

# Maintenance of hemodynamic stability during pericardiectomy with the Starfish 2 Heart Positioner

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**P**ericardiectomy for chronic pericarditis can be a technically difficult procedure associated with high mortality.<sup>1</sup> The use of cardiopulmonary bypass (CPB), although necessary on occasion, can be associated with significant bleeding, leading many surgeons to prefer its avoidance. Technologic advances in heart positioning devices have enabled the widespread application of beating-heart coronary revascularization. In this report we describe our use of the Starfish 2 Heart Positioner (Medtronic, Inc, Minneapolis, Minn) in the treatment of chronic pericarditis.

## Clinical Summaries

**PATIENT 1.** A 41-year-old Iranian war veteran had a several-week history of progressive shortness of breath, increasing abdominal girth, and peripheral edema. Echocardiography and computed tomography confirmed the diagnosis of severe constrictive pericarditis. Subsequent cardiac catheterization demonstrated the typical dip and plateau pattern. At the operation, the heart was approached through a median sternotomy with a Cell Saver system (Haemonetics Corporation, Braintree Mass) available and CPB on standby. The thickened (7 mm), calcified parietal pericardium was resected laterally toward each phrenic nerve. Once the visceral pericardium at the apex of the left ventricle was exposed, the Starfish 2 Heart Positioner was applied in the standard position used for off-pump coronary artery bypass grafting (OPCAB; Figure 1). With the Starfish retractor, the remaining parietal pericardium was resected from phrenic to phrenic nerve, including its diaphragmatic surface. In addition, the visceral pericardium (5 mm in thickness) was resected in its entirety, except for a small portion along both the left anterior descending coronary artery and posterior left atrium. The patient remained in hemodynamically stable condition throughout the case without inotropic or vasopressor support, and no blood transfusions were needed. He was extubated 5 hours after the operation and discharged from the hospital on postoperative day 6. Pathologic examination revealed nonspecific fibrous pericarditis with calcification.

**PATIENT 2.** A 29-year-old man had chronic chest pain after an episode of pneumonia that was diagnosed as pericarditis. His pain

was refractory to nonsteroidal anti-inflammatory agents, colchicine, and oral steroids. On referral to our service, he had class III New York Heart Association dyspnea. The diagnosis of pericarditis was confirmed on echocardiography and chest CT. This patient's heart was also approached through a median sternotomy with a Cell Saver system available and CPB on standby. The conduct of the operation and use of the Starfish 2 Heart Positioner were both similar to those in our first patient. The thick parietal pericardium (8 mm) was resected to both phrenic nerves and along the diaphragm. The 6-mm visceral pericardium was subsequently resected from all heart surfaces, except a small patch on the posterior left atrium. There was no need for inotropes or vasopressors, because the patient remained in hemodynamically stable condition throughout; in addition, no blood transfusions were needed. The patient was extubated 7 hours after the procedure and discharged from the hospital on postoperative day 4. Pathologic examination revealed chronic pericarditis with granulation tissue.

## Discussion

Pericardiectomy for chronic pericarditis is associated with high morbidity and mortality, despite advances in surgical technique and patient care.<sup>2</sup> Some authors have advocated the routine use of CPB for this procedure.<sup>3</sup> However, we believe that the bleeding complications from full heparinization outweigh the potential benefits afforded by routine CPB, especially when cell salvage techniques are available. Our routine operative approach is through a median sternotomy, which can require extensive heart manipulation to fully resect involved pericardium.<sup>1</sup> This manual retraction of the heart, as needed to perform OPCAB, can lead to significant hypotension or malignant arrhythmias, requiring the institution of CPB to safely complete the procedure. These issues were faced in the advancement of OPCAB procedures, and specific retractors have subsequently been developed.

The advent of the Starfish 2 Heart Positioner has allowed the safe performance of difficult OPCAB distal anastomoses. As opposed to manual retraction, the Starfish relies on the maintenance of ventricular geometry during retraction of the heart and therefore minimizes any hemodynamic alteration. We recently applied this theory to off-pump pericardiectomy. As soon as dissection of the parietal pericardium reveals the underlying heart, we apply the retractor to the apex of the heart, where a small patch of visceral pericardium is left to protect the friable underlying fat and myocardium. The Starfish device is then used for all further heart retraction to optimize visualization.

In our experience, the application of the Starfish 2 Heart Positioner to pericardiectomy allowed stable patient hemodynamics, as evidenced by the lack of any episodes of hypotension (with no additional vasopressors) in both our patients. This is the first reported case series of pericardiectomies performed with this technology, and we believe its use allows off-pump pericardiectomy to be performed with a greater margin of patient safety.

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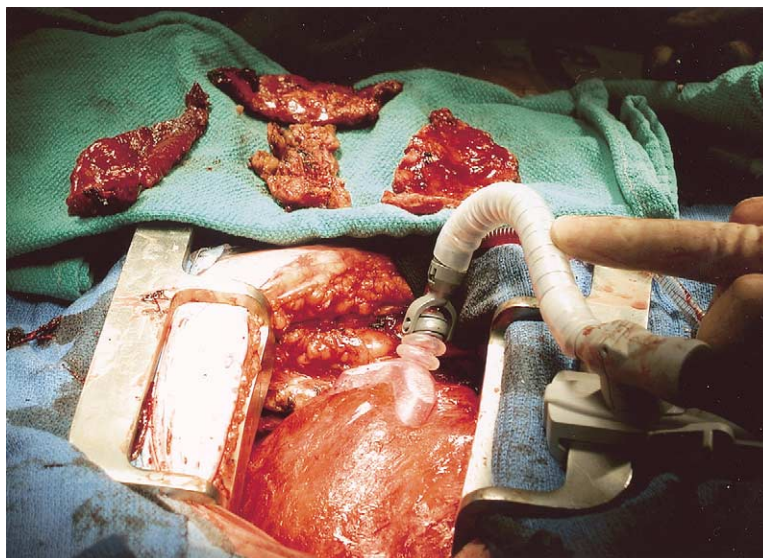
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**Figure 1.** Intraoperative photograph demonstrating position of Starfish retractor on cardiac apex before decortication of visceral pericardium. Previously resected sections of parietal pericardium shown are also shown.

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## Pulmonary venous pathway obstruction from recurrent restriction at atrial septum late after Fontan procedure

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**L**ong-term outcome of patients after the Fontan procedure is currently excellent.<sup>1</sup> Despite initial reports with high incidence of postoperative obstruction of pulmonary venous pathway,<sup>2</sup> this complication has become rare.<sup>3,4</sup> When it does occur, it can cause severe dete-

rioration of the cavopulmonary circulation,<sup>2,3</sup> and reoperation is usually necessary. We report our experience with 3 patients presenting with this lesion late after cavopulmonary connection, with the aim of better understanding the potential causes of this complication. We also discuss methods of prevention and treatment.

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#### Patients and Methods

Between January 1984 and November 2002, a total of 1092 patients with single-ventricle physiology underwent Fontan procedures at Children's Hospital Boston. Among these patients, 268 were admitted for reoperation, including 3 patients with the diagnosis of isolated pulmonary venous pathway obstruction 8, 23, and 42 months after the Fontan procedure. Patients 1 and 3 had a diagnosis of hypoplastic left heart syndrome, whereas patient 2 had diagnosis of heterotaxy syndrome with situs inversus, double-outlet right ventricle, and unbalanced atrioventricular canal with pulmonary stenosis. None of the patients had obstructive pulmo-