Sinonasal Neoplasms
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The Big Picture
- SN tumors are very rare (2000 Americans/year)
- Highly variable histology; some very aggressive
- Symptoms may mimic chronic rhinosinusitis; late diagnosis common
- SN cavity abuts critical structures: brain, orbit, cranial nerves
- Generally poor prognosis (50% mortality)

Outline
1. What is the role of the radiologist in sinonasal neoplasia?
2. Selected benign and malignant SN tumors
3. Pre-treatment mapping of SN tumors
4. Post-treatment imaging surveillance

1. WHAT IS THE ROLE OF THE RADIOLOGIST IN SINONASAL NEOPLASIA?

The Facts
- Some tumors have characteristic findings, but there is much overlap in imaging features
- Diagnosis will ultimately require tissue sampling
- Accurate assessment of disease extent is critical for both surgical and RT planning
- The primary role of the radiologist is to accurately map the tumor NOT to make the diagnosis (more later …)

But can we at least tell malignant from benign??
1. Multiplicity
2. Margins
   - well-demarcated
   - invasive
3. Bone changes
   - remodeling
   - destruction

Solitary invasive mass with bone destruction = malignant (usually!)
Imaging Options

- CT: pattern of osseous change, calcified matrix
- MRI: map tumor vs. inflammatory tissue, intracranial/orbital extension, perineural spread
- PET/CT: nodal disease, distant mets
  - PITFALLS: perineural spread, not all primaries FDG avid! (particularly ACC)

  *Imaging studies are complementary, but MRI is necessary for precise mapping*

Ethmoid adenocarcinoma with sphenoid mucocele

2. SELECTED BENIGN AND MALIGNANT SN TUMORS

Inflammatory Polyps

- NOT neoplastic
- Heaped up mucosa
- Multiple > single
- When large, may expand/remodel bone
- May coexist with allergic fungal sinusitis

Inverted Papilloma

- Benign epithelial neoplasm, locally aggressive
- Bone expansion and/or erosion
- “Cerebriform” pattern on T2 and enhanced T1
- May harbor or degenerate to SCC (5%)

Recurrent Inverted Papilloma

- Osseous strut indicates site of origin, which must be resected
Juvenile Angiofibroma
• Adolescent males with epistaxis and nasal obstruction
• Enhancing masses with large internal flow voids
• Originate at sphenopalatine foramen, often widen PPF
• Locally aggressive, frequently invade skull base

Fibro-osseous/Cartilagenous Tumors: Fibrous Dysplasia
• CT: Ground glass 50%, homogenously dense 25%, cystic 25%
• MRI: Moderate enhancement, very low T2 signal
• Shape conforms to parent bone

SN Meningioma
• 2% of meningiomas are extracranial (orbit, PNS, mastoid, nasopharynx)
• Nasal cavity > sinuses
• Hyperostosis, enhancement, T2 dark

WHO Classification of SN Neoplasms (abbreviated) (2005)
• Epithelial
  – SCC
  – Adenocarcinoma
  – Adenoid cystic ca
  – Neuroendocrine tumors
  – SNUC
• Soft tissue tumors
  – Hemangiopericytoma
  – Rhabdomyosarcoma
• Lymphoproliferative
  – NHL
  – Plasmacytoma
• Tumors of bone and cartilage
  – Chondrosarcoma
  – Osteosarcoma
• Neuroectodermal
  – Esthesioneuroblastoma
  – Ewings sarcoma
  – Melanoma

Sinonasal SCC
• Most common sinonasal malignancy (55%)
• 75% sinuses (max >> ethmoid), 25% nasal cavity
• Aggressive mass with bone invasion, perineural tumor spread, adenopathy
• Relative low T2 signal, moderate enhancement

Why is this tumor NOT SCC?
• It’s in the nasal cavity (still could be SCC!)
• It has unusual density/signal characteristics
  – Bright on T1 (melanoma)
  – Bright on T2 (adenoca, chondrosarc)
  – Diffusion restriction (lymphoma)
  – Matrix (chondrosarce, esthesio)
• Demographics are wrong (young pts → rhabdo)
**Sinonasal Rhabdomyosarcoma**

- Rare tumor of **children and young adults**
- Alveolar > embryonal
- No specific imaging features

**Tumor Location**

- **Paranasal sinuses (70-80%)**
  - SCC (maxillary)
  - Adenocarcinoma (ethmoid)
- **Nasal cavity (20-30%)**
  - Esthesioneuroblastoma
  - SNUC
  - Lymphoma
  - Melanoma
  - Chondrosarcoma
  - (SCC)

**Sinonasal Adenocarcinoma**

- Predilection for **ethmoid** sinuses and nasal cavity
- Often **higher T2 signal than SCC**
- Salivary (e.g. adenoid cystic ca) and non-salivary (intestinal/non-intestinal) subtypes

**Esthesioneuroblastoma (Olfactory Neuroblastoma)**

- Superior nasal cavity mass, transcranial extension
- Expansion and invasion
- **Marginal cysts** along intracranial component
- Calcification reportedly common

**SNUC (Sinonasal Undifferentiated Ca)**

- Rare, high grade neuroendocrine tumor
- Aggressive local growth, regional/distant mets
- May be radiographically indistinguishable from SCC (but much less common)

**SMARCB1 (INI 1) Deficient Sinonasal Carcinoma**

- Newly described (2014) aggressive sinonasal malignancy
- Rhabdoid cytopathologic appearance
- Imaging features similar to SNUC, SCC
- ↑ incidence of calcification? (spiculated)
Sinonasal Lymphoma

- Non-Hodgkins: B, T, or NK/T cell types
- Lobular, expansile
- Bone remodeling or erosion
- Homogenous, hyperdense, relatively dark on T2
- Restricted diffusion

Sinonasal Melanoma

- Increased T1 and decreased T2 signal in melanotic subtype
- Amelanotic subtype has less specific appearance
- Very poor prognosis with <15% 5 year survival

Sinonasal Chondrosarcoma

- Often septal-based
- Bright on T2, heterogenous enhancement
- Chondroid matrix

3. PRE-TREATMENT MAPPING OF SINONASAL TUMORS

Key Issues in Tumor Mapping

1. Intracranial extension
   - Extradural/dural
   - Intradural
2. Orbital extension
   - Bone erosion
   - Periorbital invasion
   - Intracanal disease
3. Perineural extension
   - V2 (V1)
   - Cavernous sinus
4. Nodal metastases
   - Retropharyngeal
   - Upper jugular

Intracranial Extension

- Common with superior nasal cavity tumors (esthesioneuroblastoma, lymphoma, SNUC)
- Extradural/dural vs. intradural disease
- Parenchymal invasion heralded by enhancement (edema may reflect mass effect)

Define entire volume of disease
**Orbital Extension**

- Bony invasion alone does not necessitate enucleation
- Focal invasion of periorbitum but NOT of orbital fat may permit eye preservation
- Breach of the periorbitum:
  - intermediate signal
  - loss of normal fat signal between tumor and EOM

**Perineural Tumor Spread**

- Most commonly branches of trigeminal n. (V2)
- SCC, ACC, melanoma, lymphoma
- Thickening/enhancement of nerves
- Widening of foramina
- Assess cavernous sinuses

**Nodal Metastases**

- Upper jugular
- Retropharyngeal
- Facial
- Parotid

**5. POST-TREATMENT IMAGING SURVEILLANCE**

**Post-op Imaging**

- Surgical bed
  - Particular attention to flap margins
- Skull base foramina/cavernous sinus
  - Look for perineural tumor spread
- Regional nodes (RP, upper jugular)
- Occasional intracranial metastases

*PET/CT will miss PNTS and is useless if primary was not FDG avid!*

s/p resection maxillary adenoid cystic carcinoma

Temporals muscle flap
A few things to remember…

- SCC is overall most common sinonasal malignancy
- While there is much overlap, some tumors have distinguishing features (e.g. IC cysts in esthesio, high T1 signal in melanoma)
- The primary role of the radiologist is accurate tumor mapping!
- Look for intracranial, orbital, perineural and nodal extension

Thanks!