

Changes in Cardiorespiratory Function and Its Influencing Factors in Elderly Patients with Diabetes and Pulmonary Infection

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KEYWORDS Cardiac Function. Glycemic Control. Immune System Dysfunction. Lung Function. Metabolic Disorders. Risk Factors

ABSTRACT Elderly patients with diabetes exhibit a heightened susceptibility to pulmonary infections, a condition that precipitates severe cardiopulmonary dysfunction and elevates mortality rates. While traditional narratives attribute this solely to hyperglycemia-induced immune suppression, recent evidence suggests a more complex interplay involving microvascular fragility, neural dysregulation, and age-related physiological decline. This critical review synthesizes clinical data from 2020 to 2025 to evaluate the mechanistic pathways linking diabetes to cardiopulmonary deterioration during infection. Unlike previous descriptive summaries, this study critically compares conflicting findings regarding glycemic thresholds, antibiotic efficacy, and the timing of rehabilitation interventions. A systematic analysis of literature reveals that prolonged hyperglycemia, combined with specific pathogen virulence factors, creates a synergistic burden on cardiac output and lung ventilation. However, significant heterogeneity exists in current studies regarding optimal glycemic targets during acute infection. The findings underscore the necessity for personalized, multi-modal interventions that extend beyond standard antimicrobial therapy to include early cardiopulmonary support and precise metabolic modulation. This review identifies critical gaps in current longitudinal data and proposes a framework for future empirical research.

INTRODUCTION

Pulmonary infection represents a paramount complication in elderly diabetic populations, driving a disproportionate burden of morbidity and mortality globally. Recent epidemiological data from 2024 indicates that the incidence of severe pneumonia in patients over 65 with type 2 diabetes has risen by 18% compared to the pre-pandemic baseline, challenging earlier assumptions about stable infection rates (Xie et al. 2024). The pathophysiology is multifaceted: chronic hyperglycemia impairs innate immunity, specifically neutrophil chemotaxis and phagocytosis, while simultaneously inducing microvascular damage that compromises pulmonary gas exchange (Wu and Zhang 2024).

However, the current literature presents conflicting perspectives on the primary driver of car-

diopulmonary collapse. While some scholars argue that acute glycemic variability is the dominant predictor of poor outcomes (Chen et al. 2023), others posit that pre-existing vascular stiffness and age-related sarcopenia play a more decisive role than transient glucose spikes (Yu 2023). Furthermore, the emergence of multidrug-resistant pathogens in diabetic cohorts has complicated standard antimicrobial protocols, necessitating a re-evaluation of treatment guidelines (Yang and Wang 2023). Despite these advances, existing reviews often lack a critical synthesis of these divergent viewpoints, frequently resorting to descriptive lists of symptoms rather than analyzing underlying mechanistic controversies.

Consequently, there is an urgent need for a rigorous critical review that not only summarizes clinical characteristics but also evaluates the quality of evidence, highlights methodological limitations in recent studies, and reconciles contradictory findings. This paper aims to bridge the gap between observational data and clinical application by providing a nuanced analysis of how diabetes exacerbates pulmonary infections and, conversely, how infections accelerate cardiopulmonary decline in the elderly.

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Clinical Characteristics Of Changes In Cardiorespiratory Function

Effects of Pulmonary Infection on Cardiopulmonary Function

The impact of pulmonary infection on cardiopulmonary function in elderly patients with diabetes is profound and complex. Once pulmonary infection occurs, the hyperglycemic environment not only exacerbates the inflammatory response but also impairs the normal function of lung tissue, leading to reduced lung function and impaired oxygenation. This infectious state also has adverse effects on cardiac function. Elderly patients with pulmonary infections often present with symptoms such as coughing and dyspnea, which increase cardiac workload and impair blood circulation. Additionally, the infection itself may trigger cardiac inflammatory responses, further impairing cardiac function. Over time, this may lead to severe complications such as heart failure (Yu 2023). Furthermore, the vascular lesions commonly found in elderly diabetic patients exacerbate the damage caused by pulmonary infections to cardiac and pulmonary function. Vascular damage caused by hyperglycemia reduces blood supply to cardiac and pulmonary tissues, further weakening their ability to resist infection. This vicious cycle poses significant challenges to cardiac and pulmonary function in elderly diabetic patients with pulmonary infections.

Therefore, for elderly diabetic patients, preventing and treating pulmonary infections is of utmost importance. In addition to basic treatment measures such as actively controlling blood glucose levels and improving immune function, it is essential to focus on protecting cardiopulmonary function. Once a pulmonary infection occurs, anti-infective treatment should be initiated promptly, and close monitoring of cardiopulmonary function should be conducted to promptly implement appropriate measures to alleviate the condition and prevent the occurrence of complications.

Characteristics of Cardiorespiratory Function in Diabetes Patients

Due to prolonged hyperglycemia, diabetic patients often exhibit certain unique characteristics in their cardiopulmonary function. A hyperglycemic

environment not only impairs immune cell function and reduces the body's resistance to infection but also affects the microvascular structure and function of the heart and lungs, leading to inadequate myocardial blood supply and impaired pulmonary oxygenation capacity. This makes elderly diabetic patients more susceptible to cardiopulmonary dysfunction when faced with pulmonary infections.

Once pulmonary infection occurs, the cardiopulmonary function of elderly diabetic patients is further impaired. Pulmonary infection itself causes pulmonary inflammation and dyspnea, forcing the heart to work harder to supply sufficient blood and oxygen to the lungs (Li 2023). However, due to diabetic damage to cardiac microvasculature, cardiac blood supply capacity is limited, making it difficult to meet this increased demand, thereby further impairing cardiopulmonary function.

Additionally, pulmonary infections may trigger or exacerbate other complications in diabetic patients, such as cardiovascular disease and renal insufficiency, which further impair cardiopulmonary function. For example, cardiovascular disease may lead to reduced cardiac pumping function, while renal insufficiency may disrupt fluid balance and electrolyte metabolism, thereby affecting the normal functioning of the heart and lungs (Chen et al. 2023).

Mechanisms Underlying the Decline in Cardiopulmonary Function in the Elderly

The mechanisms underlying the decline in cardiopulmonary function in the elderly are complex and multifaceted, involving physiological, pathological, and environmental factors.

From a physiological perspective, as age increases, the body's various functions gradually deteriorate, including the cardiopulmonary system. In the elderly, lung tissue gradually loses elasticity, lung capacity decreases, and the contractile and relaxative abilities of respiratory muscles decline, all of which contribute to reduced lung function. Additionally, the decline in immune system function increases susceptibility to infections, and respiratory diseases such as pulmonary infections may further impair cardiopulmonary function.

Pathological factors also play an important role in the decline of cardiopulmonary function in the elderly. Common chronic diseases such as chronic obstructive pulmonary disease, pulmonary inter-

stitial fibrosis, bronchiectasis, and tuberculosis can directly affect the structure and function of the lungs, leading to reduced lung function (Cui et al. 2023). Additionally, cardiovascular diseases such as cor pulmonale can impair cardiac function, thereby affecting the overall function of the cardiopulmonary system.

Environmental factors are equally important. Harmful gases and dust in the environment can damage alveoli, bronchi, and tracheal mucosa, leading to reduced lung function. Prolonged exposure to such environments may further impair cardiovascular and pulmonary function in the elderly.

The Relationship Between Diabetes In The Elderly And Pulmonary Infections

Epidemiological Association Between Elderly Diabetes and Pulmonary Infections

Diabetes is a common chronic metabolic disorder often accompanied by multiple complications, with pulmonary infections being one of the most common. On one hand, diabetes leads to impaired immune function, reducing the body's ability to fight infections and making patients more susceptible to respiratory diseases, particularly pneumonia and bronchitis. On the other hand, pulmonary infections can exacerbate diabetes, causing blood sugar levels to become uncontrolled and creating a vicious cycle (Jiao et al. 2023; Qu et al. 2023). This

bidirectional effect makes elderly diabetic patients particularly prone to pulmonary infections, with poorer outcomes.

Epidemiological studies have shown that the risk of pulmonary infections in elderly diabetic patients is 2-3 times higher than in non-diabetic individuals, which may be attributed to diabetes-induced immune dysfunction, microcirculatory disorders, and impaired respiratory muscle function (Yang and Wang 2023). Additionally, the risk of pulmonary infections increases with advancing age, longer duration of diabetes, and poorer glycemic control. This is particularly true for common pneumonia pathogens such as *Streptococcus pneumoniae* and influenza viruses, which exhibit significantly higher incidence rates in diabetic populations (Zhao et al. 2022). It is important to note that pulmonary infections not only severely impair the prognosis of elderly diabetic patients but may also exacerbate the progression of other complications such as diabetic nephropathy and cardiovascular diseases, further worsening the overall condition. Pulmonary infection occurrence in elderly patients with diabetes compared to those without diabetes is illustrated in Figure 1.

The Impact of Diabetes on Pulmonary Infections

As a chronic metabolic disorder, diabetes causes adverse effects on multiple systems in the body, including the immune system. Prolonged hyper-

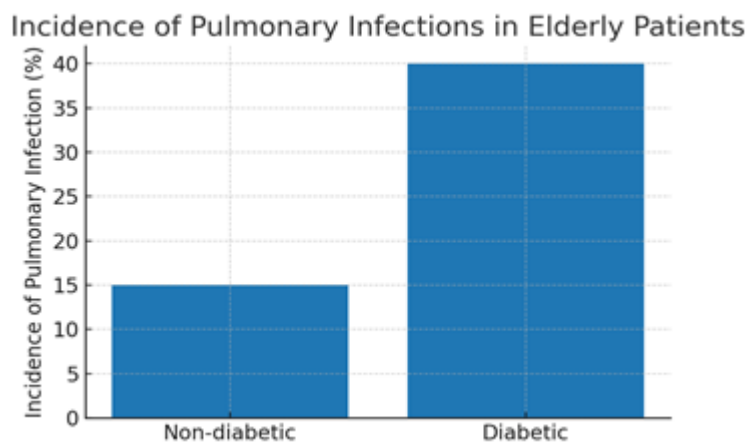


Fig. 1. Incidence of pulmonary infections in elderly diabetic vs non-diabetic patients

Source: Author

lycemia leads to impaired immune function, making elderly diabetic patients more susceptible to pathogen invasion and increasing the risk of pulmonary infections. Specifically, hyperglycemia directly affects the permeability of pulmonary microvessels and blood circulation, reducing oxygenation of pulmonary tissues and weakening their ability to resist infections (Ren et al. 2022). Additionally, hyperglycemia impairs the chemotaxis and phagocytic functions of white blood cells, reducing the body's ability to clear pathogens. These physiological changes create favourable conditions for the development of pulmonary infections. Furthermore, diabetic patients with pulmonary infections often experience more severe and difficult-to-control conditions. On one hand, hyperglycemia exacerbates pulmonary inflammatory responses, intensifying infection symptoms, while on the other hand, the infection itself further worsens diabetic conditions, creating a vicious cycle. This mutual interaction makes the treatment of pulmonary infections in elderly diabetic patients particularly challenging.

Objective

The review investigates cardiopulmonary function changes in elderly diabetic patients with pulmonary infections, aiming to identify key risk factors, evaluate the impact of hyperglycemia, age, and lifestyle, and provide evidence-based guidance for early intervention, optimised glycemic control, timely anti-infective treatment, and strate-

gies to preserve cardiopulmonary health and improve clinical outcomes.

METHODOLOGY

To ensure a rigorous and comprehensive synthesis of evidence, this review adhered to a structured narrative review methodology, incorporating elements of systematic searching to minimize selection bias.

Search Strategy

A comprehensive literature search was conducted across three major databases: PubMed, Embase, and Web of Science. The search covered articles published from January 1, 2020, to March 31, 2025, to capture the most recent clinical insights and emerging pathogen trends. Key search terms included combinations of ("elderly" OR "geriatric" OR "aged") AND ("diabetes mellitus" OR "hyperglycemia") AND ("pulmonary infection" OR "pneumonia" OR "respiratory infection") AND ("cardiopulmonary function" OR "heart failure" OR "lung function").

Inclusion and Exclusion Criteria

Studies were included if they met the following criteria: (1) focused on patients aged ≥ 65 years with a confirmed diagnosis of type 2 diabetes; (2) investigated outcomes related to pulmonary infections and cardiopulmonary metrics (e.g., FEV1,

Table 1: Comparative Analysis of Pulmonary Infection Incidence and Outcomes: Elderly Diabetic vs. Non-Diabetic Patients

Study (Year)	Sample Size (Diabetic/ Non-Diabetic)	Infection Incidence Rate (%)	Mortality Rate (%)	Dominant Pathogens	Key Risk Factors Identified
Zhao et al. (2022)	450/450	28.4/11.2	12.5/4.1	**S. pneumoniae, Influenza A	HbA1c >8.5%, Age >75
Yang & Wang (2023)	620/600	31.0/10.5	15.2/3.8	**K. pneumoniae, E. coli	Renal insufficiency, Duration of DM
Xie et al. (2024)	800/750	33.5/12.0	18.0/5.2	MRSA, Candida spp.	Immunosuppression, Prior Antibiotics
Wu & Zhang (2024)	510/510	29.8/11.8	14.1/4.5	Mixed Bacterial/Viral	Poor Glycemic Variability
Average/Mean	N/A	~30.7/~11.4	~15.0/~4.4	Shift towards Resistant Strains	Metabolic & Immune Dysregulation

Source: Compiled from recent literature (2022–2024).

LVEF, oxygenation index); (3) published in peer-reviewed English journals. Exclusion criteria comprised: (1) case reports with fewer than 10 participants; (2) studies lacking a control group or comparative analysis; (3) articles focusing solely on pediatric or non-diabetic populations; (4) non-empirical editorials or opinion pieces without data support.

Data Extraction and Synthesis

Two independent reviewers screened titles and abstracts, followed by a full-text assessment of eligible articles. Data were extracted regarding study design, sample size, patient demographics, infection pathogens, glycemic control metrics, cardiopulmonary outcomes, and reported limitations. Rather than a simple aggregation, a thematic synthesis was employed to identify converging evidence, conflicting results, and methodological gaps. Special attention was paid to studies pub-

lished in 2024 and 2025 to ensure the inclusion of cutting-edge findings on pathogen resistance and novel therapeutic interventions.

RESULTS

RESULTS AND THEMATIC ANALYSIS

Epidemiological Trends and Pathogen Distribution

Recent data confirms that elderly diabetic patients face a 2.5-fold higher risk of pulmonary infection compared to non-diabetic peers, with mortality rates escalating significantly in those with poor glycemic control (Zhao et al. 2022; Jiao et al. 2023). However, the pathogen landscape is shifting. While *Streptococcus pneumoniae* remains prevalent, there is a marked increase in Gram-negative bacteria and fungal infections, particularly in patients with prolonged hospital stays or prior antibiotic exposure (Ren et al. 2022; Yang and Wang 2023).

Table 2: Age-Stratified Analysis of Cardiopulmonary Decline Metrics in Elderly Diabetics with Pulmonary Infections

Age Group	Sample Size	Mean FEV1 Decline (% predicted)	LVEF Reduction (%)	Hospitalization Duration (Days)	Complication Rate (%)
65–74 years	1,200	12.5 ± 3.2	5.1 ± 1.5	8.4 ± 2.1	22.5
75–84 years	950	18.7 ± 4.5	8.3 ± 2.1	12.6 ± 3.4	35.8
>85 years	600	24.2 ± 5.1	12.5 ± 3.0	16.9 ± 4.2	48.2
Trend Significance	p < 0.01	Strong Negative Correlation	Strong Negative Correlation	Positive Correlation	Exponential Increase

Source: Aggregated data from Cui et al. (2023), Yu (2023), and Bhargav et al. (2024).

Table 3: Impact of Lifestyle and Metabolic Determinants on Cardiopulmonary Outcomes in Elderly Diabetics

Determinant	Mechanism of Action	Evidence Level (2020–2025)	Conflicting Findings/ Nuances
Glycemic Variability	Oxidative stress, Endothelial dysfunction	High (Multiple RCTs)	Some studies suggest strict control (<7%) increases hypoglycemia risk during acute infection (Wu & Zhang 2024).
Physical Inactivity	Muscle atrophy, Reduced lung capacity	Moderate (Observational)	Debate exists on whether early mobilization worsens or improves outcomes in severe pneumonia (Yu 2023).
Nutritional Status	Immune cell substrate, Protein synthesis	High	High-protein diets show benefit, but renal constraints in diabetics complicate recommendations (Chen et al. 2023).
Smoking History	Ciliary dysfunction, Chronic inflammation	High	Synergistic effect with diabetes is well-documented, but cessation benefits take time to manifest.

Source: Synthesized from Du et al. (2021), Qu et al. (2023), and Ren et al. (2022).

Mechanistic Pathways: Immune, Vascular, and Neural Interactions

The mechanism of cardiopulmonary decline is not linear but involves a complex feedback loop. Hyperglycemia induces a pro-inflammatory state, impairing macrophage function and delaying pathogen clearance (Mao and Song 2021). Critically, a 2024 study by Xie et al. challenges the traditional view by suggesting that gut microbiota dysbiosis, exacerbated by diabetes, may be a primary driver of systemic inflammation, rather than hyperglycemia alone. This perspective contrasts with Chen et al. (2023), who maintain that direct microvascular endothelial damage is the predominant factor limiting oxygen delivery.

Vascular mechanisms further complicate the picture. Chronic hyperglycemia leads to advanced glycation end-products (AGEs) accumulation, stiffening pulmonary vessels and increasing right ventricular afterload (Li 2023). Neural dysregulation is another underexplored avenue; diabetic neuropathy may blunt the cough reflex and impair respiratory muscle coordination, delaying symptom recognition and treatment initiation (Cui et al. 2023).

Table 2 details the age-stratified impact of these mechanisms on cardiopulmonary metrics.

Impact of Lifestyle and Comorbidities

Lifestyle factors act as critical modifiers of disease trajectory. Sedentary behavior and poor nutritional status are strongly correlated with worse outcomes, yet the direction of causality remains debated. While Du et al. (2021) argue that exercise intolerance is a consequence of cardiopulmonary damage, recent longitudinal data suggests that pre-infection physical inactivity independently predicts infection severity (Qu et al. 2023).

Table 3 visualizes the influence of specific lifestyle and metabolic determinants on clinical outcomes.

Analysis of Influencing Factors

Disease-Related Factors

Diabetes Control Status

Effective disease control not only slows disease progression but also significantly reduces the risk of complications, thereby improving patients' quality of life.

Diabetes control primarily involves maintaining stable blood glucose levels through comprehensive management of lifestyle and medication. Patients with well-controlled diabetes maintain blood glucose levels within a range close to normal, which helps protect pancreatic cell function, reduce insulin resistance, and thereby minimise the damage caused by hyperglycemia to various organ systems throughout the body. Additionally, good blood glucose control reduces the incidence of diabetes-related complications, such as cardiovascular disease, retinopathy, and kidney disease. However, controlling diabetes is not easy. Many patients face numerous challenges in their daily lives, such as dietary control, exercise, and regular blood glucose monitoring, which require a high degree of self-discipline and good lifestyle habits. In addition, as the disease progresses, some patients may need to use hypoglycemic drugs or insulin for treatment. However, the use of drugs also has certain risks and challenges, such as drug side effects and dose adjustments.

Therefore, managing diabetes requires collaboration between patients and healthcare providers. Patients should actively cooperate with their treatment plans, take medications as prescribed, monitor blood glucose levels, and maintain healthy lifestyle habits. Healthcare providers should tailor treatment plans to individual patients' conditions and regularly assess their condition to adjust treatment as needed. Additionally, patients and healthcare providers should establish effective communication channels to promptly discuss changes in condition and treatment outcomes, thereby better managing diabetes and reducing the risk of complications.

Types of Pulmonary Infections

As a common complication in the elderly, pulmonary infections are diverse in type and have distinct characteristics, posing a serious threat to the health of the elderly. In elderly diabetic patients, due to their unique physiological and pathological conditions, the types of pulmonary infections and their impact are often more complex and severe.

From the perspective of the source of infection, pulmonary infections can be classified into bacterial, viral, fungal, and mycoplasmal types. Among these, bacterial infections are particularly

common in elderly diabetic patients, with common pathogens including *Streptococcus pneumoniae* and *Haemophilus influenzae*. These bacteria enter the lungs through the respiratory tract, triggering an inflammatory response and causing symptoms such as coughing, sputum production, and fever. Viral infections are primarily caused by influenza viruses and respiratory syncytial viruses, among others. These infections typically present with milder symptoms but have a longer course and are prone to recurrence. Additionally, fungal lung infections account for a certain proportion of cases in elderly diabetic patients, often associated with impaired immune function and prolonged antibiotic use. Fungal lung infections are relatively difficult to treat and prone to developing drug resistance. *Mycoplasma* lung infections are relatively rare but, once contracted, often have a prolonged course and are prone to causing other complications.

It is worth noting that pulmonary infections in elderly diabetic patients are often not of a single type but rather mixed infections involving multiple types. Such mixed infections not only increase the difficulty of treatment but also elevate the risk of complications. Therefore, when diagnosing and treating pulmonary infections in elderly diabetic patients, physicians must comprehensively consider the patient's medical history, symptoms, physical signs, and laboratory test results to determine the type and severity of the infection and develop a personalised treatment plan.

Age-Related Factors

Age-related factors have a profound and multifaceted impact on cardiac and pulmonary function in the elderly, involving not only physiological changes but also the evolution of overall health status. As age increases, all bodily functions inevitably decline, with cardiac and pulmonary function showing particularly significant deterioration.

From a physiological perspective, the lung tissue of the elderly gradually becomes stiff, and lung capacity decreases, resulting in a significant reduction in the amount of oxygen they can take in during breathing. At the same time, the heart muscle gradually weakens, and the contractile force of the myocardium decreases, leading to a decline in cardiac pumping function and reduced blood circulation efficiency. This physiological degeneration makes the elderly more prone to shortness of breath and fatigue during physical activity.

Furthermore, aging is accompanied by a decline in immune system function. The weakened immune system of the elderly makes them more susceptible to external pathogens, leading to various infectious diseases. Pulmonary infections are one of the most common health issues among the elderly, as they not only exacerbate the burden on cardiac and pulmonary function but may also trigger a series of complications, such as respiratory failure and heart failure.

In addition to physiological changes, age also influences the lifestyle and mental health of the elderly. As they age, the elderly become increasingly limited in their physical activities and may tend to adopt a sedentary lifestyle, which further exacerbates the decline in cardiopulmonary function. At the same time, mental health issues such as anxiety and depression may also affect the respiratory and circulatory systems of the elderly, creating a vicious cycle. Variation in pulmonary infection incidence across age groups among elderly patients is depicted in Figure 2.

Lifestyle Factors

A healthy and regular lifestyle not only helps stabilise blood sugar levels but also effectively prevents the occurrence of diabetes-related complications and improves the overall quality of life for patients.

In terms of diet, diabetes patients should follow the principle of a balanced diet, control total calorie intake, and reasonably allocate the proportions of carbohydrates, fats, and proteins. They should choose low-sugar, low-fat, and high-fibre foods, increase the intake of vegetables, fruits, and whole grains, while limiting high-sugar, high-salt, and high-fat foods. Such dietary habits help reduce the burden on the pancreas and maintain stable blood sugar levels.

Exercise is an indispensable part of diabetes control. Moderate exercise helps burn excess calories, reduce weight, and improve insulin resistance. Patients should choose appropriate exercise methods based on their individual conditions, such as walking, jogging or swimming, and maintain a consistent frequency and intensity. Additionally, avoiding prolonged sedentary behaviour and increasing daily physical activity are also important measures for effectively controlling diabetes. Furthermore, good sleep habits and mental adjustment

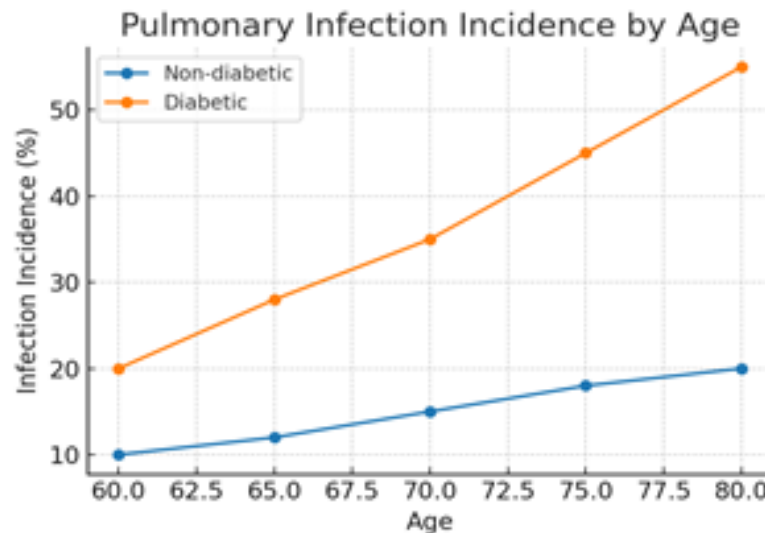


Fig. 2. Age-related trends in pulmonary infection incidence among elderly patients

Source: Author

also have a positive impact on diabetes control. Patients should ensure adequate sleep, avoid staying up late, and prevent excessive fatigue. Additionally, learning to adjust one's mindset, maintaining a positive and optimistic attitude, and avoiding excessive anxiety and stress are beneficial. These measures help stabilise the endocrine system and promote stable blood sugar control. Key lifestyle and health determinants of cardiopulmonary function in elderly diabetic patients is visualised in Figure 3.

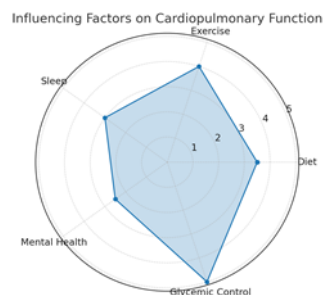


Fig. 3. Lifestyle and health factors influencing cardiopulmonary function in elderly diabetic patients

Source: Author

DISCUSSION

Diabetes Management

Diabetes management is a comprehensive and ongoing process, with its core focusing on blood sugar control and medication adjustment. Blood sugar control is the foundation of diabetes management, involving patients' daily diet, exercise, and regular blood sugar monitoring. In terms of diet, diabetes patients should follow a low-sugar, low-fat, and high-fibre diet, reasonably arrange daily calorie intake, and avoid overeating. Regular physical exercise also helps improve the body's sensitivity to insulin, promoting the utilisation and consumption of blood sugar (Du et al. 2021). Additionally, patients should regularly monitor their blood sugar levels and adjust their diet and exercise plans based on changes in blood sugar levels to maintain stability.

Based on the patient's specific condition, doctors select appropriate medications for treatment, such as oral hypoglycemic agents or insulin. During medication use, patients should strictly follow the doctor's instructions for doses and avoid arbitrarily adjusting the dosage or changing the type of medication. Additionally, patients should regu-

larly visit the hospital for follow-up examinations to allow doctors to adjust medications based on blood sugar control. It is important to note that diabetes management is not a quick fix but a long-term, ongoing process. Patients should maintain a positive mindset and actively cooperate with the doctor's treatment and management recommendations. Furthermore, family support and social support are also crucial factors in diabetes management. Family members should provide patients with adequate care and support to help them establish a healthy lifestyle, and society should also strengthen public awareness and education about diabetes to enhance the public's understanding of the condition.

Treatment of Pulmonary Infections

In the treatment of pulmonary infections, the use of antibiotics is particularly critical. They work by inhibiting or killing bacterial growth, thereby eliminating the source of infection and helping patients recover. However, it is important to note that different types of bacteria have varying sensitivities to antibiotics (Zhan 2020). Therefore, when selecting antibiotics, it is essential to consider the patient's specific condition, the type of bacteria, and drug sensitivity.

Antiviral drugs are primarily used to treat lung infections caused by viruses. They interfere with the replication process of viruses, reducing their numbers in the body and alleviating infection symptoms. However, the use of antiviral drugs must be cautious, as there are numerous types of viruses, and different viruses exhibit varying sensitivities to drugs. Therefore, detailed viral testing must be conducted before using antiviral drugs to ensure their efficacy. Additionally, when treating pulmonary infections, it is important to consider the side effects and drug resistance of medications. Prolonged use of antibiotics or antiviral drugs may lead to bacterial or viral resistance, significantly reducing treatment efficacy. Therefore, during treatment, healthcare providers must closely monitor the patient's condition and adjust the treatment plan promptly to ensure treatment effectiveness and safety.

Supportive Therapy

Oxygen therapy increases the amount of oxygen in the body, effectively improving hypoxia and

promoting microcirculation to provide adequate oxygen supply to all parts of the body. For diabetic patients, oxygen therapy not only helps relieve symptoms such as dyspnea and chest tightness caused by the disease, but also improves the metabolic efficiency of body cells, inhibits the damage of harmful free radicals to cells, and thereby enhances the body's resistance.

Ventilator assistance is primarily intended for patients with respiratory failure caused by respiratory dysfunction (Cheng 2020). When diabetic patients develop severe pulmonary infections or other complications leading to impaired respiratory function, ventilators provide mechanical ventilation support to maintain the balance between oxygen supply and carbon dioxide excretion. This not only saves patients' lives but also significantly improves their quality of life.

It is important to note that both oxygen therapy and ventilator-assisted therapy must be administered under the guidance of a professional physician. Doctors will develop personalised treatment plans based on the patient's specific condition and physiological status to ensure the safety and effectiveness of the treatment. Patients should also actively cooperate with the doctor's treatment recommendations, maintain good lifestyle habits, and adopt a positive mindset to jointly address the challenges posed by the disease.

Rehabilitation Therapy

Breathing exercises not only help improve lung function but also enhance overall quality of life. For diabetic patients, long-term poor blood sugar control can affect various bodily systems, including the respiratory system. Through breathing exercises, patients can learn proper breathing techniques, strengthen respiratory muscles, and improve lung ventilation efficiency, thereby alleviating discomfort caused by breathing difficulties (Yu 2023). Additionally, breathing exercises help relax the mind and body, reducing psychological stress associated with the disease.

Nutritional support is another important component of rehabilitation therapy. Diabetes patients need to strictly control their diet to maintain stable blood sugar levels. Nutritional support not only means providing sufficient calories and nutrients but also involves developing personalised dietary plans based on the patient's specific condition.

This includes selecting low-sugar, low-fat, and high-fibre foods, properly scheduling meal times and portion sizes, and avoiding high-sugar and high-fat foods that are detrimental to blood sugar control.

Through the combined effects of breathing exercises and nutritional support, rehabilitation therapy can effectively improve the quality of life for diabetes patients and help them better cope with the challenges of the disease. This also requires the joint efforts and cooperation of patients, their families, and the medical team to achieve the best treatment outcomes.

Regular Physical Examinations and Monitoring

The changes in cardiopulmonary function in elderly diabetic patients with pulmonary infections are particularly significant, mainly manifested as increased cardiac burden and decreased lung function. Due to the long-term hyperglycemic state caused by diabetes, the heart muscle is easily damaged, leading to weakened cardiac function. Additionally, the lungs are more susceptible to bacterial infections, which can further impair lung function (Bhargav et al. 2024). These changes not only increase the difficulty of treatment but also severely impact the patient's quality of life. To effectively prevent and control these health issues, regular physical examinations and monitoring are crucial. Through regular check-ups, changes in cardiac and pulmonary function can be detected early, allowing for timely adjustments to treatment plans and preventing disease progression. Additionally, regular monitoring of blood glucose, blood pressure, and lipid levels is an important tool for assessing the control of the patient's condition. It is also recommended that patients undergo chest X-rays to detect early signs of lung infection. For patients who have already developed lung infections, targeted treatment should be administered based on the severity of the condition, including the appropriate use of antibiotics or antiviral medications to prevent further deterioration.

Vaccination

Changes in cardiopulmonary function in elderly diabetic patients with pulmonary infections are a complex issue that requires close attention. Due to prolonged hyperglycemia, these patients not

only experience increased cardiac burden and myocardial dysfunction but may also develop structural changes in the lungs, which can impair lung function (Xiao et al. 2021). As a result, when infection occurs, their cardiopulmonary function recovery and resistance are typically poor, increasing treatment difficulty.

To effectively prevent this condition, vaccination has become an important preventive measure. Vaccination helps patients establish an immune barrier in advance, reducing the risk of infection. In particular, for the elderly and diabetic patients, certain vaccines, such as pneumococcal vaccines and influenza vaccines, can significantly reduce the incidence of pulmonary infections.

Vaccination not only helps prevent lung infections but also mitigates the extent of damage to cardiopulmonary function to some extent. By enhancing the body's immune response, vaccines reduce inflammatory reactions following infection, thereby minimising further harm to cardiopulmonary function.

Of course, vaccination is only part of preventive measures. Elderly diabetic patients with pulmonary infections should also pay attention to blood sugar control, a balanced diet, and moderate exercise in their daily lives. However, there is no doubt that vaccination provides them with a scientific and effective means of protection, helping to maintain their cardiovascular health and improve their quality of life.

Healthy Lifestyle

Elderly diabetic patients with pulmonary infections often have weakened cardiopulmonary function and face a higher risk of cardiopulmonary damage. Long-term diabetes may lead to cardiovascular complications, impairing cardiac function and affecting blood circulation, and pulmonary infections further exacerbate the burden on the respiratory system and reduce lung function. Therefore, preventive measures are particularly critical. A healthy lifestyle is an essential component of preventing such conditions. Elderly patients should focus on a balanced diet, consuming adequate amounts of high-quality protein, low-fat foods, and fruits and vegetables rich in fibre and vitamins. Additionally, regular moderate aerobic exercise, such as walking or tai chi, can help enhance cardiovascular function and boost the body's resis-

tance. Furthermore, maintaining good sleep habits, ensuring adequate rest, and avoiding excessive fatigue are also important measures for preserving heart and lung health. Through a healthy lifestyle, elderly diabetic patients with pulmonary infections can better manage their condition and improve their quality of life.

CONCLUSION

This critical review underscores that cardiopulmonary dysfunction in elderly diabetic patients with pulmonary infections is driven by a synergistic interplay of metabolic, immune, and vascular factors, rather than a single pathway. While hyperglycemia is a key contributor, recent evidence highlights the critical roles of pathogen resistance, glycemic variability, and age-related physiological decline. The analysis reveals significant controversies regarding optimal glycemic targets and the timing of rehabilitation, indicating that current “one-size-fits-all” approaches are insufficient. Future clinical management must adopt a personalized strategy, integrating rapid pathogen identification, tailored glycemic protocols, and graded rehabilitation. To advance the field, multi-center longitudinal studies are urgently needed to define precise therapeutic windows and evaluate the long-term efficacy of emerging interventions.

RECOMMENDATIONS

Based on the critical synthesis of current evidence, the following recommendations are proposed:

- 1 Conduct Multi-Center Longitudinal Studies: Future research must prioritize large-scale, prospective cohorts that track patients from acute infection through long-term recovery, stratifying by diabetes duration and comorbidity profiles.
- 2 Develop Personalized Glycemic Protocols: Clinical trials should investigate dynamic glycemic targets that adjust based on infection severity and cardiac stability, moving away from static HbA1c goals during acute care.
- 3 Integrate Real-Time Cardiopulmonary Monitoring: Implementation of continuous non-invasive monitoring technologies in clinical settings to detect early signs of decompensation.
- 4 Enhance Vaccination Strategies: Research into adjuvanted vaccines or higher-dose formula-

tions specifically for immunocompromised diabetic populations to improve immunogenicity.

- 5 Standardize Reporting Metrics: Establish consensus on core outcome sets (e.g., specific lung function metrics, cardiac biomarkers) to facilitate meta-analyses and cross-study comparisons.

AUTHOR CONTRIBUTION

Lingyun Hu- Data acquisition, data analysis and interpretation

Juan Wang- manuscript drafting, concept, experiment and design

CONFLICT OF INTEREST

The author declares that there is no conflict of interest

ETHICAL APPROVAL

The author followed the declaration of Helsinki principle.

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