RegioneEmilia-Romagna

SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA

COSTRUIAMO SALUTE
IL PIANO DELLA PREVENZIONE DELLA REGIONE EMILIA-ROMAGNA

AMBIENTE LAVORO

"Patterns" HRCT delle principali pneumopatie lavoro-correlate

Giorgia Dalpiaz

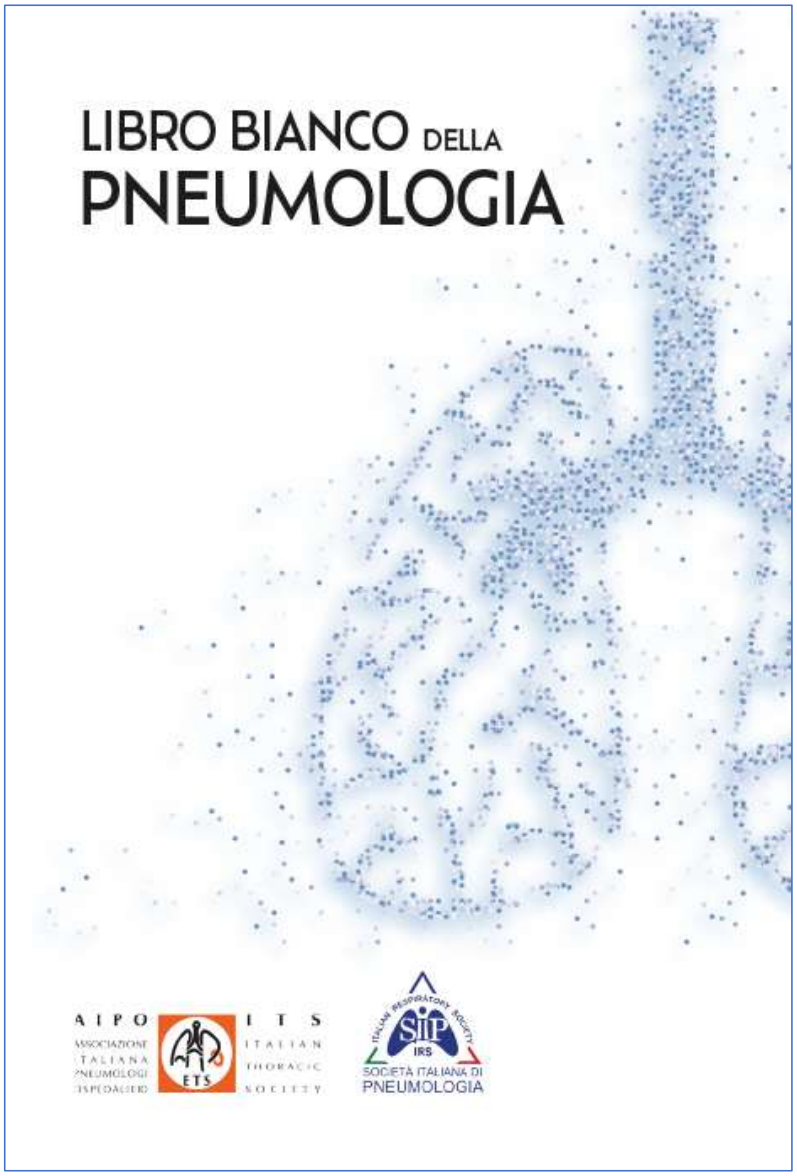
Alta Spec. in Imaging Toracico

Ospedale Bellaria - AUSL Bologna

Prof. a contratto Scuole spec. RX & Pneumologia UNIBO

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
A.D. 1088

RER



Presentazione ufficiale

14 aprile 2026, presso il **Ministero della Salute a Roma**, alla presenza del Ministro Prof. O. Schillaci

Ministero della Salute

Tecniche di imaging

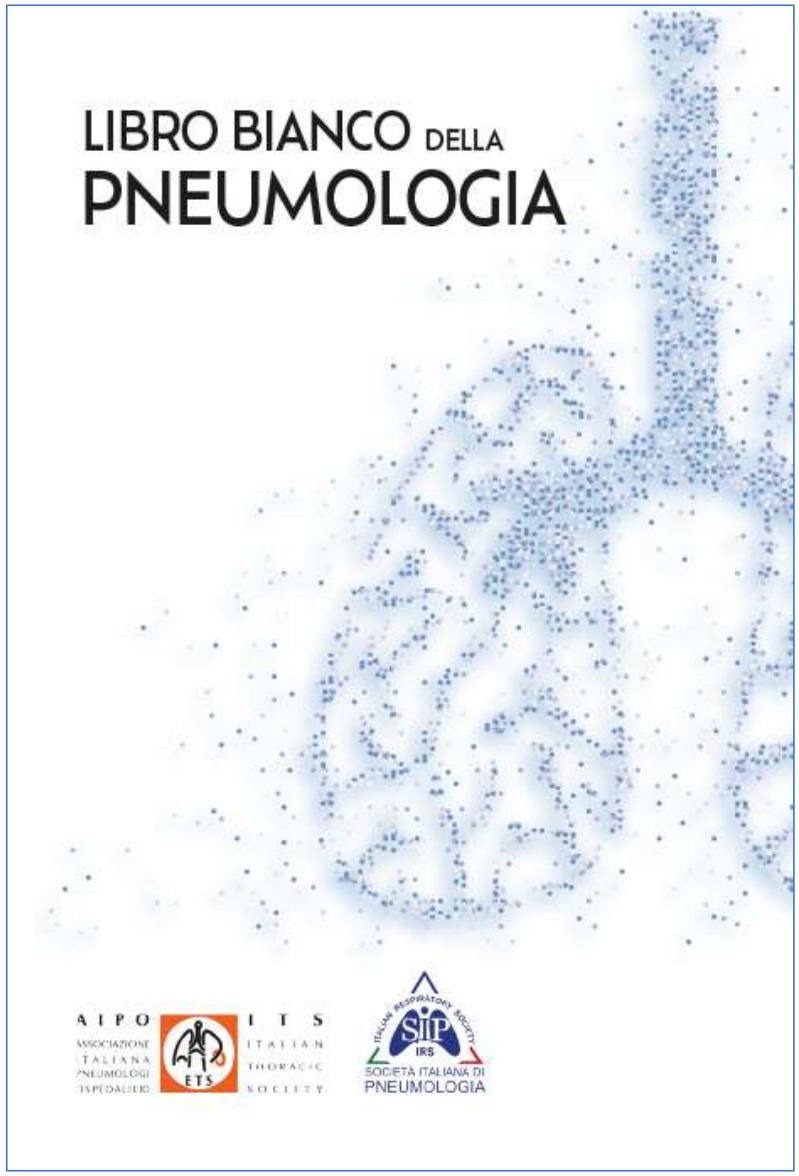
Giorgia Dalpiaz[1,2], Michele Mondoni[3,4], Gaetano Rea[5], Guido Marchi[6], Sara Piciucchi[1,7]

Malattie respiratorie occupazionali

Nicola Murgia[1], Mario Olivieri[2]

Fattori di rischio occupazionali per le patologie respiratorie

Gioele Castelli, Nicol Bernardinello, Paolo Spagnolo



3.14

Malattie respiratorie occupazionali

Nicola Murgia[1], Mario Olivieri[2]

Necessità	Possibili soluzioni
Emersione delle patologie respiratorie professionali	• Formazione (pre e post-laurea) • Maggiore attenzione all'anamnesi lavorativa • Banche dati e riferimenti bibliografici • Consulenza degli specialisti in medicina del lavoro
Gestione del paziente con patologia professionale	• Consulenza degli specialisti in medicina del lavoro • Ottimizzazione della terapia e del follow-up
Adempimenti medico legali (segnalazione/certificazione) ANCHE NEL CASO DI SOSPETTO	• Formazione • Disponibilità di piattaforme agili per la segnalazione/certificazione • Collaborazione con gli specialisti in medicina del lavoro

Approccio **multidisciplinare**

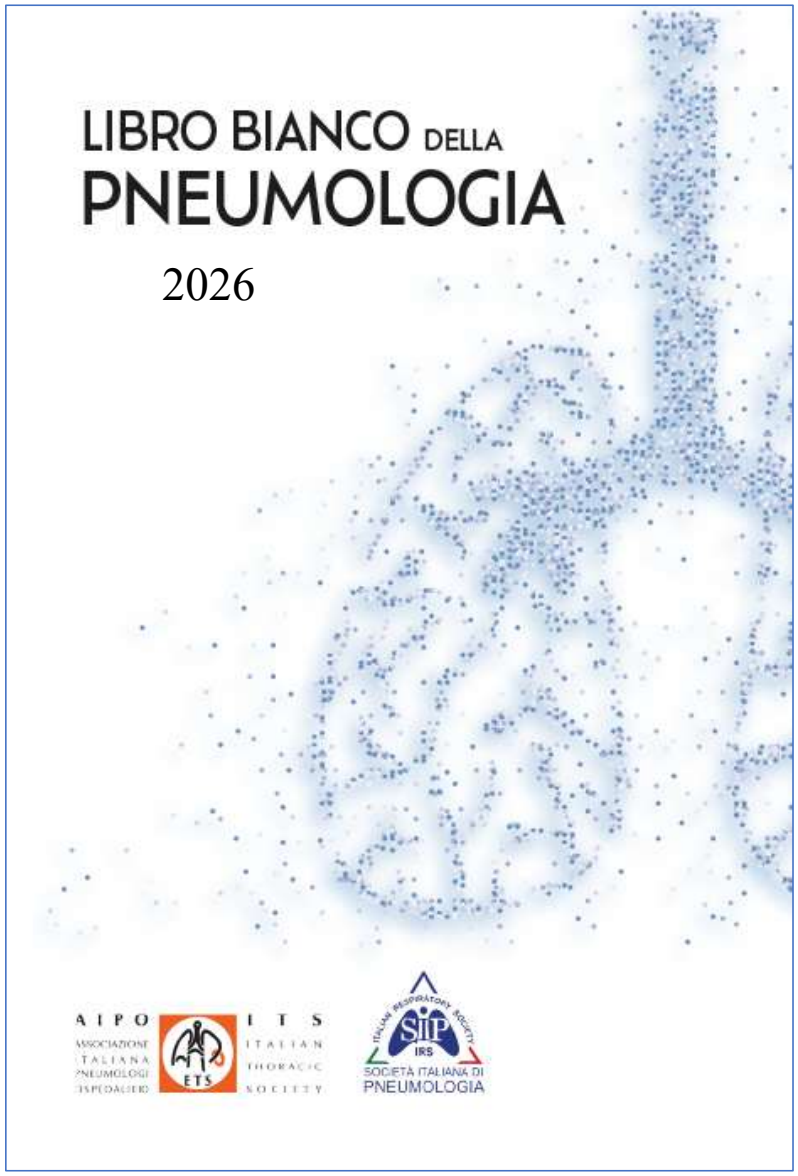
Eur Respir J 2025

EUROPEAN RESPIRATORY JOURNAL
ERS OFFICIAL DOCUMENT
C.J. RYERSON ET AL.

Update of the international multidisciplinary classification of the interstitial pneumonias: an ERS/ATS statement

Christopher J. Ryerson[1,42], Ayodeji Adegunsoye[2,42], Sara Piciucchi[3,4,42], Lida P. Hariri[5], Yet H. Khor[6,7,8,9], Marlies S. Wijsenbeek[10], Athol U. Wells[11], Amita Sharma[12], Wendy A. Cooper[13], Katerina Antoniou[14], Raphael Borie[15], Aurelie Fabre[16,17], Yoshikazu Inoue[18,19], Kerri Johannson[20], Takeshi Johkoh[21], Leticia Kawano-Dourado[22,23,24], Ella Kazerooni[25], Toby M. Maher[26,27], Philip L. Molyneaux[27,28], Raymond Protti[29], Claudia Ravaglia[3,30], Elisabetta A. Renzoni[27,31], Ryoko Saito-Koyama[32], Nicola Sverzellati[33,34], Simon L.F. Walsh[35,36,37], Paul Wolters[38], Soo-Ryum Yang[39], William Travis[40,42] and Andrew G. Nicholson[27,41,42]

It is **critically important** to pursue identification of occult exposures in such situations, including a comprehensive occupational and environmental exposure history and sometimes involving a workplace and/or **multidisciplinary evaluation** with industrial hygiene or occupational respiratory medicine expertise

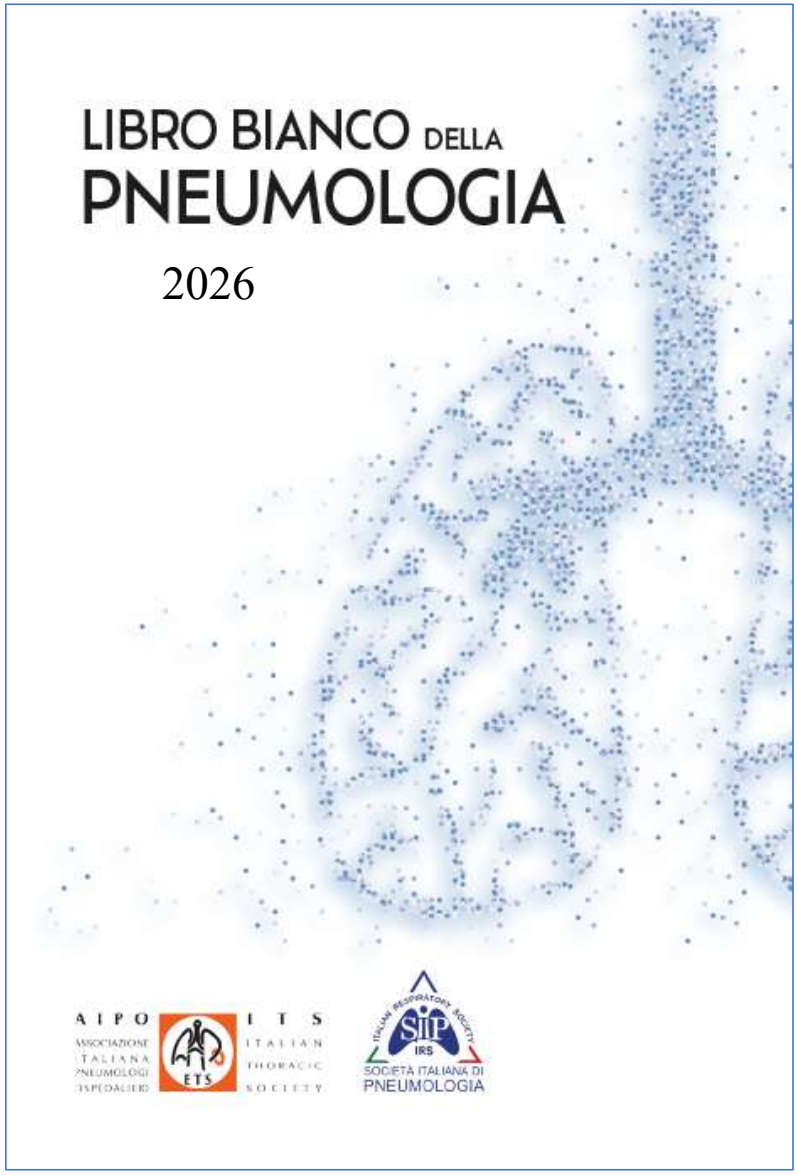


2.4

Fattori di rischio occupazionali per le patologie respiratorie

Gioele Castelli, Nicol Bernardinello, Paolo Spagnolo

PATOLOGIA	ESPOSIZIONE LAVORATIVA
Patologie ostruttive	
Asma bronchiale	Polveri organiche (cereali, caffè, farina)
	Sostanze di derivazione animale (proteine, forfora)
	Polveri inorganiche (nickel, platino, fumi)
	Polveri derivanti dall'industria tessile
	Polveri derivanti dal packaging o imballaggi
Bronchiolite obliterante	Diacetile ("popcorn lung")
	Acetilaldeide
	Polveri del deserto (soldati americani in Medio Oriente e in Afghanistan)
Interstiziopatie	
Pneumoconiosi	
Silicosi, silico-tubercolosi	Silice
Asbestosi	Asbesto
Siderosi	Ferro
Berilliosi	Berillio
Calicosi	Calice
Antracosi	Carbone
Baritosi	Bario
Bissinosi	Cotone
Talcosi	Talco
Proteinosi alveolare	Ossido di indio e stagno
Danno alveolare diffuso	Fiocchi di nylon



2.4

Fattori di rischio occupazionali per le patologie respiratorie

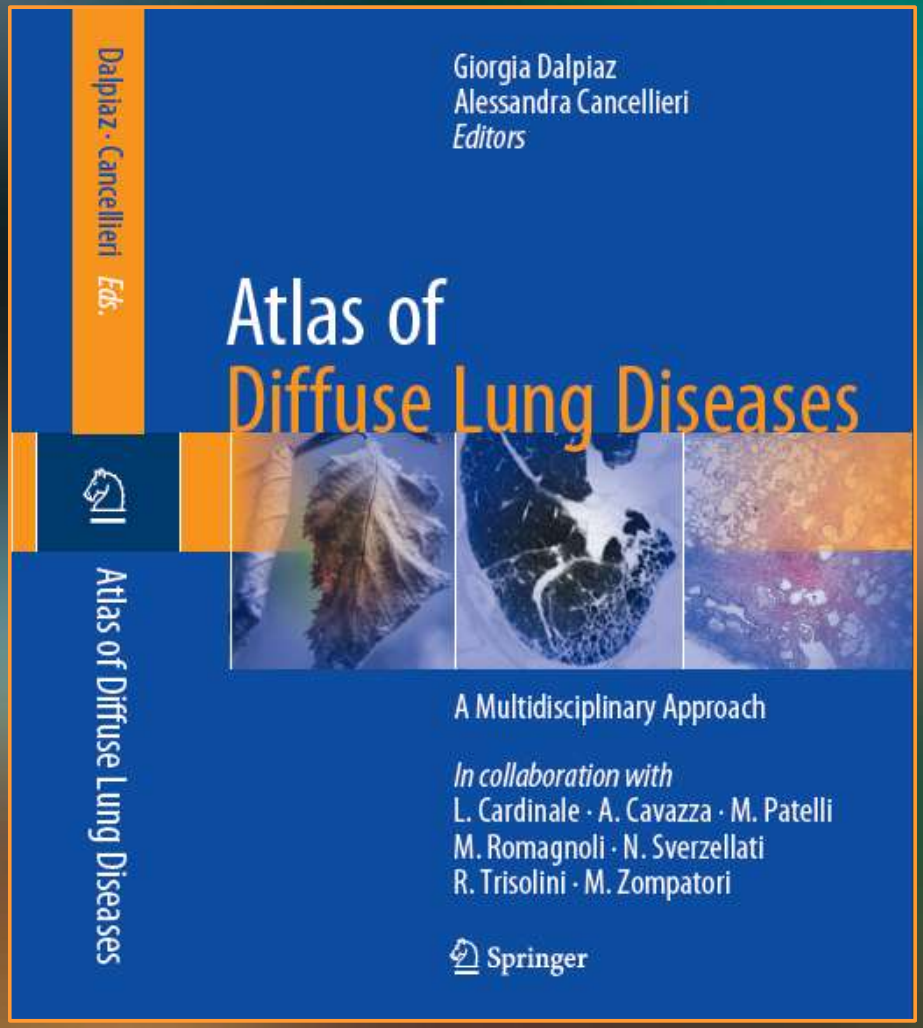
Gioele Castelli, Nicol Bernardinello, Paolo Spagnolo

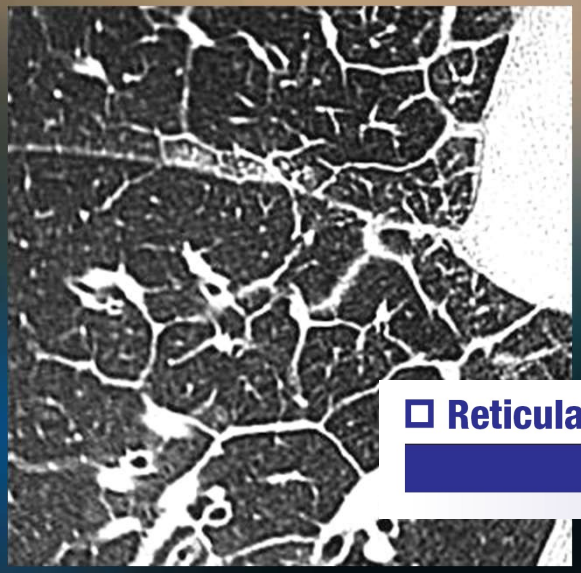
Polmonite da ipersensibilità	
Polmonite da ipersensibilità	Isocianati, zirconio, cobalto
Polmone del contadino	Saccharopolyspora rectivirgula
Polmone dell'allevatore di uccelli	Proteine aviarie di siero e piume
Bagassosi	Bagassa
Polmone del lavoratore del malto	Malto
Polmone del lavoratore di grano	Grano
Polmone del lavoratore dei frutti di mare	Molluschi
Malattie granulomatose	
Sarcoidosi	Polveri tossiche del World Trade Center
Alluminosi	Alluminio
	Zirconio
	Titanio

The **diagnosis** of **occupational ILD** is generally made based on a combination of compatible occupational exposure history and chest imaging, and the exclusion of other conditions that may mimic occupational ILD. Despite its low sensitivity for detecting early disease [74], **chest radiograph** remains a widely used imaging test for screening of occupational ILDs and for making a diagnosis, particularly in low-income countries.

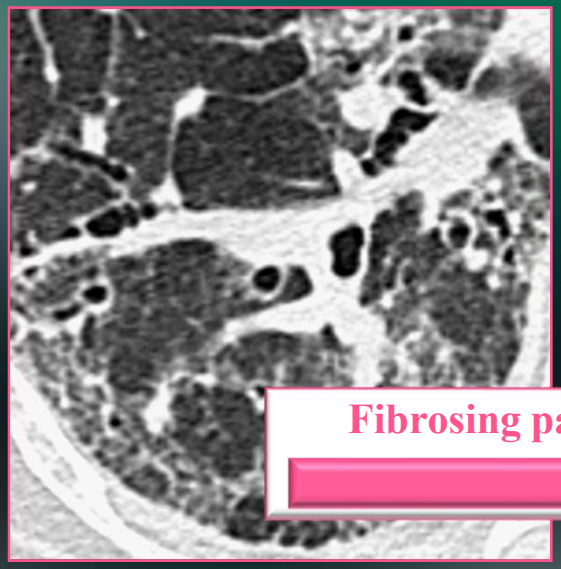
Chest CT has higher sensitivity for early disease and greater accuracy in defining disease **pattern** than chest radiograph and represents a pivotal tool in the diagnosis of occupational ILD

TC ad alta risoluzione (HRCT) - Approccio multidisciplinare

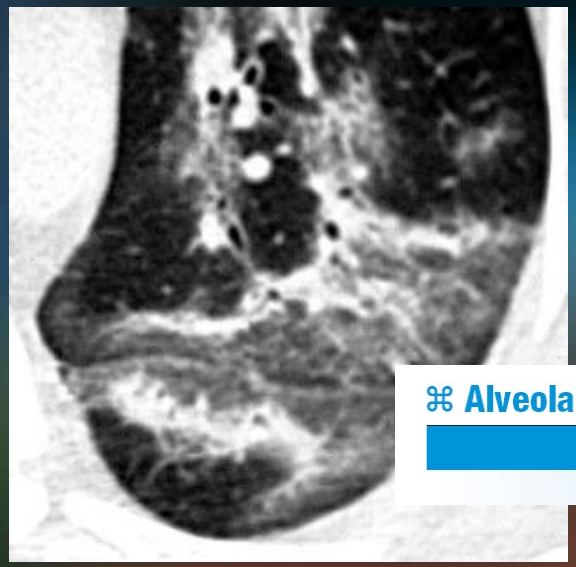




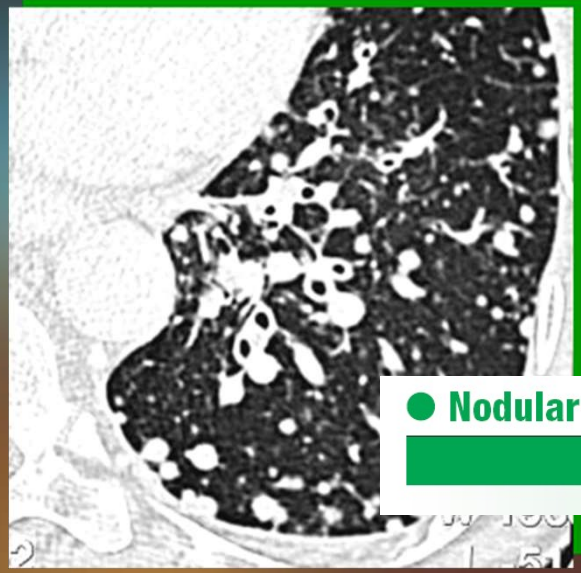
□ Reticular pattern



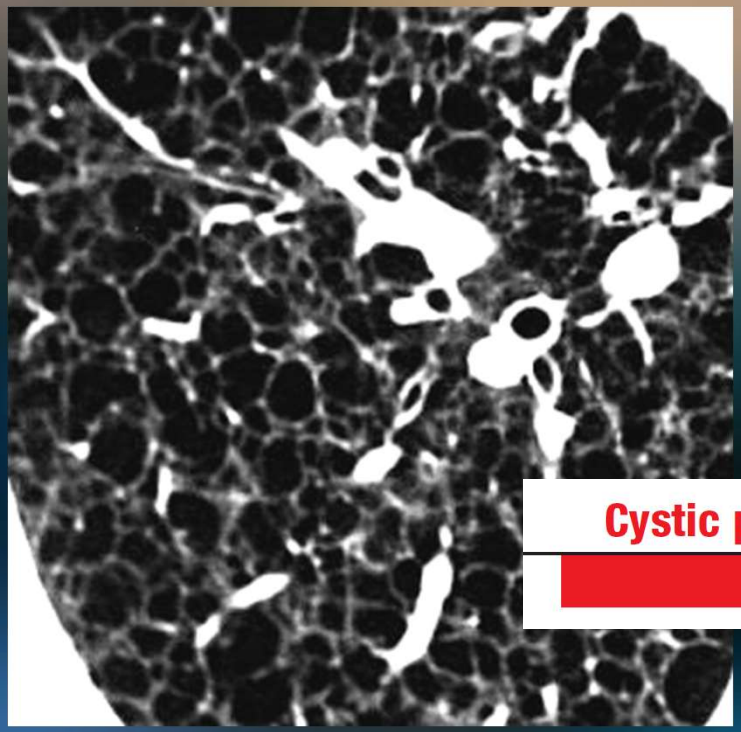
Fibrosing pattern



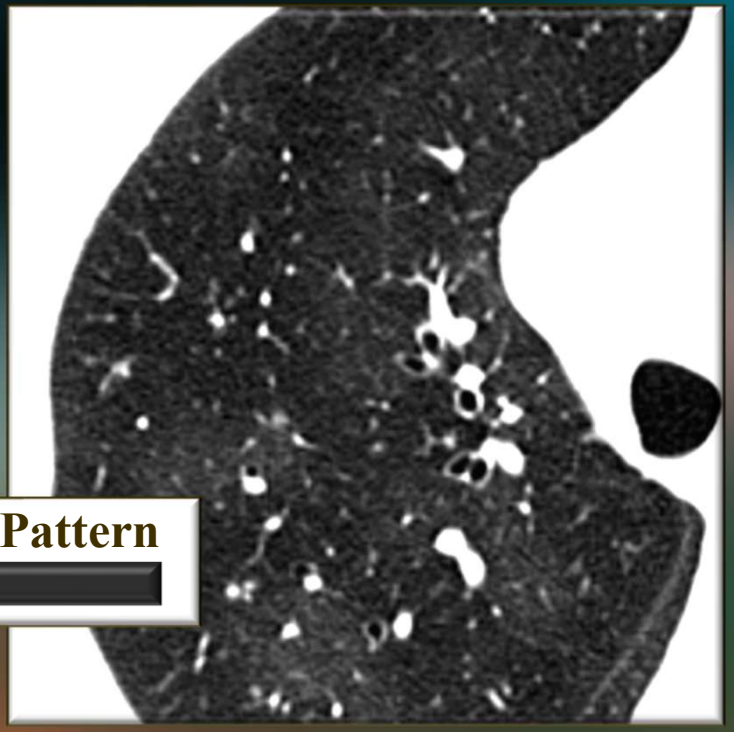
⌘ Alveolar pattern



● Nodular pattern



Cystic pattern

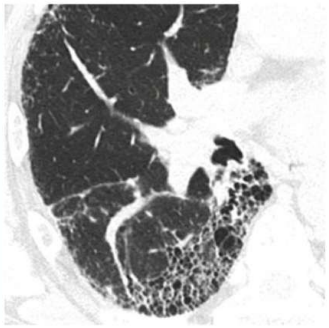


Dark lung Pattern

Fibrosing Diseases

Radiology

Giorgia Dalpiaz
Sara Piciucchi



Asbestosis Asbestos-induced pneumoconiosis

Asbestosis

Dalpiaz & Cancellieri

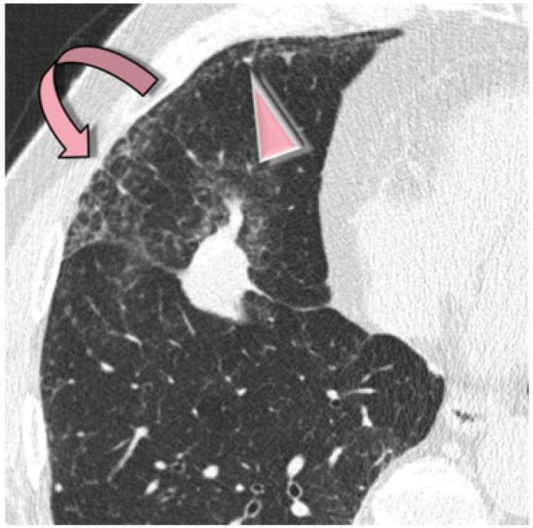
HIGH-RESOLUTION CT: HRCT

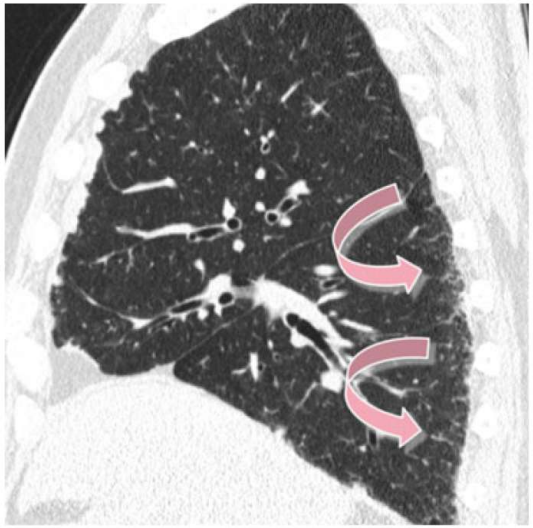
Key Signs

- In patients with early asbestosis, dot-like opacities are visible in the subpleural lung (►). Subpleural, confluent curvilinear opacities are also present. These correlate with the presence of peribronchiolar fibrosis extending to involve the contiguous airspaces and alveolar interstitium.
- Fine fibrosing reticulation such as intralobular interstitial thickening (↬).
- Irregular thickening of interlobular lines and irregular interfaces.
- Traction bronchiolectases.
- Architectural distortion.
- Parenchymal bands, with possible “Crow’s foot” appearance (50–80 %).
- Subpleural lines.

Distribution

Basal predominance of pulmonary abnormalities. It is also characteristic for these lung abnormalities being most severe in the posterior lung and subpleural regions (sagittal image ↬). The abnormalities are usually bilateral and symmetric.





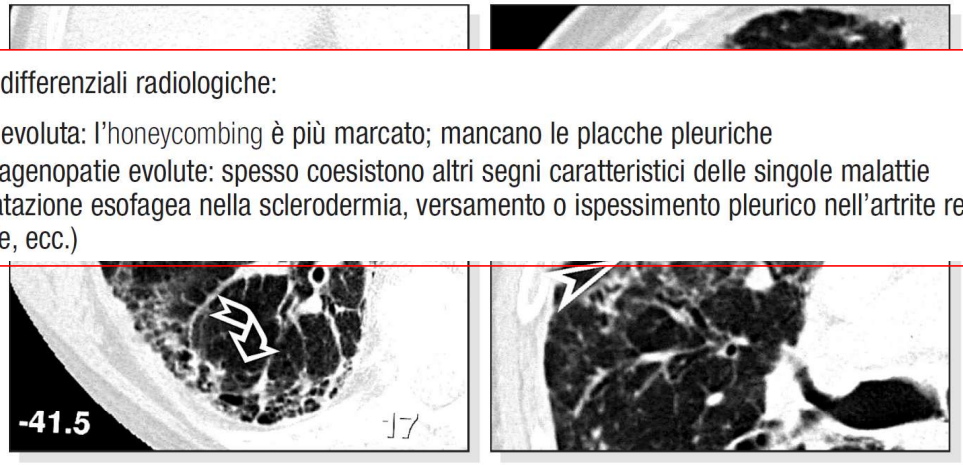
Asbestosi evoluta

ALTA RISOLUZIONE - H R T C

Lesioni elementari

Segni radiologici di base:

- Cisti rotondeggianti di piccole dimensioni (2-10 mm) che condividono pareti spesse e si dispongono su più strati concentrici in sede subpleurica (↳)(honeycombing)
- Bronchiectasie e bronchiolectasie da trazione (≫) ad andamento tortuoso e con pareti spesse



Diagnosi differenziali

Diagnosi differenziali radiologiche:

- UIP evoluta: l'honeycombing è più marcato; mancano le placche pleuriche
- Collagenopatie evolute: spesso coesistono altri segni caratteristici delle singole malattie (dilatazione esofagea nella sclerodermia, versamento o ispessimento pleurico nell'artrite reumatoide, ecc.)

Distribuzione

Bilaterale, a chiazze

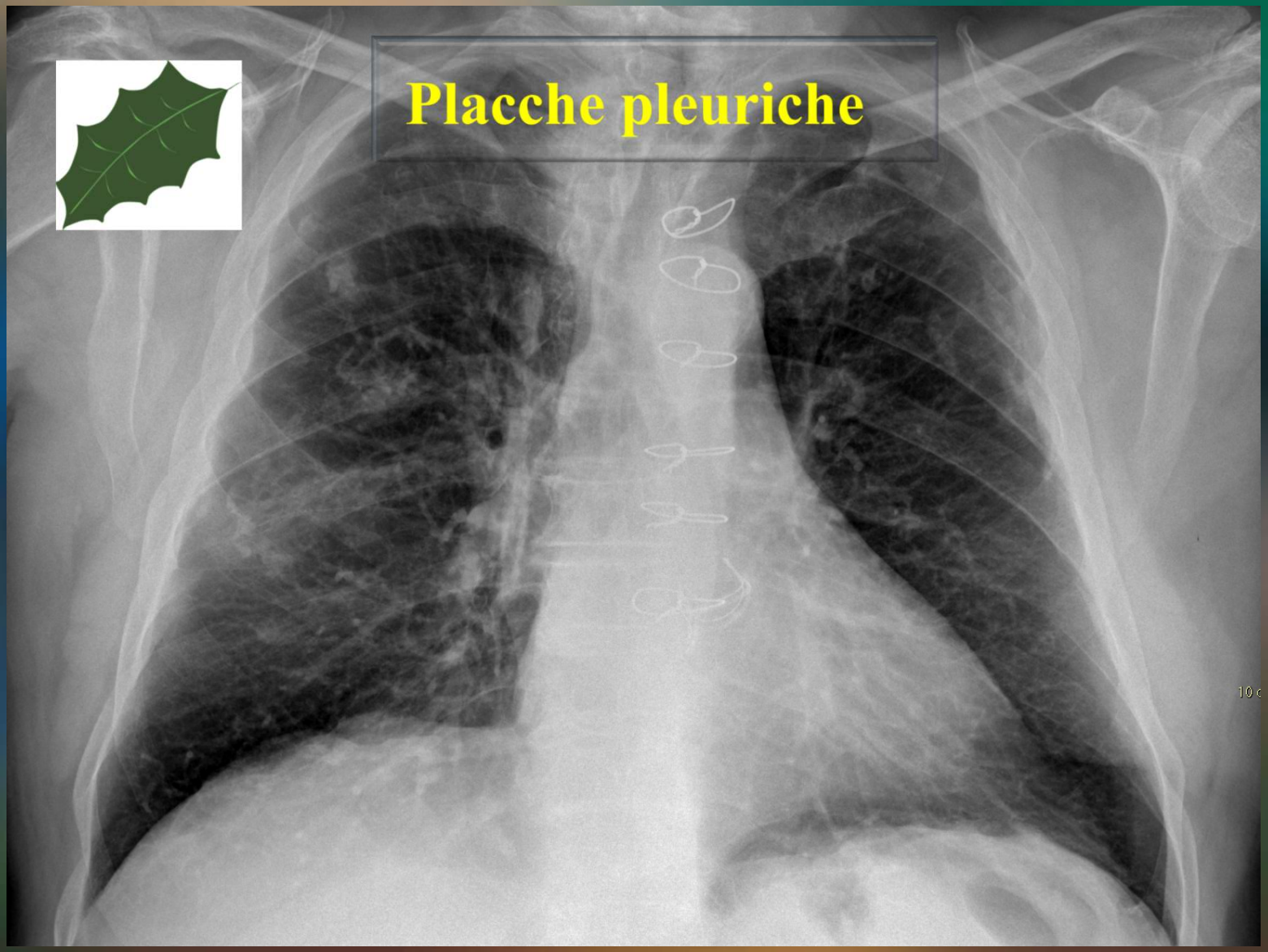
Periferica subpleurica, più accentuata posteriormente

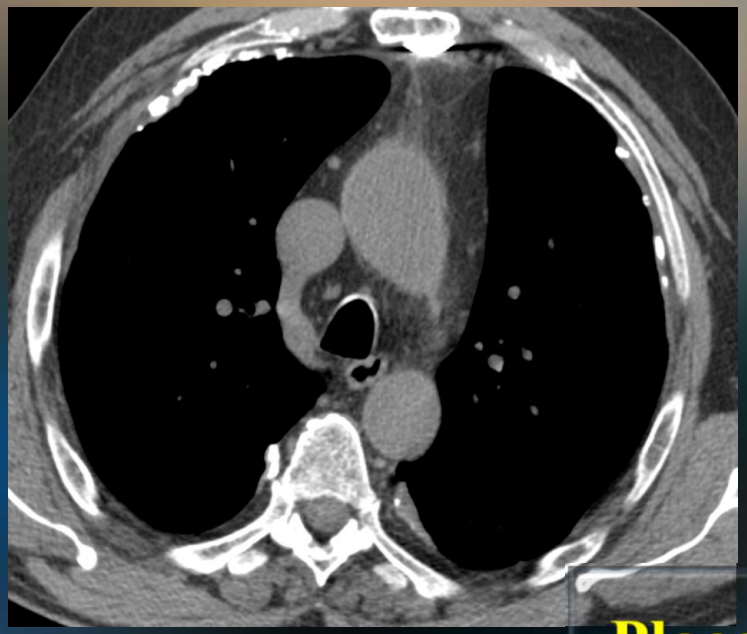
Prevalentemente basale

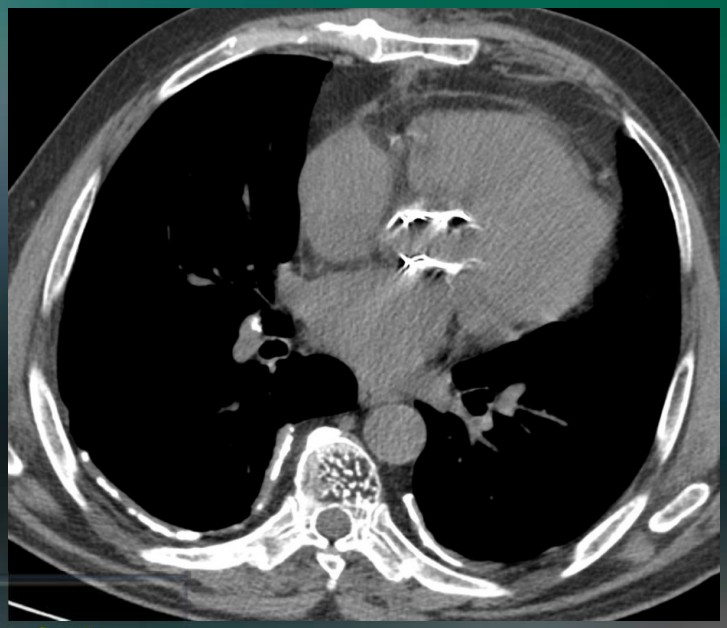
Il volume polmonare è ridotto

Aberle DR. High-resolution computed tomography of asbestos-related diseases. Semin Roentgenol 1991, 26: 118

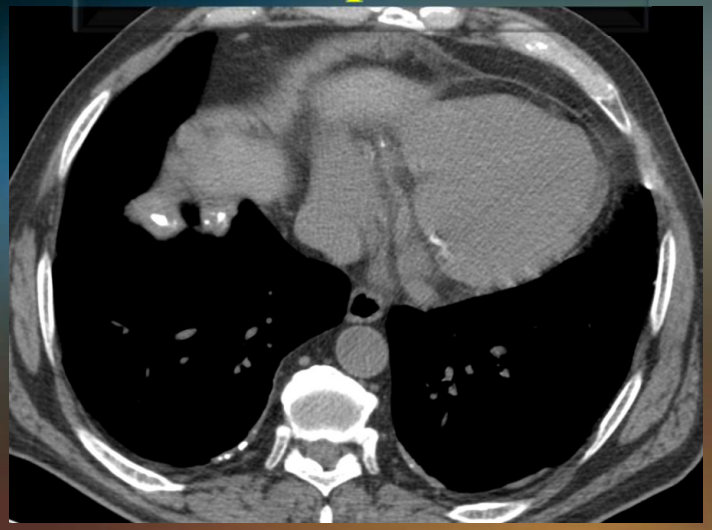
Kim KI. Imaging of occupational lung disease. Radiographics 2001, 21: 1371


Placche pleuriche





Placche pleuriche

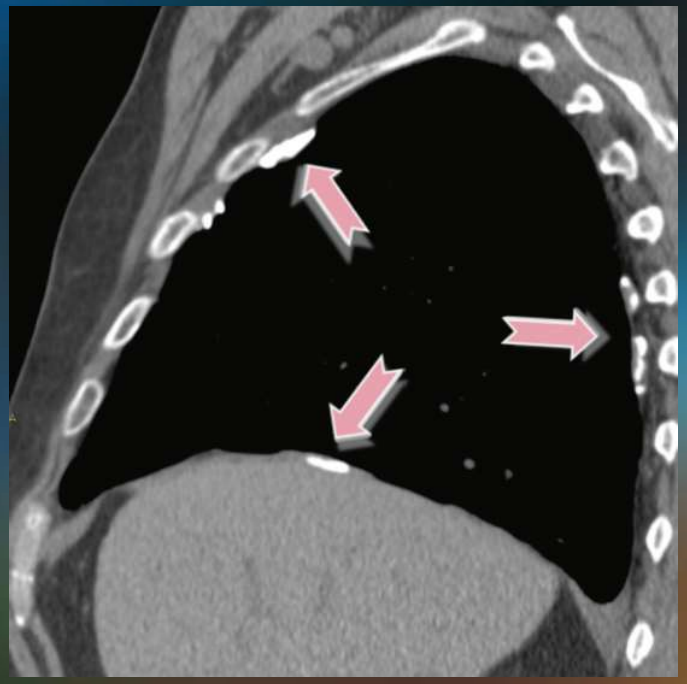


Dimensioni e numero variabili

Calcificazioni nel 10-15 %

Non-parenchymal Signs

- Pleural thickening or plaques (➡): these may be bilateral, of varying length, but with a thickness <1 cm and calcified in 10–15 % of cases. They are typically absent in the apices or in the costophrenic sinuses and tend to be arranged in a spiral pattern extending superoanterior to posteroinferior ("propeller blade" distribution). The presence of pleural plaques often lends support to the radiologic diagnosis of asbestosis. Pleural disease is often present (80 %). The diaphragmatic pleura is commonly involved in patients who have asbestos-related pleural disease.



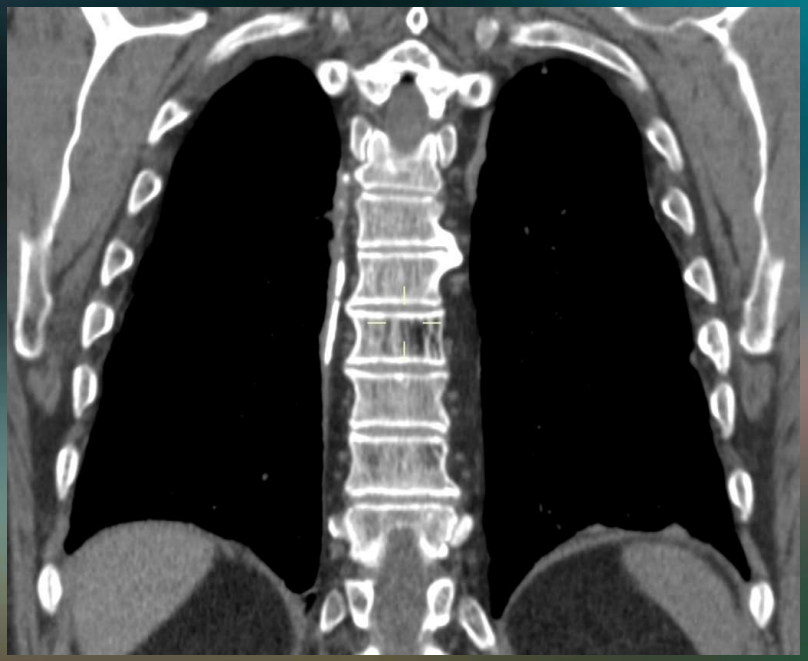
Ispessimento pleurico diffuso - DPT

Criteri proposti da *Lynch et. al. (1989)*

(definizione più citata/utilizzata negli studi TC)

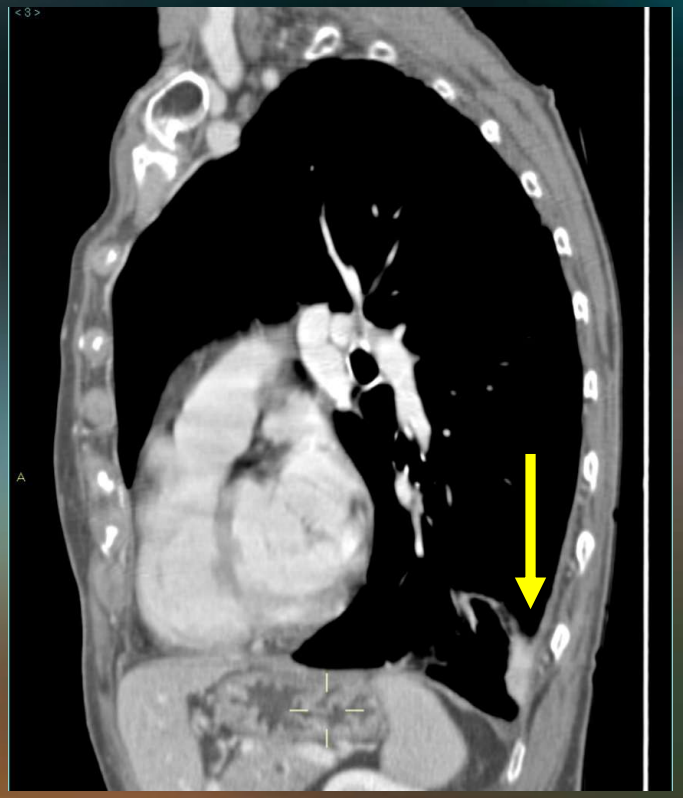
ISPESSIMENTO CONTINUO DELLA PLEURA, che risponde ai seguenti criteri dimensionali:

1. **larghezza > 5 cm**
2. **estensione cranio-caudale > 8 cm**
3. **spessore > 3 mm**



DD: infezioni croniche (es. TB), collagenopatie, talcaggio, metastasi pleuriche, mesotelioma (early)

Nodulo polmonare solitario



COMET TAIL SIGN

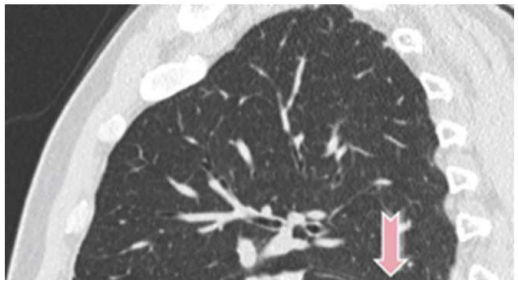
Crab nippers sign, parachute sign

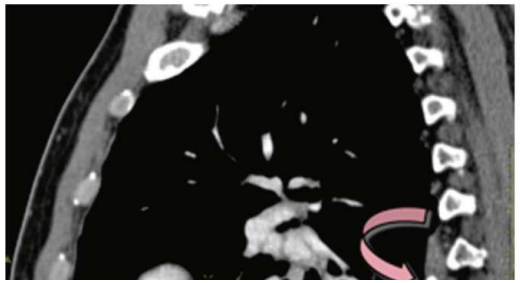
Clinical History

Male patient in his 70s, asymptomatic, with past exposure to asbestos. Chest X-ray showed multiple bilateral pleural plaques and a right basal nodule. The patient underwent a chest CT with contrast medium.

CT

MPR sagittal images show in the right lower lobe a subpleural oval parenchymal lobulated opacity connected to the ipsilateral hilum by curvilinear bands (►). It is also adherent to a pleural plaque with some linear calcifications, the latter well visible in the image with mediastinal window (⇩).



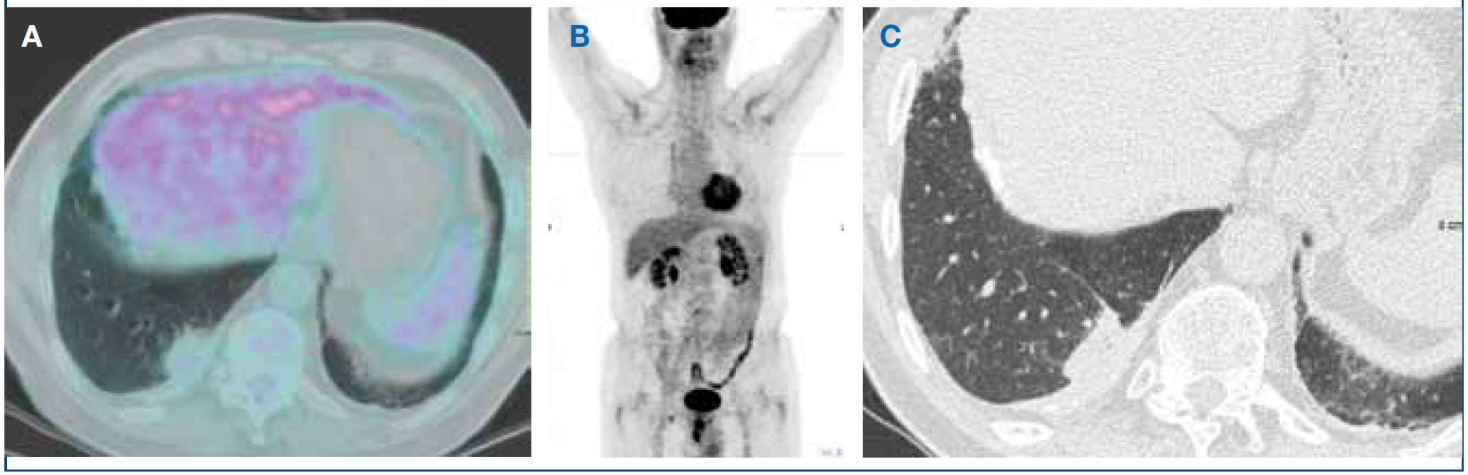


Ulteriori indagini e decorso clinico

L'ulteriore indagine radiologica che ha confermato tale ipotesi diagnostica, evitando il ricorso ad indagini invasive, è la TC-PET. Essa ha dimostrato assenza di segni di attività metabolica sia a livello delle placche pleuriche sia del nodulo nel lobo inferiore destro (Figura 2A). Assenza di captazione patologica anche a livello delle stazioni linfonodali ilo-mediastiniche o in altri distretti corporei (Figura 2B).

In presenza di un quadro TC tipico e con TC-PET negativa, molti Autori concordano nell'evitare interventi invasivi, bioptici o escissionali. È consigliato il follow-up TC, come realizzato nel caso del nostro paziente, che ha dimostrato la stazionarietà del quadro anche dopo 5 anni (Figura 2C).

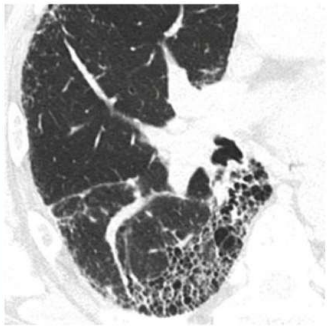
TC-PET



Fibrosing Diseases

Radiology

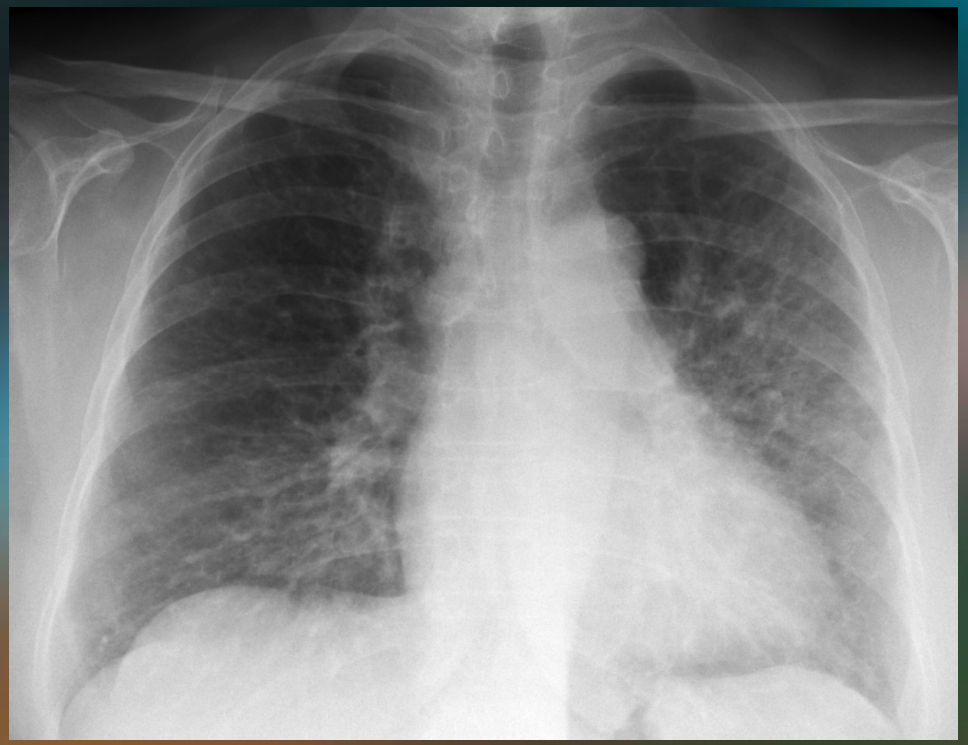
Giorgia Dalpiaz
Sara Piciucchi

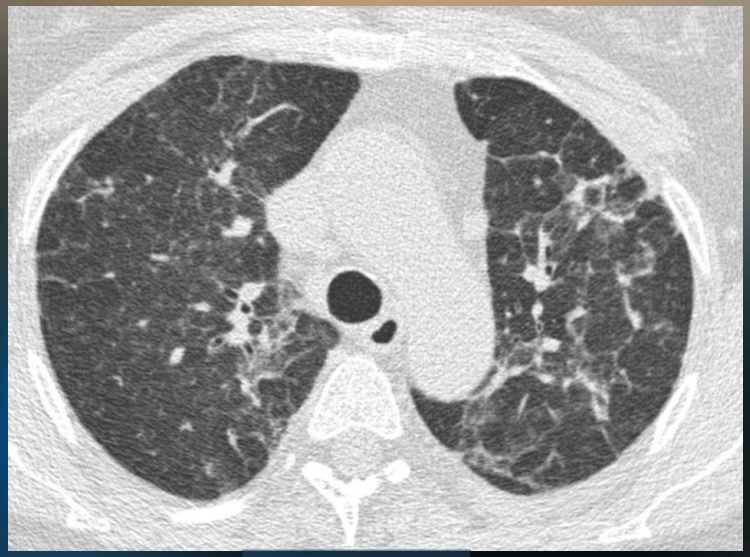


HP, chronic Hypersensitivity pneumonitis, chronic

Caso clinico

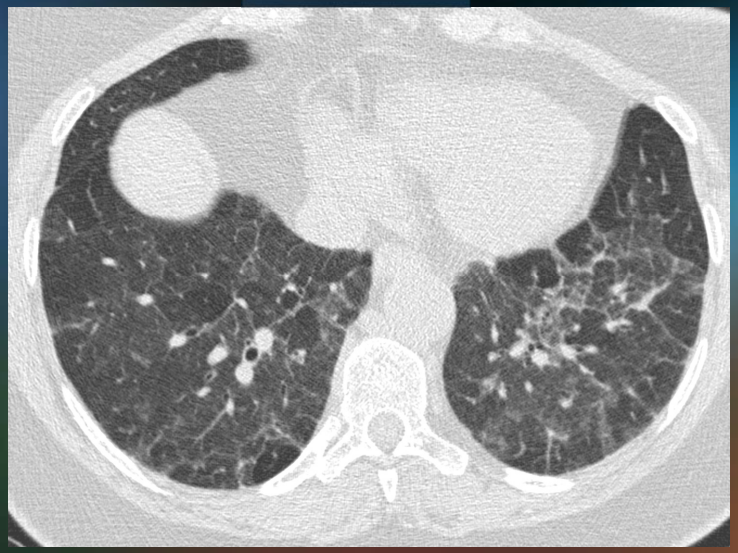
- Donna di 66 anni, pensionata, non-fumatrice
- Clinica: dispnea cronica da sforzo, non febbre né tosse
- E.O: diffuse fini crepitazioni di fine ispirazione tipo velcro
- RX Torace: interstiziopatia

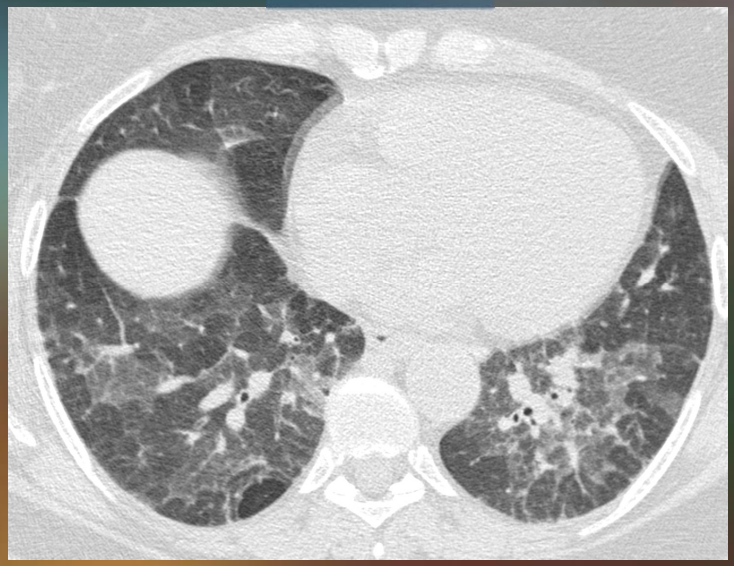




Insp.

Esp.





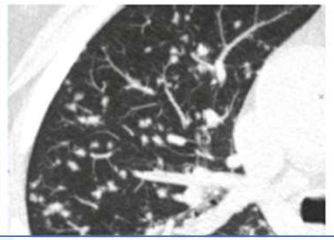
Seconda anamnesi

Solo dopo una seconda anamnesi la paziente ha ammesso di aver lavorato nel passato in una fabbrica di scarpe con periodici fenomeni disponici acuti quando in contatto con alcune sostanze

Diagnosi multidisciplinare:
HP fibrosante

Nodular Diseases

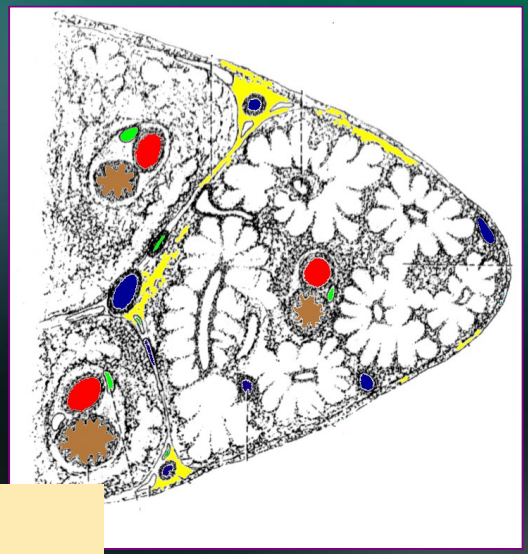
Radiology	**Nicola Sverzellati** **Mario Silva**	

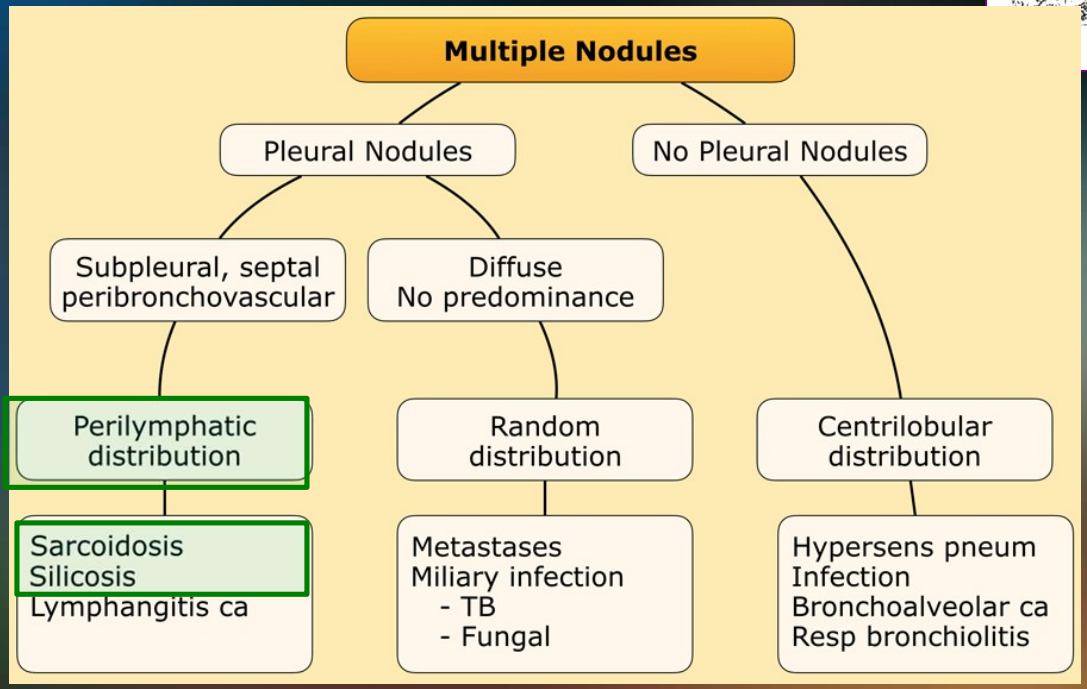


Sarcoidosis Sarcoidosis

Silicosis Silica-induced pneumoconiosis

Nodular Pattern





Radiology 1999
Chest 2006
AJR 2010

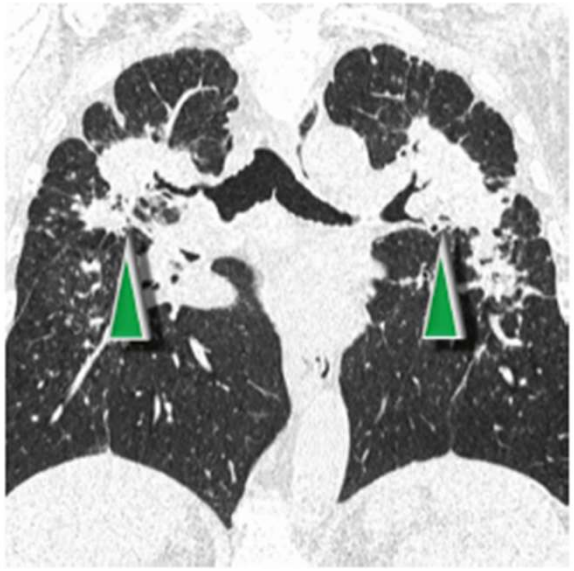
HIGH-RESOLUTION CT: HRCT

Key Signs

- Simple silicosis: solid bilateral nodules (1–10 mm) with perilymphatic distribution; the nodules tend to coalesce in the most peripheral pulmonary regions forming the so-called pseudoplaques.
- Progressive massive fibrosis: usually bilateral and symmetrical solid masses (diameter more than 1 cm) (►) surrounded by cicatricial emphysema.

Distribution

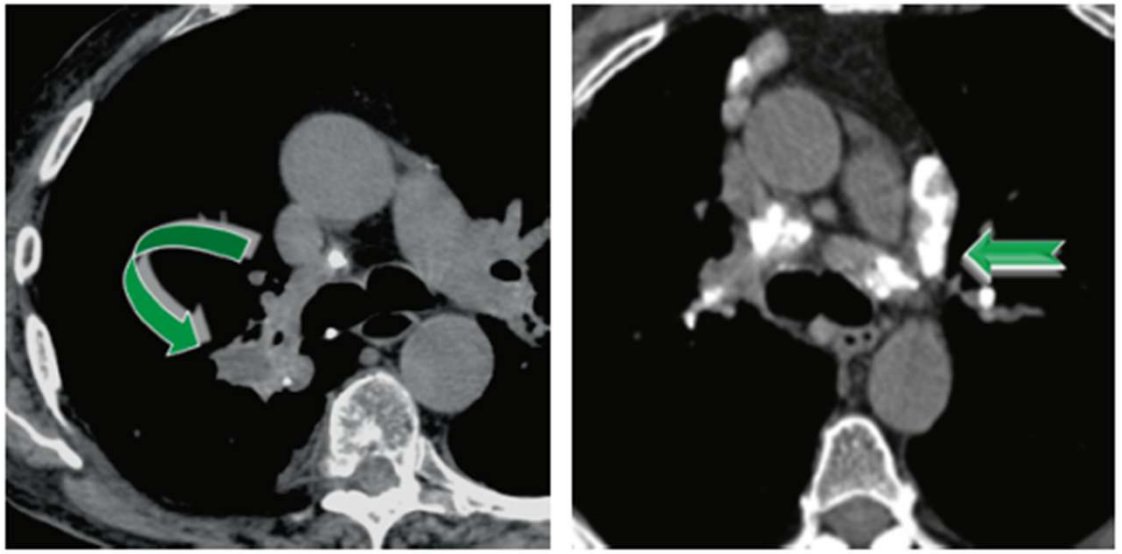
- Simple silicosis: nodules are mainly located in the upper and posterior lung zones.
- Progressive massive fibrosis (PMF): the masses tend to develop in the mid-zone or periphery of the upper lung showing a tendency to migrate toward the hila.



Silicosis

Non-parenchymal Signs

- Eggshell calcifications are seen in mediastinal lymph nodes (➡).
- Diffuse or localized thickening of the visceral pleura may be present.



The masses of complicated silicosis derive from the coalescence of the underlying nodules, and therefore their appearance is associated with a numerical reduction of the small nodules.

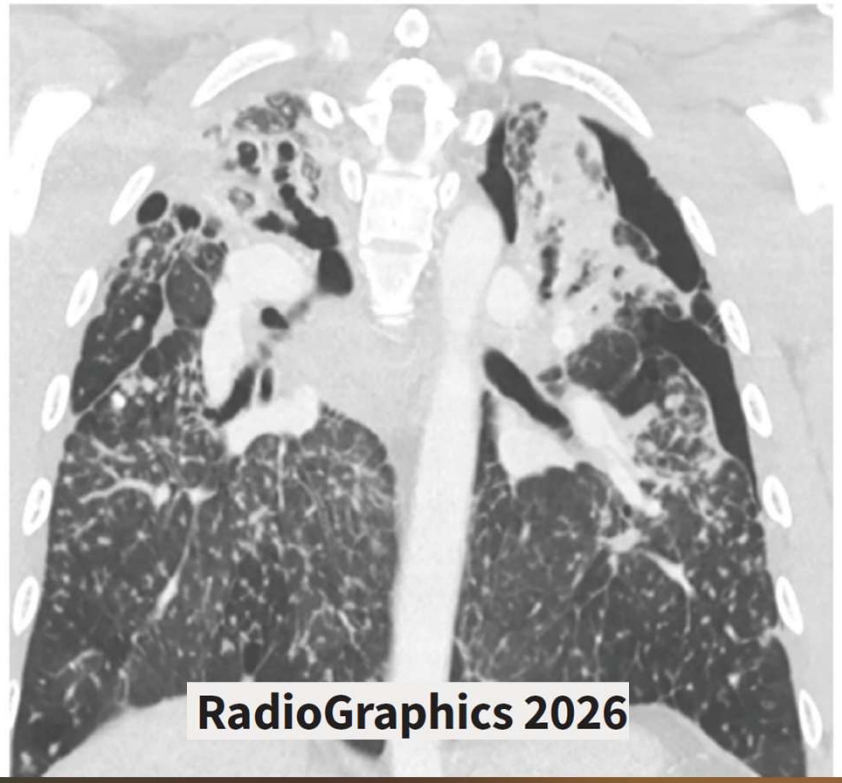
Webb W.R (2010) Pneumoconiosis, thoracic imaging: pulmonary and cardiovascular radiology. Williams and Wilkins, Lippincott

Lopes AJ (2008) High-resolution computed tomography in silicosis: correlation with chest radiography and pulmonary function tests. J Bras Pneumol 34(5):264

Silicosis Epidemic among Engineered Stone Countertop Workers: Pictorial Review

Sundus Lateef, MD[1] • Andrea Oh, MD[1] • Jonathan H. Chung, MD[2] • Jane Fazio, MD, PhD[3,4] • Nader Kamangar, MD[3,4] • Sheiphali Gandhi, MD[5,6]
Robert J. Tallaksen, MD[7] • Karoly Viragh, MD[8]
Author affiliations, funding, and conflicts of interest are listed at the end of this article.

Silicosis, the most common form of pneumoconiosis, results from the inhalation of respirable crystalline silica dust, which is defined as silicon dioxide particles small enough to penetrate lung tissue (<5 μm). Once considered a historical occupational disease primarily affecting miners, silicosis is reemerging among workers who process engineered stone countertops because of the higher silica content of engineered stone compared with natural stone materials (often termed *engineered stone pneumoconiosis*). The authors discuss imaging features of engineered stone silicosis based on a cohort of patients employed as engineered stone countertop workers in Southern California, one of the largest cohorts in the United States. Historically, silicosis has been described as predominantly chronic silicosis with upper lung–predominant small solid nodules with or without fibrosis, occasional accelerated silicosis, and rarely, acute silicosis. In the engineered stone worker patient cohort described



RadioGraphics 2026

ORIGINAL ARTICLE

Radiologic Features of World Trade Center–related Sarcoidosis in Exposed NYC Fire Department Rescue Workers

Francis Girvin, MD, Rachel Zeig-Owens, DrPH,†‡ Deepti Gupta, MD,* Theresa Schwartz, MS,†‡ Yang Liu, MPH,†‡ Michael D. Weiden, MD,†§ David J. Prezant, MD,†‖ and David P. Naidich, MD, FACCP, FACR**

J Thorac Imaging 2016;31:296–303

Purpose: An increased incidence of sarcoidosis has been demonstrated in firefighters, supporting the concern that occupational/environmental exposure may pose an etiologic risk factor. This incidence increased further after September 11, 2001 following exposure to World Trade Center (WTC) dust and gases. We review computed tomography (CT) features in this population, comparing the range of findings and physiological correlates with those typi-

Conclusions: The majority of cases of WTC-related sarcoidosis demonstrated typical radiographic appearances of sarcoidosis, with symmetric hilar and mediastinal lymphadenopathy and mid to upper lung perilymphatic nodules; these findings were consistent with other previously reported cases of sarcoid-like granulomatous disease in association with various alternate underlying etiologies.

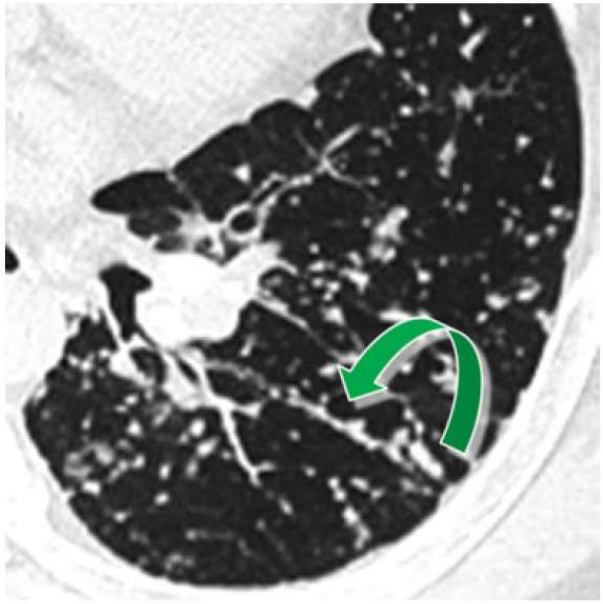
HIGH-RESOLUTION CT: HRCT

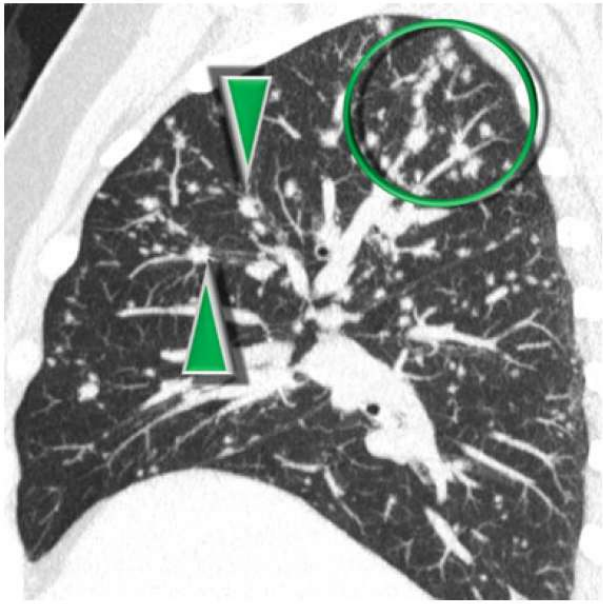
Key Signs

- Solid nodules with well-defined margins, distributed along bronchial (►) and vascular bundles (O), beneath the visceral pleura and along fissures, and interlobular septa (perilymphatic pattern, "avid for pleura") (↬).
- The nodules may have smooth or irregular (shaggy) margins and commonly measure 2–5 mm.

Distribution

Upper-lobe predominance



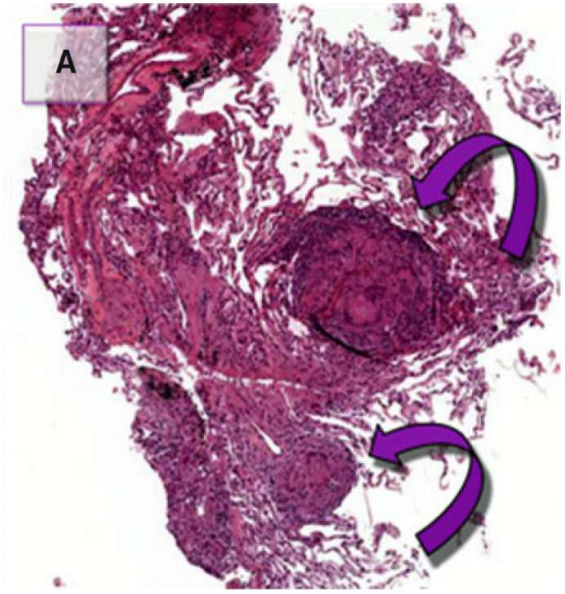


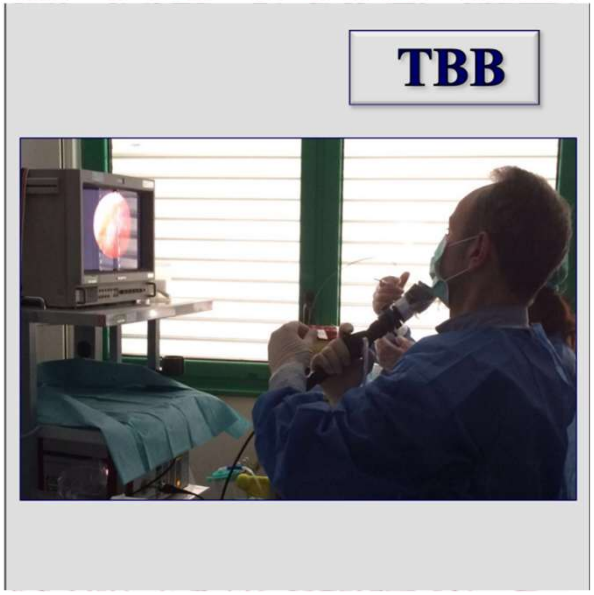
Management and Diagnosis

Transbronchial biopsy (TBB) can easily show non-necrotizing, well-formed granulomas, due to their centrilobular distribution (Figure A ↳).

Transbronchial needle aspiration (TBNA) from mediastinal lymph nodes can also provide granulomas with similar features (please also refer to TBB and TBNA in the chapter Clinical Approach to DLD).

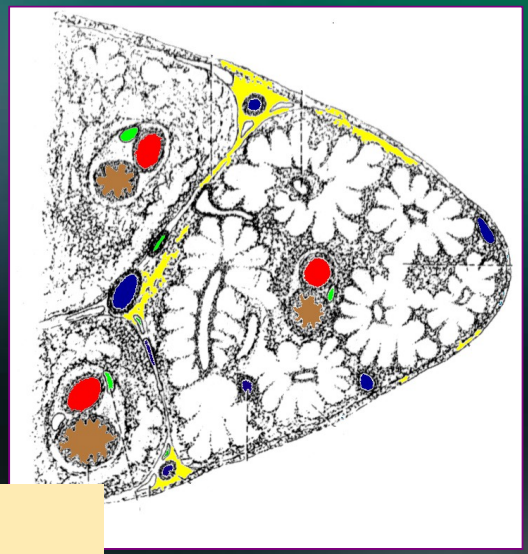
Final diagnosis: sarcoidosis

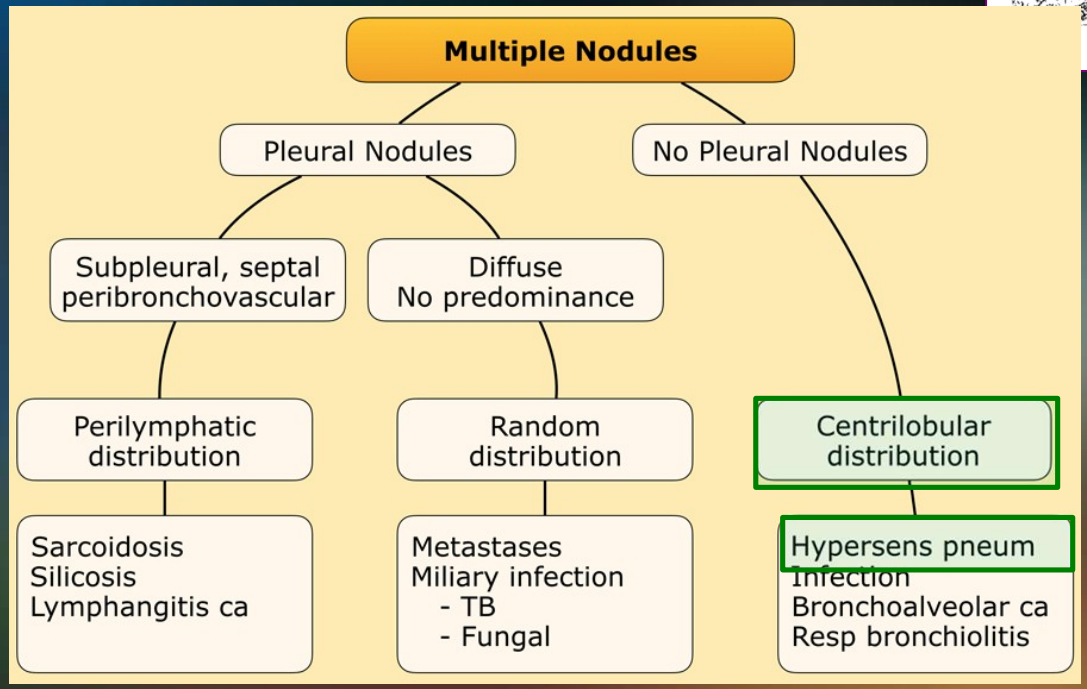




EBUS-guided lymph node biopsy

Nodular Pattern





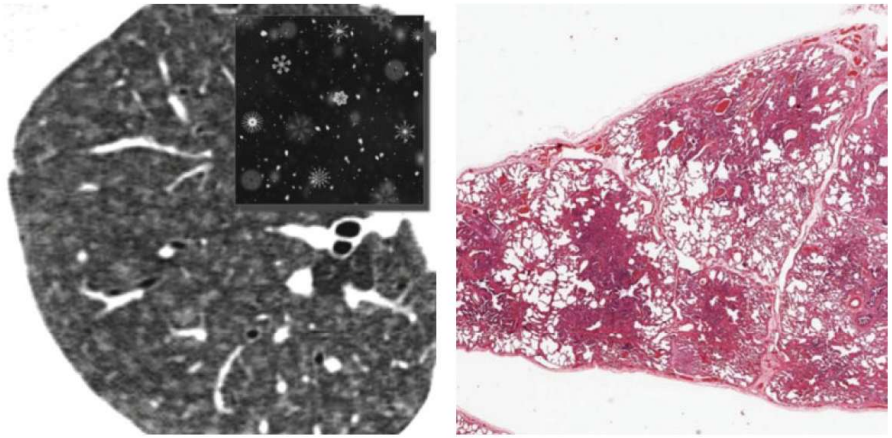
Radiology 1999
Chest 2006
AJR 2010

NODULAR SIGNS

Low-density (subsolid) nodules

With a snowflake aspect (fluffy nodules), sometimes tiny and hence difficult to recognize, these low-density (subsolid) nodules may coalesce, resulting in the appearance of more or less extensive, patchy GGO. They are commonly seen in patients with diseases primarily affecting small airways and surrounding areas. The low-density CT aspect is due to minimal thickening of the peribronchiolar interstitium or partial filling of the peribronchiolar alveoli (e.g., subacute hypersensitivity pneumonitis; please see the pictures below). Both conditions are below the CT spatial resolution, and thus the common final effect is a focal low-density lesion. The ill-defined margins are due to a progressive reduction of interstitial or alveolar involvement extending away from the centrilobular area to the periphery.

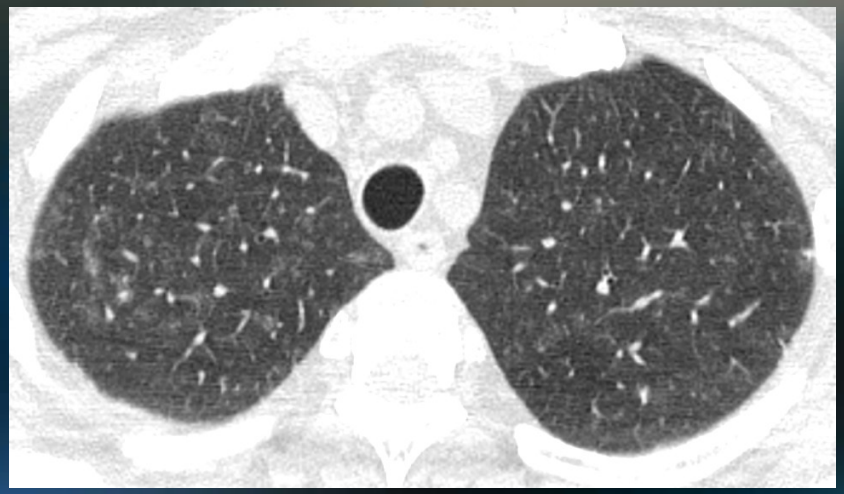
Snowflake nodules, fluffy nodules, nodular GGO, ill-defined nodules, airspace nodules



Frequent diseases with low-density (subsolid) nodules:

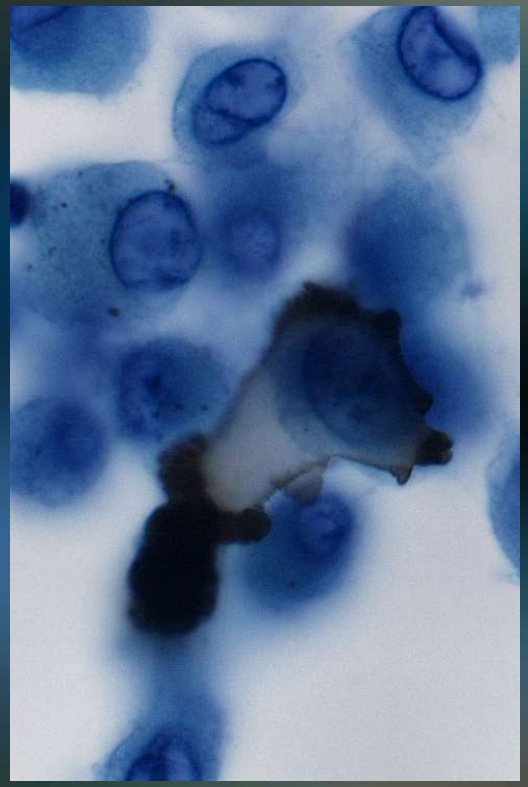
- *Hypersensitivity pneumonitis* (*HP*), *subacute*: it is the prototype disease of the snowflake nodules which are several and centrilobular (please see the figures above). The associated key sign for the diagnosis is the coexistence of sporadic lobular areas of air trapping appearing as patches of black lung. Another significant diagnostic finding, whenever present, is the so-called headcheese sign (please also refer to headcheese sign in chapters "Alveolar Pattern" and "Case-Based Glossary with Tips and Tricks"). Often the patient is a nonsmoker.
- *Respiratory bronchiolitis-interstitial lung disease* (*RB-ILD*): in young heavy smokers, the presence of very tiny centrilobular snowflake nodules predominantly in the upper zones is suggestive for RB-ILD. These

Caso clinico



Donna di 62aa, ca ovarico

Lavaggio broncoalveolare (BAL)

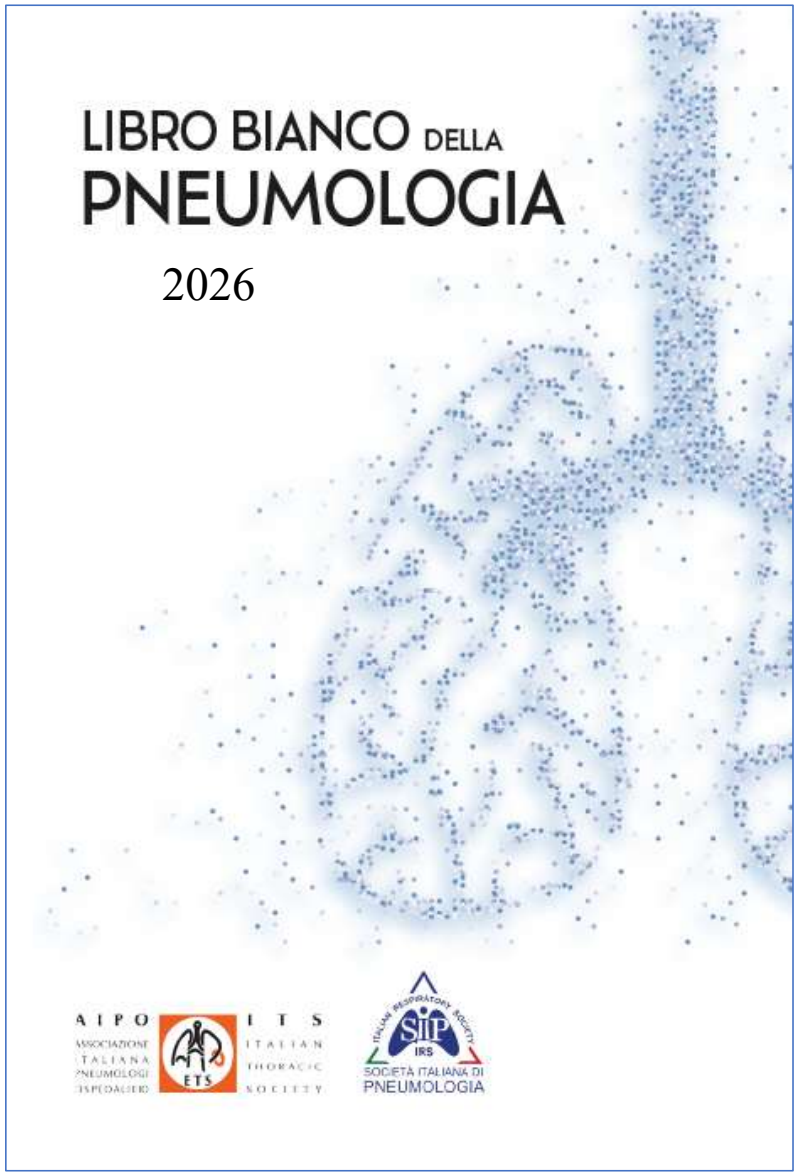


Cortesia di Alessandra Cancellieri

Am J Pathol 1981

Seconda anamnesi

La paziente riferisce di aver lavorato per 10 anni, in una fabbrica di *condom* con alta esposiziona al talco



2.4

Fattori di rischio occupazionali per le patologie respiratorie

Gioele Castelli, Nicol Bernardinello, Paolo Spagnolo

PATOLOGIA	ESPOSIZIONE LAVORATIVA
Patologie ostruttive	
Asma bronchiale	Polveri organiche (cereali, caffè, farina)
	Sostanze di derivazione animale (proteine, forfora)
	Polveri inorganiche (nickel, platino, fumi)
	Polveri derivanti dall'industria tessile
	Polveri derivanti dal packaging o imballaggi
Bronchiolite obliterante	Diacetile ("popcorn lung")
	Acetilaldeide
	Polveri del deserto (soldati americani in Medio Oriente e in Afghanistan)

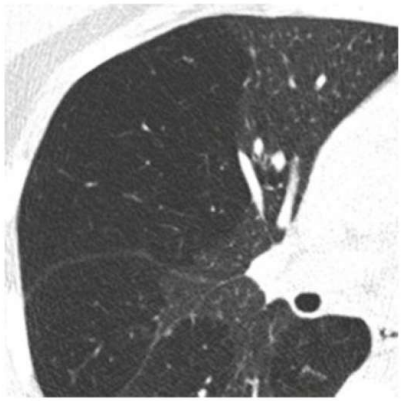
I **danni strutturali** causati dalla **bronchiolite obliterante (costrittiva)** sono **irreversibili**.
Le opzioni terapeutiche puntano a stabilizzare la patologia e a rallentare la perdita della funzione polmonare.
L'allontanamento immediato dall'esposizione è il passo più importante per bloccare la progressione della malattia

Dark Lung Pattern

Dark Lung Pattern

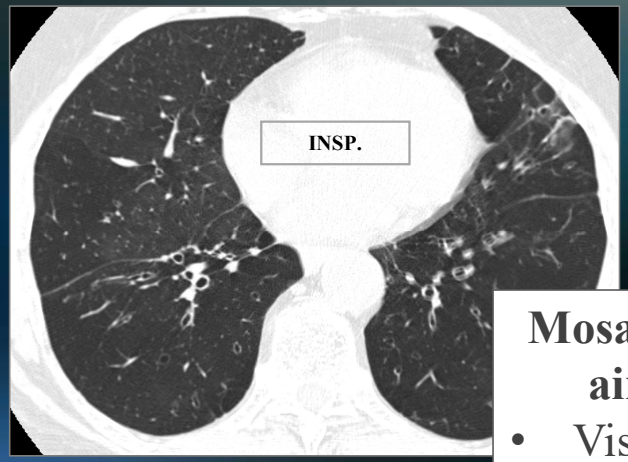
Radiology
Pathology

Giorgia Dalpiaz
Alessandra Cancellieri



Asthma vs Obliterative bronchiolitis (OB)

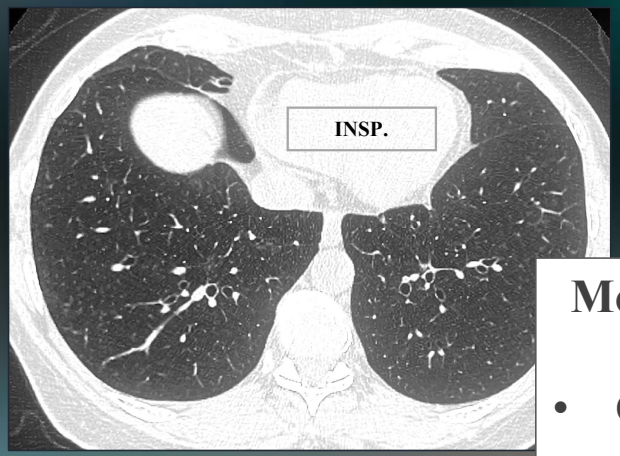
OB

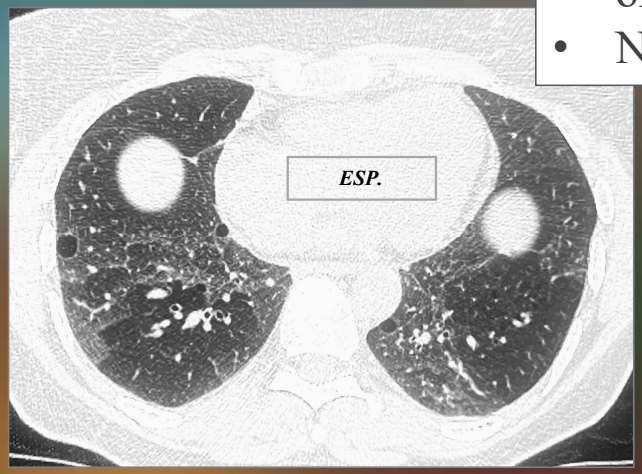


Mosaic patter with air trapping:

- Visible on *insp* & *exp*.
- Extensive

Asthma





Mosaic patter with air trapping:

- Often visible only on *exp*.
- Not extensive

Breathe 2024

The role of radiological imaging in the management of severe and difficult-to-treat asthma

Joshua Aigbirior[1], Amer Almaghrabi [1], Monder Lafi[2] and Adel H. Mansur[1,3]

Abstract

Radiological imaging has proven to be a useful tool in the assessment of asthma, its comorbidities and potential complications. Characteristic chest radiograph and computed tomography scan findings can be seen in asthma and in other conditions that can coexist with or be misdiagnosed as asthma, including chronic rhinosinusitis, inducible laryngeal obstruction, excessive dynamic airway collapse, tracheobronchomalacia, concomitant COPD, bronchiectasis, allergic bronchopulmonary aspergillosis, eosinophilic granulomatosis with polyangiitis, and eosinophilic pneumonia. The identification of the characteristic radiological findings of these conditions is often essential in making the correct diagnosis and provision of appropriate management and treatment. Furthermore, radiological imaging modalities can be used to monitor response to therapy.

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