Plueral Malignancy: Radiologic-pathologic Correlation

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Pleural Mass Characteristics

- Obtuse angles with pleural surfaces
- Sharp margins on tangential views
- Discrepant margins on different views
- Incomplete border
- May cross fissures
- Look for osseous and soft tissue—chest wall

WHO Histological Classification of Pleural Tumors

Mesothelial Tumours
- Diffuse malignant mesothelioma
  - Epithelioid mesothelioma
  - Sarcomatoid mesothelioma
  - Desmoplastic mesothelioma
  - Biphasic mesothelioma
  - Localized malignant mesothelioma

Other Tumours of Mesothelial Origin
- Well differentiated papillary mesothelioma
- Adenomatoid tumour

Lymphoproliferative Disorders
- Primary effusion lymphoma 9678/3
- Pyothorax—associated lymphoma

Mesenchymal Tumours
- Epithelioid hemangioendothelioma
- Angiosarcoma
- Synovial sarcoma
- Monophasic
- Biphasic solitary fibrous tumour
- Califying tumour of the pleura
- Desmoplastic round cell tumour

Metastases

- 40% Bronchogenic adenocarcinoma
- 20% Breast cancer
- 10% Lymphoma
- 30% Other primaries
  - Thymoma
  - Carcinoid
  - Sarcoma
- Splenosis

Malignant Pleural Mesothelioma

- 2,000-3,000 cases annually in the U.S.
- Incidence increasing worldwide
- Up to 10% lifetime risk of developing mesothelioma among asbestos workers
- Asbestos + cigarette smoking → synergistic
  - 60X more likely to develop lung cancer when compared to non-smoking, non-asbestos exposed cohort


Malignant Pleural Mesothelioma

- 3-6:1 (men:women) follows exposure
- Latency of 30-40 years (2000-3000/yr)
- Present with SOB, chest pain, cough, and weight loss
- Right side with SVC, Horner syndrome
- HPO, clubbing

Pathologic Spectrum

- Epithelioid 50%
- Mixed 34%
- Sarcomatoid 16%

Prognosis of Malignant Mesothelioma is Dependent on the Histologic Type

<table>
<thead>
<tr>
<th>Stage</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Disease confined to within the capsule of the parietal pleura; ipsilateral pleura, lung, pericardium, diaphragm, or chest wall disease limited to previous biopsy site</td>
</tr>
<tr>
<td>II</td>
<td>All of stage I with positive intrathoracic (N1 or N2) lymph nodes and positive resection margins</td>
</tr>
<tr>
<td>III</td>
<td>Local extension of disease into chest wall or mediastinum; heart, or through the diaphragm and peritoneum; with or without extrathoracic or contralateral lymph node involvement (N3)</td>
</tr>
<tr>
<td>IV</td>
<td>Distant metastatic disease</td>
</tr>
</tbody>
</table>

BWH Staging

Nodular Pleural Thickening

Radiographic Presentation

- Wide range
- Pleural effusion, small to large
- Encasement of lung
- Lobulated pleural masses

In some cases, complementary anatomical information can be derived from MRI.
Diaphragm involvement
Endothoracic fascia involvement
or solitary resectable focus tumor
T2b: invasion of transverse sinus
T3: Mediastinal fat invasion
T4: Nonanatomical pericardial involvement
T4: Diffuse or multilobed chest wall invasion (or both)
N1: Ipsilateral hilar or lymph nodes
N2: Ipsilateral mediastinal or lymph nodes

MRI is superior to CT

Diffusion Weighted Imaging

Accuracy of MPM staging by CT and MRI

<table>
<thead>
<tr>
<th>T or N Stage</th>
<th>Site</th>
<th>( A_x ) MRI</th>
<th>( A_x ) CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1a</td>
<td>Scattered hist of visceral pleural involvement</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>T2</td>
<td>Nodular apparent lymph node</td>
<td>0.95</td>
<td>0.82</td>
</tr>
<tr>
<td>T2b</td>
<td>Diaphragm involvement</td>
<td>0.73</td>
<td>0.73</td>
</tr>
<tr>
<td>T3</td>
<td>Invasion of transverse sinus</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>T3</td>
<td>Mediastinal fat invasion</td>
<td>0.76</td>
<td>0.76</td>
</tr>
<tr>
<td>T4</td>
<td>Nonanatomical pericardial involvement</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>T4</td>
<td>Diffuse or multilobed chest wall invasion (or both)</td>
<td>0.85</td>
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<td>N1</td>
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</tr>
<tr>
<td>N2</td>
<td>Ipsilateral mediastinal or lymph nodes</td>
<td>0.85</td>
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</tr>
</tbody>
</table>

Note: \( A_x \) is area under the curve. T: stage, N: presence of regional lymph node disease.
Following Neoadjuvant Chemotherapy

Rotating maximum intensity projection and fusion PET-CT images of the same patient from pre and post chemotherapy studies show reduced post treatment FDG avidity of the right pleural mass. The patient subsequently underwent successful EPP.

“Course” of MPM

- Pleural effusion dominant early
- Progressive encasement of lung
- Lobulated pleural masses late
- Invasion of lung
- Lung nodules and distant spread

Solitary Fibrous Tumor

- Benign mesothelioma
- Benign fibrous tumor of pleura
- Localized fibrous tumor of pleura
- Solitary fibrous tumor

Solitary Fibrous Tumor

- Rare
- Symptoms relate to size: cough, chest pain, dyspnea
- Paraneoplastic syndrome: clubbing, hypertrophic osteo-arthritis, hypoglycemia

Solitary Fibrous Tumor

- Visceral pleura 80%
- Parietal pleura 20%
- Encapsulated, pedunculated
- Nodular, whorled appearance
- CD34 positive; calretinin and WT-1 negative
- Hemorrhage, necrosis and cysts

Solitary Fibrous Tumor
Liposarcoma
- Typically large, infiltrative, and asymptomatic
- No evidence to suggest they arise from pre-existing lipomas
- Heterogeneous masses on CT with soft tissue and fat component. They tend to measure less than 50 HU (mean CT values) on pre and post intravenous contrast enhancement images
- On MRI, they tend to have high signal intensity on T2WI, because of myxoid degeneration, while low signal is common and have variable enhancement post gadolinium administration

Synovial Sarcoma
- Typically occurs in adolescents and young adults between the ages of 15 and 40 years
- It is believed to originate from primitive pluripotential mesenchyme capable of synovial differentiation
- Because of its rarity, it is often mistaken on imaging and histology for sarcomatoid mesothelioma
- Molecular studies for the X:18 translocation are useful for differentiation
- Focally positive: EMA, AE1/AE3, Cam5.2
  - Negative: CD34, S-100, GFAP
  - FISH: positive for SYT gene rearrangement

Lymphoma
- Both primary and secondary forms can involve the pleura. Follicular and B cell lymphoma tend to be more common
- There can be associated lymphadenopathy, as well as chest wall and marrow involvement. Tend to be low on T1WI and iso to high signal on T2WI
- Diffuse homogenous enhancement
Conclusion

- Metastases are 95% of pleural lesions
- Focal pleural tumor can be favorable DX
- Malignant pleural mesothelioma and Adenocarcinomatosis may look alike

Resources