Clin Orthop Relat Res (2008) 466:2813–2819
DOI 10.1007/s11999-008-0331-3

ORIGINAL ARTICLE

# Clinical Evaluation of the Shoulder Shrug Sign

**Xiaofeng Jia MD, PhD, Jong-Hun Ji MD,
Steve A. Petersen MD, Jennifer Keefer PA-C,
Edward G. McFarland MD**

Received: 9 January 2008 / Accepted: 16 May 2008 / Published online: 10 June 2008


**Abstract** The "shrug sign" (inability to lift the arm to 90° abduction without elevating the whole scapula or shoulder girdle) has been associated with a diagnosis of rotator cuff disease. Based on our clinical experience, we hypothesized the shrug sign is not a specific diagnostic sign for this condition, but rather is associated with various shoulder conditions and shoulder weakness and loss of range of motion. We retrospectively reviewed 982 consecutive patients who had been examined preoperatively for the shrug sign. A positive shrug sign was present in 51.3% of the patients, and the average distance lost from the horizontal was 20.5° ± 2.2° (standard error of mean). Increasing age was associated with the presence of a shrug sign. The highest incidence was in patients with adhesive capsulitis (94.7%). The shrug sign was not sensitive for tendinosis, partial rotator cuff tears, or full-thickness or massive rotator cuff tears. The shrug sign was associated with weakness in abduction, night pain, and loss of range of motion, especially passive abduction. Although the shrug sign is useful as a general sign of shoulder abnormality, particularly when associated with stiffness, it was not specific or sensitive for rotator cuff problems.

The authors have no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article. There were no funding sources for this work.
This study was exempt from IRB approval.

X. Jia, J.-H. Ji, S. A. Petersen, J. Keefer, E. G. McFarland (✉)
Division of Shoulder Surgery, Department of Orthopaedic Surgery, c/o Elaine P. Henze, BJ, ELS, Medical Editor, Johns Hopkins Bayview Medical Center, The Johns Hopkins University, 4940 Eastern Ave., #A672, Baltimore, MD 21224, USA
e-mail: ehenze1@jhmi.edu

**Level of Evidence:** Level II, diagnostic study. See the Guidelines for Authors for a complete description of levels of evidence.

## Introduction

Examining patients with shoulder problems can be challenging because (1) shoulder motion involves a complex interaction of movement of the scapula on the thorax, the humeral head on the glenoid, and the clavicle at the acromioclavicular and sternoclavicular joints [6, 13, 24]; and (2) physical examination tests for the shoulder are sensitive but not specific for one particular shoulder condition [4, 5, 10, 20, 23, 26, 29–31]. It is important clinicians understand the limitations of physical examination tests when evaluating patients with shoulder pain.

Although we have used the shrug sign as a nonspecific indicator of shoulder abnormality, we found only two studies in the English literature that refer to this test [1, 2]. Blevins et al. [2] reported a positive shrug sign in eight of 10 professional athletes with rotator cuff abnormalities. However, those authors did not report the distribution of the shrug sign by the type of abnormality (full tears, three; partial tears, five; isolated contusion, two).

Our study was designed to evaluate our clinical impressions using the shrug sign and to test the hypotheses that (1) a positive shrug sign would be insensitive and nonspecific for rotator cuff disease; (2) a shrug sign would be reasonably reliable; (3) individuals with a positive shrug sign would be more likely to have loss of range of motion (ROM) or weakness to manual muscle testing in the involved shoulder; and (4) no demographic or physical examination finding would be associated with an increased likelihood of a positive shrug sign.

## Materials and Methods

Our data were obtained prospectively and entered into a database for patients having shoulder surgery at our institution [5, 17, 18, 23, 25–27, 31, 32]. Inclusion criteria were shoulder surgery performed by the senior author (EGM) from 1994 through 2006 and the presence of shrug test data (see subsequently). Of the 991 patients in the database, 982 consecutive patients met our inclusion criteria. We obtained approval by our Institutional Review Board.

Either the senior author (EGM) or a trainee under his direct supervision (the senior author observed the tests being done and recorded the data) performed a preoperative assessment on all patients within 4 weeks of surgery, including a standardized subjective questionnaire (demographic and historical shoulder data) and a physical examination. Each patient had subjectively evaluated symptoms (eg, pain at rest, night pain, activity-related pain, pain with arm overhead, and others) through a visual analog scale of 100 points [17, 18].

In all patients, both shoulders had been exposed and examined. The examination included active and passive ROM, manual muscle strength testing, an upper extremity neurologic evaluation, and determination of other physical examination signs, including the Neer impingement sign [13, 18, 27, 31, 32], Kennedy-Hawkins impingement sign [17, 18, 27, 29, 31, 32], and Gagey sign [12] (suggested as a measure of inferior capsular contracture). Weakness in abduction or external rotation with the arm at the side had been recorded. The strength grading system used was that initially described by Lovett and Martin [22] and modified by Hoppenfeld [14]. We used preoperative radiographs (obtained for all patients) to determine a final diagnosis but did not include measurements or other analyses as part of this study.

For the shrug sign test, we asked the patient to abduct both arms to 90° in the plane of the body and to hold that position briefly. A shrug sign was considered positive if the patient had to elevate the whole scapula or shoulder girdle ("shrug") to lift the arm to 90° (Fig. 1). The magnitude of the shoulder shrug was defined as the angle between the arm and the horizontal point at which the shrug movement began (measured by a handheld goniometer) (Fig. 2).

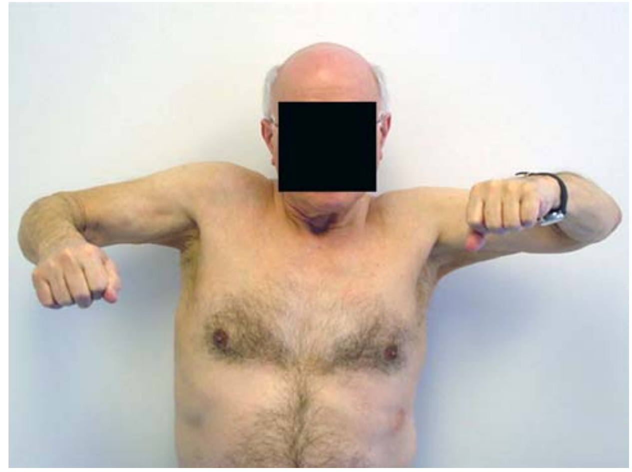

**Fig. 1** A shrug sign was considered positive if the patient had to elevate the shoulder girdle for the arm to reach 90° abduction. The right shoulder shows a shrug sign; the left shoulder is normal.

**Fig. 2** The degree of shrug sign was measured with a handheld goniometer. The patient was asked to elevate the arm until the shrug sign began, and then the angle between the horizontal and the arm was measured as shown.

The final diagnoses, based on preoperative radiographs and operative findings, included full-thickness rotator cuff tear, 261 patients; shoulder instability (anterior, anterior-inferior, posterior, or multidirectional), 221 patients; glenohumeral arthritis (osteoarthritis, osteonecrosis, or rheumatoid arthritis), 169 patients; partial-thickness rotator cuff tears, 88 patients; symptomatic rotator cuff tendinosis (no rotator cuff tear, just impingement) [8], 75 patients; isolated acromioclavicular joint arthritis, 61 patients; massive rotator cuff tear (defined as multiple tendon tears, including complete tears of two or more rotator cuff tendons), 47 patients; superior labrum anterior and posterior lesions, 25 patients; adhesive capsulitis, 19 patients; and other (infection, isolated biceps tear, failed arthroplasty, pectoralis major rupture, and benign soft tissue tumors), 16 patients. We defined rotator cuff disease as symptomatic tendinosis, partial rotator cuff tear, or full-thickness rotator cuff tear [29].

To assess the interrater reliability of the shrug sign, 30 patients (60 shoulder evaluations) not included in the study who presented to the senior author's clinic for various shoulder problems were examined by the senior author and by an experienced physician assistant (JK) independently on the same day with the technique described previously. This number of patients was determined on the basis of previous experience with testing interrater reliability. Each examiner was blinded to the results of the other. Agreement on the presence of the shrug sign between these two raters was assessed using Cohen's kappa coefficient [9], believed to be a more robust measure than a simple percentage calculation because it accounts for agreement occurring by chance. In addition to testing the reliability of the binary interpretation of the presence of a shrug sign (positive or negative), it was important to estimate the interrater agreement of the magnitude of the shrug sign. This agreement was assessed with the Shrout-Fleiss intraclass correlation coefficient to account for chance agreement [34]. We assessed the strength of the observed agreement between these two raters with a kappa coefficient.

After reliability of the evaluation for the presence of the shrug sign was established, we computed the percentage of the patient population with a positive shrug sign in each diagnosis. The diagnostic usefulness of a positive shrug sign for the presence of rotator cuff disease and other diagnoses in the involved shoulder was determined through evaluation of the test's sensitivity, specificity, negative predictive value, and positive predictive value. We considered individuals with primary diagnoses of tendinosis, partial-thickness rotator cuff tear, full-thickness rotator cuff tear, and massive rotator cuff tear as having rotator cuff disease. Individuals with a primary diagnosis of superior labrum anterior and posterior lesions, glenohumeral instability, glenohumeral arthritis, acromioclavicular joint arthritis, or adhesive capsulitis were considered as not having rotator cuff disease. To achieve this definition, the patients were stratified on the basis of each preoperative diagnosis into two groups: the study group with a positive shrug sign and the comparison group without a shrug sign. Then we calculated diagnostic values using the following equations:

$$\text{sensitivity} = \text{TP}/(\text{TP} + \text{FN});$$

$$\text{specificity} = \text{TN}/(\text{FP} + \text{TN});$$

$$\text{positive predictive value} = \text{TP}/(\text{TP} + \text{FP});$$

$$\text{negative predictive value} = \text{TN}/(\text{FN} + \text{TN});$$

$$\text{overall accuracy} = (\text{TP} + \text{TN})/(\text{TP} + \text{FP} + \text{FN} + \text{TN})$$

where TP = true-positive, FP = false-positive, FN = false-negative, and TN = true-negative.

To determine the association between the presence of a positive shrug sign and loss of ROM in the involved shoulder, patients were characterized as having a positive shrug sign and as having loss of ROM in the involved shoulder in the direction of active and passive elevation in flexion, active and passive elevation in abduction, active internal and external rotation with the arm abducted 90°, passive internal and external rotation with the arm abducted 90°, and active and passive external rotation with the arm at the side. To assess the association between these analog measures, we used bivariate analysis (Pearson correlation) to test the correlation between the magnitude of the shrug sign and the range of shoulder motion. To determine the relationship of weakness to a positive shrug sign, patients with a strength grade of 4 or less in abduction or in external rotation with the arm at the side was the independent variable and patients with normal abduction strength (ie, Grade 5) comprised the control group. A third variable studied for weakness was the "drop arm sign"; the inability to hold the arm against gravity when it was placed above 90° elevation was considered a positive sign [7, 31]. We tested the association between these three binary outcomes and the shrug sign using a chi square test of independence with one degree of freedom.

The final objective was to determine the association between demographic and clinical findings and the presence of a positive shrug sign in the involved shoulder. We compared demographic and clinical characteristics, subjective symptoms, and physical examination findings between patients with and without a positive shrug sign. Univariate analysis was performed with Student's t-test for continuous variables and the chi square test for categorical variables. To estimate the likelihood of a positive shrug sign, given these characteristics, we used logistic regression analysis. The outcome of interest was presence of a positive shrug sign. Independent variables included demographic characteristics (age, gender), clinical characteristics (eg, involvement of dominant arm, high-level sports activity, history of trauma), subjective symptoms (eg, rest pain, activity pain, night pain, lift arm above shoulder level, overhead activity pain, loss of ROM, limitation in throwing, difficulty in styling hair, limitation in sports participation), and other physical examination findings (eg, the loss of ROM in the involved shoulder). We calculated the correlation between the degree of shrug sign and other variables in these initial analyses, the 95% confidence interval, and the odds ratios by using univariate logistic regression with an alpha of 0.20. To control for potential confounding variables, stepwise logistic regression analysis was performed. We selected variables with a p value $< 0.20$ in the univariate analysis as candidates for the multivariate model to determine which factors were associated with a shrug sign. We used Statistics Program for the Social Sciences, version 15 (SPSS, Chicago, IL) for all analyses.

**Table 1.** Prevalence of positive shrug signs for patients by diagnosis

| Primary diagnosis | Shrug sign | |
|---|---|---|
| | Involved (percent positive) | Uninvolved (percent positive) |
| Rotator cuff disease | | |
| Tendinosis | 25/75 (33.3) | 1/75 (1.3)* |
| Partial cuff tear | 38/88 (43.2) | 4/88 (4.5)* |
| Full-thickness cuff tear | 162/261 (62.1) | 22/261 (8.4)* |
| Massive cuff tear | 35/47 (74.5) | 5/47 (10.6)* |
| Other diagnoses | | |
| Superior labrum anterior and posterior lesion | 6/25 (24.0) | 1/25 (4.0) |
| Glenohumeral instability | 38/221 (17.2) | 7/221 (3.2)* |
| Glenohumeral arthritis | 153/169 (90.5) | 52/169 (30.8)* |
| Acromioclavicular joint arthritis | 17/61 (27.9) | 1/61 (1.6)* |
| Frozen shoulder | 18/19 (94.7) | 1/19 (5.3)* |

* $p < 0.001$, statistically significant difference; significance was determined with the chi square test for categorical variables of the shrug sign between involved and uninvolved shoulders.

## Results

We observed a positive shrug sign in the involved shoulder in 504 of 982 (51.3%) individuals (Table 1), and the average degree lost was 20.5° ± 2.2° (mean ± standard error of mean). A positive shrug sign was most common among patients with adhesive capsulitis (94.7%), glenohumeral arthritis (90.5%), massive rotator cuff tear (74.5%), or full-thickness rotator cuff tear (62.1%). In all patient groups, the shrug sign was more likely located in the involved than in the uninvolved shoulder (Table 1), but patients with glenohumeral arthritis tended to have bilateral disease and had the highest likelihood of having the shrug sign in the uninvolved shoulder (50 of 167 [29.9%]).

The interrater agreement kappa coefficient was 0.833. The interrater agreement in shrug sign magnitude in degrees (Rater 1: 14.3 ± 1.9 [mean ± standard error of mean]; Rater 2: 14.2 ± 1.9 [mean ± standard error of mean]) had an intraclass correlation of 0.875.

The shrug sign was insensitive (46.4%) and nonspecific (48.1%) for rotator cuff disease. The shrug sign was not specific for any one shoulder diagnosis, and it was not sensitive enough nor specific enough to discriminate between patients with and without rotator cuff disease (Table 2). When examining the usefulness of the shrug sign for supporting a diagnosis, the likelihood ratio was best for glenohumeral arthritis (likelihood ratio, 2.097) followed by adhesive capsulitis (likelihood ratio, 1.877) and massive rotator cuff tears (likelihood ratio, 1.485).

Patients with increasingly large-angle shrug signs showed increasing loss of motion; the highest correlations were with loss of active flexion ($r = -0.803$), active abduction ($r = -0.772$), and passive flexion ($r = -0.720$). Patients with large-angle shrug signs also had more abnormal physical examination findings, including the Gagey sign (abduction) ($r = -0.660$, $p = 1.130E-11$). Patients with positive shrug signs were associated with less strength in abduction ($p = 1.884E-5$) and external rotation ($p = 0.0002131$) and with more ($p = 3.381E-11$) positive drop-arm signs than patients without a positive shrug sign. If a patient had weakness in abduction, weakness in external rotation, and a positive drop-arm sign, the odds ratio was 32.634 that they had a positive shrug sign. Patients with massive rotator cuff tears were weaker ($p = 0.005$) in abduction and external rotation strength and had a higher positive rate of shrug sign than patients with

**Table 2.** Clinical usefulness of the shrug sign for various diagnostic groups

| Presence of rotator cuff disease | Primary diagnosis | Sensitivity (%) | Specificity (%) | Positive predictive value (%) | Negative predictive value (%) | Overall accuracy (%) | Likelihood ratio | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Positive | Negative |
| Yes | Tendinosis | 33.3 | 47.2 | 5.0 | 89.5 | 46.1 | 0.631 | 1.413 |
| | Partial cuff tear | 43.2 | 47.9 | 7.5 | 89.5 | 47.5 | 0.828 | 1.187 |
| | Full-thickness cuff tear | 62.1 | 52.6 | 32.1 | 79.3 | 55.1 | 1.309 | 0.722 |
| | Massive cuff tear | 74.5 | 49.8 | 6.9 | 97.5 | 51.0 | 1.485 | 0.512 |
| | SLAP | 24.0 | 48.0 | 1.2 | 96.0 | 47.4 | 0.461 | 1.585 |
| No | Glenohumeral instability | 17.2 | 38.8 | 7.5 | 61.7 | 33.9 | 0.281 | 2.136 |
| | Glenohumeral arthritis | 90.5 | 56.8 | 30.4 | 96.7 | 62.6 | 2.097 | 0.167 |
| | Acromioclavicular joint arthritis | 27.9 | 47.1 | 3.4 | 90.8 | 45.9 | 0.527 | 1.531 |
| | Frozen shoulder | 94.7 | 49.5 | 3.6 | 99.8 | 50.4 | 1.877 | 0.106 |

SLAP = superior labrum anterior and posterior lesion.

other rotator cuff abnormalities (tendinosis, partial tears, or full-thickness tears; odds ratio, 2.580).

In terms of the association between patients' demographic and clinical findings and a positive shrug sign, the diagnosis of a shrug sign was associated with weakness in abduction (odds ratio, 2.649), increasing age (odds ratio, 1.390), decreased passive abduction (odds ratio, 1.035), and night pain (odds ratio, 1.010) (Tables 3, 4). Patients with a shrug sign were more likely than those without the sign to report inability to reach overhead.

**Table 3.** Univariate analysis of the demographic data, subjective symptoms, and physical examination findings

| Variable | Descriptive comparison | | | | | | |
|---|---|---|---|---|---|---|---|
| | Shrug (n = 504) | | No shrug (n = 478) | | Univariate logistic regression analysis | | |
| | Percent or mean | SD | Percent or mean | SD | Odds ratio | Confidence interval (95%) | p value |
| Demographic data | | | | | | | |
| Male gender | 47.2% | | 63.7% | | | | 0.288 |
| Mean age (years) (odds ratio per 10 years) | 57 | 14.6 | 40 | 17.2 | 1.045 | 1.017–1.074 | 0.001* |
| Involvement of dominant arm | 61.6% | | 63.0% | | 0.611 | 0.307–1.217 | 0.161 |
| High-level sports activity (higher than high school level) | 6.4% | | 29.9% | | | | 0.237 |
| Trauma history | 46.1% | | 60.3% | | | | 0.240 |
| Subjective symptoms (odd ratio per point)† | | | | | | | |
| Rest pain | 68.7 | 30.1 | 56.3 | 33.4 | 0.988 | 0.979–0.998 | 0.016* |
| Activity pain | 84.8 | 19.5 | 77.8 | 26.2 | | | 0.731 |
| Night pain | 76.2 | 25.8 | 61.4 | 33.2 | 1.010 | 0.999–1.021 | 0.067 |
| Lift arm above shoulder level | 31.8 | 29.9 | 59.3 | 28.7 | 0.983 | 0.975–0.991 | 0.000* |
| Overhead activity pain | 80.6 | 19.5 | 65.9 | 25.2 | 1.010 | 0.997–1.023 | 0.123 |
| Loss of range of motion | 72.9 | 22.8 | 47.8 | 29.2 | 1.017 | 1.007–1.028 | 0.001* |
| Limitation in throwing | 85.8 | 21.2 | 77.8 | 29.5 | | | 0.597 |
| Difficulty in styling hair | 64.7 | 32.6 | 32.7 | 33.1 | 1.017 | 1.010–1.025 | 0.000* |
| Limitation in sports participation | 83.5 | 19.2 | 76.4 | 24.4 | 0.990 | 0.978–1.002 | 0.112 |
| Physical examination findings (range of motion) (odds ratio per degree) | | | | | | | |
| Active flexion | 107 | 43.4 | 156 | 22.2 | 0.980 | 0.952–1.009 | 0.176 |
| Passive flexion | 131 | 34.7 | 161 | 17.6 | | | 0.458 |
| Active abduction | 101 | 44.8 | 155 | 22.4 | 0.978 | 0.952–1.005 | 0.106 |
| Passive abduction | 126 | 38.7 | 159 | 19.7 | 1.022 | 0.992–1.053 | 0.159 |
| Active external rotation, arm at side | 36 | 22.9 | 57 | 19.8 | 0.972 | 0.945–0.999 | 0.043* |
| Passive external rotation, arm at side | 24 | 18.8 | 39 | 16.8 | | | 0.523 |
| Active external rotation, arm 90° abducted | 36 | 22.9 | 57 | 19.8 | | | 0.686 |
| Passive external rotation, arm 90° abducted | 24 | 18.8 | 39 | 16.8 | 0.968 | 0.946–0.991 | 0.006* |
| Active internal rotation, arm 90° abducted | 34 | 29.6 | 55 | 27.7 | 1.017 | 1.002–1.033 | 0.025* |
| Passive internal rotation, arm 90° abducted | 4 | 23.7 | 20 | 21.8 | 0.979 | 0.961–0.998 | 0.027* |
| Physical muscle strength examination findings‡ | | | | | | | |
| Weakness in abduction | 52.3% | | 14.8% | | 6.328 | 4.656–8.600 | 0.000* |
| Weakness in external rotation | 31.3% | | 3.6% | | 6.085 | 4.473–8.279 | 0.000* |
| Positive drop arm sign | 50.9% | | 14.6% | | 12.275 | 7.296–20.652 | 0.000* |
| Weakness in abduction, external rotation and positive drop arm sign | 21.5% | | 0.8% | | 32.634 | 11.921–89.335 | 0.000* |

* Statistically significant difference; †the subjective symptoms were rated by the patients using a 100-point visual analog scale; ‡the association between muscle strength examination and shrug sign was analyzed through the binary outcomes by chi square test; patients with a Grade 4 or less strength in abduction or in external rotation were considered the study group and patients with normal abduction strength (ie, Grade 5) were considered the control group; SD = standard deviation.

**Table 4.** Multivariate analysis with stepwise logistic regression analysis (likelihood ratio)*

| Variable | Adjusted odds ratio | Confidence interval (95%) | p value† |
|---|---|---|---|
| Mean age | 1.390 | 1.192–1.621 | 0.000 |
| Night pain | 1.010 | 1.002–1.018 | 0.014 |
| Lift arm above shoulder level | 0.991 | 0.983–0.999 | 0.023 |
| Active abduction | 0.955 | 0.939–0.970 | 0.000 |
| Passive abduction | 1.035 | 1.015–1.056 | 0.001 |
| Passive external rotation with arm 90° abducted | 0.982 | 0.969–0.995 | 0.006 |
| Active external rotation with arm 90° abducted | 0.988 | 0.976–1.000 | 0.050 |
| Passive internal rotation with arm 90° abducted | 0.979 | 0.969–0.990 | 0.000 |
| Weakness in abduction | 2.649 | 1.636–4.289 | 0.000 |

* Model fit, chi square test for model coefficient, $p = 0.000$; −2 log likelihood initial (629.2), final (509.2); $R2 = 0.615$; †statistical significance was set at $p \leq 0.05$.

## Discussion

The "shrug sign" generally has been associated with a diagnosis of rotator cuff disease but, based on our clinical experience, we believed it to be nonspecific. We therefore hypothesized (1) a positive shrug sign would be insensitive and nonspecific for rotator cuff disease; (2) a shrug sign would be reasonably reliable; (3) individuals with a positive shrug sign would be more likely to have loss of ROM or weakness to manual muscle testing in the involved shoulder; (4) no demographic or physical examination finding would be associated with an increased likelihood of a positive shrug sign.

These findings must be interpreted with an understanding of the limitations of our study. First, our study group included only patients undergoing surgical shoulder procedures; it did not include patients who might have had other diagnoses (eg, paralysis, thoracic outlet syndrome, or neurologic conditions such as stroke) that could produce weakness in elevation and a positive shrug sign. Our patients, derived from a primarily referral shoulder practice, may have characteristics different from those of patients seen by others. There was no control group of patients without shoulder problems, but it would be difficult to perform an examination, MRI, or arthroscopy to confirm the lack of or presence of shoulder abnormality in a control group of asymptomatic patients. Second, it is possible that some of the examination findings in our population are associated with age alone. To our knowledge, there are no studies that address the relationship of the shrug sign to age alone. However, it has been shown that there is decreased shoulder ROM with age, and it is possible that increasing age alone may have influenced our results [28]. Third, we found weakness was associated with a shrug sign, but we did not measure strength objectively, and manual muscle testing is prone to interobserver variability [3, 15, 21, 33]. More sensitive measures of shoulder weakness might result in a higher or lower correlation with the shrug sign. It also is possible that the shrug sign results in part from concomitant shoulder pain because there was a high degree of rest and night pain in our patients. Fourth, although we did measure interobserver reliability of the shrug sign, we could not determine the intraobserver reliability. We found acceptable interobserver reliability, but we examined patients preoperatively and did not perform a repeated measures analysis to determine intraobserver reliability. Fifth, we did not study anatomically the structures that might contribute to a positive shrug sign. Although the shrug sign did correlate highly with a Gagey sign, a suggested measure of inferior capsular tightness [11, 12], the patterns of capsular tightness that led to a positive shrug sign could not be determined by our study. Also, we did not study scapular positioning, which might affect the type of shrug sign [16, 24]. Finally, we did not assess the long-term outcome to determine if the surgical procedure resulted in changes in the presence of the shrug sign.

Our data showed that the shrug sign is a nonspecific finding in patients with shoulder disorders and that it is not specific or sensitive for rotator cuff disease. In patients with rotator cuff disease, the shrug sign can be seen more frequently with massive rotator cuff tears because of weakness. The shrug sign is sensitive for conditions in which there commonly is loss of motion because of stiffness, especially adhesive capsulitis and glenohumeral degenerative arthritis. Specifically, the shrug sign was associated with loss of shoulder elevation and loss of rotation when the shoulder was elevated 90°. As expected, the patients' functional limitations in terms of using the arm above shoulder level were associated with a shrug sign of an increasing angle or severity. We also found a relationship between weakness in abduction and external rotation and a positive drop-arm sign. Therefore, a patient with a positive shrug sign should be evaluated for stiffness or weakness as a cause of that sign.

Our data show the shrug sign can detect shoulder abnormalities, especially those associated with loss of ROM or weakness on manual muscle testing. However, the presence of a shrug sign warrants additional evaluation of its cause. Although this sign previously was associated with rotator cuff disease, we found it more commonly was associated with glenohumeral arthritis, adhesive capsulitis, and massive cuff tears. Patients with a positive shrug sign have altered shoulder function, and the shrug sign can be used clinically as a nonspecific physical examination finding indicative of shoulder dysfunction.

## References


1. Blevins FT. Rotator cuff pathology in athletes. *Sports Med*. 1997;24:205–220.
2. Blevins FT, Hayes WM, Warren RF. Rotator cuff injury in contact athletes. *Am J Sports Med*. 1996;24:263–267.
3. Bohannon RW. Testing isometric limb muscle strength with dynamometers. *Crit Rev Phys Rehabil Med*. 1990;2:75–86.
4. Calis M, Akgun K, Birtane M, Karacan I, Calis H, Tuzun F. Diagnostic values of clinical diagnostic tests in subacromial impingement syndrome. *Ann Rheum Dis*. 2000;59:44–47.
5. Chronopoulos E, Kim TK, Park HB, Ashenbrenner D, McFarland EG. Diagnostic value of physical tests for isolated chronic acromioclavicular lesions. *Am J Sports Med*. 2004;32:655–661.
6. Codman EA. Normal motions of the shoulder joint. *The Shoulder. Rupture of the Supraspinatus Tendon, Other Lesions in or About the Subacromial Bursa*. Boston, MA: Thomas Todd; 1934:32–64.
7. Codman EA. Rupture of the supraspinatus tendon. *The Shoulder. Rupture of the Supraspinatus Tendon, Other Lesions in or About the Subacromial Bursa*. Boston, MA: Thomas Todd; 1934:123–177.
8. Cofield RH. Tears of rotator cuff. *Instr Course Lect*. 1981;30:258–273.
9. Cohen J. A coefficient of agreement for nominal scales. *Educ Psychol Measure*. 1960;20:37–46.
10. Farber AJ, Castillo RC, Clough M, Bahk M, McFarland EG. Clinical assessment of three common tests for traumatic anterior shoulder instability. *J Bone Joint Surg Am*. 2006;88:1467–1474.
11. Gagey OJ, Boisrenoult P. Shoulder capsule shrinkage and consequences on shoulder movements. *Clin Orthop Relat Res*. 2004;419:218–222.
12. Gagey OJ, Gagey N. The hyperabduction test. *J Bone Joint Surg Br*. 2001;83:69–74.
13. Hawkins RJ, Krishnan SG. The overhead athlete—challenges, decision-making. In: Krishnan SG, Hawkins RJ, Warren RF, eds. *The Shoulder and the Overhead Athlete*. Philadelphia, PA: Lippincott Williams & Wilkins; 2004:3–9.
14. Hoppenfeld S. Physical examination of the shoulder. *Physical Examination of the Spine and Extremities*. Norwalk, CT: Appleton-Century Crofts; 1976:1–34.
15. Iddings DM, Smith LK, Spencer WA. Muscle testing. Part 2. Reliability in clinical use. *Phys Ther Rev*. 1961;41:249–256.
16. Kibler WB, McMullen J. Scapular dyskinesis and its relation to shoulder pain. *J Am Acad Orthop Surg*. 2003;11:142–151.
17. Kim TK, Queale WS, Cosgarea AJ, McFarland EG. Clinical features of the different types of SLAP lesions: an analysis of one hundred and thirty-nine cases. *J Bone Joint Surg Am*. 2003;85:66–71.
18. Kim TK, Rauh PB, McFarland EG. Partial tears of the subscapularis tendon found during arthroscopic procedures on the shoulder: a statistical analysis of sixty cases. *Am J Sports Med*. 2003;31:744–750.
19. Landis JR, Koch GG. An application of hierarchical kappa-type statistics in the assessment of majority agreement among multiple observers. *Biometrics*. 1977;33:363–374.
20. Leroux JL, Thomas E, Bonnel F, Blotman F. Diagnostic value of clinical tests for shoulder impingement syndrome. *Rev Rhum Engl Ed*. 1995;62:423–428.
21. Lilienfeld AM, Jacobs M, Willis M. A study of the reproducibility of muscle testing and certain other aspects of muscle scoring. *Phys Ther Rev*. 1954;34:279–289.
22. Lovett RW, Martin EG. Certain aspects of infantile paralysis: with a description of a method of muscle testing. *JAMA*. 1916;66:729–733.
23. MacDonald PB, Clark P, Sutherland K. An analysis of the diagnostic accuracy of the Hawkins and Neer subacromial impingement signs. *J Shoulder Elbow Surg*. 2000;9:299–301.
24. McFarland EG. Shoulder range of motion. In: Kim TK, Park HB, El Rassi G, Gill H, Keyurapan E, eds. *Examination of the Shoulder: The Complete Guide*. New York, NY: Thieme; 2006:15–87.
25. McFarland EG, Kim TK, Park HB, Neira CA, Gutierrez MI. The effect of variation in definition on the diagnosis of multidirectional instability of the shoulder. *J Bone Joint Surg Am*. 2003;85:2138–2144.
26. McFarland EG, Kim TK, Savino RM. Clinical assessment of three common tests for superior labral anterior-posterior lesions. *Am J Sports Med*. 2002;30:810–815.
27. McFarland EG, Neira CA, Gutierrez MI, Cosgarea AJ, Magee M. Clinical significance of the arthroscopic drive-through sign in shoulder surgery. *Arthroscopy*. 2001;17:38–43.
28. McFarland EG, Park HB, Kim TK, Chronopoulos E, Yokota A. Shoulder problems. In: Speer KP, ed. *Injury Prevention and Rehabilitation for Active Older Adults*. Champaign, IL: Human Kinetics; 2005:89–106.
29. McFarland EG, Selhi HS, Keyurapan E. Clinical evaluation of impingement: what to do and what works. *Instr Course Lect*. 2006;55:3–16.
30. Naredo E, Aguado P, De Miguel E, Uson J, Mayordomo L, Gijon-Banos J, Martin-Mola E. Painful shoulder: comparison of physical examination and ultrasonographic findings. *Ann Rheum Dis*. 2002;61:132–136.
31. Park HB, Yokota A, Gill HS, El Rassi G, McFarland EG. Diagnostic accuracy of clinical tests for the different degrees of subacromial impingement syndrome. *J Bone Joint Surg Am*. 2005;87:1446–1455.
32. Rao AG, Kim TK, Chronopoulos E, McFarland EG. Anatomical variants in the anterosuperior glenoid labrum: a statistical analysis of seventy-three cases. *J Bone Joint Surg Am*. 2003;85:653–659.
33. Sapega AA. Muscle performance evaluation in orthopaedic practice. *J Bone Joint Surg Am*. 1990;72:1562–1574.
34. Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. *Psychol Bull*. 1979;86:420–428.