

# Primary glenohumeral degenerative joint disease: Factors predisposing to arthroplasty

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## ABSTRACT

### Objective

To evaluate the natural history of shoulder osteoarthritis (OA), in particular the requirement for arthroplasty over time, and to determine the potential predisposing factors for such arthroplasty.

### Methods

In- and out-patients with the diagnosis of OA of the shoulder seen between January 1990 and December 1994 were contacted by mail or telephone in 2000. Evaluation at the time of diagnosis: demographics, clinical and radiological data were evaluated at the time of diagnosis. The follow-up evaluation consisted of a questionnaire sent to each patient inquiring whether they had had recourse to shoulder arthroplasty and, if not, evaluated their willingness regarding this surgical approach. For the statistical analysis the requirement for arthroplasty over time was evaluated using the Kaplan-Meier technique. Potential factors predisposing to arthroplasty were determined using a Cox-model analysis.

### Results

The questionnaire was answered by 72 of the 86 contacted patients. No difference was observed in clinical and radiological variables at the time of diagnosis between responders and non-responders. The requirement for arthroplasty was low (respectively 5% and 13%, 5 and 10 years following the onset of the symptoms). Nearly half of the patients who had not undergone surgery thought that arthroplasty would have been the treatment of choice to improve their quality of life since more than one year at the time of completing the questionnaire. Two variables were picked up in the Cox analysis, with a probability of shoulder replacement higher in patients with concomitant osteonecrosis of the humeral head ( $p = 0.02$ ) and a non-eccentric glenohumeral OA ( $p = 0.011$ ).

### Conclusion

The low percentage of patients with arthroplasty over time, together with patient perception, suggest underuse of this surgical approach in shoulder OA.

### Key words

Shoulder, arthritis, arthroplasty, degenerative disease.

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## Introduction

Shoulder joint replacement is one of the more recent developments in the field of prosthetic arthroplasty. Although the 1950s saw the introduction of proximal humeral prosthetic replacement to treat humeral fracture, twenty years passed before total shoulder replacement was used to manage glenohumeral osteoarthritis (1-4). Presently, prosthetic replacement for glenohumeral osteoarthritis remains the last resort for patients who have severe shoulder pain with significantly restricted range of motion and compromise of daily living activities when a program of nonsurgical management has been unsuccessful.

Although published studies have shown good functional results and a complication rate lower than or equal to knee or hip arthroplasty, the surgical approach is less used for advanced glenohumeral osteoarthritis in daily practice than for knee or hip involvement. Moreover, osteoarthritis of the glenohumeral joint occurs less commonly than that of the weight-bearing joints. Studies comparing the different categories of shoulder prosthesis (5, 6) or evaluating the role of anatomical factors influencing surgical success (7, 8) have been widely published, but longitudinal observational studies remain rare. To our knowledge, only two studies have been published concerning the factors influencing this surgical approach (9, 10).

The purpose of the present retrospective study was to determine the rate of requirement for surgery and the predisposing factors for arthroplasty in glenohumeral osteoarthritis. We also attempted to evaluate the patient's opinion regarding this therapeutic approach.

## Materials and methods

### Study design

In August 2000, the files of 135 patients diagnosed as suffering from glenohumeral osteoarthritis between January 1990 and December 1994 in our department were retrospectively reviewed.

### Patients

We carefully analyzed the files of each

patient and included, as having primary glenohumeral degenerative joint disease, those patients fulfilling all the following criteria: 1) no history of trauma, of an another known cause of secondary shoulder osteoarthritis or of a previous local surgery 2) no history of inflammatory joint disease 3) radiographs showing narrowing of the joint space (less than 5 mm) and periarticular osteophytes and/or periarticular sclerosis

The following demographic and baseline characteristics of the included patients were recorded: sex, age at time of diagnosis of glenohumeral osteoarthritis, age at time of beginning of shoulder discomfort, clinical characteristics of shoulder arthritis (unilateral or bilateral, right side and/or left side), concomitant pathology (chondrocalcinosis, aseptic osteonecrosis), radiological characteristics of arthritis (centred or not, joint space width).

### Long term follow-up

A questionnaire was sent to each included patient. The points it considered were the following: 1) Did you resort to shoulder arthroplasty in the treatment of your glenohumeral osteoarthritis? 2) Can you evaluate the pain due to your osteoarthritis and your functional discomfort during the past week before completing this questionnaire? (Two visual analogue scales graduated between 0 to 100 (0 representing no pain or no disability to execute daily activities and 100 the greatest imaginable pain or the impossibility to execute daily activities) were sent with the questionnaire.) 3) Do you feel that the medical treatment is sufficient regarding your discomfort? If you have not resorted to surgery, what is your willingness regarding shoulder arthroplasty? Do you desire such a therapeutic approach? If your answer is yes, for how long a time do you feel that this treatment would have been preferable for you?

If no response was obtained after two weeks, a second questionnaire was sent. If no response was obtained during the 10 days following this second questionnaire, telephone contact was attempted in order to interview patients.

### Statistical analysis

The baseline characteristics of the two groups of patients (those for whom a response to the questionnaire was obtained and those who were lost to follow-up) were compared using a Student's t-test and a Chi-square test. The requirement for arthroplasty was evaluated using the life table analysis technique (Kaplan Meier). The potential predisposing factors to such surgery were evaluated using the log-rank test for univariate analysis and the Cox analysis for multivariate analysis in which the requirement for surgery was the dependent variable and both the demographics and baseline characteristics were the independent variables. The patient's opinion concerning this surgery was evaluated in two parts: the first consisted of comparison between groups (those with and those without surgery) of the level of pain and functional discomfort using the non-parametric Mann-Whitney test; the second consisted of a descriptive analysis of the patient's willingness for surgery.

### Results

#### Study course

During the study period (January 1990 to December 1994) 19,011 patients consulted the four practitioners in the department. Fifty-four patients were diagnosed as having primary glenohumeral osteoarthritis. Two patients were excluded because they suffered from rheumatoid arthritis. One patient was excluded because she suffered from systemic lupus erythematosus. Four patients were excluded because of missing data. Forty-seven patients were thus studied.

Additionally, 81 patients were hospitalized for shoulder lavage. Twenty-three of these 81 patients were also consulting patients. Eighteen patients were excluded because the lavage was done for reasons other than degenerative arthritis (rheumatoid arthritis for 9 of them, septic arthritis for 6 and psoriatic rheumatism for 3). One patient was excluded for missing data. Thirty-nine patients were studied.

A total of 86 patients were therefore included in the study, representing 130 sites of glenohumeral osteoarthritis

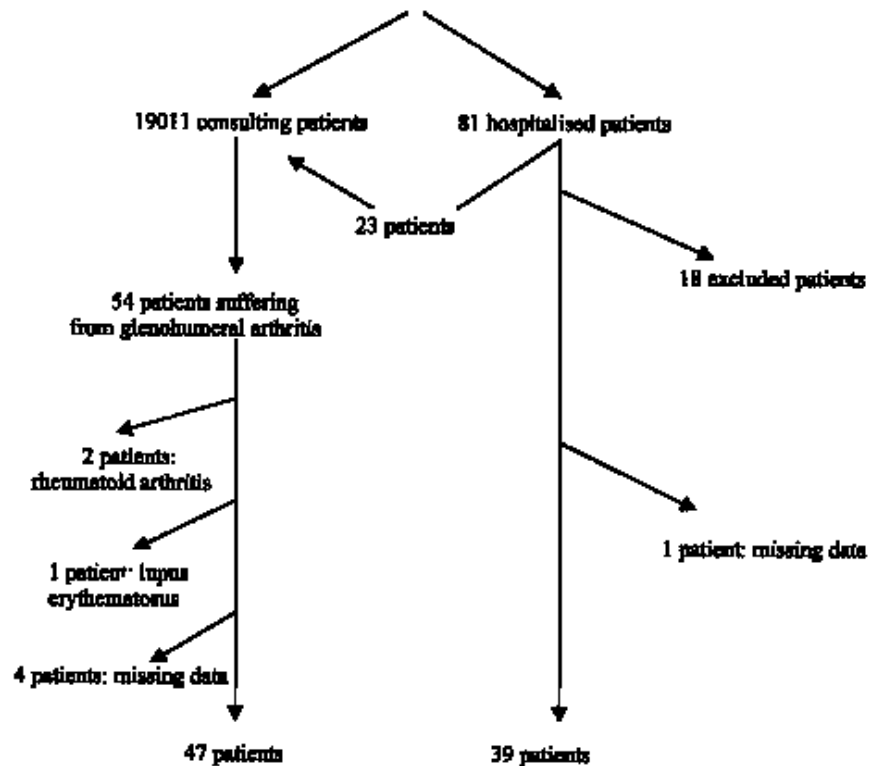


Fig. 1. Study course.

(Fig. 1). The questionnaire was returned by 72 of the 86 patients (an 84% response rate). These 72 patients suffered from either unilateral or bilateral osteoarthritis (110 sites of glenohumeral osteoarthritis).

The main characteristics of the studied patients are summarized in Table I. There was no statistical difference between the baseline characteristics of the patients from whom a response was obtained and those of the patients who were lost to follow-up.

#### Requirement for surgery and predisposing factors to shoulder replacement

The rate of requirement for surgery over time was evaluated using the life table analysis. After 5 and 10 years following the onset of symptoms, such surgery was performed in  $5 \pm 3\%$  and  $13 \pm 4\%$  of the patients.

Using log-rank univariate analysis, sex ( $p=0.64$ ), age at the onset of symptoms ( $p=0.09$ ), age at the time of diagnosis ( $p=0.16$ ), unilateral or bilateral osteoarthritis ( $p=0.2$ ), side of the involvement ( $p=0.056$ ), presence or absence

of shoulder chondrocalcinosis ( $p=0.63$ ) and joint space narrowing ( $p=0.32$ ) were not significantly associated with a higher rate of and/or more rapid surgical procedure. On the contrary, an associated ipsilateral shoulder ONA ( $p=0.02$ ) and a centred glenohumeral osteoarthritis on radiographs ( $p=0.011$ ) were shown to be associated with this surgical treatment.

Using the Cox multivariate analysis, the same two factors were shown to be associated with greater and/or more rapid surgical procedure.

#### Patient's opinion

The mean level of pain and functional impairment during the two weeks preceding the date of the follow-up questionnaire was  $49 \pm 27$  versus  $21 \pm 22$  ( $p=0.006$ ) and  $56 \pm 27$  versus  $26 \pm 23$  ( $p=0.005$ ) in the 59 patients who were managed medically versus the 13 patients in whom arthroplasty was performed.

When patients were questioned regarding their willingness for surgery, 45% of them thought that: (1) medical treatment was clearly insufficient, (2) arth-

**Table I.** Baseline characteristics.

	Patients from whom a response was obtained	Patients who were lost to follow-up	p
Number	72	14	
Number of OA shoulders	110	20	
Average age (and standard deviation) at time of diagnosis	70.3 years ( $\pm 10$ years)	68 years ( $\pm 12$ years)	0.62
Sex	n = 72	n = 14	
F	78% (56)	22% (16)	0.2
M	50% (7)	50% (7)	
Mean duration of symptoms before diagnosis (and standard deviation)	n = 72 5 years ( $\pm 3$ years)	n = 14 4 years ( $\pm 3$ years)	0.4
Unilateral arthritis	50% (36)	57% (8)	0.57
Bilateral arthritis	50% (36)	43% (6)	
CCA	n = 110	n = 20	
Yes	25.5% (28)	25% (5)	0.9
No	74.5% (82)	75% (15)	
ONA	n = 110	n = 20	
Yes	14% (15)	20% (4)	0.3
No	86% (95)	80% (16)	
Radiological data	n = 110	n = 20	
Centred arthritis	34.5% (38)	40% (8)	0.7
Eccentric arthritis	66.5% (72)	60% (12)	
Radiological data	n = 110	n = 20	0.84
Mean joint space measurement	1.6 mm $\pm$ 1.2 mm	1.7 mm $\pm$ 1.3 mm	

roplasty was necessary to ameliorate their quality of life, and (3) surgery would have been necessary since more than one year at the time of questionnaire. Moreover, 20% replied that medical treatment was clearly insufficient with regard to their daily activities (because of pain and/or functional disability).

## Discussion

In this retrospective study, we showed that only two factors influenced the resort to arthroplasty in patients suffering from primary glenohumeral degenerative joint disease: the presence of a local ONA and the radiological type of arthritis (centred or eccentric). In addition, this study underlines the fact that prevalence of shoulder arthroplasty remains low (surgery was performed for only 5% and 13% of these patients during respectively the 5 and 10 years following the onset of symptoms). Lastly, questioning patients about their willingness to undergo arthroplasty revealed that for many of them this therapeutic

approach seemed to be under-used. There are several potential limitations to our study. First, it was retrospective. Second, only 86 patients were studied out of the total number of patients who consulted in our department during five consecutive years. This figure points out the rarity of primary glenohumeral osteoarthritis and the difficulty of performing large prospective studies. Third, only few factors were studied (sex, age at time of diagnosis, interval between the onset of the symptoms and the first medical visit for shoulder pain or dysfunction, side of the disability, unilateral or bilateral arthritis, presence or absence of chondrocalcinosis or aseptic osteonecrosis, centred or eccentric arthritis on radiographs, measurement of the joint space), but these appear to be the relevant factors. Fourth, the patients' willingness or preference to undergo surgery was evaluated by means of a standardized questionnaire rather than through conversations with a rheumatologist or an orthopaedic surgeon. We

used this approach to minimize the influence that a practitioner may exert over a patient. In our opinion, the response obtained was thus representative of the subjective willingness of each patient. Fifth, because there are no standardized guidelines regarding when and in whom arthroplasty should be performed, and because a previous report showed that the primary reasons for patients to undergo arthroplasty are joint pain and functional disability (11), we estimated the potential need for surgery based on self-reported symptoms, disability and quality of daily life; on this basis, we concluded that shoulder arthroplasty was under-used. Obviously, other studies conducted in other sets of patients, in different countries, using a different design (prospective) are required in order to confirm or not this conclusion.

The only factors found to be predictive for arthroplasty were centred or eccentric osteoarthritis and associated shoulder aseptic osteonecrosis. Nevertheless, a number of points should be emphasized. First, in our study, the radiographic type of osteoarthritis (centred or eccentric) was the main factor influencing the surgical treatment. Reviewing the literature, the main factor which influences the results of shoulder arthroplasties is the condition of the rotator cuff (6,8,12,13). No lesion of the rotator cuff (and thus, a centred arthritis) is usually a good reason to propose surgery. Our results are in agreement with these previously published studies. Second, that aseptic osteonecrosis was the second factor influencing the therapeutic approach is easily explained: patients are usually younger, with a good general health status and good condition of the rotator cuff. Moreover, in this indication, post-operative results are known to be excellent (9). Third, even if no statistical difference was revealed regarding the side of the arthritis ( $p = 0.056$ ), arthroplasty seems to be more often performed on the right than on the left side. The right side being usually dominant, we can hypothesize that the functional discomfort is more rapidly and more intensely experienced by patients and thus they (and their practi-

tioners) more readily consider this therapeutic approach. Larger and prospective studies are necessary to clarify this point. Fourth, as previously noted (14-16), postsurgical relief of pain is excellent whereas improvement in functional disability appears to be less satisfactory. Patients and physicians must be aware of these points. Fifth, numerous studies (17, 18) have shown differences between males and females in the rate of using knee and hip arthroplasty (women receiving less surgical health care than men), but in our study, gender seems not to be a predictive factor for arthroplasty. However, females are over represented in our study and we can hypothesize that a selection bias was introduced.

Another main finding pointed out by this study is that, even though numerous published studies have demonstrated substantial and statistically valid improvements in pain and function after shoulder arthroplasty (6,7,16, 19), this surgical approach seems to be under-exploited. Near half of the questioned patients thought that arthroplasty would be the treatment of choice to improve their quality of life but, even if published studies have compared shoulder arthroplasty favorably with arthroplasty of the knee or hip regarding symptom improvement and complication rate, practitioners seem more hesitant to purpose arthroplasty of the shoulder than of the knee or hip. Numerous factors can explain this finding. First, being more recent, the surgical technique may appear to be less mastered. Second, glenohumeral osteoarthritis being relatively uncommon (20, 21) and pathologies of the soft tissues (rotator cuff and biceps) being markedly more common than skeletal pathologies (22), primary care physicians may be less aware of the different therapeutic possibilities and general indications of each of them for treatment of osteoarthritis. Third, it is known that the range of motion that can be obtained postoperatively and hence the degree of improvement of shoulder function is dependent in large measure on intact, functioning soft tissues. We can thus hypothesize that an associated rotator cuff deficiency re-

mains for many practitioners a contraindication for surgery even if this deficiency is limited. Nevertheless, practitioners must be aware that an appropriate surgical technique (23-26) and a surgeon familiar with shoulder pathologies (27) are often guarantees of marked postsurgical pain and functional improvement.

In conclusion, shoulder arthroplasty is shown in the literature as being both safe and effective in alleviating pain and improving joint function, and this procedure should be proposed early and used in patients with refractory pain and disability when conservative measures have failed. Moreover, as in knee or hip arthroplasty (28-32), large and prospective studies are required to clarify the prevalence and indications of shoulder arthroplasty and to evaluate in detail the willingness of patients to undergo surgery.

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