Management of Rare Combination of Cardiac Anomalies in A Patient with Noonan Syndrome

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ABSTRACT

Noonan syndrome is a rare disorder in which different cardiac abnormalities can exist. This report describes the combination of cardiac abnormalities in a patient with Noonan syndrome, which has not been reported previously. Coexisting cardiac abnormalities were: atrial septal defect, atrial fibrillation and noncompaction of the ventricular myocardium. Surgical fenestrated closure of atrial septal defect and concomitant maze procedure were performed. Surgery of congenital heart defects in syndromic patients has different difficulties than those in nonsyndromic patients. Thus, specific approach should be taken in these patients.

Key Words: Noonan syndrome; atrial fibrillation; atrial septal defect; noncompaction; sick sinus syndrome

Noonan Sendromlu Bir Hastada Nadir Olarak Saptanan Kardiyak Anomalilerin Tedavisi

ÖZET

Noonan sendromu farklı kardiyak anomalilerin de eşlik ettiği nadir görülen bir hastalıktır. Sunulan olguda Noonan sendromlu bir hastada kardiyak anomalilerin daha önce bildirilmemiş bir kombinasyonu bildirilmiştir. Eşlik eden kardiyak anomaliler atriyal septal defekt, atriyal fibrilasyon ve ventrikül miyokardında noncompaction idi. Atriyal septal defekt cerrahi olarak fenestre biçimde kapatılırken maze prosedürü uygulandı. Sendromlu hastalarda saptanan konjenital kalp defektlerinin cerrahi tedavisinde sendromu olmayan hastalara göre farklı güçlükler ile karşılaşılmaktadır. Bu nedenle sendromlu vakalarda özellikli bir yaklaşım ihtiyacı vardır.

Anahtar Kelimeler: Noonan sendromu; atriyal fibrilasyon; atriyal septal defekt; noncompaction, hasta sinüs sendromu

INTRODUCTION

Noonan syndrome (NS) is an autosomal dominant congenital genetic disorder with estimated prevalence of 1/1000-2500 live births. Characteristic findings are typical facial features, chest deformity, short stature and various congenital cardiac defects. NS diagnosis is based on clinical findings[(1)]. A broad spectrum of cardiac anomalies can be diagnosed in which pulmonary valve stenosis has been the most common cardiac defect[(2)]. Herein we describe management of a case of NS associated with atrial septal defect, atrial fibrillation (AF) and non-compaction of left ventricular myocardium, which has not been reported previously.

CASE PRESENTATION

A 13-year-old girl with NS was referred to our department for further evaluation and surgical management of atrial septal defect. She was diagnosed with NS 2 years ago. During her regular polyclinic visits atrial septal defect, atrial fibrillation and non-compaction of left ventricular myocardium had been detected. She had no complaint and had no significant family history.

Physical examination findings associated with NS were brachycephaly, tall forehead, down-slanting palpebral fissures, nasal septal deviation, prominently grooved upper lip, low-set ears, high-arched palate, micrognathia, prognathia, webbed neck, hypoplastic nipples, low posterior hairline, thoracic scoliosis and pectus carinatum. Her height was 151 cm (10-25 percentile) and her weight was 29 kg (0-5 percentile). A grade 3/6 systolic murmur was heard in mesocardiac area and no thrill was palpated. Her pulse was arrhythmic.

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Her complete blood count and blood chemistry values were normal. INR was slightly elevated. In addition to those, levels of coagulation factor II, V, VII and X were low.

Atrial fibrillation was suspected by electrocardiogram (ECG) and was confirmed by transesophageal electrophysiological study. There were no significant findings in her chest x-ray. In transthoracic echocardiography, multiple ostium secundum type atrial septal defects with left-to-right shunt, non-compaction of right and left ventricular myocardium were observed (Figure 1). Paradoxical septum motion was noted. Left ventricular ejection fraction was measured as 58 %. Right ventricular systolic pressure was 50 mmHg. Pulmonary stenosis was not observed. To confirm noncompaction cardiac magnetic resonance imaging was performed and concordant diagnosis with echocardiography was obtained (Figure 2). Electrical cardioversion was performed twice but AF was sustained. Hence, oral amiodarone therapy was initiated.

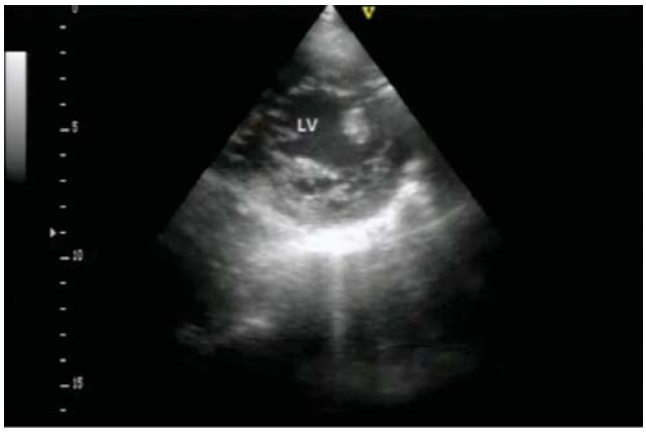

Figure 1. Preoperative TTE image of left ventricular cavity during diastole showing two-layered structure of the myocardium (epicardial compacted, endocardial non-compacted layer). Also ratio of distance between the epicardial surface and through of intertrabecular recess to distance between epicardial surface and peak of trabeculation ≤ 0.5.

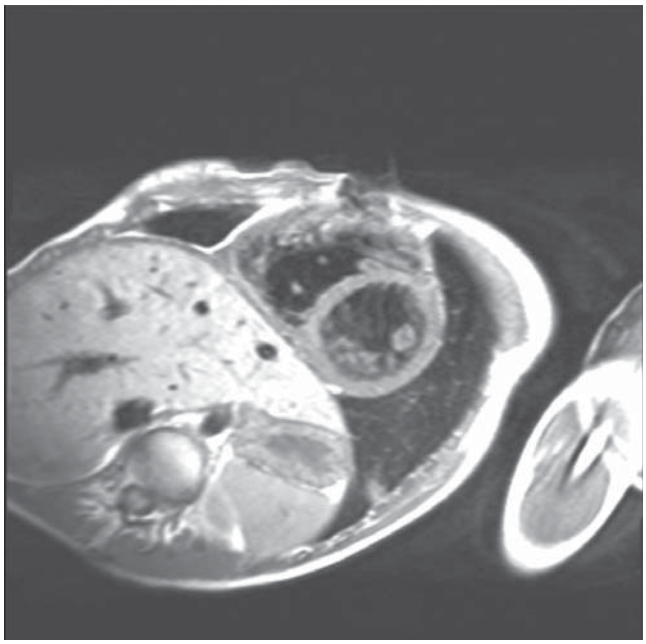

Figure 2. Preoperative MRI image of left and right ventricular cavity showing trabeculations. Ratio between the noncompacted and compacted myocardium was 2.5. Also thoracic scoliosis is remarkable.

Surgical intervention was planned for the ostium secundum type atrial septal defect and atrial fibrillation that is intractable to electrical and medical cardioversion. Midline split sternotomy was performed. Aortic and bicaval cannulation was done and cardiopulmonary bypass was initiated. Right atrium was incised. Single large cribriform ostium secundum type ASD was seen. Then left atrial set of Cox-Maze IV procedure was performed with radiofrequency ablation (Medtronic Cardioblate®). ASD was closed with Dacron patch. To prevent further attenuation of left ventricular contractile function of noncompacted myocardium after ASD closure, Dacron patch was fenestrated 4 millimeters in diameter. All incisions were closed. Patient was weaned from by-pass without any contractile or rhythm disturbances. No excessive hemorrhage or chylothorax was detected in postoperative course. On second postoperative day, she was discharged from intensive care unit to ward. During her follow-up in the ward bradycardia was noticed. Sick sinus syndrome was detected with ECG and holter monitoring. Dual chamber epicardial pacemaker implantation was performed. After implantation postoperative course was uneventful and she was discharged in postoperative 2nd day.

DISCUSSION

The most important cause of morbidity and mortality in NS is accompanying cardiac defects, with pulmonary stenosis being the most common (50%). Ostium secundum type atrial septal defect is relatively less common defect presenting in NS (8-10%). Apart from cardiac defects, 50-60 % of NS patients have dysrhythmia. Various types of dysrhythmia -from characteristic left axis deviation and existence of abnormal Q waves to fatal ventricular fibrillation- have been reported[3,4].

Noncompaction of the ventricular myocardium (NCVM) is defined as an arrest in the normal embryological process of myocardial compaction, resulting in persistence of multiple prominent ventricular trabeculations and deep intertrabecular recesses. NCVM can be identified with genetic syndromes and metabolic diseases and is mostly associated with different congenital cardiac defects. NS is one of those genetic syndromes that NCVM can be diagnosed[5]. NCVM is mostly involved solely in left ventricle, right ventricular NCVM and biventricular NCVM occur infrequently. Hypertrophic cardiomyopathy (HCM) is one of the most frequently diagnosed cardiac conditions in NS whereas NCVM presents rarely[4]. For that reason, differentiating NCVM from HCM is crucial for treatment. Morphological information derived from echocardiography may not always be sufficient to define the cardiomyopathy type. For that reason high-resolution images of the heart obtained with magnetic resonance may offer aid in differential diagnosis. Moreover, DNA analysis for mutation in the alpha-cardiac actin gene was proposed as the most definitive and promising method

for diagnosis in many patients with cardiomyopathies[6].Recent report suggested that survival is significantly worse for NS-HCM coexistence than nonsyndromic HCM[7].

Our patient had ostium secundum type atrial septal defect, atrial fibrillation and non-compaction of left and right ventricular myocardium, which has not been previously been reported in another patient with NS.

We closed the septal defect with fenestrated Dacron patch. It is well known that systolic pulmonary artery pressure is considered equal to RVSP in the absence of pulmonic valve stenosis or outflow tract obstruction. In our case right ventricular systolic pressure (RVSP) was 50 mmHg and no pulmonary stenosis presented, mildly elevated pulmonary artery pressure was detected. In addition, pulmonary venous hypertension can develop in NCVM because of both systolic and diastolic dysfunction caused by inefficient contractile capacity[5]. For that reason to unload left ventricle and prevent progression of pulmonary hypertension, we decided to fenestrate the patch on the septal defect. It has been reported that even in patients with severe pulmonary hypertension, closure of atrial septal defect can be performed safely if patch is fenestrated[8].

Since our case had sustained atrial fibrillation, left atrial set of Cox-Maze IV procedure was performed. Immediate postoperative ECG was in sinus rhythm whereas sick sinus syndrome developed during her early postoperative follow up. In literature, there are two major causes reported. First, performing right atrial set of Cox-Maze IV procedure may cause sinus node dysfunction postoperatively. Since pacemaker function within the atria is complex and not readily attributed to a single pacing site, ablation of loci in right atrium is the major risk factor for postoperative sinus dysfunction[9]. Second, it is well established that concealed sick sinus syndrome may become manifest after restoration of sinus rhythm by ablation in patients with AF[10]. As we only performed the left atrial set of Cox-Mae IV procedure, it is most likely that the latter explanation is valid for postoperative sick sinus syndrome. We chose dual chamber epicardial pacemaker because of coexistence of noncompacted myocardium of both ventricles and sick sinus syndrome. It has been reported that in sick sinus syndrome, more favorable results were obtained with dual chamber ventricular pacing[11].

Because of coagulation abnormalities (mostly coagulation factor deficiencies) that exist in NS, excessive postoperative hemorrhage can affect hemodynamic status of patient[12]. Our patient had also low levels of several coagulation factors. We prepared fresh frozen plasma, recombinant factor VIIa and platelets preoperatively to use intraoperative but no excess hemorrhage was detected in either intraoperative or postoperative course. Also it has been reported that chylous effusion is a known complication after cardiac surgery in those patients[13]. However, we did not observe any chylous drainage postoperatively.

NS can manifest one or combination of diverse cardiac abnormalities. In this letter, we report the first case of NS with ASD, NCVM and AF. Cardiac defects are major cause of morbidity and mortality in NS. Prognosis of cardiac defects in NS is somehow worse than those in nonsyndromic ones. But exact pathophysiologic mechanism is still need to be elucidated. Since pulmonary stenosis alone is not a fatal condition, NCVM may be the reason for increased morbidity and mortality in NS patients. Owing to the fact that existence of NCVM in patients with NS is underestimated likewise in nonsyndromic patients with congenital heart defects, careful screening of syndromic patients in aspect of NCVM is crucial for management. Better understanding of the pathogenesis of this disorder is needed to explain the phenotypic variations and achieve successful management.

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