Author has nothing to disclose with regard to commercial support.

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References

1. Ma W, Zhang W, Wang C. Ross procedure: what can we learn from the nonstenotic pulmonary autografts? *J Thorac Cardiovasc Surg.* 2020;159:e167-8.
2. Sievers HH. Excellent results up to 20 years with the Ross operation, albeit with some sobering. *J Thorac Cardiovasc Surg.* 2019;157:209-10.
3. Schoof PH, Takkenberg JJ, van Suylen RJ, Zondervan PE, Hazekamp MG, Dion RA, et al. Degeneration of the pulmonary autograft: an explant study. *J Thorac Cardiovasc Surg.* 2006;132:1426-32.
4. Rickers C, Kheradvar A, Sievers HH, Falahatpisheh A, Wegner P, Gabbert D, et al. Is the Lecompte technique the last word on transposition of the great arteries repair for all patients? A magnetic resonance imaging study including a spiral technique two decades postoperatively. *Interact Cardiovasc Thorac Surg.* 2016;22:817-25.
5. Merryman DW. Mechano-potential etiologies of aortic valve disease. *J Biomech.* 2010;43:87-92.
6. Hoffman BD, Grashoff C, Schwartz MA. Dynamic molecular processes mediate cellular mechanotransduction. *Nature.* 2011;475:316-23.
7. Mahler GJ, Frendl CM, Cao Q, Butcher JT. Effects of shear stress pattern and magnitude on mesenchymal transformation and invasion of aortic valve endothelial cells. *Biotechnol Bioeng.* 2014;111:2326-37.
8. Mohler ER III. Mechanisms of aortic valve calcification. *Am J Cardiol.* 2004;94:1396-402.A6.

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REPLY FROM THE AUTHOR: WHY DON'T PULMONARY AUTOGRAFTS CALCIFY IN THE AORTIC POSITION?

Reply to the Editor:

I have been following my first 212 consecutive patients who had the Ross procedure with periodical clinical and echocardiographic assessments since 1990.¹ To the end of June 2019, I had reoperated on the pulmonary autograft in 24 patients because of aortic insufficiency, partial dehiscence of the pulmonary autograft from the intervalvular fibrous body, or dilatation of the neo-aortic root, either isolated or in combination with pulmonary valve homograft replacement. On the basis of this and other studies on longitudinal outcomes after the Ross procedure, Drs Ma, Zhang, and Wang from Shanghai raised the question, “Why don’t pulmonary autografts calcify in the aortic position?” in a letter to the Editor.

I reviewed the operative notes and pathological reports on all patients who had reoperation on the pulmonary autograft and there was no mention of calcification in the cusps or annulus in any of my patients. However, I have also reoperated on 9 other patients who had the Ross procedure in other institutions and 1 patient had calcified annulus and

small islands of calcification in the left coronary cusp but aortic insufficiency was the indication for reoperation. That patient had the pulmonary autograft implanted in the subcoronary position 27 years earlier and he was 68 years old at the time of reoperation. My own series of Ross patients were relatively young (median age, 34 years; interquartile range, 28-41 years)¹ and that could be the reason we did not see any calcification in the pulmonary autografts. It might take 2, 3, or more decades for the pulmonary autograft cusps to calcify and become stenotic and the Ross procedure might not last that long.

Drs Ma, Zhang, and Wang’s potential reasons for the lack of calcification of the pulmonary cusps with consequent aortic stenosis as a mode of failure after the Ross procedure such as increased mechanical stress, higher oxygen saturation, histological and molecular structure differences between the aortic and pulmonary valves, and duration of follow-up are all valid. In addition to all that, I would add that lack of adaptation of the pulmonary valve is responsible for fragmentation of its fibrous and elastic tissues and distortion of the normal histology with thinning and elongation of the cusps with consequent aortic insufficiency instead of cusp calcification and stenosis. Ischemia might also play a role in this degenerative process because the neurovascular connections of the pulmonary root are severed during the operation. Finally, I firmly believe that older age adversely affects adaptation although my personal data are inadequate to prove my contention. In my hands the pulmonary autograft of younger patients is much more durable than in older patients. Similarly, adaptation of the aortic valve cusps after reimplantation of the aortic valve into a tubular Dacron graft (the so-called “David operation”) is far superior in younger than in older patients, that is, that type of repair is more durable in young adults than in older patients.

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Reference

1. David TE, Ouzounian M, David CM, Lafreniere-Roula M, Manlhiot C. Late results of the Ross procedure. *J Thorac Cardiovasc Surg.* 2019;157:201-8.

<https://doi.org/10.1016/j.jtcvs.2019.08.079>