tion and improvement in physiologic status may be achieved to improve survival following the transplant.³

A possible scoring system for better selection of patient criteria is sought. In this context the Acute Physiology and Chronic Health Evaluation II (APACHE II) scoring system, a multiparameter, physiology-based predictor of outcome, might be helpful. It can aid in both selection and timing of LVAD implantation, particularly in patients not meeting normal hemodynamic criteria for LVAD usage.⁴

Development of right ventricular failure often causes poor results in patients with LVADs. It is important to take into consideration the predictive factors including the need for circulatory support, female gender, and nonischemic etiology, along with the hemodynamic alterations including low pulmonary artery pressure and low right ventricle stroke work index, that might indicate poor right ventricular outcome.⁵ Careful observation of the above would assist both in patient selection and clinical handling of isolated LVAD implants.

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References

1. Dang NC, Topkara VK, Kim BT, Mercado ML, Kay J, Naka Y. Clinical outcomes in patients with chronic congestive heart failure who undergo left ventricular assist device implantation. *J Thorac Cardiovasc Surg.* 2005;130:1302-9.
2. Morgan JA, John R, Rao V, Weinberg AD, Lee BJ, Mazzeo PA, et al. Bridging to transplant with the HeartMate left ventricular assist device: The Columbia Presbyterian 12-year experience. *J Thorac Cardiovasc Surg.* 2004;127:1309-16.
3. Gammie JS, Edwards LB, Griffith BP, Pierson RN 3rd, Tsao L. Optimal timing of cardiac transplantation after ventricular assist device implantation. *J Thorac Cardiovasc Surg.* 2004;127:1789-99.
4. Gracin N, Johnson MR, Spokas D, Allen J, Bartlett L, Piccione W, et al. The use of APACHE II scores to select candidates for left ventricular assist device placement. *Acute Physiology and Chronic Health Evaluation. J Heart Lung Transplant.* 1998;17:1017-23.
5. Ochiai Y, McCarthy PM, Smedira NG, Banbury MK, Navia JL, Feng J, et al. Predictors of severe right ventricular failure after implantable left ventricular assist device insertion: analysis of 245 patients. *Circulation.* 2002;106:1198-202.
doi:10.1016/j.jtcvs.2005.12.050

Reply to the Editor:

We thank Dr Ashraf for his comments on our recent article concerning the use of left ventricular assist devices (LVADs) in patients with chronic congestive heart failure.¹ His letter invites us to discuss several important points.

First, to clarify the device type used predominantly at our center and used exclusively in our study, we favor the HeartMate XVE (single-lead vented electric) LVAD (Thoratec Corp, Pleasanton, CA) for its relative ease of implantation, durability, and lack of need for systemic anticoagulation. Our long-term experience with this device has paralleled an evolution in design, resulting in improved bridge-to-transplant and posttransplant survival rates.²

Next, we could not agree more with Dr Ashraf's observation that the timing of transplantation following LVAD insertion plays a critical role in determining survival. Our own unpublished data show near normalization of blood urea nitrogen, creatinine, and liver function values at approximately 3 months of support time, bolstering the concept of enhanced end-organ perfusion by the LVAD. Moreover, the smooth transition to cardiac rehabilitation and nutritional optimization throughout the recovery period are of critical importance.

Although we do not employ the Acute Physiology and Chronic Health Evaluation II (APACHE II) scoring system ourselves, we use similar clinical and laboratory-based parameters to select LVAD candidates. All patients referred for LVAD are generally refractory to maximal medical therapy, which often includes the use of intravenous inotropes, vasopressors, and intra-aortic balloon pumps. Exclusion is therefore done on the basis of such factors as ventilatory status, elevated pulmonary pressures, and prolonged prothrombin time.

Despite the physiologic benefits of LVADs, even as they apply to the right ventricle, right heart failure (RHF) occurs in approximately 15% to 20% of patients postoperatively.^{3,4} Multiple studies have sought to identify demographic and hemodynamic risk factors predictive of the development of RHF, but in practice, these parameters often exhibit variable outcomes. Although the best treatment for RHF is avoidance, when it does become manifest, a low threshold should be maintained to promptly start inotropic (ie, milrinone) and pulmonary vasodilator (ie, ni-

tric oxide) therapy, with a right ventricular assist device close at hand.

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References

1. Dang NC, Topkara VK, Kim BT, Mercado ML, Kay J, Naka Y. Clinical outcomes in patients with chronic congestive heart failure who undergo left ventricular assist device implantation. *J Thorac Cardiovasc Surg.* 2005;130:1302-9.
2. Morgan JA, John R, Rao V, Weinberg AD, Lee BJ, Mazzeo PA, et al. Bridging to transplant with the HeartMate left ventricular assist device: The Columbia Presbyterian 12-year experience. *J Thorac Cardiovasc Surg.* 2004;127:1309-16.
3. Goldstein DJ, Oz MC, Rose EA. Implantable left ventricular assist devices. *N Engl J Med.* 1998;339:1522-33.
4. Frazier OH, Rose EA, Macmanus Q, et al. Multicenter clinical evaluation of the HeartMate 1000 IP left ventricular assist device. *Ann Thorac Surg.* 1992;53:1080-90.
doi:10.1016/j.jtcvs.2006.01.014

Apoptosis in ischemic spinal cord injury

To the Editor:

We read the article of Suzuki and associates¹ titled "Experimental study on the protective effects of edaravone against ischemic spinal cord injury" with great interest. They studied the effect of a free radical scavenger named "edaravone" in a rabbit model of transient aortic occlusion and claimed its protective effect on the ischemia-reperfusion injury of spinal cord by suppressing the level of reactive oxygen species (ROS). We congratulate Suzuki and associates for their excellent study. We think that the introduction of microdialysis method to determine the production of ROS in the neuronal tissue after transient ischemia for the first time in the literature by the authors is a great contribution to our current knowledge.

Recently, data has accumulated that programmed cell death or apoptosis of motor neurons in spinal cord after transient ischemia is an outstanding mechanism of postoperative paraplegia or paraparesis.^{2,3} The neuronal injury following transient aortic occlusion occurs in 2 phases, namely, early and delayed. Ischemic insult in spinal cord