DEEP NECK INFECTIONS (DNI)

Presenter: Zahra Valipour, MD
Assistant Professor of Otorhinolaryngology – Head & Neck Surgery at MUMS

ROADMAP OF TODAY'S TALK

- **Epidemiology & Etiology** → who is affected, common causes
- **Anatomy & Pathways** → key neck spaces, routes of spread
- **Clinical Recognition** → history, exam, airway red flags
- **Diagnostics** → CT, MRI, ultrasound, labs
- **Medical Therapy** → empiric antibiotics, resistance, steroids
- **Surgical Management** → drainage techniques, indications
- **Complications** → vascular, mediastinal, necrotizing fasciitis
- **Follow-up & Prognosis** → monitoring, outcomes

SECTION 1: INTRODUCTION & EPIDEMIOLOGY

DEFINITION & CLINICAL IMPORTANCE

- **DNI**: infections within the fascial planes and potential spaces of the neck

- Rapidly progressive, potentially **life-threatening**
- May lead to **airway compromise, mediastinitis, vascular or neurologic complications**

- Requires early recognition, prompt imaging, and timely intervention

EPIDEMIOLOGY

- **Incidence**: ~4.6 per 100,000 children; rising in retropharyngeal abscesses

- **Adults: Odontogenic infections** most common etiology
- **Children: Waldeyer's ring infections** (tonsils, adenoids) most common

Cummings otolaryngology- head and neck surgery- seventh edition

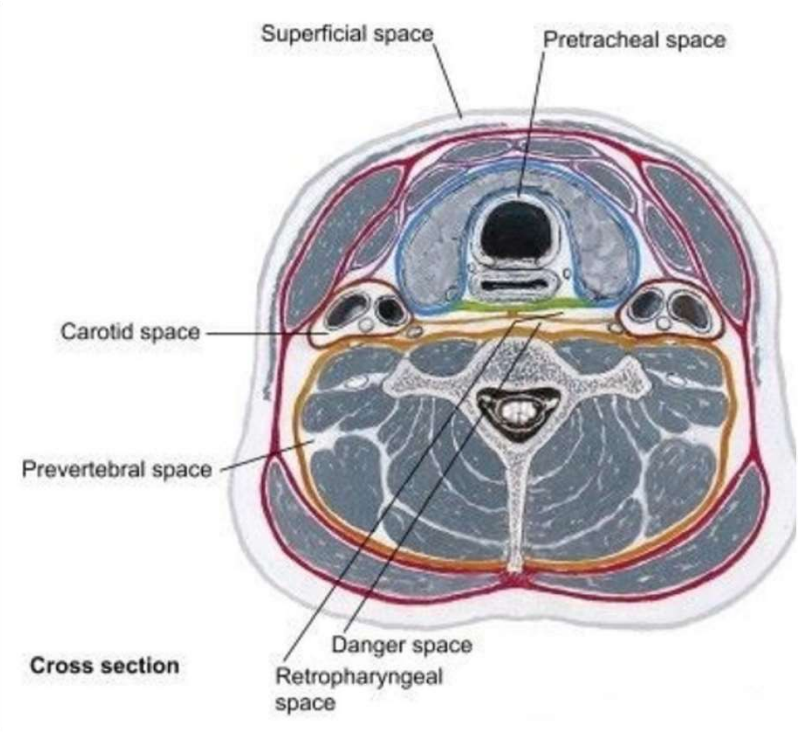
ETIOLOGY OVERVIEW

- **Other causes:**
  - **Iatrogenic** (endoscopy, intubation, oral surgery)
  - **Trauma / IV drug use**
  - **Congenital cysts** (branchial cleft, thyroglossal duct)
  - **Sialadenitis / salivary stones**
  - **Malignant necrotic lymph nodes** (5% of adult DNI cases)

SECTION 2: ANATOMY & PATHOPHYSIOLOGY

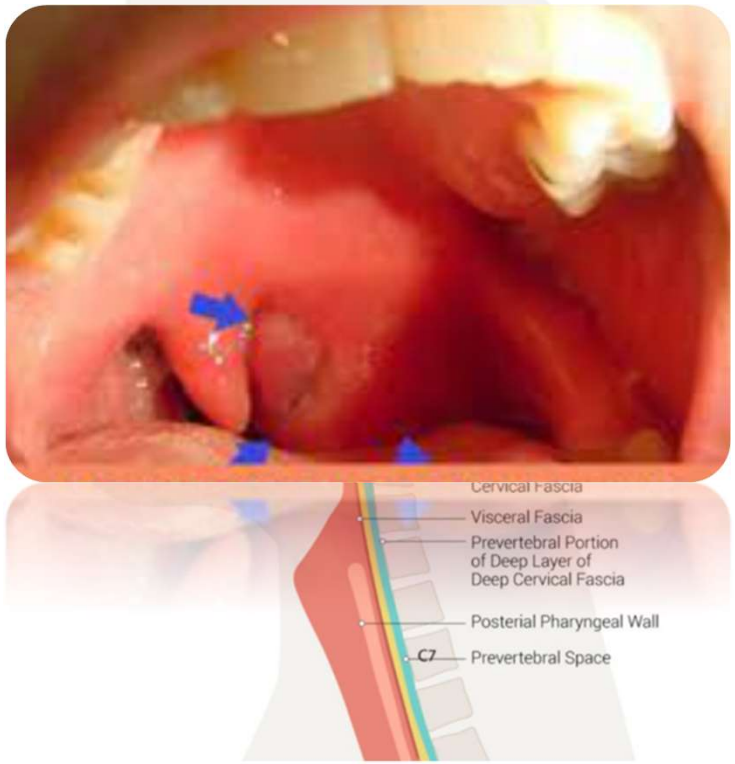
RELEVANT FASCIAL PLANES

- Neck divided by **superficial & deep cervical fascia**
- Creates true and potential spaces → pathways for infection spread
- Loose areolar tissue → facilitates rapid spread
- Clinical importance: defines surgical approaches



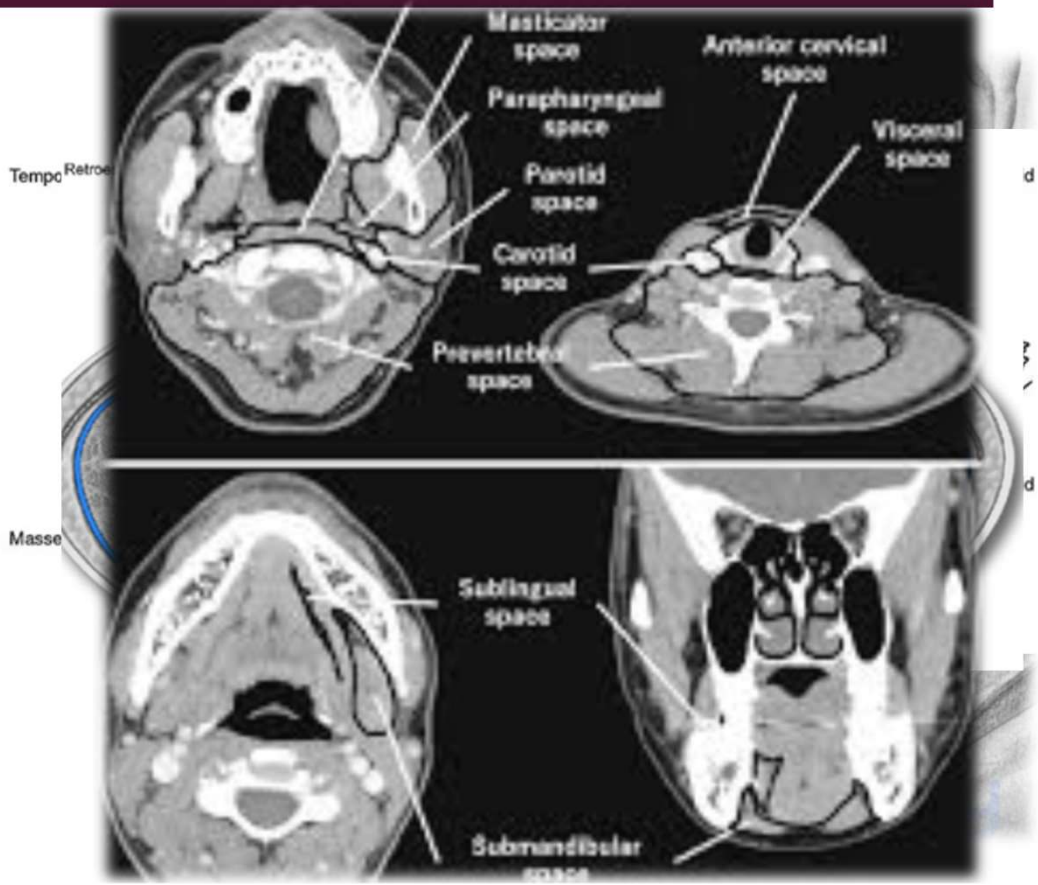
MAJOR DEEP NECK SPACES (I)

- **Peritonsillar space** – common source of PTA
- **Parapharyngeal space**
- **Retropharyngeal space** – **children > adults** (lymph nodes regress in adults)
- **Danger space** – ***extends from skull base to diaphragm → mediastinitis risk***
- **Prevertebral space**



MAJOR DEEP NECK SPACES (II)

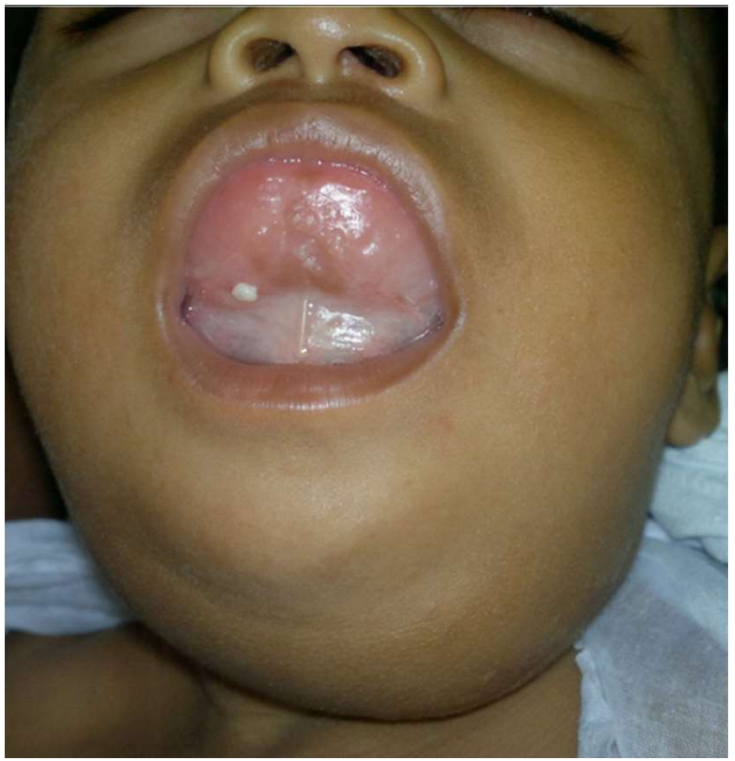
- **Submandibular & Sublingual spaces** – odontogenic infections
- **Masticator & Parotid spaces** – odontogenic spread, trismus
- **Carotid sheath** – IJV thrombosis, carotid ruptur
- **Visceral space** – extension to airway/esophagus/trachea



PATHWAYS OF SPREAD

- Contiguity of fascial planes allows multi-space involvement:

- Parapharyngeal ↔ Retropharyngeal ↔ Danger space
- Carotid sheath → mediastinum ("Lincoln Highway")
- **Ludwig's angina** → ***bilateral submandibular/sublingual → airway obstruction***

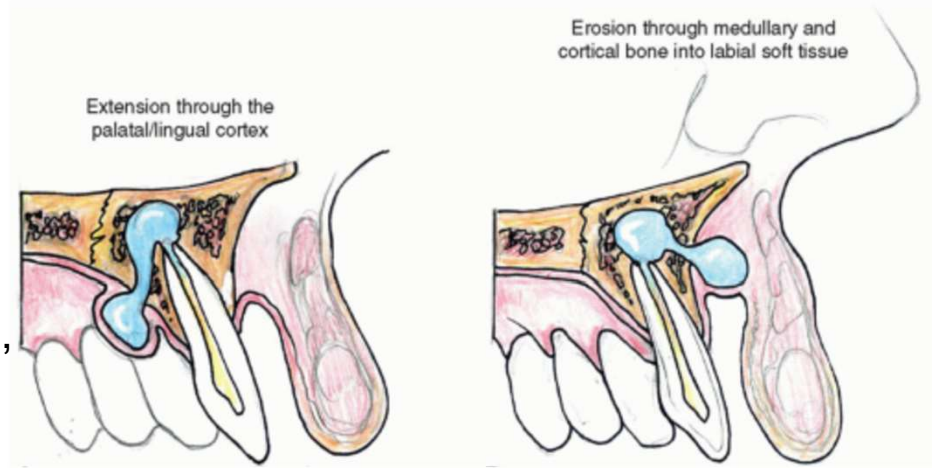


MICROBIOLOGY

- **Polymicrobial**: aerobic + anaerobic oral flora
  - **Adults**: **Streptococcus viridans** group most common
  - **Children**: **Staphylococcus aureus** (incl. ***MRSA***, esp. **<2 yrs**) rising

- **Gram-negative anaerobes** (Prevotella, Fusobacterium, Porphyromonas) common in **odontogenic cases**

- ***Resistance trends: ↑ clindamycin resistance (up to 30%)***



SECTION 3: CLINICAL FEATURES & DIAGNOSIS

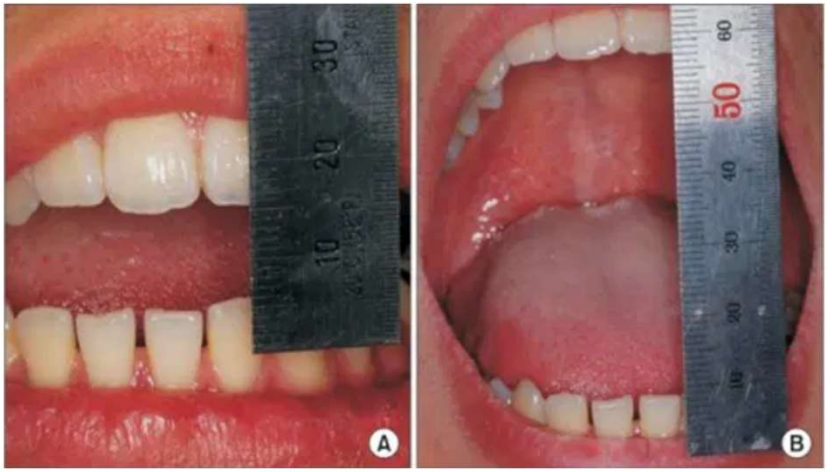
RISK FACTORS & HISTORY

- Recent dental infection or oral surgery
- Tonsillitis, pharyngitis, sinusitis (**esp. in children**)
- Iatrogenic: intubation, endoscopy, tracheostomy
- Trauma, IV drug use

- **Immunocompromised: HIV, DM, chemotherapy** → ***atypical organisms***

SYMPTOMS

- Fever, neck pain, swelling, erythema
- Dysphagia, odynophagia, drooling
- "Hot potato" voice, muffled speech
- ***Dyspnea, stridor → airway threat***
- Trismus, otalgia (refer pain)



PHYSICAL EXAMINATION

•**Neck**: tenderness, fluctuance, crepitus

•**Oral cavity**: edema floor of mouth, dental caries, uvular deviation

•**Tonsils**: swelling, asymmetric enlargement → ***abscess vs tumor***

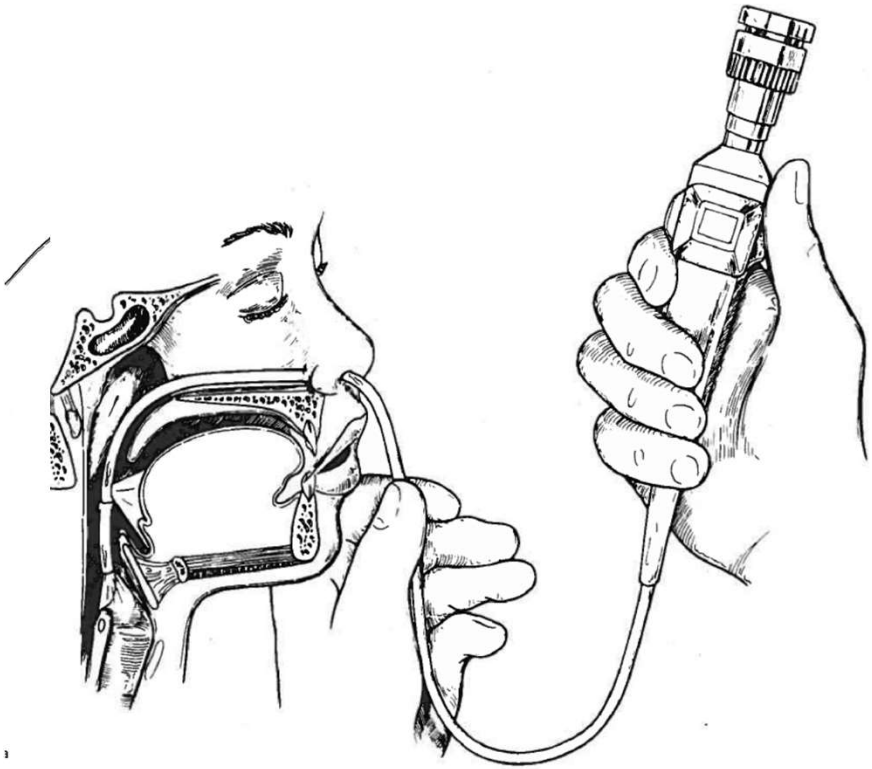
•**Cranial nerves**: ***IX–XII deficits = parapharyngeal/poststyloid involvement***

AIRWAY EVALUATION

- **Flexible fiberoptic exam: indicated in most suspected DNI**

- Detect early edema/obstruction

- ***Normal SpO_2 ≠ safe airway (falls late in obstruction)***
- ***Direct assessment before imaging → prevent emergency during CT***



LABORATORY FINDINGS

- CBC: leukocytosis
- CRP: useful marker for severity and monitoring
- Cultures
- Blood cultures if septic features

IMAGING: IMPORTANCE

- **Physical exam misidentifies space in 70% of cases**
- Imaging confirms diagnosis, defines extent, guides surgery

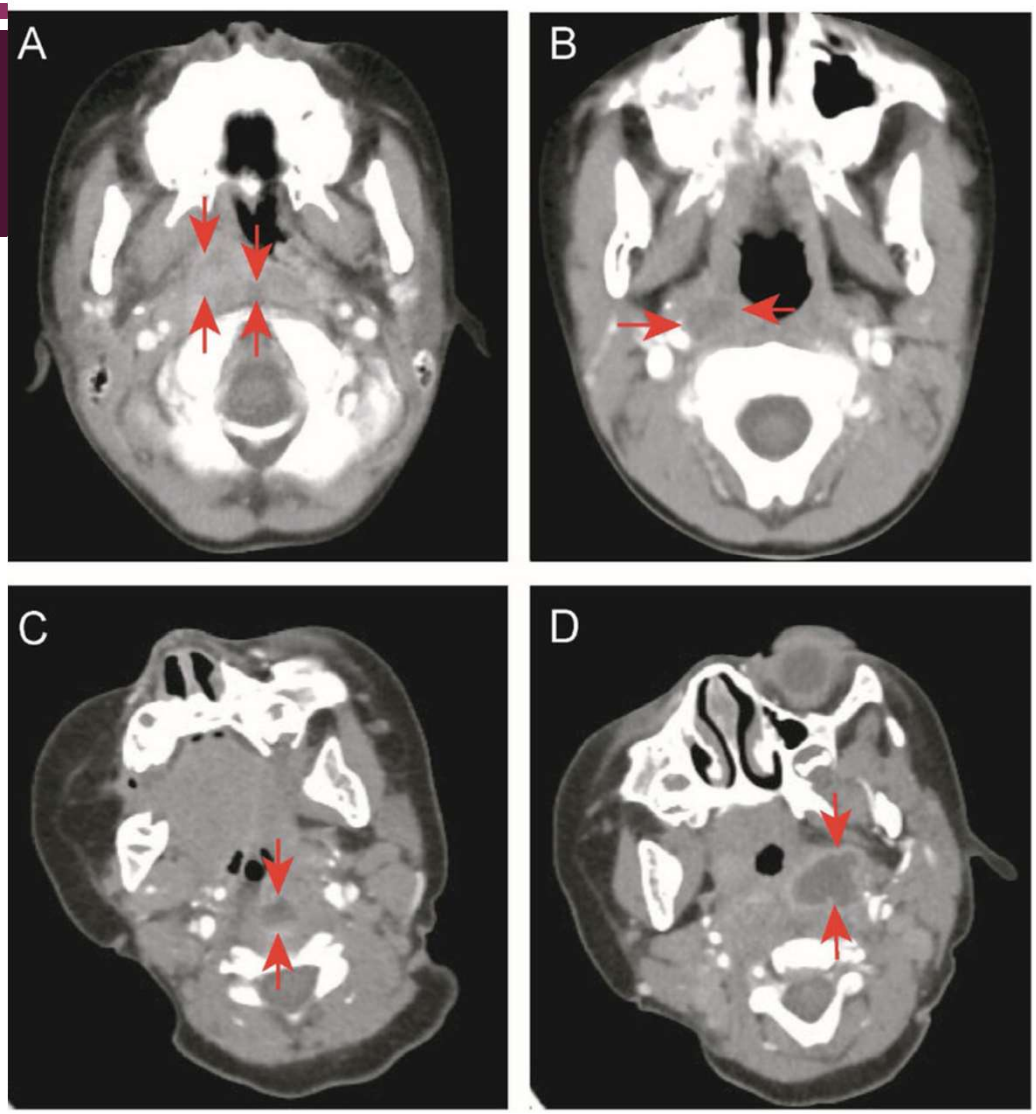
- ***Choice:***
  - ***CT (gold standard),***
  - ***MRI (vascular/intracranial),***
  - ***US (children/lateral neck,*** less sensitive for parapharyngeal/retropharyngeal spaces)

CONTRAST-ENHANCED CT

•Gold standard for DNI

•**Defines abscess vs cellulitis *(not always reliable)***

•**Limitations: cannot always distinguish phlegmon vs abscess (25% false positives for pus)**



SECTION 4: MEDICAL MANAGEMENT

INITIAL PRIORITIES

- Secure **airway** first
- Establish **IV access**, monitor vitals
- Begin **empiric IV antibiotics** immediately
- Admit to hospital (often ICU if airway risk)

AIRWAY MANAGEMENT

- ***Anticipate airway obstruction in floor of mouth, parapharyngeal, retropharyngeal DNIs***

- Awake **fiberoptic intubation** if lumen visible
- ***Always prepare for surgical airway***
- **Elective tracheotomy** if prolonged airway compromise expected

ANTIBIOTIC CHOICES - *FIRST-LINE ANTIBIOTIC ALTERNATIVES FOR DNI*

- **Community-acquired (Gram+ cocci, Gram– rods, anaerobes):**
  - **Ampicillin–sulbactam** IV 1.5–3 g q6h
  - **Clindamycin** IV 600–900 mg q8h (if PCN-allergic)
  - **Ampicillin** 1–2 g q6h + **Metronidazole** 500 mg q6h
  - **Moxifloxacin** 400 mg daily (if ***Eikenella*** suspected)
- **Compromised/Nosocomial (Pseudomonas, MRSA):**
  - **Piperacillin–tazobactam** IV 3 g q6h
  - **Imipenem–cilastatin** IV 500 mg q6h
  - **Levofloxacin** IV 750 mg q24h (if PCN-allergic)
  - **Ciprofloxacin** IV 400 mg q12h (if PCN-allergic)
- **MRSA coverage:**
  - **Clindamycin** IV + **Vancomycin** IV
  - **TMP-SMX** + **Vancomycin** IV (**if clinda-resistant**)
- **Necrotizing fasciitis:**
  - **Ceftriaxone IV + Clindamycin IV + Metronidazole IV**

DURATION OF THERAPY

- Trial IV broad-spectrum ABX empirically for ***48–72h in stable patients***

- Step down to oral when afebrile, hemodynamically stable, and tolerating PO → oral AB x 2 weeks
- **Typical total duration: ~2–3 weeks**, adjusted to space involvement and complications.

- ***If no improvement: surgical drainage indicated***

StatPearls 2024; Li Q, *Clin Microbiol Infect* 2024 (meta-analysis); Mohammed C, *J Infect* 2024 (meta-analysis).

DURATION OF THERAPY, **PEDIATRIC**

- ***IV antibiotics for ~3–6 days, then switch to oral 7–10 days (total 10–14 days).***

McMullan B, *Lancet Infect Dis* 2016 (systematic review); UCSF Pediatric Pathway 2024; Wang Y-C, *Otolaryngol Head Neck Surg* 2024 (meta-analysis); Wu C-W, *Int J Pediatr Otorhinolaryngol* 2025 (meta-analysis).

ROLE OF STEROIDS

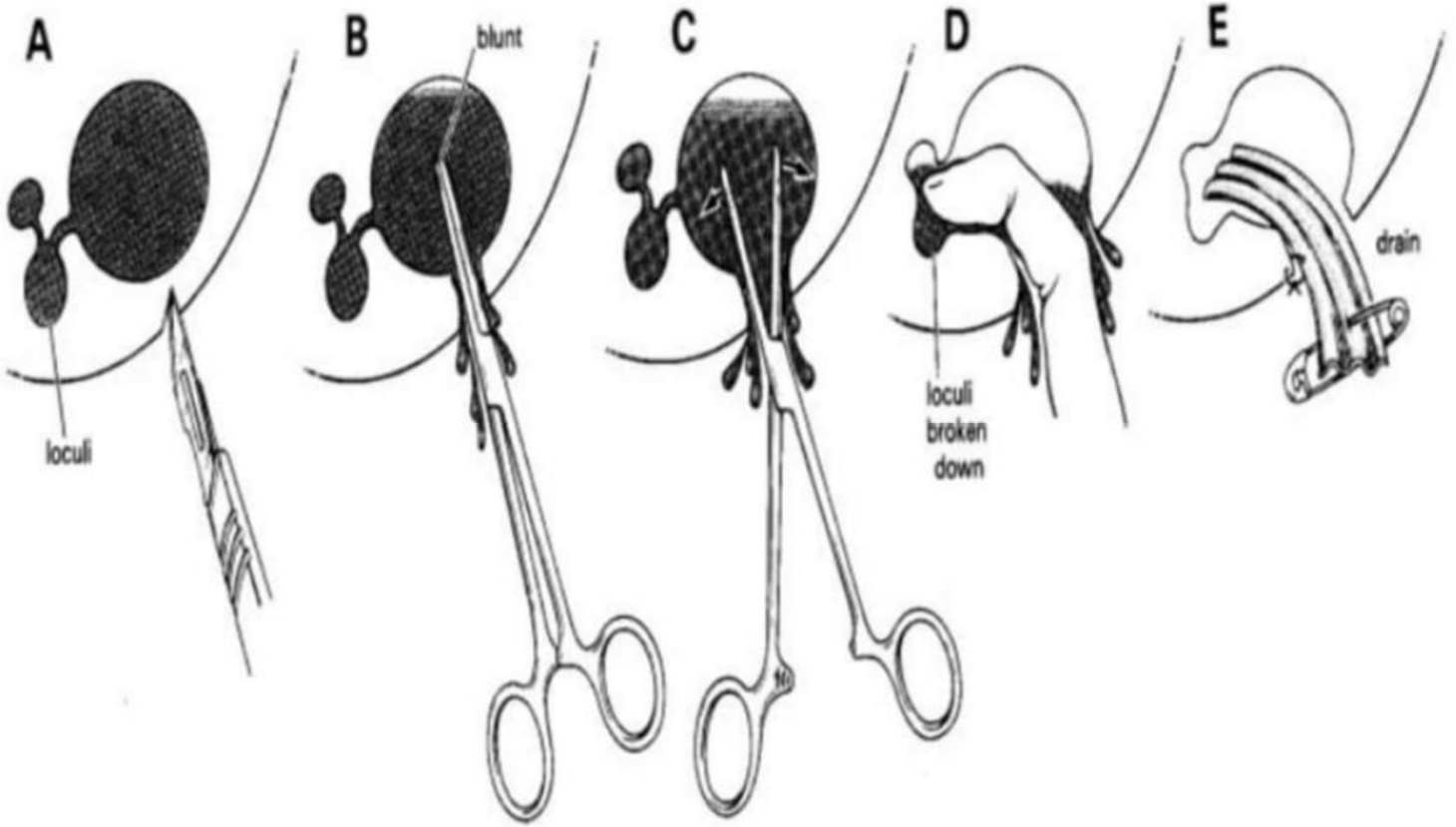
- **IV steroids: reduce edema, airway inflammation**

- **Pediatrics (RPA/PPA):** ***Meta-analysis*****: ↓ length of stay & ↓ need for surgery, no increase in adverse events.**

- Should not be withheld despite mild effect on leukocytosis

SECTION 5: SURGICAL MANAGEMENT

SURGICAL PRINCIPLES

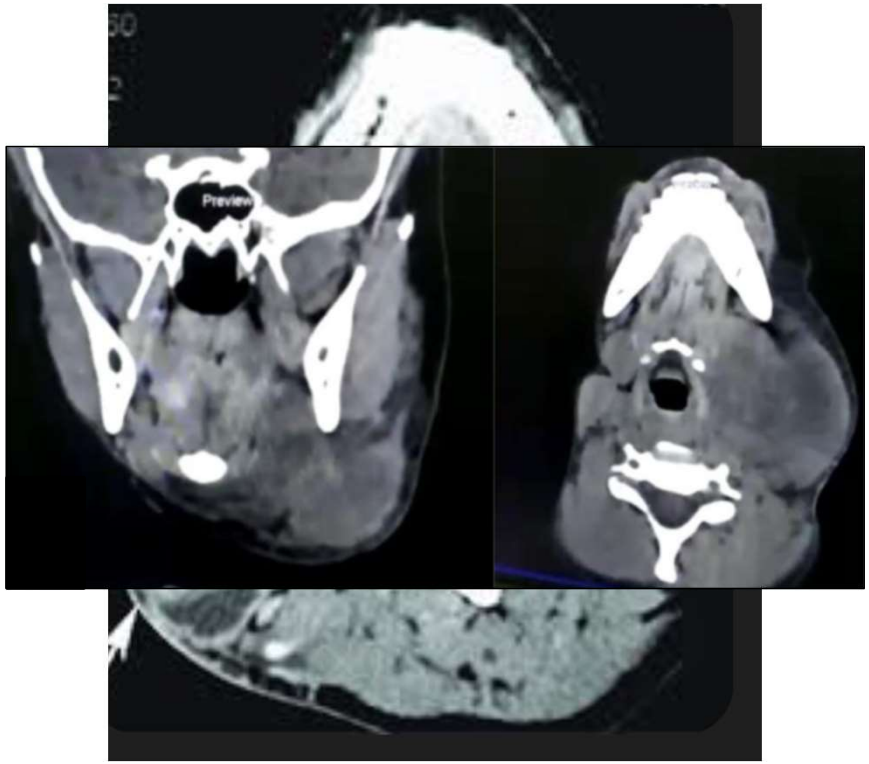


INDICATIONS FOR DRAINAGE

- **Threatened airway**

- **Abscess >2.5 cm or multi-space involvement**
- **Gas-producing organisms (on imaging)**

- **Failure of IV antibiotics after 48–72h**
- **Complications (vascular, mediastinal, CNS)**



NEEDLE ASPIRATION

- US- or CT-guided catheter placement
- **Effective for single, well-localized collections**
- Cost ↓ by ~40% vs. OR drainage

- Useful for:
  - **Small abscesses**
  - **Congenital cyst infections**
  - **Pediatric cases under sedation**

NEEDLE ASPIRATION

- **Pediatric RPA/PPA: Needle aspiration may be attempted in selected cases, but meta-analysis (2025) shows higher treatment failure vs. I&D.**

→ ***I&D remains gold standard for complicated/large abscesses.***

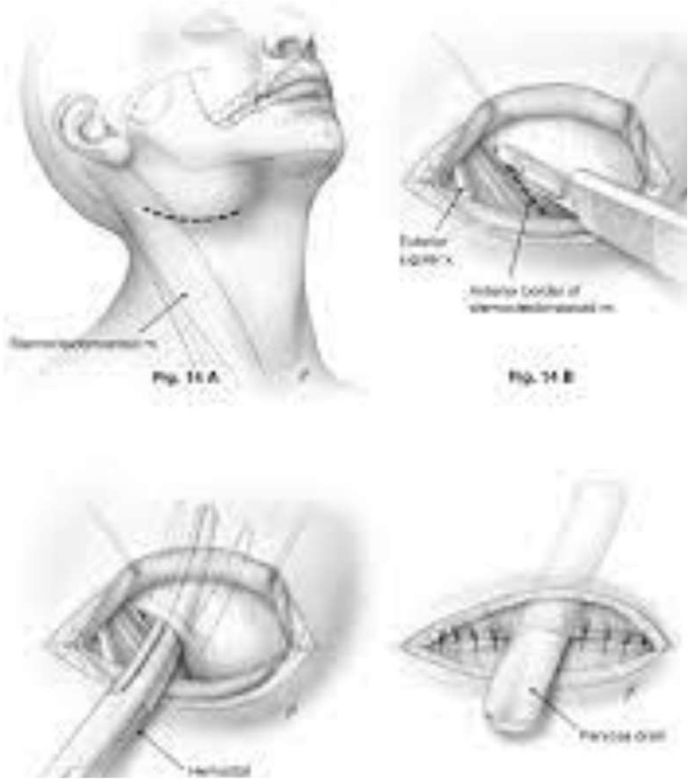
TRANSORAL DRAINAGE

- For PTA, RPA, some odontogenic infections

- ***Ludwig's angina → NOT transoral; requires transcervical***

TRANSCERVICAL DRAINAGE

- **Standard for: multi-space infections, Ludwig's angina, danger space**



DRAIN MANAGEMENT

- Remove drain once patient is afebrile, clinically improving, and output minimal (≈ ≤1 mL/h or very low daily).

- **If no improvement within 48–72 h → repeat contrast-enhanced CT to assess for residual abscess.**

Amir I, *Ann R Coll Surg Engl* 2010; Loperfido A, *Cureus* 2023; Cobzeanu BM, *Medicina* 2025.

SECTION 6: COMPLICATIONS

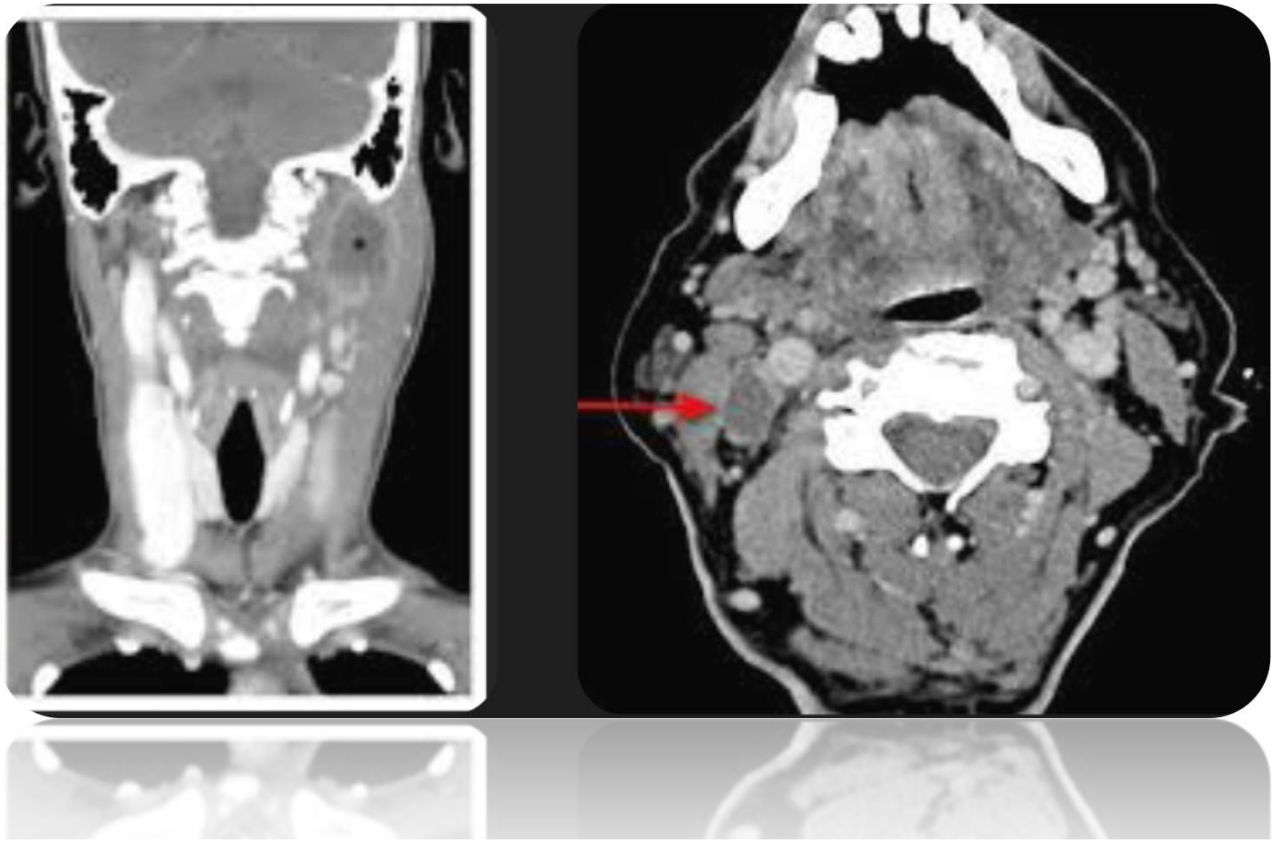
COMPLICATIONS: OVERVIEW

- Occur with delayed/missed treatment

- Mortality up to 40%
- Major categories: vascular, intracranial, mediastinal, necrotizing fasciitis

VASCULAR COMPLICATIONS

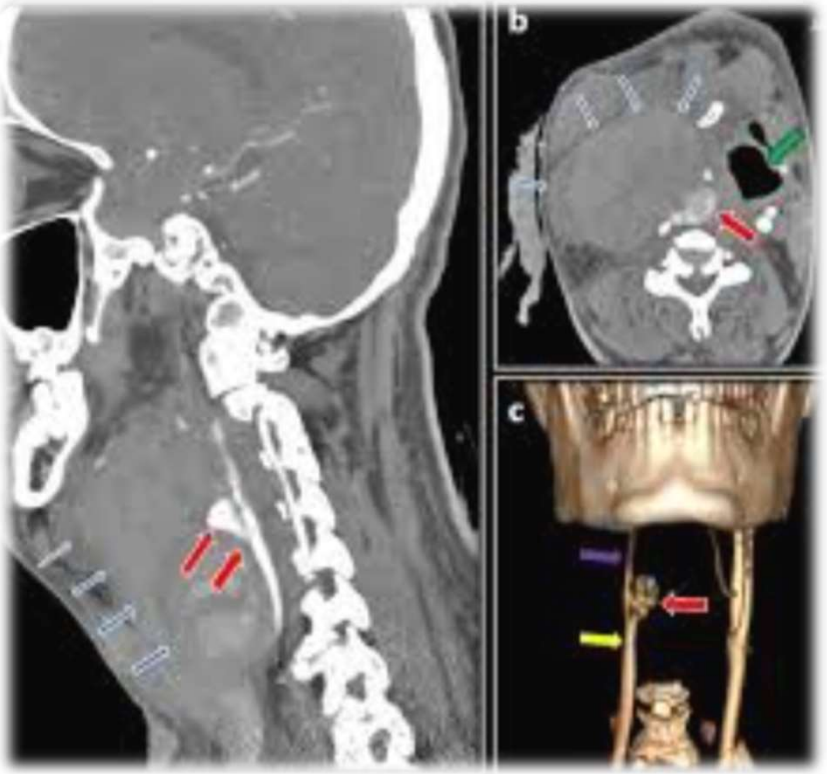
•**Lemierre's syndrome**: IJV thrombophlebitis (Fusobacterium) → septic emboli



VASCULAR COMPLICATIONS

•**Carotid pseudoaneurysm/rupture**: pulsatile mass, hemorrhage risk

•Requires IV antibiotics ± anticoagulation, surgical intervention



INTRACRANIAL COMPLICATIONS

- **Cavernous sinus thrombosis** via valveless ophthalmic veins:
  - Symptoms: fever, orbital pain, ophthalmoplegia, proptosis, CN palsies
  - MRI with contrast for diagnosis
- Treatment: broad IV antibiotics, anticoagulation

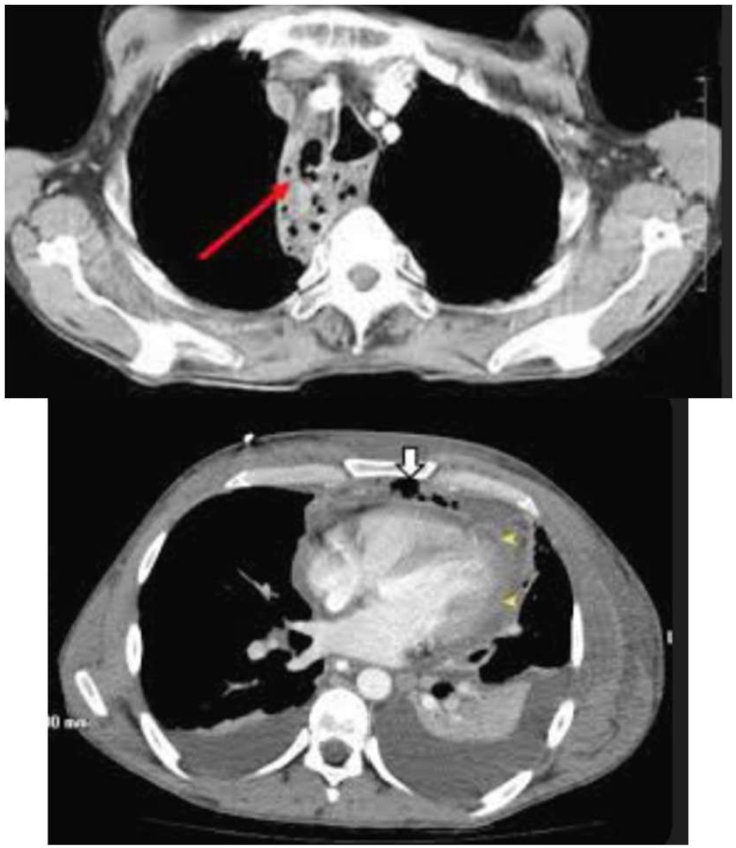
MEDIASTINITIS

- **Spread via retropharyngeal/danger space**

- Mortality: historically 30–40%; now lower with aggressive management

- ***Mortality higher with cervical drainage alone***

- **Requires *IV antibiotics + transcervical ± thoracic drainage***



NECROTIZING FASCIITIS

- **Fulminant, life-threatening** DNI form
- **Risk:** **elderly, diabetics, immunocompromised**

- Clinical: **rapid cellulitis,** ***crepitus***, ***necrotic tissue***, ***foul odor***
- Requires ***radical surgical debridement + broad antibiotics + ICU care***

- Mortality up to 30%

SECTION 7: PROGNOSIS & FOLLOW-UP

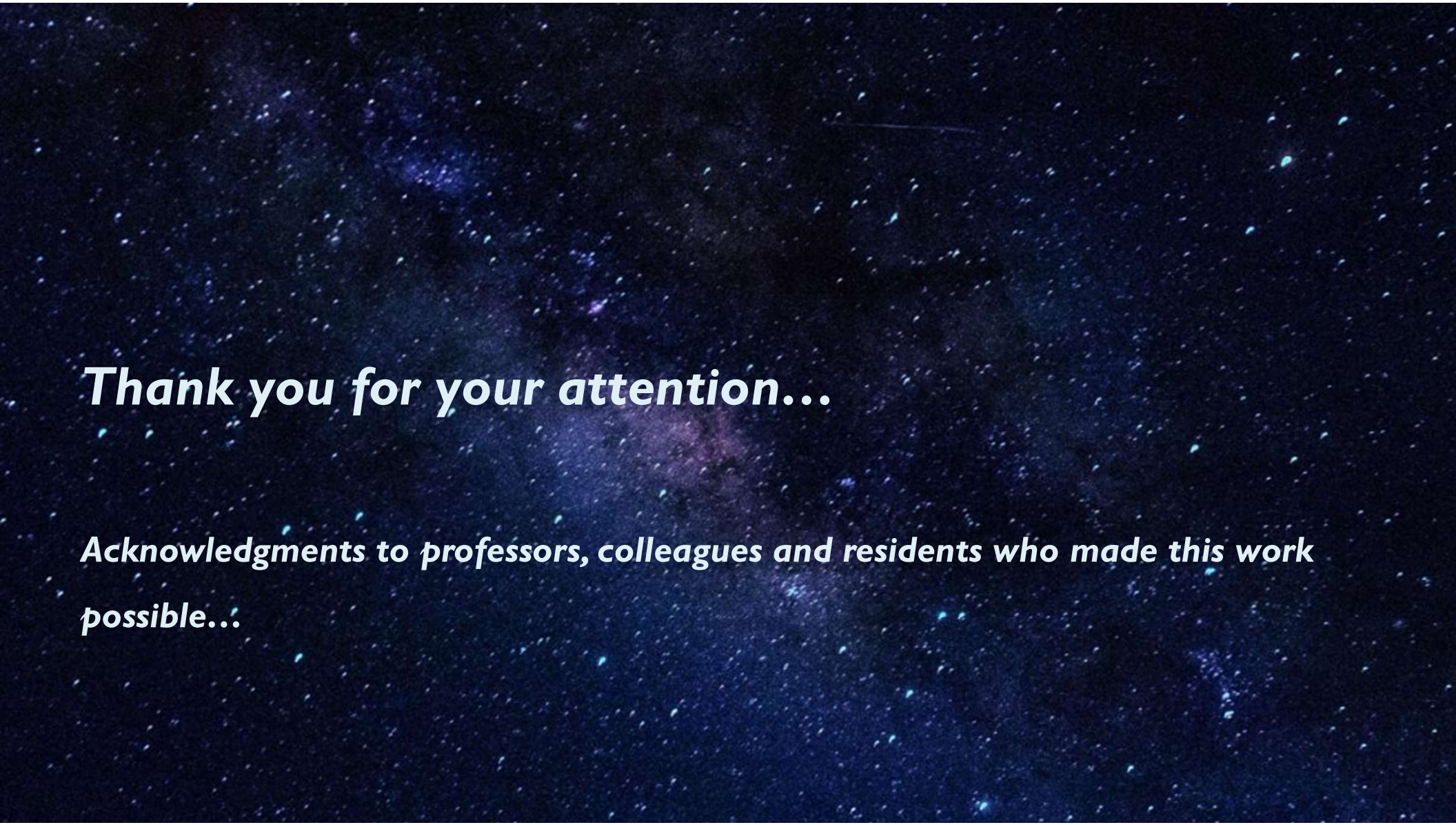
FOLLOW-UP & MONITORING

- **Reassess** clinically after ***48–72h*** of IV abx
- **Repeat imaging if no *improvement or worsening***
- **Outpatient follow-up** after discharge within ***1 week***

- **Recurrent cases:** evaluate for **congenital cysts, malignancy, immunodeficiency**

SUMMARY / TAKE-HOME MESSAGES

- DNI = **potentially life-threatening ENT emergency**
- Early **airway evaluation** is critical
- Imaging (**CT**) → defines extent, guides surgery
- **Empiric antibiotics**: cover aerobes, anaerobes, MRSA (if risk)
- **Surgical drainage if abscess >2.5 cm, airway threat, or failed medical therapy after 48-72 hr**
- Be vigilant for complications (vascular, mediastinitis, necrotizing fasciitis)
- Multidisciplinary approach improves outcomes


Thank you for your attention…
Acknowledgments to professors, colleagues and residents who made this work possible…