Conscious Sedation with Sufentanil and Midazolam for Epicardial VT Ablation

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KEYWORDS. conscious sedation, sufentanil, ventricular tachycardia epicardial approach.

Introduction

Sosa et al.,1 percutaneous pericardial access for mapping and ablation of ventricular tachycardia (VT) has been an important component of the successful management of patients with structural heart disease and refractory ventricular arrhythmias. Because catheter manipulation and ablation in the pericardial space is extremely painful, most electrophysiology (EP) centers perform the epicardial VT procedure under general anesthesia (GA). However, GA lowers blood pressure, may interfere with arrhythmia mapping, and the use of muscle relaxants precludes identification of phrenic nerve.

We report our experience with epicardial VT ablation under conscious sedation (sufentanil + midazolam).

Method

Sedation

All patients with epicardial VT ablation performed at our institution between 2006 and 2011 were included in this study. Patients with respiratory failure, chronic obstructive pulmonary disease, allergy to morphine and coronary artery bypass graft surgery were excluded. Patients intubated before the procedure for arrhythmia storm or cardiogenic shock were also excluded from the study.

All patients received premedication (hydroxyzine 0.15 mg/kg and midazolam 0.04 mg/kg) the day before the ablation. It was repeated 2 h before starting the procedure.

Sufentanil (5 μg intravenous bolus) was administered just before the epicardial puncture; further bolus doses (up to four times, 10-min interval between boluses) were given thereafter as needed to maintain satisfactory analgesia. Intravenous boluses of midazolam were repeated (up to four times) depending on the level of consciousness and anxiety (Figure 1).

The authors report no conflicts of interest for the published content.

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INNOVATIVE TECHNIQUES

RESEARCH ARTICLE

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All drug doses were adjusted according to the renal function of patients (doses were spaced).

The electrophysiologist was responsible for the whole procedure, including administering drug sedation. All operators are familiar with tracheal intubation and cardiopulmonary resuscitation. Generally two nurses assist the operator during the procedure, one for
monitoring the patient’s consciousness and clinical parameters and the second for the EP procedure.

At all times, an anesthesiologist was available on call on the same floor if needed.

**Puncture and ablation**

As there is no adhesion, the pericardial space is a virtual cavity, with only 15–50 mL of fluid. Sosa and colleagues developed a technique of subxiphoid percutaneous puncture for entry into this potential space using a needle designed for epidural access (Figure 2).

With patients under conscious sedation, the pericardium was accessed via a percutaneous subxiphoid puncture, using an epidural needle (Tuohy bevel, 18 gauge, 1.3 × 80 or 150 mm; Braun, Kronberg, Germany), originally developed to attain epidural access.

The needle has a smoothly curved distal end, intended to facilitate entry into a potential space, and to hopefully decrease the likelihood of a traumatic myocardial puncture. Percutaneous subxiphoid epicardial access was performed before heparin infusion in patients with international normalized ratios <2.0.

Skin entry is generally 2–3 cm below the xiphoid process. There are two approaches (anterior and posterior). We prefer the anterior one, directing the needle superiorly, aiming for the right ventricular apex in the strict lateral projection (Figure 2).

A small contrast injection helps access to the pericardial space; some tenting is seen when needle is in contact with the parietal pericardium; the heart shape is outlined when contrast diffuses in the pericardial space. This approach facilitates access to the anterior aspect of the right and left ventricles (Figure 2).

Externally irrigated tip catheters (3.5-mm tip, Thermocool, Biosense Webster, Diamond Bar, CA) were used for epicardial radiofrequency (RF) mapping and ablation. During epicardial ablation, the power ranged from 20 to 50 W, with irrigation of 10–30 ml/min. Intrapericardial fluid was drained by aspiration from the access sheath periodically after RF ablation or continuously by a vacuum system connected to the epicardial sheath, which was 0.5- to 1-F larger than the ablation catheter.
Catheter irrigation during epicardial mapping was set at 0 or 1 ml/min and the flow rate was increased during application to get sufficient power for ablation (temperature control mode).

Results

Pericardial access was carried out a total of 76 times in 72 patients (four patients had two procedures for recurrent arrhythmia). Data from these 72 patients (61 male, 56 ± 12 years old) were collected. The patients’ characteristics are presented in Table 1.

The mean duration of the procedure was 248 ± 90 min (endocardial procedure time included). Epicardial ablation was performed in 60 cases with mean radiofrequency duration of 9 ± 11 min. Patients received a mean dosage of 3.2 ± 1.6 mg midazolam and 10 ± 4 μgram of sufentanil.

Because of pericardial bleeding, two patients were transferred to the operating room. One patient had developed metabolic acidosis (a diabetic patient), but no major analgesia-related complications (such as respiratory failure necessitating endotracheal intubation) were observed. The presence of an anesthesiologist was not required in the EP laboratory except for emergency surgery to control epicardial bleeding.

During the same period, four VT ablation procedures with the epicardial approach were performed under general anesthesia. Two patients required deep sedation to control arrhythmic storm, and the two others were under respiratory support after cardiogenic shock.

Discussion

The main finding of the study is that conscious sedation using powerful pain killers, for epicardial VT mapping and ablation, is safe and comfortable. No

![Figure 2: Epicardial puncture. Needle in the pericardial space with the heart shape outlined by contrast.](image)
suction-related complications were observed and the presence of an anesthesiologist was not necessary.

The epicardial approach for VT ablation is often performed on patients with poor left ventricular function and/or incessant arrhythmia after failure of previous treatment. General anesthesia provides comfort, but positive air pressure lowers further blood pressure in unstable patients. In these conditions, the procedure could be difficult and dangerous.

Another inconvenient consequence of using deep sedation is the difficulty to induce arrhythmia; propofol and etomidate have been utilized for suppressing arrhythmia storm, and desflurane and sevoflurane have been demonstrated to inhibit spontaneous postinfarction ventricular arrhythmias in dogs. These can limit the assessment of procedural success.

The left phrenic nerve lies on the pericardium close to the lateral wall of the left ventricle. Before ablating in this area, pacing at high output helps localization of the nerve, and avoids diaphragmatic paralysis by RF injury. Anesthetic agents like muscle relaxants may interfere with adequate characterization of the substrate. In such cases we used sufentanil, which is a powerful opioid with interesting pharmacokinetics properties that make it well suited for EP procedures. Its time-to-peak effect is approximately 180 s, duration of action 60 min and half-life of 180 min. Sufentanil is 5–10 times more potent than fentanyl, with similar or slightly shorter duration of action.

Like other μ-opioid agonists, it potentiates the sedative effect of midazolam.

A recent study evaluated deep sedation (propofol and midazolam) in atrial fibrillation ablation. However the use of powerful opioid has been only sporadically reported for catheter ablation.

Mandel et al described a case in which remifentanil and midazolam were employed for epicardial VT ablation. They used 0.06–0.12 kg/min of remifentanil and intermittent boluses of midazolam (in total 9 mg over 10 h). No discomfort or complications were reported during epicardial puncture and/or mapping/ablation. Remifentanil is also a powerful painkiller with a short half-life (3–4 min). With this opioid, patients are immediately lucid after stopping infusion. In our experience with sufentanil, we had no problems of overdose or analgesia-related complications, despite its relatively long half life.

In 2003, Brugada et al reported their experience in epicardial VT ablation. They performed 10 procedures under conscious sedation using diazepam (10 mg before starting) and fentanyl; they do not describe details of the sedation and analgesia protocols in the paper.

VT ablation is a complex procedure for the electrophysiologist, and supervising sedation requires further concentration. Our results were obtained in a framework of trained nurses, sedation administration, and patient monitoring performed by a designated nurse.

With this analgesia strategy, patient preparation time is shorter than procedures under general anesthesia. It is easy to plan for patients in emergency situations.

In our health-care system, sedation administered and supervised by the electrophysiologist should be more cost effective, the anesthesiologist and his nursing staff are not present all the times in the EP laboratory during the procedure.

Study limitations

The major limitation to our study is the fact that the data are observational, which may be subject to selection bias. Although this study cannot demonstrate an absolute benefit of a conscious sedation for epicardial VT ablation comparing with general anesthesia, it shows the feasibility of such a strategy. Further randomized studies are needed.

Conclusion

Epicardial VT ablation under conscious sedation with sufentanil and midazolam is feasible and safe; one of the advantages is flexibility in patient planning, particularly in emergencies.

References