Alcohol Septal Ablation without Myocardial Contrast Echocardiography for Hypertrophic Obstructive Cardiomyopathy

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Objective: *Review the efficacy and safety of using the anatomical characteristics of the first septal branch to select the target vessel for alcohol septal ablation (ASA) in treating patients with medically refractory symptoms hypertrophic obstructive cardiomyopathy (HOCM), ASA without guided myocardial contrast echocardiography (MCE).*
Material and Method: *Fifteen patients with HOCM and refractory to medical therapy were screened by echocardiography and coronary angiography between November 2007 and January 2010 in Songklanagarind university hospital. The procedure was abandoned in three patients due to vessel unsuitability. The clinical and hemodynamic data of 12 patients with HOCM before and after ASA were reviewed. The authors used the anatomical characteristics of vessel to identify the suitable septal perforator artery.*
Results: *ASA was done successfully in 12 patients. The averages of left ventricular outflow tract (LVOT) peak/mean pressure gradients (PPG/MPG) were 92.4 $\pm$ 22.5/48.8 $\pm$ 12.8 before and 21.6 $\pm$ 11/12.8 $\pm$ 5 mmHg immediately after ASA. The mean absolute alcohol volume was 2.5 $\pm$ 0.64 ml. One patient had to have alcohol injection into two septal branches. Transient complete atrioventricular block occurred in two patients. All patients reported substantial symptomatic improvement.*
Conclusion: *Most patients with medically refractory symptom HCOM have suitable first septal branches for ASA. ASA without MCE in those with suitable first septal branches is effective and safe.*

Keywords: *Hypertrophic obstructive cardiomyopathy, Alcohol septal ablation, The first septal branch, Myocardial contrast echocardiography*

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Hypertrophic cardiomyopathy (HCM) is relatively common cardiac genetic disease[1]. Genetically as well as phenotypically, HCM is an extremely heterogeneous disease. The dyspnea symptom in HCM is due to increase left atrial pressure, which can result from abnormal left ventricular diastolic function, outflow tract obstruction, or significant mitral regurgitation. Most patients do not have significant resting left ventricular outflow tract obstruction (LVOT). About 20 to 30% of HCM have LVOT obstruction at rest, the entity is called hypertrophic obstructive cardiomyopathy (HOCM), cause by septal-mitral contact during systole[2]. Only 5% of HCM have medically refractory symptoms requiring further treatment. In patients with HCM, LVOT obstruction at rest is a strong, independent predictor of progression to severe symptoms of heart failure and of death[3]. Surgical septal myectomy or alcohol septal ablation (ASA) are treatments for patients with HOCM who are refractory to optimal medical therapy[2,3]. Reported results of ASA vary from a somewhat lesser degree of gradient reduction when compared with surgical septal myectomy to equivalent results[4-6]. Recent meta-analysis showed similar mortality and functional class comparing surgical myectomy and ASA although the latter was found to have higher incidence of conduction abnormalities and a higher post-intervention LVOT gradient[7]. As a more favorable experience with percutaneous coronary intervention technique, ASA is an attractive therapeutic alternative[7,8].

There are several limitations for both ASA and surgical septal myectomy including lack of easy

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accessibility to medical center skilled in septal ablation or surgery. Although the use of myocardial contrast echocardiography (MCE) has become the standard to aid in selecting the most appropriate target branches to improve the success rate of ASA and reduce the need for permanent pacing after the procedure[9], MCE is not available in Thailand. The authors report results of ASA without MCE aiming to review the efficacy and safety of using anatomical characteristics of the first septal branch to guide ASA procedure.

Material and Method

Between November 2007 and January 2010, 15 patients with medically refractory symptom HOCM scheduled for coronary angiography (CAG) viewing for ASA at our institute. The operator proceed to ASA in the same session if the patients meet all following criteria[10]: 1) symptoms that interfere quality of life despite optimal medical treatment; 2) septal thickness at least 16 mm; 3) resting LVOT peak systolic pressure gradient (PPG) at least 30 mm Hg or at least 50 mmHg with provocation; 4) accessible and suitable the first septal branch; and 5) the absence of intrinsic mitral valve dysfunction and of other conditions for which cardiac surgery is indicated. Informed consent for the procedures was obtained in each patient. The report was approved by the Ethics Committee, Faculty of Medicine, Prince of Songkla University. The ASA procedure was previously reported[11].

Suitable the first septal anatomy criteria

The operator used the anatomical characteristics to select a suitable septal branch as following: 1) the most dominant or the biggest septal branch that is anatomically supposed to give blood supply to the interventricular septum of the LVOT; 2) absence of a significant adjacent septal branch (Fig. 1). In case of multiple small septal branches supplying the LVOT, the procedure was abandoned.

Statistical analysis

Data were analyzed and expressed as mean value and standard deviation (SD).

Results

The procedure was abandoned after CAG in three patients due to the first septal anatomy unsuitability. The clinical and hemodynamic data before and after ASA and the outcome in 12 patients, are shown in Table 1.

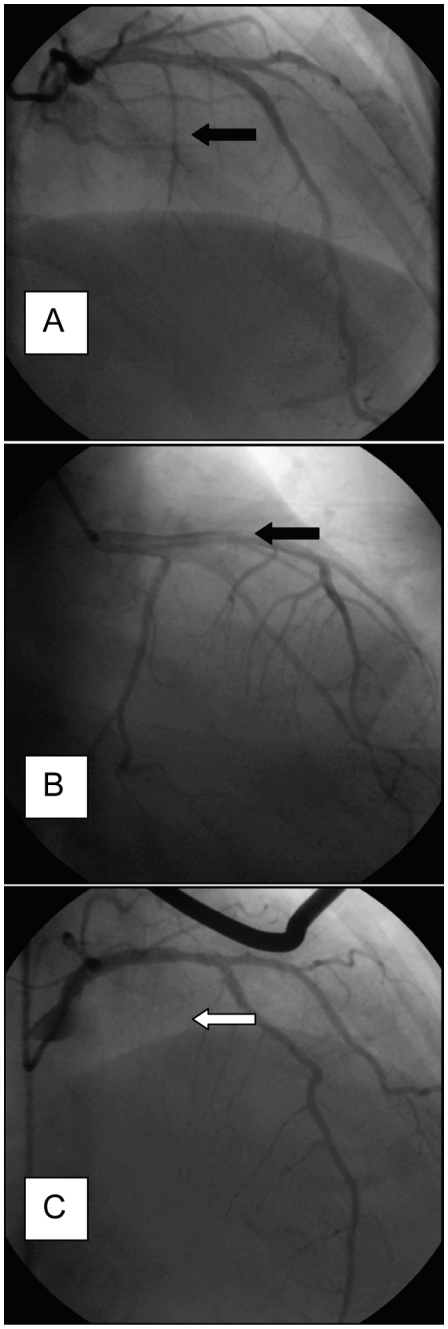

Fig. 1 A and B: The suitable first septal perforator branch of the LAD for ASA without MCE (black arrow), C: No dominant first septal branch, unsuitable for ASA without MCE (white arrow)

ASA was successful in all 12 patients. The mean alcohol volume was 2.5 ml. One patient had to have alcohol injection into two septal branches. The

Table 1. Clinical and hemodynamic data

Patient No.	Age/ sex	Functional class: Pre ASA	Alcohol volume (ml)	Pre-ASA LVOT-PPG/MPG	Immediately Post-ASA LVOT-PPG/MPG	6-12 weeks LVOT-PPG/MPG	Complications	Functional class: Post ASA
1	47/M	3	2.5	108/55	29/18	17/9	None	1
2	40/M	3	3.0	123/76	38/21	19/10	CRBBB	1
3	37/F	3	2.0	100/42	42/19	12/9	Transient CHB	1
4	73/F	3	2.5	88/52	18/13	10/6	None	2
5	54/F	4	3.0	110/64	19/7	6/3	Transient CRBBB	
6	37/M	3	3.5 (2 septal branches)	73/36	20/13	NA	RBBB	1
7	49/M	3	2.5	89/42	30/13	15/8	none	1
8	48/M	3	2.5	125/56	16/10	13/8	none	1
9	40/M	3	3.0	62/36	18/15	9/-	Transient CHB	
10	67/M	3	2.5	71/37	16/14	NA	none	NA
11	31/M	3	2.0	59/36	5/4	NA	Transient CRBBB	1
12	75/F	3	1.0	101/54	9/7	NA	Transient CRBBB	1
Mean value (SD)			2.5±0.64	92.4±22.5/48.8±12.8	21.6 ± 11/12.8±5	13/7.6 (n = 7)		

M = male; F = female; ASA LVOT-PPG/MPG = alcohol septal ablation left ventricular outflow tract peak pressure gradient/mean pressure gradient; CRBBB = complete right bundle branch block; CHB = complete heart block; NA = no data

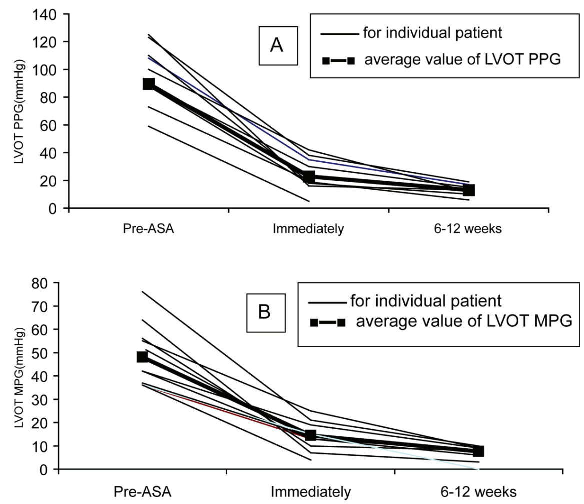

Fig. 2 A: Left ventricular outflow tract (LVOT) peak pressure gradient (PPG) and, B: LVOT mean pressure gradient (MPG) pre-ASA, immediately and 6-12 weeks after alcohol septal ablation (ASA)

averages of LVOT peak/mean pressure gradients (PPG/MPG) were 92.4 ± 22.5/48.8 ± 12.8 before and 21.6 ± 11/12.8 ± 5 mmHg immediately after ASA, consecutively. No patient experienced any major complications as the result of the procedure. Two patients developed transient complete heart block in catheterization laboratory and improved spontaneously. There were further falls in PPG and MPG at 6 to 12 week follow-up echocardiography. All patients had good symptomatic improvement. No complications were observed during 6 to 12 weeks follow-up (Fig. 2).

Discussion

ASA is an emerging percutaneous technique to treat patients with HOCM and refractory to medical therapy. ASA significantly reduces LVOT obstruction and improves symptoms in HOCM, but it has also been reported that permanent pacemaker implantation was required in 12 to 20% of the patients because of persistent complete atrioventricular block associated with this procedure[12,13]. This complication can be avoided by carefully limiting the amount of myocardial necrosis to that which is sufficient to reduce the LVOT gradient and so the most important step in ASA is to select the target septal branch. Intraprocedural MCE as an imaging technique for target vessel selection in ASA has been integrated into the procedure and reported that MCE improved both acute and chronic results[14]. The pacemaker implantation rate

after MCE-guided ASA was 7%, comparable to that associated with surgical myectomy[14]. Case report demonstrated MCE was very useful in case of patient with small, multiple septal perforator branches[15].

Although intraprocedural MCE seem to become the standard practice to help with the identification of the most appropriate septal branch, MCE is not available in our hospital. To perform ASA, the authors proceeded to ASA only if the patients have anatomically suitable the first septal branch after carefully review control coronary angiography. Twelve out of 15 patients have suitable target septal perforators (isolated, the largest septal branch without adjacent branch) and ASA was successful in these cases. Anatomical characteristics of the first septal can be used to select the target vessel for ASA procedure. ASA without MCE-guided in carefully selected patient with suitable first septal anatomy is feasible, effective, and safe. No patients need to have permanent pacemaker implantation later on.

The present study has two clinical consequences. First, despite unavailability of MCE, ASA can be done effectively by using anatomical characteristics of first septal branch to select the target vessel. Second, most HOCM patients have suitable first septal branch. MCE is not essential in every ASA procedure. Only in cases with small, multiple septal perforator branches from the LAD or coronary arteries other than the LAD supplied LVOT area, using myocardial contrast echocardiography to identify mitral-septal contact is mandatory.

The target vessel was determined by a reduction in the LVOT obstruction with temporary balloon occlusion of the culprit septal branch, but because the LVOT gradient is not always constant throughout the procedure, that method is now considered unreliable[15].

Conclusion

Most patients with HOCM naturally have suitable first septal branches. In the patient with the suitable septal branch, using anatomical characteristics of the first septal branch alone is adequate to aid in selecting the most appropriate target vessel for ASA procedure.

Potential conflicts of interest

None.

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การรักษา hypertrophic obstructive cardiomyopathy ด้วยการทำ alcohol septal ablation โดยไม่มี myocardial contrast echocardiography

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วัตถุประสงค์: *เพื่อประเมินผลการรักษาและความปลอดภัยในการทำ alcohol septal ablation เพื่อการรักษา hypertrophic obstructive cardiomyopathy โดยการเลือกหลอดเลือด septal perforator เป้าหมายจากลักษณะของหลอดเลือด และไม่มี myocardial contrast echocardiography*

วัสดุและวิธีการ: *ผู้นิพนธ์ศึกษาผู้ป่วยทั้งหมด 15 ราย ที่ได้รับการฉีดสีหลอดเลือดหัวใจเพื่อเตรียมทำ alcohol septal ablation ตั้งแต่เดือนพฤศจิกายน พ.ศ. 2550 ถึงเดือนมกราคม พ.ศ. 2553 ที่โรงพยาบาลสงขลานครินทร์ โดยรวบรวมข้อมูลทางคลินิก ผลการตรวจรักษาภายในห้องปฏิบัติการสวนหัวใจ และติดตามผลหลังการรักษา การเลือกหลอดเลือด septal perforator เป้าหมายกระทำโดยการดูลักษณะของหลอดเลือด*

ผลการศึกษา: *ผู้ป่วยจำนวน 12 ราย มีลักษณะของหลอดเลือด septal perforator เป้าหมายเหมาะสม และผู้ป่วยจำนวน 3 ราย มีลักษณะหลอดเลือดไม่เหมาะสมกับการทำ alcohol septal ablation โดยไม่มี myocardial contrast echocardiography เป็นตัวช่วย ผลการรักษาผู้ป่วยที่มีหลอดเลือด septal perforator เป้าหมายเหมาะสม ได้ผลดี ค่าเฉลี่ยของ left ventricular outflow tract peak pressure gradient (LVOT-PPG) ลดลงจาก 92.4 มิลลิเมตรปรอท เหลือ 21.6 มิลลิเมตรปรอท ทันทีหลังการรักษา ส่วนค่าเฉลี่ยของ LVOT mean pressure gradient (MPG) ลดลงจาก 48.8 มิลลิเมตรปรอทเหลือ 12.8 มิลลิเมตรปรอท ปริมาณ alcohol ที่ใช้ต่อรายเฉลี่ยเท่ากับ 2.5 ลูกบาศก์มิลลิเมตร ผู้ป่วยทุกรายอาการดีขึ้นไม่พบผลแทรกซ้อนในระยะสั้นที่รุนแรง*

สรุป: *สามารถใช้ลักษณะของหลอดเลือดช่วยในการเลือกหลอดเลือด septal perforator เป้าหมายในการทำ alcohol septal ablation ได้ และผู้ป่วยส่วนใหญ่มีหลอดเลือด septal perforator เหมาะสมต่อการทำ alcohol septal ablation โดยไม่จำเป็นต้องใช้ myocardial contrast echocardiography*