Editorial Commentary

Hypoalbuminemia in patients undergoing transcatheter aortic valve replacement: culprit or surrogate?

Edgar Aranda-Michel[1], Valentino Bianco[1], Arman Kilic[1,2], Ibrahim Sultan[1,2]

[1]Division of Cardiac Surgery, Department of Cardiothoracic Surgery, University of Pittsburgh, Pittsburgh, PA 15232, USA; [2]Heart and Vascular Institute, University of Pittsburgh Medical Center, Pittsburgh, PA 15232, USA

Correspondence to: Ibrahim Sultan, MD. Division of Cardiac Surgery, 5200 Centre Ave, Suite 715, Pittsburgh, PA 15232, USA. Email: sultani@upmc.edu.

Comment on: Gassa A, Borghardt JH, Maier J, *et al.* Effect of preoperative low serum albumin on postoperative complications and early mortality in patients undergoing transcatheter aortic valve replacement. J Thorac Dis 2018;10:6763-70.

Submitted Mar 04, 2019. Accepted for publication Mar 27, 2019.
doi: 10.21037/jtd.2019.03.98
View this article at: http://dx.doi.org/10.21037/jtd.2019.03.98

Transcatheter aortic valve replacement (TAVR) is an area of rapid advancement in cardiac surgery. Through subsequent randomized controlled trials, its indications have broadened and its use steadily increased (1,2). However, risk assessment for TAVR in the literature is somewhat limited, with groups still investigating proper vascular access and type of sedation for the procedure (3,4). The authors' paper, "Effect of preoperative low serum albumin on postoperative complications and early mortality in patients undergoing transcatheter aortic valve replacement" by Gassa *et al.*, aims to analyze TAVR patients based on preoperative albumin levels as a predictor of operative outcomes.

Their group conducted a single center retrospective analysis to examine the connection between hypoalbuminemia and operative outcomes following TAVR for severe symptomatic aortic stenosis (5). The study included at total of 457 patients composed of 51 patients in the hypoalbuminemia group and 406 patients with normal preoperative serum albumin levels (>3.5 g/dL). The authors found a statically significant increase in 30-day mortality and length of stay in the hypoalbuminemia group. Furthermore, in a multivariate regression, hypoalbuminemia was an independent predictor of acute kidney injury (AKI), infection, increased ventilation requirement, and increased transfusion requirement. The authors concluded that low albumin is directly associated with perioperative morbidity and is an important preoperative marker of increased operative risk.

Albumin, as a predictor of operative risk, can affect outcomes in multiple ways. First, albumin is a major determinant of blood oncotic pressure which affects intravascular volume and may play a critical role in perioperative fluid shift (6). Second, since albumin is synthesized from the liver and ubiquitous in the blood, it is an aggregate representation of nutritional status and chronic diseases in a patient (7). A low serum albumin indicates a malnourished state, which can lead to complications during postoperative recovery. Moreover, hypoalbuminemia can be an indicator of chronic illness which directly affect operative outcomes (7-9).

Hypoalbuminemia has been strongly implicated in the development of AKI after cardiac surgery (10,11). Starting at a hypovolemic state, the stress and hemodynamic change during cardiac surgery can precipitate AKI (12,13). While TAVR is clearly a less invasive procedure, intravenous contrast is used which can explain the development AKI in this vulnerable population (14). It is consistent with current literature that these authors found a statistically significant increase of AKI in the hypoalbuminemia group and when adjusting for confounders, determined that low serum albumin was an independent predictor for postoperative AKI (10-12).

These authors found a statically significant increase in 30-day mortality in the hypoalbuminemia group. Other groups analyzing elderly patients showed that hypoalbuminemia was independently associated with chronic conditions such as anemia, limited daily living, and heavy smoking and conferred an increased risk in post-operative morbidity (15,16). This is mirrored in the author's findings that the hypoalbuminemia group had more comorbidities such as dialysis requirements, chronic

obstructive pulmonary disease, and a worse New York Heart Association classification, which led to higher postoperative complications and a subsequent increase in mortality.

Adequate nutrition can be lacking in cardiac surgery patients, with some patients receiving only 50% of their necessary calories (17,18). Moreover, malnutrition has been directly linked to increased morbidity and mortality after cardiac surgery (19-21). With low albumin being used as a surrogate for malnutrition, it is a predictor for worse outcomes due to associated increased morbidity and mortality (7). While it is intuitive that malnutrition leading to poor wound healing in traditional cardiac surgery is associated with worse outcomes, this may have a lesser role in TAVR patients (22).

Risk stratification is an essential component of a surgical patient's workup, allowing for an appropriate risk-benefit analysis. The two main risk calculators in cardiac surgery are the EuroSCORE and the STS PROM. However, neither of these scores were developed to risk stratify TAVR; rather, they were designed for conventional cardiac surgery. Furthermore, the cohort of patients included in developing these models is remarkably different from the TAVR population (23). The average age of the patients undergoing TAVR is 81.5 years whereas data contributing to the creation of conventional cardiac surgery risk scores is based on a much younger patient population, with an average age of 62.5 (2-4,24,25). The authors found that the EuroSCORE failed to detect any expected difference in mortality between the low and normal serum albumin groups and the STS PROM score calculated a higher expected mortality in the low albumin group (5). Further investigation is warranted to determine if the STS score can be simply adapted for use in the TAVR population or if a new scoring system must be developed to effectively risk stratify these patients.

The authors' study has the typical limitations of a retrospective analysis. Additionally, the authors only reported 30-day mortality, 30-day evaluation for complications, and had a small sample size of low serum albumin patients in the study. Compounding this, there was no adjustment for multiple variables in the statistical analysis, which may confound their findings. However, this was likely intended to be an initial analysis of outcomes and larger cohort of patients extended follow-up will be needed to validate the findings in this paper.

Overall, the authors study is a valuable contribution that addresses a component of the critical issue of risk stratification for TAVR patients. With indications for TAVR becoming broader, more patients will likely opt for this procedure. To improve outcomes, proper risk stratification is crucial and further studies are required to determine if adaptation of a TAVR specific risk calculator is necessary.

Acknowledgements

None.

Footnote

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

References

1. Mack MJ, Leon MB, Smith CR, et al. 5-year outcomes of transcatheter aortic valve replacement or surgical aortic valve replacement for high surgical risk patients with aortic stenosis (PARTNER 1): a randomised controlled trial. Lancet 2015;385:2477-84.
2. Leon MB, Smith CR, Mack MJ, et al. Transcatheter or Surgical Aortic-Valve Replacement in Intermediate-Risk Patients. N Engl J Med 2016;374:1609-20.
3. Cardounel A, Gleason TG, Lee JS, et al. Surgical cut down for vascular access with conscious sedation for transcatheter aortic valve replacement: the best of both worlds? Interact Cardiovasc Thorac Surg 2018;27:494-7.
4. Bianco V, Gleason TG, Kilic A, et al. Open Surgical Access for Transfemoral TAVR Should Not Be a Contraindication for Conscious Sedation. J Cardiothorac Vasc Anesth 2019;33:39-44.
5. Gassa A, Borghardt JH, Maier J, et al. Effect of preoperative low serum albumin on postoperative complications and early mortality in patients undergoing transcatheter aortic valve replacement. J Thorac Dis 2018;10:6763-70.
6. Moman RN, Varacallo M. Physiology, Albumin. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019.
7. Cabrerizo S, Cuadras D, Gomez-Busto F, et al. Serum albumin and health in older people: Review and meta analysis. Maturitas 2015;81:17-27.
8. Wada H, Dohi T, Miyauchi K, et al. Impact of serum albumin levels on long-term outcomes in patients undergoing percutaneous coronary intervention. Heart Vessels 2017;32:1085-92.
9. Wada H, Dohi T, Miyauchi K, et al. Independent and

Combined Effects of Serum Albumin and C-Reactive Protein on Long-Term Outcomes of Patients Undergoing Percutaneous Coronary Intervention. Circ J 2017;81:1293-300.
10. Moguel-González B, Wasung-de-Lay M, Tella-Vega P, et al. Acute kidney injury in cardiac surgery. Rev Invest Clin 2013;65:467-75.
11. Toda Y, Sugimoto K. AKI after pediatric cardiac surgery for congenital heart diseases-recent developments in diagnostic criteria and early diagnosis by biomarkers. J Intensive Care 2017;5:49.
12. Lee EH, Baek SH, Chin JH, et al. Preoperative hypoalbuminemia is a major risk factor for acute kidney injury following off-pump coronary artery bypass surgery. Intensive Care Med 2012;38:1478-86.
13. Arnaoutakis GJ, Vallabhajosyula P, Bavaria JE, et al. The Impact of Deep Versus Moderate Hypothermia on Postoperative Kidney Function After Elective Aortic Hemiarch Repair. Ann Thorac Surg 2016;102:1313-21.
14. Scherner M, Wahlers T. Acute kidney injury after transcatheter aortic valve implantation. J Thorac Dis 2015;7:1527-35.
15. Kilic A, Magruder JT, Grimm JC, et al. Development and Validation of a Score to Predict the Risk of Readmission After Adult Cardiac Operations. Ann Thorac Surg 2017;103:66-73.
16. Kilic A, Sultan I, Yuh DD, et al. Ventricular assist device implantation in the elderly: nationwide outcomes in the United States. J Card Surg 2013;28:183-9.
17. Drover JW, Cahill NE, Kutsogiannis J, et al. Nutrition therapy for the critically ill surgical patient: we need to do better!. JPEN J Parenter Enteral Nutr 2010;34:644-52.
18. Rahman A, Hasan RM, Agarwala R, et al. Identifying critically-ill patients who will benefit most from nutritional therapy: Further validation of the "modified NUTRIC" nutritional risk assessment tool. Clin Nutr 2016;35:158-62.
19. van Venrooij LM, de Vos R, Zijlstra E, et al. The impact of low preoperative fat-free body mass on infections and length of stay after cardiac surgery: a prospective cohort study. J Thorac Cardiovasc Surg 2011;142:1263-9.
20. Ross F, Latham G, Joffe D, et al. Preoperative malnutrition is associated with increased mortality and adverse outcomes after paediatric cardiac surgery. Cardiol Young 2017;27:1716-25.
21. Chermesh I, Hajos J, Mashiach T, et al. Malnutrition in cardiac surgery: food for thought. Eur J Prev Cardiol 2014;21:475-83.
22. Engelman DT, Adams DH, Byrne JG, et al. Impact of body mass index and albumin on morbidity and mortality after cardiac surgery. J Thorac Cardiovasc Surg 1999;118:866-73.
23. Kim KM, Shannon F, Paone G, et al. Evolving trends in aortic valve replacement: A statewide experience. J Card Surg 2018;33:424-30.
24. Nashef SA, Roques F, Michel P, et al. European system for cardiac operative risk evaluation (EuroSCORE). Eur J Cardiothorac Surg 1999;16:9-13.
25. Vassileva CM, Aranki S, Brennan JM, et al. Evaluation of The Society of Thoracic Surgeons Online Risk Calculator for Assessment of Risk in Patients Presenting for Aortic Valve Replacement After Prior Coronary Artery Bypass Graft: An Analysis Using the STS Adult Cardiac Surgery Database. Ann Thorac Surg 2015;100:2109-15; discussion 2115-6.

Cite this article as: Aranda-Michel E, Bianco V, Kilic A, Sultan I. Hypoalbuminemia in patients undergoing transcatheter aortic valve replacement: culprit or surrogate? J Thorac Dis 2019;11(Suppl 9):S1346-S1348. doi: 10.21037/jtd.2019.03.98

