

Posterior Instability of the Shoulder with Secondary Impingement in Elite Golfers

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Background: Shoulder injuries in golf are related to the biomechanics of the golf swing and typically occur in the lead arm at the top of the back swing.

Purpose: We report a newly recognized entity in a series of elite golfers: posterior glenohumeral instability associated with subacromial impingement.

Study Design: Retrospective review.

Methods: Eight elite golfers were treated between March 1991 and July 1998 for pain occurring in the nondominant, lead shoulder at the top of the back swing. Posterior instability was diagnosed in all eight patients; six of the eight also demonstrated signs of subacromial impingement. Initial treatment consisted of rehabilitation. For patients in whom rehabilitation failed, surgery was performed.

Results: Two patients improved with nonoperative treatment and returned to play immediately. Six patients underwent shoulder arthroscopy with posterior thermal capsulorrhaphy. Four of the six also underwent arthroscopic subacromial decompression. The six surgically treated patients returned to play at an average 4 months after surgery. At an average 4.5 years of follow-up, all eight patients were playing at their previous level of competitive play. One patient had complications that led to the need for subsequent arthroscopic subacromial decompression; she eventually returned to competitive play.

Conclusion: Clinicians should be aware of posterior shoulder instability and the associated secondary diagnosis of rotator cuff impingement as a possible cause of shoulder pain in elite golfers.

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Shoulder injuries in golf are related to the biomechanics of the golf swing. Problems occur most often at the top of the back swing and, less often, at the end of the follow-through phase.⁹ These injuries tend to involve the nondominant, lead shoulder (the left shoulder in right-handed golfers).^{10,13} At the top of the back swing, there is significant cross-body adduction of the lead shoulder, with elevation up to 120°, or 30° above shoulder height (Fig. 1). A competitive golfer may reach this position 2000 or more times a week, consequently predisposing the shoulder to overuse problems.⁷ Subacromial impingement and acromioclavicular joint arthrosis, both of which have been documented in the lead shoulders of competitive golfers, have been related to this position at the top of the back swing.^{7,10,11}

Additionally, this forward flexion and cross-body adduction is the provocative position for posterior glenohumeral instability.

The purpose of this article is to describe a newly recognized entity occurring in a specific sport. We report on a series of elite golfers with posterior instability of the nondominant, lead shoulder, most of whom had secondary subacromial impingement. The evaluation, diagnosis, and treatment of the injury are discussed. Although the exact cause of the instability and secondary impingement is not known, we discuss etiologic possibilities based on biomechanical and EMG data.

MATERIALS AND METHODS

Between March 1991 and April 1998, posterior instability of the shoulder was diagnosed and treated in eight competitive golfers at one of our institutions. The mean age of the patients at the time of diagnosis was 35 (range, 16 to 47); five patients were men and three were women. All of

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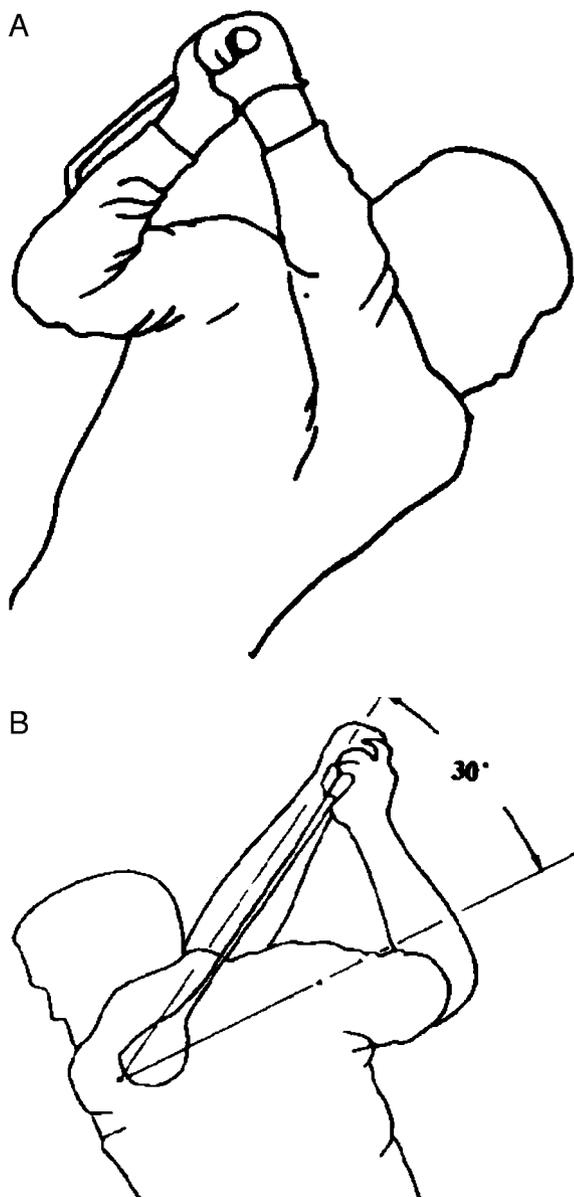


Figure 1. A, at the top of the back swing, the lead arm is fully adducted across the body. B, top of the back swing, rear view: the lead arm is elevated 30° above the plane of the shoulders. (Reprinted with permission from Mallon WJ: Golf, in Hawkins RJ, Misamore GW (eds): *Shoulder Injuries in the Athlete: Surgical Repair and Rehabilitation*. New York, Churchill Livingstone Inc, 1996, pp 427–433.)

the patients were competitive, right-handed golfers who were seen with a chief symptom of left shoulder pain and instability. Three of the golfers played at the professional level, one played at the collegiate level, one at the high school level, and three at the amateur level. All of the players had a handicap of 5 or less.

Each patient was questioned about the direction of instability and the position of the shoulder at which pain occurred. Although only a few of the patients could describe the exact direction of instability as being posterior,

all of them specifically described pain and a sense of instability at the top of the back swing when the lead arm was fully adducted across the body (Fig. 1). At the time of examination, each patient was able to reproduce the symptoms with a simulated swing.

A thorough physical examination of both shoulders was performed, including assessment for shoulder instability, rotator cuff impingement, and acromioclavicular joint arthrosis. In all patients, posterior instability was reproduced with the “load-and-shift” test³ (Fig. 2). In three of the patients, an audible clunk was appreciated, either at the top of the back swing or at the very initiation of the forward swing. All of the patients exhibited apprehension and reproduction of symptoms when the arm was forward flexed to 90°, adducted across the body, and a posterior force was applied.

Six of the eight golfers had a secondary diagnosis of subacromial impingement, evidenced by a positive Hawkins impingement sign (Fig. 3) and Neer impingement sign (Fig. 4). The impingement test was performed at the discretion of the examiner in three of these six patients. The impingement test consisted of an injection into the subacromial space of a 10-ml mixture of 1.0% lidocaine and 0.25% marcaine with triamcinolone. These three patients each received pain relief from the injection.

Each patient underwent a nonoperative rehabilitation program for strengthening the rotator cuff muscles and scapular stabilizers, including the rhomboid, trapezius, and serratus anterior muscles. Six of the eight patients did not improve with this therapy program and continued to have symptoms of pain and instability. All six patients had posterior instability and five of the six had secondary subacromial impingement. Three of these patients had relief of pain with the injection impingement test. These six patients underwent surgery to relieve the pain and instability.



Figure 2. The load-and-shift test may be performed with the patient sitting or supine. The humeral head is loaded into the glenoid and a force is applied anteriorly, posteriorly, and inferiorly to determine the degree of translation in each direction.



Figure 3. The Hawkins impingement sign is elicited by forward flexing the shoulder to 90° and then internally rotating the shoulder in this position. The reproduction of pain is a positive response.

At the time of surgery, each patient was examined under anesthesia and a load-and-shift test was performed again. Guidelines established by the American Shoulder and Elbow Surgeons¹⁴ were used for grading translation. A grade was recorded for translation in each direction: anterior, posterior, and inferior. For anterior and posterior translation, grade 0 denotes no translation, grade I represents mild translation (0 to 1 cm up the glenoid face), grade II represents moderate translation (1 to 2 cm or to the glenoid rim), and grade III represents severe translation (greater than 2 cm and over the rim). Similarly, an inferior sulcus sign was assigned in which grade 0 denotes no translation, grade I represents mild translation (0 to 1 cm), grade II represents moderate translation (1 to 2 cm), and grade III represents severe translation (greater than 2 cm).

In the six operative cases, a thorough arthroscopic evaluation of the shoulder was performed, followed by a posterior thermal capsulorrhaphy. For one patient (case 3), a laser was the heat source used to shrink the capsule; for each of the others, the heat source was a radiofrequency probe. Arthroscopic subacromial decompression was performed in the three patients who had positive impingement signs and pain relief from the impingement test



Figure 4. The Neer impingement sign is elicited by first internally rotating and then forward flexing the shoulder to full elevation. The reproduction of pain is a positive response.

(cases 1, 5, and 6). One of these patients also underwent arthroscopic distal clavicle excision for acromioclavicular joint arthrosis (case 5).

Postoperatively, the shoulder was immobilized for 2 to 3 weeks; at 4 weeks a range of motion therapy program was initiated. Six to 8 weeks postoperatively, range of motion activities were advanced and strengthening exercises were started.

RESULTS

Follow-up was obtained for all eight patients (mean, 4.5 years; range, 2.5 to 9) (Table 1). Two patients had improvement of symptoms with therapy alone and returned to play within 6 weeks. Both of these players had grade III posterior translation as indicated by the load-and-shift test. One of these players also had secondary subacromial impingement. Although both continued to report a sense of instability and a pop or clunk at the top of the back swing, they returned to their previous levels of play, one professionally and one at the collegiate level.

All six of the patients who underwent surgery demonstrated unilateral, unidirectional instability on examina-

TABLE 1
Information on Patient Characteristics, Clinical Findings, and Treatment

Case	Age at surgery (years)	Level of competition	Positive impingement signs	Surgical treatment ^a	Additional surgeries ^a	Time to return to play (months)	Complications	Follow-up period (years)
1	43	Professional	Hawkins/Neer	PTC, SAD	None	4.5	None	3.00
2	16	High school	None	PTC	None	4.5	None	2.50
3	35	Professional	Hawkins/Neer	PTC	DCR, 4.5 years later	3.0	None	4.75
4	39	Amateur	Hawkins/Neer	PTC	SAD, 7 months later	5.0	Stiffness/impingement	3.00
5	42	Amateur	Hawkins/Neer	PTC, SAD, DCR	None	4.0	None	3.33
6	47	Amateur	Hawkins/Neer	PTC, SAD	None	4.0	None	3.50
7	34	Professional	Hawkins/Neer	None	None	Immediate	None	9.00
8	22	College	None	None	None	Immediate	None	7.25

^a PTC, posterior thermal capsulorrhaphy; SAD, arthroscopic subacromial decompression; DCR, distal clavicle resection.

tion under anesthesia. Each of the six had increased posterior translation of grade II or III in the affected left shoulder relative to the uninvolved right shoulder. Five of the six surgically treated patients advanced through the rehabilitation program and were hitting short strokes (that is, putting and chipping) by 3 months postoperatively. Within 4 to 5 months after surgery, all five of these patients had returned to course play.

In one of the surgical patients (case 4), who had mild preoperative evidence of secondary impingement, posterior capsulorrhaphy alone was performed. This patient reported ongoing pain, had continued evidence of impingement, and lost motion after surgery. Two interspaces of internal rotation and 10° of forward flexion were lost. This patient also had a history of diabetes mellitus with insulin dependence. Seven months after the initial surgery, she underwent arthroscopic subacromial decompression. After 6 months of rehabilitation, she improved. At her 3-year postoperative follow-up, she had regained lost motion and stated that she was satisfied with her shoulder function. She returned to competitive golf with a handicap three strokes over her previous handicap. There were no other known complications, and all eight players reported that they were satisfied with their outcome.

One of the players (case 3) returned to professional competitive golf 3 months after his surgery. He reported a pain-free shoulder and was fully satisfied until 4.5 years after capsulorrhaphy, at which time he sought medical attention for pain in the lead shoulder. Acromioclavicular arthrosis was diagnosed and the patient underwent arthroscopic acromioclavicular joint resection. At the time of the second procedure, examination under anesthesia showed improvement from grade II to grade I posterior translation; findings were symmetric with those of the opposite side. At the time of this writing, he is rehabilitating from this second surgical procedure.

DISCUSSION

Golfers often experience shoulder pain that is typically diagnosed as subacromial impingement and rotator cuff

tendinitis. When nonoperative management fails, subacromial decompression is often necessary to return them to their active lifestyle. We have described a series of eight golfers in whom the primary finding was posterior instability with associated subacromial impingement. This more complex pathologic entity generally requires a stabilization procedure in addition to the subacromial decompression to eliminate the symptoms. The nondominant lead shoulder was the affected shoulder in all of the patients in this series, as is usually the case with shoulder injuries in this sport.¹³

As with other shoulder injuries in golfers, posterior instability is related to the biomechanics of the golf swing. At the top of the back swing, the lead shoulder is stressed to the provocative position associated with several pathologic entities. With the shoulder fully adducted across the body, the acromioclavicular joint is increasingly loaded, contributing to the pain that is experienced with acromioclavicular joint arthrosis.¹ This position also provokes subacromial impingement. With internal rotation and forward flexion, the greater tuberosity is forced under the anterior acromion, eliciting symptoms associated with rotator cuff lesions. Both acromioclavicular arthrosis and rotator cuff tears have been previously reported in golfers.^{5, 7, 10}

Finally, the top of the back swing is a provocative position for posterior instability of the shoulder. In this series, all of the patients had pain and instability at this position and only at this position. Six patients reported the greatest pain on achieving this position, whereas two reported the greatest symptoms just at the initiation of the forward swing. In both of these patients, there was an audible pop or clunk as the player began the forward swing and the posteriorly subluxated humeral head reduced.

Jobe et al.⁵ and Pink et al.¹³ have used EMG analysis to show the high degree of subscapularis muscle activity throughout the golf swing. The subscapularis muscle is noted to be very active at the top of the back swing in the lead arm, whereas the supraspinatus, infraspinatus, and deltoid muscles show much less activity. Similar findings have been shown for both male and female golfers.⁶ The

serratus anterior muscle is constantly active in the lead arm during the golf swing. Not only does this suggest the importance of a stable scapula during the swing, it also suggests that the serratus anterior muscle may be susceptible to fatigue during competitive play.⁸ Once this muscle is fatigued, the scapula may be rendered less stable, leaving the shoulder joint at risk of injury. At this point, the relatively unopposed internal shoulder rotation caused by the subscapularis muscle may significantly contribute to the development of posterior shoulder instability in golfers.

This is one hypothesis as to the etiologic process of posterior instability in these patients. We do not have specific evidence that would demonstrate this as the mechanism of instability; however, in the absence of a clear episode of trauma, fatigue from overuse is a plausible mechanism.

The association of subacromial impingement with anterior instability in athletes has been described.⁴ However, it cannot be assumed that posterior instability somehow protects against the development of the impingement syndrome. If the repetitive stress on the shoulder from the golf swing has been great enough to overload the normal static capsular restraints, it is possible that the repetitive forces are great enough to contribute to secondary rotator cuff tendinitis, either through a traction injury or a direct impingement under the coracoacromial arch.⁴

A rehabilitation program for strengthening the scapular stabilizing muscles, including the serratus anterior, as well as the rotator cuff muscles, is an appropriate initial treatment. Specific exercises such as scaption, rowing, and push-up plus are recommended as the central program for scapular stabilization.^{2,12} Two patients in our series had improvement of symptoms with a rehabilitation program alone. Although a pop or clunk of the shoulder continued, the pain decreased and both of these golfers returned to competitive play.

One complication occurred in a diabetic, insulin-dependent female patient who developed shoulder stiffness after the surgery. Before the capsulorrhaphy, her impingement signs were positive but thought to be mild and secondary to the posterior instability. She underwent posterior capsulorrhaphy alone and developed postoperative stiffness in addition to pain. She eventually regained motion and returned to competitive golf, but only after arthroscopic subacromial decompression and a lengthy rehabilitation program. She now plays with a handicap three strokes over her preinjury level. Although there is a well-known association of diabetes mellitus with shoulder stiffness, we do not know the degree to which the diabetes contributed to this complication. Clearly, the patient continued to have signs of rotator cuff impingement and eventually improved after subacromial decompression. Because her impingement signs were mild, it was initially believed that she would improve with elimination of the posterior instability. This complication illustrates the need for thorough evaluation and treatment of both the instability and impingement. This patient represented the only complication in this series, with all of the remaining patients returning to their preinjury level of competition. All of the players

stated they were satisfied with their shoulder function, and the symptoms of pain and instability were gone.

We recognize a couple of weaknesses in this study. First, this series was reviewed retrospectively because the group described was only recognized after the treatment of several players. As a result, the evaluation and treatment of these patients varied slightly. Second, a scoring system was not universally applied to grade outcomes in these patients. We recognize the value of using a scoring system to report and compare outcomes. However, it was not our purpose to report the outcome of a specific treatment in these patients, but rather to describe a previously unrecognized disorder. Therefore, we believe that the patient's subjective statement of satisfaction and objective return to a level of competition similar to that before treatment qualify as acceptable evidence of outcome.

CONCLUSIONS

This study serves to increase awareness of the diagnosis of posterior instability of the shoulder in elite golfers. Such patients may have a secondary diagnosis of rotator cuff impingement that must also be addressed. Although two players in our series improved with nonoperative treatment, six required surgery. Posterior thermal capsulorrhaphy was successful in treating the posterior instability. When present, associated subacromial impingement was successfully treated with arthroscopic subacromial decompression. All of the players in this series eventually returned to competitive golf, most at the preinjury level of competition.

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