The subacromial bursa and the impingement syndrome

A clinical and histological study of 30 cases

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Biopsies from the subacromial bursa were obtained from 30 patients with an impingement syndrome and from an autopsy series of 13 "normal" shoulders. Bursal fibrosis seemed to be a characteristic of the patient group; inflammatory cells, found in 7/30 specimens from the patients, were not found in the autopsy series. The microscopic findings could not be predicted from peroperative observations. There was an association between a poor outcome of surgery and absence of bursal fibrosis.

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Some 20 years ago Neer (1972) created the term impingement syndrome to draw attention to a mechanical cause of shoulder pain. As a logical consequence of his thoughts he introduced an operation, anterior acromioplasty, the positive effect of which is now undisputed. One obvious effect of this operation is a widening of the inlet to the subacromial space.

During forward flexion and abduction several anatomical structures—the rotator cuff, the tendon of the long biceps head and the subacromial bursa—must slide into the subacromial space. The discussion on possible morphological correlates of the impingement mechanism, impingement lesions, has usually been focused on changes in the rotator cuff (e.g., Neviaser and Neviaser 1990). Few authors have commented upon the microscopic morphology of the subacromial bursa (Strizak et al 1982, Sarkar and Uhthoff 1983).

We describe the microscopic appearance of peroperative biopsies from the subacromial bursa in patients with a presumed diagnosis of an impingement syndrome and of corresponding autopsy specimens from persons having no documented history of a shoulder disorder.

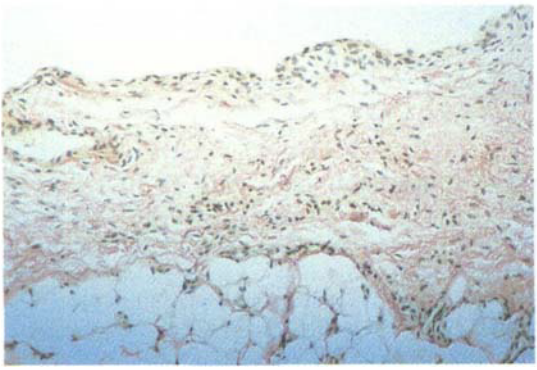
The following questions are asked: 1) Will 2 independent pathologists apply the chosen method of categorical microscopic classification in roughly the same way, i.e., is the method reliable? 2) Are there systematic morphological differences between the biopsies taken from the patients and the specimens from the autopsy series of normal shoulders? 3) Can the microscopic findings be predicted from the peroperative observations made by the surgeon? 4) Is there any association between the microscopic findings and the outcome of surgery?

Patients and methods

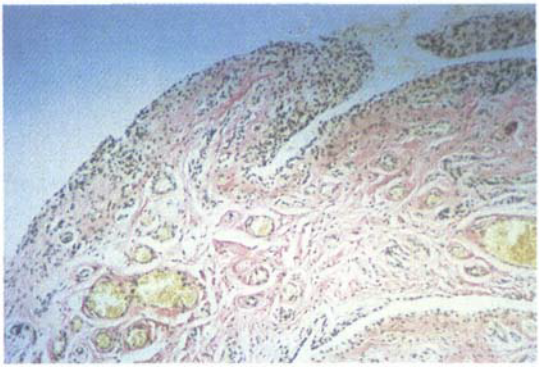
Peroperative bursal biopsies were obtained from 30 patients with a history compatible with a diagnosis of an impingement syndrome; all exhibited a positive impingement sign and a positive impingement test (Neer 1983). Their mean age was 42 (27–63) years, 13 were men, 17 women. The mean duration of their symptoms was 3 (1–12) years. 1 patient was lost to clinical follow-up. 4 patients were diagnosed as having a psychogenic pain syndrome (PPS) by a neurologist (CEW) after conclusion of the study. By definition, pain reports made by PPS patients do not reflect nociceptive pain, which means that they must be excluded from analyses, where an association between pain and morphology is investigated. Thus 25 patients remained for a meaningful clinicopathological comparison.

Preoperatively and at regular intervals up to 1 year after the operation all patients were examined by the same independent examiner, who had not been involved in any kind of treatment of the patients and had no knowledge of the microscopic appearance of their bursae. On each occasion every patient rated his pain on a visual analogue scale (VAS) ruler, the hidden backside of which was graded from 0 to 10; (a) at rest, sitting relaxed in front of the examiner; (b) during a standardized motor task. The latter involved emptying a 1 liter pot filled with water with the arm held in front of the body. This movement requires an isometric postural fixation of the humerus in forward flexion in the glenohumeral joint and an eccentrically performed inward rotation. The pain scores under conditions (a) and (b) were added to give a total pain score. The sum at 12 months after the operation (PS12) was

Figure 1. Bursa specimens. Van Gieson stain, ×100.



Normal bursa with partly intact synovial membrane and normal amount of fibrous tissue in the wall which also contains groups of fat cells.



Pathologically altered bursa with fibrous thickening of the wall and dilated blood vessels. There is no evident synovial proliferation or any infiltration of inflammatory cells.

subtracted from the sum at entry to the study (PS0), and the difference was divided by PS0. Thus a ratio (PS0–PS12)/PS0 is formed, which will reflect the relative reduction of the total pain score. According to a predetermined criterion, patients with a ratio of > 0.50, i.e., a more than 50 percent reduction of the total pain score, were classified as "successes", the rest as "failures".

Autopsy series. Bursal specimens were obtained at autopsy from 13 persons, who according to available case records had no history of shoulder disorders. Their mean age at death was 51 (25–67) years, 9 of them were men, 4 women.

Technical procedure and microscopic classification. The bursa specimens were fixed in 10 percent neutral formalin, embedded in paraffin, and sections of 5 µm thickness were stained with the van Gieson technique. 2 pathologists, A and B, classified the specimens into 2 categories, using the criterion absence/presence of fibrosis. Pathologist A, after having examined all specimens, suggested this classification and knew whether a particular specimen was derived from the clinical or the autopsy series, whereas pathologist B did not. None of them had any knowledge of the clinical status of the patients (Figure 1).

Statistics. All *P*-values reported in this article are 2-sided. The statistical analyses of the data in Table 1 were performed in accordance with the recommendations given by Bartko and Carpenter (1976). The analyses of the data in Table 2 were performed using the conventional chi-square test. All other analyses were performed using the continuity-corrected Fischer's exact test (Overall 1980). In calculating the 2-sided *P*-values, we have followed the general recommendations for the evaluation of asymmetric probability distributions given by Armitage and Berry (1985) and Mantel (1990), i.e., that the 2-tail probability should be obtained from a doubling of the single-tail probability in the observed direction.

Results

Reliability of the microscopic classification. The agreement between the pathologists regarding absence/presence of fibrosis was 91 percent, and the kappa-value (a chance-corrected measure of agreement) was 0.81 ($P < 0.0001$). There was complete agreement on the classification of the autopsy specimens (Table 1).

Comparison between clinical and autopsy series (Table 2). Fibrosis seemed to be characteristic of the patient bursae; pathologist A judged fibrosis to be present in 25/30 (0.8), pathologist B in 21/30 (0.7) of the clinical bursal specimens. Conversely, both pathologists found fibrosis in only 2/13 (0.2) of the bursae in the autopsy series. The difference between the proportions were significant (P 0.002). Inflammatory cells

Table 1. Bursal fibrosis—agreement/disagreement

		Pathologist A	
	Total	Fibrosis	No fibrosis
Total	43	27	16
Pathologist B			
Fibrosis	23	23	0
No fibrosis	20	4	16

Table 2. Comparison between autopsy and clinical series

	Autopsy	A	B
Fibrosis	2	25	21
No fibrosis	11	5	9
Total	13	30	30

A/B classification of clinical series by pathologist A and B, respectively.

Table 3. Fibrosis versus clinical outcome (patients with a psychogenic pain syndrome are presented within brackets)

	A		B	
	Fibrosis	No fibrosis	Fibrosis	No fibrosis
Success	18	1	15	4
Failure	3 (+3)	3 (+1)	2 (+3)	4 (+1)
Total	21 (+3)	4 (+1)	17 (+3)	8 (+1)

were found by either pathologist in 7/30 patient specimens, and in 0/13 autopsy specimens (P 0.07). All cells were mononuclear; no polynuclear cells were found.

Macroscopic versus microscopic classification. Using the classification of pathologist A regarding absence/presence of fibrosis, a correct prediction by the surgeon was made in 14 out of 30 cases. This is slightly less than would be expected by chance. There were 6 positive macroscopic predictions of inflammation. Only 1 of them was confirmed by the microscopic examination. Using the classification of pathologist B, the agreement was even less.

Absence/presence of fibrosis versus clinical outcome. The success ratio was 18/21 in the fibrosis group as compared to 1/4 in the non-fibrosis group, according to the classification made by pathologist A (P 0.02). Using the classification of pathologist B, the corresponding figures are 15/17 versus 4/8 (P 0.05). If one excludes the 4 cases where there was disagreement on the microscopic classification, the figures were 15/17 versus 1/4 (P 0.02; Table 3).

Discussion

The comparison between the clinical and autopsy series forms the basis of one of our main conclusions, which can perhaps be phrased in the following way: Presence of fibrosis seemed characteristic of bursal specimens in patients with a presumed diagnosis of an impingement syndrome, whereas the reverse was found in bursae from an autopsy series.

Sarkar and Uhthoff (1983) studied bursal specimens obtained from a variety of patients and from postmortem cases by means of light microscopy and electron microscopy. They focused their interest on ultrastructural aspects. Only 2 specimens came from patients with a "tight coracoacromial ligament". They summarized their findings as "proliferative or degenerative changes"; fibrosis was not mentioned.

Strizak et al. (1982) studying patients with the subacromial impingement syndrome mentioned microscopic examination of the subacromial bursa in 10 cases. 5 of these were judged to be normal, 5 showed chronic inflammatory changes. In 2 cases these changes were specified as "scarred, fibrotic subacromial bursa". The authors mentioned that they suspect that their series contained patients with subacromial pain, not related to coracoacromial impingement.

Why did not all patients have fibrotic bursae? The formulation of this question presupposes that it is possible on clinical grounds alone to diagnose the presence of mechanical impingement with complete certainty. Such an assumption is probably wrong. A positive clinical diagnosis is, in fact, based on the analysis of reports on pain—at rest, during a standardized provocation manoeuver, and after an injection of a local anesthetic. That is, all diagnostic items are based on subjective phenomena—a fact that will leave considerable room for wrong diagnoses. In particular, patients with some kind of pain-causing pathology in the rotator cuff that is etiologically unrelated to an impingement mechanism will easily be misdiagnosed, as also will patients with a psychogenic pain syndrome. Alternative explanations might of course be that the morphological method is too insensitive or that the biopsy samples are not representative, but these will leave the association with a poor clinical outcome unexplained.

The question, whether the microscopic findings can be reliably predicted from the peroperative observations is answered negatively by this study. The virtual absence of agreement leads us to the conclusion that any statements regarding the presence/absence of fibrosis or inflammation, based on macroscopic observations, should be treated with caution.

Our second main result was the association between a favorable outcome and the presence of fibrosis or, conversely, the poor outcome in the absence of fibrosis. As the main effect of Neer's operation is a widening of the anterolateral opening of the subacromial space, one explanation of a poor outcome is that mechanical impingement has not been present.

Ideally, knowledge of the microscopic appearance of the subacromial bursa should be obtained before a decision to operate or not is made. However, at least up to now and in our hands, attempts to obtain technically good bursal specimens by means of percutaneous needle biopsy have been unsuccessful.

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References

Armitage P, Berry G. Statistical methods in medical research. Blackwell Sci Publ, Oxford 1985.

Bartko J J, Carpenter W T Jr. On the methods and theory of reliability. J Nerv Ment Dis 1976; 163 (5): 307–17.

Mantel N. Comment. Statistics Med 1990; 9 (4): 369–70.

Neer C S. Anterior acromioplasty for the chronic impingement syndrome in the shoulder: a preliminary report. J Bone Joint Surg (Am) 1972; 54 (1): 41–50.

Neer C S. Impingement lesions. Clin Orthop 1983; 173: 70–7.

Neviaser R J, Neviaser T J. Observations on impingement. Clin Orthop 1990; 254: 60–3.

Overall J E. Continuity correction for Fischer's exact probability test. J Educat Statistics 1980; 5 (2): 177–90.

Sarkar K, Uhthoff H K. Ultrastructure of the subacromial bursa in painful shoulder syndromes. Virchows Arch A Pathol Anat Histopathol 1983; 400 (2): 107–17.

Strizak A M, Danzig L, Jackson D W, Resnick D, Staple T. Subacromial bursography. An anatomical and clinical study. J Bone Joint Surg (Am) 1982; 64 (2): 196–201.