

Angiographic Findings in Survivors of Sudden Cardiac Arrest

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Abstract

Background: Sudden cardiac arrest is a fatal complication and survivors of these definitively require angiographic workup for underlying etiologies.

Objective: To determine the severity of coronary artery disease and frequency of coronary arteries involved in survivors of sudden cardiac arrest.

Methodology: Study Design: Descriptive study with consecutive sampling. Setting: Department of Cardiology, Sheikh Zayed Hospital, Rahim Yar Khan. Duration: August, 2017 to March, 2018. The survivors of sudden cardiac arrest of either sex, with age range of 30 to 60 years, were included. These then underwent coronary angiography and stenosis more than 50% was taken as significant and number of vessels involved were noted.

Results: There were 96 cases of survivors of sudden cardiac arrest; 67 (69.79%) males, and mean age of 49.27±5.56 years. Severe coronary artery disease (CAD) was seen in 59 (61.46%) of cases. Severe CAD was significantly high in male, 46 (68.66%) cases (p=0.04). There was no statistical difference in age group with p= 0.33. Severe CAD was more in cases having raised BMI and DM (p=0.51 and 0.18). It was significantly high in cases with hypertension 29 (82.85%) (p= 0.001) and those with dyslipidemia affecting 29 (78.38%) cases with p=0.009. Out of the cases detected with severe CAD, double CVD was the most common 26 (27.08%) of cases.

Conclusion: Coronary artery disease is one of the most common etiology in survivors of sudden cardiac arrest and it is significantly high in male gender and those suffering from hypertension and dyslipidemia.

Key words: Sudden cardiac arrest (SCD), CAD, Angiography, Outcome

Introduction

Sudden cardiac death (SCD) is an unexpected death, due to cardiac causes occurring in a short time period (generally within one hour of symptom onset) in a person with known or unknown cardiac disease.¹ Mostly SCD cases are due to cardiac arrhythmias. Approximately more than half of all cardiac deaths can be classified as SCDs. SCD represents as first symptom of cardiac disease in many individuals who experience out-of-hospital cardiac arrest.²

It is estimated that in Australia approximately 15,000 people suffer a cardiac arrest every year. However, incorporation of angiography and revascularization either with PCI or surgery in the post resuscitation care of patients with SCA has shown higher survival of patients as compared to previous decades.^{1,2} Out of the most threatening and dangerous arrhythmias leading to SCD are tachy-arrhythmias, these are ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT).³ Both automatic external defibrillator (AED) device and an implantable

cardioverter defibrillator (ICD) have been approved to be the most effective treatment for pulseless VT and VF.⁴ The implantable defibrillator (ICD) has now becoming the main stay of treatment in the prevention and treatment of sudden cardiac death. Patients with VT including both hemodynamically stable VT and hemodynamically unstable VT carry the overall best prognosis among patients with previous sudden cardiac arrest (SCA) or at risk of SCD due to these arrhythmias with the use of these new treatments like ICD and AED and newer drugs.³ Around 20-30% of patients who present with sudden cardiac arrest have bradyarrhythmia or asystole at the time of first contact. Most of the times, it is difficult to determine with certainty the initiating event in a patient presenting with a bradyarrhythmia due to myocardial ischemic event like inferior wall MI because pulseless electrical activity (PEA) or asystole may even result from a sustained VT. Less commonly, an initial bradyarrhythmia due to myocardial ischemic event may then provoke VT or VF.⁴ Hypertrophic cardiomyopathy usually obstructive type and dilated cardiomyopathy, are

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associated with high risk of SCD. Many valvular heart conditions like aortic stenosis are associated with high risk of SCD. Acute illnesses, such as myocarditis, have both an initial and sustained risk of SCD due to increased inflammation and fibrosis of the myocardium with the passage of time. Rarely, SCD occurs in patients who are not suffering from any have apparent structural heart disease. These conditions are usually inherited arrhythmia syndromes.^{5,6} Identifying the patients who are at risk for SCD remains a challenge. The strongest known predictor of SCD is significant left ventricular dysfunction, due to any cause. The interplay between the LV dysfunction, regional ischemia and transient inciting events like worsened ischemia, arrhythmias, hypoxemia due to RTI, wall tension, drugs, metabolic disturbances, cardio renal syndrome and many more, all has been proposed as being the precipitants of sudden death.^{6,7} This article explores the epidemiology of Sudden Cardiac Death, with objective to determine the severity of coronary artery disease and frequency of coronary arteries involved in survivors of sudden cardiac arrest.

Methodology

Study Design: It was a descriptive, case series study. **Setting:** Department of Cardiology, Sheikh Zayed Hospital, Rahim Yar Khan. **Duration:** August, 2017 to March, 2018. **Sample Size:** The sample size was calculated as 96 by keeping the confidence level equal to 95% and the margin of error equal to 7.5% while anticipated prevalence of triple vessel disease on angiography in previous studies as 16.7%. **Sampling Technique:** Non-probability consecutive sampling. **Inclusion Criteria;** Age 30 to 60 years; Both sexes; Cases of sudden cardiac arrest, within last 24 hours. **Exclusion Criteria;** All cases with previous history of CABG (assessed by history and medical record); Electrolyte imbalance (potassium more than 05 mEq/L); Any surgical intervention during first 24 hours of admission for ACS; Case of having any pre-existing chronic liver or hepatic failure (assessed by history and medical record). **Sociodemographic data** like age, gender, BMI and other data like DM, hypertension, smoking, family history of CAD, dyslipidemias and duration of cardiac arrest (minutes) were taken

and recorded on a pre designed proforma. Then all these cases underwent coronary angiography at the department of Cardiology of the hospital and the findings of angiography were labeled. Survivors of Sudden Cardiac Arrest were those cases that survived, following a cardiac arrest, within last 24 hours (abrupt cessation of cardiac mechanical function, which were reversible with prompt intervention but could lead to death in its absence and measured by presence of any one of the following; Ventricular tachycardia (>100 beats/min), Ventricular fibrillation (chaotic irregular deflections of varying amplitudes with no identifiable P wave, QRS complex and T wave ECG) and asystole (presence of flat line on ECG), Complete heart block (AV dissociation with bradycardia) and Pulseless electrical activity. Angiographic findings were assessed by visual assessment as well with the help of software QCA (Quantitative Coronary Analysis) and severity was labeled as "yes" when there was stenosis of more than 50% of any coronary artery and if it was found then number of vessels involved were counted as 1CVD, 2 CVD, 3 CVD. The results were recorded on as proforma. Data was analyzed with the help of SPSS version 21. Quantitative variables like age, BMI and duration of cardiac arrest were presented in terms of mean \pm SD (Standard Deviation). Frequency and percentages were calculated for gender, DM, hypertension, smoking, family history of CAD, dyslipidemia and outcome variable i.e. severity of coronary artery disease and arteries involved. Effect modifier were controlled through stratification of age, gender, BMI, DM, HTN, smoking, family history of CAD, dyslipidemia and duration of cardiac arrest to see the effect on outcome variable i.e. severity of coronary artery disease and arteries involved. Post stratification Chi-Square test was applied, taking P-value < 0.05 as significant.

Results

In present study, there were total 96 cases of survivors of sudden cardiac arrest; out of which 67 (69.79%) males and 29 (30.21%) females. The mean age was 49.27 ± 5.56 years and mean BMI was 27.82 ± 3.70 kg/m². In this study, 17 (17.71%) cases had DM, 26 (32.10%) had Hypertension, 27 (28.13%) were smokers, 59 (61.46%) had family

history of CAD and 37 (38.54%) cases had dyslipidemia as shown in table I.

Table I: Baseline Characteristics among Study Subjects. (n=96)

Variable	Variable			
	No (%)		No (%)	
Gender	Male	67 (69.79%)	Female	29 (30.21 %)
Diabetes mellitus	Diabetic	17 (17.71%)	Non diabetic	79 (72.29 %)
Hypertension	Hypertensive	26 (32.10 %)	Non-hypertensive	55 (67.90 %)
Smoking	Smoker	27 (28.13%)	Non smoker	69 (71.88 %)
Family history	Positive	59 (61.46 %)	Negative	37 (38.54%)
Dyslipidemia	Positive	37 (38.54%)	Negative	59 (61.46 %)

Severe CAD was seen in 59 (61.46%) of cases as shown in figure I. Severe CAD was significantly high in males where it was seen in 46 (68.66%) cases with p value of 0.04. There was no statistical difference in age group with p= 0.33. Severe CAD was more common in cases that had raised BMI and DM with non significant p values of 0.51 and 0.18 respectively. It was seen significantly high in cases that had HTN affecting 29 (82.85%) cases with p= 0.001 and those with dyslipidemia affecting 29 (78.38%) cases with p= 0.009. There was no significant difference of severe CAD in terms of smoking, family history of CAD and duration of cardiac arrest. Out of the cases detected with severe CAD, 2 CVD was the most common type detected seen in 26 (27.08%) of cases. (Figure II)

Figure I: Severity of CAD detected in Study Subjects. (n= 96)

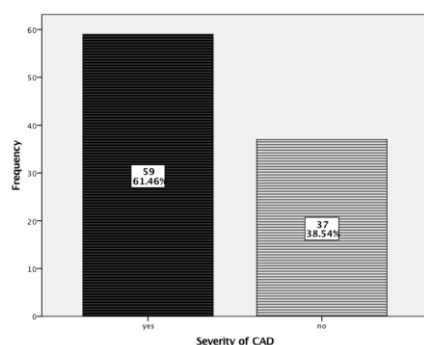
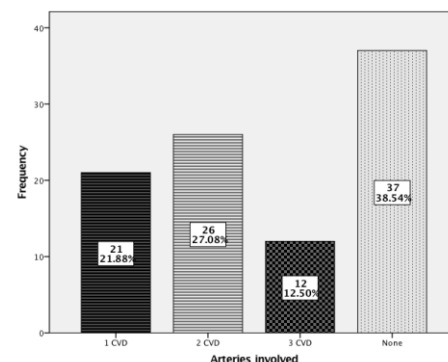


Figure II: Number of Coronary Arteries involved in Study Subjects. (n=96)



Discussion

Sudden cardiac arrest (SCA) is a leading cause of death in the developed world and coronary artery disease is the main cause in up to 90% of cases. Greater than 50% of deaths due to acute coronary syndrome (ACS) occur outside the hospital setting and early ventricular arrhythmias is the most common mechanism of death, of which ventricular fibrillation is the commonest type. Incorporation of angiography and revascularization into the post resuscitation care of patients with SCA has been shown in non-randomized case series to be associated with high rates of survival compared to historical controls.³

In the present study, severe coronary artery disease on angiography in the survivors of sudden cardiac arrest was seen in 59 (61.46%) out of 96 cases. The data in previous studies, to report percentages of sudden cardiac death due to coronary events is variable. Davies et al found 74 (74%) coronary thrombi among 100 victims leading to death, and another study reported 57% of cases of sudden coronary death, which showed acute coronary plaque changes on coronary angiography.^{4,5} In contrast, Warnes and Roberts reported very low incidence rate and they found this in only 13 cases of coronary thrombi in 70 sudden coronary death victims.⁶ However, among numerous possible causes for sudden cardiac arrest, the acute coronary syndrome is the most common cause which can be prevented.⁶

This is also proved in the past that early coronary angiography and prompt intervention have led as single independent variable for survival in such cases. This can be achieved by revascularization of possible culprit lesions or helping to trigger a search for other possible causes for cardiac arrest if angiography is negative.⁷ Coronary artery spasm is also a major cause of sudden cardiac arrest in cases of survivors of sudden cardiac arrest.^{8,9} This might be the reason of normal coronary angiography in such cases. In the present study, 37 (38.54%) of cases did not reveal any significant angiographic findings in the present study.

Severe CAD was significantly high in males where it was seen in 46 (68.66%) cases with p value of 0.04 in their respective group. This was similar to the studies done in the past where they also found that males had significant number of cases with angiographic changes and also have to have more cases with acute coronary syndrome. Male gender is a well established risk factor for ischemic heart disease and its consequences in the form of adverse outcomes.^{10,11} This can be explained by the various genetic, hormonal effects and also due to increasing trends of smoking, alcoholism and more of a stressed life style. There are multiple risk factors associated with sudden cardiac arrest in cases that are admitted in hospitals. Cardiac arrhythmias are the most common and other factors predisposing to it include diabetes mellitus (DM), hypertension (HTN), smoking; electrolyte imbalance etc.^{10,11} Severe coronary artery narrowing was seen significantly high in cases that had HTN affecting 29 (82.85%) cases with p= 0.001 and those with dyslipidemia affecting 29 (78.38%) cases with p= 0.009. This was also supported by many studies in the past. Multiple studies have developed linear correlation and association of these two variables to have a significantly high number of cases ending up in coronary artery narrowing and have significant p values of less than 0.05.^{12,13} The two modalities share the common underlying pathophysiological changes as high BP leads to intimal injury and lead to super added inflammation and aggregations of platelets and plaque formation; so is seen in cases of high lipids profiles where this deposition is also enhances in

such cases and compromise the myocardia flow. The above mentioned studies not only established significant association with HTN and dyslipidemia, but they also developed this with DM, Raised BMI, Smoking and family history of ischemic heart disease; which was not seen in the present study. The reason of this is unclear. Out of the cases detected with severe CAD, 2 CVD was the most common type detected seen in 26 (27.08%) of cases, followed by 1 CVD affecting 21 (21.88%) of cases and 3 CVD affecting 12 (12.50%) of cases whole 37 (38.54%) of cases had none of the coronary vessel involved. These results were almost close to the findings of the previous studies as well. A study done by Anyfantakis ZA et al revealed that in cases with sudden cardiac arrest out of their 72 cases 46 (63.9%) had significant angiographic findings out of which 17 (23.6%) had 1 vessel, 12 (16.7%) had 2 vessel, 17 (23.6%) had triple vessel disease while 26 (36.1%) had normal coronary angiography.¹⁴ While in another study done by on 45 patients, single vessel was involved in 13 (28.9%) cases, 2 vessel in 17 (37.8%) and triple vessel in 12 (26.7%) cases.¹⁵

Conclusion

Coronary artery disease is common in survivors of sudden cardiac arrest and it is significantly high in male gender and those suffering from HTN and dyslipidemia.

Authors Contribution: **AM:** Conception and revising. **MKI:** Design of work and drafting. **ZMB:** Acquisition and analysis and revising. **ZF:** Interpretation and drafting. **MZZ:** Design of work and drafting. **MS:** Acquisition & analysis and revising. All the authors gave the final approval for publishing and agreed to be accountable for all aspect of work.

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References

1. Cheung W, Flynn M, Thanakrishnan G, Milliss DM, Fugaccia E. Survival after out-of-hospital cardiac arrest in Sydney, Australia. *Crit Care Resusc* 2006; 8:321-27.
2. Zanuttini D, Armellini I, Nucifora G, Carchietti E, Trillo G, Spedicato L, et al. Impact of emergency coronary angiography on in-hospital outcome of unconscious

- survivors after out-of-hospital cardiac arrest. *Am J Cardiol* 2012; 110:1723-28.
3. Huang Y, He Q, Yang LJ, Liu GJ, Jones A. Cardiopulmonary resuscitation (CPR) plus delayed defibrillation versus immediate defibrillation for out-of-hospital cardiac arrest. *Cochrane Data Sys Rev* 2014;9:CD009803.
 4. Davies MJ, Thomas A. Thrombosis and acute coronary-artery lesions in sudden cardiac ischemic death. *N Engl J Med* 1984; 310:1137-40.
 5. Farb A, Tang AL, Burke AP, et al. Sudden coronary death. Frequency of active coronary lesions, inactive coronary lesions, and myocardial infarction. *Circulation* 1995; 92:1701-9.
 6. Warnes CA, Roberts WC. Sudden coronary death: comparison of patients with to those without coronary thrombus at necropsy. *Am J Cardiol* 1984; 54:1206-11.
 7. Noc M. Urgent coronary angiography and percutaneous coronary intervention as a part of postresuscitation management. *Crit Care Med* 2008; 36:S454-7.
 8. Noc M, Fajadet J, Lassen JF, et al. Invasive coronary treatment strategies for out-of-hospital cardiac arrest: a consensus statement from the European association for percutaneous cardiovascular interventions (EAPCI)/stent for life (SFL) groups. *Euro Intervention* 2014; 10:31-7.
 9. Miller DD, Waters DD, Szlachcic J, et al. Clinical characteristics associated with sudden death in patients with variant angina. *Circulation* 1982; 66:588-92.
 10. Mark DB, Califf RM, Morris KG, et al. Clinical characteristics and long-term survival of patients with variant angina. *Circulation* 1984; 69:880-8.
 11. Yasue H, Takizawa A, Nagao M, et al. Long-term prognosis for patients with variant angina and influential factors. *Circulation* 1988; 78:1-9.
 12. Iqbal MA, Khan N, Faheem M, Rauf MA, Khan SB, Shah I, et al. In-hospital complications of acute right ventricular myocardial infarction. *J Pak Med Assoc* 2013; 27(3):262-66.
 13. Noc M. Urgent coronary angiography and percutaneous coronary intervention as a part of postresuscitation management. *Crit Care Med* 2008; 36:S454-7.
 14. Anyfantakis ZA, Baron G, Aubry P, Himbert D, Feldman LJ, Juliard JM, et al. Acute coronary angiographic findings in survivors of out-of-hospital cardiac arrest. *Am Heart J* 2009; 157(2):312-18.
 15. Wijsekera VA, Mullany DV, Tjahjadi CA, Walters DL. Routine angiography in survivors of out of hospital cardiac arrest with return of spontaneous circulation: a single site registry. *BMC Cardiovascular Disorders* 2014; 14:30:1471-2261.

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