The design of the upper crown, explained above, makes this aortic valve prosthesis particularly indicated for patients with low positioning of the coronary ostia or with aortas with narrow sinuses of Valsalva, as the risk of coronary occlusion is higher in these cases.

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REFERENCES

1. Jiménez-Quevedo P, Serrador A, Pérez de Prado A, Nombela-Franco L, Biagioni C, Pan M. Selección de lo mejor del año 2016 en cardiología intervencionista: extensión de las indicaciones de TAVI a pacientes con riesgo intermedio. *Rev Esp Cardiol.* 2017;70:218–219.
2. Bagur R, Teefy PJ, Kiaii B, Goela A, Greenbaum A, Chu MW. Transcaval transcatheter aortic valve replacement with the ACURATE-neo aortic bioprosthesis: first North American experience. *JACC Cardiovasc Interv.* 2016;9:e199–e201.
3. Maeda K, Kuratani T, Torikai K, et al. A new self-expanding transcatheter aortic valve for transfemoral implantation — First in Asia implantation of the ACURATE neo/TF system: early results. *Circ J.* 2015;79:1037–1043.

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Antiplatelet Monotherapy After Percutaneous Coronary Intervention. Contemporary Long-term Outcomes and Matched Comparison With Routine Clinical Practice

Monoterapia antiplaquetaria tras intervención coronaria percutánea. Resultados contemporáneos a largo plazo y comparación con la práctica habitual

To the Editor,

Some patients cannot receive aspirin, and are therefore unable to receive dual antiplatelet therapy (DAPT) following a percutaneous intervention. For these patients, antiplatelet monotherapy (APM) with a $P2Y_{12}$ inhibitor ($iP2Y_{12}$) is a potential option, although there is little published data on this therapy. Our aim was to investigate the incidence of APM use in clinical practice and to determine the outcome in this group compared with that in patients receiving DAPT. From August 2008 to April 2016, we enrolled all patients receiving APM (ticlopidine 150 mg/12 h, clopidogrel 75 mg/24 h, ticagrelor 90 mg/12 h, or prasugrel 10 mg/24 h) following angioplasty. Patients receiving anticoagulant agents at hospital discharge or during follow-up (according to telephone contact or medical visit) were excluded, leaving a total of 37 patients for the study.

Clinical variables and the reasons for APM use were recorded (Table). The incidence of APM use was 0.42% with a median follow-up of 48.8 months; 27% had received one of the newer antiplatelet agents (6, prasugrel; 4, ticagrelor). Patients receiving APM were matched (1:1) with a control group given DAPT according to the standard clinical practice, selected from 1438 consecutive patients undergoing stent placement in our center between 2011 and 2013. The criteria for matching were age, sex, hypertension, dyslipidemia, diabetes, smoking, clinical presentation, type of stent (drug-eluting/metallic), and ejection fraction. Among the controls, 2 received prasugrel. Compared with patients given DAPT, the group receiving APM showed no significant differences in the rate of major cardiovascular events at 3 years (mortality, reinfarction, or revascularization requirement; $P = .810$) (Figure). In both groups, major cardiovascular events occurred mainly within the first year. Four patients in each group died during follow-up. There was 1 major bleeding event in the DAPT group and none in the APM group during follow-up (nonsignificant difference).

Park et al.[1] investigated the development of bleeding with APM–either aspirin or clopidogrel–following DAPT use, and reported that major bleeding rates were similar in the comparison of these 2 agents. Gastrointestinal bleeding is more common with aspirin than clopidogrel, and DAPT with these agents increases the risk of gastrointestinal bleeding by 2- or 3-fold compared with aspirin alone.[2] There were no cases of stent thrombosis during follow-up in our study, likely because of the low incidence of this phenomenon ($< 1\%$ per year) and the small size of the sample. Although previous studies have indicated that stent thrombosis rates after DAPT discontinuation are significant and are related to discontinuing the second antiplatelet agent, the absence of this event in our study raises the hypothesis that $iP2Y_{12}$ agents may be able to maintain an adequate antithrombotic state. Data on $iP2Y_{12}$ monotherapy are scarce and some information is from patients who have undergone early DAPT discontinuation. Ferreira-González et al.[3] have indicated that there is a variable relationship in time between occurrence of events and the day of discontinuation. The PARIS registry has shown that APM (understood as early discontinuation of DAPT, which may be temporary or permanent) carried out under medical supervision can provide acceptable results.[4]

Another finding of our study is related to the type of $iP2Y_{12}$. We observed a trend toward more favorable outcomes in patients receiving the newer $iP2Y_{12}$ agents (Figure B), possibly because of greater individual variability in pharmacodynamics, CYP2C19 polymorphisms in patients requiring antiplatelet therapy with clopidogrel, and a more potent antiplatelet action of the newer agents.[5]

Effective strategies are available in clinical practice for treating patients with aspirin allergy and contraindications for implanting a drug-eluting stent, such as desensitization protocols, likely the preferable option, or substituting aspirin for an analog or another antiplatelet agent (indobufen, trapidil, triflusal).[6] Nonetheless, these measures sometimes fail or are not applied for various reasons. Additionally, in populations with an elevated bleeding risk, attempts are made to reduce DAPT to a minimum. A strategy of $iP2Y_{12}$ monotherapy could be useful in both these scenarios. Results are pending for the TWILIGHT and GLOBAL LEADERS studies, which may establish broader indications for the use of APM.

Table
Baseline Characteristics of the Patients Included, and Associated Clinical Conditions in Patients With Aspirin Allergy

	APM (n = 37)	Control DAPT (n = 37)	*P*
Age, y	67.4 ± 12.3	68.3 ± 10.8	NS
Women	15 (40.5)	15 (40.5)	NS
Smoking habit			
Smoker	11 (29.7)	10 (27.0)	NS
Ex-smoker	11 (29.7)	9 (24.3)	NS
Diabetes	19 (51.4)	20 (54.0)	NS
Hypertension	27 (73.0)	29 (78.4)	NS
Dyslipidemia	28 (75.7)	27 (73.0)	NS
Cardiovascular history			
Previous infarction	5 (13.5)	5 (13.5)	NS
Previous percutaneous coronary intervention	4 (10.8)	9 (24.3)	NS
Pervious coronary revascularization surgery	0 (0.0)	3 (8.1)	.078
History of stroke/transient ischemic attack	1 (2.7)	3 (8.1)	NS
Peripheral vascular disease	4 (10.8)	6 (16.2)	NS
Ejection fraction, %	60.8 ± 10.6	58 ± 10.3	NS
Clinical presentation			
Stable angina/Silent ischemia	15 (40.5)	15 (40.5)	NS
Unstable angina	3 (8.1)	3 (8.1)	NS
Non-ST-segment-elevation acute myocardial infarction	9 (24.3)	9 (24.3)	NS
ST-segment-elevation acute myocardial infarction	10 (27.0)	10 (27.0)	NS
Previous admission for bleeding	2 (5.41)	2 (5.41)	NS
Oncologic history	3 (8.1)	4 (10.8)	NS
Associated clinical conditions in patients with aspirin allergy			
Skin reaction (erythema, urticaria, angioedema)	11 (29.7)	-	-
Glottis edema	1 (2.7)	-	-
Anaphylactic shock	2 (5.4)	-	-
Asthma history	4 (10.8)	-	-
Chronic urticaria history	4 (10.8)	-	-
Others	2 (5.4)	-	-
Antiplatelet therapy at discharge			
Use of new antiplatelet agents[a]	10 (27.0%)	2 (5.4%)	-
Follow-up time, months[b]	38.6 ± 24.1	16.9 ± 2.2	< .0001

APM, antiplatelet monotherapy; DAPT, dual antiplatelet therapy; NS, nonsignificant difference
[a] Prasugrel or ticagrelor.
[b] Understandably, follow-up times were shorter with DAPT than with APM. This is because, after a variable time period, patients receiving DAPT were changed to APM; that is, in the control arm, the mean follow-up of 16.9 months is the time patients were receiving DAPT. Thereafter, clinical follow-up continued with APM, according to the standard clinical practice.

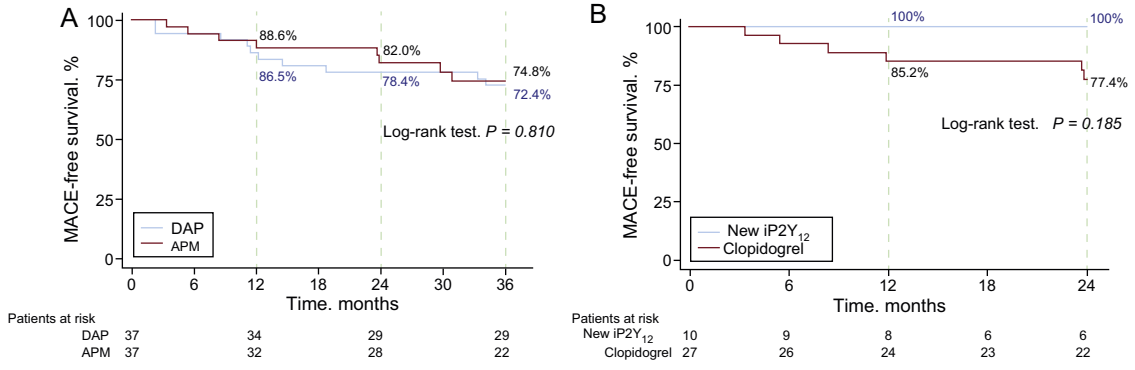

Figure. A: Kaplan-Meier survival curve for the combined event, MACE, at 3 years of follow-up. B: Kaplan-Meier survival curve of event-free time (MACE) at 2 years of follow-up in patients with APM treated with clopidogrel and the new iP2Y$_{12}$ agents.
APM, antiplatelet monotherapy; DAPT, dual antiplatelet therapy; iP2Y$_{12}$: P2Y$_{12}$ inhibitors; MACE, major adverse cardiovascular events.

Our study has the limitations derived from its design and the small number of patients included, as it evaluates an uncommon treatment. Nonetheless, it may be an indication of typical clinical practice.

In conclusion, this study is the first to provide data on patients initially treated with iP2Y$_{12}$ monotherapy. This therapeutic strategy is not commonly used in clinical practice but is a reasonable choice for patients who cannot receive DAPT containing aspirin, as the outcome at 36 months was similar to that of patients receiving DAPT. Furthermore, the new iP2Y$_{12}$ agents could be an option when APM is needed, particularly after the acute phase has passed.

CONFLICTS OF INTEREST

I.J. Núñez-Gil has participated in lectures for AstraZeneca and Lilly, and has served as an advisor for AstraZeneca. E. Cerrato is a speaker for AstraZeneca Italy and has received research grants from AstraZeneca Spain.

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REFERENCES

1. Park TK, Song YB, Gwag HB, et al. Aspirin versus clopidogrel following dual antiplatelet therapy on the era of drug eluting stents. *J Am Coll Cardiol.* 2014;63:A1612.
2. Abraham NS, Members WC, Hlatky MA, et al. ACCF/ACG/AHA 2010 Expert Consensus Document on the Concomitant Use of Proton Pump Inhibitors and Thienopyridines: A Focused Update of the ACCF/ACG/AHA 2008 Expert Consensus Document on Reducing the Gastrointestinal Risks of Antiplatelet Therapy and NSAID Use. *Circulation.* 2010;122:2619–2633.
3. Ferreira-González I, Marsal JR, Ribera A, et al. Double antiplatelet therapy after drug-eluting stent implantation: risk associated with discontinuation within the first year. *J Am Coll Cardiol.* 2012;60:1333–1339.
4. Mehran R, Baber U, Steg PG, et al. Cessation of dual antiplatelet treatment and cardiac events after percutaneous coronary intervention (PARIS): 2 year results from a prospective observational study. *Lancet.* 2013;382:1714–1722.
5. Storey RF, Angiolillo DJ, Patil SB, et al. Inhibitory effects of ticagrelor compared with clopidogrel on platelet function in patients with acute coronary syndromes: the PLATO (PLATelet inhibition and patient Outcomes) PLATELET substudy. *J Am Coll Cardiol.* 2010;56:1456–1462.
6. Vega-Hernández B, Bangueses-Quintana R, Samaniego-Lampón B, Lozano Martínez-Luengas Íaue, Gala-Ortiz G, Segovia-Martínez de Salinas E. Rapid desensitization to aspirin in patients with coronary artery disease: a single center experience. *Rev Esp Cardiol.* 2016;69:795–797.

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Functional and Morphological Assessment of Left Anterior Descending Artery in Patients With Tako-tsubo Syndrome

Análisis morfológico y funcional de la arteria descendente anterior de pacientes con síndrome de tako-tsubo

To the Editor,

Tako-tsubo syndrome (TKS) is a clinical syndrome characterized by reversible left ventricular dysfunction in the absence of epicardial coronary obstruction. Although several pathogenic mechanisms have been proposed (ie, multivessel epicardial spasm, catecholamine-induced myocardial stunning, spontaneous coronary thrombus lysis, and acute microvascular spasm), its causes are still unknown.[1,2] Possible causes of TKS are the presence of vulnerable plaques or flow alteration, but they have not been well elucidated.

In our study, we sought to perform a functional and morphological assessment of the left anterior descending artery (LAD) in TKS patients by using optical coherence tomography (OCT) and pressure-temperature wire.

From January 2016 to May 2017, 14 consecutive TKS patients, admitted to 2 institutions and defined accordingly to Mayo Clinic diagnostic criteria,[1] were included. The study was approved by the ethics committee of our center and each patient provided written informed consent. A pressure-temperature guidewire (Certus, St Jude) was introduced in the LAD at the level of the second diagonal branch. After induction of hyperemia with adenosine (140 μg/kg/min), fractional flow reserve and the index of microcirculatory resistance (IMR) were measured as previously shown.[3] Fractional flow reserve and IMR were considered abnormal if < 0.80 and > 22, respectively.[3] OCT acquisition was then performed using a commercially available system for intracoronary imaging (C7XR Fourier-Domain System; LightLab Imaging, Westford, Massachusetts, United States) on the LAD (at least 50 mm) during continuous injection of contrast medium (3 mL/s, iodixanol 370, visipaque, GE Health Care, Cork, Ireland) through the guide catheter with an injection pump. The presence of coronary plaque on OCT pullback was analyzed offline by 2 independent investigators (LightLab Imaging, Wesrford, Massachusetts, United States).

Thirteen patients (92.8%) were women, with a mean ± standard deviation age of 66.1 ± 11.5 years. Coronary angiography showed no significant stenosis of at least 50% in the LAD. OCT and pressure-temperature wire analysis were performed in 14 and 12 patients, respectively. OCT analysis showed a normal 3-layer vessel wall, without atherosclerotic plaque, images of plaques rupture, plaques erosion, or intraluminal thrombus. None of the patients had fractional flow reserve ≤ 0.80, with a mean value of 0.96 ± 0.18, while 10 (83.3%) patients had microvascular dysfunction with IMR ± standard deviation of 33.8 ± 11.4 (Table).

The physiopathology of TKS is unknown, but can be related to intracoronary thrombus, either emerging from a ruptured thin-cap fibroatheroma or plaque erosion in the LAD, which is responsible for the typical left ventricle appearance. Coronary thrombus or at least the coronary plaque, which has led to thrombus formation, may be undetectable by coronary angiography, but may be seen on OCT.[4] Nevertheless, our OCT analysis did not show any coronary plaque or thrombotic remnants on LAD, also excluding the presence of any atherosclerotic coronary plaque. This is in contrast with a recent study that showed a high prevalence of atherosclerotic plaques in these patients without any plaque rupture or thrombi.[5] Unlike that study, our patients were younger with fewer