

negative correlation was also found between the extent of microvascular dysfunction and the time from symptom onset to IMR analysis ($R = -0.69$; $P = .012$), in line with previous data⁶ (Figure). In particular, a normal IMR value was found in a patient studied 10 days after the appearance of initial symptoms, suggesting the reversibility of this microvascular dysfunction.

In conclusion, our study shows that LAD of TKS patients may exhibit some degree of microvascular dysfunction in the absence of atherosclerotic or vulnerable plaque. Future studies are needed to further determine the causes of this dysfunction.

FUNDING

G. Jiménez Brítez received a grant from Coronary and Structural Course in Barcelona 2015 for this study.

Gustavo Jiménez Brítez,^a Manel Sabaté,^a Carlos Robles,^a Pablo Elpidio García-Granja,^b Ignacio J. Amat-Santos,^b and Salvatore Brugaletta^{a,*}

^aInstituto Cardiovascular, Hospital Clínic de Barcelona, Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), Barcelona, Spain

^bDepartamento de Cardiología, CIBERCV, Hospital Clínico Universitario de Valladolid, Instituto de Ciencias del Corazón (ICICOR), Valladolid, Spain

*Corresponding author:

E-mail address: sabrugal@clinic.ub.es (S. Brugaletta).

Available online 18 September 2017

REFERENCES

1. Galiuto L, De Caterina AR, Porfidia A, et al. Reversible coronary microvascular dysfunction: a common pathogenic mechanism in apical ballooning or Tako Tsubo syndrome. *Eur Heart J*. 2010;31:1319–1327.
2. Núñez Gil IJ, Andrés M, Almendro Delia M, et al. Characterization of Tako-tsubo Cardiomyopathy in Spain: Results from the RETAKO National Registry. *Rev Esp Cardiol*. 2015;68:505–512.
3. Kim HS, Tremmel JA, Nam CW, et al. Quantitative comparison of microcirculatory dysfunction in patients with stress cardiomyopathy and ST-segment elevation myocardial infarction. *J Am Coll Cardiol*. 2011;58:2430–2431.
4. Alfonso F, Núñez-Gil IJ, Hernández R. Optical coherence tomography findings in Tako Tsubo cardiomyopathy. *Circulation*. 2012;126:1663–1664.
5. Eitel I, Stiermaier T, Graf T, et al. Optical Coherence Tomography to evaluate plaque burden and morphology in patients with takotsubo syndrome. *J Am Heart Assoc*. 2016;5:e004474.
6. Rivero F, Cuesta J, García-Guimaraes M, et al. Time Related Microcirculatory Dysfunction in Patients with takotsubo cardiomyopathy. *JAMA Cardiol*. 2017;2:699–670.

<http://dx.doi.org/10.1016/j.rec.2017.08.013>

1885–5857/

© 2017 Sociedad Española de Cardiología. Published by Elsevier España, S.L.U. All rights reserved.

Experience With the Absorb Bioresorbable Vascular Scaffold in Various Scenarios of Congenital Heart Disease



Experiencia con el armazón vascular bioabsorbible Absorb en varios escenarios de cardiopatías congénitas

To the Editor,

Percutaneous treatment in children with congenital heart disease has continued to evolve in recent years. Stent implantation plays an important role in some of these diseases.¹ However, because vessel growth is rapid in infants, there is a need for subsequent stent redilations, surgical removal, or complicated surgical reintervention. This problem could be resolved by a bioresorbable stent.²

The ideal bioresorbable stent in pediatric patients would provide sufficient radial force and acceptable flexibility for deployment into distal arteries, should be low profile, and would disappear without creating a significant local inflammatory response or systemic toxicities.

The bioresorbable vascular scaffold (BVS) (Abbott) is the most advanced, well-studied bioresorbable stent.³ The product is available in multiple sizes and it fully reabsorbs within 3 years and provides mechanical support for up to 6 to 12 months.⁴ Due to the features described, the Absorb-BVS, could meet the needs of pediatric patients.

The aim of our study was to describe our experience with BVS in the setting of various vascular lesions in children with congenital heart disease.

A retrospective, interventional and clinical follow-up study was conducted. The primary outcome measures were procedural success and complication rates. Informed consent was obtained in all patients.

BVS implantation was performed in 8 patients as an alternative to surgical intervention or bare-metal stent implantation, bridging the patient in some cases to a future more definitive surgical

intervention. The median age was 3.8 months (10 days–6.3 years) and the median weight was 3.95 kg (range, 2.3–20). The demographic data and types of vessel obstruction are summarized in the Table.

Based on the type of lesion, vascular access was gained via the femoral vein ($n = 5$) or the femoral artery ($n = 2$) and there was 1 hybrid procedure through the right ventricular free wall. Vessel lesion morphology and critical diameter were assessed angiographically. If there was pre-existing critical vessel obstruction and as a guide for proper implantation, we performed balloon predilation of the vessel in 5 patients. After the decision to implant a stent was confirmed, the Absorb-BVS was implanted. The stent sizes (mm) used were 3.5 x 12 ($n = 5$), 2.5 x 12 ($n = 1$), and 3 x 12 ($n = 2$). Vascular stenting was achieved in all patients. No recoil of the stent was observed. In 6 patients, subsequent stent overdilation was necessary to achieve the maximum diameter of the native vessel. The angiographic result was satisfactory in all patients (Figure). There were no procedure-related complications. Improvement in hemodynamic parameters or clinical recovery was achieved in all patients in the acute follow-up.

Patients underwent serial echocardiographic and clinical follow-up to evaluate hemodynamic status and the patency of the stented area. The median follow-up period was 82.1 days (range, 3–155). Angiographic reevaluation was performed in 2 patients. In patient No. 2, a balloon overdilation was performed 71 days after implantation; however, we were unable to achieve clear improvement and 5 days later the patient was accepted for total surgical correction. Patient No. 5, was reevaluated 142 days after the procedure to check vessel integrity and growth. Angiography showed the permeability and lumen integrity of the stented vessel. Four more patients underwent successful corrective surgery (Table).

With the concept of temporary scaffolding, biodegradable stents might solve one of the greatest challenges in pediatric congenital heart disease intervention: adaptation to growth.¹ So far, there is little published information on BVS use in pediatric patients.⁵ BVS

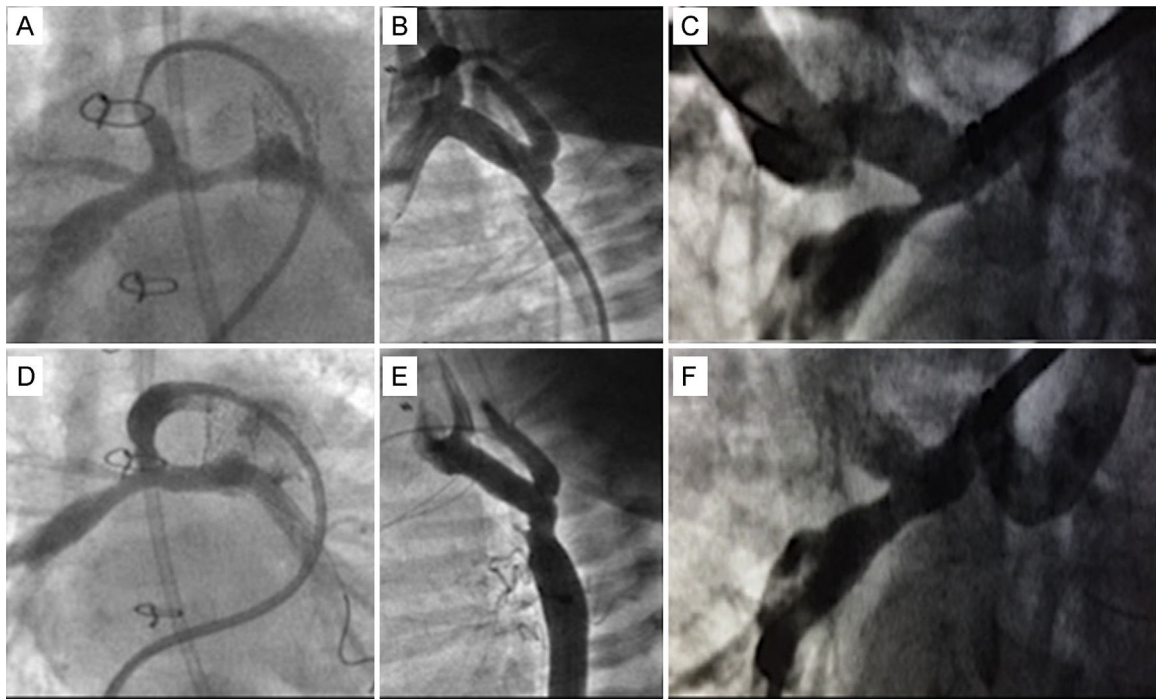


Figure. A: angiogram of the pulmonary arteries of a 4-month-old infant with hypoplastic left heart syndrome in stage I of palliation. B: angiogram of aortic arch coarctation in a neonate. C: severe right lobar pulmonary artery stenosis. D, E, F: final angiographic result after bioresorbable vascular scaffold implantation in all 3 patients.

Table
Demographic and Follow-up Data

Patient	Age at stenting	Weight (kg)	Vessel obstruction	Duration of stent patency (d)	Reintervention
1	2 mo	3.5	RPV	94	RPV marsupialization
2	10 d	2.5	Venous channel [*]	76	Direct anastomosis between RPV and lobar artery
3	4 y	17	Right coronary artery stenosis	3	-
4	1 y	11.6	RPV	21	-
5	6 y	20	Right inferior lobar artery	142	-
6	16 d	2.3	Left pulmonary branch	129	Glenn
7	4 mo	4.4	Left pulmonary branch	37	Glenn
8	14 d	3.2	Aortic arch coarctation	155	Coarctectomy. End-to-end anastomosis

RPV, right pulmonary vein confluence/surgical suture line.

^{*} Right pulmonary venous channel stenosis, draining in the inferior cava vein.

have shown excellent handling, trackability and delivery profile. The device is radiolucent, with 2 radiopaque platinum markers that allow easy visualization. Balloon predilatation is recommended if there is pre-existing critical vessel obstruction and as a guide for proper implantation. In the 5 patients who underwent balloon predilatation, the vessels were dilated up to 80% of the desired diameter, following which there was vessel recoil, reaching a mean percentage of the desired target diameter of 59%, which made stenting necessary.

Although the radial strength of the BVS has been reported to be similar to that of bare-metal stents, if the BVS is overstretched beyond its designed limits, it has been shown to lose some of its radial strength and may possibly fracture.⁵ In our cohort, to fully adapt the stent to the vessel wall, in some patients, we checked

that progressive overdilation with balloons, up to 1.5 mm larger than the diameter of the stent, was feasible and safe, and the stent structure remained intact.

From the viewpoint of the types of lesions, many different types of vessel obstruction can be treated with BVS providing a temporary or permanent therapeutic option, or serving as a bridge to more definitive future interventions.

As described above, BVS reabsorbs within 3 years and provides mechanical support for up to 6 to 12 months. Like recent reports,⁵ we observed that these times may be shorter in children. We suggest the hypothesis of a faster metabolism, or BVS placement in vessels with higher flow than coronary arteries for which they were initially designed. This might explain why the mechanical strength and the body of the stent are preserved for no more than

3 months. In patients who underwent surgery, the surgeons found no remains of the stent when they examined the treated vessel.

Given advances in the percutaneous treatment of congenital heart disease, bioresorbable stents are already a reality. The development of larger-diameter bioresorbable stents would be ideal for pediatric indications.

Alejandro Rodríguez Ogando,^{a,*} Fernando Ballesteros Tejerizo,^a Fernando Sarnago Cebada,^b Constancio Medrano López,^a Juan Miguel Gil Jaurena,^c and José Luis Zunzunegui Martínez^a

^aSección de Cardiología Pediátrica, Hospital General Universitario Gregorio Marañón, Madrid, Spain

^bDepartamento de Cardiología, Hospital General Universitario Gregorio Marañón, Madrid, Spain

^cDepartamento de Cirugía Cardiovascular, Hospital General Universitario Gregorio Marañón, Madrid, Spain

*Corresponding author:

E-mail address: arodriguez@salud.madrid.org

(A. Rodríguez Ogando).

Available online 5 October 2017

REFERENCES

1. Peters B, Ewert P, Berger F. The role of stents in the treatment of congenital heart disease: Current status and future perspectives. *Ann Pediatr Cardiol.* 2009;2:3–23.
2. Peuster M, Beerbaum P, Bach FW, Hauser H. Are resorbable implants about to become a reality? *Cardiol Young.* 2006;16:107–116.
3. Onuma Y, Ormiston J, Serruys PW. Bioresorbable scaffold technologies. *Circulation.* 2011;75:509–522.
4. Alfonso F, García-Guimaraes M. Restenosis of Coronary Bioresorbable Vascular Scaffolds. *Rev Esp Cardiol.* 2017;70:527–531.
5. McCrossan BA, McMahon CJ, Walsh KP. First reported use of drug-eluting bioabsorbable vascular scaffold in congenital heart disease. *Catheter Cardiovasc Interv.* 2016;87:324–328.

<http://dx.doi.org/10.1016/j.rec.2017.08.018>
1885-5857/

© 2017 Sociedad Española de Cardiología. Published by Elsevier España, S.L.U. All rights reserved.