Imaging Melanoma: Focus on Patient with Unsuspected Metastases

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Our Patient: Clinical Presentation

- 48 year-old woman complains of raised, itchy, non-bleeding lesion on her right chest, just inferior to her clavicle, in September 2006

- Lesion biopsied by dermatology in November 2006
  - 0.9 mm Clarks level IV melanoma with ulceration and two mitoses per high powered field

- Referred to oncology and surgery

What should be done next?
In order to understand the next steps for this patient’s management, we must first gain an appreciation for melanoma and its staging.
Melanoma

Most lethal skin cancer

Over the past 3 decades, there has been an increased rate of melanoma incidence, though 5 year survival rate has improved overall\(^1\)

5\(^{th}\) most common cancer in US for men; 6\(^{th}\) most common cancer in US for women\(^2\)

Only 15.5% patients with metastatic melanoma survive for 5 years; the 5-year survival rate for localized melanoma is 99%\(^1\)

Approximately 80% of melanomas are diagnosed at a localized stage\(^2\)
TMN Staging System

- Staging dictates prognosis and treatment options
- Staging also influences what imaging studies are chosen, but there is no clear algorithm to follow

## Stage Groupings

- **Stages I and II** - localized primary melanomas
  - Stage I: low risk
  - Stage II: higher risk of reoccurrence

- **Stage III** - involvement of regional lymph nodes

- **Stage IV** - distant metastases

### Tumor Node Metastasis (TNM) Staging System

<table>
<thead>
<tr>
<th>Stage</th>
<th>Primary tumor (T)</th>
<th>Regional lymph nodes (N)</th>
<th>Distant metastasis (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 0</td>
<td>T0</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IA</td>
<td>T1a</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IB</td>
<td>T1b</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IIA</td>
<td>T2a</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IIB</td>
<td>T2b</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage III</td>
<td>T3a, T3b</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IIIA</td>
<td>T4a, T4b</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IIIC</td>
<td>T1-4a, T1-4b</td>
<td>N0, N1, N2</td>
<td>M1</td>
</tr>
<tr>
<td>Stage IV</td>
<td>Any T</td>
<td>Any N</td>
<td>M1</td>
</tr>
</tbody>
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* Clinical staging includes microscopic evaluation of the primary melanoma and clinical/radiologic evaluation for metastases. By convention, it should be used after complete excision of the primary melanoma with clinical assessment for regional and distant metastases.

Pathologic staging includes microscopic examination of the primary melanoma and pathologic information about the regional lymph nodes after partial or complete lymphadenectomy. Pathologic Stage 0 or Stage IA patients are the exception; they do not require pathologic evaluation of their lymph nodes.

Used with permission of the American Joint Committee on Cancer (AJCC), Chicago, Illinois. The original source for this material is the AJCC Cancer Staging Manual, Seventh Edition (2010) published by Springer New York, Inc.

We have now reviewed the staging of melanoma. Let us continue to discuss the clinical course of our index patient.
Our Patient: Pathology Report

- **Primary Tumor:** T1b: Melanoma ≤ 1.0 mm with ulceration.

- **Regional Lymph Nodes:** NX: Regional lymph nodes cannot be assessed.

- **Distant metastasis:** MX: Presence of distant metastasis cannot be assessed.

Lymph nodes and metastases have not been assessed at this point. Let us begin with lymph node staging…
Lymphoscintigraphy

- Nuclear medicine study in which a radioactive colloid and/or blue dye is injected into the primary tumor site to identify the sentinel lymph node(s)

- **Gamma camera** - used to image nodes that take up tracer in nuclear medicine suite just prior to surgery. Radiologists mark focal areas of tracer uptake on overlying skin.

- **Gamma probe** – hand held probe used during surgery to redetect focal areas of tracer uptake.

- False negative rate: 5% or less\(^3,4\)

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Our Patient: Sentinel Lymph Nodes on Lymphoscintigraphy

Two foci of tracer uptake in the right axilla
Patient underwent wide excision of her right chest melanoma with concurrent right axillary sentinel lymph node sampling.

Pathology Report: No evidence of melanoma in two examined lymph nodes.

Stage 1B

Patient had 6 month follow-up skin checks with dermatologist.
Patient presents to outside hospital 4 years later, complaining of 4 months of progressive dyspnea, dysphagia, and intermittent palpitations

What imaging tests would you do?

(Hint: where do her symptoms anatomically localize to)
Our Patient: Lung Nodule and Mediastinal Adenopathy on Chest Radiograph

1. Right tracheal deviation
2. Right paratracheal abnormal soft tissue density
3. Splayed carina, and subcarinal soft tissue fullness
4. Full R hilum
5. Pulmonary nodule

Chest Radiograph, AP Frontal View
Our Patient: Lung Nodules and Mediastinal Mass on CT

Findings:
1. Two round nodules in R lung field
2. Mediastinal mass
3. Bilateral pleural effusions
4. Parenchymal opacities in right middle lobe, likely subpleural atelectasis
While the most likely etiology of our patient’s lung nodules is metastatic melanoma, let us break from the case to review the different diagnosis (ddx) of multiple lung nodules.
Ddx Multiple Lung Nodules

- Malignancy
  - Metastatic Neoplasm
  - Non-Hodgkin’s lymphoma
  - Karposi’s sarcoma in HIV+

- Inflammation
  - Amyloidosis
  - Sarcoidosis
  - Wegner’s granulomatosis
  - Rheumatoid arthritis
  - Lymphomatoid granulomatosis

- Infection
  - Abscesses
  - Septic emboli
  - Fungal infection

- Pneumoconiosies
  - Silicosis
  - Coal workers pneumoconiosis

- Pulmonary AVMs
Our Patient: Additional Staging

- Transbronchial needle aspiration of lung nodule was performed using endobronchial ultrasound

- Tissue and cytology was positive for metastatic malignant melanoma

Let us now turn our attention to the mediastinal mass seen on imaging...
Brief Anatomy Review of Mediastinum

4 Subcompartments:

- **Superior:** upper trachea, brachiocephalic vessels, thyroid, upper esophagus
- **Anterior:** thymus, germ cells
- **Middle:** heart, great vessels, pericardium, lower trachea
- **Posterior:** esophagus, descending aorta, azygous system, sympathetic chain, dorsal root ganglia, thoracic ducts

Ddx Mediastinal Mass

Ddx mediastinal mass may be based on subcompartment:

- **Superior:** upper tracheal mass, thyroid mass, Zenker’s diverticulum
- **Middle:** pericardial tumors/cysts, vascular lesions, bronchogenic tumors/cysts
- **Posterior:** esophageal dilation/masses, varices, thoracic duct cysts/chylomas, ganglion series tumors
Our Patient: Mediastinal Mass on CT

Findings:

- **Mediastinal adenopathy**, coalescing together to appear as lobulated mass
- Impingement of adenopathy upon left atrium and **inferior pulmonary veins**
Our Patient: Mediastinal Mass

Our patient has **adenopathy**, which is not specific to any mediastinal subcompartment.

*Remember:* the following may be found in any mediastinal subcompartment:
- Adenopathy
- Hemangioma
- Lymphangioma
- Connective tissue tumors
- Vascular lesions
Our Patient: Summary of Clinical Course

- 48 year old woman presents with localized melanoma on her right chest. She has wide excision of the lesion and sentinel lymph nodes are removed. Lymph node pathology report is negative for melanoma.

- Patient returns 4 years later with dysphagia, dyspnea, and palpitations, and is found on chest radiograph and CT to have 2 lung nodules in her right lung and mediastinal adenopathy, compressing her trachea, esophagus, and pulmonary veins.

*Where else might our patient have metastases?*
Melanoma Metastases

- Melanoma has a high potential for metastasis
- Common sites of metastases, in descending order of frequency\(^5\)
  - Skin, subcutaneous tissues, and nodes
  - Lungs
  - Liver
  - Brain
  - Bone
  - GI tract
  - Heart
  - Pancreas
  - Adrenals
  - Kidney
  - Thyroid

How can we survey the body to detect or rule out all of these sites of metastasis?
Menu of Imaging Tests for Metastatic Melanoma

- Lymphoscintigraphy
- Plain Radiographs
- CT Torso
- MRI Brain
- Ultrasonography
- PET and PET/CT
- Bone Scan
Our Patient: Outcome

- CT of abdomen/pelvis: negative for evidence of metastatic melanoma
- MRI head w/ and w/out contrast: negative for evidence of metastatic melanoma
- Stage IV
- Currently receiving palliative radiation to mediastinum
One imaging study which our patient did not receive during her clinical course, but is very sensitive in detecting areas of metastasis, is the PET scan.
PET and PET/CT

Physiological imaging technique versus anatomical imaging

Uses glucose labeled with 18-fluorine, called fluorodeoxyglucose or FDG, which emits positrons that are detected by crystals and converted to light signals.

Tumor cells take up FDG because they are metabolically active.

Areas of inflammation and tissue repair are also sites of FDG accumulation.

PET/CT

- combines physiologic and anatomic imaging
- has been shown to be superior to PET alone for detection of metastases\(^6\)
PET and PET/CT

Useful for:

– Detection of metastases in patients with Stage III disease
– To instruct surgery
– Detection of extent of disease in patients eligible for adjuvant interferon therapy prior to initiation of therapy
Companion Patient #1: Liver and Pelvic Metastases on PET

Findings:
- Focal areas of increased uptake in the liver, and pelvis
Companion Patient #1: Liver Metastasis on PET/CT

Focal area of increased uptake in left lobe of liver
Companion Patient #1:
Pelvic Metastasis on PET/CT

Focal area of increased uptake in right pelvis
Melanoma has a high potential for metastatic spread.

 Imaging studies are helpful in staging melanoma, surgical planning, intraoperative management, and post-treatment follow-up.

 The use of imaging studies in melanoma needs further evaluation, as current evidence does not support any particular protocol for their use and study benefits are not clear.
References


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