

## Lag Signs

We often assume that muscle testing about the shoulder will indicate the presence of a partial tear or full rupture of the rotator cuff muscles. Logically, if there is a partial tear or full rupture, active resisted testing of the muscle should cause painful weakness with a partial tear, and perhaps painless or minimally painful weakness with a full rupture. Given that rotator cuff musculature and, in particular, tendon insertion, is largely hidden by more superficial musculature, the observation of a displaced tendon or bulge of a retracted muscle tendon is not obvious.

A common testing procedure is the drop sign, in which a patient's arm is elevated to 90 degrees and the patient is asked to hold the position. Inability to hold the position indicates involvement of either the deltoid or supraspinatus. Given that the supraspinatus is more often torn, the assumption is that a tear of the supraspinatus has occurred.

An extension of this concept is to add resistance to the position. This is often referred to as the Jobe sign. With the arm at 90 degrees abduction, the examiner exerts a downward force with the patient attempting resistance. The obvious confounding factor is that this test is likely to cause pain with many shoulder conditions, and the pain is likely to cause a reflex inhibition of the muscles. The weakness, then, is more a neurologic response rather than a biomechanical inability to hold the position.

Recently, Hertel et al.<sup>1</sup> performed an evaluation of 100 consecutive patients. The results of those patients who went on to arthroscopic or open repair of any rotator cuff muscle/tendon were examined to determine the effectiveness of several tests in detecting a partial or full rupture. The tests incorporated into the study evaluation were:

- The Jobe sign. The shoulder is elevated to 90 degrees abduction with internal rotation. The patient maintains position with the examiner exerting a downward force on the arm (similar to the "empty can" test).
- The liftoff test. The patient is seated with the hand of their involved arm placed palm outward on the lower back. The patient is asked to lift the hand off of the back.
- The external rotation lag sign. The patient is seated. The elbow is passively flexed to 90 degrees and the shoulder is held at 20 degrees elevation in the scapular plane in a position of near maximum external rotation (i.e., maximum external rotation minus five degrees to avoid elastic recoil). The examiner supports the elbow and holds the arm in external rotation at the wrist. The patient is asked to hold the position while the examiner supports the elbow but releases the hold at the wrist. The degree of movement is estimated and is referred to as the "lag" (i.e., the difference between active and passive ROM).
- The drop sign (different than the standard drop sign). The patient is seated. The arm is held at 90 degrees elevation (in the scapular plane) and almost full external rotation with the examiner supporting the elbow and holding the arm in external rotation at the wrist. The patient is asked to hold

the position while the examiner supports the elbow but releases the wrist hold. The degree to which the arm falls into internal rotation is the degree of lag.

- The internal rotation lag sign. The patient is seated. The patient is asked to bring the arm behind the back with the palm facing outward. The arm is held in near maximum internal rotation and with the hand away from the back by approximately 20 degrees of extension. The patient is asked to hold the position while the examiner supports the elbow but releases the wrist hold. If the patient is unable to hold the position, the lag sign is positive.

The biomechanical principle used in the design of the lag signs was to place the muscle/tendon in the most disadvantaged positions possible, thereby requiring full function of the muscle. The position was also designed to eliminate, as much as possible, contribution from other synergists. False negatives may occur if there is a restricted passive movement pattern. False positives may occur if the arm is held in maximum rotation or if the patient has an excessive passive range of motion.

The results of the study indicate the following:

- For rupture of the supraspinatus and infraspinatus tendons, the external rotation lag sign was less sensitive but more specific than the Jobe sign. This is probably because the Jobe sign is often painful.
- The drop sign was the least sensitive, but was as specific as the external rotation lag sign.
- Partial ruptures of the supraspinatus were not revealed with the external rotation lag sign.
- For the subscapularis, the internal rotation lag sign was as specific but more sensitive than the lift-off sign.
- Partial ruptures of the subscapularis tendon could be missed with the lift-off sign but detected with the internal rotation lag sign.

### *Reference*

1. Hertel R, Ballmer FT, Lambert SM, Gerber CH. Lag signs in the diagnosis of rotator cuff rupture. *J Shoulder Elbow Surg* 1996;5:307-13.

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