The association of CT-assessed fat-free muscle fraction with frailty and malnutrition and the predictive value of their combination in patients undergoing TAVR


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Background: Frailty is a multidimensional syndrome that affects mortality after TAVR. Malnutrition is a related condition and promotes the development of frailty. The current guidelines for the management of valvular heart disease recommend an objective evaluation of frailty for risk stratification in patients with aortic stenosis. However, the proposed frailty scales are time-consuming and provide inconsistent results, due to their semiquantitative nature. Computed tomography (CT) is a part of routine pre-interventional TAVR workup and allows for additional body composition analysis, including the assessment of fat-free muscle fraction (FFMF) as an indicator of muscle quality.

Aims: The aim of this study was to evaluate the relationship between FFMF and frailty as well as malnutrition, as assessed with various scales and to examine the predictive value of FFMF and frailty in patients with AS undergoing TAVR.

Methods: Our study cohort consisted of 206 patients undergoing TAVR between 2018 and 2019. Frailty was assessed using the Fried Frailty Phenotype (FFP) and the Katz Index. Malnutrition was measured using the Mini Nutritional Assessment (MNA-LF). Furthermore, the patients were evaluated with CT scans, and skeletal muscle area at the L3/L4 level was determined. The skeletal muscle area was separated in areas of fatty and lean muscle according to densitometric thresholds to calculate the FFMF (Figure 1). Outcome of interest was one-year mortality following TAVR.

Results: The prevalence of frailty ranged from 46.1% (n=95), as assessed with the FFP score to 7.3% (n=15), as classified using the Katz Index. Nutritional assessment using the MNA-LF scale showed that 107 (51.9%) patients were at normal nutritional status, whereas 85 (41.3%) patients were at risk for malnutrition, and 14 (6.8%) patients were already malnourished. According to the CT evaluation 64 (31.1%) patients had a high FFMF, 73 (35.4%) patients had a medium FFMF, and 69 (33.5%) patients had a low FFMF. A Low FFMF was associated with higher rates of frailty and malnutrition according to all scales tested (Figure 2 A). However, depending on various scales, the prevalence of frailty and malnutrition showed a wide range among patients with a low FFMF, reaching from 10.8% as assessed with the MNA-LF to 66.0% as evaluated by the FFP scale. A low FFMF was associated with increased one-year mortality (20.3%) as compared to a medium (6.8%) or low FFMF (6.3%, p=0.01, Figure 2 B). Moreover, a combination of FFMF with frailty was superior to frailty alone in predicting patient's outcome following TAVR.

Conclusion: The CT-assessed FFMF is a strong and independent predictor of dismal outcomes in patients undergoing TAVR. A low FFMF is associated with significantly higher rates of frailty and malnutrition. Moreover, a combination of FFMF with frailty scales may better identify vulnerable patients at risk of an unfavorable outcome after TAVR.

Figure 1
Figure 2 A - B

A) Association between FF MF and frailty/malnutrition as assessed with various scales.

B) Kaplan-Meier analysis for one-year all-cause mortality according to FF MF.