Suprahyoid Neck Lesions

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Objectives

• To introduce “spatial” concept of neck anatomy with imaging correlation
• To review spaces of suprahyoid neck
• To present imaging features of variety of SHN lesions

Illustrations Courtesy of Harnsberger, DI: Head & Neck, 2004
Spaces of the Suprahyoid Neck
Spatial Approach

- Superficial, middle, and deep layers of deep cervical fascia define spaces
- Fascial layers act as barriers to disease spread between spaces
- Fascial layers cannot be seen at imaging
Diagnosing Pathology on Imaging Studies Using Spatial Approach

• Assign space of origin
  • Epicenter of lesion
  • Displacement pattern of adjacent anatomy
• What tissues normally live in each space?
• Imaging features of lesion
• Generate concise differential dx
Spaces of Suprahyoid Neck

- Suprahyoid Neck
  - Parapharyngeal
  - Pharyngeal Mucosal
  - Parotid
  - Masticator
  - Carotid
  - Retropharyngeal
  - Perivertebral
    - Prevertebral
    - Paraspinous
  - Oral Cavity
    - Submandibular
    - Sublingual
Space = Pathology

- Diagnostic challenge is often to correctly assign center of lesion
  - Imaging appearance
  - Clinical behavior
- Tumor “mapping” of note for space-specific lesions per AJCC criteria
Pharyngeal Mucosal Space (PMS)

- Contents
  - Mucosa
  - Waldeyer’s ring
  - Salivary rests
  - Salpingopharyngeus, constrictor, and levator veli palatini muscles
  - Cartilaginous end of eustachian tube
Pharyngeal Mucosal Space

Nasopharynx

Oropharynx
Pharyngeal Mucosal Space

Waldeyer’s Ring

Akesson; p 397
Pathology of PMS

- **Inflammatory**
  - Adenoidal HP
  - Tonsillitis
  - Tonsillar abscess

- **Congenital**
  - Tornwaldt cyst

- **Neoplastic**
  - SCCa
  - NHL
  - Salivary malignancies
Pharyngeal Mucosal Space

Tonsillar Abscess

Tornwaldt Cyst
Pharyngeal Mucosal Space
Nasopharyngeal Squamous Carcinoma
Pharyngeal Mucosal Space
Nasopharyngeal SCCa
Parapharyngeal Space (PPS)

- Contents
  - Fat
  - V3 branches
  - Internal maxillary and ascending pharyngeal artery
  - Venous plexus
  - Minor salivary rests
Parapharyngeal Space Lesions

- **Pseudomasses**
  - Pterygoid venous plexus

- **Primary**
  - Minor salivary tumors
  - Venolymphatic malformations
  - Rare BCC

- **Secondary**
  - Disease from any contiguous space
Primary vs. Secondary PPS Lesions
Parapharyngeal Region Lesions

- Parotid Space
  - BMT
  - ACCa
  - Mucoep Ca

- Carotid Space
  - Paraganglioma
  - Nerve Sheath Tumor
  - Pseudoaneurysm

- Pharyngeal Mucosal Space
  - SCCa
  - Lymphoma
  - Salivary Ca
Parapharyngeal Region Lesions

- Deep Lobe Parotid BMT
- Vagal Schwannoma
- Nasopharyngeal SCCa
Pleomorphic Adenoma

- **CT**
  - Often homogeneous soft tissue attenuation
  - Variable enhancement
- **MR**
  - High signal on T2
  - Small tumors are homogeneous
  - When large may be more heterogeneous
  - “Bosselated” shape
Pleomorphic Adenoma
Pleomorphic Adenoma
Pleomorphic Adenoma

“Bosselated appearance”
T2 (relatively) Homogeneous Hyperintensity (CSF)
Other Pathology of PPS

- Rare BCC
- Rare venolymphatic or lymphatic malformation
- Remember CN V tumors
- Disease from OTHER SPACES
Venous Malformation
Rhabdomyosarcoma
Rhabdomyosarcoma
Parotid Space (PS)

- **Contents**
  - Parotid gland
  - Facial nerve (VII)
  - Retromandibular vein
  - External carotid artery
  - Parotid lymph nodes
General Rules Regarding Parotid Lesions

- Infiltrative/poorly marginated lesions are bad
- Well defined lesions are not all good
- Bright on T2 is good
- Dark on T2 is usually bad
- NB: CN VII paralysis is bad
Parotid Space Lesions

- **Congenital**
  - 1st BCC
  - Hemangioma

- **Inflammatory**
  - Parotitis
  - Sarcoidosis
  - Sjogren syndrome
  - BLELs

- **Neoplastic**
  - Benign parenchymal / CN7
  - Malignant
    - Primary salivary tumors
    - Metastatic
• **1\textsuperscript{st} BCC**
  • Failure of obliteration of portion of 1\textsuperscript{st} apparatus
  • 1\textsuperscript{st} apparatus ectoderm forms EAC and outer TM
  • May communicate with EAC at bony-cart jxn
Parotid Space

Infectious / Inflammatory

Mumps

Sialolithiasis

Sarcoid
Parotid Space
Infectious / Inflammatory

- **Sjogrens Syndrome**
  - Systemic autoimmune exocrinopathy
  - 2\(^{nd}\) most common AI D/O after RA
  - Destroys salivary and lacrimal tissue
  - May be complicated by NHL
  - Enlarged parotids with solid and cystic lesions and Ca++
Parotid Space
Infectious / Inflammatory

• BLELs
  • AIDS-related parotid cysts
  • 5% of HIV pts devp BLELs
  • Cystic and solid masses
  • Look for cervical LN and PMS lymphoid HP
Parotid Space
Neoplastic - Benign

- Pleomorphic Adenoma (BMT)
  - Most common parotid mass (80%)
  - 80% arise in parotids
  - 80% in superficial portion
  - Multifocal if recurrent
  - Malignant transformation in 15% if untreated
    - “Carcinoma ex pleomorphic adenoma”
Pleomorphic Adenoma: Deep Lobe of Parotid

NO FAT!!!
Parotid Space
Neoplastic - Malignant

- **Primary**
  - Mucoepidermoid
  - Adenoid cystic
  - Acinic cell
  - Look for CN 7 PNTS!

- **Metastatic**
  - Periauricular Ca and melanoma
  - NHL
  - Systemic mets
Parotid Space
Neoplastic - Malignant

Adenoid Cystic Ca with CN7 PNTS
Masticator Space (MS)

**Contents**
- masticatory muscles
- ramus / post body of mandible
- V3
  - motor branches
  - inferior alveolar nerve
- inferior alveolar art & vein
Masticator Space Lesions

- **Congenital**
  - Hemangioma
  - Lymphatic malformation
- **Inflammatory/Infectious**
  - Odontogenic abscess
- **Fibro-osseous lesions**
- **Neoplastic**
  - Sarcomas
  - NHL
  - Metastases
  - V3 PNTS
Masticator Space
Inflammatory

- Odontogenic abscess
  - From molar tooth infection or following dental procedure
  - Adjacent to posterior body and ramus
  - 2\textsuperscript{nd} or 3\textsuperscript{rd} molar infection
  - +/- Osteomyelitis
Masticator Space
Inflammatory

Odontogenic Abscess
Masticator Space

Neoplastic

- Sarcomas
  - Osteosarcoma
  - Chondrosarcoma
  - Rhabdomyosarcoma
  - Synovial sarcoma
  - Leiomyosarcoma
  - Ewing sarcoma
Masticator Space
Neoplastic – Metastatic Disease
Masticator Space
Perineural V3 Tumor
Masticator Space

Bigger Example of V3 Disease

October 2002

February 2006

Case courtesy of Michelle Michel MD
Masticator Space

V3 PNTS
Masticator Space
V3 PNTS
Carotid Space (CS)

- **Contents**
  - CCA / ICA
  - Internal jugular vein
  - CNs 9, 10, 11, 12
  - Sympathetic plexus
  - Complex fascial enclosure
Carotid Space Lesions

- **Vascular**
  - IJ thrombosis
  - ICA aneurysm, thrombosis, dissection

- **Lymph nodes**
  - Hyperplastic
  - SCCa
  - NHL

- **Neoplastic**
  - Paragangliomas
  - Nerve sheath tumors

Cases courtesy Mauricio Castillo, MD
Carotid Space
Neoplastic

- **Paragangliomas**
  - Arise from glomus bodies of neural crest origin
  - Sporadic and familial forms
  - Multiplicity ↑ in familial
    - **Carotid Body Tumor**
      - Most common location
        - (60-70%)
      - More frequent at high altitudes
    - **Glomus Vagale**
      - Rarest site
      - 2.5% of all
Carotid Space

Carotid Body Paraganglioma

Bonus Glomus Jugulare!

CBT
Carotid Space
Glomus Vagale Paraganglioma

Bonus CBTs!
Carotid Space
Paragangliomas – Vascular Displacement

“Lyre” sign of CBT

Anterior displacement of GVP
Nerve Sheath Tumors
- Benign tumor of CN
- Schwannoma vs. neurofibroma
- Usually 2-8 cm when detected
- SHN > IHN
  - NP (CN 9-12)
  - OP to arch (CN 10)
- Fusiform, variably enhancing mass without flow voids
Carotid Space
Nerve Sheath Tumor
The Posterior Spaces
Retropharyngeal, Danger, Perivertebral
Fascial Boundaries

- Middle layer of deep cervical fascia
  - RPS between BPF and alar fascia
- Deep layer of deep cervical fascia
  - Alar fascia
    - Danger space between alar and PV fascia
  - Prevertebral fascia
    - Anterior boundary of PVS
The Posterior Spaces
Retropharyngeal, Danger, Prevertebral

- **RPS**
  - Skull base to C6-T4 level

- **Danger**
  - Skull base to above diaphragm

- **Prevertebral**
  - Skull base to coccyx
Retropharyngeal Space (RPS)

- **Contents**
  - Fat
  - Lymph nodes
    - Lateral (Rouvier)
      - Only in SHN
      - $< 1 \text{ cm}$
      - Common in younger patients
    - Medial
      - NP to HP (hyoid)
      - Involved in DTC
Retropharyngeal Space Pathology

- **Pseudomasses**
  - Tortuous, medial carotids
  - Edema or lymph fluid
  - Pseudomeningocele

- **Infectious/Inflammatory**
  - Cellulitis
  - Reactive / suppurative nodes
  - Abscess

- **Neoplasms**
  - Primary
  - Secondary
Retropharyngeal Space
Infectious/Inflammatory

- Reactive adenopathy
  - Benign enlargement
  - Look for other neck nodes
  - Usually < 1cm; round
- Suppurative adenopathy
  - RPS adenitis/intranodal abscess
  - Evaluate ICA and IJ patency
Retropharyngeal Space
Infectious/Inflammatory

- RPS Abscess
  - Tense fluid collection in RPS
  - Variable wall enhancement
  - Presence of gas
- Be sure to image inferior extent

Courtesy Bernadette Koch, MD
Retropharyngeal Space
Metastatic Nodal Disease

- Most are SCCa
- NP most common primary site (75% with nodes at Dx)
  - Often heterogeneous
- Lymphoma nodes are often uniform
- Papillary thyroid Ca: cystic, Ca++, enhance intensely
The Perivertebral Space (PVS)

Contents

- **Prevertebral**
  - Longus colli & capitis
  - Scalene muscles
  - Brachial plexus roots
  - Phrenic nerve
  - Vertebral artery and vein
  - Vertebral body

- **Paraspinal**
  - Muscles
  - Posterior vertebral elements

Grants Atlas of Anatomy
Perivertebral Space Lesions

- **Pseudotumors**
  - Osteophytes / discs
- **Vascular**
  - Vertebral aneurysms / dissection
- **Infection / Inflammation**
  - Vertebral osteomyelitis
  - Acute calcific tendonitis
- **Neoplastic**
Perivertebral Space
Acute Calcific Prevertebral Tendonitis

- Adults 30-60 years
- Crystal deposition and inflammatory tendonitis
  - Stiff neck, sore throat, no fever or hx of trauma, infection or dental disease
  - Ca+ of longus colli tendons at C1-2
- Associated RPS effusion
Perivertebral Space
Acute Calcific Prevertebral Tendonitis
Perivertebral Space Neoplasms

• **Benign**
  - Schwannoma
  - Vertebral bony tumors
  - Mesenchymal soft tissue tumors (lipoma)

• **Malignant**
  - Chordoma
  - Metastases
    - Hematogenous
    - Direct invasion
  - NHL
  - Vertebral primary malignant tumors

Paraspinous Lipoma
Perivertebral Space
Metastatic Disease
A Key Point for Each Space

- **PPS**
  - Predominantly fat containing space contiguous with SMS
  - Largely benign mixed tumors – distinguish from parotid lesion
- **PMS**
  - Most cancers are indistinguishable at imaging
  - Clinicians own this space; radiology looks deep to it
- **PS**
  - Cannot reliably confirm benign vs. malignant with imaging
- **MS**
  - Look for PNTS along V3 in patients with OC malignancies
  - Largely odontogenic lesions
A Key Point for Each Space

- CS
  - All 3 fascial layers contribute to sheath
  - Extends from skull base to mediastinum
  - Paragangliomas and PNS tumors are most common neoplasms
- RPS
  - Lesions lateralize in SHN
  - Be sure to evaluate inferior extent of disease
- PVS
  - Look for longus colli Ca++ at C1-2 if RPS edema seen
  - Epidural spread is common with prevertebral lesions