use of the left carotid artery turn-down (LCATD) technique for interrupted aortic arch. Several techniques to repair interrupted arch have been described, including the end-to-side anastomosis from sternotomy approach favored by our center.² The use of the LCATD technique may no longer be justified by the avoidance of cardiopulmonary bypass. We have demonstrated that the neurodevelopmental outcomes of these patients is not affected by the use of cardiopulmonary bypass, provided circulatory arrest is not used.³

The LCATD technique seems to have been limited to some patients, and we would have been interested to hear the thoughts of Todman and associates¹ on the limitations of this technique. In particular, we note that Todman and associates¹ included only 1 patient (2%) with type A interrupted arch and 3 with aberrant right subclavian artery (6%),¹ even though the prevalences of these anomalies are usually reported at around 34% and 20%, respectively.² In addition, we would have loved to know whether Todman and associates¹ excluded patients with single ventricle from the report or whether they found the technique contraindicated in these instances because of the known development of subaortic stenosis in these patients.

Todman and associates¹ concluded that the LCATD technique resulted in similar outcomes to those described in the literature. They kindly mentioned our work; however, they only compared their result with the entire group we reported, whereas we were actually attempting to demonstrate the superiority of the end-to-side repair. Even though our historical series was not designed as a comparative study, we believe that the 18-year survival of 97% (added to an 8% in-hospital mortality)² compares favorably with the 67% 15-year survival achieved after LCATD.¹ In addition, the 18-year freedom from arch reoperation after end-to-side repair was

78%,² a figure higher than the 57% quoted at 15 years after LCATD, especially if, as it appears, the latter technique was reserved for a selection of more favorable patients.¹

Finally, we have previously raised concerns that patients with smaller arches may be more susceptible to the development of hypertension if they do not undergo a more radical technique of repair.⁴ We have demonstrated that the growth of hypoplastic segment of aortic arches is unreliable, and we are concerned that some of their patients may have had hypertension develop.⁵ We found the 18-year freedom from hypertension after interrupted arch repair in our study to be 88%.² The finding of a similarly low incidence of hypertension after the use of the LCATD technique would be very interesting.

In conclusion, we believe that unless further details are given regarding the potential limitations of the LCATD technique, it will be difficult to ascertain its usefulness for the treatment of interrupted aortic arch.

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References

1. Todman SH, Eltayeb O, Ruzmetov M, Rodefeld MD, Turrentine MW, Brown JW, et al. Outcomes of interrupted aortic arch repair using the carotid artery turn-down procedure. *J Thorac Cardiovasc Surg.* 2013;145:176-82.
2. Hussein A, Iyengar AJ, Jones B, Donath SM, Konstantinov IE, Grigg LE, et al. Twenty-three years of single-stage end-to-side anastomosis repair of interrupted aortic arches. *J Thorac Cardiovasc Surg.* 2010;139:942-7, 949; discussion 948.
3. Beca J, Gunn JK, Coleman L, Hope A, Reed PW, Hunt RW, et al. New white matter brain injury after infant heart surgery is associated with diagnostic group and the use of circulatory arrest. *Circulation.* January 31, 2013 [Epub ahead of print].
4. Lee MG, Kowalski R, Galati JC, Cheung MM, Jones B, Koleff J, et al. Twenty-four-hour ambula-

tory blood pressure monitoring detects a high prevalence of hypertension late after coarctation repair in patients with hypoplastic arches. *J Thorac Cardiovasc Surg.* 2012;144:1110-6.

5. Liu JY, Kowalski R, Jones B, Konstantinov IE, Cheung MM, Donath S, et al. Moderately hypoplastic arches: do they reliably grow into adulthood after conventional coarctation repair? *Interact Cardiovasc Thorac Surg.* 2010;10:582-6.

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THREE-DIMENSIONAL CONFIGURATION OF THE MITRAL SUBVALVULAR APPARATUS

To the Editor:

Functional mitral regurgitation is a group of diseases in which surgical treatment is quite difficult and outcomes are not satisfactory when long term outcomes are considered. In light of published data on high recurrence rates with downsizing ring annuloplasty, many surgeons and cardiologists have carried out various studies. It is obvious that such scientific researches will further expand our horizon on the treatment of functional mitral regurgitation. In this context, we appreciate the study by Santana and colleagues¹ suggesting solutions to this problem. We would like, however, to discuss some issues probably missed by these authors.

First, when examined in detail, some inaccuracies can be seen in the article's Figure 1, which illustrates the placement of a polytetrafluoroethylene graft around papillary muscles.¹ The 3-dimensional configuration of interventricular septum, papillary muscles, and leaflets is improperly illustrated. Papillary muscles were represented as if they were aligned perpendicular to the septum, with each muscle having chordal insertions to only one leaflet.¹ Traditionally, however, it is accepted that in the left ventricular anterolateral view papillary muscles are aligned parallel to the interventricular septum, with multiple chordal attachments to both anterior and posterior leaflets.²

FIGURE 1. Anterolateral view of left ventricle and mitral subvalvular apparatus.

Moreover, all pulmonary vein orifices cannot be visualized from this view; only right superior and inferior pulmonary vein orifices can be visualized.²

As a second point, an ideal annuloplasty technique should primarily address the septolateral diameter with less impact on transverse diameter, aiming to avoid distorting both leaflets, especially in the case of functional mitral regurgitation,³ where type IIIb dysfunction is observed if fibrotic changes do not exist. It can be speculated that papillary muscle sling placement will fail to reduce equatorial septolateral dimension

while exerting its main effect on transverse diameter when spatial locations of papillary muscles in left ventricle are taken into account. Because septolateral dimensional change is one of the most important determinants of recurrence after mitral valve repair,^{4,5} papillary muscle sling placement technique seems not to add much to the conventional downsizing ring annuloplasty when long-term outcomes are evaluated.

In conclusion, correction of the illustration as shown in Figure 1 can be useful to avoid misunderstandings. We appreciate the authors for their

efforts and thank them for sharing their experiences.

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References

1. Santana O, Solenkova NV, Pineda AM, Mihos CG, Lamelas J. Minimally invasive papillary muscle sling placement during mitral valve repair in patients with functional mitral regurgitation. *J Thorac Cardiovasc Surg*. March 29, 2013 [Epub ahead of print].
2. Carpentier A, Adams DH, Filsoufi F. Surgical anatomy and physiology. In: Carpentier A, Adams DH, Filsoufi F, eds. *Carpentier's reconstructive valve surgery*. Philadelphia: Saunders; 2010:27-43.
3. Maisano F, Redaelli A, Soncini M, Votta E, Arcobasso L, Alfieri O. An annular prosthesis for the treatment of functional mitral regurgitation: finite element model analysis of a dog bone-shaped ring prosthesis. *Ann Thorac Surg*. 2005; 79:1268-75.
4. Tahta SA, Oury JH, Maxwell JM, Hiro SP, Duran CM. Outcome after mitral valve repair for functional ischemic mitral regurgitation. *J Heart Valve Dis*. 2002;11:11-8; discussion 18-9.
5. Kwon MH, Lee LS, Cevasco M, Couper GS, Shekar PS, Cohn LH, et al. Recurrence of mitral regurgitation after partial versus complete mitral valve ring annuloplasty for functional mitral regurgitation. *J Thorac Cardiovasc Surg*. 2013;146: 616-22.

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Reply to the Editor:

We greatly appreciate Tavlasmoglu and colleagues' interest in our recent publication, which reported the safety and feasibility of the placement of a papillary muscle sling during minimally invasive mitral valve repair for functional mitral regurgitation (MR).¹ We appreciate their illustration, because ours was more of a