

CASE REPORT : IMPACT OF PNEUMONIA IN HEART FAILURE

Suzette Daniel¹, Devina Sagitania^{2*}, Laras Candysa Putri Hannifa³

General Practitioner, RSUD Leona Kefamenanu, Timor Tengah Utara^{1,2}

General Practitioner, RSUD Kelas D Teluk Pucung, Bekasi, Jawa Barat^{1,2}

General Practitioner, RSUD Johar Baru, Jakarta Pusat, Indonesia³

*Corresponding Author : dsagitania17@gmail.com

ABSTRAK

Gagal Jantung Dekompensasi Akut (ADHF) merupakan penyebab terbanyak rawat inap terutama terkait dengan pneumonia. Pneumonia mungkin menjadi salah satu faktor pencetus yang meningkatkan risiko kematian pada pasien gagal jantung. Seorang wanita berusia 85 tahun mengeluh sesak napas yang berangsur-angsur memburuk dalam 1 hari. Dia menderita batuk produktif dan bengkak di kaki selama 2 minggu. Dia mempunyai riwayat hipertensi. Pada pemeriksaan fisik : TD 150/80 mmHg, HR 102 bpm regular, RR 24x/menit, udara bebas SpO₂ 89%, JVP meningkat, ronki pada auskultasi paru tengah dan bawah, serta terdapat pitting edema pada kedua tungkai. Foto rontgen dada : pneumonia dextra, dan kardiomegali. Elektrokardiografi: sinus takikardia dengan PVC multifokal dan hipertrofi ventrikel kiri batas. Infeksi saluran pernafasan merupakan faktor yang paling memicu terjadinya gagal jantung akut (AHF), karena dapat meningkatkan kebutuhan miokard dan mengaktifkan sistem renin-angiotensin-aldosteron dan sistem saraf simpatis. Pasien gagal jantung (HF) yang disertai pneumonia dapat meningkatkan risiko prognosis yang lebih buruk. Diagnosis dini dan penatalaksanaan optimal pada pasien gagal jantung dengan pneumonia penting untuk meminimalkan outcome buruk.

Kata kunci : gagal jantung, pneumonia, risiko kematian

ABSTRACT

Acute Decompensated Heart Failure (ADHF) is the most common cause of hospitalization mainly associated with pneumonia. Pneumonia might be one of the precipitating factors that increase the risk of mortality in heart failure patients. An 85-year-old woman complained about shortness of breath that gradually worsened in 1 day. She had a productive cough and swelling in the legs for 2 weeks. She has a history of hypertension. On physical examination: BP 150/80 mmHg, HR 102 bpm regular, RR 24x/minute, SpO₂ 89% free air, increased JVP, rhonchi on auscultation in both middle and low lungs, and had pitting edema in both legs. X-ray thorax: pneumonia dextra, and cardiomegaly. Electrocardiography: sinus tachycardia with multifocal PVC and borderline left ventricular hypertrophy. Respiratory infection is the most precipitating factor in acute heart failure (AHF), because it may increase myocardial demand and activate the renin-angiotensin-aldosterone system and sympathetic nervous system. Heart failure (HF) patients concomitant with pneumonia may increase the risk of a worse prognosis. The early diagnosis and optimal management of HF patients with pneumonia is important to minimize the poor outcome.

Keywords : heart failure, pneumonia, mortality risk

INTRODUCTION

Cardiovascular diseases and pneumonia stand as predominant factors contributing to illness and death worldwide. Heart failure (HF) has emerged as a significant challenge for communities worldwide, attributable to the financial strain of care, diminished quality of life, and premature mortality among those affected. Heart failure (HF) can be known as a clinical condition characterized by a structural or functional limitation in the heart's ability to efficiently fill with or pump out blood. Some symptoms of heart failure are shortness of breath, fluid retention, and a limitation of exercise tolerance. Hospital admission due to heart failure can be correlated with the level of morbidity and mortality. The most common risk of

mortality in HF patients is infection, previous studies have shown that pneumonia is associated with worsening HF in patients who are hospitalized. The worsening of HF may be the previously stable chronic HF, namely Acute Decompensated Heart Failure (ADHF) or new onset heart failure which causes hospitalization^{2,3}. Respiratory infection also emerged as a prominent factor precipitating Acute Decompensated Heart Failure (ADHF) in 15% to 29% of cases, as evidenced by large registries. Moreover, it was independently correlated with in-hospital mortality in many analyses.

Heart failure (HF) may also be a predisposing factor for pneumonia, both pneumonia and HF can precipitate each other, among patients hospitalized for pneumonia, more than one in three has HF, and acute HF exacerbation cause is a respiratory illness. Identifying pneumonia can be difficult in patients admitted for acute decompensated heart failure (ADHF) since symptoms like shortness of breath and crackling sounds (rales) are common to both heart failure and pneumonia. Therefore, it's crucial to make an immediate and precise diagnosis since a failure to diagnose or a delay in treatment can have harmful consequences for patients. Pneumonia is typically identified through clinical signs indicative of a sudden infection in the lower respiratory tract and observable infiltrations on a chest X-ray.

The global occurrence of community-acquired pneumonia is estimated to range from 1.5 to 14 cases per 1000 person-years, with variations influenced by factors such as geography, seasonality, and population demographics. Over half of the elderly patients who are admitted to the hospital with community-acquired pneumonia (CAP) have existing chronic heart conditions. Acute infections like community-acquired pneumonia (CAP) can impact the cardiovascular system through various mechanisms, potentially leading to or worsening of complication of cardiovascular complications such as heart failure, acute coronary syndromes (ACS), cardiac arrhythmias, and strokes.

Early diagnosis and management of pulmonary infections, like pneumonia, in patients with heart failure are crucial for treatment and can significantly enhance their prognosis.

CASE ILLUSTRATION

A-85-year-old woman was brought to the emergency department due to shortness of breath that gradually worsened in 1 day, especially during physical activity. She had a productive cough and swelling in the legs for 2 weeks. She has a history of hypertension but never takes antihypertensive drugs. Findings on physical examination were as follows : blood pressure 150/80 mmHg, pulse 102 bpm regular, respiration rate 24x/minute, temperature 36,8 degree Celsius, SpO₂ 89% free air and increase 97% on 3L/m by nasal cannula, increased JVP, rhonchi on auscultation in both middle and lower lungs, and had a pitting edema in both legs.

Laboratory testing yielded the following results: hemoglobin 8,7 g/dL, leukocyte 9740/ul, sodium level 142 mmol/L, potassium level 3,6 mmol/L, creatinine level 1,3 mg/dL. X-ray thorax revealed pneumonia dextra, and cardiomegaly.

Table 1. Laboratory Test Results When Patient Admitted To Emergency Department

Variable	Result	Unit	Reference Range
Complete Blood Count			
WBC	9,74	x10 ³ /L	4,0 – 10,0
LYM#	1,32	x10 ³ /L	0,6 – 4,10
MID#	0,76	x10 ³ /L	0,1 – 0,9
GRA#	7,66	x10 ³ /L	2,0 – 7,8
LYM%	13,6	%	20,0 – 50,0
MID%	7,8	%	3,0 – 10,0

GRA%	78,6	%	40,0 – 70,0
RBC	4,46	$\times 10^6/L$	3,8 – 5,8
HgB	8,7	g/dL	11,0 – 16,5
MCHC	27,9	g/dL	32,0 – 36,0
MCH	19,5	pg	26,5 – 33,5
MCV	69,9	fL	80,0 – 99,0
RDW-CV	15,1	%	10,0 – 15,0
RDW-SD	42,4	fL	35,0 – 56,0
HCT	31,1	%	35,0 – 50,0
PLT	391	$\times 10^3/uL$	100 - 300
Liver Function			
AST	20	U/L	5-40
ALT	10	U/L	5-40
Kidney Function			
BUN	29	mg/dL	10-40
SC	1,3	mg/dL	0,6 – 1,4
Blood Glucose	138	mg/dL	70 - 140
Electrolyte			
Sodium	142	mmol/L	135-155
Potassium	3,6	Mmol/L	3,5 – 5,5

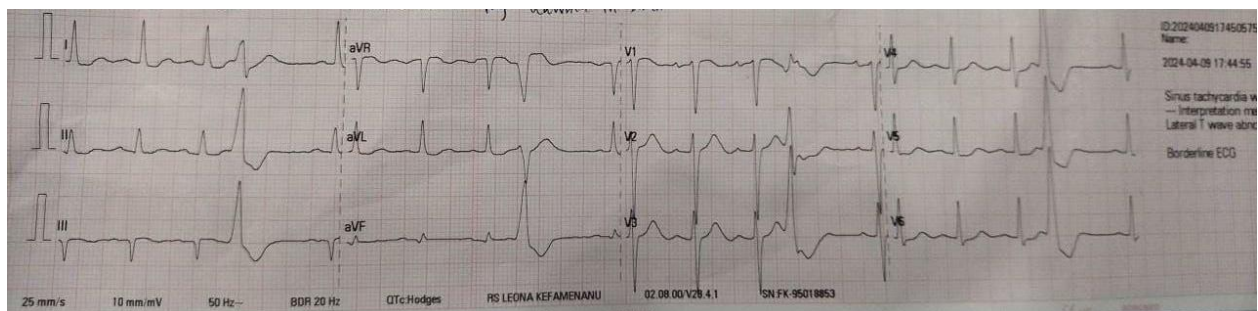


Figure 1. ECG in Emergency Department. Electrocardiography Revealed Sinus Tachycardia with Multifocal PVC and Borderline Left Ventricular Hypertrophy

The first treatments given to the patient were furosemide 40 mg injection/12 hours, oral spironolactone 25 mg/day, oral candesartan 8 mg/day, and oral NAC 200 mg three times/day. During follow up the additional therapy as ceftriaxone 1 gr/12 hours and oral azithromycin 500 mg/day after three days in hospital. After 6 days patient was admitted to ICU due to a decreased level of consciousness.

Table 2. Laboratory Test Result in ICU

Variable	Result	Unit	Reference Range
Complete Blood Count			
WBC	13,43	$\times 10^3/L$	4,0 – 10,0
LYM#	0,87	$\times 10^3/L$	0,6 – 4,10
MID#	0,48	$\times 10^3/L$	0,1 – 0,9
GRA#	12,08	$\times 10^3/L$	2,0 – 7,8
LYM%	6,5	%	20,0 – 50,0
MID%	3,6	%	3,0 – 10,0
GRA%	89,9	%	40,0 – 70,0
RBC	4,30	$\times 10^6/L$	3,8 – 5,8
HgB	8,4	g/dL	11,0 – 16,5
MCHC	27,4	g/dL	32,0 – 36,0
MCH	19,6	pg	26,5 – 33,5

MCV	71,5	fL	80,0 – 99,0
RDW-CV	15,2	%	10,0 – 15,0
RDW-SD	44,1	fL	35,0 – 56,0
HCT	30,8	%	35,0 – 50,0
PLT	268	$\times 10^3/uL$	100 - 300
Liver Function			
AST	33	U/L	5-40
ALT	34	U/L	5-40
Kidney Function			
BUN	16	mg/dL	10-40
SC	0,8	mg/dL	0,6 – 1,4
Blood Glucose	116	mg/dL	70 - 140
Electrolyte			
Sodium	142	mmol/L	135-155
Potassium	3,1	Mmol/L	3,5 – 5,5



Figure 2. X-Ray Thorax Showing Pneumonia Dextra and Cardiomegaly

After that additional treatments were Levofloxacin 750 mg/day and dobutamine start 3 mcg/kg/min, and ipratropium bromide dan salbutamol nebulization/8 hours. The urine output was 1300 ml/24 hours, the ECG revealed normosinus rhythm. The patient's condition didn't improve and 2 days later started getting a fever of 38,3 degree Celsius. The laboratory result showed hemoglobin 8,4 g/dL, leukocyte 13430/uL, Gra% 89,9%. One day after the patient died.

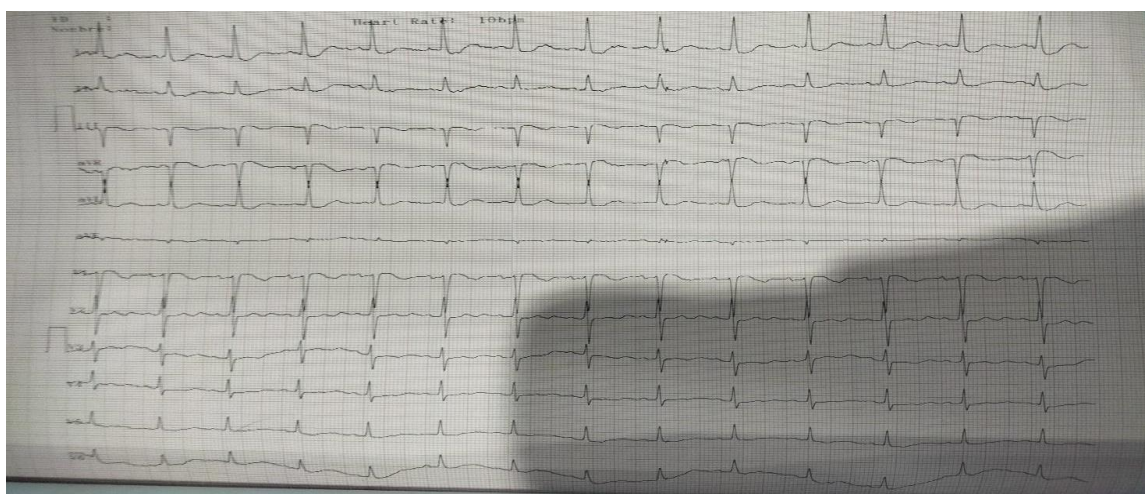


Figure 3. ECG in ICU

DISCUSSION

The prevalence of infections that cause the exacerbation of Heart failure (HF) were as follows respiratory infection, sepsis/bacteremia, urinary tract infection (UTI), as well as skin and soft tissue infection Shafazand et al. found that pneumonia and other respiratory diseases were the most common reasons for hospital admission among patients with heart failure. Community-acquired pneumonia (CAP) is mostly caused by the influenza virus and Streptococcus pneumoniae, it happens when the immune system cannot against the pathogens therefore the infection is spread from the lungs into the bloodstream and invades to the heart. Through the invasion, demand of the myocardial can be elevated and both the renin-angiotensin-aldosterone system (RAAS) and the sympathetic nervous system can be activated. Patients who are diagnosed with pneumonia often experience newly diagnosed heart failure or worsening HF as a frequent complication. The study conducted by Bornheimer et al. By the second month of follow-up, approximately 5.6% of patients HF with CAP experienced an exacerbation of HF, compared to 2.9% among the controls. Patients with heart failure who were diagnosed with community-acquired pneumonia (CAP) were about 45% more likely to experience exacerbations compared to those with heart failure who did not develop CAP. Therefore, preventing pneumonia could potentially improve the long-term results of subjects with heart failure.

In the emergency department (ER), diagnosing acute heart failure can be challenging presents because its symptoms often overlap with those of other conditions such as pneumonia. Delaying the administration of appropriate antimicrobial treatment can raise mortality rates in pneumonia patients, while insufficient use of beta-agonists can negatively affect cardiovascular function in individuals with acute heart failure. In this patient, administering antibiotics was delayed because the diagnosis of pneumonia was not immediately confirmed.

Evaluating pulmonary infiltration through X-ray thorax can be hindered in acute decompensated heart failure (ADHF) because of pulmonary congestion. Early experimental evidence suggests that pulmonary congestion might actually promote the growth of bacteria often found in pneumonia (i.e. Staphylococcus aureus and Streptococcus pneumoniae). Determining whether to administer antibiotic treatment or not in ADHF based solely on chest radiograph findings can be challenging due to the diagnosis of pneumonia being complex in such cases.

Acute heart failure commonly presents with respiratory distress and cardiogenic pulmonary edema. Elevated pressures in the pulmonary vasculature lead to fluid leaking into the alveoli, disrupting normal gas exchange and worsening concurrent conditions like pneumonia. Contrariwise, pneumonia can trigger or worsen cardiogenic pulmonary edema in heart failure, particularly when cardiac output is insufficient to meet the demands during severe infection. Given the heightened risks of morbidity and mortality associated with acute heart failure, it's vital to identify individuals prone to exacerbations and to minimize factors such as excessive fluid intake that could precipitate them. Therefore, it is important to understand the symptoms and signs as a foundation to classify the disease.

Early identification and management of precipitating factors in acute heart failure can lower the risk of progression and help prevent clinical deterioration. Patients who had previously been diagnosed with heart failure but were not using any heart failure medication before being admitted for pneumonia had notably high mortality rates during the first weeks following this event. It's crucial during this phase to ensure adequate diuretic therapy to effectively clear acute infection from the alveoli. In this case, also heart failure might deteriorate further because of hypertension and chronic heart failure that untreated, besides CAP also may make the patient's condition even worse. The worsening outcome happened

by the pathogenesis of pulmonary circulatory resistance and activation of signaling pathway mediated by pro-inflammatory cytokines, this mechanism can increase the afterload of ventricular contraction. In elderly patient, the airway barrier function is reduced. Hence, the elderly patients are fragile to get lung infection because of alveolar elasticity reduced to clear the alveolar infection. This progress at the end may cause of death in elderly patient with heart failure. The initial assessment concomitantly to hemodynamic and respiratory stabilization must be the focused. At the time of admission for Acute Heart Failure (AHF), chest radiography and laboratory examinations should be conducted to identify and potentially address any triggering factors of AHF. Potential signs of an underlying infection should be addressed with appropriate antibiotic therapy, and administering antibiotics early is likely to improve outcomes. The screening and management of sepsis should follow the standard protocols outlined in usual care sepsis bundles.

Kapoor *et al.* research showed that pneumonia/respiratory process is the higher precipitating factor for HF admission for those had preserved Ejection Fraction (EF), borderline EF and reduced EF. In patients with preserved ejection fraction (EF), factors such as pneumonia, weight gain, and worsening renal function were independently linked to longer hospital stays for heart failure patients. Additionally, Fonarow *et al.* found that risk-adjusted in-hospital mortality significantly increased when admissions were due to pneumonia, ischemia/acute coronary syndromes (ACSs), or worsening renal function. By using the risk stratification for AHF patient the management in the emergency room will be helpful because it is easier to make safer decision in highly prevalent, severe emergency room illnesses. In a cohort study, it was found that the thirty-day mortality rate for pneumonia was 24.4% among patients with heart failure, compared to 14.4% among patients without heart failure.

The American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA) guidelines for managing heart failure (HF) suggest that validated multivariable risk tools can be useful for estimating the future risk of mortality in both ambulatory and hospitalized HF patients. However, these risk stratification tools should be used as an aid for physicians rather than as a replacement for clinical judgment. Additionally, physicians must consider clinical factors that are not included in the risk score, such as end-organ damage. Abraham *et al.*, in their study using the OPTIMIZE-HF registry, found that the predictors of in-hospital mortality identified in their research are in line with those reported in other studies involving both hospitalized and stable chronic heart failure (HF) patients. The study highlighted that elevated serum creatinine (SCr), older age, increased heart rate, low systolic blood pressure (SBP), and low serum sodium levels are associated with a higher risk of death in a hospital setting. Consequently, most research has tended to address the prognostic impact of HF within the broader context of risk factors for pneumonia mortality, rather than focusing specifically on patients with both HF and pneumonia.

CONCLUSION

Heart failure patients concomitant with pneumonia may increase the risk of a worse prognosis. Diagnosing acute heart failure presents difficulties due to the symptoms often overlap with those of other conditions such as pneumonia. The optimal and early management of HF conditions and Pneumonia is important to minimize the poor outcome. It is necessary to do an initial assessment rapidly, treat the underlying cause of exacerbation, and investigate the risk factor of in-hospital mortality in HF patients. More research is needed to comprehend the pathophysiology underlying HF associated with pneumonia and the risk of poor outcomes so that it is expected that early diagnoses and management can be carried out properly.

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