Nasal cavity and paranasal sinus malignancy

(For more topics, visit www.nayyarENT.com)

EPIDEMIOLOGY

- < 1% of all neoplasms
- 3% of tumors of upper aero digestive tract
- Incidence → 0.5-1/100,000/yr
- 5th-6th decade
- M:F → 2:1
- Avg delay between the first symptom and diagnosis → six mths
- Origin (Scott Brown)
  - Maxillary sinus → most common (55%)
  - Nasal cavity → 35%
  - Ethmoid sinuses → 9%
  - Frontal and sphenoid sinuses (1%)

AETIOLOGY

- Wood workers
  - 70 times increased incidence particularly in ethmoid
  - African mahogany most dangerous
  - Biologically active compounds in wood dust impair mucociliary clearance and predispose to carcinogenesis
  - Hardwood exposure → adenocarcinoma
  - Soft wood exposure → squamous cell carcinoma
- Nickel
  - Relative risk >250
  - Interval between exposure to nickel and tumor → 18 to 36 years
- Chromium
- Leather industry
- Polycyclic hydrocarbons
- Smoking → synergistic with wood dust
- Aflatoxin (found in certain foods and dust)
- Mustard gas
- Thorotrast (thorium dioxide used in paints for watch dials)
- Radiation
- Viral → EBV, HPV
- Use of snuff (cocaine)
- Genetic role suggested but not proven

**Ohngren line**

- Running from the medial canthus of orbit to angle of mandible
- Separates tumours into two groups
  - Those that developed above the line
  - Those that developed below it
- Ohngren suggested
  - Superiorly based cancers more aggressive and poorly differentiated
  - Tumours arising from below line more amenable to treatment
- With newer imaging & surgical techniques, no longer used now

**Lymphatic drainage**

- Lymphatic drainage of nose and paranasal sinuses → relatively scanty
- Two lymphatic pathways
  - Anterior
    - Anteroinferior part of nasal cavity and skin of vestibule
    - Drain to facial, parotid and submandibular lymph nodes - the first echelon nodes
    - These drain into the upper deep cervical chain
  - Posterior
    - Remainder of nose and the paranasal sinuses
    - Pathway which runs anterior to the Eustachian tube to first echelon nodes - the retropharyngeal lymph nodes
    - Further drain to upper deep cervical chain

**Patterns of Tumour Spread**

- Local spread
  - Tend to fill sinus cavity before eroding bony walls
  - Periosteum, perichondrium and dura seem to act as a temporary barriers
  - Bone of the antronasal wall, canine fossa and orbital floor very thin → easily destroyed
  - Only 25 percent of maxillary sinus carcinomas are contained within the antrum at time of presentation
- Regional spread
  - Lymphatic spread apparent in 25-35 % of patients at some time during the course of their disease
  - Only 10 % have nodal disease at time of presentation
  - Submandibular and jugulodigastric nodes most commonly involved
Bilateral lymph node involvement likely when tumor near midline

- Distant spread
  - Adenocarcinomas → 18%
  - Squamous cell carcinomas → 10%
  - Common sites → bone, brain, liver, lung, skin

<table>
<thead>
<tr>
<th>Table 186.1</th>
<th>Patterns of local spread.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary site</td>
<td>Anteriorly</td>
</tr>
<tr>
<td>Frontal sinus</td>
<td>Skin</td>
</tr>
<tr>
<td>Ethmoid sinus</td>
<td>Skin</td>
</tr>
<tr>
<td>Maxillary sinus</td>
<td>Cheek, skin</td>
</tr>
<tr>
<td>Sphenoid sinus</td>
<td>Ethmoid sinuses</td>
</tr>
<tr>
<td>Nasal cavities</td>
<td>Skin</td>
</tr>
</tbody>
</table>

**SYMPTOMS**
- Nasal: 50%
  - Obstruction, epistaxis, rhinorrhea
- Oral symptoms: 25-35%
  - Pain, trismus, alveolar ridge fullness, malocclusion, erosion
- Ocular: 25%
  - Epiphora, diplopia, proptosis
- Facial
  - Paresthesias, asymmetry
- Neck mass
- Ears
  - Hearing loss, serous otitis media

**PHYSICAL FINDINGS**
- Nasal, facial, or intraoral mass
  - Intranasal mass
    - Often necrotic, but polypoid mucosa may obscure
  - Facial swelling → antral tumor erodes into cheek
  - Widening of the upper alveolar ridge
  - Loose teeth
  - Palatal mass and ulceration
- Proptosis
- Cranial nerve deficits
  - CN II, III, IV, VI
  - CN V (V1 and V2)
- Complete H&N exam and Endoscopy

**Diagnostic Assessment**

- **CT scan**
  - Three-dimensional image of the lesion
  - Bone destruction, orbital & intracranial involvement
- **MRI**
  - Better soft tissue delineation
  - Ability to differentiate between tumor bulk and retained secretions
  - Combined with CT → for planning surgery for sinus neoplasms
- **Angiography**
  - If the lesion demonstrates enhancement during initial CT study
  - If it approximates carotid system
  - In evaluation of unusual tumors involving the sphenoid sinus and skull base
  - In vascular tumors → for assessment of tumor extent, feeding vessels and in combination with embolization
- **Ultrasound**
  - B-mode scanning → orbital masses
- **PET**
  - Follow-up after concomitant chemoradiation
  - Assessing presence of metastatic disease
- **Endoscopy and Biopsy**
  - Punch biopsy
  - Chances of bleeding
  - Tumors contained within the sinus cavities should be biopsied transnasally
- **Dental / prosthetic consultation**

**Workup for distant metastasis**

- CXR PA view
- USG abdomen

**Workup for surgery**

- Hb, TLC, DLC
- INR, Platelet count
- Bld Grouping
- Urine RE, ME
- BS F/PP
- LFT, RFT, Electrolytes
- ECG
- Lipid profile
<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T1</strong></td>
<td>Tumor limited to maxillary sinus mucosa with no erosion or destruction of bone</td>
</tr>
<tr>
<td><strong>T2</strong></td>
<td>Tumor causing bone erosion or destruction including extension into the hard palate and/or middle nasal meatus, except extension to posterior wall of maxillary sinus and pterygoid plates</td>
</tr>
<tr>
<td><strong>T3</strong></td>
<td>Tumor invades any of the following: bone of the posterior wall of maxillary sinus, subcutaneous tissues, floor or medial wall of orbit, pterygoid fossa, ethmoid sinuses</td>
</tr>
<tr>
<td><strong>T4a</strong></td>
<td>Moderately advanced local disease</td>
</tr>
<tr>
<td></td>
<td>Tumor invades anterior orbital contents, skin of cheek, pterygoid plates, infratemporal fossa, cribriform plate, sphenoid or frontal sinuses</td>
</tr>
<tr>
<td><strong>T4b</strong></td>
<td>Very advanced local disease</td>
</tr>
<tr>
<td></td>
<td>Tumor invades any of the following: orbital apex, dura, brain, middle cranial fossa, cranial nerves other than maxillary division of trigeminal nerve (V2), nasopharynx, or clivus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N0</strong></td>
<td>No regional lymph node metastasis</td>
</tr>
<tr>
<td><strong>N1</strong></td>
<td>Metastasis in a single ipsilateral lymph node, 3 cm or less in greatest dimension</td>
</tr>
<tr>
<td><strong>N2</strong></td>
<td>Metastasis in a single ipsilateral lymph node, more than 3 cm but not more than 6 cm in greatest dimension; or in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension; or in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension</td>
</tr>
<tr>
<td><strong>N2a</strong></td>
<td>Metastasis in a single ipsilateral lymph node, more than 3 cm but not more than 6 cm in greatest dimension</td>
</tr>
<tr>
<td><strong>N2b</strong></td>
<td>Metastasis in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension</td>
</tr>
<tr>
<td><strong>N2c</strong></td>
<td>Metastasis in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension</td>
</tr>
<tr>
<td><strong>N3</strong></td>
<td>Metastasis in a lymph node, more than 6 cm in greatest dimension</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M0</strong></td>
<td>No distant metastasis</td>
</tr>
<tr>
<td><strong>M1</strong></td>
<td>Distant metastasis</td>
</tr>
</tbody>
</table>
### Anatomic Stage/Prognostic Groups

<table>
<thead>
<tr>
<th>Stage</th>
<th>Tis/T</th>
<th>N0</th>
<th>M0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>T1</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage II</td>
<td>T2</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage III</td>
<td>T3</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>N1</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>N1</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>N1</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IV[A]</td>
<td>T4a</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T4a</td>
<td>N1</td>
<td>M0</td>
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<tr>
<td></td>
<td>T1</td>
<td>N2</td>
<td>M0</td>
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<tr>
<td></td>
<td>T2</td>
<td>N2</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>N2</td>
<td>M0</td>
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<tr>
<td>Stage IV[B]</td>
<td>T4b</td>
<td>Any N</td>
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</tr>
<tr>
<td></td>
<td>Any T</td>
<td>N3</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IV[C]</td>
<td>Any T</td>
<td>Any N</td>
<td>M1</td>
</tr>
</tbody>
</table>

### Histologic Grade (G)

- GX: Grade cannot be assessed
- G1: Well differentiated
- G2: Moderately differentiated
- G3: Poorly differentiated
- G4: Undifferentiated

(For more topics, visit [www.nayyarENT.com](http://www.nayyarENT.com))
Figure 186.4 TNM diagrams of maxillary sinus carcinoma (a) T1; (b) T2; (c+d) T3 (continued over).
(For more topics, visit www.nayyarENT.com)
Figure 186.5  TNM diagrams of ethmoid sinus carcinoma: (a) T1; (b) T2; (c) T3; (d) T4 (continued over).
TREATMENT

General principles

- Most patients have very advanced disease at presentation
- All investigations & accurate staging
- Choice between treatment for cure and palliation
- Options for patients potentially curable
  - Surgery
  - Radiotherapy
  - Chemoradiotherapy
  - Combinations
  - Infusion & perfusion techniques (see combined answer)

Management Algorithms (as per NCCN 2011 guidelines)

Maxillary carcinoma

For more topics, visit www.nayyarENT.com
**Ethmoidal Carcinoma**

<table>
<thead>
<tr>
<th>Clinical Presentation</th>
<th>Primary Treatment</th>
<th>Adjuvant Treatment</th>
<th>Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newly diagnosed; T1, T2</td>
<td>Surgical resection(^b) (preferred) or Definitive RT(^d)</td>
<td>RT(^d) or Observation(^g) for T1 only (category 2B) or Consider Chemo/RT(^c,d) (category 2B) if adverse features(^f)</td>
<td></td>
</tr>
<tr>
<td>Newly diagnosed; T3, T4a</td>
<td>Surgical resection(^b) (preferred) or Chemo/RT(^c,d)</td>
<td>RT(^d) or Consider chemo/RT(^c,d) (category 2B) if adverse features(^f)</td>
<td></td>
</tr>
<tr>
<td>Newly diagnosed, T4b or patient declines surgery</td>
<td>Chemo/RT(^c,d) or RT(^d) or Clinical trial (preferred)</td>
<td>RT(^d) or Chemo/RT(^c,d) (category 2B) if adverse features(^f)</td>
<td></td>
</tr>
<tr>
<td>Diagnosed after incomplete excision (eg, polyectomy, endoscopic procedure) and gross residual disease</td>
<td>Surgery(^b) (preferred), if feasible or RT(^d) or Chemo/RT(^c,d)</td>
<td>RT(^d) or Consider Chemo/RT(^c,d) (category 2B) if adverse features(^f)</td>
<td></td>
</tr>
<tr>
<td>Diagnosed after incomplete excision (eg, polyectomy, endoscopic procedure) and no residual disease on physical exam, imaging, and/or endoscopy</td>
<td>RT(^d) or Surgery(^b) if feasible (See newly diagnosed T1, T2)</td>
<td>RT(^d) or Observation(^g) for T1 only (category 2B)</td>
<td></td>
</tr>
</tbody>
</table>
Recurrent / Persistent disease

Surgical options

- External Ethmoidectomy
- Inferior Medial Maxillectomy
- Medial Maxillectomy
- Radical Maxillectomy
- Craniofacial Resections
- Extended Craniofacial Resection
- Minimally Invasive Approaches

Surgical approaches

- Endoscopic
- Lateral rhinotomy
- Transoral/transpalatal
- Midfacial degloving
- Weber-Fergusson
- Combined craniofacial approach
External Ethmoidectomy

- **Indications**
  - Removal of benign tumors of the ethmoidal region
  - Approach to biopsy and drainage for tumors of sphenethmoidal region and medial orbit

- **Bony Excision** → medial orbital wall and the ethmoidal labyrinth

- **Surgical Approach** → incision on the lateral wall of the nose

- **Benefits** → allows excellent cosmesis and preservation of functional tissue

- **Limitations**
  - For limited tumors (middle turbinate)
  - Tendency to form a fistula to nasal cavity on irradiation

Inferior Medial Maxillectomy

- **Indications**
  - Resection of medial wall of the antrum and inferior turbinate
  - Most often used for inverted papilloma

- **Bony Excision margins**
  - Laterally → vertical line dropped from the infraorbital foramen
  - Inferiorly → floor of the nose
  - Superiorly → lacrimal fossa and the middle meatus
  - Posteriorly → dorsal end of the inferior turbinate

- **Surgical Approach** → Lateral rhinotomy

- **Benefits**
  - Adequate exposure and resection for limited tumors
  - Preserve functional tissue
  - Provide a very acceptable cosmetic result

- **Limitations** → provides en bloc removal of limited area

Medial Maxillectomy

- **Indication** → larger benign or intermediate tumors involving the entire lateral nasal wall but without extension to the orbit, anterior cranial fossa, lateral maxilla, or alveolus

- **Bony Excision** → lateral nasal wall, including all turbinate tissue, and the contents of the ethmoid and maxillary sinuses

- **Surgical Approach** → Weber – Fergusson with Lynch extension and lip split

- **Bony cuts**
  - Removal of ant maxillary wall medial to infra orbital foramen
  - Orbital cut from inferior rim carried medially to lamina papyracea
  - Nasomaxillary suture line cut extending from cut 2 into pyriform aperture
  - Cut in lateral nasal wall near floor upto post wall of maxillary sinus
  - Vertical cut from post. nasal floor to post end of sup turbinate & post ethmoidal cells
- Benefit → en bloc resection with little cosmetic deformity
- Limitations → Removal of all turbinate tissue results in an abnormal nasal cavity, often requiring chronic management of crusting

**Total Maxillectomy**

- Indications → advanced carcinoma of maxilla
- Bony Excision → removal of maxilla along with nasal bone, the ethmoid sinus, and in some instances, the pterygoid plates
- Surgical Approach → Weber – Fergusson with a Defenbach (subciliary) extension
- Bony cuts
  - Zygomatico maxillary suture line
  - Orbital floor & medial orbital wall
  - Naso maxillary suture line
  - Hard palate
  - Pterygoid process
- Can be combined with orbital exenteration
- Preformed obturator → support for packing
- Benefits → When supplemented by irradiation, cure rate 30% (Cummings)
- Limitations → Even when orbital exenteration is included → inadequate resection if ethmoidal roof, orbital apex or pterygoid region involved
- Therefore, careful evaluation & planning required before surgery

**Craniofacial Frontoethmoidectomy**

- Indications → en bloc resection for tumors of the ethmoidal and frontal regions
- Bony Excision
  - Anterior cranium (including the frontal sinus)
  - Floor of anterior cranial fossa
  - Ethmoid
  - +/- Eye
  - Nasal septum
• Benefits
  o Provides direct visualization of the cribriform plate and fovea ethmoidalis
  o Potential for en bloc removal
  o Provides wide exposure to allow effective repair of dural tears
  o Allows intraoperative irradiation or placement of a radioactive implant

• Limitations ➔ If tumor extends to sphenoid sinus, cavernous or transdurally, en bloc resection cannot be achieved

Extended Craniofacial Resection

• Indications ➔ Extensive tumors involving the anterior skull base including pterygoid plates
• Bony Margins
  o Posterior limits
    ▪ Foramen ovale
    ▪ Foramen rotundum
    ▪ ICA
  o Remaining margins ➔ as for craniofacial frontoethmoidectomy and total maxillectomy
• Surgical Approach
  ▪ Bicoronal and anterior or lateral facial incisions
  ▪ Closure ➔ split-galea flap to cover dura
  o Team ➔ neurosurgeon + otolaryngologist
  o Benefits ➔ Thorough exposure and complete excision of otherwise unresectable tumors
  o Contraindications ➔ clear-cut pterygoid plate erosion and cranial nerve invasion

Supplemental Management in Extended Craniofacial Resection

• Intraoperative iodine seed implantation
  o Adenoid cystic carcinoma ➔ more beneficial
  o Undifferentiated carcinoma and squamous cell carcinoma ➔ less optimistic
• Reconstruction (for detailed reconstruction see maxillectomy presentation)
  o Radial forearm
  o Rectus abdominis musculocutaneous flaps
  o Latissimus dorsi flap

Radiotherapy

• Conventional
  o 66-70 Gy (2.0 Gy/fraction; daily Monday-Friday) in 7 weeks
  o Neck ➔ Uninvolved nodal stations: 44-64 Gy (1.6-2.0 Gy/fraction)
• Concurrent chemoradiotherapy
  o Primary and gross adenopathy: 70 Gy (2.0 Gy/fraction)
  o Neck ➔ Uninvolved nodal stations: 44-64-Gy (1.6-2.0 Gy/fraction)
• Postoperative RT
  o Primary 60 – 66 Gy (2.0 Gy / fraction)
Neck
- Involved nodal stations: 60-66 Gy (2.0 Gy/fraction)
- Uninvolved nodal station: 44-64 Gy (1.6-2.0 Gy/fraction)
- Preferred interval between resection and postoperative RT is ≤ 6 weeks

Chemotherapy
- Primary Systemic Therapy / Concurrent RT
  - Cisplatin alone (preferred) (category 1)
  - Cetuximab (category 1)
  - Carboplatin/paclitaxel (category 2B)
  - 5-FU/hydroxyurea
  - Cisplatin/paclitaxel
  - Cisplatin/infusional 5-FU
  - Carboplatin/infusional 5 FU
  - Carboplatin / paclitaxel
- Postoperative chemoradiation
  - Concurrent single agent cisplatin
  - 100 mg/m² every 3 wks x 3 doses
  - Tata memorial uses weekly doses

Palliative therapy
- Factors important for considering palliation
  - Patient's symptoms and impact on life
  - Extent of disease
  - Distant metastases +/-
  - Informed consent
- Some tumours have a long natural history
- Often possible to achieve significant periods of good quality survival
- With this in mind, some surgeons advocate local debulking of tumour with adjunctive radiotherapy as palliative treatment

PROGNOSIS
- Control (Scott Brown)
  - 50 % at 5 yrs
  - 31 % at 10 yrs
  - 21 % at 15 yrs

Pathology of PNS tumors
- Benign Neoplasms
  - Osteomas
  - Chondromas
  - Schwanomas
  - Neurofibromas
  - Ossifying Fibromas
  - Cementomas
  - Odontogenic tumours
- **Intermediate Neoplasms**
  - Inverted Papillomas
  - Meningiomas
  - Hemangiomas
  - Hemangiopericytoma

- **Malignant lesions**
  - Squamous cell carcinoma
  - Adenocarcinoma
  - Adenoid cystic carcinoma
  - Olfactory neuroblastoma
  - Sinonasal undifferentiated carcinoma
  - Lymphoma
  - Mucoepidermoid carcinoma
  - Melanoma
  - Osteogenic sarcoma
  - Fibrosarcoma
  - Chondrosarcoma
  - Rhabdomyosarcoma
  - Metastatic tumors

**Squamous cell carcinoma**

- Most common tumor (80%)
- Location:
  - Maxillary sinus (70%)
  - Nasal cavity (20%)
- 90% have local invasion by presentation
- Lymphatic drainage:
  - First echelon: retropharyngeal nodes
  - Second echelon: subdigastric nodes
- Surgical resection with postoperative radiation

**Adenocarcinoma**

- 2nd most common malignant tumor
- Present most often in the superior portions
- Strong association with occupational exposures
- High grade
  - Solid growth pattern with poorly defined margins
  - 30% present with metastasis
- Low grade
  - Uniform and glandular with less incidence of perineural invasion/metastasis
Adenoid Cystic Carcinoma

- 3rd most common site
- <5%
- Perineural spread
- Distant mets
- Despite aggressive surgical resection and radiotherapy, most grow insidiously
- Neck metastasis is rare and usually a sign of local failure
- Postoperative XRT is very important

Olfactory Neuroblastoma (Esthesioneuroblastoma)

- Originate from basal stem cells of neural crest origin.
- Peak at 20 and 50 yrs. <5%
- Kadish Classification
  - A: Confined to nasal cavity
  - B: Involving the paranasal cavity
  - C: Extending beyond these limits
  - D: With mets to neck or distant sites
- UCLA Staging system
  - T1: Tumor involving nasal cavity and/or paranasal sinus, excluding the sphenoid and superior most ethmoids
  - T2: Tumor involving the nasal cavity and/or paranasal sinus including sphenoid/cribriform plate
  - T3: Tumor extending into the orbit or anterior cranial fossa
  - T4: Tumor involving the brain
- Aggressive behavior
- Local failure: 50-75%
- Metastatic disease develops in 20-30%
- Treatment:
  - En bloc surgical resection with postoperative XRT

Lymphoma

- Non-Hodgkins type
- Treatment is by radiation, with or without chemotherapy
- Survival drops to 10% for recurrent lesions

(For more topics, visit www.nayyarENT.com)