Sports injuries of the hand and wrist

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One in four of all fractures involves the hand or wrist. This is true of sports injuries too. Even if fractures of the distal radius are excluded, injuries to the carpus, metacarpals, and phalanges are common in sport. Soft tissue injuries to joints are almost as common.

The use of the hand and wrist in different sports affects the way they may be injured. Soccer players (except the goalkeeper) are not allowed to handle the ball, but in rugby football and its American and Australian derivatives players grasp not only the ball but their opponents, so hand injuries are more common. In basketball, netball, volleyball, handball, and fives the moving ball is struck directly by the hand, which is therefore at considerable risk of injury.¹ However, even propelling a ball at a moment of your choice in ten-pin bowling can cause problems; other throwing sports are more likely to damage the elbow or shoulder. In golf a stationary ball is struck by a club, whereas in racket games the ball is moving; in hockey and ice-hockey there are also direct clashes between players. In cricket, baseball, and rounders, while only one player uses a bat, the others may or may not wear protective gloves. Gloves are also used in boxing, but not in other fighting sports such as judo or karate.

Falling on to the outstretched hand is the main risk in athletic sports, particularly jumping, gymnastics, climbing, skating, and ski-ing. Sportsmen should therefore be taught to fall in the safest way, rolling as they hit the ground.² In some sports, the hands are used to provide propulsion, as in rowing, but more often they guide the machine, whether it be a bicycle, car, or boat (sailing or motor).

Many sports injuries to the hand are minor ones, but some are more serious than they seem and need correct diagnosis and treatment. A "dislocation" may really be a fracture-dislocation so radiographs must be taken. Wrist injuries are often serious, even with apparently normal radiographs.

Method of study

The literature has been reviewed by searching the indices of the most specific journals of sports medicine and hand surgery. Other papers were already known to me. The information thus gained has been augmented by 26 years of experience.

Soccer

The most popular organised game in the world is association football or soccer. Injuries to the hand occur in roughly equal proportions from falling on to the hand, contact with another player, and the ball striking the hand. The last occurs mostly in goalkeepers who, although

only one of 11 players, sustain one third of the hand injuries because the other players are not allowed to handle the ball. Goalkeepers are also subject to the uncommon but serious injury which was described in 1994 under the intriguing title "The goalkeeper's fear of the nets".³ Three amateur footballers before the start of their games were jumping up to suspend the netting on the hooks attached to the goalposts but instead sustained ring avulsion injuries when their rings caught on the hooks. One case was revascularised but the other two patients preferred to accept amputation.

The right hand is injured three times more often than the left. The injuries are predominantly fractures rather than joint injuries; in players under the age of 15 these are greenstick fractures. Fractures of the phalanges are the most common, followed by fractures of the metacarpals,⁴ but a significant number of players sustain a fracture of the scaphoid, which is more serious. Ligamentous injuries may occur in the carpus, leading to carpal instability later.

FRACTURES OF THE SCAPHOID

Scaphoid fractures sometimes fail to unite despite treatment, but if they are not treated they will almost certainly not unite.

Unfortunately, the diagnosis is not easy. Clinical signs are unreliable,⁵ but one should not omit clinical examination because precise localisation of tenderness allows one to order the appropriate x ray views. Radiographs may show an obvious fracture but even experienced orthopaedic surgeons and radiologists may overlook a fracture or, almost as bad, diagnose a fracture when there isn't one.⁶ Routine wrist x ray pictures are not enough, and the diagnosis requires special views to show the scaphoid well: a posteroanterior view in ulnar deviation, a semipronated oblique in ulnar deviation, a semisupinated oblique view, and a lateral. The Ziter view combines several of these elements.⁷ Other carpal bones may also be fractured.

If there is doubt, the wrist should be kept in plaster for two weeks and then reassessed. A bone scan is the most useful investigation.⁸ If that is normal, a fracture can probably be excluded. If it shows localised uptake, the matter must be pursued further: in some cases a computed tomography scan may show a scaphoid fracture when repeated ordinary scaphoid x-ray views have failed to do so.

Delay in treatment greatly increases the likelihood of non-union, but there is little unanimity as to the best method of treatment.⁹ In much of Europe and in North America, it is usual to immobilise the whole arm, including the thumb, in an above-elbow plaster for six

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weeks, followed by a below-elbow plaster for another six weeks. The case for an above-elbow plaster is not convincing, and our own studies have shown that a below-elbow plaster leaving the thumb free (as for a Colles' fracture) is just as effective as immobilising the thumb.¹⁰ The wrist must be effectively immobilised for at least eight weeks and often twelve. Sportsmen need a lot of persuading to accept this but, if there is a definite fracture of the scaphoid, it is well worth sacrificing that period at the beginning to avoid the much longer period of disability when it fails to unite. The patient must be seen every week or two to make sure the cast is still really immobilising the wrist.

Cricket

The second most popular organised game throughout the world is cricket, played by millions of people throughout the British Commonwealth, especially in the Indian subcontinent. A ball, about the size of a tennis ball but very hard, is delivered at a speed of up to 140 km per hour. A batsman attempts to strike it with a wooden bat and the fielders try to stop it and, in particular, to catch it before it hits the ground. Only one of the fielders is allowed to wear protective gloves.

In amateur cricketers, most injuries to the hand are sustained while trying to catch the ball, which often strikes the end of the finger causing serious damage to joints, especially dorsal fracture-dislocation of the proximal interphalangeal joint. This injury also occurs in baseball (although a baseball is slightly softer and lighter than a cricket ball) and in Australian rules football.

Most other hand injuries sustained at cricket have a good result, but prevent the cricketer from playing for three to twelve weeks. Professional cricketers, being more expert, are less likely to injure themselves while catching the ball but face faster bowling and are therefore more prone to finger injury while batting.¹¹ Protective batting gloves need to be improved.

FRACTURE-DISLOCATION OF THE PROXIMAL INTERPHALANGEAL JOINT

Dorsal dislocation of the interphalangeal joints may result from a forcible extension injury. An end-on blow causes the more serious fracture-dislocation, which clinically looks much the same. It is reasonable to reduce any dislocation, but essential to have the joint x-rayed immediately afterwards so as not to overlook an associated fracture.

In fracture-dislocations the anterior part of the base of the middle phalanx is broken off and stays in its previous position, while the rest of the middle phalanx dislocates dorsally. They are relatively easy to reduce and remain stable as long as the joint is flexed, but they dislocate again if the joint is extended. Many methods of treatment of varying complexity have been recommended.¹² McElfresh *et al*¹³ advocated an extension-block splint which allows flexion but prevents extension; a less cumbersome version was described by Strong.¹⁴ If this method is used, a check radiograph must be taken with the finger in the splint with the joint extended

as far as the splint allows, to make sure that concentric reduction is maintained.

Splinting alone may be inadequate. It may be necessary to transfix the reduced joint with a Kirschner wire. Twyman and David¹⁵ simply put the pin in the head of the proximal phalanx; they call this "the doorstep procedure". After three weeks, the wire is removed and an extension-block splint applied for another three weeks, during which the range of extension allowed is gradually increased. If the finger is left free after only three weeks, it may displace again. In some cases, especially if the bony fragment is large, open reduction and internal fixation may be indicated, but should be performed by a skilled and experienced hand surgeon.

Rugby football and its derivatives

In rugby union football and its relatives rugby league, Australian rules and American football, injuries are common, especially to the knee and, very seriously, to the cervical spine. In these versions of football, the players catch and carry the ball and are tackled by other players, also using their hands, so hand injuries are relatively common although fortunately seldom serious. In one season at Cambridge, a University town with many colleges, 72 patients were treated at the local hospital for hand injuries sustained while playing rugby football,¹⁶ many of which were caused deliberately. Forty six sustained fractures, mostly of the phalanges, some of these occurring when the tackling player caught his finger in the pocket of his opponent's shorts. A similar mechanism is the most common cause of the rare avulsion of the insertion of flexor digitorum profundus tendon.¹⁷ Rugby players in the southern hemisphere sensibly have no pockets in their shorts, although the tackler's fingers may still get caught in the waistband. American footballers are also prone to this injury.¹⁸

Interphalangeal dislocations are often compound. Players sustaining these injuries must be sent to hospital, both for proper treatment of the wound to prevent infection of the joint and for x-ray to detect any associated fracture. Dislocations and fracture-dislocations at the proximal interphalangeal joint also occur fairly frequently.

AVULSION OF THE PROFUNDUS TENDON

This rare injury is almost confined to rugby football. It almost always affects the ring finger. The tendon is pulled off its insertion on to the distal phalanx; there is seldom a fracture, so radiographs are normal. Experimental studies oddly enough usually do produce a fracture.¹⁹

The patient can still flex the metacarpophalangeal joint (using the intrinsics) and the proximal interphalangeal joint (using flexor digitorum superficialis) but not the distal interphalangeal, or end joint, of the finger.

If diagnosed at the time, the tendon should be reattached surgically, but the result may be disappointing because the force of the injury tears the vincula, and the tendon sheath is filled with blood which forms adhesions. The diagnosis is usually not made until later, by

which time a tendon graft to the profundus is required. Although good results can sometimes be achieved,¹⁷ there is a risk that the function of the intact and normal superficialis tendon may be compromised. Alternatives are arthrodesis or tenodesis of the distal interphalangeal joint, but many patients find the disability so slight that they choose to have nothing done.

Golf

If a golfer misses the ball and the club hits the ground, the impact is transmitted up the shaft of the club to the handle causing a fracture of the hook of the hamate.²⁰ It is always the upper hand that is injured. The same injury can be caused by a tennis or badminton racquet or a cricket or baseball bat if a particularly violent impact takes place. Beckenbaugh, the co-author of one of the best papers on this injury,²¹ sustained it himself but it was not diagnosed by his colleagues for a long time.

Two cases have been reported of golfers who wanted to change the rubber grip on the handle of a golf club and tried to separate it by injecting white spirits from a syringe into the space between the grip and handle.²² Each accidentally injected his other hand, causing severe pain and vascular problems needing treatment in hospital, after which both digits survived.

FRACTURE OF THE HOOK OF THE HAMATE

As with the scaphoid, ordinary radiographs of the wrist will not show this injury. It requires special views: an oblique one and a view through the carpal tunnel with the wrist extended, but correct and precise positioning is essential. If pain prevents full extension, lateral tomograms or a computed tomography scan will show the fracture. Because it is not shown in ordinary x-ray views, it is seldom diagnosed acutely and may present later with painful non-union. The key to diagnosis is localisation of tenderness; the hook of the hamate is about 1.5 cm distal and lateral to the easily palpable pisiform. There may be ulnar nerve symptoms, which is not surprising in view of the proximity of both the superficial sensory and deep motor branches of that nerve to the hook. Mild carpal tunnel syndrome has also been described. Some of the flexor tendons are also close to the hook, so sometimes there is pain on moving the ring and/or little fingers.

If the fracture is diagnosed immediately, immobilisation in a plaster cast can produce union. In the more common late cases, the best treatment is excision of the fragment²³; it is deeper and larger than would be expected and has flexor tendons laterally (they may be frayed or even ruptured) and the motor branch of the ulnar nerve curling round it medially and distally, so the operation needs great care. Some patients, particularly those who have suffered violent injuries such as road traffic accidents or falls, complain of weakness of grip or tenderness of the scar after excision, but most sportsmen are satisfied with the result and resume their sport. Professional cricketers are able to play again after a few weeks when the tenderness has settled.

Watson and Rogers were disappointed with their results after excision and claim that retention of the hook prevents ulnar migration of the flexor tendons, which weakens the grip. They therefore devised a method of bone grafting the hook and used it with success in four patients.²⁴ Afterwards the wrist was immobilised for six weeks. The fracture can simultaneously be stabilised with a Kirschner wire; a mini-Herbert screw should give better fixation. However, most hand surgeons have found the results of excision to be good.

Ski-ing

The most common hand injury in ski-ing is a tear of the ulnar collateral ligament of the metacarpophalangeal joint of the thumb. This is caused by the handle of the ski-stick or the loop around it, or by the ground. One would expect this injury to be more common on artificial ski slopes because the skier is out of practice and the surface is full of holes into which the thumb may slip, but a study in Belgium found that artificial slopes were more likely to break the thumb than to tear its ligaments.²⁵

The thumb is pulled sideways and usually the ligament tears off at its distal end where it is attached to the base of the proximal phalanx: sometimes the ligament remains intact but pulls off the bit of bone to which it is attached.

DETACHMENT OF THE ULNAR COLLATERAL LIGAMENT OF THE METACARPOPHALANGEAL JOINT OF THE THUMB

This is often, although wrongly, called "gamekeeper's thumb", but gamekeepers sustain a gradual stretching of the ligament by breaking the necks of rabbits over many years.²⁶ The acute injury would be better called "skier's thumb" as ski-ing is its most common cause.

If the ligament is completely torn, there is obvious laxity allowing the thumb to be displaced sideways away from the index finger. There is usually bruising on the ulnar (finger) side of the metacarpophalangeal joint of the thumb. If there is no fracture, the radiographs will be normal, but early operation is indicated because, as pointed out by Stener,²⁷ the adductor aponeurosis always comes to lie between the ligament and where it should be attached, so normal healing cannot occur. The ligament is therefore replaced and reattached surgically, after which the thumb should be protected in plaster for three weeks.

In recent years there has been some enthusiasm for conservative treatment.²⁸ This may be appropriate if the torn ligament is not displaced outside the aponeurosis. The difficulty is how to determine this. Abrahamsson *et al*²⁹ consider that the displaced ligament is palpable on clinical examination and recommend immobilisation in plaster if it cannot be felt. Other surgeons find this difficult, so ultrasonography and magnetic resonance imaging have been employed, the latter being more reliable.³⁰

If there is a fracture, the radiograph will show whether it is displaced or not. Stener and Stener³¹ showed that there can be a fracture and a torn ligament together and in about half the cases the bony fragment is attached to the

ligament and in half it is not.³² Stability should therefore be tested even if the fracture is undisplaced. If it is stable, 1–2 mm of displacement is acceptable and can be treated in a plaster of Paris thumb spica for three weeks. If the joint is unstable, if the displacement is greater, or if the fragment is rotated, it should be exposed and reattached surgically. If there are two fragments, one displaced and one not, operation is indicated because the ligament is probably attached to the displaced one.

Boxing

The term "boxer's fracture" is sometimes applied to the common fracture of the neck of the fifth metacarpal as this usually is caused by punching, although often a less inebriated opponent avoids the blow and the fist hits a wall instead. For some reason it has become common in the last 20 years to express anger by deliberately punching a wall, which is now a common cause of this fracture.

In proper boxing matches, the fighters are more skilled and their hands are protected by boxing gloves, so these fractures are less common. A study of 11 173 professional boxers in New York State over a seven year period, which rightly was concerned mainly with head injuries, found 38 fractures of which 14 were of the metacarpals and three of the phalanges.³³ Professional boxers may, however, be much troubled by compression-impaction injuries to the carpometacarpal joints of the index and middle fingers.³⁴ "Repetitive stress to the stable longitudinal arch eventually results in cartilage damage, osteochondral fracture, and a chronically painful arthrosis".³⁵ If simple rest and protection do not resolve the symptoms, arthrodesis may be required; fortunately these joints normally have hardly any movement so there is no functional loss.

In addition to the 38 fractures in the New York State study, there were 18 cases of acute or chronic synovitis causing swelling of the second or third metacarpophalangeal joints ("boxer's knuckle"); most responded to conservative treatment, although surgery has been advocated in severe cases.³³ Rupture of the dorsal capsule of the metacarpophalangeal joint of a finger is another injury caused by punches, often in proper boxing.³⁶ It is commonly overlooked but may benefit from surgery, even in late cases. This may be the true cause of what was earlier described as "synovitis".

FRACTURE OF THE NECK OF THE FIFTH METACARPAL

It is a mistake to overtreat these. Ford *et al*³⁷ proved that excellent results are obtained by minimal treatment, even in cases with marked angulation. Neither reduction nor immobilisation is necessary. A bandage should be applied to remind the patient and other people that the hand has been broken, and movement of the hand should be encouraged at an early stage. There is often an extension lag for a while, but full movements are nearly always regained, and the minor cosmetic blemish seldom troubles patients with this injury.

Rock climbing

The most common hand injury in rock climbing is to the soft tissues of the fingertips, resulting from severe and prolonged pressure combined with abrasion. Avulsion of digits through the distal or proximal interphalangeal joints in crack climbing has been reported.³⁸

DAMAGE TO THE FIBROUS FLEXOR TENDON SHEATH

Normally the flexor tendons are held in place by the fibrous flexor sheath and especially by the stronger parts of it, which form pulleys. Loss of these pulleys allows the tendon to bowstring forwards during flexion.

In May 1989 Steve Bollen, a rock climber himself, examined the hands of 67 climbers taking part in the first British Open Climbing Championship at Leeds.³⁹ He found that 25% of them had bowstringing, which is almost unknown among non-climbers. The obvious way to prevent bowstringing would be to wear a ring, but that would invite serious ring avulsion injuries if the climber fell and the ring caught on something. Non-stretch tape may limit the problem, but could also be a risk. Bollen found, by biomechanical analysis, that a man falling and taking his weight on one finger could apply a force of 450 N at right angles to the flexor tendon. If this is enough to damage a normal tendon sheath, it is hard to believe that any surgical reconstruction or replacement could withstand it.

More recently Bollen and Wright studied radiographs of the hands of 36 rock climbers aged 20–50 (mean 31) years and compared them with matched controls from the accident and emergency department. Of the climbers, 17 had osteochondral cysts, 14 had osteophytes, and two had osteoarthritis; two of the controls had cysts but none had osteophytes or osteoarthritis.⁴⁰ In addition, the climbers tended to have greater cortical thickness and scalloping of the neck of the proximal phalanx, which was attributed to thickening of the attachment of the distal end of the A2 pulley of the fibrous flexor sheath. It is planned to repeat this study in five years to see if "the young stars of the rock-climbing world of today become the gnarly-handed, middle-aged adults of tomorrow".

Ten-pin bowling

A paper from the Mayo clinic in 1972 reported 25 patients with pain and hypersensitivity over the ulnar digital nerve of the thumb, with palpable thickening of that nerve.⁴¹ Of these, 17 were keen ten-pin bowlers and played five times a week or more. In this type of bowling, the thumb is put into a hole in the bowl, and it was thought that this had caused the fibrosis around the nerve which was found in most patients who were explored, although one also had a chronic proliferative synovitis which seems to arise from the sheath of the flexor pollicis longus tendon.

The simplest treatment is rest from bowling. A change in grip may be effective. Some patients were relieved by wearing a plastic

thumb guard for from six weeks to six months. Surgical neurolysis helped in some cases.

Stress fracture of the ring finger has also been reported.⁴²

Rowing

Blisters are the really common problems of the hands, but the repetitive flexion and extension of the wrist can cause peritendonitis crepitans, a condition causing pain, swelling, and crepitus where two of the thumb tendons cross over the radial wrist extensors, about three inches above the wrist, toward the radial side of the extensor surface. For this reason, it is known in America as the intersection syndrome.

The condition settles quickly with rest, but if that is not accepted, may be cured by surgical release.⁴³

Bicycling

Racing cyclists may bear up to one third of their body weight on the handlebars. The ulnar nerve, where it enters the hand at the hypothenar eminence, has little protective soft tissue covering and may suffer compression against the handle of the bicycle.⁴⁴ The element of vibration adds to the problem. The result is impaired or altered sensation in the little and ring fingers; if the deep motor branch of the nerve is also affected, then there is weakness of the small muscles of the hand. Acute symptoms follow a very long ride, especially over rough terrain, and they may persist for months despite stopping cycling; other cases present in a more chronic form. Special padded gloves are available for cycling, and most serious cyclists use these. Periodic changes in grip is the best solution; drop handlebars allow this to be achieved more easily than upright ones.

Gymnastics

Gymnasts subject their wrists to a combination of axial compression and extreme ranges of movement, so it is not surprising that they get problems⁴⁵; indeed, they think that pain in the wrist is a "normal and direct result of the sport" so they may ignore treatable disorders. The most common is a tear of the triangular fibrocartilage between the distal end of the ulna and the triquetrum⁴⁶; this is particularly at risk if the gymnast has a slightly longer ulna than usual (called positive ulnar variance). However, a similar situation can arise as a consequence of gymnastics; in adolescent girls the epiphyseal plate at the distal end of the radius may fuse prematurely so that it stops growing prematurely while the ulna continues to grow and abuts on the carpus.⁴⁷ Arthroscopy of the wrist allows the triangular fibrocartilage to be inspected, but it may be necessary to shorten the ulna.

Other sports

In basketball, netball, and handball, the ball is propelled directly by the hands which are therefore at risk especially the thumbs. Ligamentous injuries occur but are not as common as one might expect. The use of the hand required in the game "does not tolerate most protective gear such as splints or tape".⁴⁸

Skaters may fall and have their hands run over by other skaters. On ice, this produces nasty lacerations which may be associated with compound fractures.⁴⁹

Low temperature injuries can occur in winter sports and mountaineering.

Conclusion

The problem in treating sportsmen is that their desire to continue sport may lead them to neglect serious injuries, for which they pay a heavy price later. Most serious sportsmen and women are young and understandably not inclined to think of the problems that they may be storing up for middle and old age—for example, those adolescent gymnasts who are deforming their wrists.

Merle and Dautel⁵⁰ in France "recently examined a motorcycle champion who had suffered more than 29 articular, juxta-articular, and diaphysal fractures in the course of his career. None of the digital chains was intact; they all had sequelae of fractures: malunions with bone angulation or rotation and post-traumatic arthritis.... However, his hand was quite functional, each digital chain having a useful sector and range of motion. As for his pain, this retired champion would only say 'I can live with it: it's all in the head anyway'".

However, there are injuries where proper treatment is needed, which will require a considerable absence from sport. This is not only to avoid problems 20 years later but to allow a full recovery and resumption of sport the following season. This is in the player's interest, but he or she often lacks the maturity to recognise this and certainly cannot be expected to have the knowledge to recognise the small proportion of injuries requiring serious treatment. That is the job of the sports doctor: to make a full, early, and accurate diagnosis and sort the "wheat", needing curative treatment, from the "chaff", which only needs palliation.

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