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INTERNAL DERANGEMENTS OF THE KNEE JOINT.*

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MR. PRESIDENT AND GENTLEMEN,

My reasons for bringing this subject before you to-night, quite apart from any personal interest in the matter, are that before I came out to India I had unusually favourable opportunities of studying this class of case and also I had the privilege of working under two surgeons who were pioneers at this work, *viz.*, Sir William Bennett and Mr. Herbert Allingham, and who have operated on a greater number of cases individually than any other Surgeons.

The first authentic account of a loose body being removed from the knee joint was that of Ambrose Paré, (1) who in 1558 removed one when he was opening an abscess in connection with the joint, the body springing out with the pus.

Morgagni removed one some years later, Benjamin Bell (2) in 1787 speaking of those loose bodies in the knee joint not freely movable, says "In these cases I would advise amputation of the limb, the remedy is no doubt severe, but it is less painful as well as less hazardous, than the excision of any of these concretions, that have been attached to the capsular ligament."

William Hey (3) in 1803 first described internal derangement of the knee joint as being due to semilunar displacement and also detailed his method of reduction by flexion followed by sudden extension.

Loose bodies Hey says were described by Bromfield (4) in his *Chirurgical Observations* and also by Ford (5); Hey considered them due to pedunculated bodies growing on fringes of synovial membrane and for treatment recommended a closely fitting laced knee cap.

* A paper read before the Asiatic Society of Bengal, May 1907 at Calcutta.

Reimarus (6) mentioned by Hey recommended bandaging for the knee.

The pathology of internal derangements has chiefly been based on superficial examinations of the joint during operations until Tenney (7), an American Surgeon, in 1904 went into the question thoroughly by examining 150 cadaveric joints and found nearly every variety of internal derangement. In order of their frequency he described five varieties of internal derangement, namely:

(a) *Tags* from the lubricating apparatus, which may be fine fringes or dense fibrous tags, the fringes normally probably lubricate the joint; Allingham (8) found them occur in two cases out of 59 in which he opened the joint.

(b) *Erosion of cartilage* from a shallow grazing of the cartilage to bare bone with fibrous tufts growing from the edges of the eroded space, occurring generally on the external tuberosity of the tibia.

(c) *Damaged and misplaced semilunar cartilages* with either fine fringes at the edge of the cartilages, or else the cartilages have been caught between the bones and split longitudinally, or transverse tears due to the anterior free portion of the cartilage being carried forward away from the part of the cartilage which is firmly attached to the lateral ligament of the knee; this ligament allowing very little play to the cartilage. He found transverse tears the most common injury in the joints examined. There was one case found on the cadaver of the cartilage being curled up in to the inter-condyloid notch; this condition was described by Croft (9), Barker (10) and Turner (11) previously. Hoffa (12) describes the semilunar torn from its anterior attachment and turned back on itself, and he also mentions another form of derangement, namely,

(d) *Atrophy of the quadriceps tendon*, which allows the capsule to catch between the femur or tibia and the patella.

(e) *Of ruptured ligaments*. Hints (13) has collected 31 cases of rupture of the internal lateral ligament and three of ruptured external lateral ligament, these cases not being complicated by dislocation of bones.

Robson (14) described a case of ruptured crucial ligaments a few years ago.

Of displaced cartilages Tenney collected the reports of 128 operations performed by 47 operators and found that internal cartilage trouble was seven times as frequent as external displacement, and of the internal cartilages, a transverse tear was $1\frac{1}{2}$ times as common as a longitudinal split or a separation of the anterior attachment of the cartilage.

The term "loose cartilage" is an unfortunate one and should be discarded as both semilunars have a certain amount of movement normally.

The male sex largely preponderate, only 5% of women being operated on in Bennett's Series

and damage to the left knee being twice as frequent as damage to the right.

The explanation of the causation of loose bodies in the knee joint have been well tabulated by F. G. Connell (15), namely :

(a) Dry arthritis with overgrowth of the margin of the articular cartilage.

(b) Boney growths broken away from their attachments.

(c) Infarction of articular cartilage with final separation of the infarct.

(d) A plate of bone formed outside the joint and then invaginated.

(e) Chondrification and calcification of enlarged synovial villi.

(f) Irritation and growth of embryonic cartilage and bone cells in the synovial fringes.

(g) Concretions similar to calculi formed on blood clots ; torn synovial fringes, foreign bodies, lipomata or articular cartilage.

(h) Articular cartilage or semilunar cartilage broken off by direct violence or damaged and subsequently separated.

Burghard (16) described the preceding case and confirmed it at operation.

Arbuthnot Lane (17) noticed in a case a defect in cartilage equivalent to a loose body found in the joint, his case was unique in having symmetrical loose bodies in both knees ; Bowlby (18) and Clutton (19) each have had similar cases of symmetry.

Poulet and Vaillard (20) chipped off pieces of bone in dogs' joints and sutured the wound again ; they found that the detached portion became vascularised and got completely covered with cartilage of an embryonic and irregular character and occasionally formed fresh attachments.

Müller's lipoma arborescens or subsynovial lipomata as described by Bland Sutton can also be described as loose bodies in joints.

The general lax condition of the capsule of the joint allowing lateral mobility as the result of many attacks of internal derangement has been noted by many observers including Allingham ; and Shaffer (22) laid great stress on the loss of the brake action of the patella on the femur as the result of lengthening the ligamentum patellæ and hence increased liability to sudden strain.

Bennett (23) in his most recent work points out that generally the external cartilage is much more damaged than the internal relatively, when the external is the chief seat of trouble.

Concerning the treatment of internal derangements previous to modern surgical methods, there is nothing much of note ; varieties of knee-caps were used, as mentioned by Hey, and occasionally some Surgeon bolder than the rest removed loose bodies by operation with generally unfortunate results ; also various splints were tried when the joint got too mobile from laxity of the capsule. Modern operative treatment can be said to date from 1895, as

previous to that date the cases recorded are few and far between. But at the present time, a sufficiency of cases has been recorded by various operators to give a very fair idea of the risks and dangers of active interference.

Flint (24) in 1905 analysed 310 cases of knee joint trouble in which infection had occurred, including in this series,

(a) clean knees operated on,

(b) penetrating wounds of the joint, with or without evident point of entry ;

(c) joints opened in the course of infections elsewhere, and

(d) infections following some non-penetrating trauma ; the results he tabulated as follows :

One operation in 22 (4.6 per cent.) on clean knees became sufficiently infected to demand further operation.

One operation in 35 on pathological non-traumatic knees more than five days after an acute attack of synovitis requires a secondary operation (2.9 per cent.).

One operation in 22 for simple fractured patella demands a secondary operation (4.6 per cent.).

One operation in 71 for simple fractured patella, if done after the fifth day, requires further operation (1.2 per cent.).

10.5 per cent. of operations for simple fracture of the patella, if done before the fifth day, require further operation.

11 per cent. of cases of infected knees that have been opened and drained, die.

6.6 per cent. of cases of infected knees which have been opened and drained come to amputation before recovery.

3.3 per cent. of infected knees which have opened and drained are resected.

These statistics shew us several important facts, viz :—

(a) that pathological knees, that is those with loose bodies or other non-traumatic trouble are much safer to operate on than those whose lesion is primarily traumatic, like cases of split cartilage.

(b) The great risks of operations for fractured patella if done before the fifth day and the extreme safety if done after that date.

(c) The fortunate rarity of the necessity for amputations after operation on the knee joint.

Personally I have had the misfortune to see two infected knee joint cases come to amputation during my student career, one was a case of fractured patella in a pregnant woman, which was wired and later came to amputation of the thigh with recovery ; the other was a case of a small punctured wound of the joint ; septic arthritis set in, the patella was divided transversely, and joint freely opened and washed out with strong biniodide of mercury solution (1 in 1,000), amputation had to be performed two days later and was followed by the death of the patient.

Tenney has tabulated 297 cases of operation for loose bodies in the knee joint since 1895,

with six cases of ankylosis, no amputation and no deaths; this probably includes many of the cases tabulated by Flint.

During the last year my brother Dr. Arnold Caddy and myself have had two cases of operation for internal derangement of the knee joint. The first case, a European aged 25, a well-known cricketer here, had displaced his left internal semi-lunar cartilage on six occasions since 1898, necessitating stays in bed on each occasion from fourteen days to two months; perfect extension of the joint was not possible in his case, there was general laxity of the capsule and later mobility of the tibia on the femur.

We removed his internal cartilage and he obtained a perfect result with no recurrence of symptoms.

After his operation, he developed fever for 14 days of a mild typhoid type, although no Widal reaction was obtained when tested for; the joint, however, pursued an absolutely normal course without any effusion and he was bending his joint himself 17 days after the operation.

The other case was a young European of similar age, and symptoms of some years duration also; the chief trouble being frequency of the attacks rather than their severity, this was the chief reason for the operation as the joint was not very seriously damaged as yet.

His operation was followed by a perfectly uneventful recovery, and now he is riding daily and has just recently attended the Calcutta Light Horse Camp of Exercise.

The subject of treatment is one that now follows certain fairly well defined rules.

In all cases of recent internal derangement whether from displacement of cartilage or from a loose body, if reduction of the displaced structure has not occurred, this must be attempted immediately, if necessary under an anæsthetic, and two or three separate attempts may be made if the first be unsuccessful.

Reduction having or not having taken place, the next stage in the proceedings is to combat the synovitis which is almost sure to follow.

In fact, an acute synovitis is rather more favourable than otherwise as it sometimes leads to permanent cure more readily than a sub-acute attack. The leg should be splinted and a lotion such as Goulard water and tincture of opium combined should be applied and the patient put to bed. I am not greatly in favour of ice being used in these cases, it seems to me that it must diminish the vitality of the tissues and hinder absorption of fluid, cases, also, of sloughing of the skin following the use of ice have been reported.

It is always bad to start movements of the joint directly after the injury, although massage then has an excellent effect.

This is well borne out by the indifferent results that one gets when patients attempt to 'walk off' sprains, etc., as is so often advocated by 'bone setters.'

The object of the fixations and massage, of course, is to remove fluid from the joint and to allow the loose cartilage to fall back in place and adhere.

In all, three methods of treatment have been recommended for an acutely distended joint, namely:—

- (a) Rest with massage, and movements later.
- (b) Aspiration, repeated, if necessary; and
- (c) Incision and drainage.

Lubbe (25) reports an average stay of 34.6 days in the Seamen's Hospital, Hamburg, for the first method and only 25.5 days for the aspiration method.

Incision and drainage is the method of O'Connor of Buenos Ayres; he washes out all the joints if fluid does not disappear within three weeks; he says "washing out blood clots from an injured joint is a surgical obligation."

It is surprising really the amount of fluid that the knee joint can contain, largely, of course, depending on what bursæ communicate with it.

Tenney (7) injected 14 undissected adult knees with water under pressure of a column of water 2 ft. in height, roughly equivalent to the arterial blood pressure at the knee, he found that he could get 80 cc. to 200 cc. into the joint; the patella always floated after 30 cc. of fluid had been injected. He also quotes Lubbe (25), Meisenbach (28) and O'Connor (29) aspirating from 130 cc. to 180 cc. of blood from the joint.

A point that Bennett lays great stress on is the continued massage of the leg and thigh after an attack of synovitis, especially of the gluteus maximus as this controls the ileo-tibial band of fascia and tends to brace up the capsule.

In Bennett's cases he found 41 per cent. were cured by rest and massage alone, without any mechanical support, 19 per cent. wore a support from three months to one year; 29 per cent. wore a support permanently and the remainder were operated on. No case after the third attack was cured by massage alone, a support or operation was always necessary.

Coming to the question of mechanical supports in case of internal derangement, unfortunately they often are a necessary evil they should be avoided whenever possible, as they lead to wasting of the muscles of the thigh and this, of course, increases the tendency to internal derangement.

Their sole object is to hinder rotation of the leg on the thigh, and only to allow flexion and extension of the knee, in fact, to make it a hinge joint.

Needless to say they are useful only in slipped cartilage cases, loose bodies will be uninfluenced by them.

They are generally supplied with a pad over the internal cartilage to press it into place; this is useless as the most common displacement of the cartilage is into the joint and not outwards. Similarly the small spring trusses sometime supplied are useless. Supports to be effective must firmly grip the tibia and femur, and this in

itself leads to wasting of the muscles encircled. Supporting apparatus should only be used in cases where operation is declined, or there is some reason against it; or in early cases as a temporary measure for a few months where rest and massage have failed to cure the condition.

Passing on to operative treatment; the indications for this are well recognized now; operation should only be performed on healthy individuals, as it is almost entirely an operation of expediency and not of necessity.

The chief indication is (a) general flaccidity if the joint with lateral movement the result of repeated attacks of synovitis. Also (b) cases in which numerous attacks have occurred, disabling the patient and which medical measures have failed to relieve, although there is no marked deterioration of the joint; and (c) cases of expediency, such as early cases occurring in soldiers or sailors, whose living depends on the efficiency of their knee joints. Loose bodies when actually felt should be removed at once; there is nothing to be gained by waiting and the operation is comparatively safe.

I think, that now-a-days everybody is agreed that for slipped cartilage cases, removal of the whole cartilage is the only procedure that does permanent good. Sewing the cartilage to the head of the tibia or cutting off pieces of it have all been discarded as insufficient.

The methods of operation practically resolve themselves into two main groups; the 1st method being, the opening of the joint by a horizontal incision, and the other by vertical incisions; usually on either side of the patella.

Some Surgeons do not make the skin and capsular incisions coincide, saying that, if an L shaped flap of skin be made, so as not to coincide with the incision in the joint, infection is less likely to occur. I have not come across any statistics to support this statement and cannot help fancying that it is just one of those passing decrees of fashion which Surgeons bow down to as readily at times as the general public do to the edicts of the tailor.

The commonest incisions are the vertical ones, on either side of the patella, depending on which cartilage is at fault; the internal one is the most frequently used, and in fact, Bennett says, that with a blunt hook and a pair of scissors it is comparatively easy to remove the external semi-lunar cartilage through this incision.

Another incision is along the anterior border of the Biceps tendon, opening the capsule above or below the popliteus tendon, and a fourth incision along the anterior border of sartorius, opening the joint between sartorius and the internal lateral ligament of the knee joint; through these incisions it is possible to remove the corresponding cartilage, they have no particular advantage beyond being rather better for drainage. Transpatellar operations or their modifications with supra or infra-patellar incision through the tendinous structures are practically

never required for internal derangements of the knee, however, useful they may be for other conditions; they are needlessly severe and reveal little more than may be found through the commonly adopted incisions, and they may leave an undesirable amount of weakness about the joint.

There is one method, however, which I have never seen described, and which, I believe, has the merit of being original; it might be used in those rare cases of multiple loose bodies in the knee or in any condition requiring free exposure of the joint; and that is, a vertical incision through the ligamentum patellæ patella and quadriceps tendon; this incision would have all the advantages of the trans-patellar operation, of thoroughly exposing the joint, and none of its disadvantages of dividing the patellar transversely, likewise it would not be necessary to wire the divided patella, as two halves of the bone would lie in good opposition naturally, or at the most a suture through the tendinous structure above and below the patella would secure it in place. This method I mean to try on the first favourable opportunity if a suitable case occurs.

The after-treatment of simple arthrotomy for internal derangement has no special features, most Surgeons drain the joint for 24 hours, as they find there is less pain and less effusion when this is done. Some Surgeons massage the leg and thigh daily, commencing the day following the operation; most Surgeons move the patella after the fourth day and begin bending the joint after the 7th day, discarding splints at the end of a fortnight and active exercise, such as golf or riding in usually allowed after a couple of months.

Occasionally one comes across a typical case of internal derangement, but on opening the joint no lesion is found. Allingham had 3 such cases in 59 operations and Bennett had 5 in 106 operations, and 2 of Bennett's cases operation was followed by complete cure of symptoms; in fact, he explores joints whose only symptom of disease is recurrence of effusion, following some injury, if medical measures fail to give relief after some months' trial, and, in 12 cases where this was done, he found well marked semi-lunar displacement in 7 cases; one case having the cartilage displaced into the intercondyloid notch.

In conclusion, Gentlemen, I would point out that the non-success of any of these operations means either a partially or completely stiff limb, perhaps ankylosed in a bad position, or even though happily it is extremely rare, the loss of limb, or of life of the patient.

These operations are not undertaken to save life like operations on the appendix, they are merely operations de luxe purely for the patients' convenience, as if he likes he can always have a rigid splint to fix the knee when all his symptoms cease at once. In fact, some Surgeons have argued that ankylosis, the result of an unsuccessful

ful operation is a happier condition than a flail-like joint the result of much synovitis.

One should remember that the unsuccessful knee case remains always as a living eyesore, so different from the unsuccessfully removed appendix safely hidden from sight by its protecting adhesions.

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THE INCIDENCE OF TYPHOID FEVER ON CIVILIAN EUROPEANS AND ON NATIVES IN CALCUTTA AND THE IMPORTANCE OF ANTI-TYPHOID INOCULATION OF ALL EUROPEAN IMMIGRANTS TO INDIA.

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SINCE the days of Bryden the great incidence of typhoid fever among young European soldiers during their first few years of service in India has been well known; but the prevalence of the disease among European civilians has been less closely studied on account of there being few places in India where many non-military Europeans reside, and because of the difficulty in collecting accurate statistics concerning them. Now that Sir A. E. Wright's method of inoculation against typhoid has again been favourably reported on by an expert committee and many soldiers coming to India are being given the benefit of the protection it affords, it

has become a matter of great practical importance to study the prevalence of this scourge among civilian Europeans and to consider its bearing on the advisability of their also being afforded protection before coming to India as a general rule, instead of only very occasionally as at present.

Calcutta, as the capital of the Indian Empire, contains the largest collection of Europeans in the country, while the splendid modern European General Hospital, with its private wards for paying patients, is so popular with all classes of the inhabitants that it affords unique opportunities for studying this question, the records of all the cases being carefully and accurately kept and bound. Owing, however, to the difficulties attending the accurate clinical differentiation of typhoid from certain other fevers prevalent in Calcutta, it is of great importance that any conclusions concerning the incidence of the disease should be based on cases the diagnosis of which has been confirmed by the Widal test, or which were absolutely beyond doubt clinically. During four out of the last five years I have carried out the serum tests in all the long continued and remittent fevers at the Calcutta General Hospital which could possibly be typhoid, and have notes and charts of every case in my possession, thanks to the kind permission of the succession of medical officers of the institution. An analysis of this material for another purpose has revealed facts of such great interest and importance regarding the incidence of the disease, that I propose to deal with them briefly in the present paper. Nearly 90 per cent. of the cases were verified by the serum test, the great majority having reacted in dilutions of 1 in 100, while the remainder were absolutely typical clinically.

INCIDENCE AMONG INDIGENOUS EUROPEANS AND EURASIANS.

In order to show the main facts at a glance the figures obtained by the analysis have been embodied in tables, the first of which shows the age incidence of typhoid in Europeans born and bred in India, the percentages in different age periods being compared with the figures of Dr. Curschmann and Professor Osler (1) for as far as possible similar age periods in temperate climates. The patients are derived from a large population of poor Europeans and Eurasians (of mixed European and Native blood) born and bred in India, who form a large proportion of the admissions to the General Hospital, and unlike the native population, readily bring their children when ill. They reside, for the most part, in certain more or less defined portions of the town, but many of their houses are closely intermingled with those of the native population, while their sanitary surroundings are only too often in no way superior to those of the better class natives.