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Factors associated with 1-year mortality of patients undergoing coronary artery bypass grafting at King Chulalongkorn Memorial Hospital

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Objective : *This study was conducted to investigate predictors of mortality after isolated coronary artery bypass grafting (CABG).*

Design : *Retrospective study*

Setting : *King Chulalongkorn Memorial Hospital.*

Methods : *Retrospective single-institutional data on risk factors and mortality were collected from 196 patients who underwent isolated CABG by the same group of surgeons from November 2007-October 2008. The relationship between risk factors and outcome was assessed using univariate and multivariate analyses.*

Results : *The mean age of the patients (30.1% women and 69.9% men) was 61.1 +/- 9 years. Hypertension was the most common comorbidity factor (82.7%), followed by diabetes mellitus, smoking habit, stroke, renal impairment, and chronic obstructive pulmonary disease. Postoperative atrial fibrillation and ventricular tachycardia were the two most common complications (21.4%). The patients were followed up for 12 months. The operative mortality was 11.7% (23/196) in the patients undergoing CABG. The univariate analysis*

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identified 14 preoperative and 8 postoperative risks which were significantly correlated with operative mortality. Stepwise multivariate analysis of our perioperative risk revealed that the predictors of operative mortality were male gender, length of hospital stay, preoperative intra-aortic balloon pump, duration of mechanical ventilatory support, postoperative neurological complications, and wound infection.

Conclusion : *We conclude that coronary artery bypass grafting surgery should be performed in carefully selected patients, and prevention of postoperative complications is mandatory to reduce mortality.*

Keywords : *Mortality, artery bypass grafting surgery, factor.*

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กฤษณ์ พิสัยพันธ์, อรนุช เกี่ยวข้อง. ปัจจัยที่เกี่ยวข้องกับการเสียชีวิตในหนึ่งปีภายหลังจากการผ่าตัดทำทางเบี่ยงหลอดเลือดโคโรนารีในโรงพยาบาลจุฬาลงกรณ์. จุฬาลงกรณ์เวชสาร 2555 ม.ค. – ก.พ.; 56(1): 17 – 36

วัตถุประสงค์ : *เพื่อศึกษาหาปัจจัยที่มีผลต่อการเสียชีวิตภายหลังจากการผ่าตัดทำทางเบี่ยงหลอดเลือดโคโรนารี*

วิธีการ : *การศึกษาแบบย้อนหลังในผู้ป่วยจำนวน 196 คนที่เข้ารับการผ่าตัดทำทางเบี่ยงหลอดเลือดโคโรนารีในโรงพยาบาลจุฬาลงกรณ์ ระหว่างวันที่ 1 พฤศจิกายน พ.ศ. 2550 ถึง วันที่ 31 ตุลาคม พ.ศ. 2551*

รูปแบบการวิจัย : *การศึกษาแบบย้อนหลัง*

สถานที่ทำการศึกษา : *โรงพยาบาลจุฬาลงกรณ์*

ผลการศึกษา : *จากผู้ป่วยที่ทำการศึกษา เป็นผู้ชาย 137 คน (69.9%) ผู้หญิง 59 คน (30.1%) มีอายุโดยเฉลี่ย 61.1 +/- 9 ปี ภาวะร่วมที่พบบ่อยที่สุดคือโรคความดันโลหิตสูง (82.7%) รองลงมาคือ เบาหวาน, สูบบุหรี่,โรคหลอดเลือดสมอง, การทำงานของไตผิดปกติ และโรคถุงลมโป่งพอง ภาวะแทรกซ้อนหลังการผ่าตัดที่พบมากที่สุด คือ ภาวะหัวใจเต้นผิดจังหวะ ชนิด atrial fibrillation/ventricular tachycardia พบอัตราการเสียชีวิตภายหลังการผ่าตัดทำทางเบี่ยงหลอดเลือดโคโรนารี 23 คน (11.7%) จาการศึกษานี้พบว่าปัจจัยที่เพิ่มความเสี่ยงต่อการเสียชีวิตหลังการผ่าตัดทำทางเบี่ยงหลอดเลือดโคโรนารี ได้แก่ เพศชาย, ระยะเวลาที่นอนโรงพยาบาล, การใส่ intraaortic balloon pump ก่อนผ่าตัด, ระยะเวลาที่ใช้เครื่องช่วยหายใจ, ภาวะแทรกซ้อนทางระบบประสาทหลังผ่าตัด และ แผลติดเชื้อหลังผ่าตัด*

สรุป : *การผ่าตัดทำทางเบี่ยงหลอดเลือดโคโรนารีควรเลือกทำในผู้ป่วยที่เหมาะสม และควรป้องกันการเกิดภาวะแทรกซ้อนต่าง ๆ หลังผ่าตัดเพื่อลดอัตราการเสียชีวิต*

คำสำคัญ : *การเสียชีวิต, การผ่าตัดทำทางเบี่ยงหลอดเลือดโคโรนารี, ปัจจัย.*

Coronary artery bypass grafting surgery (CABG) has been used to treat patients with coronary artery disease for over 50 years. [1] Both the severity of associated comorbidities such as diabetes and/or peripheral vascular disease and the quality of perioperative care affect the observed outcome after CABG. [2, 3] The wide spread consensus on factors that related mortality after CABG in the past has been proved difficult to achieve. A number of lists of variables used to categorize perioperative factors have been shared among the many cardiovascular databases established to monitor mortality after CABG.[4] The prediction of surgical outcome based on preoperative data can be both very beneficial, and in some instances, controversial. Therefore, the mortality risk of CABG has been the focus of numerous studies in the last few years, which have differed with respect of the time period examined, data compared, and the inclusion of patients with various concomitant procedures. This study is intended to identify factors associated with mortality among patients undergoing CABG at King Chulalongkorn Memorial Hospital.

Material and Methods

This study has been approved by the Institutional Review Board (IRB), Faculty of Medicine, Chulalongkorn University. All patients gave written informed consent before recruitment. Data for this observational study were collected from patients undergoing CABG at King Chulalongkorn Memorial Hospital between November 2007 and October 2008. Data were collected during the preanesthetic visits and perioperative periods until the patients were discharged. The postoperative data were obtained by a trained interviewer using telephone calls.

Study population

Two hundred and twenty elective and emergency CABG patients from November 2007 to October 2008 were enrolled in this study. Twenty four patients were loss to follow up during the study period.

Mortality after CABG

The identified variables describing characteristics considered useful to monitor mortality after CABG were adjusted from EuroSCORE system[5] which is the risk-analysis prediction on early mortality in high-risk patients who underwent heart surgery.

Statistical analysis

Descriptive statistics were calculated for preoperative, intraoperative, and postoperative factors. The categorical variables are presented as number and percentage. Chi-square test was used to compare categorical variables. Univariate analyses were performed between the factor variables by Chi-square test then presented as crude odds ratio with 95% confident intervals (CI) and *p-value*. Independent variables associated with mortality with a *p-value* ≤ 0.1 in the univariate analysis were considered in the multivariate model. Multiple logistic regression with fitting models were used to evaluate the significant factors contributing to operative mortality, then presented as adjusted odds ratio with 95% CI. Data were analyzed using SPSS version 16.0. A *p-value* < 0.05 was considered statistically significant.

Results

Baseline clinical characteristics of the patients are shown in Table 1. During the study period, data were collected from 220 patients. Follow ups

were completed in 196 out of 220 patients (89.09%). Overall mortality was 11.7 % (23/196) while 9 patients died in the first hospital admission, 14 patients died during the follow-up period, and 24 patients were loss to follow up during the study period. The median age was 61.1 +/- 9 years and the majority of the patients were male (69%). Almost half of the patients had poor left ventricular ejection fraction (LVEF) < 0.3. Overall the study population had significant burden of comorbidities including hypertension (82.7%), diabetes mellitus (50%), stroke (11.4%), renal impairment (11.2%), chronic obstructive pulmonary disease (10.2%), peripheral vascular disease (5.7%), and a dependency on dialysis(5.1%). Approximately one-third of the study population were active smokers at the time of surgery. Seventy-nine percent of patients were diagnosed with triple- vessel disease, and CABG was predominately the first operation in 96% of the patients. Two- thirds of the study population had New York Heart Association (NYHA) Class 1 or 2. One third had NYHA class 3 or 4, and approximately 3.2 % of study population had undergone multiple reoperations. Intraoperatively, 95.4 % of the patients were operated under conventional cardiopulmonary bypass; 85.2% of them needed at least 3-vessel bypass surgery. Postoperatively, 76.1% of the patients were mechanically ventilated in ICU $\leq$ 1 day. The prevalence of postoperative complications was low. The highest prevalence of postoperative complication was cardiac arrhythmias (atrial fibrillation or ventricular tachycardia), which developed in 21.4% of the study population; 48.5% of the patients rated their severity of postoperative pain as moderate (according to verbal numerical rating scale 4-6).

To determine the risk factors correlated to mortality in patients undergoing CABG, we performed univariate analysis separately for preoperative, intraoperative, and postoperative variables. Then, a stepwise multiple logistic regression analysis was performed separately for operative mortality. Fourteen preoperative and eight postoperative variables were included in the regression model for the operative mortality. These variables were chosen because they were significant in the univariate analysis ($p < 0.1$). The logistic regression demonstrated that male gender, length of hospital stay, preoperative intraaortic balloon pump, duration of mechanical ventilatory support, postoperative neurological complication, and wound infection correlated with increased operative mortality (Table 2 - 6).

Discussion

The ability to predict the outcome of CABG before undertaking the operation has always been of great interest to physicians and their patients. The challenge includes how to reduce or prevent morbidity and mortality, which can be facilitated by identifying the patients of high risk before surgery. The goal of this study was to identify the factors related to mortality in patients undergoing CABG. Our study found that there were a number of preoperative, intraoperative, and postoperative factors related to death in CABG patients. In the preoperative period, we found that length of stay, male gender, and preoperative IABP were risk factors of mortality.

While some controversies still exists on the subject, the majority of studies examining gender-specific outcomes after CABG surgery have demonstrated higher survival rates in men.[6-9] There were studies reporting younger women undergoing

Table 1. Preoperative conditions.

	Control n (%)
Age (Year)	
<65	94 (48.0)
65-75	69 (35.2)
75-80	24 (12.2)
>80	9 (4.6)
Gender	
Male	137 (69.9)
Female	59 (30.1)
Length of Stay (day)	
< 18	155 (79.1)
≥18	41 (20.9)
Body Mass Index Kg/m2	
Normal < 25	96 (52.2)
Overweight ≥25	88 (47.8)
History of Smoking	
No	79 (40.3)
Yes	117 (59.7)
Diabetes	
No	98 (50.0)
Yes	98 (50.0)
Renal Impairment Cr > 2	
No	174 (88.8)
Yes	22 (11.2)
Dialysis Dependent	
No	186 (94.9)
Yes	10 (5.1)
History of Stroke/TIA	
No	174 (88.8)
Yes	22 (11.2)
Hypertension	
No	34 (17.3)
Yes	162 (82.7)
Peripheral Vascular Disease	
No	186 (94.9)
Yes	10(5.1)
Angina Pectoris	
Unstable	72 (36.7)
Stable	124 (63.3)

Table 1. Preoperative conditions. (Continued)

	Control n (%)
Time of Post-angina symptoms	
< 7 days	37 (18.9)
7-30 days	27 (13.8)
> 30 days	132 (67.3)
Congestive Heart Failure	
No	37 (18.9)
Yes	159 (81.1)
Unstable hemodynamics	
No	23 (11.7)
Yes	173 (88.3)
Exercise tolerance NYHA 1-4	
1	17 (8.7)
2	105 (53.6)
3	66 (33.7)
4	8 (4.1)
Cardiac arrthymias (AF, VT)	
No	167 (85.2)
Yes	29 (14.8)
Cardiac catheterization: 3 -vessel disease	
No	38 (19.4)
Yes	158 (80.6)
Left main disease	
No	140 (71.4)
Yes	56 (28.6)
Left ventricular Ejection fraction (%)	
< 30	93 (47.4)
30-60	18 (9.2)
> 60	85 (43.4)
Preoperative intra-aortic balloon pump	
No	183 (93.4)
Yes	13 (6.6)
Status emergency surgery following PTCA or cardiac catheterization	
No	191 (97.4)
Yes	5 (2.6)
Operation	
First operation	190 (96.9)
Multiple reoperations	6 (3.1)

Table 1. Preoperative conditions. (Continued)

	Control n (%)
History of active endocarditis	
No	191 (97.4)
Yes	5 (2.6)
Valve surgery	
No	166 (84.7)
Yes	30 (15.3)
Pulmonary disease	
No	176 (89.8)
Yes	20 (10.2)
Liver disease	
No	195 (99.5)
Yes	1 (0.5)
ASA PS	
1	16 (8.2)
2	24 (12.2)
3	140 (71.4)
4	16(8.2)
5	0
Emergency	
No	191 (97.4)
Yes	5 (2.6)
Medication Beta-blocker	
No	98 (50.0)
Yes	98 (50.0)
Medication Diuretics	
No	115 (58.7)
Yes	81 (41.3)
Medication ACEI	
No	126 (64.3)
Yes	70 (35.7)
Medication Ca channel blocker	
No	160 (81.6)
Yes	36 (18.4)
Medication Statins	
No	70 (35.7)
Yes	126 (64.3)
Medication ASA	
No	39 (19.9)
Yes	157 (80.1)
Medication Clopidogrel	
No	87 (45.1)
Yes	106 (54.9)

Table 2. Univariate preoperative factors.

	Control n (%)	Death n (%)	OR crude [95%CI]	*p*-value
Age (Year)				
<65	94 (48.0)	7 (30.4)	1	
65-75	69 (35.2)	7 (30.4)	1.4[0.46-4.06]	0.58
75-80	24 (12.2)	3 (13.0)	1.7 [0.40-6.98]	0.48
>80	9 (4.6)	6 (26.1)	8.95 [2.47-32.43]	0.001
Gender				
Male	137 (69.9)	21 (91.3)	1	
Female	59 (30.1)	2 (8.7)	0.2 [0.05-0.97]	0.03
Length of Stay (day)				
< 18	155 (79.1)	9 (39.1)	1	
≥ 18	41 (20.9)	14 (60.9)	5.9 [2.38-14.54]	<0.001
Body Mass Index Kg/m2				
Normal < 25	96 (52.2)	16 (69.6)	1	
Overweight ≥ 25	88 (47.8)	7 (30.4)	0.5 [0.19-1.22]	0.115
History of Smoking				
Yes	117 (59.7)	7 (30.4)	1	
No	79 (40.3)	16(69.6)	3.4 [1.33-8.60]	0.007
Diabetes				
Yes	98 (50.0)	9 (39.1)	1	
No	98 (50.0)	14 (60.9)	1.6 [0.64-3.76]	0.324
Renal Impairment Cr > 2				
No	174 (88.8)	17 (73.9)	1	
Yes	22 (11.2)	6 (26.1)	2.8 [0.99-7.83]	0.09
Dialysis Dependent				
No	186 (94.9)	19 (82.6)	1	
Yes	10 (5.1)	4 (17.4)	3.9 [1.12-13.69]	0.046
History of Stroke/TIA				
No	174 (88.8)	20 (87.0)	1	
Yes	22 (11.2)	3(13.0)	1.2 [0.33-4.32]	0.733
Hypertension				
No	34 (17.3)	2 (8.7)	1	
Yes	162 (82.7)	21 (91.3)	2.2 [0.49-9.85]	0.384
Peripheral Vascular Disease				
No	186 (94.9)	20 (94.9)	1	
Yes	10 (5.1)	3 (13.0)	2.8 [0.71-10.98]	0.144

Table 2. Univariate preoperative factors. (Continued)

	Control n (%)	**Death n (%)**	**OR crude [95%CI]**	***p*-value**
Angina Pectoris				
Unstable	72 (36.7)	12 (52.2)	1	
Stable	124 (63.3)	11 (47.8)	0.5 [0.22-1.26]	0.150
Time of post-angina symptoms				
< 7 days	37 (18.9)	13 (56.5)	1	
7-30 days	27 (13.8)	3 (13.0)	0.3 [0.08-1.22]	0.095
> 30 days	132 (67.3)	7 (30.4)	0.2 [0.06-0.41]	< 0.001
Congestive Heart Failure				
No	37 (18.9)	12 (52.2)	1	
Yes	159 (81.1)	11 (47.8)	0.2 [0.09-0.52]	<0.001
Unstable hemodynamics				
No	23 (11.7)	11 (47.8)	1	
Yes	173 (88.3)	12 (52.2)	0.1 [0.06-0.37]	<0.001
Exercise tolerance NYHA 1-4				
1	17 (8.7)	1 (4.3)	1	
2	105 (53.6)	5 (21.7)	0.8 [0.09-7.4]	0.851
3	66 (33.7)	9 (39.1)	2.3 [0.3-19.58]	0.440
4	8 (4.1)	8 (34.8)	17.0 [1.81-160.05]	0.013
Cardiac arrthymias (AF, VT)				
No	167 (85.2)	16 (69.6)	1	
Yes	29 (14.8)	7 (30.4)	2.5 [0.95-6.66]	0.072
cardiac catheterization:				
3 -vessel disease				
No	38 (19.4)	4 (17.4)	1	
Yes	158 (80.6)	19 (82.6)	1.1 [0.37-3.55]	1.00
Left main disease				
No	140 (71.4)	17 (73.9)	1	
Yes	56 (28.6)	6 (26.1)	0.9 [0.33-2.35]	0.802
Left ventricular Ejection fraction (%)				
< 30	9347.4()	12 (52.2)	1	
30-60	18 (9.2)	7 (30.4)	3.0 [1.04-8.69]	0.041
> 60	85 (43.4)	4 (17.4)	0.4 [0.11-1.17]	0.091
Preoperative Intra-aortic balloon pump				
No	183 (93.4)	13 (56.5)	1	
Yes	13 (6.6)	10(43.5)	10.8 [3.99-29.38]	<0.001

Table 2. Univariate preoperative factors. (Continued)

	Control n (%)	**Death n (%)**	**OR crude[95%CI]**	***p*-value**
Status emergency surgery following PTCA or cardiac catheterization				
No	191 (97.4)	18 (78.3)	1	
Yes	5 (2.6)	5 (21.7)	10.6 [2.81-40.14]	<0.001
Operation				
First operation	190 (96.9)	22 (95.7)	1	
Multiple reoperations	6 (3.1)	1 (4.3)	1.4 [0.17-12.51]	0.545
History of active endocarditis				
No	191 (97.4)	22 (95.7)	1	
Yes	5 (2.6)	1 (4.3)	1.7 [0.19-15.54]	0.490
Valve surgery				
No	166 (84.7)	18 (78.3)	1	
Yes	30 (15.3)	5 (21.7)	1.5 [0.53-4.46]	0.382
Pulmonary disease				
No	176 (89.8)	20 (87.0)	1	
Yes	20 (10.2)	3 (13.0)	1.3 [0.36-4.84]	0.717
Liver disease				
No	195 (99.5)	22 (95.7)	1	
Yes	1 (0.5)	1 (4.3)	8.9 [0.54-146.73]	0.199
ASA PS				
1	16 (8.2)	0	-	-
2	24 (12.2)	2 (8.7)		
3	140 (71.4)	9 (39.1)		
4	16 (8.2)	9 (39.1)		
5	0	3 (13.0)		
Emergency				
No	191 (97.4)	15 (65.2)	1	
Yes	5 (2.6)	8 (34.8)	20.4 [5.9-70.04]	<0.001
Medication Beta-blocker				
No	98 (50.0)	14 (60.9)	1	
Yes	98 (50.0)	9 (39.1)	0.6[0.26-1.55]	0.382
Medication Diuretics				
No	115 (58.7)	7 (30.4)	1	
Yes	81 (41.3)	16 (69.6)	3.2 [1.28-8.25]	0.010

Table 2. Univariate preoperative factors. (Continued)

	Control n (%)	**Death n (%)**	**OR crude[95%CI]**	***p*-value**
Medication ACEI				
No	126 (64.3)	14 (60.9)	1	
Yes	70 (35.7)	9 (39.1)	1.2 [0.48-2.81]	0.747
Medication Ca channel blocker				
No	160 (81.6)	18 (78.3)	1	
Yes	36 (18.4)	5 (21.7)	1.2 [0.43-3.55]	0.777
Medication Statins				
No	70 (35.7)	9 (39.1)	1	
Yes	126 (64.3)	14 (60.9)	0.9[0.36-2.09]	0.820
Medication ASA				
No	39 (19.9)	3 (13.0)	1	
Yes	157 (80.1)	20 (87.0)	1.6 [0.47-5.86]	0.580
Medication Clopidogrel				
No	87 (45.1)	10 (45.5)	1	
Yes	106 (54.9)	12 (54.5)	1.0 [0.41-2.39]	0.973

Table 3. Multivariate preoperative factors.

	OR crude [95%CI]	**OR adjusted [95%CI]**
Gender		
Male	1	1
Female	0.2 [0.05-0.97]	0.2 [0.045-1.03]
Length of Stay (day)		
< 18	1	1
≥18	5.9 [2.38-14.54]	6.2 [2.27-16.98]
Preoperative intra-aortic balloon pump		
NO	1	1
Yes	10.8 [3.99-29.38]	9.7 [3.19-29.58]

Table 4. Univariate intraoperative factors.

	Control n (%)	Death n (%)	OR crude [95%CI]	p-value
Cardiopulmonary bypass time				
< 2 h	90 (43.5)	4 (33.3)	1	
2-4 h	100 (48.3)	7 (58.3)	1.6 [0.45-5.56]	0. 480
> 4 h	17(8.2)	1 (8.3)	1.3 [0.14-12.58]	0. 807
Clamping time of the ascending aorta				
< 1 h	54 (26.1)	3 (25.0)	1	
1-2 h	120 (58.0)	6 (50.0)	0.9 [0.22-3.73]	0. 885
> 2 h	33 (15.9)	3 (25.0)	1.6 [0.31-8.59]	0. 560
Number of CABG vessels				
1	8 (3.9)	1 (8.3)	1	
2	23 (11.1)	1 (8.3)	0.3 [0.02-6.23]	0. 473
>3	176 (85.0)	10 (83.3)	0.4 [0.05-3.99]	0. 477
Type of surgery				
Off-pump	10 (4.8)	1 (8.3)	1	
On-pump coronary artery bypass grafting	197 (95.2)	11 (91.7)	0.6 [0.06-4.76]	0. 470
Use of vasopressor during coming off CPB				
No	79 (38.2)	2 (16.7)	1	
Yes	128 (61.8)	10 (83.3)	3.1[0.66-14.45]	0. 218
Inhalation agentsIsoflurane				
Yes	120 (58.0)	8 (66.7)	1	
No	87 (42.0)	4 (33.3)	0.7 [0.20-2.36]	0. 765
Desflurane				
No	207	12		
Yes	0	0		
Sevoflurane				
No	114 (55.1)	7 (58.3)	1	
Yes	93 (44.9)	5 (41.7)	0.9 [0.27-2.85]	0. 825

Table 5. Univariate postoperative factors.

	Control n (%)	Death n (%)	OR crude [95%CI]	p-value
Duration of mechanical ventilatory support (hours)				
<8	46 (23.5)	4 (17.4)	1	
8 - 24	103 (52.6)	5 (21.7)	0.6 [0.14-2.17]	0. 401
24 – 48	27 (13.8)	0	-	-
>48	20 (10.2)	14 (60.9)	8.1 [2.35-27.51]	0. 001
Duration of vasopressor use (day)				
< 1	59 (30.1)	4 (17.4)	1	
1-2	81 (41.3)	5 (21.7)	0.9 [0.23-3.64]	0. 892
> 2	56 (28.6)	14 (60.9)	3.69 [1.14-11.88]	0. 029
Neurological complication				
No	186 (94.9)	14 (60.9)	1	
Yes	10 (5.1)	9 (39.1)	11.9[4.18-34.23]	<0.001
Delirium				
No	179 (91.3)	18 (78.3)	1	
Yes	17 (8.7)	5 (21.7)	2.9 [0.96-8.86]	0.063
Respiratory complication				
No	162 (82.7)	11 (47.8)	1	
Yes	34 (17.3)	12 (52.2)	5.2 [2.12-12.76]	<0.001
Cardiovascular complication				
No	176 (89.8)	12 (52.2)	1	
Yes	20 (10.2)	11 (47.8)	8.1 [3.15-20.65]	<0.001
Renal complication				
No	186 (94.9)	15 (65.2)	1	
Yes	10(5.1)	8 (34.8)	9.9 [3.41-28.87]	<0.001
Reoperation in 24 h				
No	189 (96.4)	21 (91.3)	1	
Yes	7 (3.6)	2 (8.7)	2.6 [0.50-13.19]	0. 241
Atrial fibrillation , Ventricular tachycardia				
No	154 (78.6)	13 (56.5)	1	
Yes	42 (21.4)	10 (43.5)	2.8 [1.16-6.88]	0. 019
Wound infection				
No	191 (97.4)	18 (78.3)	1	
Yes	5 (2.6)	5 (21.7)	10.6[2.81-40.14]	0. 001
Pain score				
Mild VNRS 1-3	94 (48.0)	17 (73.9)	1	
Moderate VNRS 4-6	95 (48.5)	6 (26.1)	0.3 [0.13-0.92]	0.034
Severe VNRS 7-10	7 (3.6)	0	-	

Table 6. Multiple Logistic regression for postoperative factors.

	OR crude [95%CI]	OR adjusted [95%CI]
Duration of mechanical ventilatory support (hours)		
<8 h	1	1
8 - 24 h	0.6 [0.14-2.17]	0.5 [0.11-2.01]
24 – 48 h	-	-
> 48 h	8.1 [2.35-27.51]	5.1 [1.30-19.74]
Neurological complication		
No	1	1
Yes	11.9 [4.18-34.23]	6.4 [1.82-22.49]
Wound infection		
No	1	1
Yes	10.6 [2.81-40.14]	7.6 [1.40-40.95]

CABG surgery are at a higher risk of in-hospital death than men. Possible explanations of these findings include the fact that, compared with men, women undergoing cardiac surgery are older, are more likely to have unstable angina, have higher rates of comorbid conditions, have smaller coronary arteries (technically compromising surgical anastomoses), and are referred late for myocardial revascularization procedures. [6 - 14] Ennker and colleagues proposed the theory that female gender does not increase operative risk, but shorter height, which is more common in women, affects the outcome, probably due to technical difficulties in shorter patients with smaller internal mammary arteries and coronary vessels.[15] Recent studies show that after adjusting for gender dissimilarities in preoperative risk profiles, women have no increased operative risk to CABG. [16] In contrast, our investigation found an increased risk in men, despite the application of risk-adjustment methods. Conflicting results may be caused by differing approaches to the model selection process. As a consequence, the final models may differ in the confounding factors included, and the lack of standardized criteria for comparing outcomes in relation to preoperative condition limits comparisons between institutions or different therapeutic approaches in patients undergoing coronary artery surgery.

In contrast to the previous studies[17, 18], the preoperative use of statins is not associated with in-hospital mortality in our patients.

Patients with severe left ventricular dysfunction can derive long-term benefit from coronary bypass through improved left ventricular contractility as documented by a markedly decreased systolic left ventricular dimension and increased ejection fraction. A successful bypass is associated with 59% actual 5-year survival rate and significantly improved New York Heart Association functional class.[19] In our study, preoperative symptoms of ischemia such as angina

pectoris and congestive heart failure appeared to be statistically insignificant predictors for mortality after CABG. Only preoperative intra-aortic balloon pump was associated in operative mortality. An important paradigm that must be considered is that it is not a preoperative intra-aortic balloon pump *per se* that causes an increased mortality, but rather a preoperative intra-aortic balloon pump is a marker for other condition with a propensity for mortality, such as severe left ventricular dysfunction. Stated differently, patients with preoperative intra-aortic balloon pump are just sicker. Our finding supports the observation of Hamad and colleagues. [20] The ventricular dysfunction could possibly lead to unstability of hemodynamics and need of IABP. Hence patients in these categories were at risk of mortality after CABG.

Contrary to the prevailing premise, our findings suggest that diabetes may not be a risk factor for CABG mortality. Diabetes has been found to be an independent risk for mortality among the general population undergoing CABG in several studies.[21 - 23] Several hypotheses attempting to explain this finding were suggested. One possible explanation for increased risk among diabetic patients is that the greater proportion of them had diabetic cardiomyopathy with congestive heart failure, independent of the extent of coronary disease. [24, 25]

Emergency coronary artery bypass grafting among patients with PTCA or cardiac catheterization complications and those patients not related to PTCA or cardiac catheterization is associated with high mortality even. Although, the percentage of mortality was not statistically significant. Surgical backup and collaboration between cardiologists, surgeons, and anesthesiologists are needed to reduce delay in management and patients transfer to obtain the good outcome.

Univariate analysis was unable to identify intra-operative predictor of mortality in patients underwent CABG. Duration of CPB, time of ascending aorta clamped, number of CABG vessels, intraoperative vasopressors and anesthetic agents were not associated with an increased mortality rate.

Our study agrees with other studies that neurological complications associated with substantial increases in mortality, length of hospitalization, and use of intermediate- or long-term care facilities. [26, 27] Histories of cerebrovascular disease, diabetes mellitus, peripheral, vascular disease, previous cerebrovascular accident, and hypertension were independent predictors of new postoperative neurological events, as shown in multiple studies. [26, 28]

This study demonstrates that CABG patients with wound infection have significantly increased mortality, independent of other factors that affect mortality in this population. These data confirm the suggestion by Loop *et al*. [29] The exact mechanism by which wound infection develops is unknown and multifactorial. [30] Intraoperative wound contamination has been conclusively demonstrated in a small number of cases[31, 32] and probably represents an important source of many infections. This study suggests that any preventive measures should be conducted to control contamination of surgical patients and to decrease the incidence of sternal wound infection after coronary bypass grafting surgery.

Any postoperative complications (respiratory, cardiovascular and renal complications) affected the

outcome of CABG, and were associated with higher operative mortality, although statistically insignificant. Attempts to prevent these complications would reduce the mortality rate in patients undergoing CABG.

This study is limited by its retrospective nature and the fact that it comes from a single center which makes it difficult to compare the results with those other institutes because the acuity of patient illness and the incidence of comorbidity are not necessarily equal. Although our query was designed to include all operative mortality after CABG, the data were collected from only 196 out of 220 patients. We must acknowledge the possibility that operative mortality may have been underreported, therefore biasing the data to exaggerate the mortality difference. We did not have information on socioeconomic variables, behavioral and psychosocial characteristics. Lacking such data, we were unable to determine whether these factors could play a role in the mortality differences we observed.

Conclusion

Male gender, length of hospital stay, preoperative intra-aortic balloon pump, duration of mechanical ventilatory support, postoperative neurological complications, and wound infection predicted mortality for those who underwent CABG. Conversely, gender, diabetes, smoking, urgency of the operation, symptoms of left ventricular dysfunction, obesity, COPD, and number of bypass grafts were not statistically significant predictors of mortality in our study. However, these factors were still associated with higher odds of mortality and could potentially become statistically significant if a larger study sample size was available. Obviously, the knowledge of the risk factors for mortality in these patients will help clinicians to select proper patients for CABG and to pay special attention to the patients with high- risk factors for this procedure.

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