Section: Emergency Medicine

Original Research Article

ASSESSMENT OF ETIOLOGICAL PROFILE OF PATIENTS PRESENTING WITH ACUTE CHEST DISCOMFORT IN EMERGENCY MEDICINE DEPARTMENT OF A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Acute chest discomfort is one of the most frequent and clinically challenging presentations in emergency medicine departments, encompassing a broad spectrum of etiologies ranging from benign musculoskeletal conditions to life-threatening cardiovascular emergencies. In developing countries undergoing epidemiological transition, understanding the local etiological distribution is essential for optimizing triage and management strategies. **Objective:** To evaluate clinical features, identifying pathophysiological factors, and analyzing laboratory parameters.

Materials and Methods: A hospital-based cross-sectional observational study was conducted over one year in the Department of Emergency Medicine at a tertiary care center. A total of 400 consecutive patients presenting with acute chest discomfort were enrolled after informed consent. Demographic data, clinical features, comorbidities, pain severity (Numerical Rating Scale), and vital parameters were recorded. All patients underwent electrocardiography (ECG), relevant laboratory investigations including cardiac biomarkers, and imaging studies as indicated. Final etiological classification was based on correlation of clinical, laboratory, and radiological findings. Data were analyzed using SPSS, with $p < 0.05$ considered statistically significant.

Results: The mean age of patients was 49.19 ± 14.83 years, with a male predominance (58.75%). Radiating chest pain associated with sweating was the most common presenting complaint (35.25%). Hypertension (36.5%) was the most prevalent comorbidity. ECG abnormalities were observed in 60% of patients, while elevated troponin levels were detected in 28.2%. Cardiac etiologies constituted the majority of cases (51.3%), with acute coronary syndrome accounting for 39.6% of total presentations ($p < 0.001$). Respiratory causes (24.6%), musculoskeletal causes (11.7%), and gastrointestinal causes (7.5%) followed. A high admission rate (96.5%) was noted, with an overall mortality of 3.5%.

Conclusion: Cardiac causes, particularly acute coronary syndrome, remain the predominant etiology of acute chest discomfort in the emergency setting. A structured, protocol-based approach incorporating early ECG, cardiac biomarker testing, systematic risk assessment, and targeted imaging is essential for accurate diagnosis and improved patient outcomes. Strengthening emergency triage systems and implementing standardized chest pain evaluation pathways are critical to reducing morbidity and mortality associated with this common presentation.

Keywords: Acute chest discomfort; Emergency medicine; Acute coronary syndrome; Etiological profile; Cardiac biomarkers; India.

INTRODUCTION

Acute chest discomfort is one of the most frequent and clinically significant presenting complaints in emergency medicine departments worldwide. It accounts for nearly 5–10% of all emergency visits and represents a wide clinical spectrum ranging from benign self-limiting conditions to immediately life-threatening cardiovascular and thoracic emergencies.[1] The heterogeneity of etiologies, overlapping symptomatology, and time-sensitive nature of potentially fatal causes make chest pain one of the most challenging diagnostic entities faced by emergency physicians. Delayed or missed diagnosis may result in significant morbidity, mortality, and medico-legal consequences.[2]

Chest discomfort may arise from cardiac, respiratory, gastrointestinal, musculoskeletal, vascular, or psychogenic origins. Among these, cardiac causes—particularly acute coronary syndrome —are of greatest concern due to their high fatality if not recognized promptly.[3] Other life-threatening conditions such as pulmonary embolism, aortic dissection, tension pneumothorax, and acute pericarditis also demand urgent identification. However, a substantial proportion of patients presenting with chest pain are ultimately diagnosed with non-cardiac etiologies, including gastroesophageal reflux disease, costochondritis, anxiety disorders, and other benign conditions.[4] This broad etiological range necessitates rapid risk stratification and systematic clinical evaluation in the emergency setting.

Globally, coronary artery disease remains the predominant cause of chest pain in developed countries, driven largely by modifiable risk factors such as hypertension, dyslipidemia, smoking, obesity, and diabetes mellitus.[5] In contrast, developing and low- to middle-income countries exhibit a more diverse etiological pattern. Alongside ischemic heart disease, infectious and inflammatory conditions—including tuberculosis-related pericarditis and pulmonary infections—continue to contribute significantly to chest discomfort presentations.[6] India is currently undergoing a rapid epidemiological transition characterized by increasing urbanization, sedentary lifestyles, and rising prevalence of cardiovascular risk factors. Notably, coronary artery disease in the Indian population tends to occur at a younger age and often presents with more aggressive disease patterns, thereby imposing a considerable burden on emergency services.[7]

Clinical presentation of chest discomfort varies according to age, sex, and comorbidities. Classical anginal pain may be absent in elderly individuals, women, and patients with diabetes mellitus, who frequently present with atypical symptoms such as dyspnea, nausea, fatigue, or epigastric discomfort [8]. These atypical manifestations are associated with diagnostic delays and poorer clinical outcomes. Furthermore, elderly patients often have multiple comorbidities that produce overlapping symptoms, complicating assessment in busy emergency environments.

The diagnostic evaluation of acute chest discomfort relies on a combination of clinical assessment, electrocardiography, and cardiac biomarkers such as high-sensitivity troponins. While ECG and troponin testing form the cornerstone of early ACS diagnosis, both have limitations. Early ECG findings may be non-diagnostic, particularly in non-ST elevation myocardial infarction, and troponin elevations may occur in non-ischemic conditions such as myocarditis, renal failure, pulmonary embolism, and sepsis.[9] Risk stratification tools including the TIMI, GRACE, and HEART scores assist in clinical decision-making, yet they do not eliminate diagnostic uncertainty, particularly in resource-limited settings.[10]

In India, comprehensive data describing the full etiological spectrum of acute chest discomfort in tertiary care emergency departments remain limited. Most available studies focus primarily on cardiac causes and fail to capture the broader distribution of non-cardiac etiologies encountered in routine practice.[7,8] Given the coexistence of communicable and non-communicable diseases, along with infrastructural constraints in many healthcare facilities, understanding the local etiological profile is essential for optimizing triage, improving diagnostic accuracy, and ensuring efficient resource utilization.

Therefore, a systematic evaluation of patients presenting with acute chest discomfort in a tertiary care emergency department is warranted. Such research can help bridge existing knowledge gaps, enhance early identification of life-threatening conditions, reduce unnecessary investigations and admissions, and contribute to the development of evidence-based clinical protocols tailored to regional needs.

MATERIALS AND METHODS

The present study was designed as a hospital-based cross-sectional observational study conducted in the Department of Emergency Medicine at Rajshree Medical Research Institute and Hospital, Bareilly. A cross-sectional design was selected as it enables systematic assessment of demographic characteristics, clinical features, laboratory findings, and etiological distribution of patients at the time of presentation, which is appropriate for evaluating disease patterns in acute care settings.[11] The study was carried out over a period of one year, during which all eligible patients presenting with acute chest discomfort to the emergency department were screened and enrolled consecutively.

The emergency department functions and around the clock and caters to a large population from urban and rural areas, managing a wide range of acute medical

emergencies. Availability of emergency diagnostic services including laboratory investigations, electrocardiography, cardiac monitoring, and radiological imaging facilitated comprehensive evaluation of patients.

All patients presenting with acute chest pain or chest discomfort, irrespective of age and gender, were eligible for inclusion. Patients willing to provide written informed consent were enrolled. Pregnant women were excluded due to altered physiological parameters and ethical considerations. Patients who refused investigations or declined consent were also excluded.

A consecutive sampling technique was adopted to reduce selection bias. Sample size was calculated using the standard prevalence-based formula for cross-sectional studies:

$n = Z^2pq / d^2$

where n is the required sample size, Z is the standard normal deviate at 95% confidence level (1.96), p is the estimated prevalence, $q = 1 - p$, and d is the allowable error.[12] Considering an estimated prevalence of 50%, 95% confidence level, and 5% allowable error, the minimum calculated sample size was 384. Approximately 400 patients were targeted to ensure adequate statistical precision.

After obtaining informed consent, demographic data including age, gender, and socio-economic status were recorded using a structured proforma. Detailed clinical history was obtained regarding onset, duration, character of chest discomfort, associated symptoms, and comorbid conditions such as hypertension, diabetes mellitus, coronary artery disease, chronic obstructive pulmonary disease, and pulmonary tuberculosis. Chest pain severity was assessed using the Numerical Rating Scale, a validated tool for pain assessment in clinical practice.[13]

All patients underwent comprehensive physical examination including general examination and measurement of vital parameters—heart rate, blood pressure, respiratory rate, oxygen saturation, and temperature. Systemic examination focused on cardiovascular and respiratory systems, along with assessment of chest wall tenderness or trauma.

Laboratory investigations included complete blood count, blood glucose, renal function tests, and cardiac biomarkers such as troponins when indicated. A 12-lead electrocardiogram was performed for all patients at presentation in accordance with established emergency cardiac care recommendations [14]. Radiological investigations included chest X-ray and echocardiography when clinically indicated. Final etiological classification was made by correlating clinical findings with laboratory and imaging results and categorizing cases into cardiac, respiratory, gastrointestinal, musculoskeletal, psychogenic, or other causes.

Data were entered into Microsoft Excel and analyzed using SPSS software. Descriptive statistics were expressed as mean ± standard deviation for continuous variables and frequencies and percentages for categorical variables. Inferential statistics included chi-square test and Student's *t*-test. A *p*-value < 0.05 was considered statistically significant.

Ethical approval was obtained from the Institutional Ethics Committee prior to commencement of the study. Written informed consent was obtained from all participants, and confidentiality of patient information was strictly maintained.

RESULTS

A total of 400 patients presenting with acute chest discomfort were evaluated. Clinical characteristics at admission are summarized in Table 1. Radiating chest pain associated with sweating was the most common presentation (35.25%), followed by chest discomfort with palpitations (12.5%) and localized chest pain (11.5%), with a statistically significant distribution of complaints ($p = 0.036$). Most patients reported moderate pain intensity on VAS/NRS scoring ($p = 0.9812$). Hypertension (36.5%) was the most prevalent comorbidity, followed by coronary artery disease (20.75%) and COPD (15.75%). CAD, COPD, congestive heart failure, and pulmonary tuberculosis showed significant associations ($p < 0.05$), while alcohol consumption was also significantly associated ($p = 0.0312$). The distribution of complaints, pain severity, and clinical comorbidities is illustrated in Figure 1, Figure 2, and Figure 3.

Table 1: Clinical characteristics of all the patients with acute chest discomfort at the time of admission

Sr. No	Parameter	Value	p-value
1	**Vitals**	Mean ± SD	
	Heart Rate	88.28 ± 13.01	
	Systolic BP (mmHg)	143.09 ± 15.84	
	Diastolic BP (mmHg)	84.88 ± 10.89	
	Oxygen Saturation (%)	93.39 ± 2.11	
2	**Complaint**	n (%)	0.036 (**S**)
	Radiating chest pain associated with sweating	141(35.25)	
	Chest pain with fever, cough and breathlessness	22(5.5	
	Acute onset breathlessness with chest tightness	23(5.75)	
	Localized chest pain	46(11.5)	
	Chest pain with chronic cough and weight loss	19(4.75)	
	Diffuse chest pain	23(5.75)	
	Sharp chest pain with dyspnea	17(4.25)	
	Chest pain on exertion relieved by rest	38(9.5)	

	Chest discomfort with palpitations	50(12.5)	
	Burning retrosternal pain associated with meals	21(5.25)	
	—	**400**	
4	**VAS/NRS score**	n (%)	
	0 - No pain	37 (9)	
	1 - 3 - Mild pain	111 (27.6)	0.9812 (NS)
	4 - 6 - Moderate pain	114 (28.5)	
	7 - 9 Severe pain	110 (27.5)	
	10 - Worst pain	28 (7)	
5	**Clinical co-morbidities**	n (%)	
	Hypertension	146 (36.5)	0.295 (NS)
	Diabetes	87 (21.75)	0.1667 (NS)
	Thyroid Disorder	36 (9.00)	0.3696 (NS)
	Coronary Artery Disease	83 (20.75)	**< 0.05 (S)**
	COPD	63 (15.75)	**< 0.05 (S)**
	Congestive Heart Failure	47 (11.75)	**< 0.05 (S)**
	Chronic Kidney Disease	40 (10.00)	0.7829 (NS)
	Pulmonary TB	41 (10.25)	**< 0.05 (S)**
	Immunocompromised	29 (7.25)	0.5355 (NS)
6	**Other co-morbidities**	n (%)	
	Smoking	114 (28.5)	0.9236 (NS)
	Alcohol	93 (23.25)	**0.0312 (S)**
7	**Diagnosis at the time of admission in ED**	n (%)	
	Cardiac	123 (30.75)	
	GI	50 (12.50)	
	Musculoskeletal	55 (13.75)	**< 0.05 (S)**
	Respiratory	122 (30.50)	
	Non specific	50 (12.50)	

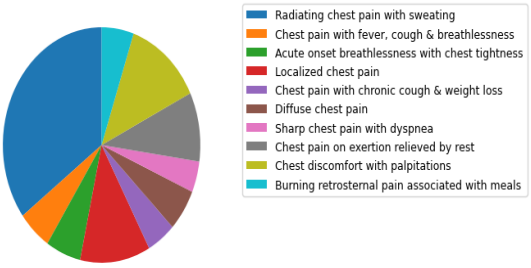

Figure 1: Distribution of Complaints

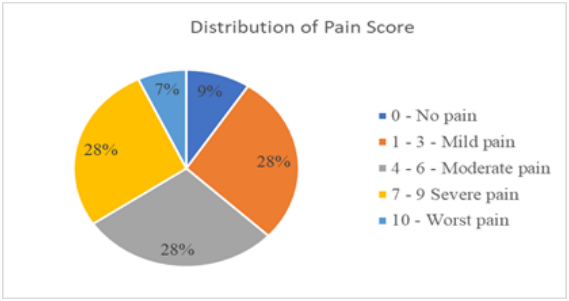

Figure 2: Distribution of Pain Score

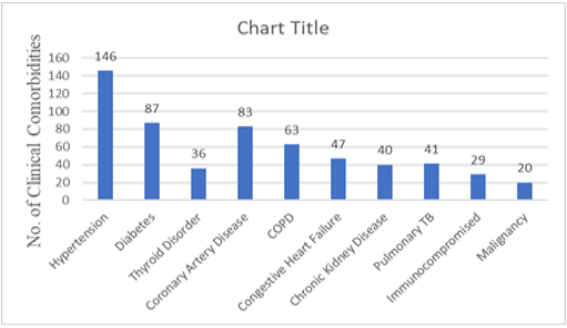

Figure 3: Distribution of Clinical Co-morbidities

Investigations performed in the emergency department are detailed in Table 2. ECG abnormalities were observed in 60% of patients, elevated troponin in 28.2%, raised hs-CRP in 29.8%, elevated CK-MB in 18.75%, and echocardiographic abnormalities in 48% of cases. The clustering of abnormal findings across investigations was statistically significant ($p < 0.001$). The distribution of ECG changes and echocardiographic findings is depicted in Figure 4 and Figure 5.

Table 2: Investigations carried out in the ED for all the patients with acute chest discomfort

Sr. No	Parameter	Value
1	**ECG Changes**	n (%)
	Normal	160 (40.00)
	Abnormal	240 (60.00)
2	**High sensitivity CRP**	n (%)
	Normal	281 (70.20)
	Raised	119 (29.80)
3	**Troponin**	n (%)
	Normal	288 (72.00)
	Elevated	112 (28.200)
4	**CPKMB**	n (%)
	Normal	325 (81.25)
	Elevated	75 (18.75)
5	**Chest Xray**	n (%)

	Normal	266 (66.50)
	Abnormal	134 (33.50)
6	**ECHO**	n (%)
	Normal	208 (52.0)
	Abnormal	192 (48.0)

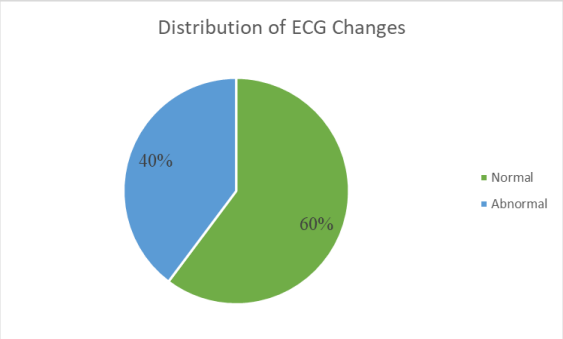

Figure 4: Distribution of ECG Changes

Patient disposition is shown in Table 3, where 96.5% of patients required admission and 3.5% mortality was recorded, with statistically significant outcomes ($p < 0.05$). Final etiological analysis of 386 patients, as presented in Table 4, revealed cardiac causes as the most common etiology (51.3%), particularly acute coronary syndrome (39.6% of total cases; $p < 0.001$), followed by respiratory (24.6%), musculoskeletal (11.7%), and gastrointestinal causes (7.5%). The distribution of major etiological categories is demonstrated in Figure 6, while emergency department disposition is shown in Figure 7. Overall, cardiac etiologies predominated, supported by significant investigation abnormalities and a high admission rate. [Figure 5]

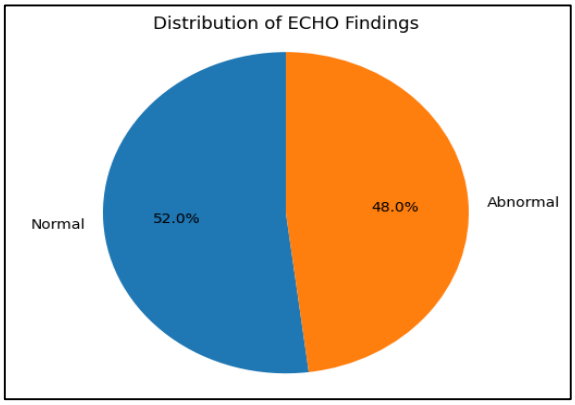

Figure 5: ECHO findings

Table 3: Patient disposition in the ED for all the patients with acute chest discomfort

Sr. No	Parameter	Value	p-value
1	Disposition in the ED	n (%)	< 0.05 (S)
	Admitted	386 (96.50)	
	Mortality	14 (3.50)	

Table 4: Final Diagnosis for patients evaluated in the ED for all the patients with acute chest discomfort (n = 386)

Etiological Category	Final Diagnosis (ordered by prevalence)	Number of Patients (n)	% within Category	% of Total	p-value
Cardiac	**Acute Coronary Syndrome (STEMI + NSTEMI + UA)**	**153**	**77.3**	**39.6**	**< 0.001**
	Chronic Stable Angina	**17**	**8.6**	**4,4**	
	Acute Pericarditis	**9**	**4.5**	**2.3**	
	Other cardiac causes	**19**	**9.6**	**4.9**	
	Total Cardiac	**198**	**100**	**51.3**	
Respiratory	**Pneumonia (all types combined)**	**40**	**42.1**	**10.4**	
	Acute Exacerbation of COPD / Asthma	**33**	**34.7**	**8.5**	
	Pneumothorax	**14**	**14.7**	**3.6**	
	Other respiratory causes	**8**	**8.4**	**2.1**	
	Total Respiratory	**95**	**100**	**24.6**	
Musculoskeletal	**Costochondritis / Chest wall pain**	**31**	**68.9**	**8.0**	
	Rib fracture / trauma-related pain	**8**	**17.8**	**2.1**	
	Other musculoskeletal causes	**6**	**13.3**	**1.6**	
	Total Musculoskeletal	**45**	**100**	**11.7**	
Gastrointestinal	**Gastroesophageal reflux disease (GERD)**	**20**	**69.0**	**5.2**	
	Peptic ulcer disease	**5**	**17.2**	**1.3**	
	Other GI causes	**4**	**13.8**	**1**	
	Total Gastrointestinal	**29**	**100**	**7.5**	
Non-specific	**Non-specific / idiopathic chest pain**	**19**	**100**	**4.9**	

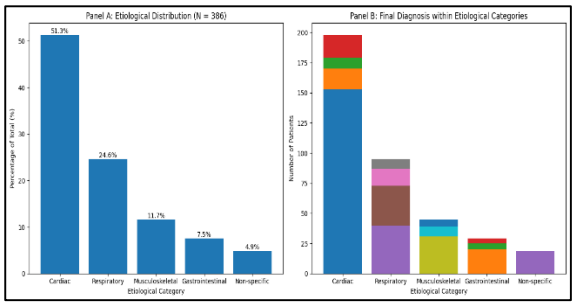

Figure 6: (A) Distribution of major etiological categories among patients presenting with chest pain. (B) Stacked bar chart depicting the relative contribution of individual sub-diagnoses within each etiological category

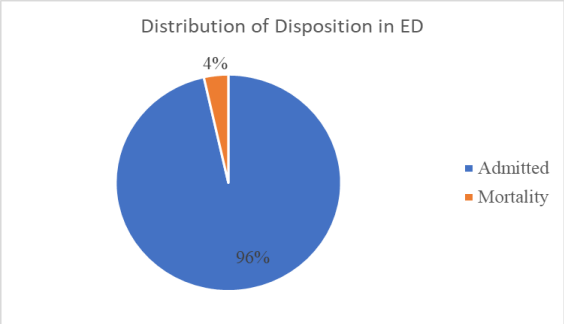

Figure 7: Distribution of Disposition in ED

DISCUSSION

The present study evaluated the etiological profile of patients presenting with acute chest discomfort in a tertiary care emergency medicine department and demonstrated that cardiac causes, particularly acute coronary syndrome, constituted the predominant etiology. Cardiac causes accounted for 51.3% of cases, with ACS alone contributing 39.6% of total presentations. These findings align with previous literature indicating that coronary artery disease remains the leading cause of acute chest pain in emergency settings, especially in populations undergoing epidemiological transition.[15] The high burden of ACS in this cohort reflects the increasing prevalence of cardiovascular risk factors such as hypertension, diabetes, smoking, and sedentary lifestyle in the Indian population.

The mean age of patients in this study was 49.19 ± 14.83 years, with a male predominance (58.75%). This relatively younger age of presentation supports earlier observations that coronary artery disease in South Asian populations tends to manifest nearly a decade earlier compared to Western populations.[16] Male predominance has been consistently reported in ACS registries and may be attributed to higher exposure to modifiable risk factors such as tobacco and alcohol use.[17] However, it is important to note that women often present with atypical symptoms, potentially leading to under-recognition.

Hypertension (36.5%) emerged as the most prevalent comorbidity, followed by coronary artery disease and COPD. Although hypertension did not show a statistically significant association independently, its high prevalence underscores its role as a major cardiovascular risk factor. Established literature has demonstrated that uncontrolled hypertension contributes to endothelial dysfunction, plaque instability, and increased myocardial oxygen demand, thereby precipitating acute coronary events.[18] Significant associations observed with CAD, COPD, congestive heart failure, pulmonary tuberculosis, and alcohol consumption suggest that comorbid systemic and respiratory illnesses substantially influence chest pain presentations in tertiary care settings.

Electrocardiographic abnormalities were observed in 60% of patients, and elevated troponin levels were detected in 28.2%, reinforcing the diagnostic importance of ECG and cardiac biomarkers in the emergency evaluation of chest pain. The clustering of abnormal findings across investigations was statistically significant ($p < 0.001$), highlighting the value of a systematic diagnostic approach. Similar studies have demonstrated that early ECG combined with high-sensitivity troponin assays significantly improves early detection and risk stratification of myocardial infarction.[19] However, it is also recognized that a normal initial ECG does not exclude ACS, particularly in NSTEMI cases, necessitating serial monitoring.

Respiratory causes accounted for 24.6% of cases, with pneumonia and acute exacerbation of COPD being the most frequent diagnoses. This substantial respiratory contribution reflects the dual burden of communicable and non-communicable diseases in developing countries. Inflammation, hypoxia, and increased pulmonary pressures may contribute to chest discomfort and may even precipitate secondary cardiac events in high-risk individuals.[20] Musculoskeletal causes (11.7%) and gastrointestinal causes (7.5%) were also notable contributors. These findings are consistent with reports indicating that non-cardiac chest pain constitutes a significant proportion of emergency presentations, though life-threatening causes must always be excluded first.[21]

The admission rate in this study was remarkably high (96.5%), with a mortality rate of 3.5%. The high admission rate likely reflects cautious clinical practice aimed at avoiding missed diagnoses of life-threatening conditions. Comparable studies have reported admission rates ranging from 70–90% in high-risk emergency cohorts, particularly in tertiary referral centers.[15] The observed mortality aligns with reported in-hospital mortality rates for acute coronary syndromes in similar settings.[17] Early recognition and intervention, particularly reperfusion therapy in STEMI, are known to significantly reduce mortality.

Final etiological categorization revealed that ACS represented the majority within cardiac diagnoses, reinforcing the need for rapid triage protocols and chest pain pathways. Implementation of standardized algorithms, including risk scores such as HEART or TIMI, may further optimize disposition decisions and

reduce unnecessary admissions while maintaining patient safety.[19] Additionally, awareness of atypical presentations in elderly, diabetic, and female patients remains essential to prevent diagnostic delay.

Overall, this study highlights the predominance of cardiac etiologies in acute chest discomfort presentations, while also emphasizing the significant contribution of respiratory, musculoskeletal, and gastrointestinal causes. The findings underscore the importance of structured clinical assessment, early ECG, cardiac biomarker evaluation, and targeted imaging. In resource-limited settings, understanding the local etiological profile can guide efficient resource allocation and improve patient outcomes.

CONCLUSION

Acute chest discomfort remains one of the most common and diagnostically challenging presentations in the emergency medicine department due to its heterogeneous etiological spectrum and the potential presence of life-threatening conditions. This prospective observational study evaluated 400 patients presenting with acute chest discomfort at a tertiary care hospital and provides a comprehensive overview of its etiological distribution, clinical characteristics, and diagnostic findings.

Chest discomfort predominantly affected middle-aged individuals with a modest male predominance, although both genders were significantly represented. Pain severity alone did not reliably differentiate benign from serious etiologies, emphasizing the importance of structured clinical evaluation. Cardiac causes were the most frequent etiology, accounting for more than half of cases, with acute coronary syndrome constituting the largest subgroup. Respiratory causes formed the second most common category, followed by musculoskeletal and gastrointestinal conditions, reflecting the broad diagnostic spectrum encountered in emergency practice.

Hypertension was the most prevalent comorbidity, and significant associations were observed with coronary artery disease, chronic obstructive pulmonary disease, congestive heart failure, and pulmonary tuberculosis. These findings highlight the critical role of risk factor assessment in guiding early diagnostic suspicion. Electrocardiography and cardiac biomarkers were central to early identification of ischemic etiologies, while radiological imaging and echocardiography enhanced diagnostic precision. The high admission rate and measurable mortality underscore the clinical seriousness of chest discomfort presentations and the need for prompt triage and intervention.

The strengths of this study include its prospective design, sizable sample, and comprehensive etiological evaluation incorporating multimodal diagnostic assessment. However, its single-center design may limit generalizability, and the absence of long-term follow-up restricts assessment of long-term outcomes. Additionally, advanced imaging modalities and structured psychiatric evaluation for non-cardiac chest pain were not routinely utilized, which may have further refined etiological categorization.

Future multicentric studies with larger populations and extended follow-up are warranted to validate these findings and assess long-term prognosis. Integration of standardized risk stratification tools, advanced diagnostic modalities, and preventive cardiology strategies is essential to improve diagnostic accuracy and reduce the burden of chest pain–related emergencies.

In conclusion, cardiac etiologies—particularly acute coronary syndrome—remain the predominant cause of acute chest discomfort in the emergency setting. A structured, protocol-based approach incorporating early ECG, cardiac biomarker testing, systematic risk assessment, and targeted imaging is fundamental to optimizing patient outcomes and reducing morbidity and mortality.

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