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FRACTURE OF THE HEAD AND NECK OF THE RADIUS

Follow-up on 61 Patients

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Opinions are divided as to the methods of treating fractures affecting the head and neck of the radius. Meekison (1945), stating that the head is to be excised in all fractures, represents the operative extreme. The extreme conservative treatment is represented by Charnley (1963) who advised excision of the radial head only if rotation of the forearm was restricted after 2 weeks' training. In between these extremes, most therapeutic patterns are grouped, using conservative treatment of the less displaced and operation of the more displaced fractures.

By submitting the present material, we want to demonstrate that the vast majority of fractures in the head and neck of the radius may be treated conservatively with good results.

MATERIAL

The material comprises all fractures of the head and neck of the radius treated in the Orthopaedic-Surgical Hospital, Sorø, Denmark, during the period January 1958 to November 1968.

Patients with associated fractures or dislocation of the elbow were excluded. So were fractures in children, i.e. patients in whom open epiphyseal lines were seen on the X-ray films. Thereafter, the material comprises 48 females and 17 males; two had bilateral fracture, making a total of 67 fractures; 25 patients were treated on an out-patient basis and 40 were admitted.

Thirteen patients were in the age range 15–30, 36 were 31–65, and 16 were over 65 years of age.

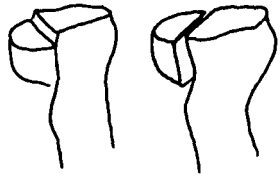
There are different ways of classifying fractures of the radial head and neck (Adler & Shaftan 1963, Bakalim 1970, Johansson 1962, Carstam 1951). As we could not naturally classify the fractures according to the named systems, we designed the system shown in Figure 1.

TREATMENT

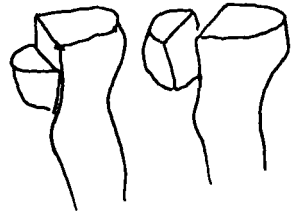
Non-operative treatment consisted in fitting a dorsal plaster cast from the knuckles to high on the upper arm, with the elbow about 80° short

Figure 1. Classification of the fractures affecting the radial head and neck into type A to F. The number of fractures within each type is given (operated cases in brackets).

Type A:8
Fracture line without any displacement.

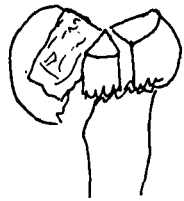


Type B:14
Fracture in which one fragment is displaced less than 1 mm.



Type C:25(2)
Fracture in which one fragment is displaced more than 1 mm.

Type D:5
Fracture with more than two fragments, but as one unit.



Type E:8 (7)
Fracture with more than two fragments which are apart.

Type F:7
Fracture of the neck only.

of full extension and with medium rotation of the forearm. The plaster cast was worn for varying periods, as may be seen from Table 1. However, 24 of the 58 conservatively treated cases were not fitted with a plaster cast.

Table 1. Duration of plaster immobilization of the various non-operated cases.

Type of fracture	A	B	C	D	E	F	Total
Without plaster	2	7	9	2	0	4	24
Plaster 1–2 weeks	4	2	6	0	0	0	12
Plaster 2–3 weeks	0	3	6	2	0	1	12
Plaster 3–4 weeks	2	1	0	1	1	1	6
Plaster more than 4 weeks	0	1	2	0	0	1	4
Total	8	14	23	5	1	7	58

Table 2. Relationship between length of training period for elbows fixed in plaster and non-immobilized elbows.

	non-immobilized	immobilized in plaster
Training 0–1 week	3	1
Training 1–2 weeks	3	11
Training 2–3 weeks	0	7
Training more than 3 weeks	7	15

Training in non-immobilized cases was started as soon as the pain had almost subsided, as a rule in 2 or 3 days. In the patients with plaster casts training was started as soon as the cast had been removed. The training was under the guidance of a physiotherapist, whether it was on an in-patient or out-patient basis.

The training period ranged from less than one week to more than three weeks (Table 2). Data are available concerning the training period for 48 patients. During the training period 7 patients had been provided with an abduction splint to counteract swelling of the elbow.

Nine fractures were treated by operation. Their data are given in Table 3. All the operations were performed within 10 days of the fracture. The training period for operated patients who were fitted with a plaster cast ranged from three weeks to six months.

FOLLOW-UP

The follow-up was conducted in the autumn of 1969. The mean follow-up period was 5.2 years. Four patients were not seen as one had died and three refused to attend.

Sixty-one patients with 63 fractures were examined at follow-up; 54 had been treated conservatively and 9 by operation. At follow-up all patients were examined clinically and 58 patients, with 59 fractures, were also examined by radiography. On the basis of the patient's statements and the clinical examination the result was recorded as excellent, good, or poor.

Excellent: No subjective complaints or negligible symptoms, i.e. occasionally mild pain on unusually severe strain or changes in the weather. Unchanged working ability. No limitation of motion.

Good: Occasionally mild pain on unusual strain or changes in the

Table 3. Data for 9 operated fractures.

Type of fract.	Type of operation	Plaster cast	Restriction of movement at follow-up				Pain	X-ray appearances	Total result
			ext.	flex.	sup.	pron.			
E	Removal of head	None	5°	0°	0°	0°	Negligible	Head irregular. A fragment, 6 × 8 mm, has not united.	Good
E	Excision of head	None	2°	0°	0°	0°	Slight when the weather is changing	Excision line smooth	Good
C	Arthrotomy and reduction. No internal fixation.	Plaster for 3 weeks	0°	0°	0°	0°	Slight	Fracture united and head of normal outline	Excellent
E	Arthrotomy, reduct. and fix. with catgut sut.	Plaster for 2 weeks	0°	0°	60°	20°	None	Head irregular. Fracture united.	Poor
E	Excision of head	Plaster for 3 weeks	0°	0°	0°	0°	Negligible	Fracture united	Excellent
E	Removal of displaced fragment	Plaster for 3 weeks	0°	0°	20°	0°	Slight on heavy strain	Head irregular. A fragment, 5 × 5 mm, not united.	Poor
C	Removal of displaced fragment	None	3°	0°	0°	0°	Slight on heavy strain	Head irregular	Good
E	Reduction without arthrotomy	Plaster for 3 weeks	5°	0°	60°	10°	None	Head irregular. Fracture united.	Poor
E	Excision of head	None	0°	0°	15°	0°	None	Excision line smooth	Poor

weather and unchanged working ability. Limitation of motion of up to 10° in one direction.

Poor: Daily pain, reduced working ability and/or limitation of motion exceeding 10° in one or more directions.

Table 4 gives the results for the 54 conservatively treated cases assessed by these criteria. Some of the results warrant further comment:

One type B fracture was assessed as poor because of a 40° extension defect and a restless feeling after prolonged strain. At follow-up there was free rotation, and radiography gave no explanation of the extension defect. This patient had been trained for 8 months.

Table 4. Results in 54 non-operated fractures at follow-up.

Type of fracture	A	B	C	D	E	F	Total
Excellent	7	11	19	4	1	6	48
Good	0	2	0	1	0	0	3
Poor	0	1	2	0	0	0	3
Total	7	14	21	5	1	6	54

Two type C fractures were assigned to the poor group, one because of a 20° extension defect; no other complaints. The other patient had free mobility, but complained of daily pain. X-rays revealed avulsions of bone where the capsule attached to the humerus.

Summing up, it may be said that none of the unoperated conservatively treated patients had deficient rotation in the forearm, and only one had major limitation of motion, *viz.* a 40° extension defect. The results for the 9 operated patients are given in Table 3.

In the radiographic follow-up we looked for a possible increase in the width of the radial head, union of the fracture, signs of osteoarthritis, avulsions of bone, and relative lengthening of the ulna at the wrist.

An increase in the width of the radial head exceeding 1 mm was found in 9 cases—5 with excellent, 3 with good, and one with poor results.

In three cases union had failed, there being a diastasis between a displaced fragment and the main fragment. These cases were in the group of excellent results.

Five non-operated cases showed small avulsions of bone medially and/or laterally at the attachment of the capsule to the humerus. Three of these cases were in the excellent, one in the good, and one in the

poor group. Three operated cases exhibited similar avulsions—one of the good and two of the poor results group. Signs of osteoarthritis were not observed in any case. None of the conservatively treated patients had upward displacement of the radius which was seen in two cases treated by excision of the radial head. None of these patients had wrist complaints.

DISCUSSION

The mechanism of trauma in fracture of the head and neck of the radius has not been consistently elucidated (Johansson 1962). If the fracture is caused by direct trauma to the elbow, it might be interpreted as an isolated injury. If, on the other hand, it is the result of an indirect trauma represented by a force acting upon the entire elbow, the fracture is not likely to be an isolated injury.

According to Radin & Riseborough (1966) direct and indirect traumas are equally common causes of these fractures.

Dickson (1949), Johansson (1962), Watson-Jones (1955), and Keon-Cohen (1966) believe that the fracture is caused by a blow which is transmitted, via the hand and forearm, to the elbow. Palmer (1961) has compared the mechanism with that in the knee, when the lateral femoral condyle collides with the lateral tibial condyle, causing a fracture of the latter.

Broadly speaking, it is widely agreed to interpret the fractures of the head and neck of the radius as a link in an extensive damage to the elbow, with injury to the capsule and collateral ligaments. We share this view. We feel that our classification from type A to E corresponds fairly well to the severity of the trauma causing the fracture, so that there is a relationship between the type of fracture and the total damage to the elbow.

Carstam (1951) interpreted small avulsions of bone at the attachment of the capsule as being equivalent to ruptures of the capsule or ligaments. In nearly all his cases he found small avulsions of bone on the follow-up radiographs. In our material we found avulsions of bone in 8 cases: 2 of type B, 3 of type C, and 3 of type E. Indeed, the tendency is for the avulsions to be most common in the most severe fractures.

Care should be taken when comparing different fractures, as there is a risk that those injuries in the elbow which are not known are not comparable. If there is to be a chance of having comparable injuries, we feel that at least each type of fracture should be compared separately.

Type A:

Meekison (1945) advised excision of the head in this type of fracture, whereas most other authors recommend a conservative treatment pattern with early active training, possibly after fixation in plaster for a time until the patient is free of pain (Adler & Shaftan 1963, Arner et al. 1957, Radin & Riseborough 1966, Castberg & Thing 1953). Bakalim (1970) feared that too early mobilization involved a risk of secondary displacement of the fragment.

Our follow-up study included 6 patients with this type of fracture, all of whom had been satisfactorily treated conservatively.

Type B:

Opinions are more divided concerning the management of this type of fracture. Charnley (1963) advised immobilization for 2 or 3 days, followed by active exercises. Bakalim (1970) immobilizes for one week. The same has been recommended by Castberg & Thing (1953), Arner et al. (1957), Adler & Shaftan (1963). Radin & Riseborough (1966) used longer-lasting immobilization because of the risk of displacement, and Dickson (1949) also advocated more prolonged fixation. Keon-Cohen (1966) excised the head or fragment at the end of a few days.

Our material comprised 14 cases of this type, all treated conservatively; 11 had an excellent, 2 a good, and 1 a poor result. The cause of the one unsatisfactory result was an extension defect and pain. As stated by Charnley (1963), it seems unlikely that an extension defect can be a consequence of the fracture itself. On the other hand, it may reasonably be ascribed to a capsular injury. One of the patients with avulsions of bone had a moderate extension defect and was grouped as a good result.

We suggest a treatment plan for this type of fracture similar to Charnley's (1963): A few days' immobilization and early training. The patient who had a poor result had worn a plaster cast for 3–4 weeks. One of those with a good result had worn a cast for 1–2 weeks, whereas the other one had not been immobilized.

Type C:

What has been stated for Type B applies in fact also to Type C. However, Radin & Riseborough (1966) feel that this type should be treated by excision of the head, if the fragment makes up more than two-thirds of the head; otherwise they recommend conservative treatment.

Adler & Shaftan use conservative treatment without regard to the size of the fragment or its displacement.

The present material included 24 fractures of this type; 22 had been treated conservatively, with a satisfactory result in 20 and a poor result in 2. One of the latter had normal mobility, but pain. The X-ray film showed avulsions of bone. This patient had been in plaster for 2–3 weeks. The other one had an extension defect and had not been in a plaster cast.

Two had been treated by operation, one by reduction and fixation, with an excellent result. In the other case the fragment was excised. The result was good, with slight extension defect and mild pain. In this case there were avulsions of bone, indicating a more extensive injury.

Types D and E:

Radin & Riseborough (1966), Bakalim (1970), Keon-Cohen (1966), and Watson-Jones (1955) recommend excision of the radial head in these types of fracture. Adler & Shaftan (1963) and Castberg & Thing (1953) found acceptable results without operation, if the fragments were not separated. Charnley (1963) advised against primary operation, but if a rotation defect persisted after training, he recommended excision of the head.

Bakalim (1970) found that 19 out of 59 fractures were spontaneously reduced when treated by early mobilization.

The operative procedure may be excision of the head or removal of loose fragments. Reduction or any other form of internal fixation is not recommended in these types of fracture.

Carstam (1951) has recommended that to some extent the operation be restricted to removal of loose fragments, *viz.* when a material part of the head is intact.

There is disagreement about the time of operation, if any. Watson-Jones (1955), Keon-Cohen (1966), and Carstam (1951) recommend operation in the course of the very first days, saying that during this period ectopic ossification is least common.

Adler & Shaftan (1963) and Arner et al. (1957), on the other hand, found no relationship between this complications and the time of operation. Charnley (1963) recommended waiting at least 2 weeks, stating that thereby he has never seen ectopic ossification.

Our 5 cases of Type D were treated conservatively, 4 with an excellent result and one with a good result, having a slight extension defect and rare pain.

Of the 8 Type E fractures one did not have an operation, and the result was excellent; 7 underwent operation, and one obtained an excellent result.

Type F:

This type is often grouped with Type A (Johansson 1962), also with respect to treatment. Our 6 cases were treated conservatively, with satisfactory results.

Should any capsular and ligamentous injuries be repaired Johansson (1962) combined treatment of the fracture and of the capsule/ligaments in 20 cases. Eight obtained free mobility in the elbow, whereas the remainder had a severe extension defect and one had ectopic ossification. These results are poorer than those of treating the fracture only and using early mobilization.

SUMMARY

Fracture of the head and neck of the radius is interpreted as that part of a more extensive cubital injury which may be demonstrated on an ordinary X-ray film. Other associated injuries are damage to the joint capsule and collateral ligaments, and cartilaginous damage on the capitulum of the humerus and the head of the radius.

The fractures were classified into groups. It was endeavoured to make the grouping correspond to a gradually greater action of force and total damage in the elbow.

During the study period 67 fractures were treated, 58 conservatively and 9 by operation. The conservative treatment consisted in no fixation or in plaster fixation for up to 4 weeks. Thereafter, training by active exercises.

Of the 63 fractures examined at follow-up, 54 had been treated conservatively. The result was excellent in 48, good in 3, and poor in 3.

On the basis of these results and studies of the literature it is concluded that fracture of the head and neck of the radius of types A, B, C, D, and F should be treated conservatively with 2–3 days' immobilization followed by active exercises.

For type E no definite treatment plan can be laid down on the basis of the present material. Reports in the literature are so heterogeneous that they also cannot support any definite procedure. Feeling that early mobilization is of decisive importance, the present authors recommend a plan in which training is instituted a few days after the

trauma. If this can be done without removal of the fragment, it is preferable, but if the exercises give rise to severe pain, it is recommended to remove the fragments at the end of 4–5 days, so that early training can be instituted.

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