coronary intervention for STEMI at the time when polymer degradation is almost completed (6). Although randomization in the trial was stratified by STEMI, our comparisons were underpowered for many of the clinical outcomes, as reflected by the wide CI for TLF. As to whether the lower strut thickness, which has the potential for less thrombogenicity and thrombus mobilization, and the passive coating with silicon carbide, which eliminates the interaction between stent surface and the surrounding prothrombotic milieu, may be relevant in reducing the risk for failures in treated lesions, these are speculative mechanisms of DP-SES that require further assessment. On the basis of the hypothesis-generating findings of this study, we have planned the BIOSTEMI (A Comparison of an Ultrathin Strut Biodegradable Polymer Sirolimus-Eluting Stent With a Durable Polymer Everolimus-Eluting Stent for Patients With Acute ST-Segment Elevation Myocardial Infarction Undergoing Primary Percutaneous Coronary Intervention) trial (NCT02579031), which will test the superiority of BP SES to DP EES among 1,250 patients with STEMI undergoing primary percutaneous coronary intervention.

Raffaele Piccolo, MD
Dik Heg, PhD
Anna Franzone, MD
Marco Roffi, MD
David Tüller, MD
André Vuilliomenet, MD
Olivier Muller, MD
Stéphane Cook, MD
Daniel Weilenmann, MD
Christoph Kaiser, MD
Peiman Jamshidi, MD
Juan F. Iglesias, MD
***Stephan Windecker, MD**
Thomas Pilgrim, MD

*Bern University Hospital
Department of Cardiology
Bern 3010
Switzerland
E-mail: stephan.windecker@insel.ch

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Three Cases of Early Lotus Valve Thrombosis

Transcatheter aortic valve replacement (TAVR) is a well-established therapeutic option for the treatment of inoperable/high-risk patients with symptomatic severe aortic stenosis. Before this therapy extends to younger and/or lower-risk populations, appropriate valve performance and durability should be verified.

One of the potential causes of valve dysfunction is valve thrombosis, an entity thought to be rare. Diagnostic criteria for valve thrombosis included a transthoracic echocardiography mean gradient increase from post-procedural value ≥20 mm Hg and mean gradient ≥40 mm Hg with reduced leaflet mobility and/or perileaflet hypodense mass consistent with thrombus by 3D transesophageal echocardiogram or multidetector computed tomography (1).

The incidence with newer second-generation valves is essentially unknown. Recent studies suggest that TAVR thrombosis incidence may be higher than previously reported (2).

The Lotus valve (Boston Scientific, Natick, Massachusetts) is a second-generation transcatheter aortic valve. Lotus is a bovine trileaflet pericardial tissue valve incorporated in a nitinol autoexpandible stent. Device features include a precise release, the potential for repositioning and full recovery after implantation, and the presence of a urethane membrane sealing system to minimize the risk of paravalvular leak. To our knowledge only 1 case of Lotus valve thrombosis has been published. In this case valve thrombosis occurred only a few days after implantation (3).

We present 3 cases of well-documented valve thrombosis in our small series of 10 patients undergoing Lotus valve implantation. A summary of

TABLE 1 Patient Baseline, Procedural, and Clinical/Imaging Data at the Time of Valve Thrombosis Diagnosis and at Follow-Up

	Patient #1	Patient #2	Patient #3
Baseline			
Age, sex	88 yrs, female	80 yrs, female	54 yrs, male
EuroSCORE/Society of Thoracic Surgeons score	20.0/4.1	7.8/2.4	1.1/0.4
Comorbidities	Frailty	Previous pulmonary embolism	Hepatic cirrhosis, esophageal varices, low platelet count
Annular area/perimeter	352 mm^2/69 mm	377 mm^2/71 mm	546 mm^2/85 mm
Antiaggregation/anticoagulation	no	Chronic VKA	no
Periprocedural data			
Lotus valve size	23	23	27
Doppler mean gradient pre/post, mm Hg	37/10	68/14	56/7
Peri-Procedural complications	Pacemaker, femoral vein thrombosis	Femoral hematoma	No
Antiaggregation/anticoagulation prescription at discharge	Clopidogrel 75 mg 6 months + VKA 3 months	VKA indefinitely	ASA 100 mg 6 months
At the time of thrombosis diagnosis			
Time since valve implantation	4 months	2 months	4 months
Symptoms	Dyspnea NYHA functional class III	Dyspnea NYHA functional class III	Dyspnea NYHA functional class III
Doppler mean gradient, mm Hg	45	70	40
TEE leaflet abnormal mobility	reduced 2 cups	reduced 3 cups	reduced 2 cups
MSCT attenuation mass	yes	yes	yes
Treatment after valve thrombosis diagnosis and early outcome			
Initial antiplatelet/antithrombotic treatment	Clopidogrel + VKA 2 months	AAS+ UFH 1 month AAS+ LMWH 1 month	AAS+ LMWH 1 month AAS + VKA 1 month
Clinical outcome	Clinical improvement	Clinical improvement	Clinical improvement
Imaging outcome	Mean gradient 10 mm Hg	Mean gradient 20 mm Hg	Mean gradient 18 mm Hg
	Normal leaflet motion	Abnormal mobility 2 cup	Normal leaflet motion
	Mild attenuation mass	Reduced attenuation mass	Mild attenuation mass
Recommended treatment for 1 year	Clopidogrel + VKA	AAS + VKA	AAS + VKA
Risk factors for thrombosis			
	Femoral vein thrombosis	Pulmonary embolism	Not known

AAS = acetylsalicylic acid; LMWH = low molecular weight heparin; MSCT = multislice computed tomography; NYHA = New York Heart Association; TEE = transesophageal echocardiography; UFH = unfractionated heparin; VKA = vitamin K antagonist.

baseline patient, procedural and follow up data of the 3 patients with valve thrombosis is shown in a **Table 1**.

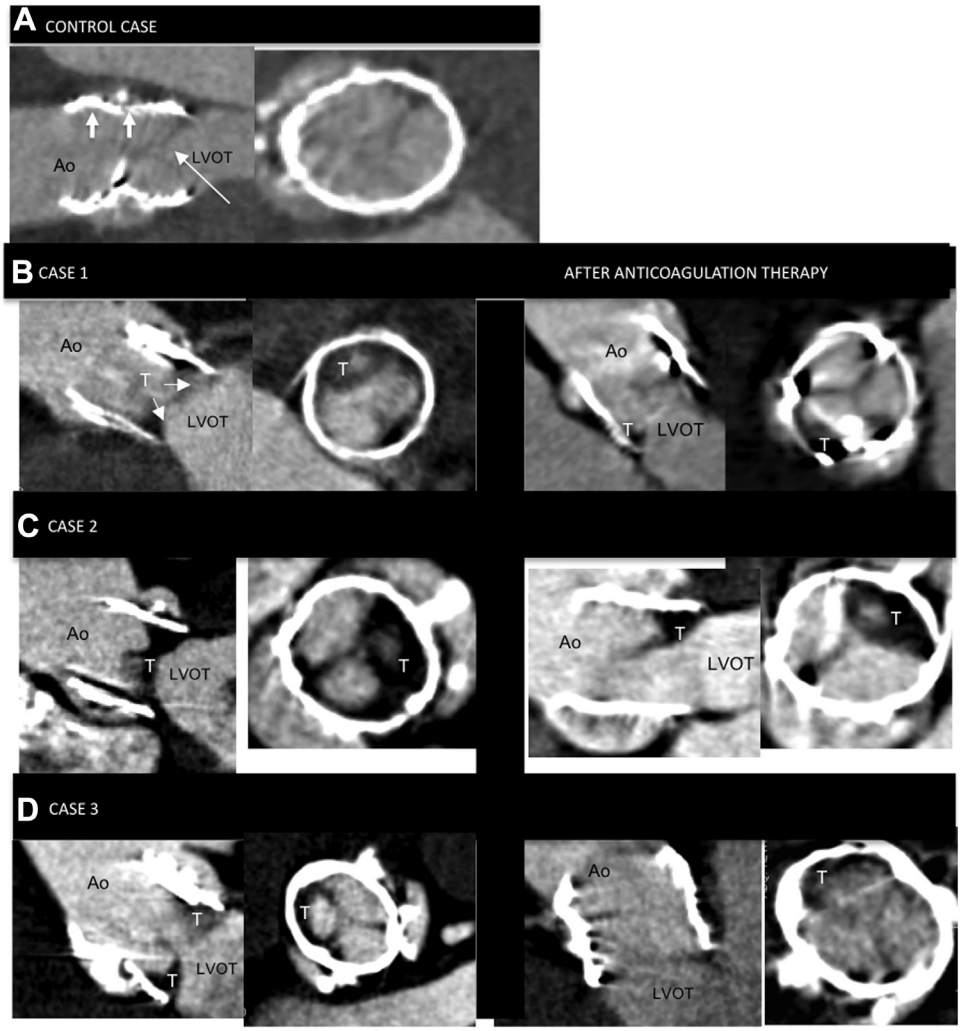
All of them not only had altered leaflet mobility but also severe transaortic gradient, computed tomography images consistent with valve thrombosis and clinical deterioration (**Figure 1**). We did not find any cases of significant gradient increase during the first few months after TAVR with any of the other valves implanted in our center (99 Edwards [Edwards Lifesciences, Irvine, California], 6 direct flow) even when follow up protocols are identical with all type of valves.

The structure of the Lotus device (**Figure 2**) with thicker, nonflat metallic components of the stent frame and the relatively bulky metallic posts may facilitate thrombus formation in the aortic face of the cusps until complete endothelization occurs, which could take up to 12 months or more.

Regarding the treatment of transcatheter thrombosis valve some cases have been published. Most of the patients, but not all, seem to have a good outcome after 1 to 2 months of anticoagulation therapy. Nevertheless some patients did not respond properly and required surgery (4). In our 3 patients transaortic gradient was reduced and clinical condition improved but remaining thrombus was evident at multidetector computed tomography in all 3 cases after 2 months of anticoagulation. There is no data to support how long anticoagulation need to be maintained. In our patients due to the fact that thrombus remains we plan at least 1 year of anticoagulation therapy.

Valve thrombosis is a rare but serious complication after TAVR. True incidence is unknown but probably underestimated. The clinical spectrum of this condition is wide, from reduced leaflet motion without

FIGURE 1 Computed Tomography Images With Valve Thrombosis

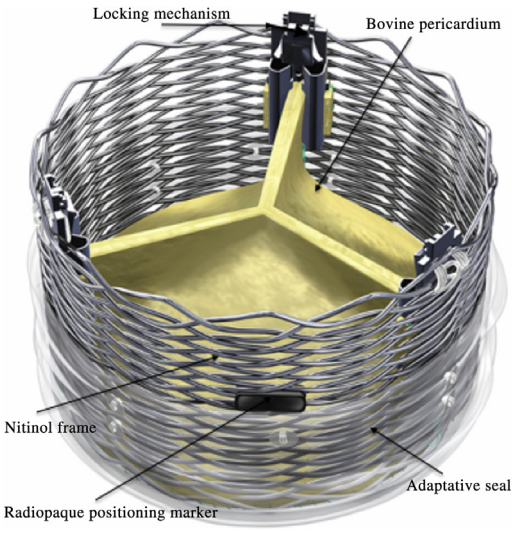


(A) Multidetector computed tomography in long **(left)** and short axis **(right)** during diastole in a normally functioning Lotus valve. Note the stent frame **(short arrows)** and the leaflets that are very thin **(long arrow)**. **(B)** Patient #1: **(left)** at the time of valve thrombosis diagnosis and **(right)** after 2 months of anticoagulation. Note a hypoattenuated mass near the stent frame **(arrows)** that extend to the cups and result in decreased leaflet movement. After anticoagulation mass has decreased and leaflet movement has improved. **(C)** Patient #2: a huge thrombus (T) is observed over the leaflets that decreased but still clearly visible after anticoagulation. **(D)** Patient #3: a T is sitting over valve leaflets. After anticoagulation therapy mass has decreased, almost disappeared, and leaflet movement has improvement. Ao = aortic root; LVOT = left ventricular outflow tract.

transvalvular gradient in asymptomatic patients, to significant valve stenosis causing severe heart failure symptoms. Predisposing factors include prothrombotic circumstances, suboptimal antiplatelet therapy, and probably valve design. Anticoagulation treatment is usually effective and has to be considered the treatment of choice. Nevertheless persistent small hypoattenuated mass persisted in all of our patients 2 to 4 months after anticoagulant therapy. Its clinical significance is unknown.

The role of routine early anticoagulation as recommended after bioprothetic surgical valves (5), in order to prevent this and other thrombotic complications after TAVR needs to be explored, particularly in patients or valves more prone for thrombosis.

FIGURE 2 LOTUS Valve System



*Luisa Salido-Tahoces, MD, PhD
Rosa-Ana Hernandez-Antolin, MD, PhD
Covadonga Fernández-Golfín, MD
Ana Palomera-Rico, MD
Ana Ayala-Carbonero, MD
Jose-Julio Jimenez-Nacher, MD
Jose-Luis Mestre-Barceló, MD, PhD
Jose-Luis Moya-Mur, MD, PhD
Jose-Luis Zamorano-Gómez, MD, PhD

*Servicio de Cardiología
Hospital Ramón y Cajal
Carretera de Colmenar Km 9100
Madrid 28034
Spain
E-mail: luisasalido@hotmail.com

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