

CONVEGNO

Venerdì 3 dicembre 2021  
8.30 – 17.00

**Evoluzione  
dell'approccio  
al mesotelioma:  
dalla multidisciplinarietà  
alla interdisciplinarietà**

**Auditorium Capretti**  
Istituto Artigianelli, via Brigida Avogadro 23 - Brescia

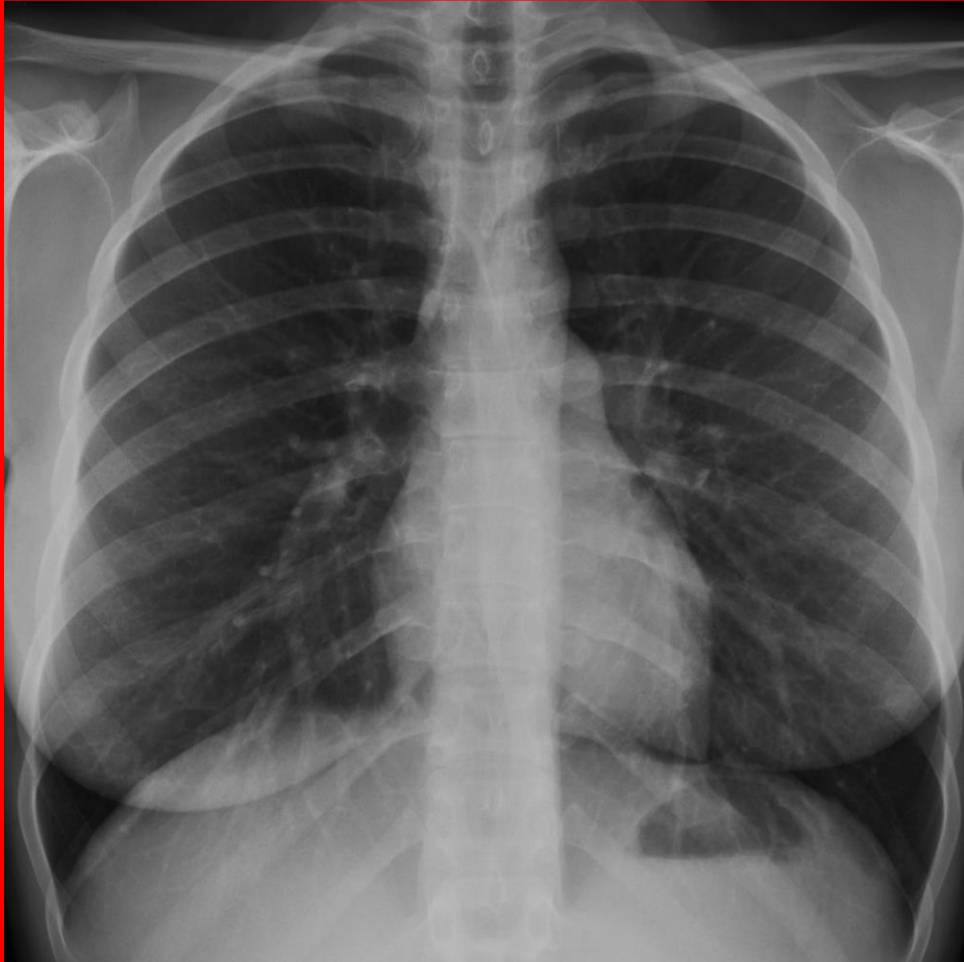


# Imaging radiologico nel paziente esposto e nel mesotelioma

**A. Borghesi**

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U.O. Radiologia 2 - ASST Spedali Civili Brescia

## **My areas of expertise**



**Thoracic Imaging**



**Dentomaxillofacial Radiology**

# Asbestos-related disease

La diagnosi di una malattia causata dall'esposizione professionale si fonda principalmente:

1. **Anamnesi lavorativa**
  - a. tipo e durata delle attività lavorative a rischio
  - b. utensili e materie prime utilizzate
  - c. caratteristiche dell'ambiente di lavoro (*es. aperto, chiuso, polverosità*)
  - d. utilizzo di mezzi di protezione
2. **Imaging radiologico (*Rx – TC Torace*)**



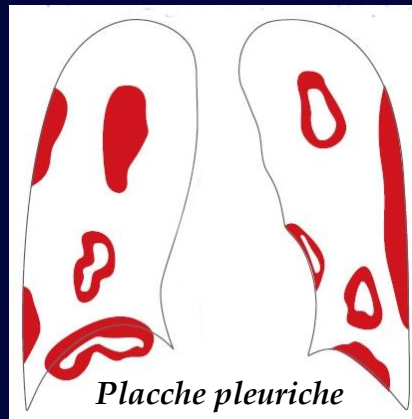
# Asbestos-related disease

- **Pleuriche Benigne**

*Placche pleuriche*

*Ispessimenti Pleurici Diffusi*

*Versamento pleurico*

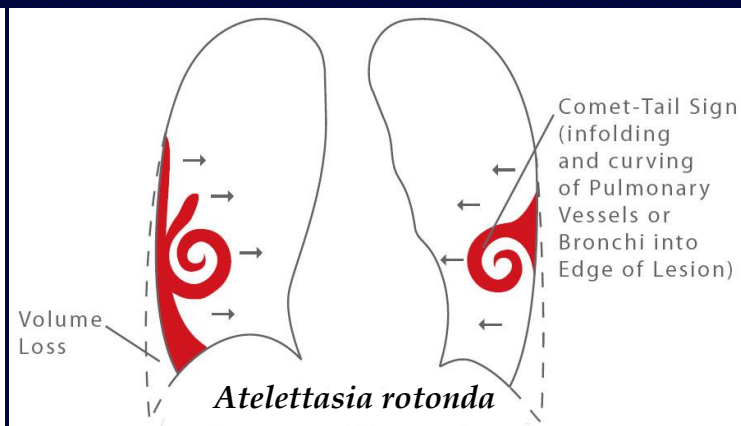
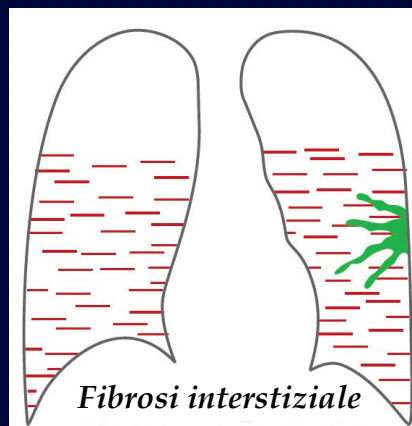


- **Parenchimali Benigne**

*Fibrosi interstiziale (Asbestosi)*

*Bande parenchimali*

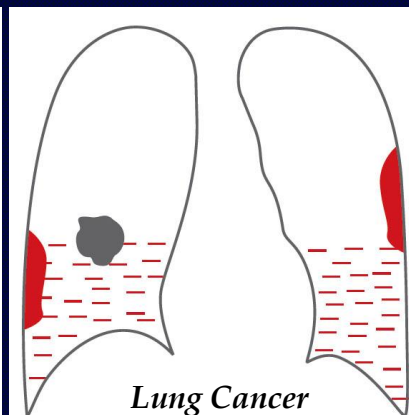
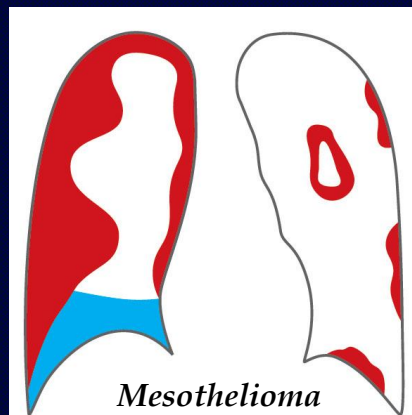
*Atelettasia rotonda*



- **Maligne**

*Mesotelioma*

*Carcinoma Polmonare*





# Pleural Plaques

## *Chest Wall and Diaphragm*



- Manifestazione **più comune** e **marker** di esposizione ad asbesto (*dopo 10-40 anni dall'esposizione*)
- Generalmente bilaterali, estensione variabile, spessore <1cm , **calcifiche 15%**
- Distribuzione elicoidale dall'alto (*anteriori*) al basso (*posteriori*)
- Quasi sempre coinvolgono la pleura parietale
- Si localizzano prevalentemente lungo la pleura costale e diaframmatica
- Risparmio degli apici e degli angoli costo-frenici
- **RX Torace:** accuratezza del **10-40%**

# Pleural Plaques

- CT is the most accurate imaging method for the detection and characterization of pleural plaques

## At a Glance Commentary

### Scientific Knowledge on the

**Subject:** Pleural plaques are the most common manifestation of benign asbestos-related disease. The association between pleural plaques and lung cancer remains controversial.

### What This Study Adds to the

**Field:** Our results indicate that

asbestos-exposed subjects with pleural plaques are at high risk of mortality from lung cancer and may benefit from low-dose CT screening, particularly when they are smokers or former smokers.



# Pleural Plaques

- CT is the most accurate imaging method for the detection and characterization of pleural plaques

## Low-dose CT a Brescia

- A) BMI < 25 → 4 CXR
- B) BMI 25-30 → 8 CXR
- C) BMI > 30 → 12 CXR

### At a Glance Commentary

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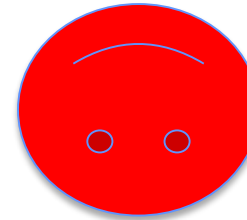
# Pleural Plaques

*Relation with cumulative asbestos exposure*

## Surface of Localized Pleural Plaques Quantitated by Computed Tomography Scanning

No Relation with Cumulative Asbestos Exposure and No Effect on Lung Function

JORIS VAN CLEEMPUT, HILDE DE RAEVE, JOHNY A. VERSCHAKELN, JOZEF ROMBOUTS,\*  
LUDOVIC M. LACQUET,<sup>†</sup> and BENOIT NEMERY



*2001 - CT*

*73 workers with  
asbestos exposure*

## Significant Relationship Between the Extent of Pleural Plaques and Pulmonary Asbestos Body Concentration in Lung Cancer Patients With Occupational Asbestos Exposure

Toshikazu Yusa, MD, PhD,<sup>1\*</sup> Kenzo Hiroshima, MD, PhD,<sup>2</sup> Fumikazu Sakai, MD, PhD,<sup>3</sup>  
Takumi Kishimoto, MD, PhD,<sup>4</sup> Kazuo Ohnishi, MD, PhD,<sup>5</sup> Ikuji Usami, MD, PhD,<sup>6</sup>  
Tetsuyuki Morikawa, MD, PhD,<sup>7</sup> Di Wu, PhD,<sup>2</sup> Kazumi Itoi, MD, PhD,<sup>8</sup> Kenzo Okamoto, MD, PhD,<sup>9</sup>  
Yasushi Shinohara, PhD,<sup>10</sup> Norihiko Kohyama, PhD,<sup>11</sup> and Kenji Morinaga, MD, PhD<sup>12</sup>

*2015 - CT*

*207 lung cancer patients with  
occupational asbestos exposure*



*2019 - autopsie*

*124 workers with  
asbestos-related disease*



## Relationship between pleural plaques prevalence and extension and biomarkers of cumulative asbestos dose. A necropsy study

PIETRO GINO BARBIERI<sup>1</sup>, DARIO CONSONNI<sup>2</sup>, ANNA SOMIGLIANA<sup>3</sup>

<sup>1</sup>Occupational Physician, formerly at Occupational Health Unit, Local Health Authority of Brescia, Italy

<sup>2</sup>Epidemiology Unit, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy

<sup>3</sup>Lombardy Regional Protection Agency (ARPA), Air Unit, Electron Microscopy Centre, Milan Department, Milan, Italy



ORIGINAL ARTICLES

# 3-Dimensional Quantification of Composite Pleural Plaque Volume in Patients Exposed to Asbestos Using High-resolution Computed

### 3-Dimensional Quantification of Composite Pleural Plaque Volume in Patients Exposed to Asbestos Using High-resolution Computed

3D semiautomatic quantification of PPV is feasible and reproducible using CT in patients with occupational exposure to asbestos. PPV measurement may be useful to correlate with other asbestos-related disease outcomes and prognosis.

As pleural plaque has been reported as a risk factor in the occurrence of lung cancer and mesothelioma, a reproducible and precise method of measurement of pleural plaque volume (PPV) is needed to further describe these relationships. The aim of the study was to assess the reproducibility of a 3-dimensional computed tomography (3D-CT) volumetric analysis of PPV in patients with occupational exposure to asbestos.

A total of 28 patients were retrospectively randomly selected from the multicenter APEXS (Asbestos Post Exposure Survey) study, which was held between 2003 and 2005. All patients underwent a 3D-CT scan. Two readers specialized in chest radiology completed the 3D semiautomated quantification of lung volume using dedicated software. They also had to categorize the visual extent of pleural plaque in terms of thickness and circumference. Reproducibility of the continuous PPV variable was assessed using the intraclass correlation coefficient (ICC) and Bland-Altman analysis. Reproducibility of categorical variables was assessed using the  $\kappa$  test.

Intraobserver reproducibility of PPV was almost perfect (ICC=0.98 [95% interval: 0.97-0.99]), and interobserver reproducibility was very good (ICC=0.93 [0.88-0.97]). At Bland-Altman analysis, the mean differences were 0.1 (limit of agreement: -11.0 to 11.2) and 3.7 cc<sup>3</sup> (-17.8 to 25.2), respectively. Visual analysis of both plaque in terms of thickness and circumference were fair to moderate, with  $\kappa$  values ranging from 0.30 to 0.60.

# Pleural Plaques *CT quantification*





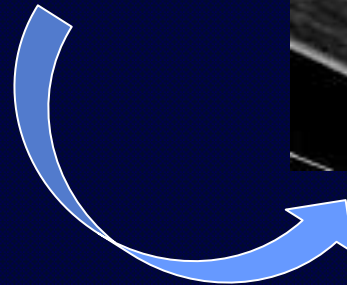
# Alterazioni pleuriche benigne

## Versamento pleurico

- *Manifestazione più precoce di esposizione ad asbesto (nei primi 10 anni)*
- *Generalmente asintomatico*
- *Risoluzione completa senza esiti (50%)*
- *Risoluzione con ispessimento pleurico (50%)*

## Ispessimenti pleurici diffusi

- *Meno frequenti delle placche pleuriche (15%)*
- *Meno specifiche di esposizione ad asbesto*
- *Si associano ad alterazioni funzionali*



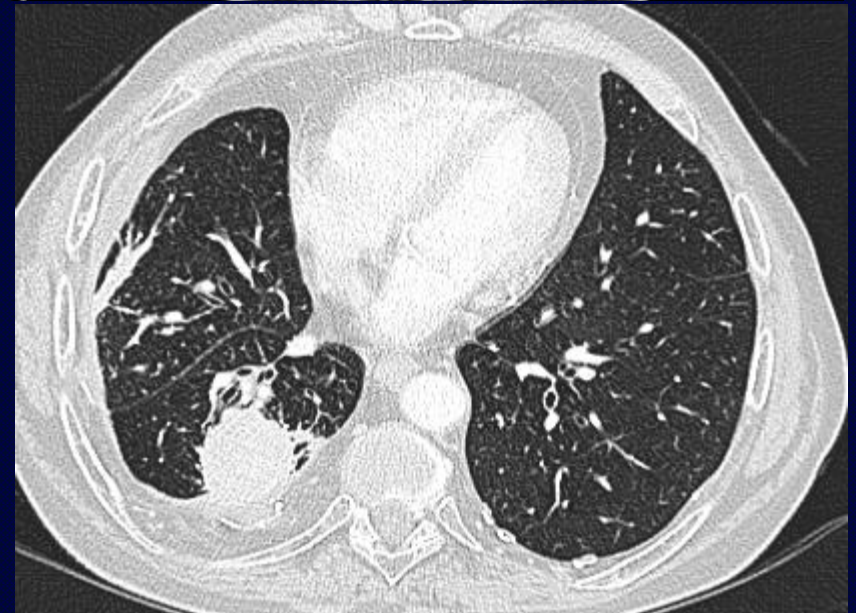
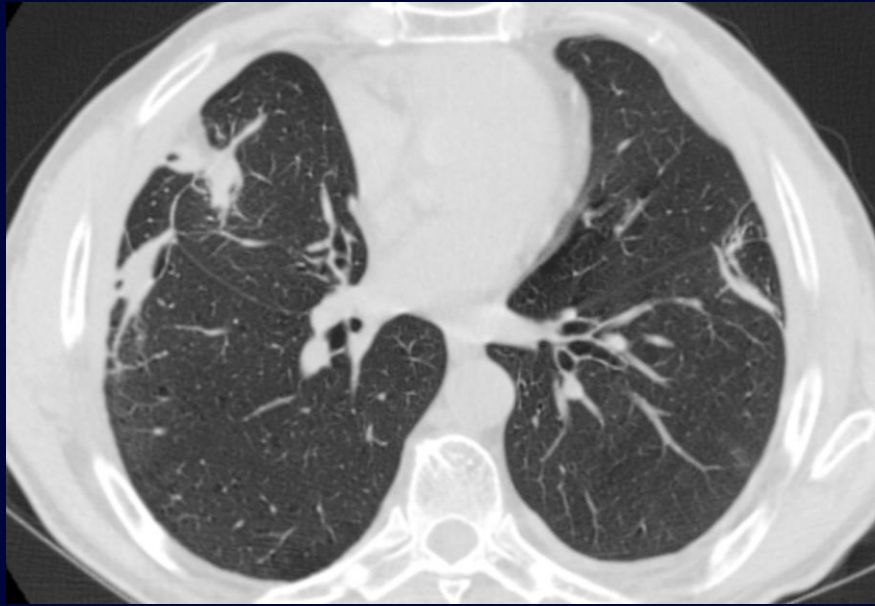


# Asbestosis

- Fibrosi polmonare interstiziale diffusa
- Esposizione prolungata (*dopo 20-40 anni*); dose-dipendente
- *Rara l'assenza di placche pleuriche*

CT features	Asbestosis group (n = 96)	IPF group (n = 65)	P-value
Reticular opacity extent	14.2 ± 12.9	17.1 ± 10.6	0.118
Traction bronchiectasis grade	4.3 ± 4.6	9.4 ± 4.1	<0.001
Honeycombing	31 (32)	46 (71)	<0.001
Interlobular septal thickening	81 (84)	61 (94)	0.034
Subpleural dots	90 (94)	30 (46)	<0.001
Subpleural lines	82 (85)	16 (25)	<0.001
<5 mm	76 (79)	9 (14)	<0.001
>5 mm	7 (7)	7 (11)	0.311
Parenchymal bands	31 (32)	1 (2)	<0.001
Mosaic attenuation	25 (26)	4 (6)	<0.001
Pleural changes	71 (74)	1 (0)	<0.001
Pleural plaques	69 (72)	0 (0)	<0.001
Diffuse pleural thickening	25 (26)	1 (2)	<0.001

# Bande parenchimali - atelettasia rotonda

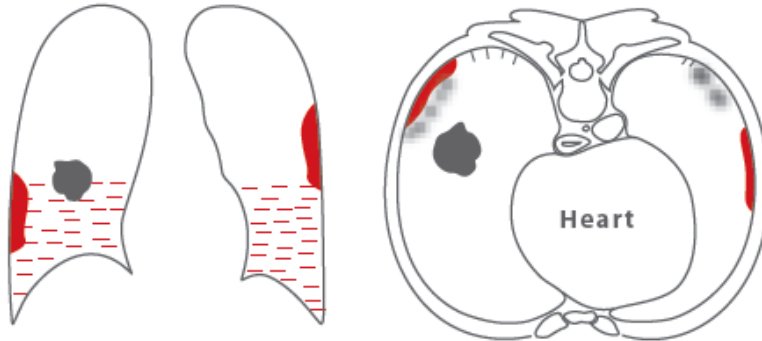




# Patologia Maligna

## Lung Carcinoma

Cancer of Lung = Lung Carcinoma



Variable time  
to appearance →

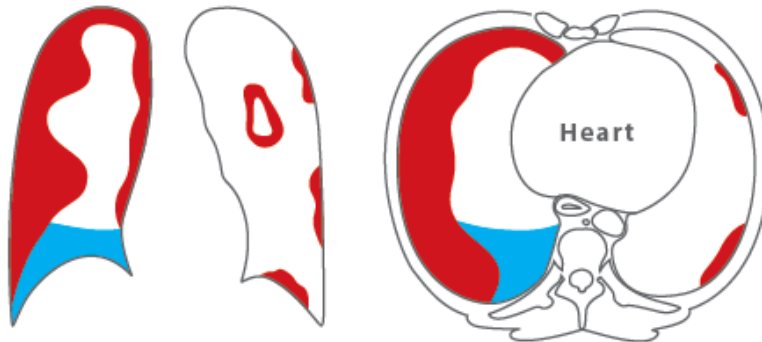
There is a 5 to 7 times increased risk of lung cancer with asbestos exposed workers compared to the non-smoking, non-asbestos exposed population.

There is a 50 - 100 times increased risk of lung cancer with asbestos exposed workers who smoke compared to the non-smoking, non-asbestos exposed population.

The cancer risk increases with the severity of exposure.

## Mesothelioma

Cancer of Chest Wall = Mesothelioma



Variable time  
to appearance  
usually  
10 - 40 years →

Can develop at any time. Can occur sooner and with less markers of asbestos-related disease, but usually takes greater than 10 years to manifest.

Classic findings include nodularity/lobulation of the pleural thickening, mediastinal pleural thickening with encasement of the lung (which fixes the mediastinum against a shift caused by the pleural effusion and is associated with volume loss), and a pleural effusion. The tumor can extend into the fissures and invade adjacent structures.



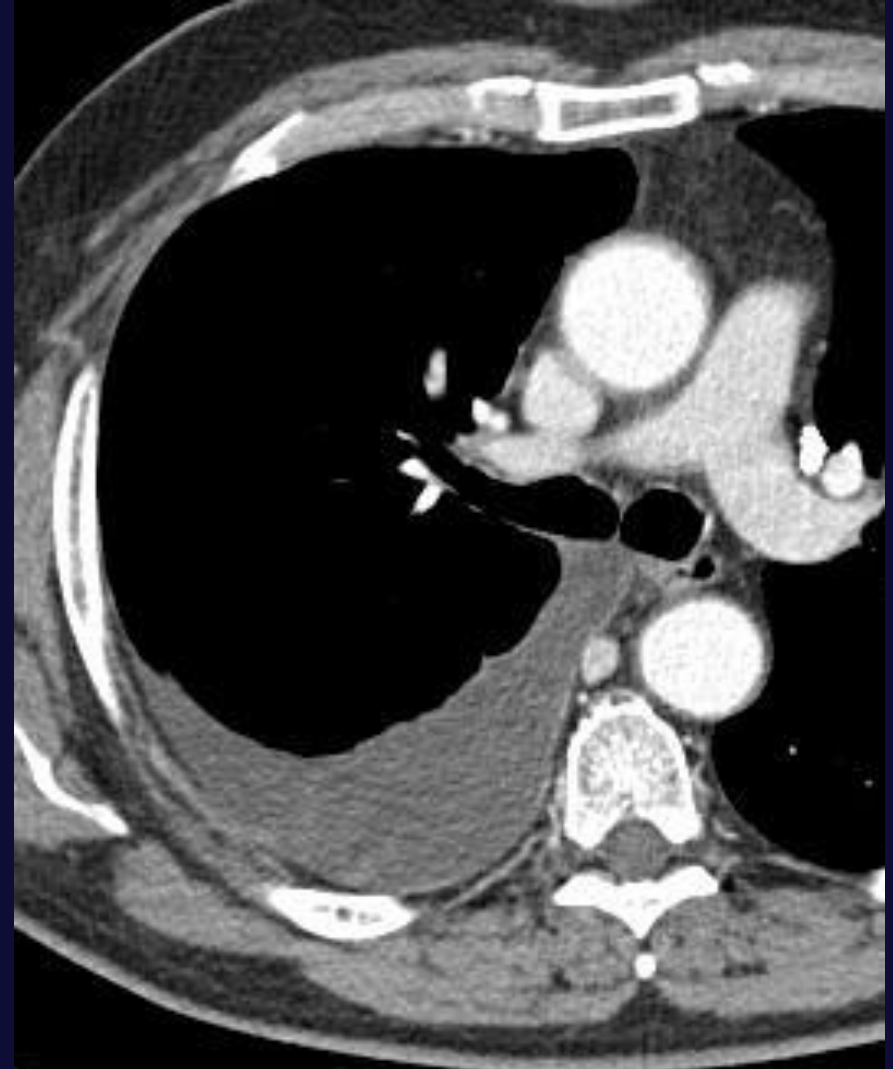
# Mesotelioma Pleurico

- Rara neoplasia maligna che origina dalla pleura
- Forte correlazione con esposizione all'asbesto (40-80%)
- L'incidenza in persone esposte è del 10%
- Può invadere pleura viscerale, pleura parietale e le strutture adiacenti (*parete toracica, mediastino, diaframma*)
- Prognosi → *mediana di sopravvivenza di 9-17 mesi dalla diagnosi*
  - *Infiltrazione del grasso mediastinico*
  - *Infiltrazione della parete toracica*
  - *Infiltrazione del diaframma*
  - *Adenopatie*
  - *Metastasi a distanza*

# Mesotelioma Pleurico

## *Ruolo dell'imaging radiologico*

- Diagnosi
- Stadiazione (TNM)
- Approccio Terapeutico
- Follow-up



# Mesotelioma Pleurico

## *Ruolo dell'imaging radiologico*

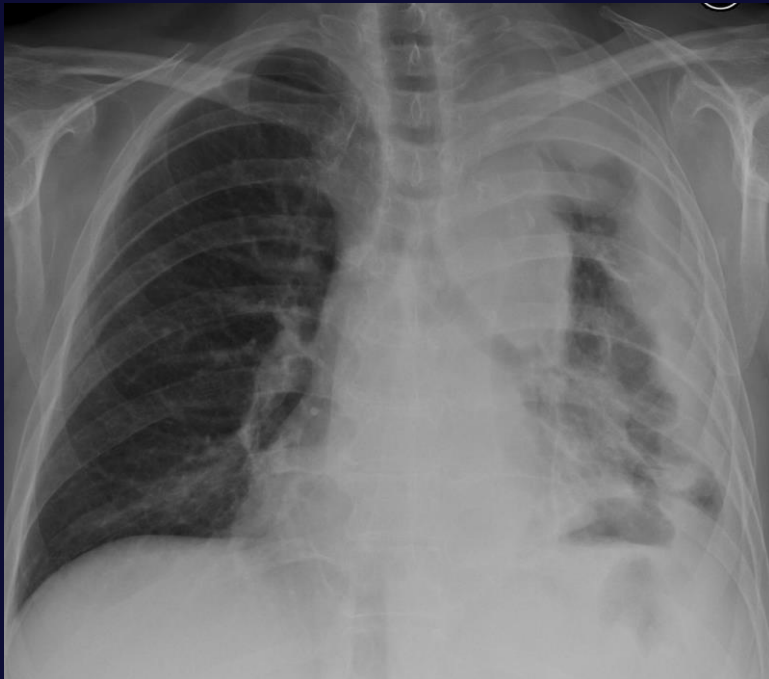
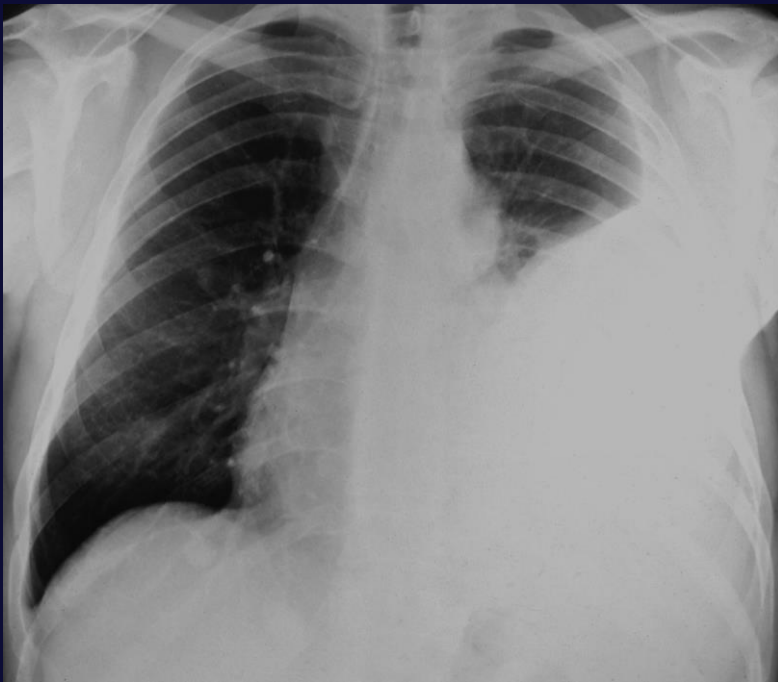
- Diagnosi
- Stadiazione (TNM)
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- Follow-up





# Mesotelioma

## *Chest X-ray (CXR)*



CXR is usually the first-line radiologic examination, but the findings are nonspecific

*Versamento pleurico dx  
Retrazione dell'emittoace sin  
Ispessimento pleurico omolaterale*

*Cardinale et al Acta Biomed 2017;  
Nickell LT jr et al Radiographics 2014*

# Mesotelioma Pleurico

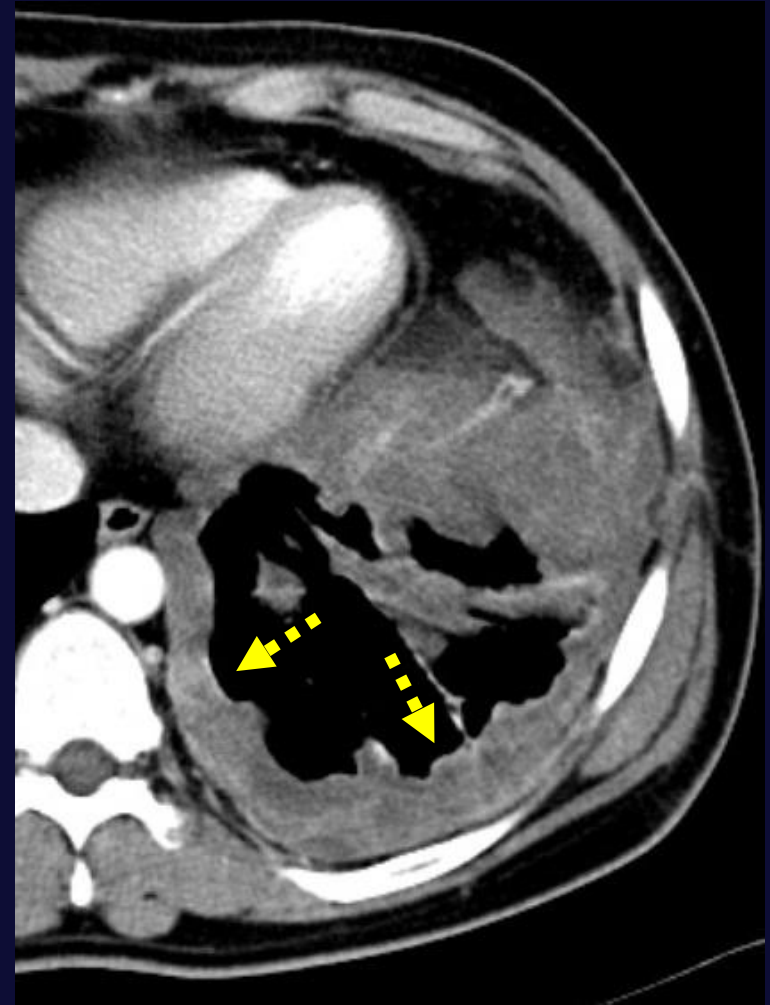
## *Contrast enhanced CT (CECT)*

Imaging modality of choice to evaluate:

- extent of primary tumor
- local invasion
- intrathoracic lymphadenopathy
- extrathoracic spread.

Chest CT alone is often sufficient for disease staging and treatment planning.

Nickell LT jr et al Radiographics 2014



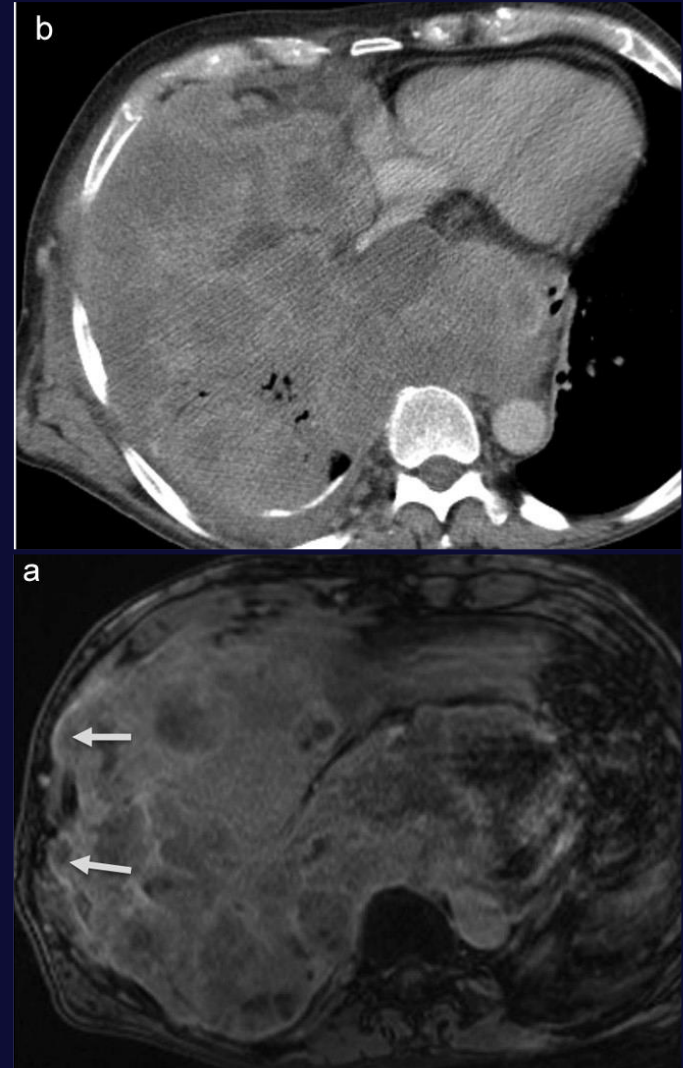
# Mesotelioma Pleurico

## *Magnetic Resonance Imaging (MRI)*

The greatest advantage of MRI is its greater sensitivity than CT

- chest wall invasion
- diaphragm invasion
- mediastinum invasion
- pericardium invasion

MR imaging is not routinely used to evaluate mesothelioma



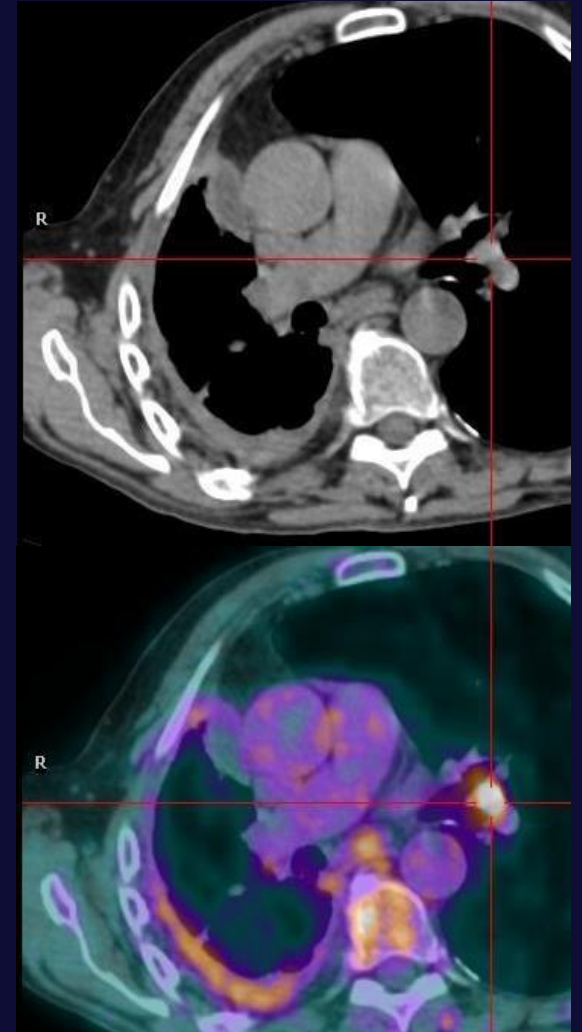


# Mesotelioma Pleurico

## *PET/CT with fluorodeoxyglucose (FDG)*

PET-CT combines the metabolic information obtained with the FDG with the anatomic detail provided by CT.

- FDG uptake (SUV) is associated with survival and prognosis ( $\uparrow\uparrow SUV_{max} \rightarrow \downarrow\downarrow survival$ )
- FP  $\rightarrow$  pleurodesis and inflammation
- Compared with CT, FDG/PET-CT better demonstrates intra and extra-thoracic lymphadenopathy and metastatic disease



# Take Home Messages

1. Imaging radiologico ha un ruolo cruciale nella valutazione della malattia asbesto-correlata
2. **Placche pleuriche** alterazione **più comune**, **marker** di esposizione ad asbesto **e fattore di rischio** il tumore polmonare e mesotelioma
3. Nel mesotelioma la CECT mantiene il suo ruolo di **attrice protagonista** nella gestione della malattia (*diagnosi/stadiazione/follow-up*)

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