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Case Reports

Berry Syndrome with Trisomy 13

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Abstract. We report on 2-day-old neonate with trisomy 13 with coexistent distal aortopulmonary septal defect, aortic origin of the right pulmonary artery, interrupted aortic arch, intact ventricular septum, and a patent ductus arteriosus diagnosed by two-dimensional and color Doppler echocardiography. Review of the literature reveals that this patient is the 24th reported case of Berry syndrome and the first case of this unusual combination of cardiovascular defects associated with trisomy 13 syndrome.

Key words: Berry syndrome — Trisomy 13

Trisomy 13 is a rare, severe form of chromosomal aneuploidy and is associated with a variety of congenital cardiac defects (> 80%). The spectrum of common cardiac defects include ventricular septal defect (50–60%), patent ductus arteriosus (PDA) (50–60%), atrial septal defect (40–50%), dextroposition (20–50%), and coarctation of the aorta (10–20%) [13]. Though uncommon, double-outlet right ventricle, hypoplastic left heart, pulmonary atresia, transposition of the great arteries, and atrioventricular canal defect have also been reported [13].

The constellation of distal aortopulmonary septal defect, aortic origin of the right pulmonary artery, interrupted aortic arch type A or severe isthmic coarctation, intact ventricular septum, and a PDA was first described as a syndrome by Berry and associates in 1982, [3]. Review of the literature revealed that 24 cases of Berry syndrome have been reported so far [1–3, 5–9, 11, 17–19, 21]. We report the first case of Berry syndrome associated with Trisomy 13.

Case Report

A full-term female infant was born by vaginal delivery to a 39-year-old mother. The triple screen or amniocentesis test was not available because the mother was registered late for prenatal care. The remainder of antenatal screening tests, including fetal sonogram, were within normal limits. The past medical history and family history were unremarkable.

The infant developed respiratory distress 2 hours after birth and was admitted to the neonatal intensive care unit. She was dysmorphic with a large forehead hemangioma, frontal bossing, right-sided microphthalmos with corneal clouding, low-set ears, wide nose tip, posterior cleft palate, micrognathia, short neck, sacral sinus, and bilateral postaxial hexadactily. Cardiovascular examination revealed normal peripheral pulses, loud P2 without any murmur, and blood pressure of 80/45 in both arms and legs with no evidence of differential cyanosis.

Chest roentgenogram revealed increased pulmonary vascular markings and moderate cardiomegaly. Electrocardiography showed right axis deviation with features of right ventricular hypertrophy (normal for age). Echocardiographic study revealed type II aortopulmonary window with the right pulmonary artery originating from the proximal part of the ascending aorta, type A interrupted aortic arch, large PDA, and intact ventricular septum (Figs. 1 and 2). The Doppler study showed dampened systolic blood flow and diastolic flow reversal in descending aorta and bidirectional atrial and ductal shunts (predominantly right to left).

On the third day of life there was worsening of respiratory distress, metabolic acidosis, and oliguria, and the patient was intubated. A repeat echocardiography revealed significant ductal narrowing with marked reduction in shunting which improved after prostaglandin E_1 infusion. The chromosome analysis revealed a 47XX + 13 karyotype. A multidisciplinary conference was held with the parents and the decision for conservative management was made. The infant expired on day 8 of life. The parents did not give consent for an autopsy.

Discussion

In 1657, a clinical pattern was described that in 1960, with the advent of chromosomal analysis, was identified by Patau as trisomy 13 syndrome. Trisomy 13 patients may show a triad of microphthalmia, cleft lip and palate, and polydactyly in addition to many other abnormalities. The common findings are ocular hypertelorism, iris coloboma, low-set ears, micro-

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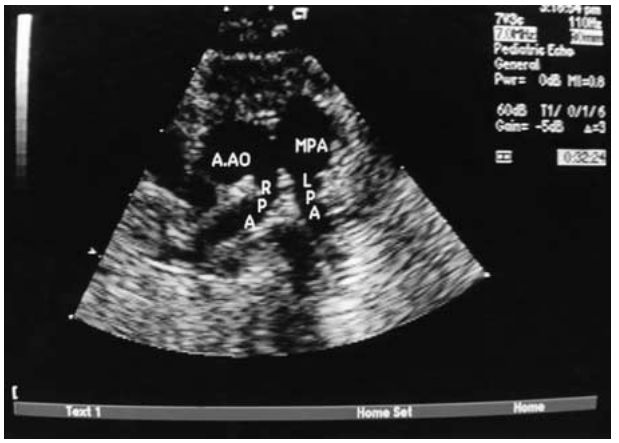

Fig. 1. Suprasternal short-axis view showing distal aortopulmonary septal defect with origin of right pulmonary artery from the ascending aorta. *AAo*, ascending aorta; *LPA*, left pulmonary artery; *MPA*, main pulmonary artery; *RPA*, right pulmonary artery.

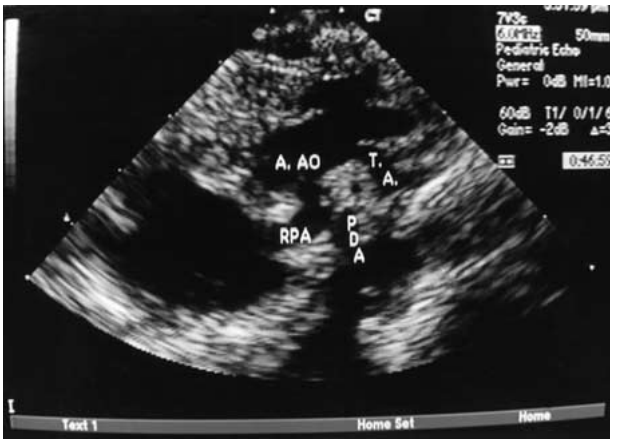

Fig. 2. Suprasternal long-axis view showing hypoplastic transverse arch, type A aortic interruption, origin of right pulmonary artery from the ascending aorta, and ductal continuation with proximal descending aorta. *AAo*, ascending aorta; *PDA*, patent ductus arteriosus; *RPA*, right pulmonary artery; *TA*, transverse arch.

Table 1. Summary of surgical intervention and results with Berry syndrome

Source, year	Age at surgery	Sex	Type of operation			Outcome	Follow-up
			APSD, abnormal RPA	IAA	PDA		
Berry et al. [3], 1982	31 days	F	RPA–MPA continuity established via tunnel patch through APSD	Dacron graft repair	Ligation	Died at 32 days	—
	25 days	F	Closure of APSD, RPA detached from AA and anastomosed to MPA	LSCA graft repair	Ligation	—	6 months repair of stenosis of aortic arch
	25 days	M	Closure of APSD, missed the abnormal origin of RPA (found at autopsy)	LSCA graft repair	—	Died at 27 days	—
	ND	F	—	—	—	—	—
	ND	M	—	—	—	—	—
	ND	M	—	—	—	—	—
	ND	M	—	—	—	—	—
	16 years	M	Repair of APSD by creation of concentric great vessels (Dacron graft)	Dacron graft repair	Division	—	Died at 19 years
Tabak et al. [19], 1983	ND	M	—	—	—	—	—
	3 days	M	Plication, suture of the defect with 3-0 Prolene with buttressed with Teflon felt	LSCA turndown and graft insertion	Ligation	—	7 months: open repair of APSD (second stage)
	3 days	M	APSD plicated with two mattress sutures buttressed with Teflon felt	Direct end-to-end aortic anastomoses	Division	—	5 months: repair of aortopulmonary window
Mendoza et al. [14], 1986	75 days	M	Closure of APSD and redirection of blood flow from MPA to the RPA by means of Gore-Tex patch	Anastomoses of both ends of aorta with a woven vascular prosthesis	Ligation	Died after the surgery	—

Table 1. Continued

Source, year	Age at surgery	Sex	Type of operation			Outcome	Follow-up
			APSD, abnormal RPA	IAA	PDA		
Ding et al. [10], 1990	3 years	M	APSD closed using Dacron baffle and blood is directed to RPA	Direct end-to-end aortic anastomoses	Ligation	—	8 months: asymptomatic
Sreeram and Walsh [18], 1991	16 days	F	Patch closure of APSD with concurrent reestablishment of continuity between the MPA and RPA	End-to-end anastomoses between LSCA and left carotid artery done	—	Died on 14th postoperative day	—
Yoo et al. [21], 1991	45 days	M	2-stage corrective surgery; tunneling the RPA to the MPA using a Dacron patch and AA is reconstructed using pericardial patch	Aortic arch reconstructed using the Gore-Tex tube	Ligated	—	6 months: asymptomatic
Boonstra et al. [5], 1992	4 days	M	APSD closed transversely by direct suture, creating a tunnel to connect RPA to MPA	End-to-end aortic anastomoses with resorbable suture	Division	—	1 year: repair of stenosis found at aortic anastomoses site
Chiu et al. [8], 1994	20 months	F	Intraarterial baffle	Gore-Tex patch partition	Used as a conduit	—	4 years: asymptomatic
Burke and Rosenfeld [6], 1994	13 days	F	Direct anastomoses of RPA and MPA; AA and MPA are separated	Direct end-to-end aortic anastomoses	Division	—	4 months: bilateral pulmonary artery hypoplasia and a gradient at arch reconstruction site
Alva-Espinosa et al. [2], 1995	6 months	M	Two-stage repair	Direct end-to-end aortic anastomoses	Division	—	—
Sharma et al. [17], 1996	17 days	M	RPA anastomosed to MPA; AA is reconstructured	Direct end-to-end aortic anastomoses	Division	—	2 years: asymptomatic
Carrel and Pfammatter [7], 1997	4 days	M	Reconstruction of the AA and RPA using a piece of homogeneous aortic issue	Direct end-to-side aortic anastomoses	Ligation	—	15 months: asymptomatic
Abbruzzese et al. [1], 1997	8 days	M	Reconstruction of RPA and MPA using a flap of arotic tissue; pericardial patch used to reconstruct AA	Direct end-to-end aortic anastomoses	Division	—	1 year: asymptomatic
Codispoti and Mankad [9], 1998	5 months	M	RPA separted from AA; MPA reconstructed using pericadial patch	Direct end-to-end aortic anastomoses	Division	—	3 years: asymptomatic
Lee [11], 2000	4 days	M	One-stage repair (details not available)	—	—	—	—
Present case	2 days	F	ND	—	—	—	—

APSD, aortopulmonary septal defect; IAA, interrupted aortic arch; PDA, patent ductus arteriosus; LSCA, left subclavian artery; RPA, right pulmonary artery; MPA, main pulmonary artery; AA, ascending aorta; ND, not done; M, male; F, Female.

gnathia, short neck, capillary hemangioma, congenital heart defects, distal palmar axial triradius, and prominent calcaneus [13].

The antenatal diagnosis of trisomy 13 is very important due to the overall poor prognosis and is based on parental risk factors and fetal sonographic find-

ings, and confirmed by chromosomal analysis. The common sonographic findings associated with fetal trisomy 13 are central nervous system abnormalities, facial cleft, echogenic kidneys, cardiac defects, and extremity abnormalities [12]. Echogenic foci within the region of the chordae tendineae were detected in 33% of trisomy 13 fetuses in one series compared with 2% of normal fetuses [12]. Cardiac defects other than echogenic chordae tendineae are detected by fetal echocardiography with varying incidence in different prenatal series, despite an incidence of almost 100% through postnatal diagnosis [12]. Valvular dysplasia, usually without evidence of regurgitation or stenosis, is considered by some authors as the hallmark of cardiac abnormalities in trisomy 13 and trisomy 18 [4]. All valves appear to be affected to some degree, with the pulmonary valve most commonly affected in an echo series of 31 infants with trisomy 13 and 18 followed by the tricuspid valve [15].

We report a rare combination of cardiovascular defect (previously described as Berry syndrome) [3] in a trisomy 13 patient. The pathogenesis of this congenital cardiovascular defect is unknown. The proposed hypothesis is that the aortopulmonary septation defect results in defective attachment of pulmonary arteries to the undivided truncal segment rather than to the main pulmonary arterial trunk [3]. The magnitude of blood flow beyond the proximal part of ascending aorta becomes reduced by such abnormal connections as aortopulmonary septal defect and aortic origin of right pulmonary artery, resulting in hypoplasia of the transverse arch and isthmal coarctation or interruption. These patients typically present with low cardiac output and respiratory distress like other ductal-dependent left-sided obstructive cardiac lesions and excess blood flow to the lungs. Acute cardiovascular collapse or heart failure may occur after spontaneous closure of the PDA in the first days of life.

Two-dimensional and color Doppler echocardiography can accurately diagnose all components of Berry syndrome [2, 11, 14]. The surgical treatment for Berry syndrome is detachment and implantation of the right pulmonary artery to the main pulmonary arterial trunk, patch closure of aortopulmonary septal defect with native or prosthetic material, and repair of interruption of the arch or coarctation. Table 1 describes previously reported cases with surgical intervention and outcome [1–3, 5–9, 11, 17–19, 21]. The common complication after surgical repair is stenosis at anastomosis sites of coarctation repair and reimplantation of right pulmonary artery. However, with the improvement in surgical technique, single-stage repair is preferred and recent case reports have shown better outcome with direct end-to-end anastomoses [1, 2, 7, 9, 11, 17].

The reported average survival of patients with trisomy 13 is 130 days [16]. However, there are reports confirming long-term survival, with patient reaching up to 19 years, although with significant mental retardation and limited quality of life [15, 16, 22]. There appears to be no clear explanation for the dismal outcome of these infants, especially those with structurally normal heart and brain. Most deaths are attributed to brain and cardiac malformations. However, most cardiac malformations are not rapidly lethal, even if not immediately corrected surgically, and can be managed effectively with decongestive therapy. Primary apnea is reported to cause death in trisomy 13 infants [20].

Certainly, most families are given a very poor prognosis and, as was the case with our patient, these infants are managed less aggressively. Whether aggressive management is in fact justified at least for trisomy 13 infants with apparently structurally normal central nervous system is uncertain. However, if the parents want aggressive measures they must be informed of the morbidity associated with surgical intervention, the palliative nature of the treatment, the ever-present risk of apnea, and the expected level of mental and social performance if their child does attain long-term survival.

The current case is an example of Berry syndrome with trisomy 13. Each component of this rare association was accurately diagnosed by echocardiography. This case report adds to the existing knowledge of various types of congenital heart defects described in association with trisomy 13 syndrome.

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