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Tear Area Predicts Natural History of Rotator Cuff Degeneration: A Retrospective Study of Supraspinatus Tear Progression

Rotator cuff (RC) tears are a common cause of shoulder pain and dysfunction, with both partial-thickness (PT) and full-thickness (FT) tears showing potential for progressive enlargement. Despite extensive literature, risk factors for tear progression remain unclear. This study introduces a novel area-based classification system and assesses its predictive power relative to conventional dimensional metrics. This retrospective study analyzed 82 patients with isolated full- and partial-thickness supraspinatus tears who underwent two MRIs at least one year apart and were managed non-operatively. Tear morphology was evaluated in anterior-posterior (AP), medial-lateral (ML), and total tear area dimensions. Tear progression was assessed using both conventional classification and a proposed area-based system, categorizing tears as small (< 100 mm^2), medium (100 – 300 mm^2), or large (> 300 mm^2). Of the 52 PT tears, 59.6% progressed to FT tears over a median of 42 months. Tear area at baseline was significantly greater in tears that progressed (76.4 mm^2 vs. 38.5 mm^2, p = 0.038). Each 50 mm^2 increase in tear area raised the risk of FT conversion by 15%. Among FT tears (n = 30), 46.7% progressed more than 5 mm over a median of 60 months, but all groups demonstrated significant increases in tear area, despite their initial classification. The proposed area-based system more effectively distinguished tears at higher risk of enlargement. Tear area is a superior metric to individual AP or ML dimensions in predicting RC tear progression. An area-based classification system may offer improved clinical insight into prognosis and surgical decision-making, particularly for small and medium isolated supraspinatus tears.

Keywords
rotator cuff tear, tear progression, supraspinatus tendon, partial thickness tear, tear area classification, shoulder MRI

Biography
Ara Nazarian, PhD, is a biomedical engineer and Associate Professor at Harvard Medical School and a principal investigator at Beth Israel Deaconess Medical Center's Carl J. Shapiro Department of Orthopaedic Surgery. He directs the Musculoskeletal Translational Innovation Initiative, leading cross-disciplinary teams that develop and evaluate technologies for fracture care, bone regeneration, and trauma systems. His work spans preclinical models, clinical trials, and data science to move discoveries from bench to bedside. Dr. Nazarian mentors surgeons, engineers, and trainees, and collaborates with industry and government partners. He is widely published and serves on editorial and review panels in musculoskeletal science worldwide.

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