

VALIDITY AND RELIABILITY OF MRI METHODS TO ASSESS MUSCLE VOLUMES

Christelle Pons¹, Bhushan Borotikar², Mathieu Lempereur², Sylvain Brochard³

¹SSR pédiatrique Ty Yann, Fondation ILDYS, Brest, France

²Laboratoire de Traitement de l'Information Médicale INSERM U1101 , Brest, France

³Service de Médecine Physique et de Réadaptation, CHRU de Brest , Brest, France

Introduction: Because of their relationship with muscle function, MRI muscle volumes can be useful in diagnostic procedures, in treatments response and diseases progression evaluation. Accurate data are needed.

Purpose: To report the evidence of metrological properties for methods quantifying skeletal muscle volumes and 3D shapes using MRI

Method: A systematic review was conducted. Pubmed, web of science, Cochrane, Scopus databases were searched using relevant keywords and inclusion/exclusion criteria. A customized scale was used to evaluate the quality of the articles.

Results: 28 articles were selected. Manual and automatic methods were assessed in 21 and 11 articles. Manual slice-by-slice segmentation was used as a gold standard. Its validity compared to dissection was moderate to excellent (2 articles), its reproducibility good to excellent (9 articles). Reduction of the number of manually segmented slices led to an increase of the volume error (5 articles). Different methods to compute volumes were identified; error was higher with cone formula, specifically with number of slices decrease (3 articles). Segmentation using parametric shape deformation and image processing (5 articles) allowed a decrease of the segmented slices for a chosen error. Methods using one slice with or without muscle length were moderately to strongly linked to manual slice by slice segmentation (6 articles). Volume errors greater than 10% were found. The importance of the error depended on the level of the slice chosen. Automatic muscle segmentations methods associated different techniques (statistical shape, atlas/ images based) and allowed good to excellent accuracy estimation of the shape compared to the gold standard (5 articles). Volumes errors were greater in the 3 articles involving pathological muscles.

Conclusions: With all the methods, errors in volume estimation can be expected. The different methods led to different errors. These data can help in choosing the appropriate segmentation technique depending on the situation.