# Alvik's glenoplasty for humeroscapular dislocation

## 6-year follow-up of 52 shoulders

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**In Alvik's modification of the Eden-Hybbinette operation, an iliac crest bone graft is inserted in a groove in the glenoid rim of the scapula. In this retrospective study, 52 shoulders in 46 patients operated on using the modified Alvik's method were reviewed. The mean age of the patients at the time of the operation was 32 years, and the average follow-up time was 6 years. There were no operative complications, and two thirds of the patients were satisfied with the operation. Spontaneous redislocation occurred postoperatively in only one shoulder. In addition, there were 10 traumatic redislocations. Postoperative arthrosis was found in nine shoulders; the arthrosis had more correlation with the patient's age at the time of the operation than with the follow-up time. In 41 shoulders, there was bony healing of the transplant.**

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The Eden-Hybbinette operation for anterior recurrent dislocation of the shoulder, modified by Alvik in 1951, has been used with success in Norway (Alvik 1951, Said and Medbø 1970), Denmark (Schrøder and Fristed 1985), Sweden (Toolanen et al. 1990), and, to some extent, in Finland (Solonen and Rokkanen 1972). The modification might be called Alvik's glenoplasty (Said and Medbø 1970).

In this retrospective study, we wanted to evaluate the results of this operation, the incidence of redislocations, the development and significance of arthrosis, and the future of the bone transplant and the importance of its possible changes.

## Patients and methods

At our hospital since 1976, 58 shoulders (52 patients with a recurrent anterior dislocation of the glenohumeral joint) have been operated on with a modified Alvik glenoplasty. Forty-six patients with 52 operated on shoulders were reviewed; 2 of them answered only the questionnaire, whereas 6 patients could not be traced. There were 35 male and 11 female patients of whom 5 men and 1 woman had a bilateral dislocation. Eight unilaterally operated on patients have also had dislocations in the contralateral shoulder, but no operations have been needed yet. Previous operations had been performed on only 1 patient. Both of her shoulders had been previously operated on in another hospital with Pazy's method, where a 5-cm-long bone graft was implanted in the coracoideus and coracobrachial tendon. During the same period, there were 3 patients who were operated on with the Putti-Platt procedure and 3 patients who were operated on using Boytschew's method.

The mean age at the operation was 32 (15–66) years, whereas the mean follow-up time was 6 (2–11) years.

The primary dislocation was traumatic in 39 shoulders; in 11 shoulders, it occurred during trivial rotation of the upper extremity; and in two shoulders, it was spontaneous. The mean age at the time of primary dislocation was 26 (10–60) years, with almost half of the patients under aged 20 years. Prior to surgery, a dislocation had occurred 10 times or less in 23 shoulders and more than 10 times in 29 shoulders.

The indications for surgery were either a documented recurrent anterior dislocation of the glenohumeral joint or clearly disabling subluxations during trivial activities.

The operation performed was a modification of Alvik's operation. The subscapularis was opened in the direction of the muscle fibers, not dissected as Alvik did. A groove, approximately 1.5 cm long and deep, was made with an osteotome through the capsule in the anterior aspect of the glenoid rim. A wedgelike iliac crest bone graft (8–10 mm × 15–20

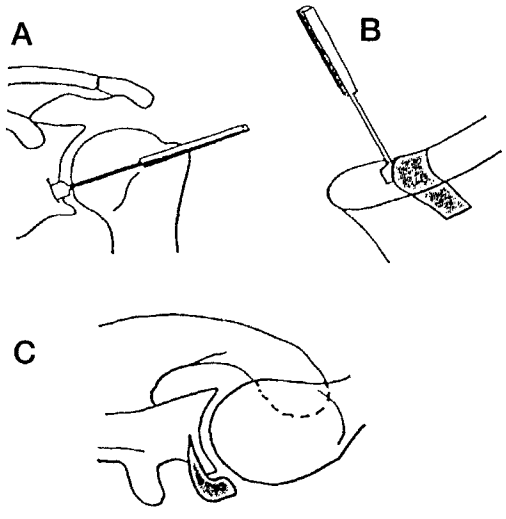


Figure 1. A groove is made with an osteotome through the capsule into the anteroinferior aspect of the scapular neck (A), an iliac-crest bone graft (B) is jammed into the groove without any fixation. Inferosuperior view (C).

mm) was jammed firmly into the groove without any fixation (Figure 1). The upper limb was kept in a Velpeau bandage for 6 weeks, whereas Alvik used an abduction splint. The supporting axillary cushion was removed after 3 weeks, and pendular movements of the extremity were allowed. The patient was encouraged to take up active exercises 6 weeks after the operation. The operations were mainly performed by 2 orthopedic surgeons.

In the questionnaire, the patients were asked to evaluate their ability to work, subjective pain, problems with the bone-graft donor site, limitations of exercise, and their overall satisfaction with the operation. The occurrence of postoperative dislocations was also listed. In addition, each patient was asked if he or she would have had the operation if the end result could have been predicted.

The clinical examination included an inspection of the symmetry of the shoulders, a determination of the range of movements of the extremities, and a determination of the differences between the left and right sides when lifting the extremities between the shoulder blades in the upward and downward directions. A modified apprehension test was performed in the standing position (*Campbell's Operative Orthopaedics* 1987).

The radiographic examination included three projections: anteroposterior views in 90° internal and maximal external rotations, and the so-called inferosuperior projection with the upper arm in 90° abduction and inward rotation, with the tube angled 30° from the frontal plane from below anterosuperiorly.

The glenohumeral arthrosis was classified into four groups: no arthrosis, incipient arthrosis (slight narrowing of the joint space), moderate arthrosis (distinct narrowing of the joint, bone erosions), and severe arthrosis (grave structural disorder of the glenohumeral joint). The changes in the transplant were compared in all directions with radiographs taken immediately after the operation to determine whether their were possible connections with postoperative dislocations or other findings and subjective symptoms. When possible, the transplant was measured with an accuracy of 1–2 mm.

Postoperative complications were listed according to the clinical records.

Pearson's chi-square test (an analysis of variance table was used to obtain means) and pairwise *t*-tests were performed using the BMDP statistical program.

## Results

There were no wound, vascular, or neural complications. Two thirds of the patients classified the result as good or excellent. Based on the subjective opinion of the operational result, the mean age of the different groups at the time of the operation were as follows: excellent—26 years, good—30 years, fair—39 years, poor—41 years. The mean age of the first two groups differed from that of the two latter groups ($P < 0.05$), whereas there was no difference in the follow-up time of these two groups. The patients with excellent and good results had fewer postoperative dislocations and a less severe degree of arthrosis ($P < 0.01$ ).

Two female patients (49 and 69 years) were incapacitated as regards work because of the impaired shoulder joint. They had respectively moderate and severe arthrosis, with reduced mobility of the shoulder joint. Otherwise, no other patient had had to change his or her occupation.

The patients with good and excellent results also stated that their shoulders were totally painless; 31 of them had no limitation as regards physical activity. Six patients had had slight transient insensibility distal to the bone graft donor site.

According to the patients' own statements, there had been a postoperative dislocation in 11 shoulders, which was medically verified in 7 cases. The

**Table 1. Patients' opinions of the end result in relation to the number of dislocations before the operation and the degree of arthrosis in 50 shoulders**

| | Dislocations | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subluxation | | | | < 5 | | | | 6–15 | | | |
| Arthrosis | E | G | F | P | E | G | F | P | E | G | F | P |
| No | 4 | 1 | | | 7 | 1 | 2 | | 1 | | | |
| Incipient | 1 | | | | 2 | | | | 6 | 2 | | |
| Moderate | | | | | | | | | 1 | 2 | | |
| Severe | | | | | | | | | | | | |

| | Dislocations | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | > 15 | | | | | | | |
| Arthrosis | E | G | F | P | | | | |
| No | 3 | 1 | 2 | 1 | | | | |
| Incipient | 3 | 2 | 2 | | | | | |
| Moderate | | 2 | 1 | 1 | | | | |
| Severe | | | | 2 | | | | |

E Excellent—no pain, no restriction of mobility.
G Good—slight transient pain, slight restriction of mobility, but not doing any harm. Possibly one traumatic redislocation treated successfully by conservative means.
F Fair—continuous pain, mobility restricted, working capacity occasionally decreased, redislocations.
P Poor—considerable pain and restriction of mobility, working capacity decreased, redislocations.

**Table 2. Restriction of mobility in 36 shoulders. The patients with a dislocation in the contralateral shoulder or who were operated on bilaterally were excluded**

| | No. of shoulders with restricted mobility | Average restriction (degrees) |
|---|---|---|
| External rotation | | |
| at side | 13 | 5 |
| in abduction | 10 | 4 |
| Internal rotation | | |
| at side | 2 | 1 |
| in abduction | 8 | 2 |
| Horizontal extension | 7 | 4 |
| Flexion | 5 | 1 |
| Abduction | 4 | 4 |
| Extension | 5 | 4 |
| Lifting the hand between the shoulder blades | | |
| downward | 26 | 9 cm |
| upward | 25 | 4 cm |

postoperative redislocation occurred 1–2 years after the operation in seven shoulders, and after 3–4 years in three shoulders. A new trauma was the etiologic factor in all of these cases. There had been one postoperative dislocation in 6 patients, two dislocations in 2 patients, and three dislocations in 2 patients. They had been treated successfully by conservative methods. The other patient with three postoperative dislocations is waiting for a reoperation. Only 1 patient had recurrent spontaneous redislocations soon after the operation. In her case, two subsequent operations have also failed.

The number of preoperative dislocations did not correlate with the number of postoperative redislocations. The correlation of preoperative dislocations and subjective result can be seen in Table 1. Regardless of the subjective evaluation of the end result, all the patients reported that they would have had the operation even if the end result obtained in each case could have been predicted.

Two patients out of 50 had slight asymmetry in the supraspinate region. They also had the greatest limitations in the mobility of the glenohumeral joint, as well as severe arthrosis.

The apprehension test was positive in 8 patients. Five of them had had postoperative dislocations according to their own statement. All of these 8 patients considered the end result only fair or poor. The results of the apprehension test had no correlation with the arthrosis or changes in the bone graft. Almost without exception, all the above 8 patients had suffered from numerous dislocations before their operation.

The glenohumeral mobility was identical in only eight shoulders when compared with the contralateral side. These patients were younger than the patients' mean age at review. Only 1 patient had limitations in all 10 tested movements. There was reduced mobility in only one direction in 10 shoulders (Table 2).

Arthrosis was present preoperatively in two shoulder joints and incipient arthrotic changes in four joints. At the review, there was arthrosis in nine shoulders and incipient changes in 18 shoulders (Table 1). These patients were older, the mean age being 46 years at the time of the operation and 54 years at the review. The mean age of the patients with no arthrosis differed from the mean age of patients with moderate ($P < 0.01$) and severe ($P < 0.001$) arthroses; likewise, the incipient arthrosis group differed statistically from the severe arthrosis group ($P < 0.001$). The mean follow-up (4 years) of the patients with no arthrosis differed from the mean follow-up time (8 years) of the moderate arthrosis group ($P < 0\ 001$), whereas the other groups had no statistical difference. Postoperative dislocations had no influence on the grade of arthrosis.

The bone transplant was well ossified in 20 shoulders, being the same size as immediately after the operation (Figure 2). The transplant had totally disappeared in two shoulders, had become smaller in 21 cases, and had moved in 2 cases (pseudarthrosis). In five shoulders, the transplant had become smaller and had moved. There was no correlation between the changes of the transplant and the grade of arthrosis, follow-up time, postoperative dislocations,

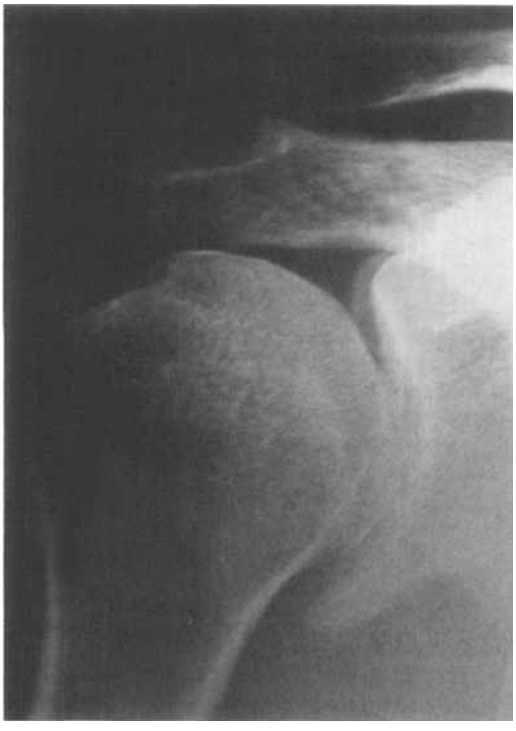

Figure 2. The end of the bone transplant can be seen inferior to the joint space. After 6 years, it was exactly the same.

or the patients' opinions. However, six of the 11 patients reporting a postoperative dislocation had changes in the bone graft.

None of the 6 patients with a glenohumeral subluxation had postoperative dislocations or arthrosis. All except 1 patient experienced the end result as good.

## Discussion

There has been a wide range in the incidence of postoperative redislocations (0–18 percent) after the Eden-Hybbinette procedure (Palmer and Widén 1948, Hindmarsh and Lindberg 1967, Øster 1969, Solonen and Rokkanen 1972, Skogland and Sundt 1973, Lindholm 1974, Paavolainen et al. 1984, Gerber et al. 1988); moreover, after Alvik's modification, the range has been quite similar (0–16 percent; Said and Medbø 1970, Solonen and Rokkanen 1972, Schrøder and Fristed 1985, Toolanen et al. 1990). The corresponding figures for the soft-tissue operations vary, for example, from 0 to 35 percent using the Putti-Platt operation (Lipscomb 1975, Paavolainen et al. 1984). However, these results are hardly ever fully comparable because of the different materials and criteria.

In our series, one fifth of the patients had postoperative redislocations or subluxations; but there was a relevant trauma in 10 out of 11 cases. Most of these patients were young, possibly reflecting the greater physical activity of these patients. In 3 cases in which only the patient's report was available, there had probably been a postoperative subluxation. Finally, only 1 patient with two additional operations can be regarded as a real failure.

The patients' mean age at the time of the operation (32 years) is one of the highest reported; in Toolanens et al.'s (1990) report, it was 27 years. This may reflect the fact that our patient material was not selected and that there was a certain pool of nontreated patients waiting to be operated on at our hospital when it opened in 1976.

The apprehension test seems to reveal a tendency towards dislocation or subluxation. In our study, almost all the patients with a positive test reported postoperative dislocations. The test seems to be a valuable clinical method (1) for examining shoulder dislocations and subluxations, which often have no other overt physical signs during manual examination, and (2) for use when there are no CT or arthroscopic facilities available or examining experience.

There is one study that has compared the classical Eden-Hybbinette method and Alvik's modification, and the latter was found to be better (Solonen and Rokkanen 1972). Our modification of Alvik's procedure logically results in a minor restriction in external rotation when compared with operations in which the subscapularis tendon is shortened (Lipscomb 1975, Paavolainen et al 1984). In Toolanen et al.'s (1990) material, the subscapularis was transsected, which resulted in a restriction in external rotation at the side of 13° as compared with our 5°. On the other hand, the scar formation might be less in our modification, resulting, however, in a weaker anterior part of the joint. This might partly explain the traumatic redislocations in our study.

The so-called bone-block operations have been reported to cause additional arthrotic changes (Gerber et al. 1988), sometimes even in the majority of the cases (Hindmarsh and Lindberg 1967). The etiology of these changes is controversial. Arthrosis may be caused by repeated trauma, as well as by the operative manipulation of the glenoid rim. In our study the arthrotic changes correlated more distinctly with the patient's age at the time of the operation than with the follow-up time. Undoubtedly, the Alvik procedure affects the

glenoid rim, and postoperative evaluation of slight arthrotic changes may be difficult. This partly explains the relatively large number of incipient arthrotic cases in our study. This might be the case, especially if the transplant is too near the glenoid rim, as it turned out to be in Toolanen et al.'s report (1990).

The postoperative scar formation after the Eden-Hybbinette operation has been suspected of being the cause of the positive results of the operation, the bone block not being of such importance (Hindmarsh and Lindberg 1967, Øster 1969, Skogland and Sundt 1973, Lindholm 1974). There were substantial changes in the transplant in one fifth of the shoulders both in our study and in Toolanen et al.'s report (1990). Seven of the 11 patients reporting a postoperative dislocation and half of the patients with positive apprehension test results had radiographic changes in the bone graft, although there was no statistical difference. Thus, the changes in the bone graft may be associated with an impairment in the clinical results (Toolanen et al. 1990). Perhaps, this problem might be resolved by using a larger transplant.

The results in our study and Toolanen et al.'s report (1990) are, on the whole, quite alike, including follow-up time and the number of patients. We had one real failure, whereas in their report there were practically no failures in terms of spontaneous redislocations. In both studies, four fifths of the shoulders showed radiographically bony healing of the transplant. Because of different criteria, these results are not fully comparable as regards arthrosis.

Finally, in conclusion, we recommend Alvik's glenoplasty as one of the methods to treat habitual anterior humeroscapular dislocation and subluxation.

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