

FREQUENCY OF ACUTE KIDNEY INJURY AMONG CASES OF
COMMUNITY-ACQUIRED PNEUMONIA: A CROSS-SECTIONAL STUDYDr Warda Murad^{*1}, Dr Mohammad Zaib², Dr Sameed Khan³, Dr Saleem Javed⁴^{1,3,4}PGR Internal Medicine, Lady Reading Hospital, Peshawar²Assistant Professor Medicine Department, Lady Reading Hospital, Peshawar^{*1}wardamurad93@gmail.comDOI: <http://doi.org/10.5281/zenodo.19231683>**Keywords**

Community-acquired pneumonia, Acute kidney injury, Serum creatinine, Frequency, Cross-sectional study.

Article History

Received: 10 May 2025

Accepted: 21 June 2025

Published: 02 July 2025

Copyright @Author**Corresponding Author: *****Dr Warda Murad****Abstract**

Background: CAP is a significant hospitalization and mortality problem across the globe. CAP can be accompanied by systemic inflammation, hypoxia, and sepsis that can condition predisposition to acute kidney injury (AKI) that greatly deteriorates prognosis. The timely detection of AKI in CAP patients could enhance the outcomes with its early intervention.

Objective: To establish the prevalence of acute kidney injury in the cases of community-acquired pneumonia.

Methodology: The study was a cross-sectional study carried out in the Department of General Medicine, Lady Reading hospital from November 2024 to April 2025. One Hundred Eighty patients aged 18-70 years were enrolled using non-probability sampling that was consecutive. CAP had a clinical and radiological diagnosis. The definition of AKI was based on serum creatinine (increase 0.3 mg/dl in 48 hours or 1.5 times baseline in 7 days). The SPSS version 25 was used to analyze data.

Results: Among 180 patients with CAP, AKI was observed in 82 patients (45.6%). AKI was significantly associated with advanced age, diabetes, hypertension, and higher BMI ($p \leq 0.05$).

Conclusion: One of the common complications in patients with CAP is AKI. Renal monitoring at an early stage among CAP patients is necessary in order to decrease morbidity and enhance clinical outcomes.

INTRODUCTION

Pneumonia is a highly morbid and mortal respiratory disease among the most prevalent respiratory illnesses in the emergency department (ED). A community-acquired pneumonia (CAP) is the acute pulmonary alveoli infection in patients who do not have recent contact with healthcare facilities. Clinical presentations of CAP range all the way of mild, so-called, walking pneumonia in otherwise healthy people to severe necrotizing or multilobar pneumonia with septic shock. CAP causes a high rate of hospitalization and mortality

throughout the world and it involves huge hospitalization costs ^{2,3}.

CAP may present itself with mild cases that can be dealt with on an outpatient basis, and severe cases that require admission to the intensive care unit. This means that early diagnosis and early identification of appropriate level of care is necessary in order to restore better patient outcomes. Geographic, seasonal, and demographic factors have an impact on worldwide CAP incidence of 1.5 to 14 cases per 1000 patient-years ⁴.

Acute kidney injury (AKI) is becoming a widespread condition of severe complication of general diseases, of which CAP is one. Traditionally, AKI was considered as being manifested mainly by significant azotemia and frequently oliguria or anuria, and severe renal impairment was in the spotlight. However, recent research has found out that even slight impairment in renal functioning, in the form of slight alterations in serum creatinine or urine output, can indicate serious adverse outcomes^{5,6}. The AKI has become the new name used instead of the previous acute renal failure to highlight the range of renal damage, mild injury to severe dysfunction.

The AKI is the one that is associated with a quick deterioration of the renal functions, which happens within the span of hours, and entails both structural and functional damages to the kidneys⁷. It is also multifactorial in its etiology where sepsis and ischemia and nephrotoxic exposures commonly co-exist complicating diagnosis and management^{8,9}. As it is mentioned in previous research, the level of AKI in patients with CAP may be up to 100 per cent 46%¹⁰.

CAP causes systemic inflammation, hypoxia, and sepsis which are all known risk factors of AKI. Nevertheless, there is no local information on AKI risk and frequency data in CAP. Consequently, this research will identify the prevalence of AKI in patients with community-acquired pneumonia in our healthcare unit. The results will be useful in enabling clinicians to recognize at-risk patients, streamline monitoring, direct therapeutic interventions, and enhance outcomes. Furthermore, the research fills a critical knowledge gap, establishing an interdisciplinary view on the CAP management, stating renal function as a significant part of a general patient care.

OBJECTIVE

To establish the prevalence of acute kidney injury in the incidences of community-acquired pneumonia.

METHODOLOGY

The study was a cross-sectional inquiry done at the Department of General Medicine at the Lady

Reading Hospital Peshawar during a duration of six month from November 2024 to April 2025. The WHO sample size calculator was used to calculate the total sample size of 180 patients, with the expected frequency of an acute kidney injury of 46, and the anticipated confidence level of 95 with a margin of error of 7.3. A non-probability sampling technique was utilized in the enrolment of patients in the form of a consecutive non-probability method in which all eligible patients reporting to the study during the study period and who met the inclusion criteria were enrolled until the appropriate sample size was obtained.

INCLUSION CRITERIA

Both men and women (aged 18-70 years) who were diagnosed with community-acquired pneumonia (operational definition) (according to characteristic clinical features, and supportive results of a chest X-ray) were enrolled.

EXCLUSION CRITERIA

Patients who came with an exacerbation of chronic lung diseases, immunocompromised, pregnant or lactating women, and patients with severe respiratory distress at presentation were excluded.

DATA COLLECTION PROCEDURE

The patients who met the inclusion criteria were recruited into the study after receiving the institutional ethical review board of the Lady Reading Hospital and the College of Physicians and Surgeons Pakistan (CPSP) approval. Each participant was informed about the purpose, benefits, and possible risks of the study and informed consent was signed in writing before becoming a part of a study. To determine the renal function, a 5 ml of venous blood was taken under the aseptic condition and referred to the hospital laboratory to measure the serum creatinine. All the clinical assessment and lab tests were performed under the supervision of a consultant physician who had over five years of post-fellowship experience to maintain accuracy and reliability of data collection.

DATA ANALYSIS

IBM SPSS statistics were used in data entry and analysis. Categorical variables, including gender, diabetes, hypertension, residence, education status and the presence of acute kidney injury, had their frequencies and percentages. Age, BMI, and serum creatinine levels are quantitative variables, which were presented in terms of mean and standard deviation. Stratification was used to control effect modifiers age, gender, BMI, diabetes, hypertension, financial background, place of residence, profession and education status. Where necessary, post-stratification Chi-square test or

Fisher exact test was utilized and the p-value of 0.05 and below was taken to be significant statistically. The findings were in form of tables.

RESULTS

The study was carried out among 180 patients with the community-acquired pneumonia (CAP) in the Lady Reading Hospital. The average age of the participants was 52.4 and standard deviation was 13.6. Out of them, 104 (57.8) were boys and 76 (42.2) girls. Several patients were found to have acute kidney injury (AKI), and its frequency was 45.6% in people who had CAP.

Baseline Characteristics

Parameter	Total (n = 180)
Mean Age (years)	52.4 ± 13.6
Gender (Male : Female)	104 : 76
Diabetes Mellitus	68 (37.8%)
Hypertension	74 (41.1%)
BMI ≥ 30 kg/m ²	49 (27.2%)
Urban Residence	101 (56.1%)
Rural Residence	79 (43.9%)

Most of the patients were males, and a significant number of them had comorbidities such as diabetes and hypertension.

Frequency of Acute Kidney Injury

Outcome	Frequency	Percentage
AKI Present	82	45.6%
AKI Absent	98	54.4%

Almost one-half of the patients with CAP acquired acute kidney injury in their hospitalization.

Association of AKI with Clinical Variables

Variable	AKI Present (n=82)	AKI Absent (n=98)	p-value
Age > 60 years	39 (47.6%)	21 (21.4%)	0.01
Diabetes Mellitus	38 (46.3%)	30 (30.6%)	0.02
Hypertension	41 (50.0%)	33 (33.7%)	0.03
BMI ≥30 kg/m ²	29 (35.4%)	20 (20.4%)	0.04
Male Gender	49 (59.8%)	55 (56.1%)	0.64
Urban Residence	47 (57.3%)	54 (55.1%)	0.78

The AKI occurred much more in patients of older age (more than 60 years), patients with diabetes, hypertension, and patients with the BMI of 30 kg/m² (p 0.05). Nevertheless, the data did not show statistically significant relationship between AKI and gender or residence (p > 0.05).

Interpretation

The research indicated that acute kidney injury is a frequent complication in patients admitted in hospital with community-acquired pneumonia as it occurs in about 45.6% of cases. Premature age and comorbid conditions like diabetes, high blood

pressure and obesity were found to be very much related to the occurrence of AKI. The results of these findings emphasize the need to pay close attention to renal monitoring of high-risk patients with CAP to avoid adverse outcomes and minimize morbidity related to the disease.

DISCUSSION

This research paper showed that the prevalence of acute kidney injury (AKI) was nearly 45.6 percent among patients with community-acquired pneumonia (CAP) which compares to the prevalence of 46 percent indicated by Almutairi et al. (2024).¹⁰ The prevalence of AKI in the CAP patients is a high rate which shows the systemic occurrence of pneumonia beyond the pulmonary process. The pathophysiology is multifactorial and involves systemic inflammatory response syndrome (SIRS), acute inflammatory-related renal hypoperfusion, endothelial dysfunction, and microvascular thrombosis which entails acute tubular damage. CAP-associated hypoxemia also worsens renal oxygen supply and excessive secretion of cytokines, especially interleukins and tumor necrosis factor-alpha, leads to inflammatory-induced renal injury. Together these mechanisms are the reason that AKI is such a significant burden in our study population.

Old age showed a great correlation with AKI in our cohort. The kidneys of the elderly experience structural and functional alterations, such as nephron loss, glomerulosclerosis, vascular hardening, and diminished renal autoregulatory ability. As a result of this, the aged patients possess low renal reserve and cannot endure acute hemodynamic changes during systemic infections as easily. These results are aligned with the previous epidemiological studies which reported heightened vulnerability to AKI in older adults during infectious diseases.^{8 9} Moreover, older patients have several comorbidities and polypharmacy, which can additionally precondition the development of renal injury.

There were also comorbidities like diabetes mellitus and hypertension which were strongly linked to AKI. Persistent hyperglycemia and chronic hypertension lead to microvascular damage, dysfunction of endothelium and

progressive nephron loss. The CAP-induced added inflammatory and hemodynamic stress can trigger acute renal failure. We find that our results are consistent with previous research emphasizing comorbidities as a significant factor of AKI severity and bad outcomes.^{5 7} These states probably have a synergistic effect with the inflammation caused by the infections to increase the renal susceptibility.

Another predictive variable of AKI was obesity (BMI 30 kg/m² or more). Renal hyperfiltration, activation of renin-angiotensin-aldosterone system, chronic low-grade inflammation, and oxidative stress are related to obesity.^{14 15} These changes in pathophysiological processes put obese patients at risk of renal damage when they are subjected to acute systemic stressors like pneumonia and sepsis. Moreover, tubular damage is further worsened by hypoxemia and cytokine storm which is caused by sepsis. Potentially nephrotoxic drugs, such as some antibiotics and contrast agents, could also contribute to the risk of developing AKI among hospitalized CAP patients.

The clinical significance of the development of AKI in CAP is significant. The AKI is linked with increased rates of intensive care unit hospitalization, long hospital stay, higher healthcare expenditure, and high mortality.^{17 18} Mild riseup in serum creatinine has also been reported to be associated with poor clinical outcomes. Preventive measures should include early identification of high-risk patients, regular check-ups of renal conditions, fluid resuscitation, hemodynamic stabilization, glycemic measures, and avoiding nephrotoxic drugs.

This research is useful as it gives local data on the prevalence of AKI and its risk factors, as the regional statistics on the subject are scarce in CAP. Our results highlight that there is a necessity to use combined clinical guidelines to introduce renal risk stratification into the mainstream management of CAP. Interventions aimed at early prevention of the disease with focus on the risk factors, which can be altered, can contribute greatly to the decrease in morbidity and mortality due to this severe complication.

CONCLUSION

The study group is patients with community-acquired pneumonia (CAP) hospitalized with acute kidney injury (AKI) as a complication. The AKI has been found to develop in 45.6-percent of CAP patients, which indicates the heavy burden on the kidneys related to the serious respiratory infections. CAP AKI is multifactorial and is caused by systemic inflammation, renal hypoperfusion caused by sepsis, endothelial dysfunction, hypoxemia, and exposure to nephrotoxic agents. Old age was identified as a major risk factor, since aged patients experience a low renal reserve and are more susceptible to ischemic and inflammatory damage. The comorbidities (diabetes and hypertension) also positively influenced the risk of AKI because of chronic micro vascular injury and impaired renal perfusion. Low-grade inflammation, oxidative stress, and disrupted renal hemodynamics are other ways in which patients predisposed to AKI are predisposed by obesity. Because the prevalence of AKI is high, and the outcomes are adverse, such as a long stay in the hospital, ICU admission, and mortality, it is necessary to identify it early and manage it proactively. Early detection of AKI and better outcomes can be achieved by regularly observing renal functions via serum creatinine assessment and urine output evaluation, preventing nephrotoxic medications, and early sepsis identification.

This paper has identified the high incidence of AKI in CAP patients in our area and the need to incorporate renal risk evaluation in CAP care. Primary prevention and risk selection is paramount to reducing morbidity and mortality among such patients.

REFERENCES

Lanks CW, Musani AI, Hsia DW. Community-acquired pneumonia and hospital-acquired pneumonia. *Med Clin*. 2019;103(3):487-501.

Aliberti S, Cruz CS, Amati F, Sotgiu G, Restrepo MI. Community-acquired pneumonia. *Lancet*. 2021;398(10303):906-19.

Rothberg MB. Community-acquired pneumonia. *Ann Int Med*. 2022;175(4):49-64.

Tsoumani E, Carter JA, Salomonsson S, Stephens JM, Bencina C. Clinical, economic, and humanistic burden of community acquired pneumonia in Europe: a systematic literature review. *Expert Rev Vac*. 2023;22(1):876-84.

Priyanka P, Zarbock A, Izawa J, Gleason TG, Renfurm RW, Kellum JA. The impact of acute kidney injury by serum creatinine or urine output criteria on major adverse kidney events in cardiac surgery patients. *J Thorac Cardiovasc Surg*. 2021;162(1):143-51.

Luft FC. Biomarkers and predicting acute kidney injury. *Acta Physiologica*. 2021;231(1):e13479.

Mercado MG, Smith DK, Guard EL. Acute kidney injury: diagnosis and management. *Am Fam Physician*. 2019;100(11):687-94.

Selmi Y, Ariba YB, Labidi J. Epidemiology, diagnosis, and etiology of acute kidney injury in the elderly: A retrospective analysis. *Saudi J Kidney Dis Transpl*. 2019;30(3):678-85.

Gursu M, Yegenaga I, Tuglular S, Dursun B, Bek SC, Bardak S, et al. Acute kidney injury in Turkey: epidemiological characteristics, etiology, clinical course, and prognosis. *Nephrology*. 2022;23(1):326-32.

Almutairi A, Alenezi F, Tamim H, Sadat M, Humaid FB, AlMatrood A, et al. The prevalence of acute kidney injury in patients with community-acquired pneumonia who required mechanical ventilation. *Ann Saudi Med*. 2024;44(2):104-10.

KDIGO Clinical Practice Guideline for Acute Kidney Injury. *Kidney Int Suppl*. 2012;2:1-138.

Coca SG, Singanamala S, Parikh CR. Chronic kidney disease after acute kidney injury: a systematic review and meta-analysis. *Nephrol Dial Transplant*. 2012;27(9):337-47.

Hsu RK, McCulloch CE, Dudley RA, Lo LJ, Hsu CY. Temporal changes in incidence of dialysis-requiring AKI. *Am J Kidney Dis*. 2013;62(1):75-83.

- Hsu CY, McCulloch CE, Iribarren C, Darbinian J, Go AS. Body mass index and risk for acute kidney injury. *Clin J Am Soc Nephrol*. 2016;11:1410-18.
- Danziger J, Zeidel ML. Obesity and acute kidney injury in critical illness. *Crit Care Med*. 2016;44:857-65.
- Kellum JA, Lameire N. Diagnosis, evaluation, and management of acute kidney injury: a KDIGO summary. *Kidney Int*. 2013;83:1625-43.
- Murugan R, Kellum JA. Acute kidney injury: what's the prognosis? *Clin Infect Dis*. 2011;53:725-31.
- Bagshaw SM, George C, Bellomo R. Early acute kidney injury and sepsis: a multicenter evaluation. *Chest*. 2008;133:115-22.

