J Shoulder Elbow Surg (2014) 23, 339-346

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Association of suprascapular neuropathy with rotator cuff tendon tears and fatty degeneration

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Background: The mutual influence of suprascapular neuropathy (SSN) and rotator cuff tendon tears on muscle pathology is unclear. Debate continues as to how retracted cuff tears can lead to SSN and whether SSN or tendon retraction causes muscle fatty degeneration.
Methods: A cohort of 87 patients suspected of having SSN was identified from a prospectively collected registry. All underwent electromyography/nerve conduction velocity study (EMG/NCV) and magnetic resonance imaging (MRI) of their shoulders. EMG/NCVs were performed and interpreted by electrodiagnosticians, and MRI cuff tendon quality and muscle fatty degeneration were interpreted by two surgeons.
Results: Out of 87 patients, 32 patients had SSN on EMG/NCV, and 55 patients had normal suprascapular nerve. MRI showed that 59 of 87 supraspinatus had no fatty degeneration or mild fatty streaks (Goutallier grades 0 and 1), and 28 patients had significant fatty degeneration (grades 2-4); infraspinatus fatty degeneration was similar. Review of supraspinatus tendon showed 41 patients with intact tendons or partial tears, and 46 with full tears. Infraspinatus tendons pathology was similar. Tendon pathology and fatty degeneration were related (P-value$<$.001), with more severe tendon pathology leading to higher degree of fatty degeneration. Infraspinatus tendon tears were associated with SSN ($P = .01$), but SSN was not related to fatty degeneration of either supraspinatus or infraspinatus (P-values .65, .54).
Conclusion: The exact association and etiology of SSN in patients with rotator cuff pathology remain unclear. SSN is correlated to tendon tear size, but it does not have significant influence on fatty degeneration of either supraspinatus or infraspinatus.
Level of evidence: Basic Science Study, Anatomy, Imaging and Electromyography.

Keywords: Suprascapular nerve; rotator cuff tear; fatty degeneration; electromyography; nerve conduction velocity

Injury to the suprascapular nerve can lead to a range of clinical symptoms including weakness and pain. Suprascapular neuropathy (SSN) is thought to be caused by either traction or compression at the suprascapular or spinoglenoid notch.[4,14,17,18,20,22] In the recent decade, there has

IRB approval agency: Partners Healthcare IRB, Protocol #2011-P-000443.
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1058-2746/$ - see front matter © 2014 Journal of Shoulder and Elbow Surgery Board of Trustees.
http://dx.doi.org/10.1016/j.jse.2013.06.011

Table I Goutallier grade for supraspinatus and infraspinatus fatty degeneration[9]

Goutallier grade	Descriptions
0	Normal muscle
1	Minor fatty streaks
2	Significant fatty streaks
3	Equal muscle and fat
4	More fat than muscle

been significant advancement in the diagnosis and the treatment of SSN; however, the relationships between nerve injury, rotator cuff tendon quality, and muscle fatty degeneration remain unclear.

Clinically, patients with SSN present with posterior/superior shoulder pain and/or weakness in abduction or external rotation; often, SSN may present with concomitant shoulder pathology. This made up of at least 4.3% of new patients presenting to a referral shoulder practice.[2] Magnetic resonance imaging (MRI) is utilized in the evaluation of those with suspected SSN and helps to assess the rotator cuff tendons, muscle quality, space occupying lesions, as well as other sources of pathology. Electromyography (EMG) and nerve conduction velocity (NCV) studies are often obtained to confirm a clinical suspicion of SSN. Standard electrodiagnostic criteria include muscle denervation, motor unit action potential changes, and NCV from Erb's point to the supraspinatus and/or infraspinatus.

Previous literature has shown that large retracted rotator cuff tears (RCTs) can lead to SSN.[14,19] Additionally, Costouros et al reported a series of patients with recovery of the suprascapular nerve after repair of the rotator cuff, presumably due to the repair relieving the traction.[3] In numerous animal model studies, RCTs are known to produce fatty degeneration, and the severity of the changes was associated with tear size and suprascapular nerve injury.[12,15] After cuff repair, fatty degeneration is not reversed, but rate of progression is slowed.[7,8]

In this report, we examined the relationship between suprascapular neuropathy, quality of rotator cuff tendon, and degree of muscle fatty degeneration. We hypothesized that: (1) patients with large retracted cuff tears will have SSN; (2) in absence of rotator cuff tendon tears, SSN should not lead to fatty degeneration.

Methods

After obtaining approval from our Institution Review Board, patients were retrospectively identified from our prospective database of a referral shoulder practice. The inclusion criterion comprised of those patients having completed EMG/NCV including the suprascapular nerve and a shoulder MRI that were less than 12 months apart. Indications for EMG/NCV studies include: (1) unexplained persistent shoulder pain over posterosuperior aspect of shoulder; (2) atrophy or weakness of supraspinatus and infraspinatus without evidence of rotator cuff tear; (3) rotator cuff tear with retraction; and (4) a labral tear with associated cyst.

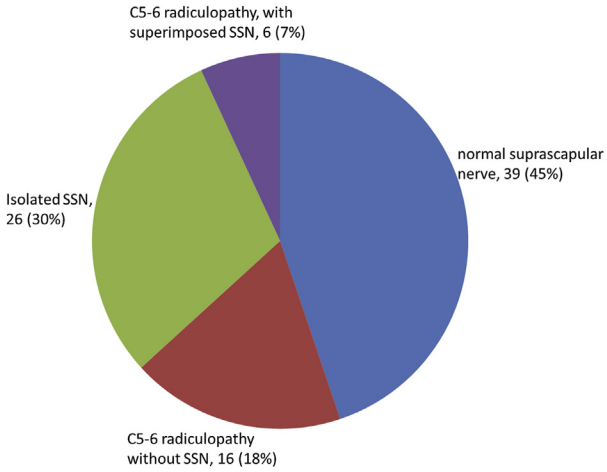

Figure 1 EMG findings of the 87 patients.

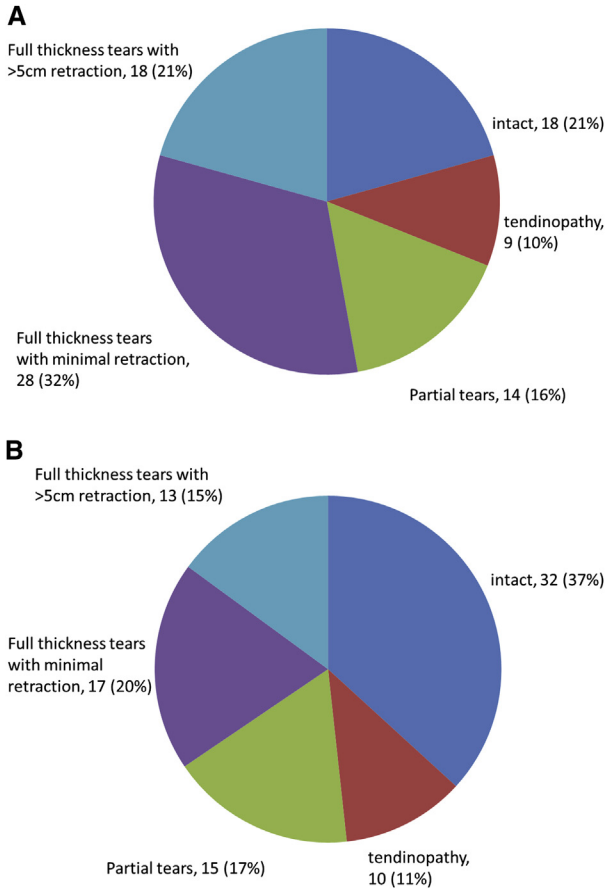

Figure 2 Supraspinatus (**A**) and infraspinatus (**B**) tendon pathology findings on MRIs.

Eighty-seven patients were identified and included in the study. A chart review was conducted to collect biographical information and EMG/NCV results. The average age of the patients was 54 years old (range, 18-77); 23 out of 87 patients were female