

Patient's classification according to complications and mortality risks after elective heart surgeries

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ABSTRACT

The investigation objective was to classify patients according to the complication and mortality risks after elective heart surgeries, using the Tuman System of Clinical Risk Score. A descriptive study, developed in a university hospital in São Paulo state, Brazil, from August of 2013 to February of 2015. A consecutive and non-probabilistic sample was constituted by patients submitted to a first myocardial revascularization surgery and/or surgeries to correct valvulopathies, and with elective scheduling of their surgeries. Results: One-hundred and twenty five patients participated. The majority presented low risk for development of post-surgery complications and mortality (n = 110; 88%). A rate of 14.6% for complications and 3.3% for mortality are expected for these patients. In this study, most patients submitted for their first time to elective heart surgeries presented low risk to develop post-surgery complications and mortality.

Descriptors: Thoracic Surgery; Mortality; Perioperative Nursing.

INTRODUCTION

Cardiovascular diseases (CVD) are the main causes of morbidity and mortality in developed countries as well as in developing ones⁽¹⁾.

Nowadays, with science advances in health, many patients can benefit from minimally invasive approaches to treat CVDs. However, heart surgery might be the only indicated and available treatment for a

large number of patients.

In accordance with data available at the Informatics Department from the Unified Health System (DATASUS), on the last five years, 179,135 heart surgeries for myocardial revascularization (MRV) and/or correction of valvulopathies were conducted in Brazil. From this total, 64% (n = 114,599) were MRV, 30% (n = 54,129) were corrections of valvulopathies and 6.0% (n = 10,407) were combined surgeries of MRV and corrections of valvulopathies. The total number of deaths during this period was 12,827, affecting 50% (n = 6,421) of MRV patients, 37% (n = 4,790) of valvulopathies' correction patients and 13% (n = 1,616) of patients submitted to combined surgeries of MRV and correction of valvulopathies⁽²⁾.

Because of the advent of minimally invasive approaches, there was a significant change in patient's profiles recently submitted to heart surgery. The MRV surgery, for example, is lately indicated for patients with more severe lesions, with higher number of pre-surgery comorbidities and in older patients⁽³⁾. On the other hand, surgeries for correction of valvulopathies are also indicated for older patients, with advanced level of valvar insufficiency and/or stenosis and people with associated chronic diseases⁽⁴⁾.

Considering the actual profile of patients submitted to heart surgery, innumerable studies have addressed the importance of pre-surgery clinical assessment, to predict the risk of pre-surgery complications and/or risk of mortality^(3,5-10).

To conduct this clinical assessment, the multidisciplinary team can use scores to classify the risk of post-operative complications and mortality of patients submitted to heart surgery, available and validated in the literature. Such scores are used since the end of the 80's decade, but until the moment, there is no consensus about the best one to be used. Even with lack of consensus, there are no doubts about the importance of this pre-surgery assessment, which can subsidize therapeutic decision, nursing assistance planning, besides allowing the adoption of individualized strategies to prevention complications and mortality. Beyond that, the assessment and follow-up of patient's risk scores, with its respective post-operative complication and mortality rates, are considered excellent quality indicators of hospital services⁽¹⁰⁾.

There are studies in the literature correlating the patient's pre-surgery clinical profile of the patient submitted to heart surgery with possible post-surgery complications and/or mortality^(3,5-10), but the use of validated scores for this assessment is scarce^(7,10).

The systematic pre-surgery classification of patients according to risk of complications and mortality after heart surgeries, through scores validated in the literature, can bring subsidies to plan multidisciplinary assistance for these patients. There are no public investigations of this nature in the institution where the present study was developed, neither others conducted in the broad area of the Health Regional Department of Ribeirão Preto – DRS XIII. We consider this assessment important, once this DRS is composed by 26 municipalities, and it attends approximately 1,433,463 inhabitants⁽¹¹⁾.

Thus, this study aimed to classify patients according to the risk of complications and mortality after elective MRV heart surgeries, correction of valvulopathies and combined MRV with correction of valvulopathies, attended in a university hospital at the interior of São Paulo state.

METHODS

This is a descriptive study developed in a university hospital from the interior state of São Paulo, Brazil, which belongs to the Regional Health Department of Ribeirão Preto – DRS XIII.

The data were collected from August 2013 to February 2015. Subjects of both genders, aged 18 years or older, constituted a consecutive non-probabilistic sample submitted to the first MRV and/or surgeries for corrections of valvulopathies, electively scheduled.

Patients were excluded when not presenting cognitive conditions to answer the questionnaire, assessed by the “Mini Mental-State Exam – MMSE”⁽¹²⁾, in the adapted Portuguese version⁽¹³⁾; those who presented clinical decompensation of heart disease at the day prior to surgery (presence of dyspnea, precordialgia and orotracheal intubation); and who had elective surgery scheduled less than 12 hours prior.

The research project was elaborated in accordance with ethical precepts from the Resolution of the National Health Council n.466 of December of 2012, and it was approved by the Ethics in Research Committee from the Nursing School of Ribeirão Preto-USP, with the number CAAE: 27214414.9.0000.5393. Each study participant was informed about the research. They read the Free and Informed Consent Term that was signed by the subject and the investigator, after the consent to participate in the study.

Sociodemographic and clinic characterization of the sample as well as the data used to classify the risk of post-surgery complications and mortality, were collected one day before the heart surgery, through individual interviews with participants and consultation to medical records.

A data collection instrument was created to collect participant’s characteristics. Face and content validation of the instrument were conducted by a committee of four judges with broad experience in cardiology and cardiovascular surgery. Each of the judges was asked to assess instrument items regarding pertinence (if the items expressed true relationship with the study proposal) and clarity (if the items were described in a comprehensible manner). If the judge assessed the item as unclear or not pertinent, there was room for suggestions as well as for addition of new items.

The instrument had sociodemographic (date of birth; gender; education in complete years; marital status; performance of paid activities and monthly family income) and clinical variables (admission date; comorbidities; main diagnosis and surgery performed). The age of participants was calculated subtracting the date of birth and the date of interview. To calculate the tobacco load, we used the number of cigarettes consumed per day reported by patients, divided by 20 and multiplied by the number of smoking years⁽¹⁴⁾.

The variables “date of birth; gender (female or male); admission date; presence of comorbidities (weight and height for calculation of body mass index; dyslipidemia; hypothyroidism; diabetes mellitus; hypertension and atrial fibrillation); main diagnose (coronary artery disease and its clinical manifestation and/or type of valvulopathy and affected valve) and performed surgery (MRV, valve replacement, valve plasty, MRV + valve replacement + valve plasty) were collected from medical records. The variables “actual or previous smoking; education in complete years; marital status; performance of paid activities and monthly

family income” were obtained through individual interviews.

For the classification of patients according to the risk of complications and mortality after heart surgeries, we used the “Tuman System of Clinical Risk Score”⁽¹⁵⁾, in its validated version in Portuguese⁽¹⁰⁾. In Chart 1 are the variables composing the Tuman System of Clinical Risk Score.

Chart 1: System of clinical risk score, according to Tuman and collaborators⁽¹⁰⁾.

Pre-surgery score	Score
Emergency surgery	4
Age	
65-74 years	1
≥ 75 years	2
Renal dysfunction	2
Previous myocardial infarction	
3-6 months	1
< 3 months	2
Female	2
Previous heart surgery	2
Pulmonary hypertension	2
Cerebrovascular disease	2
Multiple valve or MRV replacement + valvar replacement	2
Aortic or mitral valve replacement	1
Congestive cardiac insufficiency	1
Left ventricle dysfunction	1

The variable “renal dysfunction” (pre-surgery creatinine higher than 1.4 mg/dl)⁽¹⁵⁾ was collected from the blood testing at the previous day of surgery. The variables “pulmonary hypertension” (pulmonary artery pressure 25 mercury millimeters above the systemic blood pressure) and “left ventricle dysfunction” (ejection fraction of the left ventricle < 35%)⁽¹⁵⁾ were collected at the most recent echocardiogram exam, conducted pre-surgery.

For patient’s classification, we used the following cut points⁽¹⁵⁾: patients with score 0 to 5 – low risk (expected mortality rate of 3.3% and post-surgery (PS) complications rate of 14.6%); score 6 to 9 – moderate risk, (expected mortality rate of 10.0% and PS complications of 34.4%); and score of 10 or higher – high risk (expected mortality rate of 25.4% and of PS complications of 61.0%).

All data were analyzed using a statistical program. We performed descriptive analyses of simple frequency for nominal or categorical variables, central tendency (mean and median), and dispersion (standard deviation, minimum and maximum values) for continuous variables.

RESULTS

During the data collection period, from August of 2013 to February of 2015, 204 heart surgeries were performed at the referred hospital. From those, 48 patients did not meet inclusion criteria (28 patients due to type of surgery; 18 due to reoperation; and two patients were younger than 18 years); 24 patients were

excluded (15 were scheduled in less than 12 hours prior the surgery, seven did not present clinical conditions to answer questionnaires and, two patients did not present cognitive conditions); and, seven refused to participate in the study. The final sample was composed by 125 patients.

The sociodemographic characteristics of participants are presented on Table 1.

Table 1: Sociodemographic characterization of the sample. Ribeirão Preto, SP, Brazil, August 2013 - February 2015.

Variable	Total sample (n=125)				
	n (%)	Mean	Standard Deviation	Minimum	Maximum
Gender					
Male	82 (65.6)				
Age		59.10	11.8	25.8	87.7
Marital status					
Married/Consensual union	92 (73.6)				
Activity performance					
Inactive	83 (66.4)				
Education in years		5.2	4.2	zero	20
Monthly family income (in reais)		2,340	2,438	70	20,000
Number of income dependents		2.2	9.3	01	15

The clinical characterization of the sample according to the main diagnosis, is shown on Table 2.

Table 2: Clinical characterization of the sample according to main diagnosis.

Ribeirão Preto, SP, Brazil, August 2013 - February 2015.

Variable	Total Sample n (%)
Main diagnosis (n=125)	
Coronary Artery Disease (CAD)	61 (48.8)
Valvulopathy	53 (42.4)
CAD+ valvulopathy	11 (8.8)
CAD clinical manifestation (n=72)	
Stable angina	33 (45.8)
Recent AMI ^a	17 (23.6)
Previous AMI	13 (18.1)
Unstable angina	09 (12.5)
Affected valve (n=64)	
Aortic	29 (45.3)
Mitral	21 (32.8)
Aortic + mitral	13 (20.3)
Aortic + mitral + tricuspid	01 (1.6)
Type of valvulopathy (n=64)	
Stenosis + insufficiency	33 (51.6)
Insufficiency	22 (34.4)
Stenosis	09 (14.1)

AMI^a= Acute Myocardial Infarction.

Regarding the presence of pre-surgery comorbidities, we found most of patients presenting hypertension (n = 88; 70.4%), overweight/obesity (n = 74; 59.2%) and dyslipidemia (n = 64; 51.2%). We still found 49 patients (39.2%) with Diabetes mellitus; 22 (17.6%) with cardiac insufficiency; 14 (11.2%) with hypothyroidism; 11 (8.8%) with chronic cardiac insufficiency and 10 (8.0%) patients with chronic atrial

fibrillation.

Twenty-two patients (17.6%) reported actual smoking and 51 (40.8%) progress smoking. Patients who reported actual smoking (smokers until 30 days before surgery admission) smoked an average of 22.3 (SD = 21.0) cigarettes per day. The average smoking time was 35.4 years (SD = 15.0). Thus, these patients presented a mean of 43.7 (SD = 45.5) years-pack of smoking. Yet, patients who reported progress smoking, smoked an average of 19.4 (SD = 15.0) cigarettes per day. The average smoking progress was 28.8 (SD = 15.2) years. Thus, these patients presented an average of 28.1 (SD = 24.8) years-pack of smoking.

The most performed surgery was MVR (n = 60; 48%), followed by valve replacement (n = 48; 38.4%), MVR combined with valve replacement (n = 9; 7.2%), replacement combined with valve plasty (n = 4; 3.2%), valve plasty (n=3; 2.4%) and MVR combined with valve plasty (n = 1; 0.8%).

We present the distribution of patients according to variables used to calculate the Tuman System of Clinical Risk Score on Table 3.

Table 3: Distribution of variables used to calculate the Tuman System of Clinical Risk Score.
Ribeirão Preto, SP, Brazil, August 2013 – February 2015.

Pre-surgery factor	Score	Frequency (n = 125) n (%)
Emergency surgery	4	zero
Age		
65-74 years	1	29 (23.2)
≥ 75 years	2	11 (8.8)
Renal dysfunction	2	31 (24.8)
Previous myocardial infarction		
3-6 months	1	12 (9.6)
< 3 months	2	11 (8.8)
Female gender	2	43 (34.4)
Previous heart surgery	2	zero
Pulmonary hypertension	2	06 (4.8)
Cerebrovascular disease	2	03 (2.4)
Multiple valve replacement or MRV^a + valve replacement	2	15 (12.0)
Aortic or mitral valve replacement	1	61 (48.8)
Congestive cardiac insufficiency	1	22 (17.6)
Left ventricle dysfunction	1	14 (11.2)

MRV^a= Myocardial Revascularization

Regarding the patients' classification according to the risk of complications and mortality after heart surgeries, we found 110 patients (88%) presenting low risk (score 0-5), which the rate of complications is 14.6% and the expected mortality rate of 3.3%. The remaining patients (n = 15; 12%) were classified as having moderate risk (score 6 – 9) to develop post-surgery complications and mortality, which the expected rates are 34.4% and 10.0%, respectively.

DISCUSSION

In this study, most patients submitted for the first time to elective MRV heart surgeries, correction of valvulopathies and MRV combined with correction of valvulopathies presented low risk for development of

post-surgery complications and mortality.

In the validation study of Tuman score⁽¹⁰⁾, in which 296 patients submitted to elective heart surgery with extracorporeal circulation, of the MRV and/or valvar procedure (prosthesis implantation or conservative surgery), were prospectively assessed, researchers classified 85.1% of patients as low risk for post-surgery complications; 15.5% as moderate risk and, only 1.0% as high risk. These results are similar to the ones found in the present study.

After validation, this score was implemented in the pre-surgery assessment of adult patients submitted to heart surgery at the Heart Institute in São Paulo (InCor), for 154 patients. From those, 63% (n = 97) were classified as low risk; 35.7% (n = 55) as moderate risk and 1.3% (n = 2) as high risk for post-surgery complications and mortality⁽¹⁰⁾. These results also corroborate with ours, with most of patients in the low risk category. However, there was a lower frequency of moderate risk in our study, probably due to the inclusion of patients only submitted to the first heart surgery and still, elective surgery.

As previously addressed, the reduced number of articles using validated scores in the literature for patient's classification, according to the risk of complications and mortality after heart surgeries, made the comparison with our study difficult^(7,10). Another difficulty was the fact that some authors investigated exclusively patients submitted to MRV^(8,16) or exclusively submitted to surgeries for correction of valvulopathies⁽⁶⁾. In addition, other researchers investigated only mortality^(5-6,8,16).

In a study aimed to identify risk factors that influenced hospital mortality of patients submitted to mechanic valvar prosthetics implant surgery, the authors found the characteristics significantly related to mortality (rate of 3.88%) were left ventricle ejection fraction inferior to 30%, mitral valve lesion and, conduction of previous heart surgery. The serum creatinine was significantly higher in patients who died than in patients who survived. Besides, valve replacement with MRV surgery, as well as the urgent re-operation in the post-surgery, were also significantly correlated with hospital mortality⁽⁶⁾.

Regarding the studies investigating only patients submitted to MRV, we found one in which the authors identified a statistically significant association of age factors (above 70 years), hospitalization through the Unified Health System (SUS), re-operation, non-elective surgery, dialysis dependence, diabetes mellitus, pre-surgery serum creatinine higher than 1.9 mg/dl, congestive cardiac insufficiency, cardiogenic shock, lung acute edema and, pulmonary hypertension, with post-surgery mortality⁽¹⁶⁾.

In another study investigating the relationship of sociodemographic characteristics with mortality in patients submitted to MRV, the authors found female gender, age (above 70 years), hypertension, renal disease, cerebrovascular disease, emergency surgeries, the conduction of extracorporeal circulation and the re-admission to Intensive Care Unit as presenting a significant effect on mortality⁽⁸⁾.

In a study developed in the interior state of São Paulo, investigators retrospectively assessed 783 medical records of patients submitted to MRV surgeries and/or correction of valvulopathies, to determine risk factors for post-surgery mortality of septuagenarian patients. From all patients assessed, 25% (n = 197) were 70 years or older. Predictive risk factors for post-surgery mortality in septuagenarian patients were

being female, presence of chronic obstructive pulmonary disease, left ventricle ejection fraction lower than 35% , non-elective operation and time of extracorporeal circulation longer than 120 minutes⁽⁵⁾.

Thus, in the studies cited above, some factors were similar to the Tuman System of Clinical Risk Score to assess complication and mortality risk, namely: emergency surgery^(5,8,16); age^(5,8,16); renal dysfunction^(6,8,16); female gender^(5,8); previous heart surgery^(6,16); pulmonary hypertension⁽¹⁶⁾; cerebrovascular disease⁽⁸⁾; MRV surgeries with valvar replacement⁽⁶⁾; congestive heart insufficiency⁽¹⁶⁾ and dysfunction of the left ventricle⁽⁵⁻⁶⁾. Factors for previous myocardial infarction and aortic or mitral valve replacement, present in the Tuman's score, were not described in the study.

Despite the similarities of some factors from the Tuman's score with the described factors in other studies^(5-6,8,16), due to the absence of a score or a risk category, it was not possible to compare our study sample, considering the risk of complication or mortality.

Still, we found a study that created a risk classification score for post-cardiac surgery mortality, considering the pre-surgery profile of patients, intra-operative variables, and immediate post-surgery. Agreeing with this score, the age between 65 and 74 years (1 point), over 75 years (2 points), the left ventricle diameter over 45 mm (1 point), the post-surgery creatinine over 2 mg/dl (2 points), the time of extracorporeal circulation over 180 minutes (2 points), the ratio of partial oxygen pressure with the inspired fraction of oxygen lower than 100 (3 points), the use of amines (3 points) and the time of mechanical ventilation longer than 12 hours (1 point), are predictors of post-surgery mortality. According to this score, patients who score 0 – 2 present low mortality risk, and the expected rate is 3.5%; patients who score from 3 – 5 present medium mortality risk, and the expected rate is 7.5% and, at last, patients who score 6 points or more are considered high risk, with an expected mortality rate higher than 15%⁽⁷⁾.

The main limitations of this study are related to the reduced number of investigated patients, besides the exclusion of patients who waited for a cardiac re-operation of any nature and who were submitted to urgency/emergency heart surgeries. The exclusion of these patients is justified by this being the first study where we tried to assess the risk of complications and mortality in patients of lower risk (submitted to the first and elective heart surgery) and by the interest in assessing patients submitted to most frequent surgeries in the referred hospital.

The development of new studies with longitudinal approaches to verify the predictive value of these score for participants is needed. Besides, it is important to include patients who wait for cardiac re-operation and who had urgency or emergency indication for it. These inclusions could bring broader results for the studied population.

CONCLUSION

Most patients in this study presented a low risk to develop complications and mortality after elective heart surgeries of MRV, corrections of valvulopathies and MRV combined with corrections of valvulopathies. The rate for expected complications for those patients is 14.6% and for mortality, 3.3%.

Nowadays, a longitudinal study has been developed, aimed to investigate main complications that patients developed during post-surgery, as well as it is being investigated the number of deaths to calculate post-surgery mortality rate. Results of the ongoing study will allow to confirm the predictive score value used and classified in the present study, thus, validating an important tool to assess therapeutic decisions, nursing assistance planning, and the adoption of individualized strategies for the prevention of post-surgery complications and mortality.

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