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One Year Follow Up after Septal Myectomy for Hypertrophic Obstructive Cardiomyopathy

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ABSTRACT

Background: According to the European society of cardiology 2008, hypertrophic cardiomyopathies (HCM) are defined as increased ventricular wall thickness or mass, in the absence of loading conditions such as hypertension or valve disease.

Objectives: The aim of the current study was to assess the short term (1 year) outcome of the Septal Myectomy for Hypertrophic Obstructive Cardiomyopathy (HOaCM).

Patients and Methods: The study included 31 patients who underwent septal myectomy at Kasr El Einy University Hospital, to assess the short term (1 year) outcome of the procedure. This prospective study was done during the period between March 2014 and May 2018 excluding any patient with ischemic or rheumatic pathology or requiring any additional procedure.

Results: All patients had an LVOT peak gradient of more than 50 mmHg. All of the patients had preoperative mitral regurge. The preoperative septal wall thickness ranged from 1.5 to 3.5 cm with a mean of 2.1±0.7 cm. TEE showed a pressure gradient across the LVOT ranging from 4 to 20 mmHg with a mean of 7±6 mmHg, which was statistically significant in comparison to the preoperative values. Echocardiography done at one year follow up showed a peak systolic gradient across the LVOT ranging from 6 to 40 mmHg, with a mean of 18±8 mmHg. There was a statistically significant difference between the preoperative and one-year follow-up data (p value<0.001). However, there was no significant difference between the early postoperative and one-year follow-up. **Conclusion:** Septal myectomy for Hypertrophic Obstructive Cardiomyopathy (HOCM) is a safe procedure with good immediate and short-term results, and with good outcome if done by an experienced surgeon with good selection criteria.

Keywords: Septal myectomy; Hypertrophic obstructive cardiomyopathy (HOCM); Follow up after septal myectomy; Hypertrophic cardiomyopathies; Idiopathic hypertrophic subaortic stenosis (IHSS).

INTRODUCTION

Hypertrophic cardiomyopathy (HCM) was previously known as hypertrophic obstructive cardiomyopathy (HOCM) or idiopathic hypertrophic subaortic stenosis (IHSS). These two later nomenclatures are not accurate and thus not recently used as the septal and ventricular myocardium can hypertrophy without casing obstruction [(1)]. According to the European society of cardiology 2008, hypertrophic cardiomyopathies are defined as increased ventricular wall thickness or mass, in the absence of loading conditions such as hypertension or valve disease [(2)].

In 2011, the ACC/AHA guidelines included also the pediatric practice, where the term HCM refers only to conditions with LV hypertrophy due to sarcomeric protein mutations without extracardiac or metabolic findings [(3)]. In adults (based on echocardiographic findings) HCM is considered when the left ventricular wall thickness exceeds 15 mm, with values of 13 to 14 considered borderline [(4)].

The mitral valve is not uncommonly affected in HCM, whether structurally or functionally causing systolic anterior motion of the mitral valve (SAM) thus contributing to LV outflow tract obstruction [(5)].

Cardiac conduction anomalies are common in HCM patients and sudden cardiac death is the most feared complication of HCM and is known to be mostly related to ventricular arrhythmias such as ventricular fibrillation (VF) and ventricular tachycardia (VT) [(6)].

Gross morphological features in HCM include increased heart mass (weight), asymmetrical interventricular septal thickening and small left ventricular cavity. Sometimes, there is also associated right ventricular hypertrophy, dilated atria, and thickened elongated mitral valve leaflets [(7,8)].

Hypertrophic cardiomyopathy can be subdivided into 2 types: **Non-Obstructive:** Characterized by abnormal diastolic function with normal, supranormal, or even impaired systolic function and **obstructive:** Which maybe Subaortic, midventricular and/or apical obstruction [(9)].

Clinical significance of LVOT gradient: According to the LVOT transgradient HCM can be divided into three groups:

Basal (rest) obstruction: with a gradient equal to or more than 30 mm Hg under resting conditions.

Labile (dynamic) obstruction: gradient is less than 30 mmHg under resting conditions but exceeds 30 mmHg when physiologically provoked.

Non-obstructive: gradient is less than 30 mmHg even when physiologically provoked.

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The most common presenting symptoms include dyspnea, which occurs in up to 90% of symptomatic patients, angina which occurs in 70% to 80% of patients, syncope and presyncope and palpitation (usually due to atrial fibrillation) [10].

There are 3 pathways of clinical progression: sudden cardiac death due to ventricular tachyarrythmias, most commonly in patients under 35 years (including competitive athletes). Progressive heart failure with end stage systolic dysfunction. And Atrial fibrillation either paroxysmal or chronic with the risk of thromboembolism and stroke [11].

Management of HCM: For symptomatic patients, medical treatment in the form of beta blockers, calcium channel blockers and other antiarrhythmic drugs can be useful to relief the symptoms especially dyspnea and angina, and to decrease the risk of sudden cardiac death due to arrhythmias [12].
Surgical management: When maximal medical treatment fails to alleviate the symptoms of obstructive HCM, and with peak systolic gradient of 50 mmHg at rest or with provocation, surgical myectomy has been the gold standard treatment for many decades [13]. Replacement of the mitral valve was once proposed to eliminate the dynamic LVOT obstruction. Other surgical options included modified Konno-Rastan aortoventriculoplast and apico-aortic conduit which are complex operations rarely needed for classic HCM patients [14].

PATIENTS AND METHODS

This prospective study included a total of 31 patients who underwent septal myectomy at Kasr Al Ainy University Hospitals. **Approval of the ethical committee and a written informed consent from all the subjects were obtained.** This study was conducted between March 2014 and May 2018.

Exclusion criteria: Any patient with ischemic or rheumatic pathology or requiring any additional procedure.

All patients had the routine preoperative laboratory investigations. TTE was the main diagnostic tool. Cardiac MRI was done for a number of patients.

Surgical Technique

All patients were operated via standard full median sternotomy, with routine cannulation of the ascending aorta just proximal to the arch. Double staged venous cannulation was done except in 4 patients where additional mitral procedure was anticipated so bicaval cannulation was done. Venting of the LV was done via the right superior pulmonary vein. The septum was tackled via an oblique aortotomy. After retracting the aortic valve, septal myectomy was carried out starting 3 to 5 mm below the aortic annulus, in the area extending between the level of the right coronary ostium and the commissure between the right and left coronary cusps. The efficiency of myectomy was assessed after weaning from CPB by TEE, which was also useful to rule out iatrogenic ventricular septal defect.

Statistical Analysis

Data were statistically described in terms of mean ± standard deviation (± SD), median and range, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups in terms of different follow up periods was done using Student *t* test for independent samples in comparing 2 groups when normally distributed and Mann Whitney *U* test for independent samples when not normally distributed. Within group comparison of numerical variables was done using Wilcoxon signed rank test for paired (matched) samples. For comparing categorical data, McNemar test was used. Survival analysis was done using Kaplan Maier statistics calculating the mean and median survival time for each group with their 95%CI and the corresponding survival graphs. *P* values less than 0.05 was considered statistically significant and less than 0.001 considered highly significant. All statistical calculations were done using computer program SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

Preoperative and postoperative clinical and echocardiographic data will be statistically compared regarding the following parameters:

1. Patient's symptomatology especially functional class of dyspnea (according to NYHA classification).
2. Peak gradient across the LVOT.
3. Septal wall thickness.
4. Degree of mitral regurgitation: for the sake of statistical analysis and according to advice of our statistician we converted the descriptive assessment of mitral incompetence to numerical grading as follows:
   - No or trivial equals 0
   - Mild incompetence 1
   - Moderate incompetence 2
   - Moderately severe 3
   - Severe incompetence 4 ***N.B;***

Because the number of patients is different at each follow up period, comparisons were made only of the data of those patients themselves who completed each specific period. For example, 10 patients completed 5 years follow up, so, statistical analysis

will include only their own data not the whole group.

RESULTS

Demographic data: There were 17 males (54%) and 14 females (45%). The mean age in the male group was 31.6 ±14.3 years, while for the female group it was 29.1±17.6 years with no statistically significant difference between both sexes (p value >0.05)

Table (1): demographic data

	MALE	FEMALE
Number of patients	17 (54%)	14(45%)
Age (years)	31.6±14.3 years	29.1±17.6 years

Preoperative Echocardiographic data: data showed normal LV function in our patients. All patients had an LVOT peak gradient of more than 50 mmHg. The peak gradient ranged from 53 to 172 mmHg with a mean of 102.4±24 mmHg. All of the patients had preoperative mitral regurge with a mean degree of 2.1±1.1. the preoperative septal wall thickness ranged from 1.5 to 3.5 cm with a mean of 2.1±0.7 cm.

Table (2): preoperative echocardiography

	min	max	mean	SD
Pressure gradient	53 mmHg	172 mmHg	102.4	±24
Degree of MR	1	4	2.1	1.1
SWT (cm)	1.5	3.5	2.1	0.7

Operative data: The total bypass time ranged from 34 to 67 min with a mean of 44±6 min. The cross-clamp time ranged from 23 to 55 min with a mean of 31±5 min. Intraoperative TEE showed a pressure gradient across the LVOT ranging from 4 to 20 mmHg with a mean of 7±6 mmHg, which was statistically significant in comparison to the preoperative values (p value<0.001).

Table (3): Operative data

	min	max	mean	SD
CPB time	34 min	67 min	44 min	±6
Cross clamp time	23 min	55 min	31 min	±5
Pressure gradient	4 mmHg	20 mmHg	7 mmHg	±6

Postoperative data:

The mechanical ventilation time ranged from 3 to 19 hours with a mean of 7.4±3 hours. 3 patients needed postoperative inotropic support (9.6%). 2 patients had complete heart block (6.4%) requiring temporary pacing. The total ICU stay ranged from 2 to 5 days with a mean of 2.2±0.7 days. There was no in hospital mortality or within 30 days from discharge.

One year follow up: One patient died 7 months postoperatively due to non-cardiac related cause. Another patient needed permanent pace maker implantation 6 months after the operation due to complete heart block. Echocardiography done at one year follow up showed a peak systolic gradient across the LVOT ranging from 6 to 40 mmHg, with a mean of 18±8 mmHg. There was a statistically significant difference between the preoperative and one-year follow-up data (p value<0.001). However, there was no significant difference between the early postoperative and one-year follow-up (p value>0.05).

Table (4): one-year follow-up

	min	Max	Mean
preoperative	53	172	102.4±24
postoperative	4	20	7±6
One year	6	40	18±8

DISCUSSION

our patients presented with higher PG more than most of other studies except for **Swistel and Balaram** [15], who reported a pre-PG of 135 ± 43 mmHg. This study was done in USA and reported much higher gradient than most other studies with much larger numbers done also in USA, but they also reported a significant degree of SAM (dynamic obstruction) and MR in most of their patients. This might implicate that the higher gradients were due to the fact that most of their patient were in severe and advanced form of the disease, rather than a characteristic finding of their population. Apart from this study, our study reported higher gradients than other studies done in USA, Europe and Latin America. This might suggest that the Egyptian patients with HOCM shows a more severe form of obstruction. We and others had a mean cross clamp time to perform the septal myectomy of around 30 minutes [16,17,18]. In our study, the mean post-myectomy intra-operative PG was 7 ± 6 mmHg, which shows highly significant statistical difference when compared to the mean pre-operative PG of 102.4 ± 24 mmHg (P value < 0.001). Maximum intra-operative gradient was 20 mmHg. ***McCully et al.*** [17], and **Swistel and Balaram** [15] both also reported significant reduction of gradient postmyectomy, with similar mean intra-operative PG of 9 ± 11, and 10 ± 18 mmHg respectively. Ashikhmina et al. [18] reported lower post-myectomy intra-operative PG with mean of 4 ± 8 mmHg, but they also reported preoperative PG lower than most of the studies.

At one year follow up, the mean gradient across the LVOT dropped from 102.4±24 mmHg to 18±8 mmHg, which was statistically significant. In another

study done by Berg et al, the peak gradient in the left ventricular outflow tract decreased from 72 +/- 30 mmHg (range, 31 to 144 mm Hg) to 6 +/- 4 mmHg [19].

CONCLUSION

Septal myectomy for Hypertrophic Obstructive Cardiomyopathy (HOCM) is a safe procedure with good immediate and short-term results, and with good outcome if done by an experienced surgeon with good selection criteria.

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