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Management of Partial-Thickness Rotator Cuff Tears

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Partial-thickness rotator cuff tears are a common finding in the military population. Given that these lesions are often present in asymptomatic populations, it is important to perform a thorough history and physical examination along with selective injections to confirm or rule out the partial-thickness tear as a source of pain or dysfunction. Once the decision has been made to operatively treat these tears, a number of options exist, including debridement, repair in situ, or completion of the tear with subsequent repair. Selection between these options is dependent on the extent of the tear, the experience of the surgeon, and the goals of the patient. This article presents a brief discussion on tear recognition, classification, and diagnostic challenges, followed by the technical details behind arthroscopic repair. With careful attention to the clinical workup, and meticulous surgical technique, these tears can be successfully treated to return active duty patients and cadets back to full military duty.

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Rotator cuff disease is a common problem in any military orthopedic surgeon's practice. Although the scope of this condition includes a spectrum ranging from rotator cuff strain to massive full-thickness tear, a young active-duty population presents more commonly with partial-thickness tears than an older, more sedentary population might. Military demands often present unique challenges in the treatment of these lesions. Job requirements often include training with heavy packs, parachute jumps, and proficiency with firearms. Physical fitness is one of the cornerstones of military readiness, and an inability to meet physical standards can result in dismissal from the service. Additionally, at the nation's military academies, some 15,000 officers in training are held to the most stringent of fitness standards, including a physical fitness test each semester, intercollegiate or intramural participation, and daily participation in fitness maintenance. Rotator cuff pathology is not well tolerated in this group, and emphasis on a rapid return to full duty requires an aggressive approach to these injuries. This article will discuss our approach in diagnosing and treating partial thickness rotator cuff disease, as well as some of the complexities that our military population and cadets present.

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Pathoanatomy of the Partial-Thickness Rotator Cuff Tear

The etiology of partial-thickness tears of the rotator cuff is varied and controversial. Like other young athletic populations,[1] we find the majority of these tears to be articular sided and, therefore, will be our emphasis here (Fig. 1). Articular-sided partial-thickness tears in athletes who throw were first described by Andrews and coworkers[2] in 1985. The authors explained the lesion as occurring due to excessive eccentric forces acting on the undersurface of the posterior rotator cuff during deceleration of throwing. Other authors have shown that, in a fully cocked throwing position, the posterior supraspinatus tendon is compressed against the posterior–superior edge of the glenoid rim and labrum, and although such contact often is physiologic, it may be exacerbated by glenohumeral laxity, giving rise to a condition of "internal impingement"[3] as a source for the painful shoulder in the throwing athlete. Still other authors have suggested a primary posterior inferior capsular contracture mechanism that results in a relative superior translation of the humeral head, leading to the constellation of findings found in the disabled throwing shoulder.[4]

Although these explanations make sense in throwers, other factors intrinsic to the anatomy of the rotator cuff also may contribute to the occurrence of these lesions in nonthrowing athletes and military personnel. Subacromial impingement,[5] age-related degenerative changes,[6] and a zone of relative hypovascularity at the articular surface of the lateral

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Figure 1 MRI of a partial-thickness articular-sided rotator cuff tear.

supraspinatus[7] all may play a role in the development of these lesions. Finally, given that the rotator cuff has a histological 5-layer structure, it is susceptible to shear stresses, which may lead to intratendinous delaminations[8] observed in some partial-thickness tears.

Classification

Originally described as "rim rents" by Codman in 1934,[9] partial-thickness rotator cuff tears have had several different classifications. Neer[5] described stages of impingement from stage I (inflammation, hemorrhage, edema, and pain), stage II (tendon fibrosis), and stage III (progressive tearing). Ellman[10] first described his classification of partial-thickness rotator cuff tears in 1990 using location of the tear (articular, intratendinous, and bursal), depth (grade 1, <3-mm deep; grade 2, 3- to 6-mm deep; grade 3, >6-mm deep), and tear area (mm^2). Millstein and Snyder[11] also described tears in terms of location (articular, bursal, complete) and severity (a 0-4 scale from normal to >3 cm). Other authors[12] have used the medial to lateral footprint distance in classifying partial tears. Such classification systems are useful in that they aid in communication about lesions, guide treatment recommendations, and allow a more accurate analysis of results.

With the advent of magnetic resonance imaging (MRI) and arthroscopy, undersurface partial-thickness tears have become better understood. Millstein and Snyder[11] defined a partial articular supraspinatus tendon avulsion (PASTA) lesion (Fig. 2), and Conway[13] coined the term PAINT lesion for partial articular tears with intratendinous extension. Both of these lesions are a source of disability in an active duty military population.

Diagnostic Challenges and Recommended Evaluation

Determining that a patient has a symptomatic partial-thickness rotator cuff tear poses a particular challenge in our population. It is unique not because the lesion is difficult to discover but because it is often difficult not to. Because most military practitioners can easily order an MRI, most patients who present to the military orthopedic surgeon already have an MRI in hand. In addition, many of the patients know the results of the radiologist's interpretation and are convinced of the MRI's accuracy regarding their symptoms. It is well reported that partial-thickness tears occur in asymptomatic individuals.[14-16] Lohr and Uhthoff[15] noted a 32% incidence of partial-thickness tears within the supraspinatus tendon in a cadaver model. In asymptomatic patients older than 40 years of age, Sher and coworkers[16] reported a 24% incidence of partial thickness rotator cuff tears, and in a young population of healthy volunteers (average age 29), Miniaci et al[17] reported that MRI of all tendons revealed abnormalities, with 23% having significantly high signal within the tendon, which was less than full thickness.

In overhead throwing athletes, the prevalence of partial tears is even higher. Connor and coworkers[14] noted that 40% of asymptomatic throwing shoulders demonstrated rotator cuff tearing compared with 0% in the nondominant arms of the same throwers. No patient in this group had developed shoulder symptoms 5 years after the pathology was documented. The authors concluded that MRI alone should not be used as the basis for operative intervention in this population. Finally, Weber[18] reported on 80 consecutive MRI scans interpreted as a partial rotator cuff tear. He noted that correlation of MRI reports to observed arthroscopic findings was poor, with 17 of 80 patients correctly diagnosed by MRI. He reiterated that radiologic interpretation of nonspecific findings on MRI should not be used as an indication for surgery. Studies like these emphasize the importance of a solid history and physical examination to establish the diagnosis and source of the patient's symptoms.

In our experience, most patients with symptomatic partial-thickness rotator cuff tears present with pain as the chief complaint. A thorough history is taken with emphasis on quality and location of pain, as well as the degree of disability

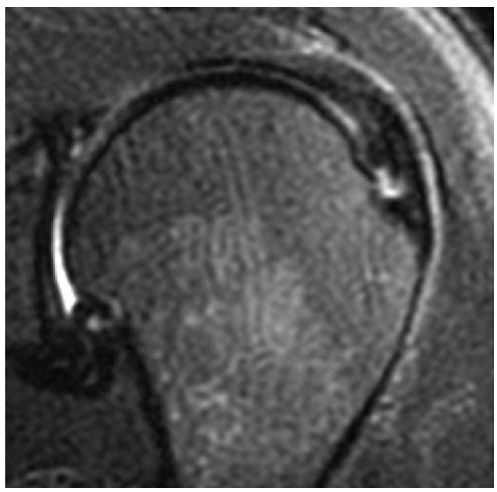

Figure 2 MRI of a partial articular supraspinatus tendon avulsion (PASTA) lesion.