ORIGINAL ARTICLE

# Aortic Valve Replacement in Intermediate Risk Patients: Surgical Outcomes

## *Reemplazo valvular aórtico en pacientes de riesgo intermedio: resultados quirúrgicos*

GERMÁN A. FORTUNATO, RICARDO G. MARENCHINO, SEBASTIÁN CIRIO, EMILIANO ROSSI*, ALBERTO DOMENECH, VADIM KOTOWICZ


## ABSTRACT

**Background:** Conventional surgery still represents the gold standard therapeutic strategy for aortic valve disease with adequate outcomes according to the operative risk. The use of transcatheter aortic valve implantation (TAVI) for the treatment of aortic stenosis (AS) has dramatically increased and is being considered for intermediate risk (IR) patients. As the information about the outcomes of surgical aortic valve replacement (AVR) in this particular group of patients is uncommon in our setting, we present the results in our "real world".
**Objectives:** The aim of the study was to report the rate of early complications in patients undergoing AVR with IR for mortality (STS PROM% 4%-8%).
**Methods:** A retrospective analysis of patients undergoing surgical AVR was conducted between January 2007 and March 2017. A total of 877 isolated AVR procedures or associated with coronary artery bypass graft surgery (CABGS) were performed. Patients with severe AS, severe aortic regurgitation, endocarditis and STS PROM 4%-8% were included in the study. Patients at low or high surgical risk (STS PROM < 4% or >8%), with double valve surgery or associated procedures (except for CABGS or aortic annular enlargement) were excluded.
**Results:** A total of 97 patients were included in the study. Mean age was 79.4±6.18 years, and 60.82% were men. Median STS PROM was 5.1% (4.4-6) and 62.9% of patients underwent CABGS. No cases of moderate or severe paravalvular leak were reported. Thirty-day mortality was 5.1%. The following complications were reported: ischemic stroke (3.1%), definite pacemaker requirement (4.1%) and reoperation due to bleeding (4.1%). Total hospital stay was 8 days (6-14).
**Conclusions:** The results in IR patients were consistent with those expected in terms of postoperative morbidity and mortality.


**Key words:** Transcatheter Aortic Valve Replacement - Risk Factors - Aortic Valve Stenosis


## RESUMEN

**Introducción:** La cirugía convencional para la enfermedad valvular aórtica continúa siendo el estándar de oro con resultados muy adecuados con relación al riesgo preoperatorio que presenta. El uso de las válvulas transcatéter para el tratamiento de la estenosis aórtica (EAO) ha crecido exponencialmente y se postula para pacientes de riesgo intermedio (RI). En nuestro medio es infrecuente el hallazgo de resultados de la cirugía en este grupo en particular, por lo que presentamos la casuística en nuestro "mundo real".
**Objetivos:** Complicaciones tempranas en pacientes sometidos a reemplazo valvular aórtico (RVA) con RI preoperatorio de mortalidad (STS PROM% 4%-8%).
**Material y métodos:** Análisis retrospectivo de pacientes sometidos a RVA desde enero de 2007 hasta marzo de 2017. Se realizaron 877 RVA aislados o asociados a cirugía de revascularización miocárdica (CRM). Fueron incluidos pacientes con EAO grave, insuficiencia aórtica grave, endocarditis y con STS PROM de 4% a 8%. Fueron excluidos los pacientes de bajo y alto riesgo (STS PROM% <4% o >8%), cirugía valvular doble, o cirugías asociadas excepto CRM o ampliación del anillo aórtico.
**Resultados:** Fue incluido un total de 97 pacientes. La edad media fue de 79,4 ± 6,18, y 60,82% de sexo masculino. La mediana de STS PROM% fue de 5,1 (4,4-6).
En el 62,9% se realizó CRM. No se registraron casos de fuga paravalvular moderado-grave.
La mortalidad a los 30 días fue de 5,1%. Las complicaciones fueron 3,1% de ACV isquémico, 4,1% requerimiento de MCP definitivo y 4,1% por reexploración por sangrado. La estadía hospitalaria total fue de 8 días (6-14).
**Conclusiones:** Los pacientes de RI presentaron resultados acordes con los esperados en términos de morbimortalidad posoperatoria.


**Palabras clave:** Reemplazo de la válvula aórtica transcatéter - Factores de riesgo - Estenosis aórtica

Rev Argent Cardiol 2018;86:114-117. http://dx.doi.org/10.7775/rac.v86.i2.11462

*Received:* 10/29/2017 – *Accepted:* 01/08/2018

*Address for reprints:* Germán A. Fortunato. Cirugía Cardiovascular. Hospital Italiano de Buenos Aires. Juan D. Perón 4190 (C1199ABD) Buenos Aires, Argentina. Phone: (05411) 4959-0200 / Fax: (05411) 4959-5804 - email: german.fortunato@hospitalitaliano.org.ar

Hospital Italiano de Buenos Aires.
Department of Cardiovascular Surgery, Hospital Italiano de Buenos Aires
*Department of Cardiology, Hospital Italiano de Buenos Aires

## Abbreviations

| | | | |
|---|---|---|---|
| **TAVI** | Transcatheter aortic valve implantation | **AF** | Atrial fibrillation |
| **IR** | Intermediate risk | **CKF** | Chronic kidney failure |
| **AVR** | Aortic valve replacement | **ACC** | Aortic-cross clamp |
| **STS PROM** | Society of Thoracic Surgeons Predicted Risk of Mortality | **MV** | Mechanical ventilation |
| **CABGS** | Coronary artery bypass graft surgery | **CPB** | Cardiopulmonary bypass |
| **AR** | Aortic regurgitation | **IABP** | Intraaortic balloon pump |
| **IE** | Infective endocarditis | **LCOS** | Low cardiac output syndrome |
| **COPD** | Chronic obstructive pulmonary disease | | |

## INTRODUCTION

Transcatheter aortic valve implantation (TAVI) for the treatment of aortic stenosis (AS) has dramatically increased since the procedure was introduced and approved.

The indication has evolved within a short period; initially, it was only indicated to inoperable patients, then to those at high risk for complications due to surgery and it is now finally considered for intermediate risk (IR) patients as defined by the STS PROM (Society of Thoracic Surgeons Predicted Risk of Mortality) score.

Since the recent publication of controlled trials comparing the results in patients undergoing conventional surgical aortic valve replacement (AVR) versus TAVI in patients at IR, (1, 2) the American guidelines for the management of heart valve disease have updated their recommendations and consider TAVI an indication in IR patients depending on some conditions. (3, 4)

In a strict sense, the information provided by randomized trials is very important and constitutes the basis to generate evidence nowadays; yet, this evidence may not be extrapolated to the local setting or the circumstances of the practice worldwide.

The clinical results in the "real world" are sometimes different from those encountered in controlled clinical trials. In addition, the STS PROM score has not been validated in our setting and, as far as we know, there are no national publications about the specific outcomes of IR patients undergoing AVR. For this reason, we made a review of the surgical results obtained in this particular group of patients, assuming that the results obtained in terms of morbidity and mortality would be similar to those predicted by the STS PROM score.

## OBJECTIVES

The aim of this study was to evaluate morbidity, mortality and perioperative complications of IR patients (STS PROM 4%-8%) undergoing conventional surgical AVR.

## METHODS

The electronic clinical records of the all patients undergoing surgical AVR between January 2007 and March 2017 were analyzed. Median follow-up was 32.56 months (1-119) with a maximum of 9 years.

During that period, 877 AVR procedures were performed, either isolated or associated with coronary artery bypass graft surgery (CABGS). Patients with severe AS (mean gradient >40 mm Hg), severe aortic regurgitation (AR), infective endocarditis (IE) and STS PROM between 4% and 8% were included in the study.

Patients at low surgical risk (STS PROM <4%), high surgical risk (STS PROM >8%), double valve surgery or associated procedures, except for CABGS or aortic annular enlargement, were excluded from the analysis.

The following independent variables were evaluated: age, sex, history, STS PROM% score, symptoms before the procedure, previous coronary artery revascularization, chronic obstructive pulmonary disease (COPD), atrial fibrillation (AF), chronic kidney failure (CKF), peripheral artery disease, ventricular function, history of neurological diseases and etiology of heart valve disease.

The clinical situation before surgery defined the procedures as: elective, urgent (heart failure, severe dyspnea or endocarditis) or emergency (cardiogenic shock, acute pulmonary edema, need of inotropic drugs or mechanical ventilation) procedures.

Patients hospitalized due to IE and who were treated with antibiotics were considered as having preoperative active endocarditis.

The following operative variables were analyzed: prosthesis type and size, presence of paravalvular leak, cardiopulmonary bypass (CPB) time, aortic cross-clamp (ACC) time, associated procedures and requirement of intraaotic balloon pump (IABP).

Early postoperative mortality was defined as mortality within 30 days after surgery or during hospitalization.

The following perioperative complications were considered: prolonged mechanical ventilation (MV) in patients extubated 48 hours after the procedure, low cardiac output syndrome (LCOS), bleeding volume at 24 hours, reoperation due to bleeding, stroke, atrioventricular (AV) block requiring definite pacemaker, AF, acute kidney failure requiring hemodialysis, mediastinitis, postoperative acute myocardial infarction (AMI) and length of hospital stay.

### Statistical analysis

The information was incorporated into a database. Each variable was included in a frequency table to analyze its distribution. Continuous variables with normal distribution were expressed as mean ± standard deviation. Non-parametric variables were expressed as median and 25-75% interquartile range. Discrete variables were expressed as percentages.

### Ethical considerations

The study was conducted following the recommendations for research studies in human subjects and legal regulations currently in force. An informed consent was not required be-

cause the study was a review of medical records and no data that would allow patient's identification were reported (except in the case of missing data, when a telephone call was made). The investigators implemented measures to protect the privacy and confidentiality of all the information according to the Argentine personal data protection law 25,326. The study protocol was approved by the institutional Ethics Committee.

## RESULTS

A total of 97 patients (11% of the total population) fulfilled the inclusion criteria. The characteristics of the study population in terms of age and preoperative risk factors are described in Table 1. Mean age was 79.4±6.18 years, and 59 patients (60.8%) were men. Median STS PROM was 5.1%. Ninety percent of the patients had severe AS with elective procedures in 65.7%.

Surgical results are presented in Table 2.

Biological prostheses were implanted in 90 patients (92.78%): Hancock II™ (Medtronic, Inc, Minneapolis, Minn), Trifecta™ (St.Jude Medical, Inc., St. Paul, MN, USA) and Mitroflow™ (SorinGroup USA Inc., Arvada, Colorado) and 14 patients (14.43%) underwent aortic annular enlargement to prevent patient-prosthesis mistmatch.

Sixty-one patients (62.88%) underwent CABGS. Cardiopulmonary bypass time and ACC time were 137 minutes (111-175) and 106 minutes (83-137), respectively. There were no moderate or severe paravalvular leaks during or after surgery. Transesophageal echocardiography was performed during surgery in all the cases.

Postoperative results and complications are presented in Table 3. Mortality at 30 days was 5.1%. Prolonged MV was the most common complication (17.5%). Ischemic stroke with neurological deficits occurred in 3% of the patients and 4.1% of the patients presented AV block requiring definite pacemaker. Total hospital stay was 8 days. (6-14)

**Table 1.** Preoperative and demographic characteristics (n = 97)

| Variable | Value (n (%)) |
|---|---|
| Age | 79.4 (SD ± 6.18) |
| Male sex | 59 (60.8) |
| Smoking habits | 33 (34.0) |
| Hypertension | 85 (87.6) |
| Diabetes | 27 (27.8) |
| Atrial fibrillation | 18 (18.6) |
| Previous hemodialysis | 3 (3.09) |
| Previous coronary artery revascularization | |
| CABGS | 3 (3.1) |
| PCI | 8 (8.3) |
| Previous cardiac surgery | 5 (5.2) |
| **Preoperative status** | |
| Elective | 64 (66.00) |
| Urgency | 31 (32.) |
| Emergency | 2 (2.1) |
| Previous AMI <21 days | 4 (4.1) |
| STS PROM% | 5.1 (4.4-6) |
| Cardiogenic shock <24 hours before surgery | 7 (7.21) |
| Active endocarditis | 4 (4.1) |
| Moderate/severe EF | 17 (17.5) |
| Peripheral artery disease | 42 (43.3) |
| Stroke/TIA | 8 (8.3) |
| COPD | 10 (10.3) |
| **Valvular heart disease** | |
| Severe AS | 88 (90.7) |
| Moderate/severe AR | 9 (9.3) |
| NYHA III-IV | 36 (37.1) |

Continuous variables with normal distribution are presented as mean (%) or median and 25-75% interquartile range for non-Gaussian distribution. SD: Standard deviation. PCI: Percutaneous coronary intervention. AMI: Acute myocardial infarction. STS PROM: Society of Thoracic Surgeons predicted risk of mortality. EF: Ejection fraction. TIA: Transient ischemic attack. AS: Aortic stenosis. AR: Aortic regurgitation. NYHA: New York Heart Association.

## DISCUSSION

The strength of indicating a procedure consists in working not only with the information that emerges from clinical trials, but also in the ability to confirm that recommendation with one's own experience. It is precisely at this point that we sometimes lack information from our setting which will allow us to get closer to the result we will obtain.

For this reason, we consider that, by providing the local results of a common procedure as AVR, we are cooperating with the decision-making process.

The analysis indicates that when we look at the population data and compare them with previous publications, the IR profile is structured differently in the different trials. As expected, the populations are not alike and neither are the risk factors.

As in other publications, our patients are old, with a mean age of 80 years. In our experience, the percentage of patients in functional class III-IV was lower than that reported by randomized trials, (1, 2) as well as the percentage of patients with diabetes, COPD, AF, and previous cardiac surgery or AMI.

Our population had high prevalence of peripheral vascular disease and of conditions that were excluded from randomized trials, as active endocarditis, cardiogenic shock and, definitely, a high percentage of patients undergoing combined procedures (AVR plus CABGS).

On the other hand, our patients were more similar to those included in contemporary observational studies evaluating IR patients not included in randomized trials; (5) in fact, we included patients with AR that were traditionally excluded from analyses comparing TAVI vs. AVR.

The surgical results in IR patients undergoing AVR are consistent with those predicted by the STS PROM score, with a mortality rate of 5.2% for a predicted mortality of 5.1% by the STS PROM score. This value is similar to the one reported by the PARTNER

**Table 2**. Characteristics of the procedure (n = 97)

| Variable | Value (n (%)) |
|---|---|
| Prosthesis implanted | |
| Biological | 90 (92.8) |
| Mechanical | 7 (7.2) |
| Prosthesis size | |
| nº 19 | 8 (8.3) |
| nº 21 | 39 (40.2) |
| nº 23 | 37 (38.1) |
| nº 25 | 12 (12.4) |
| nº 27 | 1 (1.0) |
| Annulus enlargement | 14 (14.4) |
| Associated CABGS | 61 (62.9) |
| Number of grafts | 1.3 (SD±1.18) |
| CPB time (minutes) | 137 (111-175) |
| ACC time (minutes) | 106 (83-137) |
| Paravalvular leak | |
| Mild | 6 (6.2) |
| Moderate/severe | 0 (0.0) |

Continuous variables with normal distribution are presented as mean (%) or median and 25-75% interquartile range for non-Gaussian distribution. CABGS: Coronary artery bypass graft surgery. CPB: Cardiopulmonary bypass. ACC: Aortic-cross clamp.

**Table 3**. Postoperative results (n = 97)

| Variable | Value (n (%))(%)) |
|---|---|
| Prolonged MV | 17 (17.53) |
| LCOS | 22 (22.7) |
| Postoperative IABP | 6 (6.2) |
| Postoperative AMI | 1 (1.03) |
| 24-hour bleeding | 230 (150-370) |
| Ischemic stroke | 3 (3.1) |
| AKF requiring dialysis | 5 (5.2) |
| Units of PRBCs | 2 (0-3) |
| Total hospital stay | 8 (6-14) |
| Postoperative AF | 43 (44.53) |
| AV block requiring definite pacemaker | 4 (4.12) |
| Mediastinitis | 2 (2.16) |
| Reoperation for bleeding | 4 (4.1) |
| Mortality at one month | 5 (5.2) |

Continuous variables with normal distribution are presented as mean (%) or median and 25-75% interquartile range for non-Gaussian distribution. MV: Mechanical ventilation. LCOS: Low cardiac output syndrome. IABP: Intraaortic balloon pump. AMI: Acute myocardial infarction. AKF: Acute kidney failure. PRBCs: Packed red blood cells. AF: Atrial fibrillation. AV: Atrioventricular.

2 study and higher than that of the SURTAVI study which reported a mortality rate that was clearly lower than the one predicted.

Although this figure would seem to indicate that the IR identified in our center is really such, it is known that validating a scoring system in a population of patients is not based on the mere coincidence between a figure observed and another theoretically expected.

The STS PROM score is the most commonly used preoperative scoring system to evaluate perioperative risk with certain problems. It may not accurately represent the risk of the population as it may avoid unmeasured factors, as cirrhosis, porcelain aorta, frailty, dementia, or severe pulmonary hypertension. At this point, the Heart Team is an important hospital resource for decision-making in these patients. (6, 7)

The postoperative complications resemble in some aspects and are comparable in others to those reported by the SURTAVI and PARTNER II randomized trials. The rates of postoperative AF, perioperative infarction and kidney failure were similar to those reported by the SURTAVI trial. In our series, the percentage of patients with postoperative stroke was lower than in the surgical group of large randomized trials (3.1% vs. 5.6 and 6.1%), and a similar result was found for bleeding (4.1% vs. 9.3) and pacemaker requirement (4.1 vs. 6.6 and 6.9%).

The limitations of this report are due to the methodological design of an observational and retrospective study.

## CONCLUSION

In our experience, the surgical results of IR patients are consistent with those expected in terms of postoperative morbidity and mortality.

### Conflicts of interest

None declared. (See authors' conflicts of interest forms on the website/Supplementary material).

## REFERENCES

**1.** Leon MB, Smith CR, Mack MJ, Makkar RR, Svensson LG, Kodhali SK, et al. Transcatheter or Surgical Aortic Valve Replacement in Intermediate-Risk Patients. N Eng J Med 2016;374:1609-20. http://doi.org/bff4

**2.** Reardon MJ, Van Mieghem NM, Popma JJ, Kleiman NS, Søndergaard L, Mumtaz M, et al.; SURTAVI Investigators. Surgical or Transcatheter Aortic-Valve. Replacement in Intermediate-Risk Patients. N Engl J Med 2017;376:1321-31. http://doi.org/cnr2

**3.** Mack MJ, Brennan JM, Brindis R, Carroll J, Edwards F, Grover F, et al. For the STS/ACC TVT Registry. Outcomes Following Transcatheter Aortic Valve Replacement in the United States. JAMA 2013;310:2069-77.

**4.** Nishimura RA, Otto CM, Bonow RO, Carabello BA, Erwin III JP, Fleisher LA, et al. 2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease. J Am Coll Cardiol 2017;70:252-89. http://doi.org/cnr3

**5.** Groh M, Diaz I, Johnson A, Ely S, Binns O, Champsaur G. Is Sugical Intervention the Optimal Therapy for the Treatment of Aortic Valve Stenosis for Patients with Intermediate Society of Thoracic surgeons Risk Score? Ann Thorac Surg 2017;103:1193-8. http://doi.org/f944st

**6.** Thourani VH, Suri RM, Gunter RL, Sheng S, O'Brien SM, Ailawadi G, et al. Contemporary real-world outcomes of surgical aortic valve replacement in 141,905 low-risk, intermediate-risk, and high-risk patients. Ann Thorac Surg 2015;99:55-61. http://doi.org/f6vnnp

**7.** Carabello BA, Paulus WJ. Aortic stenosis. Lancet 2009;373:956–66. http://doi.org/ctdcm6