ORIGINAL ARTICLE

MYOCARDIAL INFARCTION AMONG HOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA: A RETROSPECTIVE OBSERVATIONAL STUDY

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Background: Pneumonia combined with influenza is a leading cause of death worldwide. There is an increased risk of acute myocardial infarction in patients with respiratory tract infection during hospitalization and after discharge. This study aimed to determine the frequency of myocardial infarction (MI) in hospitalized patients with community acquired pneumonia (CAP). **Methods:** A retrospective observational study was conducted at a tertiary care hospital in Islamabad, Pakistan. A total of 209 adult patients admitted from May 2018 to Dec 2020 with primary diagnosis of CAP were identified using local ICD code. Paper chart review for clinical parameters including symptoms, laboratory values, and radiological findings was performed. Severity of pneumonia was determined using CURB-65 score. Acute MI was diagnosed on elevated troponin and electrocardiogram findings. Univariate and multivariable analyses was performed for risk factors, co-morbidities, demographics, CAP severity at the time of admission, lab values and radiological findings and $p<0.05$ was considered statistically significant. **Results:** Males were 121 (58%) and females were 88 (42%) in the study. Incidence of acute MI in CAP patients was 10.52%. Only one patient experienced ST-elevation myocardial infarction (STEMI); the rest had non-ST-elevation myocardial infarction (NSTEMI). There was significant association between MI and history of ischemic heart diseases, angina, cardiomyopathy, acute kidney injury and pulmonary oedema ($p\leq0.05$). A significant increase in trend of acute MI was observed across the CURB-65 scores. **Conclusion:** The incidence of acute MI among hospitalized patients with CAP was 10.52%. Early recognition and prompt treatment will improve outcomes.

Keywords: Community-Acquired Pneumonia, Acute Myocardial Infarction, Ischemic heart diseases, CURB-65

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INTRODUCTION

Globally, pneumonia is the third leading cause of death and is associated with several complications such as pleurisy, empyema, and lung abscess.[1] The current literature has reported an increased risk of major adverse cardiovascular events, such as acute myocardial infarction (MI), in patients suffering from respiratory tract infection[2] both during hospitalization and after discharge, and this is associated with increased short-term mortality[3]. Any acute inflammatory state, including Community Acquired Pneumonia (CAP) can contribute in acute worsening in pre-existing cardiac conditions and can trigger new cardiac events.[4]

Musher *et al*[5] were the first to report this association, as 12 (7%) out of 170 had acute MI with pneumococcal pneumonia at the time of hospital admission. Acute cardiac events are more frequently reported in patients admitted to hospital with diagnosis of pneumonia and are associated with a worse prognosis.[3] Since MI and CAP can present with similar symptoms (for example shortness of breath, palpitations, and chest pain) this can potentially mask underlying acute MI.[5]

A recent meta-analysis[6] based on a global perspective of cardiovascular complications after CAP revealed the incidence of cardiovascular complications in 13.9% of patients admitted with CAP. That updated systematic review and meta-analysis, encompassing 92,188 patients, reported that cardiovascular complications such as acute coronary syndrome (ACS), new or worsening heart failure, new or worsening arrhythmias, and acute stroke are commonly seen among patients admitted with CAP. In patient with coronary artery disease (CAD), the risk of acute MI is reported to be correlated with the severity of pneumonia.[6] Scarce data is available to assess the prevalence of acute MI in patients admitted with CAP in local population of Pakistan. This study was done to determine the incidence and risk factors for acute MI among hospitalized patients with CAP in north western region of Pakistan.

METHODS AND MATERIAL

This was a cross-sectional, observational, retrospective study conducted on adult patients admitted with a diagnosis of CAP from May 2018 to Dec 2020 in a

large tertiary care centre. This study was approved by the Institutional Review Board of Shifa International Hospital, Islamabad.

All adult patients of age 18 years and old, admitted with principal diagnosis of CAP were identified using hospital discharge database code. Retrospective chart review was done independently. Patients with pertinent findings of pneumonia on chest X-Ray (presence of reticulonodular opacities or lobar consolidation) were selected for the study. Patients with history of frequent visits to healthcare facilities, who received intravenous antibiotics in last 3 months, or developed pneumonia after 48 hours of hospitalization were excluded from the study. Patients with normal X-Ray, with neutropenia (<2,000/mm^3), on chemotherapy, or who had leukaemia/lymphoma were also excluded from the study.

Demographic features (such as age, gender, co-morbid medical conditions), risk factors (history of Diabetes Mellitus (DM), Hypertension (HTN), smoking, Chronic obstructive pulmonary disease (COPD), asthma, presence of angina, CAD, prior history of percutaneous intervention (PCI) or coronary artery bypass graft (CABG), baseline ejection fraction (EF), clinical parameters (including presence of fever, cough, shortness of breath, chest pain, altered level of consciousness) and laboratory variables, presence of acute kidney injury (AKI), radiographic findings (Pleural effusion, lung collapse and/or pulmonary oedema), electrocardiogram findings (new ST-segment elevation or depression, T-wave inversions, or no new change), CURB-65 score and presence of acute MI (at the time of hospital admission or during the hospital stay in the first 3 days) were assessed.

CAP was defined as presence of cough with associated chest X-Ray findings suggestive of Pneumonia. The severity of CAP was categorized as low risk with a (CURB score of 0 or 1), intermediate risk (CURB score of 2), and high risk (CURB score ≥3).

Acute MI was defined as the development of chest pain or palpitation or dyspnoea, along with ST-elevation or depression of at least 1 mm in 2 consecutive leads on electrocardiogram (EKG), the development of pathological Q-waves or observation of new left bundle branch block (LBBB) on EKG with or without positive cardiac enzymes (CKMB >3.4 ng/ml in females and >7.2 ng/ml in males, and raised troponin-I level >15.6 ng/ml in females and >34.2 ng/ml in males), or echocardiographic evidence of new regional wall abnormality or hypokinesia. Acute MI in the form of either ST-elevation myocardial infarction (STEMI) or non-ST-elevation myocardial infarction (NSTEMI) was diagnosed and affirmed by a certified cardiologist/ critical care consultant.

A sample size of 205 patients was calculated according to the WHO calculator[7], using a 95% confidence level, 7% anticipated population proportion, and 3.5% absolute precision. A total of 209 patients were finally included to adjust for missing data.

Data were analysed on SPSS-24. Effect modifications of presence of MI in patients admitted with CAP was obtained against the risk factors, including age, gender, comorbid conditions (DM, HTN, COPD, asthma) and risk factors for CAD (smoking, history of angina, history of PCI including CABG and presence of cardiomyopathy) were controlled by stratification. Post-stratification Pearson Chi-square test was applied and $p<0.05$ was considered significant.

RESULTS

Out of the 209 patients, 121 (58%) were males. The Mean±SD age of presentation was 66±14 years. At the time of hospital admission, acute MI was present in 22 (10.52%) patients with severe CAP. Among these patients, only one patient experienced STEMI. Chest pain was present in 33% of the patients with CAP, while fever (73%), cough (83%), and shortness of breath (84%) was also seen in of patients. HTN was the most common comorbid condition (59%), followed by DM (51%). Although asthma and COPD was not frequently observed in the patients, cardiomyopathy was found in 29% of the patients.

Baseline demographics, cardiac status, co-morbidities, symptoms, and clinical findings of the patients at the time of admission are outlined in Table-1 while radiological features and pneumonia severity scores (CURB-65) are illustrated in Table-2.

Our study did not show any gender-related difference in the prevalence of co-morbid conditions, symptoms, or complications such as acute kidney injury (AKI), except for smoking (Table-3).

Table-1: Baseline characteristics of patients admitted with community-acquired pneumonia (n=209)

Baseline Characteristics	Frequency	Percentage
Hypertension	124	59.3
Diabetes Mellitus	108	51.0
COPD	27	12.9
Asthma	41	19.6
Cardiomyopathy	49	29.0
History of angina	43	20.0
Smoking	52	24.8
History of PCI	20	9.6
History of CABG	12	5.8
Chest pain	70	33.0
Shortness of breath	177	84.0
Cough	182	87.0
Fever	155	73.0
ALOC	70	32.0
AKI	97	46.0

COPD: Chronic obstructive pulmonary disease; PCI: Percutaneous coronary intervention; CABG: Coronary artery bypass graft; ALOC: Altered level of consciousness; AKI: Acute kidney injury

Table-2: Radiological presentation and CURB-65 score of patients admitted with community-acquired pneumonia (n=209)

	Frequency	Percentage
Radiological presentation		
Collapse	7	3.3
Effusion	38	18.0
Pulmonary oedema	39	19.0
CURB-65 score		
I	59	30.0
II	68	32.0
III	45	21.0
IV	18	8.0
V	4	1.0

Table-3: Baseline characteristics of the patients with respect to gender

Baseline characteristics	Male (n=121)	Female (n=88)	*p*
Age (Years)	66	63	0.14
Hypertension	60	62	0.02
Diabetes Mellitus	54	45	0.2
COPD	29	9	0.4
Asthma	21	25	0.33
History of Angina	32	27	0.2
Cardiomyopathy	31	16	0.2
Smoking	44	14	0.000
AKI	67	44	0.72

COPD: Chronic obstructive pulmonary disease; AKI: Acute kidney injury

Our study revealed the incidence of acute MI in 10.52% of the patients admitted with CAP. Clinical features such as chest pain (50%), premorbid conditions such as a history of ischemic heart diseases (50%), and radiologic presence of pulmonary oedema (63%) suggest the presence of underlying MI. A significant correlation was seen between the acute MI and a history of ischemic heart diseases, angina, cardiomyopathy, the presence of AKI, and pulmonary oedema ($p \leq 0.05$). Characterization of pneumonia patient with respect to presence or absence of acute MI are summarized in Table-4.

Table-4: Co-morbid conditions and clinical and radiographic features of patients in the presence or absence of myocardial infarction

Clinical features	MI present (n=22)	MI absent (n=187)	*p*
Diabetes mellitus	13	86	0.26
Hypertension	15	108	0.52
COPD	4	24	0.7
Asthma	4	35	0.56
Cardiomyopathy	18	30	0.000
Smoking	8	43	0.34
History of angina	11	32	0.001
History of PCI	6	13	0.03
History of CABG	2	9	0.9
Shortness of breath	21	151	0.11
Chest pain	11	37	0.004
Pulmonary oedema	14	24	0.000
Presence of AKI	18	93	0.014

COPD: Chronic obstructive pulmonary disease; PCI: percutaneous coronary intervention; CABG: Coronary artery bypass graft; AKI: Acute kidney injury

DISCUSSION

CAP is the most common infectious disease-related cause of death worldwide.[1] Majority of patients who present to the hospital with CAP in the United States have pre-existing chronic cardiac conditions[8], and with advancing age, this association becomes more significant[9]. Acute inflammatory states including CAP, can affect cardiovascular system in numerous ways sand has been recognized as precipitant of acute cardiac events.[10] This is also relevant especially for incidences of heart failure and ACS since their symptoms can overlap with those of CAP and other associated conditions (e.g., Acute lung injury/ARDS). A meta-analysis of large pool of studies[3] revealed the incidence of overall cardiac complications, including heart failure, ACS, and incident arrhythmias in hospitalized patients with CAP as 17.7%, 14.1%, 5.3%, and 4.7% respectively.

Acute infections like CAP can trigger life threatening cardiac complication by multitude of different mechanisms.[11] One proposed patho-physiological phenomenon is induction of biomechanical stress as result of increased sympathetic activity and other haemodynamic changes (Alteration of circulatory volume and systemic coronary vascular tone), prompting plaque rupture.[11,12] Pre-existing CAD that is insufficient to produce myocardial ischemia under baseline condition can also results in significant ischemia in setting of increased myocardial oxygen demand, especially in the first few days after CAP diagnosis.[13] In the light of above facts, high frequency of MI (10%) in our sample can be justified.

Studies have suggested the association of cardiac complications in CAP with development of other medical conditions including acute renal failure, respiratory failure and shock.[14] We found that AKI is more prevalent in the patient population with acute MI, streamlined with other studies.[4,15]

Regarding predicting factors for MI, a study by Aliberti *et al*[15] reported severe sepsis and a previous history of liver disease as a strongest association with this condition. In contrast to that study, our study found a prior history of cardiomyopathy to be the strongest predictor of acute MI ($p<0.000$). Moreover, in symptoms, we found chest pain to be a depicting marker for acute MI in CAP.

It has been proposed that vaccination against respiratory infections in patients with established cardiovascular disease could serve as potentially cost-effective intervention to improve their clinical outcomes.[10,15,16] Limited evidence has been available to establish weather influenza vaccination has a role to play in primary prevention of CAD.[17] Nevertheless, the potential benefits in high-risk CAD populations is reflected in current recommendations. According to World Health Organization, influenza vaccination aims

primarily at protecting against severe pneumonia specially in vulnerable high-risk groups, including those of advance age, or with severe chronic illness.[18]

LIMITATIONS

Due to the retrospective design of the study, some variables could not be extracted from medical records. Beta Natriuretic Peptide was included in our analysis, and was not available for all patients. Patient did not have PSI score calculated which is the most used scale for the assessment of pneumonia. This study was conducted in a single hospital serving in urban area. It would be interesting to extend these observations in a large and multicentre sample.

CONCLUSION & RECOMMENDATIONS

Our study reports higher incidence (10%) of acute MI in hospitalized patients with CAP. Strategies should be employed to recognize MI early in the course of CAP to improve clinical outcomes. These can be introduction of clinical scoring system, biomarker-based approaches, non-invasive cardiac imaging, or a combination of the above. Emphasis on vaccination as an inexpensive and safe intervention which may become a first-line strategy for prevention of avoidable infections and their cardiovascular complications. There is urgent need to divert research and systemic efforts towards this area to reduce the continuing high mortality from CAP. Further studies and randomized control trial are required for better risk stratification and guidelines development.

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Contribution of Authors

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FM: Data collection
ZZ: Statistical analysis
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