Quadriiceps muscle ultrasound as a new tool for diagnosing muscle wasting in renal diseases

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VALORIZATION

The acute or chronic loss of kidney function is characterized by progressive worsening of nutritional status, in particular by an important reduction in protein stores and energy fuels, characteristic of the Protein-Energy Wasting (PEW) syndrome, a pathological condition associated with poor outcome. Thus, the assessment of nutritional status is essential both for preventing PEW in patients at risk, and for monitoring the success of nutritional and physical interventions in those with established PEW. In this regard, the assessment of skeletal muscle mass is of great importance, since many metabolic consequences of the loss of kidney function directly or indirectly promote muscle catabolism. Skeletal muscle is the largest store of Lean Body Mass (LBM) protein, and its quantitative/qualitative alterations may impact negatively on patients’ quality of life, ability to perform activities of daily living and prognosis. Skeletal muscle can be estimated by conventional bedside techniques, such as anthropometry, bioimpedance spectroscopy (BIS), or bioimpedance analysis (BIA), which however, in the renal setting have important limitations already discussed throughout this thesis. While gold standard imaging techniques such as computerized tomography (CT), magnetic resonance imaging (MRI), and Dual Energy X-ray Absorptiometry (DEXA) are expensive, not available at the bedside, require highly specialized personnel and finally may imply exposure to radiation in the case of CT and DEXA.

In the present thesis quadriceps muscle ultrasound (US) was shown to be a reliable, accurate, portable and easy to perform tool to be applied at the bedside of patients with acute or chronic kidney disease on hemodialysis. It outperformed bedside techniques such as anthropometry and BIS in predicting mortality, and diagnosing sarcopenia when assessed alongside handgrip strength (HGS). Considering the relative low cost of modern US devices and its wide availability in every hospital ward, ICU and dialysis centers, US is not only a reliable tool to be used in the evaluation of quadriceps muscle, but it is also economically viable, since no additional costs are expected to start using US to evaluate skeletal muscle. Another advantage of this technique, is that no specialized staff is needed, with proper training renal dietitians could use this tool as part of their routine assessment of patients, not increasing the work load of nurses and nephrologists. In fact, considering that 50% of the studied population had lower quadriceps muscle thickness index and were at a higher risk of mortality for that, we suggest that muscle US indeed be a part of the routine evaluation of patients, being useful as a screening tool to identify patients with worse prognosis.

As expected for every other nutritional marker, the discriminative value of US when applied by itself is low, suggesting that it should not be used as sole prognostic tool to make clinical decisions at individual level in AKI and ESKD patients on HD. On this matter, a general nutritional status evaluation is a comprehensive assessment that includes not only body composition, but also patients’ history, report of unintentional weight loss, functional parameters, physical examination, and other clinical and social parameters. On this ground, we suggest that quadriceps muscle US could add important information to multidimensional predictive
models in renal patients. In fact, the assessment of skeletal muscle mass achieves its full potential in combination with other parameters, as shown in Chapter 7. In addition, a diagnosis of low muscle mass or sarcopenia should be part of a more “holistic” approach, combining them with an evaluation of potentially modifiable factors such as dietary intake and physical activity. Findings should also be interpreted in view of its relation with a low health related quality of life, since these factors are often amenable to therapeutic intervention. Finally, non-nutritional factors associated with loss of muscle mass such as inflammation and metabolic acidosis should be assessed and corrected prior to nutritional and physical interventions, as they may hamper muscle anabolism. For instance, a patient with reduced quadriceps muscle thickness index identified at a screening phase and reduced muscle strength with adequate nutritional intake and absence of inflammation or metabolic acidosis, but with low physical activity may primarily benefit from a physical intervention. On the other hand, an inflamed and acidic patient, with poor appetite and low nutrient intake, will primarily benefit from interventions that correct metabolic acidosis, a search into the cause of inflammation and targeted nutritional intervention. A physical rehabilitation program may be ineffective and much more difficult for this patient. With all those considerations in mind, we propose an “holistic” assessment that should be the basis for a personalized approach (Figure 1).