Reply to the Editor:

My colleagues and I thank Dr Katz for his letter. Please find below our responses to his questions.

First, regarding the morphine-sparing effect, we believe that this not only is statistically significant but clinically meaningful for these patients. As you may be aware, patients undergoing coronary artery bypass grafting have impaired pulmonary function, with most having a protracted smoking history and an increasing number having ventricular dysfunction. Contributing as well are the effects of narcotics, particularly when administered early (<12 hours)—that is, at about the time of tracheal extubation. Thus we believe that morphine-sparing provided by the cyclooxygenase 2 inhibitors parecoxib and valdecoxib is clinically relevant and should not just be evaluated with patient comfort indices, as one might for less severe surgery in healthier patients.

Second, we also believe that the avoidance of morphine-associated physiologic effects is more important here than possible effects on nausea, vomiting, dizziness, sedation, fatigue, and constipation. Please note that in our patients these patient comfort measures are affected not only by the pain reliever administered, but also—and more profoundly—by the effects of extreme reperfusion, hypothermia, and the inherent cytotoxic responses affecting the end-organs with which you have concern: the brain (sedation, dizziness), the gut (nausea, vomiting), and the skeletal muscles and metabolism (fatigue). Generally, then, any analyses, as I believe you suggest, will be heavily confounded by these factors in these patients.

Third, I respectfully disagree with your comments regarding “interpretable pain data.” We believe that reporting peak pain intensity difference, calculated for each day of treatment and with a baseline control, and our measures of patient and physician global assessment, are sensitive measures, are interpretable, and are meaningful. For example, regarding the clinical relevance of a 1-unit finding on a 4-unit pain intensity scale, we believe that this is substantive, especially when considering that the control group was designed to be aggressively treated well in excess of that usually practiced. This design was specifically chosen to be conservative, therefore

imposing a higher standard for these new pain relievers.

Finally, and importantly, regarding safety, we too believe that our findings regarding infection and inflammation raise serious concerns. We, however, believe that analysis of historical data of similar populations as the placebo group may reveal important insights. We are assured (by the sponsor) that such analyses will be pursued in the near future, and we are committed to performing those analyses independently. Therefore, I reserve response to this important question which you raised until we have performed such analyses. Those results will be given in a second response letter to this *Journal*, and my group will await your comments after that publication.

Dennis T. Mangano, PhD, MD

Ischemia Research and Education Foundation
San Francisco, CA 94121

doi:10.1016/j.jtcvs.2003.08.039

Heterotopic right heart transplantation**To the Editor:**

In a recent issue of the *Journal*, Eleftheriades and coworkers¹ published their interesting short-term experimental study with the technique for isolated accessory right heart transplantation. The idea is definitely clever, and this technique will open new potential approaches in the management of patients with congenital heart defects.

According to the suggestions of the authors, this technique should be taken into consideration as a potential alternative treatment in two groups of patients¹: (1) children with congenital heart defects and right heart malformation not allowing a biventricular type of repair because of the presence of a right ventricle that is either underdeveloped or malfunctioning and (2) patients with congenital heart defects and either right ventricular failure after biventricular repair in the presence of elevated pulmonary vascular resistance, or failure of Fontan type of procedure because of the presence of mild to moderate increase of pulmonary vascular resistance.

Despite the authors' acknowledgement that cardiac surgeons will have to consider this new technique as simply another tool in their armamentarium to face complex situations, it probably is worthwhile to con-

sider other options not discussed in this article. For the patients of group 1, the alternative of one-and-a-half ventricular repair should be always ruled out before considering accessory right heart transplantation. In most children with complex congenital heart defects, it is possible to use a hypoplastic or malfunctioning right ventricle to pump the inferior vena cava venous return into the pulmonary circulation, deviating the venous return from the superior vena cava directly into the pulmonary circulation with an end-to-side anastomosis to the right pulmonary artery (bidirectional Glenn). This approach of one-and-a-half ventricular repair, which is of course suitable only in the presence of normal pulmonary vascular resistance, has been proved successful in various reported experiences.²⁻⁴

For patients in group 2, with elevated pulmonary vascular resistance, not suitable for a Fontan type of procedure or with failing Fontan procedure, the authors did not provide any proof that their technique with the two right ventricles will allow the heart to overcome elevated pulmonary vascular resistance. They did demonstrate that the system with two right ventricles can work in the short term, but they did not provide any data regarding the possibility for this combination with an unprepared donor right ventricle of supporting either a right ventricular volume overload or a pressure overload.

At this point, if we have a donor heart available and wish to consider a donor ventricle to pump against elevated pulmonary vascular resistance in heterotopic position, we consider it much better to use a donor left ventricle. A left ventricle is definitely able to overcome very high pulmonary vascular resistance, at least up to a systemic level.

This idea was tested in an acute experimental study performed when I was at University of California, Los Angeles, and we were able to prove that our heterotopic right heart assist transplant (heart with two left ventricles) was able to function against pulmonary vascular resistance artificially elevated to the systemic level.⁵ Although this technique requires a little more complicated surgical approach and understanding, as the technique reported by Eleftheriades and coworkers¹ does not require cardiopulmonary bypass, it could potentially applied to a much larger patient pop-

ulation, particularly including children with severe pulmonary hypertension.

Antonio F. Corno, MD, PD, FECTS, FRCS
Service de Chirurgie Cardio-vasculaire
Centre Hospitalier Universitaire Vaudois
Lausanne, Switzerland

References

1. Eleftheriades J, Lovoulos C, Edwards R, Tittle S, Riley T, Tang P, et al. Novel technique for isolated accessory right heart transplantation for congenital heart disease. *J Thorac Cardiovasc Surg.* 2003;125:1283-90.
2. Corno AF. Surgical treatment of complex cardiac anomalies: the "one and one half ventricle repair" [editorial]. *Eur J Cardiothorac Surg.* 2002;22:436-7.
3. Corno AF, Chassot PG, Payot M, Sekarski N, Tozzi P, von Segesser LK. Ebstein's anomaly: one and a half ventricular repair. *Swiss Med Wkly.* 2002;132:485-8.
4. Stellin G, Vida VL, Milanese O, Rubino M, Padalino MA, Secchieri S, et al. Surgical treatment of complex cardiac anomalies: the "one and one half ventricle repair." *Eur J Cardiothorac Surg.* 2002;22:1043-9.
5. Corno AF, Laks H, Davtyan H, Flynn WM, Chang P, Drinkwater DC. The heterotopic right heart assist transplant. *J Heart Transplant.* 1988;7:183-90.

doi:10.1016/j.jtcvs.2003.08.040

Reply to the Editor:

We appreciate the kind comments of Dr Corno in his letter regarding our article.¹ We also appreciate his astute delineation of the categories of congenital conditions in which our technique could be applied clinically. We wish to emphasize, however, that ours is at this point an experimental technique, confined to short-term application in the experimental laboratory. We are not advocating clinical application at this time.

To address Dr Corno's specific comments, we need to distinguish between two different experimental procedures developed in our laboratory, which are easily confused because both rely on surgical separation of the right and left ventricles into independent units. In the experiments to which the letter is addressed, we transplanted an accessory donor right heart onto a complete recipient heart, the accessory right heart transplantation procedure. This is being investigated as an alternative treatment for congenital hypoplastic lesions of the right side of the heart in children. In an

earlier series of experiments,² we reported an experimental right heart-sparing procedure in which the right ventricle of a recipient is preserved and a complete donor heart is implanted. This latter procedure is intended, in principle, for human recipients with severe ambient pulmonary hypertension, a setting in which right heart failure, possibly lethal, is frequently encountered. Both these experimental operations rely on the physical separation of right and left sides of the heart, but they represent essentially converse procedures for completely disparate indications.

Dr Corno enumerates other operations that may have application to patient groups with right ventricular hypoplasia or clinical decompensation after conventional palliative surgery. We agree that the one-and-a-half ventricular repair about which he and others have published has merit. This approach allows a bidirectional Glenn shunt to perfuse the lungs with the superior vena caval flow, while the diminutive right ventricle continues to pump the inferior vena caval flow to the pulmonary artery. We hasten to point out that this repair uses the *native* one-and-a-half ventricles and should not be confused with our right ventricle-sparing *transplant* operation,² which has at times been called the "heart-and-a-half" operation.

We agree fully that the acute experiments presented in our article did not subject the accessory right heart to ambient pulmonary hypertension. In related experiments currently in press,³ our converse procedure of right ventricle-sparing transplantation did successfully cope with severe induced iatrogenic pulmonary hypertension.

We agree that heterotopic transplantation represents a viable solution in many situations in which pulmonary hypertension precludes traditional orthotopic cardiac transplantation. In short-term experiments, Corno and colleagues used the left ventricle of a full heterotopic transplant to perfuse the right-sided circulation. There are several advantages to transplanting an isolated right heart. The operation can be done without cardiopulmonary bypass. Space issues are minimized, because there is no left ventricle. Finally, the potential donor pool is quite large and different from the standard donor pool, because hearts with left ventricular dysfunction may be acceptable. In fact, such hearts might even

be preferable, because they have "preconditioned" the right ventricle against left ventricular failure.

Standard heterotopic transplantation, described in the early era of clinical cardiac transplantation, continues to be quite limited in application, largely because of problems of embolization and arrhythmias originating in the preserved native left ventricle and because of mass effects of the heterotopic heart in the pulmonary space. Our right heart-sparing transplant procedure was designed to avoid these problems.

We congratulate Dr Corno on the important work he has highlighted and thank him for his insightful commentary on our recent article.

John A. Eleftheriades, MD

Gary S. Kopf, MD

Section of Cardiothoracic Surgery
Yale University School of Medicine
New Haven, CT 06510

References

1. Eleftheriades J, Lovoulos C, Edwards R, Tittle S, Riley T, Tang P, et al. Novel technique for isolated accessory right heart transplantation for congenital heart disease. *J Thorac Cardiovasc Surg.* 2003;125:1283-90.
2. Eleftheriades JA, Lovoulos CJ, Tellides G, Goldstein LJ, Rocco EJ, Condos SG, et al. Right ventricle-sparing heart transplant: promising new technique for recipients with pulmonary hypertension. *Ann Thorac Surg.* 2000;69:1858-64.
3. Lovoulos C, Tittle S, Goldstein L, Austin DJ, Singh S, Rocco E, et al. Right ventricle-sparing heart transplantation effective against iatrogenic pulmonary hypertension. *J Heart Lung Transplant.* In press 2003.

doi:10.1016/j.jtcvs.2003.08.041

The radial artery: Neither gold, nor silver, but bronze?

To the Editor:

I greatly appreciated reading Dr Lytle's insightful comments in his editorial on the radial artery (RA) versus the right internal thoracic artery (RITA) as a second arterial conduit for coronary surgery.¹ All that he says is true: the RITA graft, when considering its historical older brother the left internal thoracic artery (LITA) graft, should have the same long-term potential but technically poses a bigger challenge. Hence surgeons opt for a more user-friendly arterial conduit, the RA. I would like to suggest a differ-