CREATIVE CONCEPTS

"Needle-in-needle" epicardial access: Preliminary observations with a modified technique for facilitating epicardial interventional procedures

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Introduction

Since the original technique described by Sosa et al,[1] percutaneous nonsurgical epicardial access has become an important adjunctive tool in the catheter ablation of ventricular tachycardias (VTs) and other arrhythmias.[1–16] Significant pericardial bleeding (>80 mL) is the most common complication of epicardial access, with a reported incidence ranging from 3.7% to 10%[6,11,12,17,18] and is usually due to inadvertent right ventricular (RV) puncture, which may be severe enough to require surgical repair.[6,11] Methods to improve safety are of interest.[19–21]

We previously attempted access with a long 21-gauge (G) micropuncture needle, believing that inadvertent cardiac or vascular puncture with this needle may be less likely to result in significant bleeding. However, it was sometimes challenging to direct the needle under the sternum because it tended to flex over the course of insertion, and tactile assessment of force and perception of cardiac motion was limited. In this report, we describe our initial experience with the "needle-in-needle" (NIN) technique of epicardial access in which a short 18G needle is inserted under the sternum and the long 21G needle is inserted through the 18G needle. It is hoped that this technique improves the stability of the small needle and potential tactile feedback, thus reducing the risk of significant pericardial bleeding. We report preliminary results of its procedural success and acute complications compared with the standard Sosa technique,[1] which uses a 17G or 18G Touhy needle.

KEYWORDS Epicardial access; Pericardial bleeding; Ventricular tachycardia; Atrial tachycardia; Supraventricular tachycardia

ABBREVIATIONS **BWH** = Brigham and Women's Hospital; **Fr** = French; **G** = gauge; **NIN** = needle-in-needle; **RV** = right ventricle; **UPMC** = University of Pittsburgh Medical Center; **VT** = ventricular tachycardia

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Methods

Consecutive patients undergoing epicardial access for catheter ablation of atrial or ventricular arrhythmias or left atrial appendage closure from 2 centers (Brigham and Women's Hospital, [BWH] and University of Pittsburgh Medical Center [UPMC]) were included in the study. Patients from BWH underwent these procedures between 1999 and 2014, whereas those from UPMC underwent procedures between 2007 and 2014. Patients who underwent epicardial access at these centers switched from the Sosa technique to the NIN technique in 2014. Thus, in this report, we compared outcomes of a prospectively collected cohort undergoing epicardial access using the NIN technique to a retrospective cohort who underwent epicardial access with the Sosa technique. All patients gave written informed consent for their procedure. At both hospitals, procedures were performed according to protocols approved by the Hospital's Subject Protection Committee, and reporting of outcomes were in accordance with approvals granted by the Institutional Review Boards at both institutions. The present study overlaps and expands on the population reported from previous studies from the BWH.[7,17,22]

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Sosa technique of epicardial access

The Sosa technique for percutaneous epicardial access has been previously described in detail.[1] In brief, a 6-inch, 17G or 18G, 152-mm Tuohy needle (Hakko Cooperative Ltd, Chikuma-shi, Naganoken, Japan) was advanced below the xiphoid process under fluoroscopic guidance to the border of the cardiac silhouette. Small-volume contrast injection was used to identify the pericardium and confirm entry into the pericardial space. A guidewire was placed into the epicardial space, and a long sheath was advanced over the wire. The ablation catheter was then positioned in the epicardial space through the long sheath. The procedures were performed by 7 different operators with varying levels of experience.

NIN technique of epicardial access

The NIN technique uses an 18G Cook needle (Percutaneous Entry Thinwall Needle, 18G, 7 cm, Cook Medical, Bloomington, IN) and a 21G micropuncture (Cook Medical) or long spinal needle (Chiba Biopsy needle 21G, 20 cm, Cook Medical; Figures 1A and 1B). The technique expands on that described by Sosa et al,[1] with some important variations (see Online Supplementary Video). The technique involves the following:

1. Subxiphoid insertion of an 18G Cook needle is made through superficial tissue to a point just before the cardiac silhouette (Figure 1B).
2. A 21G micropuncture needle is inserted through the 18G Cook needle (Figures 1B and 1C).
3. The 21G needle alone is used to enter the pericardial space while maintaining the position of the Cook needle steady (Figure 1C) with the aid of contrast, fluoroscopy, and tactile sensation of entry into the pericardial space (Figures 1D-1G).
4. An 0.18G guidewire with a floppy tip (Hi Torque Steelcore 18 guidewire with microglide coating, 0.018 inch, 190 cm, Abbott Vascular, Santa Clara, CA) is advanced through the 21G needle into the pericardial space (Figure 1H-1J). As with the Sosa technique, confirmation that the wire is in the pericardial space is obtained by demonstrating on fluoroscopy that the wire crosses multiple cardiac chambers and hugs the border of the lateral left cardiac silhouette in the left anterior oblique projection (Figures 1K and 1L).
5. Both needles are removed (Figures 1M and 1N), and a micropuncture dilator is advanced into the pericardial space over the 0.18G guidewire (Figure 1O) and then exchanged for a 6 French (Fr) or 8Fr dilator (Figure 1P).
6. Confirmation of pericardial entry is again obtained with contrast and/or fluid aspiration (Figure 1Q).
7. The 0.18G guidewire is exchanged for a floppy-tip 0.35-inch Bentson wire (Cook Medical; Figure 1R).
8. An 8Fr sheath with dilator is inserted over the 0.35-inch wire (Figure 1S).

When maintaining the option for a second pericardial access, a second 0.35- or 0.32-inch wire is inserted into the 8Fr sheath (Figures 1T and 1U), the 8Fr sheath removed and the sheath desired for introducing the catheter, usually a long steerable sheath (Agilis, St. Jude Medical, Minneapolis, MN) is inserted while retaining the remaining guidewire for introduction of a second sheath if desired, for example, for a balloon to protect the phrenic nerve (Figure 1V).

Low-quality fluoroscopy was maintained during all parts of the epicardial access except in situations in which the NIN apparatus or the guidewire was not adequately visualized. In the latter situation, fluoroscopy dose was increased incrementally until the operator was comfortable with image quality. This increment in fluoroscopy dose was minimized to only the critical part of the procedure.

Outcomes

The following outcomes were compared between the 2 groups: (1) successful epicardial access; (2) incidence of major pericardial bleeding (defined as >80 mL of bleeding); and (3) incidence of other complications related to epicardial access (eg, injury to subdiaphragmatic vessels and abdominal viscera or coronary artery injury).

Statistical analysis

The Statistical Package for the Social Sciences for Windows (release 22, IBM SPSS, Armonk, NY) was used for analysis. Continuous variables are expressed as mean $\pm$ SD (normally distributed) or median with range (if not normally distributed). Mean values were compared using the Student t test if normally distributed. To test for associations between categorical variables, the χ^2 test or Fisher exact test was used. A 2-tailed $P < .05$ was considered significant.

Results

Baseline characteristics

The study population comprised 314 patients in whom epicardial access was obtained, using the Sosa technique in 291 patients and the NIN technique in 23 patients (Table 1).

There were no significant differences between the Sosa vs the NIN groups with regard to age, gender, body mass index, etiology of heart disease, left ventricular ejection fraction, or history of prior cardiac surgery (Table 1). Patients who underwent Sosa access were more likely to have VT as their procedural indication, whereas NIN patients had a more diverse spread of procedures, including ablation of premature ventricular contractions, left atrial appendage closure, epicardial phrenic nerve displacement procedures, and ablation of supraventricular tachycardia (Table 1).

Success rate of epicardial access

Epicardial access attempts were successful in 297 of 316 procedures (94%) performed with the Sosa technique (266/291 patients [91%]). Epicardial access attempts were successful in 23 procedures performed with the NIN technique (23 patients [100%]; Table 1). Failure of epicardial access in the Sosa group were due to prior cardiac surgery (6) or adhesions from prior epicardial mapping/ablation or episodes of pericarditis (13).