



Psoas muscle index: a novel instrument in planning the treatment of severe aortic stenosis in frail patients

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Provenance: This is an invited Editorial commissioned by the Executive Editor-in-Chief Jianxing He (Department of Cardiothoracic Surgery, The First Affiliated Hospital of Guangzhou Medical University, Guangzhou, China).

Comment on: Hawkins RB, Mehaffey JH, Charles EJ, *et al.* Psoas Muscle Size Predicts Risk-Adjusted Outcomes After Surgical Aortic Valve Replacement. *Ann Thorac Surg* 2018;106:39-45.

Submitted Oct 05, 2018. Accepted for publication Oct 18, 2018.

doi: 10.21037/jtd.2018.10.80

View this article at: <http://dx.doi.org/10.21037/jtd.2018.10.80>

In July's issue of the *Annals of Thoracic Surgery*, Hawkins and colleagues (1) investigated the correlation between psoas muscle (PM) size and post-operative outcomes after surgical aortic valve replacement (SAVR).

Over the years there has been a growing interest in investigating muscle mass and its impact on post-operative outcomes after cardiac surgery as demonstrated by the numerous published studies addressing this concept (2-6). This in a way can be traced to the increased need to establish techniques that can provide reliable and reproducible objective assessment of patient's suitability to undergo a given surgical intervention.

Life expectancy among older age groups in the western world has been rising steadily and while the aging of society has become one of the givens in today's world, the problem of chronic conditions and multiple morbidity is greatest. Elderly patients will have more comorbidities when referred for cardiac surgery and will often require combined procedures which means longer stay in hospital and potential increase in short- and long-term morbidity and mortality. Age as a number however; should not be the sole determining factor for suitability for surgery and other objective markers such as proper functional status (frailty) assessment should be considered.

Cardiac surgeons thrive to provide the highest level of care and maintain excellent surgical outcomes. Furthermore; new treatment options are becoming more

available for valve diseases (i.e., transcatheter aortic valve replacement, Mitraclip) with comparable results to surgery especially in fragile patients. Therefore, accurate and objective frailty assessment is the key in selecting the most suitable management pathway the patient will take.

Previous studies have demonstrated the negative impact of frailty scores on post-operative complications and prolonged length of stay after cardiovascular procedures (7). Correctly identify a frail patient would appear to be an easy task in theory but in reality, this can be much more complicated than one would expect despite the presence of the different approaches to describe it (7-10). Campbell *et al.* in 1997, defined frailty is "a condition or syndrome that results from a multisystem reduction in reserve capacity, to the extent that a number of physiological systems are close to, or pass, the threshold of symptomatic clinical failure. As a consequence, the frail person is at increased risk of disability and death from minor external stresses" (11). Stressors can be acute or chronic illness or iatrogenic and when exposed to these stressors, frail patients are at risk for marked and often disproportionate decompensation, adverse events and procedural complications (11). As evident, there is no univocal quantifiable parameter that can tell us if a patient is frail or not and there is lack of clarity to which is the best tool to use for this type of assessment.

Sarcopenia or muscle mass loss and function is a

component of the so called “frailty syndrome” and PM is an important parameter for evaluating muscle mass which can be easily obtained from computed tomography (CT) images (5) and has been previously correlated to other markers of frailty and its negative impact in cardiac surgery has also been established (3).

Hawkins *et al.* (1) in their study calculated PM index using CT scan in 240 moderates to high risk patients (predicted risk of mortality greater than 3%) who underwent SAVR and demonstrated that although short terms outcomes were not significantly affected by sarcopenia, long term results were significantly worse in the sarcopenic group with an almost doubled mortality rate at 1 year (31.9% *vs.* 16.9%, $P=0.029$). The group also demonstrated the importance of the PM index showing its linear correlation not only with 1year mortality, but also with prolonged ventilation, prolonged length of stay and hospital costs, thus, providing us with an easily obtained and reproducible measure of frailty that predicts risk-adjusted resource utilisation, morbidity, and long-term mortality that can help limiting post-operative complications and improving outcomes.

Similarly; the association between sarcopenia and long-term survival after cardiac surgery has been recently demonstrated by Okamura and colleagues (6) who investigated the long-term outcome of 428 patients undergoing valve surgery and demonstrated that survival rates were severely affected by the presence of sarcopenia defined based on PM area. The group identified, sarcopenia on multivariable analysis as an independent predictor for decreased survival and freedom from major adverse events [hazard ratio (HR), 2.221; 95% confidence interval (CI), 1.258–3.924; $P=0.006$ and HR, 2.802; 95% CI, 1.242–6.319; $P=0.013$, respectively].

Furthermore; in 152 consecutive transcatheter aortic valve implantation (TAVI) patients, Grag *et al.* demonstrated that measuring PMA using CT scan can be predictive of 30-day outcome and resource utilization but not 1-year mortality (12).

An inverse association between PM area and operative length of stay was also demonstrated by Zuckerman and colleagues in 2017 (3) even if they included different type of cardiac surgery operations, the authors have found that PM area was independently associated to length of stay after adjustment for other covariates, while lumbar muscle area and thoracic muscle area were not. Furthermore; a paper published in 2016 (4) has studied PM size in both SAVR and TAVI patients showing a significant impact on long

term mortality in both groups, but also revealing that PM area predicted high resources utilization after SAVR, but not after TAVR. This suggests that this tool might help to select the patients who will be most likely to derive optimal benefit from a percutaneous approach. Such findings are essential to keep in mind as shorter hospital stay will for sure offset the cost of a CT scan that can potentially impact on the planned intervention and outcomes.

Sarcopenia should be more frequently measured when undergoing assessment for aortic valve surgery. The utilisation of such simple and non-invasive CT based objective test such as the one used by Hawkins *et al.* (1) rather than subjective evaluation of frail patients before deciding for treatments is crucial when taking into account that although the gold standard for treatment of aortic valve stenosis is still surgical replacement however, there is a steady growing role for TAVI and one could be tempted to refer the “fragile patients” to the TAVI team or treat them medically.

Knowing the degree of sarcopenia of a patient could also be of great value in optimizing borderline patients before surgery using some of the several previously proposed interventions for frail elderly patients (13) such as moderate walking program and/or balanced or high protein/calorie diet as part of a multidisciplinary approach that involves multiple disciplines which should be based on identify, prepare and treat these frail patients. Clearly, it is important to keep in mind that Psoas index, while a validated measure of sarcopenia that correlates with many different measures of frailty is not a comprehensive frailty measure and potentially frail or borderline patients should be assessed fully in a multidisciplinary setting before making a final decision about their management.

In a changing society where we are operating on more complex and elderly population coupled with the rapid advancement of technology introduced in a field of surgery that we all thrive to provide the highest standards of care in, accurate and thorough assessment is essential in choosing the correct surgical approach.

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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Cite this article as: Bruno VD, Zakkar M. Psoas muscle index: a novel instrument in planning the treatment of severe aortic stenosis in frail patients. *J Thorac Dis* 2018;10(Suppl 33):S4156-S4158. doi: 10.21037/jtd.2018.10.80