SURGICAL PROCEDURES IN GENERAL PRACTICE

This is one of a series of articles contributed by invitation

COLLES'S FRACTURE AND CHAUFFEUR'S FRACTURE

BY

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I. COLLES'S FRACTURE

Of all fractures this probably is the commonest. Its reduction requires neither expert skill nor elaborate apparatus, and the after-care is simple. Accurate reduction leads to excellent results in most cases. Failure of reduction always entails some degree of permanent disability. These considerations make the treatment of Colles's fracture a matter of great importance and general interest. While most frequent in women of middle age and onwards, it often occurs in younger people of both sexes. Before the age of about 20, when the lower radial epiphysis fuses with the shaft, the corresponding injury is a fracture-separation of the epiphysis. This resembles the adult fracture in all essential features, and its treatment is the same.

The fracture occurs within about an inch of the lower end of the radius. The situation of the fracture and the displacement of the lower fragment are determined by the local anatomy and the direction of the causative

effect of such a force can best be understood by resolving it into two separate components, acting in directions at right angles to each other. In the present instance one component displaces the lower fragment upwards along the axis of the radius, and the other displaces it directly backwards and also rotates it backwards. Impaction is common, and is due to penetration of the soft cancellous bone by the sharp ends of the broken cortex. Further, the position of radial deviation into which the hand is forced at the moment of impact often causes the lower fragment to be displaced and rotated outwards, so that traction on the internal lateral ligament may result in a fracture of the styloid process of the ulna or a rupture of the ligament. The hand and carpus remain attached to the lower fragment (Figs. 1 and 2).

To summarize this, one can say that in a typical Colles's fracture the lower fragment is displaced upwards, backwards, and outwards; tilted backwards and outwards; and the ulnar styloid is broken. By far the most constant element of the deformity is the backward tilt, and this also is the most important one to correct. In addition there is always some degree of injury to the soft tissues.

Variations of the typical picture are common. Comminution may be present, with fissures running into the joint and often separation of the fragments. The bone may be cracked, with little or no displacement. The

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 1.—Colles's fracture. Antero-posterior view, showing outward rotation and displacement of lower fragment, fracture of ulnar styloid, radial deviation of hand, and abnormal relation of styloid processes.

FIG. 2.—Lateral view, showing backward rotation and displacement and dinner-fork deformity of wrist and hand.

FIG. 3.—Antero-posterior view, after reduction.

FIG. 4.—Lateral view, after reduction. The normal anterior concavity of the radius has been restored, and the lower articular surface faces slightly forwards as well as downwards.

violence. The lower inch of the radius, although expanded to twice the size of the shaft, is covered by only a thin shell of cortical bone, so that it readily yields to a breaking strain. This weakness of the bone is further accentuated by the strength of the anterior ligaments of the wrist-joint, reinforced by the tendons passing to the hand, which explains the comparative rarity of pure dislocation.

In most cases the fracture is due to a fall on the outstretched hand, or some equivalent injury. The force of impact is transmitted through the hand and wrist and bears obliquely on the lower end of the radius. The

radial styloid or the posterior lip of the radial articular surface may be fractured, the rest of the bone remaining intact. Fracture-dislocation is uncommon; displacement is marked and fixation sometimes difficult. An appreciation of these points, and some knowledge of the normal radiological anatomy of the wrist, are necessary for successful treatment.

Diagnosis is generally easy. Pain and swelling of the wrist following a fall generally signify a Colles's fracture. When there is at the same time any obvious degree of backward or radial displacement of the lower end of the radius and hand, and an area of maximum tenderness

over the bone just above the joint line, the diagnosis is certain. The classical dinner-fork deformity is found only with severe degrees of backward displacement. Lesser degrees of deformity are often masked by the general swelling, and it is important to realize that, if not corrected, these become much more conspicuous when the swelling subsides. The tip of the radial styloid normally occupies a level about one-third of an inch below that of the ulnar styloid, and an alteration in this relation, caused by the upward displacement of the lower radial fragment, may be felt (Fig. 1). A more constant sign is a loss of the forward concavity over the lower end of the radius, and with average posterior displacement this is usually obvious, even in the presence of swelling (Figs. 2 and 4).

The final diagnosis rests with the radiographs. Cases will occur where no x-ray facilities are available, and the question will then arise whether or not the fracture should be reduced before it is radiographed. This should be done if any displacement can be detected clinically, because the physical and mental relief afforded the patient by reducing and immobilizing the fracture more than counterbalances the risk of an error in diagnosis. The risk is always slight, since most injuries which bear any resemblance to Colles's fracture are Colles's fractures. In doubtful cases some temporary immobilization—for example, a Carr or improvised splint—will give relief until the radiographs can be seen.

Needless to say all possible fractures must be radiographed after reduction: to check the diagnosis, if this has not previously been made; to see the position of the fragments; and to satisfy legal requirements. It is only possible to form an approximate estimate of the accuracy of a reduction by clinical means, particularly in the presence of much swelling.

Anaesthesia

The essential surgical requirement is a quiet relaxed patient; any form of anaesthesia which ensures this is a good anaesthetic for the immediate purpose of reducing the fracture, but various other things have to be considered, especially the patient's age and general health. It is impossible, except through sheer good luck, to secure an accurate reduction in a struggling patient.

Local anaesthesia has not yet achieved any great popularity, principally because expert general anaesthesia is available in most treatment centres, but its advantages under certain conditions are so obvious that they deserve to be more widely known. With proper aseptic precautions the method is devoid of risk and can be used where general anaesthesia is for any reason undesirable or unavailable. The patient is not totally incapacitated even for a short period. No special preparation or after-care is required. Repeated manipulations can be carried out with one injection—for example, where x-ray examination shows the position to be unsatisfactory; this procedure usually requires at least two general anaesthetics. Local anaesthesia is unsuitable for nervous patients and children. It is dangerous where absolute asepsis cannot be relied upon, since the solution infiltrates the fracture cavity. It is unsuitable for fractures more than a few days old, when cellular activity is sealing up the spaces between the fragments. Finally, it cannot always be relied upon to produce complete anaesthesia on account of associated injury to soft tissues, which the solution may not reach.

Technique of Local Anaesthesia

The requirements are a sterile 2 per cent. solution of novocain, a 20 c.cm. Record syringe, needles (No. 1 Record), tincture of iodine, and sterile dressings. The novocain solution must be of guaranteed sterility. The safest solutions are those in rubber-capped bottles or sealed glass ampoules, which keep indefinitely. Solutions contained in ordinary corked bottles are always suspect.

The syringe and needles are sterilized, preferably by boiling. The backs of the forearm, wrist, and hand are cleaned and swabbed with iodine. The surgeon's hands are sterilized as for any aseptic operation. The position of the fracture line is judged by palpation and previous reference to the x-ray films. The needle, attached to the syringe containing the anaesthetic, is made to pierce the skin over the back of the radius a little above the estimated line of the fracture and between the long extensor tendon of the thumb and the common extensor tendons, and is then pushed in an oblique direction downwards and forwards until it enters the haematoma cavity. With average backward displacement there is no difficulty in doing this; with minor displacements a few trials may be necessary, but a single skin puncture is sufficient. The tip of the needle is known to be correctly placed when (1) the solution flows readily from the syringe with moderate pressure on the piston, (2) blood can be aspirated into the syringe, (3) the injection does not raise a local swelling, as it would do if placed in the superficial tissues. About 15 c.cm. of novocain are injected into the radial fracture, and then a few cubic centimetres around the ulnar styloid. The anaesthetic should be given about five minutes to act, after which the fracture can be reduced.

Reduction and Fixation

For the actual reduction it is desirable, though not essential, to have the help of two assistants, who need not be skilled. Their function is to steady the limb and maintain the reduction while the splint is being applied.

A dorsal unpadded plaster-of-Paris slab is recommended as being both safe and efficient for all cases with average displacement, but for gross displacements an encircling plaster cast is advisable. The distance from about two inches below the elbow to the knuckles is measured, and a dry slab equal to this length is made from a six-inch-wide plaster-of-Paris bandage, so that it contains eight folds or thicknesses of muslin. One of the assistants holds and steadies the elbow while the surgeon takes a firm grip of the fingers and exerts vigorous traction in the axis of the forearm, followed by a forced extension movement. This disengages the fragments, whether impacted or not, and the lower fragment can now be felt to move with the hand. While full traction is still maintained, the wrist is flexed and the hand forced to the ulnar side, and at the same time the lower fragment is taken between the thumb and forefinger of the surgeon's free hand and pressed forwards and towards the ulnar side as strongly as possible. The restoration of the normal anterior concavity of the radius, which is the clinical proof of a satisfactory reduction of the backward displacement, can be felt by the index finger. The patient's hand is now transferred to the second assistant without disturbing the position or the traction. Separation of the fragments of a comminuted fracture, if present, must be corrected at this stage by pressure between the surgeon's hands in the

appropriate plane, and where there is radial deviation the final correction of it is now made by lateral pressure.

While the limb is still being held by the assistants the plaster is thoroughly wetted in cold water, the excess of water squeezed out, and the slab applied to the back of the forearm, wrist, and hand as far as the knuckles. The plaster is carefully smoothed out everywhere to adapt it as accurately as possible to the contours of the limb and to prevent creases on its deep aspect, which might cause pressure sores. The upper end of the plaster extends only about half-way around the limb; but in the region of the much narrower wrist it extends well on to the flexor surface, and care should be taken that it encircles the radial side of the wrist more than the ulnar in order to maintain ulnar adduction. The wet plaster is now quickly covered by a few turns of a three-inch cotton bandage so that it can be handled more easily. The surgeon once more takes the hand, still keeping up the traction, and again places his thumb, this time outside the plaster, over the lower fragment, pressing it forwards and inwards. The plaster still being soft, the hand is now placed in its final position, usually one of ulnar adduction and about 20 degrees of flexion, and held until the plaster has hardened. (Fig. 5.)

FIG. 5.—The usual position of the hand after reduction. The plaster slab is shown in outline. The dotted lines indicate its anterior limits. (Cotton bandage not shown in diagram.)

A second cotton bandage is now applied, firmly but not tightly, beginning at the upper end of the plaster and finishing with a dozen or more turns about the wrist and hand, where it passes between the thumb and index metacarpal, down to, but not going beyond, the proximal transverse crease of the palm. Plaster or bandages which extend beyond this line limit flexion at the metacarpo-phalangeal joints. The thumb is left free to move. Fixation is completed by a piece of strapping around the wrist and another around the palm.

The above technique, which takes more time to describe than to perform, is applicable to the majority of fractures, but has to be modified to suit certain cases. When no radial displacement is present in the fracture the position of full ulnar adduction is unnecessary, but a slight degree of ulnar adduction is always desirable, as this is the physiological position of the hand. Where little or no displacement exists it is only necessary to apply a dorsal slab, as described, with the hand in the neutral position. Fractures with gross displacement, and also those in which fixation by the dorsal slab has proved unsuccessful, generally require an encircling

plaster cast. The only difference from the routine technique is that in the place of the second cotton bandage a plaster bandage is applied, and in exactly the same way. This form of fixation gives greater security in all cases, but it introduces an added element of danger to the circulation which necessitates closer observation in the post-reduction period.

In cases with severe backward displacement, such as fracture-dislocations, fixation with full flexion of the wrist is sometimes advisable. This should not be maintained beyond about ten days or so, because it is a position of strain, and it also makes full flexion of the fingers impossible. At the end of this time the plaster should be carefully removed, the hand brought up to the neutral or slightly flexed position, and a new plaster applied. It cannot be too strongly emphasized that the reduction of this fracture requires vigorous manipulations, and that the great majority of unsuccessful attempts are due to the application of insufficient force rather than to insufficient skill. There is no danger of over-reduction of backward or outward displacements.

Good results can be obtained by the use of rigid splints, but plaster-of-Paris has advantages over all other forms of fixation. It adheres to and exerts perfectly uniform pressure on the skin, thereby giving a maximum security to the fracture with a minimum danger of damage to the skin, and also ensuring that it shall not loosen or become displaced. With adequate strength it represents the minimum of bulk and weight, so that the arm can be passed through the sleeve and easily used. The addition of padding removes these advantages and reduces the efficiency of the splint.

Following reduction all fractures must be radiographed in two planes. The radiographical evidence of good reduction is: (1) in the lateral view, the backward displacement and tilt are corrected, the anterior concavity of the radius is restored, and the lower articular surface of the radius faces slightly forwards as well as downwards; (2) in the antero-posterior view the outward displacement and tilt are corrected, and the styloid processes occupy their correct relative positions (Figs. 3 and 4).

Minor degrees of displacement are consistent with good functional results. In judging what is a satisfactory position the special circumstances of each case, particularly the patient's age and occupation, have to be considered, and much greater latitude should be observed with elderly than with younger patients, in whom an anatomical reposition should be obtained if possible. At least one further radiograph should be taken a week or ten days following reduction to see that the correct position has been maintained. Later displacements are uncommon.

After-care

With average displacements the plaster is retained for a month; with severe displacements for six weeks. During these times the plaster must not be removed, except for the indications I have mentioned. After reduction the important instructions to the patient are that the fingers, elbow, and shoulder shall be used from the first for light work of every kind, and that pain or swelling of the hand shall be reported immediately. If the patient's co-operation cannot be depended upon the movements must be performed daily under the direction of a masseuse. A sling, if used at all, should not be worn for more than a couple of days.

The important complication is swelling of the fingers caused by a too tight bandage. Slight swelling due to

the trauma is nearly always present, and disappears with time, elevation of the limb, and finger movements. The danger signals are pain, severe swelling, and blueness of the fingers. If these appear the position of the fracture becomes of secondary importance and pressure must be relieved at once by cutting the plaster. The danger of severe circulatory obstruction is inseparable from the use of an encircling unpadded cast on a swollen limb, and for this reason, as already indicated, it should not be applied as a routine. Damage may be caused in a few hours that may not be recovered from in as many weeks, and finger movements may be permanently impaired. In doubtful cases the only safe thing to do is to divide the plaster.

There should be a complete range of finger movement and a fair grip a few days after reduction. When the plaster is removed there is nearly always some stiffness of the wrist, which generally recovers rapidly with the patient's own movements. Extension and supination are slower to recover than flexion and pronation, but there is nothing constant about this. The patient's age, the kind of reduction obtained, the presence or absence of swelling, and the patient's ability to co-operate are all important factors, but fractures comparable in all other respects often show considerable differences in the times taken to regain full function.

There is no doubt that physiotherapy helps those patients who are slow to recover movements and also those who complain of slight pain after removal of the plaster. It is doubtful, however, whether it ever influences the ultimate result, and it is quite certain that it can never give a patient a good wrist and hand where the initial treatment has been bad. For the majority of patients it is unnecessary, though harmless, except in so far as it tends to obscure what is a clear-cut surgical issue and produce a feeling of divided responsibility between surgeon and physiotherapist.

The sequels of neglect or unsuccessful treatment are various degrees of finger stiffness, weak and painful grip, stiff and painful wrist, and an obvious deformity. The shoulder-joint and elbow-joint may also become stiff from immobilization, as in wearing a sling for too long. The deformity of an unreduced Colles's fracture is an unsightly one, and constantly obtrudes itself on the notice of the patient.

Late Cases

Manual reduction may be attempted with some prospect of success up to about three or four weeks following the injury; after this the use of a wrench or an osteotomy is necessary.

Reversed Colles's or Smith's Fracture

This usually follows a fall on the back of the hand so that the lower radial fragment is displaced forwards. The wrist should be immobilized in dorsiflexion.

II. CHAUFFEUR'S FRACTURE

This generally differs from the common types of Colles's fracture only in its aetiology. It may be caused by a sudden forced hyperextension of the wrist or from an actual blow of the starting-handle. Comminution is fairly common, also isolated fractures of the radial styloid process, as from a direct blow. Some of the cases are of the reversed type. Both bones may be broken, either at the lower ends or, occasionally, higher up in the shafts. Treatment, except in the cases of shaft fractures, follows the lines already described.

Nova et Vetera

SOME ECHOES OF WITCHCRAFT

The astonishing story of the town of Hampton in New Hampshire, U.S.A., after 282 years restoring its citizenship to Eunice Goody Cole, tried as a witch in 1656, and according her a martyr's funeral opportunely coincides with the 350th anniversary of the death of one who first regarded witches as mentally sick women.

Johannes Weyer, Friend of Witches

Johannes Weyer or Wyer (latinized Wierus) was born in Grave-on-the-Maas, Northern Brabant, in 1515 or 1516. Studying under the sceptical alchemist Cornelius Agrippa at Bonn and afterwards at Paris, he took his medical degree at the age of 22. City physician at Arnheim, and personal physician to Duke Wilhelm of Jülich-Cleve-Berg, in a turbulent age he lived a serene life practising his profession and pursuing knowledge. Two of his sons were physicians, of whom one was piously named Galenus. In 1563 appeared his work on the prestidigitatory nature of the devil ("De praestigiis daemonum"), which was promptly placed on the *Index librorum prohibitorum*. In language essentially composed and even kindly, though nevertheless outspoken, he bids the monks leave the management of witches and of the bewitched to the physicians. The pain inflicted on witches is unnecessary cruelty, since their mental anguish is punishment in itself. Among his medical colleagues Weyer on the whole found less cruelty but scarcely any more sympathy or understanding. An inquisitive and talented observer, he described trichinosis, the English sweating sickness, erysipelas, and scurvy. His reputation in medical history securely rests on his humane attitude towards witches, his emphasis on their mental sickness, and his founding of clinical psychopathology. Weyer's story was told by Gregory Zilboorg in the Noguchi Lectures, "The Medical Man and the Witch during the Renaissance" (1935), and has more recently been revived by Martin Vogel in the March 17 issue of *Hippocrates*.

Richard Gale, Enemy of Witches

In the December, 1937, number of the *Transactions of the Bibliographical Society* Ethel Seaton gives an account of Richard Galis and the witches of Windsor, which, apart from its valuable detective work in bibliography, is interesting because it contains the testimony of the bewitched believer on the one hand and that of his rationalistic father on the other. Gale (Galis), an excitable and credulous fanatic, son of Richard Gale, innkeeper and three times mayor of Windsor, having suffered from the malice of witches, became their implacable enemy. His violent behaviour as self-appointed witch-hunter alienated his father and annoyed the magistrates. Imprisoned in a "deep dungeon," in answer to his prayers the chains miraculously fell off his feet. Three months after the hanging of one of the witches in 1579 he brought out a pamphlet written in fervently pious style, the main part of which is occupied by an autobiographical account of his personal dealings with the witches. Reginald (Reynold) Scott, the tercentenary of whose birth occurs this year, in his book *The Discoverie of Witchcraft* (1584) alludes to Gale as a "madman," and refers to his "follie, lewdness, impudence, and dishonestie." The most important sourcebook on the history of witchcraft, it was written with the object of preventing the persecution of aged and simple persons popularly believed to be witches. Early editions are rare, because James I ordered this work to be destroyed. It is said that from its pages Shakespeare drew inspiration for his portraits of the witches in *Macbeth*.

W. R. B.

Thomas Annandale, who became regius professor of clinical surgery at Edinburgh in 1871, when Lister went to London, was born one hundred years ago. He died in 1907, and at his university his memory is kept green by the Annandale Gold Medal for Clinical Surgery.