The natural course of lateral clavicle fracture

15 (11–21) year follow-up of 110 cases

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110 patients with non-operated on fracture of the lateral end of the clavicle were reviewed on an average 15 years after the injury. There were 73 undislocated Neer Type I fractures, 23 dislocated Type II fractures and 14 intraarticular Type III fractures. The patients' age at trauma was 36 (2–71) years. At follow-up 95 shoulders were asymptomatic. 15 shoulders had moderate pain and dysfunction and were rated fair; no patient had severe, residual shoulder disability. There were 10 nonunions, 8 of these asymptomatic. We conclude that fracture of the lateral end of the clavicle does not require operation.

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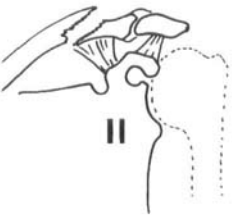
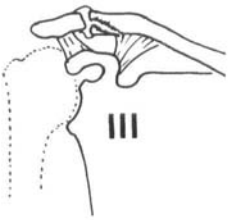
Neer (1968) proposed a classification of fractures of the distal clavicular end into 3 types based on fracture location (Figure 1). Type I fractures are stable and unite promptly without operation (Neer 1960, 1963, 1968, Jäger and Breitner 1984, Eskola et al. 1987, Post 1989). Type II fractures are characterized by disruption of the coracoclavicular ligament from the medial clavicular fragment and reduction, and internal fixation is generally recommended (Neer 1963, 1968, 1990). Type III fractures may lead to acromioclavicular arthrosis or osteolysis, requiring late resection of the clavicular end (Neer 1984). We report the long-term natural course of fracture of the lateral end of the clavicle.

Figure 1. The Neer classification of fractures of the lateral end of the clavicle.

Type I fracture of the left clavicle of a 32-year-old man (Case 46).



Type II fracture of the left clavicle of a 42-year-old man (Case 65).



Type III fracture of the right clavicle of a 18-year-old man (Case 25).

Patients and methods

During 1970–1979, 336 fractures of the lateral end of the clavicle were treated at our hospital. The fractures were classified into the three Neer (1968) types (Figure 1). The patients were reviewed in 1990–1991, on an average 15 years after their injury. 143 patients were then deceased, 76 were senile, impossible to trace, or living far away, and 7 patients had had a shoulder operation; 3 of whom for diseases not related to the clavicular fracture (Table 1). None of these patients were included in the natural course follow-up evaluation. Thus, 110 patients remained for this study (Table 2). There were 77 men and 33 women with median age at trauma 36 (2–71) years; 17 patients were younger than 15 years at the time of trauma. 19 patients had sustained 23 concomitant injuries. All 110

Table 1. Posttraumatic surgical procedures in 7 shoulders with fractures of the lateral end of the clavicle. In Cases 5, 6, and 7 the indications for operation were not related to the original fracture

Case	Fracture type	Age at trauma	Years between trauma and operation	Operation
1	II	15	0	Resection lateral clavicle + coracoclavicular lig suture
2	II	29	0.4	Resection lateral clavicle
3	I	20	2	Resection lateral clavicle
4	II	29	6	Resection lateral clavicle+ acromioplasty
5	II	31	7	Resection of costa I sin due to thoracic outlet syndrome
6	II	17	11	Resection lateral clavicle due to acromioclavicular pain after repeated shoulder traumata
7	I	71	14	Prosthetic shoulder replacement after surgical neck fracture

Table 2. Observations in 110 fractures of the lateral clavicle

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	2	2	II	2	4	12	1	1	180	180	90	90	G	1
2	3	2	I	4	0	11	1	1	180	180	90	90	G	1
3	5	1	II	4	0	11	1	1	180	180	90	90	G	–
4	8	1	III	4	0	18	1	1	180	180	90	90	G	1
5	8	1	I	2	0	13	1	1	180	180	90	90	G	2
6	8	1	I	2	0	15	1	1	180	180	90	85	G	1
7	11	1	I	4	0	17	1	1	180	180	90	80	G	–
8	11	2	I	4	0	17	1	1	180	180	90	90	G	1
9	12	1	I	2	0	17	1	1	180	180	90	90	G	1
10	12	1	I	2	0	14	1	1	180	180	90	90	G	1
11	12	1	I	3	0	15	1	1	180	180	90	90	G	1
12	13	1	II	2	0	19	2	2	180	180	90	85	F	1
13	13	1	I	2	0	12	1	1	180	180	90	70	G	1
14	13	1	I	2	0	13	1	1	180	180	90	90	G	1
15	13	1	I	3	0	14	1	1	180	180	90	90	G	1
16	14	1	I	2	4	14	1	1	180	180	90	90	G	1
17	14	1	II	2	0	13	1	1	180	180	90	90	G	1
18	15	1	II	4	0	16	1	1	180	180	90	85	G	–
19	17	1	III	2	0	20	1	1	180	180	90	80	G	2
20	17	1	I	4	0	17	1	1	180	180	90	80	G	1
21	17	1	III	4	0	16	1	1	180	180	90	90	G	–
22	17	1	III	3	0	21	2	1	180	180	90	80	F	1
23	18	2	I	4	0	13	1	1	180	180	90	90	G	–
24	18	1	II	4	0	13	1	1	180	180	90	90	G	1
25	18	1	III	2	0	11	1	1	180	180	90	80	G	1
26	19	1	II	2	0	15	1	1	180	180	90	90	G	–
27	20	1	II	4	0	12	1	1	180	180	90	70	G	3
28	21	1	III	3	9	16	1	1	180	180	90	90	G	1
29	23	1	I	2	0	15	1	1	180	180	90	70	G	1
30	23	1	III	3	0	15	1	1	180	180	90	85	G	–
31	24	2	I	2	0	11	1	1	180	180	90	85	G	1
32	24	2	I	2	0	15	1	1	180	180	90	80	G	1
33	25	1	I	2	0	16	1	1	180	180	90	90	G	1
34	26	1	I	3	0	16	1	1	180	180	90	90	G	1
35	26	1	III	3	0	11	1	1	180	180	90	90	G	2,5
36	26	1	I	4	0	14	2	1	180	180	90	80	F	2,5
37	26	2	II	2	0	17	1	1	180	180	90	85	G	1
38	27	1	II	2	7	20	2	2	150	135	90	70	F	2,5
39	28	1	III	3	0	11	1	1	180	180	90	80	G	–
40	29	1	I	4	0	12	1	1	180	180	90	80	G	–
41	29	1	I	4	0	12	1	1	180	180	90	90	G	1
42	30	2	I	2	0	18	1	1	180	180	90	70	G	1
43	30	1	I	4	0	16	1	1	180	180	90	85	G	–
44	31	1	I	4	0	11	1	1	180	180	90	80	G	3
45	32	1	I	2	0	15	2	1	170	170	90	80	F	1
46	32	1	I	1	4,9	20	1	1	180	180	90	80	G	1
47	32	1	I	1	0	18	1	1	180	180	90	80	G	1
48	34	1	III	4	0	13	1	1	180	180	90	80	G	1
49	34	2	I	3	0	15	1	1	180	180	90	85	G	–
50	35	1	I	4	0	20	1	1	180	180	90	70	G	1
51	36	2	I	2	0	20	1	1	170	170	90	70	G	1

52	36	1	I	2	1	20	1	1	180	180	90	80	G	1
53	36	1	I	2	4,6	13	1	1	180	180	90	80	G	1
54	36	2	II	4	0	15	2	2	180	180	90	80	F	3
55	37	2	I	4	0	13	1	1	160	170	90	70	G	–
56	37	2	I	4	0	16	1	1	180	180	90	75	G	–
57	38	1	I	2	0	11	1	1	180	180	90	70	G	–
58	38	1	II	4	0	12	1	1	180	180	90	80	G	2
59	39	1	I	4	0	19	1	1	180	180	90	80	G	2
60	39	1	I	3	0	18	1	1	180	180	90	90	G	2
61	39	1	I	4	0	11	1	1	180	180	90	80	G	1
62	40	1	I	4	0	14	1	1	160	160	90	60	G	1
63	40	2	I	4	0	14	2	1	160	160	90	70	F	1
64	40	1	I	1	7	18	2	1	170	170	90	65	F	2
65	42	1	II	4	0	17	1	1	170	170	90	50	G	–
66	43	1	II	2	0	17	1	2	130	130	80	70	F	2
67	44	1	I	4	1	16	1	1	180	180	90	90	G	2
68	44	1	II	2	0	13	1	1	160	160	90	70	G	2
69	45	1	II	4	0	17	2	2	135	140	90	50	F	–
70	45	1	I	1	1	13	1	1	180	180	90	70	G	1
71	46	1	I	2	0	14	1	1	180	160	90	70	G	2
72	47	1	II	4	0	19	1	1	180	170	90	70	G	2
73	47	1	I	2	7	15	2	2	135	95	90	80	F	2,5
74	48	1	I	2	0	13	2	2	150	110	90	50	F	1
75	48	2	I	4	0	14	1	1	180	180	90	60	G	3
76	49	1	III	4	0	18	1	1	180	170	90	70	G	1
77	50	1	I	2	7	20	1	1	150	180	90	60	G	1
78	50	1	I	4	0	16	1	1	170	180	90	75	G	–
79	50	1	III	4	0	19	1	1	160	180	90	70	G	–
80	51	2	I	4	0	12	1	1	160	180	90	80	G	–
81	51	1	I	2	0	16	1	1	180	180	90	70	G	2,4,5
82	51	2	II	1	0	13	1	1	180	180	90	80	G	3
83	52	1	I	1	1	13	1	1	160	180	90	65	G	2,5
84	53	1	I	2	0	12	1	1	160	180	90	60	G	2
85	53	2	I	4	0	11	1	1	150	150	90	60	G	–
86	53	2	I	4	0	16	1	2	140	140	85	45	F	–
87	54	1	I	2	0	20	1	1	170	170	90	60	G	1,4,5
88	54	2	I	4	0	19	1	1	180	180	90	75	G	1,4
89	54	1	I	3	0	15	1	1	170	180	90	80	G	2,4
90	54	1	III	4	9	20	1	1	160	170	90	70	G	3
91	54	1	I	2	0	15	1	1	180	180	90	60	G	1
92	54	2	I	2	4	13	1	1	180	180	90	80	G	1
93	54	1	III	2	0	17	1	1	160	180	90	65	G	1,4
94	55	2	I	4	0	18	1	1	170	180	90	80	G	1
95	56	2	II	4	0	11	1	1	180	170	90	80	G	3
96	56	2	II	4	0	11	2	1	180	180	90	80	F	3
97	56	2	I	4	0	12	1	1	170	180	90	70	G	2
98	57	1	I	4	0	14	1	1	180	170	90	75	G	2
99	57	1	I	2	7	13	1	1	160	170	90	90	G	1
100	58	2	I	2	0	12	1	1	170	180	90	80	G	1
101	59	2	I	2	1,4	16	2	1	180	170	90	70	F	2
102	59	2	II	4	4	20	1	1	180	170	90	60	G	2
103	62	1	II	4	0	19	1	1	160	160	90	60	G	2
104	64	2	I	4	4,9	14	1	1	160	170	90	60	G	3
105	65	2	I	2	0	15	1	1	160	170	90	75	G	1
106	68	2	I	4	0	18	1	1	150	150	90	50	G	3
107	68	1	I	2	0	11	1	1	160	160	90	70	G	1
108	68	1	I	2	0	15	1	1	160	180	90	50	G	2,5
109	69	2	II	4	0	16	1	1	180	180	90	80	G	2,4
110	71	2	I	2	0	12	1	1	160	180	90	60	G	1,4

A Age at trauma
B Sex
- 1 male
- 2 female

C Neer Type I, II or III
D Trauma situation
- 1 work
- 2 traffic
- 3 sport
- 4 falling
- 5 unknown

E Concomitant lesions
- 0 none
- 1 rib fracture
- 2 pneumothorax
- 3 lung contusions
- 4 head injury
- 5 fracture of the spine
- 6 abdominal injuries
- 7 lower extremity fracture
- 8 fracture of the contralateral upper extremity
- 9 fracture of the ipsilateral upper extremity

F Follow-up time (years)
G Persisting pain
- 1 no pain
- 2 slight or moderate pain
- 3 severe pain

H Patient estimation of motion and strength
- 1 normal function
- 2 slight or moderate disability
- 3 severe disability

I Forward elevation (degrees)
J Abduction (degrees)
K Internal rotation (degrees)
L External rotation (degrees)
M Clinical rating
- G good
- F fair
- P poor

N Radiographic results
- 1 normal union
- 2 deformity of the lateral clavicle
- 3 non-union
- 4 acromioclavicular arthrosis
- 5 ectopic ossification
- 6 osteolysis of the lateral clavicle
- – no radiographic examination

Table 3. Fracture distribution in 110 patients reviewed on an average 15 years after their injury

Fracture type	Men	Women	Total
I	48	25	73
II	15	8	23
III	14	–	14
Mean age, *SD*	33 *16*	44 *19*	36 *18*

patients were treated with a short-term figure of 8 or sling immobilization and early motion exercises.

At follow-up, the patients were interviewed and clinically examined, and 89 shoulders were examined radiographically with standard anteroposterior and lateral views of the distal clavicle and acromioclavicular joint.

Results

At the follow-up examination no patient had severe shoulder disability. 15 patients had moderate persisting shoulder symptoms—most of them slight motion pain—and they were rated fair. 95 patients had asymptomatic shoulders. All adult patients had been able to return to their previous occupation after their clavicular fracture. Case 74 had changed his sporting activity level after the injury. A hump was seen over the lateral clavicle in 33 shoulders, and this was moderately tender on palpation in 11.

Radiographically, 79/89 fractures examined were healed, 26 of these with deformity of the lateral clavicle and exuberant bone formation (Figure 2). Healing with deformation was more common (chi square P 0.006) in Type II fractures. There were 10 non-unions (Figure 3); they were more common (chi square P 0.015) after Type II fractures and the patients were older at trauma (Student's test $P < 0.001$) than those with healed fractures. There was no increased frequency of non-union after high-energy trauma. 8 shoulders with clavicular non-union were asymptomatic and 2 had moderate pain.

Discussion

Type I fractures of the distal clavicle without disruption of the coracoclavicular ligaments, usually have a favorable outcome with rapid healing after symptomatic treatment (Neer 1968, 1984, Post 1989). In our series 11 percent of the shoulders had persisting symptoms after Type I fractures, 33 percent healed with deformity, often caused by excessive bone formation, and there were 4 non-unions. However, no patient in our study had severe residual shoulder disability.

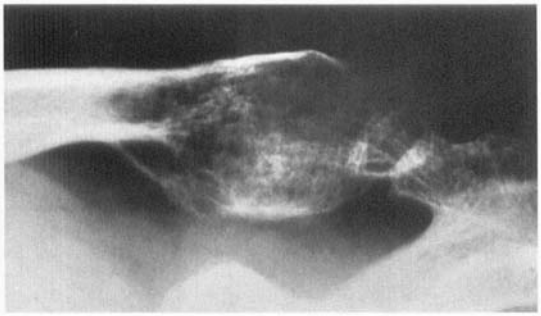


Figure 2. Case 103. Asymptomatic deformation of the outer end of the left clavicle of an 81-year-old man, 19 years after a Type II fracture.

Figure 3. Case 96. Painful nonunion of the lateral end of the right clavicle of a 67-year-old woman, 11 years after a Type II fracture.

Neer (1963) found about 30 percent non-unions at follow-up after Type II fractures with ligament disruption and fragment dislocation. Our results with 22 percent of non-union after Type II fractures were similar. According to the literature (Ghormley et al. 1941, Neer 1963, 1968, 1984, Neviaser 1963, Eskola et al. 1987, Jupiter and Leffert 1987) non-unions of the lateral clavicle are painful and operative treatment has been suggested. In the present long-term follow-up study, 8 out of the 10 non-unions were asymptomatic, and no patient wanted a surgical intervention. Clinically, there was a hump, but no marked instability, indicating that fibrous union gave the clavicle enough stability for a painless mobility. Several authors (Neer 1960, 1963), Neviaser (1963), Zenni et al. 1981, Jäger and Breitner 1984, Eskola et al. 1987, Post 1989) have recommended open reduction and internal fixation in Type II fractures of the distal clavicular end because of their tendency to slow healing and residual shoulder disability. In our series 17 out of 23 shoulders with conservatively-treated Type II fractures were asymptomatic at follow-up, and none was severely disabled.

Neer (1968, 1984) reported frequent clavicular resorption after intraarticular lateral clavicular end fractures. We found no such tendency after Type III fractures in our 14 patients. Our results suggest that short-term immobilization with a sling can be recommended as treatment in fractures of the lateral clavicle. In the few patients with symptomatic arthrosis or clavicular osteolysis, resection of the lateral end of the clavicle may be considered (Petersson 1983).

References

Eskola A, Vainionpää S, Pätiälä H, Rokkanen P. Outcome of operative treatment in fresh lateral clavicular fracture. Ann Chir Gynaecol 1987; 76 (3): 167–9.

Ghormley R K, Black J R, Cherry J H. Ununited fractures of the clavicle. Am J Surg 1941; 51: 343–9.

Jupiter J B, Leffert R D. Non-union of the clavicle. Associated complications and surgical management. J Bone Joint Surg (Am) 1987; 69 (5): 753–60.

Jäger M, Breitner S. Therapiebezogene Klassifikation der lateralen Claviculafraktur. Unfallheilkunde 1984; 87 (11): 467–73.

Neer C S. Nonunion of the clavicle. JAMA 1960; 172: 1006–11.

Neer C S. Fracture of the distal clavicle with detachment of the coracoclavicular ligaments in adults. J Trauma 1963; 3: 99–110.

Neer C S. Fractures of the distal third of the clavicle. Clin Orthop 1968; 58: 43–50.

Neer C S. Fractures about the shoulder. In: Fractures in adults (Eds. Rockwood, C. A. Jr, Green D. P.) J B Lippincott Company, Philadelphia 1984; 1: 707–13.

Neviaser J S. The treatment of fractures of the clavicle. Surg Clin North Am 1963; 43: 1555–63.

Petersson C J. Resection of the lateral end of the clavicle. A 3- to 30-year follow-up. Acta Orthop Scand 1983; 54 (6): 904–7.

Post M. Current concepts in the treatment of fractures of the clavicle. Clin Orthop 1989; 245: 89–101.

Zenni E J Jr, Krieg J K, Rosen M J. Open reduction and internal fixation of clavicular fractures. J Bone Joint Surg (Am) 1981; 63 (1): 147–51.