Aspects of Plastic Surgery

Hand Injuries

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It is possible to set down certain guide lines for the management of a patient with an injured hand. The pattern of events from the time of injury should be as follows: first aid; examination of the patient; examination of the injured hand; provisional decision about the procedure to be adopted; action in the operating theatre; and aftercare.

First Aid

The usual principles apply equally to hand injuries as to other fields—namely, the treatment of shock, haemorrhage, and pain, the prevention of further injury, and reassurance. The treatment of haemorrhage and pain is particularly important. Raising the hand together with applying a comfortable bulky dressing which immobilizes it are the best primary measures. On no account should a tourniquet be used at this stage to control haemorrhage if it can possibly be avoided. There should be no probing of the wound, nor application of any antiseptic lotions.

Examination of the Patient

When first seen in hospital, the patient may be shocked; he will certainly be apprehensive, particularly if the dominant hand has sustained a major injury. It is important to take an accurate history since this may indicate the type of injury as well as any concomitant injury which should be identified. An accurate history including such detail as the position of the hand and fingers at the time of injury may be essential at a later stage of management. At this early stage it may be necessary to set up intravenous therapy and administer appropriate analgesics.

Examination of the Hand

A doctor experienced in hand injuries should examine the injured hand, and make a general assessment of the type of injury—for example, laceration, crush, avulsion, amputation, fracture, or the likely presence of a foreign body. Almost certainly it will be a combination, but an accurate assessment is important. The degree of crushing may affect the surgery to be undertaken and will certainly affect the prognosis. Without disturbing the wound the best possible assessment is made of skin cover, vessels, nerves, tendons, and bony skeleton.

Early closure of the wound is important and at this stage it should be possible to determine whether this is likely to be accomplished by direct suture or whether the skin cover is inadequate and will require free graft or pedicle graft.

VESSELS, NERVES, AND TENDONS

Suture of vessels is indicated when the blood supply to the hand or digit is in jeopardy. This is particularly so when both the radial and ulnar arteries have been divided or when both digital arteries have been damaged—depending on the condition of the other structures in the digit.

Both the motor and sensory functions of the nerves must be tested. In a patient with a badly-damaged painful hand this is not easy and it may not be possible to make an accurate diagnosis. It is often difficult to assess sensory changes at this stage and the commonest error is to underestimate the amount of damage.

The action of the muscles concerned should be rested against resistance wherever possible; passive recoil may give a false impression.

An x-ray examination is an essential part of this stage of the management to determine whether any fractures are present.

Decision about Procedure

The detailed procedure can be decided only in the operating theatre, but it is important to assess the situation at this stage and to discuss the problem with the patient. It is here that certain information is vital and the entire line of treatment may depend on one or more of the following factors.

SEX AND AGE

After trauma the ultimate aim is usually to produce a hand with normal function and normal appearance. There are many occasions when this cannot be achieved and there must be a compromise. In a girl the appearance of her hand may be rated very highly and she might rather have a good looking hand with slight loss of power than a powerful hand which is ugly.

The recovery of an injured hand depends very largely on age; the prognosis is usually better in a child than in an adult. An outstanding example of this is in tendon repair or tendon graft—indeed, many reconstructive procedures are contraindicated merely because of the patient's age. The rapid healing of a small, full-thickness skin loss from the tip of a finger in a child is quite remarkable.

INTELLIGENCE AND MOTIVATION

As well as physical examination, a general assessment of the patient is important as a guideline for any surgery. In one patient it may be correct to embark on a series of reconstructive procedures to produce the best hand from the point of view of function and appearance; in another, a relatively simple operation, with rapid return to work—albeit it having had a compromise type of surgery—may be the correct treatment.

OCCUPATION

Different occupations demand widely different activities in the hands. For a man working with machinery it may be hazardous to have a stiff finger which could be caught in the machine. A man using a pick and shovel needs power grip whereas to the watchmaker the precision grip is all important. Not only the occupation, but also the patient's hobbies should be considered. Many hobbies require normal hand function for their pursuit.

DOMINANCE OF THE HAND

To ask whether a patient is left- or right-handed is an obvious question but nonetheless extremely important. Different types of injury affect different hands—for example, when the damage is caused by a knife it usually involves the non-dominant hand since the knife is held in the dominant. The reverse is true in a hand injury caused by a fall or the sudden grasping of a falling object when usually the dominant hand is involved. Recovery is usually quicker if the dominant hand is injured because the function of the hand is more important to the patient.

It is not always possible to restore an injured hand to normal function and appearance. Depending on the severity of the injury, operative treatment may help the hand to recover completely or it may be nothing more than a salvage procedure while most cases fall between the two extremes. The more experienced the hand surgeon the better able is he to anticipate the final outcome and plan accordingly. It is important to "set the sights" correctly in order to achieve the best result for any particular patient, whose best interests are certainly not always served by prolonged surgical treatment perhaps involving several operations.

In the Operating Theatre

The injured hand is examined in detail for the first time after the application of a pneumatic tourniquet and after correct lavage. The clinical findings may be confirmed and a catalogue made of the anatomy of the injury. Any foreign bodies are removed. The state of vessels, nerves, tendons, bones, and skin cover are all examined. The total plan of action can then be decided based partly on the preliminary examination and partly on the condition found at operation.

VESSELS, NERVES, AND TENDONS

Suture of the blood vessels in the hand or fingers is rarely necessary unless the circulation is inadequate. When it has to be done magnification is needed for dealing with the smaller vessels.

Most surgeons now agree that nerves should be repaired as a primary procedure. The sooner a major nerve is repaired, the sooner is function restored. Some conditions favour secondary repair at a later date, such as gross contamination of the wound or perhaps the complexity of the wound. The results of nerve repair are often disappointing and to achieve the best results scrupulous surgery is required to align the funiculi, when again some form of magnification is a great advantage.

As a general rule, all extensor tendons should be repaired on the day of injury. Flexor tendons should also be repaired except when damaged in "no man's land," within the fibrous tunnel in the finger (fig. 1). Repair of tendons here produce bad results because of the tendon junctions becoming adherent, either to each other or to the adjacent unyielding structures. Recently there has been a move towards primary repair of the flexor tendons in this area but this should be attempted only by surgeons with considerable experience in hand surgery. Except in a few instances, the best treatment for a flexor tendon divided in "no man's land" is the primary closure only of the skin with early mobility of the finger followed by a flexor tendon graft. The tendons most commonly taken for grafts are the palmaris longus, the plantaris, or the long extensor to the second toe.

FIG. 1—The fibrous tunnel in the ring finger has been opened.

BONES

Without stability of the skeleton of the hand, restoration of function is impossible. Correction of deformity and adequate fixation are the keys to the treatment of bone injury. In many cases the relatively simple manoeuvre of manipulation under anaesthesia (either local or general) followed by external splinting is perfectly adequate. But in some unstable closed fractures, and in many compound fractures, the deformity is reduced at open operation and the reduction maintained by internal fixation using wire, screws, or plates. The introduction of powered tools, correctly scaled for hand surgery, has greatly improved the technique of this type of operation. The very close relationship between the phalanges and the tendons in the finger often results in the entrapment of either the flexor tendon or the extensor mechanism at the fracture site. The recent development of silastic sheeting which can be inserted between damaged bone and damaged tendon has been of great benefit in helping to overcome this problem.

TRAUMATIC AMPUTATIONS

The principle of maintaining the optimal length of a finger is important but this is not necessarily the same as maximal length. So far as possible full movement and normal sensation of the tip should be restored. In many occupations a stiff finger may be a hazard but a stiff anaesthetic finger is dangerous. Sometimes the level of amputation may be decided properly only with a thorough knowledge of the patient and his work.

The amputated digit may be brought to hospital with the patient, and it is always worthwhile to consider replacing it, though there are many occasions when this is contraindicated, owing to several factors—for example, the age of the patient,

the nature of the injury, and the time lapse since the injury. In the special case of amputation of the tip of a finger, replacement is very often worthwhile and should be attempted—certainly in younger patients, and always in children, when this procedure is usually successful.

SKIN COVER

An open wound of the hand invites infection, with subsequent oedema and stiffness. Wounds should be closed within six to eight hours, the method of closure depending on the type of wound. After practically all injuries there will be some swelling, which must be anticipated in the choice and method of closure. If there has been some crushing great care must be taken to avoid tension within the hand after operation.

Loss of skin requires replacement by either free graft or pedicle graft. Free grafts are used when vital structures such as tendons, nerves, or joints have not been exposed and also as temporary dressings to avoid tension which would be caused by primary suture. The pedicle graft or skin flap is used to cover such vital structures and in cases when further reconstructive procedures are contemplated.

RECONSTRUCTION AFTER HAND INJURY

The basic aim of reconstruction after severe hand injury is to produce a prehensile hand with adequate sensation. Two examples of a hand which has lost prehension are seen in ulnar and median nerve palsies.

ULNAR NERVE PALSY

With interruption of the ulnar nerve, the intrinsic muscles to the fingers are paralysed so that they no longer monitor the action of the long flexors and extensors and a claw hand results, the fingers being extended at the metacarpophalangeal joints and flexed at the interphalangeal joints. This deformity seriously affects the gripping and holding capacity of the hand. To overcome this, a new motor is introduced whose action mimics that of the intrinsic muscles. This is achieved by detaching the flexor digitorum superficialis tendons from the middle and ring fingers, splitting each tendon, and reinserting them into the intrinsic mechanism (fig. 2). In this way extension of the metacarpophalangeal joints is controlled and there is active pull on the intrinsic bands which extends the interphalangeal joints.

FIG. 2—Correction of clawing due to paralysis of the intrinsic muscles.

MEDIAN NERVE PALSY

It is vital to the good functioning of the hand that the thumb can be brought across in front of the line of the palm. When the muscles innervated by the median nerve are paralysed, the thumb lies on the line of the palm and though it can be adducted it cannot be brought into contact with the tips of the fingers as in opposition. One way to overcome this problem is to transfer the abductor digiti minimi from the little finger to the radial side of the hand to be inserted into the tendon of the abductor pollicis brevis which is paralysed¹ (fig. 3). This muscle can be isolated with its neurovascular pedicle and in its new position its action is very similar to that of the paralysed short abductor of the thumb, which restores some degree of opposition to the thumb.

FIG. 3—Transfer of abductor digiti minimi to the thumb. Note the rotation of the muscle.

SENSATION

Though intact sensation is important to hand function, it is critical in the contact areas between the thumb and index finger. Anaesthesia of this part of the pulp of the thumb is very disabling and when the nerve damage is irrevocable some form of reconstruction is essential. This involves the taking of a piece of skin from the less important ulnar side of the ring finger with its blood and nerve supply intact and transferring the skin to a prepared defect in the thumb (fig. 4). This is the so-called "island flap" technique. By doing this new blood supply and nerve supply are given to the thumb, and, though this may not be as good as the normal nerve supply, it does provide good protective sensation. The donor area of the ring finger is covered by a graft, using the skin taken from the thumb.

Aftercare

It could be said that the aftercare begins as soon as the patient is first seen. This is an extremely important psychological moment and the success of treatment may well depend on the rapport established then between patient and surgeon. Both should be committed to the same line of treatment and aware of the implications and particularly the probable time of incapacity. Rehabilitation of the injured hand is hard work for the patient and the better he is prepared for this the better will be the final result.

The three great enemies of the hand surgeon are haematoma, infection, and oedema. The first two can be avoided by careful

FIG. 4—Transfer of skin with its neurovascular pedicle to the thumb.

surgery, appropriate antibiotics, and careful supervision immediately after operation. Oedema cannot be entirely eliminated but it can be reduced to a minimum by raising the hand and arm after operation. Good bandaging, by the surgeon himself, and correct positioning of the hand are extremely

important. Even an otherwise normal hand can be crippled by immobilization in the wrong position; how much more devastating is the effect of bad bandaging on an injured, potentially oedematous hand.

The best physiotherapy is work and the better motivated the patient is to return to work the quicker will the function of the hand recover. There are, however, many times when it is necessary to immobilize the hand for three to four weeks and the co-operation of a physiotherapist experienced in hand surgery is extremely valuable. The physiotherapist should be involved at an early stage to help to keep mobile any parts of the hand or arm which have not been immobilized and later, when the bandages and splints have been removed, to help in the recovery of these parts. Owing to the close contact with the patient, the physiotherapist can make a valuable assessment of the situation which is helpful when trying to forecast the ultimate prognosis. The patient wants to know if he will be able to return to his original job, whether he has to find lighter work, or if he has to be re-trained because of some permanent physical handicap. It is from a knowledge of the injury and its effect on hand function, together with the speed and quality of the recovery in the early days (depending as it does very largely on the effort of the patient) that an opinion can be formed and advice given about the eventual outcome.

Reference

- ¹ Littler, J. W., and Cooley, S. G. E., *Journal of Bone and Joint Surgery*, 1963, 45A, 1389.

Any Questions?

We publish below a selection of questions and answers of general interest

Sticky Eye in the Newborn

What are the most suitable eye drops for use in the newborn and young babies with "sticky eye?"

"Sticky-eye" is usually due to staphylococcal infection but sometimes *Escherichia coli* in the newborn. Occasionally at birth the eyes seem red or swollen, with slight exudate, but no infection can be demonstrated; this condition quickly clears up without treatment. As a first step in all cases a swab should be taken for culture. After that the application several times a day, not of eye-drops, but of chloramphenicol or neomycin ointment, seldom fails to cure in a few days.

Protection for Patients Sensitive to Tetanus Toxoid

What form of protection should be given to patients who react to tetanus toxoid?

Patients who have local reactions after tetanus vaccine usually have high serum tetanus antitoxin titres and therefore do not require any further injections of the vaccine.¹⁻³ If, however, the reaction occurs after the first or second injection and the serum tetanus antitoxin levels have not been determined the vaccination course may be completed by intradermal administration of 0.1 ml of tetanus vaccine in

simple solution. It should be noted that neither the intradermal route nor tetanus vaccine in simple solution should be used for the first dose of tetanus vaccine since they do not provide an adequate primary stimulus. Tetanus vaccine (adsorbed) should not be given intradermally since it may give rise to an intradermal granuloma at the site of injection.

- ¹ Levine, L., Ipsen, J., and McComb, J. A., *American Journal of Hygiene*, 1961, 73, 20.
- ² Edsall, G., Elliott, M. W., Peebles, T. C., Levine, L., and Eldred, M. C., *Journal of the American Medical Association*, 1967, 202, 17.
- ³ Relihan, M., *Journal of the Irish Medical Association*, 1969, 62, 430.

Penile Erection and Enuresis

A 6-year-old boy, until recently enuretic, regularly has a penile erection on waking and also when he is lifted late at night to empty his bladder. Is this a normal phenomenon?

The association described is not uncommon at any age from infancy to well into adult life. It is a normal phenomenon but I know of no systematic study. Enuresis, however, has been studied more systematically and it has been observed that bedwetting in young boys during deep sleep is often accompanied by penile erection.¹

- ¹ Pierce, C. M., *Canadian Psychiatric Association Journal*, 1963, 8, 415.