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Original article

Influence of Patient-Prosthesis Mismatch in the Octogenarian Undergoing Surgery for Aortic Valve Replacement Due to Severe Stenosis

Daniel Hernandez-Vaquero,[a,*] David Calvo,[b] Jose M. Garcia,[b] Íñigo Lozano,[b] Carlos Morales,[a] Jose Luis Naya,[a] Cesar Moris,[b] and Juan C. Llosa[a]

[a] Servicio de Cirugía Cardiovascular, Área del Corazón, Hospital Universitario Central de Asturias, Oviedo, Asturias, Spain
[b] Servicio de Cardiología, Área del Corazón, Hospital Universitario Central de Asturias, Oviedo, Asturias, Spain

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ABSTRACT

Introduction and objectives: The clinical impact of patient-prosthesis mismatch on the outcome in octogenarians who undergo surgery for aortic valve replacement due to severe stenosis is unknown. Our objective was to quantify the frequency of some degree of patient-prosthesis mismatch and its impact on mortality and life quality.

Methods: We analyzed all the octogenarian patients who underwent surgery for aortic valve replacement due to severe stenosis in our center from February 2004 to April 2009. Patient-prosthesis mismatch was considered to exist when the indexed effective orifice area was $\leq$0.85 cm^2/m^2. The influence of patient-prosthesis mismatch on in-hospital mortality, medium-term survival, and New York Heart Association functional class was studied using an analysis adjusted for propensity score.

Results: Of 149 patients studied, 61.7% had some degree of patient-prosthesis mismatch (mean follow-up was 32.71 $\pm$ 14.42 months). After adjusting for propensity score, there were no differences in in-hospital mortality (odds ratio=0.75; 95% confidence interval, 0.15-3.58; *P*=.72), medium-term survival (hazard ratio=1; 95% confidence interval, 0.36-2.78; *P*=.99) or functional class during follow-up (odds ratio=1.46; 95% confidence interval, 0.073-29.24; *P*=.8).

Conclusions: Although moderate patient-prosthesis mismatch is a very common finding in octogenarian patients who undergo aortic valve replacement, its influence on mortality and quality of life does not seem to be relevant. The biological profile of elderly patients with lower metabolic requirements and limited physical activity could justify the results obtained.

Influencia del desajuste paciente-prótesis en el octogenario operado de recambio valvular aórtico por estenosis severa

Palabras clave:
Estenosis valvular aórtica
Octogenarios
Desajuste paciente-prótesis

RESUMEN

Introducción y objetivos: La repercusión clínica del desajuste paciente-prótesis en el pronóstico de pacientes octogenarios operados de recambio valvular aórtico por estenosis aórtica severa es desconocida. Nuestro objetivo es cuantificar la frecuencia con que se presenta algún grado de desajuste paciente-prótesis, así como su repercusión en la mortalidad y la calidad de vida.

Métodos: Se analizó a todos los octogenarios operados en nuestro centro para recambio valvular por estenosis aórtica severa desde febrero de 2004 hasta abril de 2009. Se consideró que había desajuste cuando el área efectiva del orifico indexada era $\leq$ 0,85 cm^2/m^2. Se analizó la influencia del desajuste paciente-prótesis ajustado por *propensity score* en la mortalidad intrahospitalaria, la supervivencia a medio plazo y el grado funcional *New York Heart Association*.

Resultados: Se estudió a 149 pacientes (seguimiento medio, 32,71 $\pm$ 14,42 meses). El 61,7% presentó algún grado de desajuste paciente-prótesis. Una vez ajustados los datos por *propensity score,* no se observaron diferencias en la mortalidad intrahospitalaria (*odds ratio* = 0,75; intervalo de confianza del 95%, 0,15-3,58; p = 0,72), supervivencia a medio plazo (*hazard ratio* = 1; intervalo de confianza del 95%, 0,36-2,78; p = 0,99) ni en el grado funcional durante el seguimiento (*odds ratio* = 1,46; intervalo de confianza del 95%, 0,073-29,24; p = 0,8).

Conclusiones: Pese a que el desajuste paciente-prótesis en grado moderado es un hallazgo muy habitual en los pacientes octogenarios intervenidos para recambio valvular aórtico, su influencia pronóstica en la mortalidad y la calidad de vida no parece relevante. Las condiciones biológicas propias del paciente anciano, con menores requerimientos metabólicos y una actividad física limitada, podrían justificar los resultados obtenidos.

* Corresponding author: Servicio de Cirugía Cardiovascular, Área del Corazón, Hospital Universitario Central de Asturias, Celestino Villamil s/n, 33006 Oviedo, Asturias, Spain.
E-mail address: dhvaquero@gmail.com (D. Hernandez-Vaquero).

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Abbreviations

AVR: aortic valve replacement
EOA: effective orifice area
IEOA: indexed effective orifice area
PPM: patient-prosthesis mismatch
PS: propensity score
SAS: severe aortic stenosis

INTRODUCTION

Since its original description by Rahimtoola[1] 33 years ago, the concept of patient-prosthesis mismatch (PPM) and its influence on the prognosis of patients undergoing surgery for aortic valve replacement (AVR) has been associated with great controversy. Whereas some authors report a lower survival rate[2–5] among patients with PPM, probably related to a less marked regression of left ventricular mass, others have not observed a significant influence in this respect.[6–9] Likewise, although one could expect a worse functional class in the patients with mismatch, it is not clear whether or not this factor is affected.[9–12]

In this regard, octogenarian patients comprise a growing population in western countries with a high cumulative prevalence of severe aortic stenosis (SAS).[13] Given their particular characteristics in terms of possible cardiac surgery and their postoperative management, it is considered that these patients could be especially susceptible to the development of PPM and its consequences. Thus, they have been identified as an at-risk group because of their small, calcified annuli,[14,15] and less marked ventricular mass regression following the intervention,[9] and greater tendency to receive biological prostheses, which have a poorer hemodynamic performance than mechanical valves.[16] However, other hypotheses maintain that a short life expectancy and limited physical activity, with decreased metabolic demand, would make this group of patients less susceptible to the clinical consequences of PPM. In this situation, and given the growing number of octogenarian patients requiring surgical AVR due to SAS, it is essential to know to what extent PPM influences the clinical course in these patients, a subject of debate that has not been resolved in the medical literature.

The objective of this report is to evaluate the incidence and clinical impact, in terms of mortality and quality of life, of PPM in octogenarians who undergo surgical AVR to treat SAS. For this purpose, we studied the course of a consecutive series of patients who were treated surgically in our center.

METHODS

We studied all the octogenarian patients who underwent surgery for AVR due to SAS, with or without some degree of regurgitation, between February 2004 and April 2009. To calculate the indexed effective orifice area (IEOA), we considered the measurement of the effective orifice area (EOA)[4,17–20] (Table 1), which was divided by the body surface area, calculated according to the Dubois formula.[6] Some degree of PPM was considered to be present[21,22] when the IEOA was ≤ 0.85 cm^2/m^2 and was graded as severe with an IEOA less than or equal to 0.65 cm^2/m^2. In our study, we used the data published for the *in vivo* measurements of EOA for each prosthetic valve, as they consistently predict the postoperative gradients,[2,23–25] whereas the *in vitro* measurements tend to overestimate the true IEOA values,[25,26] a circumstance that results in a low sensitivity for the prediction of PPM.[21]

Table 1
Effective Orifice Area Corresponding to Each Valve, With Literature Reference. In Parentheses, the Number of Patients With That Valve in Our Series

Prosthetic valve	19 mm	21 mm	23 mm	25 mm	Reference
Mechanical					
St. Jude M Regent	1.6 (3)	2 (3)	2.2 (1)	2.5 (0)	17
Carbomedic Top Hat	1.1 (0)	1.2 (0)	1.4 (1)	1.6 (0)	18
Biological					
Mitroflow	1.2 (28)	1.4 (58)	1.6 (34)	(0)	4
Toronto Stentless	(0)	1.3 (1)	1.5 (0)	1.7 (0)	19
Labcor	(0)	1.1 (7)	1.4 (9)	1.5 (4)	20

All the patients were studied by means of transthoracic echocardiography within the six months prior to the intervention. To determine the left ventricular ejection fraction (LVEF), we obtained apical 2-chamber and 4-chamber views on which we based our calculations according to biplane Simpson's rule. The degree of severity of aortic stenosis was computed by means of the combined determination of the peak and mean systolic pressure gradients, as well as the valve area using the continuity equation. When Doppler flow patterns indicative of valve regurgitation were detected, the degree was quantified by determining the regurgitant orifice area and by characterizing the reversed flows in descending thoracic and abdominal aorta. The pulmonary artery systolic pressure was calculated by measuring the peak tricuspid regurgitation velocity.

Surgical Technique

All the patients underwent median sternotomy, cardiopulmonary bypass, and moderate hypothermia at 30 to 32 °C. Myocardial protection was provided by perfusion of intermittent antegrade and retrograde cold cardioplegia with Celsior® solution (Genzyme, United States) immediately after aortic clamping. Specific measuring devices were used for each valve and the largest possible prosthesis was implanted. The final decision as to the type of prosthesis to be implanted was made by the surgeon at the time of surgery, taking into account the preoperative clinical features and the intraoperative findings.

Follow-up Study

All the data regarding the hospital stay and postoperative period were collected retrospectively by reviewing the corresponding medical records. For long-term follow-up, a telephone interview was held with the patient, or with relatives when he or she was unable to engage in a normal conversation or had died. The functional class was determined on the basis of the New York Heart Association (NYHA) classification, and the patient was considered to be in functional class I/IV when ordinary activity did not produce fatigue, dyspnea, or anginal pain. In contrast, a functional class of IV/IV was indicated by the inability to perform any physical activity without the aforementioned symptoms. The data concerning possible clinical events occurring after hospital discharge were collected and compared by reviewing the medical records.

Statistical Processing

The analysis of the distribution of the continuous variables was carried out with the Shapiro-Wilk test for normality. The categorical variables were expressed as absolute number of

cases (percentage) and the continuous variables, as mean ± standard deviation or median [interquartile range], as appropriate. The comparisons between the continuous variables were analyzed using Student's unpaired t test or the Mann-Whitney U test, depending on whether or not they followed a normal distribution, respectively. The categorical variables were compared by means of χ^2 test or Fisher's exact test, as appropriate.

Because of the observational nature of the study, and to reduce the selection bias typical of reports of this type, we adjusted for the propensity score (PS), which is the probability that PPM occurs in a given patient due to his or her baseline characteristics and those of the surgical procedure employed. To estimate the PS, we created a nonparsimonious logistic regression model with the PPM as a dependent variable and, as predictors, all the variables that differed according to the PPM. To assess this last point, we used the standardized mean differences, as they are not dependent on the sample size, and as the cut-off point for inclusion in the model we chose an absolute difference > 10%. In addition, to control the possible changes that could take place in patient management over time, the year of the surgical intervention was included in the model. Once the model had been constructed, we confirmed the lack of colinearity among the predictors, as well as the supposition of linearity for the continuous variables. We also determined the discriminatory power and calibration accuracy using Harrell's C statistic and the Hosmer-Lemeshow test, respectively.

We studied the influence of PPM on in-hospital mortality and functional class by means of logistic regression, univariate first, and then, adjusting for PS, introducing the PS into the model as a continuous variable. The survival distributions during follow-up of patients with or without PPM were estimated by the Kaplan-Meier method and log-rank test, followed by Cox proportional hazards regression, again adjusting for PS. The proportional hazards assumption was confirmed using Schoenfeld residuals. This analysis of survival over time was carried out only in the patients who survived the postoperative period, and began on the day of hospital discharge or on day 30 after surgery in the case of earlier discharge. The Enter method was employed in both regression models. A two-sided *P* value < .05 was considered to indicate statistical significance.

The study was approved by the ethics committee of our center.

Definitions

Severe pulmonary hypertension: systolic pulmonary artery pressure > 50 mmHg.

Left ventricular dysfunction: LVEF < 50%.

Coronary artery disease: stenosis > 50% in at least one artery according to coronary angiography.

Peripheral arterial disease: intermittent claudication, carotid stenosis > 50% and/or previous abdominal aorta, iliac artery, or carotid surgery.

Emergency surgery due to critical condition: need for hospital admission due to unstable clinical status and/or life-threatening situation making it impossible to delay surgery.

Advanced functional class: NYHA functional class III-IV/IV.

Associated aortic regurgitation: at least grade II/IV aortic regurgitation associated with stenosis.

Neurological dysfunction: neurological damage that severely affects gait or activities of daily living.

In-hospital or postoperative mortality: that produced between the time of surgery and hospital discharge or within the first 30 postoperative days if discharge took place sooner.

Postoperative acute myocardial infarction: troponin T level over 1 ng/ml associated with compatible clinical and electrocardiographic findings.

Postoperative stroke: clinically compatible neurological event that persists for at least 24 h.

Early extubation: that which is performed within 24 h of the surgical intervention.

Persistent postoperative atrial fibrillation: presence of atrial fibrillation at discharge that had not been present prior to surgery.

RESULTS

During the study period, 149 patients met the inclusion criteria; there were 80 women (53.7%), and the mean age was 81 years [80 to 82 years]. Of the group as a whole, 92 patients (61.7%) had some degree of PPM, which was severe in only 3 cases. The median IEOA in the group of patients with PPM was 0.76 cm^2/m^2 [0.68-0.80 cm^2/m^2] and in the group without PPM, 0.91 cm^2/m^2 [0.87-0.94 cm^2/m^2. The preoperative characteristics and those corresponding to the surgical intervention are shown in Tables 2 and 3, respectively.

The variables included in the model for the creation of the PS were sex, hypertension, body surface area, body mass index, peak transaortic pressure gradient, neurological dysfunction, left ventricular dysfunction, coronary artery disease, associated aortic regurgitation, advanced functional class, emergency surgery due to

Table 2
Preoperative Patient Characteristics

	Without PPM	With PPM	*P*
Age (years)	81 [80-83]	81 [80-82]	.6
Women	27 (47.4)	53 (57.6)	.22
HT	40 (71.4)	56 (60.9)	.19
DM	10 (18.2)	17 (18.5)	.96
Hypercholesterolemia	13 (25.5)	24 (26.4)	.91
BSA (m^2)	1.66 ± 0.15	1.82 ± 0.18	.001
BMI	26.57 ± 3.64	28.76 ± 3.97	.002
Peripheral arterial disease	6 (10.5)	8 (8.7)	.71
COPD	7 (12.3)	13 (14.1)	.74
Previous stroke	5 (8.8)	6 (6.5)	.61
Previous neurological dysfunction	3 (5.3)	2 (2.2)	.31
Preoperative creatinine concentration	1.02 [0.77-1.27]	0.99 [0.85-1.14]	.89
Previous CVS	1 (1.9)	0	.18
Previous AF	8 (14)	11 (12)	.71
Previous AMI	3 (5.3)	5 (5.4)	.96
LVD	7 (12.3)	7 (7.7)	.35
SPHT	7 (12.3)	11 (12)	.95
Coronary artery disease	17 (29.8)	36 (39.1)	.24
Peak transaortic pressure gradient	84.84 ± 18.63	89.33 ± 19.79	.29
Associated aortic regurgitation	4 (7)	13 (14.1)	.18
Emergency surgery due to critical condition	3 (5.3)	8 (8.7)	.43
NYHA functional class III-IV	42 (73.7)	61 (67)	.39
Previous pacemaker implantation	4 (7.1)	4 (4.3)	.46
Standard EuroSCORE	8 [7-10]	8 [7-9]	.32

AF, atrial fibrillation; AMI, acute myocardial infarction; BMI, body mass index; BSA, body surface area; COPD, chronic obstructive pulmonary disease; CVS, cardiovascular surgery; DM, diabetes mellitus; HT, hypertension; LVD, left ventricular dysfunction; NYHA, New York Heart Association; PPM, patient-prosthesis mismatch; SPHT, severe pulmonary hypertension.
Data are expressed as number of patients (%), mean ± standard deviation or median [interquartile range].

Table 3
Characteristics of the Surgical Procedure

	Without PPM	With PPM	*P*
Emergency surgery due to critical condition	3 (5.3)	8 (8.7)	.43
Previous balloon counterpulsation	1 (1.9)	1 (1.1)	.68
CPB time (min)	81 [68-98]	81 [69-105]	.61
Aortic clamp time (min)	64 [53-72]	63 [55-78]	.29
Associated coronary revascularization	13 (22.8)	32 (34.8)	.12
Associated mitral valve surgery	0	1 (1.1)	.43
Associated ascending aorta surgery	3 (5.3)	0	.051
Biological prosthesis	51 (89.5)	90 (97.8)	.028

CPB, cardiopulmonary bypass; PMM, patient-prosthesis mismatch.
Data are expressed as number of patients (%) or median [interquartile range].

critical condition, clamp time, type of prosthesis, and year of surgery. The discrimination, measured using Harrell's C statistic, was 0.88. In the calibration analysis, the result with the Hosmer-Lemeshow test was $\chi^2 = 4.2$ ($P = .84$).

During the postoperative period, 12 patients (8.1%) died; 5 of them had PPM, with an in-hospital mortality of 5.4%, and 7 did not, with an in-hospital mortality of 12.3%; the difference was not significant ($P = .13$). None of the patients died between hospital discharge and postoperative day 30. PPM did not act as a predictor of in-hospital mortality in the model that was not adjusted for PS (odds ratio [OR] = 0.4; 95% confidence interval [CI], 0.12-1.32; $P = .13$) or in the model that was (OR = 0.75; 95% CI, 0.15-3.58; $P = .72$).

The median intensive care unit stay in the PPM group versus the group of patients without PPM was 3 days [2 to 5 days] versus 2 days [1 to 4 days] ($P = .11$), whereas the median postoperative hospital stay was 7 days [6 to 12 days] versus 6 days [5 to 12 days] ($P = .36$). The postoperative complications are shown in Table 4.

The mean duration of follow-up of the 137 patients who survived the postoperative period was 32.71 ± 14.42 months, during which 29 patients (21.16%) died. Of these, 19 (21.8%) exhibited some degree of PPM and 10 (20%) did not.

According to the comparative analysis using the log-rank test (Fig. 1), there were no significant differences in survival during follow-up ($P = .92$). The 1-year survival rate among the patients with and without PPM was 93.18% (95% CI, 85.45%-96.88%) and 97.96% (95% CI, 86.38%-99.71%), respectively, whereas the 3-year survival rate was 81.07% (95% CI, 71.2%-88.5%) and 74.13% (95% CI, 56.05%-85.66%).

Table 4
Postoperative Complications

	Without PPM	With PPM	*P*
Postoperative AMI	4 (7)	4 (4.3)	.48
Postoperative stroke	0	2 (2.2)	.26
Reintervention for dehiscence	1 (1.8)	3 (3.3)	.58
Reintervention due to bleeding	4 (7)	4 (4.3)	.48
Pericardial drainage	2 (3.5)	1 (1.1)	.31
New need for permanent pacemaker	5 (8.9)	2 (2.2)	.06
Persistent AF	3 (5.3)	3 (3.3)	.54
New need for balloon counterpulsation	4 (7)	5 (5.4)	.69
Pneumonia	3 (5.3)	1 (1.1)	.12
Late extubation	6 (12)	7 (8)	.44

AF, atrial fibrillation; AMI, acute myocardial infarction; PPM, patient-prosthesis mismatch.
Data are expressed as number of cases (%).

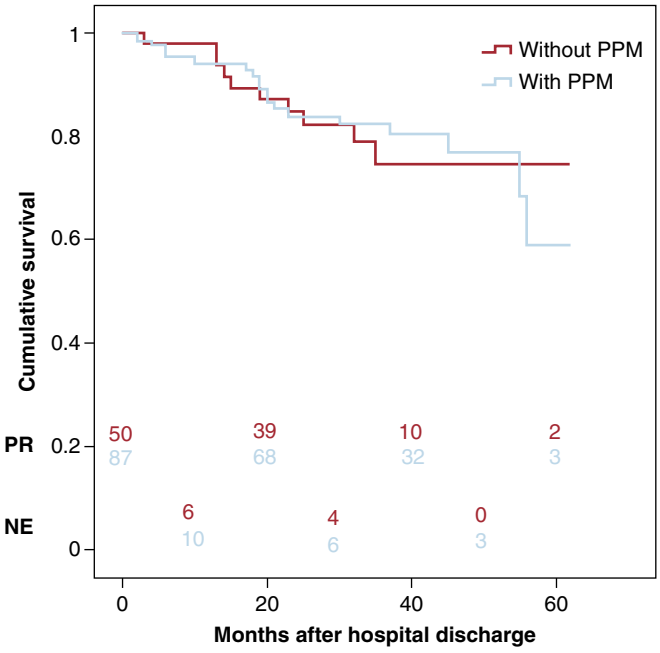

Figure 1. Comparative analysis between survival in patients with and without patient-prosthesis mismatch using the log-rank test. NE, number of events; PPM, patient-prosthesis mismatch; PR, patients at risk.

PPM did not act as a predictor of mortality during follow-up in the unadjusted model (hazard ratio [HR] = 0.96; 95% CI, 0.44-2.07; $P = .92$) or in the PS-adjusted model (HR = 1; 95% CI, 0.36-2.78; $P = .99$).

The functional class of the 108 survivors during follow-up is shown in Table 5. PPM had no influence on patient progression to an advanced functional class during follow-up in the unadjusted model (OR = 0.76; 95% CI, 0.11-5.33; $P = .78$) or in the PS-adjusted model (OR = 1.46; 95% CI, 0.073-29.24; $P = .8$).

DISCUSSION

Concept and Importance of the Problem

Aortic stenosis is a condition that increases progressively with age, and affects up to 13% of octogenarians.[13] Moreover, this patient population shows the highest rate of growth in the western world.[27] For this reason, SAS in the elderly patient has become a subject of great interest in the clinical and scientific environments. In this context, our work is the first to study the influence of PPM in this specific group of patients.

The concept of PPM following AVR was described for the first time in 1978,[1] and was defined as a valve "too small in relation to patient body size." At the present time, some authors[21,22] consider

Table 5
New York Heart Association Functional Class During Follow-up

NYHA functional class	Without PPM	With PPM	Total
NYHA I	21 (52.5)	36 (52.9)	57 (52.8)
NYHA II	16 (40)	27 (39.7)	43 (39.8)
NYHA III	3 (7.5)	4 (5.9)	7 (6.5)
NYHA IV	0	1 (1.4)	1 (0.9)
Total	40	68	108

NYHA, New York Heart Association; PPM, patient-prosthesis mismatch.
Data are expressed as number of cases (%).

PPM to exist when the IEOA is less than 0.85 cm^2/m^2. This circumstance appears to be common in octogenarian patients,[14,15] but the consequences from the clinical point of view are a matter of discussion.

Some researchers have defended the hypothesis that PPM affects survival and/or functional class,[2–5] while others consider it a phenomenon with no clinical importance or that only affects the prognosis in young patients and in patients of any age with ventricular dysfunction.[7,28,29] In the case of the octogenarian patient, there are surgical circumstances that usually affect the operative and postoperative course, and could have a significant influence on the subsequent presence of PPM. Thus, these patients frequently have small and calcified annuli,[14,15] a situation that obliges the surgeon to decide during the surgical intervention whether to implant a small-diameter prosthesis and risk PPM or resort to other alternatives. These include the placement of a mechanical valve, which usually implies the need for subsequent anticoagulation therapy, the implantation of a stentless valve, or the performance of annular enlargement, a procedure that requires longer cardiopulmonary bypass and aortic clamp times, which can have serious consequences in a population as vulnerable as that of octogenarians.

The main objective of this report was to evaluate the incidence of PPM and its influence on the mortality and quality of life of octogenarian patients treated surgically for AVR due to SAS. For this purpose, we studied 149 consecutive octogenarians who underwent surgery for SAS in our center, the majority of whom (61.7%) exhibited some degree of PPM after the intervention.

Influence of Patient-Prosthesis Mismatch on the Mortality Rate

It has been pointed out that the potential influence of PPM on survival is due to an absence of reverse left ventricular modeling,[30] a phenomenon that is completed within 2 years of the surgical intervention in most patients.[31] Taking into account this hypothesis, there are very few reports focusing on the influence of PPM in elderly patients, and the results are highly controversial.

Ding et al.[32] studied 112 patients over 70 years of age who underwent surgery for AVR due to SAS and observed that an IEOA of 0.85 cm^2/m^2 or less acted as an independent predictor of both in-hospital and long-term mortality. However, these data have not been corroborated in other reports. In the series of Vicchio et al.,[9] the study population included 377 patients with preoperative characteristics similar to those of the cases documented by Ding et al, with the difference that the patients in the former study underwent implantation of a small-diameter valve (17, 19 or 21 mm). After dividing the sample into 3 groups according to the degree of PPM (patients without PPM, with moderate PPM, and with severe PPM), they observed no differences in survival attributable to the degree of mismatch. In this respect, other studies that describe a long-term postoperative follow-up, such as those published by Urso et al.[33] (37.4 months) and Ryomoto et al.[12] (37.2 months), also found no PPM-related differences in survival. Our series, limited by the small number of clinical events that would enable a more thorough analysis of the data, lends support to the conclusions of the previous reports indicating that, at least in the case of moderate PPM, the mismatch does not appear to have a significant influence on long-term and short-term mortality in the octogenarian patients treated surgically.

Influence of Patient-Prosthesis Mismatch on Quality of Life

Along general lines, patients with PPM are considered to have a limited cardiac output and, thus, a reduced exercise tolerance. However, again, this is a controversial issue that has not been resolved in the literature. Studies of the hemodynamic performance of biological valves (probably the type most widely used in elderly patients) show no association between exercise tolerance and the IEOA, a finding that could be due to the high degree of compliance of these valves, which would tend to increase their EOA during exercise.[10,11] On the other hand, it seems logical to think that a population with lower metabolic demands and, by nature, a lower exercise capacity, as is the case of octogenarians, would have good cardiac function according to the NYHA classification following AVR, regardless of whether or not there was moderate PPM after the surgical intervention.

However, in addressing questions concerning cardiac symptoms in the elderly patient, we encounter the limitations derived from the ambiguity of the data obtained in this respect due to the various methods employed. This could justify the discrepancies among the different series. Viccho et al.[9] (using the SF-36 quality of life questionnaire) and Ryomoto et al.[12] (through subjective assessment of the NYHA functional class) found no association between quality of life and PPM. In contrast, Urso et al.[33] did demonstrate this relationship using the SF-12 questionnaire in a 3-year follow-up. The results in our series, with a follow-up similar to that of the previous study and using the NYHA functional class to evaluate the patients, agree with those studies that found no such association, a fact that supports the aforementioned hypothesis concerning the mechanical and metabolic demands characteristic of the elderly population.

Thus, the results of the present report indicate the limited clinical impact of moderate PPM on the mortality and quality of life of the octogenarian patient. Nevertheless, we should point out some of the limitations we observe. First of all, this is a single-center study, a circumstance that must be taken into account when attempting to extrapolate the results. Moreover, the functional class was assessed by telephone on the basis of the information provided orally by the patient or by his or her relatives, and thus the objective methods that would enable us to quantify the problem were not applied.

CONCLUSIONS

Despite the fact that a moderate degree of PPM is a very common finding in octogenarian patients who undergo AVR to treat SAS, its prognostic influence in terms of mortality and quality of life do not appear to be relevant. The biological profile characteristic of the elderly patient, with lower metabolic demands and limited physical activity, could explain the results obtained.

CONFLICTS OF INTEREST

None declared.

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