In this report, orthopedic surgeons for The San Antonio Orthopaedic Group in San Antonio, Texas review the latest research on subscapularis tendon tears. They provide background on anatomy, etiology (causes), diagnosis, and treatment of this condition. Both conservative (nonoperative) care and surgical treatment are included.

The subscapularis muscle is one of the four muscles and tendons that surround the shoulder called the rotator cuff. Rotator cuff tears (RCTs) usually involve the infraspinatus or supraspinatus tendons. But surgeons are starting to see more subscapularis tears in active seniors.

The subscapularis muscle rotates the shoulder inward (internal rotation). It stabilizes the shoulder and helps prevent anterior (forward) dislocation. Recent studies have shown how the subscapularis works together with the infraspinatus muscle to create smooth arthrokinetics (joint motion).

The first EMG study on dynamic muscle function of the subscapularis has been published. Besides acting as an internal rotator, it appears that the subscapularis also helps abduct the arm (move it away from the body). It functions as a shoulder stabilizer during this movement as well as during internal rotation.

With today's new technology, scientists have also discovered a concept called the tendon footprint. This refers to the shape of the tendon as it inserts or connects with the bone. Shape, width, and size of the subscapularis tendon have been mapped now.

The subscapularis footprint is shaped like the outline of the state of Nevada. It is trapezoidal with a wider area at the top. Knowing where the tear is located within the footprint helps direct treatment.

Although subscapularis tears can occur alone, they usually develop when other tendons in the rotator cuff are damaged. Injury from trauma and degenerative processes are two of the most common causes of subscapularis tears. Trauma is more likely to result in an isolated subscapularis tear. Younger patients and especially males are subject to this type of subscapularis injury.

Degenerative processes are more common in older adults. For example, stress on the footprint (place where the subscapularis inserts) from failure of other rotator cuff tendons is more likely as we age.

The roller wringer effect has been described in association with age-related degenerative disorders of the subscapularis tendon. This refers to the effect of impingement (pinching), which can cause the undersurface fibers to tear. This condition is called traumatic undersurface fiber failure (TUFF). As the subscapularis passes under the coracoid process, it gets pressed or pinched.

The coracoid process is a small finger-like structure on the upper outer portion of the scapula (shoulder blade). It points forward on a diagonal and works with the acromion (curved bone over the top of the shoulder) to stabilize the shoulder joint. Because of the shape of the coracoid process and the way the subscapularis passes under it, the tendon can get rolled and wrung out like a wet towel. That's what's meant by the roller wringer effect.

In order to make an accurate diagnosis, the surgeon must examine the shoulder carefully. Patterns of pain and loss of motion help guide the diagnostic process. New clinical tests are being developed and tested. The old tests (lift off, Napoleon, belly press) are not as accurate as we once thought. In fact, for small or partial
thickness subscapularis tears, these tests are very inaccurate.

The *belly-off sign* is very sensitive for all sizes of subscapularis tears. With the arm internally rotated and the hand resting against the belly, the patient tries to lift the hand away from the stomach while the examiner resists the motion. Inability to move the hand off the abdomen is a sign that the subscapularis is not functioning properly. But the test requires the patient to use the external rotator muscles. If these are torn in a massive rotator cuff, the test can't be used.

A new test called the *bear-hug test* may be the answer. In this test, the patient places the hand of the involved shoulder on his or her opposite shoulder. The fingers are straight and pointing back. The forearm and elbow are lifted up (the point of the elbow is facing forward).

The examiner tries to pull the patient's hand up and off the shoulder. The patient tries to keep the hand on the shoulder. With a normal, strong scapularis, the patient should be able to keep the hand down. With a subscapularis tear, the examiner will be able to easily lift the patient's hand off the shoulder. Compared with other tests for subscapularis tears, the bear-hug is the most accurate. But more studies are needed to confirm the use of this test with partial- and full-thickness tears.

In the meantime, research efforts have been made to look at preoperative imaging as a diagnostic tool. CT scans and MRIs haven't been very successful identifying subscapularis tears. Arthroscopic exam still remains the most sensitive and reliable test. It is more invasive, especially for those patients who don't have a rotator cuff tear. But it is the first-step in the treatment of rotator cuff tears. So, if the patient's history and clinical exam point in the direction of a subscapularis tear, then arthroscopic exam is advised.

If the diagnosis is confirmed that a subscapularis tear is present, then the decision about the most effective treatment must be made. Conservative (nonoperative) care is possible but only with a few, select patients. Usually these patients either don't want surgery or are too medically unstable to have surgery of any kind.

Most people with a torn subscapularis tendon need surgery for a good result. The procedure can be done with an open incision or arthroscopically through several *portals* (small puncture holes).

The surgeon may find the tear is impossible to repair. But usually, the tendon is sutured back in place. The natural footprint is restored as much as possible. With the arthroscopic approach, the surgeon can check for undersurface tears (traumatic undersurface fiber failure or TUFF). Without this arthroscopic exam, many undersurface tears would be missed.

Specific types and the use of arthroscopes and the location of the portals are described and discussed in detail. The authors provide both line drawings and arthroscopic photographs to aid the surgeon in understanding the arthroscopic treatment of this condition. Specific surgical techniques (e.g., bone bed preparation, anchor placement, suture passage, knot tying) are outlined step-by-step.

Surgery is followed by a rehab program with proper positioning of the arm and limited external rotation for the first six weeks. Once the sling is no longer needed, active motion and limited stretching are allowed. A Physical Therapist guides the patient through the rehab process, advancing to a strengthening and aggressive stretching program at the right time.