# Radiographic classification of glenohumeral arthrosis

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**ABSTRACT We studied the interobserver agreement of two radiographic classification systems for evaluation of glenohumeral arthrosis in 40 patients at long-term follow-up after the Eden Hybbinette operation for habitual dislocation of the anterior shoulder. Both observers agreed that none of the patients had severe arthrosis. The Samilson-Prieto system showed agreement using the classification in 35 of 40 operated shoulders (kappa 0.76). The Kellgren-Lawrence system showed agreement using the classification in 23 of 40 operated shoulders (kappa 0.36). The rate of arthrosis in the operated shoulder ranged from 0.2 to 0.6, depending on the classification system and the observer. None of the patients without arthrosis, but one fifth of those with arthrosis reported pain.**

**The Samilson-Prieto classification is preferable because it is simple to use and has excellent interobserver agreement.**

Primary glenohumeral arthrosis is rare even in older age groups (van Schaardenburg et al. 1994). A high prevalence of glenohumeral arthrosis has been reported at long-term follow-up of patients with habitual shoulder dislocation (Wildner et al. 1994, Hovelius et al. 1996, Neusel and Bläsius 1997, van der Zwaag et al. 1999). Various classification criteria have been used to evaluate the radiographs in glenohumeral arthrosis. However, so far as we know, interobserver agreement has not been reported. With the Kellgren-Lawrence (1958) classification, an acceptable interagreement has been reported for arthrosis of the metacarpophalangeal, hip and knee joints. Two later studies have used another classification of the radiographic findings in glenohumeral arthrosis (Samilson and Prieto 1983, Hovelius et al. 1996), but interobserver agreement has not been reported.

We evaluated interobserver agreement, using both of these classification systems for radiographic assessment of glenohumeral arthrosis, and the agreement between these systems.

## Patients and methods

The study includes 40 patients (26 men) evaluated for long-term outcome after an Eden-Hybbinette-Alvik operation for recurrent anterior glenohumeral dislocation. Their median age was 36 (28–72) years and median follow-up time after the operation 14 (9–18) years. The primary dislocation was caused by a trauma in 36 of the patients. The dominant side was involved in 24 patients. Before the operation, half of the patients had dislocated their shoulder 10 times or more.

The radiographic examinations were done in the Orthopedic Radiology Department at the National Hospital in Oslo. These examinations were carried out by two specialists in radiology, one with more than 10 years experience in orthopedic radiology (AF) and one with 5 years' experience (EM). Two projections were used: true 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. In accord with the Kellgren-Lawrence classification, arthrosis was divided into 5 grades: 0 = normal, 1 = questionable, 2 = incipient or mild arthrosis (slight narrowing of the joint space), 3 = moderate arthrosis (distinct narrowing of the joint, bone cysts and

**Table 1. The prevalence of glenohumeral arthrosis with the observer and classification systems**

| Classification system | Fraction with arthrosis | |
|---|---|---|
| | Operated shoulder | Unoperated shoulder |
| Kellgren-Lawrence observer A | 0.23 | 0.03 |
| Kellgren-Lawrence observer B | 0.48 | 0.11 |
| Samilson-Prieto observer A | 0.60 | 0.14 |
| Samilson-Prieto observer B | 0.53 | 0.22 |
| Kellgren-Lawrence consensus | 0.35 | 0.05 |
| Samilson-Prieto consensus | 0.53 | 0.19 |

**Table 2. Kellgren-Lawrence classification of glenohumeral arthrosis**

| | Observer B | | | | |
|---|---|---|---|---|---|
| | Normal | Questionable | Mild | Moderate | Total |
| Observer A | | | | | |
| Normal | 12 | | 2 | | 14 |
| Questionable | 5 | 4 | 6 | 2 | 17 |
| Mild | | | 5 | 2 | 7 |
| Moderate | | | 2 | | 2 |
| Total | 17 | 4 | 15 | 4 | 40 |

**Table 3. Samilson-Prieto classification**

| | Observer B | | | |
|---|---|---|---|---|
| | Normal | Osteophyte < 3 mm | Osteophyte 3–7 mm | Total |
| Observer A | | | | |
| Normal | 16 | | | 16 |
| Osteophyte < 3 mm | 3 | 14 | 2 | 19 |
| Osteophyte 3–7 mm | | 1 | 4 | 5 |
| Total | 19 | 15 | 6 | 40 |

**Table 4. Position of the graft**

| | Observer B | | | |
|---|---|---|---|---|
| | In place | Dislocated | Resorbed | Total |
| Observer A | | | | |
| In place | 29 | | 1 | 30 |
| Dislocated | | 1 | | 1 |
| Resorbed | 5 | | 4 | 9 |
| Total | 34 | 1 | 5 | 40 |

sclerosis) and 4 = severe arthrosis (severe structural disorder of the joint). Definite arthrosis was defined as grade 2 or more. With the Samilson and Prieto method, arthrosis was divided into 4 grades: 0 = normal, 1 = mild (osteophytes less than 3 mm on the humeral head), 2 = moderate (osteophytes between 3 and 7 mm on the humeral head or the glenoid rim) or 3 = severe (osteophytes of more than 7 mm with or without articular incongruity). In our study, all the patients had had the Eden-Hybbinette-Alvik operation in which a graft is implanted at the glenoid rim. We therefore decided not to evaluate osteophytes at the glenoid rim, and the graft was classified as ossified and correctly located, having dislocated or been resorbed.

Kappa (κ) and a weighted kappa statistic ($\kappa_w$) were used to evaluate interobserver agreement. The kappa statistic may be interpreted as the chance corrected proportional agreement and is the best approach for evaluating agreement between two observers or methods. No value of κ can be regarded universally as indicating good agreement. Kappa depends on the number of categories and the number of patients in each category.

## Results

The rate of arthrosis ranged from 0.2 to 0.6 for the operated shoulder and from 0.03 to 0.2 in the unoperated one (Table 1). There was complete agreement between the observers and methods as regards the classification of severe arthrosis.

The classification with the Kellgren-Lawrence system showed complete interobserver agreement in 21 of 40 operated shoulders (Table 2). The classification with the Samilson-Prieto system showed complete agreement in 35 of 40 operated shoulders (Table 3). Interobserver agreement about the operated shoulders was 0.36 ($\kappa_w$ 0.42) with the Kellgren-Lawrence and 0.76 ($\kappa_w$ 0.78) with the Samilson-Prieto. Interobserver agreement concerning the unoperated shoulders was 0.72 ($\kappa_w$ 0.72) and 0.61 ($\kappa_w$ 0.63), respectively. In observer A, agreement between the Samilson-Prieto and Kellgren-Lawrence methods was 0.57 ($\kappa_w$ 0.60). In observer B, agreement between the two methods was 0.43 ($\kappa_w$ 0.50).

The observers were unanimous about the evaluation of the graft in 34 of 40 shoulders (Table 4).

Figure 1. A true AP projection with the arm in the hanging position with maximal external rotation. Using the Kellgren-Lawrence system, this radiograph was classified as grade 1 or questionable arthrosis, but with the Samilson-Prieto system, it was classified as mild arthrosis (osteophyte < 3 MM on the humeral head).

Figure 2. A true AP projection with the arm in maximal internal rotation. The radiograph was classified as mild arthrosis (slight narrowing of the joint space or osteophytes 3–7 mm) according to both classification systems.

Interobserver agreement about location of the graft was 0.55.

0/19 of the patients without arthrosis and 4/21 of those with arthrosis reported mild or moderate pain in the operated shoulder.

## Discussion

The diagnosis of osteoarthrosis based on the interpretation of radiographs is a perceptual skill which uses specific structural features on plain radiographs. The radiographic indices should be clearly defined to improve interobserver agreement. We found that interobserver disagreement may account for a considerable part of the variations in the prevalence of glenohumeral arthrosis reported after surgery regarding habitual anterior shoulder dislocation. In our study, two experienced radiologists evaluated the radiographs. The Samilson-Prieto classification clearly defines the radiographic indices. This method is simple, depending mainly on the presence and size of osteophytes. Therefore, the excellent interobserver agreement found with this classification system is not surprising. The interobserver agreement with the Kellgren-Lawrence classification was not acceptable. This is probably due to the greater difficulty of classifying minor joint space narrowing in a nonweight bearing joint than of detecting and measuring osteophytes.

The rate of glenohumeral arthrosis of the uninvolved shoulder varied considerably (by a factor of 8) within and between observers (Table 1). The Samilson-Prieto classification system is based on the presence and size of osteophytes and the rate of arthrosis in the uninvolved shoulder reflects the high sensitivity of this system.

The prevalence of arthrosis is often reported in long-term follow-ups after trauma or surgery. It is important that interobserver agreement using the recommended classification systems should be acceptable. Our aim was not to evaluate the validity of the radiographic assessment of glenohumeral arthrosis. However, in particular the use of the Samilson-Prieto classification suggested a high prevalence of asymptomatic arthrosis, although all the patients who reported shoulder pain had arthrosis. The relation between mild and moderate glenohumeral arthrosis and pain remains unknown.

No competing interests declared.

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