Table 2
Hemodynamic outcomes (Student *t* test for comparison of paired samples)

	Pre	Post (24 h)	*P*	95%CI for the difference	
				Lower limit	Upper limit
MPAP, mmHg	36.79	27.04	.0001	7.74	11.75
CO, L/min	3.64	4.90	.0001	−1.55	−0.96
SPAP, mmHg	57.06	43.81	.0001	10.21	6.27
DPAP, mmHg	24.71	17.33	.0001	9.63	5.13
RVEDP, mmHg	11.09	10.09	.406	−1.50	3.56
Right atrial pressure, mmHg	12.14	9.21	.001	1.28	4.57
Miller score	22.27	11.30	.001	12.04	9.90
SBP, mmHg	114	132	.001	−12.18	−25.07
DBP, mmHg	75	80	.073	.43	−9.57
HR, bpm	104	80	.001	30.53	18.69

CO, cardiac output; DBP, diastolic blood pressure; DPAP, diastolic pulmonary artery pressure; HR, heart rate; MPAP, mean pulmonary artery pressure; RVEDP, right ventricle end-diastolic pressure; SBP, systolic blood pressure; SPAP, systolic pulmonary artery pressure.

The incidence of major bleeds with this approach is influenced by 3 factors: drug dosage and 24-hour distribution (compared with the usual r-TPA doses of 50-100 μg within 1-2 hours of ST), type of vascular access (only 7% by femoral vein vs 80% in SEATTLE[4], potentially minimizing bleeds by making them readily identifiable and controllable), and type of clinical presentation. In our series, the 2 cerebral hemorrhages occurred after syncope with traumatic brain injury and, therefore, we believe that these patients should not be treated with CDT that includes thrombolysis.

In conclusion, despite the sample size limitations, the use of CDT in PE is safe and effective, and improves hemodynamic and clinical parameters, with an acceptable rate of bleeding complications. This registry may make way for larger registries that would contribute greater evidence.

Juan J. Portero-Portaz,* Juan G. Córdoba-Soriano, Arsenio Gallardo-López, Antonio Gutiérrez-Díez, Driss Melehi El-Assali, and Jesús M. Jiménez-Mazuecos

Unidad de Hemodinámica y Cardiología Intervencionista, Servicio de Cardiología, Complejo Hospitalario Universitario de Albacete, Albacete, Spain

* Corresponding author:
E-mail address: juanjose.porteroportaz@gmail.com
(J.J. Portero-Portaz).

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Tako-tsubo cardiomyopathy in a 12-year-old girl secondary to acute asthma during orthopedic surgery

Miocardiopatia de* tako-tsubo *secundaria a asma bronquial en una niña de 12 años tras cirugía ortopédica

To the Editor,

Tako-tsubo cardiomyopathy (TTC) is a reversible clinical condition mimicking an acute myocardial infarction. Estrogens may play a protective role: the incidence and prevalence of this entity are higher in postmenopausal women than in men, while occurrence is rare in the pediatric population, as in the case reported herein.

A 12-year-old African girl was scheduled for surgical correction of bilateral flat feet and valgus knee. In childhood, the patient experienced allergic asthma treated with salbutamol. She had no history of cardiac disease and the results of a baseline electrocardiogram was normal (figure 1A). Immediately after intubation, she developed severe desaturation associated with bronchospasm and tachycardia without hemodynamic instability. Intravenous hydrocortisone and nebulized salbutamol were administered. The bronchospasm resolved quickly and the surgical intervention was carried out without further complications.

A few minutes after tracheal extubation, the patient developed pulmonary edema and cardiogenic shock. She was then reintubated and transferred to the intensive care unit. An electrocardiogram showed sinus tachycardia and diffuse ST-segment depression (figure 1B). A transthoracic echocardiogram showed marked dilatation of the left ventricle (LV) with akinesia of the mid and apical segments, hyperkinesia of the basal portions of the LV, and severe reduction of left ventricular ejection fraction. Troponin T and pro-brain natriuretic peptide were elevated (275 ng/L and 323 pg/mL, respectively). Subsequently, progressive

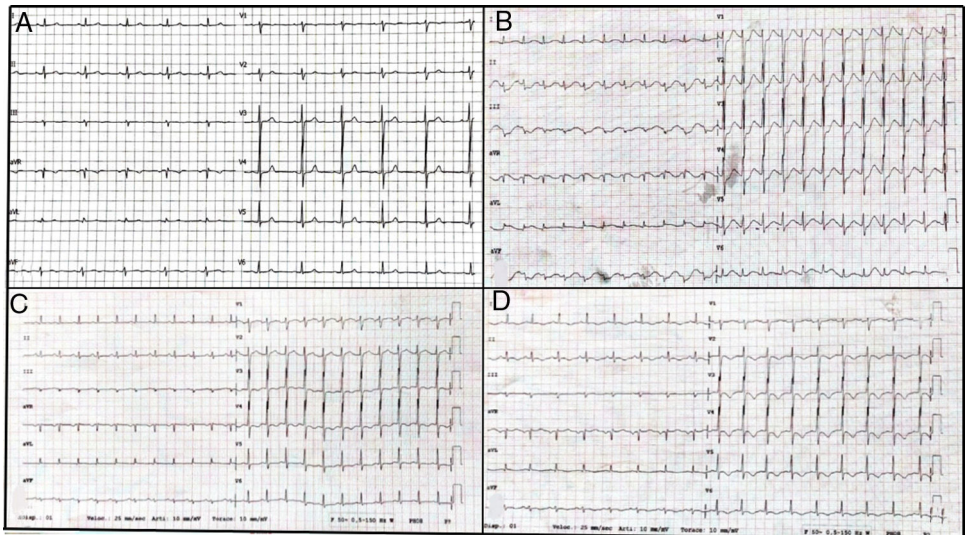

Figure 1. A: the electrocardiogram recorded before the surgical intervention was normal. B: sinus tachycardia and diffuse ST-segment depression during cardiogenic shock. C and D: changes in electrocardiograms showed progressive resolution of the ST-segment and the appearance of widespread, negative T waves.

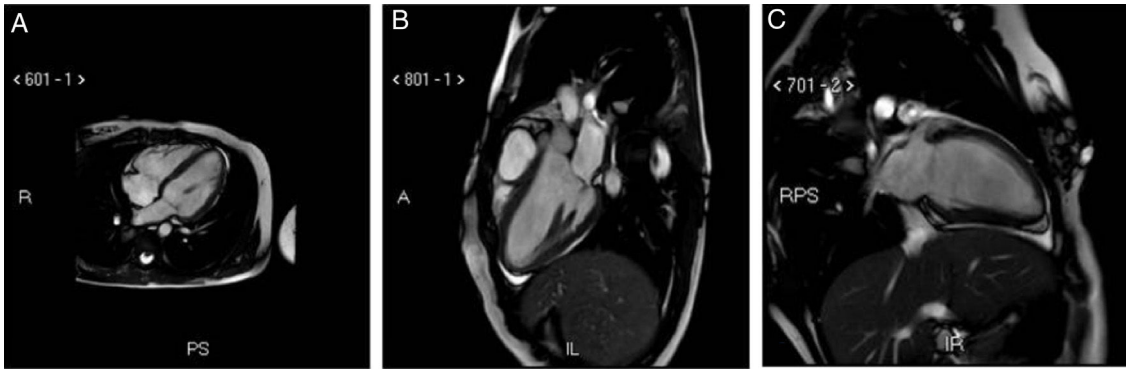

Figure 2. Cardiac magnetic resonance imaging showing hypokinesia of apical and anterolateral portions of the left ventricle with minimal, paradoxical telesystolic bulging without delayed enhancement and with normal ejection fraction.

improvement of the LV function and resolution of the pulmonary edema allowed extubation on the first postoperative day. Daily electrocardiograms showed ST-segment normalization and the appearance of widespread, negative T waves (figure 1C-D), which persisted until discharge. Echocardiography revealed rapid improvement in left ventricular ejection fraction within 2 days after surgery and full recovery at day 15. Magnetic resonance imaging (MRI) was performed 12 days after admission and showed hypokinesia of the apical portions of the LV with minimal, paradoxical telesystolic bulging, no delayed enhancement, and normal left ventricular ejection fraction (figure 2A, B, C). On day 20, the patient was discharged with her antiasthmatic medical therapy only.

In the present case, although we did not perform coronary angiography, the following findings strongly supported the diagnosis of TTC according to the Mayo Clinic criteria:[1] *a)* the rapidly reversible peculiar echocardiographic pattern, *b)* the appearance of repolarization abnormalities on the electrocardiogram, *c)* the relatively modest troponin elevation, *d)* the presence of stress triggers (bronchospasm and/or orthopedic surgery), and *e)* the absence of clinical, laboratory, and instrumental signs of pheochromocytoma or myocarditis. Nevertheless, considering the patient's medical history, her young age and the clinical manifestations, coronary involvement was deemed extremely unlikely. In our case, the patient showed 2 different physical/emotional stressors as potential triggers for the development of TTC: orthopedic surgery and bronchial asthma. In particular, the presence of bronchial hyperactivity might have been crucial. Manfredini et al.[2] reported that patients with severe respiratory diseases are at higher risk for the development of TTC and hypothesize a possible relationship with the use of high-dose β_2-agonists. The greater myocardial β_2:β_1 adreno-receptor ratio in the LV apical segments might explain greater responsiveness and vulnerability to the sympathetic stimulation and the higher risk of wall motion abnormalities of these segments. In our case, the patient, who had a marked history of asthma, developed TTC after a sudden episode of intubation-related bronchospasm requiring high doses of β_2-agonists: a specific temporal sequence (emotional stress due to the surgical intervention, asthmatic crisis, β_2-agonists drugs) leading to the development of the TTC is very likely.

According to the literature,[3] the incidence of TTC in children and young adults is fairly rare, but it could be underestimated and misinterpreted as myocarditis or dilated cardiomyopathy, or occasionally classified as "acute ventricular dysfunction of unknown etiology". From a general point of view, most of the clinical features in terms of triggers, presentation, electrocardiography, and imaging are similar to those in adults. However, several characteristics might be more specific to younger ages. First, in children and young adults, the incidence of coronary artery disease

is very rare and therefore coronary angiography is not a first-choice examination, although "nonatherosclerotic" coronary diseases should be considered. Second, in most of the reported cases and/or clinical series in childhood,[3] the most frequent clinical presentations are heart failure or cardiogenic shock, rather than chest pain. Finally, in the vast majority of cases, there is full spontaneous recovery of cardiac function, prognosis is better, and, unlike the situation in adults, there are no sex-related differences. Indeed, in older ages, the pattern of complications differs greatly between men and women and the overall prognosis seems to be more severe in men, with worse hemodynamic deterioration and a higher rate of in-hospital mortality.[4,5]

In the last few decades, cardiac MRI has become more important in the diagnosis of TTC and plays an important role in the younger population. A large, prospective, multicenter study demonstrated that cardiac MRI performed at the initial clinical presentation provided significant functional and anatomical information for the diagnosis of TTC.[6] Indeed, our patient, considering her young age and the low risk of coronary artery disease, did not undergo coronary angiography and underwent cardiac MRI, which showed no gadolinium late-enhancement, as is usually observed in TTC.

In conclusion, our case highlights the possible relationship between asthma and TTC. To the best of our knowledge, this is the first reported case of TTC in a young girl following an acute asthma attack during orthopedic surgery and is one of the few reported pediatric patients with TTC who underwent cardiac MRI.

Carla Paolini,[a,◇] Giacomo Mugnai,[a,◇,*] Stefano Casella,[b] Alessandro Mecenero,[a] and Claudio Bilato[a]

[a]*Division of Cardiology, West Vicenza General Hospitals, Arzignano, Vicenza, Italy*
[b]*Intensive Care Unit, West Vicenza General Hospitals, Arzignano, Vicenza, Italy*

*Corresponding author:
E-mail address: mugnai.giacomo@gmail.com (G. Mugnai).
◇These authors contributed equally as first coauthors.

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Aortic root surgery after arterial switch operation

Cirugía de raíz aórtica tras switch *arterial*

To the Editor,

Although progressive dilation of the neoaortic root[1] is less common than complications involving the neopulmonary root following arterial switch operation (ASO) to repair transposition of the great arteries in the neonatal period, it, together with neoaortic valve regurgitation, is a serious complication. Because the pulmonary branches are located in front of the ascending aorta after ASO (Lecompte maneuver, figure 1A-C), it is difficult to access the aortic root, unlike the situation when there is a normal spatial relationship between the aorta and the pulmonary artery. We present a small series of patients who underwent aortic root surgery for neoaortic valve regurgitation and/or dilation of the ascending aorta after ASO and describe arterial cannulation, aortic root access, and valve-sparing techniques.

Six patients aged between 6 months and 21 years (median, 12 years) and weighing between 6 and 64 kg (median, 43 kg) with a history of ASO underwent surgery for neoaortic valve regurgitation (5 patients) and dilation of the ascending aorta (6 patients, all children) (table 1). Just 1 patient—the youngest in the series—had known risk factors for neoaortic root dilation.[2,3] The patient was a 6-month-old infant who had undergone palliative ASO (previous aortic-pulmonary root size discrepancy and ventricular septal defect). The operation was the first reintervention for 4 patients, the second reintervention for 1 (previous neopulmonary valve replacement), and the third for another (2 previous neoaortic valve replacements). Chest computed tomography (figure 1) was performed to determine the spatial relationship between the great vessels (including the origin and path of the coronary arteries) and to check for adhesions to the sternum. A Doppler femoral ultrasound was also performed to assess the diameter and patency of the artery and vein.

Cannulation was femoral in 2 patients and central in 4. The pulmonary artery bifurcation (Lecompte maneuver) was mobilized in 5 patients using an inverse approach to the neonatal switch maneuver consisting of dissecting the bifurcation and moving both pulmonary arteries anterior to the ascending aorta. In the other patient, it was only necessary to separate and mobilize the right pulmonary artery to access the neoaortic root.

Neoaortic valve replacement was required in 3 patients as the valve was considered to be irreparable at the time of the intervention. One of the patients received a single prosthetic valve while the other 2 underwent valved conduit placement and reimplantation of the coronary arteries (just the right artery in 1 case) using the Bentall technique. Replacement of the ascending aorta with the valve-sparing David procedure (figure 1) and reimplantation of the coronary arteries with the Yacoub technique and Schäfers aortic annuloplasty were each performed in 1 patient. In the second case, the circumflex artery arose in the right coronary artery and followed a retroaortic path (type D, posterior loop) and was therefore very close to the area of the annuloplasty. Associated procedures included replacement of the neopulmonary valve with a valved conduit in 1 patient (third intervention) and replacement of both pulmonary arteries, both fragile, with a corrugated hilum-to-hilum conduit (fourth intervention) in another.

The case of the youngest patient in this series, aged 6 months and weighing 6 kg, deserves special mention. The infant developed progressive neoaortic valve regurgitation due to neoaortic root dilation after an initially successful palliative ASO in the neonatal period to treat single-ventricle heart disease, aortic