Original Research Article

Time Taken in Conversion of Stable Angina to Acute Coronary Syndrome in Patients with Coronary Artery Disease

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Abstract

Background*:** Coronary artery disease is a progressively worsening condition that may present as stable angina or Acute coronary syndrome (Unstable angina/Non-STEMI or STEMI) when restriction of blood flow to the myocardium occurs. The present study is undertaken to determine the time taken in conversion of stable angina to acute coronary syndrome and to compare the incidence of ACS in male and female populations. ***Objective: To study the time taken in conversion of stable angina to Acute coronary syndrome in patients with coronary artery disease and to compare the incidence of ACS in the male and female population. ***Material and Methods:*** The present cross-sectional study was conducted at the cardiac ward and follow-up in the out-patient unit, Andhra Medical College, Visakhapatnam. 50 participants, male and female, admitted with ACS were taken for study after obtaining written informed consent by purposive sampling. Data is analyzed using SPSS 20.0. The statistical test used is the student's t-test. ***Results:*** Out of the total population under study, **54%** presented for the first time to the cardiologist with ACS only, **36%** patients developed ACS from stable angina within a time interval of (**0-6months**) and **10%** of patients developed it in the time duration of (**>6months**). While the incidence of STEMI is significantly higher in females than males (***p=0.035***), the incidence of non-STEMI is significantly higher in males than females (***p=0.035***). ***Conclusion:*** The present study indicates that the majority of the patients present with ACS as a diagnosis at their first visit to a cardiologist whereas stable angina gets converted to ACS in 6 months in most of the untreated patients. We recommend further detailed multicenter study in this area with a higher sample size to confirm the results and use them for benefit of society.
Keywords: Acute coronary syndrome, Stable angina, Conversion time.

INTRODUCTION

Coronary artery disease (CAD) remains one of the leading causes of the burden of healthcare problems worldwide after infectious diseases [1]. Clinical manifestation includes stable angina, acute coronary syndromes (ACS), heart failure, and sudden cardiac death (SCD). The term ACS encompasses ST-elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (Non-STEMI) and unstable angina (UA) [2]. Overall, stable ischaemic heart disease (SIHD) remains a global public health problem of unmet need [3]. Stable coronary artery disease or SIHD, refers to the syndrome of recurrent, transient episodes of chest pain reflecting demand-supply mismatch, that is, angina pectoris. Angina is considered to be due to flow-limiting CAD [4] which by definition results in a supply-demand mismatch in myocardial perfusion. Depending upon individual specificity, the CAD severity varies. A widely used cut-off for obstructive CAD is taken as stenosis of 70% in a main coronary artery (>2.5mm) in one angiographic projection, or 50% in two projections, and 50% in the left main coronary artery [5]. Based upon clinical signs and symptoms, angina can present as simple chest pain with or without radiation to the left arm, jaw, interscapular region, etc to diaphoresis, epigastric burning pain, dizziness, and shortness of breath (Dyspnoea), pallor, lightheadedness [6]. On the other hand, acute coronary syndrome (ACS) refers to a spectrum of clinical presentations ranging from those for ST-segment elevation myocardial infarction (STEMI) to presentations found in non–ST-segment elevation myocardial infarction (NSTEMI) or in unstable angina. It is almost always associated with rupture of an atherosclerotic plaque and partial or complete thrombosis of the infarct-related artery [7]. Approximately two-thirds of ACS presentations are

with Non-STEMI and the remainder are STEMI [8]. Furthermore, with the advent of high sensitivity troponin assays, many patients previously classified as UA are now being diagnosed with NSTEMI. This has resulted in the incidence of UA fall while Non-STEMI rising [9]. While the age- and sex-adjusted incidence of ACS is falling, there remains an associated mortality risk with the condition [10]. In India, there are still a huge number of hospital admissions with ACS annually. In most cases, patients with coronary artery disease typically present acutely with severe ongoing cardiac chest pain and ST elevation on a 12-lead electrocardiogram (ECG) [11]. The standard of care for patients presenting with ACS includes early coronary angiography with a view to revascularize the patient with percutaneous coronary intervention (PCI) or coronary artery bypass surgery (CABG) [12].

In the year 2019, European Society of Cardiology (ESC) guidelines laid out on the management and classification of coronary artery diseases, the term "stable CAD" has been replaced with "chronic coronary syndrome" heralding a new era in the management of CAD [13]. Focus has now shifted on CAD as being part of a spectrum of disease. Patients with CAD can go on to develop acute coronary syndromes at any point in the progression of their disease. Hence, the term "chronic stable angina" now falling out of favour due to implications it has for the management of chronic ischaemic symptoms [14]. CAD is a dynamic process resulting from a myriad of interactions including in part, environmental and genetic [15]. These results in a disease process that can have long, stable periods, but can also become unstable at any time. This is typically due to an acute atherothrombotic event caused by plaque rupture or erosion [16]. The frequent use of the term "stable" implies that the complex pathological process that underpins angina remains dormant, which in most circumstances is far from reality [17]. Once Stable

Angina due to CAD sets in, the further course of the disease can vary to a great extent in different individuals in terms of both symptoms and time taken for the evolution of these symptoms [18]. This progression is influenced by the contractile function of the heart, condition of atheromatous plaque, condition of the vessel wall, individual physical fitness, and co-morbidities conditions besides others [19]. This study has attempted to find out the mean duration of time in which patients of coronary artery disease develop acute coronary syndrome from stable angina.

MATERIAL AND METHODS
The present study was a hospital-based cross-sectional study was conducted between September 2020 to October 2021 at the cardiac ward and follow-up outpatient unit, Andhra Medical College, which is a tertiary care referral hospital in Visakhapatnam. 50 participants, male and female, of all age groups who were admitted with ACS having no other significant co-morbidity and who have not received any prior medication for angina or stable coronary artery disease, were taken for study after obtaining written informed consent by purposive sampling. The control group included 50 patients without coronary artery disease of all gender and age groups. The study was carried out between September 2019 to October 2021. Exclusion criteria included Post (CABG) day 1 patient, patients with other significant co-morbidities, the patient's having ailments impairing memory and recall, extremely debilitated patients unable to speak, presence of a chronic condition other than angina presenting with similar or overlapping clinical symptoms, patients of coronary artery diseases who have received treatment for angina. The patient's cardiovascular disease records were obtained and were confirmed based on medical records from the Cardiology department of King George Hospital. A detailed history of the patient was taken. Cross confirmation of history for its reliability in case patient's attendants are available. Date of consulting a cardiologist/first visit to cardiologist was noted. Then patient's consent was obtained after which they were thoroughly interviewed for the presence of signs and symptoms of angina. Then the time for the appearance of those clinical features when they appeared first was noted. Entire data was noted down in the excel sheet. The duration/time gap between the onset of clinical features and diagnosis of Acute coronary syndrome is calculated by diving it into intervals. Differences in different gender groups were compared and incidence of NSTEMI and STEMI among male and female populations were also studied.

STATISTICAL ANALYSIS
Data was analyzed using means and standard deviation. To calculate the mean duration interval scales were used and to study the difference between rates of ACS in the male and female population, the student's 't'-test is used. The program used for data analysis is SPSS 21 (Statistical package for social science, version 21).

RESULTS
Among the cases of coronary artery disease, 30 (40%) were males and 20 (50%) were females in the population under study. The maximum no. of cases belonged to the age group of 41-50 years and the minimum number to <40 years age group. As per the modified Kuppuswamy scale, the majority of the cases were from the upper-middle class while the least no. of patients belonged to the lower class.

Demographic features of patients with acs understudy

AGE	Frequency(n)	Percentage (%)
<40	9	18
41-50	16	32
51-60	13	26
>60	12	24
GENDER		
MALE	30	40
FEMALE	20	50
SOCIOECONOMIC STATUS		
UPPER	04	08
UPPER MIDDLE	21	42
UPPER LOWER	09	18
LOWER	01	02
LOWER MIDDLE	05	30

SYMPTOMS	MALE (n%)	FEMALE (n%)	TOTAL
Chest pain	30 (100%)	20 (100%)	50 (100%)
Epigastric pain	01 (3.33%)	01 (5%)	02 (4%)
Radiating pain	01 (3.33%)	01 (5%)	02 (4%)
Sweating	01 (3.33%)	01 (5%)	02 (4%)
Heaviness in chest	01 (3.33%)	01 (5%)	02 (4%)
Breathlessness	02 (6.66)	03 (15%)	05 (10%)

Incidence of various symptoms in male and female (acs)

Among the reported symptoms, 100% of patients reported that they have experienced chest pain either on the day of presenting to the hospital or else earlier than that. About 4% of them experienced epigastric pain, pain radiating to the right ulnar border of the arm, jaw, interscapular region, and epigastrium, episodes of diaphoresis, and squeezing or band like heaviness in the chest. 10% of patients also experienced shortness of breath. Differences between these clinical features in the male and female populations were also studied.

Percentage distribution of patients for each conversion time interval between onset of stable angina to acute coronary syndrome

Stable angina to ACS	Frequency (n)	Percentage (%)
Same day	**27**	**54**
0-6 month	**18**	**36**
>6 month	**05**	**10**

Out of the total population under study, 54% presented for the first time to the cardiologist with ACS only. 36% of patients developed ACS from stable angina within the time interval of (0-6months). 10% - patients developed it in the time duration of (>6 months).

GENDER	NSTEMI	STEMI	P-VALUE
MALE	**21 (70%)**	**09 (30%)**	**0.035**
FEMALE	**08 (40%)**	**12 (60%)**	

Incidence of myocardial infarction in male and female population

The incidence of STEMI is found to be higher in females than males ($p=0.035$) while the incidence of Non-STEMI is found to be higher in males than females ($p=0.035$).

DISCUSSION

Time is the most important factor where the right intervention can make a difference of leaps and bounds in defining the health of a person, especially in chronic progressive diseases. There are many studies on the progression of coronary artery disease when it comes to the understanding of its pathophysiology, screening, and management but there are very few such studies that have undertaken the task of studying the progression of disease on the backdrop of time as to when a stable tolerable mildly symptomatic disease can become debilitating. Once we know this important parameter for the majority of the population, we are better equipped to decide on proper intervention in a timely specified manner. Moreover, patients will also be more aware of their condition so that they can take immediate action to reach out to proper cardiac care

providers before it's too late. The ideal design for answering the research question of this study is a cohort study with a high sample size involving multiple centers but the scope of this study is limited to King George hospital Andhra Medical College Visakhapatnam where it is carried out as a cross-sectional analytical study. It is evident from the above results that coronary artery diseases take variable amounts of time to evolve and manifest as acute coronary syndrome in different individuals who have experienced one or the other symptoms of stable or unstable coronary artery disease compared to the control group who haven't experienced any symptoms and they did not develop acute coronary syndrome. The reason for this variable progression may be attributed to differences in left ventricular systolic function, the extent of CAD, exercise duration, or effort tolerance. In the population under this study, 54% of the patients with chest pain at their first presentation to a medical facility were diagnosed to be acute coronary syndrome. In these patients, the course of evolution of coronary artery disease was asymptomatic or silent. In the remaining 46% of patients, one or the other symptom, suggestive of Acute coronary syndrome having a high positive likelihood ratio (C.I >95%) according to the established medical literature, has been reported during the past. Among these, 36% of the patients developed acute coronary syndrome within 0-6 months and 10% developed it in more than 6 months. This variation can be because of recall bias besides differences in the level of a patient's overall health. Out of the various symptoms of Acute coronary syndrome, 100% of them reported chest pain whose likelihood ratio with 95% CI is suggestive of ACS is 4.7 (2.9-12.0) in both male and female populations. They either experienced chest pain on the day when they were diagnosed to be a patient of ACS or else earlier than that during the past. Those who experienced it during the past reported that it improved on its own and they did not have access to proper cardiology medical services in their nearby locality so they did not take any treatment. With time, when the frequency of such episodes increased, they took proper consultation. As per the studies conducted in past, the positive likelihood ratio (95% CI) of chest pain radiating to the right arm or shoulder to be suggestive of progressive coronary artery disease is 4.7 (2.9-12.0). Besides chest pain, among the symptoms of CAD, 10% of patients reported that they have experienced shortness of breath which has shown progressive worsening with time. Among the cases, 4% of the patients also reported epigastric pain, 4% reported radiating pain whose likelihood ratio suggestive of ACS with 95% CI is 4.1 (2.5-6.3), 4% reported diaphoresis(sweating) whose likelihood ratio suggestive of ACS with 95% CI is 2 (1.9-2.2), 4% reported heaviness in chest with band-like tightness (discomfort) whose likelihood ratio suggestive of ACS with 95% CI is 1.3 (1.2-1.5) during past before the diagnosis of the Acute coronary syndrome. The reasons for not consulting a cardiologist at the time of symptoms for the first time stay almost the same in the majority of them that the symptoms improved on their own after some time so they neglected it initially, few of them took medication for other ailments like heartburn and did not undergo an ECG, cardiac biomarkers and exercise stress treadmill testing assuming the symptoms not to be of cardiac origin. Many of them belonged to low socio-economic class (32%), as per the modified Kuppuswamy scale, so they could not afford a proper screening and diagnosis until symptoms have advanced to the debilitating extent and few of them lives in remote areas where the ease of access to proper healthcare is not present. Among Acute coronary syndrome, the incidence of Non-STEMI and STEMI has also been compared in the male and female populations separately. According to the results of the study, males have a higher incidence of Non-STEMI which was found in 70% cases than STEMI which was found in 30% cases, while in females the incidence of STEMI which was found in 40% cases is higher than Non-STEMI which was found in 60% cases. The reason for this variability may be the presence of factors like obesity, reduced physical activity, and high cholesterol level among different gender groups. As per the previous studies, with the advancement of age, the risk of CAD is equal for males and females however in a younger population, there is a predisposition of CAD in the male population.

CONCLUSION

This study concludes that a significant majority 56% of the patient experiences symptoms for the first time when the coronary artery disease has progressed to Acute coronary syndrome however in a significant minority of 36% of them, the disease took 0-6 months to progress from a stable (stable angina) to a debilitating stage (Acute coronary syndrome) while in 10% of them it took >6 month time. Also, the incidence of STEMI is higher in females while the incidence of NSTEMI is higher in males. The need for more awareness regarding cardiovascular diseases and the role of regular screening of the population for the same has been identified in the study. The severity of the disease can be curtailed to fewer serious consequences if appropriate treatment is started in the initial stable stages. This study also suggests, further detailed multi-center, cohort study in this area with a higher sample size to confirm the results and implement preventive measures for the benefit of society in general.

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