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Preoperative evaluation in cardiac surgery: A prospective study in an intensive care unit in Morocco

Oumaima Azzouzi Idrissi *, Hafsa Aouni, Abdelkarim Shimi, Ibrahim Bechri, Ali Derkaoui and Mohammed Khatouf

Anesthesiology and Intensive Care Department A1, Hassan II University Hospital, Fez, Morocco.

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Abstract

The preoperative evaluation of cardiac surgery patients is a crucial step in assessing operative risk, defining perioperative strategies, and informing the patient about anesthesia management, intensive care, and transfusion protocols. One of the main objectives of the pre-anesthetic consultation is to identify patient and surgery-related risk factors that may lead to complications, in order to propose the most appropriate anesthetic management. Therefore, we conducted a retrospective study in the polyvalent intensive care unit (ICU) A1 at Hassan 2 University Hospital in Fes, in order to evaluate the epidemiological and demographic aspects of these patients, the preoperative evaluation strategy, and to study the morbidity and mortality related to cardiac surgery, aiming to optimize the management of these patients.

Keywords: Cardiac surgery; Preoperative evaluation; Risk assessment; Anesthesia; Prognosis; Therapeutics

1. Introduction

The preoperative evaluation of cardiac surgery patients takes into account several elements. Firstly, it aims to assess the patient's overall medical condition. This includes a thorough examination of the patient's medical and surgical history, as well as their comorbidities. Patients are then subjected to comprehensive diagnostic tests such as electrocardiography, echocardiography, chest radiography, and in some cases, coronary angiography. These examinations aim to determine the severity and extent of the underlying cardiac disease, cardiac function, the presence of significant coronary stenosis, as well as other cardiac abnormalities that may require specific intervention.

This evaluation can result in various measures, all aimed at reducing perioperative complications and morbidity/mortality: Optimization of medical treatment and management of preoperative therapies, definition of hemodynamic goals, modification of surgical and/or anesthetic techniques, intraoperative monitoring, specific postoperative surveillance, or reevaluation of the risk-benefit ratio for a scheduled surgical intervention through collegial discussion.

2. Material and methods

This is a prospective analytical descriptive study, conducted over a period of 6 months, from June 2022 to December 2022, and included 68 cases who underwent cardiac surgery.

We aim to evaluate the importance of preoperative evaluation in patients undergoing cardiac surgery in terms of preventing perioperative complications but also assess the effectiveness of the currently used tools and strategies for

* Corresponding author: Oumaima Azzouzi Idrissi; ORCID: 0000-0001-8219-0837; Email:idrissioumaima@gmail.com

preoperative evaluation in cardiac surgery patients. The study was conducted in the following units: the polyvalent intensive care unit (ICU) A1, which is responsible for the postoperative care of cardiac surgery patients, the cardiovascular surgery unit, where patients are prepared for surgery and readmitted after their stay in the ICU, and the central operating room A2.

- Study Population: The study included all patients hospitalized in the polyvalent ICU A1 at Hassan 2 University Hospital in Fes for postoperative care after undergoing either single or double valve replacement or coronary artery bypass graft surgery. Patients who underwent closed-heart surgery, pericardial drainage, or were seen for preanesthetic consultation but were rejected for surgery were excluded from the study.
- Evaluation Criteria: Data were collected from a computerized database that included preoperative, intraoperative, and postoperative parameters with the consent signed from all the patients or family and have the clearance from the ethical committee RMB/CERB Fez, Morocco.
- Preoperative period: Demographic analysis including age and gender, as well as analysis of cardiovascular risk factors and other comorbidities. Data from patient interviews, clinical examinations, and additional diagnostic tests were also included.
- Perioperative period: Analysis of the anesthetic techniques used, including the use of cardiopulmonary bypass, its duration, aortic clamping duration, as well as any intraoperative incidents or complications.
- Postoperative period: Analysis of postoperative extubating time, duration of ICU stays, early postoperative complications (hospital mortality, cardiac complications related and unrelated to prostheses, extracardiac complications), and late complications.

3. Results

3.1. Epidemiological data

3.1.1. Distribution according to Age, Sex Ratio and risk factors

-The mean age of our patients was 47.088, ranging from 21 years to 69 years. We noticed a predominance in the age group between 30-50 years. The study of the valve and coronary populations found that the mean age of the valve population (63 patients) was 46.19, ranging from 21 years to 69 years. The mean age of the coronary population (5 patients) was 58.4, ranging from 50 years to 69 years. (Figure 1)

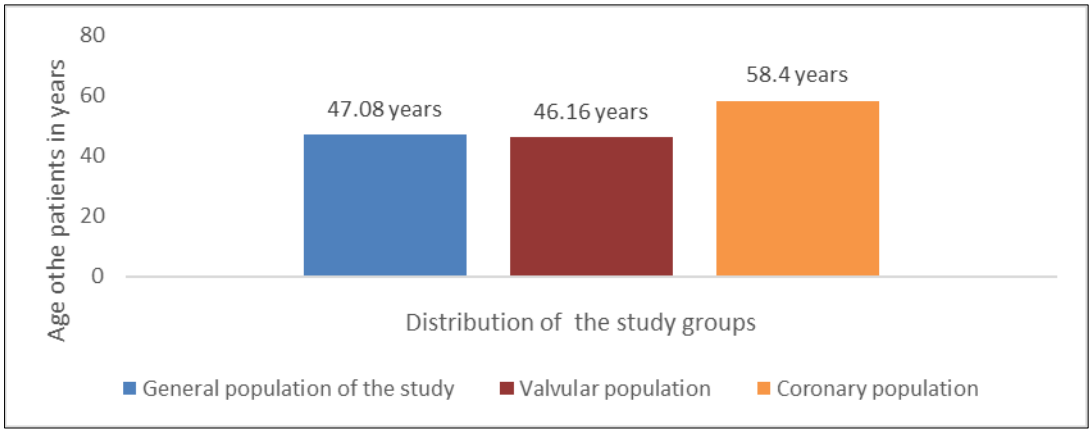

Figure 1 Mean age of the populations

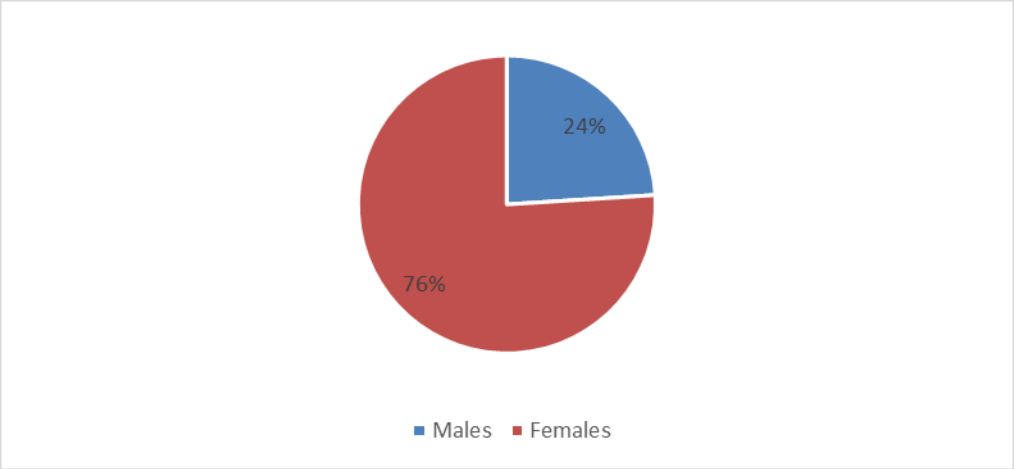

Figure 2 Distribution of patients by sex

- The Sex Ratio was of 0,31 with a predominance of the females (Figure 2)

-The study of the valve population found that females represented 81% (51 women) compared to 19% males (12 men). However, in the coronary population, males were predominant at 80% (4 men) compared to 20% females (1 woman).

-Number of cardiovascular risk factors: 39.7% (27 patients) of our population had no cardiovascular risk factors and all belonged to the valve population, whereas all patients in the coronary population had 3 cardiovascular risk factors for example. (Figure 3)

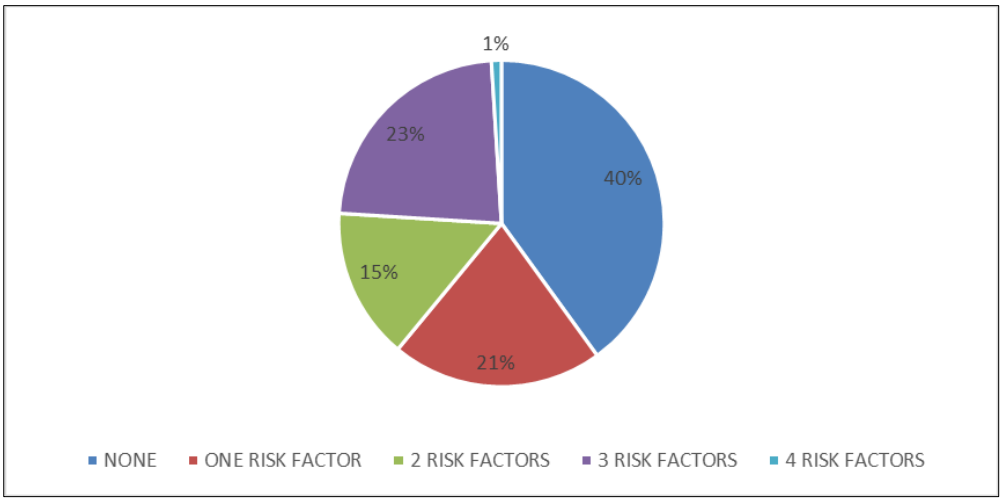

Figure 3 Number of risk factors found in our patients

-Risk factors: The risk factors investigated were age (over 45 years in men and 55 years in women), male sex, hypertension, diabetes, dyslipidemia, menopause in women, and smoking. Age was the most represented risk factor in our patients, accounting for 35.29% of the study population, followed by menopause in 32.35% of our female patients.

3.1.2. Distribution according to medical history

-All patients in the coronary population had a history of myocardial infarction, 3 patients had an ST-segment elevation myocardial infarction (STEMI), and 2 patients had a non-ST-segment elevation myocardial infarction (NSTEMI).

-Surgical history was found in 8 patients, including 1 patient who underwent surgery at the age of 2 for a peri membranous ventricular septal defect (VSD) associated with infundibular stenosis, 1 for tonsillectomy, 1 for liver hydatid cyst, 1 for cholecystectomy, 1 female patient for uterine fibroids, 1 for benign breast nodule, and 2 for fractures (Figure 4).

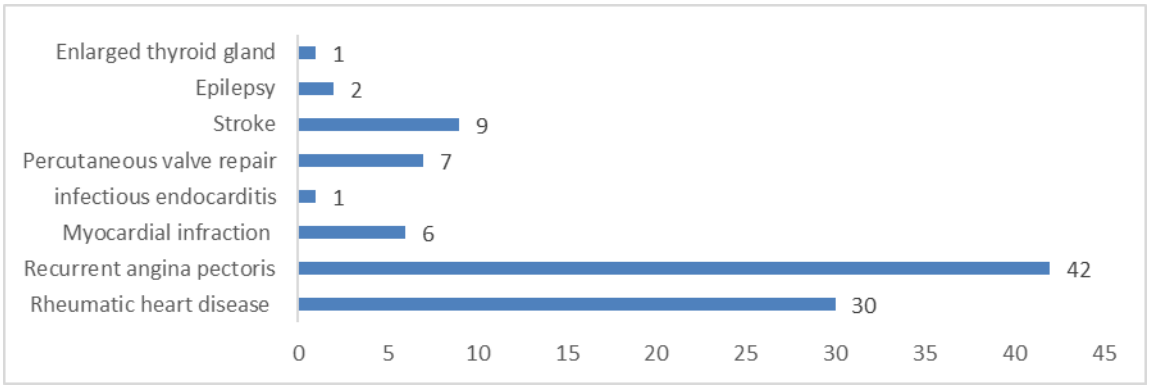

Figure 4 Distribution according to medical history

3.2. Preoperative assessment

-Dyspnea was assessed according to the New York Heart Association (NYHA) classification. All patients in our series reported dyspnea, 44 patients had NYHA class 3 dyspnea, all belonging to the valve population, accounting for 69.84% of this subpopulation. 13 patients had NYHA class 2 dyspnea, with 5 patients from the coronary population (100% of this subpopulation) and 8 patients from the valve population (12.70% of this subpopulation). 11 patients reported NYHA class 4 dyspnea, all belonging to the valve population, accounting for 17.46% of this subpopulation.

-Chest pain was evaluated according to the Canadian Cardiovascular Society (CCS) classification. Chest pain was reported by 23 patients in the general population, with 10 patients having CCS class 1 chest pain, including 9 patients from the valve population (14.28%) and 1 patient from the coronary population (20% of this subpopulation). CCS class 2 was found in 13 patients, including 9 valve patients (14.28%) and 4 coronary patients (80%). Only 1 patient had CCS class 3 chest pain in the valve population (1.58%).

-Syncope was observed in 3 patients, all belonging to the valve population. 40 patients (58.82% of the general population) had palpitations, with 39 of the valve population (61.90% of this subpopulation) and 1 patient from the coronary population.

3.2.1. Pre-operative scores and examinations findings

The ASA (American Society of Anesthesiologists) classification assesses the preoperative health status of a patient. This allows for the evaluation of the anesthetic risk, including morbidity (postoperative infection, infarction, respiratory or renal failure...) and mortality. 46 patients had an ASA 3 score, accounting for 67.64% of the overall population. 22.05% (15 patients) had an ASA 2 score, while only 10.29% (7 patients) had an ASA 4 score (Figure 5).

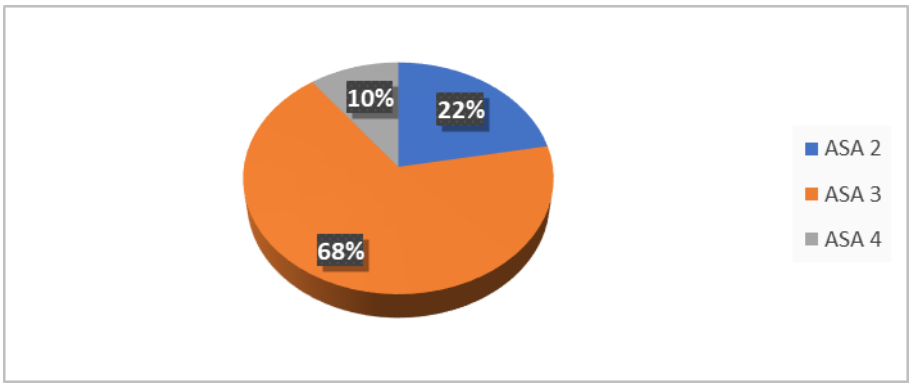

Figure 5 Distribution of patients according to ASA class

The EUROSCORE II model, the European System for Cardiac Operative Risk Evaluation, and the Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database (ACSD) operative risk calculator were both used in cardiac surgery to identify high risk patients to determine the risk of major cardiac surgery (Table 1).

Table 1: Average percentages of the results of the EUROSCORE II model in our study

CCS Grade 4	56%
NYHA grading	19% patients with NYHA class 2 dyspnea 69.84% patients with NYHA class 3 dyspnea for 17.46% patients NYHA class 4 dyspnea
LV dysfunction	45.34%
Pulmonary hypertension (PAPS > 31 mm/Hg)	76%
Recent MI within 90 days	23%
Previous cardiac surgery	13%
Active endocarditis	0.01%
Age	47.088
Gender	81% females
Chronic lung disease	3.65%
Extracardiac arteriopathy	10%
Poor mobility	20%
Critical preoperative state	3%
Renal impairment	0.02%
Diabetes on insulin	12%
Surgery on thoracic aorta	0.01%
Urgency of operation	40% urgent. 10% extreme emergency
Weight of operation (single vs multiple procedures)	75% multiple procedures

-The results of the preoperative examinations included electrocardiogram data, chest radiography, preoperative trans-thoracic echocardiography (Figure 6), supra-aortic trunk echography, and preoperative transesophageal echocardiography. Preoperative laboratory tests (Table 2) included complete blood count, C-reactive protein, platelet count, international normalized ratio, prothrombin time, complete liver function and renal tests including creatinine, complete serologies, results of cytobacteriological examination of urine, vaginal swab for women, and stool parasite testing. In our series. It is noted that all patients of our study were all free from any transmitted infections and radiological consisted infection aspects.

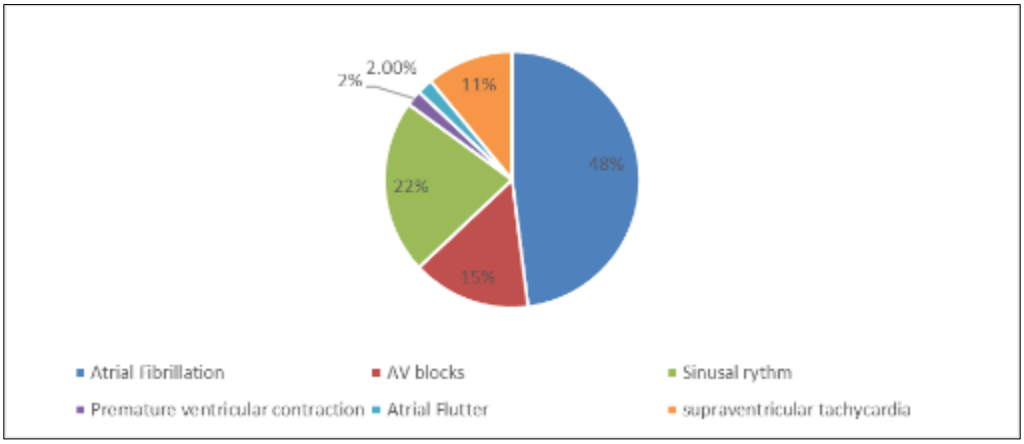

Figure 6 Pre-operative results of cardiac rhythms of our patients

Table 2 Results of preoperative laboratory tests

	mean (sd)	**min**	**max**
Ejection Fraction %	61.9	50.0	70.0
Creatinine	8.58	2.00	26.0
CRP	124	0	450
Hemoglobin	12.56	8.8	17
Kaliemia	4.8	2.1	6
Natremia	137	116	148
Prothrombin time	88.3	30.0	100
Urea	0.321	0.130	2.18

3.2.2. Preoperative mortality

There were no preoperative deaths in our study, thus no missing data

3.3. Perioperative period

- -The use of cardiopulmonary bypass especially coronary artery bypass grafting from the leg was observed in 12% of our patients, the mean aortic clamping duration was of 58 minutes.
- -Intraoperative incidents included injuries to great vessels 13%, heart 10% bypass grafts 2%

3.4. Postoperative period

Analysis of postoperative extubating time found a mean of 4 hours (min of 1hour, max of 10 hours), a 2±3,2 duration of ICU stays, early postoperative complications such as arrhythmias in 52%, low cardiac output in 25%, hypertension in 17,6%, pericardial effusion in 7% and cardiac tamponade in 2%

-Post-operative mortality was of 5%. Causes of death included inadequate myocardial protection, hemodynamic instability, stroke, and coagulopathy. Late mortality was 1,3%. Prolonged bypass time and atrial fibrillation were identified as risk factors. Mitral regurgitation occurred in 2% of patients after valve repair

4. Discussion

Cardiac surgical patients are extensively studied by anesthesiologists, and evidence from intraoperative trans-esophageal echocardiography (TOE) studies suggests that a significant proportion of patients (up to 5%) may have previously undetected pathologies such as valvular disease or patent foramen oval [1]. Therefore, a comprehensive preoperative evaluation by the anesthesiologist remains crucial in the perioperative care of these patients. Apart from the basic courtesy of meeting a key member of the medical team, the information gathered during this evaluation allows for tailored perioperative management based on the patient's specific needs.

In recent years, there has been a growing trend towards assessing elective cardiac surgical patients in pre-admission clinics, typically 1-2 weeks before the scheduled surgery [1]. This approach allows for the completion of routine paperwork, laboratory tests, and radiological imaging before admission, facilitates the organization of additional investigations without delaying surgery, notifies support services (e.g., transfusion) of potential demand, and allows for the option of admitting the patient on the day of surgery. All investigation results should be documented in the patient's medical records prior to admission. While it may be sensible to have an anesthesiologist stationed in the pre-admission clinic, it is unlikely that patients will have the opportunity to meet the specific anesthesiologist who will be responsible for their perioperative care. Therefore, most preoperative visits with an anesthesiologist take place either the day before or on the day of the scheduled surgery like in our study.

The results of our study on preoperative evaluation of cardiac surgery patients align with the findings reported in the literature [2,3], indicating that our evaluation process is comprehensive and in line with international standards. However, it is important to consider the limitations of our study, such as a small sample size and specific characteristics

of our local population. Further research in larger populations is needed to confirm our findings and enhance the understanding of preoperative evaluation in cardiac surgery patients.

In the end, the preoperative evaluation for cardiac surgery is a critical step in ensuring patient safety and optimizing outcomes. Let's delve into some key aspects [4,5]:

- Enhanced Recovery After Surgery (ERAS): ERAS programs have been shown to improve postoperative outcomes across various surgical specialties, including cardiac surgery. These programs involve evidence-based perioperative interventions. An international expert panel assembled consensus statements on potential program elements for cardiac surgery. These statements provide the foundation for best practices in managing adult patients undergoing cardiac surgery.
- Perioperative CV Risk Assessment: For noncardiac surgery, assessing cardiovascular risk is crucial. An algorithm based on emergent versus nonemergent surgery, presence of unstable conditions, previous coronary stenting, and risk calculators helps guide preoperative assessment.
- Appropriate Use of Preoperative Echocardiography: Evaluating comorbidity burden and cardiac outcomes in patients who underwent repeat echocardiograms within 60 days before surgery can provide insights into risk assessment.
- Preoperative Risk Assessment Tools for Morbidity: A systematic review of preoperative risk assessment tools for postoperative morbidity after cardiac surgery aims to identify and examine existing tools. Understanding preoperative risk helps optimize patient management.

5. Conclusion

The preoperative evaluation of cardiac surgery patients plays a crucial role in assessing the overall medical condition and optimizing patient outcomes. Our study found that the majority of patients undergoing cardiac surgery are relatively young, with a high prevalence of cardiovascular risk factors. Medical and surgical history, functional status assessment, and the ASA score are important components of the preoperative evaluation process. Our research supports current preoperative evaluation practices for cardiac surgery patients, but further study is required to validate these findings and establish optimal guidelines.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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