Short term Outcome of Urgent Coronary Artery Bypass Grafting After Acute Coronary Syndrome

Fathi Elhwat, Elrady Kamal, Mahmoud Mahgoub , Ehab Sobhy , Ehab Sabry Elalfy

Department of Cardiothoracic Surgery , Faculty of Medicine, Zagazig University, Egypt.

Cardiothoracic Surgery Department, Faculty of Medicine, Zagazig University, Egypt.

Corresponding author: **Fathi Elhwat** , Email: mtm_m2010@yahoo.com

Abstract

Background: Many patients with ACS may need urgent revascularization by percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) due to continuing ischemia. **Aim of work:** In this prospective study, we aimed to evaluate the short term outcomes, risk factors of mortality and prognosis of urgent coronary artery bypass grafting (CABG) after acute coronary syndrome (ACS) patients. **Patients and Methods:** We prospectively reviewed 60 patients who underwent urgent coronary artery bypass grafting (CABG). All underwent conventinal CABG on cardio-pulmonary bypass with cardioplegic arrest. Variables that may be related to operative risk were analyzed. **Results:** Mean age at the time of operation was 58.5 ± 7.1 years and more than half of them were males (76.7%). Preoperative mean ejection fraction was 53.4± 9.2 on preoperative echocardiography. Regarding the mortality was 11.7%. **Conclusion:** The most common cause of mortality was low cardiac output. The risk factors of mortality included prolonged cardiopulmonary bypass time, prolonged ventilator use, and extended intensive care unit stay.

Keywords: Coronary artery bypasses grafting, urgent risk factors , Outcomes

Introduction

Acute coronary syndrome (ACS) is a common cause of death, hospitalization, and morbidity worldwide. It includes a spectrum of clinical conditions, associated with decreased blood flow in the coronary arteries to the myocardial tissue [1].

Many patients may require urgent revascularization by percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) due to ongoing

ischemia. CABG offers a survival advantage compared with medical therapy for life threatening situations as unstable angina and left ventricular (LV) dysfunction [2].

Coronary artery bypass grafting (CABG) is a surgical procedure that uses another artery or vein to reroute blood around a blockage in the coronary arteries that supply the heart with blood and oxygen [3].

Urgent CABG is required during the same hospitalization to minimize chance of further clinical deterioration. Examples include, but are not limited to, worsening sudden chest pain, heart failure, acute myocardial infarction, anatomy, intra-aortic balloon pump, unstable angina, with intravenous nitroglycerin, or rest angina [4].

The aim of this study study were to evaluate the predisposing risk factors prior to and after urgent CABG after ACS, to analyze clinical outcome and prognosis, and to characterize risk factors associated with mortality.

Patients and methods

The study is a prospective observational study, carried out in Zagazig university hospitals, cardiothoracic surgery department on 60 patients post ACS undergoing urgent CABG.

Patients **included** in this study are those who had ACS and need surgery during the same admission as the medical condition urging the patient to be in hospital and can't discharged home and to minimize the chance of further clinical deterioration.

Patients **excluded** from the study are those who needed emergency CABG at the same day, having mechanical complications of MI, chronic liver or kidney diseased patients, chronic interstitial lung diseased patients, low ejection fraction patients below 30% and Patients with previous cardiac surgery.

This prospective study reviewed patients medical records (which included history, examination, investigation, surgical procedure, ICU records and postoperative records).The patient age at the time of surgery, gender, body mass index and comorbidity risk factors were reviewed. Each patient variables were analyzed including, the surgical method, the number of grafts used ,the duration of bypass time, aortic cross clamp, duration of postoperative mechanical ventilation, duration of intensive care unit (ICU) stay, duration of hospitalization, complications and perioperative death. The survival group and surgical mortality group were compared, and risk factors of mortality were analyzed.

Surgical technique:

Classical surgical techniques were utilized on conventional cardio-pulmonary bypass with cardioplegic arrest. CABG was performed using mainly left internal mammary artery, or great saphenous vein graft.

Statistical methods

Data were imported into Statistical Package for the Social Sciences (SPSS version 25.0) (Statistical Package for the Social Sciences) software for analysis.

Qualitative data were represented as frequencies and relative percentages. **Chi square test (χ2) and Fisher exact** was used to calculate difference between qualitative variables as indicated. Quantitative data were expressed as mean ± SD (Standard deviation) for parametric and median and range for non-parametric data. A **P-value** of < 0.05 was considered statistically significant &<0.001 for high significant result for two tailed tests

Results

Demographic criteria of the patients showed that forty-six patients were males (76.7%) and forteen were females (23.3%) (Male/female ratio was 3.3:1). (Mean ± SD 58.5 ± 7.1 years). (**Table 1**)

Regarding preoperative risk factors , diabetes mellitus was the most common risk factor in 44 patients(73.4%) followed by dyslipidemia (63.3%), smoking (58.3%) , previous MI (56.7%) , Family history(53.3%), hypertension (48.3%), BM≥ 30 (23.3%) and COPD (13.3). (**Table 1**).

Preoperative echocardiographic data, as presented in (**Table 2)** showed that mean of Ejection fraction of studied group was 53.4± 9.2 %, mean of LVEDD of them was 51.6 ± 7.4mm and mean of LVESD of them was 41.7 ± 5.8.

Operative data was shown in **table 3** includes total operative time, bypass time ,cross clamp time, number of grafts , inotropic support and needs for IABP .

Regarding postoperative data was shown in **table 4** includes total amount of ICD drainage with mean ± SD (1236.7±435.8 ML) time of ventilation with mean ± SD (17.4 ± 11.8 hours), postoperative ICU stay with mean ± SD (96.4± 40.6hours) and post-operative hospital stay with mean ± SD (12.7± 6.8 days) .

Regarding postsurgical complications,**(table 5)** five patients (8.3%) was reexplored for bleeding , three patients (5%) developed a superficial wound infection , one patients (1.7 %) developed deep wound infection two patients (3.3 %) developed cerebro-vascular event, nine patients (13.6%) developed post-operative arrhythmia and two patients (3.3%) developed renal impairment .We had

7 mortalities , 6 patients died of low cardiac output, 1 patient died from massive cerebral stroke .

Table 1: Risk factors among the studied patients:

Variable	**Findings**	
Age (years): • ***Mean ± SD***	58.5 ± 7.1	
Variable	**N**	**%**
Sex: • ***Male*** • ***Female***	 46 14	 76.7 23.3
DM*:* • ***No*** • ***Yes***	 16 44	 26.6 73.4
HTN: • ***No*** • ***Yes***	 31 29	 51.7 48.3
Smoking: • ***No*** • ***Yes***	 25 35	 36.4 58.3
COPD: • ***No*** • ***Yes***	 52 8	 86.7 13.3
Dyslipidemia: • ***No*** • ***Yes***	 22 38	 36.4 63.3
Family history: • ***No*** • ***Yes***	 28 32	 46.6 53.3
BM≥ 30: • ***No*** • ***Yes***	 46 14	 76.7 23.3
Previous MI: • ***No*** • ***Yes***	 26 34	 43.3 56.7

Table 2: The preoperative echocardiographic, angiographic and clinical data among the studied groups:

Variable	Findings	
Pre-operative ECHO (EF%): • ***Mean ± SD***	53.4± 9.2	
LVESD(mm): • ***Mean ± SD***	41.7 ± 5.8	
Pre-operative LVEDD(mm): • ***Mean ± SD***	51.6 ± 7.4	
Variable	**N=60**	**%**
Angiographic data :		
Left main vessel disease	34	53.3
Left main equivalent	26	45.5
Single vessel disease	4	6.7
Double vessel disease	13	21.7
Triple vessel disease	43	71.6
NYHA class :		
• **I**	0	0
• **II**	18	30
• **III**	32	53.3
• **IV**	10	16.7
Needs for inotropes:		
• **No**	56	93.4
• **Yes**	4	6.6

Table 3: Operative data among the studied patients:

Variable	Findings	
Total operation time (min): • **Mean ± SD**	287.5± 73.4	
Cardiopulmonary bypass time (min): • **Mean ± SD**	126.8± 45.6	
Cross clamp time (min): • **Mean ± SD**	73.9± 21.2	
Number of graft: • **Mean ± SD**	3± 0.68	
Variable	**N=60**	**%**

Inotropic support: • **No** • **Yes**	 26 34	 43.3 56.7
Needs for IABP: • **No** • **Yes**	 52 8	 86.6 13.3

Table 4: Post-operative data among the studied patients:

Variable	Finding
Total amount of ICD drainage (ml): • **Mean ± SD**	1236.7±435.8
Time of ventilation(hrs): • **Mean ± SD**	17.4 ± 11.8
Postoperative ICU stay (hrs): • **Mean ± SD**	96.4± 40.6
Post-operative hospital stay (days) • **Mean ± SD**	12.7± 6.8

Table 5: Complications and mortality of the studied patients:

Variable	N=60	%
Need for reexploration: • **No** • **Yes**	 55 5	 91.7 8.3
Cerebro-vascular event: • **No** • **Yes**	 58 2	 96.7 3.3
Arrhythmia: • **No** • **Yes**	 51 9	 86.4 13.6
Superficial wound infection: • **No** • **Yes**	 57 3	 95.0 5.0
Deep wound infection: • **No** • **Yes**	 59 1	 98.3 1.7
Myocardial infarction: • **No**	 52	 86.6

• **Yes**	8	13.3
Renal impairment: • **No** • **Yes**	 58 2	 96.7 3.3
Post-operative mortality: • **No** • **Yes**	 53 7	 88.3 11.7

Discussion

CABG is still a safe and feasible choice for patients with acute coronary syndrome (ACS). Moreover, it is an appropriate treatment for PCI failure, severe multivessel disease, or diabetes mellitus. CABG can obtain complete revascularization earlier and minimize cardiac ischemia [5].

However, the optimal timing for CABG is still controversial. Most of the literature does not define early CABG clearly, and the statistics were based more on the CABG time limit of 24 or 48 h. Some previous studies have shown that the mortality was higher in the early CABG (within 1 day, 2 days, or 1 week) group [6].

Our study included 60 patients who underwent urgent CABG. Regarding the baseline characteristics, the male gender predominated, which is similar to other studies; this can be explained with the higher prevalence of MI in males. [7, 8]

The age and body mass index of our patients was comparable to other studies, which showed an increased incidence of MI in elder and obese patients. [9, 10]

The incidence of diabetic patients in our study was high (81.8%), while hypertension rates were comparable to other studies [8, 10, 11].

As regards the echocardiographic characteristics, the mean ejection fraction and the association of low EF with early CABG were comparable to other studies [12 ,14] . Patients with lower ejection fraction had early surgery.

Patients with left main vessel disease was 34 patients (53.3%) while Mohammed WA et al(2018) reported 26 patients (36%) and Luqman et al (2009) 6 patients (40 %)[15 , 16].

Analysis of the operative data in our study revealed that cardiopulmonary bypass (CPB) time, cross-clamp time, and the number of grafts were comparable to many other studies [9,11, 12, 13, 17].

In the early postoperative period, some patients needed pharmacological and/or mechanical support. High inotropic support was reported in 56.7% and IABP in 13.3% of our patients. These results were lower than Mohamed and colleagues who reported high inotropic support in 66 % and IABP support in 14 % of patients with early CABG [15].

The mean mechanical ventilation time in our study was 17.4 ± 11.8 hours, which reflects their hemodynamically unstable condition. A study done by Fakhry and coworkers on reported a mean ventilation time of 19.9±18.9 hours [18].

Regarding the incidence of postoperative arrhythmia, our results were comparable to the study done by Nichols and associates. [12] On the other hand, studies done by Abd-Alaal and coworkers and Creswell and colleagues reported a higher incidence of postoperative arrhythmia in the early group [13, 20].

The incidence of postoperative stroke in our patients was one patient 4.5% the same reported by Bárta and colleagues. [10]

The mean length of the postoperative ICU stay in our study was 96.4± 40.6 hours. Allama and coworkers reported 105.76 ± 70.3 hours while Fakhry and colleagues reported 102.5±77.8 hours [21] .

The incidence of postoperative myocardial infarction was 13.3%. These results were lower than that reported by Mohammed WA et al (2018)(14%) but higher than that reported by Monteria et al (2006) (3.4%) and Kim et al (2007) (1.9%). This could be attributed to the higher preoperative risk in our patients [2,15,22].

The mortality was reported in 7 patients (11.7 %) while Hirose H et al (2000) reported 23.4% Fakhry et al (2020) reported 21.4% Kim et al (2007) reported 17.3% Allama et al (2019)) reported 12%. Despite the variation in the mortality rates between different studies, most of them agreed with the conclusion that urgent CABG is associated with higher mortality [18,21,22,23].

Conclusion

Our study demonstrated that the patients undergoing Urgent CABG have higher preoperative risk factor. Despite the higher surgical mortality rate (11.7 %) after the urgent CABG, a favorable long-term clinical outcome can be expected if the patients survive.

References:

1. Agnello L, Bivona G, Lo Sasso B, Scazzone C, Bazan V, Bellia C(2017): Galectin-3 in acute coronary syndrome. Clin Bioch; 50(13e14):797e803. Elsevier Inc. on behalf of The Canadian Society of Clinical Chemists.
2. Monteiro P (2006). Impact of early coronary artery bypass graft in an unselected acute coronary syndrome patient population. Circulation; 114(Suppl. 1).
3. Lawrence H.Cohn,MD(2008) ; Cardiac Surgery in adult 3rd edition.
4. Dehmer GJ, Badhwar V, Bermudez EA(2020): AHA/ACC key data elements and definitions for coronary revascularization: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Data Standards (Writing Committee to Develop Clinical Data Standards for Coronary Revascularization). J Am Coll Cardiol ;75:1975–2088.
5. Lang Q, Qin C, Meng W (2022): Appropriate Timing of Coronary Artery Bypass Graft Surgery for Acute Myocardial Infarction Patients: A Meta-Analysis. Front Cardiovasc Med. 2022 Mar 28;9:794925. doi: 10.3389/fcvm.794925. PMID: 35419440; PMCID: PMC8995744.
6. Liakopoulos OJ, Slottosch I, Wendt D, Welp H, Schiller W, Martens S (2020) : Surgical revascularization for acute coronary syndromes: a report from the North Rhine-Westphalia surgical myocardial infarction registry. Eur JCardiothorac Surg. 58:1137–44.
7. Weiss ES, Chang DD, Joyce DL, Nwakanma LU,Yuh DD (2008): Optimal timing of coronary artery bypass after acute myocardial infarction: are view of California discharge data. J. Thorac.Cardiovasc. Surg ; 135 (3): 503-511.
8. Chew DP, Mahaffey KW, White HD: Coronary artery bypass surgery in patients with acute coronary syndromes is difficult to predict. Am. Heart. J. 155 (5): 841-847.
9. Assmann A, Boeken U, Akhyari P, LichtenbergA(2012): Appropriate timing of coronary artery bypass grafting after acute myocardial infarction. Thorac. Cardiovasc. Surg. 60(07): 446-451.
10. Bárta J, Brát R, Gaj J, Kolek M, Novobilský K,Porzer M (2015): Immediate coronary artery bypass graft surgery for acute coronary syndrome–Outcomes and trends over the past eight years. Cor et Vasa. 57 (2): e63-e69.

11. Ladeira RT, Jatene FB, Monteiro R(2006): Coronary artery bypass grafting in acute myocardial infarction: Analysis of preoperative predictors of mortality. Arq. Bras. Cardiol. 87 (3): 254-259.

12. Nichols EL, Mc Cullough JN, Ross CS (2017): Optimal timing from myocardial infarction to coronary artery bypass grafting on hospital mortality. Ann. Thorac. Surg. 103 (1): 162-171.

13. Abd-Alaal MM, Alsabban MA, Abbas OA,Alshaer AA, Al-Saddique A, Fouda M(2010):Timing of revascularization after acute myocardial infarction. Asian. Cardiovasc. Thorac. Ann. 18 (2):118-121.

14. Deeik RK, Schmitt TM, Ihrig TG, Sugimoto JT(1998): Appropriate timing of elective coronary artery bypass graft surgery following acute myocardial infarction. Am. J. Surg.176(6): 581– 585.

15. Mohammed WA, Ashraf Z, Sayed HF(2018): Urgent versus elective coronary artery bypass grafting in acute coronary syndrome. J Egyptian Society of Cardio Thoracic Surg. 26:17-23.

16. Luqman Z, Ansari J, Siddiqui F, Sami S(2009): Is urgent coronary artery bypass grafting a safe option in octogenarians? A developing country perspective. ICVTS 9:441-5.

17. Lee DC, Oz MC, Weinberg AD, Lin SX, Ting W(2001) : Optimal timing of revascularization:transmural versus nontransmural acute myocardial infarction. Ann. Thorac. Surg. 71 (4): 1197-1202.

18. Fakhry, Ahmed & Balbaa, Yahia & Senna, Waleed & Saleh, Hesham. (2020): Timing of Coronary Artery Bypass Grafting Surgery after Acute Myocardial Infarction. The Egyptian Cardiothoracic Surgeon. 10.35810/ects.v1i1.142

19. Thielmann M, Neuhäuser M, Marr(2007): Predictors and outcomes of coronary arterybypass grafting in ST elevation myocardialinfarction. Ann. Thorac. Surg. 2007; 84 (1): 17-24.

20. Creswell LL, Moulton MJ, Cox JL, RosenbloomM(1995): Revascularization after acute myocardialinfarction. Ann. Thorac. Surg. 60 (1): 19-26.

21. Allama, Amr & Cardiovascular, Al & debis, Ragab. (2019). Early Outcome of Urgent Coronary Artery Bypass Grafting After Acute Coronary Syndrome Journal of The Egyptian Society of Cardio-Thoracic Surgery Volume 20, Number (1-2) 159

22. Kim D, Yoo K, Hong Y (2007): Clinical outcome of urgent coronary artery bypass grafting. J Korean Med Sci 22:270-6.

23. Hirose H, Amano A, Yoshida S, Nagao T, Sunami H, Takahashi A, et al (2000): Surgical management of unstable patients in the evolving phase of acute myocardial infarction. Ann Thorac Surg; 69:425–8.