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Hospital Outcomeand Prognosis of Patients with Acute Coronary Syndrome who Developed Cardio Pulmonary Arrest: A single center study in Dhaka, Bangladesh.

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Abstract
Background:*Acute Coronary Syndrome (ACS) is considered as high-risk in the presence of cardiac arrest, hemodynamic instability, or cardiogenic shock. However, studies involving patients who have developed cardiopulmonary arrest (CPA) due to acute coronary syndrome are very limited.So, this study aimed to determine the in hospital outcome and prognosis of CPA patients with ACS.*
Method & Materials*: This was a prospective observational study of our database of ACS patients from the period of January 2017 to September 2019 who had been admitted at CCU of Enam Medical College and Hospital, Savar, Dhaka, Bangladesh. A total of 104 ACSpatients, out of them 48 patients who developed cardiopulmonary arrest and 56 patients with non-cardiopulmonary arrest were included in this study. In hospital presentation at admission, treatment outcome, complications, major adverse cardiovascular outcome were noted and compare between these two groups.*
Results:*A total of 104 ACS patients were included in this study, out of them 48 (46.15%) patients were with CPA on arrival of them 41(85.41%) were STEMI of them Anterior MI were 23 and Inferior MI were 18 and 07(14.58%) were NSTEMI and 56(53.85%) patients were non CPA of them 48(85.71%) were STEMI of them Anterior MI were 19 and Inferior MI were 29 and 08(14.28%) were NSTEMI. Out of 48 CPA patients 16 were in MV of them death were 07 and their average hospital staying were 09 days and 32 were not in MV of them 03 were death and their average hospital staying were 06 days. Out of 56 non CPA patients 13 were in MV of them death were 03 and their average hospital staying were 07 days and 43 were not in MV of them 02 were death and their average hospital staying were 05 days. Studied patients showed other complications are Bradyarrhythmias were 8(16.66%), Ventricular tachycardia were 39(81.25%), Atrial fibrillation were 11(22.91%), Heart failure were 37(77.08%), Cardiogenic shock were 32(66.66%), Pulmonary edema were 38(79.16%), Pericardial effusion were 8(16.66%) and MACEs were 24(50%) and P value were significant in most parameters.*
Conclusion:*This study concluded that a significant number of ACS patients with cardiopulmonary arrest died at hospital and developed arrhythmia especially ventricular tachycardia, heart failure, cardiogenic shock and MACEs than that of non CPA patients and also increased needed for mechanical ventilator support and increased in hospital staying. Thus, clinicians should seriously consider intensive medications for the management of ACS patients who developed CPA on arrival.*
Key Words:*Acute Coronary Syndrome, Acute Myocardial Infarction, Cardiopulmonary Arrest, CardiogenicShock.*

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I. Introduction

The patients around the globe have been suffering from acute coronary syndrome (ACS) areconsidered as high-risk in the presence of life threatening ventricular tachyarrhythmia, aborted cardiac arrest, hemodynamic instability, or cardiogenic shock. Anyway, those high-risk patients are not performed well in randomized controlled trials and reliable data about their long-term prognosis are not much as well [1]. Accordingly, recommendations of international guidelines are heterogeneous for acute myocardial infarction (AMI) patients complicated by ventricular tachyarrhythmia. Acute coronary syndrome can induce lethal ventricular arrhythmias (VAs),such as ventricular fibrillation (VF0) [2].Developments in revascularization in ACS have contributed to decrease mortality due to cardiovascular disease over the past few decades [3-5]. However, patients with

cardiopulmonary arrest due to VAs still have a higher rate of mortality than those of non CPA [5]. Previous studies have documented the short- and long-term prognoses of patients with AMI [6, 7]. In those studies, the 30-daysand 1-year all-cause mortality rates were 7-10% and11–15%, respectively. Advanced age, diabetes mellitus, higher serum creatinine level, acute-phase heart failure, and low left ventricular ejection fraction (LVEF) at the onset of AMI were reported as poor prognostic factors.The term acute myocardial infarction[8] should be used when there is acute myocardial injury with clinical evidence of acute myocardial ischaemia and withdetection of a rise and/or fall of cTn values with at least one value above the 99th percentile URL and at least one of the following:• Symptoms of myocardial ischaemia;• New ischaemic ECG changes;• Development of pathological Q waves;• Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality in a pattern consistent with an ischaemic aetiology;• Identification of a coronary thrombus by angiography or autopsy (not for types 2 or 3 MIs).Post-mortem demonstration of acute atherothrombosis in the artery supplying the infracted myocardium meets criteria for type 1 MI. Evidence of an imbalancebetween myocardial oxygen supply and demand unrelated to acute atherothrombosis meets criteria for type 2 MI. Cardiac death in patients with symptomssuggestive of myocardial ischaemia and presumed new ischaemic ECG changes before cTn values become available or abnormal meets criteria for type 3 MI. However, studies involving patients who have developed cardiopulmonary arrest (CPA) due to acute coronary syndrome are very limited. So, this study aimed to determine the in hospital outcome and prognosis of CPA patients with ACS.

II. Methodology and Materials

This was a prospective observational study of our database of ACS patients from the period of January 2017 to September 2019 who had been admitted at CCU of Enam Medical College and Hospital, Savar, Dhaka, Bangladesh. A total of 104 ACS patients, out of them 48 patients who developed cardiopulmonary arrest and 56 patients with non-cardiopulmonary arrest were included in this study. Here we included acute STEMI and NSTEMI patients as Acute Coronary Syndrome those developed cardiopulmonary arrest (CPA) and non-cardiopulmonary arrest (non CPA) at time of arrival in CCU. Then the demographiccharacteristics, the cardiovascular risk factors, haemodynamic abnormality, laboratory investigations, is there any need for intubations, mechanical ventilations or not and other complications are noted in two groups of patients of ACS in CPA and non CPA group. On admission and pre-discharge Echocardiography done and standard parameters for LV functions of the patients were recorded. For clinical outcomes all the data were recorded and preserved in using EXEL sheet and the recorded data were analyzed using simple statistical data analyzing tools to find the results of this study. So, the presentations of the patients at admission, treatment outcome, complications, and major adverse cardiovascular outcome were noted and compared between these two groups to see the in hospital outcomes and prognosis of the patients with acute coronary syndrome who developed cardio pulmonary arrest.Two sample t-test were done to observe the level of significance on the p - value where $p < 0.05$ considered as significant.

III. Results

A total of 104 ACS patients were included in this study, out of them 48 (46.15%) patients were with CPA on arrival of them 41(85.41%) were STEMI and 07(14.58%) were NSTEMI and 56(53.85%) patients were non CPA of them 48(85.71%) were STEMI and 08(14.28%) were NSTEMI. The mean age of the patients was 50±16 (Mean ± SD) years. Among the patients the male were 73.07% and the female were 26.92%. The mean BMI of the patients were 25±5 (Mean ± SD) kg/m2.The study of cardiovascular risk factors were hypertension 89(85.57%) of them 41 (46.06%) in CPA and 48 (53.93%), DM were 74(71.15%) of them 39(52.70%) in CPA and 35(47.29%) in non CPA, dyslipidaemia were 68(65.38%)of them 30(44.11%) in CPA and 38(55.88%) in non CPA, family history of CAD were 61(58.65%)of them 28(45.90%) in CPA and 33(54.90%) in non CPA, Smoking were 63(60.58%) of them 26(41.26%) in CPA and 37(58.73%) in non CPA patients.

The study of clinical presentations of the patients in CPA, STEMI were 41(85.41%) of them, anterior were 23 (56.09%) and Inferior were 18 (43.90%) and NSTEMI were 07 (14.58%) on the contrary in non CPA, STEMI were 48 (85.71%) of them, anterior were 19 (39.58%) and inferior were 29 (60.41%) and NSTEMI were 08 (14.28%).The study of LVEF were <35% were 18 (37.50%) in CPA and 15 (26.79%) were in non CPA patients, 35-45% were 25 (52.08%) in CPA and 32 (57.14%) were in non CPA patients and >45% were 05 (10.42%) in CPA whereas 09 (16.07%) in non CPA patients.

Laboratory tests of the studiedpatients wereHb < 10 gm/dl were 25 (24.04%) of them 10 (20.83%) were in CPA and 15 (26.79%) were in non CPA, S. Creatinine > 1.6mg/dl were 34 (32.69%) of them 16 (33.33%) were in CPA and 18 (32.14%) were in non CPA patients, Troponin I >100 ng/ml were 98 (94.23%) of them 48(100%) were in CPA and 50 (89.29%) were in non CPA and NTpro BNP > 600 pg/ml were 79(75.96%) of them 41(85.42%) were in CPA and 38(67.86%) were in non CPA.Studied of 104 ACS patients 48 of CPA patients of them STEMI were 41 of them Anterior MI were 23 and Inferior MI were 18 and 07 were NSTEMI and non CPA patients were 56 of them STEMI were 48 of them Anterior MI were 19 and Inferior MI were 29

and NSTEMI were 08.Out of 48 CPA patients16 were in mechanical ventilator(MV) of them death were 07 and their average hospital staying were 09days and 32 were not in MV of them 03 were death and their average hospital staying were 06 days. Out of 56 non CPA patients 13 were in mechanical ventilator(MV) of them death were 03 and their average hospital staying were 07 days and 43 were not in MV of them 02 were death and their average hospital staying were 05 days. Studied patients showedother complications are Bradyarrhythmias were 8(16.66%) in CPA, 7(12.5%) in non CPA, Ventricular tachycardia were 39(81.25%) in CPA,11(19.64%) in non CPA, Atrial fibrillation were 11(22.91%) in CPA, 7(12.5%) in non CPA, Heart failure were 37(77.08%) in CPA, 36(64.28%) in non CPA, Cardiogenic shock were 32(66.66%) in CPA, 29(51.78%) in non CPA, Pulmonary edema were 38(79.16%) in CPA, 30(53.57%) in non CPA, Pericardial effusion were 8(16.66%) in CPA, 7(12.5%) in non CPA, Thromboembolism were 2(4.16%) in CPA, 2(3.57%) in non CPA, MACEs were 24(50%) in CPA, 17(30.35%) in non CPA and Deaths were 10(20.83%) in CPA, 5(8.92%) in non CPA and P value were significant in most parameters.

Table I: Demographic characteristics of the studied patients. (n=104)

Variable	(n=104)	n (%)
Age (Mean ± SD) years	50 ± 16	
BMI(Mean ± SD) kg/m^2	25 ± 5	
Sex		
\Male	76	73.07
Female	28	26.92

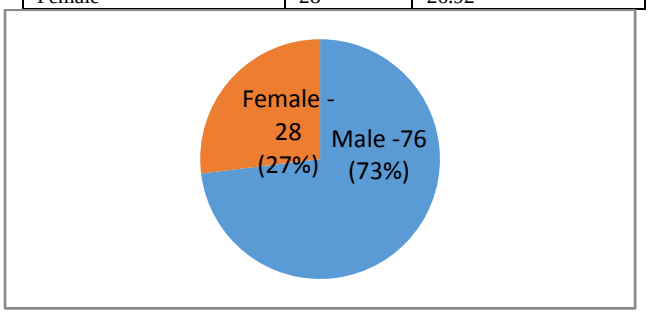

Figure I: Gender distribution of the studied patients.

Table II: Cardiovascular risk factors of the studied patients (n=104)

Variable	All (n=104)	N%	CPA (n=48)	N%	Non-CPA (n=56)	N%
Hypertension	89	85.57	41	46.06	48	53.93
Diabetes mellitus	74	71.15	39	52.7	35	47.29
Dyslipidaemia	68	65.38	30	44.11	38	55.88
Family history of CAD	61	58.65	28	45.9	33	54.9
Smoking	63	60.58	26	41.26	37	58.73

Table III: Clinical presentation of the studied patients. (n=104)

CPA(n=48)	N	%	Non CPA(n=56)	N	%
STEMI	41	85.41	STEMI	48	85.71
Anterior	23	56.09	Anterior	19	39.58
Inferior	18	43.90	Inferior	29	60.41
NSTEMI	07	14.58	NSTEMI	08	14.28

Table IV: Echocardiographic LVEF. (n=104)

LVEF	CPA(n=48)	%	Non CPA (56)	%
<35%	18	37.50	15	26.79
35-45%	25	52.08	32	57.14
>45%	5	10.42	9	16.07

TableV: Laboratory test profile of the studied patients. (n=104)

Variable	All (n=104)	%	CPA (n=48)	%	Non-CPA (n=56)	%
Hb < 10 gm/dl	25	24.04	10	20.83	15	26.79
S. Creatinine > 1.6 mg/dl	34	32.69	16	33.33	18	32.14
Troponin I >100ng/ml	98	94.23	48	100.00	50	89.29
NT-proBNP > 600pg/ml	79	75.96	41	85.42	38	67.86

Chart- I: Flow chart of the studied patients (n=104)

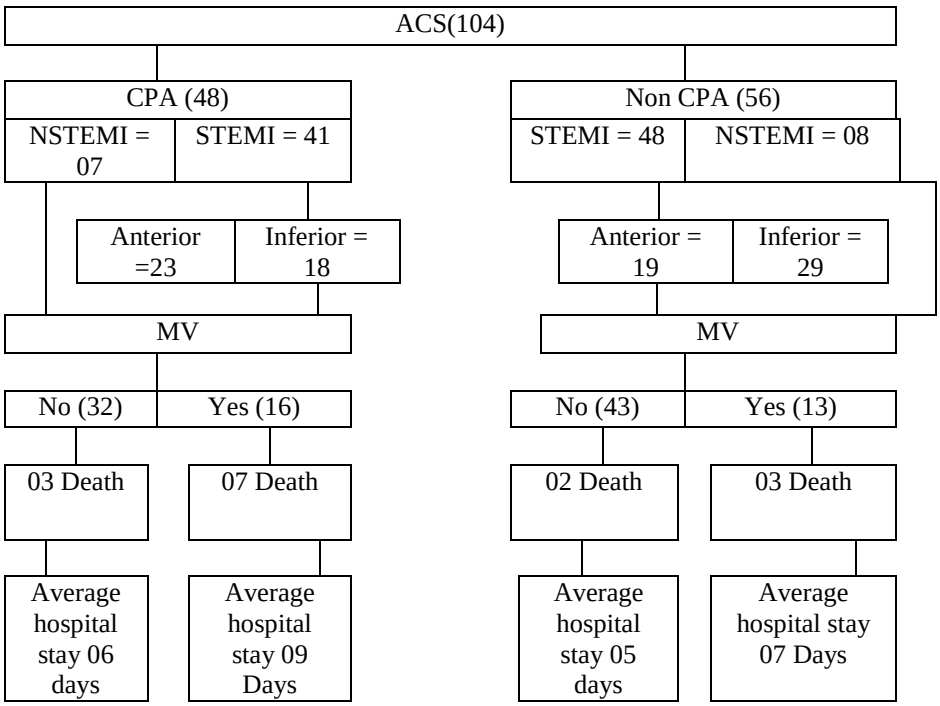

Table VI:In hospital outcomes and complications of the studied patients. (n=104)

Variable	All (n=104)	%	CPA (n=48)	%	Non-CPA (n=56)	%	P - value
Bradyarrhythmias	15	14.42	8	16.66	7	12.5	<0.001
Ventricular tachycardia	50	48.07	39	81.25	11	19.64	<0.001
Atrial fibrillation	18	17.3	11	22.91	7	12.5	<0.001
Heart failure	73	70.19	37	77.08	36	64.28	<0.001
Cardiogenic shock	61	58.65	32	66.66	29	51.78	0.031
Pulmonary edema	68	65.38	38	79.16	30	53.57	0.003
Pericardial effusion	15	14.42	8	16.66	7	12.5	<0.001
Thromboembolism	4	3.84	2	4.16	2	3.57	<0.001
MACEs	41	39.42	24	50	17	30.35	<0.001
Total deaths	15	14.42	10	20.83	5	8.92	<0.001

IV. Discussion

This study evaluated in hospital outcome, complications and prognosis of total 104ACS patients of them48 (46.15%) patients were with CPA on arrival with 41(85.41%) were STEMI and 07 (14.58%) were NSTEMI. Out of 48 CPA patients 16 were in MV of them death were 07 and their average hospital staying were 09 days and 32 were not in MV of them 03 were death and their average hospital staying were 06

days. However, in non CPA patients were 56 (53.84%) of them 48(85.71%) were STEMI and 08(14.28%) were NSTEMI. Among the non-CAP patients 13 were in MV out of them 03 were died in the hospital and their average hospital staying was 07 days and43 patients were not in MVof them only 02 died and their average hospital staying was only 05 days. However, mortality of CPA was 10(20.83%) on the other hand, mortality in non CPA patients was 05(8.92%) that was half of the CPA patients and on an average mortality rate was (14.42%) which was almost similar to some other studies by Okura N et al.[3]and Komiyama K et al[4]. They found the incidence of death was 11-15% in their studies. The main differences were the rate of cardiac death and the incidence of VA. The CPA group showed a significantly worse composite endpoint with more MACEs and total deaths compared to the non-CPA group. In this study, there are significant differences in atrial and ventricular arrhythmias that may be a contributory factor in early CPA and subsequent consequences. Cardiogenic shock and heart failure was also more in patients with CPA. But in the present study the cardiovascular risk factors of either sex were hypertension (85.57%), dyslipidaemia (65.38%), diabetes mellitus (71.15%), family history(58.65%), and smoking (38.46%) However, Patients with CPA were likely to experience hypertension and dyslipidaemia at lower rates than patients ofnon CPA. It is possible that we could not sufficiently examine the history and pre-AMI medicine use of patients with CPA, particularly of those patients who developed post-resuscitation encephalopathy. In this study, there were more patients with low EF, or high peak serum CK in the CPA group than in the non-CPA group [9]. In this study, the rates of composite endpoints with MACEs and deaths were higher in the CPA group than in the non-CPA group during the follow-up period. The rates of non-fatal MI and hospitalization for heart failure were not significantly different in the two groups. Moreover, the major differences were in-hospital mortality and VAs. Since patients with CPA often are hospitalized for prolonged periods of time, VAs in the CPA group was more likely to be documented than in patients who experienced shorter durations of hospitalization. In addition, patients in the CPA group were likely to require long-term hospitalization in another hospital due to rehabilitation or afterresuscitation encephalopathy, and were less likely to undergo new hospitalization for heart failure. The statistical two sample t test result of the present study was found almost significantin most of parameters. The same result was found in the study of MichaelC et al [10],However, regarding this issue the ACC and American Heart Association [11-13]currently recommend regionalized patient care for patients resuscitated from out-of-hospital cardiac arrest at hospitals that are designated as cardiac resuscitation centers. Prior studies have demonstrated that regionalization of care for cardiac arrest patients have improved outcomes, whether done at the city or statelevel [14-16]. One concern is that care for cardiac arrest patients at specialized centers will adversely affect their reported mortality [17].For example, Peberdy et al [18] statedecreasing numbers of cardiac arrest patients with STEMI would affect hospital mortality. Almost the same result prevailed in this present study.

Limitations of the study

This was asingle centerand prospective observational study included a small number of subjectsand wecould not assess whether intensive management improved the clinical outcomes of ACS patients. It was not possible to document all the patient's clinical outcomes in a single group of treatment delivery team.Inthefuture,amulti-center,prospectivestudywitha larger number of patients isneeded.

V. Conclusion and recommendations

This study concluded that a significant number of ACS patients with cardiopulmonary arrest died at hospital and developed arrhythmia especially ventricular tachycardia, heart failure, cardiogenic shock and MACEs than that of non CPA patients. There was also increased needed for mechanical ventilator support and increased in hospital staying of patients with CPA than that of non CPA patients. Thus, clinicians should seriously consider intensive medications for the management of ACS patients who developed CPA on arrival.

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