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STUDY OF THE TRENDS IN REPERFUSION AND OUTCOME OF STEMI PATIENTS IN THE LAST 5 YEARS AT A TERTIARY CENTRE.

Cardiology

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ABSTRACT

Background: This study aims to delineate trends in reperfusion strategies and outcomes for ST-Elevation Myocardial Infarction (STEMI) patients over a five-year period at a tertiary care centre. It provides a detailed examination of demographic shifts, clinical practices, and patient outcomes. **Method:** We conducted a retrospective and prospective cohort study of 815 STEMI patients admitted between 2019 and 2023. Comprehensive data and trends were analysed. **Results:** The study shows almost equal percentage of patients received thrombolysis and primary angioplasty post covid period. Mortality rate remained stable over five years. Around 3-fold rise in patients under 40 years from 5.8% to 15.84%. A considerable portion of patients presented late, particularly in the 1-6 hours category. Morbidity trends varied. The length of hospital stays (1to3 days) improved, reflecting enhanced healthcare access and efficiency. **Comparison with Registries:** Compared to Indian and Western cohorts, our facility showed comparable mortality rates but highlighted areas for improvement in morbidity reduction and reperfusion timing. The demographics and symptomatology recorded align well with broader trends suggesting a consistent approach towards STEMI management globally. **Conclusion:** Over the last five years, our centre has made significant strides in the management of STEMI. In hospital mortality rates remained stable or improved slightly despite the complexity of cases. The performance, while comparable to international standards in many areas, suggests specific avenues for targeted interventions to meet or exceed clinical outcome benchmarks in morbidity and timely treatment. CODE STEMI (CODE GREEN) launched on world heart day 29th September 2023 to further reduce reperfusion time

KEYWORDS

STEMI, reperfusion, primary angioplasty, thrombolysis, Tertiary care centre.

INTRODUCTION

Acute ST-Elevation Myocardial Infarction (STEMI) represents a significant health crisis, requiring immediate medical intervention to restore coronary blood flow and preserve heart muscle function. The management of STEMI, predominantly through reperfusion strategies such as thrombolysis and primary percutaneous coronary intervention (PCI), also known as primary angioplasty, is critical in reducing mortality and improving patient outcomes. Over the past several decades, these therapeutic approaches have undergone considerable evolution, influenced by technological advancements, clinical trials, and changes in healthcare policies and practice guidelines [1].

STEMI occurs when a thrombotic occlusion of a coronary artery leads to sustained myocardial ischemia and necrosis. The prompt restoration of blood flow is crucial to limit myocardial infarction size, reduce complications, and decrease the risk of heart failure and death. Reperfusion therapy, especially primary angioplasty, is now the preferred treatment in many regions of the world due to its superior outcomes compared to thrombolysis, including reduced rates of reinfarction and shorter hospital stays [2].

Global Trends and Clinical Guidelines

The shift towards primary angioplasty aligns with global trends and clinical guidelines that advocate for its use as the gold standard for STEMI treatment, provided it can be performed promptly by skilled operators. Major cardiology societies worldwide, including the American Heart Association (AHA), the European Society of Cardiology (ESC), and similar entities in other regions, have updated their guidelines over the years to reflect this preference. These guidelines are based on a robust body of evidence demonstrating the efficacy of primary angioplasty over thrombolysis if performed within a stipulated time frame after symptom onset [3].

Despite the demonstrated advantages of primary angioplasty, thrombolysis remains relevant, especially in settings where PCI is not available within the recommended time windows or at centers without PCI capabilities. Thrombolysis can be life-saving when initiated promptly and is particularly crucial in rural or underserved areas where transfer to a PCI-capable center would cause unacceptable delays [4].

Challenges and Innovations

Managing STEMI also involves navigating various challenges, including logistical issues in transporting patients to specialized centers swiftly, disparities in healthcare access, and the need for continuous education and training for healthcare providers. Innovations in healthcare, such as the development of regional STEMI networks and the use of telemedicine, have begun to address some of these challenges, improving the coordination of care and expanding access to timely reperfusion therapy [5].

The clinical outcomes of STEMI patients are also influenced by several factors including patient age, comorbidities, the time from symptom onset to treatment, and the specific reperfusion strategy employed. The ongoing analysis of these outcomes provides valuable insights into the effectiveness of current practices and highlights potential areas for improvement [6].

Study Context and Importance

This study focuses on a tertiary care center's experience with reperfusion strategies over the last five years, providing a unique insight into the practical applications of international guidelines and the real-world outcomes of STEMI management. The center, equipped with advanced cardiac care facilities and staffed by experienced cardiovascular specialists, represents an ideal setting to evaluate trends in treatment approaches and patient outcomes. This analysis not only contributes to the global body of knowledge on STEMI care but also helps in benchmarking local practices against international standards [7].

In this context, understanding the trends in the use of thrombolysis versus primary angioplasty and their associated outcomes at the center can illuminate the efficacy of reperfusion strategies and guide future improvements. Additionally, comparing these local trends with data from Indian and Western STEMI registries provides a broader perspective on how regional practices align with or diverge from global patterns [8].

This analysis aims to scrutinize the nuances of evolving STEMI treatment paradigms at the center, focusing on demographic changes, the adoption of different reperfusion techniques, and the consequent clinical outcomes over five years. Through this study, we aim to identify successes in the STEMI care pathway that could be replicated elsewhere and pinpoint areas where enhancements could be made to elevate the standard of care [9].

MATERIAL AND METHODOLOGY

Source of Data

Data were sourced from hospital records of STEMI patients admitted to the tertiary care center from 1st Jan 2019 to 31st Dec 2023. This included patient demographics, clinical presentations, reperfusion strategies used, and outcomes.

Study Design
A retrospective and prospective cohort study design was utilized to analyze the trends in reperfusion strategies and patient outcomes.

Sample Size
The study included a total of 815 patients treated for STEMI at the center between 2019 and 2023.

Inclusion Criteria
Patients admitted with a diagnosis of STEMI who received reperfusion therapy (either thrombolysis or primary angioplasty) or did not receive any reperfusion therapy were included in the study.

Exclusion Criteria
Those with non-ST elevation myocardial infarction (NSTEMI) were excluded from the study.

Study Methodology
Patient data were categorized based on the type of reperfusion strategy employed and analyzed yearly. The primary outcomes measured were in-hospital mortality and morbidity, including the incidence of complications such as cardiogenic shock, heart failure, and arrhythmias.

Statistical Analysis Methods
Descriptive statistics were used to summarize patient demographics and clinical characteristics. Trends over the years were analyzed using the Chi-square test for categorical variables and the ANOVA test for continuous variables. A p-value of less than 0.05 was considered statistically significant.

Data Collection
Data collection involved retrieving information from electronic medical records and patient charts. Parameters such as age, gender, symptoms at presentation, type of reperfusion received, hospital stay duration, and clinical outcomes were recorded systematically.

OBSERVATION AND RESULTS

Table 1: Age

YEAR	2019		2020		2021		2022		2023	
Number of Patients	N=155	%	N=193	%	N=147	%	N=156	%	N=164	%
AGE BELOW 30	4	2.58	4	2.07	4	2.72	0	0	10	6.09
31-40	5	3.22	15	7.77	14	9.52	25	16.00	16	9.75
41-50	24	15.48	39	20.20	21	14.28	30	19.23	24	14.63
51-60	47	30.32	76	39.37	41	27.89	45	28.84	47	28.65
61-70	42	27.09	38	19.68	37	25.17	31	19.87	41	25.00
71-80	29	18.70	18	9.32	24	16.32	25	16.00	21	12.80
ABOVE 80	4	2.58	3	1.55	6	4.08	0	0	5	3.04

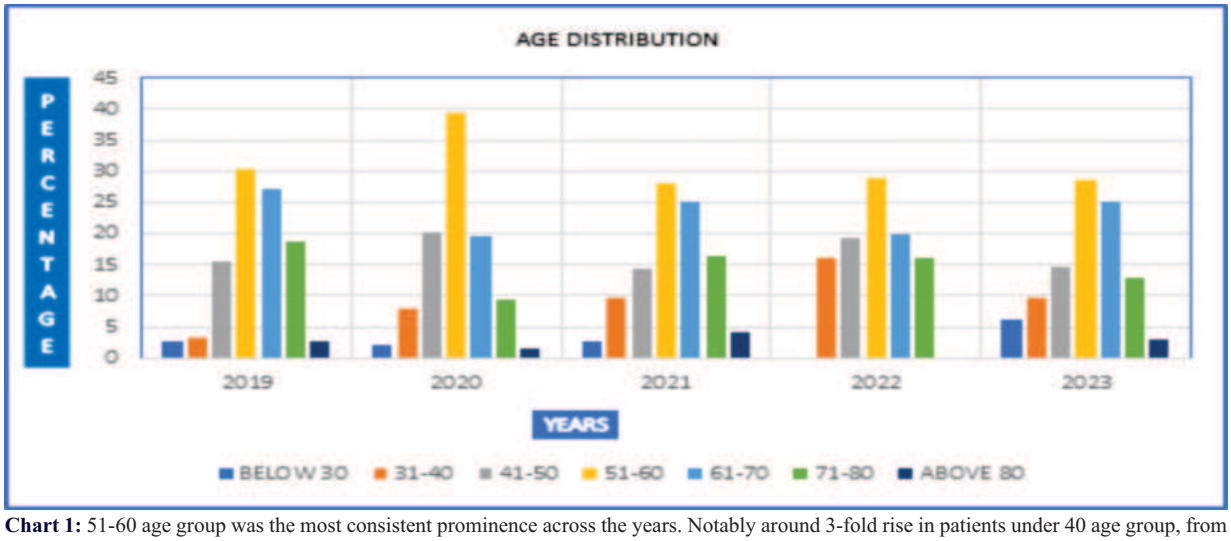


Chart 1: 51-60 age group was the most consistent prominence across the years. Notably around 3-fold rise in patients under 40 age group, from 2019 (5.80%) to 2023 (15.84%).

Gender:

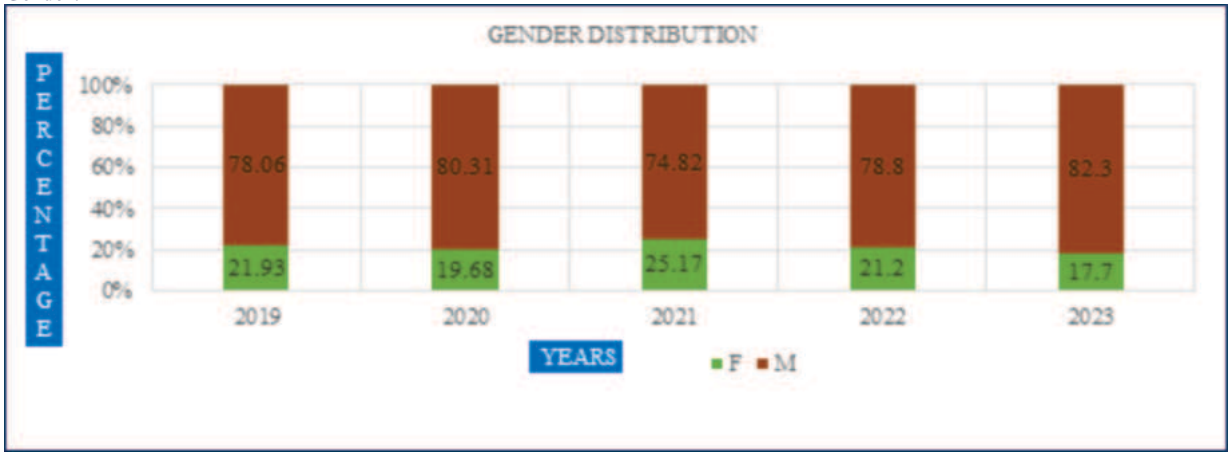


Chart 2: Predominance of male patients every year, indicating higher risk among males compared to females.

Table 2: Outcome

YEAR	2019		2020		2021		2022		2023		P Value
Outcome	N=155	%	N=193	%	N=147	%	N=156	%	N=164	%	
Death	10	6.45	13	6.73	13	8.84	14	8.97	13	7.92	0.874
Discharge	145	93.54	180	93.26	134	91.15	142	91.02	151	92.07	

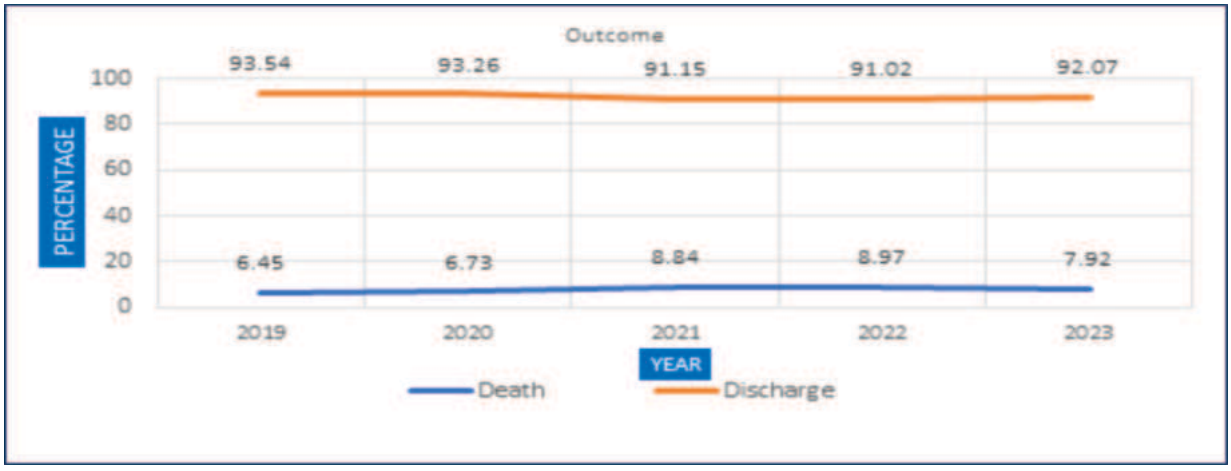


Chart 3: Over the five years, the mortality rate fluctuated slightly. The discharge rates were high throughout.

Table 3: Length of Stay:

YEAR	2019		2020		2021		2022		2023		P value
Length of stay	N=155	%	N=193	%	N=147	%	N=156	%	N=164	%	
DAYS 1-3	73	47.09	60	31.1	82	55.78	72	46.2	108	65.9	0.000
4-7	66	42.58	95	49.2	54	36.73	55	35.3	46	28.0	
8-15	14	9.03	28	14.5	11	7.48	23	14.7	7	4.3	
>15	2	1.29	10	5.2	0	0	5	3.2	3	1.8	

Chart 4: The most common length of stay was between 1-3 days, significantly high in 2023. And stay of 4-7 days was highest in 2020.

Symptoms:

Chart 5: Chest pain was consistently the most commonly reported symptom.

Past History and Risk Factors:

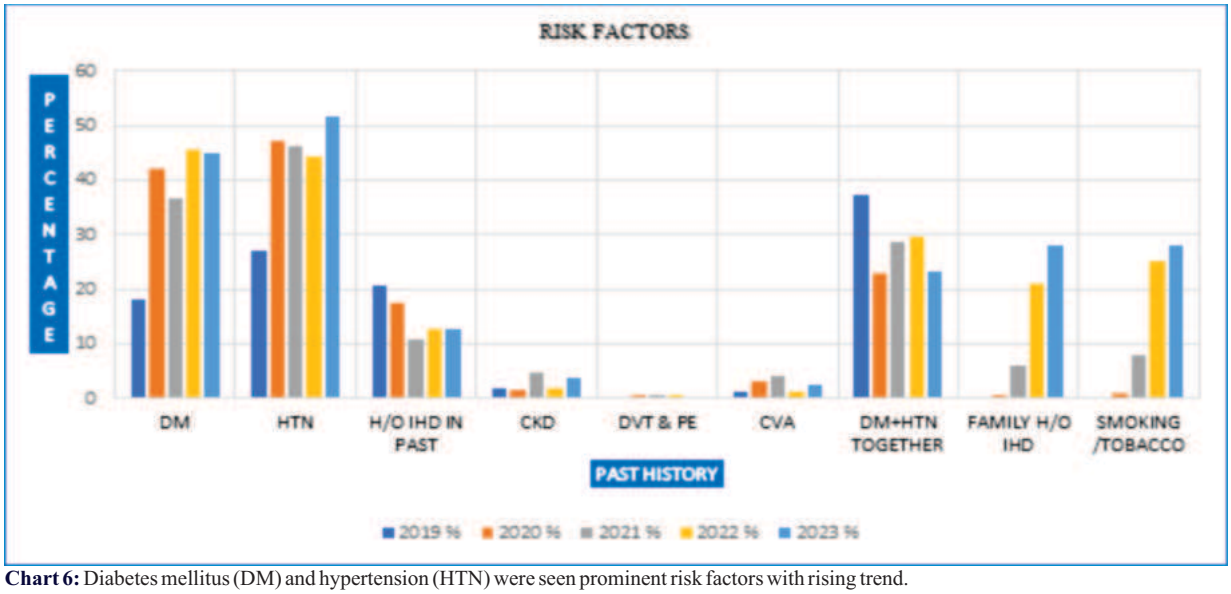
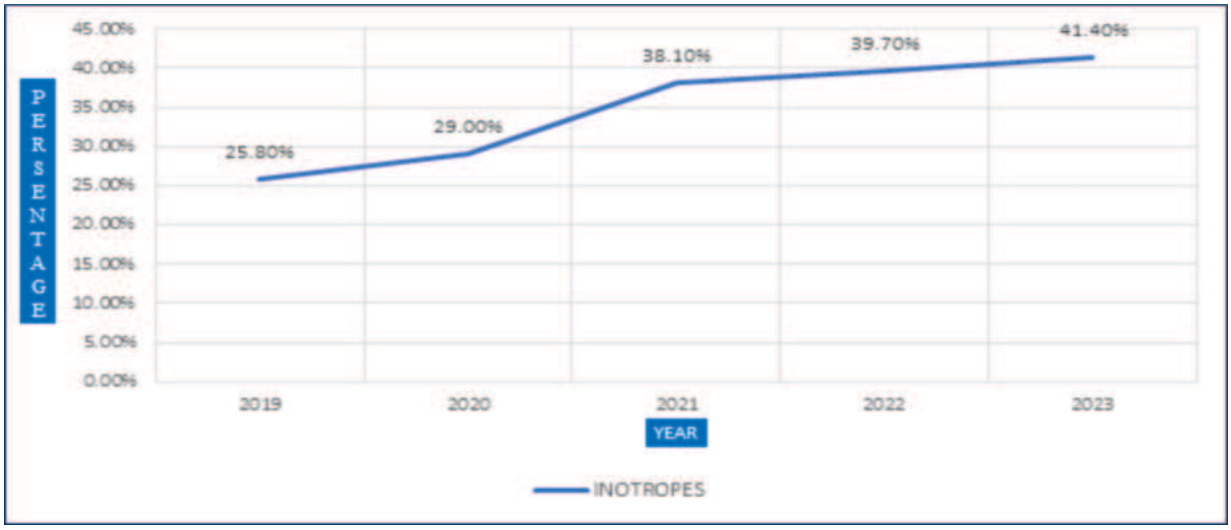


Chart 6: Diabetes mellitus (DM) and hypertension (HTN) were seen prominent risk factors with rising trend.

Table 4: Inotropes:

YEAR	2019		2020		2021		2022		2023		P value
INOTROPES	N=40	25.8%	N=56	29.0%	N= 56	38.1%	N=62	39.7%	N=68	41.4%	
Single	27	67.5	27	48.21	44	78.57	51	82.3	52	76.5	0.000
Multiple	13	32.5	29	51.78	12	24.48	11	17.7	16	23.5	



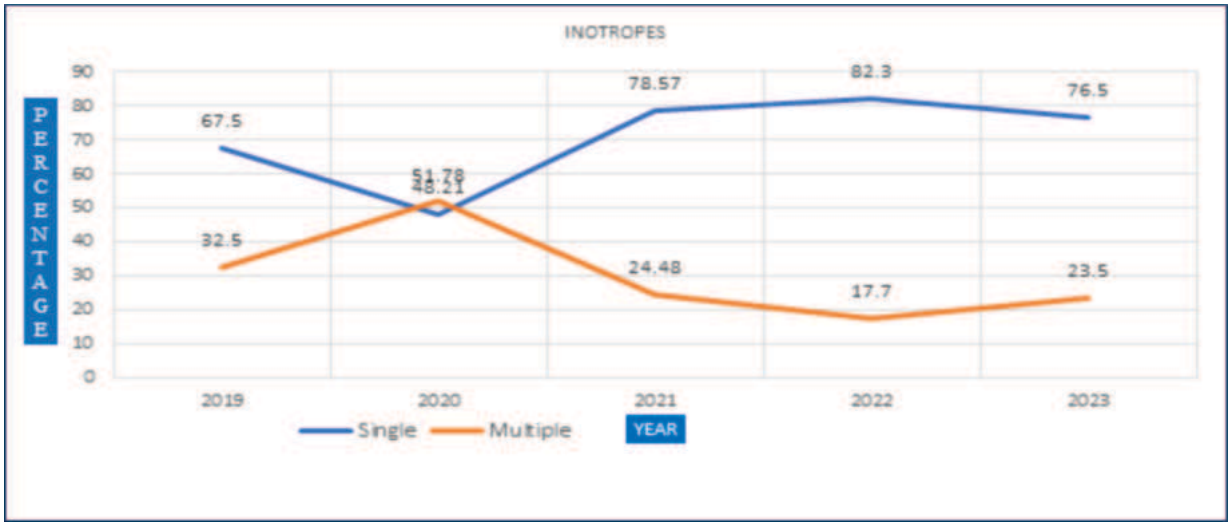


Chart 7 and 8: There is significant trend in % rise of inotrope requirement over last 5 yrs. However, the use of multiple inotropes showed a

significant drop from 51.78% in 2020 to 17.7% in 2022, suggesting a shift in clinical management strategies towards improved overall patient stability.

Table 5: Thrombolysed /PAMI/Conservative m/m :

YEAR	2019		2020		2021		2022		2023	
	N=155	%	N=193	%	N=147	%	N=156	%	N=164	%
Thrombolysed patients	43	27.7	127	65.8	71	48.2	68	43.5	72	43.9
Primary Angioplasty (PAMI) done	100	64.5	26	13.4	70	47.6	74	47.4	81	49.4
No PAMI /No LYSIS patients	12	7.7	40	20.7	6	4.1	14	8.9	11	6.7

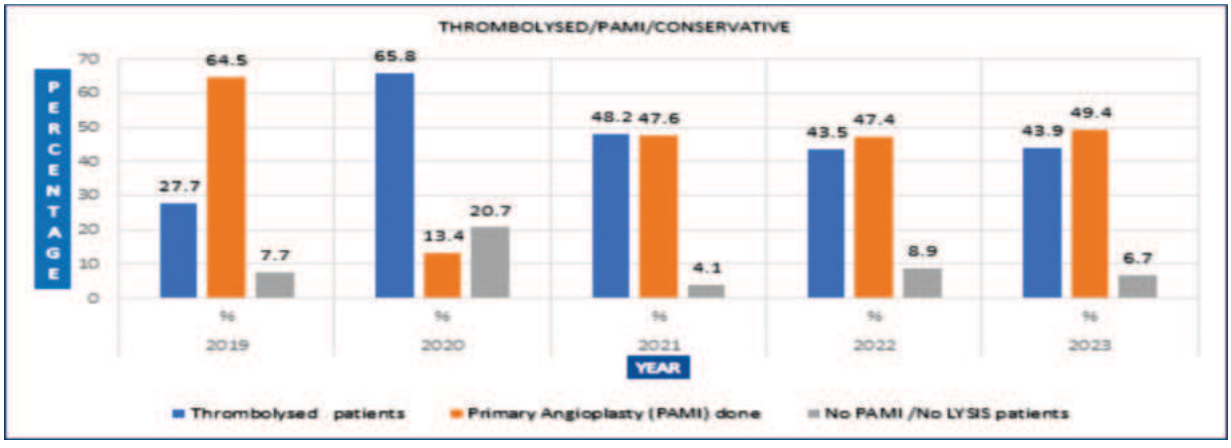


Chart 9: Thrombolysis rates varied significantly, peaking in 2020 at 65.8% and stabilizing around 43-48% in subsequent years. The use of PAMI fluctuated, dropping significantly in 2020 to 13.4%, then increasing steadily to 49.4% by 2023.

Thrombolytic Drugs:

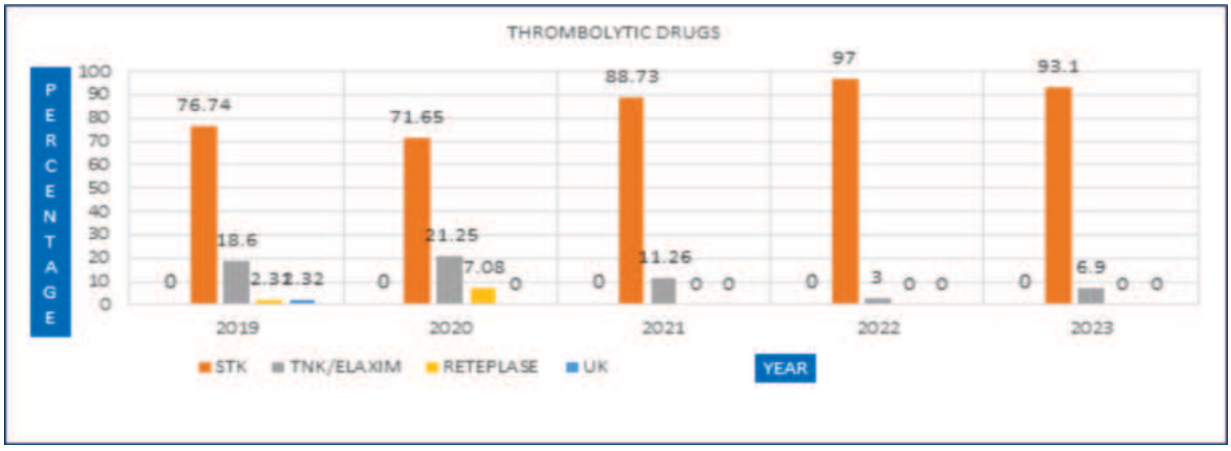


Chart 10: Streptokinase (STK) was the most frequently used drug compared to others, due to cheap and easily available.

Table 6: Door To Needle Time:

YEAR	2019		2020		2021		2022		2023		P value
Time Min	N=43	%	N=127	%	N=71	%	N=68	%	N=72	%	
</=30	12	27.90	40	31.49	11	15.49	28	41.2	29	40.3	0.000
31-60	23	53.48	24	18.89	35	49.29	28	41.2	29	40.3	
>61	9	20.93	63	49.60	25	35.21	12	17.6	14	19.4	

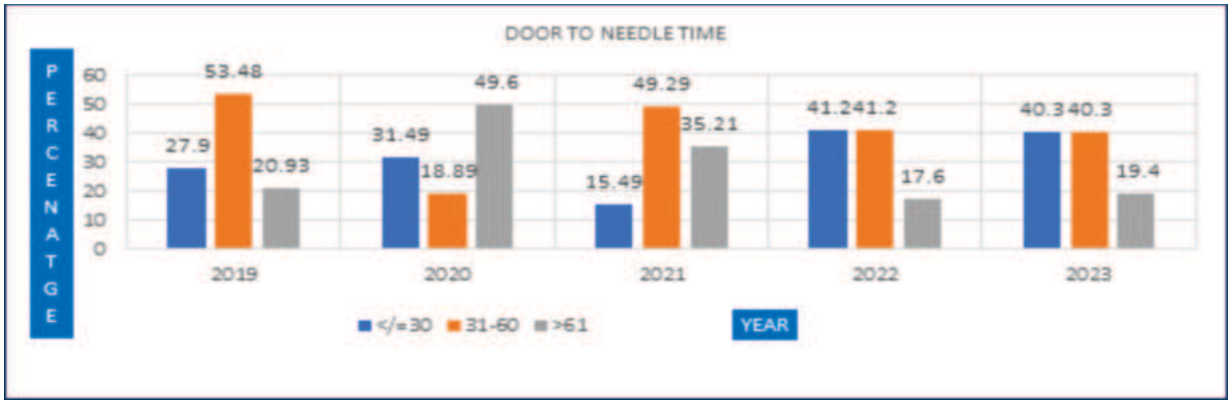


Chart 11: In 2019, only 27.90% of patients received thrombolysis within 30 minutes of arrival, but this percentage improved significantly by 2022

& 2023.
Significant delay > 60 min found in 2020 and 2021.

Significant improvement < 30 min observed in 2022 and 2023. Almost equal number in 30 to 60 min observed as PCI option given first, but delay in decision making occurs from patient's side.

Average Time To Thrombolysis:

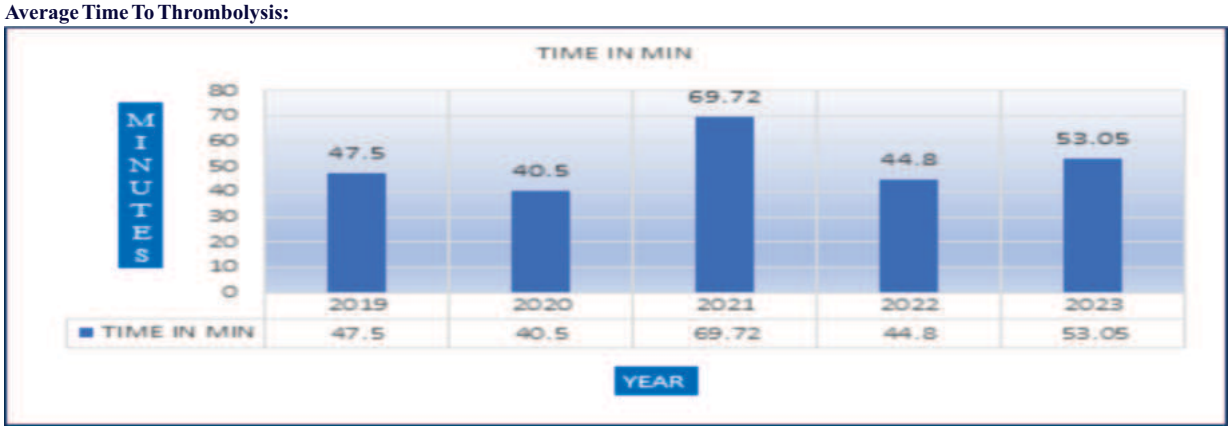


Chart 12: Shows the average time to thrombolysis across the five years. The average time fluctuated, peaking in 2021 at 69.72 minutes, suggesting operational challenges or higher caseloads. The shortest average time was recorded in 2020 at 40.5 minutes, indicating more efficient processes or lower patient volumes.

Table 7: PAMI [Door To Balloon Time]:

YEAR	2019		2020		2021		2022		2023		P value
Time Min	N=100	%	N=26	%	N=70	%	N=74	%	N=81	%	
<=90	26	26	12	46.15	21	30	28	37.83	34	42.0	0.101
>90	74	74	14	53.84	49	70	46	62.17	47	58.0	

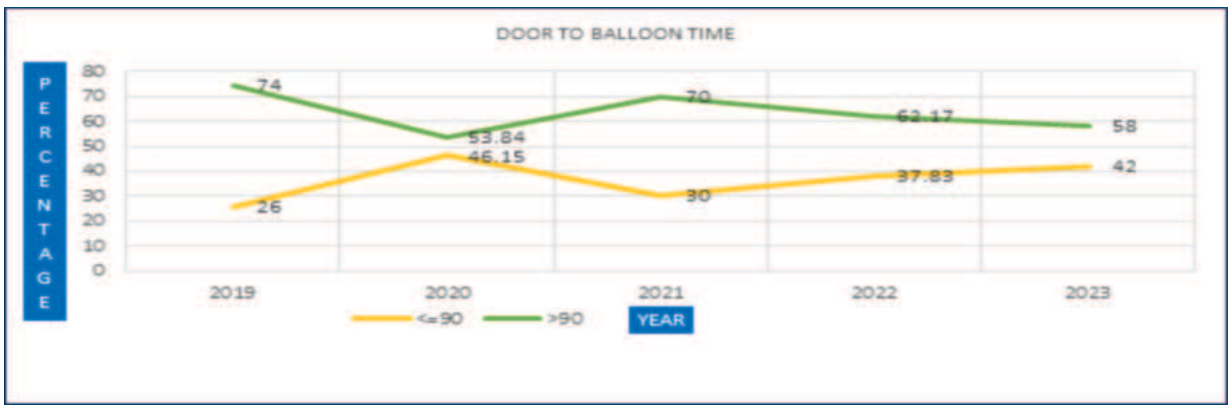


Chart 13: Significant portion of patients (over 50% in most years except 2020) had Door To Balloon times exceeding 90 minutes. In 2020, however, there was a noticeable improvement with 46.15% of patients treated within 90 minutes, though the sample size was smaller (N=26) compared to other years. Improvement in % trend of time < 90 min observed in last 3 years.

Table 8: GP IIb/IIIa:

YEAR	2019		2020		2021		2022		2023	
GPIIB/IIIA	N=80 (51.61%)	%	N=61 (31.60%)	%	N=50 (34.01%)	%	N=45 (28.84%)	%	N=72 (43.90%)	%
EPTIDAY	7	8.75	2	3.27	2	4	0	0	0	0
TIROFIBAN	73	91.25	59	96.72	48	96	45	100	72	100

Chart 14: The use of Tirofiban has Remained High and Consistent.

Table 9: Time from Symptom Onset to Our Hospital:

YEAR	2019		2020		2021		2022		2023	
Time in Hrs	N=155	%	N=193	%	N=147	%	N=156	%	N=164	%
0--1	15	9.6	10	5.18	16	10.88	8	5.12	18	11.0
1-6	62	40	61	31.60	75	51.02	71	45.51	85	51.82
6-12	29	18.70	32	16.58	28	19.04	35	22.43	32	19.5
12-24	16	10.32	29	15.02	13	8.84	15	9.61	15	9.1
24-48	19	12.25	34	17.61	6	4.08	10	6.41	10	6.1
>48	14	9.03	27	14.50	9	6.12	17	10.89	4	2.4

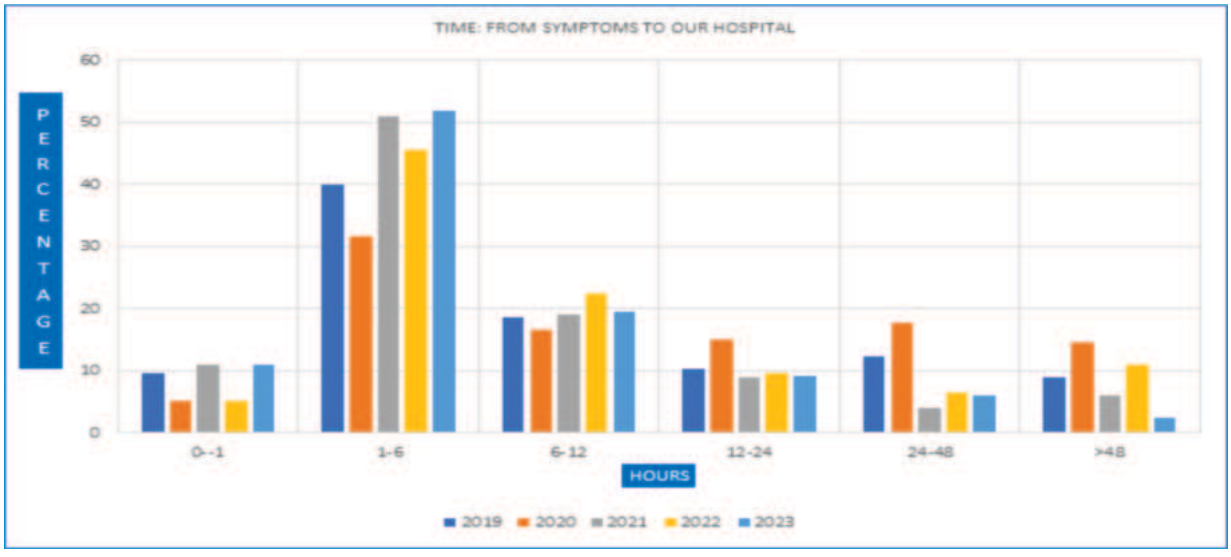


Chart 15 : Tracks the time from symptom onset to hospital arrival. Significant number of patients presented late, with the majority arriving between 1-6 hours after symptom onset. Early presentations (within 1 hour) remained relatively low, indicating potential delays in recognizing symptoms or in deciding to seek care. The data suggest a need for increased public awareness and possibly faster emergency response strategies to improve early hospital presentations.

LVEF:

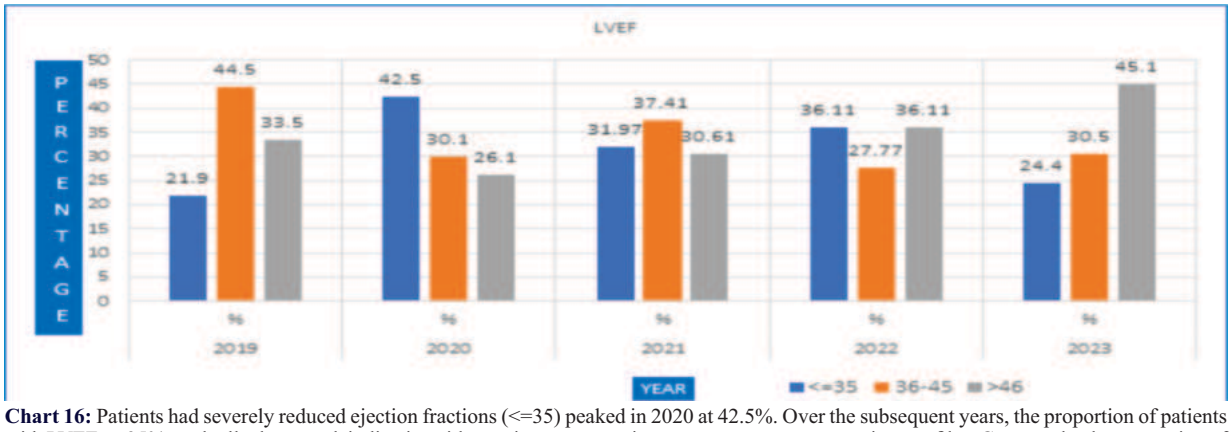


Chart 16: Patients had severely reduced ejection fractions (<=35) peaked in 2020 at 42.5%. Over the subsequent years, the proportion of patients with LVEF <=35% gradually decreased, indicating either an improvement in treatment outcomes or patient profiles. Conversely, the proportion of patients with LVEF >46% increased, reaching 45.1% in 2023, suggesting better preservation or recovery of cardiac function over time.

Site of MI:

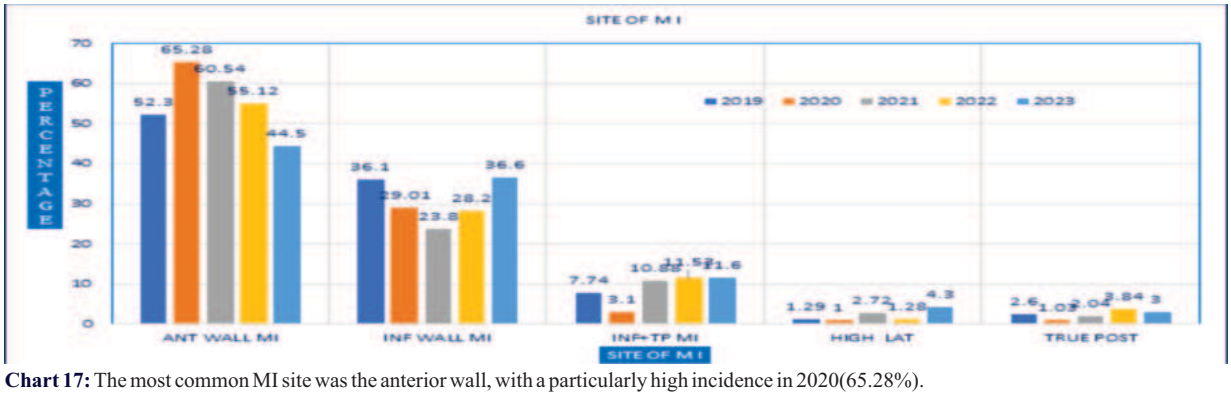
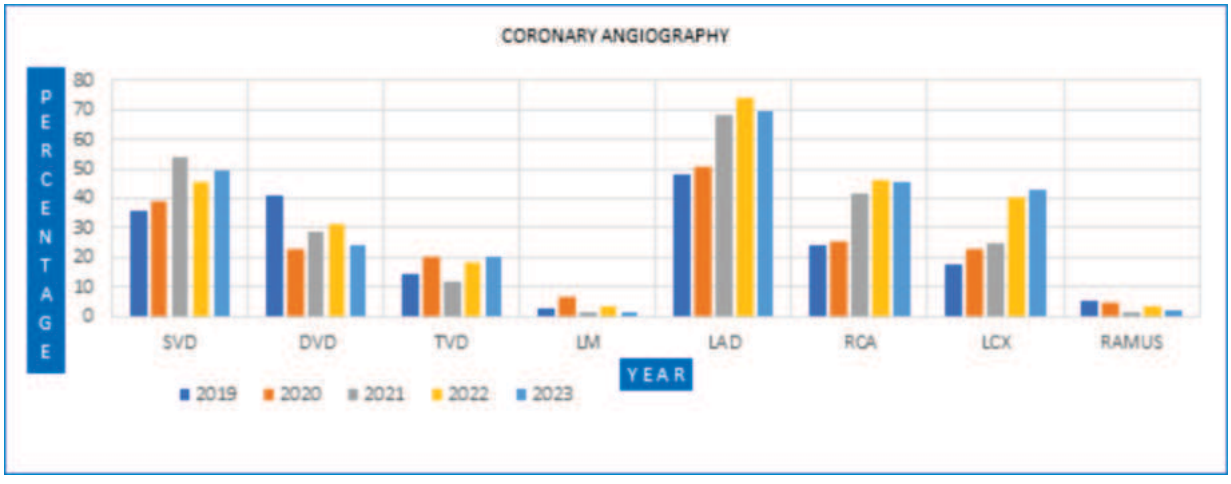


Chart 17: The most common MI site was the anterior wall, with a particularly high incidence in 2020(65.28%).

Table 10: Coronary Angiography:

YEAR	2019/N=155		2020/N=193		2021/N=147		2022/N=156		2023/N=164	
CAG Done	N=152 (98.06%)		N=169 (87.56%)		N=133(90.47%)		N=137 (87.82%)		N=147(89.63%)	
		%		%		%		%		%
SVD	54	35.52	66	39.22	72	54.13	62	45.25	73	49.65
DVD	62	40.78	38	22.61	38	28.57	43	31.38	36	24.48
TVD	22	14.47	32	20	16	12.03	25	18.24	30	20.40
LM	4	2.63	11	6.54	2	1.50	5	3.64	2	1.36
LAD	73	48.02	86	50.88	91	68.42	101	73.72	102	69.38
RCA	37	24.34	43	25.44	55	41.35	63	45.98	67	45.57
LCX	27	17.76	39	23.07	33	24.81	55	40.14	63	42.85
RAMUS	8	5.26	8	4.73	2	1.50	5	3.64	3	2.04
RECANALISED	4	2.63	6	3.55	5	3.75	4	2.91	9	6.12
NORMAL CORONARY	0	0	1	0.59	1	0.75	4	2.91	2	1.36
CAG NOT DONE	3	1.93	24	12.43	14	9.52	19	12.17	17	10.36
PTCA DONE	132	86.84	84	49.70	109	81.95	119	86.86	122	82.99
CAG DONE ADV CABG	3	1.97	17	10.11	7	5.26	10	7.29	6	4.08



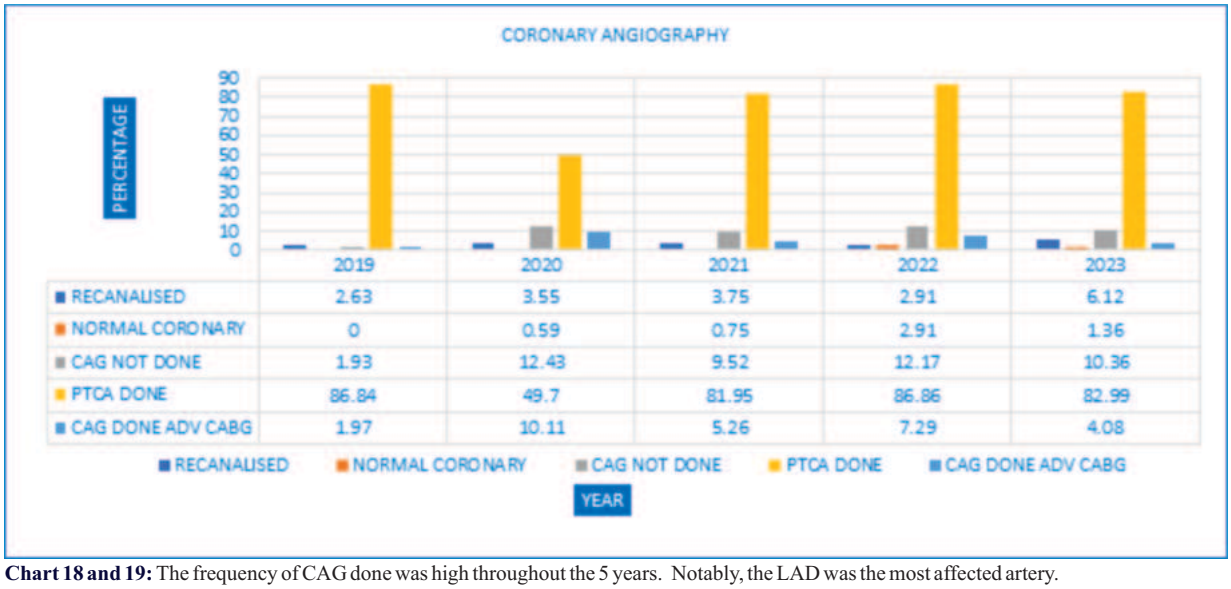


Chart 18 and 19: The frequency of CAG done was high throughout the 5 years. Notably, the LAD was the most affected artery.

The frequency of PTCA done was high all years except significant low % of in 2020.

Table 11: Complications:

YEAR	2019		2020		2021		2022		2023		P value
	N=155 %		N=193 %		N=147 %		N=156 %		N=164 %		
HEART FAILURE	46	29.67	74	38.34	69	46.93	49	31.41	57	34.75	0.0382
CARDIOGENIC SHOCK	42	27.09	56	29.01	44	29.93	54	34.61	54	32.92	0.4994
VENTRICULAR ARRHYTHMIAS	20	12.89	34	17.58	21	14.28	19	12.17	30	18.29	
ATRIAL ARRHYTHMIAS	3	1.93	3	1.55	0	0	2	1.28	1	0.60	
BRADYARRHYTHMIAS	9	5.80	4	2.07	6	4.08	3	1.92	17	10.36	
VSR	0	0	1	0.51	0	0	1	0.64	1	0.60	
MR	9	5.80	15	7.77	0	0	4	2.56	1	0.60	

IABP	2	1.29	9	4.66	3	2.04	4	2.56	3	1.82	0.1193
NONINVASIVE VENTILATION	11	7.09	17	8.80	6	4.08	6	3.84	10	6.09	0.0845
INVASIVE VENTILATION	14	9.03	25	12.95	12	8.16	20	12.82	18	10.97	0.2077
OUT OF HOSPITAL ARREST & SURVIVED	2	1.29	0	0	0	0	1	0.64	0	0	
IN HOSPITAL ARREST & CPR SURVIVED	2	16.66	1	7.14	1	7.14	4	22.22	3	18.75	

Complications:

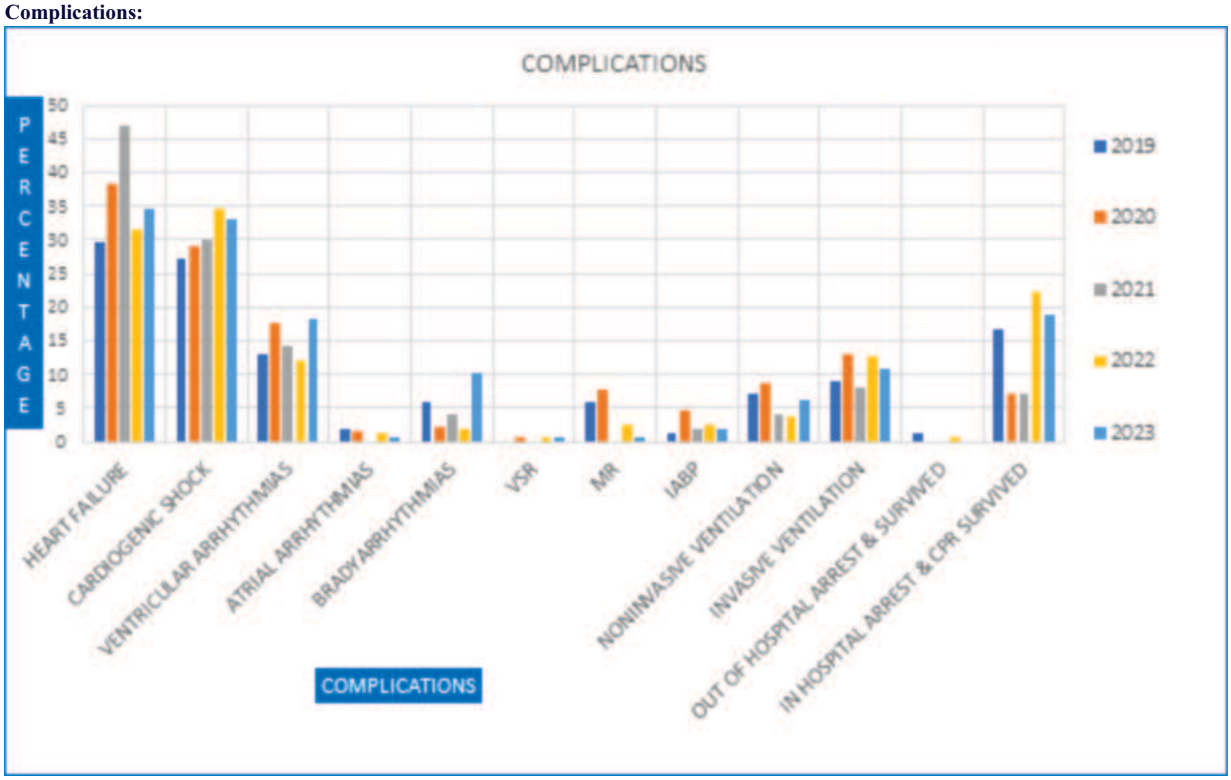


Chart 20: Heart failure and cardiogenic shock were consistently significant complications, highlighting the severe impact of STEMI on cardiac function. There is statistically significant number of heart failure patients in 2021. The use of mechanical support like IABP and ventilation points to the severity of cases managed.

DISCUSSION

The age distribution data from Table 1 and chart 1 reflects a broad range of patient ages treated for STEMI over five years, with the highest concentration in the 51-60 age group, which is consistent with global trends indicating that middle age is a common period for acute coronary events Dai X et al. (2023) [11]. The increasing number of patients aged below 30 in 2023 (6.09%) suggests either a rise in risk factors among younger populations or better detection rates. Comparative studies highlight a global increase in cardiovascular disease (CVD) risk factors among younger adults, influenced by lifestyle changes and increased prevalence of obesity and diabetes Aggarwal R et al. (2023) [12].

Data from chart 2 shows a higher prevalence of STEMI in males compared to females, which aligns with other studies indicating that men are generally at higher risk of coronary artery disease (CAD) at a younger age than women Maas AH et al. (2010) [13].

The mortality data in Table 2 and chart 3 over the five years shows a relatively stable rate of deaths, slightly increasing in the middle of the period but decreasing again by 2023. This stabilization and slight improvement in mortality rates could be reflective of advancements in treatment protocols and technologies, consistent with findings from other registries that demonstrate improved survival rates due to enhanced treatment approaches Orvin K et al. (2021) [14]. The discharge rates remaining above 90% across the years indicate effective acute management of STEMI patients at the facility.

In Table 3 and chart 4 the length of stay decreases significantly for longer durations over the five years, with the majority of stays being between 1-3 days by 2023. This trend towards shorter hospital stays can be associated with improved procedural techniques such as primary angioplasty, which allows for faster recovery and reduced hospitalization duration, echoing findings from other studies that emphasize the efficiency of PCI over thrombolysis Tigabe Tekle M et al. (2022) [15].

In Chart 5 the distribution of symptoms across five years shows chest pain as the most consistent and predominant symptom, aligning with other studies that identify chest pain as the primary symptom in STEMI patients Björck L et al. (2018) [16]. The prevalence of other symptoms such as breathlessness, sweating, and palpitations also reflects literature findings that suggest variability in symptom presentation, which can influence the speed and accuracy of STEMI diagnosis DeVon HA et al. (2008) [17].

The high prevalence of diabetes (DM) and hypertension (HTN) in Chart 6 reflects global trends where these conditions are major risk factors for cardiovascular diseases, particularly coronary artery disease Howard BV et al. (2023) [18]. The increased rates of DM and HTN over the years might indicate improved screening or rising prevalence in the general population, a trend consistent with broader epidemiological findings Chobanian AV et al. (2003) [19]. Additionally, the increase in family history of ischemic heart disease (IHD) and smoking or tobacco use highlights the significance of genetic and lifestyle factors in the risk profile of STEMI patients, consistent with data reported in cardiovascular disease studies Elisaf M.et al.(2001) [20].

The use of inotropes, as shown in Table 4 and chart 7 & 8, with a shift towards single-agent use over the years, may reflect evolving clinical practices that favor more targeted and less aggressive inotropic support, adhering to contemporary guidelines that recommend caution with inotrope use due to potential for increasing myocardial oxygen demand and arrhythmias Tariq S et al. (2015) [21]. The decreasing use of multiple inotropes might also suggest improvements in the overall management of STEMI, potentially leading to better functional status at presentation or immediate post-treatment phases.

Table 5 and chart 9 highlights the dynamic shift in reperfusion strategies over the years. The significant drop in the use of PAMI in 2020 might be an anomaly or reflect specific institutional or regional challenges that year. However, the overall increase in PAMI usage by 2023 aligns with global data advocating primary angioplasty as the

superior reperfusion method due to better outcomes, particularly in terms of reduced mortality and reinfarction rates Keeley EC et al. (2003) [22]. The use of specific thrombolytic drugs such as STK and TNK/Elaxim in Chart 10 shows a preference for STK, likely due to its cost-effectiveness and widespread availability in many healthcare settings. The decline in the use of other agents like TNK and Reteplase may be related to cost issues, availability, or emerging preference for primary angioplasty over thrombolysis, as suggested by recent guidelines and studies that compare the efficacy and outcomes of these treatments McCann CJ et al. (2008) [23].

Table 6 and chart 11 indicates fluctuations in the efficiency of administering thrombolytic therapy within the recommended 30-minute window. Studies have shown that every 15-minute delay in thrombolysis significantly increases the risk of mortality in STEMI patients McNamara RL et al. (2007) [24]. The improvement in the percentage of patients treated within 30 minutes by 2023 aligns with enhanced protocols and perhaps the increasing use of pre-hospital strategies, such as notifying hospitals ahead of patient arrival, which have been shown to improve D2N times Ellahham Md S et al. (2015) [25].

The variability in the average time to thrombolysis highlighted in Chart12 reflects operational challenges and possibly patient factors. A peak in 2021 might indicate system strain or specific logistical issues. Comparatively, a study conducted across several hospitals demonstrated a direct correlation between reduced time to thrombolysis and better patient outcomes, underscoring the importance of efficient systems Fonarow GC et al. (2007) [26].

In Table 7and chart13, the data shows a considerable number of patients in 2019 and 2021 did not meet the optimal door-to-balloon (DOB) time of 90 minutes, which is critical for the best outcomes in PAMI Karkabi B et al. (2021) [27]. However, there's an observable trend towards improvement over the years, reflecting findings from other studies which attribute advancements in hospital protocols and pre-hospital care Terkelsen CJ et al. (2010) [28].

The usage patterns of GP IIb/IIIa inhibitors shown in Table 8 and chart 14 , particularly the shift from Eptifibatide to almost exclusive use of Tirofiban by 2023, might reflect changes in clinical guidelines or formulary decisions based on the comparative effectiveness and cost considerations noted in clinical trials Zhou X et al. (2017) [29]. The high usage of these inhibitors is consistent with their known benefits in improving outcomes for patients undergoing PCI O'Gara PT, et al. (2013) [30].

Table 9 and chart 15 underscores significant delays in hospital presentation post-symptom onset, with many patients arriving beyond the optimal window for most effective STEMI treatment. A substantial number arriving within 1-6 hours and delays extending beyond 12 hours highlight a need for increased public awareness and possibly improvements in emergency medical response systems, as early treatment is crucial for survival and recovery Menees DS et al. (2013) [31].

Chart 16 shows changes in LVEF among STEMI patients over five years. The trend of decreasing severely impaired LVEF (<=35%) from 2020 onwards may indicate improvements in early reperfusion strategies and overall patient management, reflecting findings from multiple studies that emphasize the benefits of rapid intervention in preserving cardiac function Li K et al. (2022) [32]. The increase in patients with LVEF >46% in 2023 suggests better outcomes and possibly reflects advances in treatment practices like earlier use of beta-blockers and ACE inhibitors, which have been shown to improve LVEF in STEMI patients Sim HW et al. (2020) [33].

Data from Chart 17, indicating a predominance of anterior wall MI, aligns with findings that anterior MIs are generally more severe and common, associated with worse outcomes compared to other sites Khaled S et al. (2022) [34].

Coronary angiography findings from Table 10 and Chart 18/19, showing a high rate of CAG completion and a predominance of multi-vessel disease, align with global trends where advanced atherosclerosis is a common finding among patients with established cardiovascular risk factors Dzaye O et al. (2021) [35]. The increase in left anterior descending (LAD) artery involvement underscores its commonality in coronary artery disease, often leading to significant clinical implications Sidhu NS et al. (2019) [36].

The data on complications (Table 11 and chart 20) highlights significant rates of heart failure, cardiogenic shock, and arrhythmias, consistent with the known complications of acute myocardial infarction. The relatively high and increasing incidence of complications such as heart failure and cardiogenic shock over the years might suggest an aging population with more severe disease at presentation, or it could reflect variations in the accuracy of diagnostic criteria over time. The data mirrors findings from larger studies, indicating that aggressive and early management of STEMI can reduce these complications, especially with the use of reperfusion therapy and secondary prevention measures Abubakar M et al. (2023) [37].

CONCLUSION

1) The trend of improvements in door-to-balloon and door to needle times for patients shows enhanced operational efficiencies within the center. Further improvement is brought by implementing CODE STEMI (code green) from Sept 2023.
2) An increasing complexity in patient profiles, as evidenced by the prevalence of comorbidities such as diabetes and hypertension, which have steadily risen over the years
3) Improvements in patient outcomes, as indicated by stable mortality rates despite the complexity of cases.
4) Notably around 3-fold rise in number of patients in young age (<40) group observed across the years.
5) The consistent high rates of discharges (>90%) and shortening lengths of hospital stays across the years indicates effective acute management of STEMI at the facility.
6) Even though increasing trend of percentage of inotropes over years, shift from multiple to single inotropes suggest shift in improved patient clinical management and stability by timely reperfusion strategy.
7) Trend of increase number of patients with EF > 46% over years, suggest better preservation and recovery of cardiac function.
8) The persistence of certain challenges, such as managing late-presenting STEMI cases and the varying rates of complications like heart failure and cardiogenic shock, which remain areas for further improvement.
9) The data also emphasize the need for continued education and public health initiatives to reduce the time from symptom onset to hospital presentation, which remains a critical factor in optimizing outcomes for STEMI patients.

In conclusion, the study confirms that while substantial progress has been made in the acute management of STEMI at the tertiary center, opportunities for improvement remain, particularly in enhancing patient education, refining risk stratification. As the center continues to align its practices with international standards and adopt innovative treatment approaches, it is well-positioned to further improve outcomes for patients experiencing one of the most severe types of heart attacks.

Limitations of Study

While this study provides valuable insights into the trends and outcomes of STEMI management at a tertiary care center over the last five years, several limitations should be considered when interpreting the results:

1. Retrospective Design: The study's retrospective nature limits the ability to establish causality between treatment strategies and outcomes. Data collection was based on historical medical records, which might not capture all relevant variables or reflect the complex decision-making processes in real-time clinical scenarios.
2. Single-Center Data: As the study was conducted at a single tertiary care center, the findings may not be generalizable to other settings with different patient demographics, facility resources, or clinical protocols. Different regions might exhibit varied treatment outcomes due to disparities in healthcare access and quality.
3. Variability in Data Collection: The consistency and accuracy of data collection might vary over the study period, potentially affecting the reliability of trend analysis. Changes in documentation practices and healthcare personnel over five years could introduce inconsistencies in the reported data.
4. Lack of Long-Term Follow-up: The study primarily assesses immediate clinical outcomes and reperfusion strategy efficacy without considering long-term survival and quality of life.

Longer-term follow-up would be necessary to fully understand the impact of initial treatment decisions on sustained patient health and recovery.

5. Potential Confounders and Bias: There could be unmeasured confounding factors influencing both the choice of treatment and the outcomes, such as patient preferences, precise timing of symptom onset to treatment, and individual physician practice style. These factors could introduce bias that is not accounted for in the analysis.
6. Changes in Treatment Guidelines: As cardiovascular treatment guidelines evolve, the adoption of new practices and technologies over the five-year study period could influence trends in management strategies and outcomes, complicating the interpretation of changes over time.
7. Patient Compliance and Secondary Prevention: The study does not account for variations in patient compliance with prescribed medications or adherence to recommended lifestyle changes post-discharge, which are critical components of secondary prevention in STEMI patients.

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