Introduction

The idea of nonsurgically entering the normal pericardial sac for diagnostic or therapeutic purposes was unrealistic until recently. This was largely due to the perception that access to the pericardial space by a pericardial puncture was only safely possible in the presence of a sizable pericardial effusion.

Novel techniques have been developed to access the pericardial space even with small or no effusion. These techniques might enable us to make use of this space to treat cardiovascular disease in the near future [1]. Two techniques have been applied to achieve percutaneous access into the normal pericardial sac in humans and additional two were investigated in animal studies. These techniques will be reviewed in the following sections [1–8].

Subxiphoid Pericardiocentesis Using a Tuohy Needle and Fluoroscopy

Pericardial access in the absence of effusion was first reported by Sosa et al. [9] in 1996 in three patients undergoing epicardial mapping for ventricular tachycardia. He used a Tuohy needle and fluoroscopy control for subxiphoid pericardiocentesis. The same methodology was subsequently used by other authors [10–12] to access the normal pericardium. Mannam et al. [13] used this technique to evacuate small pericardial effusions. The Marburg center has followed this approach also in selected patients with very small or no effusion for intrapericardial treatment.

Technique and Potential Complications

The needle is introduced at the 45° angle in the direction of the left scapula. As the needle approaches the heart under fluoroscopic guidance, small amounts of contrast media are injected to document the penetration of the needle tip into the pericardial space. The angle of the needle can be further adjusted in order to perform the pericardiocentesis at the area of the medial third of the right ventricle and avoid major coronary vessels. The proper positioning of the needle is associated with layering of the contrast in the pericardial space. Catheters placed at the right ventricular apex and in the coronary sinus are useful markers to guide the needle tip.

The needle can occasionally perforate the right ventricle, which is noticed by the lack of layering of the contrast in the pericardial space and its prompt disappearance in the outflow tract of the right or rarely left ventricle. In case that happens, the needle is slightly retrieved and contrast medium is injected
until the pericardial space is reached. Once the needle tip is in the pericardial space, a soft floppy-tip guidewire is introduced in the pericardial space. The guidewire position is also monitored by fluoroscopy. Standard electrocardiography can provide another important clue about the position of the guidewire since an intrapericardially placed guidewire will not cause any arrhythmias in contrast to the guidewire placed intracardially. No lateral manipulations of the distal end of the needle should be performed in order to avoid laceration of the right ventricle or coronary veins.

Finally, the guidewire is exchanged for an introducer sheath and catheter and the pericardial fluid is aspirated to check for potential hemorrhage. Only a trivial amount of translucent pericardial fluid is expected. Subsequently an ablation catheter is passed into the pericardial space [14] or a pigtail catheter for application of intrapericardial treatment.

Feasibility and Safety

In the early phase of this study Sosa et al. [9, 15, 16] used electrocardiographic monitoring for ST-segment elevation from the precordial lead attached to the puncturing needle. Along with the accumulation of the experience (~250 patients with ventricular tachycardia and atrial fibrillation), this step became unnecessary. Actually, a good fluoroscopy and feeling of the heart beat touching the blunt needle tip became the most crucial step for the safety of this approach. It should be further evaluated if the use of continuous infusion of saline to create positive pressure to push the right ventricle away from the needle tip has significant impact on the safety or feasibility of the procedure.

In the initial report by Sosa et al. [9] the subxiphoid pericardial access was feasible and safe in all three patients. In the subsequent experience published in 1998 Sosa et al. [15] described in 1/10 patients hemopericardium requiring drainage, and retrosternal discomfort and pericardial friction rub in another 3/10 patients [15]. Reporting on the safety of the procedure in 2000 Sosa et al. [17] have mentioned accidental right ventricular perforation in 4/53 patients (7.5%) and in 3 of them a small hemopericardium of up to 50 ml which could be drained with a pigtail catheter at the electrophysiology laboratory. Three out of 53 patients complained of precordial discomfort and two of these had a pericardial rub. These patients were successfully treated with non-steroid anti-inflammatory drugs.

When the results of the same pericardial access technique were analyzed in a consecutive series of 173 patients, there was an 8% rate of self-limiting hemopericardium that resolved with aspiration of the pericardial space and one instance of hemoperitoneum that required surgical ligation (0.6%) [18]. All patients underwent echocardiography after pericardiocentesis and on discharge from the hospital. No other complications were noted.

The same procedure was used by Schweikert et al. [19] in 48 patients with previously failed endocardial ablation. Pericardial access was possible in all patients without any major complications that would require intervention or treatment during or after the procedure.

Josep Brugada et al. [12] reported in 2003 on the successful access to the normal pericardium in 10/10 patients indicated for an epicardial ablation procedure. There were no significant complications (Fig. 6.1). Two patients had chest pain for three days