Satisfactory long-term results after Eden-Hybbinette-Alvik operation for recurrent anterior dislocation of the shoulder

6–20 years' follow-up of 52 patients

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ABSTRACT We studied the outcome after the Eden-Hybbinette-Alvik operation for recurrent anterior shoulder dislocation in 52 patients after a mean of 14 (6–20) years. Their mean age at operation was 26 years. Redislocation occurred in 2/52 patients. The success rate was 49/52, when rated by the patients, and 38/45, using the Carter-Rowe shoulder score. 44/52 reported no pain, 48/52 no limitations at work and 37/51 no limitations in sports. Mild and moderate arthrosis were found in 24/45 on the operated side and 9/45 on the uninvolved side. None (0/21) of the patients without arthrosis and 5/24 of those with arthrosis in the operated shoulder reported mild or moderate pain.

Several surgical procedures have been advocated for the treatment of recurrent anterior instability of the shoulder (Eden 1918, Hybbinette 1931, Bankart 1938, Osmond-Clarke 1948, Hovelius et al. 1983). Some of these have since been modified (Alvik 1951, Niskanen et al. 1991). The commonest complications include a decrease in the range of motion, reduced performance, and glenohumeral arthrosis. We retrospectively assessed the long-term results after the Eden-Hybinette-Alvik operation in 52 patients.

Patients and methods

From 1979 to 1991, the Eden-Hybbinette-Alvik operation was performed in 67 patients in our hospital. At this review, 2 patients had died, 5 had moved to another country, 3 declined a follow-up examination and 5 could not be traced. Of the remaining 52 patients (30 men), 45 were reviewed, 7 of them answered only the questionnaire. The preoperative characteristics in the patients who were not available for follow-up did not differ from those of the others.

49 of the patients were active in 20 different sports, some of them at a high international level. The commonest sports were European handball, skiing (cross-country and alpine), and ice hockey. The primary dislocation was traumatic in 45/52 patients (Table 1). The dominant side was involved in 32/52 patients. Their mean age at the primary dislocation was 20 (5–39) years. 13 patients were 16 years or younger at the first dislocation (Table 1). 26/47 patients had dislocated their shoulder 10 times or more. 9 patients had dislocated both shoulders at least once. 2 patients had had previous shoulder surgery; 1 (case 32) had a Putti Platt operation and 1 had a Bankart procedure (case 17).

Surgery

Their mean age at surgery was 25 (15–57) years. A modification of Alvik's (1951) procedure was performed. The humeroscapular joint was entered via a transverse dissection of the subscapularis tendon about 15 mm from its attachment to the humerus. A wedge-shaped bone graft was harvested from the iliac crest and, by using a tamp, placed in a groove

in the anterior aspect of the glenoid rim at the site of the Bankart lesion. The lesion in the joint capsule was then repaired, and the subscapularis tendon was thereby shortened to prevent outward rotation of the shoulder joint. The arm was kept in an abduction splint for 6 weeks. Most operations were performed by 2 surgeons.

Follow-up protocol

The mean follow-up time was 14 (6–20) years. At follow-up, a standardized questionnaire was filled in by the patient and clinical and radiographic examinations were performed by independent physicians (JIB and AMF) in 45 patients. 7 patients answered only the questionnaire. The questionnaire was used to evaluate pain, limitations at work and in sports and patient satisfaction. The Carter-Rowe score (0–100 points) was used in the clinical examination (Rowe et al. 1978). This score concerns stability (50 points), range of motion (20 points), function, and pain (30 points). An apprehension test was performed in the standing position. External rotation was measured with a goniometer and the arm at the side, elbow flexed 90°. The radiographic examination included 2 projections: anteroposterior views with the patient standing, the arm in the hanging position first with maximal external and then with maximal internal rotation of the shoulder.

Arthrosis, using the Samilson-Prieto method (1983), was classified as mild (osteophytes < 3 mm on the humeral head), moderate (osteophytes between 3–7 mm on the humeral head or the glenoid rim) or severe (osteophytes > 7 mm, with or without articular incongruity). Since all the patients had been operated on using the Eden-Hybbinette-Alvik method, which includes a graft implanted in the glenoid rim, we did not evaluate osteophytes on the glenoid rim. The radiographs were read by 2 radiologists blinded to the subject and to each other (AMF and EM). Interobserver agreement was excellent and the findings are described in detail in another study in this issue (Brox et al. 2003a). The graft was classified as ossified and correctly located, disappeared or dislocated. Interobserver agreement was acceptable. However, for this study, a final consensus between the observers was made concerning all radiographs.

Pearson's chi-square test and nonparametric comparisons (Mann-Whitney U and Wilcoxon's signed rank test) and correlations (Spearman R) were performed, using the SPSS statistical program.

Results (Table 1)

There were no wound, vascular or neural complications. 2 patients (cases 23 and 30) had postoperative adhesive capsulitis. At follow-up, 3 patients (cases 7, 8 and 44) spontaneously reported that the postoperative abduction splint had been uncomfortable. 2 patients (cases 45 and 48) stated that postoperative pain from the harvesting site at the iliac crest had been worse than the shoulder pain.

The bone graft was ossified and properly placed in 32 patients, disappeared in 7 and dislocated in 1 patient. The changes in the transplant showed no relation with clinical outcome or arthrosis.

Redislocations and reoperations

2/52 patients had a redislocation. 1 (case 25) had only 1 redislocation. The other patient (case 46) reported that the result had been excellent for 10 years, but then she had 5–10 dislocations and finally a Bankart operation was performed at another hospital. She stated that she had had 3 more dislocations and a painful shoulder after the second operation. 2 patients (cases 12 and 28) had reoperations for other reasons. 1 (case 28) had bilateral subacromial decompression, but this did not relieve her symptoms. A former wrestler (case 12) had clinical signs of a superior labral lesion at follow-up. This was confirmed by MRI and he finally had an arthroscopic repair. 3 patients (cases 18, 30 and 32) had a bilateral Eden-Hybbinette-Alvik operation. Of these, 2 patients had excellent results, and 1 (case 18) rated his right shoulder as good and his left shoulder as fair.

Clinical outcome

The shoulder was rated as excellent in 41 patients, good in 8 and poor in 3. The Carter-Rowe score was excellent in 32 patients, good in 8, fair in 4 and poor in 1. The mean Carter-Rowe score was 90 and correlated well with patient satisfaction (Spearman R = 0.6) and limitations in sports (–0.6). At follow-up, 44 patients reported no shoulder pain, 5 had

Table 1. Patient characteristics

Case	A	B	C	D	E	F	G	H	I	J	K	L	M
1	F	27	T	2	28	12	E	N	N	N	95	I	N
2	M	24	T	2	27	12	E	N	N	N	100	M	N
3	M	16	T	1	17	13	E	N	N	N	100	N	N
4	M	22	T	3	30	14	E	N	N	N	100	M	N
5	F	16	T	1	19	14	E	N	N	N	95	N	N
6	F	26	T	1	28	13	E	N	N	N	95	N	N
7	M	21	T	1	23	13	E	N	N	N	95	I	N
8	M	16	NT	3	22	11	E	N	N	N	95	N	N
9	F	14	T	3	20	13	G	N	N	O	80	I	N
10	M	16	T	1	18	13	E	N	N	N	95	N	N
11	M	21	T	1	23	15	E	N	N	N	100	N	N
12	M	19	T	1	20	15	G	N	N	N	65	M	N
13	M	24	T	3	26	16	E	N	N	N	95	I	N
14	F	22	T	2	30	16	E	N	N	N	100	N	N
15	M	20	T	3	21	17	G	N	N	O	90	I	N
16	F	14	T	2	19	16	E	N	N	O	90	I	N
17	M	21	T	3	23	13	E	N	N	N	95	N	N
18	M	19	NT	2	29	15	E	N	N	S	75	M	M
19	M	20	T	1	22	13	P	N	Y	S	55	I	N
20	M	39	T	2	57	13	E	N	N	N	100	I	I
21	M	18	T	1	20	14	G	N	N	O	70	N	N
22	M	21	T	1	23	14	E	N	N	O	95	I	I
23	M	20	T	1	23	15	E	N	N	N	95	I	N
24	M	25	T		41	17	E	N	Y	N	95	I	N
25	F	18	T	1	46	15	E	Y	N	O	80	M	I
26	M	17	T	3	21	15	G	N	Y	O	70	I	N
27	F	13	NT		15	15	E	N	N	N	100	N	I
28	F	17	T	1	19	14	P	N	Y	M	40	N	N
29	M	19	T	3	21	16	E	N	N	O	100	N	N
30	F	18	T	1	22	8	E	N	N	N	100	N	N
31	F	14	T	1	22	8	G	N	N	O	80	I	N
32	M	11	T	3	17	7	E	N	N	N	80	M	I
33	M	19	NT	1	30	7	E	N	N	N	100	N	N
34	F	20	NT	1	30	6	E	N	N	N	95	N	N
35	F	16	T	3	51	17	E	N	N	N	85	I	I
36	F	5	T	3	21	11	E	N	Y	M	75	N	N
37	M	24	T	1	25	10	E	N	N	N	95	M	N
38	M	22	T	3	23	12	E	N	N	N	100	I	I
39	M	19	T	3	21	10	E	N	N	N	100	I	N
40	M	26	T	3	30	17	E	N	N	N	80	M	M
41	M	28	T	1	39	17	E	N	N	N	95	M	N
42	M	17	T	1	22	11	E	N	N	N	100	N	N
43	F	20	T	2	20	13	E	N	N	N	100	N	N
44	F	16	T	1	17	11	E	N	Y	N	100	N	N
45	F	20	T	2	23	12	P	N	N	O	90	N	N
46	F	14	T	2	33	17	G	Y					
47	F	22	NT		24	20	E	N		N			
48	M	22	T	1	23	15	E	N		N			
49	F	16	T	1	23	17	E	N		N			
50	F	19	T	3	20	9	E	N		N			
51	F	22	NT	3	24	17	E	N		N			
52	M	19	T	2	19	12	G	N		N			

A Gender
B Age at first dislocation
C Mechanism
  T Traumatic
  N Non-traumatic
D Number of dislocations before surgery
  1 < 10
  2 10–20
  3 > 20
E Age at surgery
F Follow-up (years)
G Patient satisfaction
  E Excellent
  G Good
  F Fair
  P Poor
H Redislocation after surgery (see I)
I Positive apprehension sign
  Y Yes
  N No
J Limitations in sports
  N None
  O Occasional
  M Moderate
  S Severe
K Carter-Rowe score
L Radiological arthrosis in operated shoulder
  N None
  I Incipient or mild
  M Moderate
M Radiological arthrosis in unoperated shoulder

Table 2. Limitations in sports and the apprehension test

Apprehension test	Limitations in sports None	Occasional	Moderate	Marked
Negative	30	8		1
Positive	2	1	2	1

P = 0.01; Pearson's chi-square

Table 3. Limitations in sports and postoperative arthrosis

Arthrosis	Limitations in sports None	Occasional	Moderate	Marked
None	16	3	2	1
Incipient	11	4		
Moderate	5	2		1

P = 0.6; Pearson's chi-square

mild pain and 3 moderate pain. External rotation was reduced (54° (SD 18°)) in the operated shoulder, as compared with the unoperated one (62° (16°)) (mean difference 8° (95% confidence interval 4°–11°, $p < 0.001$; Wilcoxon signed rank test).

Limitations in sports

Some of the patients had retired from competitive sports at the time of the operation. 6 patients competed at a national or international level in cross-country skiing, European handball, ice hockey and ski jumping before surgery. All these returned to the same level after the Eden-Hybbinette-Alvik operation. 2 other patients reported severe limitations in sports, 2 had moderate and 10 occasional limitations.

6 patients had a mild or moderately positive apprehension test, which was associated with limitations in sports (Table 2).

Limitations at work

48/52 patients reported no limitations at work. 1 had received a disability pension before the operation, but none of the others was sick-listed or had retired from work. 26 patients returned to their former occupation, but 2 had returned to a less demanding job after surgery. 23 patients were students before surgery. 3 of them reported that the shoulder complaints influenced their choice of occupation.

Glenohumeral arthrosis

Incipient and moderate arthrosis were observed in 24/45 of the operated shoulders and in 9/45 of the undislocated contralateral shoulders. None of the patients had severe arthrosis. None (0/21) of those without arthrosis and 5/24 of the patients with arthrosis reported mild or moderate pain in the operated shoulder ($p = 0.05$; Pearson chi-square). The range of motion in external rotation in both the involved and uninvolved shoulders was moderately correlated with arthrosis (Spearman R: –0.5 and –0.4). Mean external rotation of the operated shoulder was 62° (SD 18°) in patients with no arthrosis, 52° (12°) in incipient arthrosis and 40° (19°) in moderate arthrosis ($p = 0.005$ (no vs moderate), $p = 0.03$ (no vs incipient), $p = 0.2$ (incipient vs moderate): Mann-Whitney U-test). External rotation of the uninvolved shoulder (patients with bilateral complaints excluded) was 65° (13°) in patients with no arthrosis and 54° (11°) in incipient arthrosis ($p = 0.07$; Mann-Whitney U-test). Age correlated well with arthrosis (Spearman R 0.6). Arthrosis in the undislocated and unoperated shoulder correlated moderately with arthrosis in the dislocated and operated shoulders (Spearman R 0.5). The number of dislocations, duration of follow-up, patient satisfaction, Carter-Rowe score and limitations in sports correlated poorly with glenohumeral arthrosis (Spearman R 0.0–0.2; Table 3).

Discussion

2 of our 52 patients had redislocations. Previous studies have also shown that the Eden-Hybbinette-Alvik operation effectively prevents recurrent dislocations (Said and Medbø 1970, Rowe et al. 1978, Schrøder and Fristed 1985, Toolanen et al. 1990, Niskanen et al. 1991, Gill et al. 1997). In comparison, 35% redislocations have been reported after Putti-Platt operations (Paavolainen et al.1984).

Following capsular shrinkage, labral repair, or Bankart operations performed arthroscopically, DeBerardino et al. (2001) reported a follow-up of young military athletes 2–5 years after surgery returned to their preoperative sports level, but the

redislocation rate was 12%. Roberts et al. (1999) reported recurrent subluxations or dislocations after return to sports in two thirds of Australian football players after arthroscopic suture repair and in one third after open capsular shift and the Bankart procedure. In a recently published prospective randomized study with unblinded evaluation after 2 years, the prevalence of redislocations was 23% after arthroscopic surgery and 12% after open surgery (Sperber et al. 2001).

In our patients, limitations in sports and dissatisfaction were associated with a positive apprehension test, but not with glenohumeral arthrosis or reduction in external rotation. In accord with a previous study, all elite athletes returned to former sports (Kjeldsen et al. 1996). Previous studies have described redislocation rates of 35–70% in full contact sports (Koss et al. 1997, Manta et al. 1997, Roberts et al. 1999). Our findings suggest that some compromise in range of motion does not impair participation in most sports. However, loss of external rotation affects the ability of throwing athletes (Montgomery and Jobe 1994, Itoi et al. 2001).

Primary glenohumeral arthrosis is rare (van Schaardenburg et al.1994). In our patients, one fifth had arthrosis in the undislocated shoulder and one half in the operated shoulder. Radiographically detectable arthrosis has been observed in more than half of the patients after various surgical procedures (Wildner et al. 1994, Rosenberg et al. 1995, Singer et al. 1995, Gill et al. 1997, Neusel and Bläsius 1997, van der Zwaag et al. 1999, Chapnikoff et al. 2000, Rachbauer et al. 2000). This high prevalence of arthrosis after various surgical procedures does not indicate a causal relationship between surgical shortening of the capsule and grafting at the glenoid rim and arthrosis. 10 years after the first dislocation, Hovelius et al. (1996) found that the prevalence of arthrosis was the same in patients with or without a recurrence. In those with more than 2 recurrent dislocations, the prevalence of arthrosis was about 30% in operated and unoperated patients.

We can not exclude that 6 weeks of postoperative immobilization with an abduction splint may have contributed to the development of arthrosis in the present study (Videman, 1982). Some studies have shown that postoperative arthrosis is associated with a poorer clinical outcome (Wildner et al. 1994, Neusel and Bläsius 1997). None of our patients developed severe arthrosis. The limitation of external rotation in patients with moderate arthrosis has also been observed by others (Rosenberg et al. 1995, Singer et al. 1995, Rachbauer et al. 2000). The changes in the transplant showed no relation to clinical outcome or arthrosis. A proper placement of the graft may be essential for the short-term outcome, but other factors may contribute more to long-term success. A disadvantage of the Eden-Hybbinette-Alvik operation, according to some of our patients, is pain at the donor site and the use of an abduction splint.

All patients aged 16 years or younger at the first dislocation reported excellent or good results (Table 1). 1 patient (case 36) was 5 years at her first dislocation. She reported > 20 redislocations until she was operated on at the age of 21. She fulfilled the criteria for the hypermobility syndrome (Biro et al. 1983). No consensus exists about the treatment of children with shoulder dislocations (Lawton et al. 2002). Our study was not designed to evaluate the optimal age for surgery or the indication in patients with voluntary instability, joint laxity or the hypermobility syndrome. Many of the young patients in our study reported > 20 dislocations before surgery, and it could be questioned whether the operation should have been performed at an earlier stage.

No competing interests declared.

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