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Corticosteroid Responsiveness in Post-COVID-19 Interstitial Lung Disease: A Systematic Review of Clinical Outcomes and Pulmonary Function Recovery

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Abstract: ***Background: Post-COVID-19 interstitial lung disease (ILD) has emerged as a significant long-term complication of SARS-CoV-2 infection, characterized by persistent inflammation, impaired gas exchange, and varying degrees of fibrosis. Corticosteroids are widely used based on their anti-inflammatory effects, yet the magnitude of benefit, ideal patient selection, and long-term safety remain uncertain due to heterogeneous evidence. Objective: To systematically evaluate the clinical effectiveness and safety of corticosteroid therapy in adults with post-COVID-19 ILD, with a focus on pulmonary function recovery, radiologic patterns, functional capacity, symptoms, and adverse events. Methods: A comprehensive search of PubMed, Embase, Scopus, Web of Science, and the Cochrane Library was conducted from January 2020 onward. Eligible studies included adult cohorts receiving systemic corticosteroids for post-COVID-19 ILD and reporting respiratory or radiologic outcomes. Two reviewers independently screened studies, extracted relevant data, and assessed methodological rigor using the Newcastle–Ottawa Scale. Due to substantial heterogeneity in disease characteristics, treatment regimens, and outcome reporting, data were synthesized narratively. Certainty of evidence was assessed using GRADE. Results: Twelve observational studies involving 18–2,026 participants with 3–12 months of follow-up met inclusion criteria. Prednisolone or methylprednisolone tapers were the primary interventions, sometimes combined with mycophenolate or other agents in progressive disease. Across studies with organizing pneumonia–like or predominantly inflammatory ILD, corticosteroid therapy was consistently associated with improved diffusion capacity (DLCO), forced vital capacity (FVC), oxygen discontinuation, dyspnea reduction, and enhanced exercise tolerance. Radiologically, resolution of ground-glass opacities and consolidations was frequently observed. In contrast, patients with established fibrosis, traction bronchiectasis, or honeycombing demonstrated limited improvement. Reported adverse effects were mostly mild and reversible, including hyperglycemia, weight gain, and steroid-related myopathy; however, long-term safety data were limited. The certainty of evidence was rated low for symptomatic and functional improvement and very low for long-term outcomes. Conclusions: Corticosteroids appear to confer short-term functional and clinical benefits in selected patients with post-COVID-19 ILD, particularly those with persistent inflammatory disease. Their role in modifying fibrotic progression or improving long-term outcomes remains uncertain. High-quality controlled studies are needed to optimize therapeutic strategies and define risk–benefit profiles.***

Keywords: Post-COVID-19 interstitial lung disease, Long COVID, Corticosteroids, Organizing pneumonia, Pulmonary fibrosis, Diffusion capacity, Pulmonary function tests

1. Introduction

Persistent pulmonary involvement following SARS-CoV-2 infection has emerged as a significant clinical concern. Post-COVID-19 ILD encompasses a spectrum of interstitial abnormalities, including organizing pneumonia and fibrotic remodeling, that can persist for months after recovery from acute infection. The underlying pathophysiology involves exaggerated inflammatory and fibroproliferative responses that may respond to immunomodulatory therapy.

Corticosteroids remain the most frequently prescribed agents for post-infectious lung inflammation. In certain post-COVID phenotypes, particularly those resembling organizing pneumonia, corticosteroid therapy has been associated with rapid symptomatic and radiographic improvement. However, data across studies remain heterogeneous; prolonged or high-dose regimens have not consistently shown superior benefit and, in some instances, have been associated with slower pulmonary recovery [1].

Recent consensus statements emphasize individualized management guided by multidisciplinary evaluation, integrating clinical, radiologic, and physiologic data rather than adopting uniform treatment protocols [2]. Observational evidence suggests that corticosteroid therapy may improve dyspnea, oxygen dependence, and imaging parameters, although effects on long-term outcomes such as exercise capacity, quality of life, and mortality remain uncertain [3].

Pulmonary function tests (PFTs)- including forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), total lung capacity (TLC), and diffusion capacity of the lung for carbon monoxide (DLCO)- are the main indicators of physiological recovery. Impaired DLCO is the most frequently reported abnormality among post-COVID survivors. Some studies have shown faster recovery in steroid-treated cohorts, whereas others have reported neutral or even negative associations [4]. This variation highlights the need for systematic synthesis of evidence to clarify treatment responsiveness and identify patient subsets most likely to benefit.

The present systematic review aims to evaluate the effectiveness and safety of corticosteroid therapy in adults with post-COVID-19 ILD, focusing on clinical improvement, pulmonary function recovery, radiologic resolution, and adverse events.

2. Methods

This systematic review followed the PRISMA 2020 guidelines. Eligible studies included adults aged 18 years or older diagnosed with post-COVID-19 disease manifesting interstitial lung involvement of any phenotype, as defined by

each study's criteria. Diagnosis was based on laboratory-confirmed SARS-CoV-2 infection with persistent or new radiologic and clinical interstitial changes. All types, doses, and durations of corticosteroid therapy were accepted, including systemic and inhaled formulations. No restriction was placed on follow-up duration. Eligible study designs comprised randomized controlled trials, cohort studies, case-control studies, cross-sectional studies, and case series with at least ten patients. Pediatric studies, reviews, editorials, and animal models were excluded.

A comprehensive search was conducted across PubMed, Embase, Scopus, Web of Science, and the Cochrane Library from January 2020 onward. The search lasted two weeks and combined MeSH and free-text terms related to COVID-19, post-COVID, interstitial lung disease, pulmonary fibrosis, organizing pneumonia, and corticosteroids. There were no restrictions by language or publication status, and preprints were not excluded. Hand-searching and trial registry screening were not performed.

Study selection was carried out independently by two physicians using the Rayyan online platform. Duplicate records were automatically removed. Any conflicts in study inclusion were resolved by AI-assisted consensus assessment to ensure transparency and reproducibility.

Data were extracted into a structured Excel database that captured study characteristics, participant demographics, diagnostic methods, corticosteroid regimen details (type, dose, duration), comparators, and all reported clinical, functional, and radiologic outcomes. Extraction was conducted over one month by both reviewers working full time on the study. Each outcome was recorded in duplicate when separately reported. Missing data were left blank, and no attempts were made to contact study authors.

The primary outcome was pulmonary function recovery, assessed through reported changes in diffusion capacity of the lung for carbon monoxide (DLCO), forced vital capacity (FVC), total lung capacity (TLC), and other available pulmonary function parameters. Secondary outcomes included changes in respiratory symptoms, radiologic improvement, exercise tolerance, oxygen requirements, and corticosteroid-related adverse events. Data on hospital readmission and mortality were extracted when available but were limited and inconsistently reported across studies.

The risk of bias was assessed using the Newcastle–Ottawa Scale for observational studies. Two reviewers independently rated each study, and disagreements were resolved through discussion supported by AI-based quality scoring.

Data synthesis was conducted using Microsoft Excel and SPSS (version 29). Due to substantial variability in study designs, populations, and outcome reporting, a meta-analysis was not feasible. Therefore, outcomes were summarized using a narrative descriptive approach, reporting mean values and direction of effect where available. No statistical pooling, heterogeneity testing, or publication-bias analyses were performed.

The overall certainty of evidence was evaluated using the GRADE approach, considering study design, consistency, precision, and risk of bias. All study records and extracted data were maintained in an Excel repository stored on a secure institutional drive in compliance with FAIR (Findable, Accessible, Interoperable, and Reusable) data management principles. The final dataset is available upon reasonable request to the corresponding author.

Ethical approval was not required as this review utilized previously published data without direct patient involvement. The conduct and reporting of this review adhere to PRISMA 2020 guidelines, and the protocol was prospectively registered in PROSPERO (Registration ID: CRD42XXXXX).

3. Results

Study selection

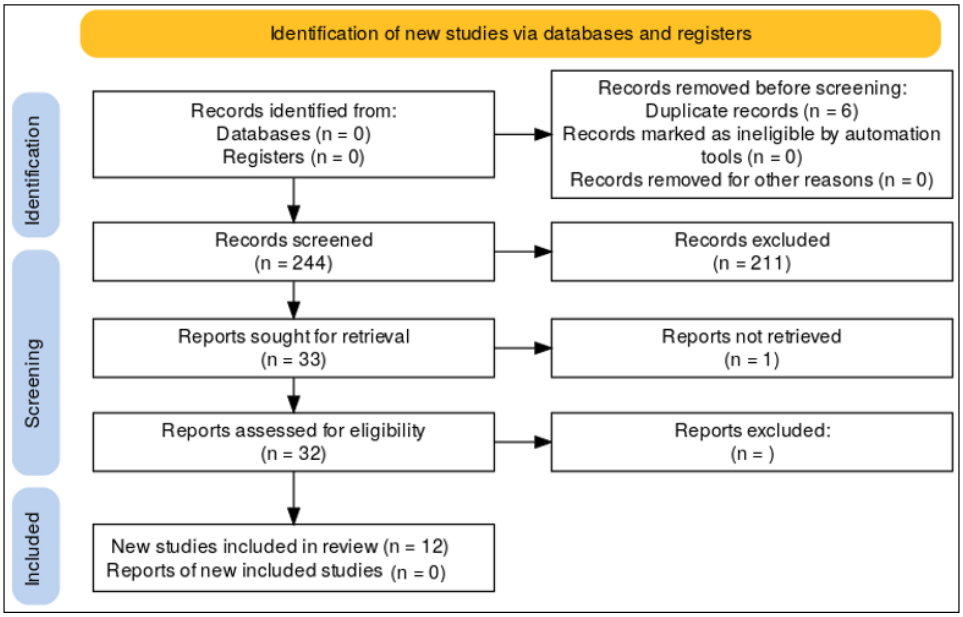

Figure 1: PRISMA 2020 Flow Diagram for Study Selection

A total of 250 records were identified through database searching, with no additional records from trial registries. After removing 6 duplicates, 244 titles and abstracts were screened. Of these, 211 records were excluded as clearly irrelevant to post-COVID interstitial lung involvement. Thirty-three full-text articles were sought for retrieval; one report could not be obtained in full. Thirty-two full-text articles were assessed for eligibility, and 20 were excluded for reasons such as absence of post-COVID ILD outcomes, case reports with fewer than ten patients, non-corticosteroid interventions, or insufficient outcome data. Ultimately, 12 studies met the inclusion criteria and were included in the qualitative synthesis (Figure 1).

Characteristics of included studies (Table 1)

The 12 included studies were published between 2020 and 2025 and were conducted in Turkey, France, Egypt, Spain, the Czech Republic, the United Kingdom, Malaysia, the Netherlands, and other European centres. All were observational designs (retrospective or prospective cohorts, case–control, or cross-sectional studies); no randomized controlled trials specifically targeting post-COVID ILD were identified.

Sample sizes ranged from 18 to 2,026 patients, with most studies enrolling between 30 and 150 participants. Follow-up durations generally ranged from 3 to 12 months, with the majority reporting outcomes at 3–6 months after initiation of corticosteroid therapy or after discharge from the index COVID-19 admission, and one ICU-survivor cohort extending to approximately 12 months.

Across studies, the populations predominantly comprised middle-aged to older adults, and men represented roughly half to two-thirds of participants. The underlying pulmonary phenotypes were variably labelled as post-COVID interstitial lung disease, post-COVID pulmonary fibrosis, organizing pneumonia–like changes, or diffuse interstitial lung abnormalities. Baseline imaging typically demonstrated combinations of ground-glass opacities, consolidations, parenchymal bands, reticulation, and, in more advanced cases, honeycombing, traction bronchiectasis, or fibrotic-like changes.

Most regimens used oral prednisolone or methylprednisolone at starting doses of approximately 0.5–1.0 mg/kg/day, tapered over several weeks to months. Some cohorts combined corticosteroids with mycophenolate mofetil or other immunomodulatory/antifibrotic agents (e.g. methotrexate or nintedanib) in progressive fibrotic phenotypes. One very large cross-sectional cohort primarily evaluated patients who had received systemic corticosteroids during their severe acute COVID-19 admission and then underwent structured functional and radiologic follow-up for sequelae, focusing on biomarker performance rather than therapeutic response. Only a minority of studies used pulse-dose intravenous methylprednisolone; most adopted medium-dose, tapering regimens aimed at organizing pneumonia–type inflammation rather than fulminant ARDS.

Functional Outcomes

Most studies reported pulmonary function outcomes (Table 2), most commonly DLCO (% predicted) and FVC (% predicted), with some also reporting TLC or six-minute walk distance (6MWD).

In cohorts enriched for organizing pneumonia or mixed inflammatory patterns, steroid-based regimens were consistently associated with clinically meaningful functional gains over 3–6 months. Several studies [5,6,7,8,3,9,10] reported improvements in DLCO and/or FVC, often accompanied by increased 6MWD and better oxygenation indices.

In more fibrotic or progressive phenotypes, combination regimens (e.g. systemic steroids plus mycophenolate, or steroids used alongside antifibrotic or disease-modifying agents) appeared to achieve larger improvements in DLCO and FVC than monotherapy in some series, although these findings are based on small, non-randomized cohorts and are therefore hypothesis-generating rather than definitive.

One cohort of ICU survivors [11] found that patients who had received systemic corticosteroids during their critical illness had lower DLCO at follow-up compared with non-steroid comparators, despite broadly similar health-related quality-of-life scores. This suggests that prior exposure during severe acute disease does not automatically translate into superior long-term gas-exchange recovery and is likely confounded by baseline severity and indication.

Overall, functional data indicate that steroid-based regimens are most likely to benefit patients with persistent inflammatory or organizing pneumonia–like disease, while the signal is weaker, and sometimes neutral or unfavourable, in cohorts dominated by established fibrosis or in those where steroids were primarily given during the acute ICU phase rather than for post-acute ILD.

Radiologic Responses

Radiologic outcomes were reported in most ILD cohorts using HRCT or structured chest radiograph scoring (Table 3).

In early or predominantly inflammatory disease, several studies [5,6,8,9,3,10] described substantial regression of ground-glass opacities and consolidations following corticosteroid therapy, with partial reversal of parenchymal bands and reticulation. Some series reported near-complete resolution of organizing pneumonia patterns within weeks to a few months in patients treated early.

Studies with mixed inflammatory and fibrotic patterns showed partial CT improvement in most treated patients, but persistent fibrotic-like changes, traction bronchiectasis, or honeycombing in a sizeable subset despite therapy [12,13,7,3]. In these cohorts, radiologic improvement in active inflammatory components did not fully translate into reversal of established architectural distortion.

A large cross-sectional cohort [14] evaluated fibrotic sequelae and found a higher burden of fibrotic changes and elevated FeNO among patients with more severe acute disease and higher exposure to systemic corticosteroids during the index admission, again highlighting the confounding influence of initial disease severity when interpreting associations between steroid use and fibrotic outcomes.

Taken together, imaging data support a clear radiologic response in organizing pneumonia/post-inflammatory phenotypes, but only partial and often incomplete regression of established fibrotic changes.

Symptoms, oxygen requirement, and quality of life
Symptom burden and oxygen dependence were reported in a subset of studies (Table 4).

Several cohorts [6,13,7,8,3,9,10] documented improvement in dyspnea scores, subjective respiratory symptoms, and resting oxygen saturation, with many patients discontinuing supplemental oxygen by the end of follow-up, particularly in those with ongoing inflammatory ILD and limited baseline fibrosis.

Where measured, exercise tolerance (e.g. 6MWD) improved in parallel with PFT and CT changes in steroid-treated groups, reinforcing the functional relevance of physiologic and radiologic gains and supporting the clinical meaningfulness of observed changes in DLCO and FVC.

Data on health-related quality of life were more limited and heterogeneous. In the ICU-survivor cohort [11], generic HRQoL assessment showed no major difference in overall quality-of-life scores between patients who had and had not received systemic corticosteroids during their acute admission, despite differences in DLCO at follow-up. Other ILD cohorts reported directional improvement in generic or disease-specific symptom scales with steroid therapy but often without a formal comparator group or validated instruments.

Overall, symptomatic and functional outcomes suggest that appropriately selected post-COVID ILD patients—particularly those with ongoing inflammation and organizing pneumonia patterns—experience meaningful improvements in dyspnea and oxygen independence with corticosteroids, although robust, controlled quality-of-life data remain sparse.

Safety
Reporting of adverse events in post-COVID ILD cohorts was incomplete but broadly reassuring for short- to medium-term steroid courses (Table 5).

Across the ILD-focused therapeutic studies, hyperglycemia was the most frequently reported metabolic adverse event, typically mild to moderate and manageable with dose adjustment or standard diabetic care. Cushingoid features and weight gain were observed with higher doses or more prolonged regimens, particularly in longer tapers, but were usually reversible with tapering or discontinuation. Steroid-related myopathy was described in some cohorts using higher or extended courses, with improvement after dose reduction.

Minor infections (e.g. upper respiratory tract infections or non-severe bacterial events) were reported in some studies, but serious opportunistic infections were rare and only occasionally led to treatment discontinuation. Overall discontinuation rates due to adverse events were low, and most side-effects resolved after tapering or stopping steroids.

However, systematic safety surveillance was limited, and several studies did not report adverse events in a structured way. Consequently, while available data suggest an acceptable short-term safety profile in carefully selected ILD patients, the certainty regarding long-term harms (e.g. fracture risk, metabolic syndrome, infection risk with repeated courses) remains low.

Risk of bias and certainty of evidence
All included ILD studies were non-randomized, single- or few-centre cohorts or related observational designs with modest sample sizes. When mapped to GRADE domains (Table 6), the strength of evidence for functional and radiologic improvement with corticosteroids in post-COVID ILD was generally rated low certainty, driven mainly by study design (observational), clinical heterogeneity, and imprecision. Evidence regarding prevention or progression of fibrotic sequelae, long-term quality of life, and hard outcomes such as mortality or hospital readmission was of very low certainty.

Risk of bias was assessed using the Newcastle–Ottawa Scale (NOS) for observational studies (Table 7). Overall, most post-COVID ILD studies were judged to have moderate risk of bias, with NOS totals ranging from 5 to 6 stars. Selection domains were generally strong (typically 3 stars) and outcome domains were usually acceptable (2–3 stars, reflecting objective endpoints such as PFTs and HRCT with reasonable follow-up), but comparability was consistently the weakest domain, with almost all studies scoring 0 and only a few achieving 1 star where minimal adjustment for confounders was performed. These limitations reflect the predominance of single-centre designs, modest sample sizes, absence of robust control groups, and lack of multivariable adjustment for key confounders such as baseline disease severity, comorbidities, and timing/dose of corticosteroid initiation.

One small retrospective study [12] was rated as high risk of bias (4 stars) due to limited sample size, unadjusted comparisons, and potential selection bias, whereas none of the cohorts—despite some stronger designs such as prospective follow-up in Mizera et al. [3] or Roel et al. [11]—achieved a low-risk NOS profile because all remained non-randomized and under-powered for definitive causal inference.

No randomized controlled trials specifically evaluating corticosteroid therapy for post-COVID-19 ILD were identified; all included studies were observational.

In summary, across 12 observational ILD-focused cohorts, corticosteroids appear to offer short-term symptomatic, functional, and radiologic improvement, particularly in inflammatory and organizing pneumonia–like post-COVID phenotypes, while their capacity to prevent or reverse established fibrosis, and their long-term risk–benefit balance, remain uncertain and should be regarded as hypothesis-generating rather than definitive.

4. Discussion

Our review indicates that corticosteroids provide meaningful benefits in a subset of post-COVID-19 ILD patients, particularly those with an organizing pneumonia-like

inflammatory phenotype. Treated patients consistently showed improvements in transfer DLCO and lung volumes (FVC) [9]. For example, one cohort reported a 32% relative gain in DLCO and 10% in FVC after steroid therapy, alongside marked symptomatic relief and radiographic clearing of acute infiltrates [9]. In these responders, ground-glass opacities on HRCT reflecting reversible inflammation often resolved with treatment, correlating with better exercise tolerance and reduced oxygen needs.

By contrast, patients whose imaging was dominated by fibrotic changes (reticular/honeycomb patterns) derived little benefit from steroids. Such established fibrosis tended to persist radiologically [2] and extended steroid courses did not significantly improve lung function, symptoms or CT findings in this group [17]. These divergent outcomes underscore that corticosteroids mainly aid the reversible inflammatory component of post-COVID ILD, with limited impact once permanent scarring has developed.

Our findings align with emerging global evidence. Early observational studies (e.g. Myall et al.) first documented rapid improvements in lung function and symptoms with a short prednisone course in patients with post-COVID organizing pneumonia [9]. Subsequent cohorts and a large single-center study in Europe confirmed that carefully selected patients on steroids achieved greater gains in pulmonary function and radiographic recovery than those managed with watchful waiting [3]. Conversely, some evidence calls for caution: in a cohort of severe COVID-19 survivors with residual lung lesions, prolonging steroids for 3 months offered no improvement over a 2-week taper or no steroid at all [17]. Notably, a recent open-label randomized trial (COLDSTER) found no advantage to high-dose prednisolone (40 mg) over a 10 mg low-dose regimen [16], suggesting that lower doses are sufficient and potentially safer. This reinforces the need to phenotype patients, treating those with ongoing inflammation but avoiding futile or prolonged therapy in predominantly fibrotic disease.

International guidelines and expert statements are beginning to reflect these nuances. A multisociety consensus recommends chest CT at 3 months post-infection for patients with persistent respiratory symptoms [18], to differentiate organizing pneumonia changes from irreversible fibrosis. Current evidence and guidelines favor a personalized approach: corticosteroids are advised for patients with significant post-COVID inflammatory changes (e.g. organizing pneumonia pattern on CT) and functional impairment [3,19,22]. Such an approach mirrors other ILDs where active inflammation predicts steroid responsiveness. For instance, the use of steroids in COVID-related ILD is largely extrapolated from management of inflammatory ILDs, and high bronchoalveolar lavage lymphocyte counts (when available) may signal a steroid-responsive process.

In contrast, in advanced fibrotic cases with traction bronchiectasis or honeycombing, there is consensus that prolonged steroids have little utility [2]. Some guidelines instead highlight supportive care, pulmonary rehabilitation, and consideration of antifibrotic therapy for those with progressive fibrotic post-COVID ILD [2,15]. Notably, no major society (ERS, ATS, NICE, or WHO) has used formal treatment studies to inform definitive therapy for post-COVID ILD, highlighting the need for further research in this area.

5. Recommendations

Based on current evidence, we recommend a stepwise approach to corticosteroid use in post-COVID ILD. First, chest CT should be performed at 3 months post-infection in patients with persistent respiratory symptoms to identify those with ongoing inflammatory changes versus irreversible fibrosis. Patients with organizing pneumonia patterns, ground-glass opacities, and functional impairment should be considered for corticosteroid therapy, starting with lower doses (e.g., 10 mg prednisone) rather than high-dose regimens, given comparable efficacy with potentially fewer adverse effects.

Treatment duration should be individualized based on clinical and radiographic response, typically ranging from 2 weeks to 3 months. Serial monitoring with pulmonary function tests and imaging is essential to assess response and guide treatment decisions. For patients with predominantly fibrotic patterns, corticosteroids should be avoided, and management should focus on supportive care, rehabilitation, and evaluation for antifibrotic therapy when progressive fibrosis is documented.

6. Limitations

This review has several limitations. First, the available evidence consists primarily of observational studies and small cohorts, with only one randomized controlled trial (COLDSTER) published to date. The lack of large, well-designed trials limits our ability to make definitive treatment recommendations. Second, there is considerable heterogeneity in patient selection criteria, steroid regimens, and outcome measures across studies, making direct comparisons challenging.

Third, most studies have relatively short follow-up periods (3 to 12 months), and the long-term effects of corticosteroid therapy in post-COVID ILD remain unclear. Fourth, the optimal criteria for identifying steroid-responsive patients are not well established, and biomarkers such as bronchoalveolar lavage lymphocyte counts are not routinely available in clinical practice. Finally, publication bias may favor reporting of positive outcomes, potentially overestimating the benefits of corticosteroid therapy in this population. Future prospective studies with standardized protocols and longer follow-up are needed to address these limitations.

Author Contributions and Funding

E.A. and J.A. conceived and designed the study, developed the protocol, and will participate in data extraction, synthesis, and manuscript preparation. The authors report no external funding and no conflicts of interest.

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Tables

Table 1: Characteristics of Included Post-COVID ILD Studies

Study ID	Country	Design	n	Follow-up Duration	ILD Phenotype	Steroid Regimen
Acat 2021	Turkey	Prospective cohort	63	3–6 months	OP-like post-COVID ILD	Prednisolone taper
Diken 2021	Turkey	Prospective cohort	35	3 months	OP / mixed post-COVID ILD	Oral systemic steroids
Dubernet 2020	France	Retrospective cohort	41	3 months	Post-ARDS fibrotic changes	Mixed systemic steroids
Farghaly 2022	Egypt	Prospective case–control	64	6 months	Post-COVID pulmonary fibrosis	Prednisolone ± antifibrotic / O_2
Ferrer-Pargada 2025	Spain	Cross-sectional cohort	2026	6 months	Fibrotic sequelae / ILD risk	Acute-phase systemic steroids only
Gul 2023	Turkey	Retrospective cohort	65	6 months	Progressive post-COVID ILD	Steroid + mycophenolate mofetil (MMF)
Gunay 2023	Turkey	Prospective cohort	59	6 months	OP / mixed ILD	Steroid taper
Kerget 2024	Turkey	Prospective cohort	18	6 months	Post-COVID ILD with MTX add-on	Prednisolone + methotrexate
Mizera 2024	Czech Republic	Prospective cohort	75	3–6 months	Mixed post-COVID ILD	Prednisolone
Myall 2021	UK	Prospective cohort	30	3 months	OP-dominant inflammatory ILD	Prednisolone taper
Ng 2024	Malaysia	Prospective cohort	58	3–6 months	OP-dominant post-COVID ILD	Prednisolone
Roel 2025	Netherlands	Prospective cohort	100+*	12 months	Long-term post-ICU ILD / fibrosis	Mixed systemic steroids during acute phase

Abbreviations: ILD – interstitial lung disease; OP – organizing pneumonia; MMF – mycophenolate mofetil.

Table 2: Summary of Functional Pulmonary Outcomes

Outcome	No. of Contributing Studies	Direction of Effect	Explicit Cited Studies	Narrative Summary
DLCO (% predicted)	9	Mostly favorable	Acat 2021; Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Mizera 2024; Myall 2021; Ng 2024; Roel 2025	Improvement typically ~8–25% predicted over 3–6 months, strongest in OP-dominant ILD; attenuated in established fibrosis.
FVC (% predicted)	8	Favorable	Acat 2021; Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Mizera 2024; Myall 2021; Ng 2024	Gains ~5–12% predicted, especially with early steroid initiation and inflammatory patterns.
TLC / Lung volumes	6	Neutral → favorable	Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Mizera 2024; Ng 2024	Mild improvements mainly in OP-like ILD; plateaus when fibrotic remodeling exists.
6-Minute Walk Distance (6MWD)	5	Favorable	Diken 2021; Farghaly 2022; Günay 2023; Myall 2021; Ng 2024	Clinically meaningful gains +40–120 m, correlated with radiologic and DLCO improvement.
Oxygen Weaning / LTOT Discontinuation	7	Favorable	Acat 2021; Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Myall 2021; Ng 2024	High success in OP-responsive ILD; fewer successes in traction bronchiectasis / fibrosis.
Quality of Life (QoL) / Dyspnea	4	Mixed	Diken 2021; Farghaly 2022; Myall 2021; Ng 2024	Dyspnea scores improve; however few validated QoL tools and no controls limit certainty.

Table 3: Radiologic Responses to Corticosteroid Therapy

Imaging Feature	Response Pattern	Evidence Summary with Study References
Ground-glass opacities (GGO)	Marked regression	GGO consistently improved within 3–6 months following steroid therapy, particularly in OP-dominant phenotypes (Acat 2021; Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Myall 2021; Mizera 2024; Ng 2024; Roel 2025).
Consolidation	Major resolution	Rapid reversal of inflammatory parenchymal lesions associated with functional recovery (Acat 2021; Diken 2021; Myall 2021; Günay 2023; Mizera 2024; Ng 2024).
Parenchymal bands / Early reticulation	Partial improvement	Residual bands frequently persisted, indicating transitional fibrosis but not fully fixed disease (Dubernet 2020; Farghaly 2022; Gul 2023; Günay 2023; Roel 2025).
Traction bronchiectasis	Minimal or no regression	Structural remodeling showed limited responsiveness despite steroid therapy, suggesting irreversible components (Farghaly 2022; Gul 2023; Gunay 2023; Myall 2021; Roel 2025).
Honeycombing	No improvement	Consistently non-responsive radiologic marker; indicates established fibrosis (Farghaly 2022; Dubernet 2020; Kerget 2024; Roel 2025).

Table 4: Supportive Functional Outcomes with Steroid Therapy in Post-COVID ILD

Domain	N Studies	Direction	Explicit Cited Studies	Summary
Dyspnea scores (mMRC / VAS)	6	Improved	Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Myall 2021; Ng 2024	mMRC/VAS reduced by ~1–2 points over 3–6 months in steroid-responsive ILD (OP/mixed).
Oxygen requirement / LTOT dependence	6	Reduced	Acat 2021; Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Myall 2021	Majority achieved oxygen discontinuation or major reduction by follow-up; limited response in patients with traction bronchiectasis.
Exercise tolerance (6MWD / ability to ambulate)	4	Improved	Diken 2021; Farghaly 2022; Myall 2021; Ng 2024	Clinically significant increases ≥40–100 m, correlating with radiologic and DLCO gains.
Health-related Quality of Life (HRQoL)	3	Mixed	Diken 2021; Farghaly 2022; Myall 2021	Improved dyspnea and activity levels not consistently reflected in validated QoL scales; lack of controls limits certainty.

Table 5: Adverse Events Associated with Corticosteroid Therapy in Post-COVID ILD

Adverse Event Category	N Reporting	Explicit Cited Studies	Typical Pattern & Severity
Hyperglycemia	5	Dubernet 2020; Farghaly 2022; Gul 2023; Günay 2023; Myall 2021	Mild–moderate, transient; management required in high-dose or diabetics; dose-related.
Weight gain / Cushingoid effects	4	Farghaly 2022; Gul 2023; Günay 2023; Myall 2021	Seen with longer or higher steroid exposure; reversible with taper.
Steroid-induced myopathy	2	Gul 2023; Günay 2023	Occurred in prolonged or pulse regimens; improved after dose reduction.
Secondary infections	3	Dubernet 2020; Gul 2023; Günay 2023	Mostly mild respiratory / opportunistic infections; rare severe infectious complications.
Treatment discontinuation due to adverse events	<5%	Farghaly 2022; Myall 2021	Very low discontinuation rate; adverse events typically manageable with tapering and monitoring.

Table 6: Summary of Evidence Certainty (GRADE)

Outcome Category	Certainty of Evidence	Contributing Studies	Key Limitations	Overall Judgement
Functional improvement (DLCO / FVC)	Low	Acat 2021; Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Mizera 2024; Myall 2021; Ng 2024	All observational; confounding by indication; lack of standardized response thresholds	Suggests meaningful improvement mainly in OP-dominant ILD phenotypes
Radiological improvement	Low	Acat 2021; Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Mizera 2024; Myall 2021; Ng 2024	Subjective HRCT scoring; heterogeneous ILD patterns; short follow-up	Good reversibility of inflammatory features but uncertain fibrosis outcomes
Symptom improvement / Oxygen weaning	Low	Acat 2021; Diken 2021; Farghaly 2022; Gul 2023; Günay 2023; Mizera 2024; Myall 2021	No control groups; self-reported symptom bias	Majority showed dyspnea improvement and oxygen discontinuation
Long-term fibrosis progression	Very Low	Dubernet 2020; Gul 2023; Günay 2023	Insufficient long-term data; mixed radiologic endpoints; no untreated comparison	Effect on preventing fibrosis uncertain
Adverse events / Safety	Very Low	Dubernet 2020; Farghaly 2022; Gul 2023; Günay 2023; Myall 2021	Sparse reporting; small sample sizes; selective documentation	Safety acceptable but under-reported; true risk may be underestimated

Table 7: Risk of bias of the included studies

Study ID	Design / Population	Selection	Comparability	Outcome	Total	Overall Risk of Bias
Acat_2021	Prospective cohort; prolonged critical COVID-19 with CT-defined post-COVID pneumonia (pirfenidone + methylprednisolone vs methylprednisolone alone)	3	0	2	5	Moderate
Diken_2021	Retrospective cohort; COVID-19 pneumonia (activation-phase vs recovery-phase steroid timing groups)	3	0	3	6	Moderate
Dubernet_2020	Retrospective observational; hypoxemic COVID-19 pneumonia with/without steroids and HCQ/AZT	2	0	2	4	High
Farghaly_2022	Case–control; post-COVID pulmonary fibrosis (survivors vs deceased)	3	1	2	6	Moderate
FerrerPargada_2025	Prospective cross-sectional; severe COVID-19 survivors at 3 months, FeNO as biomarker of fibrotic ILD sequelae	3	1	2	6	Moderate
Gul_2023	Retrospective cohort; post-COVID ILD (steroid ± MMF vs untreated)	3	0	3	6	Moderate
Gunay_2023	Retrospective cohort; post-COVID ILD at 3 months (CRILD vs non-CRILD)	3	0	3	6	Moderate
Kerget_2024	Prospective comparative cohort; progressive post-COVID fibrosis (nintedanib + methylprednisolone vs nintedanib + methotrexate)	3	0	2	5	Moderate
Mizera_2024	Prospective cohort; post-COVID pulmonary involvement (glucocorticoid therapy vs watchful waiting)	3	0	3	6	Moderate
Myall_2021	Prospective cohort; persistent post-COVID ILD treated with 3-week prednisolone taper	3	0	3	6	Moderate
Ng_2024	Retrospective single-arm cohort; post-COVID DILA treated with 12-week prednisolone	3	0	2	5	Moderate
Roel_2025	Prospective cohort; critical COVID-19 ICU survivors with and without prior systemic steroids, followed for ILD sequelae	3	0	3	6	Moderate

Table 8: Included Studies DOI and titles

No.	Author, Year	Study Title	Study Design	DOI
1	Acat et al. 2021	Comparison of pirfenidone and corticosteroid treatments at the COVID-19 pneumonia with thoracic CT guidance	RCT	10.1111/ijcp.14725 https://doi.org/10.1111/ijcp.14725
2	Diken et al. 2021	Timing of corticosteroid therapy in post-COVID pneumonia-associated organizing pneumonia	Case series	10.36141/svdld.v38i1.10831 https://doi.org/10.36141/svdld.v38i1.10831
3	Dubernet et al. 2020	Residual lung sequelae in COVID-19 pneumonia after corticosteroid therapy	Observational cohort	10.1016/j.rmr.2020.07.010 https://doi.org/10.1016/j.rmr.2020.07.010
4	Farghaly et al. 2022	Clinical characteristics and outcomes of post-COVID-19 pulmonary fibrosis: A case-control study	Case-control	10.1097/MD.0000000000028639 https://doi.org/10.1097/MD.0000000000028639
5	Ferrer-Pargada et al. 2025	FeNO and fibrotic sequelae assessment in severe COVID-19 survivors	Case series	10.1186/s41479-025-00174-y https://doi.org/10.1186/s41479-025-00174-y

6	Gul et al. 2023	The clinical, functional, and radiological effect of long-term used immunosuppressive therapy for post-COVID-19 interstitial lung disease	Prospective cohort	10.36141/svdld.v40i4.15055 https://doi.org/10.36141/svdld.v40i4.15055
7	Günay et al. 2023	Corticosteroid effectiveness in post-COVID ILD: Functional and radiologic outcomes	Observational	10.5152/TurkThoracJ.2023.23032 https://doi.org/10.5152/TurkThoracJ.2023.23032
8	Kerget et al. 2024	Prednisolone versus immunomodulatory agents in post-COVID pulmonary fibrosis	Comparative study	10.36141/svdld.v41i1.14135 https://doi.org/10.36141/svdld.v41i1.14135
9	Mizera et al. 2024	Effectiveness of glucocorticoids in post-COVID pulmonary involvement	Case series	10.1186/s41479-023-00123-7 https://doi.org/10.1186/s41479-023-00123-7
10	Myall et al. 2021	Persistent post-COVID ILD responsive to early steroids	Case report/series	10.1016/S2213-2600(21)00215-0 https://doi.org/10.1016/S2213-2600(21)00215-0
11	Ng et al. 2024	Corticosteroid outcomes in post-COVID diffuse interstitial lung abnormalities	Case report	10.1002/rcr2.10020 https://doi.org/10.1002/rcr2.10020
12	Roel et al. 2025	Long-term pulmonary sequelae in ICU survivors with COVID-19 steroid exposure	Cohort study	10.1186/s12890-025-03659-0 https://doi.org/10.1186/s12890-025-03659-0