

BRIEF REPORTS

Concordance of congenital heart defects in two pairs of monozygotic twins: pulmonary stenosis and tetralogy of Fallot

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Received: December 12, 2008; accepted September 23, 2009.

PALABRAS CLAVE

Cardiopatías congénitas en gemelos; Gemelos monocigotos con lesiones congénitas; Concordancia específica entre gemelos; Gemelos monocigóticos; Estenosis valvular pulmonar; Tetralogía de Fallot.

KEY WORDS

Congenital heart disease in twins; Congenital lesions in twins; Specific concordance in twins;

Resumen

Concordancia de defectos cardíacos congénitos en dos pares de gemelos monocigóticos. Se presentan dos pares de gemelos con concordancia específica en sus lesiones cardíacas congénitas.

Se revisaron todos los gemelos monocigóticos con concordancia específica en sus lesiones cardíacas congénitas en los últimos 18 años. Se encontraron dos pares de gemelos. El primer par, dos gemelas monocigóticas de 13 años de edad, en ambas se encontró severa estenosis infundibular y valvular pulmonar. En el segundo par, dos gemelos de 8 años de edad, se diagnosticó en ambos, mediante ecocardiografía, cateterismo cardíaco y angiografía tetralogía de Fallot. La prueba de hibridación por fluorescencia fue, en ambos pares, negativa para microdelección del cromosoma 22q11. Las diferencias anatómicas entre los gemelos estudiados, no se explican suficientemente sobre bases genéticas exclusivamente; es necesario, considerar la participación de otros factores adquiridos, probablemente durante los primeros estadios del desarrollo embriológico. Estos son los dos primeros casos de gemelos con concordancia específica reportados en México.

Concordancia en los defectos cardíacos congénitos, en dos pares de gemelos monocigóticos: estenosis pulmonar y tetralogía de Fallot

Abstract

Two pairs of twins with specific concordance in congenital heart lesions are presented. We reviewed all the monozygotic twins with specific concordance in congenital heart lesions in the last 18 years. Two pairs were found. First, a pair of 13 years-old monozygotic female twins; a

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Monozygotic twins; Valvar pulmonary stenosis; Tetralogy of Fallot.

severe infundibular and pulmonary valve stenosis was discovered in both girls. In the second pair of twins (8 years-old boys), Tetralogy of Fallot was diagnosed by echocardiogram, cardiac catheterization and angiocardiography. In fluorescence hybridization test in situ all patients were negative for microdeletion in chromosome 22q11. Anatomic differences between twins are not enough explained on genetic bases; it's necessary to consider the role of other factors, probably acquired during the first stages of embryonic development. These are the two first pairs of twins with specific concordance in congenital cardiac lesions reported in Mexico.

Introduction

Since Price's report in 1950,¹ it has been recognized that monozygotic twins provide an opportunity to study genetic contribution in the development of cardiovascular malformations. The incidence of congenital heart defects among singletons is 6/1000 live births, compared to 17.2/1000 in monozygotic twins, while in dizygotic twins the incidence is approximately 8/1000.² When both twins are affected, concordance is said to occur. Concordance incidence in dizygotic twins is 5%, compared to 25% in monozygotic twins.³ In this paper, two pairs of monozygotic twins with specific concordance of congenital heart defects are reported.

Case report 1

Monozygotic twins with pulmonary stenosis

U.H. and E.H. were 13 year-old monozygotic female twins; both girls had cardiac murmurs and were referred to our hospital. They were completely asymptomatic and their phenotypes were very similar (**Figure 1A**). Both of them had blood type B+; in a fluorescence hybridization test in situ the two girls were negative for chromosome 22q11 microdeletion. Echocardiographic examination showed a severe infundibular and pulmonary valve stenosis in both of them. Systolic gradient measured by Doppler was 140 mmHg in U.H., and 90 mmHg in E.H. During cardiac catheterization, U.H. had right ventricular pressures of 120/8 and 30/10 in the pulmonary artery, and E.H. had 200/14. Echocardiogram and selective angiogram showed severe dysplastic pulmonary valve in the right ventricle of both twins.

In June 2006, the two patients underwent cardiac surgical correction with transannular patch under cardiopulmonary bypass. During surgery, severe pulmonary valve stenosis with hypoplastic annulus was found in both of them. In addition, U.H. presented infundibular stenosis which was removed. The patients recovered uneventfully from operation. Today, six years after the procedure, both patients are asymptomatic with normal development and a control echocardiogram revealed a residual gradient below 20 mmHg and minimal pulmonary insufficiency.

Case report 2

Monozygotic twins with Tetralogy of Fallot

J.T. and N. T. were 8 year-old male monozygotic twins, with almost identical phenotypes (**Figure 1B**). Both had blood O+; in a fluorescence hybridization test in situ the two boys were negative for microdeletion in chromosome

Figure 1A. Thirteen years-old monozygotic female twins with severe pulmonary valve stenosis.



Figure 1B. Eight years-old monozygotic male twins with tetralogy of Fallot.



22q11. In both twins, Tetralogy of Fallot was diagnosed by echocardiogram, cardiac catheterization and angiocardiogram. In the first twin a Blalock-Taussig shunt had been performed. This patient had stress dyspnea and physical examination revealed cyanosis ++. Echocardiogram demonstrated Tetralogy of Fallot with an obstructive 60 mmHg gradient in the right ventricular outflow tract.

Cardiac catheterization confirmed the echocardiogram diagnosis and an additional stenosis was found at the origin of the left pulmonary artery (**Figure 2a**). The McGoon index was 1.3. In February 2008 surgical correction was performed with transannular patch, pulmonary valve prosthesis, and patches in left main coronary and pulmonary arteries; the ventricular septal defect was closed too. During surgery a laceration of the pulmonary artery with important bleeding occurred as a complication. In the intensive care unit, the patient developed pneumonia due to *Staphylococcus aureus*, with bad and long evolution. It was not possible to disconnect the patient from ventilator. Fifteen days later, this twin died because of septic shock.

In the second twin no previous shunt was done. During physical examination cyanosis ++ it was seen and arterial saturation was 82%. Echocardiography and angiography showed favorable anatomy (**Figure 2B**). The McGoon index was 2.1. Total surgical correction was performed in January 28, 2008. He recovered uneventfully. Three months later, an echocardiogram revealed a maximum gradient of 22 mmHg and the patient presented no symptoms.

Discussion

Monozygotic twins are less frequent than dizygotic twins and account for approximately a third of total number of twins, but incidence of congenital anomalies in monozygotic twins is about 10%.⁴

Congenital heart disease concordance in monozygotic twins occurs at a frequency of 25%, which is high when compared to other congenital disorders. However, in previous literature usually it is not specified whether concordance refers to either the presence of the same cardiac defect in both twins, or to some cardiac malformation present in the two. We will refer to specific concordance in the former concept.

There are very few reports on specific concordance of congenital cardiac malformations. After detailed search of the literature (PubMed/Medline) only three reports of twins with tetralogy of Fallot were found. In one of the reports, both twins had pulmonary atresia and the same intracardiac defects, with anatomic differences in large vessels. Both patients were positive for microdeletion in chromosome 22q11.⁵ In France, a pair of twins had the same disorder, but they were negative for microdeletion in chromosome 22q11 (as in both of our cases); it was reported by Laugel *et al* in 2001.⁶ The first monozygotic pair of twins with Tetralogy of Fallot in India was reported by Patel AB *et al* in 2002.⁷ In these works, authors concluded that the differences found could not be explained on genetic grounds and suggested the influence of other factors in the developing embryo.

There are two other reports of specific concordance. In the first, the presence of persistent truncus arteriosus in both monozygotic twins, without DiGeorge phenotype syndrome and no deletion in chromosome 22q11 is described.⁸ The second report presents a successfully operated pair of twins with ventricular septal defect.⁹ This work, in which we have studied two pairs of identical twins, one with pulmonary valve stenosis and the other

Figure 2A. Angiogram of the main pulmonary artery in one of the twins with Tetralogy of Fallot. Severe pulmonary stenosis at the origin of the left pulmonary artery is documented.

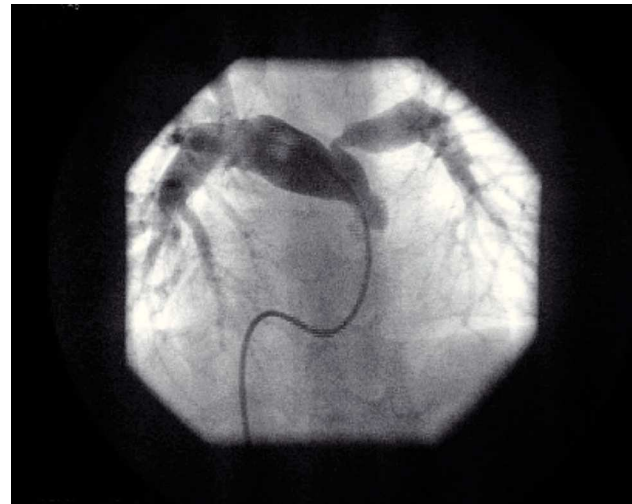
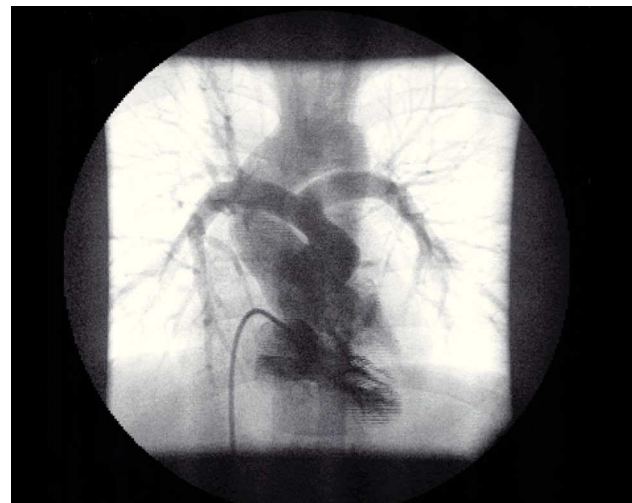


Figure 2B. Selective right ventriculogram in the second twin with Tetralogy of Fallot. Favorable anatomy is shown.



with Tetralogy of Fallot, adds to the few published cases of specific concordance. Just like in the previous reports, both twins had the same disorder, with minor differences, particularly in the severity of the lesion. In agreement with other authors, these differences could be explained by the influence of other factors probably acquired during the first stages of embryonic development.

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Acknowledgements

Authors are thankful to Hector Alva PhD for his help in the preparation of the English manuscript.