Trends and Outcomes of Acute Coronary Syndrome (ACS) In Covid-19 Pandemic: Experience from A Tertiary Care Centre

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ABSTRACT
INTRODUCTION: *COVID-19 has significant impact on health care delivery system across the globe. It has been reported that hospital admissions due to ACS declined significantly in western world, suggesting less hospital visits by patients with cardiovascular diseases. However, data regarding the effect of this pandemic and its impact at the level of health sector of Indian cardiovascular diseases are meagre.*
AIM: *Aim of the study is to analyse the impact of this pandemic on presentation and outcomes of ACS patients during this pandemic and to compare the effect of increasing pandemic on this population.*
METHODS: *Our study is a Retrospective, comparative study done at Apollo hospitals, Visakhapatnam. Patients presented to our centre with ACS from 1st March2020 to 31st August 2020 were included in the study. The population was divided into two groups based on the number of reported COVID patients in the community. The first group (Group-1) comprised of the patients presented to our hospital from 1st March 2020 to 31st May 2020. The second group (Group-2) comprised of patients presented to our hospital from 1st June 2020 to 31st August2020. The demographic profiles, clinical profiles, Clinical outcomes (In hospital mortality) were compared between the two groups.*
RESULTS: *Total number of population(n) is 327. Group 1 has 231(70.6%), group 2 has 96 (29.4%) patients. The mean age of population was 59.91+/-11.85 years which did not differ between two groups. Surprisingly the proportion of patients from rural area has significantly higher in group 2 compared to group 1 (p <0.05). This could be due to the badly affected health care facilities at the primary and secondary levels during the initial period of pandemic. Apart from this, there was no significant difference in the demographic and risk factor profile between the groups. There was significant decrease in the rates of thrombolysis for STEMI patients in group 2 (p=0.014). The rates of heart failure at the presentation were more during the first phase (p= 0.039) implicating those patients were sicker at the time of presentation in Group1. This Suggest the early referrals from the primary and secondary care centres during the latter part of the pandemic amounting to lesser sick patients in group 2. There was no significant difference in the Median length of hospital stay or the outcomes between the groups.*
CONCLUSION: *COVID 19 has affected the health care sector of India significantly. There was significant reduction of ACS admissions in parallel to the rising number of COVID-19 cases in the community. However, the clinical outcomes of ACS patients were not affected by the COVID-19 pandemic.*
Key words: *acute coronary syndrome, STEMI, COVID-19, pandemic.*

I.   Introduction

COVID-19 has significant impact on health care delivery system across the world. During this pandemic, medical services have been overburdened by admissions with COVID-19, prompting reorganization of health sector to cope with the increasing demand to treat sick patients [1]. The sudden and stressful pandemic

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has the potential to increase or precipitate cardiac events like acute coronary syndrome, cardiac arrhythmia, and even out-of-hospital cardiac arrest [2, 3]. Simultaneously, increasing demand to treat sick patients of COVID-19, and announcement of various containment measures including nation-wide lockdown by government to prevent disease spread, have significant impact on the ability of health care system to deliver adequate acute and elective care to patients with cardiovascular diseases.

Recently, it was reported that admissions due to ACS declined significantly in Europe and United States of America hospital, especially, during the lockdown period, suggesting less hospital visits by patients with cardiovascular diseases during this pandemic [4, 5]. However, data regarding the effect of infectious pandemic and social restrictions including lock down taken by government on diseases like cardiovascular diseases are meagre. Moreover, novel corona virus disease is an evolving one, and much to be known about it in respect to its degree of morbidity and mortality in various countries with different socio-economic background. It is also imperative to understand the impact of social isolation and its effect on people's health, especially, patients suffering from different diseases like cardiovascular diseases. This study was carried out to study the trend and outcomes of ACS patients admitted to our institute during the initial 3 months period of COVID-19 pandemic and national lockdown period of India, and to compare with the patients with ACS during next 3 months period of same year when lockdown was lifted partially.

II.   Methods

Study design and data collection: This retrospective comparative study was carried out to analyse the clinical characteristics of consecutive patients admitted for ACS in our institution from 1st March to 31st August for a total period of 6 months. The first group (Group-1) included initial 3-months (march, April, may) of COVID-19 pandemic when the public lockdown imposed by the government was very strict and the second group (Group-2) included   the next 3-months period (June, July, august) when lockdown was lifted partially. The first group (Group-1) comprised of the patients admitted to our hospital from 1st March 2020 to 31st May 2020. The second group (Group-2) comprised of patients presented to our hospital from 1st June 2020 to 31st August2020. As per the infection control policy of our institution, all patients visiting our hospital during this pandemic time were allowed only through single entry of emergency department. At this point, initial screening with thorough history, temperature check, and clinical examination were carried out by emergency resident doctors before directing patients to different departments. This helped to maintain social distancing by preventing unnecessary crowding in multiple gates which was a normal practice till this pandemic. Patients who were admitted in other departments and subsequently diagnosed to have ACS were excluded from the study. Our time of enrolment started from 1st March, 2020, when hospitals in our state started to institute emergency infection control protocols to contain COVID-19, till 31st of August, 2020, that included complete national lockdown period of India starting from 24th of March to 14th of April and subsequent partial lockdown with exemptions applied till 31st August, 2020. Being a coastal city in Southern state of Andhra Pradesh, India, our hospital is a tertiary care centre catering patients mostly from three districts of the state, and adjacent areas of state of Orissa and Chhattisgarh, and works as tertiary level facility in the region.

Data collected retrospectively by one of the investigators were entered in a pre-specified proforma which included history, clinical examination, treatment, and hospital events till discharge. Approval from the institutional ethical committee was taken. Informed consent was obtained from each patient. Data was collected retrospectively from our electronic data storage system searched based on key words like ACS, ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), unstable angina, and all files were also checked manually by one of the investigators. Diagnosis of ACS was established from clinical presentation, electrocardiographic findings, cardiac biomarker Troponin-I plasma concentration at admission, and in compliance with the current guidelines [6]. We compared the number of admissions with ACS between the two groups. Further analysis regarding the demographic profiles, clinical profiles, Clinical outcomes (In hospital mortality) were carried out and compared between the two groups.

During this period, policy of our state government was to conduct test for COVID-19 only in suspected and symptomatic cases, with proper notification to public health care department, therefore, same protocol was followed in our institution also. Nevertheless, all precautions to prevent and spread of the virus were undertaken during the treatment period as per the institutional guidelines. Nasopharyngeal swabs were collected from suspected cases in our hospital and were sent to the specific government laboratory situated in the city. Reverse transcription polymerase chain reaction (RT-PCR) test was conducted and reports were informed within 24-48 hours.

Statistical analysis

Statistical analysis was carried out using SPSS 25. Continuous variables were presented as mean and standard deviation, and categorical variables as absolute and relative frequencies. Chi-square test was used to

compare variables between the 2 groups where appropriate. A two-sided p value of 0.05 was considered to be statistically significant.

III.   Results

Our study included 327 consecutive patients hospitalized with ACS during the study period. Total number of ACS cases in Group-1 was 231 were compared to 96 of the Group-2 during the study period. Fig 1 shows the monthly trends of admissions with ACS in both the groups. In Group-2 (n=96), the number of admissions with ACS were reduced as compared to Group-1 (n=231) with reduction rate of 58.44%. Admissions with ACS declined by 70% from the month of March (n= 113) to August (n= 34).

Figure 2 shows the distribution of ACS subtypes. Admissions with all ACS subtypes were reduced in number. STEMI (ST-Elevation Myocardial Infarction) was reduced during study period, with a reduction rate of 54.2% (131 vs. 60), NSTEMI with a reduction rate of 58.9% (51 vs. 21) and greater reduction was observed for unstable angina, (49 vs. 15) with a reduction rate, 69.4%.

Clinical characteristics and demographic profiles of all ACS (Acute Coronary Syndrome) patients are shown in Table I. The mean age of population was 59.91±11.85 years which did not differ between two groups. The proportion of patients from rural area has significantly higher in group 2 (53%) compared to group 1 (20%) (p <0.05). There were 62 females in Group-1 and 14 females in Group-2 with significantly lower admissions for female patients was observed in the Group-2 (p=0.01). Apart from this, there was no significant difference in the demographic and risk factor profile between the groups. Hypertension was the major risk factor followed by diabetes mellitus in both the groups. Chest pain was the most common presenting symptom followed by dyspnoea.

There was significant decrease in the rates of thrombolysis for STEMI patients in Group 2 (p=0.014). The rates of heart failure at the presentation were more in the first group (Group-1) (p= 0.039)

Angiographic findings were similar in both groups with higher number of single vessel disease [126, (38.5%)]. Analysis of hospital course and outcomes revealed significantly short hospital stay in the study group as compared to previous year [5.88 $\pm$ 3.24 days vs. 7.09 $\pm$ 3.93 days; p = 0.01], and no significant difference in major cardiovascular events. There was no significant difference in the Median length of hospital stay and the outcomes between the groups.

IV.   Discussion

Ongoing COVID-19 pandemic poses a major challenge to the health care delivery system of the world. During this pandemic, our health care delivery system has been encountered enormous burden due to overwhelming number of acute cases of COVID-19. Whether this is affecting our ability to deliver adequate acute and elective medical care to other diseases like cardiac diseases is a matter of study [7]. This comparative study, which is a sample representation of South Indian population, revealed a significant reduction of acute admissions due to ACS in this region during this pandemic period. Admissions with ACS were declined by 70% from the month of March (n=113) to August (n= 34).

In Group-1, 20% of the patients were from Rural area, and 53% in Group 2. The lesser number of rural patients in group 1 may be attributable to the badly affected health care facilities at the primary and secondary levels during the initial period of pandemic because of which decreased referrals to tertiary care.

Significant reduction of STEMI, NSTEMI and Unstable Angina was observed in the study.

Recent study in Italy and Germany reported similar observations for ACS admissions during the COVID-19 outbreak and public shutdown [8, 9]. In Spain, Austria, and United States of America a smaller number of hospital admissions for cardiac emergencies were reported during this pandemic [4, 5, 10]. The rates of heart failure at the presentation were more during the first group (p= 0.039) implicating those patients were sicker at the time of presentation in Group1.

These findings might be indirect evidences of delayed hospital visits after event during this lockdown and pandemic time. Similar observation of delayed presentation of patients with STEMI with indirect evidence of high Troponin value was made in a German study during this COVID-19 pandemic [9]. Another significant finding of our study was persistent decline of hospital admissions with ACS from March to August . This declining trend of hospitalizations started from the outbreak of first few cases of COVID-19 in this region, which was exaggerated during intense lockdown period, and continued till partial lockdown phase.

Decline in hospital admissions due to ACS might be attributable to multiple factors. The first major factor is iatrophobia, which is defined as intense fear of doctors, or related medical care system, and considered as an important cause for delay in seeking advice and care for medical conditions [11]. During this pandemic, the fear of getting contact with severe acute respiratory distress corona virus-2 (SARS-CoV-2) infected patients and subsequent risk of disease kept away symptomatic cardiac patients from seeking acute medical care. Many patients with ACS and their relatives informed us that they had tried to keep away because of the fear of getting infected with COVID-19 during hospital visit, and preferred online consultation. Iatrophobia apart from public

lockdown might be the major factor of reduction of hospital admissions for patients with ACS with the increasing number of COVID-19 cases in the community as observed in our study. Iatrophobia endured patients to tolerate symptoms for longer time before seeking medical care, and thus exposed themselves for more complications. All the Cardiovascular events of ACS were declined. Recent data from Italy suggest a significant increase in mortality during this period that was not fully explained by COVID-19 cases alone [12].

Second possible factor is numerous calls by the government through various media to remain indoor, and visit hospitals only in case of emergency. However, there was no proper definition of an emergency during the pandemic and public lockdown time, which misguided many patients to delay in seeking first medical advice. In India, government declared intense lockdown on 24th March, 2020, and continuing till 14th April, 2020, followed by partial lockdown except in certain hotspots. During this period, people remained indoor and all public facilities like educational institutions, stadiums, and other sports facilities, amusement parks, cultural institutions, and shopping complexes were closed. Measures to maintain strict social distancing were implemented, and people were encouraged to work from home. This led to sudden change in social and economic front with increase in unemployment rate, and fear of economic crisis [13]. In a developing country like India this had led to huge stress on the government and public life. Whether these changes have any effect on the incidence of acute cardiac events during pandemic is also a matter for further investigations.

During public lockdown, people were staying indoor together with family members with ample time for relaxation, which might itself help in reducing stress level and decreased in adverse work-related physical stress, resulting decline in the incidence of acute cardiac events [14, 15]. It is well documented that increased stress and unaccustomed physical activity can precipitate acute cardiac events [16]. On the other hand, reverse can also happen. Panic situation due to COVID-19, and constant fear of getting infected, loss of job, sudden fall in the market and business might also increase the stress levels leading to higher rate of cardiac events among some segments in the society. And, most worryingly, the incidence of STEMI might be the same or might have increased or decreased , but patients were less likely to seek medical attention. Our finding of reduced number of ACS cases with 58.4% reduction rate during this pandemic time might be related to the same fact.

Other possible factor of reduction of admissions with ACS might be related to framing issues. In this, patients and even attending physicians might have attributed the cardiac symptoms like chest pain, breathlessness to other causes like respiratory infection, rather than ACS, resulting delay in diagnosis and referral to tertiary care centre. This has been documented in various reports during outbreak of COVID-19 pandemic [17]

Limitations of the study:

This is a single centre study with limited number of cases. It was a retrospective study. We also could not analyse accurate medical contact timings for patients with ACS in our study due to various reasons, though indirect evidence of delay in presentation was analysed with the help of cardiac function in echocardiography which is based on hypothetical ground. However, we ensured accuracy of our data collection with great sincerity, and followed each patient very closely till the time of last event. All our cases did not undergo RT-PCR test for COVID-19 during this pandemic time.

V. Conclusion

This study shows a significant decline in admissions with ACS in a regional, but representative sample of the population in Coastal Andhra Pradesh, in parallel to rising number of COVID-19 cases in the community. STEMI contributed high in ACS in both the groups. Possible reason for the decline in the number of hospital admissions could be due to iatrophobia and containment measures by the government to prevent spread of the virus. However, the clinical outcomes of ACS patients were not affected by the COVID-19 pandemic.

Our study is a glimpse of the effect of the COVID-19 pandemic on ACS in India during its early days, and further large-scale studies are required to investigate the effect of pandemic on health care delivery for diseases like cardiovascular diseases.

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Legends:

Table I: Demographics and clinical characteristics of patients with ACS in both the groups.

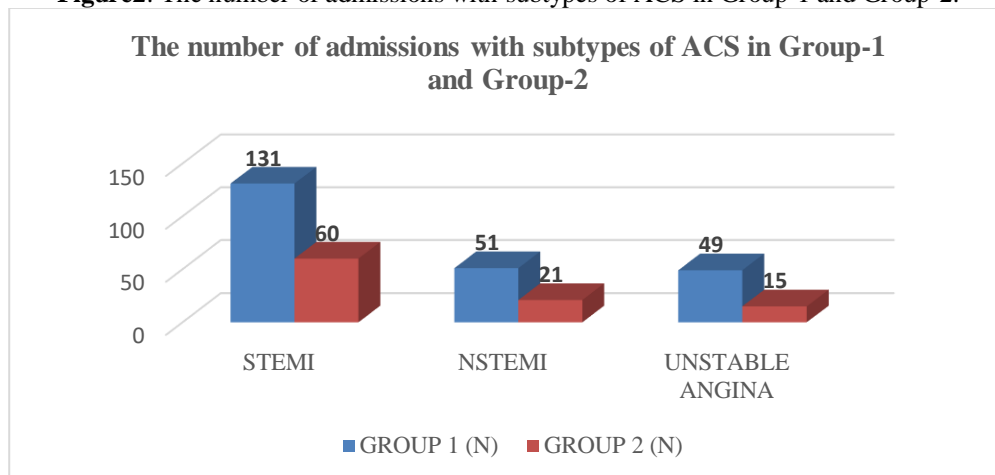|	GROUP1 (N=231)	GROUP1 %	GROUP 2 (N=96)	GROUP 2 %
MEAN AGE (YEARS)	59.59±11.4		60.65±12.86	
MALES	169	73%	82	85%
FEMALES	62	27%	14	15%
RURAL	46	20%	51	53%
CHEST PAIN	186	81%	57	59%
DYSPNOEA	79	34%	36	38%
HYPERTENSION	154	67%	65	68%
HEART FAILURE	19	8%	2	2%
SVD	81	35%	39	41%
DEATH	8	3%	2	2%

SVD: Single vessel disease

Figure1: The number of patients admitted with ACS during study period in the Group-1(Blue) and Group 2(Red)
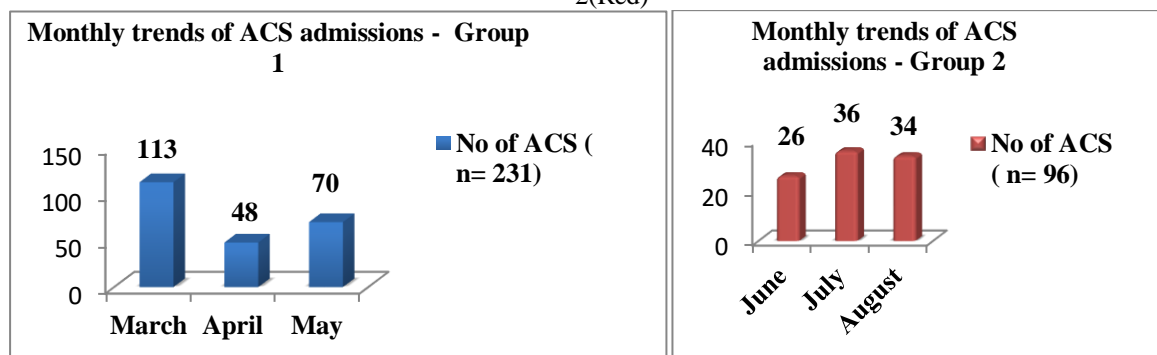
ACS: Acute coronary syndrome

Figure2: The number of admissions with subtypes of ACS in Group-1 and Group-2.

STEMI: ST-elevation myocardial infarction
NSTEMI: Non-ST-elevation myocardial infarction