

FRACTURES OF THE PROXIMAL AND MIDDLE PHALANGES OF THE FINGERS

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Fractures of the proximal and middle phalanges of the fingers present difficult and unsolved problems. In the Royal Infirmary, Edinburgh, over the last four years we have had an opportunity of following up 196 of these and the results are presented with a discussion of some of the problems involved.

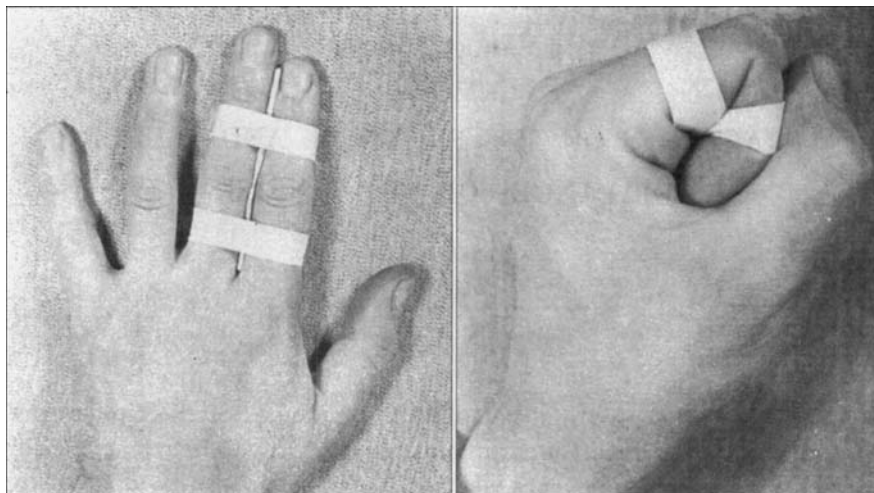
It must be explained why fractures of these two bones are considered separately from those of the metacarpals and the distal phalanges. Although fractures of the metacarpals present some similar problems the mutual support they provide each other makes them relatively easy to treat. Moreover, skin cover is rarely a problem, tendon injuries are uncommon and the tendons are not at this level, an intimate relation of the bone. It is instability of a finger that presents a major difficulty in contrast to the metacarpals.

Injuries of the end of the fingers are problems of skin and pulp damage, not of the distal phalanx.

As this is a study of the fractures of these phalanges, those patients who had fractures of the metacarpal or distal phalanx of the same ray are excluded from the series. A number of fingers with fractures have had primary amputation because of ischaemia, they also have been excluded.

In considering the result of treatment in this series the fractures have been divided into groups according to the treatment necessary. Although within each group there are fractures of varying types the most important factor other than associated soft tissue injury has been the stability or otherwise of the fracture.

A fracture of either phalanx which is stable, will, if treated by mobilisation, usually obtain full function. Unstable fractures almost invariably lose some function and are divided into two groups, those

*Fig. 1.*

Garter strapping as used for some stable fractures.

stable with plaster after reduction and those requiring internal fixation.

STABLE FRACTURES OF THE PROXIMAL AND MIDDLE PHALANXES

A total of 96 finger fractures were judged to be stable and treated by minimum splintage for a week or two followed by mobilisation, or were mobilised from the beginning. In this series no loss of position was recorded and with increasing experience more were left unsplinted.

The normal mode of limited splintage was by means of "garter" strapping to the adjacent finger. Fig. 1.

In the 96 stable fractures of proximal and middle phalanges of the fingers there were 20 patients with some loss of function. In 16 the loss of function consisted of a failure of extension at the proximal interphalangeal joint of between 5° – 15° and/or loss of flexion of the finger nail to the distal palmar crease of between $\frac{1}{4}$ "–1". These losses are functionally not serious and the more severe cases had contributory factors; contracted skin scars, multiple fingers injured, fractures into the joint, late diagnosis and mobilisation, etc. It was rare in this group of relative failures to see a loss greater than 10° in extension and $\frac{1}{2}$ " of flexion. The remainder of the hand was normal.

In four patients a greater loss of function occurred, up to 30° flexion contractures at the proximal joint and 1" loss of flexion.

*Fig. 2a.**Fig. 2b.**Fig. 2a. and b.*

Juxta-epiphyseal fractures of the proximal phalanx of the little finger and ring finger. After reduction these are usually stable.

TYPES OF STABLE FRACTURE

Criteria as to stability are obviously difficult to define and only with experience is the stability of some types appreciated. Under anaesthesia, stability is often easy to confirm.

JUXTA-EPIPHYSIAL FRACTURES OF THE BASE OF THE PROXIMAL PHALANX

In 25 fingers the proximal phalangeal base was the site of a classical juxta-epiphysial or metphysial fracture with the typical triangular fragment of such fractures. These fractures were only seen in children between the ages of 12 to 16 years. In the fingers they occur almost exclusively in the little finger but with a few in the ring finger. Fig. 2a & b.

If requiring reduction, and most do not, stability has always subsequently been maintained with garter strapping, even with activity.

OTHER STABLE FRACTURES

Many of the injuries seen in the Hand Clinic arise from coal mining, falls of stones on to the hand produce a great variety of stable transverse or irregular fissured fractures. Fig. 3a & b. Oblique fractures are usually unstable but the two fingers in Fig. 4 remained stable despite mobilising; full function was restored.

Transverse fractures may be stable and experience increasingly demonstrates the advantages of early movement. Fig. 5 shows a fracture which remained stable and to which full function was restored in three weeks.

*Fig. 3a. and b.*

Stable transverse and fissure fractures of the phalanges.

*Fig. 4.**Fig. 4. and 5.**Fig. 5.*

An oblique fracture is usually unstable. However, these were clinically stable and this was confirmed after treatment by mobilising.—An impacted fracture which proved stable, the patient obtained early restoration of full movement without immobilisation.

UNSTABLE FRACTURES TREATED BY REDUCTION AND PLASTER

There were 68 patients with 75 injured fingers with 17 fractures of the middle phalanx and 58 of the proximal phalanx. These were judged to be too unstable to be without splintage. Seven patients had two fingers broken. With increasing experience the indications for plaster decrease and some of these patients would now be regarded as stable and left unsplinted.

Seventeen fingers made a full recovery, 4 of these were one of two fingers injured. The remainder, 58 in number, lost some function.

*Fig. 6.*

A transverse fracture of the proximal phalanx of characteristic type, unstable and requiring plaster immobilisation after reduction. An unusually good reduction.



Another fracture of the proximal phalanx, showing pre-reduction and post-operative positions and the result in plaster.

*Fig. 8.*

Fracture of the neck of a phalanx is a difficult problem because the distal fragment rotates 90° or 180° . If reducible they can usually be maintained in plaster.

Loss of function arises from associated injuries as well as the fracture, compounding occurred in 19, in 6, tendons were also injured and in 10 the joint surfaces were fractured. Only one finger with a complicating injury was restored to full function. In the whole series complicating soft tissue injuries almost inevitably precluded a return to normal. A few patients with inadequate reduction regained full function.

Flexion contracture at the proximal interphalangeal joint occurred in almost all the 58, nearly as common was a loss of full flexion from stiffness of the interphalangeal joints, particularly the proximal. The metacarpo-phalangeal joints were all normal in this series. Seven patients had an appreciable angulation or rotation at the fracture site. Four fingers required late amputation, one for stiffness, one for delayed gangrene and two for sepsis following skin loss.

Reduction was performed under local or general anaesthesia, after reduction a dorsal plaster was used with the metacarpo-phalangeal joint flexed, if possible to 70° and the interphalangeal joints flexed as near to 20° at the proximal and 5° – 10° at the distal as was possible, Figs. 6–8.

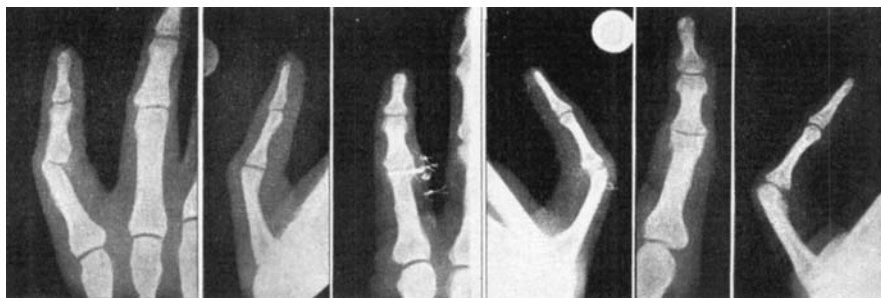
Following this treatment contractures of the metacarpo-phalangeal joints have not occurred, but flexor contractures of the interphalangeal joints have been a continuing problem despite the decreased flexion used. The hand is elevated and exercised following reduction. No complicating stiffness of an uninjured finger has occurred and the metacarpo-phalangeal joints have remained mobile. The plaster is retained for three weeks and then removed. Callus does not appear at this time in the X-ray but only one phalanx has refractured.

UNSTABLE FRACTURES TREATED BY OPEN REDUCTION OR INTERNAL FIXATION

Of this small group of 25 patients 9 had fractures of the middle phalanx and 16 of the proximal phalanx. Only 2 fingers obtained full function.

Indications for open reduction were fractures difficult to maintain after closed reduction and plaster or, where treatment was begun late when mal-union had commenced. Increasingly, unstable fractures were fixed primarily where experience indicated its necessity.

The principal indication for internal fixation primarily is an oblique fracture of a condyle. Fig. 9. Oblique fractures were rarely stable and

*Fig. 9.*

Oblique fractures of the condyles are almost invariably unstable, cause severe angulation of the fingers and require internal fixation with a small pin.

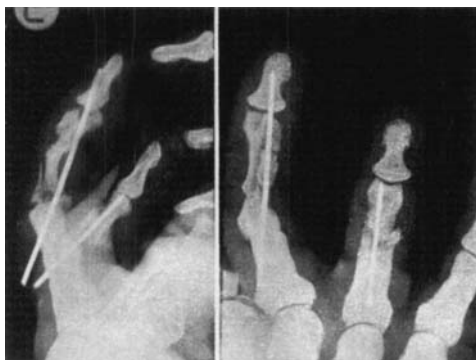
*Fig. 10.*

Gross destruction of the joint is best treated by primary arthrodesis, one technique is illustrated here.

often difficult to hold in plaster. Failure resulted in angulation of the finger or, occasionally, rotation with overlap on flexion.

Technically the procedure is difficult particularly if done late, or if the fragment is small. Pin fixation proved the most satisfactory, a fine hypodermic needle or wire suture was necessary when the fragment was very small; the result was often poor.

Ten patients had joint involvement, in four primary arthrodesis was performed because of joint destruction, particularly indicated if the extensor apparatus is also destroyed. Fig. 10. A man had a saw-mill accident in which he lost dorsal skin and tendon with grossly comminuted fractures of two fingers. Fig. 11. Pin fixation and skin graft converted two very badly damaged fingers into useful digits, with full movement at the metacarpo-phalangeal joint, but with no interphalangeal joint range.

*Fig. 11.*

This man sustained gross skin, tendon and bone injuries and had already lost his index finger. The end result was a functional finger with arthrodesed proximal interphalangeal joints and normal movement proximally.

*Fig. 12.*

Open reduction and finger pin fixation is a satisfactory method for fractures which prove unstable in plaster.

*Fig. 13.*

An alternative method using two pins to increase the stability. If two pins are used it is usually better not to cross them, as in the figure here. This tends to cause distraction.

A typical pin fixation is seen in Fig. 12 which gave excellent although not normal function. Two pins, Fig. 13 usually gave greater difficulty and loss of function although in this finger full function was restored.

Transverse or oblique shaft fractures were treated by open reduction alone (rarely possible), by pin fixation or on four occasions by an intramedullary bone graft from the olecranon. On one occasion a bone bank graft was used but this was slow to join.

If the fracture is compound, involves a joint or a tendon, it is all but certain that there will be some loss of function. The fracture that needs open reduction and pinning is unlikely to be restored to normal function. The fingers showed loss of flexion and a varying degree of flexion contracture at the proximal interphalangeal joint. The loss was rarely disabling but two fingers were finally amputated because of disabling stiffness and two from primary skin loss and late infection.

Despite this depressing picture it is believed that internal fixation has an increasing indication. The fingers may be severely damaged and it may well be impossible to save them otherwise. The pins when placed are cut off subcutaneously, this allows early movement. Loss of function in several instances has been due to poor technique, pins being deliberately passed through joints, or through the extensor expansion; neither has proved wise. Crossed pins tended to hold the fractures apart but could not always be avoided, poor apposition and fixation also caused failure. Delay in undertaking open reduction was certainly a frequent error.

It is believed that with our present appreciation of the indications the percutaneous pinning possible with the image intensifier and closed circuit television will materially improve results.

DISCUSSION

Fractures of the phalanges have varied complications special to the fingers as well as those such as non-union or infection common to all fractures.

Forward angulation of a fractured shaft is occasionally persistent and may limit flexion. Lateral angulation as small as 5° will cause overlapping of the flexing fingers. The fingers flex towards the scaphoid and a rotational deformity will also cause overlap and difficulty.

The finger joints are notoriously liable to contracture. The metacarpophalangeal joints unless held in 60° – 90° flexion during treat-

ment will develop within two to three weeks a permanent extensor contracture, limiting flexion. The interphalangeal joints particularly the proximal, rapidly develop flexion contractures when held in flexion, or extensor contractures if the finger is splinted straight, the latter particularly, causing a loss of function. Few fractures of the phalanges requiring plaster or internal fixation avoid minor flexion contractures of the proximal interphalangeal joint as a permanent sequel.

TENDONS

It is common for tendons to be lacerated or cut in association with fractures. The combination often presents insuperable difficulties to the return of full function, associated as it is with skin wounding.

Wounding of the extensor apparatus on the dorsum of the phalanges in association with fracture presents one of the most difficult of all problems in the hand.

SUMMARY

Fracture of the Fingers

	<i>Total No. of Fractures</i>	<i>No. with full function</i>
Stable	96	77
Unstable and P.O.P.	75	17
Unstable and open reduction	25	2

The result of fractures of the proximal and middle phalanges of the fingers are closely related to the degree of soft tissue wounding, skin, vessels, tendons and joints.

The majority of phalangeal fractures are stable, and active exercises with the finger splinted by its neighbour gives, in a high percentage, complete restoration of function.

When unstable, reduction and immobilisation in the flexed position in plaster gives very useful fingers but few are entirely normal. In most there is a small loss of flexion and extension is almost invariably limited at the proximal interphalangeal joint although often only by 5° to 10°. With failure to maintain reduction in plaster or in oblique condylar fractures, internal fixation with a pin cut off subcutaneously or an intramedullary graft gives adequate results despite a number of technical failures.

Delay in definitive treatment by any of the three methods was a frequent cause of serious failure.

In this paper results have been assessed in terms of limitation of joint movement and residual deformity. It was most uncommon for the patient to have a noticeable functional disability despite an imperfect result as judged by these anatomical standards.

RESUME

Fractures des doigts.

	<i>Nombre total de fractures</i>	<i>Nombre dans lesquels la fonction est entière</i>
Stables	96	77
Instables et P.O.P.	75	17
Instables et réduction ouverte ..	25	2

Les résultats obtenus dans les cas de fractures des métacarpiens et des phalanges des doigts sont étroitement liés au degré de lésion des chairs, de l'épiderme, des vaisseaux, des tendons et des articulations.

La majorité des fractures phalangiennes sont stables et des exercices actifs avec le doigt appuyé par son voisin restituent complètement la fonction dans un nombre élevé de cas.

Lorsque la fracture est instable, la réduction et l'immobilisation dans le plâtre en position de flexion donne des doigts très utiles. Toutefois, peu d'entre eux redeviennent entièrement normaux. Pour la plupart il y a une perte de flexion et l'extension est presque invariablement limitée à l'articulation interphalangienne proximale, et elle n'est que de 5 à 10°. Si l'on n'a pas opéré la réduction dans le plâtre ou lorsqu'il y a fracture condyloïde oblique, la fixation interne au moyen d'une cheville sous-cutanée ou d'une greffe intramédullaire donne de bons résultats malgré un certain nombre de non-réussites techniques.

La cause fréquente d'un grave échec est l'instauration trop tardive du traitement par l'une de ces trois méthodes.

Dans cette étude, les résultats ont été répartis en fonction de la réduction de la mobilité de l'articulation et de la déformité qui subsiste. Il est assez rare que le malade souffre d'incapacité fonctionnelle notable, même si le résultat est considéré imparfait en se basant sur ces normes anatomiques.

ZUSAMMENFASSUNG

Fingerbrüche.

	<i>Gesamtzahl der Brüche</i>	<i>Anzahl mit voller Funktion</i>
Stabile	96	77
Unstabile und P. O. P.	75	17
Unstabile und offene reposition	25	2

Die ergebnisse der Behandlung von Brüchen der proximalen und Mittelphalangen der Finger sind eng mit dem Grade der Verletzung der Weichteile, der Haut, der Gefässe, Sehnen und Gelenke.

Die Mehrzahl der Phalanxbrüche ist stabil und aktive verbunden. Übungen mit dem Finger, der an seinem Nachbarn geschient ist, ergeben in einem hohen Prozentsatz vollständige Wiederherstellung der Funktion.

Bei unstabilen Brüchen ergibt die Reposition und Ruhigstellung in gebeugter Stellung mittels Gipsverband sehr brauchbare Finger, aber nur wenige werden vollständig normal. Bei den meisten findet man einen Beugeverlust und die Streckung ist fast immer im proximalen Interphalangealgelenk herabgesetzt, häufig jedoch nur 5° bis 10°. Wenn die Aufrechterhaltung der Stellung im Pflaster misslingt oder in schrägen kondylären Brüchen gibt die interne Fixation mit einem subkutan abgeschnittenen Draht oder einem intramedullären Spahn zufriedenstellende Resultate trotz einer Anzahl von technischen Fehlern.

Verspätung von definitiver Behandlung mittels einer der drei Methoden war eine häufige Folge von ernsthaftem Misserfolg.

In dieser Arbeit wurden die Ergebnisse gemäss der Begrenzung von Gelenksbeweglichkeit und zurückbleibender Verbildung beurteilt. Nur sehr selten hatte der Patient eine merkbare Funktionseinschränkung trotz eines gemäss diesen anatomischen Masstäben beurteilten mangelhaften Ergebnisses.