Intensive Care Med (2015) 41:360–361
DOI 10.1007/s00134-014-3523-1

LETTER

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A new and promising tool to evaluate mass and structural changes of skeletal muscle in trauma patients

Accepted: 11 October 2014
Published online: 24 October 2014

Loss of mass and function of skeletal muscle during critical illness is associated with poor clinical outcome, reduced ventilator-free days, increased length of ICU stay, increased mortality, high costs of health care, and delay of rehabilitation [1]. The magnitude of muscle impairment correlates with the severity of the illness, the entity of the inflammation, and the appropriateness of nutritional support [2, 3]. Recent papers have advocated the use of ultrasound evaluation of skeletal muscle [2, 4, 5] to get information about its thickness and structural changes, which can be related to the degree of myopathy and to the final functional outcome [5].

We are investigating the morphological changes of skeletal muscle in trauma patients during their stay in our ICU, by ultrasound evaluation of the rectus femuris (RF) and anterior tibialis (AT) muscles (transverse scan 15 cm above the patella and 5 cm below the fibular head, respectively), on day 0 (within 24 h after admission to ICU) and on day 21. We adopted a 5–7 MHz linear transducer and a well-defined setting for all patients (overall gain 67 %; time gain compensation in neutral position; focal zone set in the middle of the muscle). Muscle echogenicity is rated according to Heckmatt's scale [6], which is a semiquantitative, four-rank score, the higher rank (D) corresponding to reduced visualization of bone surface and thus to a more severe degree of muscle fibrosis.

In this preliminary study, we evaluated six severe trauma patients: three women/three men; age range 44–61 years; body mass index ranging from 23.1 to 28.2; injury severity score 29–52; all but one had brain injury, with Glasgow Coma Scale at admission ranging from 3 to 11; ICU stay was 25–52 days and survival was 100 %. In all patients, we found a progressive decrease in the muscle mass and a progressive increase of echogenicity, suggesting not only protein depletion but degenerative changes: during the ICU stay, the

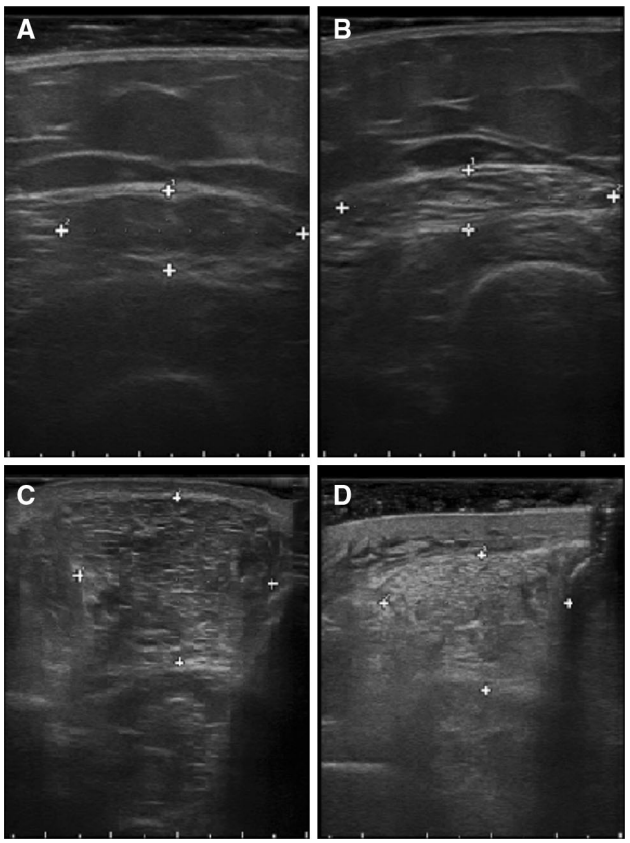

Fig. 1 Changes of muscle echogenicity during ICU stay: RF on day 0 (**a**) vs. day 21 (**b**); AT on day 0 (**c**) vs. day 21 (**d**)

anterior–posterior diameters decreased from day 0 to day 21 (RF from 14–16 to 9–14 mm, $p = 0.06$; AT from 18–24 to 15–21 mm, $p = 0.04$, by Wilcoxon signed-rank test) and the muscle areas also decreased (RF from 3.7–5.6 to 3.2–3.9 cm^2, $p = 0.03$; AT from 3.3–7.9 to 2.3–5.2 cm^2, $p = 0.07$). The echogenicity of both muscles, as rated by Heckmatt's scale, increased progressively from grade A to C (RF from 1–2.25 to 2.12–3.25, $p = 0.06$; AT from 1–2 to 1.5–4, $p = 0.07$) (see Fig. 1).

These preliminary results confirm that ultrasound evaluation of RF and AT is an easy, non-invasive, and cost-effective bedside methodology for evaluating the progressive deterioration of muscle integrity and functionality, which could be adopted for metabolic studies, as well as for the definition of prognostic scores in terms of nutritional and/or functional disability in the critically ill, as suggested by the few clinical studies currently available in this regard [2, 4, 5]. Nevertheless, in our experience, a proper standardization of the ultrasound technique and of the interpretation of the images is of paramount importance for achieving repeatable and comparable data.

Conflicts of interest On behalf of all authors, the corresponding author states that there are no conflicts of interest.

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