Case Report

A case of ventricular asystole without escape rhythm 4 days after percutaneous transluminal septal myocardial ablation in hypertrophic obstructive cardiomyopathy with drug-resistant paroxysmal atrial fibrillation

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Received 10 December 2010; received in revised form 9 June 2011; accepted 7 July 2011

Summary A 42-year-old man with a more than 10-year history of hypertrophic obstructive cardiomyopathy, but no history of heart failure or syncope, had left ventricular outflow tract pressure gradient (LVOT-PG) of 50–80 mmHg on Doppler echocardiography. In June 2010, he experienced general malaise on effort, and LVOT-PG increased to 124 mmHg. Two months later, he suffered a transient ischemic attack, complicated with atrial fibrillation (AF). He underwent cardiac defibrillation and was prescribed amiodarone, but the arrhythmia recurred easily. Therefore, percutaneous transluminal septal myocardial ablation (PTSMA) was performed to prevent AF. The procedure entailed transient complete atroventricular block (CAVB), which was resolved after a few hours. Four days later, CAVB recurred and advanced to fatal ventricular asystole without escape rhythm. The patient was resuscitated instantaneously and recovered without brain damage. Finally, a DDD permanent pacemaker was implanted 10 days after the procedure. Except for conduction problems, his cardiac condition was good after PTSMA, as paroxysmal AF disappeared and LVOT-PG was markedly decreased.

CAVB is a well-known complication of PTSMA, but fatal ventricular asystole several days after the procedure is rare. Intensive care is required after PTSMA implementation.

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Introduction

Percutaneous transluminal septal myocardial ablation (PTSMA) is a promising procedure to improve clinical symptoms and decrease left ventricular outflow tract pressure gradient (LVOT-PG) in patients with hypertrophic...
obstructive cardiomyopathy (HOCM) [1]. Complete atrioventricular block (CAVB) is a known complication of this procedure [2–8]. However, to our knowledge, there have been no reports regarding cases of ventricular asystole several days after PTSMA. Here, we present a case of ventricular asystole, which advanced from CAVB, 4 days after PTSMA.

Case report

A 42-year-old man with HOCM had been treated for more than 10 years. Echocardiography was performed on a regular basis, and revealed systolic anterior movement (SAM) of the mitral valve (Fig. 1A) and mild to moderate mitral regurgitation flow. Doppler echocardiography showed LVOT-PG of 50–80 mmHg. The patient had been well and had no signs of heart failure, syncope, or arrhythmia. However, he experienced general malaise on physical exercise in June 2010. Doppler echocardiography showed that LVOT-PG had increased to 124 mmHg (Fig. 1B) and mitral regurgitation showed deterioration.

In August 2010, he felt loss of muscle strength in the right upper and lower extremities and visited a neurosurgeon. Brain magnetic resonance imaging (MRI) revealed no significant abnormalities, and his symptoms recovered rapidly. Therefore, a diagnosis of transient ischemic attack was made. Meanwhile, electrocardiography revealed atrial fibrillation (AF), which was the first arrhythmia event in this patient. He was then transferred to our institute, and anticoagulant agents and amiodarone were prescribed. Transesophageal echocardiography revealed severe smoke-like echo in the left atrium, but no obvious thrombi were recognized. Thereafter, he underwent cardiac defibrillation and his cardiac rhythm returned to sinus rhythm. However, AF recurred 5 days and 12 days later, and he underwent cardiac defibrillation on both occasions. Despite medical therapy, including amiodarone, AF recurred frequently within a short period. Therefore, we decided to perform PTSMA to prevent the arrhythmia.

Baseline cardiac catheterization revealed normal coronary arteries. The left anterior descending artery had a large first septal branch (Fig. 2A), which was thought to be suitable for ablation. Left ventriculography demonstrated hypercontraction and moderate mitral regurgitation flow. On the day of PTSMA, a temporary pacing catheter was placed in the apex of the right ventricle to prevent CAVB. A 4 Fr pigtail catheter was inserted into the left ventricle and a 7 Fr guiding catheter was engaged in the left coronary artery ostium, so simultaneous LVOT-PG could be evaluated. An over-the-wire balloon 2.5 mm in diameter and 8 mm in length was located to the proximal portion of the large first septal branch. We attempted contrast myocardial echocardiography (CME) to delineate the area supplied by the index septal branch. Echo contrast (Levovist; Bayer Schering Pharma, Berlin, Germany) was injected through the catheter shaft, but the circulation area could not be confirmed because of technical failure. Pre-procedural LVOT-PG was 83 mmHg, but it decreased to 61 mmHg after 15 min of

**Figure 1** Pre-percutaneous transluminal septal myocardial ablation (PTSMA), systolic anterior movement (SAM) was indicated by M-mode echocardiography (A), and left ventricular outflow tract pressure gradient (LVOT-PG) was 124 mmHg on Doppler echocardiography (B). Thirty-three days after PTSMA, LVOT-PG decreased to 11 mmHg (C) and SAM disappeared (D).
probationary balloon inflation. Thereafter, bolus injection of 2 mL of pure ethanol was conducted through the catheter shaft (Fig. 2B). Pre-procedural electrocardiography revealed complete right bundle branch block (CRBBB) without atrioventricular block (Fig. 3A), but CAVB was confirmed after bolus ethanol injection. LVOT-PG dropped to 28 mmHg after the procedure. CAVB was resolved a few hours later, and Q wave appeared in V1-2 the following day (Fig. 3B). Creatine kinase level increased to 1411 IU/L and dropped thereafter.

The patient was well, and the temporary pacing catheter was removed 2 days after PTSMA. However, 4 days after the procedure, the patient lost consciousness and exhibited convulsions. The nursing staff noticed his change immediately and began cardiac resuscitation, and his heartbeat was restarted after injection of epinephrine. Fortunately, he recovered without any brain damage. A review of ambulatory electrocardiograms indicated CAVB, which advanced to ventricular asystole. Only P waves were shown, but QRS complexes disappeared suddenly (Fig. 3C and D). The temporary pacing catheter was reintroduced, and a DDD permanent pacemaker was implanted 10 days after the procedure.

With the exception of the above conduction problem, clinical symptoms and cardiohemodynamics were ameliorated after PTSMA. Paroxysmal AF and general malaise on effort disappeared completely. On Doppler echocardiography, LVOT-PG was 66 mmHg, 25 mmHg, 11 mmHg, and 11 mmHg 4, 9, 19, and 33 days after PTSMA, respectively (Fig. 1C). Furthermore, SAM disappeared (Fig. 1D), and mitral regurgitation was also ameliorated. Left atrium chamber size decreased from 50 mm to 42 mm.

**Discussion**

Our patient demonstrated CAVB not only immediately after ethanol injection, but also 4 days after PTSMA. The first CAVB was transient, whereas the second advanced to ventricular asystole without escape rhythm. Fortunately, the patient was resuscitated successfully, and recovered without any brain damage. The reason why escape ventricular beats did not appear remains unknown. To our knowledge, there have been no previous reports of CAVB advancing to ventricular asystole several days after PTSMA.

PTSMA has some complications, the most common of which is CAVB [2–8]. Accordingly, intensive care is essential during and after this procedure. CAVB usually emerges immediately after ethanol injection, and some patients require a DDD permanent pacemaker. On the other hand, there have been reports of cases showing intermittent or late conduction disturbance. ten Berg et al. [2] reported a case of recurrent CAVB after PTSMA, and Faber et al. [3] described late conduction disturbance that occurred 11 days after PTSMA. These reports emphasized the need for close rhytmological monitoring for several days following the intervention [4].

In our patient, we placed a temporary pacemaker before PTSMA to prevent bradycardia events. Transient CAVB presented for only a few hours and was resolved thereafter, so the temporary pacemaker was removed 2 days after the procedure. However, recurrence of CAVB and subsequent fatal ventricular asystole occurred a further 2 days later. Therefore, 2-day placement of a temporary pacemaker was insufficient in this case. It is not clear how long the temporary pacemaker should be used, and a standard management protocol for PTSMA will be required in the future.

Chang et al. [5] examined the incidence and determinants of CAVB after PTSMA. They reported that high age, female gender, left bundle branch block (LBBB), and first-degree atrioventricular block were predictors of permanent pacemaker requirement as baseline characteristics. Our patient was middle-aged, male, and preprocedural electrocardiography did not demonstrate LBBB or atrioventricular block. Thus, these background factors were not compatible with this case. Chang et al. [5] also reported the incidence of atrioventricular complications related to technical aspects, such as bolus ethanol injection, >2 ethanol injected septal branches, and absence of CME. Previous studies indicated that slow ethanol injection contributed to reduction of atrioventricular block [6], but we conducted

![Figure 2](image-url)  (A) Before percutaneous transluminal septal myocardial ablation, left coronary angiography revealed a large septal branch (arrowhead). (B) After ethanol injection, a large septal branch was ablated (white arrow).
bolus ethanol injection. If we had performed ethanol injection slowly, the transient CAVB that occurred immediately after the procedure may have been avoided. However, it was unclear whether slow ethanol injection could prevent recurrence of CAVB and ventricular asystole. By employing CME, Faber et al. [3] reported that the frequency of CAVB could be reduced. When patients have several coronary septal branches, selective echo contrast agent injection into each branch can identify its circulation area and can confirm the appropriate branch for ethanol injection. Using this technique, useless ethanol injection can be avoided and total ethanol volume will be limited. Hence, the volume of necrotized myocardium will also be limited, and therefore PTSMA with CME will cause less conduction disturbance. We also performed CME, but unfortunately could not identify the circulation area of the septal branch due to technical failure. However, our patient had only one large first septal branch, and it was therefore the sole target vessel. Accordingly, we would have injected ethanol into the "target" septal branch irrespective of CME, even if it had been possible to identify the circulation area. It is possible that large septal branch ablation could be related to CAVB.

HOCM with high LVOT-PG and heart failure on drug therapy are considered indications for PTSMA. Drug-resistant
paroxysmal AF is also regarded as an indication for PTSMA. Our patient showed frequent AF despite amiodarone therapy. But it disappeared after PTSMA. Comparison of echocardiography findings before and after the procedure indicated that not only LVOT-PG decreased, but mitral regurgitation flow was also ameliorated, SAM was resolved, and the left atrium showed a reduction in size. We speculated that contraction disturbance of basal hypertrophied septal myocardium led to the resolution of SAM, which caused a decrease in systolic mitral regurgitation flow and a reduction of the left atrium chamber size. Hosokawa et al. [9] reported similar speculations about the effectiveness of PTSMA in preventing supraventricular arrhythmia. They concluded that smooth blood inflow into the left ventricle and decreased atrial wall pressure stress were the key factors in its usefulness.

In conclusion, CAVB recurred and advanced to ventricular asystole without escape rhythm several days after PTSMA. Longer intensive care is necessary after the procedure.

References