LETTERS TO THE EDITOR

Intramural migration of implantable cardioverter-defibrillator patch

To the Editor:

Despite all modifications of patch implantation and fixation techniques, patch crinkling and folding causes significant morbidity. We agree with Molina, Benditt, and Adler¹ that the observed incidence of this complication is unacceptably high.

A recent case of ours illustrates an extreme consequence of patch crinkling. A patient with dilated cardiomyopathy and chronic atrial fibrillation, now 58 years old, had first undergone placement of an implantable cardioverter-defibrillator (ICD) at an outside hospital in 1989. At that time a Ventak 1600 AICD device (Cardiac Pacemakers, Inc., St. Paul, Minn.) had been connected to two epicardial patches and to two epimyocardial screw-in type electrodes. All electrodes were placed via a subxiphoid approach. How the patches were secured could not be determined from the old records. The device was replaced by a Ventak 1705 AICD device in 1992. Until 1994 eleven episodes of ventricular tachyarrhythmias had been terminated by the device. In 1994 first signs of an ICD pocket infection were observed. A labeled white cell scan aroused suspicion of additional mediastinal infection. When the patient was referred to our department in March 1995, a small area of skin over the ICD pocket was beginning to necrose. The skin over the AICD device was bulging because the device was not lying in a coronal plane, but in a nearly horizontal position. With the likely diagnosis of an ICD system infection, we opted to explant the generator and the lead system: some turbid fluid was found in the ICD pocket, and cultures grew a sensitive strain of *Staphylococcus epidermidis*. Patch explantation was not possible through a subxiphoid incision. Dissection proceeded via a median sternotomy. There were dense intrapericardial adhesions. The anterior epimyocardial patch electrode appeared embedded in fatty tissue over the acute right ventricular margin. After it was removed it became obvious that the patch had formed part of the right ventricular free wall: bleeding from the right ventricle was only poorly controlled with digital pressure. Right ventricular repair over an inflated Foley catheter or similar methods did not seem appropriate. Cardiopulmonary bypass was required, which was initiated by means of a cannula in the ascending aorta and blood returning to the pump via cardiectomy suction at first, then converted to femoral vein cannulation, because the right atrium was not accessible as a result of dense scar tissue. After the right ventricle had been repaired with sutures buttressed with two strips of pericardium, we attempted to free the other patch. The patch was overlying the right atrium and dissection had to be abandoned because of practically impenetrable scar tissue. The patient was weaned from cardiopulmonary bypass. A closed mediastinal irrigation/suction system was placed. The recovery was uneventful. Antibiotics were given for 4 weeks. Eight weeks after this

partial removal, the patient remained free of any signs of infection and he underwent implantation of a new ICD system (pectoral "active can," Medtronic 7219C [Medtronic, Inc., Minneapolis, Minn.] with a single transvenous lead). The postoperative course was uneventful.

Patch migration into the right ventricular free wall still allowed the old system to function properly at 34 joules (which was the programmed energy setting; a defibrillation threshold had not been redetermined after the initial implantation). Significant technical problems arose from patch migration in this case. We are aware that the standard management of an infected lead system dictates complete removal of all foreign material. We did compromise and left the atrial patch in place, because a large portion of the right atrium would have had to be reconstructed if we had injured the wall.

It is conceivable that a mediastinal infection had caused the severe adhesions,² as well as the migration of the patch to its intramural position.

This case lends further support to the conclusions drawn by Molina, Benditt, and Adler¹ and sheds additional light on possible severe problems with ICD patch removal.

Ulrich Wolfhard, MD

Fred H. Splittgerber, MD

Essen University Medical School Medical Center

Department of Thoracic and Cardiovascular Surgery

Hufelandstr. 55

D-45122 Essen, Germany

REFERENCES

1. Molina JE, Benditt DG, Adler S. Crinkling of epicardial defibrillator patches: a common and serious problem. *J THORAC CARDIOVASC SURG* 1995;110:258-64.
2. Kassanoff AH, Levin CB, Wyndham CR, Mills LJ. Implantable cardioverter defibrillator infection causing constrictive pericarditis. *Chest* 1992;102:960-3.

12/8/70878

Echo-free perfused space after homograft replacement of aortic valve: A morphologic study

To the Editor:

We read with interest the letter from Carrel and coworkers¹ regarding a peculiar echocardiographic finding after homograft replacement of the aortic valve, which they called "echo-free perfused space."

We recently dealt with a similar case. A 64-year-old man with chronic hepatitis C came to our observation in very poor condition after acute endocarditis caused by *Staphylococcus hominis*. Twelve years previously, he had undergone aortic valve replacement for aortic stenosis with a 25 mm Medtronic Hall valve (Medtronic, Inc., Minneapolis, Minn.). Transesophageal echocardiography

Fig. 1. A small space, about 2 mm, is visible between the aortic and homograft walls at macroscopic examination. Dehiscence of the suture is evident.

Fig. 2. Microscopic study shows the space containing fibrin. No sign of degeneration of the walls is present. A mass of fatty and muscular tissue, coming from the homograft, is visible between the vessels.

showed a normally functioning aortic valve prosthesis with a large paravalvular leak and an abscess cavity between the aortic wall and the left atrium. After medical treatment and improvement in clinical condition, the patient underwent débridement of the abscess cavity to aortic prosthesis replacement with a fresh homograft 22 mm in size secured with interrupted 3-0 Tevdek sutures (Deknatel Division, Fall River, Mass.) reinforced with pledgets. Transesophageal echocardiography performed immediately after the operation showed a well-functioning aortic prosthesis with depressed left ventricular function. A small echo-free perfused space was evident between the aortic and the homograft walls, located at the site of the previous abscess. No significant hemodynamic problems, and particularly no obstruction of the left ventricular outflow tract, were found. Unfortunately, in the postoperative course the patient had intractable low-output syndrome and died of multiorgan failure 2 days later. An autopsy was performed and the aortic root was examined. Macroscopic examination showed a very small space, about 2 mm large, between the aortic wall and the homograft and a dehiscence of the proximal suture (Fig.

1). At microscopy, the space was filled with fibrin and there was no degeneration of the aortic or homograft walls. Fatty and muscular tissue from the external layer of the homograft was lying between it and the aortic wall of the host (Fig. 2).

In 75% of their patients that had undergone aortic valve replacement with homograft, Carrel and associates¹ found a characteristic echographic finding, which they called "echo-free perfused space." They postulated that this space was related to a local dehiscence of the proximal suture line in an area of severe intrinsic structural failure. Results of the morphologic study of our patient at autopsy allow us to support the hypothesis that the echo-free perfused space is caused by a local dehiscence of the subcommissural proximal suture, rather than a structural failure of the aortic wall. No signs of necrosis of endomyocardial layer were found in our patient. Previous inflammation and consequent edema of the aortic wall could be a predisposing factor.

To our knowledge, no complications have been reported from the echo-free space; however, the dehiscence at the proximal suture site may represent an additional risk for rupture, embolus or infection. Consequently, use

of additional stitching and fibrin glue may be indicated, and a closer follow-up is mandatory in the postoperative period.

Paolo Masiello, MD^a
Generoso Mastrogiovanni, MD^a
Rosa Russo, MD^b
Pasquale Angrisani, MD^b
Giuseppe Di Benedetto, MD^a
Divisions of Cardiac Surgery^a and Pathology^b
Hospital S. Giovanni di Dio e Ruggi D'Aragona
Salerno, Italy

REFERENCE

1. Carrel T, Pasic M, Oechslin E, Jenni R, Turina M. Echo-free perfused spaces: a current postoperative finding after homograft replacement of the aortic valve. *J THORAC CARDIOVASC SURG* 1994;108:786-7.

12/8/69752

Reply to the Editor:

I am pleased to add a brief comment to the well-illustrated case described here by Masiello and colleagues confirming by macroscopic and histologic examination what we called "echo-free perfused space," or pseudoaneurysm. We defined pseudoaneurysm after aortic allograft implantation as echo-free perfused space between the native aortic wall and the residual aortic wall (the left ventricular outflow tract tissue) of the allograft observed on postoperative echocardiography. After fortunate detection of a pseudoaneurysm late after operation in one patient and early detection in another patient who required immediate reoperation, all patients who had allograft implantation were reviewed retrospectively and Doppler echocardiographic examinations were carefully studied.

The development of pseudoaneurysms could not be correlated with the infective status (active or eradicated endocarditis) at the operation, but localization of pseudoaneurysms seems to correlate with the localization of preoperative abscesses or perivalvular leaks (in prosthetic valve endocarditis). The technique of allograft implantation (interrupted or continuous proximal suture line) did not influence subsequent development of echo-free perfused spaces.

After the real incidence of abnormal but mainly insignificant echocardiographic findings was known, our group described the use of fibrin glue in aortic allograft implantation.¹ Glue is applied immediately after completion of the proximal suture line (at this time, the allograft is still inverted into the left ventricle) and during completion of the distal suture line. There is another advantage of using fibrin glue in patients with active endocarditis at the time of surgery: glue can be mixed with antibiotics, which may help to eradicate valvular and perivalvular infection or to sterilize an abscess cavity.² However, elimination of echo-free perfused spaces is best realized during implantation

of allograft by using the miniroot aortic valve replacement technique.

T. Carrel, MD
Clinic for Thoracic and Cardiovascular Surgery
University Hospital
CH-3010 Berne, Switzerland

REFERENCES

1. von Segesser LK, Oechslin E, Jenni R, Turina M. Use of glue to avoid formation of perfused recesses in aortic allograft implantation. *Ann Thorac Surg* 1994;57:494-5.
2. Pasic M, von Segesser LK, Turina M. Implantation of antibiotic-releasing carriers and in-situ reconstruction for treatment of mycotic aneurysms. *Arch Surg* 1992;127:745-6.

12/8/69783

Improved distribution of retrograde cold cardioplegic solutions

To the Editor:

In a recent article in this JOURNAL, Rudis, Gates, and Laks¹ showed conclusively that retrograde coronary sinus perfusion solutions may be distributed unevenly and leave the right ventricle inadequately protected as a result. They corrected this inhomogeneity of perfusion by occluding the coronary ostium with a purse-string suture, thereby preventing reflux and decompression of coronary veins proximal to the self-inflating balloon.

Most surgeons have probably noticed that the coronary veins closest to the coronary sinus ostium are often not fully distended during intermittent retrograde perfusion of cold cardioplegic solutions. Furthermore, the right ventricle remains relatively warm. However, when the ostium of the coronary sinus is occluded by digital compression (at the junction of the right atrium and inferior vena cava), all of the coronary veins become distended and the right ventricle becomes cold immediately. The rate of flow must usually be reduced to avoid excessive perfusion pressures to compensate for the elimination of reflux.

Other technical strategies, such as double balloon catheters, may achieve the same purpose, but the method described here is safe, simple, and inexpensive, and it adds only 3 or 4 minutes to the average cardiopulmonary bypass time.

Noel H. Fishman, MD
Department of Cardiothoracic Surgery
Dominican Hospital
1575 Soquel Dr.
Santa Cruz, CA 95065

REFERENCE

1. Rudis E, Gates N, Laks H. Coronary sinus ostial occlusion during retrograde delivery of cardioplegic solution significantly improves cardioplegic distribution and efficacy. *J THORAC CARDIOVASC SURG* 1995;109:941-7.

12/8/71011