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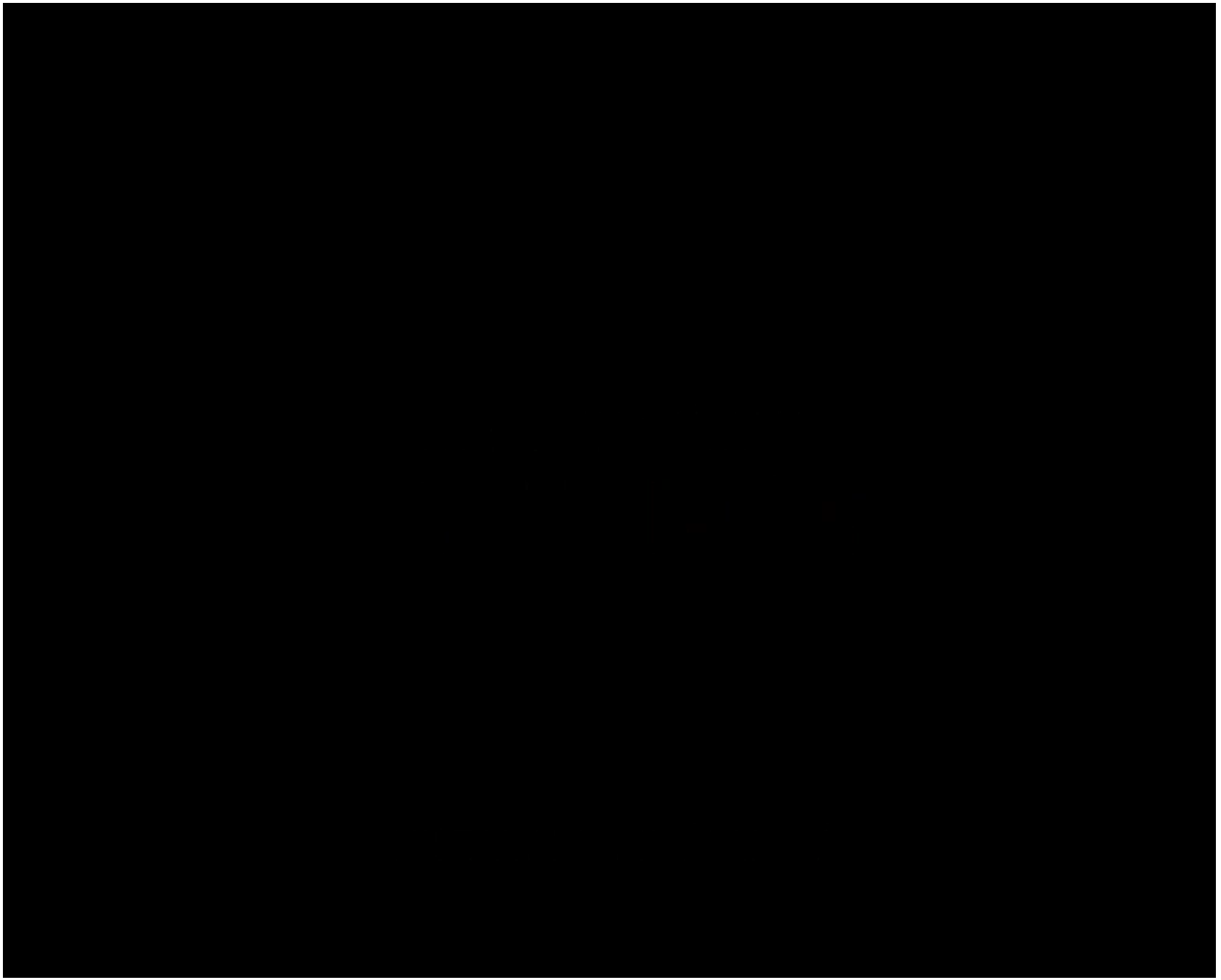


Tracheal Stenosis: An Integrated Approach to Management

Clinico-Pathological Conference

Otorhinolaryngology, Head and Neck Surgery, Benazir Bhutto Hospital

Demographic Details

- Age: 29 years
- Sex: Female
- Marital status: Married
- Occupation: Housewife
- Residence: Rawalpindi
- Date of admission: June 8th, 2024
- Mode of admission: ER

Case presentation

Presenting Complaint

- Shortness of breath – 2 days
- Stridor – 1 day

History of Presenting Complaint

Presented in M.ER with C/O shortness of breath and stridor due to phenyl poisoning -11/05/2024

Gastric lavage done and ETT passed

Patient was on ventilatory support for 1 month and afterwards weaned off and discharged.

Patient again presented in ER with stridor and emergency tracheostomy done by ENT department and patient shifted to ENT department for further management.

Past Medical History

- Not significant

Past Surgical History

- History of appendectomy.
- Bladder surgery-2015
- C-Section- 2019

Family History

- Insignificant

Drug/Allergy History

- No known allergy.

Personal History

- Non addict
- Mother of 3 children.

Comorbids

- Not significant.

Vitals

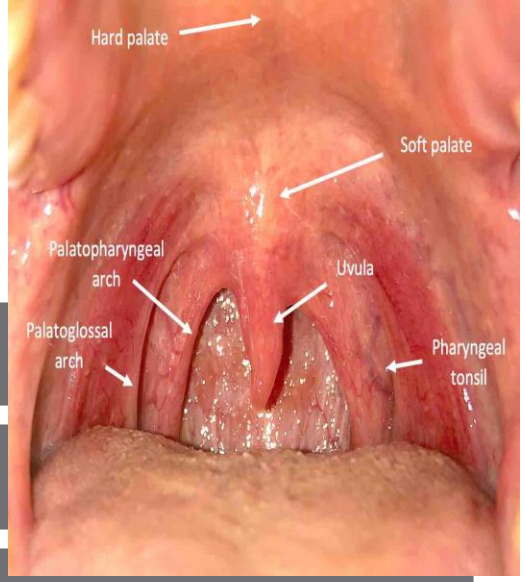
- BP: 100/70 mmHg
- Pulse: 80/min
- RR: 23/min
- Temp: A/F
- Sp02: 96% @RA after tracheostomy

General Physical Examination

- Pallor -ve
- Jaundice -ve
- Clubbing -ve
- Koilonychia -ve
- Leukonychia -ve
- JVP not raised
- No cervical lymphadenopathy

EXAMINATION

Oral Cavity& Throat Examination



Mouth opening : Adequate

Oro-dental hygiene : Satisfactory

Palate : normal movements

Buccal mucosa , floor of mouth : Normal

Inspection : tracheostomy tube patent and healthy wound site

Posterior pharyngeal wall healthy ,No congestion or PND seen

Bimanual palpation : no glands palpable

IDL:

- Vallecula, aryepiglottic folds normal
- Vocal cords mobile With visible narrowing below.

Fiberoptic direct laryngoscopy

Systemic Examination

CVS Examination

- S1+S2+0

Respiratory examination

- Chest B/L clear
- harsh breathing sounds
- No wheeze/ rhonchi/crepts

GIT examination

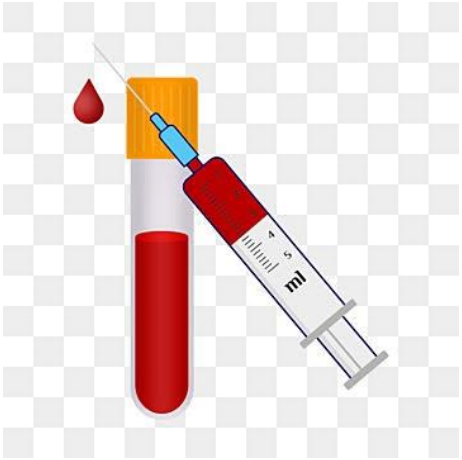
- Abdomen soft, non tender, BS +ve

CNS Examination

- GCS 15/15
- Cranial nerves intact
- Motor and sensory system intact

Investigations

Baseline Investigations



Hb: 11 g/dl

WBC count: 7900 cells/ul

Platelets: 283,000 /uI

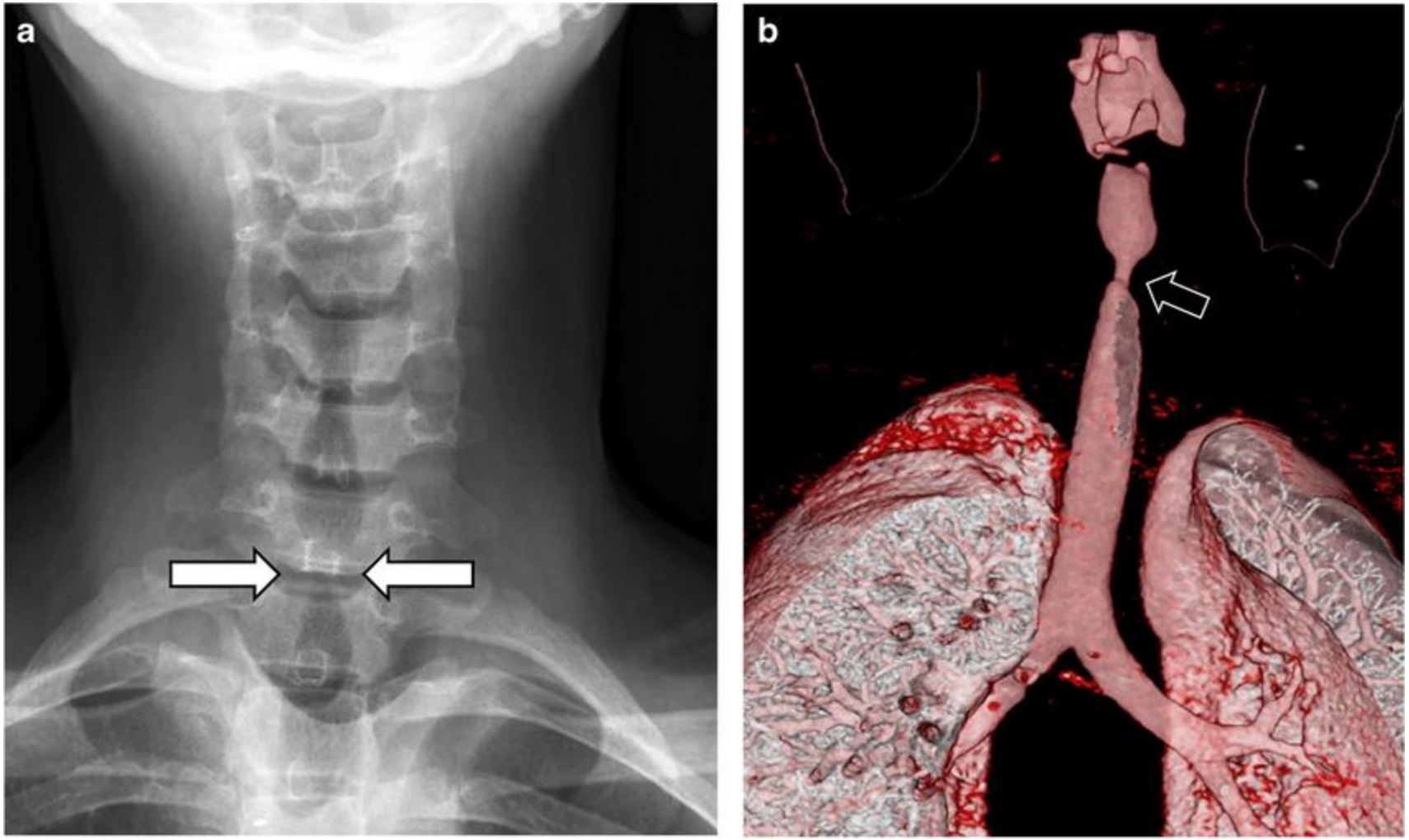
- (All other labs were in normal range.)

Specific Investigations

Imaging of Tracheal Stenosis

Dr Hina Hanif Mughal

Associate Professor/HOD Radiology, BBH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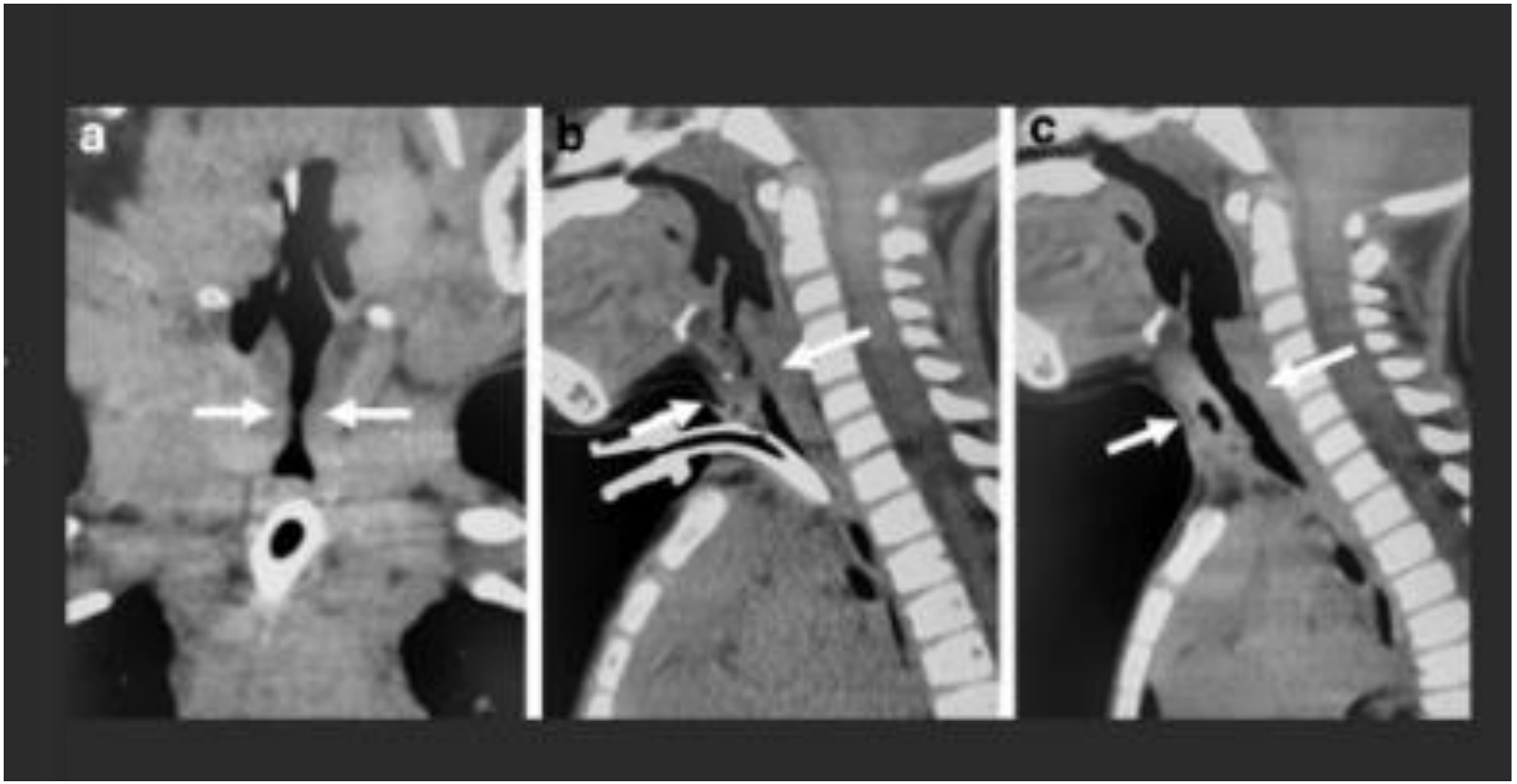
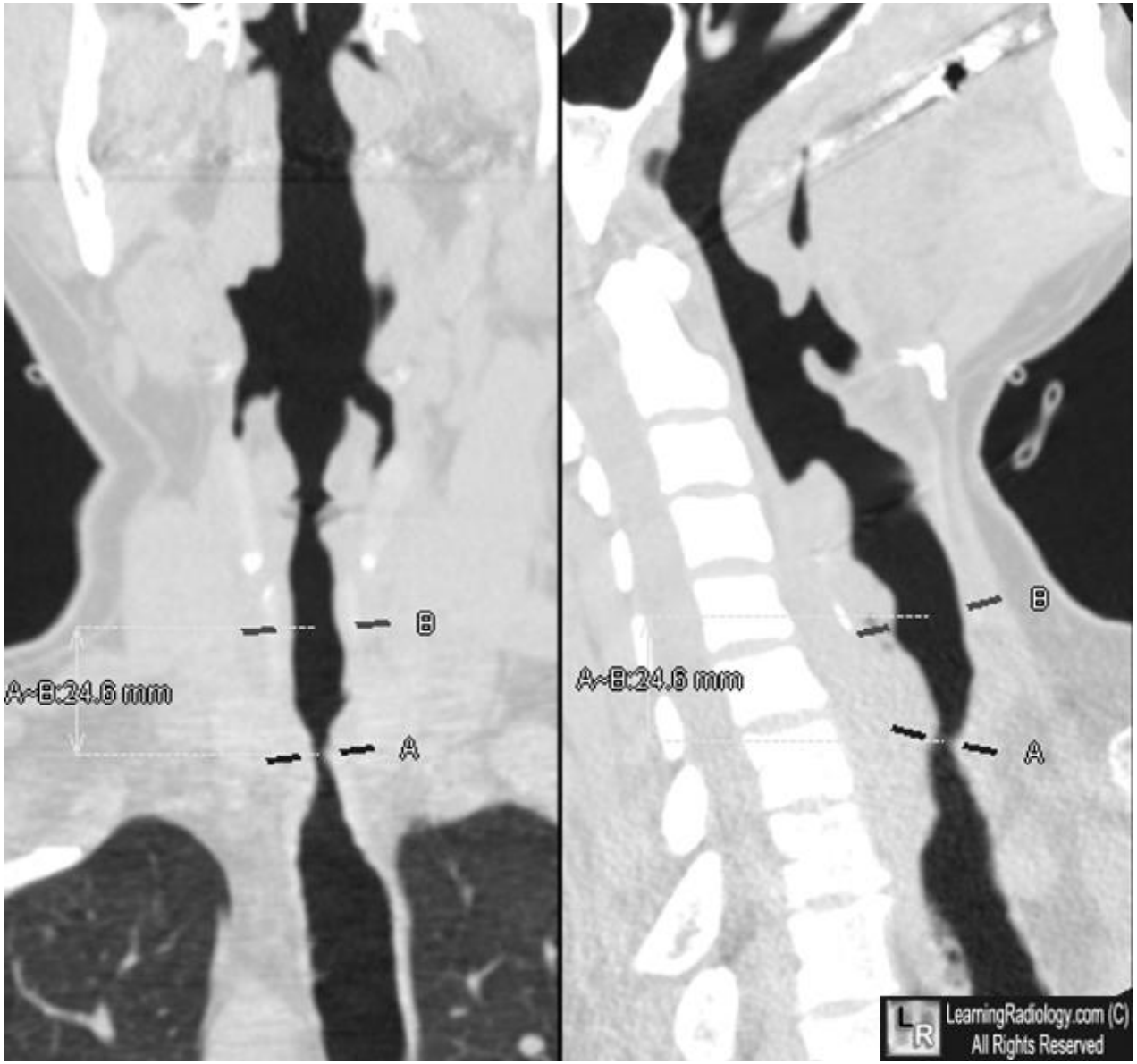
Coronal and Sagittal CT

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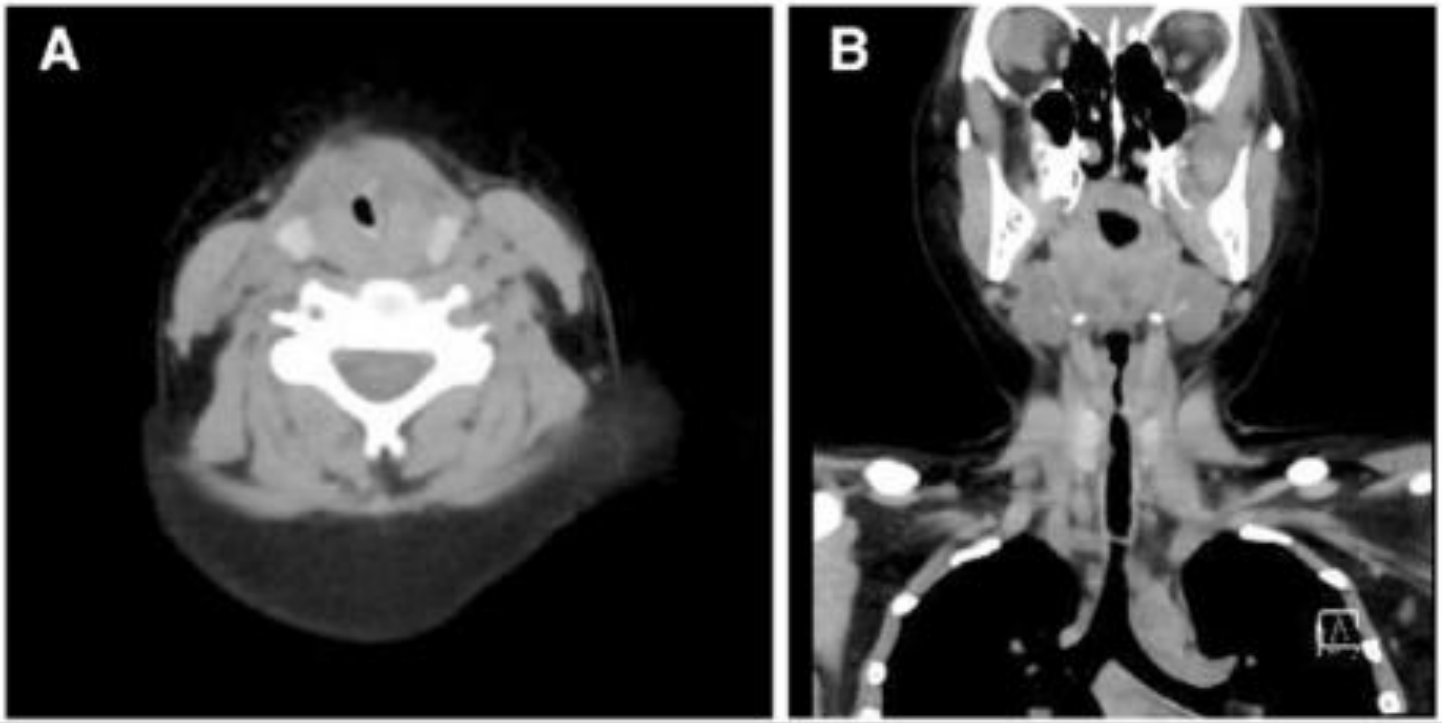
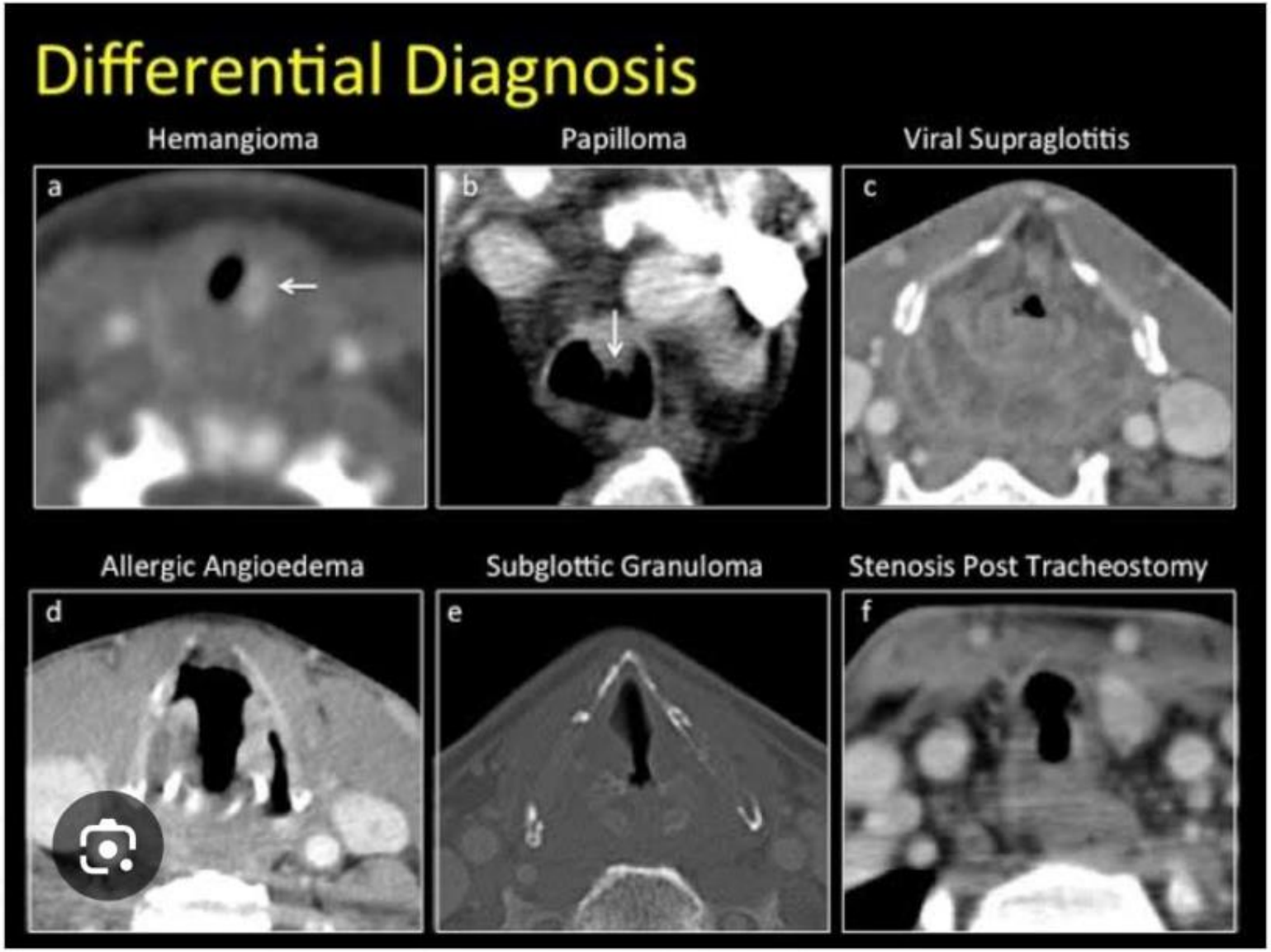
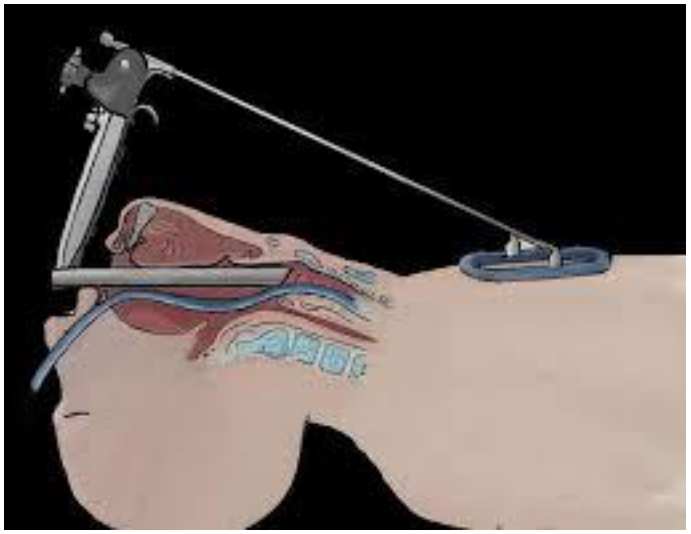
Axial and Coronal CT



Differential Diagnosis



Pan endoscopy (11/07/24)



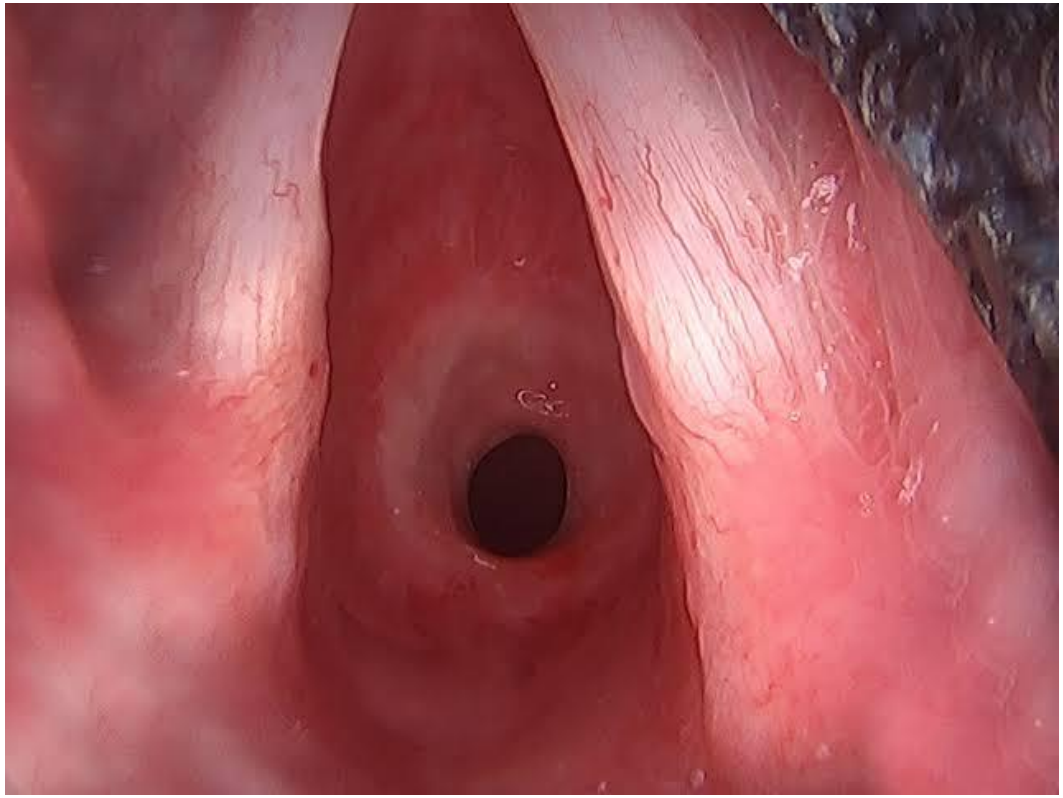
Grade 1 stenosis at 1st tracheal ring

Grade 3 stenosis 2cm below the 1st level (3rd tracheal ring)

Esophagus normal

Definitive Diagnosis

Tracheal stenosis



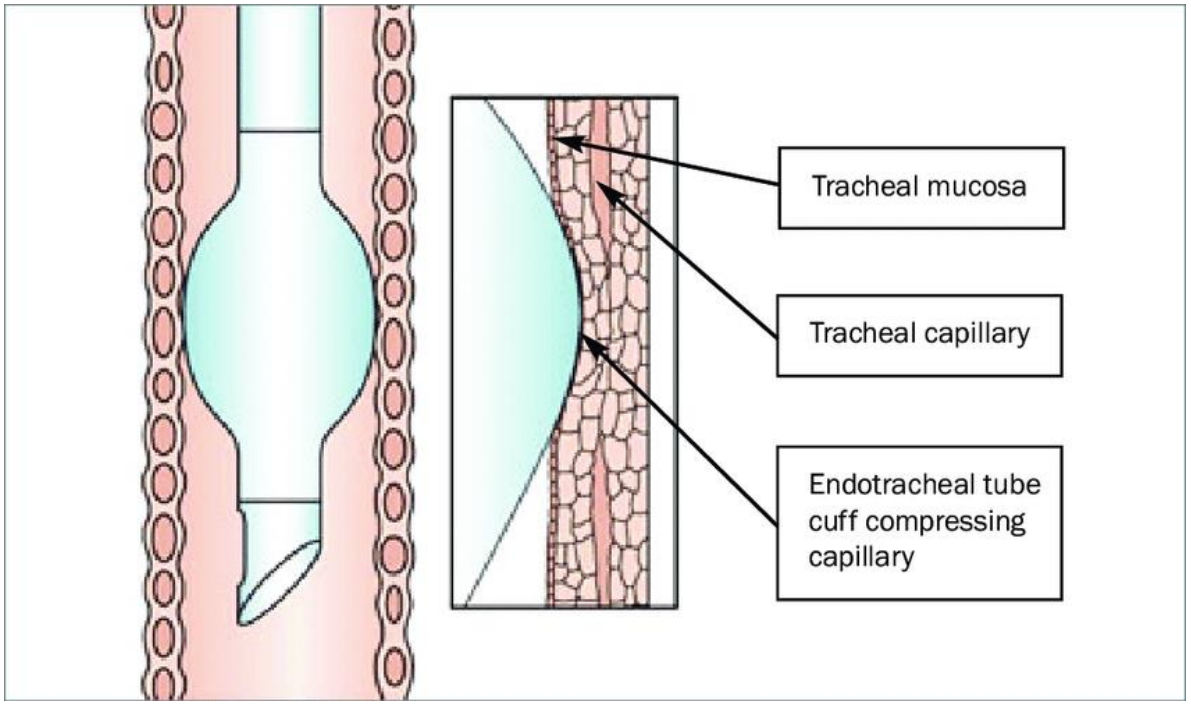
Literature Review

Pathophysiology Recap

- Pressure-Induced Ischemia
- Tissue Injury and Inflammation
- Granulation and Fibrosis
- Narrowing (Stenosis)

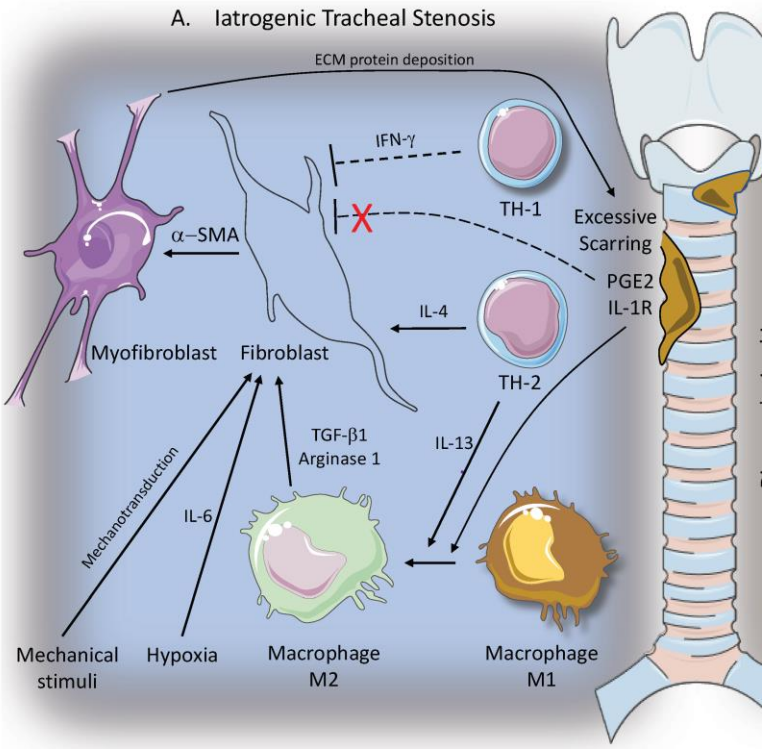
1. Pressure-Induced Ischemia

The cuff of the breathing tube exerts pressure on the inner wall of the trachea. When this pressure is too high or maintained for too long, it exceeds the normal capillary blood pressure. This causes reduced blood flow (ischemia) to the tracheal lining, leading to cell injury and death.



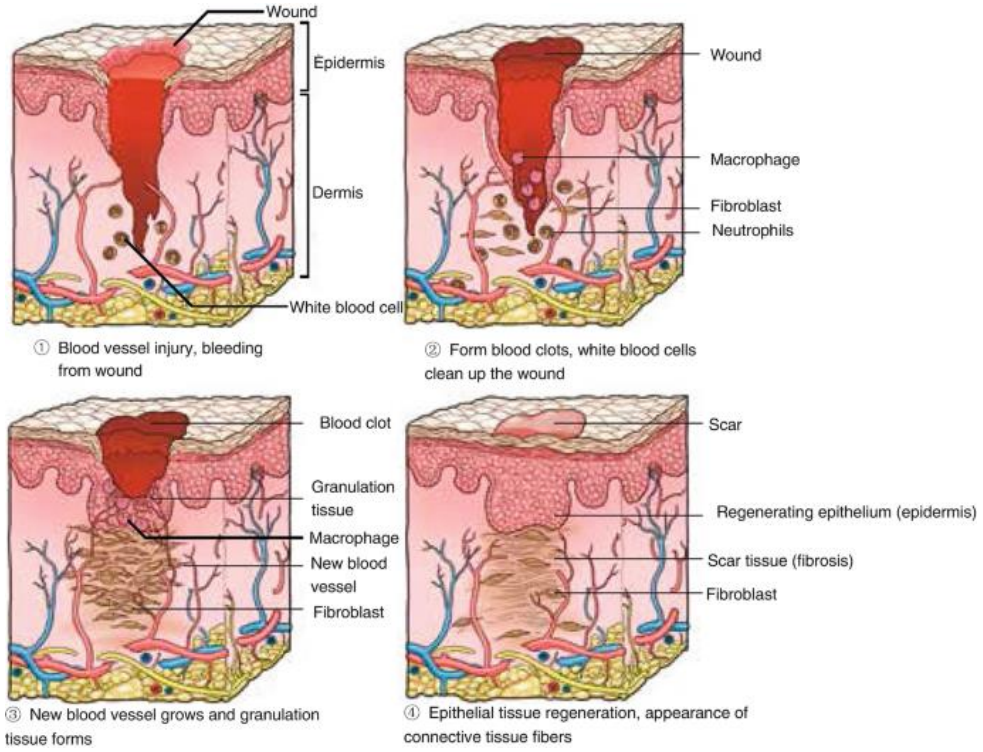
2. Tissue Injury and Inflammation

The ischemia results in the death of cells (necrosis) in the tracheal mucosa and underlying tissues. The body responds with an inflammatory reaction, bringing in immune cells to clean up the damaged tissue.



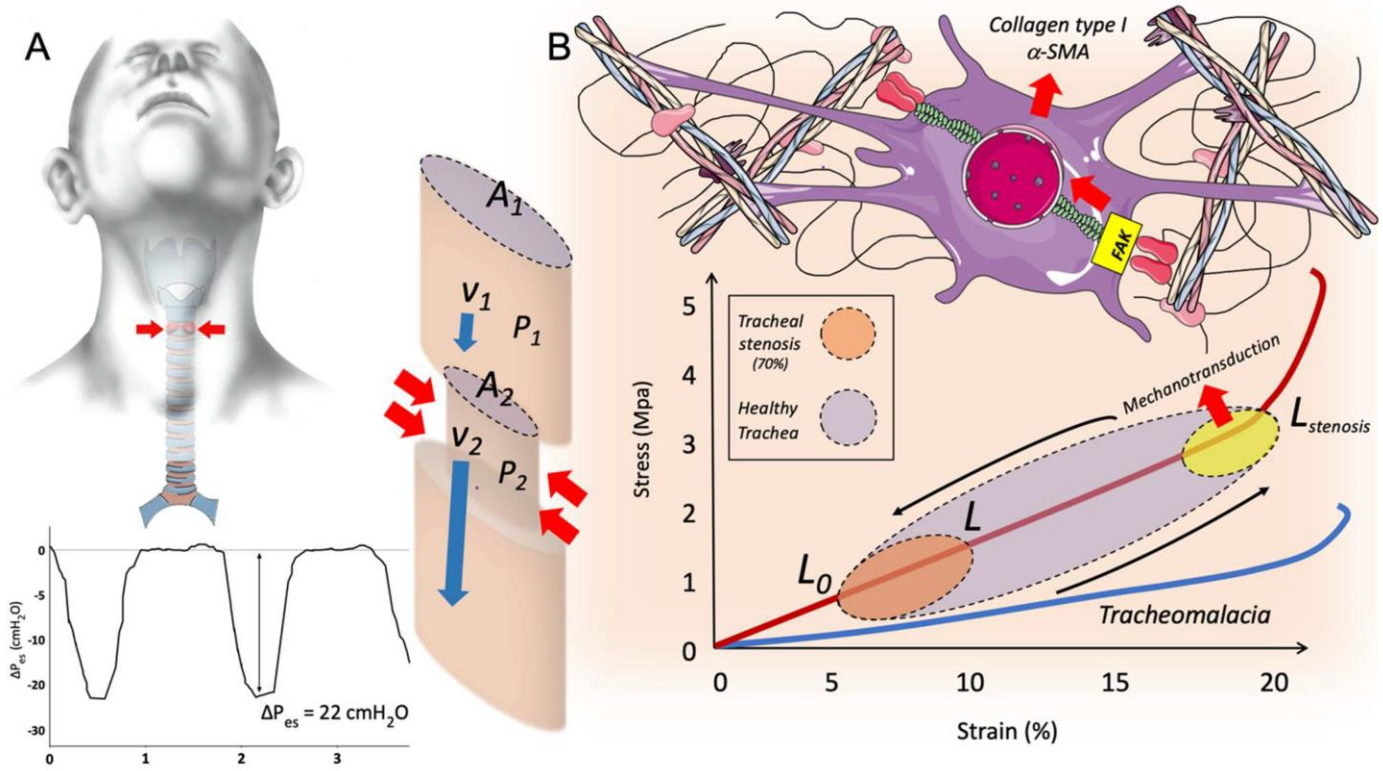
3. Granulation and Fibrosis

As part of the healing process, new tissue known as granulation tissue forms. Over time, this temporary tissue is replaced by collagen-rich scar tissue—a process called fibrosis. The scar tissue is less flexible and tends to contract.



4. Narrowing (Stenosis)

The contraction of scar tissue causes the tracheal lumen to narrow, which is the hallmark of tracheal stenosis from a pathological standpoint



Clinical Symptoms

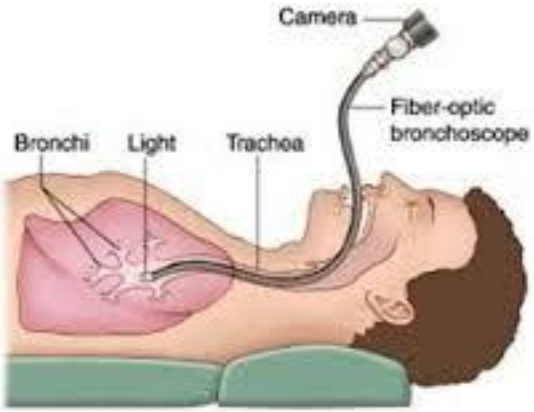
- Progressive dyspnea
- Stridor
- Voice changes (if laryngeal involvement)
- Respiratory distress.

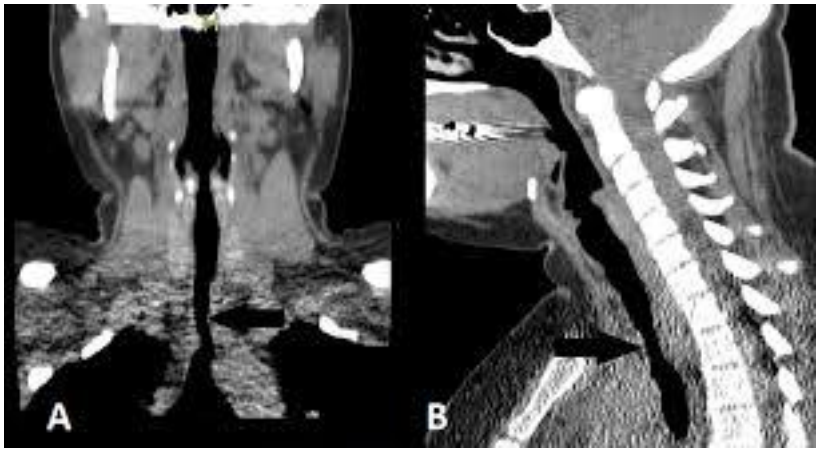
Diagnostic Modalities

Flexible bronchoscopy (gold standard)

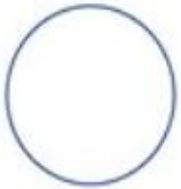
CT imaging (with 3D reconstruction for accurate localization and length estimation)

Pulmonary function tests.



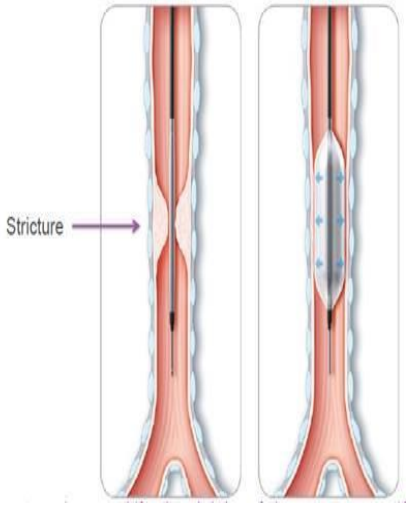


Myer-Cotton Classification

Classification	From	To	Endoscopic appearance
Grade I	 No Obstruction	 50% Obstruction	
Grade II	 51%	 70%	
Grade III	 71%	 99%	
Grade IV	No detectable lumen		

Treatment Strategies: Segment-Specific Approaches

A. Endoscopic Management (Primarily for Short-Segmen or Early-Stage Stenosis)



Balloon Dilation

Laser Ablation (CO_2 or Nd:YAG)

Adjunctive Therapies:

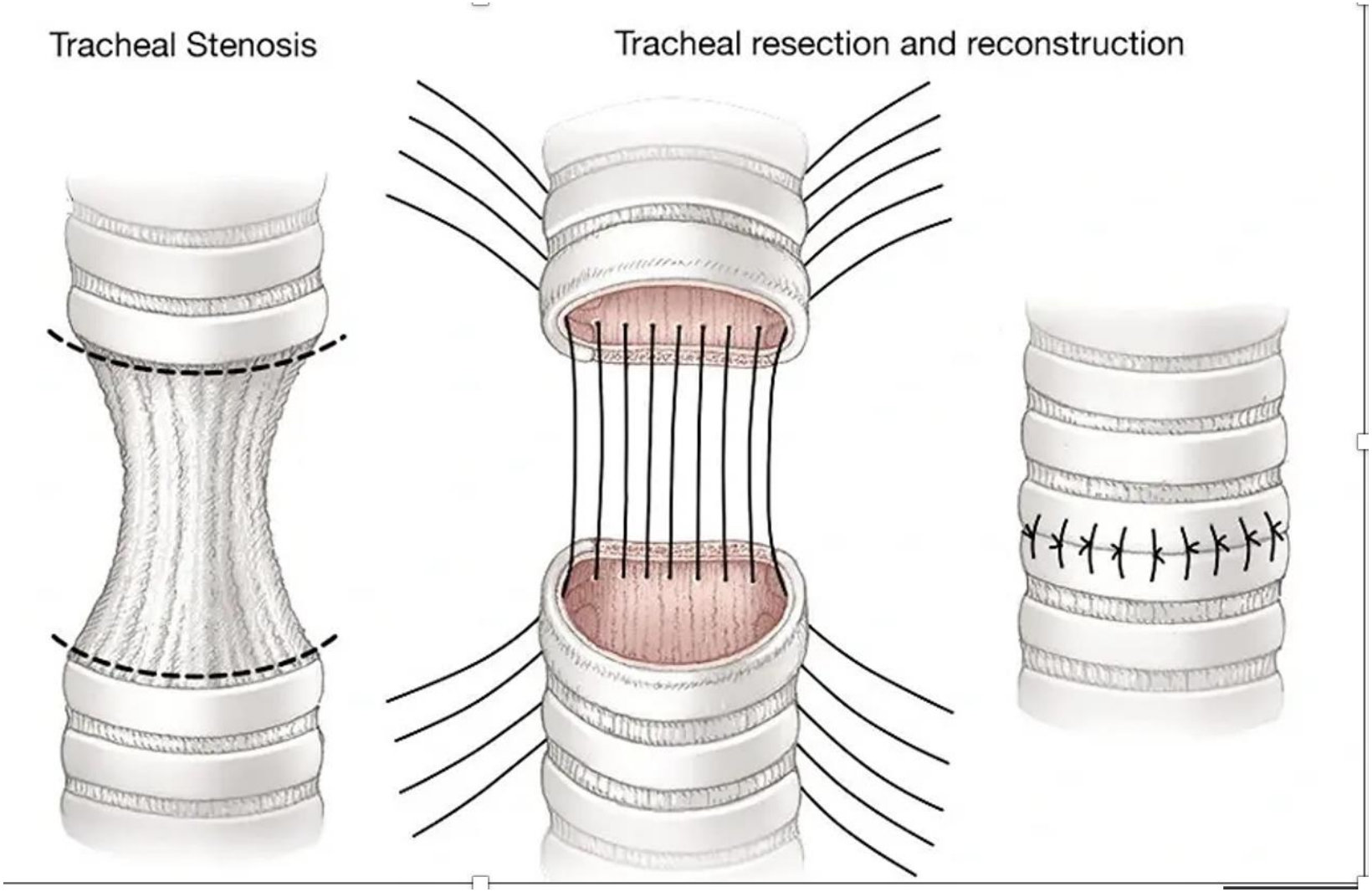
- Mitomycin-C: Topically applied after incision to inhibit fibroblast proliferation and delay restenosis.
- Corticosteroid Injections: Reduce inflammation and edema, potentially prolonging the interval between interventions.

These endoscopic options are generally considered for lesions confined to the mucosal or submucosal layers, especially when the stenosis is limited in length and has not yet led to significant cartilaginous damage.

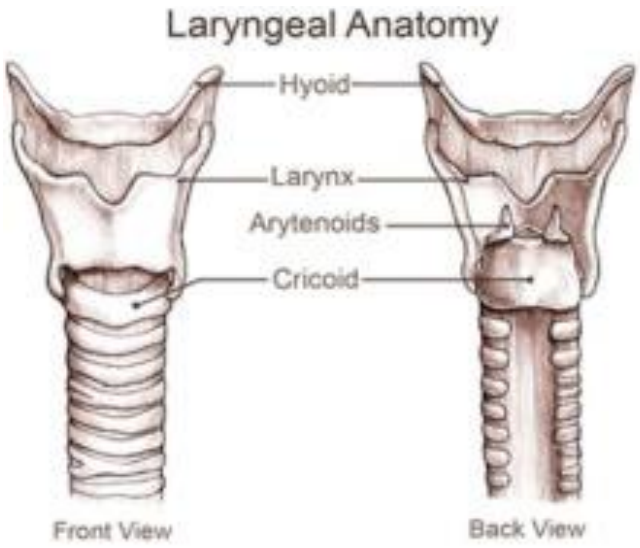
B. Open Surgical Management (For Moderate to Severe or Long-Segment Stenosis)

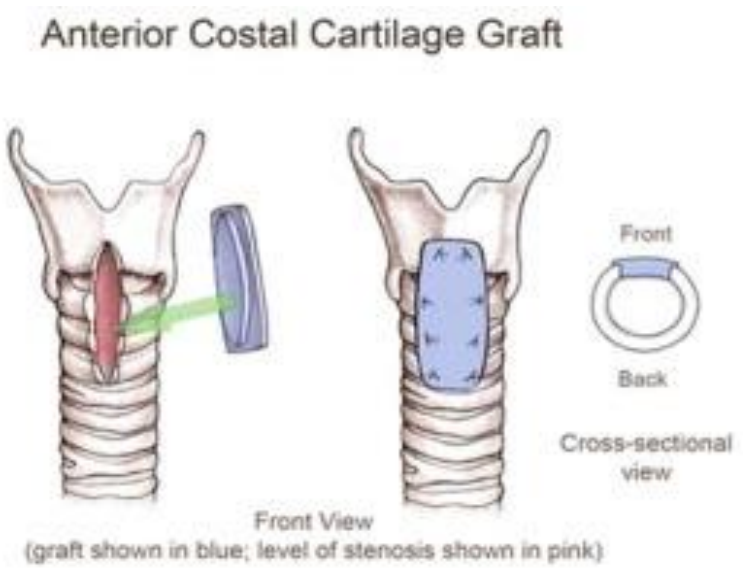
- Tracheal Resection and Primary Anastomosis
- Laryngotracheal Reconstruction
- Slide Tracheoplasty
- Cricotracheal Resection
- Tracheal Stenting

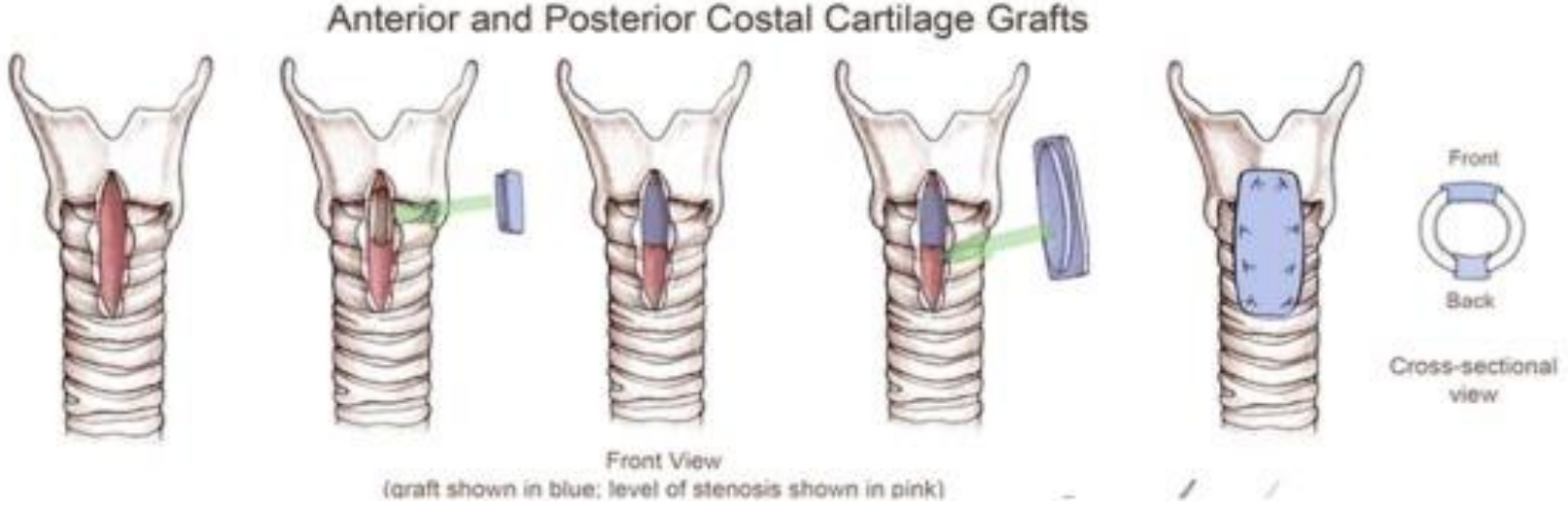
Tracheal Resection and Primary Anastomosis



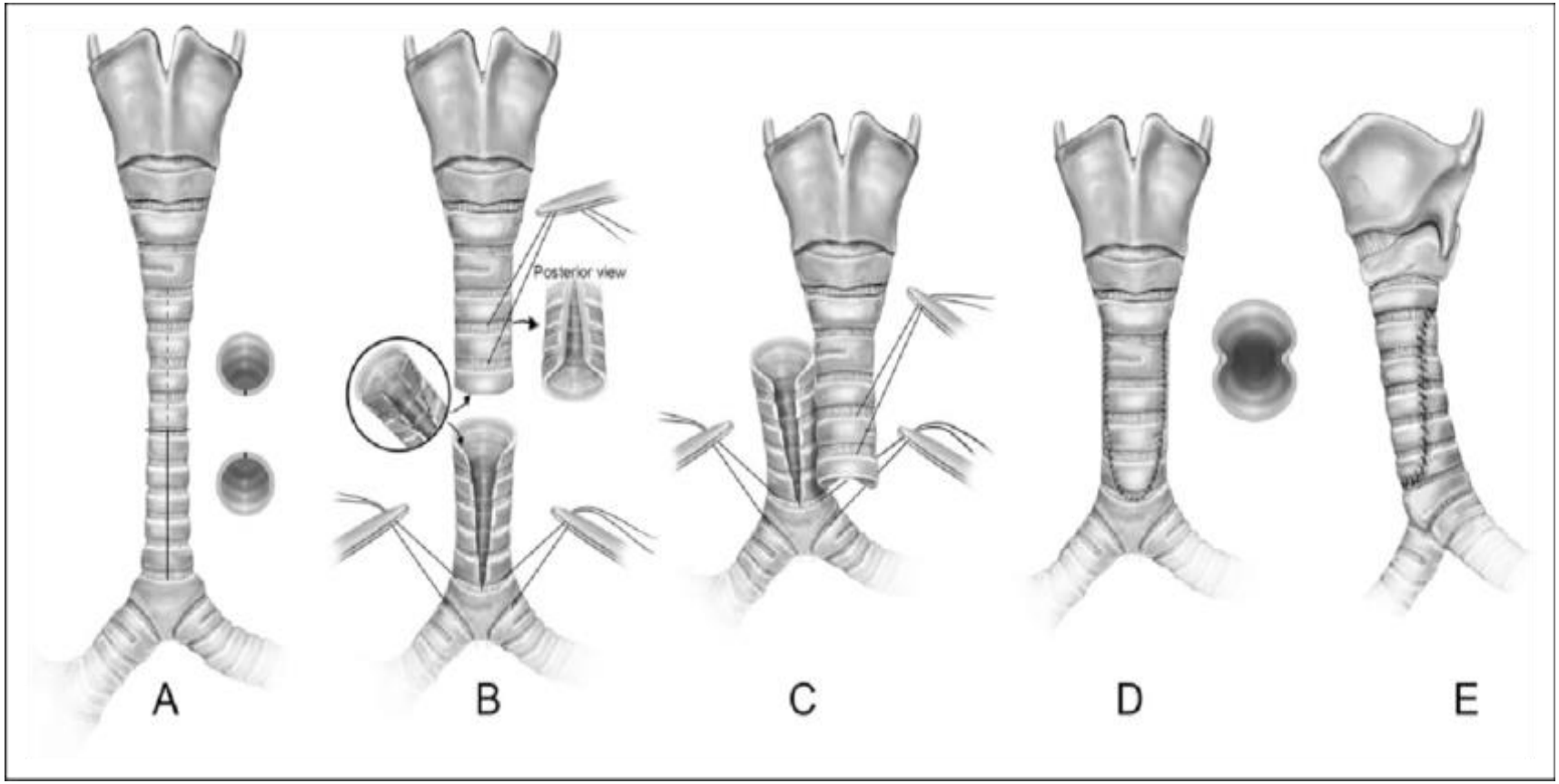
Laryngotracheal reconstruction



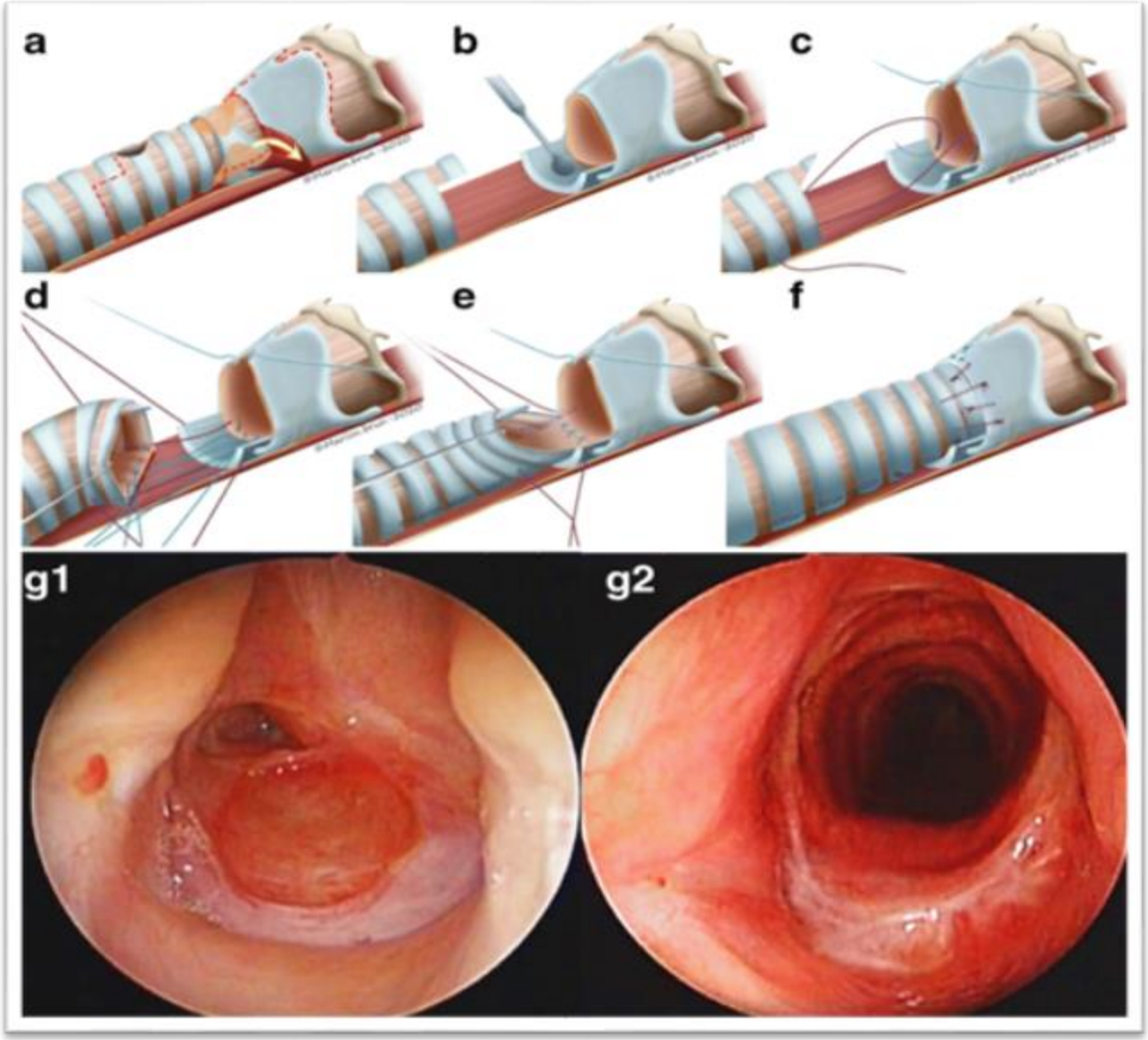




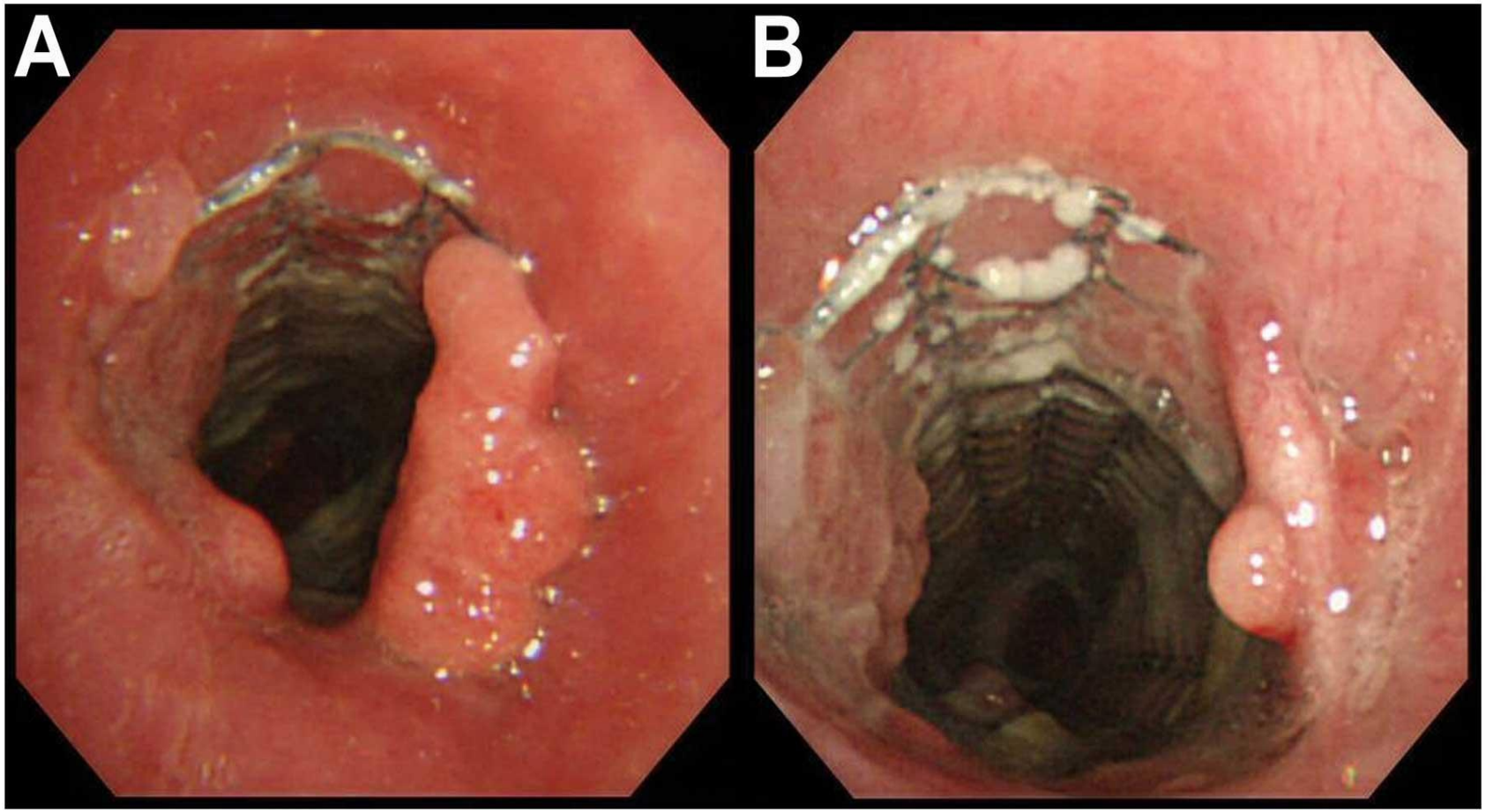
Slide tracheoplasty



Cricotracheal Resection



Tracheal Stenting



The choice of an open surgical technique depends critically on the segment affected:

- **Supraglottic and Glottic Stenoses** may require laryngeal reconstruction techniques
- **Subglottic Stenosis** is best managed with resection techniques (cricotracheal resection) or, in extensive cases, with laryngotracheal reconstruction using grafts.
- **Isolated Tracheal Stenosis** (below the cricoid) is ideally treated with segmental resection and primary anastomosis or slide tracheoplasty for longer lesions.

Prevention

Use low-pressure cuffs (<25 cmH_2O) and limit intubation duration.

Early tracheostomy (when indicated) may reduce injury from prolonged intubation.

Post-operative care

Close bronchoscopic monitoring to detect restenosis, granulation tissue, or anastomotic dehiscence.

Neck anteflexion (often maintained with a “guardian” chin-to-chest suture) to reduce tension on the anastomosis.

Multidisciplinary follow-up involving otolaryngologists, pulmonologists, and speech/swallow therapists.

Clinical Implications and Future Directions

- Tailored Treatment
- Role of Multidisciplinary Teams
- Advances in Imaging and 3D Reconstruction
- Ongoing Research

Conclusion

Endoscopic procedures are effective for short, early-stage lesions.

Open surgical techniques are the gold standard for complex or long-segment stenosis.

The optimal treatment is tailored based on the specific segment involved.

A multidisciplinary strategy is essential for a tracheostomy- and stent-free airway with preserved voice and swallowing.

References

Remacle M, Eckel HE, editors. *Surgery of the Larynx and Trachea*. 2nd ed. Cham: Springer; 2022. XI, 543 p. doi:10.1007/978-3-031-09621-1.

Scott-Brown's Otorhinolaryngology: Head and Neck Surgery. 7th ed. London: Hodder Arnold; 2008. 3900 p.

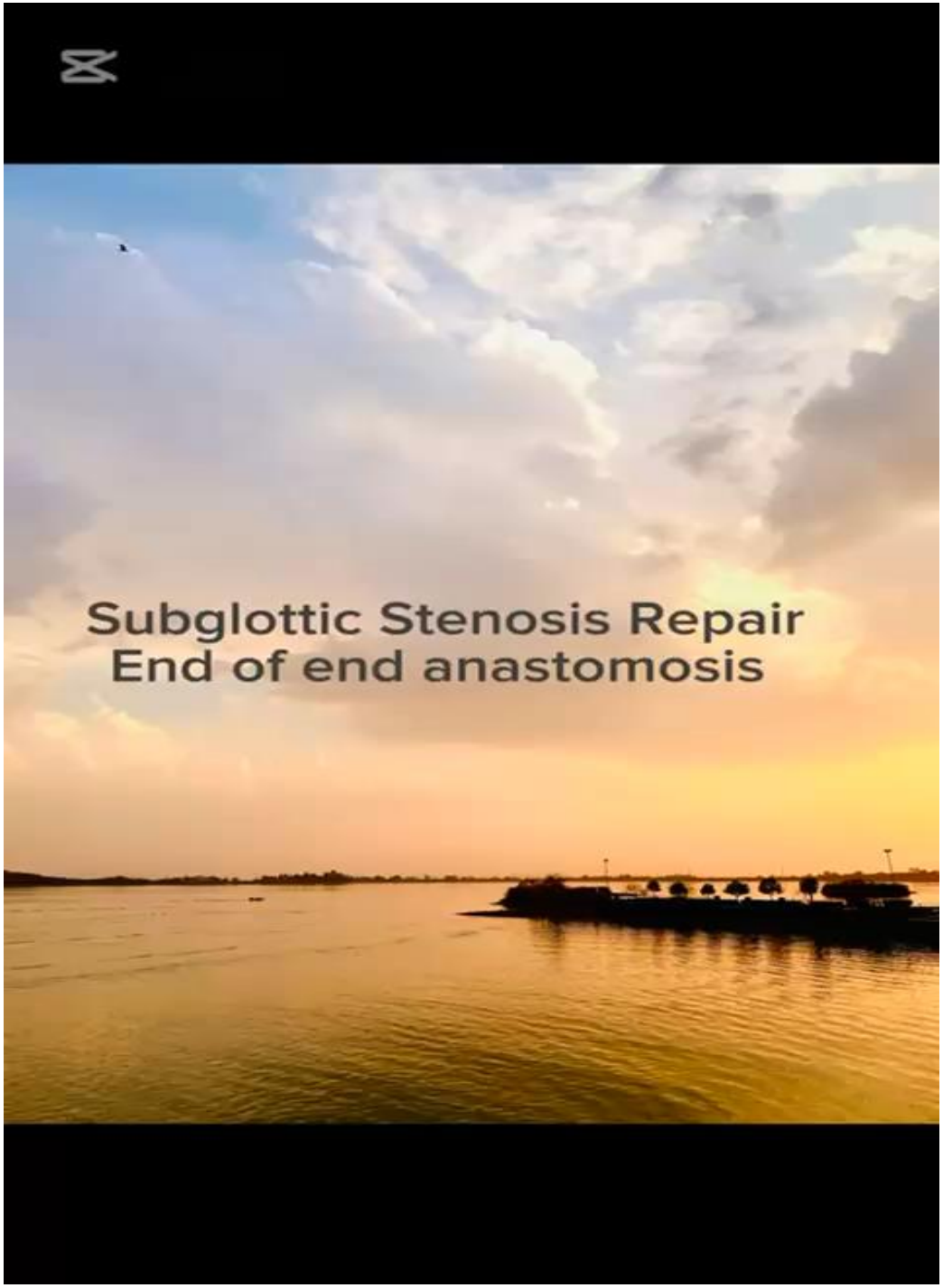
Stell PM, Maran AG, editors. Stell & Maran's Textbook of Head and Neck Surgery and Oncology. 5th ed. London: CRC Press; 2012. xii, 1182 p.

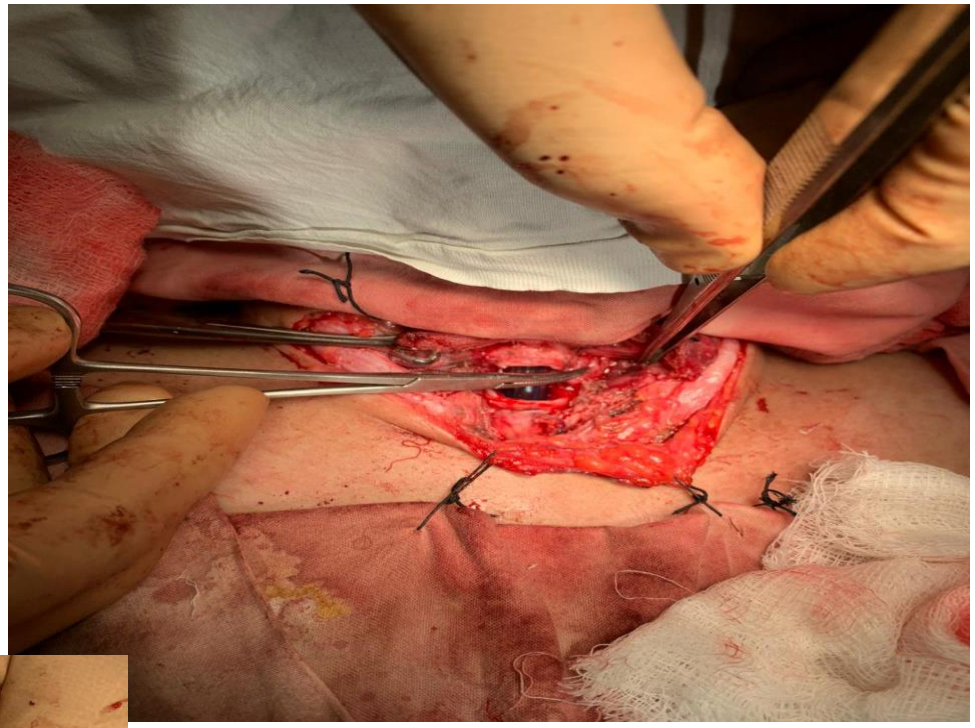
What we did???

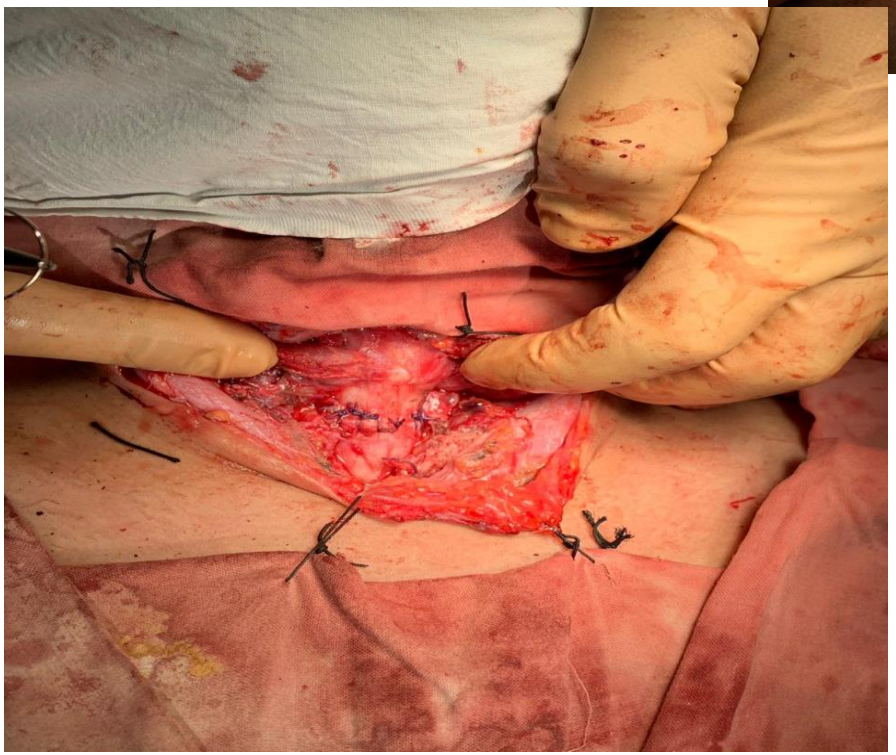
TREATMENT

Tracheal Reconstruction (Anastomosis)- 3/07/24

- Stenosed part of trachea around 4cm removed after stay suture and suprahyoid drop done. Trachea anastomosed 1st in posterior part then anteriorly by Vicryl 2.0. Air tight seal checked.


Subglottic Stenosis Repair
End of end anastomosis





7th postoperative week

Patient's post op re-evaluation done via bronchoscopy

- Findings: Granulation seen in posterior lateral wall of subglottis, granulation shaved off and Silver nitrate cautery done

Patient advised follow-up after 6 week for re-evaluation.


Thank
You