A patient with obstructive hypertrophic cardiomyopathy: a case report

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ABSTRACT

Background: Hypertrophic cardiomyopathy (HCM) is a left ventricle hypertrophic condition related to genetic disorders involving the gene encoding protein from the cardiac sarcomere apparatus. The prevalence of this disease is relatively low, but various clinical presentations make underrecognized and underdiagnosed. We reported obstructive hypertrophy cardiomyopathy patients with an episode of unexplained syncope and malignant arrhythmia.

Case Report: A 44 years old man came with the chief complaint of shortness of breathing. The patient felt the chief complaint since two years ago with getting worse during mild physical activity. The symptom got better during rest or slept with one pillow without complaining of dyspnea. One year ago, the patient started to feel palpitation disappear and arise with shortness of breathing. The patient got syncope two weeks ago during mild activities after a short period of breathlessness. For the vital sign, blood pressure was at 90/60 mmHg, blood pulse was 67 bpm irregular, breath frequency was 17x/min, and oxygen saturation was 99% room air. The electrocardiogram (ECG) showed atrial fibrillation with regular ventricular rate and left bundle branch block morphology of the QRS complex with Q wave at anterior precordial. The patient also checked for electrocardiography and ambulatory ECG monitoring using Holter. The patient was diagnosed with obstructive hypertrophy cardiomyopathy (OHCM), atrial fibrillation with regular ventricular rate and given Dabigatran 110 mg twice daily, metoprolol XL 12,5 mg once daily, and furosemide 10mg once daily for his medication.

Conclusion: Theoretically, myectomy is the best option for this case; however, due to limited high-volume hospitals in Indonesia doing myectomy for hypertrophic obstructive cardiomyopathy, alcohol septal ablation may be an alternative option if the medication was no longer adequate to improve symptoms.

Keywords: obstructive hypertrophy cardiomyopathy, syncope, malignant arrhythmia, left ventricular outflow tract.


BACKGROUND

Hypertrophic cardiomyopathy (HCM) is a left ventricle hypertrophic in the absence of another cardiac or systemic condition that produces left ventricular hypertrophy.1 Unlike ventricular hypertrophy resulting from hypertension in which the myocytes enlarge uniformly and remain orderly, the myocardial fibres are in a pattern of extensive disarray in the hypertrophied segment of hypertrophic cardiomyopathy. This myocytes disarray and fibrosis are characteristic of HCM in the common lethal arrhythmias are found in hypertrophic cardiomyopathy.2

An epidemiologic study reported that the prevalence of hypertrophic cardiomyopathy is 0.2% in the general population.1 But various clinical presentations from hypertrophic cardiomyopathy make this disease underrecognized and underdiagnosed in daily clinical practice. Data from Maron et al. reported that disease whose affected approximately twenty millions population worldwide and 50% of them are still unidentified that make the world less aware about this disease and miss diagnosis lead to improper management.3 Hypertrophy cardiomyopathy with left ventricular outflow tract (LVOT) obstruction with symptoms of heart failure and elevated resting or provoked gradient of (>50 mmHg) are a candidate for septal reduction therapy. Meanwhile, on the other side patients with hypertrophy cardiomyopathy are at risk for sudden cardiac death (SCD), and HCM patients with a high risk of having sudden cardiac death (SCD risk ≥6%) should have ICD implantation to reduce sudden cardiac death.4

In this case, we reported a patient with obstructive hypertrophy cardiomyopathy with an episode of unexplained syncope and malignant arrhythmia also recorded in his ambulatory ECG monitoring. We will discuss how to diagnose and stratify the 5-year risk of sudden cardiac death and proper management of patients with hypertrophic obstructive cardiomyopathy.

CASE REPORT

A man with the initial NM, lives in Manado, 44 years old of age, with a height...
of 166 cm and weight of 62 kg, with a good nutritional status, work as a ship engineer came to Siloam Hospital (Manado) on 30th March 2019 with the significant chief complaint of shortness of breathing.

The patient complained about his shortness of breathing that started two years before coming to the Siloam hospital. Initially, the shortness of breathing was felt only during moderate to high physical activity (e.g., playing badminton or walking for quite a distance ±1 km), but recently the shortness of breathing also occurred during mild activity such as walking for a short distance (100-200 meters). He did not complain of breathlessness during rest or sleep and never awakened in the middle of the sleep because of sudden shortness of breathing. He could sleep with one pillow daily without complaining of dyspnea; he never experienced edema on his low extremity. He also complained of palpitations that disappear and arise with shortness of breathing for the last year before going to the hospital.

Moreover, two weeks before going to Siloam Hospital, the patient had an episode of syncope while walking for a quite distance with 1-2 minutes duration. Just before syncope patient experiencing a short period of breathlessness. After waking from syncope, he did not feel like want to urinate nor defecate. Patients denied losing weight or having a long period of cough. He did not have any problem with defecating nor urinating recently. He was a non-smoker and denied any of his family members experiencing the same illness.

For the history of past illness, he denied having a history of hypertension or high blood sugar level. However, patients were treated at HCG hospital in India approximately one year before because of the same complaint except for syncope. Patient was undergone laboratory examination with the results: hemoglobin 15.7 gr/dL, hematocrit 45.6%, leukocyte 8.930 /µL, platelet 199.000 /µL, urea 19.48 mg/dL, creatinine 0.9 mg/dL, random blood sugar 89 mg/dL, Na 140 mEq/L, K 3.9 mEq/L, Cl 103.1 mEq/L, AST 28 U/L, ALT 25 U/L, TSH 2.11 µIU/mL, troponin I <0.01 ng/mL, Anti HCV was negative, HBsAg was negative, and anti-HIV was non-reactive. The patient also had a chest X-ray with the results of mild cardiomegaly and normal pulmonary vasculature. Echocardiography was also done with the results: Asymmetrical septal hypertrophy with grade I diastolic dysfunction and dilated left atrium, normal left ventricular ejection fraction (70%) and no regional wall motion abnormality. He was diagnosed having hypertrophy cardiomyopathy and have dabigatran 150mg twice daily oral, metoprolol XL 12.5mg once daily oral and furosemide 10mg once daily oral. After getting the medication patient was feeling better and discontinue his medication after finishing it for one course.

No core family members were experiencing the same illness as the patient have. His father died because of kidney failure and hypertension complications at 69 years old age. His mother died because of a stroke at 72 years old of age. He has two children, the old one is now 13 years old, and the little one is six years old. His offspring have normal growth and development and can catch up with school activity with no complaint.

For physical examination, we found that patient was moderately ill with comos mentis consciousness. For the vital sign, blood pressure was 90/60 mmHg, blood pulse was 67 bpm irregular, breath frequency was 17x/minute, and oxygen saturation was 99% in room air. Head examinations show non-anemic conjunctivae and non-icteric sclerae, neck examination show jugular venous pressure at seven cmH2O with no regional lymph node and thyroid gland enlargement. Chest examinations showed symmetrical form and movement of the chest; tactile fremitus was equal with normal auscultation for both lungs. The ictus cordis was found 2 cm laterally from the left midclavicular line; no thrill was found. Heart auscultations show normal first and second heart sound with an irregular pattern. A systolic murmur was heard at the lower left sternal border with a crescendo decrescendo pattern with no radiation. The murmur attenuated with Valsalva maneuver. The abdomen was flat, and no liver nor spleen enlargement at palpation, no epigastric tenderness, the bowel sound was typical. Lower extremities showed no edema, pulsation of the artery was equal for both sides of extremities with the capillary refill time <2 seconds.

Electrocardiogram (ECG) examination showed atrial fibrillation rhythm with normal ventricular rate (70 bpm), left axis deviation and pathological Q wave in anterior precordial lead, poor R wave progression in the lateral precordial lead (V5-V6), also broad (>120 milliseconds) QRS complex. The impression of this ECG was atrial fibrillation with normal ventricular rate (70 bpm) and left bundle branch block morphology of the QRS complex with Q wave at anterior precordial. The patient was diagnosed with obstructive hypertrophy cardiomyopathy (OHCM), atrial fibrillation with regular ventricular rate and given Dabigatran 110 mg twice daily, metoprolol XL 12.5 mg once daily, and furosemide 10mg once daily for his medication.

Echocardiography examination was also performed on the patients with left atrial dilatation results with left ventricular hypertrophy. Normal left ventricle systolic function with LV ejection fraction 91.6% and chordal SAM was found to obstruct the LVOT. The resting gradient of the LVOT was elevated to 54 mmHg during systole. Right ventricle contractility was descent with TAPSE 1.65 cm. The inferior vena cava size was 1.88 cm with > 50% collapsibility estimated five mmHg right atrial pressure (Figure 1).

On the next day, ambulatory ECG monitoring using Holter was performed for 24 hours with atrial fibrillation as a rhythm, with average heart rate at 76 bpm, minimum heart rate at 29 bpm recorded during rest, and maximal heart rate was 252 bpm recorded when the patient was sleeping. There was 163 extra ventricular systole (0.15%), with 147 occurs as single VES, six occurs as couplets and one VES run with heart rate of 160 bpm with the duration of 1.28 sec. No extra supraventricular systole was recorded, multiple paused were recorded (254 times) with maximal pauses at 3.58 sec (Figure 2). Patient SCD risk was calculated using ESC calculator and have 13.6% risk of SCD at five years and classified as high risk of SCD. The patient was planned to have an ICD implantation, but he still disagreed and signed the refusal consent.
CASE REPORT

Hypertrophy cardiomyopathy (HCM) is left ventricular hypertrophy that occurs without any cardiac, metabolic, or systemic disease (e.g. hypertension or aortic stenosis) detected that is capable of causing left ventricular hypertrophy. These cases occur in 1 from 500 general population with an equal incidence of male and female. Approximately 750,000 population in the US are affected by this disease. HCM is a genetic disorder with an autosomal dominant pattern involving one gene encoding protein from the cardiac sarcomere apparatus. This defect has more than 2000 mutations were found, and at least 11 genes or more was associated with hypertrophy cardiomyopathy. Mutation in the genes encoding β-myosin heavy chain (MYH7) and myosin binding protein C (MYBPC3) account for approximately 70% of cases with identified mutations.

Patients with asymmetrical septal hypertrophy from the proximal interventricular septum can show left ventricular tract obstruction symptoms during systole that make different hemodynamic impacts. It is essential to differentiate HCM with LVOT obstruction or HCM without LVOT obstruction. There is no disturbance in the patient with HCM without LVOT obstruction during systole, and even the left ventricle usually pumps the blood vigorously. The only problem is the stiffness of hypertrophied left ventricle, which can impair diastolic function. The elevated left ventricular pressure will be transmitted into the left atrium and pulmonary capillary vasculature, causing interstitial fluid accumulation and causing dyspnea. Approximately 2/3 patients with HCM manifested as HCM with LVOT obstruction. With 1/3 cases of the LVOT obstructions occurs at rest, and the other 1/3 cases manifested as latent HOCM that occur with maneuver or provocation.

Obstruction of the LVOT is caused by abnormal movement of the anterior mitral leaflet pulled to the hypertrophied septum during systole. Blood was ejected from the left ventricle to the aorta through the narrowed outflow tract during left ventricle contraction. The rapid bloodstream created the venturi forces that pulled the anterior mitral leaflet

DISCUSSION

Hypertrophy cardiomyopathy (HCM) is left ventricular hypertrophy that occurs without any cardiac, metabolic, or systemic disease (e.g. hypertension or aortic stenosis) detected that is capable of causing left ventricular hypertrophy. These cases occur in 1 from 500 general population with an equal incidence of male and female. Approximately 750,000 population in the US are affected by this disease. HCM is a genetic disorder with an autosomal dominant pattern involving one gene encoding protein from the cardiac sarcomere apparatus. This defect has more than 2000 mutations were found, and at least 11 genes or more was associated with hypertrophy cardiomyopathy. Mutation in the genes encoding β-myosin heavy chain (MYH7) and myosin binding protein C (MYBPC3) account for approximately 70% of cases with identified mutations.

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abnormally to the LVOT. Conventionally LVOT obstruction was defined as an elevated resting or provoked gradient of the LVOT $\geq 30$ mmHg. Increased LVOT gradient of $\geq 50$ mmHg is usually considered a threshold for the obstruction to become hemodynamically important.

Hypertrophic cardiomyopathy may show varying symptoms in affected individuals, from none to marked physical limitations. Dyspnea is the most frequent symptom owing to elevated LV diastolic pressure. The symptoms are usually provoked by exercise and excessive physical activity. Even the more severe form of heart failure symptoms such as orthopnea and paroxysmal nocturnal dyspnea can also be found.

Patients with HCM often describe angina even in the absence of obstructive coronary artery disease. Myocardial ischemia may be contributed to (1) by increased oxygen demand of increased hypertrophied muscle mass and (2) the narrowed small branches of the coronary arteries within the hypertrophied ventricular wall. If the outflow tract obstruction is present, the high systolic pressure increases the myocardial oxygen demand. Furthermore, when there is a sign of severe stable angina (Canadian Cardiovascular Society [CCS] class $\geq 3$), it is recommended to run the coronary angiography or computed tomography angiography to evaluate the coronary arteries.

Syncope in HCM may result from the reduction of cardiac output because of the LVOT obstruction or conduction abnormalities (AV block) or cardiac arrhythmias that arise because of the structurally abnormal myofibers. Syncope due to LVOT obstruction usually occurs during moderate to heavy physical activities; meanwhile, syncope due to malignant arrhythmias may occur during mild physical activities, or sometimes it occurs at rest. Palpitation may also be present and usually caused by supraventricular tachyarrhythmias, including atrial fibrillation. Patients with syncope are recommended to undergo 12 lead ECG examinations and continuous ambulatory ECG monitoring for at least 48 hours.

This patient admits having shortness of breathing on moderate to heavy physical activity. The symptoms improve after cessation of the activities matches the dyspnea as the most common symptom found in HCM. What we found interesting is that the patient had an episode of syncope. Moreover, after careful history taking, the episode of syncope occurs during moderate to heavy physical activities and just before syncope patient experiences severe tightness and heavy breathing. The anamnesis shows that the episode of syncope is likely due to decreased cardiac output caused by the LVOT obstruction. Although the mechanism of syncope leads to decreased cardiac output due to LVOT obstruction, according to 2014 ESC guidelines on diagnosis and management of hypertrophic cardiomyopathy, continuous ambulatory ECG monitoring is recommended to detect malignant arrhythmias and SCD risk stratification.

Physical examination on a patient with HCM is related to the hemodynamic condition. A patient with mild HCM may have a regular physical examination. Otherwise, a common finding is the fourth heart sound ($S_4$), generated by left atrial contraction into the stiffened LV that we do not find in this patient because of loss of atrial contraction due to atrial fibrillation. The other common sign is a double apical impulse due to forceful atrial contraction lost because the patient had...
atrial fibrillation. Other typical findings in patients with systolic outflow obstruction are that cardiac murmur which is usually rough, with crescendo-decrescendo shape and best heard at the left lower sternal border, increases in intensity with Valsalva maneuver like the one found on the patient. Twelve leads ECG examinations in HCM patients may be normal (in 6% of patients with HCM). Several abnormalities that can be found in 12-lead ECG examination are (1) Giant negative T wave (> 10 mm) in the precordial lead. (2) Abnormal Q wave ≥40ms in duration or >25% R wave depth in minimum two continuous leads. (3) Rhythm disturbance such as supraventricular tachycardia, including atrial fibrillation or ventricular tachycardia. (4) Poor R wave progression in the lateral precordial lead. We found atrial fibrillation, Q wave abnormalities in V1-4, and poor R wave progression in the lateral precordial lead, which support the diagnosis of hypertrophy cardiomyopathy. Atrial fibrillation is the most common supraventricular arrhythmias found in HCM that is also present in this case. Atrial fibrillation occurs in 20-25% of HCM patients. Clinical parameters related the most to the presence of atrial fibrillation is the left atrial enlargement. Since the left atrium size predict the incidence of atrial fibrillation and stroke in HCM patients, HCM patients with left atrium size > 45 mm with sinus rhythm as presenting ECG is recommended to have a continuous ambulatory ECG monitoring for 48 hours every 6-12 months.

Echocardiography and cardiac MRI are two primary modalities to evaluate left ventricular hypertrophy. Asymmetric septal hypertrophy found in echocardiography defined as septal/ inferior wall ratio mode than 1.3 is strongly associated with HCM. In most cases, the hypertrophied left ventricle is more than 15 mm (avg 21 mm). Massif hypertrophy was also found in several cases (30-50 mm). According to the ESC guideline on diagnosis and management of hypertrophic cardiomyopathy, the diagnostic criteria used to define HCM is septal thickness ≥15mm in one or more segments of left ventricular myocardial.

The comprehensive echocardiographic examination needs several cuts of view through transthoracic windows, including parasternal long-axis view, parasternal short-axis view, and apical window. The anterior interventricular septum is the predominant region of hypertrophy in most patients, occurring in more than 80% of patients with HCM in a large consecutive series of 600 patients. Different classification systems have been proposed to divide HCM into morphologic subtypes. One morphologic classification scheme is based on the distribution of hypertrophy: (1) type I, anterior septum alone; (2) type II, pan septal hypertrophy (involvement of anterior and posterior septum); (3) type III, extension of hypertrophy to anterolateral wall; and (4) type IV, all other patterns of hypertrophy. A more recent approach to categorizing the various morphologic subtypes is based on the septal morphology and LV cavity contour (Figure 3): (1) septal sigmoid morphology, prominent basal septal bulge, generally an ovoid LV cavity with the septum concave to the LV cavity (2) reverse septal curvature, predominant mid septal convexity toward the LV cavity, with a crescent shape to LV cavity; (3) apical, predominant apical distribution of hypertrophy; (4) neutral septum, overall straight septum that is neither convex nor concave toward the LV cavity. Patients with HCM infrequently have a concentric distribution of LV hypertrophy (all hypertrophied segments are thickened to a similar degree), with 1% prevalence observed in the study of 600 patients with HCM.

M-mode echocardiographic studies have demonstrated SAM of the mitral valve and mid-systolic notching of the aortic valve as the sign of dynamic LVOT obstruction in HCM. Morphologic features of HCM that contribute to LVOT obstruction include narrowing of the outflow tract by septal hypertrophy, intrinsic abnormalities of the mitral leaflets, anterior displacement of the mitral apparatus, and anterior malposition of the papillary muscles. The degree of SAM has been divided into three categories by M-mode echocardiography: (1) mild: SAM-septal distance of more than 10 mm; (2) moderate: SAM-septal distance of 10 mm or less, or brief mitral leaflet–septal contact (<30% of echocardiographic systole); and (3) severe: prolonged SAM-septal contact, lasting for at least 30% of echocardiographic systole.

Doppler techniques provide factual information regarding the magnitude and level of obstruction in patients with HCM. Pulsed wave (PW) doppler signals can be recorded sequentially from the LV apex to the outflow tract. Peak velocity increases as the sample volume approach the contact site between the anterior mitral leaflet and the septum. Continuous-wave (CW) doppler assessment from the apical approach with the beam directed across the LVOT can be used to determine the peak velocity (V_max) at the site of obstruction. Patients with LVOT obstruction have a characteristic spectral profile with an asymmetric leftward concave shape. This result is from a relatively rapid initial rise in velocity followed by a more gradual increase in the LVOT velocity to cause a peak in late systole, leading to a dagger-shaped Doppler profile. Patients with HOCM will have resting or provoked

![Figure 3. Septal morphology and contour of the LV on HCM.](image-url)
outflow gradient $\geq$ 30 mmHg. The peak gradient (AP) can be estimated using the modified Bernoulli equation ($AP = 4V^2_{max}$).\(^1\)

The echocardiographic result of this patient match with findings found in HCM with thickening of the septal (2.27 cm) extended through the inferior wall (1.88 cm). The left ventricle showed the morphology of neural HCM. Chordal SAM is also present in the M mode examination. Moreover, the resting gradient of 54 mmHg showed that the patient had a significant LVOT obstruction that affected hemodynamics. The left atrium also enlarged with a diameter of 47 mm, a common finding in patients with HCM.

Sudden cardiac death prevention is one of the primary management for the patient with HCM. Intra Cardiac Defibrillator (ICD) can alter the natural history of this disease and effectively terminate lethal ventricular tachyarrhythmias. ICD can be used for both primary prevention for patients with a high risk of SCD ($\geq$6% Risk-SCD at five years calculated from ESC SCD risk calculator), or secondary prevention after the patient had an episode of cardiac arrest with the level of recommendation class I and level of evidence B. the risk of SCD for HCM patient can also be count using the HCM Risk-SCD formula as follow:

$$\text{Probability}_{SCD \text{ at 5 years}} = 1 - 0.998^{[\text{Prognostic index}]}$$

where Prognostic index $= \frac{0.15939858 \times \text{maximal wall thickness}^2 - 0.00294271 \times \text{maximal wall thickness}^2 - 0.0259082 \times \text{left atrial diameter} \times \text{left ventricular outflow tract gradient (mm Hg)}}{0.00446131 \times \text{maximal (rest/ Valsalva) left ventricular outflow tract gradient (mm Hg)}} + 0.4583082 \times \text{family history SCD} + 0.82639195 \times \text{NSVT} + 0.71650361 \times \text{unexplained syncope} - 0.01799934 \times \text{age at clinical evaluation (years)}}.$\(^4\)

The restriction to exercise should be educated in patient with HCM to prevent SCD. Although documented, exercise-induced, sustained ventricular arrhythmias are rare. Especially when they have risk factors for SCD and or LVOT obstruction.\(^4\)

For this patient, ICD implantation is recommended because the patient came with unexplained syncope that malignant arrhythmias can cause and also the patient has 13.62% risk-SCD at five years after calculated using ESC calculator and according to 2014 ESC guideline on diagnosis and management of hypertrophic cardiomyopathy, ICD implantation for secondary prevention is recommended with class IIA recommendation and level of evidence B. According to a review article written by Barry J. Marron in 2018, HCM patients with $\geq$ 1 risk factor for sudden cardiac death are recommended to have an ICD implantation for primary prevention.\(^7\)

Several factors that increase sudden cardiac death risk for patient with HCM are (1) family history of HCM with sudden cardiac death; (2) unexplained syncope; (3) multiple, repetitive NSVT; (4) massive LVH ($\geq$ 30 mm); (5) LV apical aneurysm; (6) extensive LGE on MRI; (6) end-stage heart failure with ejection fraction $<50\%$.\(^7\) And two factors were found in this patient: (1) multiple, repetitive NSVT; (2) unexplained syncope. Because this patient had a high-risk SCD calculated using ESC calculator and two risk factors found in this patient, the ICD implantation is recommended to prevent SCD.

Beta-blockers, disopyramide, and calcium channel blockers are three groups of drugs used to reduce LVOT obstruction gradient and relieve the symptoms. By decreasing myocardial contractility, the speed of blood ejection from the LV is also decreased and will delay the onset of SAM, reducing the LVOT obstruction mechanically. Beta-blockers and calcium channel blockers can also reduce the ischemia by decreasing myocardial oxygen demand and prolonging the diastolic period that will raise LV passive filling. However, the administration of verapamil should be monitored closely in HCM since it can also cause vasodilatation and worsen the LVOT obstruction.\(^3\) Until now, no single anti-arrhythmic drugs proven to prevent sudden cardiac death in patients with HCM.\(^5\)

Atrial fibrillation is the most common arrhythmia found in HCM. Cardioversions remain the central management in atrial fibrillation with unstable hemodynamic. However, for stable hemodynamic atrial fibrillation found in HCM patients, rate controls and thromboembolic prevention are recommended. Thromboembolic prevention is given in all HCM patients with atrial fibrillation without considering CHA2DS2-VASc (congestive heart failure, hypertension, age, diabetes, stroke, vascular disease, and sex) scores either warfarin (target INR 2.0-3.0) or using other novel oral anticoagulants. The ventricile's rate control can be achieved using beta-blockers or non-dihydropyridine calcium channel blockers with the ventricular rate target $<100$ bpm. Another rate control agent usually used in atrial fibrillation is digoxin and it can also be used in HCM patients with atrial fibrillation if there is no LVOT obstruction. If the LVOT obstruction is present, digoxin is contraindicated.\(^4\)

The patient was given metoprolol in this case, whereas metoprolol is a cardioselective beta-blocker with no vasodilatory property. Thus it can be given. Patient symptoms were improved after treatment with metoprolol though the patient was not tested clinically. Besides metoprolol, patient was also given oral anticoagulants (dabigatran) for thromboembolic prevention without considering patient’s CHA2DS2-VASc score because atrial fibrillation in HCM will increase the risk of stroke by eight times fold than with sinus rhythm.\(^14\)

For 90% of patients with chronic, drug-refractory disability from heart failure, the primary cause is left ventricular outflow obstruction (at rest or with exercise). Moreover usually, heart failure is reversible if the septal reduction was made. Myectomy was established for the primary option in HCM with refractory heart failure (NYHA functional class III-IV) with medical therapy caused by elevated LVOT gradient $\geq 50$ mmHg.\(^14,15\)

Transaortic septal myectomy (Morrow procedure) involves resectioning a tiny portion of muscle (3-10 g) from the basal LV septum. However, now many operators have done myectomy more aggressively with muscle resection extended through distal area from the septum and sometimes reconstructing papillary muscle that contributes to cause obstruction.\(^17,15\) With abolishing the subaortic gradient and normalized the left ventricle, myectomy will permanently reverse the heart...
failure regardless of the duration of heart failure. Myectomy also improved the quality of life up to 95%, including 70% become asymptomatic. Myectomy is now established as one of the safest open-heart surgeries with a 0.4% mortality rate in the center with a high volume of obstructive HCM cases. But it needs to be considered that the risk of operative death is also increased by a factor of 12 when myectomy is performed in centers with a lower volume of such cases.

Meanwhile, the percutaneous alcohol septal ablation using echo guided has been the leading alternative. It has advantages for being a non-invasive procedure that requires a relatively shorter length of stay and is more convenient for the patients than myectomy surgery. This procedure is usually for HCM patients with refractor symptoms of heart failure who underwent medical treatment but with severe comorbidities and advanced age who are not candidates for myectomy and another procedure requiring open-heart surgery such as coronary artery bypass or valve replacement. Alcohol injected through the septal perforator artery will induce transmural infarct and causing similar effect to myectomy procedure to reduce the gradient and symptoms. The success rate from alcohol septal ablation (ASA) depends on the operator with a mortality rate of less than 1% in a high volume center. For the disadvantages of ASA, approximately 10% of patients who undergo ASA require a pacemaker for heart block; the arrhythmic burden may be increased because of septal scarring; another 10% of the patients require repeat ablation and unfavourable anatomy of the left ventricular outflow tract and septal perforator artery may limit treatment efficacy.

Alcohol septal ablation (ASA) may be an alternative for patients, especially in North Sulawesi, because myectomy septal reduction cannot be made due to limited resources. Beta-Blockers should be stopped before ASA, and intravenous fluid should be avoided for the optimal LVOT gradient measurement during the procedure. Temporary pacemaker usually prepared for every patient due to high incidence of total atrioventricular block, which is the common complication to ASA procedure.

In the study published by Spirito et al. in 2017, ethanol injection to proximal septal branch of the left anterior descending (LAD) artery does not ensure ethanol distribution and infarct caused by ethanol only limited in basal septal region. The basal septal region can also get supplied from the posterior descending artery (PDA). These arteries form anastomoses that can limit the infarcted segment but sometimes contribute to a more significant infarcted segment. In the study published by Afanasyev et al. in 2020, the targeted septal branch can not be identified in 62 from 1,014 patients (6.1%), and the procedure was cancelled without any alcohol injection. Other operators are also limiting ethanol injection only at the single septal branch. This strategy gives a good 15 years of survival without any complications.

Many research compares the results of myectomy with ASA. Two meta-analyses show no significant difference in early mortality rate with similar symptoms improvement after both procedures. There is also no significant difference with mid-term survival in both procedures, but the need for pacemaker after the procedures was significantly found in ASA with reduction of resting LVOT gradient approximately eight mmHg less compare to myectomy procedure. However, according to both meta-analyses, the long-term risk for ventricular arrhythmias and sudden cardiac death is unclear for both procedures. Overall, myectomy remains the primary option, especially in young patients with low comorbid and high life expectancy. Myectomy is also a choice for patients who need other cardiac surgery such as coronary artery bypass surgery or heart valves surgery. Echocardiography provides important information regarding which procedure to choose. Preprocedural echocardiography with septal thickness <18 mm at the location of SAM and resting LVOT gradient <100 mmHg are essential factors that support ASA procedure, and ASA is not recommended in patients with resting gradient ≥100 mmHg and HCM with septal thickness >30 mm.

In this case, patient has NYHA functional class III heart failure symptoms and an elevated resting LVOT gradient of 54 mmHg. So, according to the 2014 ESC guideline on diagnosis and management of hypertrophic cardiomyopathy, septal reduction is recommended for this case. However, in this case, heart failure symptoms show significant improvement with medical therapy hence septal reduction procedure is not an emergency need and can be postponed. Myectomy is preferable if there are high volume centres available because patients do not have severe comorbid with high life expectancy. Nevertheless, in Indonesia, there are very little & limited data about the hospital capable of doing myectomy with high volume cases. So, ASA procedure is still considerable and has become the second option for this case because no contraindication (septal thickness >30 mm & LVOT gradient ≥100 mmHg) was found in this case for ASA procedure.

CONCLUSION

Patients with hypertrophic cardiomyopathy & LVOT obstruction having atrial fibrillation with controlled rate came with an episode of syncope and dyspnea on the exertion. The echocardiographic showed septal wall thickness 25 mm with the presence of chordal systolic anterior motion (SAM) with a resting gradient of 54 mmHg. Holter examination revealed an episode of non-sustained ventricular tachycardia. The Risk-SCD at five years for this patient was 13.62%, categorized as high risk, so ICD implantation was recommended to prevent SCD. Although patient symptoms are well controlled with medication, the patient also indicated for septal reduction procedure. Theoretically, myectomy is the best option for this case; however, due to limited high-volume hospitals in Indonesia doing myectomy for hypertrophic obstructive cardiomyopathy, alcohol septal ablation may be an alternative if the medication was no longer adequate to improve symptoms.

DISCLOSURE

Author Contribution

All authors enlisted above contributed equally in writing and preparing this case report.
Ethical Consideration
This case report has been approved by the Ethical Commission of Faculty of Medicine, Universitas Sam Ratulangi. The patient also has given informed consent to join this case report and is permitted to publish the data.

Conflict of Interest
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BIBLIOGRAPHY