effective method for BIMA harvesting, yet we are reluctant to recommend skeletonization as the sole method for conduit harvest in these patients.

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References

1. Boodhwani M, Lam BK, Nathan HJ, Mesana TG, Ruel M, Zeng W, et al. Skeletonized internal thoracic artery harvest reduces pain and dysesthesia and improves sternal perfusion after coronary artery bypass surgery: a randomized double-blind, within-patient comparison. *Circulation*. 2006;114:766-73.
2. Kamiya H, Akhyari P, Martens A, Karck M, Haverich A, Lichtenberg A. Sternal microcirculation after skeletonized versus pedicled harvesting of the internal thoracic artery: a randomized study. *J Thorac Cardiovasc Surg*. 2008;135:32-7.
3. Markman PL, Rowland MA, Leong JY, Van Der Merwe J, Storey E, Marasco S, et al. Skeletonized internal thoracic artery harvesting reduces chest wall dysesthesia after coronary bypass surgery. *J Thorac Cardiovasc Surg*. 2010;139:674-9.
4. Peterson MD, Borger MA, Rao V, Peniston CM, Feindel CM. Skeletonization of bilateral internal thoracic artery grafts lowers the risk of sternal infection in patients with diabetes. *J Thorac Cardiovasc Surg*. 2003;126:1314-9.
5. Di Mauro M, Iacò AL, Acitelli A, D'Ambrosio G, Filippini L, Salustri E, et al. Bilateral internal mammary artery for multi-territory myocardial revascularization: long-term follow-up of pedicled versus skeletonized conduits. *Eur J Cardiothorac Surg*. June 26, 2014 [Epub ahead of print].

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RESUSCITATION IN CARDIAC SURGICAL PATIENTS: SYMPTOMS VERSUS CAUSE To the Editor:

Resuscitation after witnessed cardiac arrest in cardiac surgical patients is a vital issue. The recent Expert Review by Gosev and colleagues¹ and Editorial Commentary by Pulido² document improved outcomes (up to 79% survival) relative to nonsurgical setting cardiac arrest resuscitation,

for which survival is 23% and after which approximately 50% of surviving patients sustain severe neurologic damage. Cardiac surgical advantages are attributed to advanced intensive care unit capabilities, more reversible causes, mechanical circulatory support, or potentially lifesaving emergency sternotomy. Immediate defibrillation before initiating cardiopulmonary resuscitation (CPR) is emphasized, because cardioversion success declines from 78% after the first shock to 35% after the second shock and 14% after the third, with absent response thereafter. Missing is their focus on the basic reasons that cardiac surgical patients have a better response. Sudden cardiac death is the symptom of impaired cardiac action.

Sudden cardiac death after cardiac surgery is a uniquely advantageous event, because we can correct the underlying structural cardiac defect. This differs from noncardiac patients, in whom coronary or valvular disease is frequently present. In contrast, we remedy the defects to improve patient recovery. The bleak area in resuscitation exists when defibrillation is unsuccessful and, despite better hemodynamics after open-chest cardiac massage, negligible survival exists if meaningful spontaneous rhythm is not restored in 10 to 15 minutes. The reasons behind this dilemma relate to the heart sustaining impaired perfusion during CPR, resulting in its lack of recovery. This is somewhat corrected by initiating extracorporeal cardiopulmonary resuscitation, in which circumstance 34% of patients survive. We must then explain, however, why 66% of patients die even after the underlying cardiac defect has been corrected. We developed a strategy to answer this question, but it is not considered in these reviews.³

The underlying principle involves 3 goals during resuscitation. First, blood pressure should exceed 60 mm Hg to improve brain perfusion. CPR at greater than 100 beats/min improves this objective. Second, extracorporeal circulation is needed to improve body

perfusion, because negligible flow exists with CPR and is only slightly improved by open-chest cardiac compression. Third, but not needed in our cardiac patients, is going to the catheterization laboratory to find the underlying cardiac cause. Our crucial step is to do sternotomy, insert a vent, clamp the aorta, and deliver a warm substrate-enriched reperfusion for 20 minutes at approximately 50 mm Hg perfusion pressure.^{3,4} "Controlled reperfusion" remedies the flow limitations existing in cardiac surgical patients who undergo resuscitation.

This approach was worked out experimentally⁵ and has been shown to be effective in 14 patients in 1989, as reported in this *Journal*,⁴ and then in 36 patients in 2006.³ The average duration of CPR was 72 minutes, extending to 150 minutes in 1 case. Survival was 79.2%, and brain damage was 6%. It is important that our colleagues are aware of this approach, because it will save the lives of patients who are now considered without hope after failure of the approaches listed in the Expert Review¹ and Editorial Commentary.²

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References

1. Gosev I, Nikolic I, Aranki S. Resuscitation practices in cardiac surgery. *J Thorac Cardiovasc Surg*. 2014;148:1152-6.
2. Pulido JN. Unique aspects of resuscitation practices in postoperative cardiac surgical care: a call to action. *J Thorac Cardiovasc Surg*. 2014;148:1156-7.
3. Athanasuleas CL, Buckberg GD, Allen BS, Beyersdorf F, Kirsh MM. Sudden cardiac death:

Directing the scope of resuscitation towards the heart and brain. *Resuscitation*. 2006;70:44-51.

4. Beyersdorf F, Kirsh M, Buckberg GD, Allen BS. Warm glutamate/aspartate-enriched blood cardioplegic solution for perioperative sudden death. *J Thorac Cardiovasc Surg*. 1992;104:1141-7.
5. Beyersdorf F, Acar C, Buckberg GD, Partington MT, Okamoto F, Allen BS, et al. Studies on prolonged regional ischemia. IV. Aggressive surgical treatment for intractable ventricular fibrillation after acute myocardial infarction. *J Thorac Cardiovasc Surg*. 1989;98:557-66.

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THE IMPORTANCE LIES ON THE PROCESS AND CARE DELIVERY OF RESUSCITATION IN PERIOPERATIVE CARDIAC SURGICAL CARE

Reply to the Editor:

I read with interest the letter from Buckberg and colleagues, "Resuscitation in Cardiac Surgical Patients: Symptoms Versus Cause," written in response to the recent expert review of resuscitation practices in cardiac surgery by Gosev and associates¹ and the accompanying commentary.² The letter's authors report their experience treating a diverse subset of patients with perioperative sudden cardiac death by institution of cardiopulmonary bypass, insertion of left ventricular vent, aortic crossclamping, and delivery of controlled reperfusion with a substrate-enriched reperfusate.³ More importantly, they emphasize correction of the underlying etiology. This particular study involved 34 patients from 4 institutions, only 10 of whom were patients with sudden cardiac arrest occurring in the intensive care unit after cardiac surgery. All patients in this setting had sudden cardiac death occur after coronary artery bypass grafting. The controlled reperfusion technique with warm glutamate and aspartate-enriched blood cardioplegic solution was reported in 1992 by the same group, describing 14 patients with witnessed perioperative sudden cardiac arrest.⁴ Results were promising, with 11 patients being discharged

from the hospital after receiving prolonged perioperative cardiopulmonary resuscitation. These 2 studies both describe an excellent survival and neurologic outcome, and both had patients with cardiac arrest that ranged from 20 to 150 minutes before institution of extracorporeal circulation. The letter authors then propose that this method be mentioned and urge the audience to be aware of this technique, specifically in the prolonged resuscitation cases that are rendered hopeless.

Although commendable, these results are difficult to reproduce and incorporate in a standard approach. Moreover, it is difficult to conclude that the improved neurologic outcome was due to the use of the controlled reperfusion technique, rather than excellent resuscitation technique before the institution of cardiopulmonary bypass. The practice of cardiac surgery is growing more diverse than ever before, with more surgeries performed with minimally invasive or percutaneous approaches; development of multidisciplinary teams, such as the concept of the "heart team"; and the addition of more options for mechanical support. A significant part of the success of implementation of resuscitation practices, such as advanced cardiac life support, is the use of reproducible algorithms and predictable actions with clear roles and responsibilities of the different components of the care team. The major changes of advanced cardiac life support during the last 2 decades have been the adoption of simpler algorithms that enable clear goals without intricate complexities and the development of appropriate training programs with specific intervals. The intent of the expert review and commentary on resuscitation practices in cardiac surgery published last year in the *Journal*^{1,2} was to reinforce the importance of the process and standardization of resuscitation in this highly complex set of patients with a great window of opportunity for recovery as well as a call to create a

standard from which post-cardiac surgery resuscitation can evolve.

The focus on etiology is of key importance during every event requiring resuscitation. With the diverse life-threatening problems that face the modern cardiac surgical patient who develops cardiac arrest, there is an urgent need to establish a standard approach with emphasis on maintenance of perfusion and defining the appropriate time for re sternotomy and extracorporeal support. Because of the promising results of the described technique, it would be advisable to reproduce these findings in a broader cardiac surgical population with an emphasis in postoperative care.

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References

1. Gosev I, Nikolic I, Aranki S. Resuscitation practices in cardiac surgery. *J Thorac Cardiovasc Surg*. 2014;148:1152-6.
2. Pulido JN. Unique aspects of resuscitation practices in postoperative cardiac surgical care: a call to action. *J Thorac Cardiovasc Surg*. 2014;148:1156-7.
3. Athanasuleas CL, Buckberg GD, Allen BS, Beyersdorf F, Kirsh MM. Sudden cardiac death: Directing the scope of resuscitation towards the heart and brain. *Resuscitation*. 2006;70:44-51.
4. Beyersdorf F, Kirsh M, Buckberg GD, Allen BS. Warm glutamate/aspartate-enriched blood cardioplegic solution for perioperative sudden death. *J Thorac Cardiovasc Surg*. 1992;104:1141-7.

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DO EMERGENT AORTIC DISSECTION OPERATIONS INCREASE POSTOPERATIVE NEUROLOGIC COMPLICATIONS?

To the Editor:

We congratulate Shi and colleagues¹ for their report. Although it has been reported that some of the patients in the study had acute aortic dissection,