If a thick film is too thick the blood, when dry, will crack and peel off during staining. Newsprint which is just readable through a thick film is a good indication of a satisfactory thick film. Before staining thick films the blood must be quite dry, and it is a good plan to apply gentle heat to a freshly made thick film before staining it.

Staining thick films

Leishman's is not satisfactory. Dilute Giemsa gives better results but Field's stain* is probably the best of all for thick films.

Note

Detection and classifying malaria parasites in thick films is much more difficult than in thin films. Not until one is fully familiar with parasites in thin films should one undertake the responsibility of diagnosing with thick films. But when films are being sent for examination to a laboratory where specialists are available a thick film should always be included.

THE ART OF ORTHOPAEDICS

PART V

DIAGNOSIS OF DISEASES OF THE KNEE JOINT

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As in my previous articles, I propose putting forward a list of the diseases of the knee joint so that the examiner may bear these in mind whilst examining the affected joint and thus place into the jig-saw the various symptoms and signs he elicits.

These diseases can be roughly grouped under two main headings:—

- (a) Those in which the pain bears a definite relationship to a known previous injury, and
- (b) Those in which the pain, as far as the patient can recollect, has no connection with any injury.

Dealing with those under heading (a) injury will give rise to the following conditions:—

* FIELD, J. W. (1941), *Trans. Roy. Soc. Trop. Med. and Hyg.*, Vol. XXXV, No. 1, July.

1. Sprained Ligaments

The internal lateral ligament is the ligament most frequently damaged. Usually a few of the upper fibres are torn away from the periosteal attachment at the lower end of the femur. Occasionally, however, the deep fibres which are attached to the internal semilunar cartilage are partially torn without the cartilage being damaged. Occasionally, the external lateral ligament is injured. With more severe violence the anterior crucial ligament may be torn. It should be borne in mind that in relatively small injuries these ligaments are not completely torn across or pulled from their bone origins, but only a few fibres are torn away. In gross injuries, however, which are often accompanied by dislocation of the joint, the whole ligament may be torn across or the ligament will pull off a flake of bone at its base attachment. The commonest ligament to do this latter is the anterior cruciate, which pulls away a flake from the upper surface of the tibia.

2. Traumatic Synovitis

Any over-use of a knee, any sudden twist or contusion to the knee may be sufficient to either bruise, tear, or nip the synovial membrane of the joint, giving rise to a traumatic synovitis which is accompanied by an exudate of fluid and hypertrophy of the whole synovial membrane. Adhesions may follow.

3. Nipped Local Villi of the Synovial Membrane

Often a sideways twist or a direct blow, as in football, on to the knee will cause one villous process of the membrane to get nipped between two bone surfaces, giving rise to a localised synovitis. In this case the nipped process will have exudate of blood inside it, which blood will organise and clot, giving rise eventually to a pedunculated tag. This pedunculated tag gets repeatedly nipped, leading to a more diffuse synovitis; and eventually may drop off and become a loose body.

4. Internal Derangements of the Knee Due to Fracture—Dislocations of the Semilunar Cartilages

With various types of twist the semilunar cartilage may get forcibly detached from its synovial attachment and become either torn or partially loose inside the joint.

5. Foreign Bodies

There are several varieties of foreign bodies to be found in derangements of the knee joint which are due to pre-existing conditions or injuries. As noted above, portions of the semilunar cartilages may become detached at the time of their nipping, due to some twist, and these portions will slowly increase in size due to the deposition of debris collected as they roll about the joint. Flakes of the articular cartilage may become detached due to squeezing and nipping caused by sudden injuries and, like the detached portions of the semilunar cartilages, they gradually increase in size. In some cases of traumatic synovitis the enlarged processes of the synovial membrane may become grossly hypertrophied and become pedunculated, breaking off into loose bodies.

Conditions Giving Rise to Pain with no Relationship to Injury

It should be remembered that the heading "Arthritis" includes synovitis, and that disease which causes a synovitis may at some stage of its progress cause bony changes. *The common causations of synovitis in the knee joint are the following:—*

1. Chronic Synovitis Due to Unknown Idiopathic Causes

Sometimes a patient may remember no definite injury and yet the synovial membrane gives rise to fluid exudate which disappears with rest.

2. Toxic Synovitis

In many cases a traumatic synovitis which would normally clear up in a few days fails to do so. Probably the condition has been aggravated by toxins in the blood from some distant focus such as infected teeth, tonsils, etc.

3. Specific Causes Due to Definite Organisms, Such as Tuberculosis, Gonococcus, Syphilis, Streptococcus and Pneumococcus

The following are the common causes of arthritis:—

- (i) Osteo-arthritis. This is essentially a degenerative process, though it may be precipitated by trauma, fractures, or peripheral nervous diseases.

- (ii) Rheumatoid arthritis. This commences with a synovitis, but later bony changes appear—always polyarticular.
- (iii) Suppurative arthritis. This may be due to direct infection by organisms following injuries such as compound fractures: and also from direct extension of the suppurative processes from one of the bones in the vicinity, such as osteomyelitis or tuberculosis. It may also arise from metabolic infection due to disease elsewhere, such as pneumonia, gonorrhoea, and tuberculosis of other bones.

History and Examination of the Affected Knee Joint

The examiner should enquire as to the duration of the pain, swelling or stiffness; whether the patient attributes it to trauma; whether the condition has existed before and has cleared up, and whether any other joints are affected.

The examiner should note whether there is any gross muscle wasting such as is seen in tuberculosis of a joint. He should note whether the joint is distended, and then by palpation differentiate whether that distention is due to fluid, synovial thickening, or bone hypertrophy. He should note whether the affected joint is warmer than that of the other side. If there is a difference of temperature it suggests an inflammatory causation.

The examiner should now partially bend the knee and with one finger definitely palpate the following sites where specific tenderness is found in different conditions.

- (i) He should feel whether there is any tenderness of the upper end of the internal lateral ligament, the common site for injury of this ligament. Then where it crosses the joint line, where tenderness denotes tearing of the deep fibres.
- (ii) He then should press either side of the ligamentum patelli to test for tenderness of the fat pads which may have been nipped.
- (iii) He should place his finger an inch along the joint line away from the ligamentum patelli. Tenderness here would suggest damage to either the internal or external semilunar cartilages.
- (iv) He should then run the examining finger down the sharp edge of each femoral condyle. In early cases of osteo-arthritis exquisite tenderness is sometimes found from the osteophytes on the edge of the condyles.

FIG. 4a.—This diagram illustrates the sites of tenderness to be sought to exclude these lesions.

FIG. 4b.—Anatomical key to above diagram.

FIG. 5.—This diagram illustrates how the internal lateral ligament is relaxed when the knee-joint is held in slight flexion, hence in sprains of this ligament muscle spasm keeps the knee-joint in this position.

Sometimes the patient will experience tenderness at some other place about the knee joint. This would suggest that in this particular place the synovial membrane may have been pinched and bruised or the bone contused.

The patient should now be asked to demonstrate how far he can bend and straighten the joint. It should be noted that where there is distention of the joint with fluid or blood, or where the synovial membrane is thickened from any cause, full flexion will not be obtained, due to increase of the joint tension. More important than the presence of full flexion is the absence of full extension. Absence of full extension is found in three main conditions, namely:

- (a) in tears of the front part of the semilunar cartilages;
- (b) in local synovitis or nipping of the fat pads, owing to the swollen processes becoming further nipped or squashed;
- (c) where there has been an injury to the internal lateral ligament. Then full extension is not obtained owing to the fact that the ligament becomes taut, and as there has been an exudate of haemorrhage about it (due to the tearing of its fibres) the patient will not permit the ligament being put on tension. Hence there appears involuntary spasm of the muscles to protect the ligament and the adhesions.

Testing for Semilunar Cartilage Injury

The examiner should again put the joint through its range of passive movements noting, with one hand over the front aspect of the joint, not only the range of movement but whether such movement is carried out with creaking, as found in synovitis or arthritis, or clicking, as in some varieties of torn or displaced semilunar cartilages.

In tears of the posterior half of the semilunar cartilages pain is often complained of, and clicking takes place when the knee is extended after being fully flexed. In the case of posterior tears of the external cartilage it is sometimes necessary to combine rotation of the tibia with the knee in full flexion in order to obtain such clicking. If the patient cannot fully extend the knee it should be noted whether the causation of this difficulty be due to muscle spasm protecting the joint, or due to some internal blockage. If the restriction is due to a torn or displaced semilunar cartilage the examiner can usually detect a resilient recoil when the movement is stopped. In some cases where the examination is too painful it may be necessary to give the patient an anaesthetic in order to see whether the limitation of movement be due to muscle spasm or an internal blockage.

Often, in fact, this examination becomes a manipulation in cases where the examiner finds that such blockage is due to a displaced cartilage or adhesions.

In diagnosing injuries to the semilunar cartilage it may be taken as a rough rule that the internal semilunar cartilage is damaged five times more frequently than the external semilunar cartilage; that tears or displacements of the interior semilunar cartilage more often cause locking of the joint with use than do tears of the external cartilage; that with tears of the internal cartilage failure to extend the knee fully, either by the patient or the examiner, is frequently found; and that tears of the anterior part of the interior cartilage are much more frequent than tears of the anterior part of the external cartilage.

On the other hand, clicking is found more frequently with tears of the external cartilage than with tears of the internal cartilage, and tears of the posterior half of the exterior cartilage are more common than tears of the interior cartilage. Thus, if pain and clicking are found on full flexion of the knee a suggestive diagnosis of a torn external cartilage may be made, whereas if there is a blockage to full extension a diagnosis of an injury to an internal cartilage may be made provided the examiner has excluded injury to the internal lateral ligament or to one or other of the fat pads.

Loose bodies in the knee joint give rise to symptoms very similar to those of loose cartilages.

Tuberculosis of the knee joint gives rise to aching pain—worse at night—progressive stiffness and swelling of the knee joint. On examination there is usually extreme wasting of the thigh muscles. Movements of the joint are greatly restricted by muscle spasm. In some cases there may be much effusion into the knee joint, in other cases there appears little effusion but hypertrophy of the synovial membrane giving rise to a doughy feeling on palpation. X-ray photographs, depending on the duration of the disease, will show changes from decalcification down to gross erosion and destruction of the joint surfaces.

Osteoarthritis is extremely common in middle and later life and manifests itself by intermittent pain and aching, swelling and creaking of the knee joint. There is usually very little wasting of the muscles as compared to what is seen in tuberculous arthritis. The extreme ranges of movement are affected in the first instance with, later, diminution of flexion rather than extension. The diminution of the range of movement is accompanied by much creaking both from the capsule and from irregularities of the articular surfaces of the joint. Usually there is not a great deal of fluid in an osteoarthritic joint. The examining hand can usually feel thickening along the edges of the

femoral and tibial articular surfaces due to proliferation of the cartilage at the margin.

Rheumatoid arthritis shows itself commonly in the knee joint as one joint affected in a polyarticular arthritis. In these cases it is the history of swelling and diminution of movements rather than the pain which are the predominant features, as compared to tubercular and osteoarthritis of this joint. On examination the swelling of the joint often appears greater than it actually is, due to wasting of the quadriceps. The swelling is at first due to proliferation of the periarticular structures rather than to a proliferation of the synovial membrane or distention of the joint with fluid. The movement is restricted mainly by the contraction of the soft parts around the joint rather than by any bony changes. It will be remembered that rheumatoid arthritis usually commences in the smaller peripheral joints, so that in all suspected cases of rheumatoid arthritis of the knee joint it is to be expected that other joints will already be affected.

In the diagnosis of trivial injuries and diseases of the knee joint the history of the mode of onset and its connection with trauma play a very important part. The diagnosis of injuries of the semilunar cartilages and nippings of the synovial membrane and formation of loose bodies can nearly always be made on the history alone. The differentiation between a synovitis and a true arthritis is merely that of a later stage of the disease when the articular surfaces participate in the inflammatory or degenerative processes. At

times the swelling of the soft tissues of the joint, such as in tuberculosis and traumatic and toxic synovitis, would lead one to suspect that bony changes had already followed, but an X-ray will show that as yet the pathological process is still confined to the synovial membrane.

It is wise, therefore, in nearly all cases of injury or disease of the knee joint to secure X-ray photographs, and where there is a possibility of foreign bodies being present stereoscopic X-ray will enable the operating surgeon to assess the depth and position of the bodies.

Epitome

In attempting to give a résumé of the diagnosis of the orthopaedic conditions which affect the joints of the body, I am well aware, within the compass of the space allotted to me, that I have only touched on the fringe of the many conditions that may affect these joints. It is manifestly impossible for me to go into the full physical examination and, in any case, these articles are written for the postgraduate reader. I have therefore endeavoured to give a patchy physical examination but to bring out those special points which experience has taught me will enable a quick differential diagnosis to be made. I have not been able to deal with the numerous conditions of congenital malformations, nerve injuries, rheumatic conditions, or fractures which truly come within the province of the orthopaedic surgeon.

MEDICAL NEWS

Since its formation about a year ago the Medical Society of the L.C.C. Service has been flourishing and various meetings have already been arranged which were most successful. There will be a clinical meeting of this Society on Thursday, 4th October, 1945, at 3 p.m. at Lewisham Hospital, S.E.13, when members of the Staffs of Lewisham

Hospital and St. Alfege's Hospital will demonstrate cases. On Wednesday, 7th November, at the Archway Hospital there will be a meeting dealing with Pathological subjects, and on 9th January, 1946, at the County Hall, S.E.1, there will be an Annual General Meeting at which the Presidential Address will be given by Sir Allen Daley.