

Problems and Solutions in the Implementation of a Transcatheter Aortic Valve Implantation Program

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ABSTRACT

Background

Survival of severe symptomatic aortic valve stenosis is low in patients who are not candidates for cardiac surgery. Transcatheter aortic valve implantation (TAVI) represents an alternative for these patients. Candidates for TAVI are evaluated in our TAVI Program to determine if they are clinically eligible to request authorization of the procedure from the health coverage.

Objectives

The aim of this study was to evaluate the reasons for the exclusion of patients from the procedure and its clinical impact.

Methods

Thirty seven patients were admitted in the TAVI Program from April 2009 to August 2011.

Results

From the original 37 patients, 29 patients received treatment or were excluded: 14 patients underwent the procedure (TAVI group, 48.3%) and 15 were excluded (non-TAVI group, 52.7%). In the non-TAVI group, six patients (40%) were excluded by the Program and four by their health coverage, while another five died while awaiting authorization. Population median EuroSCORE was 22% (range 10-56%) and mean age was 79±8 years. At 12 month follow-up, mortality in the TAVI group and non-TAVI group was 7.1% and 33.3%, respectively (p=0.082). Overall cardiovascular mortality was 17.2%, all in the non-TAVI group.

Conclusion

More than half of the patients evaluated in a TAVI Program do not undergo the procedure in our medical setting. Medical and socioeconomic reasons influence the decision-making process to perform TAVI, with a significant mortality in untreated patients.

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Key words >

Aortic Valve Stenosis - Endovascular Procedures - Mortality

Abbreviations >

AVR Aortic valve replacement surgery
SAS Severe aortic stenosis

CHF Congestive heart failure
TAVI Transcatheter aortic valve implantation

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BACKGROUND

Aortic stenosis is the most common heart valve disease and its prevalence increases with ageing, affecting approximately 3% of the population over 75 years. (1) Numerous studies have shown that patients with severe aortic stenosis (SAS) have a poor life quality and a high mortality rate. (2-4). Aortic valve replacement surgery (AVR) represents the only ultimate therapy capable of significantly improving symptoms and long-term prognosis. (5) Nevertheless, presence of high surgical risk due to multiple comorbidities usually reduces the viability of this surgery in about 30% of patients. (6) It should be noticed that survival is scarce in medically treated patients with SAS, even in those undergoing percutaneous valvuloplasty,

Moreover, transcatheter aortic valve implantation (TAVI) with Edwards-SAPIEN® devices (expandable balloon) and Medtronic-CoreValve® (self-expanding) has proven to be a good alternative to AVR in patients with SAS and high surgical risk. (3, 7-11) However, for a correct indication of TAVI it is necessary to fulfill a series of clinical and anatomical criteria.

In our practice, all SAS patients referred to our center for potential TAVI, enter an evaluation program (TAVI Program), in which a series of studies are performed to determine clinical eligibility and request the financial approval of the prosthesis from the health coverage.

During the development of our TAVI program, we noticed that a high percentage of these patients were excluded from the TAVI procedure due to different reasons, and this, inevitably, changed the disease prognosis.

A multicenter work by Cura et al. (12) with the participation of our Hemodynamics Laboratory was recently published in this journal with the description of an initial TAVI experience in SAS patients. This experience shows implanted patient prognosis but not that of patients excluded from this practice.

The purpose of the present study was to show the clinical outcome of patients who for different reasons did not receive this treatment, including: 1) assessment of the causes (medical or socioeconomic) by which SAS patients with AVR contraindication were not submitted to TAVI and 2) description of the clinical impact derived from patient exclusion from this procedure.

METHODS

Thirty seven symptomatic SAS patients, potentially eligible for TAVI were admitted in the TAVI Program from April 2009 to August 2011. The program involves the clinical evaluation process carried out by a multidisciplinary team from our working group composed of anesthesiologists, cardiologists, cardiac surgeons, imaging and hemodynamic specialists.

In our institution, the evaluation/approval sequence for aortic valve implantation is: firstly, clinical evaluation and, if clinical and anatomical criteria are met, authorization to buy the prosthesis is requested from the patient's health coverage.

Study population

The population was divided in patients submitted or not submitted to TAVI. Patients who have not yet completely finished the TAVI Program evaluation process were excluded from this analysis (n = 8).

Patient selection criteria in the TAVI Program

The following criteria must be fulfilled to correctly select suitable patients for TAVI: 1) SAS with high surgical risk, 2) echocardiographic measurement of aortic valve annulus diameter > 20 mm y < 27 mm, 3) distance between annulus and sinotubular junction > 14 mm, 4) ascending aorta diameter at 40 mm from the valve plane < 43 mm, 5) iliac, common femoral or any of the two subclavian artery diameters > 6 mm, 6) scarce tortuosity and calcification at the level of the iliac-femoral or subclavian axis, 7) absence of severe aortic failure, 8) absence of an associated severe valvulopathy, and 9) percutaneous resolution of any associated coronary disease.

High risk was defined as EuroSCORE (European System for Cardiac Operative Risk Evaluation) > 20 or an STS (Society of Thoracic Surgeons) score > 10. Even though presence of thoracic irradiation and porcelain aorta are not included as risk factors in the mentioned score measurements, they were taken into account for surgical risk assessment.

Evaluation of anatomical criteria was performed according to the following studies: thoracic and/or transesophageal echocardiography (in case the transthoracic study was not conclusive to determine valve annulus diameter), which occurred in 90% of the cases, coronariography with aortography, and angiography of the iliofemoral territory with centimeter sizing pigtail catheter.

In 9 out of 31 patients (29%) multislice computed tomography with contrast injection was used to assess the aortic valve annulus.

Clinical follow-up

Monthly clinical follow-up by personal or telephone visit was carried out since admission in the TAVI Program.

Events were classified as: I. Death. II. Cardiovascular death. III. Rehospitalization due to congestive heart failure (CHF). IV. Stroke. V. Urgent heart surgery.

Statistical analysis

Continuous variables were expressed as mean \pm standard deviation or as median, and ranges. Categorical variables were expressed as numbers (percentages). Continuous variables were compared using Student or Kruskal-Wallis tests, as applicable. Categorical variables were compared using the chi-square test or Fisher's exact test. The Kaplan-Meier analysis was used to perform a survival study. Data were analyzed with the SPSS version 10 statistical software (Chicago, IL, USA).

RESULTS

From the 37 patients included in the TAVI program, eight of them are still in the TAVI evaluation process. Thus, up to the present, 29 patients have received or been excluded from the treatment (Figure 1C).

Fourteen of the 29 patients were submitted to the procedure (TAVI group, 13 by transfemoral approach and one through the right subclavian artery) and 15 were excluded (51.7%). Out of the total number of excluded patients (n = 15, non-TAVI group), six (40%) were excluded during evaluation in the TAVI Program

(Table 1) and four by their health coverage (which did not authorize purchase of the prosthesis), while the remaining five patients died while awaiting the health coverage long and difficult process of financial authorization. Aortic valvuloplasty was performed in four patients (26%) of the non-TAVI group as bridge to implantation.

TAVI and non-TAVI basal characteristics are shown in Table 2. Total population median EuroSCORE was 22% (range 10-56%) and mean age was 79 ± 8 years. Forty five percent of the patients were women, 31% were diabetic and 27.6% and 20.7%, respectively presented previous history of myocardial infarction or cardiac surgery. No differences were found in basal characteristics between both groups of patients, except for a larger aortic valve annulus diameter in the TAVI group.

Table 3 shows events in the TAVI and non-TAVI groups. In the 12 month follow-up (range 2-29 months), overall mortality was 20.7%, and 7.1% and 33.3% for the TAVI and non-TAVI groups, respectively ($p = 0.082$, Figure 2). Overall cardiovascular mortality was 17.2%, all deaths occurring in the non TAVI group. No strokes occurred in either group. None of the TAVI group patients had or needed a pacemaker prior to the procedure and only one patient (7.1%) in the TAVI group required permanent pacemaker after valve implantation.

Remarkably, hospitalization due to CHF was similar in both groups: one patient in the TAVI group and one in the non-TAVI group.

In the TAVI group, 85.7% of patients are in functional class I (NYHA) and the rest in functional class II. In the non-TAVI group, all alive patients are in functional class III-IV.

Table 2. Cox proportional hazards model.

Predictor variable	p	Relative risk	p
Age, years \pm SD	78 ± 8	79.5 ± 8	0.36
Male gender, n (%)	6 (42.9)	10 (66.7)	0.2
Diabetes mellitus, n (%)	6 (42.9)	3 (20)	0.18
Smoking, n (%)	5 (35.7)	4 (26.7)	0.6
Previous AMI, n (%)	4 (28.6)	4 (26.7)	0.9
Previous PTCA, n (%)	4 (28.6)	4 (26.7)	0.9
Previous cardiac surgery, n (%)	3 (21.4)	3 (20)	0.92
CHF Class III-IV n (%)	7 (46.2)	8 (53.8)	0.69
EuroSCORE	19.7 ± 7	24.9 ± 13.8	0.2
Aortic valve annulus diameter, cm	23.3 ± 2.2	21.6 ± 2.3	0.045
Aortic valve area, cm ²	0.69 ± 0.15	0.63 ± 0.15	0.35
Maximum transvalvular gradient, mm Hg	73 ± 24	76 ± 16	0.77
Mean transvalvular gradient, mm Hg	47 ± 18	46 ± 10	0.87
LEVF	53 ± 26	56 ± 15	0.66

SD: Standard deviation. AMI: Acute myocardial infarction. PTCA: Percutaneous tranluminal coronary angioplasty. LVEF: Left ventricle ejection fraction.

DISCUSSION

Although AVR represents the treatment of choice in patients with symptomatic SAS, presence of high surgical risk often prevents its execution. Several observational studies in patients with symptomatic SAS in medical treatment have documented a highly reduced survival at 12 months. However, the recent advent of TAVI has managed to broaden the spectrum of treatment of this disease, improving the prognosis of patients previously confined to medical treatment as the only option.

There is now enough evidence confirming the efficacy and safety of TAVI for the treatment of symptomatic SAS in high surgical risk patients. (3, 7, 11) However, for a successful TAVI a proper selection of cases is essential. (13) In order to perform the procedure via femoral or subclavian artery access, iliac, femoral or subclavian artery diameter > 6 mm and absence of excessive tortuosity are necessary (Figure 1). Furthermore, prosthesis implantation requires fulfillment of a number of anatomical aortic criteria for compatibility with the percutaneous valves available so far in our country: a) aortic annulus of 20-27

Table 1. Patients Excluded from the TAVI Program

Exclusion due to Medical or Anatomical Reasons
Presence of sub-aortic stenosis (n=1)
Presence of concomitant coronary disease with surgical indication (n=2)
Absence of adequate vascular accesses (n=1)
Indication of AVR (n=1)
Aortic valve annulus diameter < 20 mm (n=1)

AVR: Aortic valve replacement surgery

mm, b) ascending aorta < 43 mm and c) sinus of Valsalva height > 14 mm (Figure 1).

In our preliminary experience with the TAVI Program, about half of the candidates under evaluation prior to TAVI were excluded for medical and / or anatomical (40%) or socioeconomic (60%) reasons.

It is reasonable to point out that in excluded patients the mortality level was exceedingly high (33.3%), whereas in patients submitted to TAVI it was only 7% and for non-cardiovascular causes, emphasizing that no patient died during the procedure or because of it. Furthermore, a considerable number of patients died while awaiting the resolution of their administrative status (n = 5). These findings agree with those observed in the PARTNER study (Placement of Aortic Transcatheter Valves) cohort B which compared TAVI with medical treatment in patients not eligible for surgery (n = 358). (3, 14, 15) In this study, the annual mortality of the control group was excessive (50.7%)

despite a contemporary medical treatment that also included aortic valvuloplasty.

Several studies have reported a clear relationship between the waiting time for cardiac surgery and mortality. (16, 17) It is probable that cardiovascular instability and a fragile health, very common in SAS patients at extreme risk may not allow a prolonged procedural waiting time.

The delay and lack of endorsement by health systems may be subject to several interpretations. First of all, the TAVI technique is in its infancy, and the understanding of its role in the treatment of this disease is still subject to conflicting opinions and positions, making it necessary to establish a uniform standard for selecting candidates for TAVI. Second, the CoreValve® device, the only one available in Argentina, although approved by the National Drugs, Food and Medical Technology Administration (ANMAT), has not yet been approved by the Food and Drug Adminis-

Variables	TAVI Group (n = 14)	Non-TAVI Group (n = 15)	p value
Stroke, %	0	0	1
Urgent heart surgery, %	0	0	1
Hospitalization for CHF, n (%)	1 (7)	1 (7)	1
Death, n (%)	1 (7)	5 (33.3)	0.082
Cardiovascular death, n (%)	0	5 (33.3)	0.025
Combined events, n (%)	2 (14)	6 (40)	0.12

Table 3. Clinical events

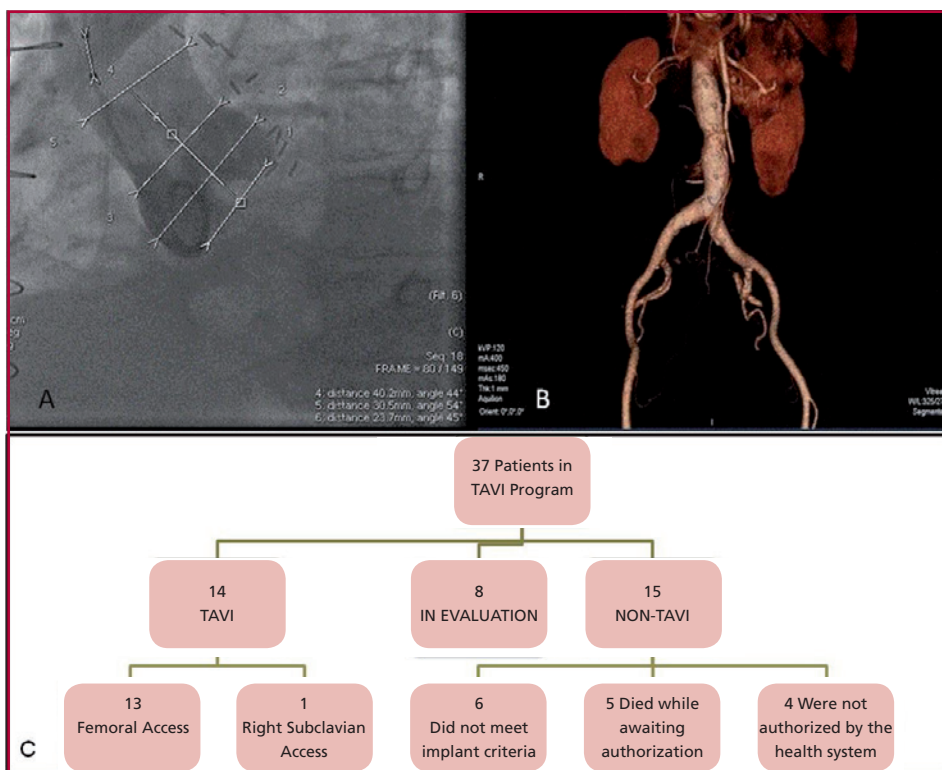
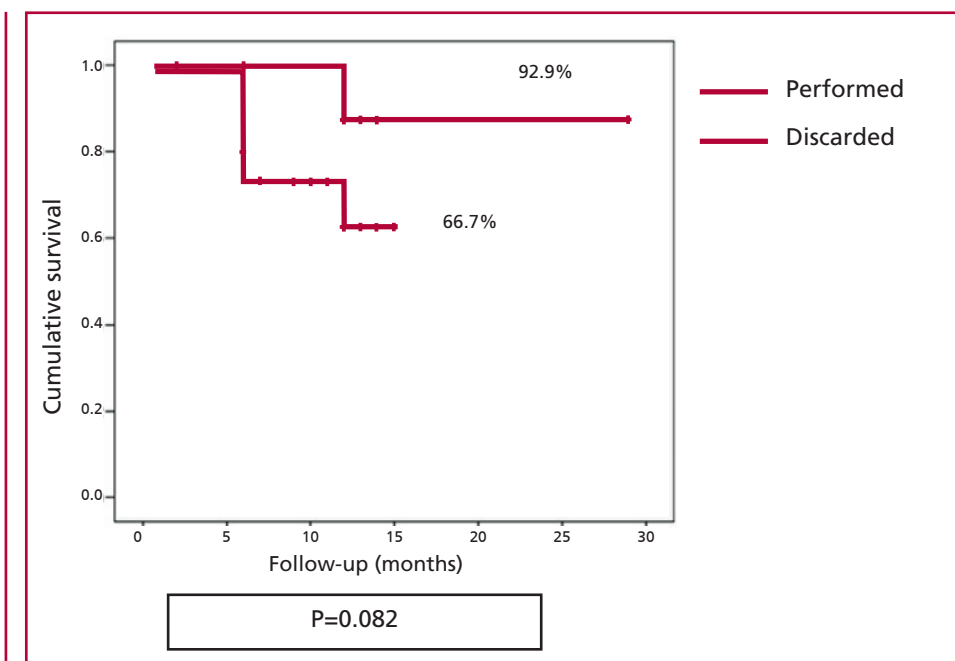


Fig. 1. A. Angiographic measurements of the ascending aorta. B. 3-dimensional image of aortoiliac-femoral axis from multislice computed tomography. C. Flow-chart with the two populations evaluated in the study.

Fig. 2. Kaplan-Meier curve for cumulative survival without adverse events in TAVI and not-TAVI groups.



tration (FDA) in U.S.A. Third, the reported experience in our environment, although growing, is still limited. Fourth, several multicenter registries have shown a disappointing TAVI long-term survival rate. Effectively, it is not uncommon to observe the success of the procedure in an elderly patient who died during the first or second year of follow-up due to pneumonia in the context of chronic obstructive pulmonary disease, unrelated to the percutaneous procedure. This would indicate that patient selection was not entirely correct, as some patients have a high annual mortality, despite the tremendous financial efforts of the health system to carry out TAVI. Fifth, sometimes the anatomical presence of SAS may act as an epiphenomenon, not being the actual cause of the symptoms and, therefore, it does not always guarantee that the treatment improves symptoms and patient prognosis. Sixth, no cost-effectiveness analysis relative to TAVI has been performed in our environment, a fact that also tends to discourage health systems when making decisions. Finally, the high cost of the prosthesis, as well as the existence of conflicts of interest to carry out the process, generates suspicion in health systems. Ideally, situations that may affect decision making during the patient selection process should be avoided.

In our study, only one patient was excluded due to the presence of aortic valve annulus diameter < 20 mm. This does not seem to be an important problem, since in the near future new CoreValve® sizes will enable the treatment of patients with small (up to 18 mm in diameter) and large (up to 29 mm in diameter) annuli.

The main limitations of the study are sample size, retrospective evaluation and reduced clinical follow-up. However, the study findings reveal a high rate of

exclusion of TAVI candidates, a fact which in turn entails a poor prognosis.

CONCLUSIONS

Only about half of the patients evaluated in a TAVI Program undergo the procedure. Both medical and socioeconomic reasons impact on decision making, showing a significant mortality in excluded patients or those awaiting the procedure. These numbers clearly describe the complex and laborious, though extremely rewarding implementation of a TAVI Program in “the real world” in our country.

RESUMEN

Problemas y soluciones en la implementación de un Programa de Implante Valvular Aórtico Percutáneo

Introducción

La sobrevida de la estenosis aórtica grave sintomática inoperable es baja. El implante percutáneo de válvula aórtica (IVAP) representa una alternativa para estos pacientes. Es nuestra práctica que los candidatos a IVAP ingresen en un programa de evaluación (Programa de IVAP) para determinar su elegibilidad clínica para, luego, solicitar la aprobación a la cobertura de salud.

Objetivos

Evaluar las causas de la exclusión de pacientes del procedimiento y su impacto clínico.

Material y métodos

Desde abril de 2009 hasta agosto de 2011, 37 pacientes ingresaron en el Programa de IVAP.

Resultados

De los 37 pacientes, 29 recibieron el tratamiento o fueron descartados: 14 fueron sometidos a IVAP (grupo IVAP, 48,3%) y 15 fueron descartados (grupo no IVAP 52,7%). Del

grupo no IVAP, seis pacientes (40%) fueron descartados por el Programa y cuatro por la cobertura médica, mientras que otros cinco pacientes fallecieron aguardando la autorización. La mediana de EuroSCORE de la población fue del 22% (rango 10-56%) y el promedio de edad fue de 79 ± 8 años. En un seguimiento de 12 meses, la mortalidad del grupo IVAP y no IVAP fue del 7,1% y del 33,3%, respectivamente ($p = 0,082$). La mortalidad cardiovascular total fue del 17,2%, en todos los casos del grupo no IVAP.

Conclusión

En nuestro medio, más de la mitad de los pacientes evaluados en un Programa de IVAP no son intervenidos. Razones médicas y socioeconómicas inciden en la toma de decisiones y en la realización o no del IVAP, observándose una mortalidad importante en los pacientes no tratados.

Palabras clave > Estenosis de la válvula aórtica - Procedimientos endovasculares - Mortalidad

Conflicts of interest

None declared.

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