Osteolytic skull lesions: case of a large calvarial plasmacytoma

My-Linh Nguyen, MS IV
Gillian Lieberman, MD
September 17, 2010

Beth Israel Deaconess Medical Center
Agenda

• Our patient: brief clinical history
• Our patient: head CT
• Differential diagnosis of an osteolytic skull lesion
• Radiographic features of common osteolytic skull lesions
• Our patient: diagnosis and clinical course
Our patient: brief history

• 42-year-old woman complains of a rapidly enlarging painless “bump” on her scalp x 4mos.

• Physical exam reveals a firm, nontender 6cm subcutaneous nodule with normal overlying skin.

• She is referred to plastic surgery for excision of a presumed epidermoid inclusion or pilar cyst.

• The procedure is aborted intraoperatively due to suspicious appearance of the mass. A head CT is obtained.
Our patient: osteolytic skull mass on head CT

- A 5cm well-circumscribed osteolytic soft tissue mass is seen emerging from the right parietal calvarium
- Narrow zone of transition
- Hyperattenuating compared to brain parenchyma
- Rim of calcified bony fragments suggests an intraosseous, possibly intradiploic, origin

A quick explanation of “intradiploic”

Skull

scalp

Diploic space:
- cancellous bone
- marrow
- blood vessels

Intradiploic lesions often arise from these structures

“Outer table” Cortical bone

“Inner table” Cortical bone

periosteum

Common etiologies:
1. Inflammatory cholesteatoma
2. CNS epidermoid cyst
3. Fibrous dysplasia
4. Hemangioma
5. Osteomyelitis
6. Eosinophilic granuloma
7. Metastatic lesion (breast, lung, thyroid, kidney, neuroblastoma)
8. Plasmacytoma

Let’s go through this list using primarily the patient’s CT to narrow the differential.

DDx #1: Companion patient 1 with inflammatory cholesteatoma

- Inflammatory cyst of the **middle ear** (location is key)
- Can cause local bone erosion

Our patient’s lesion

Cholesteatoma in characteristic middle ear location

Region of middle ear

Location **NOT** consistent with inflammatory cholesteatoma!

Companion patient #1: cholesteatoma
Axial CT head c(-)

Our patient: lateral CT scout image. PACS, BIDMC

Common etiologies:

1. *Inflammatory cholesteatoma*

2. **CNS epidermoid cyst**

3. Fibrous dysplasia

4. Hemangioma

5. Osteomyelitis

6. Eosinophilic granuloma

7. Metastatic lesion (breast, lung, thyroid, kidney, neuroblastoma)

8. Plasmacytoma

**DDx #2: companion patients 2 and 3 with CNS epidermoid cyst**

- Congenital cyst that grows via accumulation of cell debris including **cholesterol** and keratin
- Due to lipid content, is **hypoattenuating** compared to brain parenchyma

---


---

**Companion patient #2: intradiploic epidermoid cyst.**

Axial CT head c(-)

**Companion patient #3: posterior fossa epidermoid cyst.**

Axial CT head c(-)

**Our patient:** axial c(-) CT head. PACS, BIDMC

**Low attenuation epidermoid cysts**

**Our patient’s lesion is hyperattenuating**

**Attenuation pattern **NOT** consistent with epidermoid cyst!**
Common etiologies:

1. *Inflammatory cholesteatoma*
2. *CNS epidermoid cyst*
3. **Fibrous dysplasia**
4. Hemangioma
5. Osteomyelitis
6. Eosinophilic granuloma
7. Metastatic lesion (breast, lung, thyroid, kidney, neuroblastoma)
8. Plasmacytoma

---

DDx #3: Companion patients 4 and 5 with fibrous dysplasia

- Benign congenital disorder: osteoblast dysfunction causes replacement of normal bone with woven bone (mixed fibrous and osseous components)
- Lesions commonly have a “ground glass” appearance on CT (but less commonly can look homogeneously cystic or sclerotic)
- Usually a disorder of children/young adults: 75% present before age 30

Based solely on our patient’s CT, we cannot definitively rule out fibrous dysplasia. However, it would be an unlikely presentation given her age.

Differential diagnosis of an osteolytic skull lesion

Common etiologies:

1. **Inflammatory cholesteatoma**
2. **CNS epidermoid cyst**
3. **Fibrous dysplasia**
4. **Hemangioma**
5. **Osteomyelitis**
6. **Eosinophilic granuloma**
7. **Metastatic lesion (breast, lung, thyroid, kidney, neuroblastoma)**
8. **Plasmacytoma**

---

DDx #4: companion patients 6 and 7 with osseous hemangiomas

- Vascular lesion arising from diploic space
- CT: heterogeneous “honeycomb” pattern due to trabecular resorption in vascular channels and trabecular sparing between channels

Calvarial hemangiomas demonstrating honeycomb trabecular pattern

Aside from the bony fragments at its rim, no bone densities are seen within our patient’s lesion

Companion patient #6: hemangioma.1 Coronal c(-) CT head.
Companion patient #7: hemangioma.2 Axial c(-) CT head.

Our patient: axial c(-) CT head (bone window) PACS, BIDMC

Attenuation pattern NOT consistent with hemangioma!

Common etiologies:

1. Inflammatory cholesteatoma
2. CNS epidermoid cyst
3. Fibrous dysplasia
4. Hemangioma
5. Osteomyelitis
6. Eosinophilic granuloma
7. Metastatic lesion (breast, lung, thyroid, kidney, neuroblastoma)
8. Plasmacytoma

DDx #5: Companion patients 8 and 9 with osteomyelitis

- Bacterial or fungal infections.
- CT findings are non-specific: may see **patchy bone destruction**, associated **soft tissue swelling**, **abscess**

Companion patient #8: frontal bone osteomyelitis secondary to frontal sinusitis.\(^1\)
Axial c(-) CT head.

Companion patient #9: tuberculosis of frontal bone.\(^2\)
Axial c(+) CT head.

Our patient: axial c(-) CT head (bone window)
PACS, BIDMC

The bone destruction in our patient is not patchy, and there is no soft tissue swelling or abscess (the subcutaneous air seen is due to surgical exploration)

Osteomyelitis is **unlikely** based on our patient’s CT.

---

Common etiologies:

1. Inflammatory cholesteatoma
2. CNS epidermoid cyst
3. Fibrous dysplasia
4. Hemangioma
5. Osteomyelitis
6. Eosinophilic granuloma
7. Metastatic lesion (breast, lung, thyroid, kidney, neuroblastoma)
8. Plasmacytoma

DDx #6: Companion patient 10 with eosinophilic granuloma

- Most common type of Langerhans cell histiocytosis
- **Well-demarcated** lytic mass, often containing a central “**button sequestrum**” of residual bone
- Intradiploic origin; may see “**beveled edge**” due to greater lysis of inner > outer table

---

**Eosinophilic granuloma with beveled edge and possible button sequestrum**

**Our patient’s lesion is also a well-demarcated mass of intradiploic origin. However, no beveled edge or button sequestrum is seen.**

Based on our patient’s CT, eosinophilic granuloma would be **unlikely**, though we cannot definitively rule it out.

---

Common etiologies:
1. Inflammatory cholesteatoma
2. CNS epidermoid cyst
3. Fibrous dysplasia
4. Hemangioma
5. Osteomyelitis
6. Eosinophilic granuloma
7. Metastatic lesion (breast, lung, thyroid, kidney, neuroblastoma)
8. Plasmacytoma
Companion patient #11: papillary thyroid carcinoma metastasis
Axial c(+) CT head.

Companion patient #12: thyroid carcinoma metastasis
Axial c(+) CT head.

Osteolytic thyroid cancer metastases demonstrating hyperenhancement on c(+) CT

Cannot rule out metastasis, which can take on variable appearances. Our evaluation is further limited because our patient did not receive IV contrast.

Common etiologies:
1. Inflammatory cholesteatoma
2. CNS epidermoid cyst
3. Fibrous dysplasia
4. Hemangioma
5. Osteomyelitis
6. Eosinophilic granuloma
7. Metastatic lesion (breast, lung, thyroid, kidney, neuroblastoma) → possible
8. Plasmacytoma

DDx #8: Companion patient 13 with plasmacytoma of bone

- Tumor of plasma cells; may be solitary or a component of systemic multiple myeloma
- CT appearance: **Well-marginated** osteolytic mass arising from the **diploic space** (marrow) that is **hyperdense** on non-contrast CT and **hyperenhancing** on contrast CT. Lesion has no sclerotic margin but may have **peripheral bone fragments**.

Plasmacytoma demonstrating classic appearance on c(+) CT.

Peripheral bone fragments seen on bone window.

Our patient’s lesion, which is a well-circumscribed hyperdense mass arising from the diploic space (with peripheral bone fragments that are likely remnants of the destroyed outer bone tables), **could be consistent with a plasmacytoma**.

Common etiologies:
1. Inflammatory cholesteatoma
2. CNS epidermoid cyst
3. Fibrous dysplasia
4. Hemangioma
5. Osteomyelitis
6. Eosinophilic granuloma
7. Metastatic lesion (breast, lung, thyroid, kidney, neuroblastoma) → possible
8. Plasmacytoma → most likely diagnosis based solely on head CT!

Our patient’s clinical course

• Mass was excised by neurosurgery; pathology revealed *plasmacytoma*

• Diagnosis of systemic *multiple myeloma* was subsequently made
  – Additional osteolytic lesions found on skeletal survey (seen next slide)
  – Bone marrow biopsy demonstrated a high percentage of plasma cells (20%)

• The patient is now doing well after chemotherapy and autologous bone marrow transplant.
Our patient: skeletal survey revealing multiple lytic lesions

Our patient: lateral plain film, head
PACS, BIDMC

Our patient: frontal plain film, right humerus
PACS, BIDMC
In summary, we....

• Evaluated our patient’s CT, which revealed a large osteolytic skull mass

• Generated a differential diagnosis for osteolytic skull lesions

• Learned the radiographic features of common osteolytic skull lesions

• Narrowed our differential and identified the most likely diagnosis based solely on imaging

• Learned that our imaging diagnosis matched our patient’s pathologic diagnosis of plasmacytoma

• Reviewed our patient’s clinical course, which included a diagnosis of systemic multiple myeloma
THANK YOU!

Dr. Gillian Lieberman
Emily Hanson
Larry Barbaros

Dr. Ferris Hall
Dr. Jim Wu
Dr. Kevin Donohoe

Dr. Adam Jeffers
Dr. Monica Agarwal
Dr. Mai-Lan Ho