Tumors of the Paranasal Sinuses:
Approaches to Diagnostic Imaging

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Head and Neck Cancers

- Oral cavity
- Pharynx
- Larynx
- Nasal cavity
- Paranasal sinuses
- Salivary glands

Incidence in USA: 45,660/yr
Deaths in USA: 11,210/yr
Head & Neck Cancers

- Oral cavity
- Pharynx
- Larynx
- Nasal cavity
- Paranasal sinuses: 3% of HNC
- Salivary glands
Agenda

- Meet the patient: Mr. R
- Common signs/symptoms of sinus disease
- Radiological Menu of Tests
- Normal anatomy
- Differential diagnosis
- Radiological findings
- Companion cases
- Putting it all together: Mr. R
Meet the patient: Mr. R

- **HPI:**
  - 57 y/o disabled former electrician c/o “fullness” in R cheek

- **PMH:**
  - DM-II, well-controlled on oral medications
  - HTN
  - Hyperlipidemia
  - L3-L4 disc herniation, residual R weakness
  - S/p cholecystectomy

- **SHx:** Quit smoking 10 yrs ago

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Common Signs/Symptoms

- “It’s just my sinusitis!”
  - Nonspecific! Broad indications for imaging.
- Think about *origin* and *routes of spread*
- Sinus symptoms
  - Nasal stuffiness or discharge
  - Sinus pain, frontal headache
  - Cheek discomfort
  - Facial swelling, pain or numbness
  - Poor clearing of unilateral “sinusitis” on radiograph
Symptoms of local spread

- Into nasal cavity: Unilateral epistaxis
- Into orbit: Ocular dysfunction, proptosis, diplopia
- Into oral cavity: Pain/loosening of upper teeth; “dentures don’t fit”
- Into inferior pterygoid muscle: Trismus
Radiologic Menu of Tests

- CT: *Modality of choice*
- MRI: *Complementary*
- X-Ray
Radiologic Menu of Tests: CT

- **CT: Modality of Choice**
  - #1 for both inflammatory and neoplastic processes
  - Thin sections (3mm), axial and coronal
  - Evaluates invasion into bony structures
  - Shows thin septations and air/soft-tissue interfaces
  - Contrast may be useful in some cases
  - **Limitations:**
    - Hard to distinguish tumor from soft tissue swelling and secretions
    - Radiation exposure
Radiologic Menu of Tests: MRI

- **MRI**: *Complementary*
  - Assessment of soft tissue infiltration, esp intracranial
  - Multiplanar capability, esp. sagittal
  - Differentiates neoplasm from adjacent inflammation
  - No radiation exposure
  - Gadolinium: correlates with vascularity of tumor
  - Limitations:
    - *Normal* septae and mucosal layers are undetectable
    - Malignant osseous lesions are poorly distinguished
    - Cost

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Radiologic Menu of Tests: Plain Films

- X-Ray
  - No longer preferred
  - Limited by overlapping structures, especially in ethmoids/OMC
  - Used only in ICU settings
Mr. R: Coronal CT

Where is the lesion?

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Mr. R: Coronal CT

R Maxillary Antrum

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Anatomy: Frontal View

- Frontal
- Ethmoid
- Maxillary
- Sphenoid

From PDRhealth.com

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Anatomy: Frontal View

- Frontal
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Anatomy: Lateral View

Nose and Nasal Cavities

- Frontal sinus
- Middle nasal concha
- Inferior nasal concha
- Nasal concha
- Sphenoid sinus
- Internal naris
- Nasopharynx
- External naris

From http://training.seer.cancer.gov

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Pathways of Drainage

- OMC drains:
  - Frontal
  - Ethmoid
  - Maxillary
- Sphenoethmoidal recess

From PDRhealth.com

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Plain Film: Waters View

Plain Film: Waters View

Frontal Sinus
Orbit
Nasal septum
Maxillary Sinus
Maxillary Alveolar Ridge


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Anatomy on Coronal CT

Anatomy on Coronal CT

- Cribiform Plate
- Frontal Sinus
- Temporal Bone
- Orbit
- Lamina Papyracea
- Ethmoid Sinus
- Nasal Septum
- Maxillary Sinus
- Septation (normal variant in maxillary sinus)
- Maxilla
- Tongue


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Anatomy on Axial MRI
Mr. R: Coronal CT

Mass in floor of R Maxillary Antrum

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DDx of Paranasal Sinus Mass

- **Fake-outs**
  - Cyst
  - Mucosal inflammation
  - Retained secretions

- **Benign Tumor**
  - **Epithelial**
    - Polyp, Papilloma, Adenoma
  - **Non-epithelial**
    - Fibroma, Chondroma, Osteoma,
    - Neurofibroma, Hemangioma, Lymphangiom

- **Locally Aggressive Tumor**
  - Inverted papilloma
  - Angiofibroma
  - Ameloblastoma
  - Ossifying fibroma
  - Giant cell tumor

- **Malignant Tumor**
  - **Epithelial**
    - SCC (most common; 80%)
    - Adenoid Cystic Carcinoma, Adenocarcinoma, Mucoepidermoid Carcinoma, Undifferentiated
    - Melanoma
    - Olfactory neuroblastoma
  - **Non-epithelial**
    - Chondrosarcoma, Osteogenic sarcoma
    - Soft tissue sarcomas (e.g. fibrosarcoma, angiosarcoma)
    - Lymphoproliferative (e.g. lymphoma, plasmacytoma)
    - Metastatic

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Radiological Findings

Assess for:

- Bone changes
  - Destruction -- aggressive process
    - Look for spread across sinus borders
  - Bowing -- slow growth
  - Foramen enlargement -- growth along nerve
  - Sclerotic walls -- chronic process
  - Enlargement -- bone dysplasia or marrow
  - Fracture

- Opacification/decreased aeration
  - Low uniform density -- retained secretions
  - Non-uniform: tumor vs. inflamed mucosa

- Masses
  - Soft tissue, foreign body, calcifications, teeth

- Mucosal thickening
- Cyst formation
- Air-fluid levels
Companion Patient #1: Axial CT

Destructive bone changes: SCC in R maxilla of 77 y/o woman,
Note destruction of posterior sinus wall, extension to the nasal cavity, and an AF level in the L sinus.


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Companion Patient #2: Coronal CT

Destructive bone changes:
SCC with extension into orbit


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Companion Patient #3: Axial MRI

Destructive bone changes:
- SCC with soft tissue extension into orbit

Companion Patient #4: Axial CT

Sclerotic walls:
Chronic sinusitis resulting in sclerosis of maxillary sinus wall.
Companion Patient #5: Coronal CT

Inverting Papilloma:

Benign soft tissue mass projecting from nasal cavity into ethmoid and maxillary sinuses.
Mr. R: Coronal CT

Mass in floor of R Maxillary Antrum

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Mr. R: Axial CT

Findings:
- High-attenuation mass
  - Floor of R maxillary sinus
  - 1.8 x 1.3 cm
  - Smooth, rounded contour
  - Well-circumscribed
  - Homogenous
  - No bone destruction
  - Mild mucosal hypertrophy
- Remainder of sinuses are clear
- OMC patent bilaterally
- Left deviation of nasal septum

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Mr. R: Coronal CT

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Mr. R: Magnification of Coronal CT

Describing the mass:
- **Shape:**
  - Lobulated
  - Sharply-defined margin
- **Size:**
  - 1.8 x 1.3 cm
- **Appearance:**
  - Homogenously opaque, fibro-osseous
- **Adjacent bone:**
  - Sclerosis and bony remodeling
  - Non-aggressive, no bone destruction seen
- **Soft tissue:**
  - Minimal membranous thickening in the sinus
Mr. R: Radiologic Differential

“Ossified, well-circumscribed lesion with benign characteristics”

- **Osteoma**
  - Relatively common, slow-growing lesion.
  - Usually asymptomatic, but risk of major complications.
  - Most common in facial bones but rare in maxillary sinus.

- **Ossifying fibroma**
  - Locally aggressive lesion: Destructive, slow-growing, deforming.
  - High rate of recurrence.
  - Most commonly found in mandible in adults.

- **Osteochondroma**
  - Very common lesion of cartilage and bone, also known as a bone spur.
  - Most commonly found in long bones.

- **Chondromyxoid fibroma**
  - Extremely rare lesion with lytic and sclerotic components.
  - Most commonly found in tibia
Mr. R: Biopsy

- **Pathology:**
  - Dense immature and mature bone
  - Focal remodeling
  - Benign characteristics
  - Mesenchymal and fibroadipose tissue
  - “Most consistent with an osteoma”
Osteoma

- #1 mesenchymal neoplasm of paranasal sinuses
- Slow-growing and usually asymptomatic
- Most common in frontal and ethmoid
  - Rare in maxilla!
- 2:1 male-to-female ratio
- Complications:
  - Extension into nose: nasal obstruction/swelling
  - Extension into orbit: proptosis
  - External fistulae
- Treatment:
  - Surgical resection
Companion Patient #6: Waters View

Osteoma in frontal sinus

Mr. R: Treatment and Follow-up

- S/p R maxillectomy
- Follow-up CT q 6 mos
- No recurrence of tumor for 2 years
- He’s doing well!
References


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