Typical signs of secundum atrial septal defect in a young man

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Summary

We report the case of a 22-year-old man with dyspnea during a long-distance military march. The ECG showed signs of right ventricular overload. The chest X-ray showed an enlargement of central pulmonary arteries, pulmonary plethora and a small aortic knuckle. Atrial septal defect (ASD) was suspected and transthoracic echocardiography (TTE) subsequently confirmed the presence of a large ostium secundum ASD. A surgical closure with an equine pericardium patch was performed. Two months after the surgical repair, the ECG and TTE showed the regression of signs of right ventricular overload.

Key words: ECG; ASD type II

Figure 1

ECG: sinus rhythm with peaked P-waves in lead II, right deviation of QRS axis; "crochetage" on R-wave in inferior limb leads, rsR' pattern in precordial lead V_1 and R/S = 1 in lead V_5-V_6 .



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Case report

A 22-year-old man was evaluated in our department because of dyspnea during a long-distance military march. Cardiac auscultation revealed a normal S1 heart sound, a systolic ejection murmur at the upper left sternal border and fixed splitting of the 2nd heart sound. The ECG showed sinus rhythm with peaked Pwaves in lead II, right axis deviation of QRS, an rsR' pattern in lead V₁ with R' of 9 mm in amplitude, an R/S = 1 in lead V₅–V₆ and a "crochetage" on R-wave in inferior limb leads (fig. 1). The chest X-ray showed enlargement of central pulmonary arteries, pulmonary plethora and a small aortic knuckle (fig. 2). Atrial septal defect (ASD) was suspected and transthoracic

echocardiography (TTE) subsequently confirmed the presence of a large ostium secundum ASD with a left ventricular diastolic D-shape suggestive of right ventricular overload (fig. 3) and severe left-to-right shunt with a calculated Qp/Qs (pulmonary artery blood flow relative to systemic blood flow) of 3.2. Estimated systolic arterial pulmonary pressure was 35 mm Hg. Transoesophageal-echocardiography confirmed a large secundum ASD with maximal superio-inferior diameter of 32 mm and allowed the exclusion of the presence of anomalous pulmonary venous drainage. The anatomy of the defect was unsuitable for percutaneous closure, thus surgical closure with an equine pericardium patch was performed. Two months after the surgical repair, the ECG showed sinus rhythm

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Figure 2

Chest X-ray: enlargement of central pulmonary arteries, pulmonary plethora and a small aortic knuckle.



Figure 3

TTE, parasternal long-axis view: left ventricular diastolic D-shape. LV = left ventricle; RVOT = right ventricle outflow tract.



with reduction of P-waves amplitude in lead II, mild right QRS axis deviation, reduction of rsR' ratio pattern in precordial lead V₁, disappearance of crochetage on R-wave in inferior limb leads and normalisation of R/S ratio in lead V₅–V₆ (fig. 4). The TTE showed no evidence of right ventricular overload (fig. 5).

Discussion

Besides the patent foramen ovale, there are four major types of interatrial communications: ostium primum ASDs (partial atrioventricular septal defect), ostium secundum ASDs, sinus venosus defects and coronary sinus ASDs. The ostium secundum ASDs are common and can present at any age. Females constitute about two-thirds. Many patients with ASDs are free of overt symptoms, although most will become symptomatic at some point in their lives. The age at which symptoms appear is highly variable and is not exclusively related to the size of the shunt. Exercise intolerance in the form of exertional dyspnoea or fatigue is the most common initial presenting symptom [1]. Effort intolerance due to the ASD in this case study was only revealed during the military service. Physical examination is in most instances informative and assists in diagnosis and management. A wide and fixed splitting of the 2nd heart sound at the upper left sternal border is the auscultatory hallmark of an ASD but is not always present. The ECG may be an important clue to diagnosis. Patients with a secundum ASD may have peaked P-waves in lead II suggesting right atrial enlargement, but in the majority of patients P-wave amplitude and duration are normal [2]. When the left-to-right shunt is significant, there is almost always right ventricular conduction delay and right ventricular overload with an rsR' pattern in lead V_1 [3]. The QRS axis is typically rightward [4]. Another sign that could be found and which correlates with shunt severity is the "crochetage" (notch) on R-wave in inferior limb leads [5]. In the current case, all ECG criteria men-

tioned above were present (fig. 1). Surgical closure of secundum ASD resulted in normalisation of ECG signs in our patient (e.g., signs of right atrial dilatation and right ventricle volume overload). These changes are consistent with the data of previous studies [6].

The diagnosis is made on the basis of history, symptoms, clinical findings and TTE. The ECG can provide

Figure 4

ECG after surgical closure: sinus rhythm, reduction of P-waves amplitude in lead II, mild right QRS axis deviation, reduction of rsR' ratio pattern in pre-cordial lead V₁, disappearance of crochetage on R-wave in inferior limb leads and normalisation of R/S ratio in lead V₅-V₆.



Figure 5

TTE after surgical closure, parasternal long-axis view: no evidence of right ventricular overload. LV = left ventricle; RVOT = right ventricle outflow tract.



clues to differentiate the various types of ASDs. The distinctive feature of an ostium primum ASD is left axis deviation of the QRS. Right ventricular conduction delay and hypertrophy are frequently seen in the presence of significant mitral valve insufficiency associated with cleft mitral valve [2]. The less common sinus venosus defect of SVC type, the P-wave axis in frontal plane in patients with sinus rhythm, is either left and supe-

rior or normal [7]. The chest X-ray film is often, but not always, abnormal in patients with significant ASD. Right heart dilation is better appreciated in lateral films. The central pulmonary arteries are characteristically enlarged, with pulmonary plethora indicating increased pulmonary flow. A small aortic knuckle is characteristic, which reflects a chronically low systemic cardiac output state, because increased pulmonary flow in these patients occurs at the expense of reduced systemic flow [8]. TTE documents the type and size of the ASD, the direction of the shunt, and, in experienced hands, the presence of anomalous pulmonary venous drainage. Patients with a significant ASD should usually be offered elective closure. Surgical closure is required for patients with secundum ASDs which are anatomically unsuitable for percutaneous closure [9].

References

- 1 Gary Webb, Michael A. Gatzoulis. Atrial septal defects in the adult recent progress and overview. Circulation. 2006;114:1645–53.
- 2 Surawicz B, Knilans T. Chou's Electrocardiography in clinical practice, sixth edition. Philadelphia: Saunders, Elsevier; 2008. p. 672–4.
- 3 Azhari N, Shihata MS, Al-Fatani A. Spontaneous closure of atrial septal defects within the oval fossa. Cardiol Young. 2004;14:148.
- 4 Nadrai A. ECG in the diagnostics of atrial septal defect. Acta Paediatr Acad Sci Hung. 1964;65:201–15.
- 5 Heller J, Hagège AA, Besse B, Desnos M, Marie FN, Guerot C. "Crochetage" (Notch) on R Wave in inferior limb leads: a new independent electrocardiographic sign of atrial septal defect. J Am Coll Cardiol. 1996;27(4):877–82.
- 6 Guray U, Guray Y, Mecit B, et al. Maximum p wave duration and p wave dispersion in adult patients with secundum atrial septal defect: the impact of surgical repair. Ann Noninvasive Electrocardiol. 2004;9:136.
- 7 Davia JE, Cheitlin MD, Bedynek JL. Sinus venosus atrial septal defect: analysis of fifty cases. Am Heart J. 1973;85:177.
- 8 Egeblad H, Berning J, Efsen F, Wennevold A. Non-invasive diagnosis in clinically suspected atrial septal defect of secundum or sinus venosus type: value of combining chest x-ray, phonocardiography, and M-mode echocardiography. Br Heart J. 1980;44:317–21.
- 9 Murphy JG, Gersh BJ, McGoon MD, Mair DD, Porter CJ, Ilstrup DM, et al. Long-term outcome after surgical repair of isolated atrial septal defect: follow-up at 27 to 32 years. N Engl J Med. 1990;323:1645–50.