# New Approaches to Diagnosis and Arthroscopic Management of Partial-Thickness Cuff Tears

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**KEYWORDS**

• Partial-thickness • Rotator cuff
• Overhead athlete • Diagnosis • Treatment

Partial-thickness cuff tears (PTCTs) are increasingly recognized as a source of pain and athletic impairment, especially in overhead athletes.[1,2] Improvements in diagnostic imaging have enhanced the ability to detect and quantify partial cuff disease, and arthroscopic advances have led to novel techniques by which partial cuff tears can be repaired.[2–6] Despite increasing recognition and improved understanding of this condition, the natural history, clinical evaluation, and management of partial tears remain elusive. This is because of the disparity between the extent of partial cuff tearing and the wide variability in clinical impairment and the frequent overlay of concomitant labral and subacromial pathology.

When should operating on an athlete with a partial cuff tear be considered? What percentage of cuff tear justifies repair rather than debridement? Does this threshold vary according to the athlete or sport? And if the partial tear is repaired, what can be expected in terms of return to activity, particularly in a high-level thrower? The purpose of this manuscript is to provide an overview of partial cuff tears and their evaluation and management.

## BACKGROUND

Partial cuff tears have been recognized since they were first described in 1934 by Codman,[7] who estimated their incidence to be likely twice that of full-thickness tears. The actual prevalence of partial-thickness rotator cuff tears, however, remains

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somewhat unclear because of the variable methods by which tears have been assessed. Most data are derived from cadaveric and imaging studies of nonathletes. MRI studies in asymptomatic shoulders have found a variable percentage of partial-thickness tears, most of which occur within the supraspinatus tendon.[1,8,9] In one review of 306 cadaveric shoulders, 32% had partial-thickness tears of the supraspinatus tendon.[10] Intratendinous tears have been particularly common in comparison with articular- or bursal-sided tears. In a study of 249 cadaver shoulders, Yamanaka and Fukuda[11] found a 13% incidence of partial-thickness tears of which 55% were intratendinous, 27% were articular-sided, and 18% were bursal-sided.

In throwers, pathology within the cuff is especially common, particularly undersurface tears of the supraspinatus and infraspinatus. In a population of young athletes, Payne and colleagues[12] reported that articular-sided tears comprised 91% of all partial-thickness tears. Connor and colleagues,[1] in a study of 20 throwers, reported partial- or full-thickness cuff tears in 8 of 20 (40%) dominant shoulders, compared with none in nondominant shoulders. Because many athletes are never imaged, the true prevalence of PTCTs is probably higher than that reported.

## ETIOLOGY OF PARTIAL CUFF TEARS

Partial cuff tears can occur on the bursal side, articular side, or within the tendon. The etiology of partial cuff tears is multifactorial,[4,13,14] with clinical and basic science research suggesting that underlying mechanisms can be broadly categorized as either intrinsic or extrinsic to the rotator cuff tendons.[13–16] Intrinsic factors are those that are inherent to the tissue, such as age-related degenerative tearing resulting from vascular and metabolic changes[17] and internal shear stresses.[10,18] Extrinsic factors include subacromial impingement, internal impingement, and stresses from repetitive overhead activities.

### *Intrinsic Factors*

Age-related degenerative changes, more common in older athletes, include decreased cellularity, fascicular thinning and disruption, accumulation of granulation tissue, and dystrophic calcification.[4,14] The hypovascular zone at the articular surface of the rotator cuff lateral to the so-called "rotator cable"[19–22] is also accentuated with aging and likely contributes to the pathogenesis of partial-thickness tears.[4,14,15,22] In addition, the bursal surface has more prevalent vessels with larger arterioles,[19–21,23] and this more prominent blood supply has been suggested to play a role in the healing potential of bursal-sided tears. Intrinsic changes in the cuff vascularity and age-related degenerative changes may be responsible for articular-surface tears in patients older than 40 years without other clear mechanisms. This concept is further supported by clinical and cadaveric studies that have shown an increasing prevalence of partial-thickness rotator cuff tears with age and a histologic correlation noted between patterns of degenerative changes and areas of relative decreased vascularity.[10,13,20,24,25]

### *Extrinsic Factors*

Extrinsic factors include classic subacromial impingement as described by Neer,[26] shoulder instability,[27] traumatic injury, repetitive microtrauma, and internal impingement. Internal impingement most commonly occurs in overhead athletes, with the shoulder in abduction and external rotation (**Fig. 1**) and this contact may be pathologic or physiologic.[25,28,29] Several potential factors may contribute to the development of pathologic internal impingement, including repetitive microtrauma and intratendinous strain during eccentric contraction of the rotator cuff in the deceleration phase of throwing. Other factors include subtle anterior instability through attenuation of the