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SHOULDER

Primary anterior dislocation of the shoulder: long-term prognosis at the age of 40 years or younger

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Abstract
Purpose We describe the long-term prognosis in 257 first-time anterior shoulder dislocations (255 patients, aged 12–40 years) registered at 27 Swedish emergency units between 1978 and 1979.
Methods Half the shoulders were immobilised for 3–4 weeks after repositioning. Follow-ups were performed after two (questionnaire), five (questionnaire), 10 (questionnaire and radiology) and 25 (questionnaire and radiology) years in 227 patients (229 shoulders). Twenty-eight patients died during the 25 years of observation.
Results Early movement or immobilisation after the primary dislocation resulted in the same long-term prognosis. Recurrences increased up to 10 years of follow-up, but, after 25 years, 29 % of the shoulders with ≥2 recurrences appeared to have stabilised over time. Arthropathy increased from 9 % moderate to severe and 11 % mild at 10 years, to 34 % moderate to severe and 27 % mild after 25 years. Alcoholics had a poorer prognosis with respect to dislocation arthropathy ($P < 0.001$). Age <25 years and/or bilateral instability represent a poorer prognosis, where stabilising surgery is necessary in every second shoulder. Fracture of the greater tuberosity means a good prognosis, and we have found no evidence that athletic activity, gender, a Hill–Sachs lesion and minor rim fractures had any prognostic impact. During the 25 years in which these patients were followed, 28/255 died (11 %), representing a mortality rate (SMR) that was more than double that of the general Swedish population ($P < 0.001$).
Conclusion Almost half of all first-time dislocations at the age of <25 years will have stabilising surgery and two-thirds will develop different stages of arthropathy within 25 years.

Keyword Shoulder · Dislocation · Long-term prognosis · Dislocation arthropathy

Introduction

A description of the long-term prognosis for the first shoulder dislocation should be based on solid knowledge. We know that one-third of all individuals with a primary dislocation handle the dislocation by themselves and never come to hospital [17, 18, 21]. These dislocations will never be included in prognostic studies. Consequently, we have to rely on patients who come to hospital with their first dislocation. A shoulder dislocation can be classified differently. "Traumatic" (less laxity, unidirectional) towards "Atraumatic" (more laxity, multidirectional) [40] or, as described by Carter Rowe [44], in five main groups: (1) traumatic, (2) atraumatic dislocation or subluxation, (3) voluntary dislocation or subluxation, (4) traumatic recurrent transient subluxation or (5) involuntary dislocation or subluxation. Thomas and Matsen [49] had a third model for classification based on the acronyms AMBRI and TUBS. The shoulder dislocations we describe are dislocations with a different aetiology, unknown degree of laxity and so on, but they manifested with a first time anterior dislocation that brought the person to an emergency unit.

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First-time dislocations occur in a fairly similar manner at all ages. The male/female ratio varies with age. More than 80 years ago, it also became evident that age had a prognostic impact when recurrence was considered [4, 13]. Rowe and McLaughlin subsequently provided a great deal of information based on large retrospective studies [35, 42].

Dislocation arthropathy was fairly unknown until Samilson and Prieto published their paper in 1983 [46]. In his classic paper dealing with the Bankart repair [43], for example, Carter Rowe reported that none of 124 shoulders had degenerative joint changes after a mean of 6 years. With current knowledge, it is possible to question this statement!

During the last 40 years, a large number of papers dealing with the prognosis have been written [12, 15, 32, 41, 47]. However, most of them are retrospective or have various kinds of limitation, e.g. the studied patients are in military personnel or athletes [2, 18, 37]. These studies naturally provide valuable information, but their impact on our knowledge of the long-term prognosis is unclear.

In their prospective study of 252 first-time shoulder dislocations (ages 15–35 years, all receiving immobilisation treatment), Robinson et al. [41] confirmed the poor prognosis at ages below 25 years and reported a better prognosis in females, with respect to recurrences. However, their study had dropouts and the follow-up time for all patients was unclear, even if it did not exceed 5 years in all shoulders. In their prospective study, Ryf and Matter [45] collected 504 shoulders, of which 324 (64 %) were followed for 5 years. Other prospective studies dealing with the arthroscopic repair of first-time dislocations [1, 7, 33], arthroscopic lavage [48, 50] or immobilization in external rotation have recently appeared, [9, 31, 34], but the mean follow-ups are somewhat short.

In 1978, we initiated a prospective multicenter study at 27 Swedish hospitals [17, 19, 20]. Two hundred and fifty-five patients (259 shoulders) aged 12–40 years were included, and they underwent treatment with or without immobilisation. This cohort has been followed up after 2 years [17, 19, 20], 5 years [22] and 10 years with a radiographic examination [23] and after 25 years with radiographic examination [25, 27, 28]. During the 25-year observation period, 28 patients died. These patients were analysed separately [25].

Since our treatment with immobilisation had no prognostic impact, this cohort, coming to the emergency units in different areas of Sweden, with a first-time dislocation (Fig. 1), should reflect the long-term behaviour in connection with this disorder.

Methods

In 1977, we initiated a prospective study to evaluate the results of immobilising first-time dislocation in patients aged 40 years or younger. The study covered about a quarter of Sweden (Fig. 1) and 27 Swedish hospitals were included. Two hundred and twenty-six dislocated shoulders were reduced at hospital and 31 were reduced just before coming to the emergency unit. The diagnosis of dislocation was then verified radiographically or by an experienced orthopaedic surgeon. Table 1 shows the aetiology of the initial dislocation. The dislocations were treated either by immobilisation for 3–4 weeks (minimum 21 days), Group 1 (112 shoulders), or with the arm in a sling for some days until the patient was comfortable, Group 2 (104 shoulders). The collection of patients for the study took place in 1978 and 1979, and, early in the study, a third group, Group 3, was established. This group included patients who, for various reasons, could not be allocated to Groups 1 and 2 (41 shoulders, Table 1). The 2-year follow-up started in January 1980 and ended at the beginning of 1982. All the patients answered a questionnaire by letter or telephone 2 years ± 15 days after the primary dislocation had occurred. Two hundred and fifty-seven dislocations (255 patients) were then included in the study, Group 1, 112 shoulders, Group 2, 104, and Group 3, 41 shoulders [17, 19]. In 1983 and 1984, a 5-year follow-up was performed in the same way in all 254 patients, as one patient in Group 3 had died [22]. In 1988, we started the 10-year follow-up, which included radiography. A further eight patients were then deceased and one could not be found. Two hundred and forty-seven shoulders were included in the 10-year

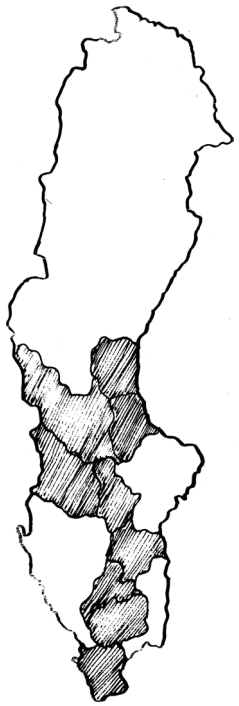

Fig. 1 Parts of Sweden covered by this prospective study

Table 1 Cause of primary dislocation and reason for inclusion in Group 3

	Age groups			
	12–22	23–29	30–40	Total
Fall NUD	24	13	44	81 (32 %)
Traffic	12	4	7	23 (9 %)
Epileptic	1	3	0	4 (2 %)
Unspecified	5	4	7	16 (6 %)
Spontaneous				
No athlete	2	2	1	5 (2 %)
Athlete	12	1	0	13 (5 %)
Contact sports	21	10	9	40 (15 %)
Slalom skiing	12	10	14	36 (14 %)
Various sports	13	13	13	39 (15 %)
Total	102	60	95	257 (100 %)
Fixation period not fulfilled				
Patient's own initiative				20
Incorrect instruction				10
Reduction not within 24 h				3
Alcoholism				2
Subluxations prior to dislocation				2
Epilepsy (severe)				2
Acutely operated fracture				2
Total	16	9	16	41

follow-up, 185 with radiography [23]. Finally, we started a 25-year follow-up in 2003, which was completed in 2005. All patients then alive, 229 shoulders, including the patient who could not be found after 10 years, took part in the follow-up after a mean of 25 years (24.2–26.4 years) [27]. Two hundred and twenty-three (97 %) also underwent a radiographic examination [28], and 214 patients (216 shoulders) also completed the DASH questionnaire [3, 29]. In all, 28/255 patients (11 %) entering this study had died at 25 years and were analysed in a separate paper [25]. We used the classification according to Samilson and Prieto [46] when arthropathy at 10 and 25 years was evaluated.

At the 2-year follow-up, we had five classes of instability: "not recurred"; "not recurred but subjectively unstable"; 1 recurrence"; ≥2 recurrences; and "surgically stabilised". At 10 years, we defined a group of shoulders as "healed or stabilised with time", which meant they had had ≥2 recurrences within the first 5 years but no recurrences during the last 5 years. This classification at 25 years was used for recurrent shoulders with no recurrence during the last 10 years. Since shoulders with a fracture of the greater tuberosity had a better prognosis, they were excluded when we produced our histograms showing age/recurrence at 2, 5, 10 and 25 years.

For further information with respect to material, methods and results, we refer to our original papers.

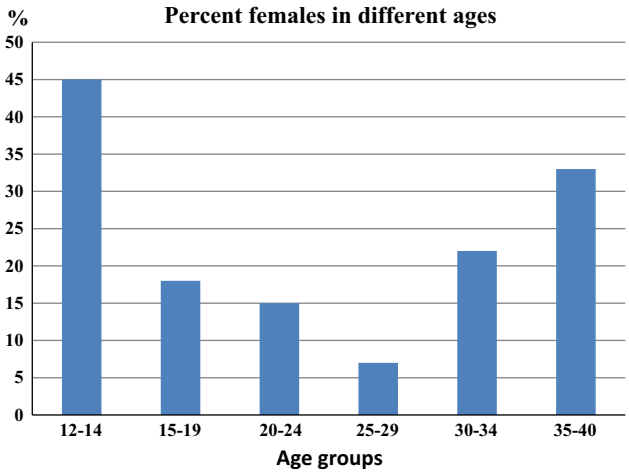

Fig. 2 Per cent females in different age groups of 257 first-time dislocations

Demographics

The youngest patients who entered the study were 12 years of age. Table 1 shows the aetiology and numbers of shoulders in three different age groups entering the study. Fifty-two of 257 dislocations were in female shoulders, and Fig. 2 shows a very low incidence at the ages of 25–29 years where only 7 % were females. Three of the dislocations occurred in pregnant women who fell (6 %) and attempted to protect their abdomen; 50 % of the primary dislocations were related to some sports activity (128/257). Eighteen of 257 were caused by insignificant trauma ("spontaneous"), and 14/18 of these were at the ages of 12–22 years ($P < 0.01$) (Table 1).

Reduction in first-time dislocation

Sixty-five dislocations were reduced without medication, 71 with some sedation and 90 under general anaesthesia. General anaesthesia was used significantly more frequently at the age of ≥30 years than at the age of ≤22 years ($P < 0.01$).

Radiological observations at the first dislocation

Two hundred and thirty-nine of 257 shoulders had radiographs that could be reliably evaluated and were the basis for analysis with respect to fractures of the greater tuberosity (Table 2). These were more common at the age of 12–13 years and after 35 years (Fig. 3). When we analysed the impression fracture of the posterior area of the humeral head [13, 14, 36], fractures of the greater tuberosity (32 shoulders), together with some unreliable radiographs, were excluded and the analysis was based on 195 shoulders. One hundred and forty-five shoulders had radiographs

Table 2 Radiographic findings at primary dislocation and recurrences after 2 years related to impression fractures of the posterior part of the humeral head

Age	Chip fractures	Arm locked in abduction	Greater tuberosity fractures	Evident impression fracture		No evident impression fracture	
				No.	No. with later redislocation	No.	No. with later redislocation
12–22 years	4/94 (4 %)	5/50	8/97	43	21 (49 %)	41	19 (44 %)
23–29 years	4/50 (8 %)	7/34	5/56	30	11 (37 %)	18	2 (13 %)
30–40 years	10/82 (12 %)	8/61	19/86	34	7 (21 %)	29	2 (7 %)
Total	18/226 (8 %)	20/145	32/239	107	39 (36 %)	88	23 (28 %)

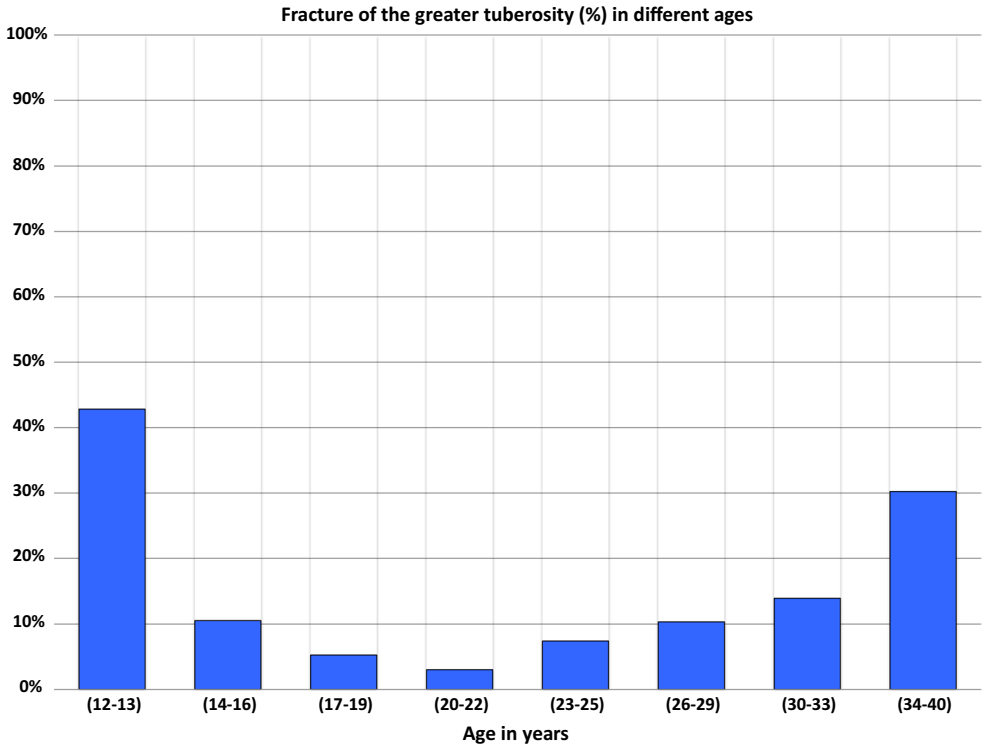

Fig. 3 Incidence of fractures of the greater tuberosity in eight different age groups of 239 first-time dislocations (239/257, radiographic examinations)

in a dislocated position, and 20 of these (14 %) showed the shoulder in an abducta position (Fig. 4; Table 2). The table demonstrates that glenoid rim fractures (chip fractures) increased at ages after 30 years. At least two of 226 shoulders had a fracture of the coracoid process, and in 10/226 shoulders, old or acute AC-joint injuries were demonstrated.

Results over 25 years of observation

Immobilisation for 3–4 weeks

At 25 years, we found no impact of immobilisation in terms of the prognostic outcome after 25 years (Table 3). Nor were any of the three previous follow-ups able to demonstrate any differences between the three treatment groups.

Age and recurrence (after excluding shoulders with a fracture of the greater tuberosity)

Figure 5 shows the findings with respect to stability 2 years after the first-time dislocation. At ages of ≤22 years, 36 % had recurred twice or more (surgically stabilised shoulders included), 15 % had recurred once, and a further 16 % regarded their shoulders as unstable, although they had had no recurrence; 33 % (1/3) regarded their shoulders as recovered. The corresponding figures for ages of ≥30 years

Fig. 4 Radiograph demonstrating luxatio abducta: 20/145 shoulders had this position by dislocation. With permission of J Bone Jt SurgA

were quite different. Only 11 % had recurred twice or more, and 71 % regarded their shoulders as "cured".

Fifteen of 34 recurring at the age of ≤22 years, eight of 15 at the age of 23–29 years and four of nine at the age of ≥30 years had been operated on or were on the waiting list for stabilising surgery, 16, 15 and 5 %, respectively, in each age group.

Figure 6 shows that the number of shoulders with surgical stabilisation had doubled after 5 years at the ages of 12–22 years, 29/94 (31 %). Twenty-nine of 94 (31 %) had not recurred, and nine (10 %) had recurred once in this youngest age group.

At the 10-year follow-up (Fig. 7), still fewer than 40 % of the shoulders in the youngest cohort had undergone stabilising surgery. A total of 49 (20 %) shoulders were then classified as recurring without surgery, but 24 of these (49 %) had had no redislocation since the 2- or 5-year follow-ups and were classified as probably having spontaneously stabilised. In the histogram (Fig. 8) showing the prognosis after 25 years, we included shoulders as spontaneously healed when no further dislocation had occurred between 15 and 25 years in a shoulder with a previous ≥2 recurrences.

Gender

After 25 years, 13/41 (32 %) female shoulders had been surgically stabilised compared with 47/164 (29 %) male shoulders, when fractures of the tuberosity were excluded. Nor were we able to demonstrate any difference with respect to gender and recurrence at 2, 5 and 10 years.

Athletic activity

During all follow-ups, the degree of activity was analysed for the three age groups, but the definition of physical activity varied during our follow-ups. At 2 years, we compared patients in terms of "no physical activity", "recreational" or "athletics". At 5 years, we compared patients "with absolutely no reported athletic involvement" with these shoulders where "the first dislocation was caused by athletic activity and/or the patients were still engaged in sports". At 25 years, we compared patients in terms of "engaged in contact sports", "other sports including recreational activities" and "no sports". With the numbers available in our

Table 3 Results of treatment at 25-year follow-up, with respect to recurrence and surgery at different ages

	Not recurrent (stable)	Became stable over time	Recurrent	Surgically stabilised	Total
Age 12–22 years					
Group 1	14 (33 %)	5 (12 %)	5 (12 %)	19 (44 %)	43
Group 2	9 (25 %)	8 (22 %)	5 (14 %)	14 (39 %)	36
Group 3	3 (23 %)	5 (38 %)	1 (8 %)	4 (31 %)	13
Total	26 (28 %)	18 (20 %)	11 (12 %)	37 (40 %)	92
Age 23–29 years					
Group 1	8 (44 %)	3 (17 %)	3 (17 %)	4 (22 %)	18
Group 2	13 (48 %)	5 (19 %)	2 (7 %)	7 (25 %)	27
Group 3	1 (20 %)	1 (20 %)	0	3 (60 %)	5
Total	22 (44 %)	9 (18 %)	5 (10 %)	14 (28 %)	50
Age 30–40 years					
Group 1	21 (72 %)	4 (14 %)	1 (3 %)	3 (10 %)	29
Group 2	19 (73 %)	1 (4 %)	1 (4 %)	5 (19 %)	26
Group 3	6 (75 %)	1 (13 %)	0	1 (13 %)	8
Total	46 (73 %)	6 (10 %)	2 (3 %)	9 (14 %)	63

The values are given as numbers of shoulders. Shoulders with fractures of the greater tuberosity are excluded. When the non-recurrent shoulders were compared with the others while controlling for age, there was no effect of treatment ($P = 0.705$, multiple logistic regression analysis)

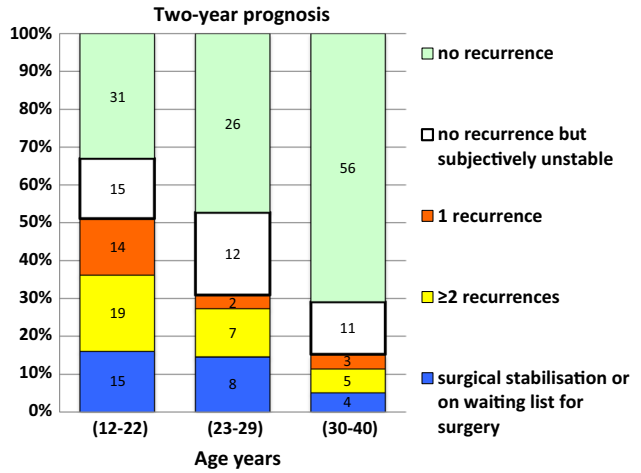

Fig. 5 Histogram at 2-year follow-up, demonstrating the percentage of shoulders that had no redislocation, those that had no redislocation but had a feeling of instability, those that had recurred once, those with ≥2 redislocation but not surgically stabilized and those who had been surgically stabilized or were on the waiting list for stabilization, according to three different age groups (fractures of the greater tuberosity excluded)

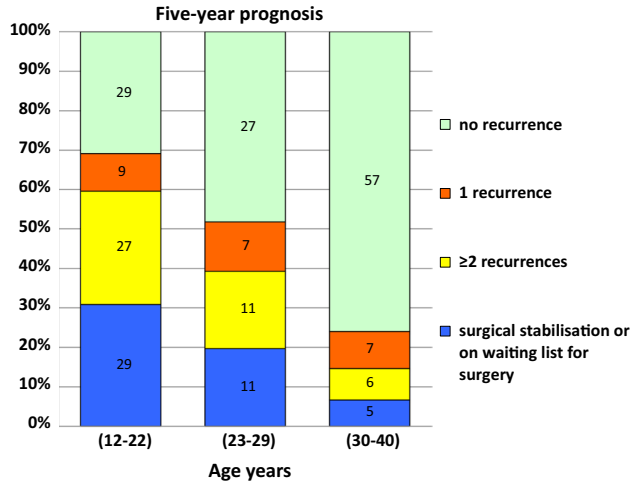

Fig. 6 Histogram at 5-year follow-up, demonstrating the percentage of shoulders that had no redislocation, those that had recurred once, those with ≥2 redislocation but not surgically stabilized and those who had been surgically stabilized or were on the waiting list for stabilization, according to three different age groups (fractures of the greater tuberosity excluded)

study, we found the same prognosis with respect to different degrees of physical activity after 2, 5 and 25 years.

Dislocation of the contralateral shoulder (bilateral dislocation)

Table 4 shows reported bilateral dislocation during the four follow-ups. At the 5-year follow-up, we found no correlation between recurrences/stabilisation if just one or both shoulders were involved. At the 10-year follow-up, the prevalence of bilateral involvement had increased in the younger age groups; ages 12–25 years compared with ages 26–40 years ($P < 0.03$) and ages ≤29 years compared with ages ≥30 years ($P < 0.002$).

At 25 years, 38/229 shoulders were bilaterally involved (17 %). When we compared shoulders classified as solitary at 25 years, seven of 99 (7 %) had bilateral dislocation as different from operated shoulders where 14/62 (23 %, $P = 0.009$) had both shoulders involved. This difference also remained when analysed according to age ($P = 0.036$).

Fracture of the greater tuberosity

At the 2-year follow-up, none of the 32 shoulders with a tuberosity fracture had recurred and, after 5 years, one was considered "recurrent". At 10 years, one patient with a tuberosity fracture had died and one of 31 had undergone surgery because of instability, two were considered as recurrent and one had had one redislocation. After 25 years, 24 shoulders with a fracture remained and two of them (8 %) had had stabilising surgery. During all four follow-ups, shoulders with a fracture of the greater tuberosity had a significantly better prognosis than shoulders without this injury.

Impression fracture of the humeral head [13, 14, 36]

At 10 years, we found a poorer prognosis at the age of 23–40 years with this injury ($P < 0.01$). However, at the 2-, 5- and 25-year follow-ups, we were unable to demonstrate any differences in shoulders with or without this injury.

Glenoid rim fracture and type of trauma

A spontaneous (non-traumatic) aetiology and fracture of the glenoid rim had no prognostic impact in this series of shoulders. Nor did the analysis of the degree of trauma ("no trauma"; moderate; and severe) causing the first-time dislocation reveal any prognostic differences.

Surgical treatment because of recurrent instability

Eight of 62 shoulders with surgical stabilisation (13 %) had the operation after the 10-year follow-up. Six of 62 (10 %) had revision surgery because of a recurrence of instability. At the 10-year follow-up, subjects aged ≤25 years had had surgery earlier (≤5 years after the first dislocation) and subjects aged ≥26 years later (between 5 and 10 years after the first dislocation, $P < 0.02$). The eight shoulders undergoing surgery between the 10- and 25-year follow-ups (13 %) were evenly distributed among all age groups.

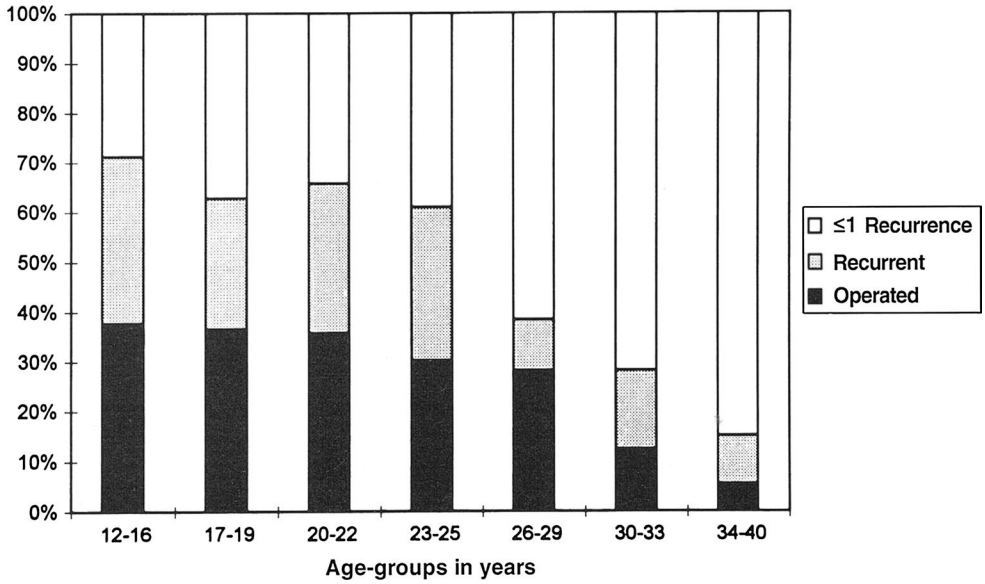

Fig. 7 Histogram at 10-year follow-up, showing the percentage of shoulders that had no redislocation or had recurred once, those with ≥2 redislocation but not surgically stabilized and those, who had been surgically stabilized, according to seven different age groups (fractures of the greater tuberosity excluded). With permission of J Bone Jt Surg Am

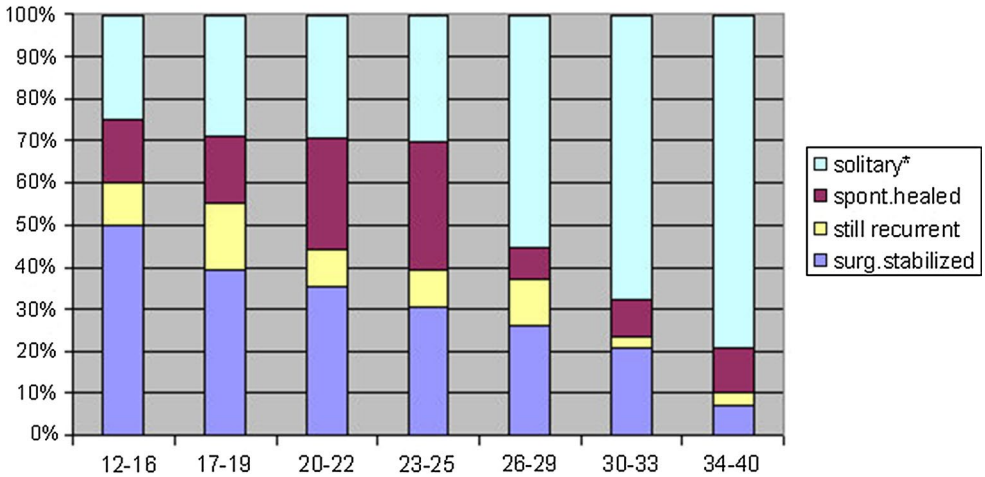

Fig. 8 Histogram at 25-year follow-up, showing the percentage of shoulders that had had no or only 1 redislocation (Solitary), those with ≥2 redislocation but stabilized over time, those with ≥2 redislocations not surgically stabilized, considered as still unstable and those, who had been surgically stabilized, according to seven different age groups (fractures of the greater tuberosity excluded). With permission of J Bone Jt Surg Am

Table 4 Dislocation in the contralateral shoulder found at 2-, 5-, 10- and 25-year follow-ups, related to three different age groups

	Age groups		
	12–22 years	23–29 years	30–40 years
2-year follow-up	6/102 (6 %)	10/60 (17 %)	3/95 (3 %)
5-year follow-up	13/102 (13 %)	12/60 (20 %)	3/94 (3 %)
10-year follow-up	16/99 (16 %)	12/57 (21 %)	3/91 (3 %)
25-year follow-up	18/98 (18 %)	13/54 (24 %)	7/77 (9 %)

"Luxatio abducta"

Figure 4 and Table 2 show this entity. The humeral head is in a high position under the coracoid, as different from the erecta position where the head is inferior to the glenoid. When these dislocations recur, they commonly have the same arm position. It is distinctly described by the patient, "difficulty getting in a car with the arm in 90° of abduction", "arm elevated, pointing out from the body" and this position is perhaps combined with a poorer prognosis with respect to both recurrence ($P = 0.08$ at 10 years) and arthropathy ($P = 0.081$ at 25 years). This position occurred in our study in 20/145 (14 %, Table 2) dislocated shoulders.

Radiology at 10 and 25 years

Figure 9 shows that the follow-up with respect to radiology was more complete after 25 years (223/229, 97 % then had an X-ray) than after 10 years (208/247, 84 %). Thirty-one shoulders analysed after 25 years had no radiological examination at 10 years. Figure 9 also shows that 59/146 (40 %) normal shoulders at 10 years had different degrees of arthropathy 15 years later. Nineteen of 30 (63 %) shoulders with mild arthropathy at 10 years had become

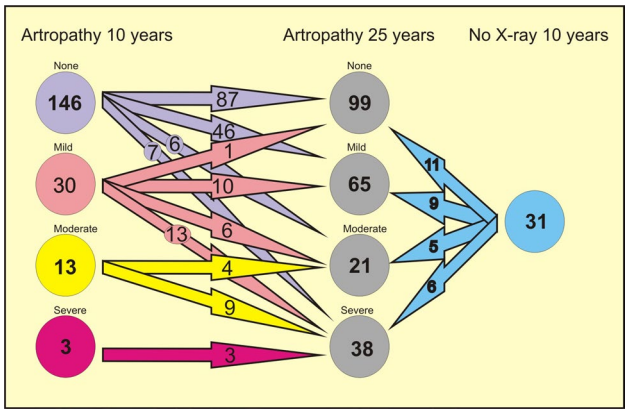

Fig. 9 Evolution of arthropathy between the 10- and 25-year follow-ups. With permission J Shoulder Elbow Surg

Fig. 10 Demonstrates an incongruent joint, meaning that the articular joint lines of the humeral head and glenoid are not parallel

moderate or severe at the 25-year follow-up, and nine of 13 shoulders classified as moderate at 10 years had become severe at 25 years.

"Joint incongruence" and arthropathy

At 10 years, articular incongruity (Fig. 10) was seen on the radiographs of 32 shoulders and 23 of these had evidence of arthropathy (72 %) compared with 79/179 congruent shoulders (44 %, $P = 0.001$). At 25 years, 82 % of the incongruent shoulders at 10 years had arthropathy (mild, moderate or severe) compared with 50 % in the congruent shoulders ($P < 0.0001$). The best radiological view for demonstrating incongruence is the AP-IR view ($P = 0.049$) [11].

Age and arthropathy

Patients aged ≤25 years or younger when the primary dislocation occurred had less arthropathy after 25 years than patients aged 26–40 years ($P = 0.01$).

Alcoholic abuse and arthropathy

Seven of 221 patients were classified as alcoholics at 25 years (Table 5), and seven of seven "alcoholic shoulders" had moderate/severe arthropathy compared with 52/216 "non-alcoholic" shoulders ($P < 0.001$). The alcoholics were excluded when we analysed levels of instability and arthropathy.

Arthropathy, levels of instability at follow-up and original trauma

At 10 years, 23/208 shoulders had mild arthropathy (11 %) and 18/208 (9 %) had moderate or severe arthropathy, according to Samilson and Prieto [46]. These figures had more than doubled at 25 years (Table 5). When alcoholics were excluded, 17 % of the shoulders with no recurrence after 25 years had moderate/severe arthropathy compared with 43 % in the group which was classified as stabilised over time (healed recurring) ($P = 0.007$) and still recurring (29 %, $P = 0.047$). Operated shoulders (12/58, 21 %) did not differ from shoulders with no recurrence with respect to moderate/severe arthropathy ($P = 0.725$), but they had less arthropathy than shoulders that stabilised over time ($P = 0.047$).

Table 5 Arthropathy at 10- and 25-year follow-ups with respect to levels of instability

	Normal	Mild	Moderate or severe	Total
Degree of arthropathy				
At 10-year follow-up				
No recurrence	89 (84 %)	11 (10 %)	6 (6 %)	106
1 recurrence	8 (80 %)	1 (10 %)	1 (10 %)	10
≥2 recurrences	29 (74 %)	5 (13 %)	5 (13 %)	39
Surgically stabilised	41 (77 %)	6 (11 %)	6 (11 %)	53
At 25-year follow-up				
No recurrence	48 (51 %)	30 (32 %)	17^{+} (18 %)	95
1 recurrence	4 (24 %)	7 (41 %)	6 (35 %)	17
Healed recurrent	7 (23 %)	10 (32 %)	14^{+} (45 %)	31
Still recurrent	5 (28 %)	7 (39 %)	6^{+} (33 %)	18
Surgically stabilised	35 (56 %)	11 (18 %)	16* (26 %)	62

$^{+}$ 1 alcoholic, * 4 alcoholics

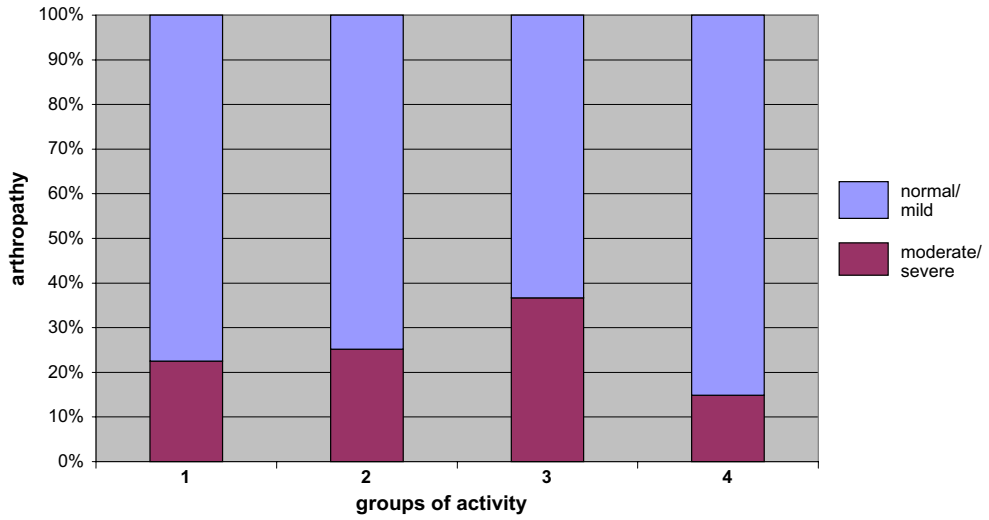

Fig. 11 Percentage of moderate/severe arthropathy is shown with respect to aetiology when the primary dislocation occurred: (1) no sporting activity; (2) all types of sport; (3) traumatic sports; and (4) non-traumatic sports. With permission J Shoulder Elbow Surg

Figure 11 shows that the group that sustained the primary dislocation because of traumatic sports had the highest percentage of moderate/severe arthropathy (37 %), while the non-traumatic sports had the lowest (15 %; $P = 0.009$).

Arthropathy and surgical treatment

Thirty-four of 62 shoulders were treated with bone-block methods (27 Bristow-Latarjet, standing position, one screw) [5, 21, 24] and seven according to Eden–Hybbinette [8, 30]. When the alcoholics were excluded, we found no difference between the two groups of bone-block and soft-tissue repairs ($P = 0.830$). The restriction of outward rotation at the 10-year follow-up did not influence the evolution of arthropathy at 25 years ($P = 0.81$).

Subjective assessment of shoulder function and degree of arthropathy

Subjective assessments of function of the shoulder did not differ significantly when shoulders with or without arthropathy were compared at 10 years. At 25 years, the shoulders with severe arthropathy had poorer (higher) DASH scores compared with the other groups ($P = 0.001$) (Fig. 12).

Arthropathy and bilateral instability

Of 35 shoulders with contralateral dislocation, four had moderate/severe (11 %) and six mild (17 %) arthropathy at 25 years compared with three of 177 moderate/severe (2 %) or 17/177 (10 %) mild, when the contralateral shoulder had had no dislocation ($P = 0.016$ for mild/moderate/severe and $P = 0.015$ for moderate/severe).

Mortality at 25-year follow-up

When we established our cohort of 255 patients with 257 shoulder dislocations at the 2-year follow-up, five patients exhibited alcoholic behaviour. We excluded three alcoholics since the information was second hand and unreliable [19] and two alcoholics were kept in the study but were allocated to Group 3. At 25 years, a total of 28 patients were deceased. One of these living in Denmark when the dislocation occurred was excluded, when mortality was compared for this group of patients and the Swedish population. Table 6 shows that 11/27 had died from injury or intoxication (S00-T98, ICD10), which is more than expected relative to the causes of death for the general Swedish population in 2003 and 2004, when our 25-year follow-up was undertaken ($P < 0.001$). Figure 13 shows that the mortality rate (SMR) for our cohort of primary dislocations was more than double that of the general Swedish population ($P < 0.001$). A higher proportion of the deceased patients had an aetiology other than sports-related activity as a cause of their initial dislocation ($P = 0.04$).

Discussion

Knowing the natural history of a disease or the healing potential after an injury is essential in order to decide how to treat a specific condition. If the natural history is not known, there is always a risk of incorrect treatment. The patient is either overtreated or adequate treatment is withheld. None of our follow-ups of these shoulders was able to demonstrate that immobilisation of the arm for 3–4 weeks after the primary dislocation compared with immediate

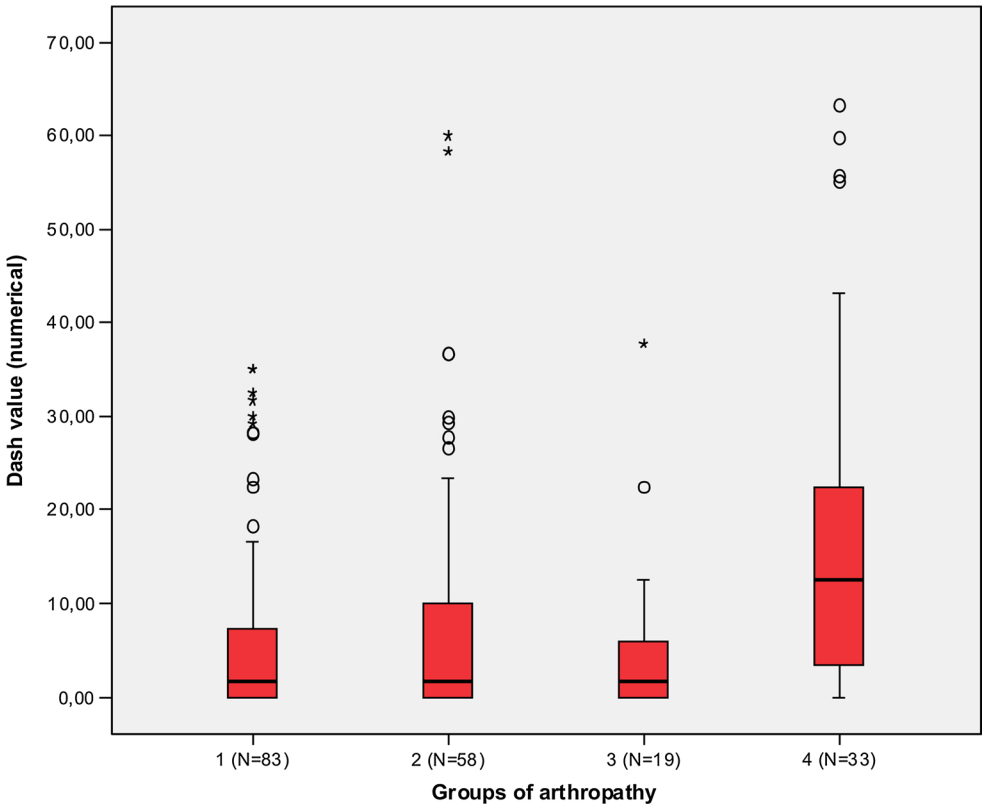

Fig. 12 *Box* and *whisker plot* demonstrates median disabilities of arm, shoulder and hand (DASH) values for (1) normal shoulders; (2) those with mild; (3) moderate; and (4) severe arthropathy. With permission J Shoulder Elbow Surg

Table 6 Causes of death according to ICD10 classification in our series and for the general population in 2003–2004 (Statistics Sweden)

Cause of death	ICD10	*n*	%	*P* value[a]
Malignancies	C00-C75	4	14.8	0.5
Endocrine	E00-E90	1	3.7	0.7
Central nervous system	G00-G99	2	7.4	0.1
Cardiovascular	I00-I99	6	22.2	0.03[b]
Genitourinary	N00-N99	1	3.7	0.3
Injury and poisoning	S00-T98	11	40.7	<0.001[b]
Non-specific		2	7.4	<0.001[b]
Other natural causes		0		0.004[c]
All causes		27	100	

[a] Difference from the general Swedish population

[b] Higher

[c] Lower

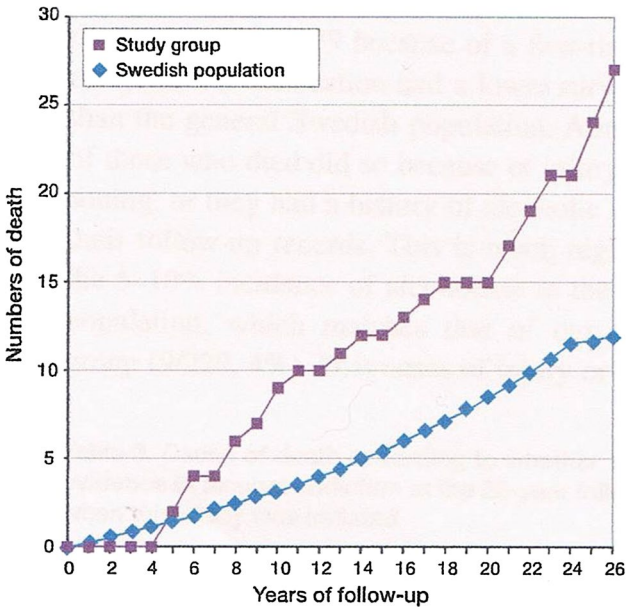

Fig. 13 Demonstrates the rate of mortality for the average Swedish population (*blue*) and for the patients that entered this study 1978–1979 (*red*). With permission of Acta Orthop Scand

mobilisation changed the long-term prognosis [19, 22, 23, 27]. Two hundred and fifty-seven first-time shoulder dislocations were followed for 25 years at regular intervals without a single dropout at the 25-year follow-up, apart from the deceased individuals. Our Swedish system, in which a social security number is given at the time of birth, makes it possible to determine where a person is living. With this identifier, it is also possible to reach relatives and through them contact patients living abroad, thereby explaining some of the completeness of our follow-ups. We consequently conclude that it is impossible to come closer to the

natural history of the first-time anterior shoulder dislocation than through these studies. About one-third of all individuals with a first-time dislocation handle their dislocation by themselves (17, 18 21). The natural history of these patients will perhaps be unknown. This follow-up summary deals with all the patients that have come to hospital asking for medical help, as different from many others dealing with just military personnel or athletes [1, 2, 16, 37]. This reflects the behaviour in relation to this disorder in a general population.

When we initiated this study in 1978, our goal was to examine the effect of immobilisation of the arm for 3–4 weeks after the primary dislocation, compared with early mobilisation, in a 2-year follow-up study. Carter Rowe (personal communication) asked why we chose "40 years" as the highest age for inclusion in the study. At that time, we had never thought about following the patients for 25 years, but, in retrospect, although 28/255 patients have died, our upper age limit was very appropriate, even though, when initiating the study [17, 19], we excluded some alcoholics because of second-hand information. The alcoholics differ from the other patients with respect to survival and arthropathy [38, 39]. When we analysed the mortality rate in this series of shoulders (Fig. 13), we concluded that "the doubled mortality rate in our cohort of patients is most probably explained by the inclusion of a disproportionate number of patients with alcoholic behaviour" [25].

As expected, Figs. 5, 6, 7 and 8 demonstrate that the prognosis with respect to recurrent dislocation in three different age groups is better with increasing age at the time of the first dislocation. In the cohort aged 22 years or younger, 46/94 (49 %) had not recurred after 2 years, but 15 of these 46 (1/3) were subjectively unstable (Fig. 5). The figures at 5 years (Fig. 6) were almost the same, but the number that had undergone surgery or were on the waiting list for surgery had doubled to 29/94 (31 %) at the age of ≤22 years. The histograms after 10 and 25 years (Figs. 7, 8) show the prognosis for seven different age groups and reveal that, after 10 years, at the age of ≤22 years, about 35 % had been surgically stabilised and one-third were classified as recurrent without surgery. At the 10-year follow-up, we found that 49 % of all shoulders with two or more redislocations at 2 and 5 years appeared to stabilise spontaneously [23]. At 25 years, these figures had increased to 65 % [27] (Fig. 8). We do not know anything about the disability patients suffered between the different follow-ups. We do not know whether they had any functional impairment or whether they had adapted to their unstable shoulder. Should we then surgically stabilise all shoulders after the first dislocation? This is perhaps the most important question this long-term study should clarify. Based on Fig. 8 histogram, it seems evident that 40 % of the shoulders at the age of 12–16 years and 60 % at the age of 23–25 years would have undergone unnecessary surgery, if routine, immediate surgery had been performed. Perhaps it should be a question between the patient, surgeon and the institution/community responsible for surgery payment? In special cases, when a dislocation of the shoulder is a catastrophe for the patient, routine prophylactic surgery on a first-time dislocation should perhaps be performed at all ages? Furthermore, Buss et al. [6] studied 30 athletes with a first-time shoulder dislocation and concluded that "the nonoperative treatment of anterior shoulder instability episodes can be an effective option for young athletes who are interested in returning to their athletic activities in-season". So why not "wait and see"? Or, do athletes today impose greater demands on shoulder function, indicating earlier surgical intervention?

Perhaps the results of our radiological follow-ups are the most important findings in this study. Although some of the patients lived abroad and were spread all over Sweden when the study was initiated (Fig. 1), we managed to obtain a radiological examination of 223/229 (97 %) shoulders after 25 years. Furthermore, 212/223 shoulders also had the contralateral shoulder examined. Figure 9 demonstrates that, astonishingly, more shoulders had radiology after 25 years than after 10 years. The classification of arthropathy can be discussed [11, 26], and since the Samilson and Prieto system was used at the 10-year follow-up [23], we used the same classification at 25 years, to be able to compare the changes that occurred between these follow-ups.

Moderate/severe arthropathy in 26 % of the shoulders after 25 years was a surprisingly high figure. Compared with our figures after 10 years (9 %) [23], moderate to severe arthropathy appeared to increase by 1 % point/year. When mild arthropathy is included, the figure rises to 56 % after 25 years. All shoulders in patients classified as alcoholics at 25 years had severe arthropathy. Table 5 demonstrates that 17 % of shoulders without any recurrence at all had moderate or severe arthropathy and a further 32 % had mild arthropathy (when the alcoholics are excluded). This means that a shoulder dislocation *per se* is associated with arthropathy and also, in our opinion, means that operated series of shoulder dislocations with follow-ups exceeding 20–25 years should contain a certain number of shoulders with arthropathy. Table 5 also demonstrates that 12/58 (21 %) operated shoulders (alcoholics excluded) had moderate/severe arthropathy and a further 19 % mild. These figures are lower than those for shoulders stabilised over time or still recurring shoulders and raises the question of whether stabilising surgery perhaps prevents the evolution of arthropathy. Since none of the patients had undergone shoulder replacement after 25 years, this question is perhaps hypothetical. In any case, if a 40-year follow-up is going to be performed, we are sure that some of our patients then will have an arthroplasty performed. These findings

also make it clear that, when we accuse a method for repairing shoulder instability of causing arthropathy, it may be just the evolution of the natural history. However, if a method is combined with 26 % shoulder replacements after a mean follow-up of 14.5 years [10], the method should be accused! Our observation that 63 % of the shoulders with mild arthropathy at 10 years were classified as moderate/severe after 25 years raises many questions. Moreover, the fact that incongruity of the joint at 10 years (Fig. 10) was significantly ($P = 0.001$) associated with moderate/severe arthropathy 15 years later is valuable knowledge.

Primary dislocation at the age of <25 years had less arthropathy than dislocations at the age of >25 years, and these findings are in agreement with our study of the Bristow–Latarjet repair in which the age limit was 23 years [24]. It is important to be aware that traumatic sports causing the primary dislocation were more often associated with moderate/severe arthropathy than non-traumatic sports. Not surprisingly, this means that the trauma causing the first dislocation is responsible for the subsequent evolution of arthropathy.

We have demonstrated a high rate of bilateral dislocation (17 %) at the 25-year follow-up (Table 4). Two patients are involved with both their shoulders in this study. One dislocated both shoulders at the same time during downhill skiing, and the other patient dislocated shoulder no 1 in 1978 and shoulder no 2 in 1979 [17]. In previous studies, we showed that bilateral involvement was related to younger age [17, 19, 20]. This finding is also confirmed after 25 years ($P = 0.029$) [27]. In addition, the patients who underwent stabilising surgery had more bilateral involvement than those who had a solitary dislocation ($P = 0.009$), which supports the notion that constitutional factors such as capsular redundancy, glenoid configuration, or other variations in shoulder anatomy may be of importance and may be involved in determining the prognosis after the primary dislocation.

Gender, athletic activity or minor bony Bankart lesions had no impact on the recurrence rate or the need for stabilising surgery in our material, as different from bilateral involvement. Shoulders with fractures of the greater tuberosity had a significantly better prognosis in all age groups and at all four follow-ups and were therefore excluded when we produced our prognostic histograms (Figs. 5, 6, 7, 8). Figures 2 and 3 demonstrate variations in age both for the occurrence of fracture of the tuberosity and for incidence and gender. Why do first-time dislocations in females seldom occur at the age of 25–29 years (7 %)? Why are fractures of the greater tuberosity more common before the epiphysis is closed and then increase in incidence after the age of 30 years? We know that fracture of the eminentia of the knee often occurs in adolescents instead of anterior cruciate rupture. Is a similar mechanism responsible for the higher incidence of tuberosity fractures in teenagers? Every tenth shoulder had the arm in an abducta position during the dislocation ("luxatio abducta", Fig. 4). Being aware of this fairly unknown entity will perhaps make it possible, in future studies, to evaluate whether an abducta position has a prognostic impact?

These studies reflect the Swedish tradition and indications for surgery. We do not know whether young patients would have had a better prognosis regarding subsequent arthropathy and an enhanced quality of life if they had undergone surgery after their first dislocation. What we do know is that a fairly large number would then have undergone unnecessary surgery!

The completeness of the follow-ups in this series of patients with the same follow-up period after 2, 5, 10 and 25 years and the large number of radiological examinations after 10 and 25 years should make it fairly unique and should also make it a reference in future studies of the prognosis after primary dislocation.

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