International Journal of Medical Science and Dental Research

Sonographic Prevalence of Supraspinatus Tendinopathy In Naïve Patients Seeking Care From A General Practitioner Due To Shoulder Pain: A Strobe-Compliant Single –Center Cross-Sectional Study

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Abstract: The general population experiences a high prevalence of shoulder pain during their lifetime (about 66.7%), and up to 3% of adults consults General Practitioner (GP). Rotator cuff anatomy is intricate, and a meticulous differential diagnosis is necessary to understand the underlying cause of pain: this could be linked to supraspinatus (SP) damage; however SP damage incidence is poorly understood in general practice. The goal of this study is to evaluate the prevalence of supraspinatus (SP) tendinopathy, and explore the association between SP damage and other rotator cuff pathologies using ultrasound shoulder scan (USS) in the general population presenting to a GP surgery with previously undiagnosed shoulder pain. On this basis, 39 patients were enrolled in this study, and USS was performed. Subscapularis (SC), supraspinatus (SS), infraspinatous- teres minor (IS-TM) complex, and biceps long head (BLH) tendons were investigated; moreover, presence of osteoarthritis (OA) signs (e.g. irregular bone profile, cartilage thinning) and joint effusion was also evaluated. Statistical parametric and not-parametric analysis were performed. RESULTS: We found that 65% of the cohort was affected by SP damage; furthermore, almost 90% of the cohort presented other cuff tendon related injuries, and 52% showed osteoarthritis signs ; finally, anatomical injury increased linearly with the age.

Keywords – *General Practice, Shoulder Pain, Supraspinatus damage*

I.   Introduction

Shoulder pain is a health condition that usually induces patients to ask for medical examination: the pain is typically related to tendon injuries (1). Indeed, rotator cuff injury (inflammation or tear) is associated with shoulder pain, change in shoulder movement, decreased range of motion, pain radiating down into the deltoid muscle area, and muscle atrophy (2).

Rotator cuff anatomy is also intricate: tendons form confluence with the joint capsule and coracohumeral ligament, and insert on the humeral tuberosity. The subscapularis (SC) is the largest and strongest cuff muscle,

and it is inserted on lesser tuberosity, while the supraspinatus (SS), infraspinatus (IS), and teres minor (TM)™ are inserted over the superior, middle, and inferior facets on to the greater tuberosity (3).

The primary function of the rotator cuff is to keep the head of the humerus centred into the glenoid fossa, permitting a single centre of rotation, while allowing efficient abduction or forward elevation of the arm: damage of rotator cuff leads to mechanical overload, inflammation with pain, and ultimately, tears (4).

To explain damage, two types of cuff tear theories are commonly accepted: traumatic and degenerative. Traumatic (or extrinsic) damage is mediated by impingement, inflammation, or direct trauma (5). Degenerative damage is instead characterized by degenerative-microtrauma models: among them, age-related degeneration associated to repetitive microtrauma, leads to tendon fibrillary tear (6,7). In facts, general population has high rate prevalence of shoulder pain during lifetime (about 66.7%) and up to 3% of the adult population consults General Practitioner (GP) due to new-onset shoulder pain (8,9), mostlyrelated to rotator cuff tears; nevertheless, other pathologies are possible (e.g. adhesive capsulitis, frozen shoulder, glenohumeral osteoarthritis, and acromioclavicular joint disorders) and these should be taken into consideration during differential diagnosis (10).

Diagnosis algorithms are based on ultrasound scanning (USS) of shoulder region. In expert hands, USS is sufficient to visualize the four muscular components of the rotator cuff (SC, SS, IS-TM complex and biceps long head), the cartilage of the humeral head, and to identify the presence of bursitis or joint effusions (11): moreover, magnetic resonance (MRI) could be helpful in order to visualize muscular belly under coracoacromion arch (12).

The goal of this study is to evaluate the prevalence of supraspinatus (SP) tendinopathy and to investigate potential association between SP damage and other rotator cuff injuries using ultrasound shoulder scan (USS) in general population, with previously undiagnosed shoulder pain, seeking care at a GP surgery in Noci (Italy).

II.   Methods

The study was conducted as a single-center cross-sectional study, utilizing computerized GP medical records CareStudio © Software by ISED SpA in a GP surgery in Noci (Italy). On January 2023, previously undiagnosed patients affected by shoulder pain in the period February 2022 - January 2023, were analysed.

For each patient, ultrasound shoulder scan (USS) was performed, and subscapularis (SC), supraspinatus (SS), infraspinatous- teres minor (IS-TM) complex and biceps long head (BLH) tendons were investigated; moreover, presence of osteoarthritis (OA) signs (e.g. irregular bone profile, cartilage thinning) and joint effusion was also evaluated. USS was performed using General Electric Logiq V2 © ultrasound device. Data were collected using an Excel file (Microsoft Corporation ^{tm}). Absolute prevalence and percentage were calculated for patients with positive USS scanning. Descriptive statistics were performed to define the baseline characteristics of the study sample. Chi-square were utilized for categorical variables and Yates correction was performed due to the small size of the cohort (possible bias). Results were reported as the mean and frequency with percentages for continuous and categorical variables, respectively. To assess the linear relationship between individual variable (age) and damage degree (from 1 to 4 tendon tears in each patient), Pearson correlation coefficient was carried out and p-value from Pearson score (R-score) were performed. Chi-square and R-score were calculated with the relative 95% confidence interval (CI). All the results with a p-value<0.05 were considered statistically significant. All analyses were conducted with SSS software (©2023, Jeremy Stangroom). No missing data were detected.

Finally, this study was compliant to STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) guidelines.

III.   Results

The research performed in January 2023 pointed out that during the period from February 2022 to January 2023, 39 previously undiagnosed patients sought for medical examination due to shoulder pain: among them, 23 were

females and 16 were males (respectively, 59% and 41%). The cohort average age was 58.0 years (57.73 years in women and 58.37 years in males). After USS evaluation, 25 over 39 patients (64.1%) showed SS damage: among them, 16 were females and 9 males. Moreover, 69.5% of woman and 56.25% of males enrolled in the study reported a SS damage: this difference was not statistically significant (X^2= 0.1107 with p-value= 0.739356; X^2 with Yates correction = 0.0009 with correct p-value is 0.97658). USS analysis of other rotator cuff components suggested that, among patients affected by SS tears, 87.5% of females (14/16) and 88.9% of males (8/9) showed other cuff tendons damages: nevertheless, this difference was not statistically significant (X^2= 0.0105 with p-value= 0.918299; X^2 with Yates correction= 0.29 with correct p-value =0.590214). Furthermore, osteoarthrosis (OA) echography signs (e.g. irregular bone profile, cartilage thinning) were detected in 7 women and 6 males with SS damage (respectively, 43.75% and 66.6%): alike, this difference was not statistically significant (X^2= 1.2119 with p-value= 0.270948; X^2 with Yates correction= 0.4677 with p-value=0.4940519). Interestingly, OA signs were more frequent in patients presenting SS damages (respectively 52% vs 7.14%): this difference was statistically significant (X^2= 7.8474 with p-value=0.005089; X^2 with Yates correction= 6.0191 with p-value=0.014152).

Finally, linear correlation, between age as X value and number of damaged cuff tendons per participant as Y value, resulted in a Pearson correlation coefficient = 0.44 with p-value= 0.031428, indicating a statistically significant result.

IV.   Discussion

Shoulder pain can be a symptom of rotator cuff damage. As observed in animal models, tendon tears is triggered by the combined activation of several pro-inflammatory pathways (extracellular matrix synthesis-decomposition imbalance, oxidative stress, metabolic disorder, traumatism and mechanical overload) (13). Moreover, shoulder pain is commonly experienced during life-time: in a recent review over 61 studies, *Lucas et al.* pointed out that in a 12- months period, 10.8-55.2 % of general population suffered from shoulder pain, but only 1.0-4.8% referred to GP seeking for a diagnosis (14). It is also known that rotator cuff damages are more frequently during working age (15), while fewer studies pointed out the prevalence of rotator cuff damages in patients without previous diagnosis in general population: in a cohort of 130 patients affected by subacromial pain syndrome, *Alaiti et al.* showed that SS damages (partial or full-thickness tear) were present in 75 % of cases, a result comparable to ours (69%), despite the different imaging technique (MRI). On the other hand, unlike our study, their research did not provide information regarding the correlation between sex and SS damages or the association between OA signs and SS damages; moreover, the study was limited to patients with a sole diagnosis of subacromial pain syndrome (16).

In our study we found that SS damages was strongly associated with other tendons tears, without gender difference, as well as shown in other studies: in particular, subscapularis (SC) damages seem to be the cause of shoulder pain as well as SS tears (17).

In this context, multiple tendon tears are likely associated with increased age: in facts, a linear correlation was observed between age and number of damaged tears, suggesting that more tears accumulate over time. An age-related pathway appears to be suggested by a recent report on a JAK/STAT3-mediated inflammatory status triggered by LDL tendons entrapments (18).

Finally, we found that SS damage was statistically associated with presence of osteoarthrosis signs (e.g. irregular bone profile and cartilage thinning), regardless of aging: an age-independent and cuff injury-related pattern of OA was observed in animal models, and it is likely caused by a subchondral bone collapse due to fibrosis started by capsuloligamentous complex damage (19).

V.   Conclusion

Rotator cuff injury, in particular supraspinatus tendon tears, is a common problem in general population, but only a minority of patients seek medical valuation. In our experience, supraspinatus tendon tear should be heavily investigated especially among people suffering from shoulder pain without certain diagnosis. On this basis, these patients should be quickly directed toward examination with ultrasound scanning tests or other high

definition imaging techniques (MRI), in order to obtain a detailed diagnosis with the aim to undergo best medical, physical and surgical therapy; this to avoid complication such as tendons tears exacerbation and early osteoarthrosis.

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