Radiological Manifestations of Metastatic Melanoma

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Our patient: Clinical Presentation

• A 24 year-old male. Former smoker.
• 8 months ago, he suffered a burn in his right hip while working.
• Then he noticed the area wasn’t healing well and that a big, pigmented and raised mole appeared in the area where he noticed a mole a few years prior to the accident.
Our Patient: Melanoma local Management

• The biopsy showed a nodular melanoma with positive margins.
• He underwent a wide excision and inguinal + femoral lymphadenectomy.
Now that seen the local management of our patient’s malignant melanoma, let’s review some important aspects of melanoma
Risk Factors for Malignant Melanoma

- Risk factors:
  - More than 100 moles in the entire body
  - Familial history of melanoma
  - Personal history of melanoma
  - More than 4 atypical nevi

Features of Suspicious Moles

• ABCDE of Moles:
  A for Assymetry
  B for irregular Borders
  C for Color variegation
  D for Diameter > 6 mm
  E for enlargement/ evolution
• Let’s check our patient’s follow up studies
Our Patient: Right lower lobe nodule

- Right lower lobe pulmonary nodule, 1 cm in diameter
Our Patient: Left lower lobe nodules

- Tiny submillimeter nodules in the lower segment of the left lower lobe
Our Patient: Left lower lobe nodules

- Tiny submillimeter nodules in the lower segment of the left lower lobe
Our Patient: Gastrohepatic lymph node mass

• Large conglomerate lymph node mass identified within the gastrohepatic ligaments

Axial, C+, Abdominal CT
Our Patient: Hepatic Metastases

- There are metastasis in the liver.
- The largest measures 5.0 x 4.5 cm in segment II of the liver.
- And in the segment VII measuring 1.4 x 1.5 cm.
Our Patient: Hepatic Metastases

- There are metastasis in the liver.
- The largest measures 5.0 x 4.5 cm in segment II of the liver.
- And in the segment VII measuring 1.4 x 1.5 cm.
- He also was found to have metastasis in segments IVa and III.
Finding’s Summary

• In the follow up CTs we found:
  – Pulmonary Metastases
  – Conglomerate lymph node mass in gastrohepatic ligament
  – Liver Metastases
Metastatic Sites

• Where does melanoma spread to?

- Lungs and Mediastinum: 23%
- Skin & Soft Tissue: 22%
- Liver: 18%
- Lymph node: 25%
- Other: 12%

Our patient: Further work up

- He underwent a Head MRI to see if there was also brain lesions.
Our Patient: Frontal Lobe nodule

- There is an approximately 1 cm enhancing mass within the right frontal lobe, which may lie within the cortex or could be sulcal, concerning for a metastatic lesion.
Our Patient: Frontal Lobe nodule

- There is surrounding vasogenic edema within the right frontal lobe, though without mass effect or shift of midline.
Our Patient: Temporal Lobe nodule

• Within the inferior left temporal lobe there is an enhancing lesion measuring approximately 3 mm without significant surrounding edema.

Axial MR, Flair sequence

PACS, BIDMC
Head MRI Findings Summary

• There is a 1 cm enhancing mass within the right frontal lobe, with surrounding vasogenic edema, concerning for metastatic lesion.
• In the left temporal node, a second enhancing lesion can be seen, without surrounding edema.
Our patient: Further work up

• To further characterize the lesions, a PET CT was performed.
• But before we see our patient’s PET CT, we are going to learn how a PET CT is done.
PET CT: The Pasteur Effect

- In aerobiosis, glucose is transported into cells to be used in energy production. This is called Glycolysis.
- In anaerobic conditions, the energy production process is less effective so there is enhanced uptake. This is called the Pasteur effect.

PET CT: The Warburg Effect

- In tumor, there is enhanced glycolysis even in aerobic conditions. This is called the Warburg effect.

PET CT: Changing Glucose for FDG

Physiologic Process

- When we do a PET, we use a glucose analog, FDG, that can’t be metabolized, so it stays in the cell. When it decays, emits protons that are sensed by the detectors.
- The more uptake, the darker it looks.

PET CT: The CT contribution

- Unfortunately, the PET by itself doesn´t give enough anatomical information, but when is combined with a non contrast CT, we can see the anatomic position of a high FDG uptake focus.

- This test is normally used to look for metastases.

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PET CT: It’s not perfect

Sources of error:

• False positive
  – High uptake due to active infections.
  – High uptake due to brown fat.

• False negative
  – Tumors with low metabolic activity
  – Too small tumors (less than 7 mm in diameter)
  – Hyperglicemia: Glucose and FDG compete for the same receptors.
Follow up PET

• So now that we understand how it works, let’s see what we find
Our Patient: Subcarinal lymph node conglomerate

• CHEST: A 2.2 cm subcarinal lymph node conglomerate to the right of midline, with increased uptake with SUV max of 6.6.
• The previously seen right lower lobe nodule near the diaphragm measures 1.5 cm and demonstrates minimal avidity with SUV max 2.1.
Our Patient: Liver Mets and Lymph node conglomerate

- Extensive diffuse FDG avidity is seen in the liver, predominantly in the left lobe.
- Also involving the periportal tissue, IVC and aorta, corresponding to regions of known liver metastases and lymph node conglomerates.
Our Patient: Vertebral C5 early metastasis

- A focus of FDG tracer uptake is seen in the vertebral body of C5 with SUV max 3.6.
- It has no correlation in CT
- Concerning for early metastasis.
PET CT Findings Summary

• Focus of FDG tracer uptake was seen in
  – Subcarinal lymph node conglomerate
  – The liver, predominantly in the left lobe.
  – The vertebral body of C5
PET CT Findings Summary

• Focus of FDG tracer uptake was seen in
  – Subcarinal lymph node conglomerate
  – The liver, predominantly in the left lobe.
  – **The vertebral body of C5**

• Next, we will review some basic facts on bone metastases
Bone Metastasis

• Metastasis are the most common variety of bone tumor
• Always consider them in an older patient.
• The most common primary tumors are...

Bone Metastasis: Most common primary tumors

- Thyroid
- Breast
- Lung
- Kidney
- Prostate
- Uterus

Also gastric cancer, colon, urinary, melanoma

Bone Metastasis: Favorite Localizations

- Axial skeleton
- Proximal parts of limbs

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- Axial skeleton
- Proximal parts of limbs

Bone Metastases: Lytic vs Blastic

- Lytic lesions represent ~75%:
  - Kidney
  - Lung
  - Breast
  - GI tract
  - Thyroid

- Blastic lesions represent ~15%:
  - Prostate
  - Seminoma
  - Breast
  - Cervix
  - Ovary

**Mixed Lesions:** Represent 15%. Most common are Breast and Lung

Companion Patient 1: An example of lytic metastasis of Renal Carcinoma

Courtesy of Dr. Corrie Yablon
Companion Patient 1: An example of lytic metastasis of Renal Carcinoma

- Expansile lytic ovoid destructive lesion at the periphery of the proximal humerus.
- Destroying and scalloping the underlying bone with an associated soft tissue mass.

Courtesy of Dr. Corrie Yablon
Companion Patient 2: An example of mixed metastases of Breast Cancer

Courtesy of Dr. Corrie Yablon
Companion Patient 2:
An example of mixed metastases of Breast Cancer

Blastic Lesion in body of T12

Sagittal, C- Spinal CT

Courtesy of Dr. Corrie Yablon
Our Patient: Treatment choices and Prognosis

- Poor prognosis: Melanoma stage IV with brain metastases.
- Plan:
  - Brain Metastaes: Stereotactic Surgery
  - Quimiotherapic treatment: Temozolomide
    - Alkylationing agent
    - Bonds to Guanine in DNA
    - DNA damage
    - Cell death
  - Ipilimumab remains as an alternative
    - Monoclonal antibody
    - Targeted against CTL4, antigen that works as an inhibitor of T cell activity.
    - Ipilimumab blocks the inhibitor, resulting in T cell stimulation
    - T cells recognize and attack the tumor.
Summary of the presentation

In this presentation, we have reviewed:

• History of a patient with metastatic melanoma
• Risk factors for melanoma
• ABCDE of moles
• Metastatic melanoma on a Chest CT
• Metastatic melanoma on an Abdominal CT
• Frequent locations of melanoma metastases
• Metastatic melanoma on Head MRI
• How a PET CT works
  – Pasteur effect
  – Warburg effect
Summary of the presentation 2

• How a PET CT works
  – FDG and its difference with glucose
  – The CT contribution
  – Sources of error
    • False Positive
    • False Negative
• Metastasic Melanoma on PET CT
• Bone Metastases
  – General Aspects
  – Most common Primary Tumors
  – Favorite localizations
  – Lytic vs Blastic Lesions
• Stage IV Melanoma Treatment:
  – Temozolomide
  – Ipilimumab
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References