

OLECRANON FRACTURES TREATED IN THE
ORTHOPÆDIC HOSPITAL, COPENHAGEN 1936—47
A FOLLOW-UP EXAMINATION

BY
INGEBORG LOU

In 1947 Francis M. McKeever and Ronald M. Buck published in the *Journal of the American Medical Association* 10 cases of fracture of the olecranon, treated by excision of the proximal fragment and plastic operation on the triceps tendon. The authors maintain that the fragment can be excised when only the coronoid process and the distal vertical part of the olecranon's joint surface is preserved. They maintain that this treatment gives good and early movement, good power of the triceps and little inconvenience from the elbow-joint, and conclude that:

1) pseudarthrosis of the olecranon should be treated by this method,

2) bone-grafting should not be done in these pseudarthroses,

3) severely comminuted fractures of the olecranon should be treated immediately by excision of the fragments and a plastic operation on the triceps tendon.

4) Older patients with fresh olecranon fractures should be treated by this method.

5) Fragments of the olecranon which do not form part of the joint surface should be removed.

6) One need not fear instability of the elbow-joint if the coronoid process and the distal vertical part of the joint

surface of the semilunar (trochlear) notch is preserved. They consider that up to 80 % of the semilunar notch can be removed without fear of instability of the joint.

7) There is no danger of significant triceps insufficiency even when large fragments of the olecranon are removed.

Watson-Jones recommends excision of the fragment in older patients, especially when the fracture is high and the fragment includes less than $\frac{1}{3}$ of the semilunar notch. He considers that the method has the advantage that the elbow-joint is not immobilised for a long period (10 days), while McKeever and Buck immobilise in a plaster cast for 3 weeks, followed by 10 days in a sling and then active exercise. Since these authors claimed such excellent results in both fresh and old fractures, I decided to follow up the cases of olecranon fracture which had been seen and treated in the Orthopædic Hospital in Copenhagen 1936-47, to discover whether there were any grounds for believing that the results of treatment would be better if the olecranon fragments were removed in more cases than had been our custom.

During the period mentioned 45 patients with olecranon fractures had been treated; there were 23 men and 22 women; 10 had been treated mainly elsewhere, and 35 had been treated mainly in this hospital. The following methods were used:—

- 1) Sling.
- 2) Plaster, with or without preliminary reduction.
- 3) Osteosynthesis with
 - a) screws
 - b) Alemann's nail
 - c) Wire or Darnyl thread.
- 4) Removal of the fragment.

Table I shows that of 45 patients treated 39 were followed up. Of these 39, 2 were treated with a sling, 12 with plaster, 22 by osteosynthesis, and 3 by removal of the fragments. Of the 6 patients who could not be found 3 had had plaster and 3 osteosynthesis.

Table II shows how the fractures occurred; of the 45 cases the origin of the fractures was unknown in 2; in only 4 was it produced by direct trauma at work, in 6 by complicated

TABLE I
*Olecranon Fractures treated at the Orthopaedic Hospital,
 Copenhagen 1936-47.*

	Total	Followed up	Not followed up
Sling	2	2	
Plaster			
with reduction	2	1	1
without reduction	13	11	2
Osteosynthesis			
a) screw	4	3	1
b) Alemann's nail	8	8	
c) Wire or Damyl	13	11	2
Removal of fragment	3	3	
	45	39	6

TABLE II
Origin of Injury.

Total No. of Injuries	Fall on the arm	Road Accident	Direct Trauma at work	Unknown
45	33	6	4	2

injury (road and sport accidents) while in 33 the patient fell on the arm while walking in the street or in his own home or by falling down stairs, etc. The observation period varied between 4 months and 14 years (this last case was a patient who had been treated elsewhere for an olecranon fracture 12 years previously). 31 patients have been observed for over a year. (Table III).

The age distribution of the patients is shown in Table IV.

TABLE III
Period under Observation.

1 Year or less	1-2 Years	3 Years	4 Years	5 Years and more
8	11	5	2	13

TABLE IV

Method of Treatment	Age groups				Total
	Under 18	18-40	40-60	ov. 60	
Sling	2				2
Plaster					
with reduction	1				1
without reduction	4	1	1	5	11
Osteosynthesis					
a) screw			3		3
b) Alemann's nail		4	3	1	8
c) Wire or Damyl	1	7	2	1	11
Removal of fragment			3		3
	8	12	12	7	39

The majority, 24, are within the wage-earning ages, from 18 to 60 years, but, as has already been mentioned, only very few were injured at work. They include most of the patients who were treated by osteosynthesis.

TABLE V
Duration of Immobilisation.

	2 weeks or less	2-4 weeks	5-6 weeks	7-8 weeks	ov. 8 weeks	Un- known	Total
Sling	1					1	2
Plaster							
with reduction		1					1
without reduction	2	5	3	1			11
Osteosynthesis							
a) screw	1		2				3
b) Alemann's nail		4	2		1	1	8
c) Wire or Damyl	2	5	1	2		1	11
Removal of fragment		1				2	3
	6	16	8	3	1	5	39
Under 18 years	2	4	1			1	8
18-40 „	1	4	3	2		2	12
40-60 „	2	4	3		1	2	12
over 60 „	1	4	1	1			7
	6	16	8	3	1	5	39

Table V shows how long immobilisation was continued, in relation to both the method of treatment and the patient's age. Only one case was immobilised for over 8 weeks; it was immobilised for 12 weeks and will be discussed later.

TABLE VI
Unable to Work.

	1 Month or less	1-2 months	3-4 months	5-6 months	ov. 6 months	Un- known	Total
Sling	1					1	2
Plaster							
with reduction	1						1
without reduction	1	6	1			3	11
Osteosynthesis							
a) screw			2			1	3
b) Alemann's nail		3	3		2		8
c) Wire or Danyl	1	5	1	1		3	11
Removal of fragment	1	2					3
	5	16	7	1	2	8	39
Under 18 years	3	2				3	8
18-40 "	1	6	1	1	1	2	12
40-60 "	1	5	4		1	1	12
over 60 "		3	2			2	7
	5	16	7	1	2	8	39

Table VI shows how long the patients were unable to work in relation to both the method of treatment and to their age. It shows that only 2 patients were off work for more than 6 months; the rest returned to work from 1 to 6 months after injury. 21 of the 39 cases who were followed-up returned to work within 2 months; of the 24 patients in the age-group 18 to 60 years 13 were at work within 2 months.

Table VII shows the result of treatment in relation to the method and the age-group. 38 of the 39 cases are able to do full work, though 6 of these must be considered to have serious trouble (reduced joint movement, reduced power, or pain). 11 have insignificant impairment, usually slight restriction of extension without otherwise any triceps insuffi-

TABLE VII
Results of Treatment.

	Perfect	Minor troubles	Major troubles not interfering with work	Major troubles reducing working capacity	Total
Sling		2			2
Plaster					
with reduction	1				1
without reduction	8	2	1		11
Osteosynthesis					
a) screw		3			3
b) Alemann's nail	3	2	2	1	8
c) Wire or Darnyl	7	1	3		11
Removal of fragment	2	1			3
	21	11	6	1	39
Under 18 years	5	2	1		8
18-40 „	7	1	4		12
40-60 „	5	5	1	1	12
over 60 „	4	3			7
	21	11	6	1	39

ciency. The remaining cases are perfect and it is interesting to note that these fractures did not have serious after-effects in any of the older patients. Our oldest patient was 95 years. The 11 patients who had unimportant after-effects will not be considered further, since there were similar after-effects in some of the patients in the American material. Nor shall I discuss further the cases with perfect results, since the methods used are shown in the tables. Rather will I go through the 7 cases with serious disabilities, of whom, however, 6 are fully employed in their usual occupations. Some are office-workers and others light labourers.

Only one is unable to work in his usual occupation, that of groom.

67/45. A 46-year old groom, who was kicked on the right olecranon by a horse, and received a fracture which split the whole olecranon, the fracture line running from 1 cm

below the tip of the coronoid process on the joint surface obliquely posteriorly and downwards to 2-3 cm distal to the joint. He was treated in Department I of the Orthopædic Hospital. 2 weeks after the injury reduction and fusion with Alemann's nail was tried without success. Later, reduction was attempted using a wire through the forearm just above the wrist joint, and 6 weeks after the injury a further osteosynthesis was made using a thicker nail, which held the fracture securely. Plaster for 2 months; the nail was removed at the same time as the plaster. The position appeared to be quite good, though there was considerable decalcification and undoubted incongruence of the joint surfaces.

On examination 2½ years after the injury the right elbow movements were: flexion 130-80°, a few degrees of supination, and pronation 70°. There were pain and crepitation in the joint on movement. The patient was able to work a little now and then, but not steadily. If one wonders whether his condition would have been better if the olecranon fragment had been removed, one must, I think, suppose that it would not have been better, since the fracture line extended too far down the ulna, and the greater part of the semilunar notch was on the loose fragment, leaving only a small part of the joint surface on the coronoid process, so that his elbow-joint would presumably have been unstable and unsuitable for his work.

10074/44. A 9-year-old girl treated elsewhere with plaster for fracture of the left olecranon. She was seen in the Orthopædic Hospital in October 1944, 2 months after the injury. Radiography showed the results of a comminuted fracture. The semilunar notch was well preserved. Flexion was 150-30°; there was no pain. No further treatment was given beyond active exercises, and the patient was not seen again until the follow-up examination in Nov. 1947. Flexion at the elbow was considerably reduced, to 140-30°. She complained of weakness of the elbow on movement and discomfort in the joint. Radiography showed a deformity of the olecranon with at least one of the original fragments in a position which prevented movement, that is to say, extension. After removal of this fragment

and a plastic triceps operation the range of movement was improved to 30-165°, and was painless.

It is noted that this is the only patient treated with sling or plaster who had serious disability later.

This patient benefitted from the operation recommended by the Americans, since the extension in the elbow-joint was improved by 25°.

3424/47. A 30-year-old housewife and grocer's assistant, treated elsewhere 6 months previously for fracture of the right olecranon by osteosynthesis using an Alemann's nail. She came to the Orthopædic Hospital in April 1947 because of reduced movement in the elbow-joint and pain in the shoulder, arm and forearm. Flexion of the elbow was 160/75°. Radiography showed, as well as an old olecranon fracture (in good position), patchy decalcification of the olecranon: no definite evidence of arthrosis.

With heat treatment the condition improved, and at examination 1 year after injury flexion in the elbow-joint was 165-50°; there was no evidence of triceps insufficiency, but radiography showed deformity of the joint. This patient was able to work after 7 months. One could of course try chiselling off the olecranon spike, but it is not certain that the condition would be improved.

6688/43. A 25-year-old female accountant, treated in Department I of the Orthopædic Hospital for a 2-day-old fracture of the olecranon, running transversely across it, so that the separated fragment was about 3 cm long, and included nearly half of the joint surface. An osteosynthesis using an Alemann's nail was done, and she returned to work 6 weeks after operation. Everything went well, though the joint movement was a little reduced, until 5½ months after operation, when she clung too hard to a tram which was starting, and refractured the bone; it was put in plaster for a month. Result: Pseudarthrosis. When she was examined 4 years after the first fracture, flexion was 160-40°, there was slight crepitation on movement of the joint, full pronation and supination; occasional pain, but not enough to prevent

her working. Radiography shows pseudarthrosis and incongruence of the joint. She is reluctant to have an operation, and can certainly only be helped by removal of the fragment and a plastic operation on the triceps tendon.

3109/46. A 36-year-old housewife treated elsewhere by osteosynthesis with wiring. Infection occurred postoperatively. At examination at the Orthopædic Hospital 6 months after operation there was found to be considerable reduction of movement and pain when movement was attempted. With heat treatment and discontinuation of the massage and exercises ordered elsewhere there was fair improvement. On examination 2 years after injury there was reduced movement and pain in the elbow-joint (Flexion $110-65^{\circ}$; supination and pronation 70°). Radiography showed severe arthrosis in the elbow-joint. She is able to do her work.

She has a marked arthrosis as well as infection in her history, so that operation is contra-indicated.

3265/46. A 43-year-old waiter with a fresh comminuted fracture of the olecranon, treated in Department II of the Orthopædic Hospital, with osteosynthesis using Damyl sutures after reduction of the fracture. Plaster for 4 weeks. Able to carry on with his work 3 months after injury. At examination flexion was $155-50^{\circ}$, pronation full and supination nearly full. There was occasional tenderness of the elbow region with crepitations on movement; some triceps insufficiency. Radiography showed an irregular semilunar notch and arthrosis, but otherwise good shape of the joint.

It is possible that this patient could have been benefitted by removing the two fragments originally, since only about $\frac{1}{3}$ of the semilunar notch had been fractured for half the bone's width although for the other half of the width more than half of the notch was lost.

4064/45. A 22-year-old small farmer, treated elsewhere 12 years before he was seen at the Orthopædic Hospital, for a fracture on the right olecranon which had been treated by wiring. The patient had been in hospital for 15 days; it is not known how long the elbow was immobilised. 4 months after

operation suppuration occurred and the wire was removed.

Examination 12 years after the injury showed a pseudarthrosis at the site of the fracture, a piece of the olecranon $1\frac{1}{2}$ cm long being separated from the rest.

When re-examined 2 years later, 14 years after the accident, he was working as a cement worker; sometimes he had a few sharp pains at the site of the olecranon. Flexion $160-50^{\circ}$, supination and pronation were full. Slight triceps insufficiency. 1 cm atrophy of the arm.

This patient could have been benefitted by excision of the fragment and a triceps tendon plastic operation when he was first seen 12 years after the injury, but, since 2 years later he was fully able to do heavy work, one did not like to recommend an operation.

The results of the different methods of treatment given do not differ much from one another. It is not surprising that 6 of the 7 patients with serious after-results are found in the group treated by osteosynthesis, since most of the severest fractures are found in this group, and many of them belong to the wage-earning age-group. 2 of the cases evidently had had osteitis postoperatively. No conclusions can be drawn from the fact that no patient treated by removal of the fragment had serious after-effects, since the fragments removed were small, and there are only 3 such cases.

4 of the 7 patients with serious complaints were between 18 and 40 years, 2 between 40 and 60; none were over 60, though there were 7 patients over 60, the eldest being 95. Only one was under 18. Certainly many of those between 18 and 60 had greater strain on the joint at work, as a result of which arthrosis develops more readily, and, when present, gives more trouble than to a patient who is not working. Only 3 of the patients whose period off work is known were unable to work for over 4 months, and one, already mentioned, must be said to be permanently disabled. As I have already stated in going through the histories I think that 3 of the patients would have been benefitted by excision of the fragment and a triceps plastic operation, 1 primarily, 2 secondarily, apart

from the young girl in whom the operation was done 3 years after the injury, and whose condition was definitely improved. I think one should consider removing the olecranon fragment in those cases in which one cannot obtain good position either by open or closed reduction, and in which the fracture line meets the joint surface on the vertical part of the olecranon; also in cases where there are small fragments lying under the skin, and causing tenderness of the elbow; and, finally, in cases where a disabling pseudarthrosis develops after treatment.

S U M M A R Y

The results of 45 olecranon fractures treated in the Orthopaedic Hospital, Copenhagen, are reported. 39 of these were studied with special attention to the possibility of obtaining better results by excision of the proximal fragment, combined with a plastic operation on the triceps tendon.

The treatments which had been used were:

- 1) sling,
- 2) plaster with or without reduction,
- 3) osteosynthesis using
 - a) a screw,
 - b) Aleman's nail,
 - c) wire or Damyl,
- 4) removal of the fragment.

The last-mentioned treatment was used in only 3 cases, where quite small fragments were removed, and in one case who was found to have marked impairment of extension at the follow-up examination. There was definite improvement in this case after removal of the fragment.

Out of all the cases followed up one had serious reduction of his working capacity, 6 had a major disability, which did not however interfere with their work, 11 had a minor disability, and 21 had definite good results.

The follow-up showed that 4 patients would have benefited from initial or later excision of the proximal fragment with a triceps plastic operation. This operation seems to be indicated in cases where the proximal fragment includes only

the vertical part of the semilunar notch, and in which a good position can be obtained neither with closed nor open reduction; also in cases in which small subcutaneous fragments cause tenderness in the elbow, or a disabling pseudarthrosis develops after treatment.

R E S U M E

Communication du résultat du traitement de 45 fractures de l'olécrâne traitées à l'Hôpital Orthopédique de Copenhague.

39 de ces cas ont été examinés ultérieurement pour voir notamment s'il était possible d'obtenir de meilleurs résultats en extirpant le fragment proximal de l'olécrâne et par opération plastique du triceps.

Le traitement appliqué a été:

- 1) mitella
- 2) plâtre avec ou sans reposition
- 3) ostéosynthèse par
 - a) vis
 - b) clou Alemann
 - c) fil métallique ou damyl
- 4) extirpation du fragment.

Ce dernier traitement n'a été appliqué que dans 3 cas où il s'agissait de tout petits fragments et dans un cas dans lequel un nouvel examen montra qu'il y avait une grosse défectuosité d'extension. Dans ce cas, l'extirpation du fragment a provoqué une amélioration sensible.

Dans les cas examinés à nouveau, on a fait les constatations suivantes: capacité de travail réduite de manière permanente dans un cas, 6 malades se plaignaient d'inconvénients sérieux qui ne les gênaient cependant pas dans leur travail, 11 souffraient de légers inconvénients et 21 étaient réellement bons.

Il ressort des examens pratiqués que pour 4 malades il aurait mieux valu extirper immédiatement ou plus tard le fragment proximal et pratiquer l'opération plastique du triceps. Cette opération semble indiquée dans les cas où le frag-

ment proximal ne comprend que la partie verticale de l'incisura semilunaris et où l'on n'obtient pas une bonne position en pratiquant la reposition ouverte ou fermée, ainsi que dans les cas où de petits fragments sub-cutanés provoquent des sensations douloureuses dans le coude, ou bien encore lorsqu'il se développe des pseudarthroses gênantes après le traitement.

ZUSAMMENFASSUNG

Es werden die Ergebnisse von 45 Olekranonfrakturen mitgeteilt, die im Orthopädischen Krankenhaus in Kopenhagen behandelt wurden. 39 davon wurden nachuntersucht, besonders im Hinblick darauf, ob durch Exstirpation des proximalen Olekranonfragments und Vornahme einer Tricepsplastik ein besseres Behandlungsergebnis zu erzielen gewesen wäre.

Es wurden folgende Behandlungen angewendet:

- 1) Mitella,
- 2) Gips mit oder ohne Reposition,
- 3) Osteosynthese mit
 - a) Schraube,
 - b) Alemann'schem Nagel,
 - c) Metalldraht oder Damyl,
- 4) Entfernung eines Fragments.

Die letzte Behandlung ist nur in 3 Fällen angewendet worden, wo es sich um ganz kleine Fragmina handelte, und in einem Falle, der bei der Nachuntersuchung einen grossen Extensionsdefekt zeigte. — Die Entfernung des Fragments erwies sich in diesem Falle als eine wesentliche Besserung des Zustandes.

Von allen nachuntersuchten Fällen hat einer dauernd herabgesetzte Arbeitsfähigkeit, 6 haben wesentliche Beschwerden, die jedoch ihre Arbeitsfähigkeit nicht beeinflussen, 11 unwesentliche Beschwerden; 21 sind unbedingt gut.

Aus der Nachuntersuchung geht hervor, dass man 4 Patienten hätte besser helfen können, wenn man sofort oder später das proximale Fragment exzidiert und eine Triceps-

plastik gemacht hätte. Diese Operation scheint in den Fällen angezeigt zu sein, wo das proximale Fragmen nur den vertikalen Teil der Incisura semilunaris umfasst, und wo man durch offene oder unblutige Reposition keine gute Stellung erzielen kann, sowie in Fällen, in denen kleine subkutane Fragmente Schmerzen im Ellbogen verursachen, oder wo sich nach der Behandlung eine Beschwerden verursachende Pseudarthrose entwickelt.

L I T E R A T U R E

McKeever and Buck: J.A.M.A. Vol. 135, 1947, p. 4.

Watson-Jones: Fractures and Joint Injuries. Livingstone, Edinburgh, 1946.