real ventricular assist device developed in Japan. However, although she is able to walk around the hallway, her exercise capacity is very limited. Her latest data of peak oxygen consumption during exercise was 6.9 mL · min^{-1} · kg^{-1}. Additional placement of a right ventricular assist device may improve her exercise capacity, but the risk of device-related complication would increase with biventricular assist. In Japan, the mean waiting period for a status-1 heart transplant candidate is more than 1 year. To minimize possible complication, univentricular assist is better for prolonged support lasting more than 1 year.

Experimentally, Takano and coworkers[5] have shown the possibility of prolonged circulatory maintenance with an LVAS by studying goats in VF. To our knowledge, this is the first clinical case demonstrating that long-term circulatory support of a non-heart-beating patient is possible with left ventricular support only, when pulmonary vascular resistance is in the normal range.

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Combination of the HEARTSTRING proximal seal system with a blower mister: A possible source of gas emboli

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Using a side clamp for the performance of proximal anastomoses in coronary artery bypass surgery may injure the ascending aorta and cause intimal tears, with subsequent dissection or debridement of atherosclerotic material and stroke. Several devices were developed to perform proximal bypass anastomoses without the necessity of side clamping, the latest being the HEARTSTRING proximal seal system (Guidant Corp, Santa Clara, Calif). The system comprises the proximal seal, a delivery device, and an aortic punch. The proximal seal is delivered into the aorta via a punch hole site and provides a sealed region to facilitate the proximal anastomosis.[1] The proximal seal covers the punch hole from inside the aorta, because the blood pressure pushes and a tension spring mechanism pulls the seal against the aortic wall.

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Patient

The first use of the HEARTSTRING device in our clinic was scheduled in an 83-year-old woman who presented with unstable angina. Three bypasses were implanted including the left internal thoracic artery connected to the left anterior descending and 2 saphenous vein grafts for the first diagonal branch and the distal right coronary artery. The proximal anastomoses were performed with the aid of the HEARTSTRING device after removal of the crossclamp without using a side clamp. Because of bleeding during the performance of the proximal anastomoses, the operative field was cleared with a blower mister (Medtronic Inc, Minneapolis, Minn) as recommended by the manufacturer.[1] Mean arterial pressure was above 70 mm Hg. Postoperatively the patient was hemodynamically stable without inotropic support. As the patient did not wake up a cerebral computed tomography (CT) scan was performed immediately followed by a second CT of the brain, thorax, and abdomen 11 hours later. It revealed a new hypodense right frontal area (2 × 2 cm large) in the region of the anterior cerebral artery (see Figure 1) and multiple spleen infarctions.

Animal Experiment

A German land race pig (35 kg) was anesthetized, intubated, and ventilated. For arterial blood pressure monitoring as well as blood gas sampling, the right carotid artery was cannulated. The chest

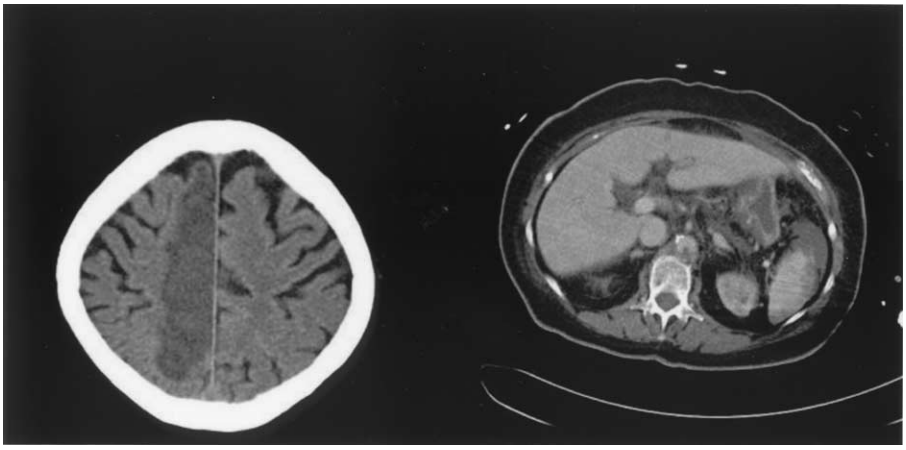

Figure 1. CT scans 11 hours postoperatively demonstrating a large frontal ischemic stroke and multiple spleen infarcts. An 83-year-old woman did not wake up after bypass surgery using the HEARTSTRING device and a blower mister for facilitating the proximal anastomoses. Air emboli caused by the devices were suspected.

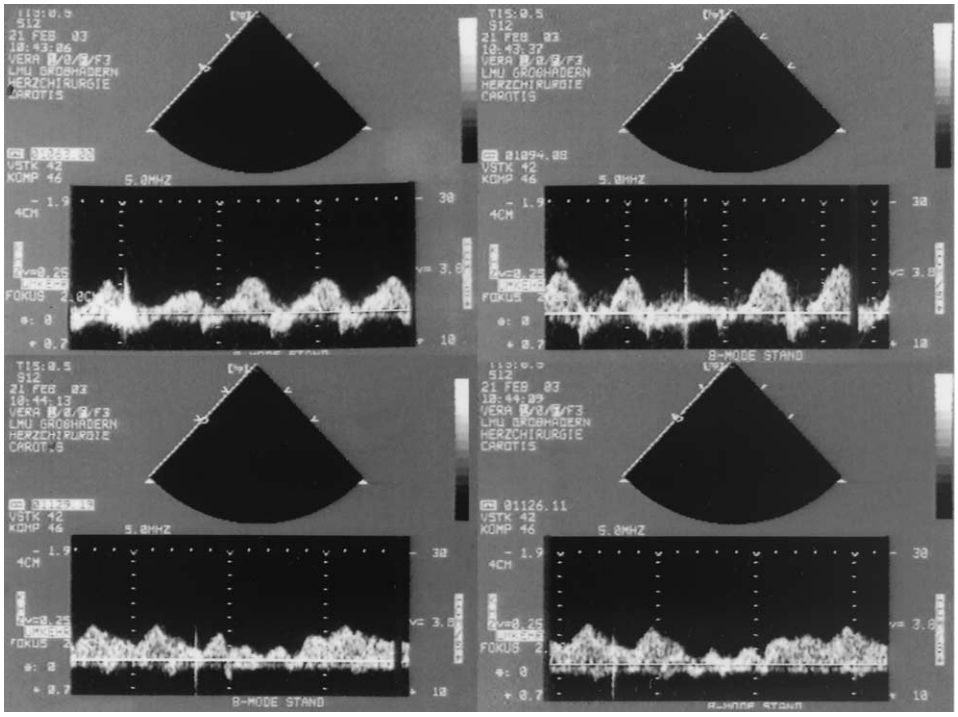

Figure 2. Detection of air emboli in the left carotid artery during an animal experiment. Several high-intensity signals were recorded with a continuous wave 7.5-MHz probe during simulation of a proximal anastomosis using the HEARTSTRING device and a blower mister. The figure shows 4 subsequent high-intensity signals detected within 30 seconds at a mean arterial pressure of 75 mm Hg.

was opened by median sternotomy. Air emboli to brain were monitored using a 7.5-MHz continuous wave Doppler ultrasound probe (Sonos5500, HP Inc, Andover, Mass) on the left carotid artery.[2] Performance of proximal anastomoses was simulated using the HEARTSTRING device and a blower mister as described by the company.[1] During this maneuver we recorded several high-intensity signals in the carotid artery fulfilling the criteria for air emboli.[2] Figure 2 demonstrates 4 emboli within 30 seconds at a mean arterial pressure of 75 mm Hg.

Comment

We do not know whether the embolic complication in our patient is related to the use of the HEARTSTRING device in combination

with a blower mister, because other mechanisms like crossclamping or cannulation of the ascending aorta bear a stroke risk of more than 8% in octogenarians[3] and may have been the cause for emboli. However, we cannot rule out that air provided by the blower mister device entered the aorta through a leak between the proximal seal and the aortic wall and caused the emboli. The possibility of such a mechanism was proven in an animal experiment. This should be sufficient reason to strongly discourage the simultaneous use of the HEARTSTRING device in combination with a blower mister.

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Life-threatening anaphylactic shock caused by porcine heparin intravenous infusion during mitral valve repair

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Adverse skin reactions to low-molecular-weight heparin and systemic allergic reactions coupled with heparin-induced antibody reactions have been described.[1-3] In this report we describe a case of cardiogenic anaphylactic shock caused by porcine gut heparin infusion in the cardiac surgery theater before starting cardiopulmonary bypass (CPB) in a young man with degenerative mitral valve incompetence.

Clinical Summary

A 36-year-old man was referred to the Cardiovascular Institute of Padua University for mitral valve repair of valve incompetence caused by a floppy valve. He had a history for asthma treated with β-stimulants and a documented *Acarus* species allergy. He had mitral valve incompetence for about 6 years, which more recently progressed to New York Heart Association class II. Physical examination revealed significant systolic murmur (5/6 grade). Electrocardiography disclosed normal sinus rhythm (97 beats/min), mild left ventricular hypertrophy, and an enlarged atrial component. The hematologic and biochemical values were within normal range. Chest radiography showed an increased cardiothoracic ratio. Two-dimensional echocardiography showed severe mitral regurgitation and left atrial and ventricular dilatation with a normal ejection fraction. These data were confirmed by cardiac angiography with hemodynamic study. The spirometry analysis showed mild airways obstruction with reduced tidal volume.

Dr Bottio

After providing written informed consent, the patient received premedication consisting of 2 mg of oral lorazepam administered 1 hour before the start of anesthesia. The patient was prepared by introduction of an intravenous catheter in the right arm for balanced salt solution infusion and an arterial catheter with local anesthesia in the left radial artery for continuous blood pressure monitoring.

Monitoring also included electrocardiographic leads II and V_5 with automated ST-segment analysis and trending, pulse oximetry, and capnography. After a 5-minute preoxygenation period, general anesthesia was induced with thiopental (2.5 mg/kg), followed by fentanyl (5 μg/kg) and vecuronium (0.1 mg/kg). After loss of consciousness, mask ventilation was maintained with 100% oxygen, and 2 minutes later, an endotracheal tube was introduced. Mechanical ventilation with a mixture of oxygen-air (60%) was adjusted to maintain end-tidal carbon dioxide between 30 and 35 mm Hg, with an airway peak pressure of less than 25 mm Hg and a normal capnography curve. Maintenance of anesthesia was achieved with fentanyl up to 20 μg/kg before sternotomy and with a continuous infusion of propofol (3 mg $\cdot$ kg^{-1} $\cdot$ h^{-1}) and cisatracurium (1.5 μg $\cdot$ kg^{-1} $\cdot$ min^{-1}). Intravenous antibiotic prophylaxis (cephazolin, 30 mg/kg) was given. After induction of anes-

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