

Original article

Thirty-day outcome of patients who present with chest pain to the emergency department of a tertiary care hospital of Sri Lanka

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Abstract

Background: Patients present with chest pain causes significant burden to the workload in an emergency department (ED). Quick but thorough attention is needed for life threatening emergencies and to minimize unnecessary admissions. We assess the burden of chest pain and 30-day outcome of patients who present with chest pain to the ED.

Methodology: Prospective observational study of all adult patients presented to ED over one month with the primary complain of chest pain were evaluated and followed for 30 days.

Results: A total of 661 (20.3% of total admissions) patients (mean age 56.7 ± 14.9 years, 51% males) were studied. Common causes for the chest pain included gastroesophageal reflux disease (GORD) (29%) and acute coronary syndrome (ACS) (25%). ACS patients included ST-elevation myocardial infarction (STEMI) (10%), Non-ST-elevation myocardial infarction (6.7%) and unstable angina (8.3%). Fifty patients (75% of the STEMI patients) were thrombolysed. Primary angioplasty facility was not available in the hospital during the study period. Five patients (3% of the ACS patients) had coronary revascularization during the follow-up period – 2 patients had angioplasty and 3 patients had coronary bypass surgery. In-hospital mortality was 2.7%. Thirty-day mortality was 3.2%. Thirty three percent of them continued to have recurrent chest pain despite thorough investigation and treatment.

Conclusions: Chest pain carries a significant burden to the workload of a busy ED. The commonest causes for chest pain were ACS and GORD. A considerable number of patients continued to experienced chest pain despite investigations and treatment.

Keywords: acute coronary syndrome, chest pain, emergency department, tertiary care hospital, Sri Lanka

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Introduction

Chest pain presentations to emergency department (ED) are challenging clinical scenarios with a diagnostic dilemma to healthcare providers. The imperative is twofold: promptly identify and manage life-threatening cardiac conditions and use healthcare resources judiciously in evaluating non-cardiac chest pains.

The consequences of misdiagnosing cardiac chest pain as non-cardiac or atypical chest pain can be grave, including missed opportunities for early intervention and increased risk of morbidity and mortality. This concern is particularly notable in settings where the healthcare infrastructure is still evolving, such as in many developing countries, including Sri Lanka

Atypical chest pain, while often non-life-threatening, represents a considerable portion of ED visits, with its management and diagnostic pathways remaining under-explored, particularly in the developing world. This is of particular concern in regions like Sri Lanka, where the burden of non-communicable diseases is rapidly escalating.¹ The complexity of chest pain evaluation in the ED involves not only distinguishing between cardiac and non-cardiac origins but also the prognosis and management of those considered non-cardiac, which are filled with the potential for misdiagnosis and the subsequent risk of adverse outcomes.²

The term acute coronary syndrome (ACS) encompasses a spectrum of coronary artery diseases, including unstable angina (UA), non-ST elevation myocardial infarction (NSTEMI) and ST-segment-elevation myocardial infarction (STEMI). Although clinical trials have furnished clinicians with evidence supporting various interventions and medications for ACS, observational studies offer valuable insights into variations and deficiencies in management practices across countries and within different regions of the same country.

Internationally, the rates of adverse cardiac events following an initial diagnosis of non-cardiac chest pain in the ED have demonstrated a significant range. In a French study, Montassier *et al.* (2012) found that 3.7% of patients discharged with non-cardiac diagnoses experienced adverse cardiac events within 60 days.³ This finding emphasizes the underlying risk linked to the way chest pain is managed in the ED and highlights the necessity for vigilant follow-up.

In developing regions, data are often scarce and inconsistent. Soltani *et al.* (2016) conducted a study in Iran, where they found a 3.1% incidence of adverse cardiac events within 30 days post-discharge in patients initially labelled with non-cardiac chest pain.² Such outcomes not

only reflect the diagnostic challenge but also raise concerns about the follow-up processes and the accessibility of healthcare.

In the context of Sri Lanka, a developing country with an alarmingly high rate of cardiovascular disease (CVD) mortality and an early onset of CVD compared to Western counterparts, the management of chest pain presents unique challenges. The discrepancies in health outcomes and the effectiveness of current management practices for ACS in Sri Lanka versus those recommended by global standards raise crucial questions about optimizing healthcare resources and protocols.¹

This study intends to investigate the thirty-day outcomes of patients presenting with chest pain to the ED of a tertiary care hospital in Sri Lanka, aiming to uncover insights into the prognostic aspects and management efficacy in a resource poor setting.

This study not only fills the existing knowledge gap concerning the natural history and outcomes of patients presenting with chest pain in a developing country, but also provides a comprehensive examination of the broader implications of chest pain management practices within such healthcare systems.

Methodology

This was a prospective observational study that lasted one month and specifically focused on patients presenting to the ED at Teaching Hospital, Kurunegala.

The study targeted all patients aged 14 and above who presented to the ED with the principal complaint of chest pain during the specified timeframe. Inclusion was dependent on patient consent, with a subsequent 30-day follow-up. Patients with direct trauma to chest were excluded.

Every consenting individual fitting the age criteria and primary presenting complaint of chest pain was included in the study. Patient management remained uninterrupted, and personal identities were kept confidential.

Data collection was facilitated using a datasheet aligned with the American College of Cardiology (ACC) guidelines, which included demographic data, initial investigations, treatment, and follow-up. Patient follow-ups, following discharge, were conducted in clinics at Teaching Hospital, Kurunegala and via telephone conversations with patients and their families. Data collection and follow-up were done by two trained medical officers and four pre-intern doctors who were trained by the two principal investigators and

under thorough surveillance. Interviewer bias was minimized as none of the researchers was a part of the treatment team.

Standard procedures, including ECGs for all patients presenting with chest pain, were adhered to. Documentation of other investigations—such as chest X-rays, echocardiograms, exercise ECGs, coronary angiograms, cardiac markers, and blood investigations (including fasting blood sugar, lipid profile, and full blood count)—were done depending on availability.

Documented treatments were noted, but the study did not influence the treatment plans or management.

The collected data were analyzed using the SPSS version 24 software package. Continuous variables were compared using t-tests, and categorical variables were evaluated with chi-square tests.

Ethical approval for the study was obtained from the Ethical Review Committee of Teaching Hospital, Kurunegala. Additional permissions were obtained from the Director and attending specialists within the relevant wards and intensive care units. Informed written consent was obtained from all participants, or their legally acceptable representatives in situations where participants were unable to provide consent themselves. All data were collected anonymously, and confidentiality was rigorously maintained.

Results

There were 3,261 admissions to the ED from which, 661 (20.3%) patients presented with the main complaint of chest pain. Their gender distribution was equal, with females representing 49.3% (n=326) and males 50.7% (n=335) of the cases. The mean age was 56.72 (+/-14.95) years, with a minimum age of 14 and a maximum age of 94. Both male and females have a similar age distribution. Two patients could not be contacted for follow-up.

The median duration of hospital-stay for patients presented with chest pain was 48 hours (IQR 40), but 137 (20.7%) of these patients were discharged within 24 hours of admission.

Electrocardiogram (ECG) was the commonest investigation done on admission, with 435 (65.8%) within 10 minutes, 620 (93.8%) patients receiving one within 20 minutes of arrival to ED, and 147 (22.2%) having a second ECG 20 minutes after the first ECG. Of them, 266 (43%) had normal ECGs, whereas the rest had abnormal findings, including ischaemic changes. Only 39 had chest X-rays on admission. Capillary blood sugar was measured in 608

patients, with 64 having CBS of >180 mg/dL. Troponin I was tested in 503 patients including 42 STEMI, with 86 testing positive (29 (11.8%) females and 57 (22.1%) males). Rest of the STEMI patients Troponin I was not performed as the ECG criteria and history confirmed the diagnosis. All patients suspected ACS (n=166) were given loading doses of antiplatelets and statins. Total (n=661) administration of aspirin, clopidogrel and atorvastatin were 49.8%, 50% and 49.2% respectively.

There was a statistically significant gender difference in troponin positivity ($p=0.002$), with males showing a higher rate of positive troponin tests compared to females, indicating more myocardial infarctions among males.

Out of the 661 patients included in the study, 166 (25.1%) were diagnosed with acute coronary syndrome. Among them, there were 67 (10.1%) patients with ST-elevation myocardial infarction (STEMI), 44 (6.7%) patients with non-ST elevation myocardial infarction (NSTEMI), and 55 (8.3%) patients with unstable angina. Left ventricular failure (LVF) was diagnosed in 19 (2.9%) patients, and 94 (14.2%) of them were diagnosed with stable angina (SA). Fifty (75%) STEMI patients were thrombolysed. Six (0.9%) presented with supraventricular tachycardia, and three had sick sinus syndrome (0.5%). Overall, patients with cardiac conditions were 288 (43.6%) out of all admissions. Gastroesophageal reflux disease (GORD) [194 (29.3%)] remained the most common non-cardiac diagnosis, followed by 59 (8.9%) musculoskeletal pain, 36 (5.4%) lower respiratory tract infection (LRTI)/pneumonia, and six (2.4%) had exacerbation of asthma. One patient was diagnosed with a pneumothorax. None of the GORD patients had an endoscopy during those 30 days.

Following admission to medical units, including the cardiology unit, 246 (37.2%) (108 females, 136 males) had 2D echocardiograms, 148 (60%) had normal ejection fractions (EF), and 98 (40%) had low ejection fractions. (Table 2) Only 11 ACS patients had EF < 40% compared to seven non-ACS. This analysis suggests a potential differential pattern where higher ejection fractions are more associated with non-ACS diagnoses, while mid-range ejection fractions more frequently correlate with ACS diagnoses.

A total of 629 (95.15%) patients were successfully followed up after initial treatment, while there were 30 deaths (4.5%) during the follow-up period. In-hospital mortality was 2.7%. Deaths were mainly due to myocardial infarction 23 (76.7%), left ventricular failure 5 (16.7%), and pneumonia 2 (6.7%). Among these, 11 (3.4%) were female and 19 (5.7%) were male, and gender does not appear to be a significant predictor of mortality ($p=0.156$).

Most [97% (250/258)] of patients with acute coronary syndrome and other cardiac diagnoses had a follow-up

during 30 days in subsequent cardiac and medical clinics. [STEMI 54 (8.4%), NSTEMI 43 (6.5%), UA 53 (8%), SA 93 (14.1%), and LVF 7 (37%)].

Only 18 (6.9%) of 260 (ACS + SA) patients underwent a coronary angiogram. Three patients had coronary artery bypass graft (CABG) surgery while two patients had percutaneous coronary intervention (PCI).

There were only eight (1.3%) readmissions, which showed a lower incidence of return to the hospital. Only three of

them had cardiac causes for readmission (two unstable angina and one left ventricular failure).

The treatment outcome at the 30-day follow-up revealed that 405 (61.3%) [184 females and 221 males] were completely free of their symptoms. A higher proportion of males reported being completely free of symptoms than females at the 30-day follow-up ($p=0.003$). Thirty-three percent of them continued to have recurrent chest pain despite thorough investigation and treatment while 225 (35.7%) were still on medication and follow-up

Table 1. Diagnosis

<i>Diagnosis n=661</i>	<i>Frequency</i>	<i>Percentage %</i>
Cardiac causes 288 (43.8%)		
Acute coronary syndrome	166	25.1
Stable aAngina	94	14.2
LVF	28	4.2
SVT	6	0.9
Sick sinus syndrome	3	0.5
Gastrointestinal/muscular causes 252 (38.1%)		
GORD	193	29.2
Musculoskeletal chest pain	59	8.9
Respiratory and infectious causes 73 (11%)		
LRTI/Pneumonia	37	5.6
Asthma	16	2.4
Chronic obstructive pulmonary disease (COPD)	3	0.5
Bronchitis	5	0.8
Dengue fever	12	1.8
Other causes 39 (5.9%)		
Anxiety	6	0.9
Chronic kidney disease (CKD)	3	0.5
Transient ischaemic attack (TIA)	1	0.2
Anemia	2	0.3
Benign paroxysmal positional vertigo (BPPV)	3	0.5
Postpartum psychosis	1	0.2
Hemorrhagic stroke	1	0.2
Pneumothorax	1	0.2
Non-specific	21	3.2

*BPPV – Benign paroxysmal positional vertigo

Table 2. Investigations on arrival of the patient

Name of the investigation (N=661)	Results		
ECG1	620	Ischaemic changes	354
		Normal	66
ECG 2	147		
Chest X-ray	39	Inflammatory shadows	11
		Normal	27
		Pneumothorax	1
Troponin I	503	Positive	86
		Negative	417
2D echocardiogram (all done after admissions)	246	EF<20%	4
		EF 20 - 39%	14
		EF 40 -59%	80
		EF >60%	148
Capillary blood sugar (CBS)	608	>180 mg /dL	64
		<180 mg/dL	544
Serum amylase	8	High	5
		Normal	3

Discussion

Gender distribution and patient demographics

During the period of study, majority of the patients diagnosed with ACS were males (59%). On the contrary findings from Medagama *et al.* (2015) states that females (55.1%) outnumbered males (44.9%). The mean age of patients in this study was 56.72 years, consistent with the demographic profiles reported in other studies on chest pain and ACS, indicating that middle-aged and older adults are predominantly affected.⁴ Sweeney M published that 20% of overall admissions were for chest pains, which is similar to our figures.⁵

Diagnostic and treatment approaches

In our study, 65.8% of patients had an electrocardiogram (ECG) done within 10 minutes of arrival, 93.8% of patients had an ECG done within 20 minutes of arrival, and 22.2% received a second ECG within 40 minutes. This rapid diagnostic approach adheres with best practices and compares favorably with other studies. For example, Soltani *et al.* (2016)² reported that adherence to diagnostic protocols significantly influences outcomes. However,

only 39 patients received chest X-rays, highlighting a careful selection of patients for comprehensive diagnostic imaging.

Troponin I test were performed on 503 patients, with 86 positive tests. A significant gender difference was observed in troponin positivity (p=0.002), with males more frequently testing positive. This finding aligns with the literature, which often reports higher rates of positive troponin tests and ACS diagnoses among males. The use of aspirin (49.8%), clopidogrel (50%), and atorvastatin (49.2%) in our study is comparable to the medication usage rates reported by Medagama *et al.*¹ indicating adherence to established ACS treatment protocols. All ACS patients had been given loading doses.

Cardiac and non-cardiac diagnoses

Of the patients studied, 25.1% were diagnosed with ACS, including 10.1% with STEMI, 6.7% with NSTEMI, and 8.3% with unstable angina. Soltani *et al.* (2016) reported a significantly higher prevalence of ACS at 41%.² However, Nilsson T *et al.* reported 10-12% of ACS, which is half the percentage of our study.⁶

GORD was the most common non-cardiac diagnosis (29.3%), consistent with the prevalence of non-cardiac chest pain (NCCP) observed in other studies, such as those by Mol *et al.* (2018).⁴ Musculoskeletal pain (8.9%) and respiratory conditions like pneumonia (5.4%) were also significant contributors to chest pain, reflecting the diverse aetiologies of this symptom. Patients who diagnosed to have sick sinus syndrome presented with dull diffuse chest pain and dengue fever presented with non-specific chest pain while haemorrhagic stroke presented with typical ischaemic pain.

Outcomes and follow-up

The 30-day follow-up period revealed a 4.5% mortality rate, primarily due to myocardial infarction and left ventricular failure. We had only 1.8% readmissions during 30 days follow-up where this rate was higher as 3.7% with acute coronary events reported by Montassier *et al.* (2012)³ over a 60-day period but aligns with other findings that emphasize the importance of post-discharge follow-up for cardiac patients. The low rate of re-admissions (1.3%) and high rate of symptom resolution (61.3%) are encouraging, indicating effective initial treatment and follow-up care.

Comparative analysis

The utilization of basic diagnostic and therapeutic interventions in this study was satisfactory in a resource-poor setting. The high rate of ECG usage and troponin testing aligns with international standards and emphasizes the importance of early and accurate diagnosis in managing chest pain.^{5,7} Compared to the findings from Soltani *et al.* (2016) and Medagama *et al.* (2015)^{1,2}, our study demonstrates similar patterns of care but highlights specific areas for improvement, such as the limited use of coronary angiography and advanced cardiac interventions. Emergency department door-to-ECG timing should be minimized to 10 minutes in every chest pain case, which needs improvement.

Chest pain carries a significant burden to the workload of a busy ED. The most common causes for chest pain were ACS and GORD. Establishing a chest pain unit in ED will markedly reduce this burden. Our study's results reinforce the importance of rapid diagnostic protocols and comprehensive treatment plans in improving patient outcomes. Future studies should focus on enhancing diagnostic capabilities and exploring the reasons behind the gender disparities in ACS outcomes.

Limitations

The cardiac catheterization laboratory of the hospital was out of order during the study period, which significantly

impacted the investigation and treatment of cardiac patients. Additionally, this study was conducted as a survey to observe outcomes, and detailed data regarding patients' previous history or risk factors were not collected.

Author contribution

MMPTJ, the corresponding author and co-investigator and RANKW developed the research concept and was involved in the supervision of data collection, the verification of the accuracy of data, funding, statistical analysis and the preparation of the final document. Both were also involved in the revision of the manuscript. TNDN, WKMNW and MBN aided with data collection and verified the accuracy of the data. EMDTE analyzed data and AKB assisted with article writing.

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