



Rotator cuff tear and sarcopenia: are these related?

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Background: Sarcopenia is the loss of muscle mass and consequent loss of muscle function with aging. Its prevalence among the general population is 12% to 30% in those aged >60 years. We evaluated (1) the difference in the prevalence of sarcopenia between patients with rotator cuff tear and controls and (2) the sarcopenia severity according to the size of the rotator cuff tear.

Methods: Group 1 included 48 consecutive patients with chronic symptomatic full-thickness rotator cuff tears (mean age, 60.1 ± 6.5 years; range, 46–76 years), and group 2 included 48 age- and sex-matched patients. The sarcopenic index was evaluated by using the grip strength of the asymptomatic contralateral side and the skeletal muscle mass.

Results: No significant differences were found in the baseline data and demographic factors between the groups. The sarcopenic index was significantly inferior in the rotator cuff tear group than in the age- and sex-matched control groups ($P = .041$, $.007$, and $.05$, respectively). Patients with large to massive tears had a significantly inferior sarcopenic index than those with small and medium tears.

Conclusion: The results showed that sarcopenia was more severe in patients with a chronic symptomatic full-thickness rotator cuff tear than in the age- and sex-matched control population and was correlated with the size of the tear, with the numbers available. Despite the individual variance in the underlying medical condition and physical activities, this study suggests that clinicians should consider the sarcopenic condition of patients with a rotator cuff tear, especially in elderly patients with large to massive tears.

Level of evidence: Level IV; Diagnostic Study

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The Institutional Review Board of Kyungpook National University Hospital approved this study: No. KNUH 2015-06-019. All patients provided written informed consent.

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The term *sarcopenia*, coined by Rosenberg in 1989,¹⁷ has been defined as a loss of muscle mass (lean body mass) and the consequent loss of muscle function associated with the physiologic aging process.³⁶ It is now recognized as a major clinical concern in older persons, and research in this area is expanding exponentially.³¹ Other conditions, such as cachexia and muscle wasting, are also associated with loss in the quantity of muscle fibers, although this process results from an altered protein catabolism,

whereas sarcopenia represents a specific condition of energy balance.^{15,23,35}

The prevalence of sarcopenia in 60- to 70-year-old persons ranges from 5% to 13%. This prevalence increases to 11% to 50% in those aged 80 years or older.²² Estimates by the World Health Organization suggest that there were 600 million people aged 60 years or older with sarcopenia in 2000, and this number will increase to 1.2 billion by 2025.³⁷ Recent studies have reported that sarcopenia is strongly associated with systemic diseases such as obesity, diabetes mellitus (DM),³⁷ hypercholesterolemia, cardiovascular disease,³⁷ and osteoporosis.^{4,10,15,32,35,37,38} Moreover, some studies have investigated the association between low muscle mass and mortality. The mortality risk was highest for persons with a low arm muscle area and low triceps skinfold thickness.¹¹ Heitmann et al reported that lower levels of fat-free mass as estimated from potassium-40 counting were associated with an increased mortality risk among 787 men aged 60 years and older who were observed for 22 years.¹⁴

Rotator cuff tear is a localized tendon disease; however, it is known to be influenced by systemic diseases such as DM, hypercholesterolemia, thyroid disease, and osteoporosis.^{1,7,26,33} In addition, a chronic rotator cuff tear leads to decreased shoulder function and muscle atrophy.²⁵ Therefore, it is possible that rotator cuff tears are also significantly correlated with sarcopenia. However, to our knowledge, no information is currently available on the correlation between rotator cuff tears and sarcopenia. Knowledge of this correlation will be helpful in the general management of patients with rotator cuff tears.

In this study, we aimed (1) to evaluate whether the prevalence of sarcopenia differs between patients with rotator cuff tears and a control population and (2) to determine the severity of sarcopenia according to the size of the rotator cuff tear. We hypothesized that (1) the prevalence of sarcopenia is higher in patients with rotator cuff tears than in a control group and (2) sarcopenia is more severe in patients with larger rotator cuff tears.

Materials and methods

Demographic data

This was a prospective case-control study. Between November 2013 and February 2014, 48 consecutive patients with a full-thickness rotator cuff tear were surgically treated at our institution, and all patients underwent grip strength evaluation and skeletal muscle mass measurement. Surgery was indicated if patients had persistent severe pain and disability and were not responding to at least 6 months of conservative treatment. None of the patients had contralateral shoulder pain, and none had a problem in taking nutrition. Group 1 included 48 patients with chronic symptomatic full-thickness rotator cuff tears, with a mean age of 60.1 years (range, 46-76 years; standard deviation, 6.5 years). The sample size of 48 was calculated to detect a significant difference (mean difference, 4.2 kg; standard deviation, 9.2 kg) in grip strength. This was based on the mean and standard deviation of grip strength obtained in a pilot study of 15 patients. A

sample size of 48 patients in each group was required for a power of 80% at a type I error level of .05. Group 2 included 48 patients without any shoulder symptoms and disease, who were age and sex matched with each patient of group 1 and who consented to the grip strength evaluation and skeletal muscle mass measurement. The controls were selected from persons who visited the health care center of the authors' hospital for a regular health examination in the same study period. All of the controls did not have any specific disease entities except general medical conditions, such as hypertension or diabetes. Moreover, none of them had visited the shoulder division of the department of orthopedic surgery. Therefore, the subjects in both groups were matched to ensure the same mean age and sex ($P = 1.000$). The tear was measured intraoperatively in the anterior-posterior direction at the lateral edge of the footprint by using a calibrated probe after débridement of degenerated tendon edges and categorized as follows: small (<1 cm) tears in 7 patients, medium (>1 to <3 cm) tears in 20 patients, large (>3 to <5 cm) tears in 13 patients, and massive (>5 cm) tears in 8 patients. The associated shoulder disorders of group 1 patients were as follows: superior labrum anteroposterior lesions (15 patients; type I: 9, type II: 6), biceps disorders (25 patients; 22 partial and 3 complete tears), and acromioclavicular arthritis (4 patients). For both groups, the sarcopenic index was evaluated by using 2 standard measurements for evaluating sarcopenia: (1) grip strength of the contralateral side and (2) skeletal muscle mass measurements according to guidelines based on previous studies.^{13,16,30}

Clinical variables

Demographic and other patient characteristics including age, sex, hand dominance, smoking, and underlying diseases (DM, hypertension, thyroid disease, and heart disease) were recorded. The level of sports activity was defined as high (dynamic or contact sports such as boxing, basketball, rugby, and tennis), medium (static sports such as golf, yoga, and running), and low (milder or no sports activities). A high work level was defined as heavy manual labor, medium as manual labor with less physical activity, and low as sedentary work. Clinical outcomes were assessed at least 1 year after surgery by using the pain visual analog scale (VAS; score ranging from 0 to 10, with 10 being the worst), Simple Shoulder Test (SST), and American Shoulder and Elbow Surgeons (ASES) scoring system. The ASES score involves a score summation in a 100-point system (50 points each for daily function and pain).

Grip strength

Previous studies have reported grip strength to be a reliable and representative measurement of the severity of sarcopenia.^{6,8,15,19} Grip strength measures and muscle strength are well correlated with lower extremity strength and clinical outcomes.⁹ Longitudinal studies have shown that poor strength, as measured on the basis of the hand grip strength, is a predictor of functional disability.²⁹ In this study, grip strength was measured with a Jamar hand dynamometer (Patterson Medical, Bolingbrook, IL, USA), and the additional pinch strengths (palmar pinch and key pinch) were measured with the same device. For each of the strength assessments, the subjects were seated with the shoulder adducted and neutrally rotated, elbow flexed to 90° with the forearm in the neutral position, and wrist between 0° and 30° of flexion and between 0° and 15° of ulnar deviation. The

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