- grafting in the northwest of England: a 5-year multi-institutional experience. *Eur J Cardiothorac Surg*. 2003;24:940-6.
9. Lundblad R, Abdelnoor M, Geiran OR, Svennevig JL. Surgical repair of postinfarction ventricular septal rupture: risk factors of early and late death. *J Thorac Cardiovasc Surg*. 2009;137:862-8.
 10. Perrotta S, Lentini S. In patients undergoing surgical repair of post-infarction ventricular septal defect, does concomitant revascularization improve prognosis? *Interact Cardiovasc Thorac Surg*. 2009;9:879-87.
 11. David TE, Dale L, Sun Z. Postinfarction ventricular septal rupture: repair by endocardial patch with infarct exclusion. *J Thorac Cardiovasc Surg*. 1995;110:1315-22.
 12. Komeda M, Fremes SE, David TE. Surgical repair of postinfarction ventricular septal defect. *Circulation*. 1990;82(5 Suppl):IV243-7.

Key Words: myocardial infarction, coronary artery bypass grafting, ventricular septal defect, cardiac surgery

EDITORIAL COMMENTARY

Postinfarction ventricular septal defect: Beyond patching the hole

Juan A. Crestanello, MD

From the Division of Cardiac Surgery, Wexner Medical Center, The Ohio State University, Columbus, Ohio.

Disclosures: Author has nothing to disclose with regard to commercial support.

Received for publication Feb 7, 2016; accepted for publication Feb 10, 2016; available ahead of print March 8, 2016.

Address for reprints: Juan A. Crestanello, MD, Division of Cardiac Surgery, Wexner Medical Center, N-820 Doan Hall 410 West 10th Ave, Columbus, OH 43210 (E-mail: juan.crestanello@osumc.edu).

J Thorac Cardiovasc Surg 2016;151:1716-7

0022-5223/\$36.00

Copyright © 2016 by The American Association for Thoracic Surgery

<http://dx.doi.org/10.1016/j.jtcvs.2016.02.024>

Juan A. Crestanello, MD

Central Message

Effectively sealing the VSD is mandatory but not enough to improve postinfarct VSD outcomes.

See Article page 1711.

Postinfarction ventricular septal defect (VSD) remains a formidable surgical challenge with high operative mortality, high rate of residual-recurrent shunt, and decreased long-term survival.^{1,2} Three main issues remain controversial in the care of these patients: (1) timing of the surgery, (2) surgical technique, and (3) how to manage the tremendous preoperative and postoperative physiologic derangements that these patients have. In addition, these cases are rare, and no single surgeon has a large experience treating these patients.

In terms of timing of surgery, most authors agree that early surgery is beneficial because medical management alone is almost uniformly fatal.^{3,4} However, early surgery was associated with substantially increased operative mortality in a recent report of the Society of Thoracic Surgeons database that included more than 2800 patients with postinfarction VSD.¹ This is likely explained by selection bias when patients with more severe hemodynamic compromise underwent operation earlier. On the other hand, delaying surgery hoping to “stabilize” the patient and for the “edges of the VSD to mature” works only in very selected patients with less hemodynamic compromise and potentially exposes them to congestive heart failure and cardiogenic shock for longer periods of time, increasing the incidence of end-organ dysfunction. The patients who were considered too sick to undergo surgery or those who died awaiting surgery were not reported in that article.¹

The conventional management of the hemodynamic and physiologic derangements (heart failure, cardiogenic shock) associated with an acute VSD is demanding and not always successful.⁴ The widespread availability of venoarterial extracorporeal membrane oxygenation and other temporary circulatory support devices allows for perioperative support of these patients and potentially for patient optimization and surgery at a delayed stage, and may result in improved survival.^{5,6}

The technical aspects associated with VSD repair have remained challenging. From the early description of Cooley and colleagues⁷ to the most recent report in this issue of the *Journal*,⁸ many techniques have been described to address the frailty of the tissues and prevent recurrent or residual VSD.^{9,10} The high rate of recurrent-residual VSD is related not only to the surgical technique but also to the extension and location of the myocardial infarction and therefore

may itself be a marker of a sicker group of patients. Recurrent-residual VSD is associated with a 2.7 times higher relative risk of long-term mortality.² In an effort to decrease the rate of recurrent-residual VSD, several technical improvements have been described over the years. The technique of infarct exclusion was first described by David and Armstrong,³ Komeda and colleagues,⁹ and David.¹¹ The technique uses a patch to exclude the VSD from the left ventricular (LV) circulation, maintains LV geometry, with no stitches placed in the peri-infarct friable myocardium. In these reports,^{3,9,11} this technique was associated with lower operative mortality (10%-19%) and satisfactory long-term survival (59%-62%). The rate of recurrence after VSD repair ranges from 10% to 30%.¹²

In this issue of the *Journal*, Okamoto and colleagues⁸ describe a modification of the infarct exclusion technique using 3 bovine pericardial patches supported by fibrin glue to seal the VSD.⁸ One patch was used to close the VSD, and 2 other patches were used to exclude the first patch from the LV cavity. The last 2 patches were easily sewn together and shaped to preserve LV geometry. The space between the last 2 patches, the VSD patch, and the LV free wall was filled with fibrin glue. Sugimoto and colleagues¹³ first described this technique in 2008. They used it in 21 patients over 11 years. Thirty-day mortality was 23.8% with an 8-year survival of 57.9%. Residual or recurrent VSD was observed in 3 patients (14%) but disappeared over time in 2 of the 3 patients.

The outcomes in the current report are remarkably similar to the postinfarction VSD literature. There is a high early mortality associated with preoperative cardiogenic shock, end-organ dysfunction, larger shunt fraction, earlier surgery, and longer operative procedure. The effect of residual shunt on long-term survival was not examined in the current report.⁸ The triple patch and fibrin glue technique is a useful tool that adds to the armamentarium to treat this difficult clinical problem. Albeit likely more effective in sealing the VSD, this technique did not change the natural history of postinfarction VSD. These patients

still have a very high operative mortality and compromised long-term survival. As surgeons, we should go beyond new techniques to “patch the hole” and think of new ways to support these patients’ hemodynamics in the preoperative and postoperative periods. Mechanical circulatory support by venoarterial extracorporeal membrane oxygenation or other short-term devices may make a big difference in outcomes by preserving end-organ perfusion while the heart is allowed to recover.

References

1. Arnaoutakis GJ, Zhao Y, George TJ, Sciortino CM, McCarthy PM, Conte JV. Surgical repair of ventricular septal defect after myocardial infarction: outcomes from the Society of Thoracic Surgeons National Database. *Ann Thorac Surg*. 2012;94:436-44.
2. Jeppsson A, Liden H, Johnsson P, Hartford M, Rådegran K. Surgical repair of post infarction ventricular septal defects: a national experience. *Eur J Cardiothorac Surg*. 2005;27:216-21.
3. David TE, Armstrong S. Surgical repair of postinfarction ventricular septal defect by infarct exclusion. *Semin Thorac Cardiovasc Surg*. 1998;10:105-10.
4. Poulsen SH, Praestholm M, Munk K, Wierup P, Egeblad H, Nielsen-Kudsk JE. Ventricular septal rupture complicating acute myocardial infarction: clinical characteristics and contemporary outcome. *Ann Thorac Surg*. 2008;85:1591-6.
5. Hobbs R, Korutla V, Suzuki Y, Acker M, Vallabhajosyula P. Mechanical circulatory support as a bridge to definitive surgical repair after post-myocardial infarction ventricular septal defect. *J Card Surg*. 2015;30:535-40.
6. Conradi L, Treede H, Brickwedel J, Reichenspurner H. Use of initial biventricular mechanical support in a case of postinfarction ventricular septal rupture as a bridge to surgery. *Ann Thorac Surg*. 2009;87:e37-9.
7. Cooley DA, Belmonte BA, Zeis LB, Schnur S. Surgical repair of ruptured interventricular septum following acute myocardial infarction. *Surgery*. 1957;41:930.
8. Okamoto Y, Yamamoto K, Asami F, Kimura M, Mizumoto M, Okubo Y, et al. Early and mid-term outcomes of triple patch technique for postinfarction ventricular septal defects. *J Thorac Cardiovasc Surg*. 2016;151:1711-6.
9. Komeda M, Fremes SE, David TE. Surgical repair of postinfarction ventricular septal defect. *Circulation*. 1990;82(5 Suppl):IV243-7.
10. Daggett WM, Buckley MJ, Akins CW, Leinbach RC, Gold HK, Block PC, et al. Improved results of surgical management of postinfarction ventricular septal rupture. *Ann Surg*. 1982;196:269.
11. David TE. Operative management of postinfarction ventricular septal defect. *Semin Thorac Cardiovasc Surg*. 1995;7:208-13.
12. Caputo M, Wilde P, Angelini GD. Management of postinfarction ventricular septal defect. *Br J Hosp Med*. 1995;54:562-6.
13. Sugimoto T, Yoshii S, Yamamoto K, Sakakibara K, Iida Y, Uehara A, et al. A modified infarct exclusion technique: triple-patch technique for postinfarction ventricular septal perforation. *J Thorac Cardiovasc Surg*. 2008;135:702-3.