Medimay Electronic Journal 2026; Volume 33:e2797
ISSN: 2520-9078 RNPS: 2441 RNSW A1269

ORIGINAL ARTICLE

Características clínicas y epidemiológicas de pacientes operados de sustitución valvular aórtica y mitral

Clinical and epidemiological characteristics of patients operated on aortic and mitral valve replacement

[I]M. Sc. Yuliet González Nieves, [I]Dr. C. Lodixi Cobas Planchez, [I]Dr. Luis Reinaldo Suárez Fleitas, [I] M. Sc. Gleidys Dunia Solano González

[I] Hermanos Ameijeiras Clinical Surgical Hospital. La Habana. Cuba.

Cite as: González Nieves Y, Cobas Planchez L, Suárez Fleitas LR, Solano González GD. Clinical and epidemiological characteristics of patients operated on aortic and mitral valve replacement. Medimay [Internet]. 2026 [cited: citation date];33:e2797. Available at: https://medimay.sld.cu/index.php/rcmh/article/view/2797

RESUMEN

Introducción: Las enfermedades de las válvulas cardíacas tienen un impacto significativo en esta cirugía. En la actualidad la etiología degenerativa presenta marcada incidencia. **Objetivo:** Caracterizar desde la clínica y epidemiología a los pacientes con sustitución valvular aórtica y mitral. **Métodos:** Se realizó un estudio observacional descriptivo y retrospectivo, en operados de sustitución valvular mitral y aórtica, de enero de 2018 a enero de 2022, en el Hospital Clínico Quirúrgico Hermanos Ameijeira. El universo estuvo constituido por 142 pacientes, la muestra se seleccionó por un muestreo no probabilístico, por conveniencia; quedo conformada por 93 operados. Las variables estudiadas fueron: edad, sexo, índice de masa corporal, comorbilidades, tasa de filtrado glomerular, etiología, tiempo quirúrgico, tiempo de circulación extracorpórea, complicaciones. **Resultados:** La media de edad de los pacientes fue de 60.6 ± 10.4 años, predominaron las féminas en el 50.5 %. El 60.2 % de los pacientes presentó una tasa de filtrado glomerular disminuida, antes del proceder quirúrgico, al 66.7 % de los pacientes se le diagnosticó estenosis aórtica y la etiología degenerativa sobresalió en el 59.1 %, p=0.00 y más en la enfermedad de la válvula aórtica. El 68.8 % tuvieron hipertensión arterial, como riesgo aterogénicos. La media de los tiempos quirúrgicos fue de 4.6 ± 0.9 horas y el 83.9 % presentaron complicaciones. **Conclusiones:** Los pacientes operados de sustitución valvular aórtica y mitral son adultos mayores, predomina el sexo femenino, con una elevada frecuencia de sobrepeso y obesidad. La etiología degenerativa prevalece, de forma especial en la válvula aórtica

ABSTRACT

Introduction: Cardiovascular diseases are one of the leading causes of death worldwide, and heart valve disorders have a significant impact on cardiac surgery. Currently, degenerative etiology shows a marked incidence. **Objective:** To characterize patients undergoing aortic and mitral valve replacement surgery. **Methods:** An observational, descriptive, and retrospective study was conducted in patients undergoing mitral and aortic valve replacement surgery between January 2018 and January 2022 at the Hermanos Ameijeiras Clinical Surgical Hospital. The study sample consisted of 93 patients. The variables studied were: age, sex, body mass index, comorbidities, glomerular filtration rate, etiology, surgical time, cardiopulmonary bypass time, and complications. **Results:** The mean age was 60.6 ± 10.4 years, with a predominance of females (50.5 %). A decreased glomerular filtration rate before the surgical procedure was observed in 60.2% of patients; 66.7 % of patients were diagnosed with aortic stenosis, and degenerative etiology was predominant at 59.1% (p=0.00), especially in aortic valve disease. Hypertension was found in 64 patients (68.8 %) as an atherogenic risk factor. The mean surgical time was 4.6 ± 0.9 hours. Complications occurred in 78 patients (83.9 %). **Conclusions:** Patients undergoing aortic and mitral valve replacement are older adults, predominantly female, with a high prevalence of overweight and obesity. Degenerative etiology predominates, particularly in the aortic valve.

Received: 07/09/2025 | | **Accepted:** 05/21/2026 | | **Published:** 09/20/2026

Palabras clave: riesgos, complicaciones , implantación de prótesis , enfermedad de la válvula aórtica, enfermedades cardiovasculares; comorbilidad
Descriptores: factores de riesgo; complicaciones posoperatorias; implantación de prótesis de válvulas cardíacas; enfermedad de la válvula aórtica; cardiología; comorbilidad

Keyword: risk factors, postoperative complications, implantation of heart valve prostheses, aortic valve disease, cardiovascular diseases, comorbidity
Descriptors: risk factors; postoperative complications; heart valve prosthesis implantation; aortic valve disease; cardiology; comorbidity

INTRODUCTION

Cardiovascular diseases are known to be one of the leading causes of death worldwide, and heart valve disorders have a significant impact on cardiac surgery. The treatment of this condition is undergoing notable changes globally. Currently, degenerative etiology shows a marked incidence, with calcific aortic stenosis and mitral regurgitation being its greatest expression. Population aging makes this a health problem in the elderly. [1]

Aortic valve disease accounts for 61 % of deaths from heart valve disease, while mitral valve disease accounts for 15 %. Aortic stenosis is the most common valvular heart disease in developed countries, affecting 9 million people worldwide, and mitral regurgitation affects 24 million people, with large differences between countries; secondary mitral regurgitation accounts for 65% of cases.[2]

The number of valve interventions in Spain increased exponentially from 16,363 between 1998 and 2002, reaching 22,685 between 2013 and 2017. In 2020, during the pandemic, a total of 8,375 operations were reported, and between 2022 and 2023, a total of 10,852 interventions were reported with an observed mortality rate of 6.4 %.[3,4]

The AGES-Reykjavík study,[5] initiated in 1967 in Iceland, had already demonstrated by 2014 that, due to population aging in the coming decades, heart valve disease in people aged ≥70 years will have multiplied by 2.4 by 2040 and will triple by 2060, thus constituting a major health problem.

In the Americas region, the Carlos Alberto Peschiera Carrillo National Cardiovascular Institute[6] in Peru reported 503 cardiac surgeries in 2022, of which 136 were aortic or mitral valve replacements, with a mortality rate of 4.5 %. Cuba reports a total of 665 deaths from heart valve disease between 2022 and 2023, for a rate of 6.5 per 100,000 inhabitants.[7]

Cardiac surgery is recognized as an integral part of the national healthcare system. However, the Global Initiative for Cardiac Surgery points out that nearly 6 billion people worldwide lack access to safe, high-quality cardiac care.[8]

Cuba concentrates cardiovascular surgery in highly specialized centers, which allows for better resource management and high quality care standards, given the complexity of this type of surgery. The Hermanos Ameijeiras Clinical Surgical Hospital is a referral center for the treatment of cardiovascular diseases.

Despite the measures and protocols in place, the number of patients with a confirmed diagnosis of heart valve disease is increasing significantly. Therefore, being aware of surgical needs in advance allows us to design health strategies to mitigate the problem of heart valve diseases. The lack of local research and the impact on morbidity and mortality motivated the conduct of this study, with the objective of characterizing patients undergoing aortic and mitral valve replacement surgery.

METHODS

An observational, descriptive, and retrospective study was conducted in patients who underwent mitral and aortic valve replacement surgery, during the period from January 2018 to January 2022, at the Cardiovascular Surgery Service of the Hermanos Ameijeiras Clinical Surgical Hospital.

From a universe of 142 patients, 49 were excluded, and the study sample[9] was composed of 93 patients.

Study variables
-Age: completed years, according to the patient's date of birth, as recorded on their identity document.
-Sex: referring to biological sex, defined as Female or Male.
-Body Mass Index (BMI): determined by the formula: BMI = weight in kg / (height in m)², expressed in kg/m² (Underweight: BMI ≤ 18.5

kg/m²; Normal weight: BMI 18.6–24.9 kg/m²; Overweight: BMI 25–29.9 kg/m²; Obese: BMI ≥ 30 kg/m²).[10]

-Comorbidities: defined according to the presence (yes/no) of the following: chronic kidney disease, previous stroke, ischemic heart disease, ventricular dysfunction documented by echocardiography, permanent atrial fibrillation, pulmonary hypertension, extracardiac arteriopathy, anemia, and dyslipidemia.

-Atherogenic risk factors (ARF) considered in the study included the following: arterial hypertension, diabetes mellitus, dyslipidemia, obesity, overweight, smoking, age over 60 years, decreased glomerular filtration rate, and male sex.

-Low glomerular filtration rate (GFR) (yes/no): considered when the calculated filtration rate was ≤ 89 ml/min. The formula applied was the CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration, 2021).[11]

-Left ventricular ejection fraction (LVEF): assessed using the results of the postoperative echocardiogram, performed 72 hours after the procedure, using methods already described. LVEF ≥ 50% was considered preserved function, LVEF 35–49 % moderate dysfunction, and LVEF ≤ 34% severe dysfunction.[12]

-Etiology: four etiologies were considered: degenerative, rheumatic, myxomatous, and congenital. These were defined based on the patient's medical history and the characteristics of the valvular apparatus described in the preoperative echocardiogram.

-Surgical time (ST): defined as the time from the start of the skin incision in the operating room until the completion of surgery with the final suture on the chest. It was considered adequate when ≤ 4 hours, prolonged when > 4 hours and < 6 hours, and very long when ≥ 6 hours.[13]

-Anoxic cardiac arrest time: total induced aortic cross-clamp time (ischemia time) during the surgical procedure, expressed in minutes. It was considered prolonged when > 60 minutes.[14]

-Cardiopulmonary bypass time: total time on the heart-lung machine, expressed in minutes. It was considered prolonged when > 120 minutes.[13,14]

-Complications (yes/no): the following were considered: low cardiac output, new-onset atrial fibrillation, cardiac rhythm disorders or atrioventricular conduction disturbances, infections, bleeding, pericardial effusion, renal dysfunction, gastrointestinal disorders, respiratory disorders, and anemia.

-Postoperative death (yes/no): defined as the patient's death occurring during the period from surgery until hospital discharge, due to any cause.

-Heart failure (yes/no): signs and symptoms of heart failure occurring after 30 days following cardiac surgery, with reduced LVEF documented by echocardiography.

-Perioperative myocardial infarction (yes/no): determined according to the diagnosis recorded in the medical record, taking into account the presence of perioperative ischemia and elevated troponins. Perioperative ischemia was defined as new hemodynamic, electrical, and echocardiographic alterations appearing after the procedure.

-New stroke (yes/no): considered upon the appearance of new neurological signs and symptoms, both motor and sensory, lasting more than 24 hours, documented by clinical examination and imaging studies such as brain CT performed 24 hours after the event.

-Reoperation for any cause (yes/no): considered when there was a need to return to the operating room for a new surgical intervention, regardless of the cause.

The data obtained were processed using the statistical software packages MINITAB 16.0 and MEDCAL for Windows. The simple counting method and the Chi-square (χ^2) test were used to establish the association between this type of variables, with data expressed as absolute numbers and percentages.

The study was conducted in accordance with international ethical recommendations for this type of research involving human subjects. An informed consent form was prepared and provided to the patients, ensuring full confidentiality of all information requested for this investigation.[15]

RESULTS

The mean age was 60.6 ± 10.4 years, with a predominance of females (50.5 %). The mean BMI was 27.3 ± 4.8 kg/m²; patients were classified as overweight/obese, representing 45.2 % and 26.9 %, respectively (p = 0.00). A decreased glomerular filtration rate before the surgical procedure was present in 60.2 % of patients, while 83.9 % had a preserved left ventricular ejection fraction.

Aortic stenosis was diagnosed in 66.7 % of patients, and degenerative etiology was predominant, accounting for 59.1 % (p=0.00). Atrial fibrillation and pulmonary hypertension were observed in 17.2 % and

30.1 % of patients, respectively, in table 1.

Table 1. Distribution of patients according to clinical, sociodemographic, and anthropometric characteristics

Characteristics	No. (%) n=93		p
Age in years (mean ± SD)	60.6 ± 10.4		
Sex			
Male	46	49.5	1.00
Female	47	50.5	
Nutritional status according to BMI			
BMI (mean ± SD; kg/m²) | 27.3 ± 4.8	27.3 ± 4.8		
Underweight	3	3.2	0.00*
Normal weight	23	24.7	
Overweight	42	45.2	
Obese	25	26.9	
Comorbidities			
Yes	31	33.3	0.00
No	62	66.7	
Preoperative corrected glomerular filtration rate			
Normal	37	39.8	0.06
Decreased	56	60.2	
Previous LVEF			
Normal	78	83.9	0.00*
Moderately decreased	9	9.7	
Severely decreased	6	6.5	
Affected valve that prompted the intervention			
Aortic stenosis	62	66.7	0.00*
Aortic regurgitation	4	4.3	
Mitral stenosis	7	7.5	
Mitral regurgitation	20	21.5	
Previous atrial fibrillation			
Yes	16	17.2	0.00
No	77	82.8	
Pulmonary hypertension			
Yes	28	30.1	0.00
No	65	69.9	

p: Chi-square test (χ^2) without continuity correction
*: Chi-square test (χ^2) with continuity correction
LVEF: left ventricular ejection fraction

Regarding the etiology of valvular heart disease, degenerative etiology predominated in patients with aortic valve disease, accounting for 59.1 % (p = 0.00). In patients with mitral valve disease, myxomatous etiology predominated, accounting for 40.7 %, table 2.

Table 2. Distribution of patients according to etiology and type of affected valve

Ethiology	Aortic		Mitral		Total		p
	No.	%	No.	%	No.	%	
Degenerative	49	74.2	6	22.2	55	59.1	0.00
Rheumatic	4	6.1	10	37.0	14	15.1	0.18
Myxomatous	0	0.0	11	40.7	11	11.8	-
Congenital	13	19.7	0	0.0	13	14.0	-
Total	66	100	27	100	93	100	0.00

p: Chi-square test (χ^2) without continuity correction

Among the atherogenic risk factors, arterial hypertension was 68.8 %, followed by decreased glomerular filtration rate in 56 patients in 60.2 %. Of the patients, 53.8 % were aged 60 years or older, 49.5 % were male, and 45.2 % were overweight. Dyslipidemia was present in 38.7% and smoking in 29.3 %, table 3.

Table 3. Distribution of patients according to atherogenic risk factors

Atherogenic risk factors	No.	%
Arterial hypertension	64	68.8
Diabetes mellitus	11	11.8
Dyslipidemia	36	38.7
Overweight	42	45.2
Obesitty	25	26.9
Smoking	27	29.3
Age over 60 years	50	53.8
Decreased glomerular filtration rate	56	60.2
Male sex	46	49.5

The average surgical time was 4.6 ± 0.9 hours. Prolonged surgical time was observed in 59.1% of the surgeries. The average induced anoxic arrest time was 60.6 ± 10.4 minutes, being prolonged (> 60 minutes) in 74.2% of cases (p = 0.00).

The average cardiopulmonary bypass (CPB) time during the surgical procedure was 110.6 ± 40.4 minutes, and it was normal (< 120 minutes) in 69.9% of interventions (p = 0.00), table 4.

Table 4. Distribution of patients according to intraoperative characteristics

Intraoperative characteristics	No.	%	p
Surgical time (hours) (mean)	4.6 ± 0.9		-
Short: 4 hours or less	38	40.9	0.09
Prolonged: more than 4 hours	55	59.1	
Induced anoxic arrest time (minutes) (mean)	60.6 ± 10.4		-
Normal: 60 minutes or less	24	25.8	0.00
Prolonged: more than 60 minutes	69	74.2	
CPB time (minutes) (mean)	110.6 ± 40.4		-
Normal: 120 minutes or less	65	69.9	0.00
Prolonged: more than 120 minutes	28	30.1	

CPB: cardiopulmonary bypass p: Chi-square test (χ^2) without continuity correction
*: Chisquare test (χ^2) with continuity correction

Complications occurred in 83.9 %, while 16.1 % of patients had no complications (p = 0.00). Regarding major adverse events, congestive heart failure predominated in 15.1 %, followed by reoperation in 14 % and mortality in 10.8 %. Perioperative infarction and cerebrovascular accident occurred in 3.2 % of operated patients (p = 0.01), table 5.

Table 5. Distribution of patients in the postoperative period according to complications and major adverse events

Complications	No.	%	p
Si	78	83.9	0.00
No	15	16.1	
Major adverse events			
Mortaliity	10	10.8	0.01*
Congestive heart failure	14	15.1	
Perioperative infarction	3	3.2	
Cerebrovascular accident	3	3.2	
Reoperation	13	14.0	

p: Chi-square test (χ^2) without continuity correction
*Chi-square test (χ^2) with continuity correction

DISCUSSION

The mean age of the cohort, 60.6 ± 10.4 years, reflects an aging population, consistent with global trends where age-related valvular degeneration is the main etiology of valvular heart disease in developed countries.[1] This finding contrasts with the reality of low-and middle-income nations, where rheumatic fever remains the dominant cause in young adults, as evidenced by the REMEDY study in 14 African and Asian countries, where 68 % of patients with mitral valvular disease were under 50 years of age.[16]

Cuba exhibits an unusual epidemiological transition: although the control of streptococcal infections has reduced rheumatic etiology (15.1 %), the persistence of congenital causes (14 %) and limited access to early diagnosis in rural areas reflect remaining challenges. The transition toward degenerative etiologies (59.1 % in aortic valves) suggests an epidemiological profile similar to that of Europe and North America, linked to increased life expectancy (81 years in 2023).[17]

The equitable sex distribution (50.5 % female) contradicts international reports of a higher male prevalence in aortic stenosis. This particularity could be explained by the high burden of obesity (26.9 %) and dyslipidemia (38.7 %) in Cuban women, factors that accelerate valvular degeneration.[18,19] The collective overweight status (mean BMI: 27.3 kg/m²; 45.2 % overweight, 26.9 % obese) underscores a regional crisis: 62 % of Latin American adults are overweight.[20] It is urgent to integrate preoperative nutritional programs, as recommended by European guidelines,[1] to reduce complications such as wound infections and prosthetic dysfunction.

Present in more than half of the of cases a low glomerular filtrationthis triples the risk of postoperative mortality.[21] In Cuba, where 10 % of adults suffer from chronic kidney disease,[7,17] protocols for optimized hydration and nephrotoxicity monitoring are required. Preliminary correlations ($r = 0.34$; $p < 0.05$) suggest that prolonged cardiopulmonary bypass (CPB) times aggravate renal ischemia, a finding that demands studies using logistic regression models.[22]

Regarding cardiac function, 83.9 % of patients showed preserved left ventricular ejection fraction (LVEF ≥ 50 %), a factor associated with better surgical outcomes in severe aortic stenosis.[23,24] However, 30.1 % presented with pulmonary hypertension (PH), a condition with postoperative mortality of 20–30% according to records from the Society of Thoracic Surgeons.[25]

PH in this study exceeded the prevalence reported in Europe (15-20 %), which could be related to delays in surgical referral of patients with chronic mitral regurgitation, where right ventricular remodeling is progressive. This finding supports the implementation of periodic echocardiography in asymptomatic patients with valvular heart disease, as proposed by the 2022 ACC/AHA guidelines.[26,27]

Myxomatous etiology (40.7 % of mitral valvulopathies) reflects the Cuban epidemiological transition, similar to that of the USA,[28] possibly enhanced by diagnostic improvements (3D echocardiography).[29,30] However, surgical times exceeded international standards. Nevertheless, the absence of patients with endocarditis (excluded by the study criteria) limits a complete understanding of the etiological spectrum, a bias that future studies should correct by including more diverse populations.

The prolonged surgical times (>4 hours in 59.1 % of cases) and anoxic cardiac arrest >60 minutes (74.2 %) exceed the standards of the Society of Thoracic Surgeons (STS), which recommend less than 120 minutes of CPB and 60 minutes of ischemia.[13,14,31] Every additional 10 minutes of CPB time increases the risk of low cardiac output syndrome by 8 %, according to a meta-analysis published by researchers.[32] In the present study, 30.1 % of surgeries exceeded 120 minutes of CPB, correlating with complications such as heart failure and reoperations.

These results point to the need to adopt minimally invasive techniques, such as partial sternotomy or robotic surgery, which reduce ischemia times by 25 % according to European trials.[33] Furthermore, the use of novel cardioplegic solutions such as del Nido cardioplegia could mitigate reperfusion injury, a strategy that has been validated.[34]

The postoperative mortality rate of 10.8 % exceeds that reported in contemporary registries (3-5 % for isolated replacements).[6] This discrepancy could be explained by the high prevalence of comorbidities: 68.8 % of patients had a history of arterial hypertension, 60.2 % had decreased GFR, and 33.3 % had multiple comorbidities. In comparison, the Euro Heart Survey study showed that patients with ≥3

comorbidities have an adjusted mortality of 12.4 %, close to that presented by the patients in the present study.[35] Furthermore, the exclusion of combined surgeries may have selected a higher-risk population, since these procedures are usually performed in younger patients with physiological reserve.

The reintervention rate is higher than the international average (5-10 %), which could be attributed to technical and biological factors. In myxomatous mitral valves, repair instead of replacement offers better long-term results, with reintervention rates of 3 % at 10 years.[35,36] However, repair requires advanced surgical experience and depends on specialized training programs. Additionally,[28] the use of annuloplasty with semi-rigid rings instead of mechanical prostheses could reduce thrombotic risk in patients with atrial fibrillation (17.2 % of the cohort).[13,24]

Neurological complications, such as cerebrovascular disease, although less frequent (3.2 %), have devastating consequences on quality of life. Air or particulate embolism during CPB is responsible for 60 % of intraoperative strokes. Technologies such as transcranial Doppler (TCD) embolus monitoring systems allow real-time detection of microemboli, adjusting CPB flow to minimize risks.[37]

Cuba faces a unique epidemiological transition where degenerative diseases coexist with conditions typical of underdevelopment. The optimization of preoperative strategies (nutritional management, renal screening), together with surgical innovations (minimally invasive techniques, advanced cardioplegia), are crucial to improve outcomes in a population with a high burden of comorbidities. These findings provide an analytical model for countries undergoing accelerated epidemiological transition.

Among the limitations of the study and future directions, the single-center design and small sample size limit generalization. The exclusion of emergent and combined surgeries could underestimate the real complexity. Future multicenter studies should:
-Include diverse populations (endocarditis, emergencies).
-Validate correlations between renal dysfunction and CPB times.
-Evaluate the impact of minimally invasive techniques in resource-limited settings.

It is concluded that patients undergoing aortic and mitral valve replacement are older adults, predominantly female, with a high prevalence of overweight and obesity. Degenerative etiology is particularly prevalent in the aortic valve. Arterial hypertension, reduced glomerular filtration rate, and age over 60 years are the most frequent atherogenic risk factors. Postoperative complications occur in a significant group of patients, reflecting a complex surgical population with a dual epidemiological profile.

BIBLIOGRAPHIC REFERENCES

1.Vahanian A, Beyersdorf F, Praz F, Milojevic M, Baldus S, Bauersachs J, et al. Guía ESC/EACTS 2021 sobre el diagnóstico y tratamiento de las valvulopatías. Rev Española Cardiol. 2022;75(6):524.e1-524.e69. doi: http://dx.doi.org/10.1016/j.recesp.2021.11.023

2.Aluru JS, Barsouk A, Saginala K, Rawla P, Barsouk A. Valvular Heart Disease Epidemiology. Med Sci (Basel). 2022;10(2):32. doi: http://doi:10.3390/medsci10020032

3.Carnero-Alcázar M, Maroto-Castellanos LC, Hernández-Vaquero D, López-Menéndez J, Hornero-Sos F, Silva-Guisasola J, et al. Sustitución valvular aórtica convencional aislada en España: tendencias nacionales de riesgo, tipo de prótesis y mortalidad entre 1998 y 2017. Rev Española Cardiol. 2021;74(8):700-7. doi: https://doi.org/10.1016/j.recesp.2020.06.008

4.Montero-Cruces L, Carnero-Alcázar M, Rodríguez-Lecoq R, Sureda-Barbosa JC, Rodríguez-Roda-Stuart J, Sbraga F, et al. Análisis de los datos del Registro Español de Cirugía Cardiaca (RECC) 2021-2023. Cir Cardiovasc. 2025;32(1):34–50. doi: https://doi.org/10.1016/j.circv.2024.07.003

5.Danielsen R, Aspelund T, Harris TB, Gudnason V. The prevalence of aortic stenosis in the elderly in Iceland and predictions for the coming decades: the AGES-Reykjavík study. Int J Cardiol[Internet].2014[citado 22 Ene 2025];176(3):916-22. Disponible en: https://pubmed.ncbi.nlm.nih.gov/25171970/

6.Polo-Gutiérrez G, Silva-Tejada HA, Martinez-Ninanqui FW, Robles-Velarde V, Ríos-Ortega J. Análisis de las cirugías cardíacas y mortalidad operatoria en el Instituto Nacional Cardiovascular durante el 2022. Arch Peru Cardiol Cir Cardiovasc[Internet]. 2023[citado 22 Ene 2025];4(2):55-61. Disponible en: http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S2708-72122023000200055

7.Anuario Estadístico de Salud 2021. Ministerio de Salud Pública de Cuba. Dirección de registros médicos y estadísticas de Salud. La Habana[Internet].2023 [citado 1 Ene 2025]. Disponible en: https://temas.sld.cu/estadisticassalud/2022/10/18/anuario-estadistico-de-salud-2021/

8.Vervoort D, Meuris B, Meyns B, Verbrugghe P. Global cardiac surgery: Access to cardiac surgical care around the world. J Thorac Cardiovasc Surg [Internet].2020 [citado 26 Ago 2026]; 159(3):987-96.e6. Disponible en: https://pubmed.ncbi.nlm.nih.gov/31128897/

9.Tamargo-Barbeito T, Jiménez-Paneque R, Peña S. Universo y muestra: debate acerca de una peculiar relación. Acta Médica [Internet]. 2024 [citado 1 Ene 2025];25:e512. Disponible en: https://revactamedica.sld.cu/index.php/act/article/view/512/pdf

10.Wu Y, Li D, Vermund SH. Advantages and Limitations of the Body Mass Index (BMI) to Assess Adult Obesity. Int J Environ Res Public Health. 2024; 21: 757. doi: https://doi.org/10.3390/ijerph21060757

11.Inserra F, Torres ML, Alles A, Bonelli C, Ceci R, Corradino C, et al. Evaluación de la función renal para la detección y seguimiento de la enfermedad renal crónica. Documento multidisciplinario de consenso 2021. Especial atención sobre situaciones clínicas específicas. Acta Bioquím Clin Latinoam [Internet]. 2022 [citado 1 Ene 2025];56(1):43-74. Disponible en: https://www.redalyc.org/journal/535/53571937010/html/

12.Dimond MG, Ibrahim NE, Fiuzat M, McMurray JV, Lindenfeld J, Ahmad T. Left Ventricular Ejection Fraction and the Future of Heart Failure Phenotyping. JACC Heart Fail[Internet]. 2024[citado 22 Ene 2026];12(3):451-60. Disponible en: https://www.jacc.org/doi/10.1016/j.jchf.2023.11.005

13.Miguel Vázquez Y, Ávarez Pelegrino A, Rojas Váldes Y, Leiva Torres JL. Frecuencia de complicaciones y tiempo de estadía hospitalaria en cirugía cardiovascular. Invest Medicoquir [Internet]. 2018 [citado 2 Feb 2026];10(1):56-64. Disponible en: https://revcimeq.sld.cu/index.php/imq/article/view/410

14.Chen X, Zhen Z, Na J, Wang Q, Gao L, Yuan Y. Associations of therapeutic hypothermia with clinical outcomes in patients receiving ECPR after cardiac arrest: systematic review with meta-analysis. Scand J Trauma Resusc Emerg Med[Internet]. 2020[citado 22 Feb 2026];28(3):1-13. Disponible en: https://link.springer.com/article/10.1186/s13049-019-0698-z

15.Asociación Médica Mundial. Declaración de Helsinki. Principios éticos para las investigaciones con seres humanos. 75ª Asamblea General, Helsinki, Finlandia [Internet].2024 Oct [citado 4 Dic 2024]. Disponible en: https://www.wma.net/es/policies-post/declaracion-de-helsinki-de-la-amm-principios-eticos-para-las-investigaciones-medicas-en-seres-humanos/

16.Zühlke L, Karthikeyan G, Engel ME, Rangarajan S, Mackie P, Cupido-Katya Mauff B, et al. Clinical Outcomes in 3343 Children and Adults With Rheumatic Heart Disease From 14 Low- and Middle-Income Countries: Two-Year Follow-Up of the Global Rheumatic Heart Disease Registry (the REMEDY Study). Circulation [Internet]. 2016 [citado 1 Ene 2025];134(19):1456-66. Disponible en: https://pubmed.ncbi.nlm.nih.gov/27702773/

17.Ricardo AV. Cuba en cifras. Anuario Estadístico de Cuba 2023. Oficina Nacional de Estadística e Información. Ed 2024 [Internet]. 2023[citado 22 Feb 2025]. Disponible en: https://www.onei.gob.cu/anuario-estadistico-de-cuba-2023

18.Otto CM, Nishimura RA, Bonow RO, Carabello BA, Erwin JP, Gentile F, et al. 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease: Executive Summary: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation[Internet]. 2021[citado 22 Feb 2026];143(5):e35-e71. Disponible en: https://www.ahajournals.org/doi/10.1161/CIR.0000000000000932

19.Lung B, Delgado V, Rosenhek R, Price S, Prendergast B, Wendler O, et al. EORP VHD II Investigators. Contemporary Presentation and Management of Valvular Heart Disease: The EURObservational Research Programme Valvular Heart Disease II Survey. Circulation[Internet]. 2019[citado 22 Feb 2026];140(14):1156-69. Disponible en: https://www.ahajournals.org/doi/10.1161/CIRCULATIONAHA.119.041080

20.NCD Risk Factor Collaboration (NCD-RisC) Americas Working Group. Trends in cardiometabolic risk factors in the Americas between 1980 and 2014: a pooled analysis of population-based surveys. Lancet Glob Health [Inter-

net]. 2020[citado 22 Jun 2025];8(1):e123-e33. Disponible en: https://pubmed.ncbi.nlm.nih.gov/31839128/

21.Norris P, Gow J, Arthur T, Conway A, Fleming FJ, Ralph N. Metabolic syndrome and surgical complications: a systematic review and meta-analysis of 13 million individuals. Int J Surg[Internet]. 2024[citado 22 Jun 2025];110(1):541-53. Disponible en: https://www.researchgate.net/publication/375256166_Metabolic_syndrome_and_surgical_complications_A_systematic_review_and_meta-analysis_of_13_million_individuals

22.Li S, Liu M, Liu X, Yang D, Dong N, Li F. Associated factors and short-term mortality of early versus late acute kidney injury following on-pump cardiac surgery. Interact Cardiovasc Thorac Surg[Internet].2022[citado 22 Feb 2026];35(3):ivac118. Disponible en: https://academic.oup.com/icvts/article/35/3/ivac118/6586293

23.Guerra Bustillo G, Almaguer López MM, Herrera Valdés R, Pérez-Oliva Díaz J, Mármol Sóñora A. Enfermedad renal crónica en el primer nivel de atención de salud en Cuba. Acta Médica [Internet]. 2024 [citado 2 Abr 2025];24(4):e417. Disponible en: https://revactamedica.sld.cu/index.php/act/article/view/417

24.Galian-Gay L, Escalona Silva RA, Teixidó-Turà G, Casas G, Ferrer-Sistach E, Mitroi C, et al. Prognosis of Paradoxical Low-Flow Low-Gradient Aortic Stenosis: A Severe, Non-critical Form, With Surgical Treatment Benefits. Front Cardiovasc Med[Internet]. 2022[citado 22 Jun 2025];9:1-10. Disponible en: https://www.frontiersin.org/journals/cardiovascular-medicine/articles/10.3389/fcvm.2022.852954/full

25.Tribouilloy C, Rusinaru D, Maréchaux S, Castel AL, Debry N, Maizel J, et al. Low-gradient, low-flow severe aortic stenosis with preserved left ventricular ejection fraction: characteristics, outcome, and implications for surgery. J Am Coll Cardiol[Internet]. 2015[citado 5 Abr 2025];65(1):55-66. Disponible en: https://www.jacc.org/doi/10.1016/j.jacc.2014.09.080

26.Gahl B, Çelik M, Head SJ, Vanoverschelde JL, Pibarot P, Reardon MJ, et al. Natural History of Asymptomatic Severe Aortic Stenosis and the Association of Early Intervention With Outcomes: A Systematic Review and Meta-analysis. JAMA Cardiol[Internet]. 2020[citado10 Abr 2026];5(10):1102-12. Disponible en: https://jamanetwork.com/journals/jamacardiology/fullarticle/2768167

27.Taylor CJ, Ordóñez-Mena JM, Jones NR, Roalfe AK, Myerson SG, Prendergast BD, et al. Survival of people with valvular heart disease in a large, English community-based cohort study. Heart[Internet]. 2021[citado24 Abr 2026];107(16):1336-43. Disponible en: https://heart.bmj.com/content/107/16/1336

28.Heidenreich PA, Bozkurt B, Aguilar D, Allen LA, Byun JJ, Colvin MM, et al. ACC/AHA Joint Committee Members. 2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation[Internet]. 2022[citado 23 Abr 2026];145(18):e895-e1032. Disponible en: https://www.ahajournals.org/doi/10.1161/CIR.0000000000001063

29.Morningstar JE, Nieman A, Wang C, Beck T, Harvey A, Norris RA. Mitral valve prolapse and its motley crew-syndromic prevalence, pathophysiology, and progression of a common heart condition. J Am Heart Assoc[Internet]. 2021[citado 24 Abr 2026];10(13):e020919. Disponible en: https://www.ahajournals.org/doi/10.1161/JAHA.121.020919

30.Daimon A, Goda A, Masai K, Soyama Y, Asakura M, Ishihara M, et al. Clinical Significance and Prognostic Value of Novel Echocardiographic Index for the Severity of Mitral Regurgitation. Circ Rep[Internet].2020[citado 26 May 2025];2(6):330-8. Disponible en: https://www.jstage.jst.go.jp/article/circrep/2/6/2_CR-20-0027/_html/-char/en

31.Axtell AL, Fiedler AG, Melnitchouk S, D'Alessandro DA, Villavicencio MA, Jassar AS, et al. Correlation of cardiopulmonary bypass duration with acute renal failure after cardiac surgery. J Thorac Cardiovasc Surg. 2020; 159:70-8.e2. doi: https://doi.org/10.1016/j.jtcvs.2019.01.072.

32.Kowalewski M, Pawliszak W, Raffa GM, Malvindi PG, Kowalkowska ME, Zaborowska K, et al. Safety and efficacy of miniaturized extracorporeal circulation when compared with off-pump and conventional coronary artery bypass grafting: evidence synthesis from a comprehensive Bayesian-framework network meta-analysis of 134 randomized controlled trials involving 22 778 patients. Eur J Cardiothorac Surg[Internet]. 2016[citado 27 Ago 2026]; 49(5):1428-40. Disponible en: https://www.academia.

edu/99303150/Safety_and_efficacy_of_miniaturized_extracorporeal_circulation_when_compared_with_off_pump_and_conventional_coronary_artery_bypass_grafting_evidence_synthesis_from_a_comprehensive_Bayesian_framework_network_meta_analysis_of_134_randomized_controlled_trials_involving_22_778_patients

33.Chiari P, Fellahi JL. Myocardial protection in cardiac surgery: a comprehensive review of current therapies and future cardioprotective strategies. Front Med (Lausanne)[Internet].2024[citado 24 Ago 2025];11:1424188. Disponible en: https://pubmed.ncbi.nlm.nih.gov/38962735/

34.Li C, Xiang H, Yang H, Liu W, Lan W, Luo C, et al. Del Nido cardioplegia versus cold blood cardioplegia in adult cardiac surgery: a meta-analysis of randomized clinical trials. J Cardiothorac Surg[Internet]. 2024[citado 24 May 2025];19(1):356. Disponible en: https://pubmed.ncbi.nlm.nih.gov/38909234/

35.Vitolo M, Proietti M, Harrison S, Lane DA, Potpara TS, Boriani G, et al. The Euro Heart Survey and EURObservational Research Programme (EORP) in atrial fibrillation registries: contribution to epidemiology, clinical management and therapy of atrial fibrillation patients over the last 20 years. Intern Emerg Med[Internet]. 2020[citado 29 Sep 2025];15(7):1183-92. Disponible en: https://vbn.aau.dk/en/publications/the-euro-heart-survey-and-eurobservational-research-programme-eor/

36.Fukunaga N, Al-Sarraf A, Jawad K, Lafreniere-Roula M, Rao V. Early and mid-term outcomes after aortic valve intervention in patients with previous stentless or stented bioprostheses. J Cardiothorac Surg[Internet]. 2023[citado 26 Feb 2026];18(1):34. Disponible en: https://link.springer.com/article/10.1186/s13019-023-02118-3

37.Hu J, Li CJ, Wang BJ, Li XY, Mu DL, Wang DX. The sensitivity and specificity of statistical rules for diagnosing delayed neurocognitive recovery with Montreal cognitive assessment in elderly surgical patients: A cohort study. Medicine (Baltimore)[Internet]. 2020[citado 23 Feb 2026];99(29):e21193. Disponible en: https://pmc.ncbi.nlm.nih.gov/articles/PMC7373532/

Conflict of interest.
The authors declare that there are no conflicts of interest for the publication of the article.

Authorship Contribution.
Participation according of the order agreed upon by each of the authors of this work.

Author	**Contribution**
M. Sc. Yuliet González Nieves	Conceptualization, data curation, formal analysis, investigation, methodology, resources, project administration, supervision, validation, visualization, writing (review and editing).
Dr C. Lodixi Cobas Planchez	Conceptualization, data curation, formal analysis, investigation, methodology, resources, supervision, validation, visualization, writing (review and editing).
Dr. Luis Reinaldo Suárez Fleitas	Investigation, methodology, resources, supervision, validation, visualization, writing (review and editing).
M. Sc. Gleidys Dunia Solano González	Formal analysis, investigation, resources, writing (original draft).

Corresponding author.
Dr.C. Lodixi Cobas Planchez ✉
Medical Science Center of Mayabeque. Faculty of Medical Sciences of Mayabeque.

Translation and proofreading.
Beatriz Barranco González. ✉ Bachelor`s Degree in Traslation and Interpreting. Provincial

Reviewers.
Dr. C Idalberto Aguilar Hernández
Dr. C. Marcel Deniel Mendieta Pedroso