INTRODUCTION

Inter-muscular and intra-muscular adipose tissues are defined as the adipose tissue visible between muscle groups and muscle fibers, respectively. The quantities of inter-muscular adipose tissue (inter-MAT), intra-muscular adipose tissue (intra-MAT) and muscle in the thigh reflect adverse metabolic effects and muscle function.

OBJECTIVES

1. Propose a robust and semi-automatic algorithm for the quantitative assessment of volume of thigh muscle, inter- and intra-muscular fat; Overcome the time-consuming and operator-dependent problems in traditional manual analysis, especially towards 3D datasets.
2. Apply this technique to the Osteoarthritis Initiative (OAI) MRI data to explore differences of such metrics between those with radiographic osteoarthritis (ROA) and those without ROA (non-ROA).

METHODS

A semi-automatic quantification framework was developed, which includes 5 major steps: 1) intensity inhomogeneity correction; 2) subcutaneous adipose tissue (SAT) removal; 3) tissue labeling for bone, marrow, fat and muscle; 4) inter- and intra-MAT classification; 5) tissue assessment.

RESULTS

There was no significant difference between ROA and non-ROA legs for inter-MAT volume presented as mean ± SD (103.09±39.24 cm³ vs 92.73±41.92 cm³, p = 0.27), intra-MAT volume (64.49±20.40 cm³ vs 65.49±23.52 cm³, p = 0.84), and total muscle volume (713.32±173.99 cm³ vs 743.35±194.42 cm³, p = 0.47). Gender differences were found for inter-MAT volume (109.88±60.69 cm³ vs 86.17±35.45 cm³, p < 0.01), intra-MAT volume (74.45±17.25 cm³ vs 51.49±19.14 cm³, p < 0.01), and total muscle volume (822.31±141.99 cm³ vs 585.01±129.17 cm³, p < 0.01), where male has higher volumes than female, with no significant gender differences for KLG status and total thigh volume. Figure 3 shows the KLG scores to the volume of thigh inter-MAT, intra-MAT and muscle. The boxplots are divided into two groups by genders. Each column in the boxplots represents different KLG score to the corresponding tissue assessment.

CONCLUSION

Preliminary results showed gender differences in adipose tissue and muscle content in thigh tissue quantification but according to KLG status. The proposed framework provides a semi-automated approach for quantitative thigh tissue assessment, which has a potential for clinical and clinical trial applications. Further validation is required and there are ongoing development efforts which include comparison to manual segmentation, enhancement of clustering and contouring accuracy and precision for fatty infiltration, and individual muscle group segmentation.

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