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Ventricular Tachycardia Ablation Complicated with Ventricular Rupture

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Abstract Patients with cardiomyopathy (CM) are at increased risk for sudden cardiac death (SCD), specifically, secondary to ventricular arrhythmias such as ventricular tachycardia (VT) or ventricular fibrillation (VF). Those that have CM are further stratified based on risk of death from ventricular arrhythmias. If determined high risk, implantable cardioverter-defibrillators (ICD), anti-arrhythmic medication or even ablation procedures are considered in order to minimize the risk of SCD. Ablation procedures have increased in number over the years, along with the recognition of high-risk CM patients. Along with the increase in number of ablation procedures, complications from such procedures have decreased in number and the ventricular arrhythmia ablation remains a relatively low-risk procedure. Here we describe a patient with known CM, specifically hypertrophic cardiomyopathy (HCM) with a relatively rare and high-risk complication, being ventricular aneurysm. HCM patients with ventricular aneurysm are often referred for ablation procedures as they are at a significantly higher risk for SCD due to arrhythmias. Our patient not only underwent an ablation procedure, but suffered from the rare complication of tamponade, which occurs on average <2% annually. Although, risk assessments exist for stratifying CM as high-risk prior to invasive procedures, risk assessments are lacking for the specific population of HCM patients with LV aneurysm, thus presenting us with an area for further research.

Keywords: *ventricular tachycardia, ablation, ventricular rupture, cardiac tamponade*

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1. Introduction

Sustained ventricular tachycardia (SVT), specifically in the setting of cardiomyopathy (CM) or heart failure, poses an increased risk for sudden cardiac death in patients. In fact, sudden cardiac death (SCD) is estimated to be one of the leading causes of death in the United States with approximately 326,000 events a year, of which, approximately 25% have an initial shockable rhythm such as ventricular tachycardia (VT) or ventricular fibrillation (VF) [1]. As such, it is imperative to identify and treat these arrhythmias accordingly, specifically in those patients with known CM.

In patients with hypertrophic cardiomyopathy (HCM) and high-risk features including ventricular aneurysms, the current guidelines recommend an implantable cardioverter-defibrillator (ICD) placement for primary or secondary prevention of SCD [1,2]. ICD shocks are quite effective at terminating VT and ultimately preventing SCD, however, they carry with them, the burden of painful shocks, decreased patient satisfaction and possibly increased mortality [3,4,5]. Thus, augmenting treatment with anti-arrhythmic medication or ablation to reduce number of shocks and arrhythmias becomes necessary. If anti-arrhythmic drugs are not desired, ablations pose a favorable option for the termination of VT arrhythmia, prevention of frequent ICD shocks and to improve patient satisfaction [6,7,8]. Over the last 20 years the number of ablations performed annually in the US has increased and along with it, advancements and improvements in technique and complications. Data collection from VT ablations from the early 2000 to 2014 show a significant decrease in complication risk, which varies based on technique, disease severity and complexity of the patient [9,10,11]. In summary, complication risks are quite low for such a procedure and total less than 7% annually [9,10,11].

Herein we discuss a female who presented with multiple episodes of sustained VT in the setting of HCM with ICD. VT ablation was complicated by cardiac tamponade likely secondary to ventricular aneurysm rupture. Prompt recognition of such a complication is necessary as it may alter prognosis and treatment moving forward.

2. Case Presentation

A 52 year-old female with a past medical history of hypertrophic obstructive cardiomyopathy (HOCM) with inserted ICD presented to our institution with AICD shock. She was diagnosed with HOCM five years ago. She experienced recurrent sustained VT in the 3 months prior to presentation warranting external cardioversion and placement of a dual chamber ICD. She stated that prior to emergency room arrival, she had palpitations lasting 2-3 minutes and a chest burning sensation associated with mild shortness of breath. Afterwards, she felt a sudden shock from her device. She denied any other prodromal symptoms earlier in the day and had no change in exercise activity prior to symptoms. She endorsed compliance with her medications. After AICD shock, her symptoms resolved. Physical examination revealed a well-developed female not in distress. She was afebrile with a blood pressure of 114/79 and a heart rate of 80. Her electrocardiogram showed normal sinus rhythm (NSR) with T wave abnormality and prolonged QTc 474 (Figure 1). Her troponin I was normal. Device interrogation showed 4 episodes of VT noticed; 1 episode of sustained VT, returned to NSR after anti-tachycardia pacing (ATP) therapy; 1 episode of non-sustained VT resolved spontaneously; and 2 episodes of sustained VT, where ATP therapy was attempted and failed, resulting in shock delivery. Cardiac catheterization performed 2 months prior to presentation, showed normal coronaries and an estimated ejection fraction of 75%. She received a bolus of amiodarone 150 mg intravenously then was started on amiodarone drip. She was taken for VT ablation on the next day. During the procedure, monomorphic ventricular tachycardia with at least 3 separate morphologies of premature ventricular tachycardia (PVC) were seen and targeted for ablation. Six radiofrequency applications were applied at the border zone of a left ventricular aneurysm, however, immediately following radiofrequency ablation the patient became hypotensive. Bedside echocardiography showed pericardial effusion likely due to left ventricular aneurysm rupture. Attempts at ablation were aborted given pericardial tamponade. Immediate percutaneous pericardial drainage was attempted and 400ml was drained. The drain remained in place for 24 hours with minimal drainage (<20mL) and subsequently removed on the following day. The repeat transthoracic echocardiography revealed apical aneurysm that was moderate sized with moderate reduction of systolic function. Estimated ejection fraction was 35 % with no effusion (Figure 2). She was started on heart failure medications. The rest of her hospital stay was free of VT episodes.

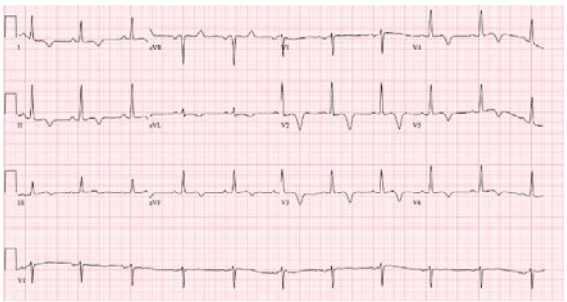

Figure 1. EKG showing normal sinus rhythm with T wave abnormality and prolonged QTc 474

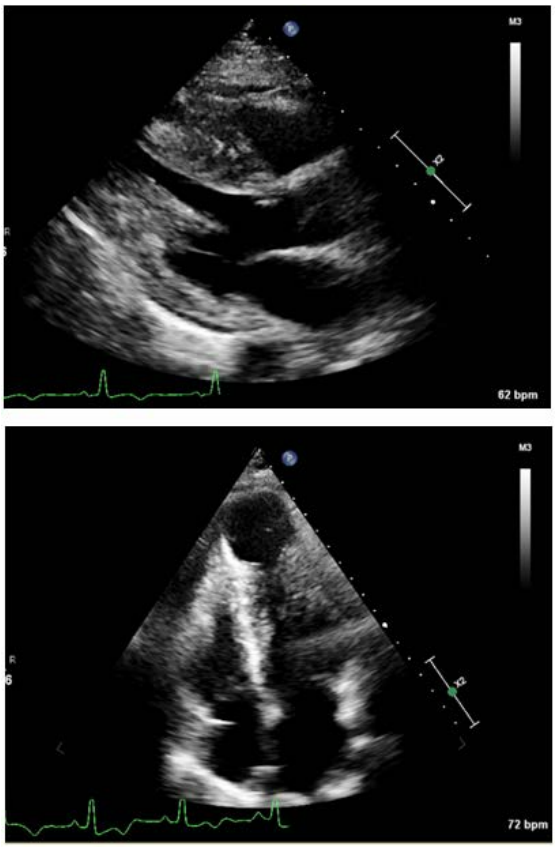

Figure 2. transthoracic echocardiography revealed apical aneurysm that is moderate sized with moderate reduction of systolic function. Estimated ejection fraction was 35% with no effusion.

3. Discussion

Patients with HCM have an increased risk of SCD from arrhythmias, specifically VT. These patients are risk stratified based on high-risk criteria, which commonly include; previous cardiac arrest or sustained arrhythmia, family history of SCD secondary to HCM, frequent syncopal episodes, significant LV hypertrophy, reduced ejection fraction (EF) <50% or the presence of LV aneurysm [2,12]. LV aneurysm alone may increase occurrence of VT arrhythmias up to five-fold in HCM patients [1]. Our patient had both frequent sustained VT episodes and evidence of apical aneurysm on echocardiogram, thus requiring ICD for prevention of further arrhythmias and SCD.

The presence of a ventricular apical aneurysm in a HCM patient is a rare finding. Presence of the ventricular apical aneurysm alone is a predictor of increased mortality and SCD. In a retrospective analysis of 1,940 patients diagnosed with HCM, less than 5% were found to have left ventricular apical aneurysms, in which there was a significantly increased rate of arrhythmia related deaths, thromboembolic events and risk of end stage heart failure compared to their HCM counterparts [13]. High-risk patients, such as our patient, should be offered ICD for primary prevention, but should also be considered for ablation of VT if such arrhythmias should present. In addition, ablation has been shown to be quite effective in such patients. Several studies are showing increased success rates of VT ablation with an epicardial approach

in this sub-set of patients that may be attributed to easier mapping and localization of the focus of VT, which tends to originate around the ring of the ventricular aneurysm [14,15].

Despite benefits for ablation in this small sub-set of patients, the procedure is not without complications. Complications are broad, however over the last 20 years there has been a decreasing rate of complications associated with such procedures. An observational study performed in the US, which looked at approximately 81,000 patient who had received an ablation for VT reported a rate of complications of approximately 11.2% in the early 2000s [9]. The study had limitations in that co-morbidities and complexity of the patients were not assessed, however an overall rate of 11.2% was reported consistently over the course of the 9-year period. More recent studies have shown a significant decline in the overall rate of complications. A prospective study on 1,676 patients requiring ablation for various cardiac etiologies, showed that the overall risk of complications associated with ablation for SVT in the setting of structural heart disease was about 6% over the course of a two year period in late 2000s [16]. Of the 6% complications in VT associated ablations, less than 2 % were due to perforation including tamponade or effusion. A more recent study focused specifically on 722 VT ablation procedures from 2006 to 2012 and standardized for endocardial ablation procedures only. Data was significant for an overall risk of major complications for patients undergoing VT ablation with structural heart disease of 6%, of which < 0.5% of patients developed tamponade or effusion [10]. All three studies draw the conclusion that risk of complications increases to as high as 12-15% depending on the approach to the ablation and the comfort of the operator.

Recent work is aimed at stratifying patients who require ablation depending on their risk to develop hemodynamic compromise during the procedure. One such score includes the PAAINESD score, which focuses on the presence of pulmonary disease, age >60, anesthesia use, ischemic CM, symptomatic heart failure, EF<25%, presence of VT storm or DM. Such a score is designed to identify high risk patients for hemodynamic compromise during ablation and those that may require further evaluation [17]. Similar scores do not exist in order to further stratify patients who are already considered high-risk due to structural disease such as our patient.

In summary, VT ablation is a relatively safe procedure with risk of pericardial effusion and tamponade being an even more rare complication of the procedure. There have not been many reports of complications in this subset of patients, being HCM patient with known ventricular aneurysm. As it has been shown, these patients are at increased risk for thromboembolism, arrhythmia related death, and worsening heart failure compared to their HCM counterparts. Due to known increased risk of mortality and complications in the natural disease process, there may be an increased risk for complications in procedural ablations as well. Additional studies will be warranted in order to further classify these patients based on risk and to help determine management.

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