



Original Article

Clinical outcome in nonagenarians undergoing transcatheter valve replacement



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ABSTRACT

Background: Nonagenarians are mostly denied from different therapeutic strategies due to high preoperative risk. We present the results of nonagenarians with severe aortic stenosis (AS) undergoing transcatheter aortic valve replacement (TAVR).

Methods: Our retrospective analysis include baseline and procedural data along with clinical outcome. Clinical follow-up was performed in all patients after TAVR.

Results: Out of 689 patients, 33 nonagenarians with a mean age of 90.9 ± 1.4 years suffering from severe AS and elevated comorbidity index (logistic EuroSCORE of $16.3 \pm 9.6\%$, STS score $11.1 \pm 9.9\%$) underwent TAVR between September 2009 and July 2016 using self-expanding prosthesis. Baseline transthoracic echocardiography reported a mean aortic valve area (AVA) of 0.64 ± 0.12 cm² with a mean pressure gradient of 56.1 ± 16.1 mmHg. Five (16.2%) patients had postprocedural moderate/severe aortic regurgitation. One patient died intraoperally due to ventricular perforation during predilatation, while two patients died within the first 30 days, one due to cardiogenic shock and the other due to pneumonia. No patient experienced a myocardial infarction or a stroke, while ten (30.3%) required permanent pacemaker placement. At follow-up (mean 20.3 months, range 1–78 months), all cause and cardiovascular mortality was 24.2% and 15.1%, respectively. Two patients presented heart failure and 12 (40%) had exertional dyspnea. By echo, mean valve area was 1.72 ± 0.12 cm² and mean gradient 11.2 ± 1.4 mmHg. Two patients (16.7%) presented moderate aortic regurgitation.

Conclusion: Our case series demonstrate that even with elevated comorbidity index, clinical endpoints and valve-associated results are relatively favorable in nonagenarians treated with TAVR.

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1. Introduction

Improvements in healthcare have led to a steady increase in survival and the number of nonagenarians worldwide.¹ In these individuals, symptomatic severe aortic stenosis (AS) is common and it is often dealt conservatively (due to the elevated surgical risk), reducing quality of life and survival.² Worldwide adoption of transcatheter aortic valve replacement (TAVR) enabled disease correction in inoperable elderly patients, prolonging life survival.^{3,4}

Nonagenarians though accounted for only a small fraction of subjects in current large randomized clinical trials. Such scarcity of outcome data in this patient subset makes therapeutic decisions very challenging.

Thus, the purpose of this study was to report the procedural, 30-day, and mid-term outcomes

of nonagenarians undergoing TAVR in current clinical practice using a dedicated multicenter database from Argentina.

1.1. Patients

We performed a retrospective analysis of all nonagenarians from a prospectively collected database that combines the TAVR experience of six academic tertiary centers from Argentina (1.

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Hospital Universitario Fundación Favaloro, 2. Hospital Italiano Buenos Aires 3. Instituto Cardiovascular de Buenos Aires, 4. Sanatorio Güemes, 5. Instituto de Cardiología de Rosario, 6. Sanatorio Allende). The criteria for inclusion and exclusion to the TAVR procedure have been described elsewhere. All TAVR procedures were performed by a multidisciplinary team comprised of an interventional cardiologist, cardiac surgeon, and anesthesiologist. Patients with severe AS being considered for an intervention underwent cardiac catheterization, angiographic cardiac and peripheral vessels computed tomography (CT) and a transesophageal echocardiogram (TEE), except for those too fragile patients. Treatment strategy was in compliance with the Helsinki Declaration. Our local ethics committee approved this treatment strategy. Patients gave informed consent prior TAVR. Pacemaker implantation at follow-up was considered indicated in case of complete AV block, type II second-degree AV block or first degree AV block with associated left bundle branch block.

1.2. Procedure

Details of the implantation procedures have been described elsewhere. In brief, all patients were operated in an interventional suite under general anesthesia. TAVR was performed via femoral access under fluoroscopic imaging either surgically or percutaneous using the ProStar XL closure device (Abbott Vascular, Illinois, USA). The aortic valve was initially dilated using a standard balloon valvuloplasty (18–25 mm x 40–100 mm) with a nominal diameter slightly (2–6 mm) smaller than the aortic valve and followed by insertion of the prosthetic valve. Some patients underwent direct valve implantation according to operators' discretion and experience. In case of residual aortic insufficiency or valve under expansion a balloon dilation dilatation was performed to ensure complete apposition. After TAVR patients were transferred to intensive care unit to monitor conduction disorders. All patients were prophylactically given a temporary pacemaker via femoral venous access; with VVI mode the active pacing was 40bpm.

At the beginning of the experience general anesthesia was used but now these procedures using percutaneous approach are done under sedation and neurolepto-analgesia with transthoracic echocardiographic control, while TEE was left as a back-up tool.

Follow-up assessments were conducted on an outpatient basis or by telephone interview. We were able to determine the survival status for all patients. Echocardiographic assessment was performed pre-discharge, at 30 days, 6 and 12 months. All included patients provided written informed consent which allowed use of their clinical data for publishing purposes. Institution's ethical committees approved this study.

1.3. Definitions

Definitions of all clinical outcomes were performed according to the Valve Academic Research Consortium.⁵

1.4. Statistical analysis

Continuous variables are presented as means \pm standard deviation or medians (interquartile range) and categorical variables as frequencies (%).

2. Results

Out of 689 patients a total of 33 (4.8%) nonagenarians underwent TAVR from September 2009 to July 2016. Many patients exhibited high comorbidity index resulting in a high mean logistic EuroSCORE and a STS score (Table 1). The analysis of ECGs revealed sinus rhythm in 26 patients (78.8%) and atrial fibrillation in 7

Table 1
Baseline Characteristics.

Variable	n = 33
Age (years)	90.9 \pm 1.4 (range 90–96)
Females	17 (51.5)
Hypertension	23 (69.7)
Diabetics	2 (6)
Dyslipidemia	18 (54.5)
Permanent pacemaker	5 (15.1)
Prior coronary bypass-grafting	0
Prior percutaneous coronary intervention ^a	11 (33.3)
Renal insufficiency	8 (24.2)
Severe chronic obstructive pulmonary disease	5 (15.1)
Atrial fibrillation	7 (21.2)
NYHA class II/III-IV	13 (26)/38 (74)
Logistic Euroscore	16.3 \pm 9.6
STS Score ^b	11.1 \pm 9.9

^a 7 procedures were performed withing 3 month of the aortic procedure.

^b Society of Thoracic Surgery.

Table 2
Baseline Echocardiographic and CT Variables.

	Population (n = 33)
Echo	
Severe aortic valve calcification (%)	30 (90.9)
Aortic annulus diameter, mm	23.7 \pm 2.6
Mean aortic gradient, mm Hg	56.1 \pm 16.1
Aortic valve area, cm ²	0.64 \pm 0.12
Interventricular septum, cm	14.3 \pm 3.5
LVEF, %	53.6 \pm 13.1 (range 34–68)
Moderate/severe mitral insufficiency, %	5/32 (16.5)
CT	
Sinus Valsalva height (mm)	23.1 \pm 1.6
Aortic annulus diameter (mm)	24.3 \pm 1.2
Aortic angulation	132.7 \pm 11.4
Distance aortic annulus to RCA ostium (mm)	12.4 \pm 1.3
Distance aortic annulus to LM ostium (mm)	13.2 \pm 2.1
Calcificación valvular	3842 \pm 2097

PASP: indicates pulmonary artery systolic pressure. CT: computed tomography. RCA: right coronary artery. LM: left main coronary artery.

individuals (Table 2). Baseline transthoracic echocardiography reported a mean AVA of 0.64 \pm 0.12 cm² with a mean pressure gradient of 56.1 \pm 16.1 mmHg (Table II). Out of 33 patients, 11 (81.8%) had moderate mitral regurgitation.

TAVR was successfully performed in 32/33 patients (97%) and no conversion to surgical aortic valve replacement was necessary. Predilatation and postdilatation were performed in 51.5% and 34.4% of the cases, respectively. 28 patients received a CoreValve (Medtronic, Minneapolis, USA), size 26 in 12 cases, 29 in 13 cases and 31 in 3 cases. Three cases were done with an Accurate size S (Symetis, Ecubens, Switzerland) and 1 with a Lotus Valve size 27 (Boston Scientific Corp.). Migration was not observed and no patient received two valves. Five (16.2%) patients had postprocedural moderate/severe aortic regurgitation, 3/5 (60%) of these patients received a 29 mm Corevalve. One patient died during the procedure due to ventricular perforation during predilatation, while two patients died within the first 30 days, one due to cardiogenic shock and the other due to pneumonia (Table 3). No patient experienced a myocardial infarction or a stroke, while ten (30.3%) required permanent pacemaker placement. Three patients had vascular complications.

At follow-up (mean 20.3 months, range 1–78 months), all cause and cardiovascular mortality was 24.2% (n = 8) and 15.1% (n = 5), respectively. Two patients presented heart failure and 12 (40%) had exertional dyspnea. The composite endpoint of death, stroke and

Table 3
30-day Clinical outcome.

	Population n = 33
Major Bleeding	6 (18.2)
Vascular complications	3 (9.1)
Death	3 (9.1)
Death, myocardial infarction, stroke, bleeding or vascular complications	9 (27.3)

re-hospitalization for heart failure at follow-up was observed in 7 patients (5 deaths and 2 re-hospitalizations). By transthoracic echo, mean valve area was $1.72 \pm 0.12 \text{ cm}^2$, mean transvalvular gradient was $11.2 \pm 1.4 \text{ mmHg}$. Two patients (16.7%) presented moderate aortic regurgitation and none severe. There were no neurological events at follow-up.

3. Discussion

The projections of American and European populations show sustained increases in life expectancy, with nonagenarians experiencing the largest growth in proportion.^{6,7} This will inevitably lead to a rise in the need of AS treatment. For decades, many nonagenarians with AS have been treated conservatively,² while recently TAVR emerged as the most suitable alternative. Data from the PARTNER trials and the STS/ACC TVT Registry regarding nonagenarians showed that the procedure can be performed with an acceptably mortality and morbidity^{8,9}; nonetheless, there is still insufficient experience to identify those patients most likely to benefit.

In the present study, procedural success rate was high (97%) and the reduction in afterload after TAVR resulted in immediate marked hemodynamic improvement. Due to advanced age and perceived patients' frailty, operators perform direct implantation in almost half of the cases. Consequently, patients often required balloon post-dilation (33.3%) and there was a high moderate/severe aortic regurgitation rate (27.3%). As expected in very elderly individuals, severe aortic valve calcification was ubiquitous, which strongly predicts the development of post-TAVR moderate/severe AR. In line with our findings, a high rate of moderate/severe aortic regurgitation in this patient subset (17.6%) was also reported in a large sub-analysis of the STS/ACC TVT Registry.⁸ Currently, there is a trend toward simplification of the procedure avoiding the use of general anesthesia and surgical vascular access, while adopting light sedation, local anesthesia, and a full percutaneous approach. Although pre-dilatation can help device crossing and allow lesion preparation, it requires fast pacing and can provoke hemodynamic deterioration in high-risk individuals and increase stroke risk. Furthermore, current valve devices have a low profile, allowing easy crossing. In addition, they possess enough radial force to obtain satisfactory post-implantation mean gradients and valve areas. Balloon pre-dilation also carries an increased risk of stroke. Perhaps, the absence of neurological events in our report was linked to a low pre-dilatation rate. However, such rate may be offset by the risk of crossing the device to a narrow and severely calcified valve.

The need for a permanent pacemaker was common after TAVR (37%), somewhat higher to the one reported in younger patients receiving auto-expandable valve prosthesis.

Thirty-day survival rate in our study was high (90.9%) and close to the one reported by the STS/ACC TVT Registry (91.2%).¹ It was also encouraging to observe that patients who survived the procedure had a reasonable life expectancy (73.3% survival rate at mean 20.3 months, range 1–78 months). This outcome was also similar to the one reported by the STS/ACC TVT Registry (75%).¹ Thus, TAVR in the very elderly has the potential to improve

functional status and quality of life, at an acceptably low peri-procedural price.

Several limitations of this retrospective study deserve mentioning. The sample size was small and there was no comparative group. Furthermore, although we used standard TAVR risk scores (EuroSCORE or STS score), they insufficiently assess the degree of frailty and the overall risk in very elderly individuals undergoing cardiovascular procedures. The use of multidimensional scores evaluating nutritional and cognitive status as well as gait function and activity level would also have helped understand the overall frailty and mortality risk of the studied population and identify cases in which it was futile to proceed with TAVR due to a low life expectancy.^{10–12}

We did not collect data concerning quality of life, medical resource use and hospital costs that would have helped us estimate the quality-adjusted life expectancy, lifetime medical care cost and cost-effectiveness. Nonetheless, patients who survived had an overall improvement in their clinical symptoms (heart failure at follow-up: 6.7%, functional class ≤ 2 in 28 cases).

4. Conclusion

The current study provides further evidence of the feasibility and safety of TAVR in carefully selected nonagenarians, which suggest that individuals from undergoing TAVR should not be excluded only in the basis of his age.

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