Imaging in Metastatic Melanoma

Nilanthi Gunawardane
Gillian Lieberman, MD
March 2008
Malignant Melanoma

- Neoplasm of pigment-forming cells, melanocytes, and nevus cells

- Types of melanoma
  - Superficial spreading
  - Lentigo maligna
  - Nodular
  - Acral lentiginous

www.metrohealth.org
In 2008, an estimated 62,480 individuals will be diagnosed with melanoma and 8420 will die of this disease.

Lifetime risk of developing melanoma is increasing dramatically:

- 2001: 1 in 71
- 1985: 1 in 150
- 1965: 1 in 600
### AJCC 2002 Melanoma Clinical Stage Grouping

<table>
<thead>
<tr>
<th>Stage</th>
<th>Grouping</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Tis N0 M0</td>
</tr>
<tr>
<td>IA</td>
<td>1a N0 M0</td>
</tr>
<tr>
<td>IB</td>
<td>1b N0 M0</td>
</tr>
<tr>
<td></td>
<td>2a N0 M0</td>
</tr>
<tr>
<td>IIA</td>
<td>2b N0 M0</td>
</tr>
<tr>
<td></td>
<td>3a N0 M0</td>
</tr>
<tr>
<td>IIB</td>
<td>3b N0 M0</td>
</tr>
<tr>
<td></td>
<td>4a N0 M0</td>
</tr>
<tr>
<td>IIC</td>
<td>4b N0 M0</td>
</tr>
<tr>
<td>III</td>
<td>Any T Any N M0</td>
</tr>
<tr>
<td>IV</td>
<td>Any T Any N M1</td>
</tr>
</tbody>
</table>
Sites of Metastases

- Lymph nodes
- Lungs
- Liver
- Subcutaneous tissue
- GI tract
- Brain
- Less common: heart, muscle, spleen, kidneys, adrenal glands, gallbladder, breast
Our Patient Mr. H: Initial Presentation

- 84 yo M presented to a dermatologist with a dysplastic nevus
- Hx of extensive sun exposure, no hx of skin cancer
- No family hx of melanoma
- Lesion resected
- Followed conservatively
Imaging modalities for the work up of suspected malignant melanoma

- Plain films
- Computed Tomography (CT)
- Positron Emission Tomography (PET)
- PET-CT
- Magnetic Resonance Imaging (MRI)
- Lymphoscintigraphy
- Ultrasound
## Imaging Modalities

<table>
<thead>
<tr>
<th>Modality</th>
<th>Stage I and II</th>
<th>Stage III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CXR</strong></td>
<td>Recommended</td>
<td>Optional periodic CXR q3-6 months</td>
</tr>
<tr>
<td></td>
<td>Functions as baseline</td>
<td>Low sensitivity for detection of metastasis but higher than stage I and II</td>
</tr>
<tr>
<td></td>
<td>Optional periodic CXR q3-6 months</td>
<td>Low yield of brain, torso CT in asymptomatic patients</td>
</tr>
<tr>
<td></td>
<td>Low sensitivity for detection of metastasis</td>
<td>Selective imaging indicated</td>
</tr>
<tr>
<td></td>
<td>Low yield and high false positive rate (10-20%)</td>
<td>Imaging prior to lymph node dissection or IF therapy</td>
</tr>
</tbody>
</table>
## Imaging Modalities

<table>
<thead>
<tr>
<th>Modality</th>
<th>Stage I and II</th>
<th>Stage III</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET &amp; PET/CT</td>
<td>Not indicated</td>
<td>Recommended</td>
</tr>
<tr>
<td></td>
<td>Low sensitivity</td>
<td>More sensitive than MRI, CT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PET/CT more accurate than PET b/c able to correlate anatomic localization with physiologic information</td>
</tr>
<tr>
<td>MRI</td>
<td>Not indicated</td>
<td>Most sensitive modality to assess brain mets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Routine imaging in asymptomatic patients controversial</td>
</tr>
</tbody>
</table>
Lymphoscintigraphy

- Staging of patients who are clinically node negative
- Lymph node involvement most important prognostic factor
- Method: Radioactive colloid injected intradermally around tumor. Imaged by gamma camera/gamma probe
- Allows preoperative and intraoperative identification of sentinel lymph nodes for biopsy

Courtesy of Dr. Donohoe, BIDMC
Mr. H: Follow-up

Two years later:

- CT chest at OSH showed small right lung lesion
- Decided to follow-up with repeat CT in 6 months

Two years, seven months later:

- Repeat CT at BIDMC
Mr. H: Mass on Non-contrast Chest CT

Rounded opacity in RLL, 3cm in diameter, no calcification, no cavitation
Mr. H: Multiple Nodules on Non-contrast Chest CT

2mm nodule LUL

Subpleural 8mm nodule RUL

From PACS, BIDMC
DDx for Multiple Pulmonary Nodules

- Malignancy: Metastasis, Lymphoma
- Infectious: Abscesses, Septic emboli, Fungi
- Non-infectious: Wegener’s granuloma
- AVM
- Pneumoconiosis
Mr. H: Lung Mass on PET

Focal area of increased FDG uptake in right lung
Lung Mass on PET-CT

Focal area of increased FDG uptake on PET

Fusion image: area of increased FDG uptake on PET correlates with lung mass on CT

Lung mass on CT

Courtesy of Dr. Donohoe, BIDMC
DDx for PET enhancement

- Neoplasm
- Infection
- Inflammation
- Uptake in brain, skeletal muscle, brown fat, myocardium, bowel
- Urinary collecting system
**Mr. H: Further Follow-up**

- Bronchoscopy - resection of two nodules
- Pathology – poorly differentiated metastatic melanoma
- Followed with torso CTs

- Developed acute low back pain
- MRI findings suspicious for metastasis
- L2 biopsy showed melanoma
Mr. H: Vertebral Metastases on Spinal MRI

Sagittal T1 MRI thoracic & lumbar spine: Decreased signal intensity suspicious for metastasis in L2 vertebral body and T11 spinous process
One year post-imaging at BIDMC

- Patient awoke with diplopia
- MRI at OSH – metastatic lesions in brain
- Whole brain radiation

One month later:

- Transferred to BI for further care
Mr. H: Cerebral Mets on MRI

2X3 cm area of increased signal intensity in right frontal lobe

Sagittal T1 weighted non-contrast brain MRI
Axial T1 weighted non-contrast brain MRI

From PACS, BIDMC
Mr. H: Cerebral Mets on MRI

Axial T1 weighted non-contrast brain MRI

Two areas of increased signal intensity in right hemisphere

From PACS, BIDMC
Axial T1 weighted non-contrast brain MRI

Axial T2 GRE

Increased signal intensity area on T1 corresponds with decreased signal intensity area on T2 GRE, consistent with a hemorrhagic lesion

Mr. H: Hemorrhagic Cerebral Mets on MRI
DDx for Hemorrhagic Brain Mets

- Melanoma
- Anaplastic lung carcinoma
- Thyroid carcinoma
- Choriocarcinoma
- Hypernephroma
Companion Patient #1: Melanotic Pattern of Melanoma

Non-enhanced axial T1 MR

Non-enhanced axial T2 MR

Increased signal intensity on T1
Decreased signal intensity on T2

Companion patient #1: 54 yo with brain metastasis from acral lentiginous melanoma

Escott E, Radiographics. 2001;21:625-639
Companion Patient #2: Amelanotic Pattern of Melanoma

**Non-enhanced axial T1 MR**

- Hypo & Isointense on T1

**Non-enhanced axial T2 MR**

- Hyper & Isointense on T2

Companion patient #2: 40 yo M with melanoma brain metastasis

Escott E, Radiographics. 2001;21:625-639
Mr. H: Final Events

- Patient developed SBO and pneumoperitoneum
- Patient expired
Companion Patients: Other Sites of Metastases

Patient #3: Necrotic hepatic melanoma met

Patient #4: Subcutaneous melanoma met

Patient #5: CT and US of renal melanoma met
Summary

- Melanoma can metastasize to any organ.
- Imaging is an essential component of melanoma staging.
- Multitude of imaging modalities are utilized in the staging and follow-up of metastatic melanoma.
- Metastatic melanoma lesions, especially in the brain, can have a variety of appearances on imaging.
Acknowledgments

- Dr. Lieberman
- Dr. Andrew Hines-Peralta
- Dr. Kevin Donohoe
- Rachel Jimenez
- Maria Levantakis
References

- Au Shiela, eMedicine: CNS Melanoma
- Buzaid AC, Gershenwald JE, Ross MI. Staging work-up for melanoma and follow-up guidelines. Up To Date 2008
- Buzaid AC, Gershenwald JE, Ross MI. American Joint Commission on Cancer staging system and prognostic factors in cutaneous melanoma. Up To Date 2008
References

- Yock DH. Magnetic Resonance Imaging of CNS. Mosby Yearbook, Inc. 1995