the absence of any other operative indication, and I firmly believe that if this rule is observed the dangers of lateral sinus disease will be almost entirely eliminated both in acute and in chronic cases.

Ophthalmic changes appear to be rare, and except for a very occasional squint (five cases in all, two being chronic) are rather late signs. Papilloedema was noticed in 12 cases (7 being chronic) and nystagmus in 15, 9 being acute.

Changes in the central nervous system were also very rare. Definite signs of cerebral irritation were noted in 8 cases altogether, 5 being of the chronic type, while disturbances of various reflexes were noticed in 14 cases, 9 being chronic. Facial paralysis occurred only in two chronic cases. Examination of the cerebro-spinal fluid is of no early value. It will only show whether there is any meningitis or not.

Diagnosis.

Having enumerated the various symptoms and their relative frequency I am now in a position to give a short clinical picture of an early case of lateral sinus infection.

If a patient with acute or chronic suppurative otitis media is found to be abnormally ill, yet with nothing definite to account for the grave general feeling of ill-being, suspect sinus infection; look into the meatus and should the red oedematous meatal spot be present—operate! The accompaniment of deep mastoid tenderness, herpes and sordes, a swinging temperature and auditory pain should complete the early diagnosis, and operation should then prevent the occurrence of the more obvious signs.

Another necessary early diagnosis may occur during a mastoid operation when it may be difficult to tell whether the interior of the sinus is infected or not. I make the following observations on this.

In the case of a perisinus abscess and a pulsating sinus surrounded with normal granulations, I have never known this condition not clear up with ordinary drainage. The wash-leather sinus is the other difficult type. Pulsation may be hard to get, though the sinus is felt to be full. Inserting a needle is dangerous, as is also opening, on account of the possibility of infection. If on compressing the sinus wall with a blunt probe and suddenly releasing I find the wall return to normal evenly and instantly, I always leave alone and watch for further indications later. This sign has proved to be of great value.

It will probably be a surprise to some of the specialists present that so little has been stated of pathological aids. I wish to make this point very definitely, that the early diagnosis of this condition can only be done on purely clinical grounds; if the surgeon waits till the pathologist has made his diagnosis for him the chances of the patient are greatly minimized.

The time to make the diagnosis is in the phlebitic stage, or not later than that of the mural clot. The pathological changes in the blood and cerebro-spinal fluid should have been prevented by the surgeon, and even if the patient is seen only at a late stage, there should be no need for a good clinical observer to lose valuable time in awaiting laboratory tests.

The differential diagnosis at this stage is rendered difficult by the absence of any definite symptoms in an otherwise generally ill condition. Unless the great importance of a previously discharging ear is recognized, it is quite easy to slip into such diagnoses as pyrexia of unknown origin and typhoid fever.

In all symptomless febrile conditions a thorough search of the usual toxic foci should be undertaken, and it ought then to be wellnigh impossible to overlook the existence of a suppurative otitis media. The resulting aural examination would disclose the presence or absence of the red oedematous meatal spot and offensive discharge. Having now been placed on the right track, the observer should easily elicit the other abstruse signs of an infective sinus. Being absolutely sure of the meatal spot I would definitely insist on a mastoid operation. If there is one thing that has impressed itself on my mind it is the mistake of looking for two morbid conditions in the same person. Coincidences of this character are extremely rare.

The alleviation of a chronic mastoiditis, even if the sinus is not yet infected, must surely be helpful; on the other hand, the finding of a recently infected sinus not only clinches the diagnosis but saves the patient from a much graver situation.

FRACTURES OF THE ARTICULAR SURFACES OF THE KNEE-JOINT.*

BY

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Of all the injuries which affect the knee-joint those which cause most concern in practice are the fractures of the weight-bearing surfaces of the joint.

Statistical evidence is of little value in dealing with such a subject as this, because fractures of the articular surfaces of the knee-joint, exclusive of fractures of the patella, occur by no means commonly. At Salford Royal Hospital, Manchester, in the centre of a great industrial area, about 250 fractures of the lower limb are admitted to the wards each year. Two periods of three years were selected, and it was found that in the first period (excluding fractured patella and epiphyseal separations) 14 fractures of the articular surfaces of the knee were admitted, and in the second period 17 cases, an average of about 2 per cent. of all leg fractures admitted.

Fractures of the Femoral Condyles.

I intend first to deal with examples of the minority group—namely, the fractures of the femoral side of the joint. There are, in the first place, the gross fractures which split the two condyles apart and extend upwards along the shaft with more or less displacement of fragments.

FIG. 1.

FIG. 2.

FIG. 3.

This is usually spoken of as a T-shaped fracture into the joint. A typical example of this injury is shown by an outline sketch from the radiogram of the right knee of a man, aged 51, who received direct violence from the impact of a motor car (Fig. 1). Under general anaesthesia extension was applied and adequate reposition of the fragments obtained. A Thomas splint bent at the knee to an angle of 150 degrees was applied. Union was firm after eleven weeks, and massage and active movements were commenced. A calliper walking splint was worn for a further ten weeks, and the end-result is shown, so far as knee movement is concerned, by further radiograms, which demonstrate the fullest voluntary extension and flexion—namely, 180 degrees to 75 degrees. Stability of the joint was good. The man returned to work twenty-five weeks after his accident. An example of a more severe fracture of this type is that shown by the next patient, a man aged 50. His right knee was crushed between two buffers and the joint surfaces of both femur and tibia were shattered (Fig. 2). A moderately good reposition of the fragments was obtained and a Thomas splint with extension applied. The end-result, as might

* Read in opening a discussion in the Section of Orthopaedics at the Annual Meeting of the British Medical Association, Winnipeg, 1930.

be anticipated from such an extensive articular injury, was poor as regards movement, a range from 180 to 140 degrees only being obtained. Stability was good and weight bearing painless.

Fractures of a Single Condyle.

The more usual type of fracture of a single condyle is that shown by a man, aged 35, whose knee was forcibly and suddenly abducted by a weight striking the outer side of the joint. The external condyle was found to have been fractured obliquely and forced upwards. Traction on a Thomas splint restored the position, and the end-result was good, there being a range of movement from 180 degrees to a right angle. Another and less common fracture of a single condyle is that in which the condyle is displaced backwards. In this case, a man aged 26 received a blow on the flexed knee in a motor collision; when I saw him eight weeks later the major portion of the internal condyle was found to have been driven backwards and a smaller fragment was lying loose in front of the joint. The loose portion was removed. The functional result has been excellent—a stable joint with a full range of movement.

Osteochondritis Dissecans.

In a description of the articular fractures of the lower end of the femur one must refer to the condition described first by Koenig as osteochondritis "dissecans," sometimes incorrectly referred to in textbooks as "dissicans." We are familiar with the punched-out area of articular cartilage, usually incompletely detached and lying in its bed in the lateral aspect of the internal condyle (Fig. 3). Are we to regard this as a fracture? Certain points in favour of this view cannot be neglected. The condition is found fifteen times more frequently in males than in females. Further, it is found usually during the most active period of man's working life. There is hardly a case on record where a trauma has not been noted in the history; lastly, the lesion is found at the point of greatest impact in the joint—namely, the area where the inner condyle bears against the tuberosity of the tibia. For these reasons I think we must regard the condition as a localized fracture of the articular surface, and, as the fragment fails to join up with the bed from which it is detached, it corresponds to an ununited fracture.

Microscopically it has been shown that, although the cartilage cells of these fragments are normal in appearance and seem to be viable, the underlying layer of bone is definitely dead. The cavity from which the fragment is punched is lined by a layer of fibrous tissue. Treatment consists in the removal of the fragment and the paring down of the overhanging edges of the remaining "crater."

Tibial Fractures.

The fractures of the upper end of the tibia are a more varied group, and present a number of problems. They may be divided into: (1) general fractures of the whole upper surface; (2) single tuberosity compression or avulsion fractures; (3) avulsion of the tibial spine and neighbouring cartilage; and (4) punched fractures of a small area of a tuberosity. The results of these injuries are often poor for these reasons—first, considerable comminution is present; secondly, there is difficulty of reposition of the fragments; thirdly, the frequent association of ligamentous tears; fourthly, the absorption of bone and cartilage which occurs, leaving an irregular articular surface; and lastly, the later development of osteo-arthritis changes. In general, one may say that the further away the fracture line lies from the centre of the joint the better is the prognosis.

The following cases illustrate the varieties of tibial fracture.

A man, aged 25, received a severe blow on the outer side of the knee at football. The outer third of the external tuberosity was broken off and displaced outwards and backwards. Under general anaesthesia it was manipulated into position and the knee fixed in a plaster cast for six weeks. Active movement was commenced at the end of this period. He commenced to walk a week later with a calliper splint, which was retained for three months. The end-result showed a little widening of the condyle with a perfect range of knee movement.

In the next case, a collier, aged 51, had a crush of the knee from a fall of coal; the upper tibia was shattered, and as there was a soiled wound leading almost to the bone it was impossible to do anything but apply extension to the limb, with some lateral compression of the fragments. The result was poor, with a union of the separated fragments and absorption of articular cartilage. The knee was stable enough for walking, and was not painful, but the range of movement was from 180 to 150 degrees only.

The next case is an illustration of the infinitely better result which can be obtained by open operation in this type of fracture.

A man, aged 25, received a direct blow on the head of the tibia in a motor cycle accident. Much shattering occurred, with

FIG. 4.

FIG. 5.

separation and displacement downwards of a large fragment comprising the internal tuberosity, tibial spine, and part of the external tuberosity (Fig. 4). Open reduction was performed, and the fragments fixed by a transverse ivory peg. A good apposition was thus obtained, and the limb fixed in a plaster cast for six weeks (Fig. 5). At the end of this time active movement was commenced. A calliper was fitted two weeks later, and this was worn for four months. At the end of six months he returned to work. The end-result eighteen months after the accident showed a very stable knee, with a range of movement from 180 to 90 degrees.

Punched fractures of the articular surface of the tibia are not uncommon, and are best dealt with, as in the case of the femur, by excision of the separated fragment.

A man, aged 30, fell 15 feet, and came down awkwardly on his left foot. The articular surface of the inner condyle of the tibia was fractured, and a fragment of cartilage and bone was removed. The specimen showed a piece of bone covered by articular cartilage about $1\frac{1}{2}$ by $1\frac{1}{2}$ inch broad. The end-result after a year was good, and the surface had obviously regenerated considerably. Movement from 180 to 90 degrees was freely performed.

There remain to be mentioned the fractures of the tibial spine. These are usually brought about by severe wrenches of the joint, and are associated with more or less tearing of the crucial ligament.

An example of the less severe type is that of a woman, aged 40, who fell downstairs and wrenched the knee, producing a forced

FIG. 6.

FIG. 7.

adduction. The head of the fibula was avulsed and the tibial spine broken (Fig. 6). The knee was fixed in plaster for six weeks, and at the end of that time active movement was commenced. No calliper was worn, and the end-result was a perfectly functioning joint.

The last case I wish to refer to is that of a man, aged 36, who fell 20 feet from a scaffolding and suffered a complete dislocation of the right knee. The tibia was dislocated forwards and the tibial spine torn away, with complete rupture of crucial ligaments (Fig. 7). After reduction a plaster cast was applied, and retained for ten weeks. A calliper was worn for a further three months, and, later, a knee cage allowing movement from 180 to 135 degrees for another three months. At the end of a year the knee was fully stable, and the joint moved through a range of 180 to 90 degrees.

In summarizing I would say that, in my experience, the tibial tuberosities are broken more commonly by violence directly applied to the flexed knee or by forced abnormal lateral movement than by the so-called "compression"—a term so frequently employed in describing the fractures of this region. The tuberosities appear to be fractured with about equal frequency.

Treatment.

There is such a wide variation in this group of fractures that it is absurd to dogmatize and to insist, as many writers have done, that either non-operative or operative treatment is the method of choice for all types. Each must be treated according to its particular needs.

All fractures which involve the joint surfaces must be dealt with by early manipulation under full anaesthesia, so as to restore the position as perfectly as possible. Open operation must be resorted to if a satisfactory reduction cannot be otherwise obtained. Bone pegs should be used where the fragments tend to move so as to jeopardize the adequate reposition. Small separated fragments should be excised. Fixation in plaster for an average period of six weeks has been, in my own experience, the most satisfactory means of maintaining position.

After-Treatment.

In the later treatment a strong distinction must be drawn between movement and weight bearing. Gently graduated active movement should be commenced as early as possible after union is attained, but, in the severer injuries at least, weight bearing must be delayed for at least three months by the adoption of a calliper walking splint.

The end-result, after such treatment, is frequently better than the primary injury would lead one to hope for, but the recovery of movement is usually slow, and I have many times been surprised to find how a knee which has suffered a severe articular fracture and, at the end of six months, showed 30 or 40 degrees of movement would, after another six or twelve months, regain a range of more than a right angle of free and painless movement.

This paper was illustrated by numerous radiograms, of which a small selection are reproduced as line drawings.

RADIUM IN GYNAECOLOGY.*

BY

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THIRTY years ago radium made an entry into surgical therapeutics, and was greeted with enthusiasm on reports of the cure of malignant tumours. Claims were made which were never substantiated, or results were so transient that recurrence of the growth followed hot-foot upon the reports. In the course of five or six years disillusionment was complete, and radium treatment was left to the few who still had faith. We are now in the second advent, and the enthusiasm displayed suggests that history is repeating itself. Responsible men are making themselves answerable for statements that 70 to 80 per cent. of early cancers are curable by radium; such claims may possibly be prophecy; they are not history. There is a glut of hastily written books on treatment by radium, and a still greater stream of reports of cases treated within the year. I recently attended a lecture by the director of a radium clinic who recorded cures of one, two, and three years' standing. What does the word "cure" mean? Is it the disappearance of symptoms for a limited time, or is it permanent freedom from disease? Assuredly the latter is the only meaning, and the propriety of using the word in any other sense is open to grave criticism. This enthusiasm, sired by our profession and nourished by the press, has placed an enormous sum of money in the hands of a Radium Commission for the purchase of 24 grams of radium element. It is proposed to distribute the whole of this for clinical work, not one milligram being allocated to biological research. One would suppose that there was

nothing unlearned of the effects of radium upon living tissues, and that, given the supply, the disappearance of the cancer was only a matter of application. A certain amount of work has been done upon normal tissues, tissue cultures, and animal tumours. The knowledge gleaned from these sources is of great value, but it must be multiplied ten, twenty, and a hundredfold before we are in a position to direct the gamma ray with precision and certainty. At present the only research radium in the country amounts to something less than a gram, privately owned and divided into small quantities; if all the problems to be investigated are to depend on this supply alone, then another generation must pass away before they are solved. These problems are urgent and imperative, and must be attacked while the wave of enthusiasm is high. The Radium Commission would serve the community to the best advantage in the organization of research work and in the allocation of whatever radium was necessary for the purpose.

How Radium Acts.

It is a matter of dispute between workers whether radium acts directly upon the cell or upon the stroma. The microscope shows us the change of structure which has taken place in the tissue after irradiation, but it tells us nothing of how or why the change has taken place. The ingenious application of cinematography, by Canti, to irradiated tissue cultures has extended the knowledge acquired by the study of the dead cell, but while we have a dramatic view of the cell being struck down it does not solve the question why it is smitten. This effect may be due to direct action on the cell by the gamma wave, but it is equally probable that it is caused by a primary change in the stroma. After a long investigation¹ of the effects of radium upon normal and malignant tissues I was forced to the conclusion that the primary action was upon the stroma, and the cell change secondary to it. This problem, however, is not to be settled by the study of structure alone; it must be combined with observation of the change of function in secreting and excreting glands after irradiation. Furthermore, the help of the biochemist must be enlisted to investigate changes in the chemistry of the cell after exposure to radium. The importance of this question cannot be exaggerated, for upon its solution depends the decision of the dose to be employed.

Screens.

One would think that the value of metal screens must have been settled long ago, and yet the following values are given in three different books for the absorption of 99.9 per cent. beta rays:

	Brass.	Silver.	Lead.	Platinum.
Cade... ..	1.60 mm.	1.30 mm.	1.20 mm.	0.60 mm.
Larkin	2.0 mm.	1.0 mm.	1.0 mm.	0.50 mm.
Simpson	1.10 mm.	0.80 mm.	0.80 mm.	0.40 mm.

Russ² has shown that with 0.5 mm. platinum about 20 per cent. of the ionization is due to the moderately penetrating rays, and they are responsible for the necrosis which occurs around the source of energy. This necrosis is either beneficial or inimical to the treatment, and therefore it is of paramount importance to ascertain the true value of the screen. Needles containing one, two, three, or more milligrams of radium element are being used for cancer of the tongue, breast, and cervix with a thickness of 0.5 mm. platinum, and the immediate results are reported to be satisfactory. On the other hand, the Radium Institutes of Stockholm³ and Paris use a minimum equivalent of 1 mm. platinum, from which permanent results are reported. It is not probable that both methods are equally favourable, and it is imperative to determine which is the more favourable. Some experiments by Lazarus-Barlow,⁴ in which he used screens of varying thickness—0.5 mm., 1 mm., 1.5 mm., and 2 mm. platinum—throw light on this problem. He found that the minimum injury to normal tissues and the maximum to actively proliferating cells was produced when the heavy screens were used. These results are crucial, but they need to be

* Read in opening a discussion in the Section of Obstetrics at the Annual Meeting of the British Medical Association, Winnipeg, 1930.