WebLog Journal of Pulmonology and Respiratory Medicine
Systematic Review
Published: 05 Sep, 2026

Pulmonary Talcosis Across Five Decades: A Route-Based Systematic Review of 40 Patient-Level Cases

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WebLog Open Access Publications
Article ID : wjprm.2026.i0501
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Abstract

Objective: To synthesize patient-level evidence on pulmonary talcosis and compare demographic, exposure-related, clinical, radiologic, histopathologic, management, and outcome patterns across exposure routes.

Methods: PubMed, Google Scholar, and ScienceDirect were searched from inception through April 2026 for patient-level reports. PRISMA 2020, PRISMA-S, and SWiM guidance were followed. Data were summarized descriptively, and selected route comparisons used Fisher exact tests and odds ratios with 95% confidence intervals.

Results: Thirty-five articles describing 40 patients were included. Mean age was 43.8±15.2 years, and 25 patients (62.5%) were male. Intravenous drug or excipient exposure was most common (21/40, 52.5%), followed by occupational or industrial inhalation (8/40, 20.0%), cosmetic talc inhalation (7/40, 17.5%), cocaine or recreational inhalation (3/40, 7.5%), and mixed exposure (1/40, 2.5%). Dyspnea occurred in 28 patients (70.0%), cough in 20 (50.0%), and hypoxemia or respiratory failure in 9 (22.5%). Foreign-body granulomas and birefringent particles were reported in 30 (75.0%) and 29 (72.5%), respectively. Fibrosis was more frequent in occupational than nonoccupational cases (75.0% *vs*. 31.3%; p=0.042). Ten deaths (25.0%) were reported, but publication bias and incomplete follow-up precluded mortality estimation.

Conclusions: Pulmonary talcosis demonstrates route-specific clinicopathologic patterns. Diagnosis depends on a detailed exposure history and, when needed, tissue examination with polarized light microscopy. Management is primarily exposure cessation and supportive care; evidence supporting disease-specific treatment remains insufficient.

Keywords: Talc; Lung Diseases, Interstitial; Pneumoconiosis; Granuloma, Foreign-Body; Substance Abuse, Intravenous; Occupational Exposure

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Received Date: *23 Jul 2026*
Accepted Date: *03 Sep 2026*
Published Date: *05 Sep 2026*

Citation:
Adhikari B, Parajuli P, Dhital A, Bhandari R, Adhikari B. Pulmonary Talcosis Across Five Decades: A Route-Based Systematic Review of 40 Patient-Level Cases. WebLog J Pulmonol Respir Res. wjprm.2026.i0501. https://doi.org/10.5281/zenodo.22646694

Abbreviations

CI: Confidence Interval; IQR: Interquartile Range; IV: Intravenous; OR: Odds Ratio; PMF: Progressive Massive Fibrosis; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PRISMA-S: PRISMA literature-search extension; SWiM: Synthesis Without Meta-analysis; VATS: Video-Assisted Thoracoscopic Surgery

Introduction

Pulmonary talcosis is an uncommon foreign-body granulomatous and pneumoconiotic lung disease caused by deposition of talc, a hydrous magnesium silicate, in the respiratory tract or pulmonary vascular bed. Talc is used in industrial processes, cosmetic powders, and pharmaceutical tablets. Pulmonary exposure therefore occurs through occupational or cosmetic inhalation, inhalation of talc-adulterated recreational substances, or intravenous injection of crushed oral medications and adulterated drugs containing talc as an excipient [1-35].

The disease represents a clinicopathologic spectrum rather than a single radiologic entity. Intravenous exposure can produce intravascular and perivascular particle deposition, foreign-body granulomas, pulmonary arterial remodeling, pulmonary hypertension, and extrapulmonary

embolic deposition [1-5, 8, 11, 12, 14, 16-18, 21, 23, 26, 29, 34, 35]. Inhalational disease more often produces bronchiolocentric or centrilobular injury, whereas occupational exposure can lead to chronic fibrotic pneumoconiosis and progressive massive fibrosis-like lesions [6, 7, 9, 10, 13, 15, 19, 20, 22, 24, 25, 27, 28, 30-33].

Recognition is difficult because pulmonary talcosis can mimic miliary tuberculosis, Pneumocystis pneumonia, sarcoidosis, hypersensitivity pneumonitis, granulomatosis with polyangiitis, asbestosis, malignancy, and pulmonary embolic disease [3, 7, 13, 14, 17, 18, 24, 29, 30, 33, 34]. Published evidence is dispersed across case reports and small case series, and route-specific differences have not been consistently summarized. This systematic review therefore synthesized all available patient-level reports and compared exposure, clinical, imaging, histopathologic, management, and outcome patterns across routes of exposure.

Materials and Methods

Review design and reporting

This systematic review was reported according to the PRISMA 2020 statement and PRISMA-S recommendations, with structured synthesis guided by the SWiM framework [36-38]. The terms "Talcosis" OR "Talc" combined with "pulmonary" OR "lung" were used.

Eligibility criteria

Peer-reviewed case reports and case series were eligible when they provided individual patient-level data on pulmonary talcosis, talc granulomatosis, talc pneumoconiosis, or pulmonary foreign-body granulomatosis attributable to talc or tablet excipients. Diagnosis could be supported by histopathology, polarized light microscopy, mineralogical or elemental analysis, autopsy findings, or a compelling exposure and radiologic pattern when biopsy was not performed. Reports were excluded when they described therapeutic talc pleurodesis without parenchymal talcosis, lacked extractable patient-level data, duplicated a previously published case, or provided insufficient clinical detail for structured extraction.

Information sources and search strategy

PubMed, Google Scholar, and ScienceDirect were searched from database inception through April 2026. The core search combined talcosis or talc with pulmonary or lung. Searches were adapted to each source, and the complete strategies are provided in Table 1. No meta-analysis filter was applied because the condition is rare and inconsistently indexed. The search yielded 322 records: 64 from PubMed, 126 from Google Scholar, and 132 from ScienceDirect.

Study selection and data extraction

Records were deduplicated and screened at title/abstract and full-text stages against the eligibility criteria. Data were extracted into a standardized patient-level table. Variables included publication year, country, age, sex, exposure route, clinical presentation, imaging findings, histopathology or other confirmation, treatment, follow-up, and outcome. Unreported variables were classified as not reported and were not assumed to be absent. When only an approximate age or decade was provided, a midpoint estimate was used solely for descriptive age summaries.

Methodological quality assessment

Methodological limitations were appraised qualitatively using domains adapted for case reports and case series: selection, exposure and diagnostic ascertainment, alternative explanations, and completeness of follow-up and reporting [39]. No composite score was calculated because the review was intended to characterize clinical patterns rather than estimate causal treatment effects. Certainty of evidence was not graded with GRADE because no comparative treatment-effect estimates were synthesized.

Data synthesis and statistical analysis

Because of marked clinical and methodological heterogeneity, the primary synthesis was descriptive and no meta-analysis was performed. Categorical variables are presented as counts and percentages using the patient-level denominator of 40. Age is summarized as mean ± standard deviation and median with Interquartile Range (IQR). Exposure routes were grouped as intravenous drug/excipient, cosmetic inhalation, cocaine/recreational inhalation, occupational/industrial inhalation, or mixed exposure. Selected route-based contrasts were explored with two-sided Fisher exact tests and odds ratios with 95% confidence intervals. These comparisons were hypothesis-generating and were not interpreted as population-level estimates because case reports are highly susceptible to selection and publication bias.

Ethics

Ethics committee approval and informed consent were not required because the review used previously published, nonidentifiable data and involved no new patient contact.

Results and Discussion

Study selection

After removal of 17 duplicates, 305 records were screened. Of these, 263 were excluded during title and abstract screening. Forty-two full-text reports were assessed, 7 did not meet the eligibility criteria, and 35 articles describing 40 patients were included (Figure 1).

Study and patient characteristics

The reports were published from 1976 through 2026 and originated from 15 countries. Seventeen patients (42.5%) were reported before 2000, 6 (15.0%) during 2000-2009, 14 (35.0%) during 2010-2019, and 3 (7.5%) during 2020-2026. The United States accounted for 15 cases (37.5%), Canada for 6 (15.0%), and India for 3 (7.5%). Mean age was 43.8±15.2 years; median age was 42.5 years (IQR, 32.8-54.0; range, 22-82). Twenty-five patients (62.5%) were male (Table 2).

Exposure routes and clinical manifestations

Intravenous drug or excipient exposure was the leading route (21/40, 52.5%), followed by occupational or industrial inhalation (8/40, 20.0%), cosmetic talc inhalation (7/40, 17.5%), cocaine or recreational inhalation (3/40, 7.5%), and mixed intravenous plus inhalational exposure (1/40, 2.5%) (Figure 2).

Dyspnea or breathlessness occurred in 28 patients (70.0%), cough in 20 (50.0%), hypoxemia or respiratory failure in 9 (22.5%), weight loss in 8 (20.0%), fever or low-grade fever in 6 (15.0%), and hemoptysis in 4 (10.0%). Pneumothorax, asymptomatic or incidental detection, pulmonary hypertension or cor pulmonale, and sudden death or postmortem presentation each occurred in 3 patients (7.5%). Symptoms differed by route: dyspnea and cough were especially common in cosmetic and occupational exposure, whereas pulmonary hypertension was confined to intravenous cases. Pneumothorax was concentrated in cocaine-associated inhalational disease (Figure 3).

Table 1: Search strategies.

Source	Search strategy	Records identified
PubMed	("talcosis" OR "talc") AND ("pulmonary" OR "lung")	64
Google Scholar	allintitle/keyword combinations of talcosis OR talc with pulmonary OR lung; results screened for patient-level pulmonary reports	126
ScienceDirect	("talcosis" OR "talc") AND ("pulmonary" OR "lung")	132
Search period	Database inception through April 2026	Total, 322

Table 2: General characteristics of included pulmonary talcosis cases.

Variable	Value	Comment
Included articles	35	Article-level reports in the final synthesis
Patient-level cases	40	All extractable patient rows retained
Age, mean ± SD	43.8 ± 15.2 years	Approximate ages used only when exact age was unavailable
Age, median (IQR)	42.5 (32.8-54.0) years	Range, 22-82 years
Male sex	25 (62.5%)	
Female sex	15 (37.5%)	
Publication period	1976-2026	Five decades of case-based literature
Before 2000	17 (42.5%)	
2000-2009	6 (15.0%)	
2010-2019	14 (35.0%)	
2020-2026	3 (7.5%)	

IQR: Interquartile Range; SD: Standard Deviation

Table 3: Radiologic and histopathologic findings by exposure route.

Feature	Overall (N = 40)	IV/excipient (n = 21)	Nonoccupational inhalational (n = 10)	Occupational/industrial (n = 8)
Radiologic patterns				
Diffuse micronodules/miliary pattern	8 (20.0%)	7/21 (33.3%)	1/10 (10.0%)	—
Centrilobular nodules or ground-glass opacity	7 (17.5%)	2/21 (9.5%)	4/10 (40.0%)	1/8 (12.5%)
Conglomerate masses/PMF-like lesions	8 (20.0%)	4/21 (19.0%)	1/10 (10.0%)	3/8 (37.5%)
Fibrosis/reticulation/honeycombing	6 (15.0%)	1/21 (4.8%)	2/10 (20.0%)	3/8 (37.5%)
Emphysema/bullous disease/hyperinflation	7 (17.5%)	3/21 (14.3%)	3/10 (30.0%)	1/8 (12.5%)
Tree-in-bud pattern	3 (7.5%)	3/21 (14.3%)	—	—
Cavitary nodules/lesions	3 (7.5%)	2/21 (9.5%)	1/10 (10.0%)	—
Pneumothorax	3 (7.5%)	1/21 (4.8%)	2/10 (20.0%)	—
Pulmonary hypertension/cor pulmonale signs	2 (5.0%)	2/21 (9.5%)	—	—
Normal or unreported chest imaging	5 (12.5%)	3/21 (14.3%)	—	2/8 (25.0%)
Histopathologic/diagnostic findings				
Birefringent/polarized talc particles	29 (72.5%)	13/21 (61.9%)	9/10 (90.0%)	7/8 (87.5%)
Foreign-body/talc granulomas	30 (75.0%)	18/21 (85.7%)	8/10 (80.0%)	3/8 (37.5%)
Multinucleated/foreign-body giant cells	18 (45.0%)	7/21 (33.3%)	7/10 (70.0%)	4/8 (50.0%)
Interstitial or perivascular fibrosis	16 (40.0%)	4/21 (19.0%)	5/10 (50.0%)	6/8 (75.0%)
Intravascular/perivascular/arteriolar or capillary talc	10 (25.0%)	8/21 (38.1%)	—	1/8 (12.5%)
Autopsy/postmortem confirmation	5 (12.5%)	4/21 (19.0%)	—	1/8 (12.5%)
Mineralogical/elemental confirmation	4 (10.0%)	1/21 (4.8%)	—	2/8 (25.0%)
No biopsy or no direct talc confirmation	3 (7.5%)	—	1/10 (10.0%)	2/8 (25.0%)

Values are n (%) or n/N (%). IV, intravenous; PMF, progressive massive fibrosis. The mixed-exposure case (n = 1) is included in the overall column but not in route-specific columns.

Radiologic and histopathologic findings

Radiologic patterns were heterogeneous and often overlapped. Diffuse micronodules or a miliary pattern and conglomerate masses or progressive massive fibrosis-like lesions were each reported in 8 patients (20.0%). Centrilobular nodules or ground-glass opacity and emphysema, bullous disease, or hyperinflation were each reported in 7 (17.5%). Fibrosis, reticulation, or honeycombing was reported in 6 (15.0%). Intravenous cases most often showed diffuse micronodules, tree-in-bud change, and pulmonary vascular complications. Nonoccupational inhalational cases more often showed centrilobular

Table 4: Management, outcomes, and exploratory route-based comparisons.

Category/feature	Finding	Interpretation/statistic
Management		
Exposure cessation/supportive care/oxygen/observation	15/40 (37.5%)	Primary management approach
Corticosteroids/prednisone/prednisolone	11/40 (27.5%)	Benefit inconsistently reported
Antimicrobials or empiric anti-tuberculous therapy	7/40 (17.5%)	Usually before diagnosis or while excluding infection
Surgical biopsy/resection/VATS/thoracotomy	10/40 (25.0%)	Mostly diagnostic
Lung transplantation	2/40 (5.0%)	Advanced IV excipient disease
Outcomes		
Survived/improved/stable	15/40 (37.5%)	Includes stabilization, discharge, or recovery
Death	10/40 (25.0%)	Not a population mortality estimate
Progressive disease or loss to follow-up	2/40 (5.0%)	
Outcome not reported/limited	7/40 (17.5%)	
Other/unclear	6/40 (15.0%)	
Exploratory comparisons		
Death: IV/excipient vs all other routes	7/21 *vs* 3/19	OR 2.67 (95% CI, 0.58-12.33); *p*=0.281
Vascular deposition: IV/excipient vs all other routes	8/21 *vs* 2/19	OR 5.23 (95% CI, 0.95-28.91); *p*=0.069
Histologic fibrosis: occupational vs other routes	6/8 *vs* 10/32	OR 6.60 (95% CI, 1.13-38.60); *p*=0.042
Dyspnea: occupational vs other routes	7/8 *vs* 21/32	OR 3.67 (95% CI, 0.40-33.72); *p*=0.396

CI: Confidence Interval; IV: Intravenous; OR: Odds Ratio; VATS: Video-Assisted Thoracoscopic Surgery

nodules, ground-glass opacity, emphysema, or pneumothorax, whereas occupational disease had a more chronic fibrotic and mass-like pattern (Table 3).

Foreign-body or talc granulomas were reported in 30 patients (75.0%), birefringent or polarized talc particles in 29 (72.5%), multinucleated or foreign-body giant cells in 18 (45.0%), and interstitial or perivascular fibrosis in 16 (40.0%). Intravascular, perivascular, arteriolar, or capillary talc deposition occurred in 10 (25.0%). Fibrosis was more frequent in occupational cases than in all other cases (6/8 [75.0%] *vs* 10/32 [31.3%]; Odds Ratio [OR], 6.60; 95% CI, 1.13-38.60; *p*=0.042). Vascular deposition was more frequent in intravenous cases than in other routes (8/21 [38.1%] *vs* 2/19 [10.5%]; OR, 5.23; 95% CI, 0.95-28.91; *p*=0.069).

Management and outcomes

No disease-specific therapy was consistently reported. Exposure cessation, oxygen, observation, rehabilitation, or other supportive care was described in 15 patients (37.5%). Corticosteroids were used in 11 (27.5%), but dosing and duration were inconsistently reported and clinical benefit was variable. Antimicrobials or empiric anti-tuberculous therapy were used in 7 (17.5%), commonly before talcosis was recognized. Surgical biopsy or resection was reported in 10 (25.0%), usually to exclude infection or malignancy, and lung transplantation was reported in 2 advanced intravenous methylphenidate-related cases (Table 4).

Survival, clinical improvement, stabilization, discharge, or recovery was documented in 15 patients (37.5%). Death was reported in 10 (25.0%), progressive disease or loss to follow-up in 2 (5.0%), and outcome information was limited or absent in 7 (17.5%). Death was more frequently reported in intravenous cases than in other routes, but the difference was not statistically significant (7/21 [33.3%] *vs* 3/19 [15.8%]; OR, 2.67; 95% CI, 0.58-12.33; *p*=0.281). These proportions represent published cases and should not be interpreted as incidence or mortality rates.

Methodological quality

All reports were vulnerable to selection and publication bias because they represented published cases rather than a defined population. Exposure and diagnostic ascertainment were generally stronger when polarized microscopy, histopathology, mineralogical analysis, or autopsy directly demonstrated talc or foreign-body material. Three articles lacked direct talc confirmation, and follow-up was absent or limited in several reports. Treatment descriptions were frequently incomplete, precluding causal inference regarding corticosteroids, immunosuppressive therapy, or transplantation.

Discussion and interpretation

This review identifies pulmonary talcosis as a route-dependent clinicopathologic spectrum. Intravenous drug or excipient exposure accounted for slightly more than half of the cases, but nearly half arose from cosmetic, occupational, cocaine-associated, or mixed inhalational exposure. Consequently, the absence of injection drug use should not remove talcosis from the differential diagnosis when exposure history, imaging, and pathology are compatible [1-35].

Clinical and imaging patterns differed by route. Inhalational and occupational cases more often presented with dyspnea and cough, consistent with airway and parenchymal particle deposition [6, 7, 9, 10, 13, 15, 19, 20, 22, 24, 25, 27, 28, 30-33]. Intravenous disease more commonly produced diffuse micronodules, tree-in-bud change, vascular deposition, pulmonary hypertension, and severe emphysematous or fibrotic complications [1, 8, 11, 12, 18, 21, 23, 26, 29, 34, 35]. Cocaine-associated cases were notable for pneumothorax, whereas occupational disease showed chronic reticulation, conglomerate masses, and progressive fibrosis. These patterns can mimic infection, sarcoidosis, pneumoconiosis, malignancy, septic emboli, and other interstitial lung diseases [1, 3, 6-18, 22, 24-35].

Histopathology provides the most specific diagnostic evidence. Birefringent particles within foreign-body granulomas, interstitium, or pulmonary vessels strongly support talc or excipient-related lung

disease in the appropriate clinical context. The higher frequency of vascular deposition in intravenous cases is biologically consistent with embolization of insoluble tablet material [2, 5, 11, 16, 18, 21, 23, 26, 29, 34, 35]. The greater frequency of fibrosis in occupational disease is also plausible because such exposures are typically prolonged and may involve mixed mineral dusts [19, 22, 24, 25, 28, 30, 31, 33]. Nevertheless, the exploratory p values should be interpreted cautiously because the cases were not sampled from a defined population and the comparisons were not adjusted for age, exposure duration, diagnostic era, or reporting intensity.

Management remains largely supportive. Exposure cessation, oxygen therapy, rehabilitation, and treatment of complications are central [1, 7, 8, 11, 18, 23, 24, 27, 29, 35]. Corticosteroids were used in approximately one quarter of cases, but reports were heterogeneous and susceptible to confounding by indication; no regimen can be recommended from these data [19, 22-24, 27]. Lung transplantation may be considered for carefully selected patients with advanced irreversible disease, but recurrence after resumed injection exposure underscores the importance of sustained abstinence and addiction-medicine support [4, 5]. Clinicians should also monitor for pulmonary hypertension, progressive fibrosis, chronic hypoxemia, and recurrent pneumothorax.

The review's main strength is its patient-level synthesis across five decades and multiple routes of exposure. Important limitations remain. Case reports overrepresent unusual, severe, or diagnostically challenging presentations and cannot provide incidence, prevalence, or unbiased mortality estimates. Search coverage was limited to PubMed, Google Scholar, and ScienceDirect; Embase and other bibliographic databases were not searched. Screening procedures were not prospectively registered, and outcome, exposure duration, pulmonary function, treatment dose, and follow-up were inconsistently reported. Approximate ages were used for a small number of descriptive calculations. Finally, route-based statistical comparisons were exploratory and should be regarded as hypothesis-generating.

Conclusion

Pulmonary talcosis is a heterogeneous but recognizable disease caused by intravenous, cosmetic, recreational inhalational, and occupational talc exposure. Route-specific patterns include greater vascular involvement in intravenous disease and more fibrosis in occupational disease. Diagnosis requires a detailed exposure history and, when non-invasive evaluation is inconclusive, tissue examination with polarized light microscopy is essential. No disease-specific treatment is established; exposure cessation, supportive care, and surveillance for pulmonary hypertension, fibrosis, hypoxemia, and pneumothorax remain the foundation of management.

Acknowledgements

No additional acknowledgements are reported.

Funding

No specific funding was received for this work.

Conflicts of Interest

The authors declare no conflicts of interest.

Author Contributions

Biplab Adhikari: conceptualization, methodology, literature search, data curation, formal analysis, visualization, writing of the original draft, and project administration.

Prekshya Parajuli: literature review, data organization, interpretation, writing, and critical revision.

Alina Dhital: literature screening, data verification, validation, and critical revision.

Rita Bhandari: clinical interpretation, validation, and critical revision for important intellectual content.

Bipin Adhikari: supervision, conceptual guidance, methodology, interpretation, and critical revision.

All authors approved the final manuscript and agree to be accountable for the integrity and accuracy of the work.

Data Availability

The extracted patient-level data and additional extraction details are available from the corresponding author on reasonable request.

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