independent predictor of this event in both the series of Downing et al.[3] and our own. Elevated pulmonary pressures and resistances, and smaller pulmonary arteries are known factors of poor prognosis in this population.

FUNDING

None reported.

ETHICAL CONSIDERATIONS

All patients signed the informed consent and the study was approved by the hospital's ethics committee. Possible sex and gender variables have been considered in accordance with the SAGER guidelines.

DECLARATION OF USE OF ARTIFICIAL INTELLIGENCE

Artificial intelligence has not been used during the preparation of this manuscript.

AUTHORS' CONTRIBUTIONS

A. Mendoza, and L. Albert: study idea, and data mining and analysis. M. Flores, D. Herrera, B. Toral, and A. Caro: manuscript review and edition.

CONFLICTS OF INTEREST

None whatsoever.

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Relationship between membranous septum length and need for pacemaker implantation after transcatheter aortic valve implantation

Relación entre longitud del septo membranoso y necesidad de marcapasos tras implante de válvula aórtica

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To the Editor,

Transcatheter aortic valve implantation (TAVI) can trigger significant conduction disorders due to the mechanical compression caused by the transcatheter heart valve. This is because of the proximity between the aortic annulus, the atrioventricular node, and the membranous septum (MS) of the left ventricular outflow tract. The rate of pacemaker implantation after TAVI ranges from 4% to 33%.[1]

This retrospective analytical study included symptomatic patients with severe aortic stenosis referred for multidetector computed tomography as part of the TAVI protocol from December 2012 through October 2022. Written informed consent was obtained from all patients prior to the tomography scan by obtaining approval to conduct the study. We excluded patients with bicuspid aortic valve anatomy, pacemaker carriers, and those with previous surgical bioprosthetic valve. The aim of this study was to determine whether MS length is associated with the need for pacemaker implantation after TAVI. MS length was measured as the maximum distance from the plane of the aortic annulus to the top of the muscular portion of the ventricular septum in the coronal plane during systole (figure 1A,B).[2] Qualitative variables were analyzed using the chi-square test or Fisher exact test, while quantitative variables were analyzed using the Mann-Whitney *U* test. *P* values < .005 were considered statistically significant. A receiver operating characteristic (ROC) curve was constructed to assess the predictive accuracy of MS length for pacemaker implantation. Data were analyzed using the IBM SPSS statistical software package, version 26 (United States).

A total of 134 consecutive patients were assessed: 71 (53%) were men and the mean age was 75.5 ± 7.6 years.

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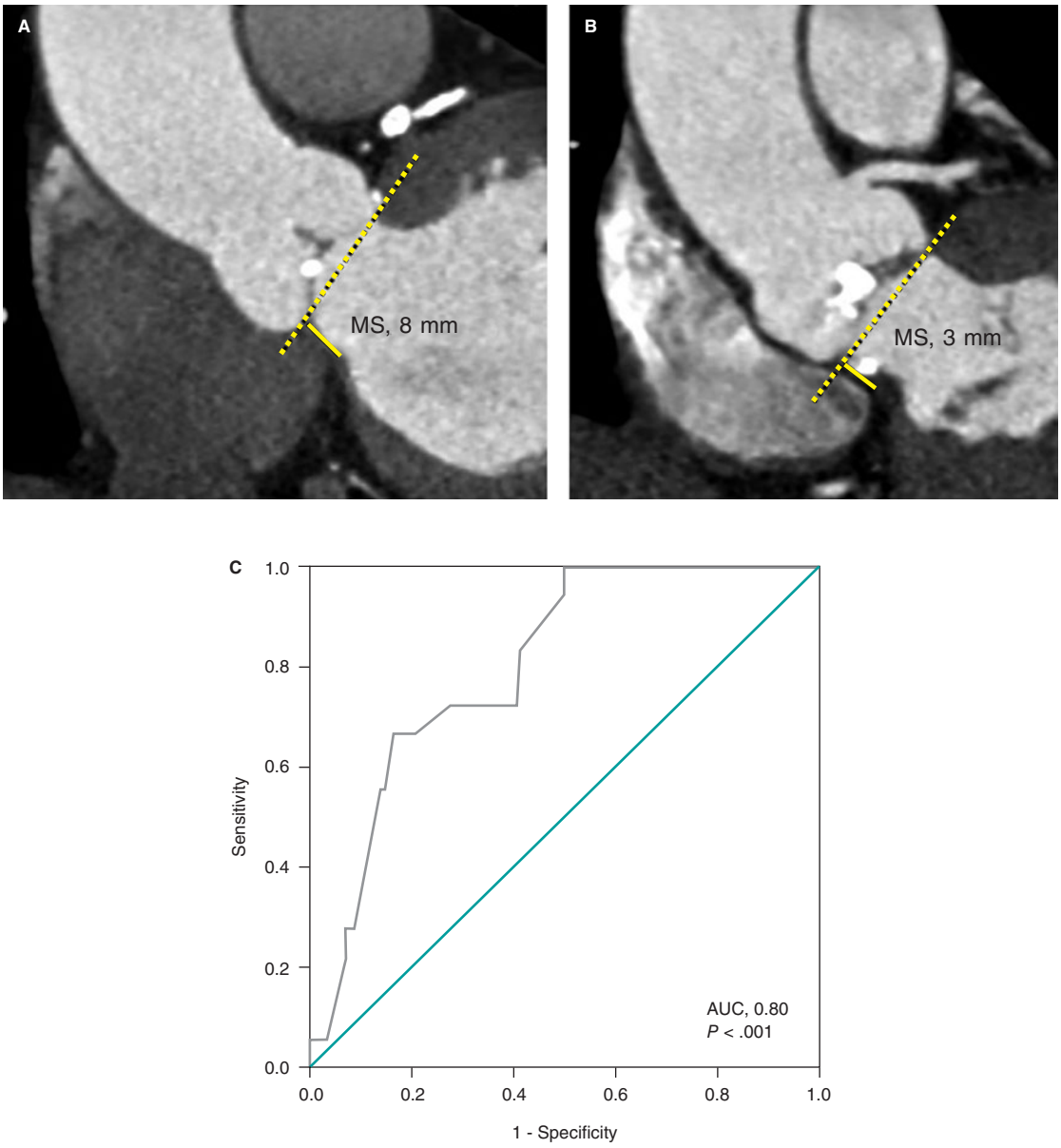

Figure 1. Measurement of membranous septum (MS) length by multidetector computed tomography in the coronal view. **A:** patient with an 8-mm MS not requiring no pacemaker implantation. **B:** patient with a 3-mm MS and left ventricular outflow tract calcification who underwent pacemaker implantation due to third-degree atrioventricular block after transcatheter aortic valve implantation. **C:** receiver operating characteristic (ROC) curve. Membranous septum length as a predictor of pacemaker implantation. The area under the curve (AUC) was 0.80 with cut-off, sensitivity, and specificity values of 5.5 mm, 0.67%, and 0.84%, respectively ($P < .001$).

In the pre-TAVI electrocardiogram, 117 patients (87.3%) were in sinus rhythm, 14 (10.4%) had atrial fibrillation, and 34 (25.4%) had conduction disorders (table 1).

The most commonly used balloon-expandable valve was Edwards SAPIEN 3 (Edwards Lifesciences, United States), which was used in 60 patients (44.8%), while the most widely used self-expanding valve was Evolut R, which was implanted in 17 patients (12.7%) (table 1).

After TAVI, 16 patients (11.9%) developed third-degree atrioventricular block, and 12 (9%) developed persistent new left bundle branch block (table 1).

Pacemaker implantation was performed in 18/134 patients (13.4%). Of these, balloon-expandable valves were implanted in 12/82 (14.6%), while self-expanding valves were implanted in 6/52 (11.5%). There was a significant correlation between CoreValve (Medtronic, United States) and pacemaker implantation (odds ratio [OR], 5.24; 95% confidence interval [CI], 1.32-20.86; $P = .029$).

In our Mexican population, the mean body mass index (BMI) was 26 kg/m^2, while MS length was 6.86 mm. In patients receiving a pacemaker (n = 18), MS length was significantly shorter (5.3 ± 1.2 vs 7.1 ± 1.7 mm; $P < .001$), with a cut-off value of 5.5 mm ($P < .001$) (figure 1C). On univariate analysis, the OR for the association between MS length < 5.5 mm and need for pacemaker implantation was 6.80 (95%CI, 2.36-19.58).

The MS lengths reported in the literature vary. In a Japanese population with a mean BMI of 21.7 kg/m^2, the mean MS length

Table 1. Clinical and electrocardiographic characteristics before and after TAVI, tomographic parameters, types of transcatheter heart valve, and complications after TAVI

Variables	Total n = 134	With pacemaker implantation n = 18	Without pacemaker implantation n = 116	*P*
Clinical characteristics				
Age, years	75.5 ± 7.6	76.2 ± 7.8	75.5 ± 7.5	.63
Masculine sex, n (%)	71 (53%)	12 (66.7%)	59 (51%)	.21
BMI, kg/m²	26 ± 4.3	28 ± 6.8	25.7 ± 3.7	.2
Hypertension, n (%)	91 (67.9%)	10 (55.6%)	81 (69.8%)	.23
Ischemic heart disease, n (%)	74 (55.2%)	9 (50%)	65 (56%)	.63
Diabetes mellitus, n (%)	43 (32.1%)	8 (44.4%)	35 (30.2%)	.23
Dyslipidemia, n (%)	36 (26.9%)	5 (27.8%)	31 (26.7%)	1
Smoking, n (%)	33 (24.6%)	3 (16.7%)	30 (25.9%)	.56
Kidney disease, n (%)	18 (13.4%)	3 (16.7%)	15 (12.9%)	.71
Electrographic characteristics prior to TAVI				
Rhythm				
Sinus, n (%)	117 (87.3%)	17 (94.4%)	100 (86.2%)	.47
Atrial fibrillation, n (%)	14 (10.4%)	0	14 (12.1%)	.21
Flutter, n (%)	3 (2.2%)	1 (5.6%)	2 (1.7%)	.35
Conduction disorder				
RBBB, n (%)	13 (9.7%)	4 (22.2%)	9 (7.8%)	.07
LBBB, n (%)	10 (7.5%)	2 (11.1%)	8 (6.9%)	.66
First-degree AVB, n (%)	8 (5.9%)	3 (16.7%)	5 (4.3%)	.13
LBBB + First-degree AVB, n (%)	2 (1.5%)	0	2 (1.7%)	1
Incomplete left bundle branch block, n (%)	1 (0.7%)	0	1 (0.9%)	1
Tomographic parameters				
MS length, mm	6.86 ± 1.72	5.3 ± 1.2	7.1 ± 1.7	< .001
Presence of LVOT calcification, n (%)	39 (29.1%)	9 (50%)	30 (25.9%)	.036
Type of transcatheter heart valve				
Balloon-expandable				
Edward SAPIEN 3, n (%)	60 (44.8%)	8 (44.4%)	52 (44.8%)	.9
Edward SAPIEN, n (%)	14 (10.4%)	3 (16.7%)	11 (9.5%)	.4
Edward SAPIEN XT, n (%)	8 (6%)	1 (5.6%)	7 (6%)	1
Self-expandable				
Evolute R, n (%)	17 (12.7%)	1 (5.6%)	16 (13.8%)	.47
ACCURATE Neo, n (%)	14 (10.4%)	0	14 (12.1%)	.21
Portico, n (%)	11 (8.2%)	1 (5.6%)	10 (8.6%)	1
CoreValve, n (%)	10 (7.5%)	4 (22.2%)	6 (5.2%)	.029
Electrocardiographic characteristics after TAVI				
Third-degree AVB, n (%)	16 (11.9%)	16 (88.9%)	0	< .001
Isolated persistent new-onset LBBB, n (%)	10 (7.4%)	0	10 (8.6%)	.5
Persistent LBBB + AF + NSVT, n (%)	1 (0.8%)	1 (5.6%)	0	.13

(Continues)

Table 1. Clinical and electrocardiographic characteristics before and after TAVI, tomographic parameters, types of transcatheter heart valve, and complications after TAVI *(continued)*

Variables	Total n = 134	With pacemaker implantation n = 18	Without pacemaker implantation n = 116	*P*
Persistent LBBB + nodal rhythm, n (%)	1 (0.8%)	1 (5.6%)	0	.13
Transient third-degree AVB, n (%)	8 (6%)	0	8 (6.9%)	.65
First-degree AVB, n (%)	6 (4.5%)	0	6 (5.2%)	.41
Transient LBBB, n (%)	4 (3%)	0	4 (3.4%)	.56
Isolated AF, n (%)	2 (1.5%)	0	2 (1.7%)	.75
Transient nodal rhythm, n (%)	1 (0.8%)	0	1 (0.9%)	.87
Flutter, n (%)	1 (0.8%)	0	1 (0.9%)	.87
Complications after TAVI				
Local: Iliac or femoral artery dissection, hematoma	8 (6%)	0	8 (6.9%)	.30
Pericardial effusion/Tamponade	3 (2.2%)	1 (5.6%)	2 (1.7%)	.35
Ischemic stroke	3 (2.2%)	0	3 (2.6%)	.35
Kidney disease	3 (2.2%)	1 (5.6%)	2 (1.7%)	.35
Intraoperative mortality	5 (3.73%)			
Massive ischemic stroke	1 (0.8%)	0	1 (0.9%)	.86
Hypovolemic shock due to iliac artery perforation	1 (0.8%)	0	1 (0.9%)	.86
Cardiogenic shock due to acute myocardial infarction	3 (2.2%)	0	3 (2.6%)	.65
Out-of-hospital mortality > 30 days after TAVI				
Non-cardiac causes	4 (2.98%)	0	4 (3.4%)	.55

AF, atrial fibrillation; AVB, atrioventricular block; BMI, body mass index; LBBB, left bundle branch block; LVOT, left ventricular outflow tract; MS, membranous septum; NSVT, non-sustained ventricular tachycardia; RBBB, right bundle branch block; TAVI, transcatheter aortic valve implantation.

was5.3 mm ± 1.3 mm in pacemaker carriers vs 6.6 mm in noncarriers (*P* = .001).[3] In a North American population with a mean BMI of 28 kg/m^2, MS length was 7.5 mm with measurements of 6.4 mm ± 1.7 mm in pacemaker carriers vs 7.7 mm ± 1.9 mm in patients without pacemakers (*P* = .001).[4]

Pre-existing right bundle branch block was a risk factor for high-degree atrioventricular block. Among the 13 patients with pre-existing right bundle branch block, 4 (22.2%) underwent pacemaker implantation (*P* = .07). The mean MS length was 7.22 mm with measurements of 5.78 mm in the 4 pacemaker carriers vs 7.86 mm in noncarriers (*P* = .063).

Ten patients had baseline left bundle branch block with a mean MS length of 5.85 mm. In the 2 patients who underwent pacemaker implantation, the mean length was 4.8 mm vs 6.11 mm in those without a pacemaker (*P* = .3).

A significant association was found between left ventricular outflow tract calcification with pacemaker implantation (OR, 2.86; 95%CI, 1.04-7.89; *P* = .036) and conduction disorders (OR, 2.65; 95%CI, 1.22-5.72; *P* = .012).

None of the 14 patients with pre-existing atrial fibrillation underwent pacemaker implantation. Mentias et al.[5] reported that the rate of pacemaker implantation was significantly lower (*P* = .001) in patients with pre-existing atrial fibrillation (24.9%) than in those with baseline sinus rhythm (25.3%) and new-onset atrial fibrillation (28.2%).

The rate of new-onset left bundle branch block after TAVI ranges from 8% to 30% with balloon-expandable valves and from 22% to 50% with self-expanding valves such as CoreValve.[2] In the present study, the rate was lower, at 9% (12/134), with 5/82 patients (6.1%) being implanted with balloon-expandable valves and 7/52 patients (13.5%) with self-expanding valves. Sammour et al.[6] demonstrated that the depth of transcatheter heart valve implantation is a predictor of new left bundle branch block. A limitation of the present study is that we did not measure the depth of valve implantation. Other limitations are the small sample size drawn from a single hospital and the lack of measurement of the degree of annular overexpansion.

In conclusion, both MS length and left ventricular outflow tract calcification, assessed by multidetector computed tomography, are important predictors of the need for pacemaker implantation.

FUNDING

None.

ETHICAL CONSIDERATIONS

As a a single-center retrospective observational study, without any kind of intervention, ethics committee approval was not deemed necessary, nor informed consents as anonymity was guaranteed. The decision to perform the tomography was taked at the doctor's discretion. According to the SAGER guidelines, sex and gender variables were taken into consideration.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

No artificial intelligence tools were used.

AUTHORS' CONTRIBUTIONS

D.I. Katekaru-Tokeshi conceived the study, conducted data collection and analysis, and drafted the manuscript. H.A. Ale-Gonzáles collected and analyzed data and contributed to manuscript drafting. P. Custodio-Sánchez analyzed the data and reviewed the manuscript. M. Jiménez-Santos interpreted the computed tomography studies and reviewed the manuscript. E. Kimura-Hayama reviewed both the manuscript and the images. F. Castillo-Castellón interpreted the computed tomography studies and critically revised the manuscript. All authors approved the manuscript final version.

CONFLICTS OF INTEREST

None.

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Comparison of long-term outcomes between a single versus a multiple stent brand strategy during *"full metal jacket"* procedures

Comparación de los resultados a largo plazo entre las estrategias de una y múltiples marcas de stent durante los procedimientos full metal jacket

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To the Editor,

Treatment failure is a major concern after full metal jacket (FMJ) stenting procedures, defined as overlapping stent length ≥ 60 mm. These procedures are often required to treat tandem or extensive coronary lesions.[1] Several brands of stents are currently approved, each displaying different characteristics and performance. However, real-world practice is not restricted to the use of a brand exclusive strategy and may involve a combination of different brands. Limited data exist on the relative safety and efficacy of these different strategies during percutaneous coronary intervention (PCI). Therefore, our aim was to compare clinical outcomes after the use of a single stent brand vs multiple stent brands following successful FMJ PCI.

From a dedicated database of 23 021 consecutive PCI procedures performed between January 2002 and December 2018 at a high-volume coronary intervention laboratory, we retrospectively identified 592 patients (3%) who underwent FMJ procedures. Written informed consent was obtained from all patients. Stent selection was left to the operator's discretion. We excluded patients with unsuccessful procedures and those lost to follow-up from the analysis. Demographic, clinical, angiographic, and procedural variables were evaluated. The primary endpoint consisted of major adverse cardiac events (MACE), which included all-cause death, myocardial infarction (MI), and target vessel revascularization (TVR). The secondary endpoint was target lesion failure (TLF), a composite of cardiac death, target vessel-related MI (TV-MI), and target lesion revascularization (TLR). Stent thrombosis and in-stent restenosis were also assessed. Clinical follow-up was conducted via telephone and hospital records were reviewed.

Univariate and multivariate Cox regression analysis were performed to determine independent predictors of outcome. All reported *P* values are 2-tailed, with a *P* value < .05 indicating statistical significance. Data were analyzed using IBM SPSS for Windows (version 25.0).

The study cohort included 353 patients, with a mean age 65.4 ± 11.4 years. Most of the patients were male (78%), presented with chronic stable angina (55%), and had a history of hypertension (77%) and

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