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Clinical Features and Management of Community-Acquired Pneumonia (CAP) In The Elderly

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ABSTRACT
Community-Acquired Pneumonia (CAP) or pneumonia acquired outside health facilities is one of the main causes of morbidity and mortality in the elderly age group. As we age, immune function decreases and is accompanied by comorbidities such as diabetes, heart disease, and chronic lung disease that worsen the course of the disease. This study aims to find out the clinical picture and management of Community-Acquired Pneumonia (CAP) in the elderly. This study uses qualitative research methods. The data collection technique in this study is by studying case report documents. The data that has been collected is then analyzed in three stages, namely data reduction, data presentation and drawing conclusions. The results show that Community-Acquired Pneumonia (CAP) in the elderly is a complex condition with challenges in diagnosis and management, as the symptoms are often atypical and involve various risk factors. Clinical guidelines emphasize the importance of basic supporting examinations such as thoracic imaging and organ function evaluations, as well as prompt and appropriate administration of empirical antibiotics. Treatment should be adjusted to the severity of the patient's frailty, comorbidities, and frailty status. Supportive therapy plays an important role in recovery, while an individualized approach based on risk factors such as malnutrition, sarcopenia, and aspiration is needed to improve prognosis and lower mortality in the elderly with CAP.
Keywords*: Clinical, Management, Community-Acquired Pneumonia*

Introduction

The increasing incidence of community-acquired pneumonia (CAP) in the elderly population presents a significant challenge that requires deeper understanding in clinical practice. In this vulnerable age group, pneumonia is a frequent cause of hospitalization, often referred to as *frailty-associated pneumonia* (FAP) (Pletz et al., 2020). The COVID-19 pandemic has further underscored the urgent need for a comprehensive approach to pneumonia management in older adults, who are more susceptible to infection and prone to severe complications.

The diagnosis of CAP relies on a thorough medical history and physical examination of suspected cases. However, the clinical manifestations of CAP cannot consistently establish an etiological diagnosis with adequate sensitivity and specificity. Therefore, accurate bacteriological confirmation is critical in supporting a definitive diagnosis (Singer et al., 2016).

In older adults, the treatment of CAP is influenced by several factors, including the

causative pathogen, disease severity, and the patient's overall health status. Intravenous glucocorticoids have been considered as adjunctive therapy in critically ill patients with severe CAP who do not have contraindications, with evidence suggesting potential benefits in reducing mortality and the length of intensive care unit (ICU) stay (Nuttall, 2019; Froes et al., 2019; Mi et al., 2018; Hagel et al., 2018; Meduti et al., 2022; Peng et al., 2023).

Although expert opinions vary, some guidelines recommend the use of corticosteroids in severe CAP accompanied by septic shock, while others support combining standard care with corticosteroids in ICU-admitted patients. Thus, clinical practice guidelines issued by the Infectious Diseases Society of America (IDSA), the British Thoracic Society (BTS), and the *Perhimpunan Dokter Paru Indonesia* (*PDPI*) play an essential role in providing structured recommendations for the diagnosis, management, and treatment of CAP in elderly populations (Graham et al., 2022).

Previous studies have highlighted the complexities of CAP management in the elderly, yet critical gaps remain. For example, Pletz et al. (2020) introduced the concept of FAP, emphasizing the interplay between aging, comorbidities, and immune dysfunction. Their work, however, primarily focused on pathogen identification and antibiotic resistance, leaving the role of individualized, patient-centered management strategies underexplored. Similarly, Singer et al. (2016) examined the effects of frailty and immunosenescence on CAP outcomes but did not address the integration of multidisciplinary interventions—such as physiotherapy and nutritional support—which are particularly important in the elderly.

In this literature review, the most recent guidelines from IDSA, BTS, and *PDPI* will be analyzed with regard to their applicability in elderly patients and relevance to real-world clinical practice. By understanding and applying these guidelines, healthcare professionals can more effectively identify, evaluate, and manage elderly patients with CAP, ultimately improving clinical outcomes and reducing the morbidity and mortality associated with this condition.

This study aims to bridge existing knowledge gaps by providing a comprehensive examination of CAP management in older adults, integrating insights from international and national clinical guidelines (IDSA, BTS, *PDPI*) while emphasizing tailored approaches to care. By critically evaluating the limitations of previous research, this review seeks to enhance understanding of how frailty, comorbidities, and atypical clinical presentations influence diagnosis and treatment strategies. The findings are intended to offer practical recommendations for optimizing patient outcomes, reducing mortality, and improving quality of life in elderly patients with CAP, thereby contributing to the evolving discourse on pneumonia care in geriatric populations.

Research Methods

This study employs qualitative research methods, which are designed to explore and understand social, cultural, and behavioral phenomena in greater depth. The main objective of this approach is to investigate the meaning, experiences, and perspectives of individuals or groups within a specific situation or context. As described by Sari et al. (2022), qualitative methods encompass various approaches, each with distinct applications, data collection techniques, and analysis procedures. These methods enable researchers to gain comprehensive

insights beyond the scope of purely quantitative measurements.

In this article, qualitative methodology is applied through a document review of *case reports*. Data were sourced from the medical records of elderly patients diagnosed with CAP and managed in a healthcare facility. The information extracted included patient demographic characteristics, presenting clinical symptoms, results of relevant diagnostic investigations, the type and route of antimicrobial therapy provided, the presence of comorbidities, and recorded clinical outcomes.

Results and Discussion

In an effort to understand and manage community-acquired pneumonia (CAP) in the elderly group, clinical guidance from various medical organizations such as the Infectious Diseases Society of America (IDSA), British Thoracic Society (BTS), and the Indonesian Pulmonary Doctors Association (PDPI) is an important reference in its diagnosis and management. According to PDPI, CAP is an acute inflammation of the pulmonary parenchyma that occurs in the community due to infection with microorganisms such as bacteria, viruses, fungi, parasites, or protozoa, and is not caused by Mycobacterium tuberculosis (Indonesian Pulmonary Doctors Association, 2021). Meanwhile, IDSA defines pneumonia as a serious clinical condition due to lung infection by a specific pathogen, and CAP is pneumonia that occurs outside of a healthcare facility or hospital (Metlay et al., 2019). BTS provides a more complex definition, distinguishing between CAP that appears in the community and CAP that develops in patients undergoing hospital treatment (British Thoracic Society, 2019). The following is a comparison of the definition of CAP according to the IDSA, BTS and PDPI guidlines presented in Table 1 below.

Table 1. Comparison of CAP definitions according to IDSA, BTS, and PDPI guidelines

IDSA	Pneumonia that occurs outside of a healthcare facility, such as a hospital or long-term care facility.
BTS	Symptoms of acute lower respiratory tract disease (cough and at least one other lower respiratory tract symptom), accompanied by new signs on chest examination. At least one systemic feature (either symptoms of sweating, fever, chills, pain and/or temperature ≥38°C).
PDPI	Acute inflammation of the lung parenchyma acquired in the community is caused by microorganisms (bacteria, viruses, fungi, parasites, protozoa), not due to M.tb.

Source: IDSA (Metlay et al., 2019), BTS (2019), PDPI (2021)

CAP can affect individuals of any age, but there are certain causative organisms that are more commonly found in certain subgroups of patients. Risk factors that increase susceptibility to CAP include disturbances in mucociliary function and the cough reflex, such as smoking habits, as well as medical conditions that cause aspiration, such as damage to brain blood vessels, disorders of the esophagus, and neuromuscular disorders. In addition, old age, dehydration, cardiovascular disease, and pulmonary structural abnormalities also contribute to worsening the manifestations of these diseases (Martin-Loeches et al., 2023).

In the elderly, frailty or fragility is an important factor that aggravates CAP, where the mechanism reflects the complexity of the aging process. López-Otín and colleagues identified

nine hallmarks of aging molecularly and cellularly, including mitochondrial dysfunction, telomere attrition, and immune system aging, which are influenced by genetic, epigenetic, and environmental factors. Additional factors such as lack of physical activity, malnutrition, as well as age-related diseases such as dementia and osteoporosis also reinforce fragility conditions. The combination of these factors can trigger pathobiological disorders such as chronic inflammation, immune and endocrine dysfunction, as well as muscle disorders such as sarcopenia. When a weakened physiological reserve faces acute stressors such as exacerbations of COPD or other critical illnesses, the risk of disability, morbidity, and even death increases (Singer et al., 2016).

In the elderly with frailty-associated pneumonia (FAP), the infection triggers a maladaptive immune response, characterized by decreased mononuclear cell proliferation and weakening of the adaptive immune system, as well as increased expression of inflammatory agents that exacerbate chronic inflammation and accelerate the decline of body functions. This ineffective immune response causes the infection to become more severe and increases the risk of death. The pulmonary defense system such as airway patency, mucociliar escalator function, and effective coughing play an important role in preventing infection. Mucus production by goblet cells, submucosal glands, and clara cells, as well as immune modulation by epithelial cells and alveolar macrophages are influenced by circadian rhythms. In the elderly with weakness, immunosenescence and circadian rhythm disorders this leads to decreased coordination of mucocilliary defenses, thereby increasing susceptibility to lung damage and pneumonia (Singer et al., 2016).

Knowledge of the epidemiology of CAP is essential in determining appropriate antimicrobial therapy, although there are still few studies evaluating the suitability of empirical therapeutic guidelines on a multinational scale. According to IDSA/ATS guidelines, in addition to classic pathogens, several new pathogens have been identified as causes of CAP, such as Hantavirus (1993), human metapneumovirus (2001), coronavirus that causes SARS (2002), and MERS-CoV (2012). Community-acquired methicillin-resistant Staphylococcus aureus (MRSA) is also of concern as a new pathogen. Although the influenza virus is only noted as a footnote in some guidelines, it is considered one of the causes of severe pneumonia especially in intensive care units (Soedarsono et al., 2021).

Meanwhile, the BTS guidelines say that the distribution of pathogens and patterns of antimicrobial resistance can vary depending on location and time. Globally, Streptococcus pneumoniae is still the most common pathogen, followed by Haemophilus influenzae, Staphylococcus aureus, Chlamydia pneumoniae, Legionella spp., and Mycoplasma pneumoniae (Froes et al., 2019). M. pneumoniae and Legionella infections are less common in the elderly population, while CAP caused by Acinetobacter is more common in the elderly with alcoholism and has a high mortality rate (Nuttall, 2019).

Studies in Indonesia, such as those conducted at Dr. Soetomo Hospital, show that the main pathogens causing CAP include Acinetobacter baumannii, Klebsiella pneumoniae, Pseudomonas aeruginosa, Escherichia coli, Enterobacter cloacae, Stenotrophomonas maltophilia, Streptococcus pneumoniae, Enterobacter aerogens, Staphylococcus aureus, and Pseudomonas putida. However, in about 50% of CAP cases, the causative pathogen cannot be identified, which

is most likely due to insufficient respiratory sampling or the use of empirical antibiotics prior to sampling (Martin-Loeches et al., 2023). A cohort study in the UK that compared pneumonia patients acquired in nursing homes and elderly patients in the community did not find a significant difference in the distribution of pathogens. Meanwhile, research from Israel shows that Chlamydia pneumoniae infection tends to affect elderly patients, but it does not show a marked clinical difference compared to pneumococcal and mycoplasmic infections (Temesgen et al., 2019).

Table 2. The most common etiology of CAP

Outpatient	Non-ICU Hospitals	Severe (ICU)
Streptococcus pneumoniae	S.pneumoniae	S.pneumoniae
Mycoplasma pneumoniae	M.pneumoniae	
Haemophilus influenzae	Chlamydophila pneumoniae	Stafilokokus aureus
c. pneumoniae	H.infulenzae	Legionella spp.
Respiratory viruses	Legionella spp.	Gram-negative basil
	Respiratory virus aspiration	H.influenzae

a. Influenza A dan B, adenovirus, syncytial respiratory viruses, parainfluenza.
Source: Froes et al. (2019), Soedarsono et al. (2021), Martin-Loeches et al. (2023)

Common symptoms of community-acquired pneumonia (CAP) include fever, chills, productive cough with purulent sputum, shortness of breath, pleuritic chest pain, and weight loss. However, in patients with alcohol use disorders or weakened immune systems, classic symptoms such as fever may not appear, and complaints that arise can be non-specific systemic symptoms such as weakness, lethargy, changes in mental status, dyspepsia, or upper gastrointestinal complaints. Some specific symptoms can provide clues to etiology, such as diarrhea, headache, and confusion (caused by hyponatremia) that lead to Legionella infection, or symptoms such as otitis media, Stevens-Johnson syndrome, and hemolytic anemia with jaundice leading to Mycoplasma infection. In addition, pneumonia can also trigger acute decompensation from pre-existing chronic diseases, such as congestive heart failure, which can complicate early diagnosis and delay appropriate treatment (Martin-Loeches et al., 2023).

Diagnosis of CAP based on guidelines such as IDSA, BTS, and PDPI requires a combination approach of clinical evaluation, laboratory examination, and chest radiography. In addition to classic signs such as fever, coughing up phlegm, shortness of breath (dyspnea), and chest pain, some extra-pulmonary symptoms can also appear, especially in atypical CAP. These symptoms include disorientation, headache, muscle pain (myalgia), ear and abdominal complaints, diarrhea, rash, non-exudative pharyngitis, hemoptysis, and splenomegaly (BTS, 2019). Given the diversity of these clinical manifestations, the guidelines from IDSA, BTS, and PDPI emphasize the importance of implementing comprehensive diagnostic criteria as indicated in their guidance table (Table 3).

Table 3. Comparison of diagnosis criteria based on IDSA, BTS, and PDPI guidelines

IDSA	Criterion Minor: • *Respiratory rate* ≥ 30 breaths/minute • Rasio PaO2/FiO2 ≤ 250 • Infiltrate multilobar • Disorientation • Uremia (blood urea nitrogen levels ≥ 20 mg/dl) • Leukopenia* (white blood cell count < 4,000 cells/µl) • Thrombocytopenia (platelet count < 100,000/µl) • Hypothermia (mouth < 36°C) • Hypotension requires aggressive fluid resuscitation Major Criteria: • Septic shock with the need for a vasopressor • Respiratory failure requires mechanical ventilation
BTS	Similar to the definition, i.e. symptoms of acute lower respiratory tract disease (cough and at least one other lower respiratory tract symptom), accompanied by new signs on chest examination. At least one systemic feature (either symptoms of sweating, fever, chills, pain and/or temperature ≥38°C).
PDPI	Based on a thoracic photographic image in the presence of an infiltrate or water bronchogram, plus the following symptoms: ● Cough ● Changes in sputum/purulent characteristics ● Body temperature > 38°C (axilly)/history of fever ● Chest pain ● Crowded ● On physical examination, signs of consolidation, bronchial breathing sounds, and ronki can be found ● Leukocytes > 10,000 or < 4500

Source: IDSA (Metlay et al., 2019), BTS (2019), PDPI (2021)

Supporting examinations in pneumonia include various methods to establish the diagnosis and determine the cause of the infection. In the diagnosis of pneumonia, supporting examinations must be adjusted to the cause of the infection and the severity of the symptoms that arise (Nuttall, 2019). Comparison of examination guidelines on CAP based on IDSA, BTS and PDPI is shown as shown in table 4.

Table 4. Comparison of supporting examinations based on IDSA, BTS, and PDPI

Examination	IDSA	BTS	PDPI
Photo thorax	+	+	+
Procalcitonin	+	-	+
Smear sputum	+ CAP is severe & has been/infected with MRSA/ *P. aeruginosa*	+ *moderate-CAP* s/d *severe-CAP*	+
Culture sputum	+	-	+
Blood culture	+ CAP is severe & has been/infected with MRSA or *P. aeruginosa*	+ *moderate-CAP* s/d *severe-CAP*	+
Spo2	+	+	+

Urea	+	+	+
Electrolite	+	+	+
CRP	-	+	+
Number of leukocytes	+	+	+
Calculate the type of PMN lecocytes	-	-	+
Aerobic, anaerobic and atypical sensitivity tests	-	-	+
Haemostasis	+	+	+
Liver and kidney function tests	+	+	+
Culture and sensitivity test of transtracheal aspirate/transthoracic aspirate/bronchial flush	-	-	+
Blood gas analysis	-	-	+
CT scan thoracic contras	-	-	+
Bronchoscopy	-	-	+

Remarks: recommended (+), not recommended (-).

Source: IDSA (Metlay et al., 2019), BTS (2019), PDPI (2021)

For the management of community-derived pneumonia (CAP) according to IDSA guidelines, it is divided based on five categories of adult patients, namely:

1) Healthy adult patients without comorbidities or risk factors against antibiotic-resistant pathogens.
2) Outpatients with comorbidities such as heart, lung, liver, chronic kidney disease, diabetes mellitus, alcoholism, cancer, or asplenia.
3) Patients suspected of being infected by MRSA or Pseudomonas aeruginosa.
4) Patients who have contraindications to macrolides and fluoroquinolone.
5) Inpatients with severe CAP who do not have risk factors for MRSA or P. aeruginosa.

Each of these patient groups requires an antimicrobial treatment approach tailored to existing clinical characteristics and risk factors (Metlay et al., 2019). Meanwhile, the BTS guidelines emphasize the importance of supportive therapy and close monitoring. All patients should receive oxygen therapy tailored to oxygen saturation, with a target PaO2 above 8 kPa and SpO2 between 94–98%. For patients at risk of hypercapnic respiratory failure, oxygen therapy should be adjusted based on arterial blood gas analysis. Treatment also includes intravenous fluid administration in case of volume depletion, as well as venous thromboembolism prophylaxis using low-molecular weight heparin for immobile patients.

The BTS guidelines also recommend nutritional support, gradual improvement of mobility, and the use of airway clearance techniques when patients have difficulty performing phlegm. Clinical parameters such as body temperature, respiratory rate, pulse, blood pressure, mental status, and oxygen saturation should be monitored at least twice a day, or more often in severe cases. Follow-up evaluation through remeasurement of C-reactive protein and chest X-ray photos is recommended if improvement has not been seen after three days of therapy. Patients should only be discharged if they do not show more than one clinical sign indicating an unstable condition, such as high fever, tachycardia, tachypnea, hypotension, hypoxemia, mental status disorder, or inability to maintain oral intake (British Thoracic Society, 2019).

The BTS guidelines divide the administration of antibiotics for CAP pneumonia patients

based on severity into three groups, namely outpatients (low severity), patients with moderate severity, and patients with severe CAP (high severity) who require therapy immediately after the diagnosis is established. For cases of severe CAP without a clear microbiological etiology, empirical treatment for 7–10 days is recommended, and the duration may be extended to 14 to 21 days depending on the clinical condition, especially if it is suspected or proven to be caused by Staphylococcus aureus or enteric Gram-negative bacilli. The oral route is recommended for hospitalized mild to moderate CAP patients, as long as there are no contraindications. Patients who initially received parenteral antibiotics should be immediately switched to oral preparations when clinical conditions improve and body temperature is stable for 24 hours (British Thoracic Society, 2019).

Meanwhile, guidelines from the PDPI recommend that empirical antibiotic administration be carried out as soon as the patient arrives at the emergency department. The medical management of CAP according to PDPI is divided into four groups, namely outpatients who were previously healthy and did not use antibiotics in the last three months, non-ICU inpatients, ICU inpatients without risk of Pseudomonas infection, and ICU inpatients with a risk of Pseudomonas or MRSA infection. If there is no improvement within 72 hours, antibiotics need to be adjusted based on the results of the sensitivity test. Non-medicated therapies are also necessary, including symptomatic medications such as antipyretics, mucolytics, expectorants, and bronchodilators. Oxygen therapy is administered according to clinical needs, using devices such as nasal cannulas to mechanical ventilators. In severe conditions, the administration of systemic corticosteroids, IVIG (intravenous immunoglobulin), and APC (Activated Protein C) can be considered as part of the follow-up management (Indonesian Pulmonary Doctors Association, 2020).

Table 5. Implementation of each guideline (IDSA, BTS, PDPI)

IDSA	BTS	PDPI
No comorbidities/ risk factors for antibiotic-resistant pathogens: - Amoxicillin 3x1g (strong recommendation, moderate quality evidence), or - Doxycycline 2x100mg (conditional recommendation, low-quality evidence), or - Macrolides (azithromycin 500 mg the first day then 250 mg daily/ clarithromycin 2x50mg / clarithromycin *long acting* 1x1,000mg) **Outpatient with comorbidities:** - Amoxicillin/clavulanic acid 3x500mg/ 3x125mg, or amoxicillin/clavulanic acid 2x875mg/ 2x125mg, or 2x2,000mg/2x125mg, or cephalosporins (cephpodoxim 2x200mg or cefuroxic acid 2x500mg); **AND**	**Empirical antibiotics,** Outpatients: - Amoxisilin 3x500mg per oral - Doxycycline 200mg loading dose then 100mg orally, or clarithromycin 2x500mg orally (penicillin-hypersensitive patients) **Antibiotics with low severity CAP** - Amoxicillin 3x500mg per oral (inpatient due to unstable comorbidities or social needs. - Paramountal therapy of intravenous amoxicillin 3x500mg or intravenous benzylpenicillin 1.2g, or intravenous clarithromycin 2x500mg.	**Outpatient (Patients who were previously healthy or had no history of antibiotic use in the previous 3 months):** - Lactam β or lactam β group plus lactamase anti-β **OR** - New macrolides (clarithromycin, azithromycin) **Patients with comorbidities or have a history of antibiotic use 3 months ago** - Respiratory fluorochlorinolone (levofloxacin 750 mg, moxifloxacin) **OR**

- Macrolides (azithromycin 500 mg on the first day then 250 mg daily, clarithromycin [2x500mg/ *Long acting* 1x1,000mg]) (strong recommendation, moderate-quality evidence for combination therapy), or doxycycline 2x100mg (conditional recommendation, low-quality evidence for combination therapy); **OR**
- Monotherapy: Respiratory fluoroculolone (levofloxacin 1x750mg/ moxifloxacin 1x400mg/ gemifloxacin 1x320mg) (strong recommendation, moderate-quality evidence).

Suspected of being infected with MRSA or P. aeruginosa

- Combination therapy:

  Beta-lactam (ampicillin 1 sulbactam 1.5–3 g every 6 hours, cefotaximis 3x1–2g, cephtriaxone 1x1–2g, or cephtarolin 2x600mg and macrolides (azithromycin 1x500mg or clarithromycin 2x500mg) (strong recommendation, high-quality evidence), **OR**
- Monotherapy: respiratory fluoroquinolone (levofloxacin 1x750mg, moxifaxacin 1x400mg) (strong recommendation, high-quality evidence).

Contraindications to both macrolides and fluoroquinolones:

- Combination therapy with beta-lactam (ampicillin 1 sulbactam, cephotaxisim, cephtarosone, or cephtriaxone, dosage as above) and doxycycline 2x100mg (conditional recommendation, low-quality evidence)

Hospitalized patients with severe CAP in adults with no risk factors for MRSA or P. aeruginosa:

- A b-lactam supplemented with macrolides (strong recommendation, moderate-quality evidence); or
- Beta-lactam supplemented with respiratory fluoroquinolone (strong

Empirical antibiotics with moderate severity CAP

- Oral therapy with amoxicillin 3x500mg orally and macrolides (clarithromycin 2x500mg orally)
- Monotherapy with macrolides (patients do not respond well to amoxicillin therapy before hospitalization)
- Parenteral options with intravenous amoxicillin 3x500mg or benzylpenicillin 1.2g intravenously and clarithromycin 2x500mg intravenously
- Doxycycline 200mg loading dose then 100mg orally (intolerant to penicillin or macrolides) or Levofloxacin 1x500mg orally and moxifloxacin 1x400mg orally
- Parenteral monotherapy: levofloxacin or second-generation cephalosporins (e.g., cepuroximes) or third-generation cephalosporins (e.g., cephaloximes or cephtriaxons) along with clarithromycin.

Antibiotics with high severity CAP

- Intravenous combinations: broad-spectrum beta-lactamase such as co-amoxicillaviv 3x1.2g along with macrolides such as clarithromycin 2x500
- co-amoxisilav, along with clarithromycin. (allergy to penicillin, second-generation cephalosporins (e.g., cephoroxim) or third generation (e.g., sefotaxicum or cephtriaxone))
- Lactam β group plus anti-β lactamase **OR**
- β lactam plus macrolides

Non-ICU Hospitalization:

- Fluoroculolone, respiration, levofloxiacin 750 mg, moxifloxacin **OR** β lactam plus macrolides.

ICU Hospitalization

- **No risk of pseudomonas:** β-lactam (cephotaximy, cephtriaxone or ampicillin sulbaktam) plus new macrolides or intravenous (IV) respirated fluoroquinolones
- **There is a risk of pseudomonas: Anti-pneumococcal, anti-pseudomonas:** β-lactam (such as piperacillin-tazobactam, cefepime, imipenem, or meropenem) may be added with levofloxacin 750 mg. **OR** β-lactam is added with aminoglycosides and azithromycin. **OR** β-lactam added aminoglycosides and anti-pneumococcal fluoroquinolone (for patients allergic to penicillin, β-lactam can be replaced with aztreonam).
- **There is a risk of MRSA:** add vancomycin or linezolid

recommendation, low-quality evidence).	

Source: IDSA (Metlay et al., 2019), BTS (2019), PDPI (2020)

Administrative guidelines in Table 5. is generally intended for adult patients in general and has not specifically discussed the management of CAP pneumonia in the elderly population. However, each guideline such as IDSA, BTS, and PDPI has additional records related to the handling of elderly patients. The IDSA recommends the use of validated clinical prediction tools to assess prognosis, suggesting the use of the Pneumonia Severity Index (PSI) rather than CURB-65. PSI is considered more accurate in assessing the need for hospitalization in adult patients diagnosed with CAP, especially in the elderly, as it considers more clinical factors and comorbidity risk (Singer et al., 2016).

Meanwhile, BTS highlighted a significant increase in hospitalizations due to CAP in the elderly population. A study in the UK showed a 34% increase in the incidence of hospitalization due to pneumonia between 1997–1998 and 2004–2005, with the most notable increase occurring in elderly patients. The elderly also have longer length of hospitalization, experience more frequent non-specific symptoms, and have more comorbidities. In addition, the elderly group tends not to show fever, and is more at risk of complications such as aspiration and radiological deterioration during treatment. Radiological healing is also slower, especially in patients with multilobar involvement. In another study, it was found that the rate of lung cancer was quite high in elderly smokers, so it was recommended to perform thoracic scan as part of the follow-up evaluation. BTS also notes that Mycoplasma pneumoniae, although an important cause of CAP in the general population, is rarely a cause in the elderly, so special consideration is needed in the selection of antibiotics. Rapid administration of antibiotics has been shown to reduce mortality, with studies showing a 15% reduction in mortality if antibiotics were given within 8 hours in patients aged ≥65 years. Unlike IDSA and BTS, the PDPI guideline has not provided a specific discussion on the management of CAP in elderly patients (British Thoracic Society, 2019; Indonesian Pulmonary Doctors Association, 2021).

Antibiotic therapy in elderly patients with pneumonia requires special consideration that includes the type of pneumonia (whether acquired from the community or hospital), the severity of the infection, and the patient's frailty status. The selection of early empirical antibiotics is strongly influenced by the type and severity of pneumonia, the patient's general condition including frailty, as well as risk factors for infection by specific pathogens. In addition, antibiotic dose adjustments need to be made based on the glomerular filtration rate to avoid toxicity, considering that decreased kidney function is common in the elderly population (Mandell, 2015).

Elderly patients with hospitalized CAP, particularly those undergoing treatment in the intensive care unit (ICU), often require mechanical ventilation support and physiotherapy services to speed recovery. The study by Lisa et al. (2024) provides comprehensive recommendations related to physiotherapy which include physiotherapy assessment, patient selection and priority, and therapeutic interventions. These physiotherapy actions include

humidification, the patient's body position, hyperinflation techniques, manual techniques on the chest wall, normal saline instillation, and mobilization and active therapy. Although antibiotic therapy remains at the core of treatment, this physiotherapy approach was developed to support the recovery process of lung and respiratory function optimally in patients with CAP (Mandell, 2015).

Predicting prognosis in elderly patients with frailty-associated pneumonia (FAP) is essential to determine appropriate treatment, including palliative approaches when needed. However, the complexity of the pathophysiology of pneumonia in the elderly population makes prediction a major challenge. Traditional prediction tools such as CURB-65, Pneumonia Severity Index (PSI), and A-DROP recommended in the guidelines are often inaccurate in this context (Mandell, 2015). This is because pneumonia in the elderly is often multifactorial, with up to 90% of cases related to aspiration, so the severity of pulmonary inflammation is not the only major determinant of the final outcome.

The prognosis is more determined by a combination of factors such as comorbidities, frailty, sarcopenia, malnutrition, poor oral hygiene and strength, as well as immune disorders. Therefore, the term Frailty Associated Pneumonia (FAP) is used to describe this condition more comprehensively. Some of the factors associated with poor prognosis include multimorbidity, aspiration, weak cough reflex, malnutrition, old age, high level of dependence, loss of muscle mass, and the use of anticholinergic drugs. To date, there has not been a single prognostic indicator that can accurately predict the outcome of pneumonia in the elderly. However, the incidence and death rates of pneumonia in this age group remain high, indicating the need for a more appropriate and individualized approach in its management.

Conclusion

Community-acquired pneumonia (CAP) in the elderly is a multifaceted condition that requires special attention in both diagnosis and management. Guidance from professional organizations, such as the Infectious Diseases Society of America (IDSA), the British Thoracic Society (BTS), and the *Perhimpunan Dokter Paru Indonesia* (*PDPI*), highlights that CAP in older adults is associated not only with classic pathogens, but also with novel microorganisms that have emerged over the past two decades. Diagnosis of CAP in the elderly demands a highly precise approach, as typical symptoms are often subtle and frequently accompanied by nonspecific clinical features. Although the ancillary investigations recommended by different guidelines may vary, chest radiography, assessment of oxygen saturation, and evaluation of renal and hepatic function are consistently endorsed as core diagnostic tools. Management of CAP in the elderly must be individualized, taking into account disease severity, comorbidities, and frailty status. Prompt initiation of empirical antibiotic therapy is essential and should be tailored to the most likely causative pathogens, considering both epidemiological risks and the patient's clinical presentation. Supportive interventions—such as supplemental oxygen, nutritional support, and pulmonary physiotherapy—are critical to promoting recovery in elderly patients with CAP. Furthermore, prognostication in elderly individuals with CAP, particularly those affected by *frailty-associated pneumonia* (FAP), continues to pose a significant challenge due to the absence of a single reliable prognostic indicator. Therefore, a personalized approach

that carefully considers risk factors including multimorbidity, sarcopenia, malnutrition, and aspiration is vital for optimizing treatment outcomes and reducing mortality in this vulnerable age group.

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