3. Spence JD, Eliasziw M, DiCicco M, Hackam DG, Galil R, Lohmann T. Carotid plaque area: a tool for targeting and evaluating vascular preventive therapy. Stroke 2002;33:2916–22.

4. Coli S, Magnoni M, Sangiorgi G, et al. Contrast-enhanced ultrasound imaging of intraplaque neovascularization in carotid arteries: correlation with histology and plaque echogenicity. J Am Coll Cardiol 2008;52:223–30.

5. Ammirati E, Cianflone D, Vecchio V, et al. Effector memory T cells are associated with atherosclerosis in humans and animal models. J Am Heart Assoc 2012;1:27–41.

6. Taqueti VR, Di Carli MF, Jerosch-Herold M, et al. Increased microvascularization and vessel permeability associate with active inflammation in human atheromata. Circ Cardiovasc Imaging 2014;7:920–9.

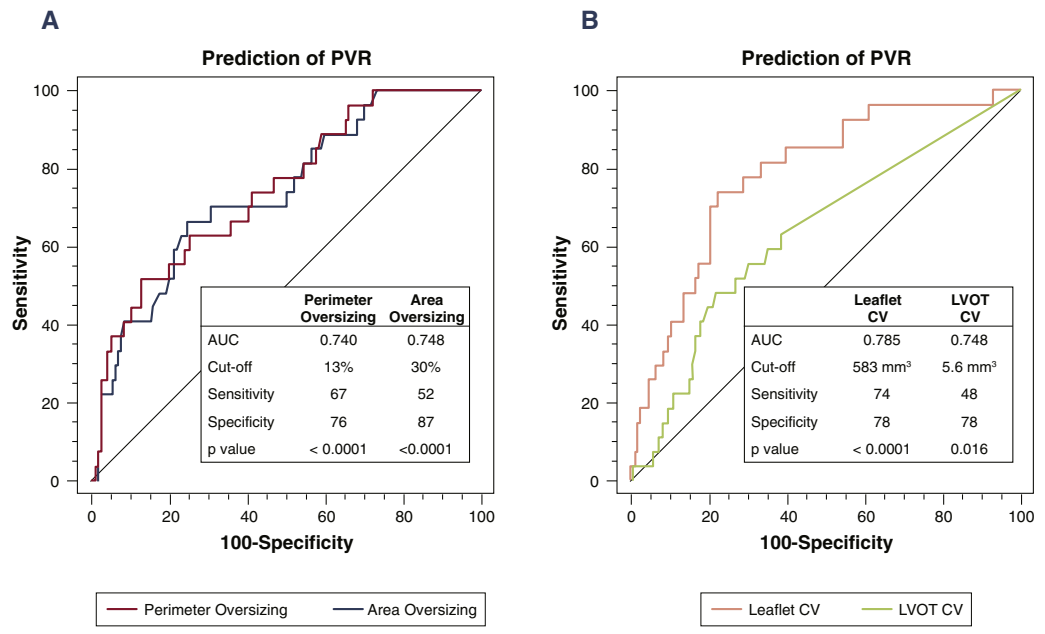
Predictors for Paravalvular Regurgitation After TAVR With the Self-Expanding Prosthesis: Quantitative Measurement of MDCT Analysis

Paravalvular regurgitation (PVR) remains a major concern of transcatheter aortic valve replacement (TAVR) as it is associated with poorer outcomes. PVR after TAVR results from several factors, including, device undersizing, aortic valve calcification, and prosthesis malposition (1). We sought to evaluate the impact of device sizing and aortic valve calcium distribution on PVR after TAVR with self-expanding prosthesis (CoreValve, Medtronic Inc., Minneapolis, Minnesota).

We examined 183 consecutive patients treated with TAVR using self-expanding prosthesis undergoing pre-procedural multidetector computed tomography after exclusion of patients with low prosthesis implantation (distance between basal skirt of prosthesis and lower edge of noncoronary cusp ≥10 mm) and valve-in-valve. All computed tomographic Digital Imaging and Communication in Medicine data were centrally collected and annulus dimensions and calcium volume were retrospectively analyzed at core laboratory in Asan Medical Center as described previously (2). PVR was assessed by transthoracic echocardiography at discharge according to VARC-2 definitions and PVR ≥ moderate was categorized as significant PVR (3).

The mean age was 80.2 ± 6.2 years and 48% of patients were female. All patients had severe aortic stenosis with mean pressure gradient of 55.6 ± 18.3 mm Hg and mean aortic valve area of 0.64 ± 0.18 mm^2. PVR ≥ moderate was found in 27 patients (14.8%). The PVR ≥ moderate group showed larger annulus size (area 482.9 ± 74.4 mm^2 vs. 421.3 ± 85.4 mm^2; p = 0.001; perimeter 79.4 ± 5.8 mm vs. 74.3 ± 7.4; p = 0.001) and significant smaller

FIGURE 1 The Interaction of Device Sizing and Aortic Valve Calcification on Paravalvular Regurgitation



Receiver-operating characteristic curve analyses for prediction of significant PVR by **(A)** perimeter/area oversizing and **(B)** leaflet/LVOT CV scores are shown. AUC = area under the curve; CV = calcium volume; LVOT = left ventricular outflow tract; PVR = paravalvular regurgitation.

JACC: CARDIOVASCULAR IMAGING, VOL. 9, NO. 10, 2016
OCTOBER 2016:1228–34

device relative to annulus dimensions (area oversizing 33.2 ± 13.1% vs. 48.6 ± 18.6%; $p < 0.001$; perimeter oversizing 12.7 ± 5.5% vs. 18.5 ± 7.0%; $p < 0.001$). In terms of aortic valve calcification, calcium volume in leaflet was higher in the PVR ≥ moderate group (837 ± 498 mm^3 vs. 420 ± 347 mm^3; $p < 0.001$), but there were no differences in left ventricle outflow tract (16 ± 34 mm^3 vs. 9 ± 25 mm^3; $p = 0.23$).

Receiver operating characteristics curves for device oversizing variables and aortic valve calcium volume scores in predicting significant PVR identified cut-off values of perimeter oversizing and leaflet calcium volume as 13% and 583 mm^3, respectively (**Figures 1A and 1B**). In the multivariable analysis, perimeter oversizing was associated with a reduction in the incidence of significant PVR (odds ratio: 0.90; 95% confidence interval: 0.83 to 0.98; $p = 0.01$), whereas leaflet calcium volume was associated with increased PVR (per increase of 100 mm^3, odds ratio: 1.18; 95% confidence interval: 1.06 to 1.31; $p = 0.002$). Note that patients with perimeter oversizing >13% had lower incidence of significant PVR compared to those with a lower degree of oversizing even satisfying the sizing criteria of manufacturer's recommendation (7.1% vs. 33.3%; $p < 0.001$), as well as those with undersized prosthesis by the sizing criteria of manufacturer's recommendation (7.1% vs. 30.8%; $p < 0.05$).

The present study demonstrates that device undersizing and leaflet calcium volume are independently associated with significant PVR following self-expanding prosthesis implantation. In the present study, incidence of significant PVR for patients with severe calcification was much higher than those without severely calcified leaflet even received prosthesis with perimeter oversizing >13% (26.1% vs. 2.9%; $p < 0.05$). This appears to be the limitation of current prosthesis and further analysis for new generation prosthesis should be assessed. In addition, our study tends to suggest that a higher degree of oversizing than reported in the manufacturer's recommendation is warranted to reduce the incidence of significant PVR. We should acknowledge that the present study is retrospective study and the PVR grading was adjudicated by each local center rather than by a core laboratory. However, board-certified echocardiographers experienced in PVR imaging assessed PVR grading according to the established guidelines.

Sung-Han Yoon, MD
Jung-Min Ahn, MD
Yohei Ohno, MD
Marco Barbanti, MD
Jason Chan, MD
Mao-Shin Lin, MD
Young-Hak Kim, MD, PhD
Dong Hyun Yang, MD, PhD
Daisuke Sugiyama, MD, PhD
Kam-Tim Chan, MD
Sebastiano Immé, MD
Claudia I. Tamburino, MD
Carmelo Sgroi, MD
Duk-Woo Park, MD, PhD
Soo-Jin Kang, MD, PhD
Seung-Whan Lee, MD, PhD
Cheol Whan Lee, MD, PhD
Seong-Wook Park, MD, PhD
Michael Lee, MD
Hsien-Li Kao, MD
Corrado Tamburino, MD, PhD
Seung-Jung Park, MD, PhD*

*Department of Cardiology
Asan Medical Center
388-1 Poongap-dong, Songpa-gu
Seoul 138-736, South Korea
E-mail: sjpark@amc.seoul.kr

http://dx.doi.org/10.1016/j.jcmg.2015.10.011

Please note: This study was supported by a grant from the CardioVascular Research Foundation, Seoul, Republic of Korea. Dr. Corrado Tamburino is associated with Abbott and Medtronic; and has received honoraria for speaking. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose. Drs. Yoon and Ahn contributed equally to this article.

REFERENCES

1. Athappan G, Patvardhan E, Tuzcu EM, et al. Incidence, predictors, and outcomes of aortic regurgitation after transcatheter aortic valve replacement: meta-analysis and systematic review of literature. J Am Coll Cardiol 2013;61:1585–95.

2. Jilaihawi H, Makkar RR, Kashif M, et al. A revised methodology for aortic-valvar complex calcium quantification for transcatheter aortic valve implantation. Eur Heart J Cardiovasc Imaging 2014;15:1324–32.

3. Kappetein AP, Head SJ, Genereux P, et al. Updated standardized endpoint definitions for transcatheter aortic valve implantation: the Valve Academic Research Consortium-2 consensus document. J Am Coll Cardiol 2012;60:1438–54.