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Original Research Article

A Comparative Assessment of the Outcome after out-of-Hospital Cardiac Arrest in Patients with Ischaemic and Non-Ischaemic Heart Disease

Mukesh Shandilya[1], Chandrabhanu Chandan[2]

[1]Senior Resident (Academic) Department of Cardiology, IGIMS, PATNA, Bihar, India

[2]Assistant Professor, Department of Cardiology, IGIMS, PATNA, Bihar, India

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Corresponding Author: Dr. Mukesh Shandilya
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Abstract

Aim: The aim of the present study was to investigate all-cause mortality, cardiac death, and return to work among patients admitted after OHCA with IHD and non-IHD.

Methods: Patients with OHCA were consecutively enrolled in the study at admission at the Department of Cardiology, IGIMS, PATNA, Bihar, India. 150 patients were included in the study. We included patients admitted after OHCA including patients with return of spontaneous circulation (ROSC) prior to admission.

Results: Patients in the IHD group were significantly older than patients in the non-IHD group (median age 67 years vs. 58 years) and were more often males (83% vs. 64%). In addition, a significantly larger pro-portion of IHD patients had ventricular tachycardia or ventricular fibrillation as the initial arrest rhythm and were more likely to take medication for heart disease compared with non-IHD patients. Of the patients with IHD, 57 patients (57%) underwent percutaneous coronary intervention.

Conclusion: Cardiac death was the predominant cause of death. Most working patients returned to work within five years with a median time until return to work of six months. There was no statistically significant difference in all-cause mortality, cardiac death, and return to work between patients with IHD and patients with non-IHD, but a trend toward a higher mortality in patients with non-IHD driven by non-cardiac causes was found, which may indicate that IHD is a favourable cause of cardiac arrest.

Keywords: Sudden cardiac death Ischaemic heart disease Cardiac arrest Out-of-hospital cardiac arrest Return to work

Introduction

The prognosis in patients who have out-of-hospital cardiac arrest is poor, with a mortality of up to 65% even among those who undergo successful resuscitation and admission to the hospital. [1] Acute coronary syndrome accounts for up to 60% of out-of-hospital cardiac arrests in which a cardiac cause has been identified. [2] The finding of ST-segment elevation on post resuscitation electrocardiography (ECG) has good positive predictive value for acute coronary lesions triggering the cardiac arrest. [3,4] In the far larger subgroup of patients without ST-segment elevation, the spectrum of underlying causes is considerably broader and includes both cardiac and noncardiac causes. [3,4] In patients with myocardial infarction, early revascularization can preserve ventricular function and prevent negative consequences of myocardial injury, such as heart failure or arrhythmias. However, routine, unselected early coronary angiography may also result in negative effects, including procedural risks and delays in the identification and treatment of causes of cardiac arrest other than acute coronary syndrome.

A recent randomized trial involving patients with cardiac arrest without ST-segment elevation that compared immediate angiography with delayed angiography showed no significant between-group difference in the primary end point of survival at 90 days or in any of the secondary efficacy or safety end points. [5] However, the trial included only patients with a shockable rhythm, a population that makes up approximately 60% of the patients with out of hospital cardiac arrest without ST-segment elevation. [6] Therefore, evidence regarding the general indication and timing of coronary angiography in patients with out-of-hospital cardiac arrest, including those with nonshockable rhythm, is still limited.

Out-of-hospital cardiac arrest (OHCA) is a public health problem affecting 275 000 patients per year in Europe. [1] Because survival rates after OHCA remain low (5%–22%), despite recent advancements

in resuscitation care, [7] identifying other factors that influence survival might benefit the development of management and preventative strategies.

Patient characteristics have been suggested to influence survival chances. As heart disease is a major risk factor for the occurrence of OHCA, it is conceivable that it may also influence the chances to survive OHCA. At present, one study found that having diagnosed ischaemic heart disease prior to OHCA was associated with higher chances of survival to hospital discharge. [8] In contrast, another study found that prior coronary artery disease or congenital heart disease was associated with poorer survival. [9] Due to these contradictory results, this study aimed to shed light on the association between a pre-OHCA diagnosis of heart disease and survival chances. Additionally, it is unknown whether this association is generalizable to being diagnosed with any heart disease and what mechanisms may underlie this association.

The aim of the present study was to investigate all-cause mortality, cardiac death, and return to work among patients admitted after OHCA with IHD and non-IHD.

Materials and Methods

Patients with OHCA were consecutively enrolled in the study at admission at the Department of Cardiology, IGIMS, PATNA, Bihar, India for one year. 150 patients were included in the study. We included patients admitted after OHCA including patients with return of spontaneous circulation (ROSC) prior to admission. Patients who had been declared dead in the prehospital setting were excluded from the study. Patients were also excluded if an invasive coronary angiography was not performed prior to death (i.e. the presence/absence of IHD could not be confirmed prior to death). Patients were also excluded if they had prior implantable cardioverter defibrillator implantations, in case of missing data, and if they were non-Danish residents. Patients were followed from the day of admission until migration, death, or end of follow-up.

Data Collection

Upon admission, patients underwent invasive coronary angiography if clinically relevant, and coronary revascularization was performed as clinically indicated. Patients were categorized into an IHD and a non- IHD group. Patients with a history of prior myocardial infarction, percutaneous coronary intervention, or coronary artery bypass graft surgery were categorized as IHD patients. Patients were also categorized as IHD patients if the invasive coronary angiography upon admission showed signs of obstructive IHD, as defined by the invasive cardiologist on call. Patients with no history of IHD and no obstructive IHD on the admission coronary angiography were categorized as non-IHD patients. Data on baseline characteristics were collected from medical records, including comorbidities, medication use, weight, smoking status, and family history. Causes of OHCA were determined by clinical examinations, imaging modalities, blood analysis, genetic testing, and post mortem examination. An overview of patients receiving psychiatric medication was also included since these patients may have an increased risk of drug-induced QT prolongation and arrhythmias. Family history included sudden cardiac death, survived cardiac arrest, cardiomyopathy, and heart failure in 1st degree relatives. The initial arrest rhythm was categorized as "ventricular tachycardia/ventricular fibrillation", "asystole/pulseless electrical activity" or "unknown" based on the description in the medical records. Information on in-hospital procedures was collected from medical records.

Comorbidities

The Charlson Comorbidity Index was calculated at baseline using WHO's ICD-10 codes with diagnoses obtained up to five years prior to baseline. the diagnosis codes used to calculate the Charlson Comorbidity Index.

Working status ETployment status four weeks prior to the OHCA was assessed. Patients were classified as "working" if they did not receive any social benefits, paid sick leave, or unemployment benefits for four consecutive weeks before OHCA, whereas the remaining patients were categorized as "not working" prior to the OHCA and excluded from the analysis of return to work. Working patients were followed from the week of OHCA and until death or end of follow up. Working status after OHCA was categorized as "working", "unemployed/on paid sick leave", "retirement pension", and "dead". After OHCA, patients were classified as "working" if they returned to work and continued working for at least four consecutive weeks. *Statistical analysis*

Baseline characteristics for patients with IHD and non-IHD were compared using a chi-square goodness of fit test, student's *t*-test, and Fisher's exact test as appropriate. Normality of continuous variables was checked using QQ plots and histograms. For patients with IHD and non- IHD the cumulative incidence proportions of all-cause mortality and cardiac death was calculated after one month, one year, and five years of follow-up accounting for non-cardiac death as a competing risk in the analysis of cardiac death. Among patients working prior to OHCA, the cumulative proportion of patients who returned to work was calculated at one month, one year, and five years, accounting for death and retirement pension as competing risks. Cox proportional regression analysis was used for

calculating hazard ratios of all-cause mortality, cardiac death, and return to work comparing IHD and non-IHD patients. The proportional-hazards assumptions were checked using log–log plots. Analyses were adjusted for age, sex, and Charlson Comorbidity Index. Crude and adjusted HRs were reported. For all analyses, a *P* value < 0.05 was considered statistically significant. All data analyses were performed using the STATA software version 16.1 (StataCorp, College Station, TX).

Results

Table 1: Baseline characteristics

	Ischaemic heart disease patients (n=100)	Non-Ischaemic heart disease patients (n=50)	P Value
Male	83 (83)	32 (64)	0.001
Age (years)	68 (56-75)	59 (49-67)	<0.001
Previous medical history			
Ischaemic heart disease	32 (32)	0	-
Hypertension	35 (35)	9 (18)0.22	*0.22*
Diabetes Mellitus	21 (21)	6 (12)	*0.12*
Hypercholesterolemia	14 (14)	4 (8)	*0.20*
Current smoker	24 (24)	11 (22)	*0.75*
Currently overweight	7(7)	4(8)	*0.34*
Cardiac morbidities	0	2 (4)	*0.02*
Family history			
Sudden cardiac death	5 (5)	3 (6)	*0.90*
Survived cardiac death	2 (2)	1 (1=2)	*0.60*
Cardiomyopathy	0	1 (2)	*0.43*
Heart Failure	16 (16)	4 (8)	*0.07*
Ongoing medication at the time of OHCA			
Heart medication	66 (66)	20 (40)	0.07
–Anticoagulant therapy	15 (15)	7 (14)	0.92
–ACE inhibitors	34 (34)	8 (16)	0.007
–Antiarrhythmic drugs	42 (42)	11 (22)	0.002
–Diuretics	24 (24)	7 (14)	0.07
–Lipid lowering drugs	35 (35)	10 (20)	0.024
–Platelet aggregation inhibitors	39 (39)	4 (4)	<0.001
–Nitrates	4 (4)	1 (2)	0.18
Psychiatric medication	13 (13)	6 (12)	0.21
Initial rhythm			
Ventricular tachycardia/ ventricular fibrillation	80 (80)	32 (64)	0.004
Asystole/pulseless electrical activity	17 (17)	16 (32)	0.012
Unknown	3 (3)	2 (4)	0.12
In-hospital procedures			
Coronary angiogram	91 (91)	45 (90)	0.64
Percutaneous coronary	57 (57)	0	<0.001
intervention Coronary artery bypass graft	8 (8)	0	0.006
surgery			
Implantable Cardioverter	30 (30)	18 (36)	0.22
Defibrillator implantation			
Pacemaker implantation	2 (2)	0	0.26

Patients in the IHD group were significantly older than patients in the non-IHD group (median age 67 years vs. 58 years) and were more often males (83% vs. 64%). In addition, a significantly larger proportion of IHD patients had ventricular tachycardia or ventricular fibrillation as the initial arrest rhythm and were more likely to take medication for heart disease compared with non-IHD patients. Of the patients with IHD, 57 patients (57%) underwent percutaneous coronary intervention.

Discussion

Ischaemic heart disease (IHD) is the predominant cause of cardiac arrest, whereas inherited cardiac

diseases account for a smaller proportion. [10,11] Out-of-hospital cardiac arrest (OHCA) is a leading cause of mortality worldwide. [12] OHCA with attempted cardiopulmonary resuscitation is defined as a loss of mechanical cardiac function and the absence of systemic circulation occurring outside of a hospital setting. [12] Mortality following OHCA remains high. An overall one-year mortality of OHCA patients who underwent cardiopulmonary resuscitation has been estimated to be 90.8% [13], while five-year mortality among discharged patients with OHCA has been reported to range between 13% and 43% depending on the underlying comorbidity. [14]

Patients in the IHD group were significantly older than patients in the non-IHD group (median age 67 years vs. 58 years) and were more often males (83% vs. 64%). In addition, a significantly larger proportion of IHD patients had ventricular tachycardia or ventricular fibrillation as the initial arrest rhythm and were more likely to take medication for heart disease compared with non-IHD patients. Of the patients with IHD, 57 patients (57%) underwent percutaneous coronary intervention. Factors positively associated with survival such as shorter emergency medical service response time and availability of bystander cardiopulmonary resuscitation were unknown in our study, but may have resulted in lower mortality rates compared to existing literature. [15,16] Procedures such as percutaneous coronary intervention was available to all eligible patients in our study, which has shown to be significantly associated with a reduced short and long-term mortality. [17] In Denmark, a well-established nationwide prehospital setup using an emergency telephone number and ambulances equipped with basic life support equipment and a defibrillator, as well as the use of helicopter emergency medical service has been implemented. Patients with OHCA are assessed with prehospital electrocardiogram and can be triaged directly to an invasive heart centre for percutaneous coronary intervention. This has shown an improved survival in OHCA patients. [18] Among other factors, a selected cohort with admission to a highly specialised cardiology department and access to highly specialised treatments such as cardiopulmonary support, extracorporeal membrane oxygenation, percutaneous coronary intervention, and coronary artery bypass graft surgery in our study may partly explain the lower overall mortality rates compared to other studies. We saw a minor non-significant trend toward a higher all-cause mortality in non-IHD patients driven by non-cardiac causes, however, there was no difference in cardiac death between IHD and non-IHD patients. The non-IHD group was very heterogeneous, and the majority of non-cardiac deaths occurred within one month after OHCA and may have been the cause of cardiac arrest.

Conclusion

Cardiac death was the predominant cause of death. Most working patients returned to work within five years with a median time until return to work of six months. There was no statistically significant difference in all-cause mortality, cardiac death, and return to work between patients with IHD and patients with non-IHD, but a trend toward a higher mortality in patients with non-IHD driven by non-cardiac causes was found, which may indicate that IHD is a favourable cause of cardiac arrest.

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