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Screening, Diagnosis, and Prevention in Clinical Practice: Evidence from Argentine and Latin American Medicine (English Version)
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Pneumonia and pulmonary fibrosis: a narrative review

Neumonía y fibrosis pulmonar: una revisión narrativa

Cristhian Amir Ramírez Arcentales[1] ✉, Jhan Antony Vinces Paredes[1], Bety Consuelo Cordova Cruz[1], Diana Katherine Choquehuanca Guevara[1], Tatiana Vargas Ramírez[1], Wilter C. Morales García[2] ✉, Víctor Álvarez-Manrique[1], Mardel Morales-García[3]

[1]Escuela Profesional de Enfermería, Facultad de Ciencias de la Salud, Universidad Peruana Unión. Tarapoto, Perú.
[2]Dirección General de Investigación, Universidad Peruana Unión. Lima, Perú.
[3]Unidad de Salud Pública, Escuela de Posgrado, Universidad Peruana Unión. Lima, Perú.

Corresponding author: Wilter C. Morales García ✉

ABSTRAC

Objective: to briefly review the literature on pneumonia and its incidence in pulmonary fibrosis, considering treatment, prognosis, risk factors, and diagnosis.
Design: literature review based on a narrative synthesis. *Data sources:* Scopus, ScienceDirect, and PubMed. Data selection: Documents were selected and analyzed using a critical literature review, considering inclusion and exclusion criteria.
Results: a corpus of 30 articles was analyzed, of which 18 were retrospective, 5 prospective, 2 cross-sectional, 1 systematic, 3 multicenter, and 1 single-center. The study population included different categories: adults, older adults, children, adolescents, men, and women. The studies were conducted in various countries: Japan, China, Egypt, South Korea, Turkey, Argentina, Italy, the United States, and Germany, each contributing a unique perspective to the research. Seven articles were identified that addressed treatment and interventions associated with different medications for treating fibrosis, ten articles that focused on the efficacy or improvement of diagnostic techniques such as computed tomography, five articles that addressed the prognosis and evolution of pneumonia and pulmonary fibrosis, and eight articles on risk factors. Regarding socioeconomic status, the reviewed articles did not include information related to this aspect, so it was not possible to determine whether the participants' economic conditions influenced the onset or evolution of pneumonia and pulmonary fibrosis.
Conclusion: antifibrotic and immunosuppressant drugs, such as nintedanib, pirfenidone, and thrombomodulin, reduce inflammation and lung damage, improving respiratory function and quality of life. Post-COVID pulmonary fibrosis, whether due to myositis or interstitial pneumonia, generally progresses slowly, requiring early treatment to improve the patient's prognosis. It is highlighted that chronic pulmonary inflammation and exposure to harmful agents promote the development of fibrosis, bronchiectasis, and lung cancer. Crackles, microscopic polyangiitis, and the systemic immunoinflammation index are key to the early detection of inflammation and lung damage, facilitating the diagnosis and management of fibrotic diseases.

Keywords: Pneumonia; Pulmonary Fibrosis; Interstitial Pneumonia.

RESUMEN

Objetivo*:* analizar la literatura disponible sobre la neumonía y su incidencia en la fibrosis

pulmonar de acuerdo con tratamiento, pronostico, factores de riesgo y diagnóstico.
Método*:* revisión de la literatura basa en una síntesis narrativa. Fuentes de datos: Scopus, Science direct y Pubmed. *Selección de datos:* los documentos fueron seleccionados y analizados bajo una revisión crítica de literatura tomando en cuenta los criterios de inclusión y de exclusión. **Resultados:** se analizó un corpus de 30 artículos de los cuales 18 retrospectivo, 5 prospectivo, 2 Transversal, 1 Sistemática, 3 Multicéntrico, 1 Unicéntrico. La población estudiada contiene diferentes categorías: se centraron en adultos, adultos mayores, niños, adolescentes, hombres y mujeres. Los estudios se realizaron en diversos países: 1 Diferentes países internacionales, Japón, China, Egipto, Corea del sur, Turquía, Argentina, Italia, Estados unidos, Alemania, cada uno aportó una perspectiva única a la investigación, cada uno aporto una perspectiva única a la investigación. Se identificaron 7 artículos que abordaron tratamiento e intervención asociados a los diferentes medicamentos para tratar la fibrosis, 10 artículos que se enfocaron en la eficacia o mejora de técnicas diagnósticas como la tomografía computarizada, 5 artículos que trataron sobre pronostico y evolución de la neumonía y fibrosis pulmonar, y 8 artículos sobre factores de riesgo. Respecto al nivel socioeconómico, los artículos revisados no incluyeron información relacionada con este aspecto, por lo que no fue posible identificar si las condiciones económicas de los participantes influyeron en la aparición o evolución de la neumonía y la fibrosis pulmonar. **Conclusión:** los antifibróticos e inmunosupresores, como nintedanib, pirfenidona y trombomodulina, reducen la inflamación y el daño pulmonar, mejorando la función respiratoria y la calidad de vida. Mayormente la fibrosis pulmonar post-COVID, por miositis o neumonía intersticial progresa lentamente, requiriendo tratamiento temprano para mejorar el pronóstico del paciente. Se resalta que la inflamación pulmonar crónica y la exposición a agentes nocivos favorecen la aparición de fibrosis, bronquiectasias y cáncer pulmonar. Los crepitantes, la poliangeítis microscópica y el índice de inmunoinflamación sistémica son claves para detectar tempranamente la inflamación y el daño pulmonar, facilitando el diagnóstico y control de enfermedades fibróticas.

Palabras clave: Neumonía; Fibrosis Pulmonar; Neumonía Intersticial.

INTRODUCTION

Idiopathic pulmonary fibrosis is a lung disease associated with a type of interstitial pneumonia called usual interstitial pneumonia. It is chronic, worsens over time, and is incurable (J. Kim et al., 2024) in patients who do not receive antifibrotic treatment (Wuyts et al., 2013), increasing serious complications that require timely medical attention. It is not yet known whether COVID-19 survivors with pneumonia are at risk based on indicators of disease progression (Alsomali et al., 2023), and their long-term quality of life is attracting increasing interest in follow-up. Sixty-two percent of coronavirus survivors were reported (Sanclemente-Cardoza et al., 2024), and there is no modern treatment; however, early use of anti-fibrotics in severe cases with ARDS could reduce its development (Caro et al., 2022).

Idiopathic pulmonary fibrosis is becoming a major public health problem, causing increased incidence and mortality worldwide (Baqir et al., 2022). Some findings report that pulmonary fibrosis is evidenced by mild or severe manifestations such as lung cancer, lung inflammation, or even influenza, which, if not treated in time, can progress to pneumonia, leading to mechanical ventilation and strong medications in difficult situations (Chen et al., 2021).

Pulmonary fibrosis tends to progress to more severe forms (Nakayasu et al., 2025). However, it has been found that patients with chronic respiratory diseases have a slower progression

at the onset but develop greater complications and deterioration of lung function over time (Tanaka et al., 2014).

Identifying risk factors is important for anticipating the onset of pulmonary fibrosis and improving the management of patients recovering from severe COVID-19 (H. Kim et al., 2020), given a survival rate of only 20 % that reflects the lack of effective therapies (Wuyts et al., 2025). Acute exacerbations represent a medical emergency with high mortality, making it essential to understand their risk factors in patients (David et al., 2024), with pulmonary rehabilitation being important in helping to recover respiratory capacity (Samet et al., 2015). Likewise, the creation of registries and databases allows for a better understanding of the disease and improves the diagnosis, treatment, and follow-up of patients in Latin America (Sambataro et al., 2022).

For this reason, the present study aims to briefly review the literature on pneumonia and its incidence in pulmonary fibrosis, focusing on treatment, prognosis, risk factors, and diagnosis.

METHOD

A comprehensive narrative review of pneumonia and pulmonary fibrosis was conducted to explore the existing scientific literature, consulting the following databases: Scopus, PubMed, and ScienceDirect. To refine the search, the following terms were used: (pneumonia and pulmonary fibrosis). In addition, the Boolean operator AND was used to refine and broaden the search scope, and the search period was extended from August to November 2025, with articles published between 2020 and 2025 included in the review. This search covered texts written in any language, specifically excluding case reports, interviews, letters to the editor, theses, and books, due to their less empirical nature or specific focus.

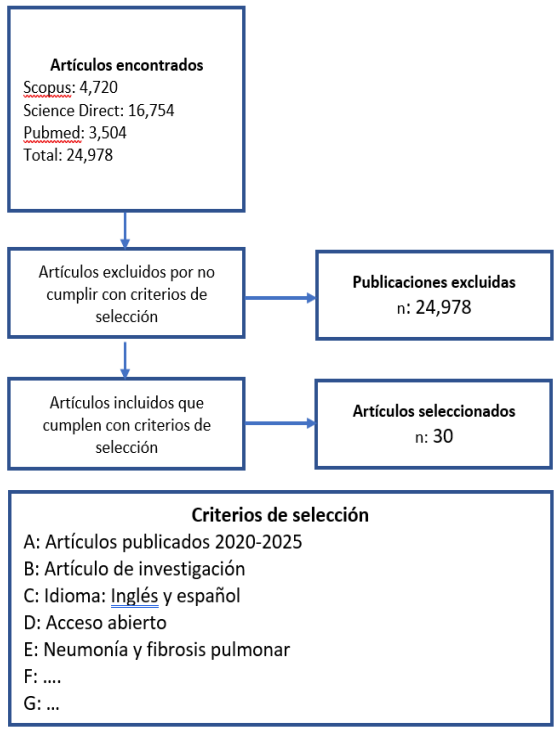

Figure 1. Flow diagram

Within the databases, a total of 24,978 articles were initially identified using the designed search string. Of these, 16,754 corresponded to the ScienceDirect database, 3,504 to PubMed, and 4,720 to Scopus.

Next, 0 duplicate articles were removed. Subsequently, 24,978 articles that did not align with the study objective and others that did not meet the established inclusion criteria were excluded. As a result of this filtering and selection process, a final corpus of 30 articles relevant to the review was obtained.

RESULTS

A corpus of 30 articles was analyzed, comprising 18 retrospective, 2 cross-sectional, 5 prospective, 1 systematic, 1 single-center, and 3 multicenter studies. The population studied included women, men, adolescents, adults, older adults, and children.

The studies were conducted in various countries, including Japan, China, Egypt, South Korea, Turkey, Argentina, Italy, the United States, and Germany, providing perspectives from diverse social, economic, and cultural realities. Seven articles addressed treatment and interventions associated with different medications for fibrosis; 10 articles focused on the efficacy or improvement of diagnostic techniques such as computed tomography; 5 articles on the prognosis and evolution of pneumonia and pulmonary fibrosis; and 8 articles on risk factors for pulmonary fibrosis.

The clinical conditions of the participants in the aforementioned studies were analyzed in 30 articles: pulmonary fibrosis, usual interstitial pneumonia, idiopathic pulmonary fibrosis, idiopathic interstitial pneumonia, severe pneumonia due to COVID-19, microscopic polyangiitis, nonspecific interstitial pneumonia, eosinophilic pneumonia, diabetes, and myositis. Regarding socioeconomic status, the reviewed articles did not include information on this aspect, so it was not possible to determine whether participants' economic conditions influenced the onset or progression of pneumonia and pulmonary fibrosis.

Table 1. Results table

Study title	Methodology	Objective/sample	Main results
(Chen et al., 2021) An increased risk of lung cancer in combined pulmonary fibrosis and emphysema patients with usual interstitial pneumonia compared with patients with idiopathic pulmonary fibrosis alone: a systematic review and meta-analysis	Systematic review and meta-analysis	The study sought to determine whether patients with combined pulmonary fibrosis and emphysema (CPFE) and usual interstitial pneumonia (UIP) are at greater risk of lung cancer than those with idiopathic pulmonary fibrosis (IPF) alone. Sample: 933 patients, including 374 patients with CPFE and UIP	The prevalence of lung cancer is higher in pulmonary fibrosis with emphysema and usual interstitial pneumonia than in idiopathic pulmonary fibrosis.
(Nakayasu et al., 2025) Association between the HAL score and the development of progressive pulmonary fibrosis in idiopathic interstitial pneumonia: A prospective observational study	Post-hoc analysis of a prospective, multicenter cohort study.	The study seeks to verify whether the clinical scoring scale (HAL) can serve as a tool for predicting patients who may develop progressive pulmonary fibrosis Sample: 144 patients, 29 developed PPF	Idiopathic pulmonary fibrosis is related to progressive pulmonary fibrosis.

(Hosoda et al., 2016) Clinical features of usual interstitial pneumonia with anti-neutrophil cytoplasmic antibody in comparison with idiopathic pulmonary fibrosis	Retrospective review	To clarify the clinical, radiological, and pathological characteristics of usual interstitial pneumonia associated with myeloperoxidase-type antineutrophil cytoplasmic antibodies (ANCA-MPO). Samples: 12 patients with ANCA/UIP and 108 with IPF/UIP	Pathological and radiological findings help differentiate antibody-associated interstitial pneumonia (ANCA/UIP) from idiopathic pulmonary fibrosis with usual interstitial pneumonia (IPF/UIP).
(Fang et al., 2020) Pulmonary fibrosis in critically ill patients recovered from COVID-19 pneumonia: Preliminary experience	Retrospective review	To investigate chest computed tomography (CT) findings associated with severe COVID-19 pneumonia in the early recovery period. Sample: 12 patients with fever, dyspnea, and cough	Fibrous streaks and obstructive fibrosis are common in critically ill patients with COVID-19 pneumonia in early recovery.
(Ali & Ghonimy, 2021) Post-COVID-19 pneumonia lung fibrosis: a worrisome sequela in surviving patients	Prospective cross-sectional	Early detection and prediction of patients who may develop progressive pulmonary fibrosis due to post-COVID-19 pneumonia, in order to provide anti-fibrotic treatment Sample: 80 patients with clinical manifestations and COVID-19	Post-COVID-19 pulmonary fibrosis causes permanent damage, and predicting which patients are at risk allows for early treatment.
(Tominaga et al., 2015) Diagnostic certainty of idiopathic pulmonary fibrosis/usual interstitial pneumonia: The effect of the integrated clinico-radiological assessment	Retrospective Multi-institutional	To evaluate cases of idiopathic pulmonary fibrosis (IPF) that were diagnosed by surgical lung biopsy (SLB) in order to confirm the presence of usual interstitial pneumonia (UIP) and analyze the influence of computed tomography on this diagnosis. Sample: 95 with idiopathic pulmonary fibrosis	In some cases of idiopathic pulmonary fibrosis, the diagnosis was uncertain and could be confused with other interstitial diseases.
(Zhao et al., 2019) Clinical features and prognosis of microscopic polyangiitis with usual interstitial pneumonia compared with idiopathic pulmonary fibrosis	Retrospective study	To analyze the prevalence of usual interstitial pneumonia associated with microscopic polyangiitis (UIP-MP), compare its clinical characteristics and prognosis with usual interstitial pneumonia not associated with microscopic polyangiitis and idiopathic pulmonary fibrosis (IPF). Sample: 73 patients with UIP-MP and 68 patients with IPF	Usual interstitial pneumonia was the main pattern in microscopic polyangiitis (UIP-MPA), with chronic onset and prolonged symptoms prior to diagnosis.
(H. Kim et al., 2020) Right-Angled Traction Bronchiectasis in Differentiating Idiopathic Pulmonary Fibrosis Without Honeycombing From Idiopathic Nonspecific Interstitial Pneumonia	Retrospective study	To determine whether right-angled traction bronchiectasis on CT scans can help differentiate idiopathic pulmonary fibrosis (IPF) without honeycombing from nonspecific interstitial pneumonia (NSIP). Sample: 78 consecutive patients with idiopathic NINE or IPF	Bronchiectasis showed more scarring on the outer part of the lung and helped differentiate idiopathic pulmonary fibrosis from nonspecific interstitial pneumonia.

(Tsubouchi et al., 2023) Survival and acute exacerbation for patients with idiopathic pulmonary fibrosis (IPF) or non-IPF idiopathic interstitial pneumonias: 5-year follow-up analysis of a prospective multi-institutional patient registry	prospective observational prospective and multicenter	To evaluate disease progression and cause of death in patients with idiopathic pulmonary pneumonia (IPP) or idiopathic pulmonary fibrosis (IPF) in real-world conditions. Sample: 528 patients with IPF	Acute exacerbations were similar in idiopathic interstitial pneumonias and idiopathic pulmonary fibrosis, being a major cause of death in both cases.
(Yoo et al., 2024) Early pulmonary fibrosis-like changes between delta and pre-delta periods in patients with severe COVID-19 pneumonia on mechanical ventilation	Post-hoc analysis of a multicenter registry	Compare pulmonary fibrotic changes between two periods of SARS-CoV-2 variants (delta and predelta) in critically ill patients with SARS-CoV-2 pneumonia. Samples: 184 patients, aged 64-65, presented with fibrosis on chest CT	Critically ill patients with pulmonary fibrosis due to COVID-19 were more severe and frequent during the delta variant period compared to the pre-delta period.
(Sargin et al., 2025) Systemic immune-inflammation index in the evaluation of Sjogren's syndrome associated with interstitial lung disease, interstitial pneumonia with autoimmune features, and idiopathic pulmonary fibrosis	Cross-sectional review	To evaluate whether the systemic immune-inflammation index (SII) can help diagnose and differentiate between different types of interstitial lung disease, such as that associated with Sjögren's syndrome, interstitial pneumonia with autoimmune features, and idiopathic pulmonary fibrosis. Sample: 109 patients with interstitial pneumonia with autoimmune features (FAPI), idiopathic pulmonary fibrosis (IPF), and interstitial lung disease associated with Sjögren's syndrome	The systemic immunoinflammation index helps to assess inflammation and differentiate between different types of interstitial lung diseases and pulmonary fibrosis.
(Chertcoff et al., 2015) Survival in patients with usual interstitial pneumonia in the context of idiopathic pulmonary fibrosis and connective tissue disease	Retrospective study	Compare the severity and survival of patients with usual interstitial pneumonia in the context of connective tissue disease (UIP-CTD) caused by idiopathic pulmonary fibrosis. Sample: 102 patients, 81 with idiopathic pulmonary fibrosis and 21 with interstitial pneumonia	Patients with usual interstitial pneumonia caused by problems affecting the joints and tissues of the body live longer than those with idiopathic pulmonary fibrosis.
(Sambataro et al., 2022) "Usual" interstitial pneumonia with autoimmune features: a prospective study on a cohort of idiopathic pulmonary fibrosis patients	prospective cohort study	To analyze whether patients with usual interstitial pneumonia with autoimmune features (UIPAF) are at greater risk of developing an autoimmune disease compared to those with idiopathic pulmonary fibrosis (IPF). **Sample:** 190 patients with idiopathic pulmonary fibrosis (IPF)	Patients with usual interstitial pneumonia with autoimmune features are more likely to develop an autoimmune disease than those with idiopathic pulmonary fibrosis alone.

(Baqir et al., 2022) Idiopathic Chronic Eosinophilic Pneumonia Evolving to Pulmonary Fibrosis: A Retrospective Analysis	Retrospective study	To identify factors that may cause pulmonary fibrosis in patients with idiopathic chronic eosinophilic pneumonia (ICEP), describe the chronology of pulmonary fibrosis after diagnosis, and how it manifests on radiological images. **Sample:** 62 patients with idiopathic chronic eosinophilic pneumonia (ICEP)	Chronic eosinophilic pneumonia can cause pulmonary fibrosis in older men, but asthma reduces the risk of developing this complication.
(Ehrlich et al., 2010) Patients Diagnosed With Diabetes Are at Increased Risk for Asthma, Chronic Obstructive Pulmonary Disease, Pulmonary Fibrosis, and Pneumonia but Not Lung Cancer	Retrospective longitudinal cohort	To evaluate and compare the incidence of asthma, chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, pneumonia, and lung cancer in patients diagnosed with diabetes **Sample** 1,811,228 people enrolled in Kaiser Permanente in California. Of these, 77,637 had diabetes and 1,733,591 did not have diabetes	People with diabetes are at increased risk for asthma, chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, and pneumonia, but they do not show an increased risk for lung cancer.
(Umemura et al., 2021) Efficacy and safety of nintedanib for pulmonary fibrosis in severe pneumonia induced by COVID-19: An interventional study	Single-center interventional study	To evaluate whether the drug nintedanib, which helps slow pulmonary fibrosis, is effective and safe in patients with COVID-19, given that this fibrosis is one of the most serious complications of the disease. **Sample:** 30 patients with COVID-19 who received the drug nintebanib and 30 patients who did not receive nintedanib	Nintedanib improved breathing and reduced lung damage in severely ill patients with COVID-19, so it could help prevent fibrosis.
(Wang et al., 2023) Progressive pulmonary fibrosis in myositis-specific antibody-positive interstitial pneumonia: a retrospective cohort study	Retrospective cohort	To assess how many patients with interstitial pneumonia associated with idiopathic inflammatory myopathy develop progressive pulmonary fibrosis and to identify the factors that influence its progression. **Sample:** 307 patients, 91 developed progressive pulmonary fibrosis (PPF)	Patients with acute interstitial pneumonia and low lung capacity are at greater risk of progressive fibrosis, but immunosuppressants and antifibrotic drugs can slow its progression.
(Sakamoto et al., 2021) Effectiveness of pirfenidone for idiopathic pulmonary fibrosis associated with pleuroparenchymal fibroelastosis-like lesions and nonspecific interstitial pneumonia	Retrospective study	To determine whether pirfenidone is effective in slowing lung deterioration in patients with idiopathic pulmonary fibrosis who have fibrotic lesions and in those with nonspecific interstitial pneumonia-like lesions. **Sample:** 58 patients with IPF treated with pirfenidone	Pirfenidone slowed the loss of lung function in idiopathic fibrosis, but patients with nonspecific interstitial pneumonia had worse outcomes.

(H. E. Lee et al., 2016) Incidence and prevalence of idiopathic interstitial pneumonia and idiopathic pulmonary fibrosis in Korea	Institutional review	To determine how many people in Korea suffer from idiopathic interstitial pneumonia (IIP) and idiopathic pulmonary fibrosis (IPF) by analyzing health data from across the country. **Sample:** 6,657 cases of idiopathic pulmonary fibrosis and 17,826 cases of idiopathic interstitial pneumonia	Idiopathic pulmonary fibrosis in South Korea is as common as in Western countries, making it a significant public health issue.
(Abe et al., 2015) Efficacy of thrombomodulin for acute exacerbation of idiopathic pulmonary fibrosis and nonspecific interstitial pneumonia: a nonrandomized prospective study	prospective study	To evaluate whether recombinant human thrombomodulin (rhTM), a drug used in Japan for coagulation problems, can improve the course of acute exacerbations in patients with idiopathic pulmonary fibrosis and nonspecific interstitial pneumonia. **Sample:** 22 patients with idiopathic interstitial pneumonia due to acute exacerbation (AE)	The use of recombinant thrombomodulin reduced mortality in patients with idiopathic fibrosis or nonspecific interstitial pneumonia in acute crisis, without side effects.
(Yu et al., 2020) Prediction of the Development of Pulmonary Fibrosis Using Serial Thin-Section CT and Clinical Features in Patients Discharged after Treatment for COVID-19 Pneumonia	Retrospective study	To determine which clinical factors and CT findings can help predict the development of pulmonary fibrosis in patients who recovered from COVID-19 pneumonia. **Sample:** 32 patients with COVID-19	Patients with severe COVID-19 pneumonia and high inflammation are at greater risk of pulmonary fibrosis, and CT can predict this early.
(Aggarwal et al., 2017) Myositis-associated usual interstitial pneumonia has a better survival rate than idiopathic pulmonary fibrosis	Cohort study	Compare how long patients with myositis-associated usual interstitial pneumonia survive compared to those with idiopathic pulmonary fibrosis. **Sample:** 81 patients with idiopathic pulmonary fibrosis and 43 with myositis-associated usual interstitial pneumonia	Patients with usual interstitial pneumonia caused by inflammation in the muscles (myositis) live longer than those with idiopathic pulmonary fibrosis.
(Li et al., 2020) Effects of phycocyanin on pulmonary and gut microbiota in a radiation-induced pulmonary fibrosis model	Retrospective study	To evaluate whether phycocyanin, a compound in spirulina (a type of algae) with anti-inflammatory properties, can prevent or reduce pneumonia and pulmonary fibrosis caused by radiation therapy **Sample:** Patients with pulmonary fibrosis and pneumonia	Phycocyanin could prevent or reduce pneumonia and pulmonary fibrosis caused by radiation therapy.
(Hyun Lee Chang, 2006) CT analysis of the anterior mediastinum in idiopathic pulmonary fibrosis and nonspecific interstitial pneumonia	Retrospective study	Compare whether the amount and shape of fat in the anterior mediastinum in patients with usual or nonspecific interstitial pneumonia differed from that in healthy individuals. **Sample:** 26 patients with nonspecific interstitial pneumonia and 26 with interstitial pneumonia	In patients with interstitial pneumonia and pulmonary fibrosis, the fat in the chest is similar to that of healthy individuals, but with a convex shape and changes in size.

(Araya et al., 2008) Clinically occult subpleural fibrosis and acute interstitial pneumonia: a precursor to idiopathic pulmonary fibrosis?	Retrospective study	To analyze whether patients with acute exacerbation of idiopathic pulmonary fibrosis have clinical and pathological characteristics similar to acute interstitial pneumonia. Sample: 14 patients with acute interstitial pneumonia	Fibrosis in the outer part of the lung is common in acute interstitial pneumonia, but it cannot be distinguished from those who only have this pneumonia with tests and X-rays.
(Vyshedskiy et al., 2005) Transmission of Crackles in Patients with Interstitial Pulmonary Fibrosis, Congestive Heart Failure, and Pneumonia	Retrospective cohort	To determine whether lung sounds (crackles) in patients with interstitial pulmonary fibrosis are different from those in pneumonia or heart failure, in order to facilitate better diagnosis and treatment. Sample: 20 patients with pneumonia, 17 patients with congestive heart failure, and 19 patients with idiopathic pulmonary fibrosis	Differences in lung sounds (crepitations) can help to better diagnose and treat interstitial pulmonary fibrosis.
(Shimizu et al., 2018) Association of serum high-mobility group box protein 1 level with outcomes of acute exacerbation of idiopathic pulmonary fibrosis and fibrosing nonspecific interstitial pneumonia	Prospective study	To study HMGB1 (high-mobility) protein adequately in the role of acute exacerbation of interstitial pneumonia Sample: 36 patients with acute exacerbation of idiopathic pulmonary fibrosis.	Patients with idiopathic pulmonary fibrosis in acute crisis had high HMGB1 levels, and reducing these levels improved survival, so it could be used as a biomarker and treatment.
(Oda et al., 2014) Distinct Characteristics of Pleuroparenchymal Fibroelastosis with Usual Interstitial Pneumonia Compared with Idiopathic Pulmonary Fibrosis	Retrospective review	Describe how pleuroparenchymal fibroelastosis manifests itself with a pattern of usual interstitial pneumonia and compare it with idiopathic pulmonary fibrosis. Sample: 9 patients with pleuroparenchymal fibroelastosis	Fibroelastosis that damages the outer part and inner tissue of the lung is different from idiopathic pulmonary fibrosis and should be considered a separate disease.
(Schaaf et al., 2000) Neutrophil Inflammation and Activation in Bronchiectasis: comparison with pneumonia and idiopathic pulmonary fibrosis	Retrospective	Compare whether the levels of defenses and inflammatory markers in bronchoalveolar lavage were different between patients with bronchiectasis, pneumonia, and idiopathic pulmonary fibrosis. Sample: 11 patients with bronchiectasis, 30 patients with pneumonia, 15 patients with idiopathic pulmonary fibrosis, and 12 healthy patients	In bronchiectasis, immune imbalance promotes progressive lung damage

(Gao et al., 2021) Six-Month Outcomes of Post-ARDS Pulmonary Fibrosis in Patients with H1N1 Pneumonia	Cohort retrospective	To evaluate the evolution of patients who survived severe influenza virus pneumonia and developed pulmonary fibrosis, using tomography studies and respiratory function tests. **Sample** 280 patients with influenza virus	Patients with pneumonia whose lungs were damaged after the flu and developed pulmonary fibrosis survived the disease, but with sequelae.

DISCUSSION

The findings have enabled the identification of treatment, prognosis, risk factors, and diagnostic criteria for pneumonia leading to pulmonary fibrosis, which other sources will analyze.

Treatment and intervention

COVID-related pulmonary fibrosis allows for the identification of patients at risk, so that early treatment can be initiated (Ali & Ghonimy, 2021), requiring the use of immunosuppressants and antifibrotic drugs that can slow its progression (Wang et al., 2023). Nintedanib improved breathing and reduced lung damage in patients (Umemura et al., 2021), while recombinant thrombomodulin reduced mortality in patients in acute crisis with no side effects. (Mitsuhiro et al 2015), as did pirfenidone, which improved cases of interstitial pneumonia (Li et al., 2020). In cases of idiopathic pulmonary fibrosis, high levels of high-mobility group box 1 (HMGB1) improve survival as a biomarker and treatment (Shimizu et al., 2018). However, phycocyanin prevents lung damage caused by pulmonary fibrosis, but patients with nonspecific pneumonia had worse outcomes (Sakamoto et al., 2021).

Immunosuppressants

To slow the progression of pulmonary fibrosis, immunosuppressants and antifibrotics (Sargin et al., 2025) are the main drugs used in clinical treatment. However, their efficacy is limited, and they can cause serious side effects (Qin et al., 2023). However, good treatment and medical supervision help reduce side effects (J. K. Lee et al., 2023) and slow the progression of lung damage, preventing pulmonary fibrosis from progressing to more severe forms (Jo et al., 2025). People with compromised immune systems may be at greater risk of progressive fibrosis (Shi et al., 2025), but immunosuppressants and antifibrotic drugs can slow its progression (Wang et al., 2023).

Nintedanib

Nintedanib improved breathing and reduced lung damage in patients (Umemura et al., 2021), demonstrating that it can slow the decline in lung function without side effects, making it an option for delaying the progression of progressive pulmonary fibrosis (Wuyts et al., 2025) and increasing life expectancy in people, showing that it can halt the progression of lung damage (Andrisano et al., 2025), making it a key treatment for controlling pulmonary fibrosis and slowing progressive lung damage (Yoo et al., 2024). Nintedanib is effective in slowing the rate of fibrosis progression and improving lung function in patients (Ehrlich et al., 2010). Furthermore, its continued use helps reduce episodes of respiratory deterioration and maintain a better quality of life (Samet et al., 2015).

Recombinant thrombomodulin

The use of recombinant thrombomodulin reduces mortality in patients in acute crisis, without side effects (Abe et al., 2015). It was safe and showed signs of benefit in the treatment of advanced pulmonary fibrosis (Awano et al., 2022). It also improves survival in patients

with acute exacerbation of idiopathic interstitial pneumonia, especially in those with a poor prognosis (Arai et al., 2020), and is a therapeutic alternative that can improve patient survival and recovery (Nakayasu et al., 2025). Recombinant thrombomodulin has shown promising results in reducing inflammation and protecting lung tissue from further damage (Yu et al., 2020), so its early application can help stabilize respiratory function and prevent serious complications during the critical phases of the disease (Nakayasu et al., 2025).

Pirfenidone

Pirfenidone reduces the decline in lung function, but its effects are less favorable in patients with interstitial pneumonia (Li et al., 2020). However, it is effective in reducing inflammation and lung damage, helping to slow the progression of fibrosis (Akashi et al., 2009), and is considered an important treatment for controlling pulmonary fibrosis and preventing more serious damage (Silva, Müller, Lynch, et al., 2008). This medication improves breathing and maintains stable lung function in most patients (Sanclemente-Cardoza et al., 2024). In addition, its continuous use slows disease progression and improves quality of life (Zhao et al., 2019). It has mild side effects but remains a safe and well-tolerated option (Tsubouchi et al., 2023).

Phycocyanin

Phycocyanin prevents lung damage caused by pulmonary fibrosis, but patients with nonspecific interstitial pneumonia had worse outcomes (J. Kim et al., 2024). However, it helped reduce inflammation and lung tissue damage, slowing the progression of fibrosis (Sverzellati et al., 2020), making it a key treatment for improving lung health and slowing fibrosis progression (Lombardi et al., 2024). Its use improves respiratory capacity and maintains stable lung function in most patients (Caro et al., 2022). With continuous treatment, the progression of the disease can be slowed, and severe complications avoided (Oda et al., 2014). In addition, it is well-tolerated and has few side effects when administered under medical supervision (David et al., 2024).

Prognosis and progression

COVID-related pulmonary fibrosis was severe and frequent during the delta variant period compared to the pre-delta period (Yoo et al., 2024), being a major cause of death in both interstitial pneumonia and idiopathic pulmonary fibrosis (Tsubouchi et al., 2023) with permanent sequelae in the lungs (Gao et al., 2021). Survival is more likely in people with interstitial pneumonia than idiopathic pulmonary fibrosis (Chertcoff et al., 2015), as well as in cases associated with myositis (Aggarwal et al., 2017).

Delta

COVID-related pulmonary fibrosis was more severe and more frequent during the Delta variant than during the previous period (Yoo et al., 2024), with a more prolonged course associated with inflammation and diffuse alveolar damage (Lombardi et al., 2024). However, a slower pulmonary recovery with a higher risk of fibrotic sequelae was observed (Sverzellati et al., 2020). Patients who developed fibrosis after infection showed reduced lung function and slower recovery over time (J. K. Lee et al., 2023). In addition, in several cases, persistent lung damage was observed, affecting respiratory capacity and quality of life (Hyun Lee Chang, 2006). Therefore, clinical follow-up and pulmonary rehabilitation are essential to improve prognosis and prevent long-term complications (Ehrlich et al., 2010).

Myositis

Pulmonary fibrosis due to myositis can progress slowly and affect the lungs, complicating the

patient's recovery (David et al., 2024). With treatment and constant monitoring, it is possible to improve muscle strength and maintain better lung function (Yu et al., 2020). Therefore, early detection and adequate medical care are essential to improve quality of life (Shi et al., 2025). Patients with myositis may experience muscle weakness, fatigue, and shortness of breath when inflammation also affects the lungs (Lombardi et al., 2024). It can cause pain and muscle weakness (Wuyts et al., 2013). On the other hand, patients with usual interstitial pneumonia caused by myositis live longer than those with pulmonary fibrosis (Jo et al., 2025).

Interstitial pneumonia

In cases of interstitial pneumonia, it is a major cause of death, as in idiopathic pulmonary fibrosis (Tsubouchi et al., 2023). It usually progresses slowly but tends to worsen over time (Fang et al., 2020). Despite treatment, interstitial pneumonia progresses to pulmonary fibrosis, demonstrating the need to intervene earlier to prevent lung deterioration (Chertcoff et al., 2015). Patients with more advanced forms of interstitial pneumonia show a lower response to treatment and constant respiratory deterioration (Ali & Ghonimy, 2021). In many cases, lung damage becomes irreversible, reducing life expectancy (Ehrlich et al., 2010). However, the prognosis depends largely on early diagnosis and continuous monitoring to avoid complications (Sverzellati et al., 2020).

Risk factors and pathogenesis

Patients with COVID-related pulmonary fibrosis can be detected early in cases of high inflammation using tomography (Yu et al., 2020), and it tends to progress to more severe forms (Nakayasu et al., 2025). Chronic eosinophilic pneumonia can cause pulmonary fibrosis in older men, although asthma reduces this risk (Baqir et al., 2022). Likewise, patients with usual interstitial pneumonia are more likely to develop autoimmune diseases (Sambataro et al., 2022). Furthermore, the combination of pulmonary fibrosis, emphysema, and usual interstitial pneumonia increases the risk of lung cancer compared to idiopathic fibrosis alone (Chen et al., 2021). In cases of diabetes, patients are at risk of fibrotic diseases but do not show an increased risk of lung cancer (Ehrlich et al., 2010). On the other hand, bronchiectasis in a weak immune system promotes progressive lung damage (Schaaf et al., 2000). In South Korea, it is as common as in Western countries, making it a significant public health problem (H. E. Lee et al., 2016).

Eosinophilic pneumonia

Chronic eosinophilic pneumonia can cause pulmonary fibrosis in older men, although asthma reduces this risk (Baqir et al., 2022). It can also be caused by allergies, medications, or respiratory infections (Sargin et al., 2025), as well as exposure to smoke, pollutants, and certain chemicals that irritate the airways (Aggarwal et al., 2017). Eosinophilic pneumonia occurs when the body's white blood cells accumulate in the lungs, leading to inflammation (Sverzellati et al., 2020). However, people with allergies or breathing difficulties are more likely to develop this disease (Nakayasu et al., 2025). In addition, regular medical checkups can reduce the risk of developing eosinophilic pneumonia (Jo et al., 2025).

Lung cancer

The combination of pulmonary fibrosis, emphysema, and usual interstitial pneumonia increases the risk of lung cancer compared to idiopathic fibrosis alone (Chen et al., 2021). In addition, a history of chronic respiratory diseases increases the likelihood of developing lung cancer due to continuous damage to lung tissue (Yu et al., 2020).

Lung cancer is one of the leading causes of death, and its treatment can be complicated

when interstitial pneumonia is present, as this condition increases the risk of worsening and limits therapeutic options (H. E. Lee et al., 2016). Prolonged exposure to smoke, dust, or air pollutants also increases the risk of lung cancer (Li et al., 2020). In many cases, symptoms appear in advanced stages, making early diagnosis difficult and reducing the chances of recovery (Jo et al., 2025), which is why it is important to have regular medical checkups and avoid factors that can damage the lungs (Wuyts et al., 2013).

Bronchiectasis

Bronchiectasis (inflammation of the esophagus) with a weak immune system promotes progressive lung damage (Schaaf et al., 2000). It occurs when the bronchi widen and accumulates secretions, which facilitate the development of respiratory infections (Ohkubo et al., 2016). However, over time, repeated infections damage the bronchial walls and worsen lung function (Alsomali et al., 2023). People who smoke or have had prolonged respiratory illnesses are more likely to develop it (Shi et al., 2025). Exposure to aerosols and addiction to harmful substances that irritate the airways also play a role (Sargin et al., 2025). In addition, low defenses or immune deficiencies increase the risk of more severe episodes of bronchiectasis (Papanikolaou et al., 2008).

Diagnosis and characterization

Crackles facilitate the diagnosis of pulmonary fibrosis (Vyshedskiy et al., 2005), which can be confused with other interstitial diseases (Tominaga et al., 2015a). In microscopic polyangiitis, symptoms usually develop slowly and late (Zhao et al., 2019). The systemic immunoinflammation index allows differentiation between fibrotic and interstitial diseases (Sargin et al., 2025), whereas radiological studies only differentiate cases related to interstitial diseases (Hosoda et al., 2016). Bronchiectasis allows for differentiation between idiopathic fibrosis and interstitial pneumonia (H. Kim et al., 2020), and changes in chest shape serve as diagnostic signs (Hyun Lee Chang, 2006). Fibrous streaks and obstructive fibrosis have characterized severe COVID pneumonia (Fang et al., 2020), which can cause scarring that is not always distinguishable on images (Araya et al., 2008). On the other hand, fibroelastosis should be recognized as a distinct disease from idiopathic fibrosis (Oda et al., 2014).

Crackles

Crackles facilitate the diagnosis of pulmonary fibrosis (Vyshedskiy et al., 2005), are produced by the opening of collapsed alveoli, and reflect lung tissue damage (Yu et al., 2020). As the disease progresses, these sounds become more intense and constant during breathing (Wang et al., 2023). Furthermore, they are a key option for the monitoring and timely diagnosis of interstitial lung diseases (H. E. Lee et al., 2016), allowing pulmonary changes to be identified before serious symptoms appear (Fang et al., 2020). Likewise, with adequate medical supervision, they can be used to evaluate the evolution and response to treatment (Shi et al., 2025).

Microscopic polyangiitis

Microscopic polyangiitis in usual interstitial pneumonia often presents with delayed, subtle symptoms in its diagnosis (Zhao et al., 2019). However, with early diagnosis and appropriate treatment, inflammation can be controlled (Akashi et al., 2009), improving disease progression and quality of life (Alsomali et al., 2023). Some patients experience persistent cough, fatigue, and shortness of breath that worsen over time (Sanclemente-Cardoza et al., 2024), leading to inflammation of the lung blood vessels (Sverzellati et al., 2020). Moreover, its progression can lead to scarring that reduces breathing capacity (Bautin et al., 2024).

Systemic immunoinflammation index

The systemic immunoinflammation index allows differentiation among various fibrotic and interstitial diseases (Sargin et al., 2025). It is essential for early detection of inflammatory changes and prevention of complications (Alsomali et al., 2023). In addition, blood tests provide a quick and easy way to assess the patient's condition (Silva, Müller, Hansell, et al., 2008). The systemic immunoinflammation index reflects the body's response to infection or disease (Tominaga et al., 2015). When its values increase, it indicates greater inflammatory activity in the body (Ohkubo et al., 2016). Moreover, this increase may be related to progressive lung damage and a worse clinical outcome (Kuwano et al., 2000).

This research has some limitations, as it was not possible to cover all the available literature on the subject. Consequently, only certain clinical and associated factors were analyzed. Likewise, the studies cited in the discussion present specific approaches tailored to the population and methodology used, whereas the present work adopted a more general analysis. Therefore, the search and review of sources should be expanded in order to develop a more comprehensive systematic review in the future.

CONCLUSION

Pulmonary fibrosis is a chronic disease that requires treatment with immunosuppressants and antifibrotics, which reduce inflammation and slow the progression of lung damage. However, their efficacy may be limited and cause side effects, requiring appropriate management to control these risks and prevent the disease from progressing to more severe forms. Nintedanib prevented lung damage without side effects, delaying the progression of fibrosis, improving lung function, and helping reduce episodes of respiratory worsening, thereby improving quality of life. The use of recombinant thrombomodulin reduced inflammation and lung damage without side effects, improving patient survival and recovery, maintaining respiratory function, and preventing serious complications during critical phases of the disease. Pirfenidone reduces lung deterioration, helping to slow the progression of fibrosis, improve breathing, and maintain stable lung function, making it a safe and effective option that provides a better quality of life for patients. Phycocyanin reduced inflammation and lung tissue damage, helping to slow the progression of fibrosis, improve breathing, and maintain stable lung function, showing good tolerance and efficacy in preventing severe complications.

COVID-related pulmonary fibrosis was more severe during the Delta variant, showing slow progression and persistent damage to the lungs, so medical follow-up and rehabilitation are essential to improve recovery and prevent complications. Pulmonary fibrosis due to myositis progresses slowly but steadily, affecting both lung function and muscle strength. However, early detection and proper medical care can improve breathing, reduce symptoms, and improve quality of life. Interstitial pneumonia is a major cause of death. It progresses gradually, leading to deterioration of respiratory function despite available treatment. Early intervention and continuous monitoring are therefore essential to avoid complications and improve patient prognosis.

Chronic eosinophilic pneumonia is associated with persistent lung inflammation that can lead to fibrosis, especially in people with exposure to chemicals, allergies, or prior respiratory diseases, underscoring the importance of medical checkups to reduce the risk of this disease. The combination of pulmonary fibrosis, emphysema, and usual interstitial pneumonia increases the risk of lung cancer, especially in people with a history of respiratory problems or prolonged exposure to smoke and air pollutants. Medical check-ups and avoiding factors that can damage

the lungs are important. Bronchiectasis is associated with recurrent respiratory infections and a weakened immune system, which can promote progressive lung damage. It is more common in people who consume harmful substances and are exposed to aerosols that increase the risk of more severe episodes of bronchiectasis.

Crackles facilitate the diagnosis of pulmonary fibrosis as they reflect the opening of collapsed alveoli and the presence of lung damage. Their intensity increases as the disease progresses, making them a key tool for monitoring and early detection of interstitial diseases. Microscopic polyangiitis is characterized by a slow onset and late symptoms, including persistent cough, fatigue, and shortness of breath that worsen over time. However, with early diagnosis and proper treatment, the inflammation can be controlled. The systemic immunoinflammation index enables early detection of inflammation and lung damage, facilitating clinical monitoring and helping prevent complications in fibrotic and interstitial diseases.

BIBLIOGRAPHIC REFERENCES

Abe, M., Tsushima, K., Matsumura, T., Ishiwata, T., Ichimura, Y., Ikari, J., Terada, J., Tada, Y., Sakao, S., Tanabe, N., & Tatsumi, K. (2015). Efficacy of thrombomodulin for acute exacerbation of idiopathic pulmonary fibrosis and nonspecific interstitial pneumonia: A nonrandomized prospective study. Drug Design, Development and Therapy, 9, 5755–5762. https://doi.org/10.2147/DDDT.S90739

Aggarwal, R., McBurney, C., Schneider, F., Yousem, S. A., Gibson, K. F., Lindell, K., Fuhrman, C. R., & Oddis, C. V. (2017). Myositis-associated usual interstitial pneumonia has a better survival than idiopathic pulmonary fibrosis. Rheumatology (United Kingdom), 56(3), 384–389. https://doi.org/10.1093/rheumatology/kew426

Akashi, T., Takemura, T., Ando, N., Eishi, Y., Kitagawa, M., Takizawa, T., Koike, M., Ohtani, Y., Miyazaki, Y., Inase, N., & Yoshizawa, Y. (2009). Histopathologic analysis of sixteen autopsy cases of chronic hypersetnsitivity pneumonitis and comparison with idiopathic pulmonary fibrosis/usual interstitial pneumonia. American Journal of Clinical Pathology, 131(3), 405–415. https://doi.org/10.1309/AJCPNWX4SLZRP9SW

Ali, R. M. M., & Ghonimy, M. B. I. (2021). Post-COVID-19 pneumonia lung fibrosis: a worrisome sequela in surviving patients. Egyptian Journal of Radiology and Nuclear Medicine, 52(1). https://doi.org/10.1186/s43055-021-00484-3

Alsomali, H., Palmer, E., Aujayeb, A., & Funston, W. (2023). Early Diagnosis and Treatment of Idiopathic Pulmonary Fibrosis: A Narrative Review. In Pulmonary Therapy 9(2). https://doi.org/10.1007/s41030-023-00216-0

Andrisano, A. G., Castaldo, N., Giuliana, F., Femia, D., Morana, G., Patruno, V., Monteleone, G., Reccardini, N., Cifaldi, R., Hughes, M., Wang, Y., Confalonieri, P., Salton, F., Geri, P., Confalonieri, M., & Ruaro, B. (2025). Retrospective Observational Study of Nintedanib in Managing Idiopathic and Progressive Pulmonary Fibrosis in Routine Practice. Journal of Clinical Medicine, 14(18). https://doi.org/10.3390/jcm14186665

Arai, T., Kida, H., Ogata, Y., Marumo, S., Matsuoka, H., Gohma, I., Yamamoto, S., Mori, M., Sugimoto, C., Tachibana, K., Akira, M., & Inoue, Y. (2020). Efficacy of recombinant thrombomodulin for poor prognostic cases of acute exacerbation in idiopathic interstitial

pneumonia: Secondary analysis of the SETUP trial. BMJ Open Respiratory Research, 7(1). https://doi.org/10.1136/bmjresp-2020-000558

Araya, J., Kawabata, Y., Jinho, P., Uchiyama, T., Ogata, H., & Sugita, Y. (2008). Clinically occult subpleural fibrosis and acute interstitial pneumonia a precursor to idiopathic pulmonary fibrosis? Respirology, 13(3), 408–412. https://doi.org/10.1111/j.1440-1843.2008.01277.x

Awano, N., Jo, T., Izumo, T., Inomata, M., Morita, K., Matsui, H., Fushimi, K., Urushiyama, H., Nagase, T., & Yasunaga, H. (2022). Recombinant human soluble thrombomodulin for acute exacerbation of idiopathic pulmonary fibrosis: a nationwide observational study. Journal of Intensive Care, 10(1). https://doi.org/10.1186/s40560-022-00608-5

Baqir, M., Peikert, T., Johnson, T. F., Tandon, Y. K., Yi, E. S., Schroeder, D. R., & Ryu, J. H. (2022). Idiopathic Chronic Eosinophilic Pneumonia Evolving to Pulmonary Fibrosis: A Retrospective Analysis. Sarcoidosis Vasculitis and Diffuse Lung Diseases, 39(2). https://doi.org/10.36141/svdld.v39i2.12656

Bautin, N., Ferlin, J., Terce, G., Ternynck, C., Valentin, V., Wemeau, L., & Chenivesse, C. (2024). Frequency and characteristics of refractory dyspnea in idiopathic fibrosing interstitial pneumonia. Respiratory Medicine, 222. https://doi.org/10.1016/j.rmed.2023.107526

Caro, F., Buendía-Roldán, I., Noriega-Aguirre, L., Alberti, M. L., Amaral, A., Arbo, G., Auteri, S., Bermúdez, A., Curbelo, P., Verduzco, M. de J. D., De la Fuente, I., Enghelmayer, J. I., Fernández, M., Florenzano, M., Guillen, F., Kairalla, R., Liberato, Y., Matiz, C., Mejía, M., … Selman, M. (2022). Latin American Registry of Idiopathic Pulmonary Fibrosis (REFIPI): Clinical Characteristics, Evolution and Treatment. Archivos de Bronconeumologia, 58(12), 794–801. https://doi.org/10.1016/j.arbres.2022.04.007

Chen, Q., Liu, P., Zhou, H., Kong, H., & Xie, W. (2021). An increased risk of lung cancer in combined pulmonary fibrosis and emphysema patients with usual interstitial pneumonia compared with patients with idiopathic pulmonary fibrosis alone: a systematic review and meta-analysis. Therapeutic Advances in Respiratory Disease, 15. https://doi.org/10.1177/17534666211017050

Chertcoff, J., Quadrelli, S., Otaola, M., Tabaj, G., Aguirre, R., Bosio, M., & Quadrelli, S. A. (2015). Survival in Patients with Usual Interstitial Pneumonia Secondary to Idiopathic Pulmonary Fibrosis and Connective Tissue Disease. In ARTICLE American Journal of Respiratory Medicine, 15(1).

David, P., Sinha, S., Iqbal, K., De Marco, G., Taheri, S., Mclaren, E., Maisuria, S., Arumugakani, G., Ash, Z., Buckley, C., Coles, L., Hettiarachchi, C., Payne, E., Savic, S., Smithson, G., Slade, M., Shah, R., Marzo-Ortega, H., Keen, M., … Mcgonagle, D. (2024). MDA5-autoimmunity and interstitial pneumonitis contemporaneous with the COVID-19 pandemic (MIP-C). 15(24), 489-494. https://doi.org/10.1016/j.ebiom.2024.105136

Ehrlich, S. F., Quesenberry, C. P., Van Den Eeden, S. K., Shan, J., & Ferrara, A. (2010). Patients diagnosed with diabetes are at increased risk for asthma, chronic obstructive pulmonary disease, pulmonary fibrosis, and pneumonia but not lung cancer. Diabetes Care, 33(1), 55–60. https://doi.org/10.2337/dc09-0880

Fang, Y., Zhou, J., Ding, X., Ling, G., & Yu, S. (2020). Pulmonary fibrosis in critical ill patients recovered from COVID-19 pneumonia: Preliminary experience. American Journal of Emergency Medicine, 38(10), 2134–2138. https://doi.org/10.1016/j.ajem.2020.05.120

Gao, J., Chu, W., Duan, J., Li, J., Ma, W., Hu, C., Yao, M., Xing, L., & Yang, Y. (2021). Six-Month Outcomes of Post-ARDS Pulmonary Fibrosis in Patients With H1N1 Pneumonia. Frontiers in Molecular Biosciences, 8. https://doi.org/10.3389/fmolb.2021.640763

Hosoda, C., Baba, T., Hagiwara, E., Ito, H., Matsuo, N., Kitamura, H., Iwasawa, T., Okudela, K., Takemura, T., & Ogura, T. (2016). Clinical features of usual interstitial pneumonia with anti-neutrophil cytoplasmic antibody in comparison with idiopathic pulmonary fibrosis. Respirology, 21(5), 920–926. https://doi.org/10.1111/resp.12763

Hyun Lee Chang, C. Hyun Lee, K. Ri Son, E. Ju Chun, K. Young Lim, J. Mo Goo, J. Gi Im, J. Nam Heo, J. Woo Song (2006). CT Analysis of the Anterior Mediastinum in Idiopathic Pulmonary Fibrosis and Nonspecific Interstitial Pneumonia. Korean Journal of Radiology, 7(3), 356-360. https://doi.org/10.3348/kjr.2006.7.3.173

Jo, Y. S., Lee, H. K., Park, S. H., Joh, J. S., Jang, H. J., & Park, J. S. (2025). Korean Guidelines for Diagnosis and Management of Idiopathic Nonspecific Interstitial Pneumonia. In Tuberculosis and Respiratory Diseases 88(2). Korean National Tuberculosis Association. https://doi.org/10.4046/trd.2024.0168

Kim, H., Yoon, S. H., Lee, H. J., Song, S. G., Koh, J., Jeon, Y. K., Chae, K. J., Jin, G. Y., Jin, K. N., Lee, K. Y., & Goo, J. M. (2020). Right-Angled Traction Bronchiectasis in Differentiating Idiopathic Pulmonary Fibrosis without Honeycombing from Idiopathic Nonspecific Interstitial Pneumonia. Investigative Radiology, 55(6), 387–395. https://doi.org/10.1097/RLI.0000000000000651

Kim, J., Chae, G., Kim, W. Y., Chung, C. R., Cho, Y. J., Lee, J., Jegal, Y., Joh, J. S., Park, T. Y., Hwang, J. H., Nam, B. Da, Yoon, H. Y., & Song, J. W. (2024). Pulmonary fibrosis followed by severe pneumonia in patients with COVID-19 infection requiring mechanical ventilation: a prospective multicentre study. BMJ Open Respiratory Research, 11(1). https://doi.org/10.1136/bmjresp-2024-002538

Kuwano, K., Kawasaki, M., Maeyama, T., Hagimoto, N., Nakamura, N., Shirakawa, K., & Hara, N. (2000). Soluble form of Fas and Fas ligand in BAL fluid from patients with pulmonary fibrosis and bronchiolitis obliterans organizing pneumonia. Chest, 118(2), 451–458. https://doi.org/10.1378/chest.118.2.451

Lee, H. E., Myong, J. P., Kim, H. R., Rhee, C. K., Yoon, H. K., & Koo, J. W. (2016). Incidence and prevalence of idiopathic interstitial pneumonia and idiopathic pulmonary fibrosis in Korea. International Journal of Tuberculosis and Lung Disease, 20(7), 978–984. https://doi.org/10.5588/ijtld.16.0003

Lee, J. K., Ahn, Y., Noh, H. N., Lee, S. M., Yoo, B., Lee, C. K., Kim, Y. G., Hong, S., Ahn, S. M., & Kim, H. C. (2023). Clinical effect of progressive pulmonary fibrosis on patients with connective tissue disease-associated interstitial lung disease: a single center retrospective cohort study. Clinical and Experimental Medicine, 23(8), 4797–4807. https://

doi.org/10.1007/s10238-023-01212-z

Li, W., Lu, L., Liu, B., & Qin, S. (2020). Effects of phycocyanin on pulmonary and gut microbiota in a radiation-induced pulmonary fibrosis model. Biomedicine and Pharmacotherapy, 132. https://doi.org/10.1016/j.biopha.2020.110826

Lombardi, F., Stewart, I., Fabbri, L., Adams, W., Kawano-Dourado, L., Ryerson, C. J., & Jenkins, G. (2024). Mycophenolate and azathioprine efficacy in interstitial lung disease: A systematic review and meta-analysis. BMJ Open Respiratory Research, 11(1). https://doi.org/10.1136/bmjresp-2023-002163

Nakayasu, H., Karayama, M., Enomoto, N., Inoue, Y., Yasui, H., Suzuki, Y., Hozumi, H., Furuhashi, K., Kono, M., Toyoshima, M., Imokawa, S., Fujii, M., Akamatsu, T., Koshimizu, N., Yokomura, K., Matsuda, H., Kaida, Y., Nakamura, Y., Shirai, M., … Suda, T. (2025). Association between the HAL score and the development of progressive pulmonary fibrosis in idiopathic interstitial pneumonia: A prospective observational study. Respiratory Investigation, 63(1), 138–145. https://doi.org/10.1016/j.resinv.2024.12.011

Oda, T., Ogura, T., Kitamura, H., Hagiwara, E., Baba, T., Enomoto, Y., Iwasawa, T., Okudela, K., Takemura, T., Sakai, F., & Hasegawa, Y. (2014). Distinct characteristics of pleuroparenchymal fibroelastosis with usual interstitial pneumonia compared with idiopathic pulmonary fibrosis. Chest, 146(5), 1248–1255. https://doi.org/10.1378/chest.13-2866

Ohkubo, H., Kanemitsu, Y., Uemura, T., Takakuwa, O., Takemura, M., Maeno, K., Ito, Y., Oguri, T., Kazawa, N., Mikami, R., & Niimi, A. (2016). Normal lung quantification in usual interstitial pneumonia pattern: The impact of threshold-based volumetric CT analysis for the staging of idiopathic pulmonary fibrosis. PLoS ONE, 11(3). https://doi.org/10.1371/journal.pone.0152505

Papanikolaou, I., Skouras, V., Voulgaridis, A., Tsaramirsi, M., Mermigkis, D., Tsakanika, K., Karagiannidis, N., & Polychronopoulos, V. (2008). Flow cytometry of bal cytokines in patients with idiopathic pulmonary fibrosis and organizing pneumonia. Chest, 134(4), 114P. https://doi.org/10.1378/chest.134.4_meetingabstracts.p114002

Qin, S., Tan, P., Xie, J., Zhou, Y., & Zhao, J. (2023). A systematic review of the research progress of traditional Chinese medicine against pulmonary fibrosis: from a pharmacological perspective. In Chinese Medicine (United Kingdom) 18(1). BioMed Central Ltd. https://doi.org/10.1186/s13020-023-00797-7

Sakamoto, S., Shimizu, H., Isshiki, T., Nakamura, Y., Kurosaki, A., Isobe, K., & Homma, S. (2021). Effectiveness of pirfenidone for idiopathic pulmonary fibrosis associated with pleuroparenchymal fibroelastosis-like lesions and nonspecific interstitial pneumonia. Clinical Respiratory Journal, 15(3), 272–279. https://doi.org/10.1111/crj.13292

Sambataro, G., Ferrara, C., Torrisi, S., Spadaro, C., Vignigni, G., Vancheri, A., Del Papa, N., Orlandi, M., Colaci, M., Malatino, L., Palmucci, S., Cavagna, L., Sambataro, D., Vancheri, C., Sambataro, G., Ferrara, C. A., Torrisi, S. E., Spadaro, C., Vignigni, G., . (2022). "Usual" interstitial pneumonia with autoimmune features: a prospective study on a cohort of idiopathic pulmonary fibrosis patients Usual interstitial pneumonia with autoimmune

features / G. Sambataro et al. In Clinical and Experimental Rheumatology 40(1).

Samet, J. M., Coultas, D., & Raghu, G. (2015). Idiopathic pulmonary fibrosis: Tracking the true occurrence is challenging. In European Respiratory Journal 46(3). European Respiratory Society. https://doi.org/10.1183/13993003.00958-2015

Sanclemente-Cardoza, V., Payan Salcedo, H. A., & Estela-Zape, J. L. (2024). Enfoque de la fibrosis pulmonar post-Covid-19 a través de la rehabilitación pulmonar extrahospitalaria. Respirar, 16(4). https://doi.org/10.55720/respirar.16.4.7

Sargin, G., Baris, K., & Gulen, S. T. (2025). Systemic immune-inflammation index in the evaluation of Sjogren's syndrome associated with interstitial lung disease, interstitial pneumonia with autoimmune features, and idiopathic pulmonary fibrosis. Advances in Medical Sciences, 70(1), 57–61. https://doi.org/10.1016/j.advms.2024.12.001

Schaaf, B., Wieghorst, A., Aries, S.-P., Dalhoff, K., Braun, J., & Schaaf, B. (2000). Clinical Investigations Neutrophil Inflammation and Activation in Bronchiectasis: Comparison with Pneumonia and Idiopathic Pulmonary Fibrosis, 21(4), 42-46. https://doi.org/10.1159/000029463

Shi, Y., Li, Y., Chen, R., Fang, N., Wang, M., Li, Z., Chen, Q., Shao, C., Lin, M., & Huang, H. (2025). Peripheral and pulmonary telomere lengths in patients with non-idiopathic pulmonary fibrosis interstitial lung diseases. BMC Pulmonary Medicine, 25(1). https://doi.org/10.1186/s12890-025-03865-w

Shimizu, H., Sakamoto, S., Isshiki, T., Furuya, K., Kurosaki, A., & Homma, S. (2018). Association of serum high-mobility group box protein 1 level with outcomes of acute exacerbation of idiopathic pulmonary fibrosis and fibrosing nonspecific interstitial pneumonia. PLoS ONE, 13(5). https://doi.org/10.1371/journal.pone.0196558

Silva, C. I. S., Müller, N. L., Hansell, D. M., Lee, K. S., Nicholson, A. G., & Wells, A. U. (2008). Nonspecific interstitial pneumonia and idiopathic pulmonary fibrosis: Changes in pattern and distribution of disease over time. Radiology, 247(1), 251–259. https://doi.org/10.1148/radiol.2471070369

Silva, C. I. S., Müller, N. L., Lynch, D. A., Curran-Everett, D., Brown, K. K., Kyung, S. L., Man, P. C., & Churg, A. (2008). Chronic hypersensitivity pneumonitis: Differentiation from idiopathic pulmonary fibrosis and nonspecific interstitial pneumonia by using thin-section CT. Radiology, 246(1), 288–297. https://doi.org/10.1148/radiol.2453061881

Sverzellati, N., Silva, M., Seletti, V., Galeone, C., Palmucci, S., Piciucchi, S., Vancheri, C., Poletti, V., Tomassetti, S., Karwoski, R., & Bartholmai, B. J. (2020). Stratification of long-term outcome in stable idiopathic pulmonary fibrosis by combining longitudinal computed tomography and forced vital capacity. European Radiology, 30(5), 2669–2679. https://doi.org/10.1007/s00330-019-06619-5

Tanaka, J., Moriyama, H., Terada, M., Takada, T., Suzuki, E., Narita, I., Kawabata, Y., Yamaguchi, T., Hebisawa, A., Sakai, F., & Arakawa, H. (2014). An observational study of giant cell interstitial pneumonia and lung fibrosis in hard metal lung disease. BMJ Open, 4, 4407.

https://doi.org/10.1136/bmjopen-2013

Tominaga, J., Sakai, F., Johkoh, T., Noma, S., Akira, M., Fujimoto, K., Colby, T. V., Ogura, T., Inoue, Y., Taniguchi, H., Homma, S., Taguchi, Y., & Sugiyama, Y. (2015a). Diagnostic certainty of idiopathic pulmonary fibrosis/usual interstitial pneumonia: The effect of the integrated clinico-radiological assessment. European Journal of Radiology, 84(12), 2640–2645. https://doi.org/10.1016/j.ejrad.2015.08.016

Tominaga, J., Sakai, F., Johkoh, T., Noma, S., Akira, M., Fujimoto, K., Colby, T. V., Ogura, T., Inoue, Y., Taniguchi, H., Homma, S., Taguchi, Y., & Sugiyama, Y. (2015b). Diagnostic certainty of idiopathic pulmonary fibrosis/usual interstitial pneumonia: The effect of the integrated clinico-radiological assessment. European Journal of Radiology, 84(12), 2640–2645. https://doi.org/10.1016/j.ejrad.2015.08.016

Tsubouchi, K., Hamada, N., Tokunaga, S., Ichiki, K., Takata, S., Ishii, H., Kitasato, Y., Okamoto, M., Kawakami, S., Yatera, K., Kawasaki, M., Fujita, M., Yoshida, M., Maeyama, T., Harada, T., Wataya, H., Torii, R., Komori, M., Mizuta, Y., … Okamoto, I. (2023). Survival and acute exacerbation for patients with idiopathic pulmonary fibrosis (IPF) or non-IPF idiopathic interstitial pneumonias: 5-year follow-up analysis of a prospective multi-institutional patient registry. BMJ Open Respiratory Research, 10(1). https://doi.org/10.1136/bmjresp-2023-001864

Umemura, Y., Mitsuyama, Y., Minami, K., Nishida, T., Watanabe, A., Okada, N., Yamakawa, K., Nochioka, K., & Fujimi, S. (2021). Efficacy and safety of nintedanib for pulmonary fibrosis in severe pneumonia induced by COVID-19: An interventional study. International Journal of Infectious Diseases, 108, 454–460. https://doi.org/10.1016/j.ijid.2021.05.055

Vyshedskiy, A., Bezares, F., Paciej, R., Ebril, M., Shane, J., & Murphy, R. (2005). Transmission of crackles in patients with interstitial pulmonary fibrosis, congestive heart failure, and pneumonia. Chest, 128(3), 1468–1474. https://doi.org/10.1378/chest.128.3.1468

Wang, H., Wang, Y., Sun, D., Yu, S., Du, X., & Ye, Q. (2023). Progressive pulmonary fibrosis in myositis-specific antibody-positive interstitial pneumonia: a retrospective cohort study. Frontiers in Medicine, 10. https://doi.org/10.3389/fmed.2023.1325082

Wuyts, W. A., Agostini, C., Antoniou, K. M., Bouros, D., Chambers, R. C., Cottin, V., Egan, J. J., Lambrecht, B. N., Lories, R., Parfrey, H., Prasse, A., Robalo-Cordeiro, C., Verbeken, E., Verschakelen, J. A., Wells, A. U., & Verleden, G. M. (2013). The pathogenesis of pulmonary fibrosis: A moving target. In European Respiratory Journal 41(5). https://doi.org/10.1183/09031936.00073012

Wuyts, W. A., Bonella, F., Chaudhuri, N., Varone, F., Antin-Ozerkis, D., Song, J. W., Miede, C., Dumistracel, M., Coeck, C., & Cottin, V. (2025). Continued Treatment with Nintedanib in Patients with Progressive Pulmonary Fibrosis: Data from INBUILD-ON. Lung, 203(1). https://doi.org/10.1007/s00408-024-00778-z

Yoo, J. W., Kim, W. Y., Chung, C. R., Cho, Y. J., Lee, J., Jegal, Y., Kim, J., Joh, J. S., Park, T. Y., Baek, A. R., Park, J. H., Chae, G., Hwang, J. H., & Song, J. W. (2024). Early pulmonary fibrosis-like changes between delta and pre-delta periods in patients with severe COVID-19

pneumonia on mechanical ventilation. Scientific Reports, 14(1). https://doi.org/10.1038/s41598-024-77405-7

Yu, M., Liu, Y., Xu, D., Zhang, R., Lan, L., & Xu, H. (2020). Prediction of the development of pulmonary fibrosis using serial thin-section ct and clinical features in patients discharged after treatment for COVID-19 pneumonia. Korean Journal of Radiology, 21(6), 746–755. https://doi.org/10.3348/kjr.2020.0215

Zhao, W., Dai, H., Liu, Y., Zhu, M., Bao, N., Ban, C., Zhang, S., Ren, Y., Ye, Q., & Wang, C. (2019). Clinical features and prognosis of microscopic polyangiitis with usual interstitial pneumonia compared with idiopathic pulmonary fibrosis. Clinical Respiratory Journal, 13(7), 460–466. https://doi.org/10.1111/crj.13032