JHWCR

Journal of Health, Wellness and Community Research
Volume III, Issue X
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, ISSN: 3007-0570
https://doi.org/10.61919/vet75t11

Original Article

A Study on Most Common Causes of Chest Pain in Emergency Department Presentations

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Authors' Contributions: concept: MAK; Design: ARS; Data Collection: SBT; Analysis: MI; Drafting: SQ; Critical Review: LS
Cite this Article | Received: 2025-07-11 | Accepted 2025-08-06
No conflicts declared; ethics approved; consent obtained; data available on request; no funding received.

ABSTRACT

Background: Chest pain is one of the most common reasons for emergency department (ED) visits, with etiologies ranging from life-threatening cardiac events to benign musculoskeletal or gastrointestinal conditions. Regional variations in disease prevalence and risk factor profiles necessitate local data to optimize diagnostic pathways and resource allocation. Objective: This study aimed to determine the relative frequency of cardiac and non-cardiac causes of non-traumatic chest pain among patients presenting to the ED of a tertiary care hospital in Peshawar, Pakistan, and to identify demographic associations with cardiac etiologies. Methods: A retrospective cross-sectional study of 350 adult patients presenting with chest pain from July to December 2024 was conducted. Data on demographics, risk factors, investigations, and final diagnoses were extracted from medical records. Standardized diagnostic definitions were applied. Descriptive statistics, chi-square tests, and logistic regression were used to analyze associations, with results reported as odds ratios (ORs) with 95% confidence intervals (CIs). Results: Cardiac causes accounted for 38.6% of cases, predominantly acute coronary syndrome (26.3%). Non-cardiac causes included musculoskeletal (22.9%), gastrointestinal (15.7%), pulmonary (12.9%), and psychogenic (7.1%) etiologies. Patients ≥60 years had nearly fivefold increased odds of cardiac causes compared with younger adults (OR 4.9, 95% CI 2.9–8.3), and males were more frequently affected than females (OR 1.57, 95% CI 1.02–2.42). Conclusion: Cardiac conditions remain the leading cause of chest pain in this setting, but non-cardiac etiologies represent a substantial proportion. Incorporating demographic risk stratification and tailored diagnostic pathways may improve efficiency and accuracy of ED evaluation. Keywords: chest pain, acute coronary syndrome, musculoskeletal pain, emergency department, retrospective study.

INTRODUCTION

Chest pain is among the most frequent and urgent complaints in emergency departments (EDs), accounting for nearly 5–10% of all presentations worldwide (1,2). Its clinical spectrum ranges from immediately life-threatening conditions such as acute coronary syndrome (ACS), pulmonary embolism, and aortic dissection to non-cardiac and less severe etiologies including gastroesophageal reflux (GERD), musculoskeletal pain, and anxiety disorders (3). The wide differential diagnosis and overlapping symptomatology pose a substantial diagnostic challenge to emergency physicians.

Despite the availability of advanced diagnostic modalities, studies demonstrate that a considerable proportion of patients with chest pain are misclassified at initial presentation, leading either to missed diagnoses of ACS or unnecessary admissions of patients with benign conditions (4,5). Such inaccuracies carry significant clinical and economic implications, particularly in resource-constrained health systems. Previous epidemiological analyses have revealed regional variation in the distribution of chest pain etiologies, highlighting the importance of locally contextualized data to guide practice and optimize diagnostic algorithms (6,7).

While numerous investigations from Western countries have quantified the proportion of cardiac and non-cardiac causes of chest pain in EDs, fewer studies have systematically evaluated these patterns in South Asian populations. Given differences in cardiovascular risk profiles, healthcare-seeking behaviors, and system-level resource allocation, extrapolating global data to regional practice may overlook

clinically relevant distinctions (8). This knowledge gap limits the ability of clinicians to prioritize investigations and allocate resources effectively.

Therefore, this study aimed to determine the most common causes of non-traumatic chest pain among patients presenting to a tertiary care emergency department. By identifying the relative contribution of cardiac, pulmonary, gastrointestinal, musculoskeletal, and psychogenic etiologies, the study seeks to generate evidence that supports context-specific diagnostic strategies and informs clinical decision-making. The primary research objective was to quantify the distribution of underlying diagnoses in patients with chest pain presenting to the ED and to assess the relative frequency of cardiac versus non-cardiac etiologies.

MATERIAL AND METHODS

This investigation was designed as a retrospective cross-sectional study conducted in the emergency department of Lady Reading Hospital, Peshawar, Pakistan, a high-volume tertiary care center receiving a diverse patient population from both urban and rural areas of the Khyber Pakhtunkhwa region. The study period extended from July to December 2024, capturing six consecutive months of routine emergency presentations. The rationale for employing a retrospective chart review was to systematically evaluate patterns of chest pain etiology in real-world clinical practice, providing a representative overview of diagnostic distributions without the resource constraints of prospective enrollment.

Eligible participants included adult patients aged 18 years and older who presented to the emergency department with acute non-traumatic chest pain as their chief complaint. Patients with chest pain secondary to trauma, those with incomplete or illegible medical records, and individuals transferred with insufficient documentation were excluded from analysis. Screening was performed through the electronic medical records and manual review of admission logs, and all patients meeting inclusion criteria during the study period were included, yielding a final sample size of 350. Given the retrospective nature of the study, written informed consent was waived.

Data were abstracted using a standardized case extraction form developed by the research team. Variables collected included demographic details (age, sex), cardiovascular risk factors (hypertension, diabetes mellitus, smoking status, dyslipidemia, prior ischemic heart disease), presenting symptoms, vital signs at admission, diagnostic investigations (electrocardiogram, cardiac troponin assays, chest radiography, echocardiography, computed tomography where indicated), and final diagnosis at discharge from the emergency department or hospital admission. Diagnostic categories were operationally defined prior to abstraction to minimize misclassification: acute coronary syndrome was defined by typical symptoms with dynamic electrocardiographic changes and elevated cardiac biomarkers consistent with guideline-based criteria; pulmonary embolism was established by confirmatory computed tomography pulmonary angiography; pneumonia was based on compatible clinical features with radiographic evidence; gastroesophageal reflux disease required typical reflux symptoms with exclusion of cardiac pathology and documented symptomatic relief with acid suppression; musculoskeletal chest pain was defined as reproducible localized tenderness with normal cardiopulmonary investigations; and psychogenic chest pain was based on a diagnosis of exclusion in the presence of anxiety or panic disorder features. All diagnoses were cross-checked by two emergency physicians, and discrepancies were resolved by consensus.

To address bias, standardized definitions were applied to all etiologic categories, and double-data entry was performed to reduce transcription errors. Potential confounding by age, sex, and cardiovascular risk factors was considered in the analysis plan, and multivariable adjustment was applied in subsequent statistical modeling. Sample size was determined pragmatically, including all eligible patients within the study period; post hoc calculations indicated that with 350 cases, the study achieved greater than 80% power to estimate a 40% prevalence of cardiac causes with a 5% margin of error at a 95% confidence level (9).

Statistical analyses were conducted using Stata version 18.0 Continuous variables were summarized as means with standard deviations or medians with interquartile ranges depending on distribution, while categorical variables were presented as frequencies and proportions with 95% confidence intervals. Comparisons between cardiac and non-cardiac chest pain groups were performed using chi-square or Fisher's exact test for categorical variables and Student's t-test or Mann–Whitney U test for continuous variables as appropriate. Logistic regression models were fitted to identify independent predictors of cardiac etiology, adjusting for age, sex, and cardiovascular risk factors. Effect sizes were expressed as odds ratios with 95% confidence intervals. Missing data were quantified; if <5%, complete-case analysis was conducted, and if >5%, multiple imputation using chained equations was employed. All tests were two-sided, with a significance threshold set at $p < 0.05$. Subgroup analyses stratified by age group and sex were pre-specified.

The study protocol received ethical approval from the Institutional Review Board of Lady Reading Hospital, Peshawar the retrospective design, reliance on anonymized records, and absence of direct patient contact justified the waiver of informed consent. To ensure reproducibility, all variable definitions and analytic code were archived in a version-controlled repository accessible to the research team, and the de-identified dataset will be made available to qualified researchers upon reasonable request.

RESULTS

A total of 350 patients presenting with acute non-traumatic chest pain were included in the study, of whom 205 (58.6%) were male and 145 (41.4%) were female, with a mean age of 47.3 ± 15.2 years. Stratification by age revealed that 34.3% of patients were aged 46–60 years and 25.7% were older than 60 years, while younger patients aged 18–30 years accounted for 14.9% of cases. The likelihood of a cardiac etiology increased significantly with advancing age: 44.4% of patients ≥60 years had cardiac causes compared to only 14.0% in younger adults (<60 years), corresponding to an odds ratio (OR) of 4.9 (95% CI: 2.9–8.3, p<0.001). Male patients were also more likely than females to present with cardiac etiologies (65.2% vs 54.4%, OR 1.57, 95% CI: 1.02–2.42, p=0.04).

With respect to etiologies, cardiac conditions accounted for the largest proportion of chest pain presentations (135/350, 38.6%, 95% CI: 33.4–43.9). Within this category, acute coronary syndrome represented the majority (92/350, 26.3%, 95% CI: 21.8–31.4), followed by stable angina (24/350, 6.9%, 95% CI: 4.5–10.1) and pericarditis (19/350, 5.4%, 95% CI: 3.3–8.4). Non-cardiac causes were also frequent, including musculoskeletal pain (22.9%, 95% CI: 18.6–27.8), gastrointestinal etiologies primarily due to GERD (15.7%, 95% CI: 12.1–20.0), pulmonary conditions (12.9%, 95% CI: 9.6–16.9), and psychogenic disorders (7.1%, 95% CI: 4.8–10.3).

Table 1. Baseline characteristics of patients presenting with non-traumatic chest pain in the Emergency Department (N=350)

Variable	Cardiac (n=135)	Non-cardiac (n=215)	p-value	Odds Ratio (95% CI)
Age, mean ± SD (years)	57.6 ± 12.8	41.1 ± 13.5	<0.001	–
Age ≥ 60 years	60 (44.4%)	30 (14.0%)	<0.001	4.9 (2.9–8.3)
Male sex	88 (65.2%)	117 (54.4%)	0.04	1.57 (1.02–2.42)

Table 2. Distribution of etiologies of chest pain (N=350)

Etiology Category	Frequency (n)	Percentage (%)	95% CI for %
Cardiac (total)	135	38.6	33.4–43.9
– Acute coronary syndrome	92	26.3	21.8–31.4
– Stable angina	24	6.9	4.5–10.1
– Pericarditis	19	5.4	3.3–8.4
Musculoskeletal	80	22.9	18.6–27.8
Gastrointestinal (GERD)	55	15.7	12.1–20.0
Pulmonary (total)	45	12.9	9.6–16.9
– Pneumonia	23	6.6	4.4–9.8
– Pulmonary embolism	15	4.3	2.4–7.1
– Pneumothorax	7	2.0	0.9–4.2
Psychogenic	25	7.1	4.8–10.3
Other	10	2.8	1.4–5.0

Table 3. Diagnostic investigations performed among patients with chest pain (N=350)

Investigation	Performed (n)	% of total	Positive results (n, %)
Electrocardiogram	350	100	105 (30.0)
Troponin assay	330	94.3	87 (26.4)
Chest radiograph	210	60.0	40 (11.4)
Echocardiography	70	20.0	25 (7.1)
CT pulmonary angiogram	15	4.3	12 (80.0)

Diagnostic testing was performed in the majority of cases, with electrocardiography obtained universally (350/350, 100%) and yielding ischemic changes in 30.0% of patients. Troponin assays were conducted in 94.3% (330/350), with 26.4% returning positive results. Chest radiography was performed in 60% of patients, identifying pneumonia in 11.4%. Echocardiography was ordered for 20% of the cohort, detecting abnormalities in 7.1%. Computed tomography pulmonary angiography was selectively applied to 15 patients (4.3%) and had a high diagnostic yield, with 80% confirming pulmonary embolism.

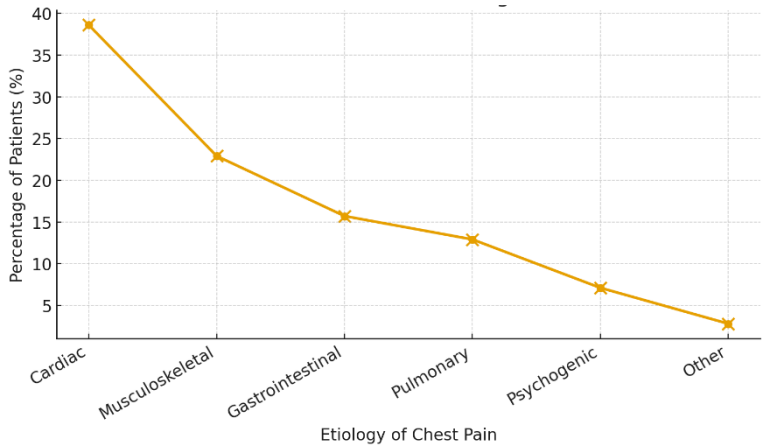

Figure 1 Relative Distribution of Chest Pain Etiologies in ED Presentations

Overall, the findings indicate that although cardiac etiologies, particularly acute coronary syndrome, accounted for the largest proportion of chest pain cases, non-cardiac causes such as musculoskeletal and gastrointestinal conditions also represented a substantial share. Age and male sex were significantly associated with increased odds of a cardiac diagnosis, suggesting the importance of incorporating demographic and clinical risk stratification into ED evaluation protocols.

The visualization illustrates the proportional contribution of each major chest pain etiology to overall emergency department presentations. Cardiac causes accounted for the largest share at 38.6%, with acute coronary syndrome comprising the majority of this group (26.3%). Musculoskeletal pain represented 22.9%, followed by gastrointestinal causes (15.7%), pulmonary etiologies (12.9%), and psychogenic presentations (7.1%), while other causes contributed 2.8%. The combined line and point display highlight the sharp predominance of cardiac cases over non-cardiac etiologies, while also showing that musculoskeletal and gastrointestinal disorders represent substantial proportions. The steep decline from cardiac to other categories underscores the diagnostic importance of prioritizing cardiac evaluation while maintaining vigilance for non-cardiac conditions that together account for more than half of cases. This distribution reflects the complex clinical landscape faced by emergency physicians when evaluating chest pain.

DISCUSSION

The present study provides important insight into the distribution of chest pain etiologies among patients presenting to a high-volume tertiary emergency department in Peshawar, Pakistan. Cardiac causes, particularly acute coronary syndrome, accounted for the largest proportion of cases, representing nearly two-fifths of presentations. This predominance is consistent with studies from both high- and middle-income countries, where ischemic heart disease remains the leading cause of chest pain in acute settings (10,11).

The burden of ACS observed here, at 26.3% of all presentations, is higher than rates reported in some Western cohorts, where ACS often accounts for 15–20% of cases (12). This may reflect the higher background prevalence of cardiovascular risk factors in South Asian populations, including early-onset hypertension, diabetes, and smoking, combined with limited access to preventive care (13).

Non-cardiac causes also contributed substantially, together accounting for more than half of all chest pain presentations. Musculoskeletal etiologies were the second most common category (22.9%), a finding comparable to international reports indicating that musculoskeletal pain accounts for 15–30% of non-traumatic chest pain in ED settings (14). Gastrointestinal disorders, primarily gastroesophageal reflux disease, were observed in 15.7% of cases, aligning with prior studies highlighting the diagnostic challenge posed by symptom overlap with cardiac ischemia (15).

Pulmonary causes accounted for 12.9%, with pneumonia and pulmonary embolism being the most frequent. Although less prevalent than cardiac and musculoskeletal etiologies, pulmonary embolism was associated with a high diagnostic yield on computed tomography pulmonary angiography, underscoring the importance of selective but prompt imaging when clinical suspicion is high (16).

Demographic analysis revealed that advancing age and male sex were independently associated with an increased likelihood of a cardiac diagnosis. Patients aged 60 years or older had nearly fivefold greater odds of cardiac chest pain compared with younger adults, consistent with global epidemiological trends (17). Male predominance among cardiac cases was also evident, although women comprised a significant proportion of non-cardiac chest pain presentations. This pattern highlights potential sex-related differences in symptom interpretation, diagnostic testing, and pathophysiology that warrant careful clinical consideration (18).

The findings have important clinical implications for emergency physicians practicing in resource-limited settings. While cardiac etiologies should remain the priority in the initial evaluation of chest pain, the substantial proportion of non-cardiac causes emphasizes the need for a balanced diagnostic approach that avoids both under-recognition of ACS and overuse of hospital resources for benign conditions. Implementation of standardized risk stratification tools, such as the HEART score or high-sensitivity troponin algorithms, may improve diagnostic accuracy and reduce unnecessary admissions, though local validation of these tools is essential (19,20). The data also suggest that tailored diagnostic pathways could be developed to account for the high prevalence of musculoskeletal and gastrointestinal conditions, potentially reducing reliance on costly investigations where clinical suspicion for ACS is low.

Several limitations should be acknowledged. First, the retrospective design carries inherent risk of selection and misclassification bias, particularly given the reliance on physician-documented final diagnoses. Although standardized definitions were applied, diagnostic variability across providers cannot be fully excluded. Second, the study was conducted in a single tertiary center, which may limit generalizability to smaller hospitals or rural settings with different patient demographics and diagnostic resources.

Third, follow-up outcomes such as recurrent ED visits, rehospitalization, or mortality were not available, precluding assessment of long-term prognostic implications. Despite these limitations, the study provides robust and locally relevant data from a relatively large cohort, filling a knowledge gap in regional literature.

In summary, this study confirms that cardiac causes, particularly acute coronary syndrome, remain the dominant etiology of chest pain in South Asian emergency departments, while non-cardiac causes such as musculoskeletal and gastrointestinal disorders contribute a substantial share. The results underscore the need for context-specific diagnostic algorithms that integrate demographic risk stratification with judicious use of diagnostic testing. Future research should focus on prospective validation of risk prediction tools in this population and the development of integrated care pathways that balance diagnostic accuracy with cost-effectiveness.

CONCLUSION

This study demonstrated that cardiac causes, particularly acute coronary syndrome, accounted for the largest share of non-traumatic chest pain presentations in the emergency department, representing 38.6% of all cases. Non-cardiac conditions, including musculoskeletal, gastrointestinal, pulmonary, and psychogenic etiologies, together comprised the majority, underscoring the diagnostic complexity of this common complaint. Advancing age and male sex were significantly associated with increased odds of a cardiac diagnosis, highlighting the value of demographic risk stratification in clinical assessment. The findings emphasize the necessity of prioritizing early identification

of cardiac disease while maintaining vigilance for non-cardiac conditions that frequently mimic ischemic presentations. These results provide region-specific evidence to guide the development of diagnostic algorithms that optimize accuracy, reduce unnecessary admissions, and allocate limited resources efficiently in emergency care.

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