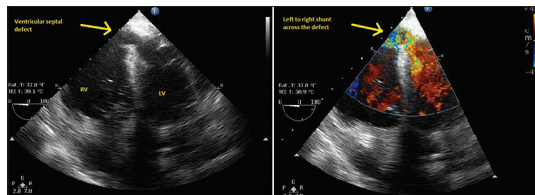


## High cardiac output by Swan-Ganz catheter after repair of ventricular septal rupture-patch dehiscence or false overestimation?

The Editor,

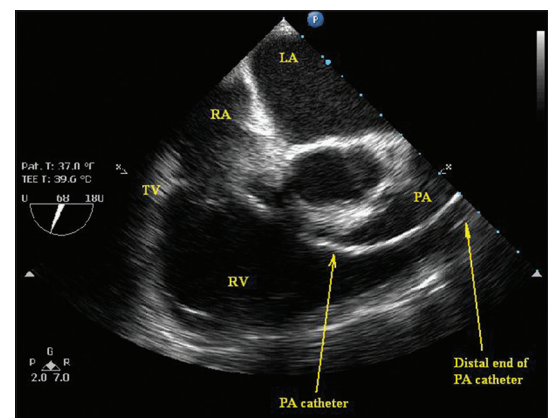
A 56-year-old male presented with chest pain on mild exertion since 2 days. His electrocardiogram was suggestive of inferior wall myocardial infarction. Coronary angiography revealed double vessels coronary artery disease. Echocardiography was performed and it showed the left ventricular ejection fraction 45% with a large apical muscular ventricular septal defect (approximate size of 2 cm) with the left to right shunt [Figure 1 and Video 1]. The right-sided chambers were dilated. Echocardiographically calculated cardiac index was 2 L/min/m<sup>2</sup>. The patient was scheduled for coronary artery bypass grafting surgery along with repair of postmyocardial infarction ventricular septal rupture (VSR). Anesthesia was induced without any incident. Under hypothermic cardiopulmonary bypass, two saphenous vein grafts were anastomosed to the left anterior descending artery and posterior descending artery. The ventricular septal defect was closed using a pericardial patch. Postbypass transesophageal echocardiography confirmed the adequacy of ventricular septal repair. Patient's hemodynamics was maintained with the help of inotropic support. After shifting the patient to postoperative recovery room, it was decided to insert a pulmonary artery (PA) catheter to monitor cardiac output and other



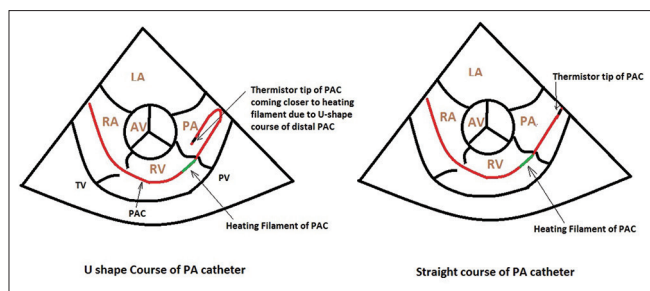
**Figure 1:** Transesophageal echocardiography transgastric short axis view showing large muscular ventricular septal defect with the left to right shunt

hemodynamic parameters. Swan-Ganz catheter was inserted through the right internal jugular vein till the length of 48 cm as the position of distal end of the catheter was confirmed in PA by an arterial waveform. Catheter was attached to calibrated continuous cardiac output monitor (Vigilance). The catheter was further tried to progress to obtain pulmonary arterial wedge pressure, however, further advancement was stopped considering the appearance of episodes of ventricular tachycardia. The monitor displayed cardiac index in the range 6–7 L/min/m<sup>2</sup>. The patient's temperature was in the range of 35.8–36.7°C. Such supranormal cardiac index raised the suspicion of dehiscence of patch closing the ventricular septal defect. Transesophageal echocardiography examination was performed and it revealed no shunting of blood across the closed ventricular septal defect [Video 2]. However, U-shape course of PA catheter from PA to the right ventricle was observed [Figures 2, 3 and Video 3].

Cardiac output measurement by the thermodilution technique in PA catheter is



**Figure 2:** Transesophageal echocardiography mid-esophageal aortic valve short axis view showing the distal end of pulmonary artery catheter turning back in pulmonary artery



**Figure 3:** Schematic diagram showing U-shape course of pulmonary artery catheter in pulmonary artery (left panel). Transit time of warm blood from heating filament to thermistor is less as compared to the straight course of the catheter (right panel). RA: Right atrium, LA: Left atrium, RV: Right ventricle, PA: Pulmonary artery, TV: Tricuspid valve, PV: Pulmonary valve, PAC: Pulmonary artery catheter

used by giving cold saline bolus or by using continuous automated cardiac output monitor using heater wire in PA catheter.<sup>[1-3]</sup> This thermal filament is located at about 20 cm from the distal end of the catheter. Intermittent heating of this filament warms the blood and temperature change is noted by the thermistor at the tip. Cardiac output is estimated by using the computer-generated thermodilution curve. The temperature versus time curve is the basic principle of measuring cardiac output by the thermodilution method. Anything that results in less or more cold or warm blood reaching the thermistor and anything affecting its transit time will adversely influence the accuracy of the technique. Over or under estimation of cardiac output can be caused by conditions such as tricuspid regurgitation, intracardiac shunt, and fluid administration through the proximal part of the catheter. In bolus thermodilution method, injectate volume more or less than programmed volume (typically 10 ml) and injectate temperature warmer or colder can give erroneous cardiac output measurement. In ventricular septal defect with the left to right shunt, more blood coming to the right ventricle and PA, hence, more cardiac output measurement by PA catheter. Abnormally large value of the cardiac index in the present case made us doubt the adequacy of VSR repair. However, it was the U-shape course of Swan-Ganz catheter in PA that brings distally placed thermistor near the thermal filament thereby decreasing

the transit time for warm blood to reach thermistor. This leads to overestimation of the cardiac output value.

#### Financial support and sponsorship

Nil.

#### Conflicts of interest

There are no conflicts of interest.

**Monish S. Raut, Arun Maheshwari, Sujay Shad<sup>1</sup>**

Departments of Cardiac Anesthesiology and <sup>1</sup>Cardiac Surgery, Sir Ganga Ram Hospital, New Delhi, India

#### Address for correspondence:

Dr. Monish S. Raut,  
Department of Cardiac Anesthesiology,  
Sir Ganga Ram Hospital, New Delhi, India.  
E-mail: drmonishraut@gmail.com

#### REFERENCES

1. Mihajevic T, von Segesser LK, Tönz M, Leskosek B, Seifert B, Jenni R, *et al.* Continuous versus bolus thermodilution cardiac output measurements – A comparative study. *Crit Care Med* 1995;23:944-9.
2. Le Tulzo Y, Belghith M, Seguin P, Dall'Ava J, Monchi M, Thomas R, *et al.* Reproducibility of thermodilution cardiac output determination in critically ill patients: Comparison between bolus and continuous method. *J Clin Monit* 1996;12:379-85.
3. Robin E, Costecalde M, Lebuffe G, Vallet B. Clinical relevance of data from the pulmonary artery catheter. *Crit Care* 2006;10 Suppl 3:S3.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

Videos Available on: [www.annals.in](http://www.annals.in)

Access this article online

Quick Response Code:



Website:

[www.annals.in](http://www.annals.in)

DOI:

10.4103/0971-9784.185556

**Cite this article as:** Raut MS, Maheshwari A, Shad S. High cardiac output by Swan-Ganz catheter after repair of ventricular septal rupture-patch dehiscence or false overestimation?. *Ann Card Anaesth* 2016;19:535-6.