5. Chapoutot L, Nazeyrollas P, Metz D, et al. Floating right heart thrombi and pulmonary embolism: diagnosis, outcome and therapeutic management. Cardiology 1996;87:169–74.
6. Greenfield LJ, Proctor MC, Williams DM, et al. A long term experience with transvenous catheter pulmonary embolectomy. J Vasc Surg 1993;18:450–7.
7. Decousus H, Leizorovicz A, Parent F, et al. A clinical trial of vena cava filters in prevention of pulmonary embolism in patient with proximal deep-vein thrombosis. N Engl J Med 1998;338:409–15.

Epicardial Left Ventricular Mapping Using Subxiphoid Video Pericardioscopy

Marco A. Zenati, MD, Alaa Shalaby, MD, Gregory Eisenman, RT(R), John Nosbisch, BSN, RCIS, Jeremy McGarvey, BS, and Takeyoshi Ota, MD, PhD

Division of Cardiac Surgery, University of Pittsburgh, and Sections of Electrophysiology, VA Pittsburgh HealthCare System and University of Pittsburgh, Pittsburgh, Pennsylvania; and St. Jude Medical Inc, Minnetonka, Minnesota

FEATURE ARTICLES

We report a novel subxiphoid video pericardioscopy approach for epicardial mapping that allows direct visualization of the epicardium with minimal use of fluoroscopy. The FLEXview system (Boston Scientific Cardiac Surgery, Santa Clara, CA), which is capable of a free navigation around the heart owing to its flexible neck, was inserted into the pericardial space through a small subxiphoid incision. A commercially available mapping catheter advanced through the working port of the device could be navigated around virtually the entire biventricular epicardial surface. The subxiphoid video pericardioscopy approach using the FLEXview system provided adequate visualization and access to the epicardium of both ventricles for electroanatomic mapping while minimizing surgical invasiveness.

(Ann Thorac Surg 2007;84:2106–7)

Treatment of ventricular tachycardia (VT) remains a challenge due to inaccessibility of the epicardial left ventricular (LV) myocardium from the endocardial approach. It is estimated that up to 40% of patients with hemodynamically unstable VT require additional epicardial ablation after an endocardial ablation attempt, and 57% of those with previously failed ablations have an epicardial circuit [1]. Sosa and Scanavacca [2] described a subxiphoid approach for LV epicardial mapping; however, this technique requires significant fluoroscopically guided catheter manipulation [3] and lacks sufficient visualization of epicardial landmarks. In this report, we present a novel subxiphoid video pericardioscopy (SVP) approach for epicardial mapping that allows direct visualization of the LV epicardium with minimal use of fluoroscopy.

Mr Eisenman discloses a financial relationship with St. Jude Medical, Inc.

Accepted for publication July 9, 2007.

Address correspondence to Dr Zenati, Division of Cardiac Surgery, University of Pittsburgh, C700 PUH, 200 Lothrop St, Pittsburgh, PA 15213; e-mail: zenatim@upmc.edu.

A 48-year-old man with an extensive cardiac history, including two myocardial infarctions, congestive heart failure, and ischemic cardiomyopathy, presented with recurrent hemodynamically intolerable VT and multiple firings of the implantable cardiac defibrillator. After unsuccessful maximal pharmacologic management and endocardial radiofrequency ablation, the patient was deemed a candidate for epicardial LV mapping and ablation.

After induction of general anesthesia and successful placement of the endotracheal tube, the intended subxyphoid and femoral access sites were prepped and draped using sterile technique. Percutaneous femoral arterial/venous sheaths were inserted and electrophysiology multielectrode catheters were advanced into the right atrium, coronary sinus, and right ventricle. Then a 15 mm subxyphoid incision was made followed by minimal tissue dissection down to the pericardial level. A small (5 mm) pericardiotomy was performed under direct visualization. A SVP device (FLEXView System; Boston Scientific Cardiac Surgery, Santa Clara, CA), consisting of a 7-mm extended length endoscope with two proximal entry service ports (Figs 1A and B), was then inserted inside the pericardial cavity and the anterior LV was easily visualized (Figs 1C and D).

Through one of the working ports of the FLEXView device, a 6F decapolar catheter (St. Jude Medical, Minnetonka, MN) was introduced and directly visualized through the FLEXView scope to have proximal electrodes in contact with the LV epicardium. A three-dimensional geometric shell and voltage map (Fig 2) was then created of the collected points by using a noncontact mapping system (NAVX; St. Jude Medical). Scope and catheter position were cross-referenced in orthogonal views using brief fluoroscopy views.

The atrial surface was excluded using direct visualization through the endoscope and cardiac electrogram signals. The patient was found to have a large anterolateral scar with an isthmus of moderate voltage tissue on the voltage map that was defined as a potential target for ablation.

The target site was visualized to have a thick epicardial fatty surface and was found to be directly adjacent to a patent left anterior descending artery by coronary angiography. Given a high risk for occlusion of the left anterior descending artery, radiofrequency ablation was not performed. The incision was closed with a pericardial drain left in place. The procedure lasted a total of 4 hours 37 minutes, with 10 minutes 45 seconds of fluoroscopy time.

Comment

A significant percentage of hemodynamically unstable and ablation-resistant VT has an epicardial component

0003-4975/07/$32.00
doi:10.1016/j.athoracsur.2007.07.032

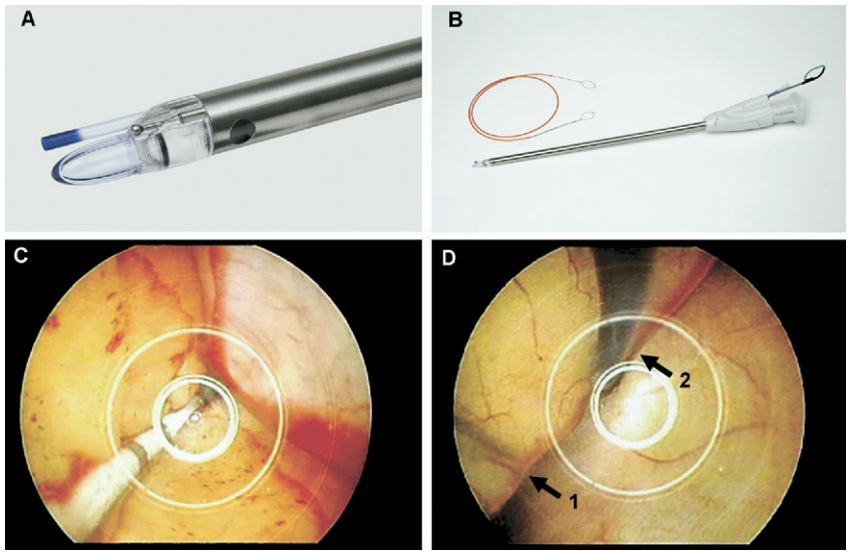

Fig 1. (A and B) FLEXView device (Boston Scientific Cardiac Surgery, Santa Clara, CA). (C) FLEXView pericardioscopic view of the mapping catheter and (D) coronary artery (arrow 1) and vein (arrow 2).

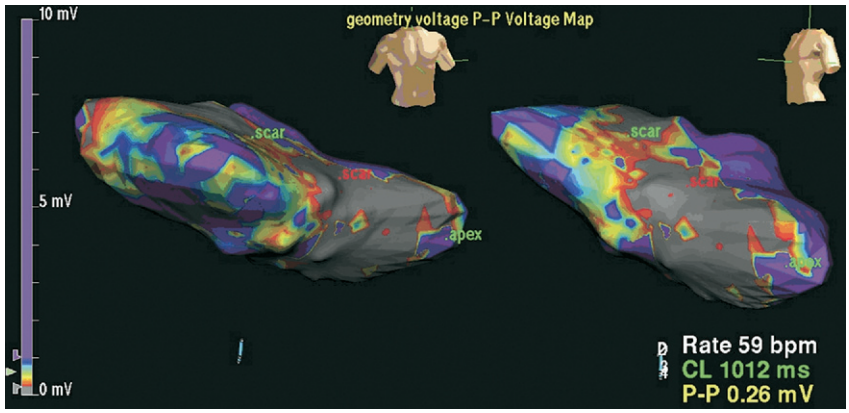

Fig 2. A NAVX (St. Jude Medical, Minnetonka, MN) three-dimensional geographic substrate map of the left ventricle in frontal and left oblique views shows an isthmus of low-amplitude activation targeted for ablation.

that requires epicardial mapping and ablation. The subxiphoid approach for epicardial LV mapping described by Sosa and Scanavacca [2] does not allow access for targeted epicardial ablations and relies heavily on prolonged use of fluoroscopy. Furthermore, alternative approaches such as coronary vein mapping are inherently restricted to their area of distribution. Average fluoroscopy times in one published catheter-based epicardial mapping study were considerably higher, at 48.2 minutes, than the 10.75 minutes in this report [3].

The SVP approach using the FLEXView system provided adequate visualization and access to the epicardium of both ventricles for electroanatomic mapping, while minimizing surgical invasiveness. We believe that the subxiphoid video pericardioscopic approach may facilitate minimally invasive ablation of VTs and further develop related minimally invasive epicardial interventions [4]. With specialized, dedicated tools for surgical mapping and ablation on the epicardium, minimally invasive subxiphoid techniques have the potential to reduce associated risks while allowing unrestricted epicardial access. We hope in the future to further reduce fluoroscopy times using this technique and to use novel minimally invasive robotic probes for increased access to remote epicardial locations for mapping and ablation [5].

The FLEXView device was purchased from Boston Scientific.

References

1. Schweikert RA, Saliba WI, Tomassoni G, et al. Percutaneous pericardial instrumentation for endo-epicardial mapping of previously failed ablations. Circulation 2003;108:1329–35.
2. Sosa E, Scanavacca M. Epicardial mapping and ablation techniques to control ventricular tachycardia. J Cardiovasc Electrophysiol 2005;16:449–52.
3. Soejima K, Couper G, Cooper JM, Sapp JL, Epstein LM, Stevenson MD. Subxiphoid surgical approach for epicardial catheter-based mapping and ablation in patients with prior cardiac surgery or difficult pericardial access. Circulation 2004;110:1197–201.
4. Zenati MA, Bonanomi G, Chin AK, Schwartzman D. Left heart pacing lead implantation using subxiphoid videopericardioscopy. J Cardiovasc Electrophysiol 2003;14:949–53.
5. Ota T, Degani A, Zubiate B, et al. Epicardial atrial ablation using a novel articulated robotic medical probe via a percutaneous subxiphoid approach. Innovations 2006;1:335–40.