SURGICAL PROCEDURES IN GENERAL PRACTICE

This is one of a series of articles contributed by invitation

TREATMENT OF FRACTURES IN THE REGION OF THE KNEE

(EXCLUSIVE OF PATELLA)

BY

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Whenever a joint surface is fractured the main object of treatment is the restoration of the form and plane of the articular surface. This is more difficult in the knee than in any other joint because only a small part of the opposed articular surfaces is in contact at any one period. At the same time the restoration of the true plane is rendered more important because the knee is a weight-bearing joint lying between two bones of great length. Here again, although a complete range of movement is very desirable, full extension is of much more consequence than full flexion; furthermore, extension must be strongly controlled by active muscles, for there is no value in full extension if it cannot be fully maintained against gravity. The particular manœuvres directed towards these objects of restoration of form, of movement, and of muscular control are: (a) the exact reduction of the fracture; (b) the maintenance of traction; (c) the institution of early assisted active movements.

One principle is of paramount importance in the treatment of every fracture—namely, the assurance of free circulation in the whole limb.

Lower End of Femur

Fractures at the lower end of the femur may be supracondylar, intercondylar, T-shaped, unicondylar, or fracture-separation of the epiphysis. Widespread extravasation

(padding). If no proper splint is available the limbs should be tied together and their movement eliminated so far as possible by improvised splinting. This splintage should not be disturbed until an antero-posterior radiograph has been taken to determine the site and character of the injury; then, after division of the bandages, a cassette can be placed between the limbs and a lateral view be taken from the side without movement of the broken limb.

Supracondylar fracture is typically associated with posterior angulation of the distal fragment, a deformity commonly due to the originating force and maintained by the pull of the gastrocnemius. Reduction can almost always be achieved by a pin or wire inserted through the tibial crest just below the tubercle, the leg being slung in a Thomas splint with a flexing knee-piece at 150 degrees. This allows pull in the long axis of the femur and relaxes the gastrocnemius. Open reduction is rarely required. Prognosis is good, though even after accurate reduction there may be some permanent limitation of flexion, with otherwise good stability and range of movement.

Fracture-separation of Lower Femoral Epiphysis.—This is not very uncommon during the period of school life. Radiographs show that there is separation at the epiphysal plate rather than a true fracture; the distinction is most important, as the prognosis is less certain. Reduction must be exact, but even so premature fusion of the epiphysal line is common and one or two inches of shortening may result by the time the patient is full-grown. On the other hand, full function of the knee is readily restored. Reduction is best carried out by manipulation in flexion with radiographic control. It is often wise to retain about 90 degrees of flexion in plaster (pelvis to foot) for a fortnight or three weeks, then to

FIG. 1.—Showing the treatment of shattered head of tibia—second stage, with distraction provided and retained by two Steinmann pins, which can be seen in the close-up held in a thigh and leg plaster respectively, with a hinge applied to allow mobility.

FIG. 2.—Close-up of Fig. 1.

within and without the joint occurs so quickly that accurate clinical diagnosis is seldom to be expected without radiography. As a first-aid measure immobilization of the lower extremity as it lies is imperative. This is best effected by the application of a Thomas splint. A temporary fixed traction can be used by putting a bandage clove-hitch round the ankle over the boot or shoe (in the latter case the ankle itself should be protected by adequate

padding). If no proper splint is available the limbs should be tied together and their movement eliminated so far as possible by improvised splinting. This splintage should not be disturbed until an antero-posterior radiograph has been taken to determine the site and character of the injury; then, after division of the bandages, a cassette can be placed between the limbs and a lateral view be taken from the side without movement of the broken limb.

T or Y fractures of the femur or tibia are often the result of direct violence, and then show little displacement. But any broadening of the articulating end of either is to be avoided. A Böhler clamp may be used, or the method, introduced by Kindersley of Bath, of applying, first, traction (of, say, 20 lb.), secondly, an Esmarch bandage (firmly), and, thirdly, a heavy hammer round both sides of the joint with moderation and with purpose in relation to the radiographs. This manœuvre achieves two aims: first, to correct the longitudinal alignment, and, secondly,

to reduce the lateral separation; the former by skeletal traction applied through the crest of the tibia, and the latter by circumferential compression and moderate hammering, directed rather towards replacement than to impaction of the fragments. Operative correction followed by screw or bone-peg retention is advisable when radiographs indicate inadequate reduction; this operation can be performed without disturbance of the skeletal traction.

Fracture of one condyle is usually reducible by manipulation in the direction of over-correction of the lateral deformity, perhaps assisted by a few purposeful blows with a mallet over a felt pad. The reduction is always confirmed by radiographs. If accurate reduction has been achieved it can be maintained by a plaster from groin to toes with a good padded hold at the tuber ischii. Then after a fortnight hinges can be added, with the axis of movement very carefully and accurately placed and enough plaster cut away over the knee itself to allow of movement (Fig. 1). The plaster is of course slung and the usual pulley attachment for active movements instituted (Fig. 1). If, however, radiographs show that the position is imperfect, open reduction with fixation by bone peg is indicated. This operation can be done by working through a large window in the plaster. After the operation the hinges can at once be fitted. A technical point helpful towards the exact placing of the hinges is to take a true lateral radiograph with an "R" on the right side of the limb and an "L" on the left, arranged in the position which seems likely to be the right one.

Comminution.—In really difficult cases, especially where there is much comminution, the best method is reduction and retention by Steinmann pin or Kirschner wires, described above.

It was particularly for comminution of the upper end of the tibia that Kindersley's method was designed. In all these fractures of the tibia skeletal traction is even more essential than in those of the femur. Occasionally

FIGS. 3 and 4.—Plaster treatment for a rather late case of traction fracture of tibial spine.

a detached condylar fragment of femur or tibia may be controlled by a Steinmann pin poked through the skin without open operation. It has already been mentioned that the exact displacement of the articular plates of the tibia is most important, and in cases in which good reduction has not been achieved it is wise to operate. At the operation the joint should be opened in order to control the reduction and to make sure that the menisci are in their right position. As a rule, especially on the outer side, it is better to remove a meniscus which appears to have been damaged or is likely to interfere with function.

Spine of the Tibia.—A traction fracture of the anterior tibial spine is fairly common. It is, of course, pulled off by the anterior cruciate ligament. There is a resultant lack of the normal control of forward movement of the tibia on the femur, but the sign most commonly present is lack of full extension of the knee. This must not be mistaken for a cartilage displacement, which it closely resembles. Accurate antero-posterior and lateral radiographs will distinguish the condition. The treatment is retention for six to eight weeks in full extension. When the case is seen after a week or two full extension cannot be immediately achieved owing to an upward displacement of the spine and infiltration between it and its attachments. In such cases it is wise to put a plaster on in as full a degree of extension as can be readily obtained. Then by cutting and wedging the plaster once or twice at four- or five-day intervals it is possible to obtain full extension by gradually squeezing down the spine into position (Figs. 3 and 4) and so to avoid any stretching of ligaments. It is important that the plaster should get good well-moulded holds behind on the tuber ischii and on the back of the heel; in front, round rather than on the patella.

Complications

Haemarthrosis.—A fracture involving any joint is apt to cause haemarthrosis, but this complication is especially common and troublesome in the knee. Aspiration may be necessary, but it should be delayed or avoided unless the part is very tense and painful. No attempt should be made to get rid of the whole content of blood, for this is both impracticable and undesirable. The earlier and the more complete the relief by aspiration the more likely is the joint to fill again.

The Menisci.—In the knee, too, the presence of the semilunar cartilages adds to the delicacy and complexity of its internal mechanism. The menisci are often troublesome in depressed fractures of the articular plates of the tibia.

Patellar Surface of Femur.—Not long ago I saw a young lady about 21 years of age whose knee was crushed by a car which had been left standing on a hill and had run away. The fore-part of the external condyle of the femur had been crushed inwards across the front of the patellar surface. Such a displacement is not clearly shown in radiographs, and in this case was not recognized. When I saw her the knee was locked in full extension. It was fortunately possible to restore free movement by the removal of the patella and by an extensive plastic operation on the quadriceps and external vastus over a fascia lata transplant.

Ischaemia or Gangrene.—Loss of circulation may be due to an unrelieved popliteal haematoma or even to perforation or thrombosis of the main popliteal vessels following delay in reduction or adequate fixation of supracondylar fractures. Early operation is indicated. The signs and symptoms are pain, cold pulseless foot, and, as a rule, a large extravasation in the popliteal space.

Injuries to Nerves.—These are rare as a direct result of the fracture. I have had one case in which the sciatic nerve was almost divided by the sharp knife-like oblique edge of the lower femoral fragment. But subsequent paralysis of the external popliteal nerve is common and due to pressure on the nerve behind the head of the fibula or as it winds round its neck. Numbness, tingling, and loss of voluntary dorsiflexion of the toes are indications for the immediate relief of pressure at this situation.

Compound Fractures

Compound fractures involving the knee demand immediate operative treatment. After thorough cleansing of the skin by soap and water the edges of the wound are excised and all bruised and avascular tissues accurately cut away. Small detached fragments of bone are removed, and if the patella is extensively fragmented it is better excised. Opinions differ as to the advisability of prolonged lavage of the joint. The wounds need not be sutured, though when the patella has been removed a central suture with fine non-chromicized catgut is best. The suture should not be drawn tight. In cases in which drainage is likely to be required two vertical lateral incisions should be made and fine non-chromicized catgut sutures used to prevent premature closure. Two stitches are applied in each wound, one in front and one behind. By each the skin and perisynovial tissues are gently sewn together; thus granulation is prevented. Following the operation immobilization is essential. It is my practice to carry this out by fixed traction, preferably skeletal, on a Thomas splint with a flexion piece. In my last three cases of this serious type where lateral drainage was necessary I have obtained extraordinarily favourable results by a method learned from Dr. Maurice of Marlborough. In this method the surgeon once a day *very gently* grasps the back and sides of the knee with his two hands, exercising *mild* pressure on the posterior pouches and gently lifting the knee upwards to give it just 5 or 10 degrees of flexion movement. This induces an escape, through the lateral incisions, of fluid from the posterior pouches, which otherwise so insidiously and disastrously spreads into the intermuscular planes above and below the knee.

Acute Septic Arthritis

Whenever this occurs, with illness and high fever, much more radical drainage is necessary. Both lateral ligaments are divided transversely and the incisions are carried back round the posterior pouches with due regard to the popliteal vessels and nerves; the knee is immobilized completely on a Thomas splint with about 20 degrees of flexion in order that ankylosis may take place at a useful angle. If pus spreads into the intramuscular planes amputation is indicated, and should be carried out without delay by a modified guillotine method, followed by skin traction on a short Thomas splint with a terminal ring.

An article on the health of munition workers by Dr. H. M. Vernon, investigator to the Industrial Health Research Board, appears in the November issue of *Industrial Welfare and Personnel Management* (published by the Industrial Welfare Society, 14, Hobart Place, S.W.1, price 1s.). Dr. Vernon, who carried out many investigations for the Health of Munition Workers' Committee appointed by Mr. Lloyd George in 1915, in this article, the first of a series, summarizes the results of the experience of that committee in dealing with the problems of the last war, and indicates their application to the organization of work on the home front in the present struggle. The most important point Dr. Vernon emphasizes is that the experience of the last war showed how foolish it was to work excessively long hours in the hope of securing a larger output. Employers should not be discouraged by the fact that output will fall temporarily after hours are reduced, until the workers get into their stride under the new conditions. Another important conclusion of the Munition Workers' Committee was the need for the appointment of welfare supervisors in munition and other factories.

A FIRST-AID POST IN LONDON

The following article has been written by two medical Students, Mr. Desmond O'Callaghan and Mr. R. A. Shooters of St. Bartholomew's Hospital Medical College, who have been working since the beginning of the war at the first-aid post established at Aldermanbury, in the City of London.

First-aid posts have been instituted to relieve the casualty receiving hospitals from a rush of minor casualties and to act as filters passing on only cases whose injuries necessitate a period of treatment in hospital. Thus "walking" and "sitting" cases will all be directed to first-aid posts, but in addition "stretcher" cases may arrive carried in because they have occurred near to an aid post or because transport direct to hospital is for some reason delayed. By telephoning to the local control centre an ambulance can be summoned to convey "stretcher" cases to hospital, other cases being sent home after treatment. It is obviously an advantage to have first-aid posts situated in a hospital or other medical building, but in the City of London the only hospital, St. Bartholomew's, is a casualty clearing hospital. It has therefore been necessary to establish the five first-aid posts in non-medical buildings.

The post to which we have been attached since the beginning of the war is situated in the basement of a modern steel-framed commercial building five stories high, all the floors being constructed of reinforced concrete. All the windows which look on to areas, and also the pavement lights, have been heavily sandbagged, so that the personnel of the post and any casualties under treatment will be safe against everything but a direct hit from a very large bomb.

Arrangements for Admission

There are three separate entrances into the post. Casualties, male and female, who were not contaminated by blister gas would be admitted through the double doors of the main entrance, and would proceed down a wide flight of stairs, through an air lock, into the male and female first-aid rooms. These have been made quite simply by dividing a large room, formerly a restaurant, into two sections by hessian screens. What was a serving counter is used as an office; folding tables for drugs, dressings, and instruments, and trestle tables for stretcher cases requiring treatment, are provided. Two improvised tables, common to both male and female, support the sterilizer and poison cupboard; and chairs, placed back to back, are provided for sitting cases.

Casualties contaminated by blister gas would enter from the opposite side of the building, where there are separate entrances for men and women. Stencilled placards guide the casualties to their respective cleansing rooms. The male cleansing room is a cloakroom-lavatory which has been converted by the addition of sprays attached to the wash-basin taps; a bar of cement has been laid across the floor to localize waste water, while a hole has been made in the wall to drain away the water to a gully in an area outside. The female cleansing room, the former kitchen, is planned on the same simple lines. These changes have been made at little cost and have involved no structural alterations. "Stretcher" cases which have been contaminated would be admitted by the main entrance, but would be stripped before being taken into the post, where they would first of all be taken into the male or female cleansing room, as the case may be, and then carried into the appropriate first-aid room.

The medical equipment of the post is that prescribed in the Ministry of Health Circular 1789.

Personnel of the Post

The personnel of the post comprises three doctors, who will only attend after an actual air raid on the City