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A Retrospective Observational Study of Myocardial Infarction at Younger Age less than 40 years in a Tertiary Care Hospital in India.

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Abstract

Introduction: Acute myocardial infarction is a public health problem in developed and developing countries. Previously seen in older age group, now has become commoner in younger age groups also. ***Aims & Objectives:*** The primary objective of this study is to characterize the clinical presentation, cardiovascular risk factors profile and coronary angiographic patterns in young adults less than 40 years presenting with ST elevation Myocardial Infarction (MI). ***Materials and Methods:*** In the present study we are analysing 50 patients with ST elevation MI in a tertiary care hospital, demographic variables, angiographic profiles and outcomes. ***Results:*** In our study, there were 26 patients diagnosed with Anterior wall MI having LAD involvement. 13 patients with Inferior wall MI, with RCA as the culprit artery. 4 patients had double vessel disease with LCX and LAD involvement, and one patient had triple vessel disease. This infers that the Anterior wall MI is more common in young MI group (<40 years), Inferior wall MI being next common with few Lateral wall MI with LCX as culprit artery. In our study, there were 10 Diabetics, 12 Hypertensives, 21 Smokers, & 24 alcoholics with overlapping risk factors. Focused public health initiatives, early screening for cardiovascular risk factors, and tailored preventive strategies are imperative to curb the rising burden of premature coronary artery disease in this population. Larger, multicentre studies with long-term follow-up are warranted to further elucidate outcomes and refine management approaches for young patients with STEMI. ***Conclusion:*** Young STEMI patients constitute a significant and vulnerable subgroup with unique clinical and angiographic characteristics.

Categories: Cardiology

Keywords: comorbid obesity, coronary stent, dyslipidaemia, intracoronary thrombolysis, myocardial infarction in young adults, primary coronary angioplasty, st-elevation myocardial infarction (STEMI), thrombus aspiration.

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INTRODUCTION

Myocardial infarction has traditionally been considered a disease of elder individuals. However, it has increasingly been observed in younger adults as well. This emerging trend is a matter of concern, particularly in developing countries such as India.

Our study was undertaken to evaluate the clinical presentation, cardiovascular risk (CV) factor profile, and coronary angiographic patterns among adults younger than 40 years and diagnosed with ST-elevation myocardial infarction (STEMI).

We analyzed 50 patients with STEMI admitted to a tertiary care hospital. Demographic profiles, CV risk factors, angiographic findings, and clinical outcomes were assessed.

Our research shows that young individuals suffering from STEMI form a unique and at-risk group, exhibiting specific clinical and angiographic traits. Consequently, it is crucial to promptly identify and address CV risk factors within this demographic profile.

Public health initiatives that emphasize early detection, modification of risk factors, and specific preventive strategies could potentially alleviate the increasing prevalence of premature coronary artery disease among young people. Further multi-center investigations with increased sample sizes and prolonged follow-up are required to improve our understanding of the outcomes and refine management strategies for young individuals presenting with STEMI.

Coronary artery disease (CAD) is still among the top causes of health issues and fatalities around the world, with India being no exception. Our country is currently undergoing an epidemiological transition in which the burden of communicable diseases is gradually declining while non-communicable diseases are increasing rapidly, resulting in a dual disease burden.

Younger patients diagnosed with STEMI are frequently thought to have a more favorable prognosis than their older counterparts. Nevertheless, enhanced outcomes can only be achieved with prompt recognition and timely management.

Despite the increasing incidence of myocardial infarction among younger individuals, there is limited published data regarding the CV risk factor, Coronary angiographic profile, procedural strategies and their outcomes. Therefore, our study was undertaken to evaluate the above mentioned criteria in young patients diagnosed with STEMI.

MATERIALS AND METHODS

This was an observational, investigator-initiated, single-center study done in the Department of Cardiology at Vydehi Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka, India.

The study was done in accordance with the principles of Good Clinical Practice and the Declaration of Helsinki. Written informed consent was taken from all patients or from their legal representatives at the time of the index procedure.

INCLUSION CRITERIA:

Observational study comprising 50 patients,

1) AGE < 40 YEARS,
2) Confirmed diagnosis of STEMI.

EXCLUSION CRITERIA

1) Stable angina,
2) Unstable angina and
3) NSTEMI.

Ethical committee approval has been taken from local institutional ethical committee of VIMS and RC. All enrolled patients gave written informed consent.

PRIMARY OBJECTIVE OF THE STUDY:

1) To characterize the clinical presentation, CV risk-factor, coronary angiographic patterns in young adults (<40 years) diagnosed with STEMI.

SECONDARY OBJECTIVES:

1) To evaluate the angiographic extent and pattern of coronary artery disease, including the number of vessels involved and the distribution of culprit vessels.
2) To assess the procedural strategies and outcomes
3) To assess left ventricular systolic function using echocardiography, including measurement of left ventricular ejection fraction (LVEF) and identification of regional wall motion abnormalities.

RESULTS

Acute myocardial infarction (AMI) in young adults is recognized as an important clinical entity with distinct epidemiological and angiographic characteristics compared to elder populations. In our study, there was a predominance of male patients (90%) which also matches with widely reported global data indicating that AMI is 4 to 8 times higher in young males. Several studies attribute this to higher prevalence of smoking, alcohol consumption, and stress-related sympathetic activation among younger men. The low number of female patients is consistent with the cardio protective effect of estrogen, which delays atherosclerosis until later decades of life.

Our study suggests majority of the patients were aged between 30 to 40 years and the distribution of age & gender distribution among patients is as shown in Figure-1. A total of 50 patients, with a sample of 12, 14 and 24 in the age groups of 25 to 30 years, 31 to 35 year and 36 to 40 years respectively, was studied and observed that the STEMI incidence was more in young males than in females.

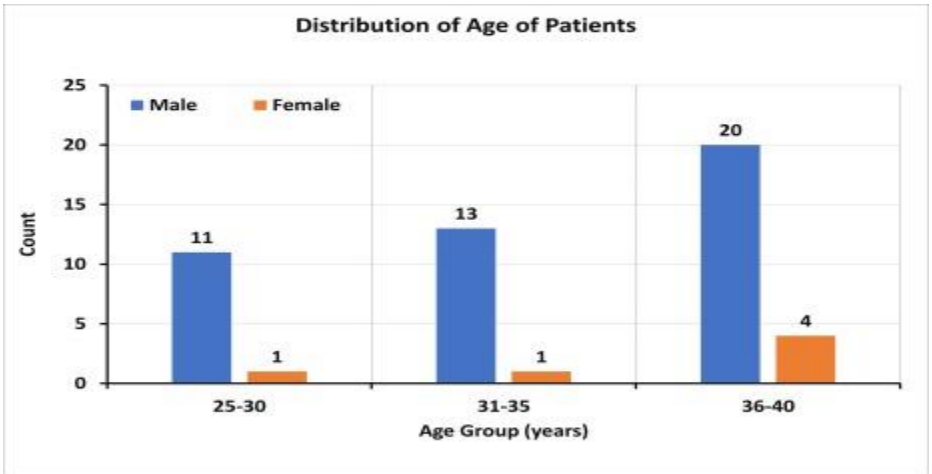

FIGURE 1: Distribution of patients in terms of age group

This difference may be partly explained by the higher prevalence of risk factors such as alcohol consumption, smoking, and substance use among males. A major finding of our study was the high proportion of lifestyle related risk factors, particularly smoking (42%) and alcohol consumption (48%), the distribution of which is shown in Figure-2. In contrast, younger females may experience a degree of protection due to the cardio protective effects of estrogen.

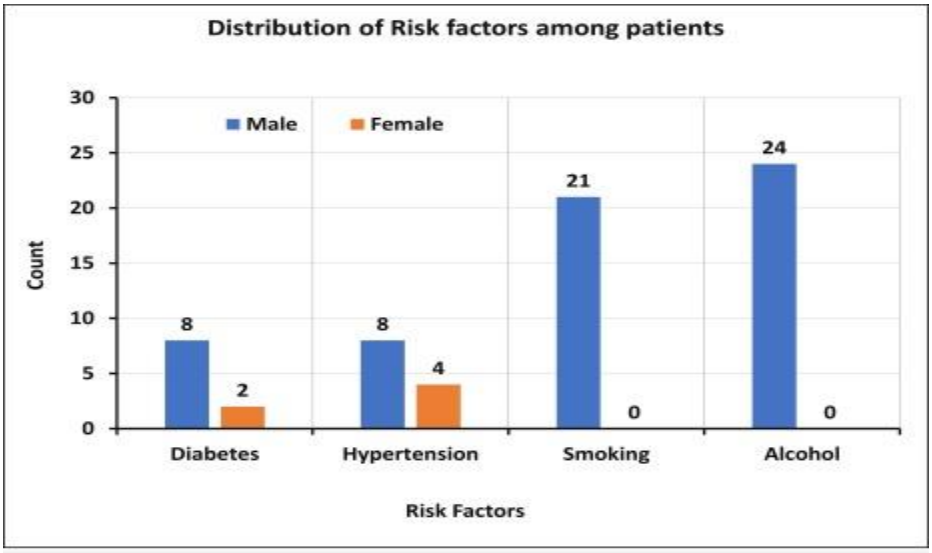

FIGURE 2: Distributions of risk factors among patients

Multiple studies have shown smoking to be the significant risk factor in young MI, often associated with endothelial dysfunction, hypercoagulability, and increased platelet activation. They are prone to develop high thrombus-burden lesions, predisposing them to acute thrombotic occlusion, even in the presence of underlying atherosclerosis. Alcohol consumption, especially binge patterns, has been independently linked to coronary vasospasm, arrhythmogenicity, and altered lipid metabolism.

Lifestyle-related factors are crucial in the development of young MI. Occupational stress, irregular work schedules, and disrupted sleep patterns may influence hormonal regulation, autonomic balance, and inflammatory pathways, thereby increasing cardiovascular risk.

Obesity emerged as an important risk factor affecting both males and females in this study. Obesity is recognized as a pro-inflammatory state, which may accelerate atherosclerosis and adds to the earlier onset of MI.

The study evaluated patient demographic profile, CV risk factors, echocardiographic findings, angiographic characteristics, and treatment strategies among individuals diagnosed with STEMI.

Angiographic patterns provide crucial insight into the pathophysiology of AMI in younger cohorts. The findings, from our data shown in Figure-3, revealed that single-vessel disease (68%) was far more common than multi-vessel involvement. This is consistent with the hypothesis that soft, lipid-rich plaques rather than calcified, mature atherosclerotic lesions; are more likely to rupture in younger individuals. Studies have suggested that coronary thrombosis is triggered by erosion of the plaque which is more common than plaque rupture among young smokers, which can explain the localized, non-diffuse pattern of coronary involvement.

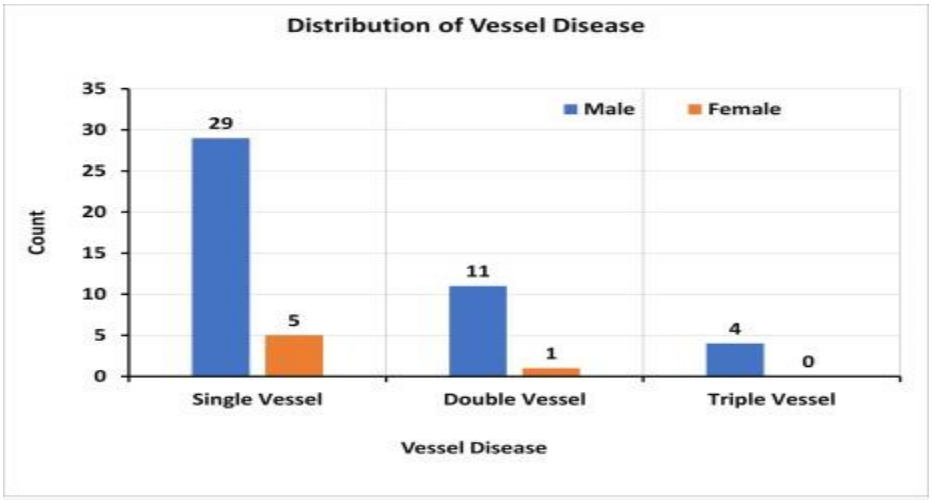

FIGURE 3: Distribution of vessel disease among patients

In our study, there were 26 patients diagnosed with Anterior wall MI having LAD involvement. 13 patients with Inferior wall MI, with RCA as the culprit artery. 4 patients had double vessel disease with LCX and LAD involvement, and one patient had triple vessel disease, as shown in Figure-4. This infers that the Anterior wall MI is more common in young MI group (<40 years), Inferior wall MI being next common with few Lateral wall MI with LCX as culprit artery.

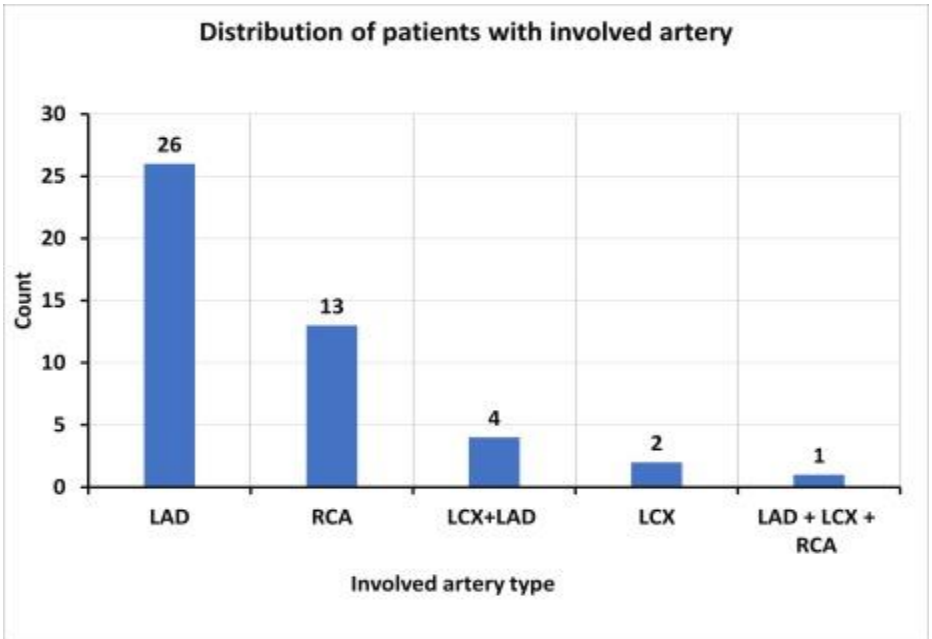

FIGURE 4: Distribution of patients with involved artery

Among the patients included in the study, 28 received intracoronary tirofiban. Of these, 18 patients received 1500 mcg intracoronary tirofiban, while 12 patients received 1000mcg of tirofiban.

Intra-coronary administration of tirofiban (1000-1500 mcg bolus) helped to establish ante-grade flow in culprit artery, delineate the extent of lesion,

Correctly estimating the stent size thereby shortening the duration of the procedure and reducing the major adverse cardiovascular events (MACE) immediately and at 30-day follow-up. The Usage of intracoronary balloons to establish coronary flow may be minimized by using Tirofiban, which also facilitates quick stenting in STEMI patients and avoid slow flow and no reflow in coronaries.

Intra-coronary tirofiban followed by intravenous tirofiban may improve coronary blood flow and micro vascular perfusion, enhance myocardial reperfusion after PCI, and reduce adverse cardiovascular events immediately and at 30-day follow-up without increasing bleeding risk.

Administration of tirofiban improves prognosis in patients undergoing percutaneous coronary intervention for STEMI. Drug eluting stents were deployed after intracoronary tirofiban. We used Everolimus, eluting FDA approved stents in all of our cases. The Direct stenting strategy mostly deployment at 12-14 atm were used in most of the cases with no post dilatation achieving TIMI III flow.

DISCUSSION

Typical chest pain was identified as the most common symptom in the study cohort, though its occurrence decreased with age. According to Kamali M, et al [1], younger patients had a significantly reduced time from the onset of symptoms to their first medical contact. However, about 30% of the younger group presented late, more than six hours after the onset of symptoms. This underscores the necessity for health education programs for patients and their families to reduce hospital delays, not only for older individuals but also for younger ones, who are generally considered to be at lower risk. Reports [2,3] indicate that Anterior wall myocardial infarction (MI) is more frequently seen in the younger population than in adults, as per previous studies. Alexander et al [4] found that the average age for the onset of STEMI was 40 years. Khraishah H et al.[5] observed a 47-fold increase in the incidence of MI in those under 40 years over the last two decades. The VALIANT study revealed that 69.7% of patients aged 18 to 45 years and 56.4% of those over 65 years were affected [5]. Our findings align with this trend. The dominance of anterior wall myocardial infarction (AWMI) in our study reflects trends noted in contemporary cardiology literature, where the LAD artery is often implicated in younger patients. The LAD artery is crucial for a significant portion of myocardial perfusion, and its occlusion typically leads to larger infarct sizes. This has important prognostic implications, as AWMI is associated with a higher risk of complications such as heart failure, arrhythmias, and left ventricular remodeling.

The INTER HEART study conducted by Shukla AN, et al. [6] found that the MI occurred in 4.4% of Asian females and 9.7% of males under 40 years, which is roughly two fold times higher than that of the West European population. Our data suggests that STEMI was more prevalent in males compared to females.

Gupta R et al. [7] point out a consistent finding that the prevalence of STEMI was 80.4% in males. In our cohort, comorbidities like diabetes mellitus and hypertension were also observed, indicating the growing prevalence of metabolic syndrome among younger individuals. Early onset diabetes is recognized for its role in accelerating atherosclerosis through mechanisms such as chronic inflammation, oxidative stress, and micro vascular dysfunction. Furthermore, hypertension in young people, which is often asymptomatic and goes undiagnosed, contributes to endothelial damage and the development of coronary plaques.

Recent data from the North India STEMI Registry (NORIN-STEMI), published by Mohit D. Gupta et al. [8] in 2024, highlighted a significant prevalence of ST-elevation myocardial infarction (STEMI) among the young population (defined as <50 years). In their cohort of 5,335 patients, nearly one-third (32.8%) were categorized as young, presenting with a distinct risk profile characterized by high rates of physical inactivity (75.1%), alcohol consumption (67.8%), and tobacco use (66.6% vs. 52.4% in older counterparts). Notably, while young patients demonstrated lower incidences of diabetes (16% vs. 26.3%) and hypertension (18.5% vs. 29.9%), they experienced more favourable clinical outcomes, including reduced in-hospital and 30-day mortality rates. Our findings mirror several of these epidemiological trends, though with notable variances in comorbidity prevalence. In our study, diabetes mellitus (DM) was present in 20% of the cohort, and hypertension was recorded in 24%-figures slightly higher than those reported in the NORIN-STEMI young cohort. Consistent with Gupta et al., we observed a stark gender disparity in risk factors; DM and hypertension were predominantly identified in males (16% and 16%, respectively) compared to females (4% and 8%). While our study did not evaluate

physical inactivity-a key predictor in the NORIN-STEMI registry-our data reinforces the critical role of modifiable lifestyle factors. We identified significant rates of tobacco use (42%) and alcohol consumption (48%) among males. These results underscore the urgent need for targeted primary prevention and aggressive management of risk factors in the young North Indian population to mitigate the burden of CAD.

Another study by Sutton et al. [9] had stated that 20% of their patients reported a 35% LVEF after acute STEMI. Whereas in our study 18% showed 30-40% LVEF with RWMA, 42% of patients showed a 41-49%LVEF with RWMA, 18% of patients had 50-55% LVEF with RWMA, 22% of patients had no RWMA with LVEF> 60%.

LVEF assessment showed most patients had preserved or slightly reduced ventricular function, indicating that early detection and rapid reperfusion can significantly limit myocardial damage. Research suggests younger myocardial infarction patients tend to recover better due to less chronic comorbidities.

When compared with older MI populations, young patients often have better short-term survival but similar long-term recurrence risk, if risk factors are not aggressively managed. This highlights the need for structured cardiac rehabilitation programs focusing on smoking cessation, weight management, dyslipidaemia treatment, and psychological support.

Somera Naz et al. [10] conducted a prospective study on 78 patients aged 45 or younger with confirmed STEMI via electrocardiography and coronary angiography. The study, held at a tertiary care center in Islamabad from September to December 2024, aimed to evaluate angiographic profiles and risk factors in this demographic. Participants had an average age of 40.2 years, with a majority being male (71.8%). Over half exhibited cardiovascular risk factors, predominantly smoking, followed by hypertension and diabetes.

Data on demographics, risk factors, and angiographic findings were collected, including assessments of coronary artery involvement and lesion characteristics. Statistical analysis was performed using SPSS version 23, with significance set at $p < 0.05$. Results showed 41.02% of participants were aged ≤35, and 58.98% were aged 36-45. The most affected coronary artery was the RCA (43.75% in ≤35 and 47.83% in 36-45), followed by the LAD and LCx. No significant gender differences were found in angiographic characteristics, emphasizing the profile of young STEMI patients, particularly the male predominance. Our study highlights the angiographic and demographic traits of young STEMI patients, particularly the higher prevalence of males with significant cardiovascular risk factors, especially alcohol & smoking. Larger studies are needed to confirm these findings and explore gender differences.

Angiographic evaluation revealed that the right coronary artery was the most affected, followed by the left anterior descending and left circumflex arteries. Proximal segment involvement and severe lesions were common, with multi-vessel disease more prevalent than single-vessel disease across age and gender groups. No significant gender differences in angiographic features were observed. This study highlights that young STEMI patients often have significant coronary artery disease linked to modifiable risk factors, emphasizing the need for early prevention and targeted risk modification strategies.

Younger patients showed a greater incidence of tobacco use, alcohol intake, and lack of physical activity, while diabetes mellitus and hypertension were less frequently observed in comparison to older patients. Additionally, younger individuals with STEMI were inclined to seek medical attention earlier and usually demonstrated better-maintained left ventricular systolic function, as shown by a comparatively elevated left ventricular ejection fraction.

The clinical outcomes were more advantageous for the younger cohort. In-hospital mortality was significantly lower among young patients (5.9% versus 10.0%), and there was also a reduction in 30-day mortality (11.1% compared to 16.2%) relative to older patients. Among all variables analyzed, LVEF ≤30% and female sex emerged as the strongest predictors of mortality.

In summary, these findings show that young STEMI patients account for a notable fraction of myocardial infarction cases in India. The results stress the importance of implementing targeted preventive strategies, swiftly identifying modifiable risk factors, and ensuring timely interventions to lessen the burden of early coronary artery disease in this population.

CONCLUSION

ST-elevation myocardial infarction (STEMI) in young adults is increasingly recognized as a unique condition, especially in India. Our research shows a notable male predominance and highlights the impact of modifiable lifestyle factors, particularly tobacco and alcohol use, on early coronary events. While younger individuals typically have less traditional comorbidities like diabetes and hypertension, many still exhibit significant coronary artery disease. In our study, the left

anterior descending artery was most commonly affected, with single-vessel disease being the prevalent angiographic pattern.

The angiographic findings from this study suggest that localized, thrombus-rich coronary lesions are common in younger patients, highlighting that early plaque erosion or rupture may play a key role in myocardial infarction in this group. Most patients had preserved or slightly reduced left ventricular systolic function, likely due to earlier healthcare engagement, timely reperfusion treatment, and the greater myocardial recovery potential seen in younger individuals.

The use of modern reperfusion techniques, such as primary PCI, additional intracoronary antiplatelet therapy, and selective thrombus aspiration, was associated with excellent short-term outcomes and low mortality rates. However, positive short-term results should not lead to complacency, as young patients still face significant long-term risks if lifestyle and metabolic factors are not managed. Prompt identification of STEMI mimics, accurate diagnosis, and quick intervention are essential to prevent adverse outcomes. Additionally, proactive secondary prevention strategies, including smoking cessation, lifestyle modifications, managing metabolic risks, and participating in structured cardiac rehabilitation, are crucial.

In summary, young STEMI patients are a vulnerable group with unique clinical features. Targeted public health measures, early CV risk screening, and tailored prevention strategies are crucial to address the rise of early coronary artery disease in this demographic. More multicenter studies with larger samples and longer follow-ups are needed to improve understanding and management of long-term outcomes for these patients.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Lalitha S, Manaswini S, Mohit Garg Kamal Saba MD

Acquisition, analysis, or interpretation of data: Lalitha S, Manaswini S, Mohit Garg Kamal Saba MD

Drafting of the manuscript: Lalitha S, Manaswini S, Mohit Garg Kamal Saba MD

Critical review of the manuscript for important intellectual content: Lalitha S, Manaswini S, Mohit Garg Kamal Saba MD

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. VYDEHI INSTITUTION OF MEDICAL SCIENCES AND RESEARCH CENTRE ETHICS COMMITTEE issued approval VIEC/2024/APP/08. APPROVED. Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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