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AVOIDABLE DISASTERS* Montgomery BY Medical Library

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We spend our student years being taught exact diagnosis and correct treatment; then we go out into practice and begin to learn from our mistakes. To err is human, and it is easy to be wise too late; yet how much happier it is for us all, and for our patients, when we can manage to be wise in time, learning from the mistakes of others to avoid some at least of our own.

Acute Pyogenic Infections

There is all the difference between making and missing the early diagnosis of acute pyogenic osteitis or arthritis. This throws a great responsibility on the general practitioner, who is at a disadvantage in that he naturally dislikes alarming parents unnecessarily, and is therefore inclined to diagnose rheumatism tentatively, and to try salicylates. Yet delay is so dangerous that, if his suspicions are aroused, prompt consultation or dispatch to hospital is wise; for the surgeon, guided by his greater experience of this fell disease, is anxious, and often able, to make the diagnosis at a time when there is opportunity for early relief of tension in the acutely inflamed bone or joint. In acute osteitis the initial focus is commonly in the cancellous bone close to the epiphyseal disk, and if it can be discovered and drained, a limited operation may prevent a disastrous spread to the medulla or the joint.

When the disease starts in the medulla its early diagnosis is even more difficult, for its signs and symptoms are less definite; yet it can be made.

In 1929 I saw a boy within twenty-four hours of the onset of his symptoms. He had a high temperature, with severe pain in his thigh, though, as is common where the inflammation is endosteal, neither the pain nor the tenderness was localized. There was widespread tenderness of the femur, rather greater in the upper half than in the lower. The hip was almost fixed by muscular spasm, but not swollen or tender to direct pressure.

Believing in the primary need for relief of tension, I first tried precautionary aspiration of the hip, but drew blank, as I expected. I then drilled a series of 1/4-inch holes into the femoral medulla, starting in the middle and proceeding upwards to include the lower part of the upper metaphysis at intervals of about one inch. From the first two drill-holes blood or bloody fluid gushed out under pressure; from the others it welled up at a normal rate. *Staphylococcus aureus* was cultivated from the femoral fluid and the blood. The patient had a week of severe fever and illness, but there was no sequestration, and the end-result was perfect.

The doctor, by his promptitude in bringing the boy, had averted the disaster of extensive infection and necrosis of the femoral diaphysis. This was of immense local

significance; but something even more vital was involved. The operation eliminated a major septic focus which would otherwise have been the source of a massive and persistent flow of cocci into the blood.

As a contrast I would like to mention the case of a man aged about 30, who had his thigh shattered in air combat in the war. Sepsis followed, but ultimately the thigh healed. Some years later he became suddenly ill, with severe pain in his thigh. Here again the pain, though severe, was ill defined, but in this case it was labelled sciatica, and the patient was treated for two days by morphine. As a result of the sepsis and the unrelieved pressure within the bone extensive necrosis and sequestration followed, with long-continued illness.

Extensive necrosis and sequestration is indeed characteristic of acute endosteal osteitis, and is, I believe, due to a combination of toxins and pressure within the medulla, for the pressure quickly becomes great enough to limit circulation and to prevent further diapedesis. Thus the living tissues within the bone are attacked by sepsis, starved of circulation, and cut off from the protective reinforcement of the leucocytes. Sepsis runs riot in the ischaemic field.

Acute pyogenic arthritis presents an emergency almost as critical, for here again bacteria thrive under a pressure which is harmful to the living tissues. The bactericidal synovial fluids soon become stagnant and inert, changing from fresh exudate, lethal to the organisms, into a culture medium favourable to their growth. Early, and if necessary repeated, aspiration relieves pressure, removes the stale fluids, and promotes fresh active bactericidal exudation. Where the bacteria are virulent, and in particular where a juxta-articular bone focus is a persistent source of reinfection, drainage may be necessary.

But once the pus leaks out of the joint and spreads upwards and downwards in the intermuscular planes the outlook alters altogether, and becomes rapidly more serious.

A few months ago a doctor rang up to tell me of a boy who had had pain in his knee and a high temperature for five days. He had originally regarded it as rheumatism. I removed the patient to hospital for operation with the utmost speed, but it was very late. The boy was desperately ill, and there was pus not only in the joint but spreading round the femur far up the thigh. Only by immediate amputation was there any prospect of saving the boy's life. After a stormy time he did well, and is now walking on a provisional limb.

There is, of course, a kinship between acute rheumatism and acute sepsis, but the distinction can usually be quickly made. First, the clinical picture of acute pyogenic infection of a joint is different from that of acute rheum-

* A British Medical Association Lecture delivered to the Ayrshire Division on October 23rd, 1935.

atism. In the one case there is acute illness, with a high, or very high, temperature, a hot dry skin, a bounding pulse, and intense pain confined to one limb. In acute rheumatism, on the other hand, the illness is more general, less sudden and severe, and the pain is less intense and more widespread. It is also, of course, characteristic of rheumatism that it does not remain monarticular; but I would urge that the diagnosis should be made, or at least consultation sought, without waiting to see whether other joints will become affected. Incidentally, it is worth remembering that an acute monarticular rheumatic arthritis associated with a temperature of 101° F. or more is a very great rarity.

Compound Fractures

We now know the vital importance of early and thorough wound toilet of compound fractures, other than those in which there has been a brief perforation of the skin from within by a sharp fragment of bone. A frank compound fracture should be regarded as an emergency comparable to that of gastric perforation or the rupture of an ectopic gestation, and demanding immediate and expert operation. For we know that only within the first brief hour or two is it practicable to excise all the devitalized and infected tissues so effectually that the wound and the fracture can be relied upon to unite without delay or sequestration. If this fleeting opportunity is lost the infection will have spread in the tissues beyond all reasonable surgical reach. These are, indeed, cases in which prompt expert operation can stave off disaster. I need not mention the necessity of the administration of anti-tetanus and anti-gas-gangrene sera to avoid the risk of even greater disasters.

Failures in Diagnosis of Fractures

The Wrist.—Fractures may simulate sprains. Without α -ray examination a fractured scaphoid is commonly missed. Even after α -ray examination, unless an oblique view has been taken—perpendicular to the long axis of the scaphoid—a transverse fracture of its waist is not always perceptible.

The Hip.—An impacted fracture of the neck of the femur may easily be mistaken for a severe bruise. For a few hours, even a day or more, after such a fracture the patient may be able to hobble, but unless the fracture is discovered and protected it will come adrift in the process of absorption of the crushed impacted trabeculae by the living bone on either side. Patients dislike coming apart without warning! It is an awkward situation which can be avoided by an accurate clinical examination and α -ray confirmation of fracture.

The Elbow.—I have recently seen several cases in which a fracture of the ulna has been associated with forward dislocation of the head of the radius. In two instances the dislocation, much the more serious lesion, was missed because attention was concentrated on the fracture. This was unfortunate because, with the orbicular ligament torn, stable reduction of the radial head and good ultimate radio-ulnar mobility depend on early and accurate reduction of the dislocation, and this in turn depends on perfect anatomical restoration of the ulna.

The Shoulder.—The importance of a thorough α -ray investigation of all injuries of the shoulder in which fracture is reasonably possible cannot be over-emphasized. The radiographs should be taken in two planes or, where that is impossible, they should be stereoscopic. Then follows a very careful scrutiny of the films by the radiologist, and, later, by the doctor, who can correlate the α -ray evidence with that of his own hands and eyes.

Incidentally, I do not think it is fair to place all the responsibility of diagnosis on the radiologist, who has to deal with shadows while we have the substance.

A patient at present in my care had a hunting accident in February, 1935, which involved serious injury to the shoulder. A fracture of the great tuberosity was diagnosed, but, despite stereoscopic radiographs, a posterior dislocation of the shoulder was missed. Before coming to me in June he had seen various people and been manipulated by a bone-setter, but the posterior dislocation remained. He had a painful and almost useless shoulder. Both stereoscopic and axillary radiographs demonstrated the posterior dislocation, but now in addition there was much new bone formation round the joint, which had probably been aggravated by the ill-advised manipulation. Quite apart from this extensive pericapsular bone formation, the long-established dislocation gave rise to extreme difficulty in reduction, in retention of reduction, and in restoration of active movement.

The reduction, coupled with the removal of the pericapsular bone, necessitated a very extensive operation: altogether the lack of exact diagnosis has involved the patient in a severe and prolonged disability.

The Spine.—Quarries and coal mines, hunting, racing, and the roads provide a stream of crush fractures and fracture-dislocations of the spine. Their transport to hospital is critical, but outside my scope. While there is little likelihood of a fracture-dislocation of the spine being missed, a crush fracture may easily escape recognition if concussion or some other severe injury is attracting a great deal of attention.

I have seen two examples of undiagnosed spinal fractures within the last two months. In one a medical student turned a corner too fast on his motor cycle, and was taken to hospital with concussion and a broken collar-bone. For these injuries he was adequately treated, but although he complained about his back it was not α -rayed. In the second instance a woman who had been thrown from her horse remained in hospital for three weeks, and was then sent home rather in disgrace for persistent complaints about her back. Here again no radiographs were taken, yet in both cases fractures urgently requiring treatment should have been discovered.

The value of lateral as well as antero-posterior radiographs of the spine can hardly be over-emphasized; for a crush fracture of a body with wedging or the detachment of an anterior angular fragment is seldom clearly visible in an antero-posterior view.

X-Ray Confirmation of Reduction

I often see fractures in which the diagnosis has been made by radiographs, but no radiographic confirmation of reduction has been made, with the result that malunion has been allowed to take place. Such economy in the use of radiographs is mistaken.

X-Ray Confirmation of Union

Before α rays were discovered certain periods were adopted for the splinting of the various fractures. In practice these periods were checked by careful examination by all who were wise by nature or had become so by bitter experience. For union does not take place at a uniform rate; there are many variable factors, such as the site, the degree and extent of damage to the bone, and the impairment of its circulation. Nowadays radiographs are available to present the facts. Nevertheless within the last year or two three patients have been passed on to me with malunion and four-inch shortening of the femur. In each case this has been due to the limb having been taken off the Thomas splint too early, owing to reliance having been placed on a time period rather than on α -ray evidence of union.

In children with mid-shaft fractures of both forearm bones consolidation is slow. Secondary deformity is very liable to occur if, after the splintage has been removed, the wrist is supported by a sling, but there is relatively little danger when the arm is allowed complete freedom. Probably it is wise to keep the forearm in a light plaster until the limb can be set free.

Splints

The use of splints is a fascinating and dangerous art. When applied to fractures their object is to immobilize part of a limb in comfort with free circulation, particularly round the fracture, and without hampering the active function of any part which can be safely used.

Splints used to be made of wood, but they never fitted the limb. They could be used by expert craftsmen, but involved many needless difficulties and dangers, of which the most obvious was their tendency to make the limb fit the splint! One of the worst of these old splints was the "internal angular," which I hope and believe to be extinct. Another is a slat of wood to which the forearm and hand was supposed to be applied; this also is becoming very rare. Of course, for fractures of the leg the traditional wooden back splint and foot-piece with two side splints is handy, and by deft padding can be made to fit any leg to an upholsterer's satisfaction, but I have seen every sort of trouble follow its use in difficult fractures.

I think we should now banish altogether every wooden splint, except, perhaps, short pieces of Gooch splinting. With plaster-of-Paris, the Thomas splint, and the collar-and-cuff one can do almost everything. Plaster can be fitted accurately to the shape of the limb, as it is or as you want it to be. Plaster can be moulded not only to fit, but to provide just that degree of support which every part needs. In a recent fracture it should seldom, if ever, be completely circumferential, although it is perfectly correct to apply a plaster completely if one divides it longitudinally right down to the padding over the whole length of the splint. Where there is padding this is easy, and in skin-tight plasters a strip of wool may be placed over the line of the cut to protect the skin.

One great virtue of the plaster accurately moulded to its holds is that neighbouring parts can be left free for function which would, with less accurate fitting, have to be immobilized. For instance, in every forearm fracture the thumb and fingers can be free for active use—a point of supreme importance. Almost all the bad or delayed results in these fractures are due to one or more of the following mistakes:

1. The splint or plaster is put on too tightly, or becomes too tight owing to internal swelling.
2. Splints are taken off too soon, with the idea that massage and mobilization are necessary—at the cost of secondary displacement.
3. Splints are so extensive that they interfere with the active function of the hand.
4. Incomplete reduction.

Delayed union and malunion will be avoided if the plaster is accurately moulded but remains capable of expansion to meet the needs of internal swelling, allows free movement of the thumb and fingers, and—given this vital factor—is kept on until the danger of secondary displacement is over; for there is no indication for massage and passive movements provided that the reduction is complete and the thumb and fingers are freely used. With a comminuted Colles fracture which has been accurately reduced and suitably splinted there is no danger of leaving the plaster on too long, but a distinct danger

of taking it off too soon. The following instance illustrates many faults.

A few months ago I saw a woman aged 50 who had had a Colles fracture two and a half months previously. She still complained of a great deal of pain and almost complete loss of movement and power in the hand, and the history illustrated almost every known mistake in the treatment of a fracture. Her doctor had (1) made a half-hearted attempt to set her fracture without an anaesthetic; (2) never corrected the deformity; (3) put her up in wooden splints which were so long that they reached the tips of her fingers, entirely preventing any active movement of any part of her hand, and so tightly applied that she soon began to suffer great pain; and (4) kept the whole forearm and hand constricted and immobilized for nearly seven weeks. He omitted one mistake: he did not take her splints off too soon—apparently because he preferred to put on splints that were too big, bind them on too tight, and leave them on undisturbed in spite of the patient's pain.

Sometimes patients are quite innocently at fault, for after a fracture they are prone to expect pain and to bear it without complaint. But pain persisting or recurring after a fracture has been set and splinted is a danger signal. It commonly indicates movement at the fracture from inadequate splintage, or pressure from internal haemorrhage, tight bandaging, or badly fitted splints. Pain caused by inadequate splintage is usually intermittent, but the pain due to pressure is constant; it is ill defined if due to widespread compression, or localized if due to a pressure point. In each instance it is a cry for relief. We should therefore instruct our patients to mention pain promptly and our nurses to report it without delay; then comes our responsibility to make sure of our ground before ordering morphine, for morphine is no remedy for any of these ills.

Ischaemic Contracture

It is of vital importance to realize that the pressure can be external or internal or both combined, and that in the elbow the anatomical relations are such that ischaemic contracture can develop from internal pressure alone, without any external control by splint or bandage, and even with the elbow below a right angle. In such cases multiple division of the deep fascia to lessen the subfascial pressure is the essential need. In injuries of the elbow in children one safeguard should always be observed: the doctor should never leave the patient unless the radial pulse is present and the hand is warm, of good colour, and free from pain. Further, the most stringent instructions must be given as to the need for immediate action if any of the danger signs should appear later as a result of reactionary swelling. I feel strongly on this subject, as I have seen eighteen cases of Volkmann's ischaemic contracture in the last fifteen years—disasters due to lack of appreciation of these points. Of these, fourteen followed supracondylar fractures, two fractures in the neighbourhood of the wrist, and two fractures in the neighbourhood of the ankle. The contracture can develop fully in a very short time; when this has happened the elasticity and power of the muscles are permanently lost.

One of the most tragic cases was that of a boy aged 11, who fell while swinging on a lamp post. He had a supracondylar fracture, and was taken to hospital. The surgeon of the week manipulated the fracture, put the elbow up in flexion, and then went into the theatre. But on revisiting the ward at the end of his operations he found that ischaemic paralysis was present. In this case flexion of the swollen elbow was the fault. I saw the boy two months later. He had complete paralysis of the median and musculo-spiral nerves, fixed flexion of the elbow, and claw-hand with trophic sores on his fingers. Everything possible was done, but five years later the hand and arm were still utterly useless, and

trophic sores were so persistent that amputation became inevitable.

Another instance was a boy, aged 6, who by the time I saw him had Volkmann's contracture with complete paralysis of his median, ulnar, and musculo-spiral nerves. In his case the surgeon had undertaken repeated manipulations.

I have already indicated the line of safety. The first care must be the circulation of the limb, and it is sometimes wise to wait a day or two before attempting reduction of the fracture. For it is indeed fruitless to reduce a supracondylar fracture until one can put the elbow in flexion above a right angle. Furthermore, if manipulative reduction under full anaesthesia has been tried once and failed, I am wholly in favour of avoiding further manipulation, because I think it far safer to operate, and thus attain the three objectives of evacuating the haematoma, safeguarding the neuro-vascular bundle, and reducing the fracture accurately. Then, in taking the confirmatory radiograph, great care should be exercised to avoid external rotation of the lower fragment, which easily occurs if the elbow is raised by the forearm rather than by putting one's fingers under the lower third of the arm.

Arterial Embolism

There is seldom any opportunity of relieving primary ischaemia due to some defect in or damage to the arterial supply of a part, but the sudden embolism of the main artery of a limb requires immediate recognition if disaster is to be avoided. Jefferson published an admirable article on arterial embolectomy (*British Medical Journal*, 1934, ii, 1090). I have recently operated on a man aged 71 with embolism at the bifurcation of his left femoral artery. His doctor had made the diagnosis immediately, giving me a most urgent call, and the patient has done very well.

Some other Disasters

The following is a remarkable instance of ignorance and fraud on the part of a bone-setter on whose diagnosis and treatment the patient most foolishly relied.

A woman consulted a well-known bone-setter in London about her knee. He examined her, told her a cartilage was out, and "put it in" without an anaesthetic. She was no better. A week or so later he stated that an anaesthetic was necessary. She submitted, but woke up from the anaesthetic with her leg in plaster, and was told that it had "turned out to be not a misplaced cartilage but a fracture," but that when the plaster was taken off in six weeks' time she would be all right. When the plaster was taken off her knee was useless. He told her that massage was necessary, so it was started; but on the advice of the masseuse she came to see me. An x-ray examination revealed carcinoma of the upper end of the tibia, with pathological fracture.

Referred Pain and Tuberculosis of the Adult.—I am almost ashamed to mention the long-familial danger of failing to recognize that a pain referred to the abdomen may arise from the back. Yet I have recently seen a patient with spondylolisthesis, and from time to time have seen patients with Pott's disease, who have had abdominal operations carried out without relief of their referred pain. To treat such cases over long periods as rheumatic is even more common. Furthermore, tuberculosis of the hip in middle or old age is rare, and is very likely to be regarded as osteo-arthritis until an abscess appears.

Insidious Deformity.—Dangerous optimism is common in regard to the deformities of children. It seems legendary that children will "grow out of them," but in fact they seldom do. It requires a good deal of experience to distinguish those that will get right from those that will not.

Delay in obtaining expert opinion may be disastrous, particularly in regard to congenital dislocation of the hip, where the earlier the diagnosis the more nearly perfect the result will be. We know that any anatomical misfit of the hip means great trouble later on. Danger lurks in the painlessness of the deformities of childhood. They appear negligible, but they increase insidiously, and the opportunity of their cure slips by. Years afterwards, when supple tissues have grown stiff and articular cartilage has worn thin, the tiring muscles ache, and then even relief may be hard to attain.

Infection of a Tuberculous Cold Abscess.—An iliac or psoas abscess may be the first discovered sign of disease of the spine, sometimes indirectly after having been mistaken for a hernia. A more common error is to open such an abscess unnecessarily; but occasionally, even after expert treatment of the patient and the lesion from which it arises, a cold abscess may have to be drained. Yet its pyogenic infection can be avoided, and it is, I believe, more than three years since a tuberculous sinus has become infected in the Wingfield-Morris Orthopaedic Hospital. Bacteria may find access from the neighbouring skin from careless or insecure dressings, or from the mouth of the dresser. After the first few days a tuberculous sinus discharges little, and needs dressing only once or twice a week, but the dressing must be ample and firmly secured, and applied with strict aseptic and antiseptic technique. The nurse who dresses the sinus wears a mask, and the skin round the sinus is painted with a mixture of equal parts of 5 per cent. crystal violet and 5 per cent. brilliant green in spirit. If rigid precautions are taken infection will not occur; they are well worth while, for a purely tuberculous sinus will soon heal if the lesion and the patient are rightly treated.

Danger of the Obvious.—It is dangerous to be more interested in form than function, for we may be misguided enough to operate on an obvious deformity, only to find that the underlying source of trouble is made worse rather than better by our treatment. Hallux valgus is often merely the obvious sign of a spreading fore foot and the harbinger of metatarsalgia. In such cases, to remove the first metatarsal head is to take away a part with most valuable weight-bearing capabilities, throwing on the second and third metatarsal heads weight which they are quite unfitted to carry. Unhappy results are only too common.

The Line of Least Resistance.—This may prove an unfortunate path to follow.

Some years ago I saw a girl aged 16 with an awkward gait and limitation of movement in both hips. Radiographs revealed symmetrical and most unusual lesions of the heads of her femora. In the course of an examination I discovered that she was a pseudohermaphrodite. She had bilateral operation scars, left by operations four or five years before at a distant hospital. I made inquiries from this hospital, and discovered that the operations were for double femoral hernia, but that the "sacs" had turned out to be solid. They had been removed, and on microscopical examination had been found to be testicles. Nothing more was said or done, and the patient left the hospital.

There were two unfortunate sequelae: first, the femoral lesions, probably associated with bilateral orchidectomy at 11 years of age; and, secondly, since the doctor took the line of least resistance, "Mary" was allowed to remain "Mary," whereas her character and interests were those of "John." The next four or five years were ill spent. Her people were innocently trying to make "Mary" help in the home, while "John" was always slipping round the corner to join the boys at football! After thorough psychological investigation it was clear that a change was indicated. So "Mary" left her village and "John" started life elsewhere. He is now a carpenter, in good work, and writes most cheerfully.