Definitions

Four Categories
1. Carcinomas (epithelial origin)
2. Sarcomas (mesenchymal origin)
3. Hematopoietic origin
4. Metastases

Clinical Presentation of Malignant Lesions

- Onset of symptoms of malignancies is often rapid
- Prevalence of oral malignancies is low. Due to lack of experience, detection is often delayed. This results in larger tumors, metastases, and poorer prognosis
- Survival rates for oral cancers have not improved over the years. This is thought to be due to late diagnosis

The Role of Radiology

- Initial Diagnosis
- Spread of the lesion
- Size and location of the lesion for surgical planning

Definitions

- Malignancies are uncontrolled growths of tissue
- Primary tumors represent de novo tumors in their initial site
- Metastatic tumors originate from distant primary growths
- Malignancies are generally classified by tissue of origin

Clinical Presentation of Malignant Lesions

- Displaced or mobile teeth
- Ulceration
- Foul odor
- Swelling
- Paresthesia
- Dysesthesia
- Pain
- Dysgeusia (decreased taste)
- Dysphagia (difficulty swallowing)
- Dysphonia (difficulty speaking)
- Dysphasia (impaired speech)
- Exposed bone
- Poorly healing or non-healing surgical or trauma sites
- Sensory or neural deficits
- Weight loss
- Hemorrhage
Radiographic features of oral malignancies

**Location**
- Varies depending on the type.
  - Carcinomas: soft tissue locations
  - Sarcomas: mandible and posterior region of jaws
  - Metastatic lesions: common in the posterior mandible and maxilla and within the follicles of developing teeth

**Periphery and shape**
- Ill-defined border with lack of cortication and absence of encapsulation. Associated non-healing soft tissue ulceration and or swelling is highly suggestive
- Shape is generally irregular

**Internal Architecture**
- As most malignancies do not produce bone or stimulate the formation of reactive bone, internal aspect is typically radiolucent
- Lesions such as osteosarcomas produce frank sclerosis, whereas some tumors such as prostate and breast metastatic lesions can induce bone formation at distant sites

**Effects on adjacent structures**
- Ill-defined, invasive borders
- Bone destruction
- Destruction of cortical borders
- Soft tissue mass
- Invasion of PDL
- Widened PDL space

Adapted from White & Pharoah, fifth edition
Radiographic features of malignancies
Effects on adjacent structures

- Destruction of bone at apices
- Displacement of developing tooth

Adapted from White & Pharoah, fifth edition

Radiographic features of malignancies
Effects on adjacent structures

- Teeth appear to float due to bone destruction

Adapted from White & Pharoah, fifth edition

Radiographic features of malignancies: Effects on cortical bone

- Cortical bone destruction without periosteal reaction
- Laminated periosteal reaction + cortical bone destruction
- Codman's triangle
- Sunray or sunburst periosteal reaction

Adapted from White & Pharoah, fifth edition

Codman's triangle

- Codman's triangle is the radiographic appearance of the rim of new subperiosteal bone which forms when a lesion such as a tumor lifts the periosteum away from the bone.
- The small triangle of bone is seen at the advancing margin of the lesion.
- The three main causes for a Codman's triangle are:
  - Osteosarcoma
  - Ewing's sarcoma
  - Subperiosteal abscess
- Layering of the new bone may result in an "onion skin" appearance.

Source: http://www.gpnotebook.co.uk

Carcinomas
Lesions of Epithelial Origin

Squamous Cell Carcinoma
**Squamous Cell Carcinoma**

- Malignant tumor from surface epithelium
- Invades
  - Deeper soft tissue
  - Connective tissue
  - Underlying bone
  - Local and regional nodes
  - Metastases to liver, lung, and skeleton

**Squamous Cell Carcinoma**

Clinical Appearance

- Red, white, or mixed lesion
- Ulcerated
- Indurated or rolled borders
- Can be painful or painless
- Rubbery or hard lymph nodes that are “fixed” to underlying structures.
- Usually occurs in patients >50 years
- More common in males

**Location**

**Squamous Cell Carcinoma**

Radiographic features

- Location
  - Often on lateral border of the tongue
  - Therefore, it is seen radiographically in the posterior mandible
  - Lesions in lip and floor of the mouth may invade anterior mandible
  - Gingival lesions may initially mimic periodontal disease

**Squamous Cell Carcinoma**

Radiographic features

- Shape and Borders
  - Commonly irregular and ill-defined borders
  - Finger-like projections demonstrating invasion
  - Occasionally, the lesion may have smooth borders, indicating erosion
  - Pathologic fractures may occur. Sharp, thin edges may be evident

**Squamous Cell Carcinoma**

Radiographic features

- Internal architecture
  - Squamous cell carcinoma tends to be completely radiolucent. There may be trapped pieces of residual bone within the lesion
Squamous Cell Carcinoma

Radiographic features

- Effects on adjacent structures
  - Periodontal ligament space will initially appear to widen. Eventually, teeth will appear to “float” in the lesion, and may be displaced as lesion expands
  - Tumor may spread along the mandibular canal, giving a widened appearance
  - Adjacent cortical borders may be effaced (destroyed)

Images courtesy of Ashai University School of Dentistry
Squamous Cell Carcinoma

Soft tissue origin

Invasive from the floor of the mouth

Presurgical panoramic radiograph

Cropped panoramic radiograph

Originating in a cyst

- Uncommon lesion
- May arise from
  - Periapical inflammatory cysts
  - Residual cysts
  - Dentigerous cysts
  - Odontogenic keratocysts (OKC)

Clinical Features

- Pain
  - Dull
  - Several months duration
- Swelling
- Pathological fracture
- Regional lymphadenopathy
- Maxillary lesions may invade sinus

Case courtesy of Dr. Maano Milles, Dept of Oral and Maxillofacial Surgery UMDNJ
Squamous Cell Carcinoma
Originating in a cyst

Radiographic Features

- **Location**
  - Tooth-bearing areas
  - Most occur in the mandible
- **Shape and Borders**
  - Initially indistinguishable from a cyst.
  - Smooth, corticated and hydraulic
  - Advanced lesions are ill-defined, diffuse, and lack cortication

Squamous Cell Carcinoma
Originating in a cyst

Radiographic Features

- **Internal Architecture**
  - Entirely radiolucent
- **Effect on adjacent structures**
  - Destroys cortices and adjacent lamina dura of teeth.
  - Capable of destroying alveolar processes

Residual cyst with Squamous Cell Carcinoma

Cropped panoramic radiograph

Squamous Cell Carcinoma
Originating in bone

Residual cyst with Squamous Cell Carcinoma

Adapted from White & Pharoah, fifth edition

Squamous Cell Carcinoma
Originating in base of the tongue
Central Mucoepidermoid Carcinoma

Clinical Features
- Mimics benign lesions such as a cyst or tumor
- Painless swelling
- May displace teeth or cause asymmetry
- May cause tenderness or paresthesia
- More common in females

Central Mucoepidermoid Carcinoma

Radiographic Features
- Location
  - Twice as common in the mandible than the maxilla
  - Usually in the premolar or molar region
  - Occurs superior to the mandibular canal. This might indicate odontogenic origin

Central Mucoepidermoid Carcinoma

Radiographic Features
- Borders and shape
  - Unilocular or multilocular mass
  - Thick, corticated borders
- Internal architecture
  - Multilocular soap bubble appearance similar to ameloblastoma or odontogenic myxoma
  - Septae are from remodeled residual bone

Central Mucoepidermoid Carcinoma

Epithelial tumor arising in bone
- Possibly originates from pluripotential odontogenic epithelium or from the lining of a cyst
- Leaves cortical plates intact
Central Mucoepidermoid Carcinoma

Central Mucoepidermoid Carcinoma

Cropped panoramic radiograph

Case courtesy of the Korean Academy of Oral & Maxillofacial Radiology

Case courtesy of White & Pharoah, fifth edition

The boy is right. We must take a break.

Sarcomas
Lesions of Mesenchymal Origin

Osteosarcoma

Malignant neoplasm of bone
New bone is produced by the lesion (not by reactive bone formation of surrounding osteoclasts)
Three major types
1. Chondroblastic
2. Osteoblastic
3. Fibroblastic

Osteosarcoma
Osteosarcoma

Clinical Features
- Rare. Jaws account for only 7% of all osteosarcomas
- 2:1 Male: Female ratio
- Peak in 4th decade
- Initially reported due to swelling or bleeding

Osteosarcoma

Radiographic Features
- Location
  - More common in the mandible
  - Usually arises in the posterior mandible. The molar areas and ramus are most commonly affected
  - In maxilla, usually arises in the posterior. The ridge, sinus, and palate are most commonly affected

Osteosarcoma

Radiographic Features
- Borders and shape
  - Ill-defined
  - Radiolucent without capsule or surrounding osteosclerosis
  - If the periosteum is involved, sunray spicules (aka: “hair-on-end” trabeculae, or orthoradial striations) may be present

Osteosarcoma

Radiographic Features
- Internal architecture
  - May be radiolucent, mixed density, or completely opaque
  - May have varied osseous appearances, such as granular, cotton wool, wisps, etc. In all cases, normal trabeculation is lost

Osteosarcoma

Radiographic Features
- Effects on adjacent structures
  - Widening of the PDL
  - Destruction of cortices
  - May destroy or widen the cortex of the inferior alveolar canal
  - Codman’s triangles are seen

Images courtesy of Nagasaki University School of Dentistry
Osteosarcoma

Axial CT Bone window
Images courtesy of Nagasaki University School of Dentistry

Axial CT Soft tissue window
Images courtesy of Nagasaki University School of Dentistry

Osteosarcoma

Panoramic View
Images courtesy of Ashai University School of Dentistry

Cropped Panoramic View

Osteosarcoma

Osteosarcoma

Cropped Panoramic View
Osteosarcoma

Chondrosarcoma

Clinical Features
- Malignancy of cartilaginous origin
- Firm to hard bony mass of long duration
- Four subtypes
  1. Clear cell
  2. Dedifferentiated
  3. Myxoid
  4. Mesenchymal
- Occurs within the bone, peripheral to the bone, or, less commonly, in soft tissue
- Mean age: 47 yrs
- Affects males and females equally

Radiographic Features
- Location
  - Unusual in the facial bones. Accounts for only 10% of all cases
  - Occurs equally in maxilla and mandible near cartilage
  - Maxillary lesions tend toward the anterior, while mandibular lesions occur in the coronoid process, head of the condyle and neck, and sometimes in the mandibular symphysis
- Borders and Shape
  - Round, ovoid, or lobulated
  - Borders can range from smooth and well corticated to indistinct
  - If the periosteum is involved, sunray spicules (aka: “hair-on-end” trabeculae, or orthoradial striations)
- Internal architecture
  - May appear as multilocular lucencies to highly calcified lesions. Usual appearance is mixed density
  - Radiographic appearance – may be “flocculent” (snow-like)
  - “Moth eaten appearance” may be seen, amid islands of unaffected bone
- Effects on adjacent structures
  - Expand cortical boundaries due to slow growth
  - Can remodel condyle and glenoid fossa
  - Widened PDL and lack of lamina dura of associated teeth
Chondrosarcoma

Radiographic Features
- In general, chondrosarcomas share the general radiographic features of malignant neoplasms

Chondrosarcoma

Differential Diagnosis
- Osteosarcoma
- Benign fibro osseous lesions
- Odontogenic myxoma
- Fibroma
- Osteoma
- Ameloblastoma
- Central bone malignancies

Chondrosarcoma

Ewing’s Sarcoma

Clinical Features
- Rare in Jaws
- Generally found in long bones
- Origin is uncertain
- Most common in second decade of life
- 2:1 M:F ratio

Ewing’s Sarcoma

Distribution of cases
Ewing’s Sarcoma

**Radiographic Features**

- **Location**
  - 2:1 mandibular to maxillary cases
  - Found in posterior
  - Lesions start in marrow spaces and expand to involve cortices

- **Shape and Borders**
  - Poorly demarcated
  - Non-corticated borders
  - There is no typical shape to lesions of Ewing’s sarcoma

- **Internal Architecture**
  - Radiolucent

- **Effects on adjacent structures**
  - May stimulate the periosteum to lay down new bone in sunray pattern or Codman’s triangles
  - Will destroy cortices of normal anatomy such as lamina dura of teeth
Ewing's Sarcoma

Fibrosarcoma

Composed of malignant fibroblasts that produce collagen and elastin
Unknown etiology
May arise in tissues that have been irradiated

Fibrosarcoma

Clinical Features
- M=F
- Generally occurs in 4th decade of life
- Slowly to rapidly enlarging mass
- If entirely within bone, the lesion is often painful
- May exit bone and invade soft tissue, or may begin peripherally

Radiographic Features
- Location
  - Mandible
  - Premolar and molar region
- Borders and Shape
  - Ill-defined, ragged borders
  - Poorly demarcated and non-corticated
  - Non-encapsulated

Fibrosarcoma

Radiographic Features
- Internal Architecture
  - Usually radiolucent
  - May include reactive bone formation
- Effects on adjacent structure
  - Destruction
    - Alveolar cortices
    - Inferior cortex of the mandible
    - Follicular cortices
    - Floor of the maxillary sinus
  - Displacement of teeth (rather than resorption)
**Fibrosarcoma**

- Malignant neoplasm of plasma cells
- Most common malignancy of bone in adults

**Hematopoietic Origin**

- M+F ratio
- Average age 60 yrs

**Multiple Myeloma**

- Malignant neoplasm of plasma cells
- Most common malignancy of bone in adults

**Clinical features**

- M+F ratio
- Average age 60 yrs

**Radiographic features**

- Location
  - Uncommon in the jaws
  - More frequent in the mandible than the maxilla
  - In the mandible, usually found in the posterior body and ramus
  - In the maxilla, it is usually found in posterior areas

- Shape and Borders
  - Well-defined, “punched out” lesions
  - Non-corticated borders
  - No bone reaction seen
  - Some lesions have ragged borders, although most are round or ovoid
Multiple Myeloma

Radiographic features

- Internal architecture
  - No apparent internal architecture
  - Uniformly radiolucent appearance
- Effects on adjacent structures
  - Teeth may appear excessively opaque, due to the radiolucent appearance of demineralized bone
  - Lamina dura may be lost, along with other cortices
  - Cortical borders may be effaced

Non-Hodgkin’s Lymphoma

- Refers to a family of tumors
- Composed of malignant cells of the lymphatic system
Non-Hodgkin’s Lymphoma

Clinical features
- Occurs in all age groups, but is uncommon in first decade
- Teeth may become mobile as bone is lost
- Patients may feel unwell and lose weight
- Night sweats are a common pathognomonic feature of lymphoma

Radiographic features
- Location
  - Lesions of the head and neck occur in the lymph nodes
  - Extranodal lesions are found in the maxillary sinus, posterior mandible, and maxilla

Shape and Borders
- Initial lesions are shaped like the host bone
- Long standing lesions can destroy the cortices of the bone
- Borders are poorly-defined and demonstrate invasive processes
- Lesions in spaces such as the maxillary sinus may have a smooth border

Internal architecture
- Uniformly radiolucent

Effects on adjacent structures
- May efface the walls of the maxillary sinus
- Lymphomas grow in the PDL space of teeth
- May efface the cortices of the follicles of the developing teeth and displace them superiorly

Lymphoma involving the maxillary sinus

Lymphoma v. Leukemia

Case courtesy of the KAOMFR
Metastatic Lesions

- Metastatic tumors are foci of malignant disease that originated in a distant primary tumor
- Usual pathway is through the bloodstream
- Metastases located in the jaws generally arise from primary tumors located below the clavicles
- Usually, the primary has been discovered prior to the discovery of jaw metastases

Metastatic Lesions

- Common type of primary tumor is carcinoma (epithelial origin)
- Common primary sites include:
  - Breast
  - Kidney
  - Lung
  - Colon
  - Rectum
  - Prostate
  - Thyroid
  - Stomach
  - Melanoma
  - Testes
  - Bladder
  - Ovary
  - Cervix
**Metastatic Lesions**

**Clinical Features**
- Most common in 5th to 7th decade of life
- Complaints may include:
  - Pain
  - Numbness
  - Paresthesia
  - Bleeding
  - Pathologic fracture of the mandible

**Radiographic Features**
- Location
  - Posterior regions of the jaws
  - More common in:
    - mandible > maxilla > maxillary sinus > anterior hard palate > mandibular condyle
  - Metastases may be bilateral
  - Lesions may be located in the periodontal ligament space. They may be confused with periodontal or apical inflammatory lesions

- Borders and Shape
  - Moderately well-demarcated
  - Non-corticated borders
  - May also have ill-defined, invasive borders
  - Polymorphous in shape (i.e.: irregular)

- Internal architecture
  - Lesions are generally lucent
  - Normal trabeculation may be seen, interspersed with radiolucent areas, representing osteolysis. (bone destruction)
  - May be multiple lesions, which may later coalesce

- Effects on adjacent structures
  - Effacement of the lamina dura
  - Widening of the PDL space
  - Periosteal reaction. May perforate cortices and form a soft tissue mass extraorally or intraorally
  - Teeth may “float” in a soft tissue mass and may be displaced
Metastatic bone lesions

Metastatic Lesions

Metastatic bone lesions

A = from breast ca, B = from renal cell cal
C and D = lesions from gastric ca

Metastatic Lesions

Age Distribution of Common Primary Tumors of Bone

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<th>Age group</th>
<th>Most common benign lesions</th>
<th>Most common malignant tumors</th>
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<td>Ewing's sarcoma, leukemia</td>
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<td>eosinophilic granuloma</td>
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From: [http://www.umidj.edu/tutorweb/introductory.htm](http://www.umidj.edu/tutorweb/introductory.htm)

Part Four: Time and Eternity

XXVII

BECAUSE I could not stop for Death,
He kindly stopped for me;
The carriage held but just ourselves:
And Immortality.

We slowly drove, he knew no haste,
And I had put away
My labor, and my leisure too,
For his civility.

We passed the school where children played
At wrestling in a ring;
We passed the fields of gazing grain,
We passed the setting sun.

We paused before a house that seemed
A swelling of the ground;
The roof was scarcely visible,
The cornice but a mound.

Since then 'tis centuries; but each
Feels shorter than the day
I first surmised the horses' heads
Were toward eternity.

Emily Dickinson