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Original Research Article

2D ECHOCARDIOGRAPHY CHANGES IN ELDERLY PATIENTS PRESENTING WITH CHEST PAIN

Miet Shah[1], Yogesh V. Khithani[2], Amar Pazare[3]

[1]*Resident, Department of Medicine, K J Somaiya Medical College, Sion, Mumbai, Maharashtra, India*
[2]*Assistant Professor, Department of Medicine, K J Somaiya Medical College, Sion, Mumbai, Maharashtra, India*
[3]*Professor, Department of Medicine, K J Somaiya Medical College, Sion, Mumbai, Maharashtra, India*

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Corresponding Author:
Dr. Yogesh V. Khithani,
Assistant Professor, Department of Medicine, K J Somaiya Medical College, Sion, Mumbai, Maharashtra, India.
Email: dr.yogeshkhithani@gmail.com

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ABSTRACT

Background: Chest pain is a common reason for emergency and outpatient visits among older adults, yet its evaluation is challenging due to atypical presentations and diverse underlying etiologies. Early differentiation between cardiac and non-cardiac causes is essential to prevent missed acute coronary events while avoiding unnecessary admissions and investigations. Echocardiography has emerged as a valuable bedside tool for rapid diagnostic assessment in this population. The aim is to evaluate the clinical presentation, cardiovascular risk factors, echocardiographic findings, and diagnostic utility of 2D echocardiography in elderly patients presenting with non-traumatic chest pain.

Materials and Methods: A descriptive cross-sectional study was conducted in a tertiary care hospital among 96 patients aged 60 years and above presenting with acute chest discomfort. All participants underwent clinical assessment, laboratory investigations, ECG, and 2D echocardiography. Patients were stratified into low, moderate, and high risk categories using the HEART-2 scoring system. Data were analysed using descriptive and inferential statistics, with $p < 0.05$ considered significant.

Results: The majority of patients were between 70–74 years of age, with a high prevalence of multiple cardiovascular risk factors. Cardiac causes of chest pain were identified in 69.8% of cases. Regional wall motion abnormalities were detected in 26 patients, of whom 96.2% were diagnosed with myocardial infarction or angina. Valvular abnormalities and cardiomyopathies also contributed to symptoms. Echocardiography demonstrated a sensitivity of 80.5%, specificity of 72.4%, PPV of 87.1%, and NPV of 39.4% in identifying cardiac etiologies. High HEART-2 scores showed strong correlation with cardiac causes.

Conclusion: 2D echocardiography is a valuable diagnostic modality in elderly patients presenting with chest pain, aiding in the differentiation of cardiac and non-cardiac causes and supporting timely clinical decision-making. Integration of echocardiography with clinical evaluation, ECG, biomarkers, and structured risk scoring enhances diagnostic accuracy and reduces unnecessary hospitalization.

Keywords: Chest pain; Elderly patients; 2D echocardiography; Acute myocardial infarction; Regional wall motion abnormality.

INTRODUCTION

Over the years life expectancy in India from has been prolonged from 58.6 years in the 1990 to nearly 72.3 years in 2014.[1] Given the high incidence of medical problems in older inhabitants, older people now account for an increasing share of emergency or outpatient visits.[2] An increasing number of elderly people attend the hospital for assessment of chest pain. For adults age 65 years or older, ischemic heart disease is highly prevalent and is the leading cause of morbidity and mortality.[3] However, chest pain in older patients can also be noncardiac in origin or of a cardiac aetiology other than coronary artery disease.[4]

A retrospective study with 1000 patients, very high costs, to the tune of €3,000, generated by patients with chest pain in the ED.[5] Substantial over-admission indicates that better ED diagnostics and triage could decrease costs considerably.[6] An accurate identification of life-threatening and serious causes of chest pain must be accomplished without over-testing and overtreating patients with less serious causes. To face this challenge, an increasing array of diagnostic strategies and modalities have been investigated during the past decades, including new cardiac biomarkers, clinical risk scores, early stress testing, accelerated diagnostic protocols (ADPs), and non-invasive imaging of the myocardium and coronary arteries to provide a rapid and cost-effective evaluation.[7,8]

Echocardiography is the most effective imaging modality for the assessment of patients exhibiting cardiac symptoms such as dyspnoea or chest pain (9). In patients with CVD, echocardiography provides important information on the severity of the disease, the decision-making process for treatment strategies, prognosis prediction, and treatment response evaluation.[10-12] The problem of conventional echocardiography of not yielding information about myocardial deformation, has now been overcome with technological advancements of echocardiographic equipment, the incorporation of novel echocardiographic techniques like myocardial strain imaging and three-dimensional (3D) echocardiography.[13,14] In addition the newer techniques have removed operator dependency and lack of reproducibility.

The role of echocardiography in the evaluation of chest pain especially in elderly patients is significant.[15] It can be used to monitor cardiac output, determine disorders of cardiac physiology, and provide anatomical information relevant to diagnosis.[16] In a study published in the Journal of the American College of Cardiology, researchers found that echocardiography was a valuable tool in diagnosing cardiac conditions in patients over 70 years old, particularly in those with known or suspected coronary artery disease.[17] Echocardiography is also useful in diagnosing non-ischemic cardiac conditions that can present with chest pain. For example, a study published in the Journal of the American College of Cardiology found that echocardiography was effective in diagnosing pericardial effusions with and without tamponade, aortic dissections, and acute right ventricular dysfunction in patients with acute chest pain.[18] These conditions are often difficult to diagnose using other imaging modalities, and echocardiography provides a non-invasive and portable means of diagnosing these conditions.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted on patients presenting with chest pain attending the outpatient department or admitted as inpatients at KJ Somaiya Hospital, Mumbai, between 2022 and 2024. The study population consisted of individuals aged 60 years and above, and all eligible participants were enrolled consecutively following evaluation by attending physicians. Patients were included if they presented with chest pain, were over 60 years of age, and were able to provide informed consent, while no exclusion criteria were applied. The minimum sample size calculated using OpenEpi Version 3, based on an anticipated prevalence of 20%, absolute precision of 8%, a 95% confidence level and 5% significance level, was 96, and this number was achieved. All participants underwent detailed clinical examinations along with laboratory investigations, ECG, and echocardiography, and relevant information was recorded in a predesigned and pretested proforma. Data collection was carried out after stabilisation of vitals and patient comfort, or where necessary, through relatives or caregivers if the patient was unable to communicate at the time of assessment. The study utilized investigation reports, ECG findings, and echocardiography results as primary data tools, and recorded variables included demographic characteristics, presenting symptoms, cardiovascular risk factors, anthropometric measurements, biochemical profiles, radiographic findings, ECG patterns, troponin values, and echocardiographic interpretations. Patients were categorised into low, moderate, and high risk groups according to the HEART 2 scoring system, and the study protocol received approval from the Institutional Ethics Committee, with written informed consent obtained from all participants to ensure confidentiality and ethical compliance. Data entry was performed in Microsoft Excel and statistical analysis was carried out using IBM-SPSS Version 20.0. Descriptive statistics were expressed as proportions and percentages and represented using tables and graphical charts, while analytical tests such as Chi-square and t-test were applied according to the type of data, with a p-value of less than 0.05 considered statistically significant.

RESULTS

The study included 96 elderly patients presenting with chest pain, with the majority belonging to the 70–74-year age group (27.1%). Females constituted a higher proportion of participants (61.5%) compared to males (38.5%). The most frequently reported accompanying symptom was chest pressure, fullness, or tightness. Evaluation of lipid profile showed that most patients had desirable total cholesterol levels (<200 mg/dl, 88.5%), optimal LDL levels (<100 mg/dl, 69.8%), and low HDL levels (<40 mg/dl, 57.3%). BMI assessment revealed that 64.6% of the study population had normal body weight, while 32.3% were overweight. A significant proportion of participants had multiple cardiovascular risk factors, with 69.8% having three or more. Troponin

assessment demonstrated elevated levels in many patients, with 27.1% having values ≥3 times the normal range. ECG abnormalities were common, with ST segment elevation observed in 36.5% of patients, T wave inversion in 45.8%, and arrhythmias in 39.6%, of which atrial fibrillation was the most frequent (19.8%). Chest X-ray findings were predominantly normal (78.1%), with fewer cases showing emphysematous changes, cardiomegaly, or effusion. Echocardiography revealed regional wall motion abnormalities in 26.1% of patients and reduced ejection fraction in 22.9%, while most patients had normal atrial dimensions (85.4%) and normal left ventricular size (53.1%). Overall, echocardiography identified structural and functional cardiac changes in a considerable subset of elderly patients presenting with chest pain, supporting its diagnostic utility in this population.

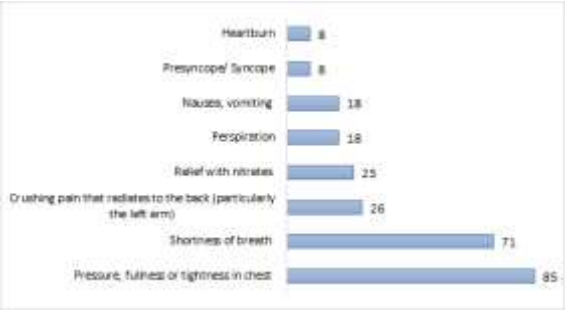

Figure 1: Symptoms Associated with Chest Pain (multiple responses)

Table 1: Distribution of Study Participants by Age (n=96)

Age group (years)	Frequency	Percentage (%)
60–64	16	16.7
65–69	21	21.9
70–74	26	27.1
75–79	21	21.9
≥80	12	12.5
Total	96	100.0

Table 2: Distribution by Sex (n=96)

Sex	Frequency	Percentage (%)
Female	59	61.5
Male	37	38.5
Total	96	100.0

Table 3: Total Cholesterol Levels (n=96)

Category	Level (mg/dl)	Frequency	Percentage (%)
Desirable	<200	85	88.5
Borderline high	200–239	10	10.4
High	≥240	1	1.0
Total	—	96	100.0

Table 4: LDL Cholesterol Levels (n=96)

Category	Level (mg/dl)	Frequency	Percentage (%)
Optimal	<100	67	69.8
Near/above optimal	100–129	21	21.9
Borderline high	130–159	5	5.2
High	160–189	3	3.1
Total	—	96	100.0

Table 5: HDL Cholesterol Levels (n=96)

Category	Level (mg/dl)	Frequency	Percentage (%)
Low	<40	55	57.3
Normal	40–59	39	40.6
High	≥60	2	2.1
Total	96	100.0	

Table 6: BMI Classification (n=96)

Category	Percentage (%)
Normal weight	64.6
Overweight	32.3
Obesity Class I	2.1
Underweight	1.0

Table 7: Risk Factors in Study Population (n=96)

Risk factor / history	Frequency	Percentage (%)
≥3 risk factors	67	69.8
1–2 risk factors	29	30.2
None	0	0
Total	96	100.0

Table 8: Troponin Levels (n=96)

Category	Frequency	Percentage (%)
≤ normal	47	49.0
1–3 × normal	23	24.0
≥3 × normal	26	27.1
Total	96	100.0

Table 9: ECG Abnormalities (n=96)

ST Segment Changes		
Type	**Frequency**	**Percentage (%)**
Depression	14	14.6
Elevation	35	36.5
Non-specific	8	7.3
Normal	35	36.5
T Wave Changes		
Type	**Frequency**	**Percentage (%)**
Inversion	44	45.8
Non-specific	8	8.3
Normal	44	45.8
Q Waves		
Presence	**Frequency**	**Percentage (%)**
Present	38	39.6
Absent	58	60.4
Arrhythmias		
Category	**Frequency**	**Percentage (%)**
Present	38	39.6
Absent	58	60.4

Table 10: Arrhythmia Types (n=96)

Arrhythmia type	Frequency	Percentage (%)
Atrial fibrillation	19	19.8
SVT	6	6.3
incomplete RBBB	3	3.1
VPC	2	2.1
Bradycardia	2	2.1
1st degree AV block	1	1.0
RBBB	1	1.0
Sinus bradycardia	1	1.0
VT	1	1.0
Artefact	1	1.0

Table 11: Chest X-ray Findings (n=96)

Finding	Frequency	Percentage (%)
Normal	75	78.1
Emphysematous changes	10	10.4
Cardiomegaly	8	8.3
Pleural effusion	3	3.1

Table 12: Echocardiography Findings (n=96)

RWMA		
Status	**Frequency**	**Percentage (%)**
Present	26	26.1
Absent	70	72.9
Ejection Fraction		
Status	**Frequency**	**Percentage (%)**
Normal	74	77.1
Decreased	22	22.9
Atrial dimensions		
Status	**Frequency**	**Percentage (%)**
Normal	82	85.4
Enlarged	8	8.3
Decreased	5	5.2
Collapse	1	1.0
LV dimensions		
Status	**Frequency**	**Percentage (%)**
Normal	51	53.1
Increased	38	39.6
Decreased	2	2.1

DISCUSSION

Despite being a common feature of every emergency/ medicine outpatient department, a detailed search of the available literature did not reveal any study looking into the reasons for emergency visits in the elderly due to chest pain.[16] The present descriptive cross-sectional study was undertaken to evaluate elderly patients with non-traumatic acute chest discomfort in the tertiary care hospital in Delhi, India. Ninety-six patients 60 years or above were enrolled in the study following a thorough work-up by the attending physicians. All patients received treatment based on the standard guidelines and institutional protocols.

Older patients are less likely to present with typical chest pain in a cardiac event or present with symptoms like nausea, fatigue, or delirium, leading to delayed or missed diagnosis of an AMI.[17] The National Registry of Myocardial Infarction (NRMI) showed that of elderly patients presenting with AMI only 40% complained none/ atypical chest pain. Since ischemic heart disease accounts for 81% of mortality in patients above the age of 65,[18] AMI should be the first diagnosis considered when an older adult presents for medical care with chest pain. However, overcaution sometimes results in the unnecessary admissions, investigations, occupancy of costly ICU beds and psychological distress for the patients.

Most patents in the study population were between 70–74 years (27.1%). Elderly patents attending an emergency medical service in Australia had a mean age of 61.8 years in the males and 61.4 years in the females.[19] Almost half of the patients in their study cohort belonged to ≥ 65 years age group in both males and females. There was a high prevalence of cardiac risk factors in the study cohort. Comparison with pooled international data from patients with ischaemic coronary heart disease enrolled in different trial registries showed far lower prevalence rates for an age-matched population.[20] A retrospective study of elderly frequent attenders presenting with chest pain at emergency department, by Zarisfi et al, reported hypertension in 92.4% compared to our cohort of 61.5%, dyslipidaemia 65.2% compared with 76%, diabetes 49.4% compared to 56.2%, and smoking 26.6% compared to tobacco use of 20.8% in our study group.[21,22] The higher prevalence of risk factors in the cohort described by Zarisfi et al, is probably because most patients in the cohort were over 75 years old, with four or more attendances to the ED.

The 2D echocardiography is a useful bedside tool that provides accurate anatomical and functional information about the cardiovascular system, especially the heart, and has become one of the most widely used tools for differentiating ischaemic from non-ischaemic cardiac disease.[23,24] With the development of smaller portable devices, echocardiography now plays a vital role in physicians for rapid diagnosis and management of patients with cardiac symptoms.[25]

Among cardiac causes of chest pain, ischaemic heart diseases are detected by the demonstration of regional wall motion abnormalities which indicate myocardial ischemia or infarction.[26,27] During an acute event, areas of hypokinesis, akinesis, or dyskinesis on 2D echocardiography can point to the affected myocardium. In the present study 25/26 (96.2%) cases on RWMA can be attributed to myocardial infarction/ angina, while 1/26 (3.8%) was seen in a patient with a final diagnosis of musculoskeletal chest pain. In the absence of a history of an acute myocardial event, the RWMA can be attributed to a previous inapparent/ atypical MI that has been missed. However, RWMA may be missed in case of mild ischemia or microvascular disease. Other diagnostic modalities like stress testing, nuclear imaging, or invasive coronary flow reserve assessment may be needed to detect ischemia in such cases.[13,28,29] Stress echocardiography enhances the detection of ischemia by revealing wall motion abnormalities induced by combining 2D echocardiography with stress induced by exercise or drugs.[30] For detecting transient wall motion abnormalities resulting from acute ischemia, the sensitivity of echocardiography diminishes the longer the time between resolution of chest pain and acquisition of the echocardiographic images.

Valvular heart disease, like aortic stenosis and mitral valve prolapse, can present with chest pain.[31,32] 2D echocardiography is effective in diagnosing and assessing the severity of valvular lesions, by visualizing the thickened, calcified valve leaflets and measuring increased transvalvular gradients. In mitral valve prolapse, echocardiography shows the prolapse of the mitral valve leaflets into the left atrium during systole. In the present study 2 patients with chest pain were diagnosed with aortic stenosis, 4 patients were diagnosed with AV calcification and 11 patients were diagnosed with Mitral regurgitation. Valvular stenosis reduces blood flow and puts strain on the heart. Valvular insufficiency or regurgitation also makes the heart work harder to compensate for backward flow.

Cardiomyopathies, such as hypertrophic cardiomyopathy (HCM) and dilated cardiomyopathy (DCM), are other cardiac causes of chest pain.[33-35] In HCM, 2D echocardiography reveals asymmetric septal hypertrophy and dynamic left ventricular outflow tract obstruction, which can contribute to chest pain. In DCM, it shows a dilated left ventricle with reduced systolic function, which may cause chest pain due to heart failure.

Although echocardiography cannot directly diagnose non-cardiac causes of chest pain, it can help rule out cardiac causes by showing normal cardiac structure and function,[36-39] thus steering the diagnostic focus towards a non-cardiac origin. Thus, physicians are more confident in diagnosing musculoskeletal disorders, including costochondritis and muscle strain, which remain common non-cardiac causes of

chest pain.[35] Gastrointestinal conditions, such as gastroesophageal reflux disease (GERD) and esophageal spasm, can mimic cardiac chest pain.

Levitt et al studied the effect of real-time 2D echocardiography on medical decision-making in the emergency department and demonstrated that physicians altered their diagnostic and treatment decisions in 37% of cases.[40] The study also determined that physician levels of confidence were significantly positively affected in 50% of patients by having the availability of real-time echocardiography results.

In the present study cardiac causes of chest pain (ischaemic and/or non-ischaemic) were seen in 67/96 (69.8%) of study population. Of these 44/67 (65.6%) were seen in high-risk patients, 11/67 (16.7%) in moderate risk patients and 12/67 (17.9%) in low-risk patients according to HEART 2 scoring. In a study on 250 consecutive patients between 18 and 80 years admitted with chest pain in a tertiary care hospital in Saudi Arabia, Mahmoud MZ used the HEART 2 score to divide patients into three groups.[41,42] The findings were slightly different from the present study probably due to the different age distribution of the two populations.

In their study, Mahmoud MZ reported a sensitivity of 85.86%, specificity of 100%, and PPV of 100% for detecting causes of chest pain with 2D transtracheal echocardiography.[40] Kontos et al reported that the sensitivity of echocardiography for predicting cardiac events was 91% and specificity was 75%.[6]

In the present study conventional echocardiography was done. The study reported a sensitivity of 80.5%, specificity of 72.4%, PPV of 87.1% and NPV of 39.4%. The reasons for the lower values could be differences in technique and age demographics. Aging has been associated with alterations in echocardiographic parameters.[44]

CONCLUSION

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