent." The radiograms (Figs. 2 and 3) showed an interesting combination of lesions:

FIG. 2.—S. T.; from a radiogram of knee-joint, showing (a) loose body, (b) patch of osteochondritis dissecans.

FIG. 3.—S. T.; from an antero-posterior radiogram of knee.

(a) a definite loose body lying on the outer head of the tibia; and (b) an irregular patch in the intercondylar region at the classical site for osteochondritis dissecans. The appearance here suggested that a plaque of the articular surface was in process of separation.

Removal of the loose body was advocated, but for certain reasons the operation was postponed for a year, during which time further attacks of locking occurred.

When the knee-joint was opened a loose body the size of a threepenny-piece was seen, attached by a slender pedicle just in front of a pit on the lateral surface of the inner condyle. After its removal a search was made for the rounded loose body which had always shown up well in the radiograms. This was discovered lying on the outer head of the tibia, but enclosed in a synovial pocket and obviously incapable of shifting sufficiently to account for the symptoms of locking.

This case is an excellent example of the classical osteochondritis dissecans following a known injury, and with the loose body incompletely detached but already causing symptoms. It is further interesting in that a second loose body, obviously of an older "vintage," was at first assumed to be the sole cause of the derangement, and yet was proved to be incapable of free migration.

2. The Loose Body Invisible.

A loose body may also escape recognition after complete detachment. This happens when its lime content is small, and particularly when the faint image is superimposed on the denser shadow of the femoral condyles. But this should be a rare occurrence under the conditions of modern radiographic technique, when the clinical signs have led to a presumptive diagnosis of loose body.

3. Multiple Bodies.

It does not seem to be widely recognized that operations for the removal of multiple loose bodies are by no means uncommon. I find in my own clinical material that the incidence is between 40 and 50 per cent. For this reason the pre-operative counting of multiple loose bodies is a

most essential part of the radiographic diagnosis. But the mere enumeration is not sufficient; the exact localization of each body or group of bodies, with reference to the internal anatomy of the knee-joint, is also required.

It will be remembered that the joint cavity is divided into five distinct but intercommunicating compartments—three in front and two behind. These are the *supra-patellar* pouch; the *antero-mesial*, the *antero-lateral*, the *postero-mesial*, and *postero-lateral* compartments. It is important also to realize that each pouch allows of separate exploration through a relatively small capsular incision.

A loose body originating in one of the anterior compartments finds a free passage from one to another, but does not ordinarily make its way into a posterior compartment, as the connecting path is somewhat circuitous. Free communication between the two posterior pouches is, for practical purposes, blocked by a mid-line synovial partition connected with the posterior crucial ligament, which is attached in the intercondylar region, so that a loose body originating in either of these pouches tends to have a comparatively small range of excursion.

It is a common experience to find multiple loose bodies distributed in both the anterior and posterior divisions of the knee-joint, and, in the absence of definitive information, it is an easy matter to explore such a joint and to leave one or more bodies behind. Such omissions have been brought forcibly before my notice in my earlier operative experience in this field.

Wherever possible the enumeration and localization of each separate group should be carried out the day before the operation. The joint should never be explored on information several weeks old, as a redistribution of the bodies may occur during the interval. The patient himself is occasionally conscious that the bodies have moved, and it is always wise to question him deliberately on this point.

EXPLORATION OF THE KNEE-JOINT FOR THE REMOVAL OF LOOSE BODIES.

The removal of a solitary loose body which has been accurately localized is an operation of extreme simplicity. The appropriate pouch is entered through a small capsular incision, which may be little more than a mere stab cut. In such a procedure the joint disturbance is negligible, and full recovery of function is seen within a few weeks.

I hold very strongly that the operative treatment of multiple loose bodies should be based on the same conservative principle. Each pouch should be invaded separately. For this an equal number of short skin incisions may be used, or alternatively a convenient flap, which provides access to two or more compartments simultaneously. The vast majority of multiple loose bodies can be dealt with in this manner with great advantage to the patient and the future of his knee-joint.

In exceptional circumstances it is advisable to display the interior of the knee-joint more completely, as in the removal of synovial chondromata when present in large clusters. This will naturally be accomplished by one of the recognized types of full arthrotomy, in which the patella is either divided in the mid-line or displaced to one side or the other. It must be remembered that such an exposure allows an inspection of the three anterior pouches only. The posterior compartments must of necessity be approached separately.

The value of arthrotomy in miniature will be further appreciated when it is realized that in certain joints, after removal of multiple loose bodies, a fresh "crop" may develop at some future date and re-exploration become necessary.

COMPARTMENTAL SURGERY OF THE KNEE.

The removal of multiple loose bodies illustrates what may be termed the *compartmental* surgery of the knee-joint. In the exploration of the different pouches there are certain special anatomical and technical peculiarities to which brief reference may now be made.

1. The Anterior Division of the Knee-joint.

(a) The antero-mesial and antero-lateral pouches are frequently entered for the removal of injured semilunar cartilages, operations which are amongst the commonplaces

of joint surgery. Identical exposures are used for the extraction of loose bodies. It may be remarked that the typical plaque of osteochondritis dissecans on the inner condyle, and the flapping, loose body are best seen and dealt with from the antero-lateral pouch.

(b) The supra-patellar pouch is inspected through a short vertical incision in the rectus femoris. The removal of a loose body from this pouch via a stab wound is reminiscent of the old style of operation of the pre-antiseptic era.

2. The Posterior Division of the Knee-joint.

This is a less familiar hunting ground, as the pouches are rarely explored except for the extraction of loose bodies.

(a) The postero-mesial pouch is exposed after defining the posterior edge of the internal lateral ligament and retracting the sartorius as it skirts the posterior border of the femoral condyle. (Fig. 4.) With the knee flexed to a right angle the pouch bulges prominently, and when opened by a vertical cut shows a capacious interior. Access to the postero-lateral compartment is barred by the median partition already described.

Bodies which occupy the posterior compartments often tend to disappear into the intercondylar region, and are occasionally most difficult to find. When present in considerable numbers, small groups may become encysted in synovial "nests," which must be opened before the bodies can be extracted. Illumination of the interior of the pouch by means of a head lamp is useful, if the search tends to become prolonged. If the number removed does not correspond to the pre-operative count, it is a wise precaution to syringe out the pouch with saline under considerable pressure. An elusive body may then float into view. This manoeuvre is, of course, applicable to all pouches. Movements of the knee, and particularly rotation of the tibia on the femur, sometimes helps to dislodge a concealed body.

(b) The postero-lateral pouch is opened behind the external lateral ligament, and the same principles are again illustrated.

(c) *Popliteal Approach.*—There is an alternative method of approach to the posterior division of the knee-joint which was advocated some years ago by Brackett and Osgood. In this a mid-line incision is made over the popliteal space, and after displacement of the tibial nerve and popliteal vessels the joint capsule is opened. Either pouch may be opened separately or the intercondylar fossa is readily displayed. Where there is a temporary encystment of a group of loose bodies in a pocket connected with the median partition the popliteal approach offers many advantages.

CONCLUSIONS.

1. When the symptoms of internal derangement of the knee suggest the presence of a loose body, a systematic radiological examination is essential. This should be carried out with a view to the possible demonstration of (a) an area of osteochondritis dissecans; (b) a loose body in process of detachment; or (c) one or more loose bodies free in the joint cavity.

2. When a single loose body is demonstrable the existence of additional bodies should always be suspected.

3. Multiple loose bodies demanding removal are common. Before operation is undertaken they should be accurately counted and their exact location defined with reference to the various joint compartments. This information should be obtained during the few days immediately preceding the operation.

4. Given an accurate pre-operative diagnosis, the removal of multiple loose bodies through an extensive arthrotomy is rarely necessary. The bodies should be extracted in turn from the various pouches, which are entered by means of short capsular incisions. With such a technique there is a

FIG. 4.—Diagrammatic view of antero-mesial and postero-mesial pouches with loose bodies *in situ*.

minimum interference with the knee-joint, and rapid return of function is favoured. (Arthrotomy in miniature.)

5. A complete arthrotomy should be reserved for knee-joints in which loose bodies occur in considerable profusion in the three anterior pouches.

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An Address

ON

THE TREATMENT OF OBSTRUCTIVE LESIONS
OF THE COLON.*

BY

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TWENTY years ago chronic obstructive lesions of the colon were rarely, if ever, diagnosed, except as the result of an operation for acute obstruction or a *post-mortem* examination. At the present day the majority—I would almost like to say the great majority—of such lesions are diagnosed and treated before the onset of acute symptoms. Statistics on such a subject are difficult to obtain, but a paper recently published by Burgess of Manchester contains figures which illustrate this point.¹ Out of 485 cases of cancer of the colon admitted between the years 1913 and 1922 to the Manchester Infirmary 173 had acute obstruction—that is, 64.4 per cent. were diagnosed before acute obstruction had occurred. I know from my own experience that each year I see more cases where the diagnosis is made or suspected in time to prevent the onset of acute symptoms.

The results of operations for obstructive lesions of the colon twenty years ago were very bad. The mortality was high and the recoveries were for the most part accompanied by a permanent faecal fistula of some kind. As the result mainly of improved diagnosis all this has been changed, and there are now few serious conditions which show better results from skilled surgery.

The fact that the surgeon is now able to operate upon lesions of the colon before the onset of obstruction has entirely altered the type of operation performed for this condition, and with proper precautions and careful technique it is now possible to resect that portion of the colon containing the lesion and to join the bowel up by axial union in one operation with very little risk—a procedure which was almost unheard of twenty years ago, when Paul's two-stage method, Senn's plates, Robson's bobbin, or Murphy's button were in use.

I do not propose to describe in detail the symptoms of obstructive lesions of the colon, but only to say that in my experience the most important early symptom is repeated irregularity of the bowel actions without adequate cause, more particularly repeated attacks of slight diarrhoea alternating with constipation and vague abdominal discomfort. We have a number of methods to help us in making a diagnosis, but it is as well to own that none of them are very reliable. The presence of occult blood in the stools on microscopical examination is valuable in cases of cancer, but cannot be relied upon, and is of no negative value.

X-ray examinations after a barium enema are very useful, but must be very well done with a first-rate apparatus having a very short exposure so as to eliminate movement of the bowel and ensure a sharp edge to the shadows. Also the examination must be repeated to avoid as far as possible accidental appearances. The

appearances of a well marked filling defect in one part of the colon if the examination is repeated some days later affords valuable evidence, more particularly if belladonna has been administered to eliminate spasm. It is not, however, entirely reliable, and the absence of a filling defect will not exclude a lesion. Lesions due to diverticulitis can now be diagnosed with considerable accuracy by the x rays and a barium enema, but very good photographs are necessary.

A sigmoidoscopic examination is very useful, and such evidence as it affords is reliable. It does not, of course, enable a growth above the middle of the pelvic colon to be seen, but it at least has this advantage—that the absence of a lesion up to this level tells the surgeon that any lesion present will be sufficiently high up to allow of resection from the abdomen, or short-circuiting by lateral anastomosis, and that colostomy can be avoided.

Too often it happens that with all our efforts we cannot arrive at an exact diagnosis, although there remains a grave suspicion that a lesion in the colon is present. In such circumstances we should not hesitate to back our opinion and advise an exploratory laparotomy. The "wait and see" policy generally results in disaster. The risks of exploratory laparotomy are very slight, while the danger of leaving a carcinoma of the colon is very grave, more especially as the results of partial colectomy for cancer of the colon are better at an early stage than those for removal of cancer in any other part of the body. Restoration of function is usually perfect and the tendency to recurrence after removal of a cancer in the colon is very slight compared with cancer elsewhere.

The majority of obstructive lesions in the colon are the result of cancer, but there are a number of other conditions which also cause such symptoms. One, which of recent years has come into considerable prominence, not because it is rare, but because it had not hitherto been recognized, is diverticulitis. This curious condition causes a tumour very similar to a malignant growth and partial obstruction of the bowel lumen, often quite suddenly, as the result of acute inflammation in, or around, the diverticula. The distinction between diverticulitis and cancer is not always easy, but the facts that the former is accompanied by signs of inflammation, while the latter is not, and that bleeding is rare in cases of diverticulitis, while it is the rule in cases of cancer, help considerably in forming a diagnosis. An x-ray examination after a barium enema will generally give well marked evidence of diverticulitis; but, of course, the presence of diverticula in the bowel does not necessarily exclude the presence of a growth also, as the two conditions are often associated.

Of recent years it has proved possible to resect completely a portion of the large bowel badly damaged by diverticulitis and restore the bowel by axial union.

Hyperplastic tubercle is a rare disease which gives rise to stricture and tumour in the colon and closely simulates diverticulitis. It can be completely cured by resection of the affected portion of the bowel. Bands and adhesions are, of course, frequently met with, involving the colon and causing obstructive symptoms. They are difficult to diagnose, but very easy to treat once they are detected.

Chronic volvulus is a rare condition, which is occasionally diagnosed as the result of an x-ray examination. Quite recently I was able to make this diagnosis in a middle-aged lady who had repeated attacks of obstruction, which came on quite suddenly with great pain and distension. The attacks had gone on for a number of years, but were getting more severe and less easily amenable to treatment. At operation a very large volvulus of the sigmoid was found, which was exactly as seen in the x-ray photographs; I resected the whole loop and performed an end-to-end junction with complete success.

The patients suffering from obstructive lesions of the colon are usually elderly, and this adds an element of risk. Fortunately with proper care we are now able to operate on quite elderly people with little more risk than would be the case with younger patients, providing certain precautions are taken, but these precautions must be very carefully observed.

I attach great importance to very careful preparation of the patient. At least a week should be devoted to this.

* A paper read before the Nottingham Medico-Chirurgical Society, March, 1927.