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Fractures around the elbow

Late results of treatment of supracondylar humeral fractures in children

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During the period 1966-1977, 106 children were treated for supracondylar humeral fractures: 64 boys and 42 girls with a mean age of 8 (1-15) years. Seven (7 per cent) of the fractures were of the flexion type. Treatment consisted of reduction under anesthesia and plaster cast immobilization, or of reduction and overhead traction. An open reduction was performed in 8 cases. The hospital period averaged 18 (1-35) days.

The follow-up of 87 children (82 per cent) averaged 15 (10-21) years and consisted of evaluation of subjective complaints, function tests, and radiographs of both elbows. The subjective final result was excellent in 71 patients (82 per cent); only 3 per cent considered it poor. A difference in movement exceeding 20° existed in 3 of the 51 patients with overhead traction (6 per cent) and in 3 of the 28 patients with plaster cast immobilization (11 per cent). This was observed in 8 patients (9 per cent) of the entire group.

Anatomic results: 12 of the 28 patients treated with plaster cast immobilization (43 per cent) and 25 of the 51 with overhead traction (49 per cent) had a difference from the contralateral elbow of more than 5° in carrying angle. Only 9 patients developed a true cubitus varus (i.e., a carrying angle of less than 0° on the affected side). No ectopic ossifications or Volkmann contractures were seen.

The Høyer criteria were applied in evaluating the results of the different methods of treatment. These criteria encompass both subjective and objective results

(difference in function and carrying angle). According to these criteria, 83 per cent of the group showed good-to-ideal results: 90 per cent of the overhead traction, 75 per cent of the plaster cast immobilization, and 62 per cent of the open reduction cases. The changes in carrying angle during further growth were also studied. In 86 per cent of the patients no or only a minimal difference in carrying angle developed (0-4°).

Dislocated supracondylar humeral fractures in children: Long-term follow-up after percutaneous pinning

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During 25 years, 345 supracondylar fractures in children were treated. Most were not dislocated or stable after reduction. In 75 cases (all of the extension type), the reduction could not be maintained (Holmberg type III and type IV), and percutaneous Kirschner wiring was performed. The mean patient age was 8 years, and 44 patients were available for follow-up after an average of 6 years.

Applying the Flynn criteria, results were good to excellent in 81 per cent of the cases. Four patients had a cubitus varus. Elbow mobility was slightly restricted in 5 and severely restricted in 2 cases. The carrying angle (as compared with the unaffected arm) was diminished in 21, increased in 8, and unchanged in 15 cases. Muscular atrophy (about 1 cm) was observed in three arms. Most patients showed a symmetric angle after a prolonged follow-up. In 5 cases the length of the humerus was less than that on the contralateral side.

Nine patients showed percutaneous perforation of the Kirschner wire, leading to fistulization with subsequent curettage and recovery in 1 case; one Kirschner wire could not be removed from the bone.

Neither Volkmann contractures nor myositis ossificans developed. In all the cases, pronation was symmetric. Strength was scored as 5 on the Highet scale in all the cases except 1 (4/5 in flexion-extension). Six patients had neurologic problems at admission; 1 patient showed radial nerve dysfunction after reduction. These 7 patients had all recovered completely at the time of the follow-up. In 2 cases radial artery pulsations were diminished at admission, but returned to normal after reduction.

Treatment of dislocated supracondylar humeral fractures in children by percutaneous Kirschner wiring is a simple procedure. Results can be described as good, and complications are few and of a minor nature.

Dislocated supracondylar humeral fractures in children

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During the period 1972–1983, 105 children were admitted with a dislocated supracondylar humeral fracture. Most of them were treated by closed reduction and plaster cast immobilization, or by reduction and overhead traction. The former method frequently led to redislocation and reoperation under anesthesia. The mean period of hospitalization was 14 days in this group. A follow-up study revealed a cubitus varus in 31 patients (difference in carrying angle more than 5°). Only 4 of these 31 patients expressed complaints about the angle.

During the period 1984–1987, 24 children with a dislocated supracondylar fracture were admitted. All of them were treated by closed reduction under anesthesia followed by plaster cast immobilization in all of them and percutaneous Kirschner wire fixation in all but 1 case. The Kirschner wires protruding from the skin were removed at the outpatient clinic after 3 weeks, whereupon elbow movement was resumed. The mean period in the hospital was 2 days in this group. The follow-up showed no complications. No cubitus varus was observed, but in 1 case the operation had to be repeated after 24 hours in view of an unsatisfactory position.

We conclude that reduction and percutaneous Kirschner wire fixation is the treatment of choice for dislocated supracondylar fractures in children.

The "forgotten" medial humeral epicondyle

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Nine primarily overlooked avulsions or fractures of the internal humeral epicondyle sustained at age 11–16 years were found between 1981 and 1986 to cause so many complaints that operative intervention was justified. The operations were performed 2 months to 14 years after the original accident. Seven cases originally involved dislocation of the elbow with additional injury that was overlooked and left restricted extension and ulnar nerve irritation. In 1 case a solitary avulsion of the epicondyle was overlooked. In 1 case, a fracture of the olecranon with avulsion of the epicondyle was overlooked. In 6 cases the epicondyle was removed, with a favorable result. One was successfully treated by osteosynthesis of the epicondyle. Arthrolysis with removal of the epicondyle from the trochlea was done in 2 cases (good and moderate result, respectively).

Our conclusion is that adequate primary treatment of fractures of the internal humeral epicondyle is essential.

Treatment of radial head fractures: operative or conservative?

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From August 1979 until January 1984 (period I), 69 radial head fractures were treated operatively (upon broad indications). During the following period (II) from January 1984 until August 1986, these fractures were in principle treated conservatively (59 of a total of 64 patients).

Operative therapy comprised osteosynthesis according to AO principles or extirpation for severely comminuted fractures. Conservative treatment was functional: pressure bandage and/or plaster splint for 1 week, followed by intensive exercise.

A retrospective study of the results obtained in these two series involved a follow-up after 4 (3–7) years of the patients of period I, and after 18 (4–36) months of the patients of period II. During period I, 22 simple fractures (Mason type I or Murray types I and II) were treated: internal fixation was successful in 21 cases, 1 case requiring extirpation. During period II, 24 comparable fractures were all treated conservatively.

The final results were excellent in both groups; no

patient had any complaint of significance, and restrictions of elbow-joint function were virtually absent.

During period I, 47 dislocated and comminuted fractures (Mason types II and III, Murray types III and IV) were treated surgically: 25 by internal fixation and 22 by extirpation (without implantation of a prosthesis). During period II, 35 similar fractures were treated functionally, only 1 by osteosynthesis and 4 by extirpation.

After 25 osteosyntheses, 2 patients had more than 10° loss of extension, and in 5 cases rotation was restricted (maximally 30°). After functional therapy, extension was diminished in only 5 cases, and loss of rotation was observed only once. After 26 radial head extirpations, 7 patients had troublesome pain around the elbow joint or wrist joint; more than 10° loss of extension in 9 cases was combined with loss of rotation, in some cases exceeding 30°.

These retrospective findings would seem to warrant the following conclusions:

1. simple radial head fractures heal without major problems, regardless of the type of therapy;
2. in comminuted fractures, results of surgical and conservative therapy do not differ even if internal fixation succeeds;
3. surgical treatment of comminuted fractures leads to extirpation in half of the cases;
4. after radial head extirpation without implantation of a prosthesis, functional results are moderate to poor in one third of the cases.

Indications for surgical therapy, even in cases of severely comminuted and dislocated radial head fractures, should be determined with great prudence.

Overlooked radial head dislocations in children

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During the period 1973–1983, 5 patients with suspected traumatic radial head dislocation were treated by operation. In all the cases the dislocation had existed for more than 2 years. In only 1 case could reduction be retained. Morphologic changes associated with long-standing dislocation of the head of the radius impeded attempts at anatomic restoration in the other cases. In the end, a primary or secondary radial head extirpation was performed in these cases.

In view of these findings, it seems advisable to be prudent in defining operative indications in the group

of patients with long-standing radial head dislocations: reconstructive possibilities diminish as the duration of the dislocation increases.

Operative therapy of radial head fractures

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Between December 1973 and May 1985, 22 patients with a radial head fracture were treated surgically. Indications were more than 2-mm dislocation, dislocated comminuted fracture, and a loose fragment of at least one third of the articular surface. Operations were performed as soon as possible (1–3 days) after the accident; in 1 case the operation was performed after 6 days.

The joint was approached via a posterolateral incision; the joint was opened and washed out, loose, nonreducible fragments were removed, and the fracture was reduced. Maximum pronation and supination usually made it possible to inspect the entire articular surface.

Fixation was effected with one or two 2.7-mm AO screws in 21 cases. An antiglide plate was used in 1 case because the fracture was too comminuted.

Postoperative management: plaster cast immobilization for 14 days followed by active exercises in order to achieve maximum function as quickly as possible. After about 3 months, the osteosynthesis material was removed.

Of the 22 patients, 19 were available for a follow-up to evaluate subjective complaints, function, and radiographic features. Function was quantified by means of the scoring system of Firica and Troianescu. The mean follow-up was 3.5 (0.5–10) years.

Sixteen patients scored "very good" and 3 scored "good." Osteosynthesis of a radial head fracture may generally be expected to give excellent results.

Retrospective study of therapeutic results in radial head fractures in adults

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Treatment of types I and II fractures consisted of 1–3 weeks in a pressure bandage or plaster splint; types III

and IV were nearly always treated by radial head resection followed by a few weeks of immobilization.

After a mean follow-up period of 22 months, 43 patients were available for a follow-up (13 with type I, 18 with type II, 9 with type III, and 3 with type IV).

Fractures of types I and II had a favorable prognosis: minor pain complaints upon intensive use of the elbow and slight restriction of extension. The prognosis of types III and IV fractures was less favorable: more marked and more frequent restrictions of extension and supination; arthrotic lesions were more marked, but not clearly related to reduced function or pain complaints. The literature frequently mentions proximal migration of the radius following radial head excision, but this was not found in our series.

Radial head fractures: Radial head excision versus replacement arthroplasty

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Radial head excision has long been the accepted treatment of comminuted radial head fractures. However, many residual problems have been described, mostly due to proximal migration of the radius and ossification at the stump. In the past there has been doubt between conservative therapy and excision, and a few years ago replacement of the head of the radius by a prosthesis attracted attention. Implantation of a prosthesis should maintain the anatomic relationship between the radius and ulna.

We performed a follow-up study of radial head fractures treated during the period 1980–1984: 19 patients treated by radial head excision and 13 by implantation of a prosthesis. The mean age was 42 years in the excision group and 45 years in the prosthesis group. The excision group comprised 8 men and 11 women, whereas the prosthesis group consisted of 4 men and 9 women.

The fractures were classified according to Rockwood and Green: 3 type II, 13 type III, and 3 type IV fractures in the excision group; 2 type II, 8 type III, and 3 type IV fractures in the prosthesis group. The follow-up averaged 47 (15–66) months in the excision group and 20 (15–25) months in the prosthesis group.

Results in terms of pain were slight elbow pain in 4 and severe pain in 3 patients of the excision group, and slight pain in 6 patients in the prosthesis group. Slight wrist pain in 3 and severe pain in 1 patient of the excision group, and slight pain in 4 patients of the prosthesis group.

Activities were slightly restricted in 8 and severely

restricted in 4 patients of the excision group (5 and 2, respectively, of the prosthesis group).

Ulnar nerve symptoms developed in 2 patients in both groups. Subluxation in the distal radioulnar joint was found in 4 excision patients, 2 of whom had complaints. Increased cubitus valgus was observed in 9 excision patients and in 4 prosthesis patients. Extension was normal in 15 excision patients and in 4 prosthesis patients. Flexion was restricted in 4 excision patients and in 6 prosthesis patients. Restricted pronation was not seen in the excision group, but occurred in 2 prosthesis patients. Restricted supination was seen in 7 excision patients and in 5 prosthesis patients. Loss of strength was evident in 9 excision patients and in 6 prosthesis patients.

The findings indicate that both therapies may cause frequent complaints and residual symptoms. Only a limited number of patients have no complaints and show optimal function.

Some of the complaints after excision are due to ossification at the radius stump. In this series there were hardly any indications of proximal migration of the radius causing complaints. Some of the symptoms following arthroplasty may have been due to incorrect fitting of the prosthesis or ossification.

Excision has the advantage of relative simplicity, but a well-shaped and well-finished stump is an absolute necessity.

Replacement arthroplasty is more difficult, and a snug fit of an appropriately sized prosthesis is important. A disadvantage is that evaluation by standard radiographic examination is difficult, that the life span of a prosthesis is limited, and the long-term results are as yet unknown.

Late results of radial head excision after radial head fracture

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Excision of a fractured radial head was performed in 29 cases over the period 1975–1983. Twenty patients were available for a follow-up. The patients were classified by fracture type (Mason I-III) and early or late excision.

The Broberg and Morrey score was used as an objective functional score. It proved to correlate well with the subjective score indicated by the patients.

Twelve patients described the result of the operation as excellent or good; 8 had been treated by early excision of a type III fracture. Ten patients defined the result as moderate to poor (five type II fractures, of which four were treated by late excision).

Function tests showed that mobility and strength were inferior in the late excision group. Radiographic evidence of arthrotic lesions was obtained in 80 per cent of the patients; four grades were distinguished. The objective functional score was excellent/good in 13 and moderate/poor in 7 patients.

The findings show that radial head excision after fracture often fails to produce a good result. Fair-to-good long-term results may be expected after early excision of the head of the radius in patients with type III fractures.

Treatment of comminuted intercondylar humeral fractures

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Treatment of comminuted intercondylar humeral fractures (Riseborough and Radin type IV, AO type C III) is known to pose problems.

A prospective study was performed at the King Edward VIII Hospital, Durban, South Africa. In the order of arrival, fractures were treated alternately by 1) overhead traction using an olecranon screw for 3 weeks, followed by functional treatment with a collar and cuff (n 10); 2) open reduction and internal fixation with a Y-plate, followed by functional treatment (n 10); 3) patients not willing to participate in the study were given a collar and cuff for 6 weeks.

In addition, a retrospective study was performed of the results obtained by olecranon screw traction at Leiden University Hospital during the period 1980–1985.

The results can be summarized as follows:

	Therapy	No. of patients	Mean motility
Prospective study	Collar and cuff	4	43–95°
	Overhead traction	10	37–104°
	Internal fixation	10	35–97°
Retrospective study	Overhead traction	5	45–110°

A complication developed in 3 patients treated by internal fixation: transient ulnar nerve palsy in 2 cases and partial loss of fixation in 1 case.

We conclude that traction is to be preferred in the treatment of comminuted intercondylar humeral frac-

tures in view of good functional results and low morbidity.

Results of treatment of distal humeral fractures

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During the period 1975–1985, 59 adults with distal humeral fractures were treated. The fractures were classified according to the AO system: 19 type A fractures, one type B fracture, and 39 type C fractures. C2 and C3 fractures accounted for 36 of the 39 type C fractures.

Osteosynthesis was performed in 57 cases; in 1 case a fragment of a lateral epicondyle (A1) was resected, and one fracture was treated in a plaster cast.

Results were very good or good in 37, moderate in 9, and poor in 2 of the 59 patients. In 11 instances follow-up was lacking. The results after osteosynthesis were very good or good in 36 cases. The eight moderate and two poor results were largely found in the group of type C fractures.

Postoperative management in a plaster cast proved to have a negative effect on the final result. Early exercise is of decisive importance for functional restoration of the elbow after a fracture of this category. This functional therapy is feasible only if an exercise-stable fixation of the fracture fragments is achieved.

Conservative treatment of distal humeral fractures in adults rarely leads to acceptable results. The considerable lever forces acting on this region of the upper arm nearly always lead to incongruences and deformities, with chronic pain and/or loss of function. Operative therapy is to be preferred for distal humeral fractures in adults.

Results of operative treatment of olecranon fractures

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Data in this study concerned 71 of 81 patients with an isolated olecranon fracture treated during the period 1981 through 1985. The mean age at the time of the accident was 50 years. In 50 instances the fracture was caused by a direct fall on the elbow, whereas 20 patients

sustained the fracture in a traffic accident. The fractures were either comminuted or transverse.

Seventy fractures were treated surgically: 69 by tension-band wiring according to Weber-Vasey and one by AO-plate osteosynthesis. One patient was treated conservatively.

In 40 cases the operation was followed by plaster cast immobilization during an average of 3.6 (1–6) weeks, whereas 30 patients received functional postoperative treatment.

Therapeutic results were classified according to Macko and Szabo (1985). They were good to excellent in 55 cases, moderate in 8, and poor in 6. Migration of one or both Kirschner wires occurred in 22 cases; complaints necessitated premature removal of the osteosynthesis material in 7 cases. In this series no correlation was demonstrable between the length of the Kirschner wire and any subsidence of it. Migration of wires, premature removal of osteosynthesis material or the duration of postoperative plaster cast immobilization had no demonstrable effect on the final results.

The poor results were obtained in the treatment of comminuted olecranon fractures.

We conclude that operative treatment of isolated olecranon fractures applying the tension-band wiring principle of Weber-Vasey is a reliable procedure with few complications and good final results.

Fractures of the olecranon

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During the period 1974–1984, 90 patients with fractures of the olecranon and proximal ulna were treated: 5 cases were not available for a follow-up.

Causes of fractures were traffic accidents (47 cases, including 15 multiple-injury patients), domestic accidents (24 cases), work (5 cases), sports (3 cases), and other causes (11 cases). Additional injuries of the same arm existed in 13 cases; 12 fractures were open. The mean age was 40 years; the sex ratio and left:right ratio were 1:1. The age distribution showed two peaks: one in the second and one in the seventh decade of life.

In addition to the AO classification system distinguishing A1, A2, and A3 fractures, the Eitel and Schweiberer classification distinguishing fracture types A, B, C, and D was used. The latter system is simple and seems more readily manageable. Sixty fractures were transverse or oblique and 28 fractures multiple-fragment or comminuted.

In all, 48 fractures were treated by tension-band

wiring and 16 by tension-band screw. All A fractures and the majority of B fractures were treated by tension-band wiring. Plate osteosynthesis was performed in half of the D fractures and in one fifth of the C fractures. Postoperative treatment was functional.

The results were evaluated using a simple-system scoring: pain, function and radiographic features. The scores obtained were very good in 63 cases, good in 14, moderate in 5, and poor in 3 cases.

There were few complications. No infections developed. Pseudarthrosis occurred in 3 fractures. One patient was an elderly lady with rheumatoid arthritis whose type-B fracture was treated conservatively/functionally. Her final score was moderate. Two patients with a type-C fracture developed pseudarthrosis due to poor osteosynthesis (tension-band wiring). They scored "good" and "very good," respectively, after re-osteosynthesis with plate and screws. The 8 patients who scored moderate/poor included 5 with a highly comminuted type D fracture, the above-mentioned RA patient, and 1 female patient with posttraumatic osteoporosis (Sudeck).

Fractures of the olecranon and proximal ulna are relatively simple fractures for which a clearly defined technique is available. Classification is useful because it indicates the appropriate therapy: plate osteosynthesis for unstable type-C and comminuted type-D fractures. A striking fact is that the pseudarthrosis in this series developed in patients with unstable type-C fractures treated by tension-band wiring. If no plate is used, then, tension-band wiring combined with lag-screw osteosynthesis is the minimum required. This view is supported in the publication of Eitel and Schweiberer.

The poor results were mostly observed in the D-fracture group with considerable joint destruction despite adequate osteosynthesis. A and B fractures can be treated without problems by simple tension-band wiring.

Preliminary experience and results of functional dynamic treatment of elbow dislocations with the aid of a hinged elbow splint

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Elbow dislocations were treated according to the following protocol.

1. After reduction the patient wears a plaster splint for 3 days.
2. On the fourth day a hinged elbow splint is fitted and the range of movement adjusted. The physiother-

apist readjusts the range of movement three times a week for 2 weeks on the basis of pain, swelling, and stability. The patient is instructed to exercise actively and to use the arm functionally within the preset range.

3. The hinged elbow splint is removed after 2 weeks, and physiotherapy is continued for about 3 weeks.

In 7 cases this functional dynamic treatment protocol was completed. After about 6 weeks, movement was restored to full excursions in all the cases. Complications, such as redislocation or myositis ossificans, were not observed.

Radiographic diagnosis of posttraumatic lesions of the elbow

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In posttraumatic restrictions of motion and/or locking complaints suggestive of chondral damage and corpora libera, arthrotomography is indicated: After injection of 1 ml of iodinated contrast medium (Hexabrix 320) and 8–12 ml air, the joint is laterally tomographed with a section interval of 3–5 mm. The preferable position is about 110° flexion of the elbow. In the case of restricted movement, this examination should be supplemented with a lateral tomogram in the locked position. In the case of osteonecrosis of the capitulum, supplementary tomography in the oblique position at maximum extension is indicated.

In a group of 45 patients of whom 18 had a history of trauma, the arthrotomographic findings were reviewed.

In 14 patients, chondral or osseous corpora libera was found: 7 showed osteonecrosis of the capitulum; 2 had restricted movement caused by chondral or osseous hooks or ridges; and in 3 cases, motion was restricted because of consolidation of a fracture in a dislocated position.

Chondral damage was found in 12 patients, and 6 showed constriction of the capsule or adhesions. In 3 patients the capsule was too wide, and extraarticular ossifications were demonstrable in 5 patients. Four patients showed improvement or disappearance of their complaints after arthrography.

In 2 cases an adhesiolysis was performed under arthrographic control; this resulted in distinct improvement in motility. In 43 cases the arthrotomographic findings determined the choice between operative and conservative therapy.

Operations were performed on 13 patients, and in all of them the findings at arthrotomy corresponded well with the arthrographic findings.

Supracondylar corrective osteotomy of the humerus for posttraumatic deformity of the elbow

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Eight patients with a mean age of 22 (15–31) years were treated for a deformity of the distal humerus by a supracondylar corrective osteotomy. Four patients had a valgus deformity averaging 25° (10–40°), and 4 had a varus deformity averaging 40° (20–70°). An extension restriction in 7 patients averaged 30° (10–50°).

A normal arm axis was achieved in 5 patients, whereas an axis deviation of 5–10° persisted in 3. The extension restriction in 7 patients diminished by an average of 23° to an average of 7° (0–20°). One patient suffering from ulnar nerve irritation due to a valgus deformity no longer had any complaints after the operation.

All the patients showed a loss of flexion proportionate to the gain in extension. In 1 patient, however, a loss of flexion, as well as of extension, existed (10°).

Osteotomy and fixation with a small DC-plate was in all the cases followed by uneventful consolidation. Six patients were satisfied with the functional result; 2 were only moderately satisfied. All of them were very satisfied with the cosmetic result.

Supracondylar osteotomy of the humerus to correct a posttraumatic deformity of the elbow is a rewarding procedure, but patients should be informed of the fact that an increase in extension generally entails a decrease in flexion. The most favorable timing of the correction is immediately after completion of growth.

Pseudarthrosis of the distal humerus

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Four children presented with pseudarthrosis of the medial humeral condyle. One was asymptomatic and therefore was not treated. The operative indications in the other 3 cases were pain, valgus deformity with ulnar nerve irritation, and 10–45° restriction of extension. An excision was performed in 1 case, and the other 2 involved screw osteosynthesis with proximal tension-band wiring.

Pseudarthroses of the lateral condyle were treated in 3 children. Operative indications were restricted flexion, pain, and valgus deformity resulting from a growth disorder. Operations involved reduction, cancellous bone graft, and fixation – in 1 case tension-band wiring

and Kirschner wire, and plate osteosynthesis in 1 case. An ulnar nerve release was performed in 1 case. Postoperative re-osteosynthesis was required in 2 cases owing to a broken plate. In 2 cases, osteosynthesis material was removed and a release was performed in view of loss of function resulting from the operation.

At follow-up 5 years after the operation, all of these children were free from pain and had a stable elbow. All of them showed improved function, but 2 had required a release for this.

Seven adults presented with pain, instability, and loss of function. Two had a neuropathy. Therapy consisted of arthrodesis in 1 patient with a unicondylar pseudarthrosis in view of severe deformity and a very contracted joint.

Three supracondylar and three bicondylar pseudarthroses were treated by primary radial stabilization with a DC plate – if necessary after shortening or implantation of cancellous bone and chips. Ulnar stabilization with screw or plate was achieved in 4 cases showing insufficient stability. Postoperative loss of function was observed in 2 cases.

At the follow-up, all the patients were free from pain. All of them showed some functional limitation, but no instability. In 1 case arthrosis had developed.

Conclusions: 1) The aim of therapy should be rigid fixation with neurolysis if necessary; the functional result takes precedence over the anatomic result; 2) in loss of function resulting from osteosynthesis, osteosynthesis material should be removed and arthrolysis performed.

Arthrolysis of the elbow joint in the case of posttraumatic restriction of movement

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A retrospective study was performed of 14 patients (10 males and 4 females) submitted to arthrolysis of the elbow joint in view of posttraumatic restriction of movement. The original lesions were three transcondylar humeral fractures, two fracture-dislocations, one humeral capitellum fracture, two radial head fractures, four dislocations, one fracture of the medial epicondyle, and one elbow distortion.

Indications for arthrolysis were a flexion range less than 90°, no gain in mobility after 6 months' of active exercise therapy, and absence of degenerative lesions at

radiographic examination. The operation was performed via the lateral approach according to Kocher.

Transient paresthesiae in the ulnar region developed after the operation in 3 patients. In 1 patient, persistent paresthesiae in the ulnar region necessitated anterior transposition of the ulnar nerve.

The results of arthrolysis were scored by the relative gain method (Cauchoix and Deburge 1965). The mean gain in elbow mobility in this group was 41 per cent. The gain was 35 per cent after an intraarticular lesion and 51 per cent after an extraarticular lesion. After an operation performed within 13 months of the accident, the gain averaged 51 per cent, whereas that after operations performed later, averaged 33 per cent. In patients older than 30 years, the relative gain averaged 39 per cent, versus 46 per cent in patients younger than 30 years.

Nine patients resumed their former work, 4 were given different work, and 1 remained unfit for work.

Arthrolysis of the elbow joint

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During the period 1981 through 1986, open arthrolysis of the elbow joint was performed in 20 patients (9 females), with a mean age of 32 (12–61) years, showing posttraumatic restriction of elbow function. Eleven patients complained of pain before the operation.

In the case of periarticular calcifications, the technetium scan should become negative before arthrolysis is performed.

The operation encompassed wide resection of ossifications and the ventral joint capsule, as well as in 4 patients neurolysis of the ulnar nerve. The mean follow-up was 2.6 years.

As a result of the operation, the mean preoperative restriction of extension improved from 46° (25–95°) to 32° (5–95°), whereas mean flexion improved from 103° (45–150°) to 123° (100–150°).

The mean functional gain in this series was 34°; 3 patients ultimately showed no gain, but no patient showed any further loss as a result of the operation.

Of the 11 patients who indicated pain before the operation, 6 had no pain at the follow-up; in 3 the pain was less; in 2 there was no alleviation of pain.