Urgent coronary artery bypasses grafting versus elective post-acute coronary artery syndrome

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Abstract

Background: Coronary artery bypass grafting (CABG) can be divided according to its timing into elective, urgent, emergency and salvage. Urgent CABG has a higher morbidity and mortality than elective CABG. Aim of work: to compare the early outcome of urgent coronary artery bypass grafting surgery post-acute coronary syndrome versus elective coronary artery bypass grafting surgery about early outcome and prognosis including early post-operative morbidity and mortality. Patients and Methods: 44 patients underwent coronary artery bypass grafting for acute coronary syndrome. Patients were divided into two groups according to the timing of surgery. The urgent group included 22 patients, and the elective group included 22 patients. The two groups were compared regarding preoperative, operative, and postoperative data.Results: Patients in the urgent CABG group had a higher frequency of smoking (p=0.049), higher number of patient with left main vessel disease and higher STS score for morbidity and mortality otherwise, all baseline characteristics were comparable between the two groups. All the operative data were comparable between the two groups except the usage of inotropic support was significantly higher in the urgent CABG group compared to the elective CABG group (p=0.03). Although both groups had a relatively similar survival rate (p= 0.664), urgent CABG patients were more liable to postoperative prolonged ICU stay (p=0.029) and hospital stay (p=0.029). Our analysis showed that preoperative higher frequency of smoking (p=0.049), use of inotropes (p=0.03) and prolonged ventilation time (p=0.011) were independent risk factors for mortality after urgent CABG. Conclusion: Patients undergoing urgent CABG have a significantly higher preoperative risk and a significantly worse early postoperative outcomes. Postoperative mortality is expected to be higher in the urgent CABG patients but without a statistically significant difference between them and the elective patients.

Keywords: Acute coronary syndrome, Coronary artery bypass graft, Urgent.

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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].

Elective CABG refers to the patients whose cardiac function allowed them to be discharged from the hospital and readmitted at a later date. The procedure could be delayed without increasing the risk of compromised cardiac outcome. Urgent CABG refers to procedure required during the same hospitalization due to medical factors urging the patient to stay in hospital [3].

CABG has become one of the safest forms of heart surgery. However, such favorable clinical outcome can be expected only if the procedure is elective [4].

This study is conducted to compare the urgent CABG after ACS with the elective procedures as regarding early outcome and prognosis including early post-operative morbidity and mortality.

Patients and methods

This study was done at the cardiothoracic surgery department of Zagazig University. It included 44 patients underwent CABG for ACS. Patients were divided into two groups, the urgent group which included 22 patients underwent urgent CABG, and the elective group which included 22 patients underwent elective CABG.

Patients included in this study

• Patients 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 who had ACS and whose cardiac function status allowed them to be discharged home and surgery can be done later on without increasing the risk of compromised cardiac function.

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

The two groups were compared regarding preoperative, operative, and postoperative data.

Statistical analysis:

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represent

as number and percentage , quantitative continues group represent by mean ± SD , the following tests were used to test differences for significance. Chi square Test ($\chi 2$), fisher test: used to study comparison and association between two qualitative variables.T-Test, Mann Whitney (MW): were used for comparison between two groups having quantitative variables with normal and non-normal distribution resp. (for parametric data and non-parametric resp. Repeated measure Anova: was used for comparison between repeated quantitative variable. A P-value of < 0.05 was considered statistically significant &<0.001 for high significant result for two tailed tests.

Results

The current study included 44 patients (22 in each group). Except for smoking status (p=0.049), number of patient with left main vessel disease (p=0.014) and STS score for mortality (p=0.045) and mortality & morbidity (p=0.034) that were higher in urgent group all baseline characteristics were comparable between the two groups (p>0.05) **(Table 1,2)**.

A comparison between the preoperative echocardiographic , risk score, angiographic and clinical data of both groups **(Table 3)**.

Table 1: Some demographic data among the studied groups:

Variable	Elective group (N=22)		Urgent group (N=22)		P-value
Age (years): • Mean ± SD • Range	56.9± 5.8 43-66		57.8± 5.7 46-68		0.622
Variable	**N**	**%**	**N**	**%**	**P-value**
Sex: • Male • Female	15 7	68.2 32.8	17 5	77.3 22.7	0.269

Table 2: Risk factors among the studied groups:

Risk factors	Elective group (N=22)		Urgent group (N=22)		P-value
	N	%	N	%	
DM:					
• No	9	40.9	4	18.2	0.185
• Yes	13	59.1	18	81.8	
HTN:					
• No	11	50	10	45.5	1
• Yes	11	50	12	54.5	
Hyperlipidemia:					
• No	13	59.1	7	31.8	0.129
• Yes	9	40.9	15	68.2	
Smoking:					
• No	15	68.2	8	36.4	0.049*
• Yes	7	31.8	14	63.6	(S)
COPD:					
• No	21	95.5	19	87.4	0.35
• Yes	1	4.5	3	13.6	
BM≥ 30:	19	87.4	17	77.3	0.46
• No	3	13.6	5	22.7	
• Yes					
Family history:					
• No	12	54.5	10	45.5	
• Yes	10	45.5	12	54.5	0.763

Table 3: The preoperative echocardiographic, risk score, angiographic and clinical data among the studied groups:

Variable	Elective group (N=22)		Urgent group (N=22)		P-value
Pre-operative ECHO (EF%): • *Mean ± SD* • *Range*	55.2± 7.1 38-64		51.1± 8.8 36-66		0.098
LVESD(mm): • *Mean ± SD* • *Range*	38.3± 6.5 23-43		40.8 ± 5.7 27-51		0.634
LVEDD(mm): • *Mean ± SD* • *Range*	47.3± 5.3 35-58		50.8 ± 7.1 43-62		0.515
STS score: Mortality: • *Mean ± SD*	3.44 ± 1.49		7.33 ± 3.44		**0.045*** (S)
Mortality & morbidity: • *Mean ± SD*	19.83 ± 10.2		29.51 ± 15.77		**0.034*** (S)
Variable	**N**	**%**	**N**	**%**	**P-value**
Left main vessel disease	4	18.2	12	54.5	**0.014*(S)**
Left main equivalent	7	31.8	10	45.5	0.37
Single vessel disease	1	4.5	1	4.5	1
Double vessel disease	7	31.8	5	22.7	0.49
Triple vessel disease	14	63.6	16	72.7	0.74

NYHA class : • *I* • *II* • *III* • *IV*	 1 9 11 1	 4.5 40.9 50 4.5	 0 8 11 3	 0 36.4 50 13.6	 0.560
Needs for inotropes: • *No* • *Yes*	 22 0	 100 0	 21 1	 95.5 4.5	 1
Needs for IABP: • *No* • *Yes*	 22 0	 100 0	 20 2	 90.9 9.1	 0.488

The total operative time was comparable between both (urgent group 267.5± 64.4 versus 250.2± 51.7 elective group p=0.332) .Mean cardiopulmonary bypass time (urgent group 107.9± 39.4versus 97.5± 42.8 elective group p=0.404)and mean aortic cross-clamp time(urgent group 61.6± 19.5 versus 61.6± 26 elective group p=1) were not different in the two groups . The number of used grafts was comparable between both groups(urgent: 3± 0.87, elective: 3.31 ± 1.01, p =0.739).Intra-operative usage of inotropic support was higher in the urgent group with significant difference between both groups (p =0.013).While the needs for IABP was comparable between both groups (p =0.664) **(Table 4)**.

Patient in the urgent group had a significantly longer ventilation time. The elective group had a significantly shorter intensive care unit (ICU) stay and total hospital stay **(Table 5)**.

Postoperative complications did not show any statistically significant difference between both groups . We had 6 mortalities (2 in the elective group and 4 in the urgent group). In the urgent group, 3 patients died of low cardiac output, 1 patient died from massive cerebral stroke. In the elective group, 2 patients died of low cardiac output. No significant difference could be detected between the two groups regarding mortality **(Table 6)**.

Regarding the post-operative ECHO, the was no statistically significant difference between both groups regarding post-operative ECHO **(Table 7)**.

Table 4: Operative data among the studied groups:

Variable	Elective group (N=22)		Urgent group (N=22)		P-value
Total operation time (min):					
• Mean ± SD	250.2± 51.7		267.5± 64.4		0.332
• Range	150-350		170-410		
Cardiopulmonary bypass time (min):					
• Mean ± SD	97.5± 42.8		107.9± 39.4		0.404
• Range	25-180		30-170		
Cross clamp time (min):					
• Mean ± SD	61.6± 26		61.6± 19.5		
• Range	20-105		20-90		1
Number of graft:					
• Mean ± SD	2.9± 0.91		3± 0.87		0.739
• Range	1-4		1-4		
Variable	**N**	**%**	**N**	**%**	**P-value**
inotropic support:					
• No	17	77.3	9	40.9	**0.030***
• Yes	5	22.7	13	59.1	**(S)**
Needs for IABP:					
• No	20	90.9	18	81.8	0.664
• Yes	2	9.1	4	18.2	

Table 5: Post-operative data among the studied groups:

Variable	Elective group (N=22)	Urgent group (N=22)	P-value
Total amount of ICD drainage (ml): • Mean ± SD • Range	586.4± 360.6 100-1450	868.2± 583.2 100-1950	0.061
Time of ventilation(hrs): • Mean ± SD • Range	9.4± 3.7 5-17	16.9 ± 12.7 5-40	**0.011*** **(S)**
Postoperative ICU stay (hrs): • Mean ± SD • Range	65.4± 17.1 48-96	86.3± 39.9 48-170	**0.029*** **(S)**
Post-operative hospital stay (days) • Mean ± SD • Range	9.1± 2.6 2-13	11.9± 8.8 6-47	**0.029*** **(S)**

Table 6: Complications and mortality of the studied groups:

Variable	Elective group (N=22)		Urgent group (N=22)		P-value
	N	%	N	%	
Need for reexploration: • No • Yes	21 1	95.5 4.5	20 2	90.9 9.1	1
Cerebro-vascular event: • No • Yes	22 0	100 0	21 1	95.5 4.5	1

Arrhythmia: • No • Yes	19 3	86.4 13.6	19 3	86.4 13.6	1
Superficial wound infection: • No • Yes	19 3	86.4 13.6	21 1	95.5 4.5	0.432
Deep wound infection: • No • Yes	22 0	100 0	20 2	90.9 9.1	0.488
Myocardial infarction: • No • Yes	21 1	95.5 4.5	18 4	81.8 18.2	0.345
Renal impairment: • No • Yes	20 2	90.9 9.1	20 2	90.9 9.1	1
Post-operative mortality: • No • Yes	20 2	90.9 9.1	18 4	81.8 18.2	0.664

Table 7: Post-operative ECHO data of the studied groups:

Variable	Elective group (N=22)	Urgent group (N=22)	P-value
(EF %): • Mean ± SD • Range	56.3± 8.9 0-66	53.8 ± 10.1 0-64	0.41
LVESD(mm): • Mean ± SD	34.3± 6.5	36.5 ± 4.4	0.662

• Range	20-43	23-47	
LVEDD(mm):			
• Mean ± SD	48.3± 7.4	50.9± 6.3	0.643
• Range	36-62	40-60	

Discussion

The outcome of CABG for ACS has improved significantly over the last few decades. Performing CABG during the same hospitalization for ACS seems to represent a short-term mortality benefit. This is particularly relevant, because these patients have worse risk factors, more coronary lesions, and increased hospital morbidity [5].

In the present study smoking was higher in urgent group with statistically significant difference between elective and urgent group ($p<0.05$). this agrees with Mohammed WA et al (2018) ,Brandrup-Wognsen et al (1995) and Weiss et al (2008) as they reported higher incidence of smoking in patents undergoing urgent CABG. However also Luqman et al (2009) reported that there were no significant differences in smoking between both groups. [3,6,7,8]

Our result documented that there was statistically significant difference between both groups as regard STS score for mortality being higher in urgent group . This agrees with Mohammed WA et al (2018) and Allama et al (2019) as they found statistical significant difference between both groups as regard STS score for mortality being higher in urgent group. [5,6]

Our result showed that there was statistically significant difference between both groups as regard the angiographic data in the number of patients with left main vessel disease being higher in urgent group (12 patients 54.5% in urgent group versus 4 patient 18.2% in elective group) This agrees with Mohammed WA et al (2018) ,Allama et al (2019) and Luqman et al (2009). [3,5,6]

Although the number of grafts did not show a significant difference between both groups that was comparable to many other studies[9,10, 11, 12, 13], Our results revealed that there was no statistically significant difference in total operative time with mean (urgent group 267.5± 64.4 versus 250.2± 51.7 elective group), bypass time with mean (urgent group 107.9± 39.4versus 97.5± 42.8 elective group) and the clamp time with mean (urgent group 61.6± 19.5 versus 61.6± 26 elective group) between both groups however being longer in the urgent group this may be attributed to the lower ejection fraction of the urgent group patients with difficulty to wean them from the cardiopulmonary bypass. This agrees with Abd- Alaal et al (2010) who did not record a significant difference between both groups regarding the bypass time or the clamp

time [12]. Luqman et al (2009) also found no statistically significant difference in the bypass time and the clamp time[3].While Kim et al (2007) demonstrated a significantly longer total operative time, bypass time and the clamp time[4]. While ,Allama et al (2019) and Mohammed WA et al (2018) found that there was statistically significant difference in the bypass time and the clamp time but total operative time was longer in the urgent group but without significant difference between both groups [5,6].

In our results intra and post operative inotropic was higher in urgent group with statistically significant difference between both groups .Allama et al (2019) found that there was statistically significant difference between both group in the usage of post operative inotropic support [5]. Bana et al (1999) reported high inotropic support in 12.5%[14].Also Fakhry et al (2020) in his postoperative outcomes revealed that early CABG was significantly associated with high inotropic support[15].

We observed longer ventilation time 16.9 ± 12.7 hours with range from 5-40 hours in the urgent than elective group 9.4± 3.7 hours with range from 5-17 hours with significant difference between them .Fakhry et al (2020) found the same with mean19.9±18.9 hours in the urgent than elective group 9±13.6 hours with significant difference between them[15].While Mohammed WA et al (2018), Allama et al (2019) documented longer time of ventilation in the urgent group with mean 20.35±15.36 hours than elective group 11.23±6.89 hours with significant difference between them[5,6] .However Luqman et al (2009) documented longer time of ventilation in the urgent than elective group but without significant difference between them [3].

The length of the postoperative ICU stay in our study was significantly higher in the urgent group with mean 86.3± 39.9 and 65.4± 17.1in the elective group which could be explained by longer time of ventilation and higher amount of chest tube drainage and high inotropic support in the urgent group . This agrees with Abd-Alaal et al (2010) and Mohammed WA et al (2018) who reported longer postoperative ICU the urgent groupthan elective group[6,12] . Also Fakhry et al (2020) showed that The length of the postoperative ICU stay in our study was significantly higher in the urgent group with mean 102.5±77.8 versus 55.8±22 in the elective group. [15]

Regarding the postoperative hospital stay, it was was significantly higher in the urgent group with mean 11.9± 8.8 in urgent group versus 9.1± 2.6 in the elective group this agrees with Abd-Alaal et al (2010) who found the same . Also Allama et al (2019) showed that the postoperative hospital stay it was longer in the urgent than elective group with mean 15.32±9.3 in urgent group and 8.68±3.27 in the elective group. However Fakhry et al (2020) documented that there was no significant difference between urgent and elective group as regarding the postoperative hospital stay.

Our results revealed that post-operative mortality was higher in the urgent group but with no significant difference between both groups .Fakhry et al (2020) and Allama et al (2019) showed

that it was higher in the urgent group but did not reach a statistically significant difference level which could be attributed to the sample size[5,15] . Also Luqman et al (2009) didn't found a statistically significant difference between urgent and elective group [3].However Mohammed WA et al (2018) who reported higher mortality in the urgent group with a statistically significant difference between both groups [6]. Kim et al (2007) and his co-authors they reported mortality of 17.3% (18\104) and considered that EF less than 40% is a risk factor for mortality while Hirose H et al (2000) demonstrated (11\47) 23.4% mortality in his group of urgent CABG and he considered that an ejection fraction < 50% is a risk factor for death after MI [4,16].

Regarding the post-operative ECHO , the was no statistically significant difference between both groups regarding post-operative ECHO before discharge and follow up at 6 months. This agrees with Allama et al (2019) and Mohammed WA et al (2018) [5,6]

Conclusion

Based on the results of our study, we conclude that patients undergoing urgent CABG have a significantly higher preoperative risk as regard smoking, STS score and the number of patients with left main vessel disease with a significantly worse early postoperative outcomes as regard use of inotropic support , ventilation time , postoperative ICU stay and postoperative hospital stay. Postoperative mortality is higher in the urgent CABG patients but without a statistically significant difference between them and the elective patients and during follow up there was no significant difference between both groups regarding the post operative follow up ECHO data.

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