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Review

Case Report

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Feminine heart puzzle in 2015

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Abstract

In order to decrease the cardiovascular morbidity and mortality special attention should be given to the feminine heart. The first step is to evaluate the major differences in the pathophysiology, symptom onset and clinical outcomes of ischemic heart disease between the genders. Next is to find the best imaging modality that will lead to appropriate treatment.

Keywords: Heart disease, coronary artery, female

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Heart disease has been stated to be number one killer in women[1] and in 2015 nothing much seems to have changed. It is still the leading killer of women at all ages affecting more women under the ages of 55 years than breast cancer.[2-5]

In order to solve this global problem, special attention should be given to gender differences in the etiology, pathophysiology,clinical presentation, prognosis and treatment of ischemic heart disease(IHD) which has been accepted as a more inclusive term to define the pathology in women.[6]

Clinical presentation

The onset of clinical manifestations of coronary artery disease (CAD) in women has been stated to lag behind men by about 10 years.[1] Following menopause the symptoms become more manifest in women. However instead of typical symptoms, atypical semptoms defined as dyspnea and fatigue may be more prominent in women.[7] Moreover in almost 60% of women with IHD the initial presentation can be acute myocardial infarction(AMI) or sudden cardiac death[3,4,8-11] and up to 50% of women presenting with an AMI may not report any prior chest pain symptoms.[2,12]

This gender difference in clinical presentation carries utmost importance as it may lead to underdiagnosis of IHD in women.

Moreover,even with the clinical diagnosis of angina and traditional risk factors in women there may not be any evidence of CAD at angiography which was first demonstrated by The Coronary Artery Surgery Study (CASS).[7,13,14]

Almost 50% of women with chest pain suggestive of angina pectoris will have normal or insignificant CAD as compared to 17% of men and 20% of these women will still have evidence for myocardial ischemia.[15,16]

In such cases coronary microvascular dysfunction involving endothelial and nonendothelial pathways[7,17] can be identified as reported by Reis et al.[18]

However ischemia in the setting of vascular dysfunction is not so innocent[8] and coronary endothelial dysfunction is reported to be associated with adverse cardiovascular outcomes regardless of CAD severity in the WISE study.[7,19]

The underlying difference in pathophysiology including smaller arterial size, more prominent positive remodeling and greater role of the microvasculature as demonstrated by various noninvasive imaging modalities has been claimed to carry a greater prognostic weight in women.[8,20-27]

Risk factors

As stated before,the CASS study was one of the first landmark studies evaluating the cardiac risk factors in women which showed that the use of traditional risk factor assessment was limited in the prediction of CAD in wome.[7,13,14]

The WISE study further revealed that the CV events were independently predicted by coronary vascular endothelial function independent of risk factors and extent of CAD.[15,19]

This study also showed prominent gender differences in the impact of CV risk factors such as not obesity but metabolic syndrome was reported to be a better predictor for the underlying severity of CAD and eventfree survival in women.[15,28,29]

Moreover waist circumference has been reported to be a stronger risk factor in women[30] and DASI was reported to be strongly correlated with the occurrence of CAD and adverse events.[31]

Bairey Merz CN et al.[32] added new insights to risk factor analysis in women and showed that disruption of ovulatory cycling resulting in hypoestrogenemia in premenopausal women appeared to be associated with increased risk of obstructive CAD which claims that hypoestrogenemia might be the underlying reason for obstructive CAD during the postmenopausal years.

Clear differences also exist regarding the impact of lipid parameters such as Manolio et al.[2,33] reported that HDL cholesterol inversely predicted CAD in younger women and men as well as older (>65 years) women; whereas the relative risks for IHD in women and men as related to total and LDL-cholesterol were found to be similar.[2-4,10]

As for the triglyceride levels a meta-analysis of 17 studies revealed that hypertriglyceridemia increased the CAD relative risk by 32% in men and 76% in women [2,34] and diabetes was also reported to be a stronger risk factor for IHD in women.[2,35]

Smoking also deserves special attention in women. As it is complicated by hormonal variables, it has a larger detrimental impact in female hearts and especially in young women smoking is the most important risk factor for sudden cardiac death.[36] A recent meta-analysis demonstrated a 25 % higher relative risk of heart disease in women smokers compared to men.[37]

Specific conditions during pregnancy also need emphasis[35] such as preeclampsia doubles the risk for subsequent IHD[38] and gestational diabetes increases the risk of development of diabetes and thereby IHD.[39]

Prognosis

As mentioned before 50% of women referred for the evaluation of suspected myocardial ischemia were found to have no obstructive CAD and the prognosis of future adverse cardiac events was reported to be intermediate for these women.[7]

After an acute coronary syndrome(ACS) women and especially younger women with less obstructive CAD will also have a poorer prognosis.[35,40,41]

It should also be remembered that although the total number of sudden cardiac deaths is higher in men[42], 52% of women are more likely to die of a cardiac arrest before hospital arrival as compared to 42% for men.[2,4, 42, 43]

Sex differences in cardiac catheterization and revascularization use and timing which are associated with poorer outcomes in women after an ACS[35,44-46] cause a dilemma in treating the feminine heart.

Although stent usage is similar in women and men[19,47] they tend to be treated less often with platelet glycoprotein IIb/IIIa receptor antagonists, possibly due to the increased incidence of bleeding which also may limit the effectiveness of the therapy.

Coronary artery Bypass Surgery(CABG) is also troublesome in women.Following CABG the operative mortality is 4.0% for women and 3.2% for men[48], in part due to excessive rates of congestive heart failure.[8,48-51]

In addition, women have a higher incidence of bleeding complications[1,19] and a more difficult recovery after CABG[8,52] which may prolong the duration of hospital stay.

Diagnostic tests

Due to pathophysiological differences in IHD traditional tests for diagnosis that focus on identifying obstructive CAD work suboptimal in women.[8]

Thus a need for an alternative strategy that would rely upon the estimation of the “culprit patient” or prognosis instead of culprit” obstructive coronary lesions has been proposed in wome.[8]

In order to choose the best noninvasive imaging modality the American Heart Association (AHA) has proposed to include the pretest risk stratification as low, intermediate and high risk before diagnostic testing referral[53] which added a valuable insight for diagnosis.

We also agree with Lerman et al.[7] who emphasize strongly that nonobstructive coronary angiograms in women should not be ignored and till new imaging modalities that will clearly diagnose ischemia due to vascular dysfunction are utilised, careful attention should be paid to the clear evidences of ischemia such as a positive troponin or an abnormal stress perfusion test in the absence of coronary artery obstruction.

Treatment

The necessity of earlier and agressive primary prevention in women has been clearly reported.[1]Prudent treatment directed at improving endothelial function, atherosclerosis and established risk factors in women including lipid-lowering, angiotensin-converting enzyme inhibitors and aspirin is well established.[7]

However there is still a necessity for the FDA to monitor inclusion of proportional amount of women in all stages of drug research and as offered by Wenger et al.[1]

further evaluation of the possible sex-based differences in drug metabolism is required before choosing the optimal management strategy for the female heart.

Till the feminine heart puzzle is completely solved there is a compelling need to drive sustained attention to the female heart and remind the physicians to be more more aware of the basic differences between the 2 genders.

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Long-Term survival in a young adult with total artificial heart: A success story

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Abstract

We presented here the result of a successful surgical treatment of 16 years old male diagnosed as dilated cardiomyopathy with the history of siblings' early sudden death at the age of fifteen. The patient had to underwent total artificial heart implantation (TAH-T), (SynCardia) operation due to rapid biventricular detoriation and intracardiac trombus formation after his admittance to the ward. Due to lack of donor in the region he had to wait for long time with accurate anticoagulation and no serious complication during this long follow up period. He lived with TAH-T implantation both in the hospital and at home later was transplanted successfuly after 32 months. The patient is now activly working at a private company in NYHA Class 0 status. We have published this case due to its rarity in a young adult begins in childhood and longevity of the survival without any complication in TAH-T.

Keywords: Total artificial heart, SynCardia, Heart transplant, Dilated cardiomyopathy.

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Introduction

Ventricular assist devices have been emerged for the pediatric population to mechanical circulatory support since late 1980s' as a bridge to heart transplantation (HTx).[1] Park and colleagues have demonstrated that the Total Artificial Heart (TAH-T) (SynCardia Systems Inc., Tuscon, AZ) has been approved for compassionate use by the Food and Drug Administration for patients with end-stage biventricular heart failure as a bridge to heart transplantation since 1985 and has had FDA approval since 2004.[2] In cases where total artificial heart (TAH-T) and ventricular assist devices (VAD) used as a bridge to heart transplantation mostly inhibits patients dying from end-stage bi-ventricular heart failure associated with ischemic or non-ischemic dilated cardiomyopathy. Beyond progressive chronic heart failure, the TAH-T has provided great efficacy in patients with acute irreversible heart failure. Altough common use of TAH-T in patients with heart failure since 80's, usage in young adults and childhood age are rare. We present our experience with a young patient who had lived with a SynCardia TAH-T during 32 months for bridge to heart transplantation.

Case Report

16 years old- male had been admitted to our clinic with dilated cardiomyopathy. His background revealed that his elder brother had been diagnosed with same disease and died. He was suffering from exhaustion, exertional dyspnea and angina. His physical examination findings were fine crackles with lung auscultation and pretibial oedema +++/+++, based on these findings intravenous diuretic treatment was administered. In addition levosimendan treatment was initiated.

His echocardiogram resulted as left ventricule ejection fraction was 10-15%, dilated cardiomyopathy, mild-severe mitrale regurgitation (accompanied with coaptation deficiency), mild-severe tricuspid regurgitation (accompanied with coaptation deficiency),

interventicular septum diameter: 0.8, left ventricule diastolic diameter: 7.7, left ventricule systolic diameter: 7.4, left ventricule posterior wall diastolic diameter: 0.7, right atrium: 7.5x6.5 cm, left atrium: 7.5x7 cm and trombus formation was imaged in left atrial appendix. Severe right ventricular failure has shown with low EF and high pulmonary arterial pressure (PAP) measured as 65 mmHg and tricuspid annular plane systolic excursion (TAPSE) was scored >18mm.

Cardiology- cardiovascular surgery multidisciplinary heart team decided on artificial heart implantation and immediate heart transplant for this particular patient. In 10.2012 the case underwent SynCardia total artificial heart implantation operation. He was extubated postop 1. day with no complications, the treatment carried on at cardiovascular surgery service unit. Acetylsalicylic acid 1x100 mg and warfarine dosage that arranged due to INR level were medicated daily. On account of prevention a possible thrombosis, the INR range was kept above 3. Following 32 months were complication-free. In the third year of our search for the donor heart we found a compatable one, unfortunately due to the short CPR story of the donor, we returned from the harvest empty-handed.

Finally in 06.2015 a suitable donor heart was found. Donor was a 23 year old male whom brain death had been occured, there was no story of CPR, with 2.5 mcg/kg/min. dobutamine support, echocardiogram showed no contraction fault in his heart, 55% left ventricule ejection fraction. After median sternotomy, we evaluated the donor heart. Neither contusion sign nor contraction fault were mentioned. The heart was harvested and transfered to our clinic in accuruate storage conditions. Before the operation, prednole and antibiotics administered to the patient. Patients were taken to the operation simultaneously, SynCardia total artificial heart was taken out. Transplant operation carried out with heterotropic heart implantation procedure.

In postop follow-up we detected over 100 cc/h bleeding from drainage tubes, because these findings indicated a possible hemorrhage, we immediately initiated revision surgery. The bleeding source was founded in the left atrium anastomose, and it had been controlled with resutures. After bleeding control completed, layers were closed in anatomical plan and patient was taken to the intensive care unit (ICU) again. 5 mcg/kg/min dobutamine and 3 mcg/kg/min dopamine infusions were administered. Blood gas values were controlled hourly and values were around normal range. Due to patients norological evaluation and awakeness, patient was

extubated. Inotrope support was decreased and eventually stopped. Anti Tymocyte Globulin (ATG), prednole, tacrolimus and micofenolate mofetile treatments were initiated. White blood cell levels had dropped therefore ATG treatment was stopped and prednole dosage was decreased. Due to lack of C-reactive protein (CRP) increase, prednole treatment was stopped. Tacrolimus and micofenolate mofetile were administered at maintanance dosage. While admission he was suffered by fever and diarrea. After consulting the infectious disease department, we started variconasole, linezolide, cholistine, tigecycline combination as antibiotherapy. After the serologic tests resulted CMV antigenemia and high level of viral DNA load detected. The complications were considered to CMV infection thus valganciclovir therapy has started at dosage of 1000 mg/day PO after induction therapy and revised due to viral load in follow-up.

Blood cultures, tracheal aspiration cultures, catheter cultures was examined in follow up regularly. Due to having no fever and diarrea anymore, we stopped antibiotheraphy after 15 days in addition there were no organism growth in any cultures and serologic tests. Later on patient had swelling and pain in his left leg, lower limb venous doppler ultrasound revealed subacute deep vein thrombosis in left leg, as treatment rivaroksaban was administered. In following days there were no other complications so patient was discharged.

At 04.2016, patient complained about left side pain and shortness of breath at 300m walk. Lung x-ray showed thickened fissure, so we admitted the patient with prediagnosis of fissurite. Myocardial biopsy was performed to exclude rejection of donor. Biopsy results revealed no sign of rejection. Given the fact that he has a deep vein thrombosis story, thorax bt anjiography was performed to see if there is a clue of pulmonary embolism. Screening results showed no sign of thromboembolism. In follow-up symptoms regressed and patient was discharged.

Discussion

This case is rare because a 16 years old patient had waited with SynCardia total artıficial heart implantation among 32 long months for a heart transplant and bridge to transplantation (BTT) was successful.

Heart failure is as one of the top diagnoses for inpatients. The hospital admission mortality rates for heart failure are high with over 10% and over 20% mortal within 1 year of discharge. With limited numbers of solid organ donors for heart transplantation, one choice for this population is to use mechanical circulatory support devices.

Ventricular assist devices are widely accepted as a therapeutic option for bridge to transplant operation. El-Banayosy and colleagues have demonstrated that there are still limitations to the patient collective eligible for VAD placement, who might therefore benefit from the implantation of a total artificial heart.[1] The SynCardia TAH-T is the only FDA-approved TAH-T in the world.[2] The TAH-T is indicated for use as a BTT in patients at imminent risk of death from non-reversible bi-ventricular failure.[2] The SynCardia is the only device that eliminates the symptoms.[2-5] SynCardia TAH-T is the most effective and safe therapeutic system, providing a high cardiac output (~10 L/min) [6]. Nishimura et al.[7] reported the importance of effective flow for the recovery of end-organ disfunction those who have non-reversible bi-ventricular failure with multi-system failure and also emphasized the necessity for a minimum cardiac index of 3.0 L/min/m2 for the recovery of pre-operative end-organ dysfunction.

The TAH-T implantation is occurring at an ever increasing rate in the recent years. Slepian recommend that looking to the future a major unmet need remains in providing total heart support for children and small adults.[2] The length of the blood-flow path is shorter and the inflow and outflow valves are larger than in any other bridge-to-transplant device, resulting in greater blood flow at smaller pre-load.[3-4] Such a device should be optimal for bridging transplant candidates who have biventricular failure and for whom all other therapies have failed.[4]

Dilated cardiomyopathy is the primary indication with an estimated 1.000 to 1.500 new pediatric cases diagnosed each year in the United States.[5] The disease accounts for 65 percent of heart transplants in children

11 to 17 years old.[6-8] This group of patients is subject to the longest waiting-list mortality in Turkey.

Herein, the cardiology- cardiovascular surgery multidisciplinary team determined the SynCardia Heart was the only available choice for the patient because of exclusive conditions. The patient waited for an appropriate donor for cardiac transplantation nearly for 32 months at hospital. 16 years old- male was supported, rehabilitated and subsequently transplanted.

During device support, most mortality outcomes were related to pre-implant problems. Infection and stroke are rare events.[4] Following the implantation, the patient experienced progressive subacute deep vein thrombosis in left leg. During post-implant period, in case of a thrombosis, the INR range was kept above 3.

In this article, we aimed to present our experience with a young patient who had waited with SynCardia total artificial heart implantation over years for a heart transplant and bridge to transplantation. Unfortunately, these patients on the waiting list can suffer from worsening of the clinical status or even die while waiting for the transplantation, and this occurs despite close follow-up and intensive medical therapy.

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Ivemark syndrome with cor triatriatum, primum ASD, cleft mitrale and pulmonary stenosis

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Abstract

Ivemark syndrome is a rare anomaly with a reported incidence of 1 in 10000 – 20000 live births. It is characterized by agenesis of spleen, a dextropozed, hypoplastic or lobulated spleen or multiple spleens in association with complex cardiac anomalies. These malformations are usually associated with trilobulated or bilobulated lungs and abnormalities of other abdominal organs. Here we report a case of Ivemark syndrome, accompanied by polysplenia, accessory gall bladder, dilatation of the intrahepatic ducts, cor triatriatum, primum ASD, pulmonary stenosis, dysmorphic face and mild mental retardation.

Keywords: Ivemark syndrome, cor triatriatum, primum ASD, cleft mitrale, pulmonary stenosis

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Introduction

Ivemark syndrome is a rare anomaly with a reported incidence of 1 in 10000 – 20000 live births. It is characterized by agenesis of spleen, a dextropozed, hypoplastic or lobulated spleen or multiple spleens in association with complex cardiac anomalies.[1,2] These malformations are usually associated with trilobulated or bilobulated lungs and abnormalities of other abdominal organs. Some other anomalies like Howell-Jolly and Heinz bodies in peripheral blood, agenesis of corpus callosum and facial abnormalities were also noted.[3, 4]

Here we report a case of Ivemark syndrome, accompanied by polysplenia, accessory gall bladder, dilatation of the intrahepatic ducts, cor triatriatum, primum ASD, pulmonary stenosis, dysmorphic face and mild mental retardation.

Case Report

A 20-year-old woman was admitted to Dr. Sami Ulus Research and training Hospital because of dyspnea and palpitation. Family history was unremarkable. At the time of admission her height was 164 cm and body weight was 49 kg. Physical examination revealed that she had mild cyanosis with facial anomalies including prominent nasal bridge, malformed ears, simple philtrum, narrow forehead, hypotelorism and mild mental retardation. **(Figure 1)**

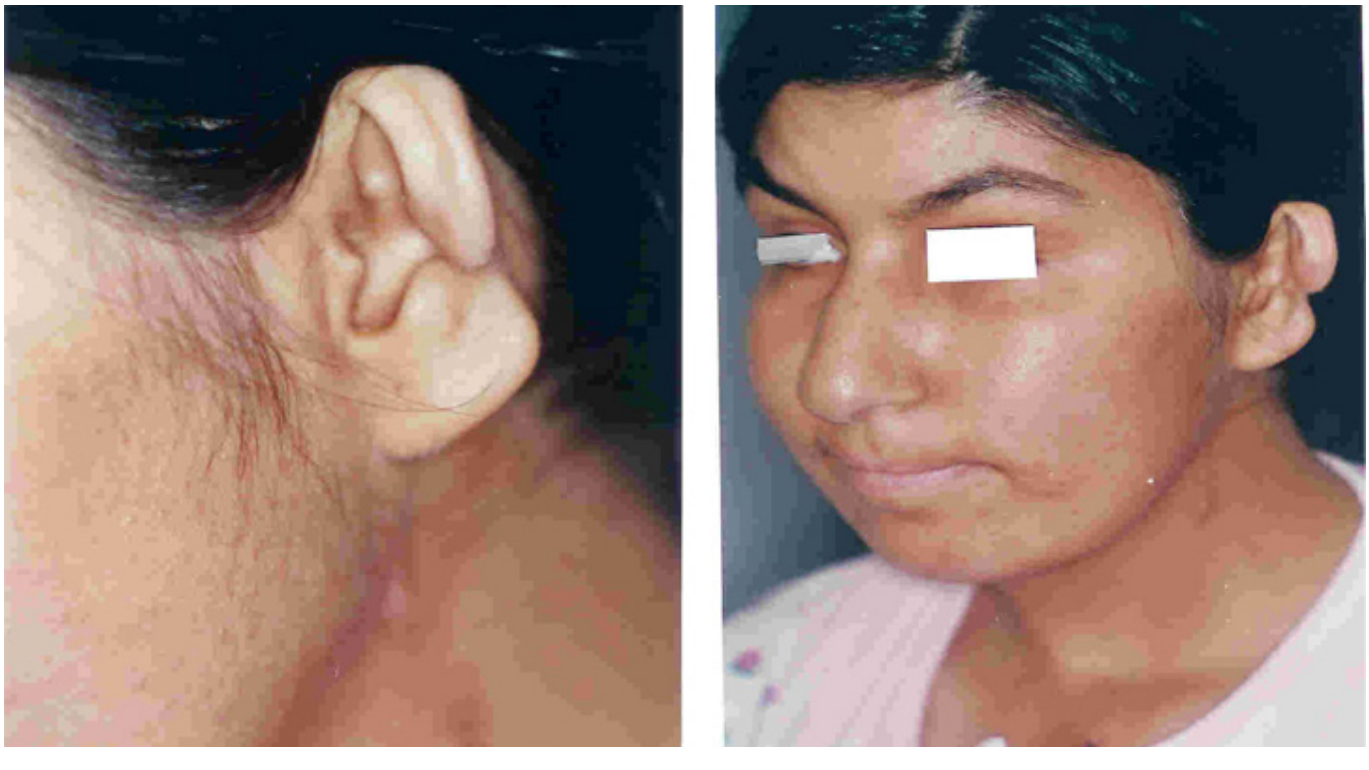
Auscultation revealed augmentation of the S1 sound, and a 20/60 systolic murmur was heard at the left side of the sternum. The heart rate was 72 / min and systolic blood pressure was 90 mm.Hg. The liver was enlarged to 2-3 cm below costal margin.

Telecardiogram showed an enlarged heart with a cardiothoracic ratio of 0.6. Transthorasic echocardiography revealed mild pulmonary stenosis with a 45 mm Hg gradient, primum ASD, a membrane in the right atrium and mitral insufficiency. **(Figure 2)**

Abdominal ultrasonography indicated polysplenia, accessory gallbladder and dilatation of intrahepatic ducts. Cranial tomography was normal. **(Figure 3)**

She underwent an operation.Cardiopulmonary bypass with bicaval cannulation was directly established from the superior and inferior vena cava. Standart cardiopulmonary bypass with systemic hypothermia at

Figure 1. Her appearence including prominent nasal bridge, malformed ears, simple philtrum, narrow forehead, and hypotelorism.



280 C were used. Cold potassium crystalloid cardioplegia and topical hypothermia were used for myocardial protection.

Then right atriotomi was performed. On exploration it was observed that the right atrium was divided into two portions by a membrane. The membrane was fully resected. The mitral cleft was repaired with 5-0 prolene suture and the primum ASD was closed with a pericardial patch. Pulmonary valvular stenosis was treated by commissurotomy. The post-operative course was uneventfull and she was discharged at 6th postoperative day.

Comment

Ivemark syndrome is a very rare congenital disorder that includes complex cardiac malformations, splenic agenesis and abnormalities of other abdominal organs. Most of the cases are sporadic, but familial occurence also has been described, suggesting autosomal recessive inheritance. The etiology of the syndrome has not been clearly defined, but the teratogenic effect seems to occur between the 30th – 40th days of intrauterin life. A study by Britz-Cunningham indicated that a mutation of the connexin 43 (CX43) gene might also be responsible for Ivemark syndrome.[4]

Ivemark syndrome is a multiple organ syndrome and symmetric liver, malrotation or dilatation of the bowel, duplication of uterus and vagina were observed.[5,6] In our case, in addition to polysplenia, accessory gallbladder, multiple facial anomalies and mild mental retardation were observed. But Ivemark Syndrome's lung or hematologic signs were absent.

Ivemark syndrome accounts for 1-3 % of all congenital heart defects. The most frequent cardiac mal-

Figure 2. **Echocardiographic findings**

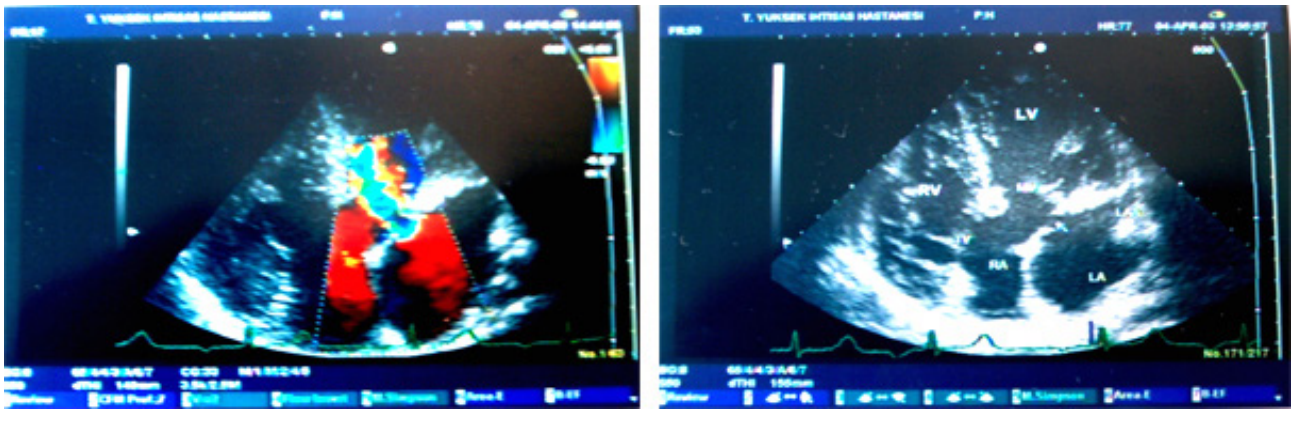
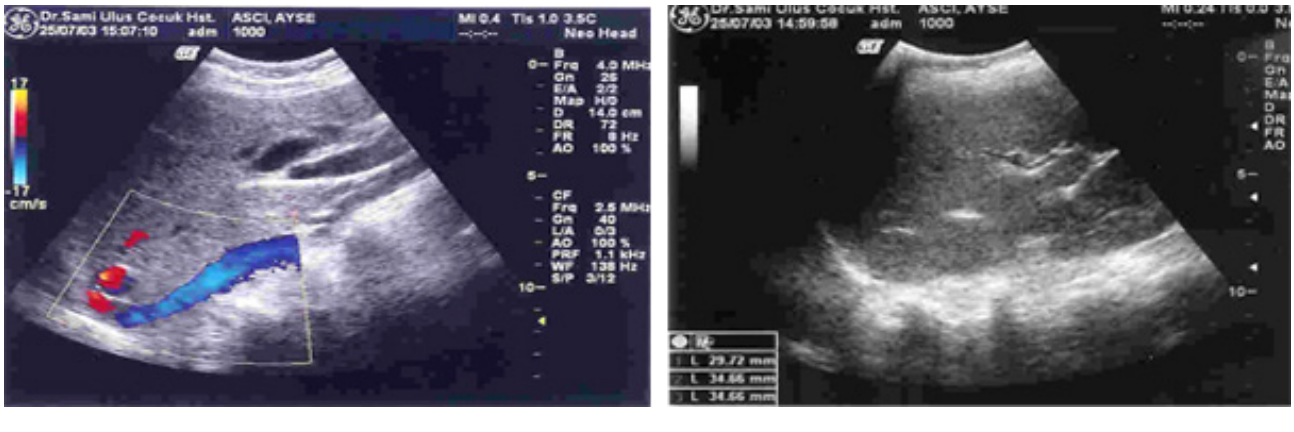


Figure 3. **Ultrasonography revealed the dilatation of the bile ducts**



formations are as follows: Persistent atrioventricular canal, patency of ductus arteriosus, atrial septal defect, ventricular septal defect, truncus arteriosus and dextrocardia.[7] The cardiac anomalies can increase the mortality risk and prognosis depends mainly on the degree of malformation of the heart.[8] Due to our knowledge the association of cor triatriatum with Ivemark syndrome has not been reported previously.

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Recurrent large pericardial effusion after cardiac surgery presenting with reversible hyponatremia

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Summary

Abstract: Pericardial effusion is a common complication of open heart surgery and more frequently occurs after coronary artery by-pass grafting. There are classical symptoms such as chest pain, dyspnea and orthopnea. However, hyponatremia is an unusual finding on presentation, and reported only three times in the literature. In this paper, a case in which recurrent pericardial effusion developed after coronary artery by-pass grafting presented with reversible hyponatremia was described. Hyponatremia was resolved rapidly, only after removal of large pericardial effusion by a successful pericardiocentesis. The possible mechanisms of reversible hyponatremia, relationship with pericardial effusion, and discrepancies about diagnosis were discussed, briefly.

Keywords: Cardiac surgery, hyponatremia; pericardial effusion.

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Introduction

Pericardial effusion is not a rare complication of cardiac surgery and more common in patients undergoing coronary artery by-pass grafting (CABG).[1-3] Patients may present with various symptoms like chest pain, dyspnea, and orthopnea.[4] But presentation with hyponatremia is extremely rare. Here, we described a case with recurrent pericardial effusion after CABG and its first attack presented with reversible hyponatremia.

Case

A 55 year old woman was admitted to emergency department with dyspnea on mild exertion, fatigue, abdominal pain, and vertigo. She has undergone CABG operation, two months ago. Past medical history was including hypertension. Her medications were silazapril, acetytsalcilic acid and famotidin.

On physical examination, blood pressure was 100 /60 mm Hg, heart rate was 84 beats/min, respiratory rate was 18 breaths/min. Heart sounds were distant and deep on cardiac auscultation. There was distension on abdominal examination. Mental status was normal.

Laboratory studies were as follows: Serum sodium, 124 mmol/L; potassium, 4.3 mmol/L; chloride, 90 mmol/L; blood urea nitrogen, 54 mg/dl; and serum creatinine 1.6 mg/dl. An electrocardiogram showed low voltage on chest leads (**Figure 1**).

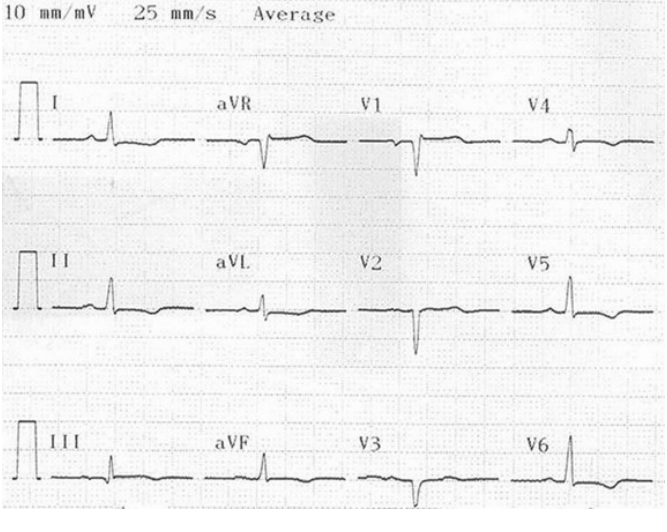

Figure 1. *(Legend) The 12-lead electro-cardiogram showing low voltage on chest leads.*

Chest radiograph showed cardiomegaly. Transthoracic echocardiogram demonstrated large, diffuse pericardial effusion with evidence of right atrial collapse (**Figure 2**). Valvular and left ventricular systolic functions were normal.

Because of the progressive symptoms and size of the pericardial effusion pericardiocentesis was performed via subxiphoid route and approximately 1500 ml serous pericardial fluid was removed. A pigtail catheter was leaved in pericardial cavity and during the following 24 hours 1700 ml blood-tinged fluid removed, subsequently. Control laboratory studies were; serum sodium, 134 mmol/L; blood urea nitrogen, 36 mg/dl; serum creatinine, 1.1 mg/dl. Surprisingly, serum sodium was normalized after pericardiocentesis without any specific therapy. In control echocardiography only minimal residual pericardial fluid was detected and patient was discharged with colchicine 0.5 mg 2x1 and ibuprofen 800 mg 2x1 therapy.

10 days later, patient presented with dyspnea at rest and orthopnea. Echocardiography showed recurrence of large, diffuse pericardial effusion with evidence of right atrial collapse. Serum sodium levels were normal. Pericardiocentesis was performed again, approximately 2500 ml serous pericardial fluid removed and a pigtail catheter was leaved in pericardial cavity. Pericardial

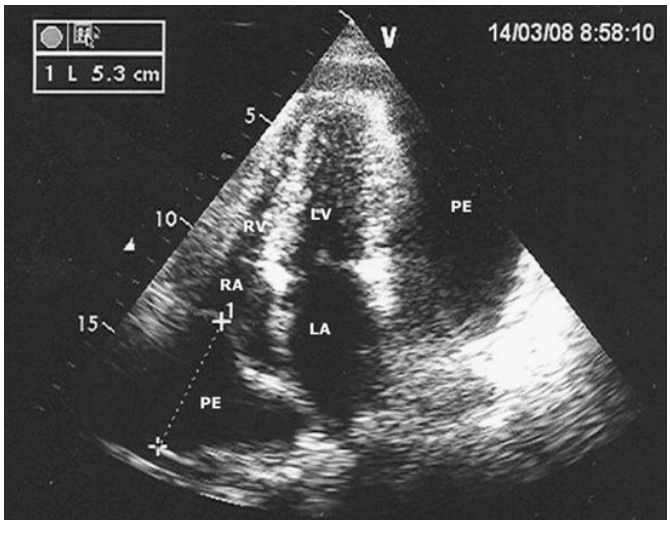

Figure 2. *Transthoracic echocardiography from apical 4-chamber view demonstrating large pericardial effusion and right atrial collapse (LA: left atrium, LV: left ventricle, RA: right atrium, RV: right ventricle, PE: pericardial effusion).*

fluid studies were negative for evidence of infectious, neoplastic, or rheumatologic causes.

Pericardial fluid adenosine deaminase level was in normal ranges. During the following 72 hours 2000 ml pericardial fluid removed, subsequently. Two days later, control echocardiography demonstrated recurrence of large, diffuse pericardial effusion again. Owing to the frequent recurrences of large pericardial effusion and risk of tamponade, patient was referred for pericardiopleural fenestration. After a successful operation, she is following up uneventfully for 2 months.

Discussion

Following cardiac surgery the incidence of pericardial effusion is high (range, 50 to 85%) and CABG accounts for more than half of the cases.[1-3] Patients may be asymptomatic or present with various symptoms including chest pain, dyspnea, orthopnea, cough, fatigue and palpitations.[4]

Presentation of a pericardial effusion with hyponatremia is extremely rare. In previous reports, inappropriate secretion of antidiuretic hormone as a response to diminished cardiac output in pericardial tamponade was accepted as most plausible mechanism for hyponatremia.[5-7] This response is mediated by baroreceptors in the carotid sinus, which sense a reduction in pressure or stretch, and can overcome the inhibitory effect of hyponatremia on ADH secretion.[8]

Reversibility of hyponatremia and rapid correction after pericardiocentesis without any specific treatment for low serum sodium levels support this hypothesis. After removing the large, diffuse pericardial effusion leading low cardiac output, the cause for secretion of antidiuretic hormone disappeared and serum sodium levels normalized by loosing extra volume.

However, in this case, pericardial effusion was recurrent, resistant to pericardiocentesis and hyponatremia was only detected at the first attack of pericardial fluid accumulation. Serum sodium levels were normal at subsequent episodes of pericardial effusion. Therefore, inappropriate secretion of antidiuretic hormone is not an enough explanation for hyponatremia in this case. Yet, we don't fully know why there was an imbalance between previously mentioned mechanisms in first attack of pericardial effusion and led to hyponatremia, and why there was not for subsequent episodes.

In conclusion, patients with pericardial effusion developed after CABG may present with hyponatremia. Currently, the most reasonable cause of hyponatremia seems to the imbalance between the antinatriuretic and antidiuretic responses to pericardial effusion leading to low cardiac output. Hyponatremia resolves, only when the effusion removed without any specific therapy. Further investigations are needed to understand all factors contributing hyponatremia in patients with pericardial effusion.

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