Rev Esp Cardiol. 2016;69(1):37–44

Original article

Long-term Follow-up After Transcatheter Aortic Valve Implantation for Severe Aortic Stenosis

Pablo Salinas,[a,*] Raúl Moreno,[a] Luis Calvo,[a] Ángel Sánchez-Recalde,[a] Santiago Jiménez-Valero,[a] Guillermo Galeote,[a] Teresa López-Fernández,[a] Ulises Ramírez,[b] Luis Riera,[c] Ignacio Plaza,[d] Isidro Moreno,[e] José María Mesa,[b] and José Luis López-Sendón[a]

[a] *Servicio de Cardiología, Hospital Universitario La Paz, Madrid, Spain*
[b] *Servicio de Cirugía Cardiaca, Hospital Universitario La Paz, Madrid, Spain*
[c] *Servicio de Cirugía Vascular, Hospital Universitario La Paz, Madrid, Spain*
[d] *Servicio de Cardiología, Hospital Infanta Sofía, San Sebastián de los Reyes, Madrid, Spain*
[e] *Servicio de Anestesia y Reanimación, Hospital Universitario La Paz, Madrid, Spain*

Article history:
Received 6 February 2015
Accepted 23 March 2015
Available online 30 July 2015

Keywords:
Transcatheter aortic valve implantation
Transcatheter aortic valve replacement
Aortic stenosis
Valvular heart disease
Valve Academic Research Consortium definitions

ABSTRACT

Introduction and objectives: Transcatheter aortic valve implantation is used as an alternative to surgical valve replacement in patients with severe aortic stenosis who are considered high-surgical-risk or inoperable. Two of the main areas of uncertainty in this field are valve durability and long-term survival.
Methods: This prospective single-center registry study from a tertiary hospital included all consecutive patients who underwent percutaneous aortic valve implantation between 2008 and 2012. Clinical follow-up lasted a minimum of 2.5 years and a maximum of 6.5 years. Valve Academic Research Consortium-2 definitions were used.
Results: Seventy-nine patients were included, with an immediate success rate of 94.9%. The median survival was 47.6 months (95% confidence intervals, 37.4-57.9 months), ie, 4 years. One quarter of deaths occurred in the first month, and most were of cardiovascular cause. After the first month, most deaths were due to noncardiovascular causes. The mean values of valve gradients did not increase during follow-up. The cumulative rate of prosthetic valve dysfunction was 15.3%, with no cases of repeat valve replacement.
Conclusions: Half of the patients with aortic stenosis who underwent transcatheter aortic valve implantation were alive 4 years after the procedure. There was a 15.3% prosthetic valve dysfunction rate in cumulative follow-up, with no cases of repeat valve replacement.

Seguimiento a largo plazo tras implante percutáneo de válvula aórtica por estenosis aórtica grave

Palabras clave:
Implante percutáneo de válvula aórtica
Reemplazo percutáneo de válvula aórtica
Estenosis aórtica
Valvulopatía
Definiciones *Valve Academic Research Consortium*

RESUMEN

Introducción y objetivos: El implante percutáneo de válvula aórtica se utiliza como alternativa a la sustitución valvular quirúrgica para pacientes con estenosis aórtica grave de alto riesgo quirúrgico o inoperables. Dos de las principales áreas de incertidumbre son la durabilidad de la válvula y la supervivencia a largo plazo.
Métodos: Registro unicéntrico prospectivo de un hospital terciario que incluyó consecutivamente todos los implantes percutáneos de válvula aórtica entre 2008 y 2012. Se realizó seguimiento clínico durante un mínimo de 2,5 años y un máximo de 6,5 años. Se utilizaron definiciones *Valve Academic Research Consortium-2*.
Resultados: Se incluyó a 79 pacientes, con un éxito inmediato del 94,9%. La mediana de supervivencia fue de 47,6 (intervalo de confianza del 95%, 37,4-57,9) meses, es decir, 4 años. Un cuarto de las muertes sucedieron en el primer mes, la mayoría de causa cardiovascular. Después del primer mes, la causa más frecuente fue no cardiovascular. Los valores medios de gradientes valvulares no se incrementaron en el seguimiento. La tasa acumulada de disfunción protésica fue del 15,3%, sin ningún caso de resustitución valvular.
Conclusiones: La mitad de los pacientes con estenosis aórtica intervenidos mediante implante percutáneo de válvula aórtica sobreviven 4 años después del procedimiento. Se detectó un 15,3% de disfunción protésica en el seguimiento acumulado, sin casos de resustitución valvular.

* Corresponding author: Servicio de Cardiología, Hospital Universitario La Paz, P.º de la Castellana 261, 28046 Madrid, Spain.
E-mail address: salinas.pablo@gmail.com (P. Salinas).

http://dx.doi.org/10.1016/j.rec.2015.03.017
1885-5857/

Abbreviations

AR: aortic regurgitation
AS: aortic stenosis
TAVI: transcatheter aortic valve implantation
VARC: Valve Academic Research Consortium

INTRODUCTION

Aortic stenosis (AS) is the most common acquired valvular heart disease, with a prevalence of up to 4.6% in patients older than 75 years, and is the primary reason for valve surgery in adults.[1] In developed countries, the most common cause is degenerative AS.[2] The natural history of the disease begins with a long subclinical period, which cannot be modified by medical treatment.[3] Symptoms appear when AS is hemodynamically severe, and from that point the survival rate rapidly falls if the valve is not replaced. Survival in patients with severe AS only began to improve with the introduction of surgical valve replacement.[4] However, despite 60 years of experience, it has been estimated that more than a third of eligible candidates do not undergo surgical valve replacement.[2,5] The main reason is their high surgical risk, assessed with scores such as EuroSCORE or the STS (Society of Thoracic Surgeons) score, although there are other limiting factors: advanced age, liver disease, porcelain aorta, coronary artery bypass graft, pulmonary hypertension, right ventricular dysfunction, and the condition known as hostile chest.[6]

It was with these circumstances in mind that transcatheter aortic valve implantation (TAVI) was developed, a procedure that has grown exponentially since its introduction little more than a decade ago. The current indication for TAVI is symptomatic severe AS in patients considered inoperable by a multidisciplinary team due to high surgical risk (class I-B recommendation). In patients who are operable but high-risk, the decision to operate should be made on an individual basis (class IIa-B recommendation).[7] These indications are primarily based on 2 randomized clinical trials, in which TAVI was shown to have similar outcomes to surgical valve replacement in patients with high surgical risk (PARTNER A),[8] and to improve survival and functional class more than medical treatment (including valvuloplasty) in inoperable patients (PARTNER B).[9]

Transcatheter aortic valve implantation is successfully performed in approximately 90% to 98% of patients.[10–13] Several registries have reported 30-day mortality of around 5% to 15%,[8,13,14] 1-year mortality of 15% to 30.7%,[9,14,15] and 2-year mortality of 26.3% to 43%.[12,16,17] However, data beyond 2 years postprocedure are scarce, especially in Spain. Among the areas of uncertainty relating to TAVI are long-term patient survival and valve durability.

METHODS

Aims

The primary aim of this study was to analyze long-term all-cause death-free survival in a cohort of consecutive patients with severe AS, indication for valve replacement, and high surgical risk who underwent TAVI. The secondary aims were to describe the cause and timing of deaths, adverse events, and valve function at follow-up.

Design and Sample Selection

This was a prospective observational study with follow-up of all consecutive patients (N = 79) who had a TAVI procedure in our center between June 2008 and June 2012.

All patients had a diagnosis of severe AS and indication for valve replacement according to the European Society of Cardiology guidelines on the management of valvular heart disease.[7] Patients were considered high-surgical-risk if predicted mortality was $\geq$ 15% on EuroSCORE, or $\geq$ 10% on the STS score and if they were considered to be inoperable based on Heart Team assessment of comorbidities and other factors.[6]

Procedure

Clinical assessment and diagnostic testing of patients with severe AS and high surgical risk were similar to published recommendations and have been previously described.[6,18–20] Informed consent was obtained from all patients. The procedures were performed in a cardiac catheterization laboratory under sterile conditions, according to the manufacturer's established protocols, under general anesthetic, and with continuous transesophageal echocardiographic monitoring.[19,20] If significant coronary artery disease was found, the patients underwent revascularization and TAVI was postponed for 1 month. Vascular access was obtained via surgical femoral cutdown, with the exception of the first 10 patients (percutaneous closure). Post-TAVI medical treatment consisted of acetylsalicylic acid 100 mg (indefinitely) and clopidogrel 75 mg (6 months). The implanted prosthesis was Edwards SAPIEN or the subsequent Edwards SAPIEN XT (from 2010), both from Edwards Lifesciences. In patients with adequate vascular access (iliofemoral diameter $<$ 7 mm, or $<$ 6 mm in XT model), transfemoral access was used, otherwise transapical access was used.

Study Parameters

The variables were entered in a specially-dedicated database. In October 2011, the first European consensus document on TAVI, called Valve Academic Research Consortium (VARC), was published and subsequently revised in the VARC-2 recommendations.[6] For our study, all variables were adapted to VARC-2 definitions, with the exception of postprocedure acute kidney injury (24-h diuresis not recorded) and the combined early safety endpoint (which included acute kidney injury). The following are definitions of the most relevant variables (definitions of all variables are available in the appended supplementary material):

- Mortality: all-cause mortality (primary endpoint), subclassified as cardiovascular or noncardiovascular (secondary endpoint); deaths of unknown cause were attributed to cardiovascular causes.
- Major adverse event: all-cause mortality, stroke, readmission for valve-related symptoms or for worsening heart failure, deterioration in functional class to class III-IV, or prosthetic valve dysfunction; equivalent to the VARC-2 composite endpoint of clinical efficacy after 30 days.
- Acute kidney injury postprocedure, not requiring hemodialysis: creatinine raised by $>$ 0.5 mg/dL or $>$ 50% of baseline value.
- Device success (VARC-2): post-procedure survival, correct positioning of a single prosthetic heart valve in the proper anatomical location and intended performance of the prosthetic heart valve (absence of mismatch, mean gradient $<$ 20 mmHg or peak velocity $<$ 3 m/s and absence of moderate or severe aortic regurgitation [AR]).