In-Hospital and 30-Day Mortality After Percutaneous Aortic Valve Implantation. Usefulness of Different Surgical Risk Scores

Transcatheter aortic valve implantation (TAVI) is undergoing a staggering growth. Since the first implantation in 2002, (1) advances in this technique have expanded its recommendation. Today, TAVI is a practice used only in patients at high surgical risk and therefore, risk scores have a key role. However, risk scores do not include variables commonly observed in elderly patients with aortic stenosis (AoS) that suggest poor outcome, such as hostile thorax, porcelain aorta, frailty, and others. Furthermore, as they were developed on the basis of cohorts of patients undergoing surgery, their correlation with the prognosis of patients undergoing TAVI is unknown. The different specific prediction models for TAVI are not widely spread, and in Argentina there is little information reported; therefore, our objective was to describe the clinical characteristics of patients undergoing TAVI in our center, and to analyze whether there is a relationship between different surgical risk scores and short-term mortality.

We used data from the continuous prospective registry of patients undergoing TAVI in a tertiary care center in the city of Buenos Aires from 2009 to April 2016. The decision to perform TAVI was evaluated by an interdisciplinary team of professionals (clinical cardiologists, interventional cardiologists and cardiac surgeons). Follow-up was performed by electronic health record and telephone contact, evaluating in-hospital and 30-day events. The success of the intervention was defined as absence of mortality in the procedure, correct positioning of the prosthetic valve, gradient <20 mmHg, peak velocity <3 m/s, and absence of moderate to severe residual aortic regurgitation (AoR); the rest of the definitions were based on the Second VARC (Valve Academic Research Consortium) Consensus (2). The relationship between mortality and the logistic EuroSCORE (3), EuroSCORE II (4), STS-PROM (5) risk scores, and the OBSERVANT risk score (6) –specifically designed for TAVI– was evaluated. Then, mortality rate was assessed according to the risk stratification for each evaluated score. Discrete variables are described as numbers and percentages, and continuous variables as mean and standard deviation or median and interquartile range according to the type of distribution. Comparative analyses were performed with Student's t-test, chi-square test, Fisher's exact test, or ANOVA, as appropriate. Epi Info 7.2® software was used, and a value of $p < 0.05$ was considered as significant.

Eighty-eight consecutive patients were included in the study. Mean age was 80±6.68 years, 43% were men, and there was high prevalence of hypertension and other comorbidities (Table 1). All patients had symptomatic severe AoS with an aortic valve area of 0.6±0.15 cm2 and maximum velocity of 4.2±0.84 m/sec.

A self-expanding Corevalve® prosthesis was used via transfemoral access in 98% of cases, with a 95% success rate for the intervention (4 patients with moderate residual AoR). A significant improvement in the peak to peak gradient (80 mmHg to 4 mmHg post-intervention) was registered, with no severe residual AoR cases reported. Two cases of cardiopulmonary arrest (2%) successfully resuscitated in the operating room were registered, with no cases of prosthetic migration or periprocedural infarction. A low rate of complications was found during hospitalization (Table 1). Median post-implant hospital stay was 4 days (3-6) with an in-hospital mortality of 4%. No deaths within 30 days and no cases of bradyarrhythmia or new pacemaker requirements were reported.

All surgical risk scores significantly discriminated in-hospital and 30-day mortality (Table 2), and were approximately four times higher among dead patients. In addition, the logistic EuroSCORE, EuroSCORE II, STS-PROM, and OBSERVANT risk scores presented a significant difference in mortality rate according to their risk stratification in low, intermediate or high (Figure 1). No other analyses were performed due to the small number of deceased patients.

Proper risk assessment is an essential element to be determined in any type of medical intervention. If we take into account the great impact of valve replacement on the prognosis of patients with symptomatic severe AoS, the benefit of TAVI for patients excluded from surgical treatment due to their comorbidities is indisputable. However, with the development and expansion of this technique, we have learnt that patients' behavior after TAVI is different. There are currently few risk scores analyzing what the prognosis of patients after TAVI is. Although traditional surgical risk scores are routinely used, their application to these patients is questionable. The OBSERVANT risk score could become a reproducible score due to its simplicity and usefulness, providing more information and even identifying a subgroup of patients who would potentially not benefit from this procedure.

The main findings of this study were the good progress and low rate of complications presented by our cohort, and, especially the ability of all scores to discriminate in-hospital and 30-day mortality.

As limitations, it was a single-center study with a low rate of events, so it was not possible to perform

Table 1. Demographic, procedure and outcome data

DEMOGRAPHIC DATA	
Age	80 (± 6.69)
Male subjects	43% (38)
Body mass index	26.7 (± 4.4)
Cardiovascular risk factors	
- Hypertension	93% (82)
- Smoking / Ex-smoking	23% (20)
- Diabetes mellitus	28% (25)
- Dyslipidemia	51% (45)
Cardiovascular history	
- Previous AMI	19% (17)
- Non-cardiac arterial disease	27% (24)
- Previous TIA / Stroke	5% (4)
- Previous PCI	16% (14)
- Previous CABG	15% (13)
- Previous pacemaker	8% (7)
Other previous history	
- Kidney failure	26% (23)
- Creatinine clearance (MDRD)	53 (± 23.7)
- COPD	20% (18)
Symptoms	
- Syncope	15% (13)
- Angina	44% (39)
- Dyspnea	
FC I	3% (3)
FC II	45% (40)
FC III	41% (36)
FC IV	10% (9)
Echocardiography	
- AVA (cm2)	0.63 (± 0.15)
- Gmax (mmHg)	74.26 (± 23.33)
- GMean (mmHg)	46.43 (± 17.51)
- Vmax (m/sec)	4.2 (± 0.84)
- EF (Simpson)	64 (± 12.31)
Scores	
- Logistic EuroSCORE	13.19 (9.20 – 19.85)
- EuroSCORE II	4.23 (2.69 – 6.7)
- STS-PROM	4.02 (3 – 7.72)
- OBSERVANT score	4 (0 – 7)
PROCEDURE DATA	
Type of valve	
- Corevalve®	98.86% (87)
Femoral access	97.70% (86)
Valve in valve	5.68% (5)
Residual AoR (aortography)	
- 0 – I	89% (78)
- II	10% (9)
- III	1.14% (1)
- IV	0% (0)
Peak to peak gradient (aortography)	4 (0 – 8)
Procedure success	95% (84)
OUTCOME	
In-hospital complications	
- Cardiac tamponade	4.55% (4)
- Surgical conversion	1.14% (1)
- Complications at catheter site	
- Minor	12.5% (11)
- Major	0% (0)
- Bleeding:	
- Life threatening	4.55% (4)
- Major	2.27% (2)
- Minor	6.82% (6)
- Acute conduction alterations.	30.68% (29)
- CLBBB	25% (22)
- Complete AVB	6.82% (6)
- Permanent pacemaker	19.32%
- Ischemic stroke	1.14% (1)
- Death	4.55% (4)
Subsequent days of hospitalization	4 (3 – 6)
Global mortality at 30 days	4.55% (4)

AMI: Acute myocardial infarction. TIA: Transient ischemic attack. PCI: Percutaneous coronary intervention. CABG: Coronary artery bypass grafting. MDRD formula: Modification of Diet in Renal Disease. COPD: Chronic obstructive pulmonary disease, FC: Functional class. AVA: Aortic valve area. G(max): Peak gradient. G(mean): Mean gradient. V(max): Peak aortic jet velocity. EF: Ejection fraction. CLBBB: Complete left bundle branch block. AVB: Atrioventricular block.

Table 2. Mean value of each risk score according to mortality

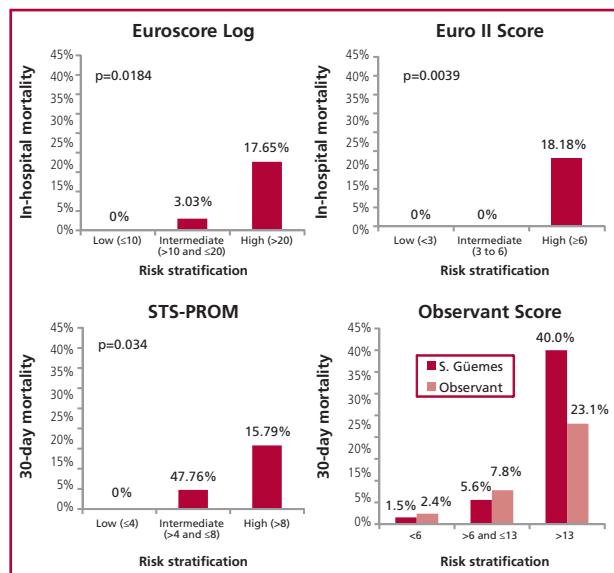| Score	Dead patients (n=4)	Live patients (n=84)	p
Logistic EuroSCORE	47.5 (± 38.8)	16 (± 11.3)	0.023
EuroSCORE II	29.9 (± 19.7)	7.28 (± 10.4)	< 0,001
STS-PROM	17.59 (± 15.73)	5.46 (± 4.1)	0.01
OBSERVANT score	13.25 (± 6.7)	4.65 (± 4.65)	0.0048

Fig. 1. In-hospital mortality according to risk stratification by logistic EuroSCORE (**A**) and EuroSCORE II (**B**). 30-Day mortality according to stratification by STS-PROM (**C**) and OBSERVANT scores (**D**). In the latter, a correlation was made between mortality found in our patient series (S. Güemes) and mortality in the original study (Observant).

subgroup or correlation analyses. It was a population at lower risk than that described in larger cohorts, mostly undergoing surgery via transfemoral access with a first-generation self-expanding valve, limiting its extrapolation to other types of patients. Still, it should be pointed out that no other analyses on this type of subjects have been carried out in our setting.

In conclusion, patients undergoing TAVI in a high-volume center in the city of Buenos Aires present a low rate of complications including in-hospital and 30-day mortality <5%. When evaluating the prognosis according to the different risk scores, we observed a significant difference with a four times higher average in the subjects who died. The use of the OBSERVANT risk score presented good correlation according to the different risk strata. We consider it necessary to carry out studies on a larger scale to confirm these results and to validate predictors of events in patients after TAVI in our country.

Conflicts of interest

None declared.

(See authors' conflicts of interest forms on the website/ Supplementary material).

Ignacio Manuel Cigalini, Ezequiel José Zaidel, Ricardo Villarreal, Marcelo Bettinotti, Álvaro Sosa Liprandi, Matías Sztejfman

Sanatorio Güemes, CABA.
Ignacio M. Cigalini
Arribeños 3230, 4to piso, departamento 10.
Ciudad Autónoma de Buenos Aires - 1429
e-mail: imcigalini@gmail.com

REFERENCES

1. Cribier A, Eltchaninoff H, Bash A, Borenstein N, Tron C, Bauer F, et al. Percutaneous transcatheter implantation of an aortic valve prosthesis for calcific aortic stenosis: first human case description. Circulation 2002;106:3006-8. http://doi.org/cv6smx

2. Kappetein AP, Head SJ, Généreux P, Piazza N, van Mieghem NM, Blackstone EH, et al. Updated standardized endpoint definitions for transcatheter aortic valve implantation: the Valve Academic Research Consortium-2 consensus document. J Am Coll Cardiol 2012;60:1438-54. http://doi.org/f2m2dn

3. Nashef SA, Roques F, Michel P, Gauducheau E, Lemeshow S, Salamon R. European system for cardiac operative risk evaluation (EuroSCORE). Eur J Cardiothorac Surg 1999;16:9-13. http://doi.org/ b9r62k

4. Nashef SA, Roques F, Sharples LD, Nilsson J, Smith C, Goldstone AR, et al. EuroSCORE II. Eur J Cardiothorac Surg 2012;41:734-44. http://doi.org/pvr

5. Shroyer AL, Coombs LP, Peterson ED, Eiken MC, DeLong ER, Chen A, et al; Society of Thoracic Surgeons. The Society of Thoracic Surgeons: 30-day operative mortality and morbidity risk models. Ann Thorac Surg 2003;75:1856-64. http://doi.org/cp46t9

6. Capodanno D, Barbanti M, Tamburino C, D'Errigo P, Ranucci M, Santoro G, et al; OBSERVANT Research Group. A simple risk tool (the OBSERVANT score) for prediction of 30-day mortality after transcatheter aortic valve replacement. Am J Cardiol 2014;113:1851-8. http://doi.org/f3hqp3

Surgical Treatment of Chagasic Cardiomyopathy

Chagas disease was discovered more than 100 years ago, and still today, in Latin America, there are 6 million people infected with Trypanosoma cruzi. Chagas disease is the cause of heart failure in 19% of Latin American immigrants with non-ischemic cardiomyopathy in the United States. Cases of chagasic cardiomyopathy are found all over the world today as there are more than 400,000 immigrants with this disease in Europe and the United States. In patients with chronic chagasic cardiomyopathy, the overall all-cause mortality rate at 1, 5, and 10 years is 12%, 35%, and 60%, respectively, and for patients with severe myocardial involvement, mortality per year is 90-100%. Ventricular arrhythmias are the most important cause of sudden death in patients with Chagas cardiomyopathy. Nonsustained ventricular tachycardia (NSVT) has been reported in 30% of patients without heart failure and 50 to 73% of patients with heart failure. Variables such as ejection fraction below 30%, age over 65 years,

and low level of education have been identified as predictors of poor prognosis. (1)

The most significant finding of chagasic cardiomyopathy is the presence of apical aneurysm in the absence of coronary heart disease, which affects 21% of patients and is highly suggestive when it appears in the presence of NSVT. Constant risk in patients with Chagas disease is thromboembolism, mainly pulmonary embolism. Strokes are also a problem that affect 11% of patients. In more than 90% of cases, the cause of sudden death is due to ventricular tachycardia, generating ventricular fibrillation. (1, 2)
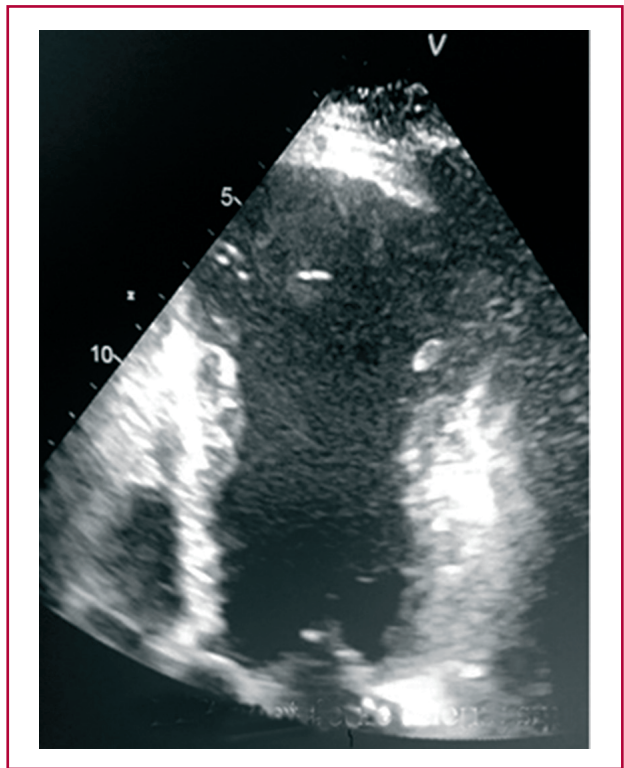
In advanced stages, significant chamber enlarge-

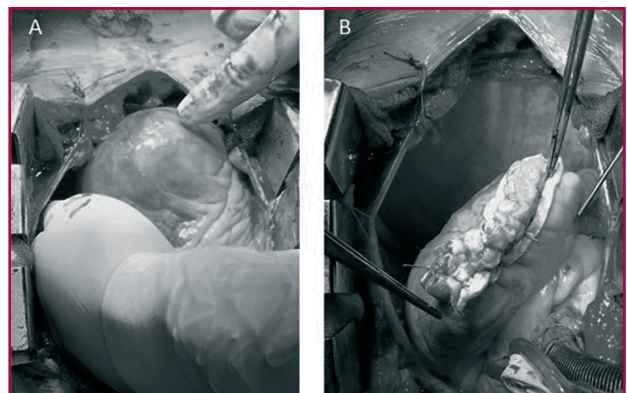**Fig. 1.** Transthoracic echocardiography

Fig. 2. Intraoperative findings. **A.** Left ventricular aneurysm. **B** Left ventricular aneurysmorrhaphy

ment with diffuse hypokinesia and mitral and tricuspid regurgitation secondary to annulus dilation, as well as ventricular aneurysms may be observed in 47-67% of cases associated with increased thromboembolic risk (apical position) and ventricular arrhythmias (inferobasal or posterolateral), identifying a group with mortality risk 2.14 times higher. (3)

A 76-year-old male patient was admitted to the emergency department with sustained monomorphic ventricular tachycardia, and history of untreated Chagas disease. During hospitalization, he repeated 4 episodes of monomorphic sustained ventricular arrhythmia, requiring cardioversion only on 2 occasions and then reverting with i.v. amiodarone. Transthotacic echocardiography (TTE) revealed a large left ventricular (LV) aneurysm (Fig. 1) with marked wall hypomotility, good global ventricular function, and no valve disease. Coronary angiography was normal. Due to the patient's context and inaccessibility to periodic medical check-ups which would hampper medical treatment, surgery was indicated: aneurysmectomy with extraction of abundant clots from the left ventricle plus endoaneurysmorrhaphy with beating-heart technique (Fig. 2 A - B). It was decided not to place a pericardial patch after volumetric LV measurement by TTE. The patient had a postoperative course of 5 days and was discharged without complications and without anticoagulation. Four months later, the patient did not repeat the arrhythmic episode. Postoperative TTE is shown in Video 1 together with the surgical technique used.

Few significant advances in left ventricular aneurysm surgery have occurred since Cooley reported the first open resection in 1958, and later Jatene and Dor proposed a new repair in 1980. The aneurysm is approached by a 2-cm incision from the anterior descending artery. Apical aneurysm in Chagas disease is a very peculiar abnormality of the left ventricular apex, which is much less frequently observed in the right ventricle. Apical thrombosis has been found in 25% of cases. Unlike myocardial infarction -which leaves a scar on the endocardium- in chagasic heart disease, we can only see a thickened endocardium. Clinical management includes anticoagulation and possibly aneurysmectomy, which is also used in the treatment of complex LV arrhythmias in selected cases. Carrasco et al. studied the presence of ventricular arrhythmias in 172 patients, concluding that they significantly increase mortality in patients with ejection fraction below 30%. (4, 5)

Our case represents a common pathology in our population, but with a rare presentation manifesting LV aneurysm with multiple thrombi and good ventricular function in the absence of cerebrovascular events. It was resolved surgically with very good results, and we recommend its use for similar cases.

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

Videos are available at:
https://youtu.be/cwka-fTBCnA

Ernesto Bravo [1], Germán J. Chaud [1], Fernando Moll [1], Edgar Aguilar [2], Víctor Yunes, Carlos Manfredi

[1] Cardiovascular Surgery Department, Clínica Yunes
Santiago del Estero, Argentina, 2018
[2] Cardiovascular Intensive Care Unit, Clínica Yunes,
Santiago del Estero, Argentina, 2018
Germán J. Chaud. Department of Cardiovascular Surgery Clínica Yunes,
Santiago del Estero. Arsenio Salazar 1134. 4200
Santiago del Estero, Argentina.
E-mail: germanchaud@gmail.com

REFERENCES
1. Bocchi EA, Bestetti RB, Scanavacca MI, Cunha Neto E, Issa VS. Chronic Chagas Heart Disease Management: From Etiology to Cardiomyopathy Treatment. J Am Coll Cardiol 2017;70:1510-24. http://doi.org/gbw3w8
2. Gori M, Iacovoni A, Senni M. Haemodynamics of Heart Failure With Preserved Ejection Fraction: A Clinical Perspective. Card Fail Rev. 2016;2:102-5. http://doi.org/czkv
3. Andrade JP de, Marin Neto JA, Paola AA de, Vilas-Boas F, Oliveira GM, Bacal F, et al. I Diretriz Latino-Americana para o diagnóstico e tratamento da cardiopatia chagásica: resumo executivo. Arq Bras Cardiol [Internet]. 2011;96:434-42. http://doi.org/cpz8ns
4. Nogueira EA, Ueti OM, Vieira WR. The apical ventricular lesion in Chagas' heart disease. Sao Paulo Med J 1995;113:785-90. http://doi.org/c4xdzw
5. Rassi A, Rassi SG. Predictors of mortality in chronic Chagas disease: A systematic review of observational studies. Circulation. 2007;115:1101-8. http://doi.org/fkvqf4

Takotsubo Syndrome in Postoperative Mitral Valve Repair

We describe the case of a 43-year-old female patient who progressed to severe heart failure after cardiotomy secondary to Takotsubo syndrome. This entity presents low frequency of occurrence in the postoperative period after cardiovascular surgery, and induces a variable degree of transient left ventricular dysfunction and low cardiac output syndrome whose extreme form of presentation is cardiogenic shock.

The patient had history of severe mitral valve regurgitation (MVR) secondary to infective endocarditis in 2010, chronic atrial fibrillation (AF) under anticoagulant therapy, and several hospitalizations due to heart failure. She was referred to our center for valve surgery. The patient was admitted to the Coronary Care Unit with congestive heart failure, functional class IV dyspnea, clinical signs of right heart and pulmonary congestion, displaced apex beat, and holosystolic murmur with presence of R3. The admission electrocardiogram (ECG) showed AF rhythm with moderate ventricular response, electrical axis at - 30º

and indirect signs of left ventricular hypertrophy. Anteroposterior chest X-ray revealed increased cardiothoracic ratio, and left fourth arch and hilar congestion with redistribution of vascular flow towards the lung apices. Evaluation was completed with color Doppler ultrasonography, which showed slightly enlarged left ventricle (diastolic and systolic diameter 60 mm and 34 mm, respectively), with preserved wall thickening, without regional asynergy, ejection fraction (EF) 57% by Simpson method, and severely enlarged left atrium (55 cm2) with mega-appendage. Mitral valve regurgitation was severe by multiple mechanisms: dilated annulus, flail P1scallop of the posterior leaflet, and two regurgitant jets due to partial rupture of the anterior leaflet A2 scallop. Backflow in the pulmonary veins, and mitral antegrade hyperflow were also present. Effective regurgitant orifice area was 70 mm2 and the estimated pulmonary systolic pressure reached 50 mmHg. Transesophageal echocardiography (TEE) was also performed, which showed atrial appendage free of thrombi.

A Swan-Ganz catheter was placed for preoperative adjusted therapy, which was consistent with post-capillary pulmonary hypertension (mean pulmonary artery pressure [mPAP] 33 mmHg, pulmonary wedge pressure [PWP] 20 mm Hg, pulmonary resistances [PR] 2.8 Wood units [WU]) with preserved cardiac output [CO] 4.5 L/min, and cardiac index [CI] 3.1 l/min/m2). Vasodilators and diuretics were administered with adequate response (mPAP 20 mm Hg, PWP 12 mm Hg, PR 1.7 WU). Pre-surgical coronary angiography (CAG) was also performed, showing no significant lesions.

On the fourth day of hospitalization, complex mitral valve repair and atrial fibrillation ablation (Maze IV procedure) was performed with extracorporeal circulation time (ECC) of 142 minutes and aortic clamping time of 105 minutes. Intraoperative course was satisfactory and without complications, and follow-up echocardiography showed mild residual mitral regurgitation with good biventricular function. (Figure 1A)

The patient was admitted in the Coronary Care Unit under mechanical ventilation and low-dose vasopressors. Postoperative ECG showed AF rhythm with controlled response, electrical axis –30, without acute changes. (Figure 1B)

Six hours after surgery, the patient progressed to cardiogenic shock, so inotropic and vasopressor support was initiated up to maximum doses (milrinone 0.7 ug/kg/min and noradrenaline 0.3 ug/kg/min). The patient presented recurrent supraventricular tachycardia, requiring electrical cardioversion on 3 occasions. The ECG showed absence of R wave in right precordial leads, and right axis deviation. (Figure 2A) A color Doppler ultrasonography showed severe impairment of systolic function (EF 15%) with ballooning of middle and apical segments and basal hypercontractility, enlarged right ventricle with moderate impairment of systolic function, and mild residual MVR. (Figura 2B) From a
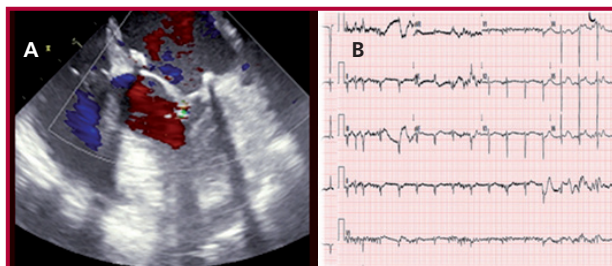

Fig. 1. A. Transesophageal echocardiography at 30 degrees, revealing excluded appendage with minimal remnant, post-repair mitral valve with normal functioning and mild regurgitation.
B. Immediate postoperative ECG: AF rhythm with moderate ventricular response, electrical axis at - 30° and indirect signs of left ventricular hypertrophy.
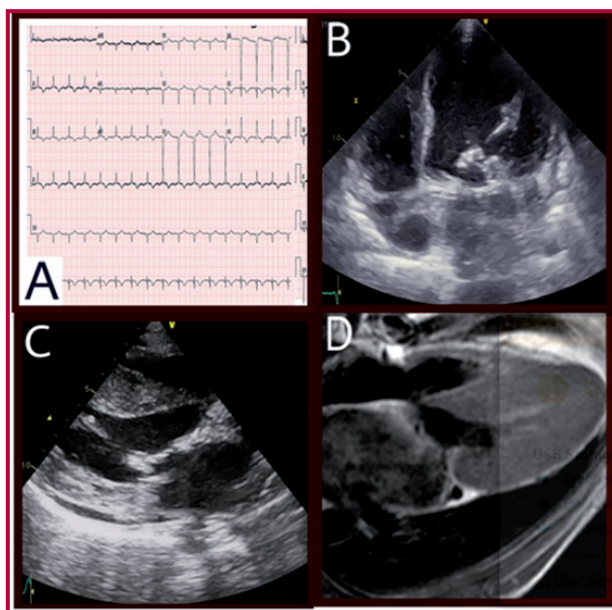

Fig. 2. A. Postoperative ECG at 6 hours: Supraventricular rhythm with absence of R wave in right precordial leads, and right axis deviation. **B.** Three-chamber view showing enlarged left ventricle with apical akinesia and hypercontractility of basal segments consistent with takotsubo syndrome. **C.** Long axis parasternal view showing increased LV wall thickening. Good biventricular function. **D.** Cardiac magnetic resonance imaging showing 4-chamber view in cine sequence where preserved volumes of left atrium and left ventricle are observed, without mitral regurgitation, and preserved ejection fraction. Increased wall thickening consistent with edema.

biochemical point of view, the patient presented signs of tissue hypoperfusion with hyperlactacidemia metabolic acidosis (lactic acid 7 mmol/L), central venous saturation of 45% and delta pCO2 of 10 mmHg. In this context, a Swan-Ganz catheter was placed with hemodynamic parameters consistent with cardiogenic shock (CI 1.8 L/min/m2, systemic resistance 1500 dynes, PR 240 dynes, left ventricular work index 16 g . m /

m2, right ventricular work index 5 g . m /m2, PWP 24 mmHg, and left atrial pressure 12 mmHg).

Despite vasopressor and inotropic support, the patient persisted with signs of tissue hypoperfusion and liver (duplication of transaminase dosage) and renal function worsening (creatinine 3 mg/dl). Within the first 12 postoperative hours, the patient progressed to stage 2, equivalent to INTERMACS Scale (Interagency Registry for Mechanically Assisted Circulatory Support for the classification of patients with advanced heart failure), described as a patient with intravenous inotropic support and acceptable blood pressure values, but with rapid deterioration of renal function, nutritional status or signs of congestion.

The need for short-term ventricular assist device was discussed with the HEART TEAM. With a postoperative echocardiography showing no increased interventricular gradient or significant residual MVR, (1) it was decided to perform intra-aortic balloon counterpulsation (IABC) 1:1 with maximum augmentation as a bridge to recovery versus greater ventricular assistance according to patient evolution.

After 48 hours of pharmacological and mechanical support, the patient evolved with improvement of hemodynamic, biochemical, tissue and biventricular function parameters, achieving IABC weaning.

Twenty-four hours after removing the circulatory support, the patient was definitely withdrawn from mechanical ventilation, with vasopressor reduction and levosimedan infusion as a bridge to weaning off milrinone. Anti-remodeling medication titration was started.

At 7 postoperative days, the echocardiography showed good biventricular function with no hypertension or significant valve disease.

The patient was discharged 15 days after surgery in outpatient follow-up. She coursed asymptomatic. Follow-up ECG showed sinus rhythm, good R-wave progression in precordial leads, with symmetrical negative T-waves. A new echocardiography evidenced ejection fraction of 65% with reduced longitudinal systolic strain -10%, and moderate increase of concentric wall thickening. The assessment was completed with a cardiac magnetic resonance imaging that showed ejection fraction of 75 %, increased wall thickening secondary to wall edema with negative delayed enhancement. (Figure 2D) This is a case of cardiogenic shock secondary to Takotsubo syndrome in the immediate postoperative period of mitral valve surgery. Cardiogenic shock is one of the main causes of death after cardiac surgery. Takotsubo syndrome is a rare entity after this type of cardiac surgery. There are four previous cases reported in the literature. (2, 5) There is no clear cause for the etiology of this syndrome.

The excessive accumulation of both endogenous and exogenous catecholamines, associated with coronary microcirculatory dysfunction and coronary spasm, is postulated as a hypothesis. (6)

We emphasize the importance of a correct differential diagnosis among the first causes of post-cardiotomy cardiogenic shock, such as postoperative acute myocardial infarction, poor protection in ECC by ischemia/reperfusion mechanism, coronary or air embolism and vascular thrombosis.

In our case, the clinical, electrocardiographic, and echocardiographic findings were consistent with Takotsubo syndrome. The favorable course towards recovery of ventricular function is another point when considering that the cause of cardiogenic shock was a Takotsubo syndrome, and suspecting that pre and post-surgical stress was the cause of increased release of catecholamines.

Conflicts of interest
None declared.

(See authors' conflicts of interest forms on the website/ Supplementary material).

Videos are available at: https://youtu.be/C8OHEAVV1I0

**Eliana G. Ortis, Sofía Krause,
Guillermo S. Gutiérrez, José C. Santucci,
Sergio Baratta, Guillermo N. Vaccarino**
Hospital Universitario Austral
sofia.krause@gmail.com

REFERENCES
1. Lyon AR, Bossone E, Schneider B, Sechtem U, Citro R, Underwood SR, et al. Current state of knowledge on Takotsubo syndrome: a Position Statement from the Taskforce on Takotsubo Syndrome of the Heart Failure Association of the European Society of Cardiology. Eur J Heart Fail 2016;18:8-27. http://doi.org/f3m2s8
2. Blázquez JA, González JM, Dalmau MJ, López J. Takotsubo cardiomyopathy after elective mitral valve replacement. Interact Cardiovas Thorac Surg 2010;11:117-9. http://doi.org/cj66wt
3. Gariboldi V, Jop B, Grisoli D, Jaussaud N, Kerbaul F, Collart F. Takotsubo syndrome after mitral valve replacement for acute endocarditis. Ann Thorac Surg 2011;91:e31-2. http://doi.org/cxpfrj
4. Kogan A, Ghosh P, Schwammenthal E, Raanani E. Takotsubo syndrome after cardiac surgery. Ann Thorac Surg 2008;85:1439-41. http://doi.org/cm7j3b
5. Date K, Kaneko T, Edure M, Sato Y, Hasegawa Y, Okada S, et al. Thoracoabdominal aortic aneurysm repair in a patient with a left ventricular assist device. Ann Thorac Surg 2014;97:1778-81.
6. Ghadri JR, Wittstein IS, Prasad A, Sharkey S, Dote K, Akashi YJ, et al. International Expert Consensus Document on Takotsubo Syndrome (Part I): clinical Characteristics, Diagnostic Criteria, and Pathophysiology. Eur Heart J 2018; 39: 2032-46.