Deep Neck Spaces and Infections

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Deep Neck Spaces and Infections

- Anatomy of the Cervical Fascia
- Anatomy of the Deep Neck Spaces
- Deep Neck Space Infections
Cervical Fascia

- **Superficial Layer**
- **Deep Layer**
  - Superficial
  - Middle
  - Deep
Cervical Fascia

- **Superficial Layer**
  - Platysma
  - Muscles of Facial Expression
Cervical Fascia

- **Superficial Layer of the Deep Cervical Fascia**
  - **Muscles**
    - Sternocleidomastoid
    - Trapezius
  - **Glands**
    - Submandibular
    - Parotid
  - **Spaces**
    - Posterior Triangle
    - Suprasternal space of Burns
Cervical Fascia

- Middle Layer of the Deep Cervical Fascia
  - Muscular Division
    - Infrahyoid Strap Muscles
  - Visceral Division
    - Pharynx, Larynx, Esophagus, Trachea, Thyroid
    - Buccopharyngeal Fascia
Cervical Fascia

- **Deep Layer of Deep Cervical Fascia**
  - **Alar Layer**
    - Posterior to visceral layer of middle fascia
    - Anterior to prevertebral layer
  - **Prevertebral Layer**
    - Vertebral bodies
    - Deep muscles of the neck
Cervical Fascia

- **Carotid Sheath**
  - Formed by all three layers of deep fascia
  - Contains carotid artery, internal jugular vein, and vagus nerve
  - “Lincoln’s Highway”
Deep Neck Spaces

- Described in relation to the hyoid
  - Entire length of the neck
  - Suprahyoid
  - Infrahyoid
Deep Neck Spaces

- Entire Length of Neck: Superficial Space
  - Surrounds platysma
  - Contains areolar tissue, nodes, nerves and vessels
  - Subplatysmal Flaps
  - Involved with cellulitis and superficial abscesses
  - Treat with incision along Langer’s lines, drainage and antibiotics
Deep Neck Spaces

- Entire Length of Neck:
  - Retropharyngeal Space
    - Posterior to pharynx and esophagus
    - Anterior to alar layer of deep fascia
    - Extends from skull base to T1-T2
Deep Neck Spaces

- Entire Length of Neck: Danger Space
  - Anterior border is alar layer of deep fascia
  - Posterior border is prevertebral layer
  - Extends from skull base to diaphragm
Deep Neck Spaces

- Entire Length of Neck: Prevertebral Space
  - Anterior border is prevertebral fascia
  - Posterior border is vertebral bodies and deep neck muscles
  - Extends along entire length of vertebral column
Deep Neck Spaces

- Entire Length of Neck: Visceral Vascular Space
  - Carotid Sheath
  - “Lincoln’s Highway”
    - Can become secondarily involved with any other deep neck space infection by direct spread
Deep Neck Spaces

- **Suprahyoid:** Submandibular Space
  - Anterior/Lateral—mandible
  - Superior—mucosa
  - Inferior—superficial layer of deep fascia
  - Posterior/Inferior—hyoid
Deep Neck Spaces

- **Suprahyoid:**
  - **Submandibular Space**
    - Sublingual Space
      - Areolar tissue
      - Hypoglossal and lingual nerves
      - Sublingual gland
      - Wharton’s duct
    - Submylohyoid Space
      - Anterior bellies of digastrics
      - Submandibular gland
Deep Neck Spaces

- Suprahyoid: Parapharyngeal Space
  - Superior—skull base
  - Inferior—hyoid
  - Anterior—pterygomandibular raphe
  - Posterior—prevertebral fascia
  - Medial—buccopharyngeal fascia
  - Lateral—superficial layer of deep fascia
Deep Neck Spaces

- **Suprahyoid:** Parapharyngeal Space
  - Prestyloid
    - Medial—tonsillar fossa
    - Lateral—medial pterygoid
    - Contains fat, connective tissue, nodes
  - Poststyloid
    - Carotid sheath
    - Cranial nerves IX, X, XII
Deep Neck Spaces

- **Suprahyoid:** Peritonsillar Space
  - Medial—capsule of palatine tonsil
  - Lateral—superior pharyngeal constrictor
  - Superior—anterior tonsil pillar
  - Inferior—posterior tonsil pillar
Deep Neck Spaces

- **Suprahyoid: Masticator and Temporal Spaces**
  - Formed by the superficial layer of deep cervical fascia
    - Masseter and pterygoids
    - Temporalis

Cross-Section of Temporal Spaces
Deep Neck Spaces

- Suprahyoid: Parotid Space
  - Superficial layer of deep fascia
  - Dense septa from capsule into gland
  - Direct communication to parapharyngeal space
Deep Neck Spaces

- **Infrahyoid: Anterior Visceral Space**
  - Middle layer of deep fascia
  - Contains thyroid, trachea, esophagus
  - Extends from thyroid cartilage into superior mediastinum
Deep Neck Space Infections

- Presentation/Origin of Infection
- Microbiology
- Imaging
- Treatment
- Complications
- Special Consideration


Presentation/Origin

- Retropharyngeal Abscess
  - 50% occur in patients 6-12 months of age
  - 96% occur before 6 years of age
  - Children--fever, irritability, lymphadenopathy, torticollis, poor oral intake, sore throat, drooling
  - Adults--pain, dysphagia, anorexia, snoring, nasal obstruction, nasal regurgitation
  - Dyspnea and respiratory distress
  - Lateral posterior oropharyngeal wall bulge
Presentation/Origin

- **Pediatrics**
  - Cause—suppurative process in lymph nodes
    - Nose, adenoids, nasopharynx, sinuses

- **Adults**
  - Cause—trauma, instrumentation, extension from adjoining deep neck space
Presentation/Origin

- Danger Space
  - Presentation and exam nearly identical to retropharyngeal space infection
  - Cause—extension from retropharyngeal, prevertebral or parapharyngeal space
Presentation/Origin

- Prevertebral Space
  - Back, shoulder, neck pain made worse by deglutition
  - Dysphagia or dyspnea
  - Cause—Pott’s abscess, trauma, osteomyelitis, extension from retropharyngeal and danger spaces
Presentation/Origin

- Visceral Vascular Space
  - Induration and tenderness over SCM
  - Torticollis toward opposite side
  - Spiking fevers, sepsis
  - Cause—intravenous drug abuse, extension from other deep neck spaces
Presentation/Origin

- **Submandibular Space**
  - Pain, drooling, dysphagia, neck stiffness
  - Anterior neck swelling, floor of mouth edema
  - Cause—70-85% have odontogenic origin
    - First molar and anterior
    - Second and third molars
  - Sialadenitis, lymphadenitis, lacerations of the floor of mouth, mandible fractures
Presentation/Origin

- Ludwig’s angina
  - 1. Cellulitis, not abscess
  - 2. Limited to SM space
  - 3. Foul serosanguinous fluid, no frank purulence
  - 4. Fascia, muscle, connective tissue involvement, sparing glands
  - 5. Direct spread rather than lymphatic spread
- Tender, firm anterior neck edema without fluctuance
- “Hot potato” voice, drooling
- Tachypnea, dyspnea, stridor
Presentation/Origin

- **Parapharyngeal Space**
  - Fever, chills, malaise
  - Pain, dysphagia, trismus
  - Medial bulge of lateral pharyngeal wall
  - Cause—Infection of pharynx, tonsil, adenoids, dentition, parotid, mastoid, suppurative lymphadenitis, extension from other deep neck spaces
Presentation/Origin

- Peritonsillar Space
  - Fever, malaise
  - Dysphagia, odynophagia
  - “Hot-potato” voice, trismus, bulging of superior tonsil pole and soft palate, deviation of uvula
  - Cause—extension from tonsillitis
Presentation/Origin

- **Masticator Temporal Space**
  - Pain, trismus
  - Posterior FOM edema
  - Swelling along ramus of mandible
  - Cause—odontogenic, from third molars

- **Parotid Space**
  - Pain, trismus
  - Medial bulge of posterior lateral pharyngeal wall
  - Cause—parotitis, sialolithiasis, Sjogren’s syndrome
Presentation/Origin

- **Anterior Visceral Space**
  - Hoarseness, dyspnea, dysphagia, odynophagia
  - Erythema, edema of hypopharynx, may extend to include glottis and supraglottis
  - Anterior neck edema, pain, erythema, crepitus
  - Cause—foreign body, instrumentation, extension of infection in thyroid
Microbiology

- Preantibiotic era—S. aureus
- Currently—aerobic Strep species and non-strep anaerobes
- Gram-negatives uncommon
- Almost always polymicrobial
- Remember resistance
Lateral neck plain film

- Screening exam—mainly for retropharyngeal and pretracheal spaces
- Normal: 7mm at C-2, 14mm at C-6 for kids, 22mm at C-6 for adults
- Technique dependent
  - Extension
  - Inspiration

- Nagy, et al
  - Sensitivity 83%, compared to CT 100%
Imaging

- High-resolution Ultrasound
  - Advantages
    - Avoids radiation
    - Portable
  - Disadvantages
    - Not widely accepted
    - Operator dependent
    - Inferior anatomic detail
  - Uses
    - Following infection during therapy
    - Image guided aspiration
Imaging

- **Contrast enhanced CT**
  - Advantages
    - Quick, easy
    - Widely available
    - Familiarity
    - Superior anatomic detail
    - Differentiate abscess and cellulitis
  - Disadvantages
    - Ionizing radiation
    - Allergenic contrast agent
    - Soft tissue detail
    - Artifact
Imaging

- Contrast enhanced CT
  - Modality of choice
  - Miller, et al: CT vs. PE
    - Accuracy of diagnosis: CT = 77%, PE = 63%
    - Sensitivity: CT = 95%, PE = 55%
MRI

**Advantages**
- No radiation
- Safer contrast agent
- Better soft tissue detail
- Imaging in multiple planes
- No artifact by dental fillings

**Disadvantages**
- Increased cost
- Increased exam time
- Dependent on patient cooperation
- Availability

Munoz, et al: MRI vs. CT
Treatment

- Airway protection
- Antibiotic therapy
- Surgical drainage
Treatment

- **Airway protection**
  - Observation
  - Intubation
    - Direct laryngoscopy: possible risk of rupture and aspiration
    - Flexible fiberoptic
  - Tracheostomy
    - Ideally = planned, awake, local anesthesia
    - Abscess may overlie trachea
    - Distorted anatomy and tissue planes
Treatment

**LUDWIG’S ANGINA = PERILOUS AIRWAY**

- Parhiscar and Har-El
  - Review of 210 patients with deep neck abscess
  - Overall, 20.5% required tracheostomy
  - Ludwig’s angina, 75% required tracheostomy
    - Attempted intubation in 20 patients
    - Failed in 11 patients, necessitating “slash” tracheostomy
Treatment

- **Antibiotic Therapy**
  - **Cellulitis**
  - Improvement in 24-48 hours
  - **Abscess?**
    - Mayor, et al: review of 31 patients, 19 with CT evidence of abscess, 90% response
    - Nagy, et al: review of 47 pediatric patients, 51% response rate, only 7 of these had CT evidence of abscess
Treatment

- **Antibiotic Therapy**
  - Polymicrobial infections
    - Aerobic Strep, anaerobes
    - Ampicillin/sulbactam with metronidazole
  - Beta-Lactam resistance in 17-47% of isolates
  - Alternatives
    - Third generation cephalosporins
    - clindamycin
  - Culture and sensitivity
Surgical Drainage

- Transoral
  - Preoperative CT—where are the great vessels?
  - Cruciate mucosal incision, blunt spreading through superior pharyngeal constrictor
  - Nagy, et al: retro-, parapharyngeal or combo in kids
    - 22/23 successfully treated with intraoral incision and drainage

- External
Treatment

- Surgical Drainage
  - External
    - EXPOSURE, EXPOSURE, EXPOSURE
    - Levitt: anterior vs. posterior approach
    - Submandibular incision
    - Submental incision
    - T-incision
Treatment

- Image-guided Aspiration
  - Patient selection
    - Smaller abscesses, limited extension, uniloculated
  - Poe, et al: CT guided aspiration
    - Early specimen collection, reduced expense, avoidance of neck scar
  - Yeow, et al: Ultrasound guided aspiration
    - 8/10 patients successfully treated with needle aspiration
    - 5/5 patients successful treated with pigtail catheter insertion
Complications

- **Airway obstruction**
  - Endotracheal intubation
  - Tracheostomy

- **Ruptured abscess**
  - Pneumonia
  - Lung Abscess
Complications

- Internal Jugular Vein Thrombosis
  - Lemierre’s syndrome
  - F/C, prostration, swelling and pain along SCM
  - Bacteremia, septic embolization, dural sinus thrombosis
  - IV drug abusers
  - Treatment
    - IV antibiotic therapy
    - Anticoagulation?
    - Ligation and excision
Complications

- Carotid Artery Rupture
  - Mortality of 20-40%
  - Sentinel bleeds from ear, nose, mouth
  - Majority from internal carotid, less from external carotid, and fewest from common carotid
  - Treatment
    - Proximal and distal control
    - Ligation
    - Patching or grafting?
Complications

- Mediastinitis
  - Mortality of 40%
  - Increasing dyspnea, chest pain
  - CXR = widened mediastinum

Treatment
  - EARLY RECOGNITION AND INTERVENTION
  - Aggressive IV antibiotic therapy
  - Surgical drainage
    - Transcervical approach
    - Chest tube vs. thoracotomy
Special Consideration

**Recurrent Deep Neck Space Infection**

- THINK CONGENITAL ABNORMALITY
- Imaging should help make the diagnosis
- Nusbaum, et al: 12 cases of recurrent deep neck infection
  - Most Common: second branchial cleft cyst
  - Others: first, third, fourth branchial cleft cysts, lymphangiomas, thyroglossal duct cysts, cervical thymic cyst
Case Presentation

- 43 y/o man presents to the ER complaining of mouth and neck pain, he finds it difficult to swallow and has been spitting out his saliva.
- He also reports progressive swelling in his neck that it tender to touch.
Case Presentation

- Additional history
  - Denies recent URI or pharyngitis
  - Had an infected third molar pulled about 5 days ago
  - No difficulty breathing at rest
Case Presentation

- **Past Medical History**
  - HTN, renal failure

- **Past Surgical History**
  - Kidney transplant

- **Medications**
  - Prednisone, cyclosporin, metoprolol

- **Allergies**
  - nkda

- **Social History**
  - Nonsmoker, occasional alcohol
Case Presentation

Physical Exam

- BP 124/70, P 96, RR 18, T 38.0, O2 sat 98% RA
- Gen: no distress, uncomfortable, muffled voice
- Tender, erythematous edema over right level I & II, no distinctly palpable nodes, no fluctuance
- FOM is slightly edematous and tender but soft, the tongue is not elevated, evidence of tooth extraction
Case Presentation

- **Laboratory Studies**
  - WBCs 21,000, elevated bands
  - Electrolytes wnl
  - Cyclosporin level ok
Case Presentation

- CT Neck
Case Presentation

Treatment
- To OR for external incision and drainage, using a transverse, submandibular skin incision
- Specimens sent for culture and sensitivities
- Penrose drain left in place for continued drainage
- IV antibiotic therapy started with Unasyn
- POD #2, remains febrile, neck is still erythematous and indurated
Case Presentation

- Follow up on culture and sensitivities
- Broaden antibiotic therapy for better anaerobic and gram-negative coverage