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## Tumors of the Parapharyngeal Space

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Otorhinolaryngology –  
Head and Neck Surgery

## Anatomy

- Understanding the anatomy of the parapharyngeal space is the key to understanding surgery of the parapharyngeal space
- Seems difficult to characterize the anatomy of the PPS but its actually really easy

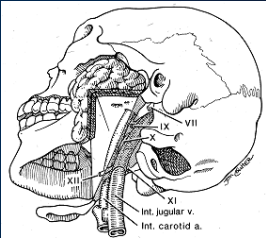


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Li et al. Surg Radiol Anat. 2004

## Anatomy

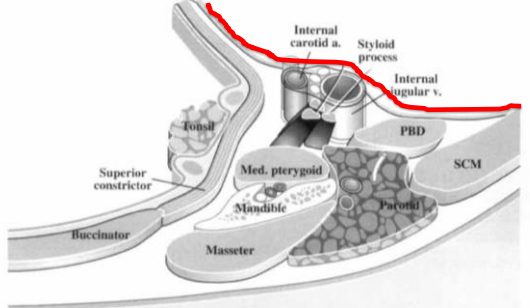
- Potential space invested by various layers of the deep cervical fascia
- Inverted triangle
- Base at base of skull at the petrous temporal bone
- Apex at the greater cornu hyoid bone



Cancer of the Head and Neck Myers, Suen, Myers, Hanna

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Internal carotid a. Styloid process  
Internal jugular v.  
Tonsil PBD SCM  
Superior constrictor  
Buccinator Med. pterygoid  
Mandible Parotid  
Masseter

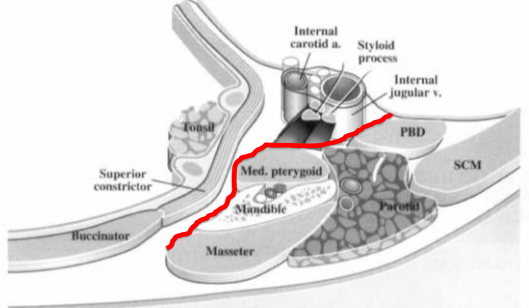
### Posterior boundary

- prevertebral fascia, prevertebral muscles and vertebrae

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Miller et al. Head and Neck 1996

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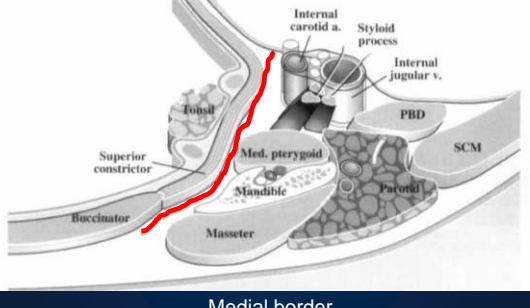
### Lateral border

- posterior belly of the digastric muscle, the mandible (ascending ramus, coronoid process and condylar head), the pterygoid muscles and their fascia

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### Medial border

- buccopharyngeal fascia covering the superior constrictor muscle.

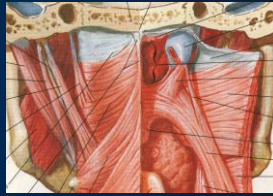
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## Anatomy

- Near the skull base the superior constrictor is often dehiscent
- The pharyngobasilar fascia forms the medial wall of the PPS

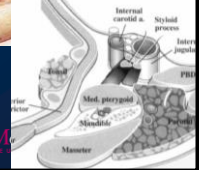
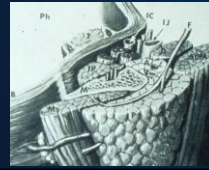
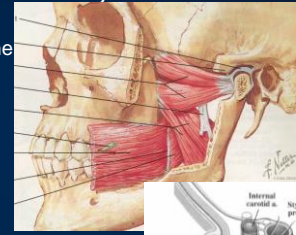


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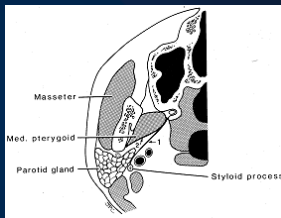
## Anatomy

- Anterior border is the fascia of the pterygoids and the pterygomandibular raphe



## Anatomy

- Classic teaching is that the PPS is divided by the styloid process into the prestyloid space and the poststyloid space



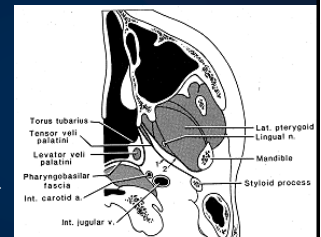
Cancer of the Head and Neck Myers, Suen, Myers, Hanna

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## Anatomy

- Fascia of the tensor veli palatini extends from the styloid process up to the skull base.
- It is this fascia that actually divides the parapharyngeal space.



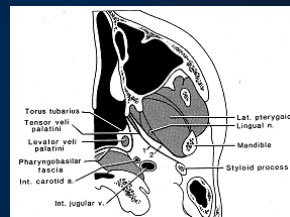
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## Anatomy

- Prestyloid = Anterolateral
- Poststyloid = Posteromedial



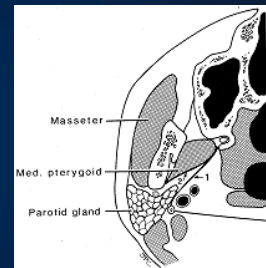
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## Contents of Prestyloid Space

- Potential space
- Fat, lymph nodes, loose connective tissue, minor arteries and veins, and nerves
- The deep lobe of the parotid bulges variably into the prestyloid space



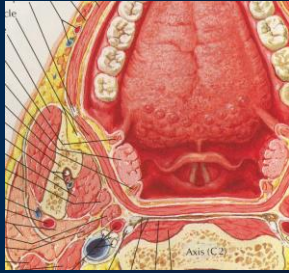
Cancer of the Head and Neck Myers, Suen, Myers, Hanna

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## Contents of Poststyloid Space

- Carotid sheath
  - the carotid artery, jugular vein, vagus nerve
- Cranial nerves IX, XI, XII



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## Presentation

- Symptoms
  - Vary greatly depending on both the type of tumor and its location
  - Can help determine both the location and the malignant potential of the tumor
- Benign tumors
  - Mass effects
- Malignant lesions
  - Functional deficits due to invasion

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## Symptoms

### Benign

- None
- Pharyngeal mass
- Neck mass
- Dysphagia
- Hoarseness
- FBS
- Pain
- Hearing loss

### Malignant

- Pain
- Trismus
- Otagia
- Pharyngeal mass
- Neck mass
- Dysphagia
- Hoarseness
- FBS
- Hearing loss

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## Physical Findings

### Benign

- Pharyngeal mass
- Neck mass
- Parotid mass
- Cranial nerve defect
- Horner's

### Malignant

- Pharyngeal mass
- **CN Defect**
- **Trismus**
- Neck mass
- Parotid mass
- Horner's

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## Tumor Location

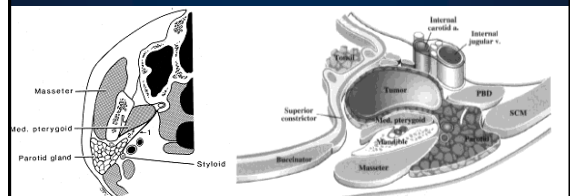
- Consistent relationship between location and pathology
- Prestyloid PPS lesions mostly salivary
- Poststyloid PPS lesion mostly neural
- Imaging can determine location of lesion (pre vs. post styloid) and hence likely pathology

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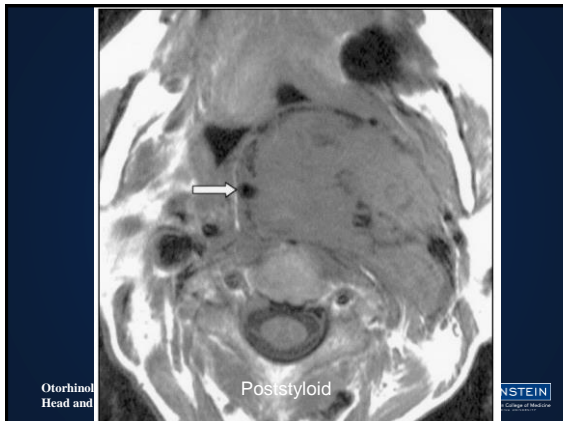
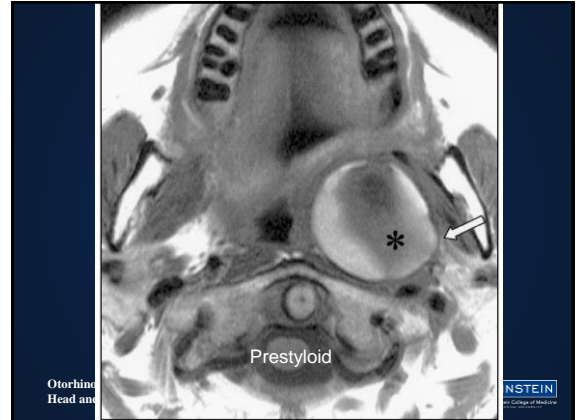
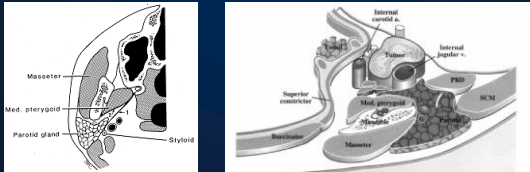
## Prestyloid PPS

- Lesions are anterior to the carotid artery and posterior to the medial pterygoid
- The fat of the prestyloid PPS is compressed upon the medial edge of the tumor



## Poststyloid PPS

- Lesions almost always arise from neural elements located posterior to the carotid artery
- The carotid is displaced anteriorly
- The parapharyngeal fat is pushed anteriorly and laterally by a poststyloid lesion



## Angiography

- Most commonly used for post styloid lesions
- Gold standard for relationship to great vessels
- Main utility is for embolization
- Most people recommend embolization of paragangliomas > 2 CM

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## FNA

- Not frequently used
  - Radiology and symptoms often yield diagnosis
  - Potential for bleeding with paragangliomas
- More useful if the tumor is suspicious for malignancy
- Can be done using CT guidance

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## PPS Tumors

- Neoplasm of the PPS account for 0.5% of H+N neoplasms
- Mean age upper 40's
- 60-70% women
- 80% benign
- Most are salivary or neurogenic
- Primary, metastasis, direct extension

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Miller et al H+N 1996



## Primary PPS Tumors

- Salivary 40-50%
- Neurogenic 20-30%
- Miscellaneous 20-30%

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## Primary PPS Tumors

- Salivary 40-50%
  - 80% benign
  - 20% malignant
  - Almost always prestyloid
  - Vast majority are pleomorphic adenoma
    - Deep lobe PA
    - Minor salivary PA
  - Mucoepidermoid CA most common malignant

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## Neurogenic Tumors

- 3 main types
  - Schwannomas
  - Parangliomas
  - Neurofibromas
  - Location is almost always poststyloid

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## Primary PPS Tumors

- Schwannoma
  - Most common neurogenic neoplasm in most studies
  - Arises from neuroectodermal sheath of peripheral nerve
  - Vagus and sympathetic chain most common
    - V,IX,X,XI,XII
  - Benign, slow growing
  - <1% malignant
  - Nerve often unaffected
    - Depending on location of origin within the nerve it can be dissected free from nerve

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## Primary PPS Tumors

- Paranglioma
  - Vagal Paranglioma
    - Often present high in the neck
  - Carotid body tumor
    - Only involve the parapharyngeal space if very large

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## Primary PPS Tumors

- Neurofibroma
  - Originates from schwann cells
  - Rarely encapsulated
  - Nerve fibers are within tumor
  - Often associated with von Recklinghausen's disease
  - Risk of malignancy is higher in these patients
  - Requires sacrifice of nerve

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## Primary PPS Tumors

- Other 20-30%
  - Hemangioma
  - Sarcoma
  - Lymphoma
  - Lipoma
  - Branchial cleft cyst
  - Castleman's disease
  - Meningioma

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## Treatment

- Surgery is mainstay of treatment
- Radiation therapy
- Observation
- Unlike most H+N tumors key is preventing morbidity not mortality
- Rehabilitation

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Evanson LJ, H+N 1998



## Observation

- Paragangliomas grow 1-1.5 mm/year
- 60% of masses increased 20% over 4 year period
- Useful in patients with significant co-morbidities
- Especially useful in patients with partial cranial neuropathies
  - Why?

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## Radiation

- Limited Role
- 90% local control at 5 years
- Mostly stops growth
- Useful in patients who are not good surgical candidates and lesion is growing

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## Surgical Approaches

- Transoral
- Transcervical submandibular
- Transcervical transparotid
- Mandibulotomy
- Infratemporal fossa/Transmastoid/Craniofacial

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## Transoral Approach

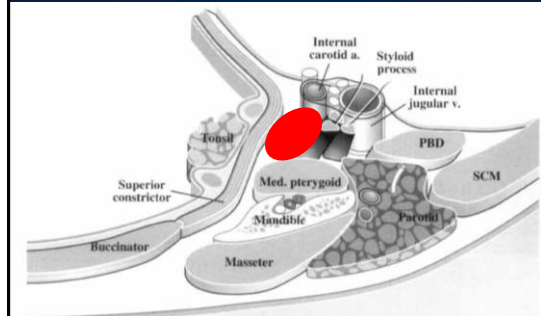
- Not commonly used
- Can be used for select lesions in the superomedial PPS



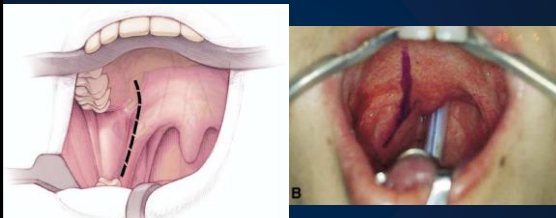
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## Transoral Approach



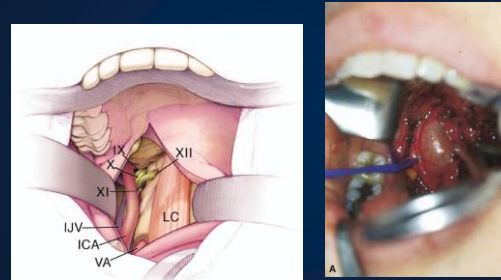
## Transoral Approach



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## Transoral Approach



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## Transoral approach

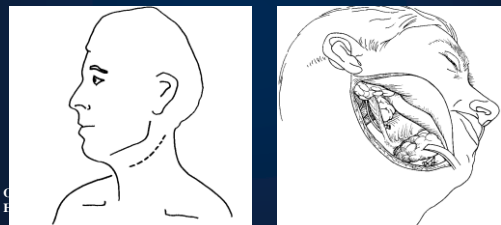
- Can be used for select small superomedial lesions (<6cm)
- Advantages
  - No cervical incision
  - Short hospitalization
  - Less risk to facial nerve
- Disadvantages
  - Limited exposure
  - Poor control of great vessels
  - High potential for tumor spillage



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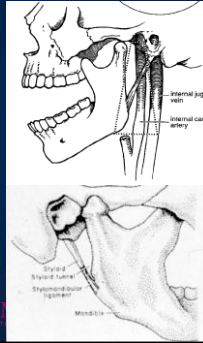
## Transcervical Approach

- Most common approach used in all series
- Can be either transcervical submandibular or transcervical transparotid

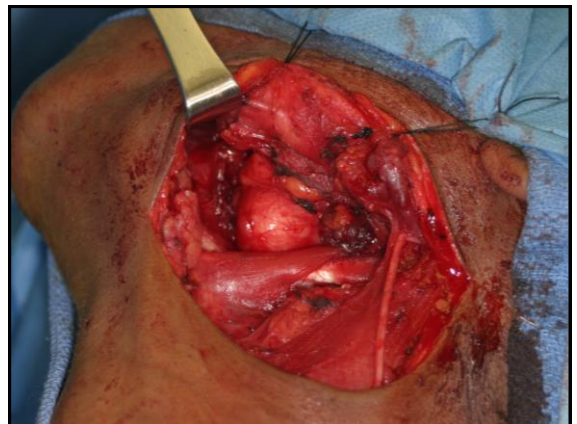
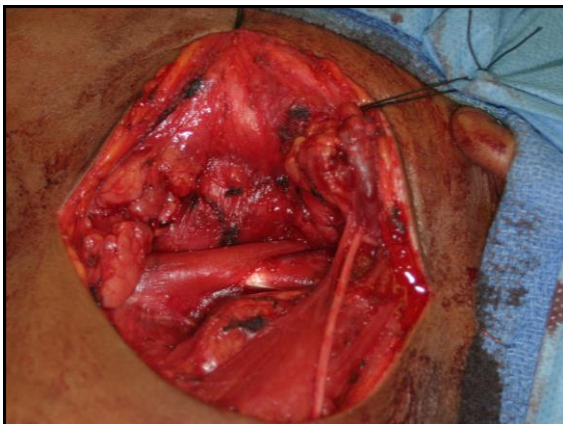


## Increasing Exposure

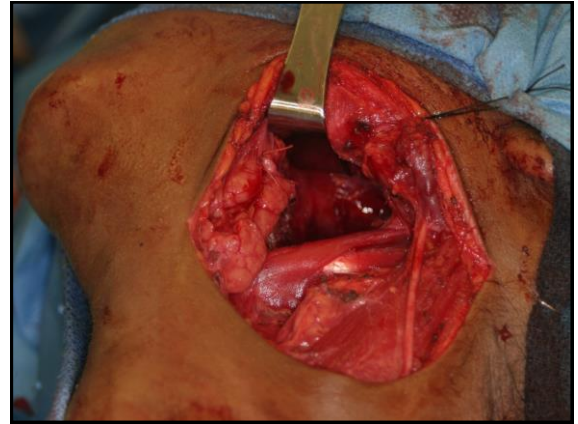
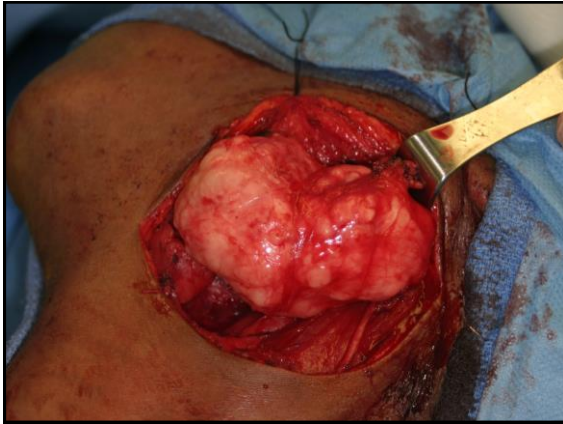
- Dividing the stylomandibular ligament and anterior dislocation of the mandible increase exposure by 50%
- Hyperextension of the neck and contralateral rotation of the head
- Can remove the styloid process, styloid musculature and posterior belly of the digastric



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### Transcervical Transparotid

- Main use for deep lobe of the parotid tumors
  - Many people use submandibular approach for most deep lobe masses
- Downside?
  - Causes significant retraction on facial nerve with increased temporary palsies

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### Mandibulotomy

- Recommended for exposure in the superior PPS
- Used in 2-20% of cases
- Used for
  - Tumors larger than 8cm
  - Tumors incasing/involving the internal carotid
  - Malignant tumors invading skull base or vertebrae

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## Mandibulotomy

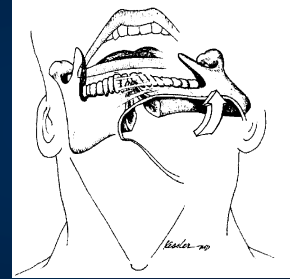
- Downsides
  - Risk of inferior alveolar nerve anesthesia
  - Malocclusion
  - Loss of dentition
  - Possible mandibular nonunion
  - Possible tracheostomy
  - Delayed PO and increased hospital stay
  - Unsightly scar

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## Subcutaneous Mandibulotomy

- Increased access compared to transcervical approach
- No lip splitting incision, trach or prolonged hospital stay



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Tong MS, Genden EM, Bachhador D, Ulfuss ML, Laryngoscope 2009; 119:1000

## Complications

- Recurrence
  - Recurrence rates are generally <10%
  - Highly dependant upon pathology
- Expected defects
  - CN defects
- Preventable defects
  - First Bite syndrome
  - Facial nerve weakness
  - CN defects
  - Trismus
  - Dysphagia

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## First Bite

- Severe pain with first bite of a meal
- Improves with each subsequent bite
- Worst at the first meal of the day

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## First Bite Continued

- Caused by
  - Loss of sympathetic innervations to the parotid gland
  - Denervation supersensitivity by myoepithelial receptor cells
  - Cross reactivity from parasympathetics when chewing
- 12 patients with first bite
  - 6 had transection of the sympathetic chain due to tumor
  - 6 others underwent ligation of external carotid with transection of sympathetic plexus

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Netterville JL et al. Arch Oto-HNS 1998  
Chiu et al. H+N 2002

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## Questions

1. What is the posterior boundary of the parapharyngeal space  
Posterior boundary is the prevertebral fascia, prevertebral muscles and vertebrae
2. What is the lateral boundary of the PPS  
Lateral border is the posterior belly of the digastric muscle, the mandible (ascending ramus, coronoid process and condylar head), the pterygoid muscles and their fascia
3. What is the medial boundary of the PPS  
Medial border is the buccopharyngeal fascia covering the superior constrictor muscle.
4. What borders are rigid  
Superior, lateral and posterior borders are rigid.
5. What actually divide the PPS into Pre- and Post styloid  
Fascia of the tensor-veli-palati extends from the styloid process up to the skull base.
6. Match these up  

Prestyloid	↘	posteromedial
Poststyloid	↙	anterolateral
7. What is in the prestyloid space  
Fat, lymph nodes, loose connective tissue, minor arteries and veins, and nerves
8. What is in the post styloid space  
Carotid sheath the carotid artery, jugular vein, vagus nerve Cranial nerves IX, X, XI
9. Most lesions of the prestyloid space are  
Parotid
10. Most lesions of the post styloid space are  
Neural
11. Which usually requires sacrifice of the nerve schwannoma or neurofibroma  
Neurofibroma

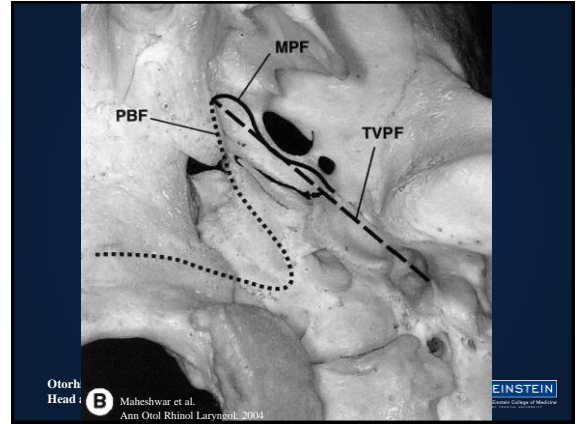
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2. Cohen SM, Burkey BB, Netterville JL Surgical management of parapharyngeal space masses *Head and neck* 2005 27(8) 669-75

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Otorh  
Head :

**B** Maheshwar et al.  
*Ann Otol Rhinol Laryngol.* 2004.

