

## Original Research Article

# Prevalence of co-morbidities among adult patients presented for open heart surgery and the implication on convalescence period

Hayel Al-Adwan, Ashraf Fadel\*, Yanal F. Al-Naser, Abdallah Al Qaysi, Rami Qsous, Ahmad Omar Al-issa R. N.

Department of Cardiac Anaesthesia, Queen Alia Heart Institute, Amman/Jordan

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### \*Correspondence:

Dr. Ashraf Fadel,

E-mail: [ashraffadel1975@yahoo.com](mailto:ashraffadel1975@yahoo.com)

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### ABSTRACT

**Background:** Improvements in perioperative medical care, anesthetic management, surgical and myocardial protection techniques made cardiac surgery feasible in the high risk surgical patients. The aim of the study was to determine the prevalence of comorbidities in adult patients undergoing open heart surgery and to evaluate their implications on recovery profile.

**Methods:** This randomized retrospective observational study of 100 adult patients presented for heart surgery for different pathologies took place at Queen Alia heart Institute in the period of time between February 2013 and June 2014. Patients' data was collected in forms, tabulated and retrospectively analyzed. Patients' demographics, comorbidities and type of surgery were recorded. Risk stratification models (ASA-American Society of Anesthesiology and EUROSCORE 2- European system for cardiac operative risk evaluation) were used. Time of extubation, ICU discharge and hospital discharge was recorded with each patient.

**Results:** Age of patients ranged from 18 to 77 years (mean±SD: 58±12). 83% of patients were male and 17% were female. 80 patients were presented for CABG and 20 patients for heart valve(s) surgery. BMI (body mass index, mean±SD) was 28.9±4.6 kg/m<sup>2</sup>. The prevalence of smoking was 56% (6 times higher among males (64%), in comparison to females (12%). Hypertension was prevalent in 72% of patients; diabetes was present in 53%, respiratory disease in 30%, previous myocardial infarction in 23%, 37% of patients had left ventricular impairment, renal impairment in 6%, renal failure in 2% and previous stroke in 2%. EUROSCORE values ranged between 0.5 to 5.3 % (mean 1.4%). ASA grades ranged from 2 to 4 (85% of patients were grade 3). 5% of surgeries were emergent. Average operative time was 248±47 minutes (mean±SD). 30% of patients needed inotropic support and 6% needed intra-aortic balloon. Mean time in the intensive care was 43.2±28.8 hours (mean±SD).

**Conclusions:** There is a high prevalence of co-morbidities in patients presented for cardiac surgery. Most common associated diseases were hypertension, obesity, smoking, previous myocardial infarction and diabetes; which are all well known risk factors of ischemic heart disease. Preoperative risk scoring is of paramount importance.

**Keywords:** Cardiac surgery, Cardiopulmonary bypass, Comorbidities, Convalescence, Hospitalization time, Intensive care unit

### INTRODUCTION

Improvements in perioperative medical care, anesthetic management, surgical and myocardial protection

techniques made cardiac surgery feasible in the high risk surgical patients. Also, the increasing age of patients presented for cardiac surgery resulted in increased burden of risk factors and reduced functional levels. Different

risk stratification models (Parsonnet score, EUROSCORE, CARE (Cardiac anaesthesia risk evaluation) score, STS (Society of Thoracic Surgeons) score, ASA (American Society of Anesthesiology) score and many others) were used with variable success to evaluate the preoperative risk of cardiac surgical population. Each of these scores takes into account several variables of risk factors that can help in patient counseling, selection of treatment options, assessment of risk/benefit, prediction postoperative morbidity and/or mortality, comparison of postoperative results, and quality-improvement programmes.<sup>1,2</sup>

Among the aforementioned risk stratification tools, the EuroSCORE and the STS score are the two most frequently used in Europe and North America respectively. EuroSCORE involves 18 clinical parameters among three categories; each weighted accordingly, while STS score comprises 40 clinical parameters (or variables).<sup>3,4</sup> Many published clinical articles studied and compared the performance of the up-to-date risk scoring models (tools) in accordance to demographic differences between patient's population and type of cardiac surgery. Some authors had conflicting opinions of superiority of one score over another while other authors resumed very similar in predictive performance.<sup>5,6</sup>

Along with most commonly studied risk factors (left ventricular impairment, chronic respiratory disease, renal dysfunction, hypertension, diabetes mellitus, obesity, peripheral vascular disease, previous stroke, previous myocardial infarction, smoking, redo cardiac surgery and others) age of patient, gender and the urgency of surgery (being elective, urgent or emergency) are used in preoperative risk assessment.

Important moments that can delineate early postoperative (convalescence) period are removal of endotracheal tube (extubation), intensive care unit discharge and hospital discharge. The influence of preoperative factors (demographic factors and comorbidities) on recovery will be demonstrated in this study.

## METHODS

This observational study was performed at Queen Alia Heart Institute from February 2013 till June 2014. Ethical committee approval obtained. 100 adult patients presented for coronary artery grafting, valve(s) surgery or combined (CABG and valve) surgeries with cardiopulmonary bypass and aortic cross clamping were enrolled in this study. Data collected in a special form designed for the purpose of this study.

Inclusion criteria included: adult age, on-pump CABG, valve(s) or combined (CABG and valve). Exclusion criteria included: OPCAB (off-pump coronary artery

bypass), ASD (atrial septal defect), AAR (aortic arch replacement) and pre-operative cardiac arrest, mechanically ventilated prior to surgery and paediatric surgeries.

European system for cardiac operative risk evaluation (EUROSCORE) has been calculated using the new model (also called EUROSCORE II), values ranged between 0.5 to 5.3 % (risk of mortality) with an average of 1.4%.

Independent t-test was used to determine the effect of gender, hypertension, diabetes, smoking, morbid obesity, left ventricular impairment, urgency of surgery. Correlation test was used for determine the effect of the BMI, operative time.

Comorbidities are coexisting diagnoses that are indirectly related to the principal surgical diagnosis but that may alter the outcome of operation. Left ventricular impairment was defined by an echocardiographic assessment of the left ventricular segmental motion. Previous myocardial infarction (MI) was defined if the patient had any Q wave appearance or enzyme leak in the past 6 months from surgery.

Respiratory disease was considered for any patient who is being followed or treated under the care of the pulmonology team. Smoking status is, any patient who did not quit smoking for the last 6 months before surgery is considered a smoker.

## RESULTS

Average age of patients was 58 years (ranged between 18 and 77). Male: female ratio 4.9. The number of patients who underwent CABG is 84 (84%); the internal mammary artery was harvested and used in 60 patients (71.4% of those undergoing CABG, and 60% of the total number of patients in the study).

**Table 1: Patients' demographics and comorbidities.**

Variable	n (%) or mean±SD
Age(years) mean ± SD	57.5±11.5
BMI (kg/m <sup>2</sup> ) mean ± SD	28.9 ± 4.6
Morbid obesity BMI≥40 kg/m <sup>2</sup> n (%)	2 (%)
Female n (%)	17 (%)
Male n (%)	83 (%)
Respiratory disease n (%)	30 (%)
Hypertension n (%)	73 (%)
Diabetes n (%)	54 (%)
Smoking n (%)	57 (%)
Previous MI n (%)	24 (%)
LV impairment n (%)	38 (%)

**Table 2: Intraoperative characteristics and their influence on hospitalization time.**

Intraoperative variables	Mean±SD	TOMV p-value	LOICUS p-value	LOH p-value
Operative time (minutes)	247±46	0.23	0.27	0.008
CPB time (minutes)	86±26	0.44	0.02	0.18
AXC time (minutes)	48±21	0.43	0.006	0.11
Hypothermia ( ° Celsius)	33±1.3	0.016	0.001	0.133

One valve surgery was performed in 8 patients. Four patients had more than one valve repaired and/or replaced, and another 4 patients had combined valve and CABG surgery. Most of the cases were elective (95 patients) and five cases were urgent.

**Table 3: Postoperative characteristics.**

<b>Inotropic support n (%)</b>	<b>33 (%)</b>
Post-operative blood loss (ml) mean±SD	412.7±328.7
Reopening (resternotomy) n (%)	4 (%)

**Table 4: Effect of preoperative parameters on duration of hospitalization.**

Variable		Number of patients (%)	ICU time Mean±SD	Hospital time Mean± SD
Gender	Male	83 (%)	1.7±1.1	4.9±0.9
	Female	17 (%)	1.9±1.4	5.8±2
p-value			0.580	0.007
LV Impairment	Yes	38 (%)	2.2±1.4	5.4±1.2
	No	62(%)	1.5±0.9	4.8±1.2
p-value			0.002	0.024
HTN	Yes	72(%)	1.8±1.2	5.1±1.3
	No	28 (%)	1.6±1	5±0.8
p-value			0.446	0.790
DM	Yes	54 (%)	1.8±1.2	5±1
	No	46 (%)	1.7±1.2	5.1±1.4
p-value			0.597	0.654
Previous MI	Yes	24 (%)	1.7±1.2	4.8±1
	No	76 (%)	1.8±1.1	5.1±1.3
p-value			0.847	0.336
Morbid obesity	BMI*≤40	2 (%)	1.7±1	5±1
	BMI>40	98 (%)	3.5±3.5	8.5±5
p-value			0.043	0.001
Smoking	Yes	56 (%)	1.7±1.2	4.9±1
	No	44 (%)	1.8±1.2	5.3±1.4
p-value			0.850	0.104
Respiratory illness	Yes	30 (%)	2±1.3	5.1±1.3
	No	70 (%)	1.7±1.1	5.1±1.2
p-value			0.195	0.817
Urgency	Elective	95 (96%)	1.7±1.2	5±1.25
	Urgency	5 (5%)	2.8±1.5	5.8±0.8
p-value			0.056	0.19

BMI: Body mass index (kg/m<sup>2</sup>).

## DISCUSSION

Increased risk after cardiac surgery have been attributed to many different conditions such as renal dysfunction, diabetes, recent acute coronary syndromes, old age, left ventricular dysfunction, reoperation, urgency of surgery,

female gender, type of surgery and body habitus.<sup>2</sup> The first model for risk scoring for cardiac surgery was introduced by Paiement et al. in 1980 at the Montreal Heart Institute.<sup>7</sup>

Since then many risk stratification tools were developed by cardiac surgeons, anaesthetists and intensive care

doctors to aid patient counseling and decision making.<sup>8-12</sup> Validation of these risk stratification tools and comparisons between their performances was investigated thoroughly in recent literature.<sup>13-19</sup> Although risk scoring was originally designed to predict perioperative mortality after cardiac surgery its use for prediction intensive care unit length of stay and duration of hospitalization has been increasing.<sup>20-22</sup>

Outcome after cardiac surgery is not solely affected by preoperative factors and anatomy or pathology of the heart and coronaries but also affected by durations of cardiopulmonary bypass and aortic cross clamping, blood (and products) transfusions, postoperative bleeding and re-sternotomy, postoperative stroke and renal failure.<sup>23-31</sup> It is important to note that mortality and morbidity can be cardiac and non-cardiac, and if cardiac, it can be ischemic or non-ischemic. Most authors consider early (30 day) mortality as most definitive outcome, in our study we consider outcome as when patient is discharged from ICU or when he or she is discharged from hospital and sent home. Prediction of duration of ICU and hospital stay has been shown to be an important factor in planning, better resource utilization and for establishing priority criteria, that is to decide who would benefit from the treatment in the proper time, all to “serve” the largest number of patients in need, in the proper time.<sup>32,33</sup>

Of the preoperative factors discussed in this study preoperative left ventricular dysfunction ( $p = 0.02$ ), morbid obesity ( $p = 0.001$ ), and female gender ( $p = 0.007$ ) had most significant influence on postoperative convalescence as hospital discharge was delayed (Table 4). Other preoperative factors that caused statistically non-significant delay in postoperative recovery were diabetes, hypertension, urgency of surgery and smoking. Gender and old age were found to be as independent risk factors by many authors.<sup>34,35</sup>

Intraoperative factors studied are duration of surgery, duration of cardiopulmonary bypass (CPB), duration of aortic cross clamping (AXC) and the level of hypothermia utilized during surgery. Operative time had most significant influence on overall hospital stay ( $p = 0.008$ ); probably due to accumulation of anesthetic drugs used which could result delayed extubation. Intraoperative hypothermia and durations of CPB and AXC delayed intensive care unit stay but didn't have statistically significant influence on overall hospitalization. Possible explanation of the effect of duration of hypothermia utilized during open heart surgery is the effect on phrenic nerve which may cause diaphragmatic weakness and delay in extubation.<sup>36</sup> Implications of prolonged CPB were attributed to increase in micro-embolic load which also may delay early postoperative recovery.<sup>37</sup> Postoperative factors here that were found to influence postoperative recovery were inotropic support, postoperative bleeding (and eventually re-sternotomy) and re-intubation, are usually due to comorbidities (preoperative factors) such as preoperative

left ventricular dysfunction, coagulopathies (and blood thinning drugs) and respiratory disease. Incidence of re-sternotomy (reopening) in our study was 4%. Patients presented for urgent surgery usually receive antiplatelet therapy (clopidogrel) prior to coronary angiography and have higher tendency for bleeding, which attribute for delay in recovery; probably due to re-administration of induction doses of anesthetic drugs and need of massive blood (and products) transfusion with consequent risk of acute lung injury, which can disastrous in patients with compromised pulmonary function preoperatively.<sup>38,39</sup>

## CONCLUSION

Cardiac surgical patients often have comorbid illnesses that can have serious implications postoperatively. Preoperative assessment and optimization of comorbid patients is of paramount value and is best achieved by multidisciplinary approach and careful planning. Scores that can predict convalescence period duration need to be developed.

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