Successful alcohol septal ablation for late recurrence of left ventricular outflow tract obstruction after surgical myectomy in hypertrophic obstructive cardiomyopathy

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An 18-year-old male patient, known with familial hypertrophic obstructive cardiomyopathy underwent a septal myectomy 10 years ago for significant left ventricular outflow tract (LVOT) obstruction. During follow-up a progressive increase in LVOT gradient was noted in association with severe mitral valve regurgitation.

The patient underwent percutaneous alcohol septal ablation to induce regression of left ventricular hypertrophy. Coronary angiography, with intracoronary contrast and guided by echocardiographic imaging, was applied for localisation of the appropriate septal branch. The vessel was subsequently injected with 1.5 cc ethanol. No procedure-related complications were reported. The LVOT gradient decreased from 90 mmHg to 48 and 45 mmHg at rest 6 weeks and 6 months, respectively, after the procedure. Mitral valve regurgitation was significantly reduced.

This case nicely illustrates the feasibility of percutaneous alcohol septal ablation for recurrent LVOT obstruction 10 years after myectomy.

Keywords: *cardiomyopathy – septal alcohol ablation.*

Case report

We present an 18-year-old male patient, known with familial hypertrophic obstructive cardiomyopathy (HOCM), with underlying MYH7 mutation. Despite significant hypertrophy and marked intraventricular pressure gradients, the patient has never been symptomatic.

At the age of eight years, a surgical myectomy was performed for progressive left ventricular outflow tract (LVOT) obstruction (gradient up to 60 mmHg at rest) associated with significant mitral valve regurgitation (MVR) due to systolic anterior movement (SAM) despite treatment with atenolol. The LVOT gradient was reduced to 25 mmHg, with disappearance of SAM.

During follow-up, however, a progressive hypertrophy of the interventricular septum (IVS) to 37 mm was noted on echocardiography associated with a marked intraventricular gradient (maximum pressure gradient LVOT 90 mmHg at rest) and severe MVR caused by SAM.

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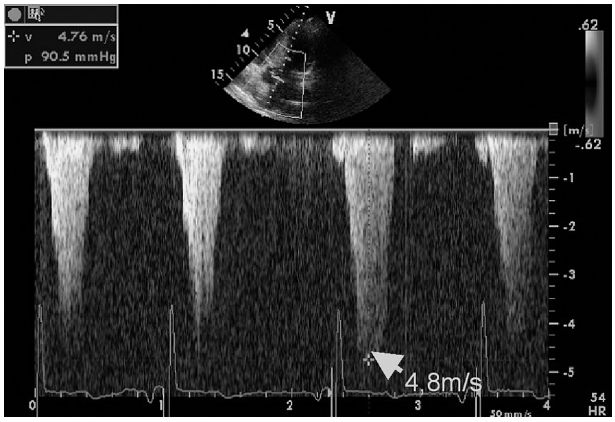
The feasibility of septal alcohol ablation was assessed with the use of coronary angiography for the evaluation of septal branch anatomy. An appropriate branch was identified with intracoronary contrast (Levovist®) through the central lumen of a balloon catheter under simultaneous transoesophageal echocardiographic monitoring. The patient underwent subsequent percutaneous alcohol septal ablation with 1.5 cc ethanol to induce regression of the LVOT gradient.

A pacemaker lead was placed in the right ventricle prior to the procedure.

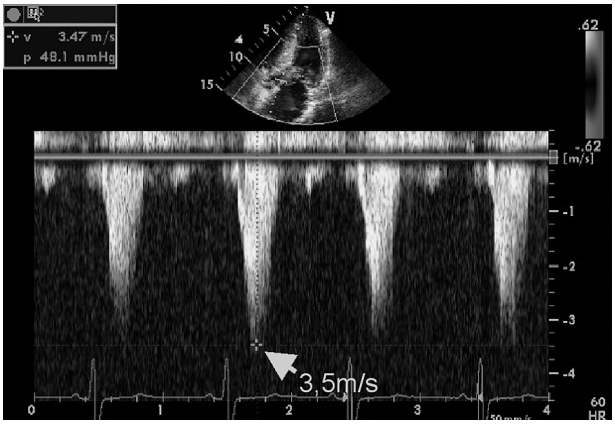
There were no procedure-related complications. The temporary pacemaker in standby mode could be removed after 24 hours. The peak CK concentration was 648 U/L.

Initial transthoracic echocardiography performed 12 hours after the ablation showed no reduction in IVS thickness or LVOT peak gradient. However, echocardiography at 1 and 6 months showed a reduction of the LVOT peak gradient to 48 mmHg and 45 mmHg at rest (figure 1). SAM persisted but there was a reduction in the severity of MVR.

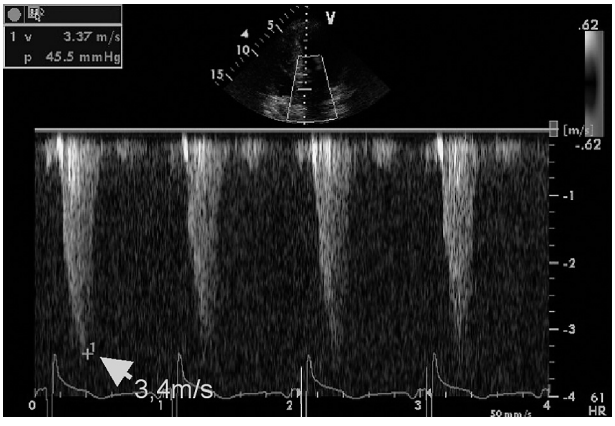
Six months after the ablation procedure cardiac magnetic resonance imaging (MRI) was performed for evaluation of the infarction and residual LVOT gradient. Cardiac MRI showed scattered regions of fibrosis in the middle and anterior part of the hypertrophic



A. LVOT gradient before septal ablation



B. LVOT gradient one month after septal ablation



C. LVOT gradient six months after septal ablation

Fig. 1. – Echocardiographic follow-up of the LVOT gradient before, one month and six months after septal ablation.

IVS, as well as a focal scarring in the outflow segment of the myocardium (figure 2). By phase contrast flow mapping (not shown) a residual gradient of 20 mmHg was measured.

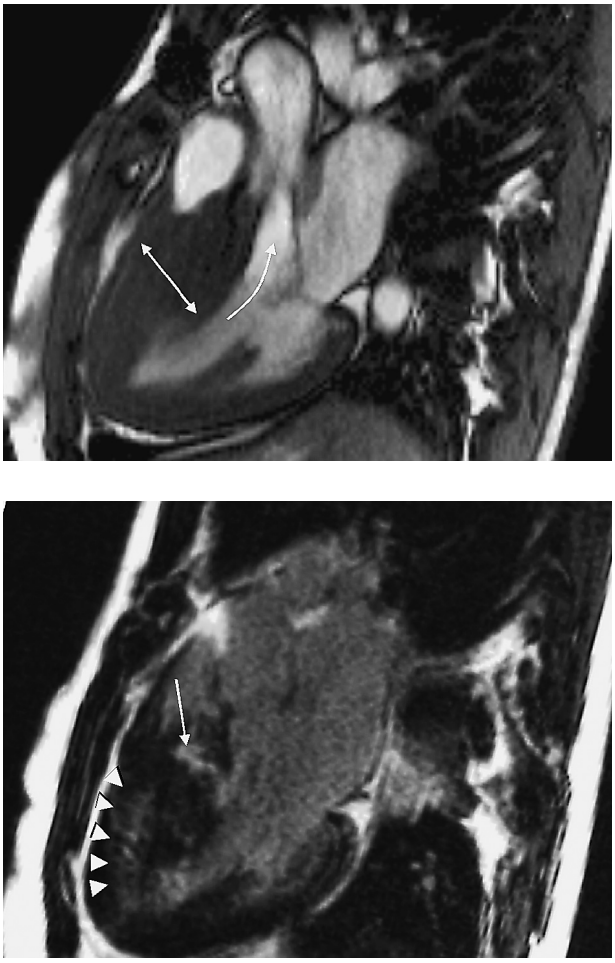


Fig. 2. – Cardiac MRI was performed six months after septal ablation: (a) systolic still image of a balanced gradient echo cine in LVOT view, showing the hugely thickened IVS (double headed arrow) and the stenotic jet it produces (curved arrow). (b) Late gadolinium enhancement in the same orientation, showing the post-ablation scarring in the LVOT segment (arrow), and extended fibrosis in the middle and anterior part of the IVS (arrowheads). A residual gradient of 20 mmHg is measured (not shown).

Discussion

Familial hypertrophic obstructive cardiomyopathy (HOCM) is an autosomal dominantly inherited disease of the myocardium characterised by left ventricular hypertrophy, including the interventricular septum. This may lead to progressive elevation of the intraventricular pressure gradient. The estimated incidence is 0.2%[1]. It is a clinically heterogeneous disorder with both inter- and intrafamilial variation[1]. The primary cause is a defect of the sarcomere function[1]. In about 60% of HOCM families mutations have been found in one of the 11 HOCM genes: β-myosin heavy chain (MYH7 and MYH6), cardiac myosin-binding protein C (MYBPC3), cardiac troponin I (TNNI3), myosin ventricular regulator light chain 2 (MYL2), myosin ventricular essential light chain 1 (MYL3), α-tropomyosin (TPM1), cardiac α actin (ACTC), tintin (TNNC1) and protein kinase A γ subunit (PRKAG2)[1]. Mutations in MYH7 and MYBPC3 represent 40% and 42%, respectively, of the mutant chromosomes[1].

Table 1.

Risk factors for sudden death in HCM (ACC/ESC 2003)	
Major	Prior cardiac arrest
	Spontaneous sustained ventricular tachycardia
	Family history of sudden cardiac death at < 45 years
	Unexplained syncope, especially if syncope is repetitive, associated with exertion or occurring in children
	Massive left ventricular hypertrophy: interventricular wall thickness greater than or equal to 30 mm
	Non-sustained ventricular tachycardia
	Hypotensive blood pressure response to exercise
Possible	Significant left ventricular outflow tract gradient > 30 mmHg
	Myocardial ischaemia
	High-risk mutations
	Atrial fibrillation
	Intense (competitive) physical exertion

Adapted form ACC/ ESC 2003[1]

Many patients with HOCM have no or limited symptoms. Nevertheless the disease is associated with a markedly increased risk for heart failure and/or malignant arrhythmias. Common symptoms of HOCM are: dyspnoea, chest pain, palpitations, presyncope, syncope and fatigue. There is no clear correlation between the degree of LVOT obstruction and symptoms. The majority of symptomatic patients demonstrate a modest deterioration in left ventricular function with advancing age.

The diagnosis in the index patient is usually made after an episode of (malignant) arrhythmias or heart failure. Subsequent clinical screening of relatives with electrocardiography and echocardiography may reveal asymptomatic patients with left ventricular hypertrophy. Ultimately, additional genetic testing may be helpful for the identification of asymptomatic carrier of the disease. This is especially useful in children and young adults who may not yet present significant left ventricular hypertrophy on electrocardiography and/or echocardiography.

Asymptomatic patients should be evaluated with electrocardiography, echocardiography, exercise testing including assessment of blood pressure response and Holter monitoring.

In symptomatic patients, inducible LVOT should be excluded with echocardiography during Valsalva manoeuvre or with exercise/stress echocardiography.

Recurrent syncope -especially associated with exertion and occurring in children-, a family history of sudden cardiac death (at < 45 years) and wall thickness of > 30 mm are considered risk factors for sudden death[1,2]. Also, the age of the patient at diagnosis, the presence or absence of symptoms and non-sustained ventricular tachycardia is of prognostic value[1]. Mortality is substantially increased when identified during childhood and in symptomatic patients[1,3]. All HCM patients should have a risk stratification[1]: in individuals with two or more major risk markers (table 1), an ICD implantation should be considered[3]. Applying this risk stratification to our case reveals that the patient did not meet the criteria for ICD implantation. He was asymptomatic, Holter monitoring showed no arrhythmias, there was no impaired blood pressure response during exercise testing and there was no family history of sudden cardiac death at young age.

Furthermore, significant LVOT obstruction is an independent predictor of poor prognosis in patients with HOCM, symptomatic or not and should therefore be treated appropriately[1].

Marked LVOT obstruction unresponsive to medical therapy can be treated with either surgical myectomy or percutaneous transluminal septal myocardial ablation.

A possible major complication of both techniques is the occurrence of complete heart block. Ventricular septum defect (VSD) can be a rare but also major complication. Another concern and point of discussion is the possible risk of ventricular arrhythmias after percutaneous septal ablation.

Surgical myectomy for significant LVOT obstruction was developed in the early 1960 s and is still considered as the gold standard. Clinical and haemodynamic success rates achieve > 90% with a currently low operative mortality of < 1-2% in experienced centres. The rate of post-procedure pacemaker dependency is < 5%[4].

Percutaneous alcohol septal ablation was introduced in 1995[5]. Pacemaker dependency rate varies between 5% and 20%, and is higher in patients with pre-existing left bundle-branch block. With contrast echocardiography and slow ethanol injection, the risk for complete heart block has decreased[6]. Although no electrophysiological study after septal ablation indicated an increased arrhythmogenic substrate, cases of ventricular tachycardia and sudden death occurring after this procedure have been reported and need further investigation[7].

Hospital mortality in experienced centres is now comparable to that in the best surgical myectomy series (1-2%)[8]. Long-terms results have to be awaited.

The site and the extent of myocardial damage differ substantially between the two techniques[9].

Septal myectomy affects the endocardial portion of the basal anterior septum, whereas the effect of percutaneous septal ablation is less predictable, and causes a transmural infarction located more inferiorly in the basal septum, usually extending into the right ventricular side of the septum at the midventricular level[9]. When an extended transmural region is affected, percutaneous alcohol ablation can cause a VSD. However, VSD has also been reported with extended septal myectomy.

Non-randomized trials have shown significant reductions in LVOT gradient and symptomatic improvement with both techniques. So far, no randomized study has been performed to compare surgical myectomy with alcohol septal ablation[10,11]. A recent meta-analysis suggests a better outcome of septal myectomy for HOCM with regard to relief of LVOT gradient and lower risk of pacemaker requirement compared to percutaneous septal alcohol ablation[12]. However, septal ablation is a relatively new technique and better outcome is now achieved with the use of contrast echocardiography and slow ethanol injection in more experienced centres, achieving the same level as for surgical myectomy.

In the literature, most studies describe the results of percutaneous septal myocardial ablation and septal myectomy in short- and long-term follow-up, and the comparison of these two techniques is still a subject of debate and disagreement[4]. Crossover and repeat procedures do occur with both techniques, but few data are found in the literature. Some small studies have already shown successful treatment with myectomy after failed alcohol ablation[13].

The feasibility of alcohol septal ablation after myectomy is largely unknown.

To our knowledge, only one case of alcohol septal ablation performed immediately after failed surgical myectomy has been published recently[14].

After profound multidisciplinary discussion of both techniques, we decided to perform septal alcohol ablation in our patient (good septal branch, previous thoracotomy). This case illustrates the possible complementary effect of both techniques. Of course, a larger number of patients and further long-term follow-up will be necessary to confirm these findings.

In this case, no acute reduction in LVOT gradient was noted immediately after the septal ablation, compared to other reports[9]. Further literature study, however, reveals that younger patients had smaller reductions in gradient probably because of greater septal thickness and additional structural deformities such as papillary muscles. About 50% of young patients with inadequate acute results show improved gradient reduction at follow-up, due to post-infarct remodelling and shrinkage of the ablated area of the septum. The outcome of the remodelling process, which can take up to 12 months, should therefore be awaited[15].

Conclusion

In this case, a significant reduction in LVOT gradient was obtained with percutaneous alcohol septal ablation for recurrent LVOT obstruction 10 years after septal myectomy.

A larger number of patients and further long-term follow-up are necessary to establish the odds for this strategy and to evaluate the maintenance of the regression of LVOT gradient.

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