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EDITORIAL COMMENT

Predictors for aneurismal formation

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Patients who survive an acute aortic dissection remain at lifelong risk for aortic aneurysm formation, aortic rupture extension, or recurrence of aortic dissection. This applies for both patients with unrepaired type B dissection and for patients with repaired type A dissection. After successful repair of acute type A dissection, patients often have persistent dissection of the distal aortic segments, anatomically equivalent to a type B dissection.

In this issue of the journal, Almeida et al. report a prospective study on midterm outcomes of 70 consecutive patients without Marfan syndrome, who underwent ascending aortic replacement for acute type A aortic dissection [1]. The aim of the investigators was to identify early predictors for aneurismal formation. Aortic aneurysm was defined as an aortic diameter $\geq$5.5 cm. All patients underwent a baseline evaluation by means of cardiovascular magnetic resonance (CMR) at 2 months postoperatively and thereafter three additional CMR evaluations yearly for 3 years. Using univariate analysis, increased pulse pressure, larger initial aortic dimensions, lower distensibility, and the presence of a residual flap were associated with late progression to aortic aneurysm formation. On multivariate analysis, only initial aortic diameter of the descending thoracic segment and pulse pressure were confirmed independent predictors for aneurysm formation.

The rate of distal aortic dilation and late survival after discharge from the hospital have been shown to be similar for patients with all types of aortic dissection and modes of therapy [2]. A similar rate of aortic dilation among various types of surgery can be at least partly explained by the fact that the false lumen remains commonly patent after ascending aortic surgery for type A dissection. Zierer et al. studied risk factors for aortic growth in 168 survivors of type A dissection. Aortic diameter, elevated systolic blood pressure, and presence of a patent false lumen were independent risk factors for aortic growth [3]. Song et al. found the initial false lumen diameter at the upper thoracic aortic to be the most powerful independent predictor of late aneurismal change in patients with type A or type B dissections [4]. A large false lumen probably reflects high false lumen pressure, which may play a critical role in dilating the false lumen itself and generating an aortic aneurysm. In the study of Song et al. the Marfan syndrome was also found to be an independent predictor of late aneurysm.

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Aortic diameter has been recognized to be an important predictor for progressive aortic growth and aneurismal formation not only in patients with a previous aortic dissection, but also in patients without a previous event, both in patients with and without Marfan syndrome [5–7]. Indeed, also other risk factors for rapid aortic growth and aneurismal formation are largely comparable for patients with and without previous aortic root surgery and for patients with and without Marfan syndrome [8, 9].

In unoperated patients with Marfan syndrome, natural aortic growth rate and aneurismal formation have been studied in both children and adults [10–12]. Rapid aortic growth may occur in a small subset of patients and has been shown to be a risk factor for aortic dissection. Initial aortic diameter, a distensibility $<3 \times 10^{-3}$ mmHg in the thoracic descending aorta, previous aortic root replacement, hypertension, and aortic regurgitation have been identified as predictors for rapid aortic growth [13, 14]. In a study of 23 female patients with Marfan syndrome and 33 pregnancies, pregnancy appeared to have a small but significant influence on long-term aortic growth in women with an aortic root diameter $\geq$4.0 cm [15].

The onset of aortic enlargement after aortic dissection is unpredictable. Therefore, careful monitoring and regular imaging of the entire aorta is essential for optimal timing of surgery or percutaneous intervention. During the last decades, remarkable advances have been made in endovascular stent-grafting repair. Although randomized trials have not been conducted, the available data suggest that among those with vascular complication of type B dissection, early mortality is lower for stent grafting than for surgical repair [16]. Presently, it is still unknown whether prophylactic stent grafting may improve long-term outcome for uncomplicated distal aortic dissection. Identifying patients with distal dissection who may benefit from prophylactic stent grafting requires improved methods of risk stratification.

Current available data indicate that modification of surgical techniques cannot improve most factors associated with the degree of aortic enlargement. Thus, optimal long-term outcome demands lifelong radiographic follow-up. Moreover, the importance of rigorous antihypertensive medical treatment, aiming at a systolic blood pressure <120 mmHg has been stressed by several experts [3]. Beta-blocker therapy may be protective, independent of its effects on blood pressure, by reducing the impulse of left ventricular ejection [17].

Due to the advances in medical, surgical, and interventional therapy, life expectancy of patients with aortic dissection has improved substantially. Patients surviving multiple and complex re-operations or interventions have become a real challenge for aortic imaging with CMR or CT-studies [18, 19]. Lifelong and regular imaging in these patients requires involvement of trained specialists with ample imaging expertise in a tertiary referral center.

References

1. Almeida AG, Nobre-Ricardo AL, Pereira RA, Costa-Pereira A, Tavares C, Cravino J, Lopes MG (2008) Impact of aortic dimensions and pulse pressure on late aneurysm formation in operated type A dissection. A magnetic resonance imaging study. Int J Cardiovasc Imaging. doi: 10.1007/s10554-008-9296-2
2. Doroghazi RM, Slater EE, DeSanctis RW, Buckley MJ, Austen WG, Rosenthal S (1984) Long term survival of patients with treated aortic dissection. J Am Coll Cardiol 3:1026–1034
3. Zierer A, Voeller RK, Hill KE, Kouchoukos NT, Damiano RJ, Moon MR (2007) Aortic enlargement and late reoperation after repair of acute type A aortic dissection. Ann Thorac Surg 84:479–487
4. Song JM, Kim SD, Kim JH, Kim MJ, Kang DH, Seo JB, Lim TH, Lee JW, Song MG, Song JK (2007) Long-term predictors of descending aorta aneurismal change in patients with aortic dissection. J Am Coll Cardiol 50:799–804
5. Engelfriet P, Boersma E, Oechslin E, Tijssen J, Gatzoulis MA, Thilén U, Kaemmerer H, Moons P, Meijboom F, Popelová J, Laforest V, Hirsch R, Daliento L, Thaulow E, Mulder B (2006) The spectrum of adult congenital heart disease in Europe: morbidity and mortality in a 5 year follow-up period. The Euro Heart Survey on adult congenital heart disease. Eur Heart J 26:2325–2333
6. Nollen GJ, Groenink M, Tijssen JG, Van der Wall EE, Mulder BJ (2004) Aortic stiffness and diameter predict progressive aortic dilatation in patients with Marfan syndrome. Eur Heart J 25(1146):52
7. Engelfriet PM, Boersma E, Tijssen JGP, Bouma BJ, Mulder BJM (2006) Beyond the root: dilatation of the distal aorta in the Marfan's syndrome. Heart 92:1238–1243
8. Nollen GJ, Meijboom LJ, Groenink M, Timmermans J, Barentsz JO, Merchant N, Webb GD, Lamb HJ, Tijssen JGP, Van der Wall EE, Mulder BJM (2003) Comparison of aortic

elasticity in patients with the Marfan syndrome with and without aortic root replacement. Am J Cardiol 91:637–640
9. Nollen GJ, Mulder BJM (2004) What's new in Marfan syndrome? Int J Cardiol 97(Suppl. 1):103–108
10. Meijboom LJ, Timmermans J, Zwinderman AH, Engelfriet PM, Mulder BJM (2005) Aortic root growth in men and women with the Marfan's syndrome. Am J Cardiol 96:1441–1444
11. Groenink M, Rozendaal L, Naeff MSJ, Hennekam RCM, Hart AAM, Van der Wall EE, Mulder BJM (1998) Diagnostic and prognostic value of aortic root growth in children and adolescents with Marfan syndrome. Heart 80(163):9
12. Rozendaal L, Groenink M, Naeff MSJ, Hennekam RCM, Hart AAM, Van der Wall EE, Mulder BJM (1998) Marfan syndrome in children and adolescents: an adjusted nomogram for screening aortic root dilation. Heart 79(69):72
13. Lazarevic AM, Nakatani S, Okita Y, Marinkovic J, Takeda Y, Hirooka K, Matsuo H, Kitamura S, Yamagishi M, Miyatake K (2006) Determinants of rapid progression of aortic root dilatation and complications in Marfan syndrome. Int J Cardiol 106:177–182
14. Legget ME, Unger TA, O'Sullivan CK, Zwink TR, Bennett RL, Byers PH, Otto CM (1996) Aortic root complications in Marfan's syndrome: identification of a lower risk group. Heart 75(389):95
15. Meijboom LJ, Vos FE, Timmermans J, Boers GH, Zwinderman AH, Mulder BJ (2005) Pregnancy and aortic root growth in the Marfan syndrome: a prospective study. Eur Heart J 26:914–920
16. Eggebrecht H, Nienaber CA, Neuhauser M, Baumgart D, Kische S, Schmermund A, Herold U, Rehders TC, Jacob HG, Erbel R (2006) Endovascular stent-graft placement in aortic dissection: a meta-analysis. Eur Heart J 27(489):98
17. Meijboom LJ, Westerhof BE, Nollen GJ, Spaan JAE, De Mol BAJM, Jacobs MJHM, Mulder BJM (2004) Beta-blocking therapy in patients with Marfan syndrome and entire aortic replacement. Eur J Cardiothorac Surg 26(901):906
18. Meijboom LJ, Groenink M, Van der Wall EE, Romkes H, Stoker J, Mulder BJM (2000) Aortic root asymmetry in Marfan patients; evaluation by magnetic resonance imaging and comparison with standard echocardiography. Int J Card Imaging 16(161):168
19. Symersky P, Vriend JW, Spijkerboer AM, Mulder BJ, Legemate DA, De Mol BA (2005) Endovascular treatment of a bleeding aortic aneurysm after descending aortic aneurysm repair with island reimplantation. J Thorac Cardiovasc Surg 130:576–577