with thoracic aortic pathology.¹ Selection of a control group that is perfectly matched for ethnic ancestry with a group of affected individuals is indeed a major challenge in studying the associations between candidate genes and diseases. Not surprisingly, most published studies have imperfectly matched case-control populations. Nevertheless, the substantial geographic difference between our control and study populations clearly warrants discussion.

Although geographically diverse, white populations from Australia and the United States are genetically similar. The majority of the white Australian population has ancestors who, within only a few generations, originated from the European continent. Previous studies of other genetic polymorphisms have demonstrated great similarities between the white Australian population and white subjects residing on other continents.^{2,3} Our American patients with thoracic aortic disease were classified as white with European origin and therefore share a similar genetic origin with white Australians. Although the Australian and American populations have resided on two different continents for a number of generations, the migration and constitutive establishment for both countries date back only approximately 200 years. The founder effect is generally small within such a short period. Still, even within a given white population, genetic admixture can be large for certain genes. Because of this and other inherent limitations, studies in separate populations are required to confirm any significant genetic associations observed from one particular population.

Given the genetic similarities between white Australians and white Americans (despite the geographic difference), we chose our control population for the absence of angiographic evidence of proximal thoracic aortic aneurysms or dissection. This reduced the likelihood that control subjects had thoracic aortic disease, which would have confounded the comparisons with our patient groups. To address at least somewhat the issue of geographic diversity in our study, we demonstrated that the frequencies of the three *MMP9* SNPs in our control group were not significantly different from those previously described by Applied Biosystems (Foster City, Calif) in a white population from the United States.¹ The presence of Hardy-Weinberg equilibrium in the control group is also reassuring; there was no significant deviation from Hardy-

Weinberg equilibrium for the three *MMP9* polymorphisms in the control group ($P = .81$ for -8202A/G; $P = .98$ for IVS4 + 3G/T; $P = .93$ for 2003A/G). No significant deviation from Hardy-Weinberg equilibrium was observed for IVS4+3G/T and 2003A/G in patients with thoracic aortic aneurysms or dissection; a significant deviation from Hardy-Weinberg equilibrium was observed for -8202A/G in our case patients.

Recent publications have suggested the existence of haplotype blocks. Haplotypes at these blocks could serve as multiallelic markers in disease-association studies.⁴ Examining all observed haplotypes for associations, rather than just those that are proxies for known SNPs, increases power to detect rare causal alleles, but at the cost of reduced power to detect common causal alleles. Furthermore, the haplotype-SNP-based approach does not always have higher power than the single-SNP-based study, as is supported by theoretic considerations. With the data collected in our population, some linkage analysis can be conducted for haplotype construction. Estimated haplotype frequencies cannot be treated as observed data, however, and therefore there is no valid statistical test for evaluating the possible contribution of individual haplotypes. Although testing haplotype blocks of the *MMP9* locus and surrounding regions by including more SNPs might provide additional information, the most effective way to validate the findings reported in our study is to confirm the association in other case-control populations.

As with all genetic association studies, our study has limitations and the findings should be interpreted cautiously. Studies in separate populations will be required to confirm the association that we observed between the *MMP9* -8202A/G polymorphism and thoracic aortic aneurysms and dissection. We hope that our data will stimulate expanded research regarding the genetic aspects of thoracic aortic disease, particularly in patients who do not have archetypal heritable disorders such as Marfan syndrome. Our participation in the newly established Specialized Center of Clinically Oriented Research in Thoracic Aortic Aneurysms and Dissection will provide exciting opportunities to perform such studies and expand our understanding of the genetic determinants that underlie thoracic aortic disease.

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Placement of the Impella Recover LD microaxial blood pump through a bioprosthesis is technically feasible To the Editor:

We read with great interest the article of Strauch and colleagues¹ regarding their experience with Impella Recover LD support for postcardiotomy low-output syndrome in a patient undergoing aortic valve replacement with a bioprosthesis. In our initial experience² we reported the use of the Impella Recover LD to support a patient with valvular cardiomyopathy who underwent conventional mitral valve repair and aortic valve replacement with a 21 mm Carpentier-Edwards bioprosthesis. Despite maximal inotropic support (epinephrine dose, $0.2 \mu\text{g}/\text{kg}^{-1}/\text{min}^{-1}$), the patient could not be weaned from extracorporeal circulation, with hypotension, increased filling pressure (left atrial pressure, 28 mm Hg), and oliguria (urine output, $<30 \text{ mL/h}$). The calculated intra-aortic balloon pump (IABP) score for the patient was 2, which predicts a 52% 30-day mortality according to Hausmann and coworkers.³ The Impella LD was then implanted with the standard technique and advanced in the left ventricle through the prosthesis under echocardiographic guidance. In our experience passing the biologic valve was not immediate

but requires some attempts. Transesophageal echocardiography confirmed right pump placement and no interference between valve leaflet movements and outflow-tip antegrade flow. A trivial aortic regurgitation was detected, probably because of the relative stiffness of prosthetic compared with natural valve leaflets. The postoperative course was characterized by persistent oliguria that required central veno-venous haemofiltration, with slow improvement of cardiac function. Inotropic support was continued for 6 days and then slowly decreased. After 15 days of support, the patient was weaned from the device and discharged home. Follow-up echocardiography showed markedly improved left ventricular contractility and good performance of the aortic valve without signs of damage to the leaflets.⁴

We agree with the author that in the setting of postcardiotomy heart failure, deciding when to start a patient on mechanical support without wasting any precious time is the key to success. Recently, we have introduced in our clinical practice the IABP score as a very useful tool in the decision-making process of mechanical support in postcardiotomy heart failure. Hausmann and colleagues³ defined an IABP score based on 4 parameters they found statistically significant to predict survival or death 1 hour after IABP implantation in patients with low-output syndrome in cardiac surgery. The Hausmann IABP score has been validated also by Siegenthaler and associates⁵ in their study of 24 patients supported with the Impella LD for postcardiotomy heart failure. In addition, they were able to identify patients who will not benefit from the Impella Recover. Patients with a residual cardiac function of 1 L/min or less had an 88% chance of death. This observation is likely due to the fact that the Impella device provides insufficient support in the presence of virtually absent myocardial function.

In conclusion, we agree with the authors that timely insertion of such a device in the postcardiotomy setting, even in borderline situations or after stented biologic aortic valve prosthesis implantation, can provide a greater chance of survival in a poor-prognosis population. Careful clinical, hemodynamic, and residual cardiac function evaluation can allow surgeons to stratify patients for prolonged IABP-inotropic support or timely Impella implan-

tation or even to receive a conventional left ventricular assist device if cardiac performance is dismal.

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Off-pump pulmonary valve implantation

To the Editor:

We would like to comment on the article by Berdat and Carrel¹ entitled "Off-pump pulmonary valve replacement with the new Shelhigh Injectable Stented Pulmonic Valve." They are to be congratulated for having embarked on a novel approach.

Because we have also reported recently on our first surgical experience implanting the Shelhigh valve, 2 points should be made.²

First, it is misleading to report on a pulmonary valve "replacement" in this setting. All 4 patients from the mentioned group had either undergone the transannular patch procedure during tetralogy of Fallot repair or commissurotomy. Likewise,

we have also gained, to date, experience with a total of 6 patients (mean follow-up, 7.8 months; range, 2.0-13.5 months). All of these had previous tetralogy of Fallot repair. Therefore use of the Shelhigh valve in its current form allows only for valve "implantation" because the stented valve can only self-expand and the original pulmonary valve apparatus remains obviously in situ.

Second, we disagree with the judgment that a reduction plasty for an enlarged main pulmonary trunk of larger than 28 mm is mandatory to ensure an adequate position of the stented valve. Berdat and Carrel¹ made this statement on their experience with 1 patient only. In our experience with 6 patients (valve sizes, 23-31 mm), perioperative assessment included the whole right ventricular outflow tract, dimensions of the right ventricle to pulmonary trunk junction, sinus of Valsalva, pulmonary trunk, and pulmonary bifurcation. Interestingly, the final position of the stented valve was, in our experience, at different sites: at the level of the pulmonary valve, just above it, and even much more distally just in front of the bifurcation. Therefore we would rather emphasize the need for both transesophageal and epicardial echocardiographic navigation and "oversizing" of at least 2 mm to allow for a perfect fit of this new valve along its struts.

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Reply to the Editor:

We appreciate the comments by Schreiber and Lange. We believe that making a difference between "implantation" and