Evaluation of teres minor muscle in patients with rotator cuff tear using magnetic resonance imaging

INTRODUCTION
We have encountered several patients with rotator cuff (RC) tear involving supraspinatus (SSP) who experienced postoperative loss of muscle strength for external rotation. Although infraspinatus (ISP) is a muscle that may be associated with such loss of muscle strength, teres minor (TM) should also play a role in the postoperative disturbance of external rotation. However, few reports have evaluated the role of TM in patients with RC tear. Accurate evaluation of the RC is essential for good shoulder joint reconstruction and magnetic resonance imaging (MRI) has been reported to be useful for assessing muscle volume and quality and RC tear size. The purpose of this study was to measure the volume of TM using MRI to obtain baseline data that we can use to evaluate the influence of TM in the postoperative results of RC tear.

METHODS
Seventy-four shoulders (45 males and 29 females, average age 61.2±9.9 years old) which have small RC tear without TM tear were studied. We measured the cross-sectional area (CSA) of the RC muscle on the most lateral slice on which the scapular spine was in contact with the scapular body using the oblique sagittal MRI taken before surgery (Fig. 1). SSP, ISP, TM, and subscapularis (SSC) were measured. Fatty degeneration in the muscle was evaluated using Goutallier’s classification method and divided into two groups: muscles in Goutallier stages 0 and 1 were defined as the non-denatured group and muscles in stages 2, 3, and 4 were defined as the denatured group. Statistical analyses were performed using Mann-Whitney test. Statistical significance was set at p<0.05.

RESULTS
Seventy-four shoulders consisted of small SSP or ISP tear including 8 SSC tear and there was no apparent TM tear. The CSAs of the RC muscles (SSP, ISP, TM, and SSC) were 648.6, 908.2, 385.6 and 1760.0 mm², respectively. The CSAs in male patients were larger than that of female patients (Fig. 2). To minimize the differences in CSAs between sexes, we first attempted to divide the CSA of the TM by the patient’s height or weight. However, this method was not successful. Next, we divided the CSA of TM by that of other RC muscle. The sex difference was standardized when the CSA of TM was divided by that of the SSC (Fig. 3).

DISCUSSION
There were significant differences between male and female patients in terms of RC muscle volume assessed by CSA. Such difference could not be standardized by height or weight. Kaniehisa et al reported that the muscles of the lower extremity can be adjusted by height, but those of upper extremity cannot. They suggested that there might be a difference in growth balance between the upper and lower extremities. Our next attempt to adjust the CSA of TM by other parameters viewed on the same MRI slice indicated that the CSA of TM could be adjusted by dividing it by the CSA of SSC. Because fatty degeneration was uncommon in SSC and TM, we suggest that we can adjust the sex differences by the CSA of SSC. On the other hand, when we adjusted the CSA of TM with denatured RC muscles, we obtained variable data because the denatured RC muscles exhibited fat accumulation and atrophy.

In this study, we have no TM tear with only one fatty degeneration in all small RC tear patients. These data indicated that CSA of the TM could be one of the baseline references for the assessment of muscle volume and quality in RC tear. TM is involved in external rotation of the shoulder joint and centripetal positioning of the humeral head at the glenoid. Future analysis of possible functional changes in apparently intact TM in patients with large or massive RC tears should also be necessary.

CONCLUSION:
Muscle volume analysis of TM should be important in RC tear and CSA of TM could be adjusted by dividing it by other RC muscle without fatty degeneration.

REFERENCES: