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Research Paper

Acute and mid-term results of pecutaneous transluminal septal myocardial ablation in patients with hypertrophic obstructive cardiomyopathy

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Abstract

Objective: To assess the acute and mid-term results of cardiac function improvements and left ventricular outflow tract gradient (LVOTG)changes in 30 patients displaying hypertrophic obstructive cardiomyopathy (HOCM) treated with percutaneous transluminal septal myocardial ablation (PTSMA). **Methods:** PTSMA was intended for 32 patients comprising of 13 women and 19 men (average years being 54.1 ± 15.5) to be treated in accordance with the following inclusion criteria: The New York Heart Association(NYHA) definition for cardiac functional class III or IV ,or class II but for whom medical therapies were not tolerated or with syncope; intraventricular septal(IVS) and left ventricular posterior wall(LVPW) hypertrophy asymmetrically associated with ratio of IVS to LVPW ≥1.3 and LVOTG ≥50 mm Hg at rest or ≥100 mm Hg at provocation (Valsalva maneuver). The target vessels were determined by coronary arteriography that demonstrated more than one septal branch and probatory balloon occlusion produced greater than 50% decrease of LVOTG . Once the target vessel established, the alcohol was administrated into septal ventricular via over-the-wire balloon. LVOTG was assessed by means of echocardiography measurements immediately after procedure and 3 months. Simultaneously, cardiac function class was also evaluated. **Results:** Two patients were abandoned prior to intervention due to inappropriate septal target vessels and DDD Pacemakers were chosed. Immediately after the procedure, resting LVOTG was reduced from 73.8 ± 35.5 to 16.6 ± 7.8 mmHg, at provocation LVOTG from 149.3 ± 42.5 to 61.9 ± 43.0 mmHg($P < 0.0001$ each) by echocardiography measurements. After 3 months, the mean New York Heart Association class was reduced from 2.8 ± 0.6 to 1.1 ± 1.0($P < 0.0001$) and the LVOTG also remained decrease(28.5 ± 6.4 mmHg at rest and 75.3 ± 11.6 mmHg at provocation). **Conclusion:** PTSMA is a promising nonsurgical technique for relief of symptoms and reduction of LVOTG in hypertrophic obstructive cardiomyopathy.

Keywords: hypertrophy; cardiomyopathy; ablation; echocardiography

INTRODUCTION

Nonsurgical catheter treatment of hypertrophic obstructive cardiomyopathy(HOCM) was introduced in 1994[1]. Patients selected for surgical myectomy during the past 20 years have been shown to display a reduction in clinical symptoms and LVOTG by means of alcohol-induced percutaneous transluminal and septal myocardial ablation(PTSMA). In order to determine the efficacy of target septal vessel ablation, we integrated the echocardiographic measurements (as an imaging technique) into the ablation procedure. Here we reported the acute and mid-term results in patients treated with PTSMA.

MATERIALS AND METHODS

Patients selection

Between January 2000 and December 2004, 32 patients with HOCM were enrolled to our interventional center for further evaluation. Patients with coexistent cardiac abnormalities requiring surgery were excluded. No patients had myectomy performed be-

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fore PTSMA and some patients had not responded to previous DDD pacemaker implantation. For the purpose of study, 30 of the 32 patients were selected to Interventional treatment, who met with the following inclusion criteria: New York Heart Association (NYHA) cardiac functional class III or IV; intraventricular septal (IVS) thickness ≥15mm and left ventricular posterior wall (LVPW) hypertrophy asymmetrically associated with ratio of IVS to LVPW ≥1.3;obstruction below subaortic valve; and LVOTG ≥50 mmHg at rest or ≥100 mmHg at provocation (Valsalva maneuver). Patients with class II were accepted for intervention, only if medical treatment was not tolerated or with syncope, or with a high LVOTG, but combining with the presence of multiple risk factors associated with sudden cardiac death.

Echocardiography

Echocardiographic measurements were obtained before procedure, immediately after and at 3 months. LVOTG was assessed by Continuous Wave Doppler Echocardiography (CWDE) at rest and while performing the valsalva maneuver. Mitral regurgitation and systolic anterior movement(SAM) of the mitral valve apparatus were graded semiquantitatively (ie, from 0 = absent to 3 = severe/with complete septal apposition).

Intervention

Before PTSMA, a diagnostic coronary arteriography was performed via the femoral artery. All patients received a 5 Frech transfemoral pacemaker lead (Cordis) which was introduced into the right ventricular apical region with10 000 IU heparin intravenous as an antithrombotic prophylaxis.

If there was suitable septal branch, the presumed target vessel was then selectively intubated with a 0.014-inch guide wire through a 7F percutaneous transluminal coronary angioplasty guiding catheter (show in ***Fig 1***).

A short, slightly oversized over-the-wire balloon (1.5 to 2.5 mm) compared to native septal branch was introduced and inflated, and the distal vessel bed was contrasted through the central hole of over-the-wire balloon to confirm there was no collateral flow from the distal vessel bed to left artery descending (LAD) and/or circumflex and/or left ventricule (LV). If probatory vessel closure by the in flated balloon had resulted in significant LVOTG reduction. The alcohol was injected and dose was determined in presence of transient Ⅲ°AVB(atrial

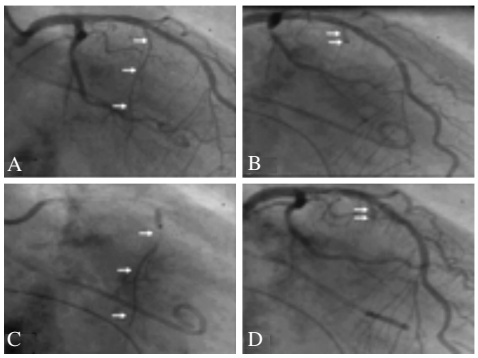

Fig 1 Coronary angiograms: A, Identification of target vessel in right anterior oblique view (arrows). B, Balloon inflation in proximal part of target vessel. C, Injection of contrast through central hole(via the over-the wire balloon) to confirm perfusion area of target vessel was maintained (did not reflux into LAD or LV). D, Final visualization of septal branch stump after completed PTSMA.

ventricular conduction block) in patients. Patients received 5 to 10 mg morphine intravenous injection 5 minutes previous to the introduction of alcohol. The balloon remained inflated for 10 minutes after the alcohol administration in order to enhance tissue contact. Immediately after the procedure was finished, LVOTG was assessed by pigtailed catheter and CWDE.

Follow-up studies

All patients were monitored in the coronary care unit (CCU) for ≥48 hours. The femoral artery sheath was removed after normalization of the coagulation measurements and the femoral vein sheath was removed after heart rhythm recovered to sinus (in presence of Ⅲ°AVB). Cardiac enzymes and ECG records were done every 4 hours. Drugs treatment was continued with a cardioselective β-blocker or, in case of contraindications, with verapamil or diltazem. After 3 months, all patients underwent clinical symptoms and noninvasive follow-up evaluation, especially LVOTG measurements with CWDE.

Statistics analysis

Results of continuous variables were presented as mean ± SD. Student´s t tests for paired and unpaired samples were used for group comparisons (baseline measurements, in-hospital immediated follow-up, and 3-month follow-up). Differences were considered significant if the 2-tailed P value was < 0.05.

RESULTS

Technical aspects

PTSMA was completed in 30 patients, with a mean procedural time of 134 ± 65 minutes (91 to

184) and a fluoroscopy time of 35 ± 16 minutes (20 to 58). The amount of injected alcohol was 2.8 ± 1.1 ml(1.5 to 5) with average 1.1 ± 0.3 target vessels occluded. These exclude2 patients because there were no appropriate target vessels, therefore no ablation was undertaken.

Comparison of echocardiographic measurements and cardiac function capacity(NYHA) before and after immediately and 3 months procedure

After immediate and 3 months post procedure, LOVTG markedly decreased at rest and during valsalva, along with septal thickness, left ventricular posterior wall (LVPW) and SAM grade also decreased. Surprisingly, 9 patients showed complete LVOTG elimination. There were slight changes in diameter of LA and LVEDD. After 3 months , patients reported a mean NYHA class reduction from 2.8 ± 0.6 to 1.1 ± 0.8($P < 0.05$).(As shown in ***Tab 1***)

Tab 1 **Comparison of echocardiographic measurements and cardiac function capacity(NYHA) before, and after immediatedly and 3 months procedure**

Group	LOVTG rest	LOVTG valvalsa	SAM grade	LA	LVEDD	NYHA	LVPW
before	73.8 ± 35.5	149.3 ± 42.5	2.6 ± 0.6	43.3 ± 8.4	46.4 ± 5.4	2.8 ± 0.6	12.3 ± 1.3
immediately	16.6 ± 7.8	61.9 ± 43.0	2.2 ± 1.1				
3 months	28.5 ± 6.4*	75.3 ± 11.6*	1.4 ± 0.5*	42.2 ± 6.4	45.8 ± 6.2	1.1 ± 0.8	9.6 ± 0.8

*$P < 0.05$.

Complications

During in-hospital course: None of patients needed permanent DDD pacemaker implantation, one had ventricular fibrillation and was successful resuscitated after 6 hours operation in hospital.

ECG changes: In 19 patients, a new bundle branch block was present after PTSMA. The right branch was predominantly affected (87%). After 3 months, 13 patients' bundle branch blocks had disappeared.

DISCUSSION

Obstruction of LV outflow, diastolic dysfunction, and rhythm disturbances including sudden cardiac death are the main issues facing patients with HOCM. Medical therapy, surgical myectomy, and AV sequential pacing predominantly aim at LVOTG reduction. The evidences up to date demonstrated the effects of medical treatment and AV sequential pacing are limited. Although good symptomatic and hemodynamic improvements have been seen in survivors of surgery, considerable perioperative morbidity and mortality rates cast shadows on invasive surgical intervention.

The induction of a limited "therapeutic" infarction within the hypertrophied septal myocardium[1-4] leads to localized thinning and contractile dysfunction, expands the LV outflow tract, and thus reduces LVOTG and improves cardiac capacity. In 1995, Sigwart[1] published the first report on definitive septal branch alcohol-induced LVOTG reduction in 3 severely symptomatic patients. The first small samples showed promising results concerning symptoms and LVOTG reduction, with acceptable complication rates[5,6].

Our experiences available with 30 patients are in line with these reports. In our opinion, an important improvement of the new method has been gained by the integration of echocardiographic monitoring for midterm follow-up. Analysis had shown that probatory balloon occlusion of the presumed target vessel did not reliably predict the definitive treatment result. That meant that In some patients, up to 2 or 3 vessels had to be occluded for satisfactory LVOTG reduction[7,8].

Surprisingly, not only septal hypertrophy decreased, but also LV posterior wall thickness. This may be due to a relief of pressure overload and this may also influence diastolic function parameters.

Taking into account the fact that a learning curve is easily available in this field, PTSMA seems to be a quite safe procedure. Complications, however,may be avoided as previously reported if cardiologists not only strictly select PTSMA indications but also have excellent interventional skill. Complications comprise of thoracic discomfort, AV conduction disturbances, ventricular dysrhythmias and death, but fortunately death is rare[9-11].

Several limitations must be considered in this report. Ventricular tachyarrhythmias or AV conduction disturbances are still difficult to predict. The echo indexes are rough markers of diastolic LV function. Finally, the patients were not randomly assigned to interventional treatment but by individual indication.

PTSMA is a promising interventional treatment modal for patients with HOCM who do not show satisfactory response to medical therapy. Elimination or a substantial reduction of the LVOT gradient in

the majority of the patients is possible. It is necessary to make reliable recognition of those patients who displayed irreversible conduction defect.

Furthermore, the long-term effect of PTSMA on global systolic and diastolic function and on prognosis remains to be assessed. A prospective registry of all interventional treated patients with HOCM will be very helpful in clarifying these problems [12-15]. A prospective, randomized trial is still needed to define the true definitive value of PTSMA as compared with other treatment modalities.

References

[1] Sigwart U. Non-surgical myocardial reduction for hypertrophic obstructive cardiomyopathy. *Lancet* 1995;346:211-4.

[2] Schulte HD, Borisov K, Gams E, Gesan H. Management of symptomatichypertrophic Obstuctive cardiomyopathy long-term Results after surgical Therapy. *Thorac Cardiovasc Surg* 1999;47:213-8.

[3] Seggewiss H, Faber L, Gleichmann U, Laham D, Senwens G. Percutaneous Transluminal Septal Myocardial Ablation in hypertrophic obstructive cardiomyopathy. *Thorac Cardiovasc Surg* 1999;47:94-100.

[4] Lameh F. Advances in Molecular Genetics and Management of Hypertrophic Cardiomyopathy. *JAMA* 1999;281:1746-52.

[5] Lothar F, Hubert SW, and Ulrich G, Mason E, Midesae H. Percutaneous Transluminal Septal Myocardial Ablation in Hypertrophic Obstructive Cardiomyopathy: Results With Respect to Intraprocedural Myocardial Contrast Echocardiography. *Circulation* 1998;98: 2415-21.

[6] Flores RR, Lakkis NM, Middleton KJ, Kasen A, Uhamdes S, Carwensde F. *et al*. Echocardiographic insights into the mechanisms of relief of left ventricular outflow tract obstruction after nonsurgical septal reduction therapy in patients with hypertrophic obstructive cardiomyopathy. *J Am Coll Cardiol* 2001; 37:208-14.

[7] Maron BJ. Hypertrophic cardiomyopathy: a systematic review. *JAMA* 2002;287:1308-20.

[8] Qin JX, Shiota T, Lever HM, Kasendar T, Wendesa R. Outcome of patients with hypertrophic obstructive cardiomyopathy after percutaneous transluminal septal myocardial ablation and septal myectomy surgery. *J Am Coll Cardiol* 2001;38:1994-2000.

[9] Seggewiss H. Current status of alcohol septal ablation for patients with hypertrophic cardiomyopathy. *Curr Cardiol Rep* 2001;3:160-6.

[10] Chris L, Folkert JC, Marcel LG, Faberhen T .Percutaneous Versus Surgical Treatment for Patients With Hypertrophic Obstructive Cardiomyopathy and Enlarged Anterior Mitral Valve Leaflets. *Circulation* 2005;112: 482-8.

[11] Tsung C, Carey DK, Barry JM, Barrens K, Denkera W. In Percutaneous Transluminal Septal Myocardial Ablation for Hypertrophic Obstructive Cardiomyopathy, It Is Not the Speed of Intracoronary Alcohol Injection But the Amount of Alcohol Injected That Determines the Resultant Infarct Size. *Circulation* 2004; 110: e23.

[12] Barey DK, Barry JM.Role of Percutaneous Septal Ablation in Hypertrophic Obstructive Cardiomyopathy. *Circulation* 2004; 109: 452-6.

[13] Chris L, Marcel JM, Lex A, Zuneus A, Schuttle D, Amdernson G. Sustained Improvement After Combined Anterior Mitral Leaflet Extension and Myectomy in Hypertrophic Obstructive Cardiomyopathy. *Circulation Oct* 2003;108: 2088-92.

[14] Rigopoulos G, Faber L, Ziemsen P Catenues F, Zendenes D. Echocardiography-guided percutaneous septal ablation in patients with HOCM:one-year follow-up. *Hellenic J cardiol* 2003;44:171-179.

[15] Rigopoulos G, Anastasakis A. HOCM: Recent aspects and knowledgef of last decade. *Hellenic J Cardiol* 2002;41:212-234.