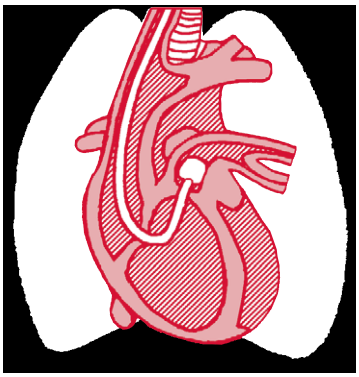

CASE CONFERENCE

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CASE 1—2009
Retrocardiac Sponge-Induced Hemodynamic Instability After Cardiac Surgery

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UNINTENTIONAL FOREIGN BODIES, like surgical sponges, left within the pericardial cavity during cardiac surgery may be associated with morbidity and mortality. A surgical sponge placed posterior to the heart may remain undetected and be the source of persistent hemodynamic instability. The authors report an incident wherein a surgical sponge placed posterior to the heart during cardiopulmonary bypass (CPB) was detected by intraoperative transesophageal echocardiography (TEE) to be the cause of unstable hemodynamics in the post-CPB period.

CASE REPORT*

A 57-year-old male patient, weighing 68 kg, was scheduled for coronary artery bypass graft (CABG) surgery using CPB for quadruple-vessel disease. His preoperative medical history included a 2-month-old anterior wall myocardial infarction, chronic smoking, diabetes mellitus (on insulin 40 units daily in 3 divided doses), and hypertension. Coronary angiography revealed 4-vessel disease, with total occlusion of the left anterior descending artery, 70% stenosis of the right coronary artery, 70% stenosis of the major obtuse marginal artery, and 70% stenosis of the posterior descending artery (arising from the marginal artery). Preoperative transthoracic echocardiography (TTE) revealed mild mitral regurgitation in addition to moderate-to-severe hypokinesia of the interventricular septum, apex, distal inferior wall, and entire posteroinferior wall. The left ventricular ejection fraction was estimated to be 35%. Right ventricular systolic pressure could not be assessed because of minimal tricuspid regurgitation.

On the morning of the day of the surgery, general anesthesia was induced with intravenous fentanyl (500 μg), midazolam (2 mg), propofol (70 mg), and pancuronium (10 mg). He was uneventfully tracheally intubated and ventilated with oxygen, air, and supplemental inhaled isoflurane. Before the induction of general anesthesia, an invasive arterial catheter inserted into the left radial artery revealed a baseline blood pressure of 136/84 mmHg. Electrocardiography at this time revealed sinus rhythm with a heart rate of 52 beats/min. Anesthesia was subsequently maintained with additional fentanyl (1 mg), midazolam (5 mg), pancuronium (2 mg), and isoflurane. Intraoperative monitoring consisted of 5-lead electrocardiography (with ST-segment analysis), invasive arterial blood pressure, central venous pressure, pulse oximetry, capnography, nasopharyngeal temperature, and urine output.

A TEE probe (multiplane) was inserted after the induction of general anesthesia. The midesophageal 4-chamber view revealed a hypocontractile lateral wall of the left ventricle and hypokinesia of the mid- and apical interventricular septum. The grade of mitral regurgitation was mild. The 2-chamber view at the midventricular level revealed that the inferior wall was also hypokinetic. The estimated left ventricular fractional area change in the transgastric short-axis view at the midpapillary level was 36%.

After the injection of intravenous heparin (21,000 units), standard CPB was established, the aorta cross-clamped, and antegrade cold blood cardioplegia was delivered into the aortic root. The 4 vessels grafted included the left anterior descending artery, the second diagonal artery, the major obtuse marginal artery, and the posterior descending artery. The left internal mammary artery was used for revascularization of the left anterior descending artery, whereas the other 3 vessels received reversed saphenous venous grafts. The surgeon placed a folded surgical sponge (size 20 cm × 20 cm) behind the posterior aspect of the heart for better access to the heart during revascularization.

After completion of all proximal anastomoses, an intravenous epinephrine infusion was initiated electively at the rate of 0.05 μg/kg/min, and the patient was weaned from CPB. Immediately after separation from CPB, the blood pressure was 100/70 mmHg, heart rate was 85 beats/min, and central venous pressure was 8 mmHg. Electrocardiography revealed sinus rhythm, and no ischemic ST-T changes were detected. The heart appeared a bit rotated to the right side. Before the admin-

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istration of protamine, the heart was inspected with TEE, which, however, revealed only dark shadows at the midesophageal 5-chamber view (Video 1 [supplementary videos accompanying this article are available online]). In the midesophageal 4-chamber view, the authors noted rightward diastolic rotation of the heart. No new alterations in the grade of mitral regurgitation or regional wall motion abnormalities were detected. The interatrial septum was not bowing toward the left atrium. It was also observed that the entire image was getting darkened because of a shadow, which became denser in diastole and lighter during systole (Video 2). When the probe was withdrawn to the level of the ascending aorta, clear TEE views could be obtained. When the probe was advanced into the stomach, the imaging quality of the transgastric short-axis view at the basal and midpapillary levels appeared degraded. Imaging was frequently lost. The heart appeared distorted, as if pushed from the posterior side, although the septal, anteroseptal, and inferior walls could be visualized to some extent. The left ventricle appeared underfilled. Regional wall motion abnormalities could not be assessed in the transgastric views because of this distorted imaging.

The blood pressure started to decrease within 5 minutes after weaning the patient from CPB while the TEE examination was being performed. Initially, the hypotension responded well to volume administration. However, in another 5 minutes, the central venous pressure increased to 14 mmHg, and the systolic blood pressure decreased to 70 mmHg. The infusion of blood from the oxygenator reservoir and 50-μg boluses of intravenous phenylephrine failed to improve hemodynamics. Hence, the dose of epinephrine was increased to 0.1 μg/kg/min, which increased the blood pressure to 120/82 mmHg, with the central venous pressure decreasing to 10 mmHg. A second attempt was made to inspect the heart at the midesophageal ventricular level and a clear border of dense shadow was noted on the posterior aspect of the left ventricle in the midesophageal long-axis view. The left atrium and left ventricle could be seen in systole, but the posterior wall of the left ventricle was covered by a dark shadow during diastole (Fig 1 and Video 3). The right ventricular inflow-outflow view revealed a narrow right ventricular

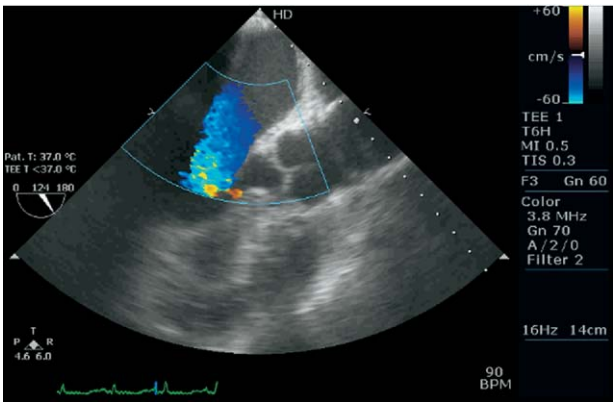

Fig 1. A midesophageal long-axis view at the ventricular level showing a clear border of dense shadow covering the posterior aspect of the left ventricle during diastole. (Color version of figure is available online.)

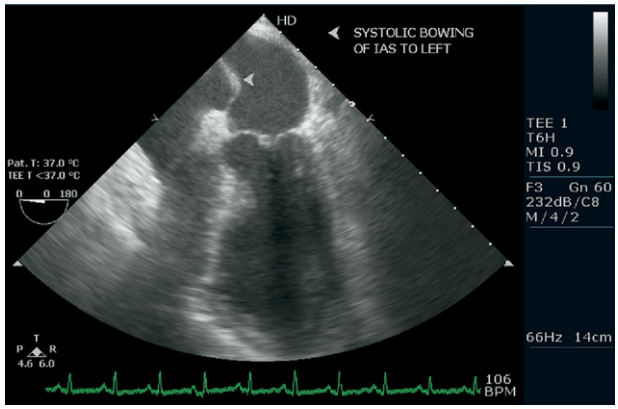

Fig 2. The interatrial septum bowing into the left atrium during systole.

cavity and right ventricular outflow tract. Transgastric echocardiographic images were unclear and distorted, as during the previous attempts. The authors thought of the probability that a surgical sponge was lying behind the heart. At this time, it was requested that the scrubbed assistant nurse and floor nurse perform a sponge count. They found that a surgical sponge was missing from the sponge count. It was requested that the surgeon search for the sponge on the back side of the heart. He lifted the apex of the heart gently but did not find any surgical sponge underneath. Searching for the missing sponge in other areas of the thoracic cavity was unsuccessful. However, when the surgeon was informed about the likely presence of a retrocardiac foreign object, most likely a sponge, he recollected that he had placed a sponge on the back of the heart during a graft anastomosis, which was probably left in situ. Lifting the heart carefully, he then successfully retrieved the sponge lying on the posterior aspect of the heart, after which TEE imaging became clear. The left ventricular fractional area change improved to 54%, the left ventricular diastolic filling improved, the blood pressure gradually increased to 180/110 mmHg, and the central venous pressure decreased to 8 mmHg within 10 minutes after the removal of the sponge. The total duration of hemodynamic instability was about 20 minutes.

Subsequently, the dose of intravenous epinephrine was decreased to 0.05 μg/kg/min. However, the interatrial septum was found to be bowing into the left atrium during systole (Fig 2). The interventricular septum appeared flat, and the right ventricular systolic pressure, measured with the tricuspid regurgitation jet method, was 48 mmHg (signs of mild right ventricular dysfunction). Heparin was reversed with a slow infusion of intravenous protamine. Systolic blood pressure remained stable during protamine administration. TEE features of right ventricular dysfunction persisted for about 20 minutes after the removal of the retrocardiac sponge. The postoperative period was uneventful, and tracheal extubation was performed after 4 hours of mechanical ventilation. Intravenous epinephrine was subsequently weaned and discontinued over the next 6 hours. TTE performed on postoperative day 2 revealed that the left ventricular ejection fraction was 46% and that the right ventricular systolic pressure was 25 mmHg by the tricuspid regur-

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