

Trachea Disease and Surgery

장효준

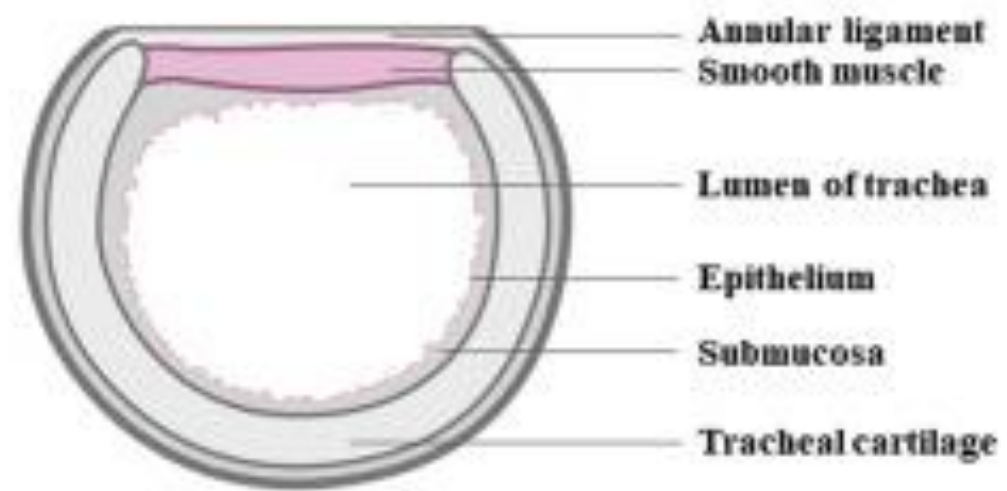
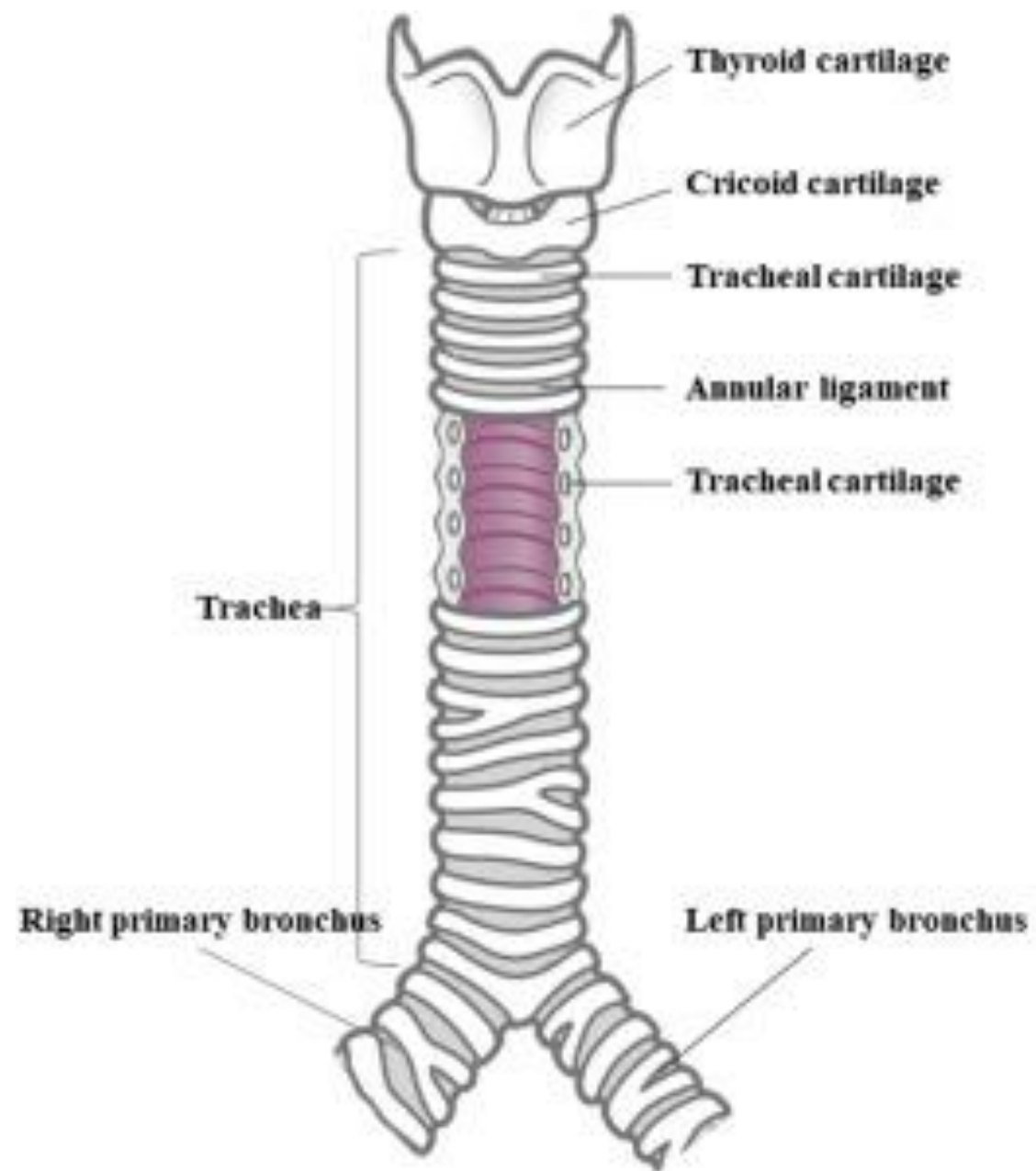
Trachea Surgery

- Dr. Hermes Grillo (1923-2006)
 - Professor at Harvard Medical School.

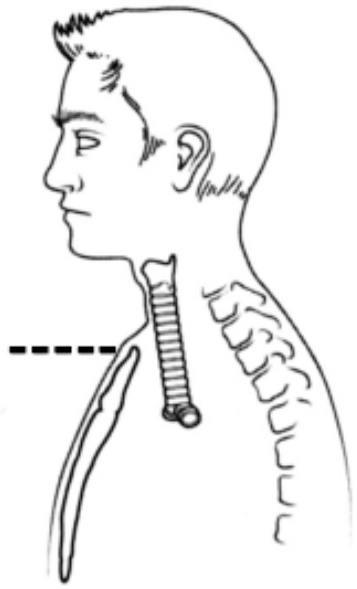


Anatomy

- Length: average 11.8cm (10~13cm), from the infracricoid level to the top of the carina spur
- Two cartilage ring : 1cm
- Internal diameter : 2.3cm (laterally), 1.8cm(anteoposteriorly)

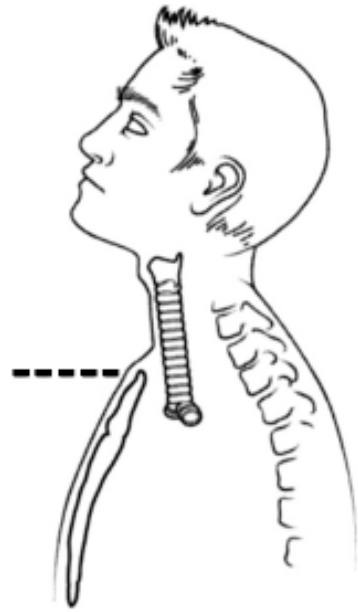


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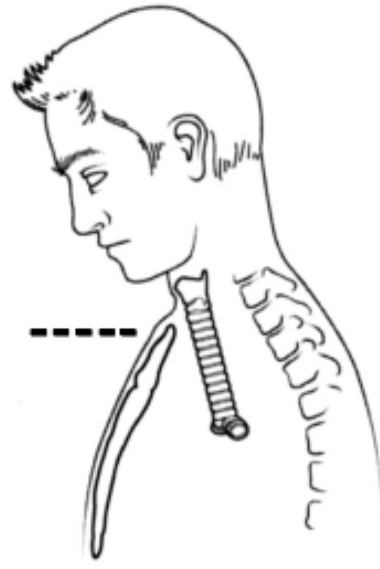
a

Neutral position



b

Extension



c

Flexion

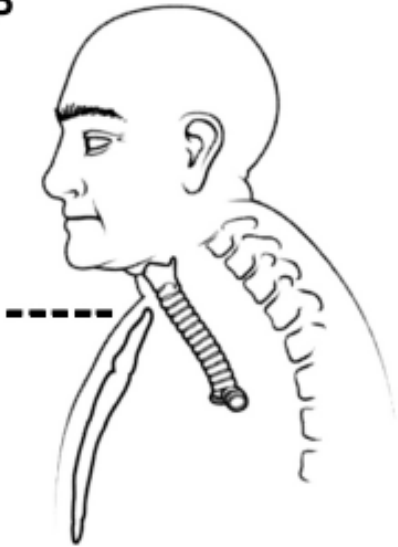
- Neck extension

: 1/2 cervical position, 1/2 thoracic position

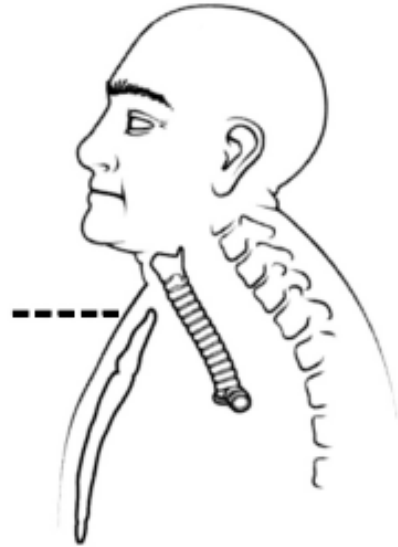
- Neck flexion

: almost thoracic position

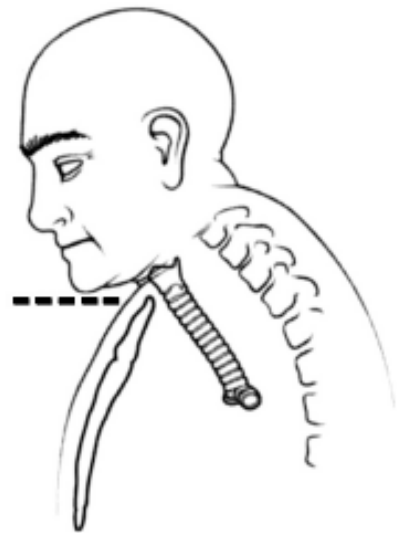
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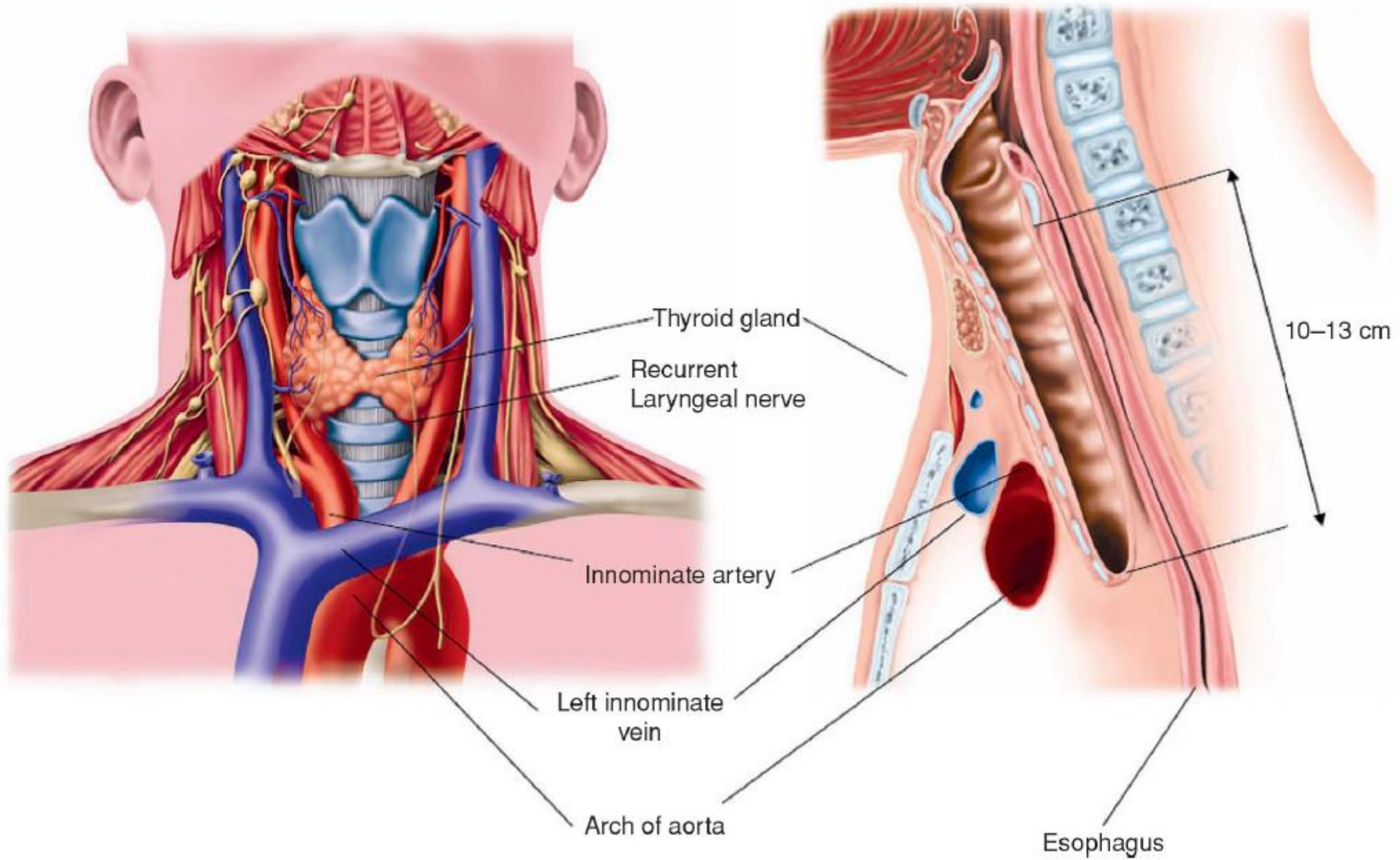
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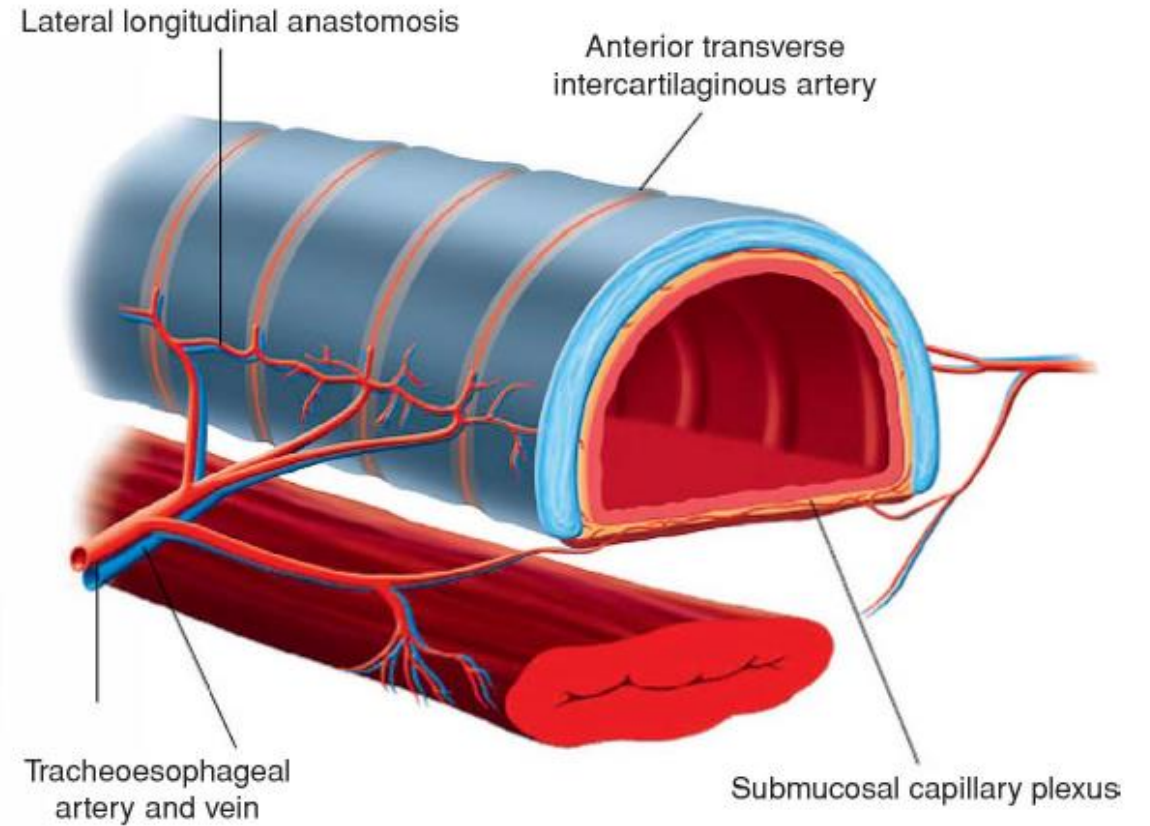
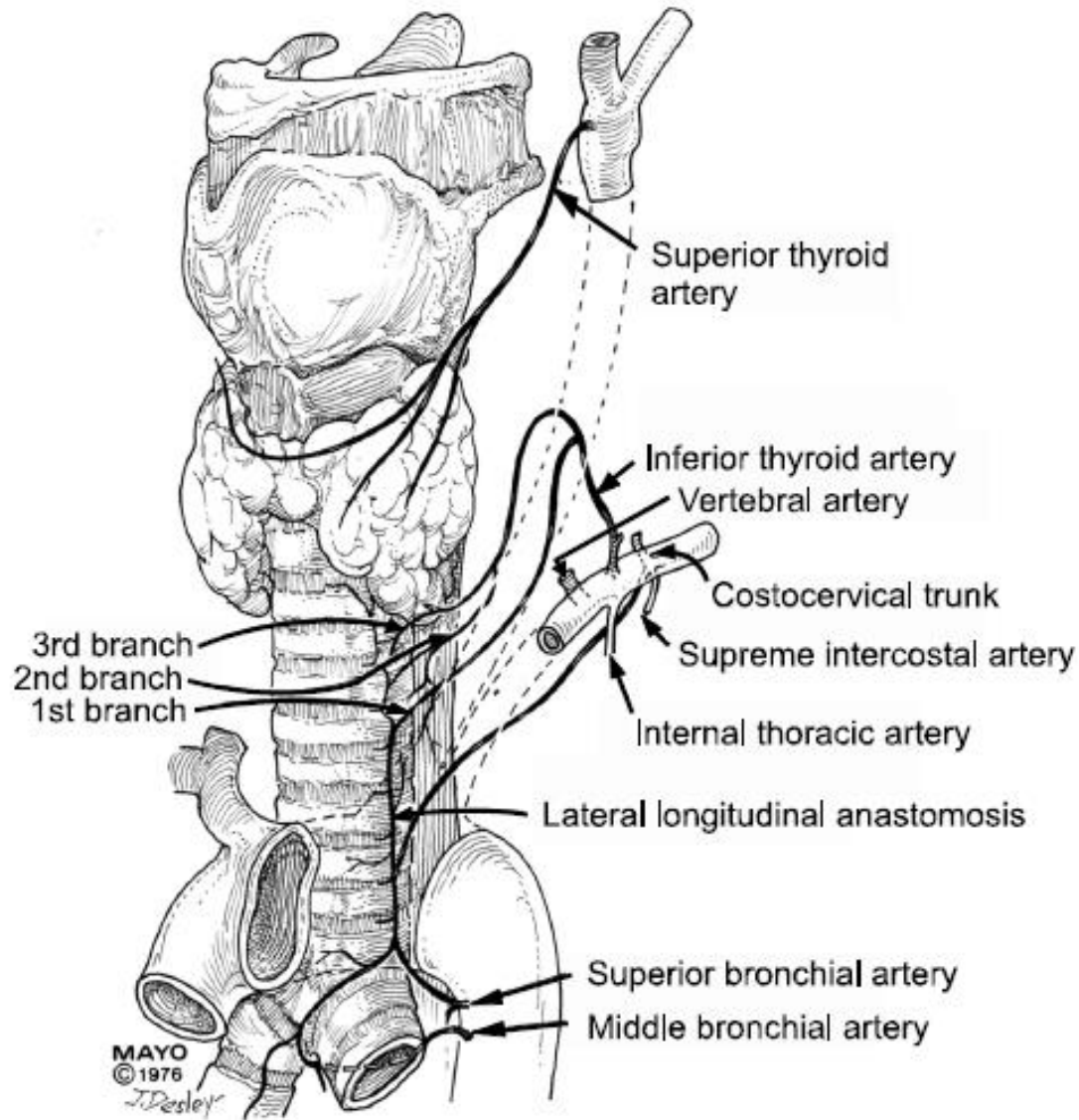


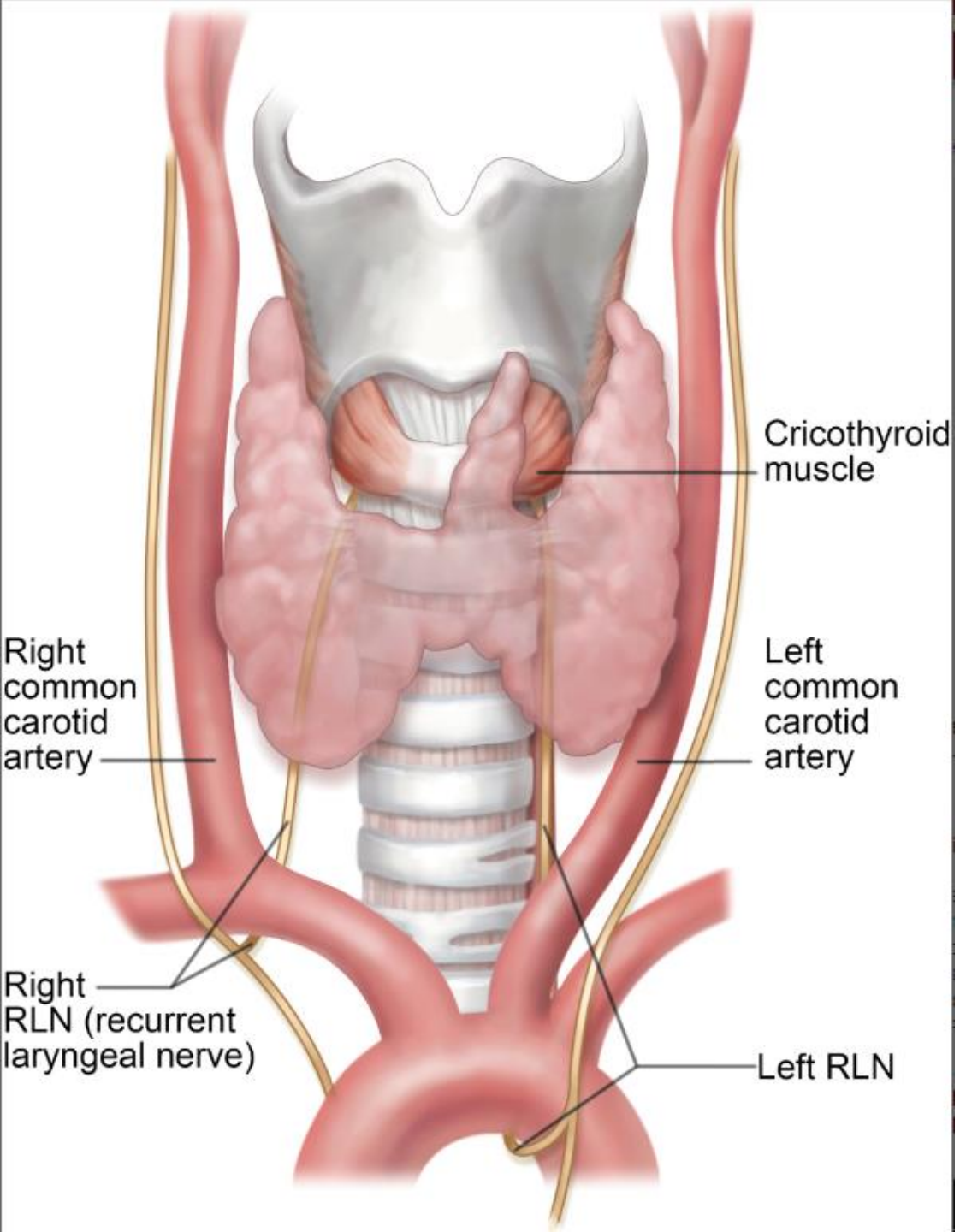
b



c







- Recurrent laryngeal nerve : proximity to tracheal (Lt.>Rt.)

Trachea Disease

- 1. Tumor

: Adenoid cystic carcinoma, Squamous cell carcinoma

- 2. Infection

: Tuberculosis

- 3. Trauma

: Postintubation and posttracheostomy injury (m/c)

- 4. Congenital tracheal stenosis

Presentation

- Symptoms

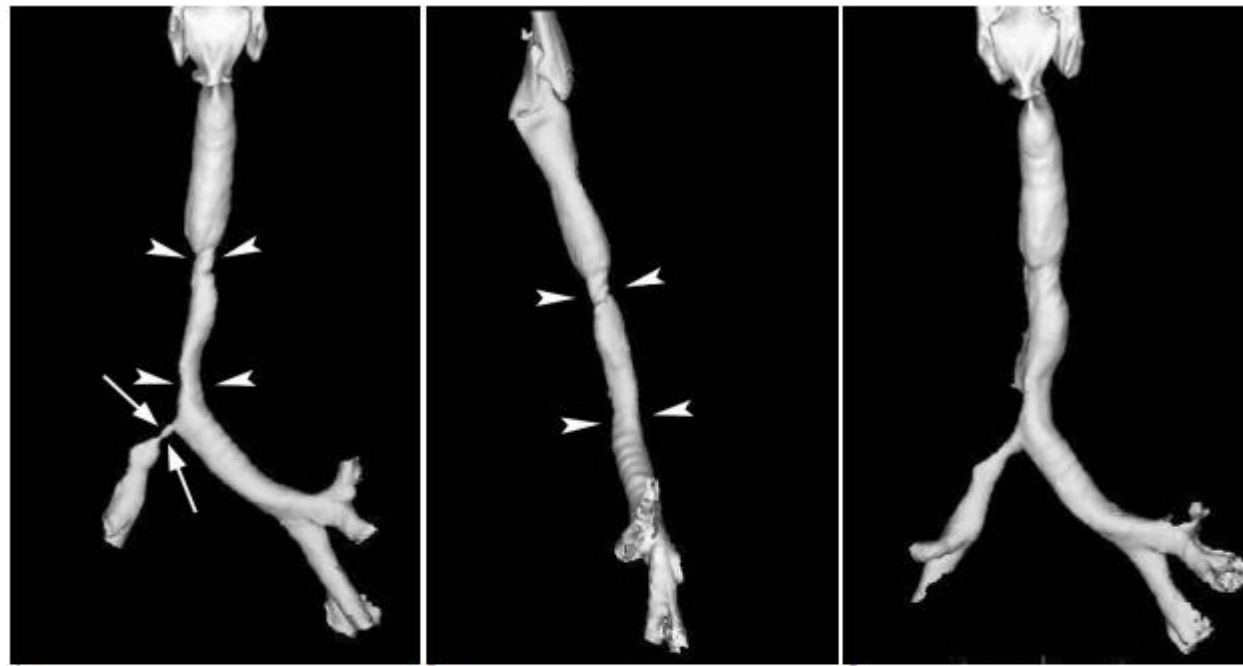
- : wheezing, shortness of breath with exertion, stridor

- : more than 70% narrow on the cross-sectional lumen

Evaluation

- Tracheal reconstruction, CT scan
- Flexible bronchoscopy
- Rigid bronchoscopy
- Pulmonary function test
- Esophagoscopy for suspicious esophageal involvement,

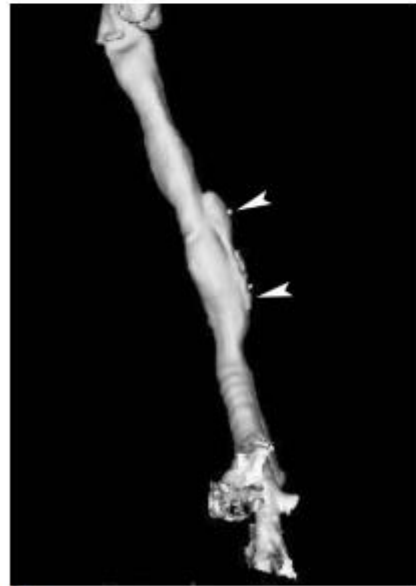




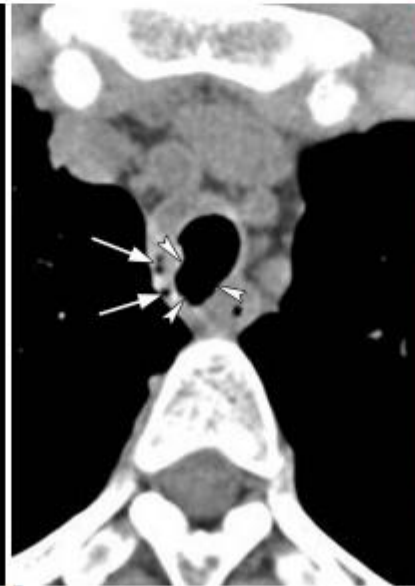
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B

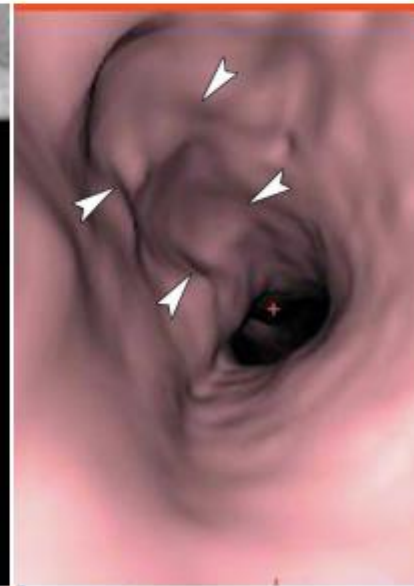
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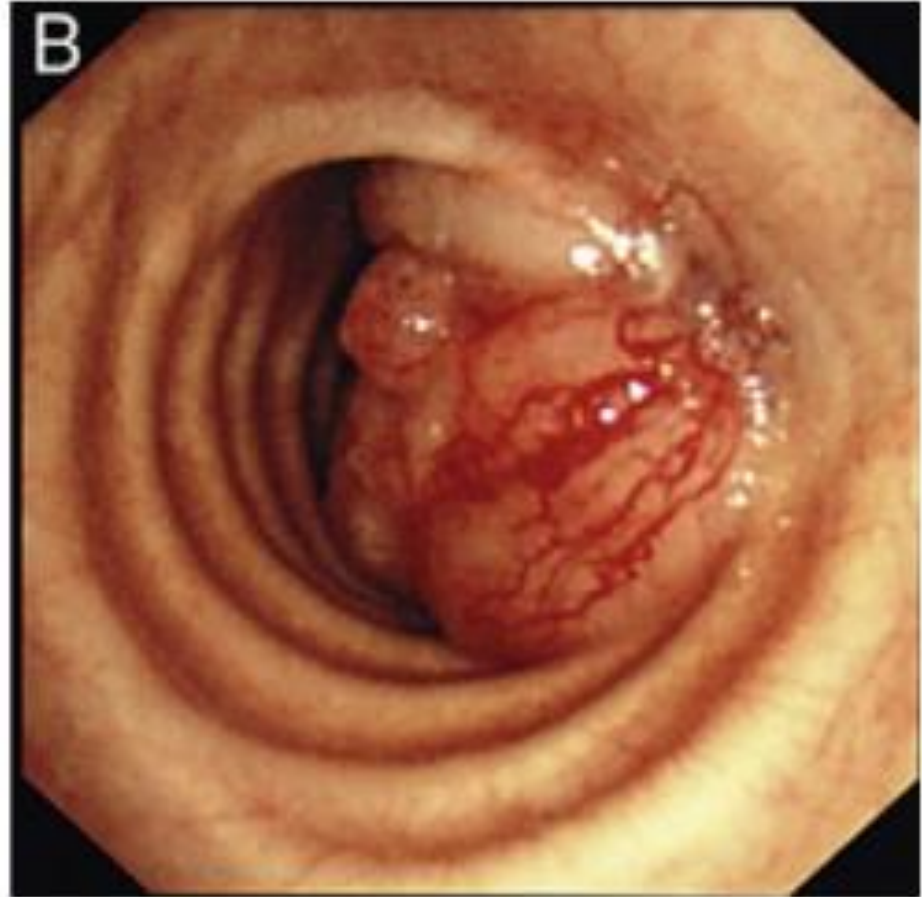
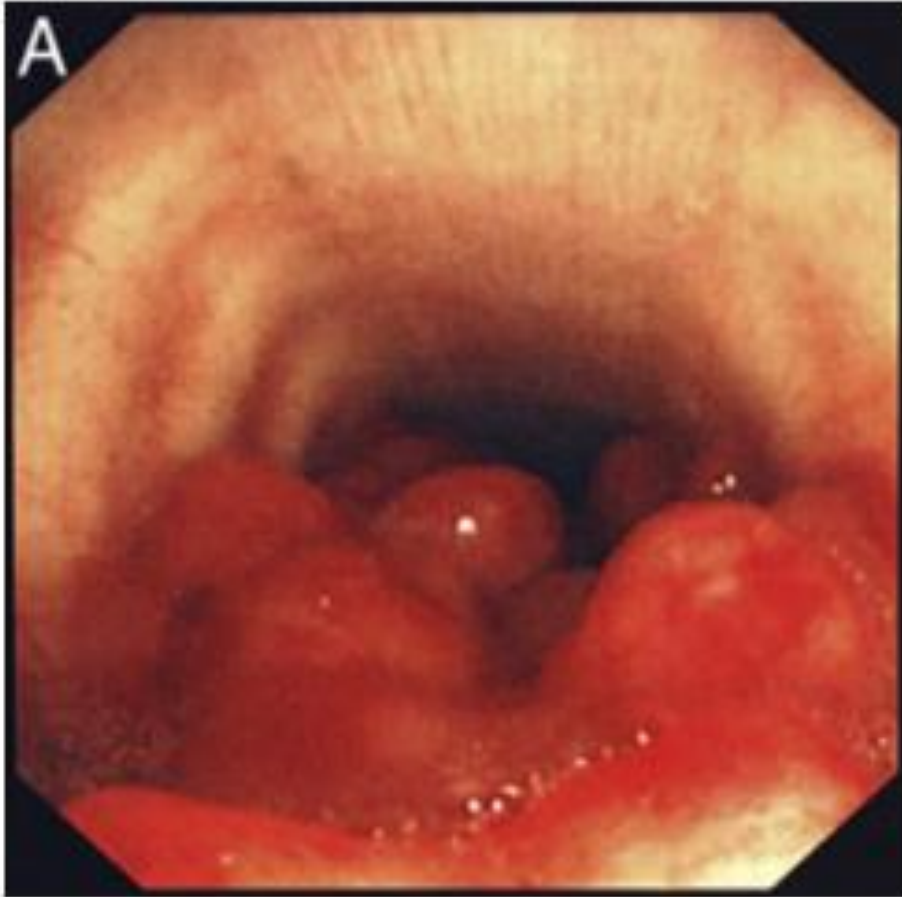
D



E



F



Flow Volume Loops

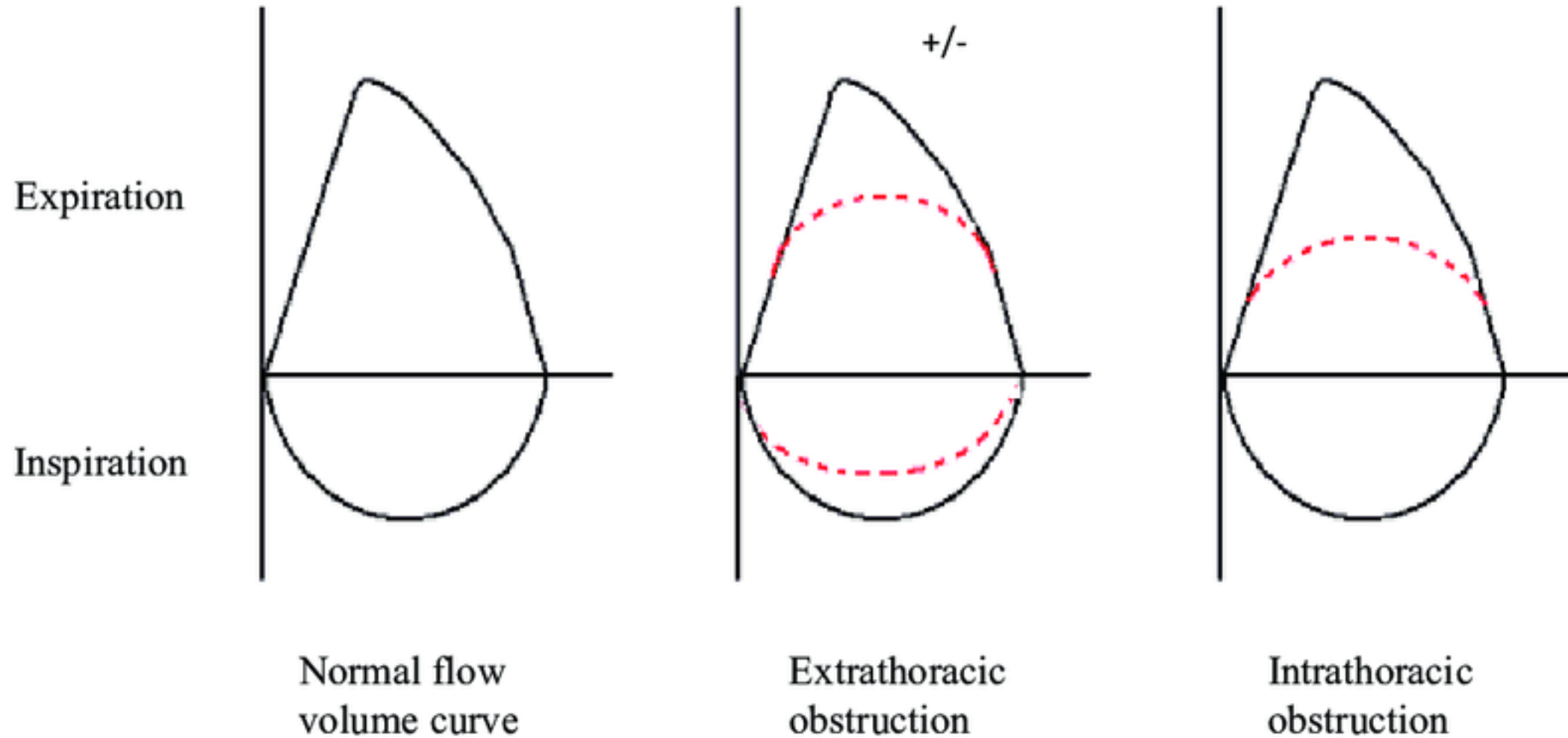


TABLE 74.3 Tumor Histology Encountered in 360 Specimens of 357 Patients Over 4 Decades***Malignant Lesions***

Adenoid cystic carcinoma	135
Squamous cell carcinoma	135
Carcinoids	11
Typical	10
Atypical	1
Lymphoma	2
Melanoma	1
Mucoepidermoid carcinoma	14
Non-squamous carcinoma	15
Small cell carcinoma	5
Adenocarcinoma	4
Large cell carcinoma	4
Adenosquamous carcinoma	2
Sarcoma	13
Spindle cell sarcoma	6
Chondrosarcoma	3
Leiomyosarcoma	1
Carcinosarcoma (pseudosarcoma)	1
Invasive fibrous tumor	1
Malignant fibrous histiocytoma	1
Total malignant tumors	326

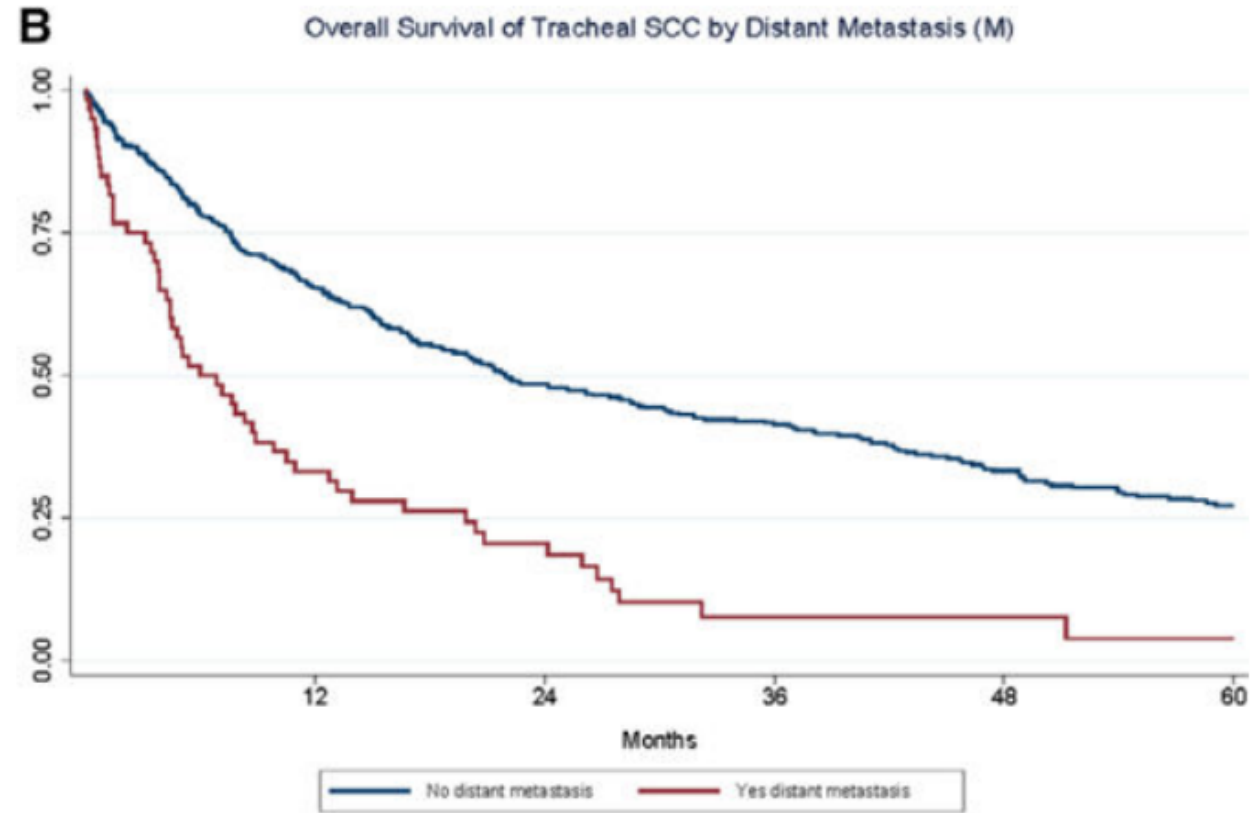
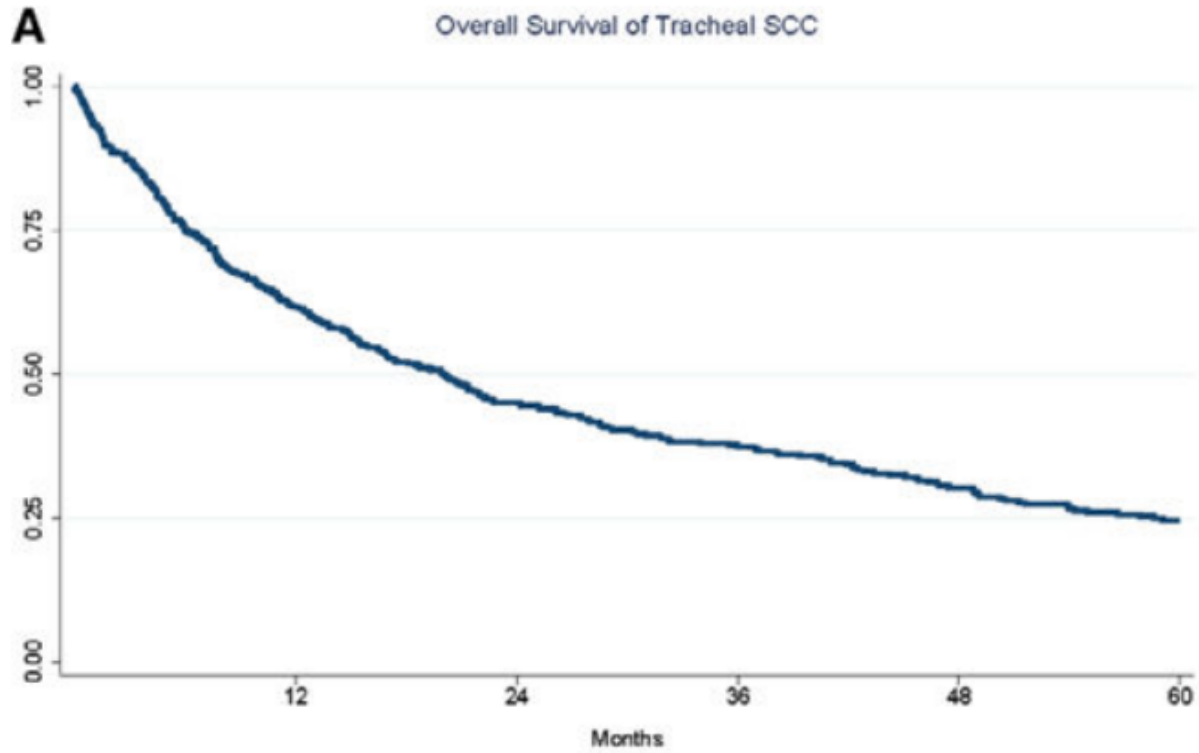
Benign Lesions

Capillary hemangioma	1
Chondroblastoma	1
Chondroma	2
Fibrous histiocytoma	1
Glomus tumor	1
Granular cell tumor	2
Hamartoma	2
Hemangiomatous malformation of the mediastinum	1
Inflammatory pseudotumor (plasma cell granuloma)	1
Leiomyoma	3
Neurogenic tumor	4
Schwannoma	1
Plexiform neurofibroma	1
Peripheral nerve sheath tumor	1
Atypical schwannoma	1
Paraganglioma	1
Pleomorphic adenoma	3
Pyogenic granuloma	1
Squamous papillomas	9
Multiple	5
Solitary	4
Vascular tumor of borderline malignancy	1
Total benign tumors	34
All tumors	360

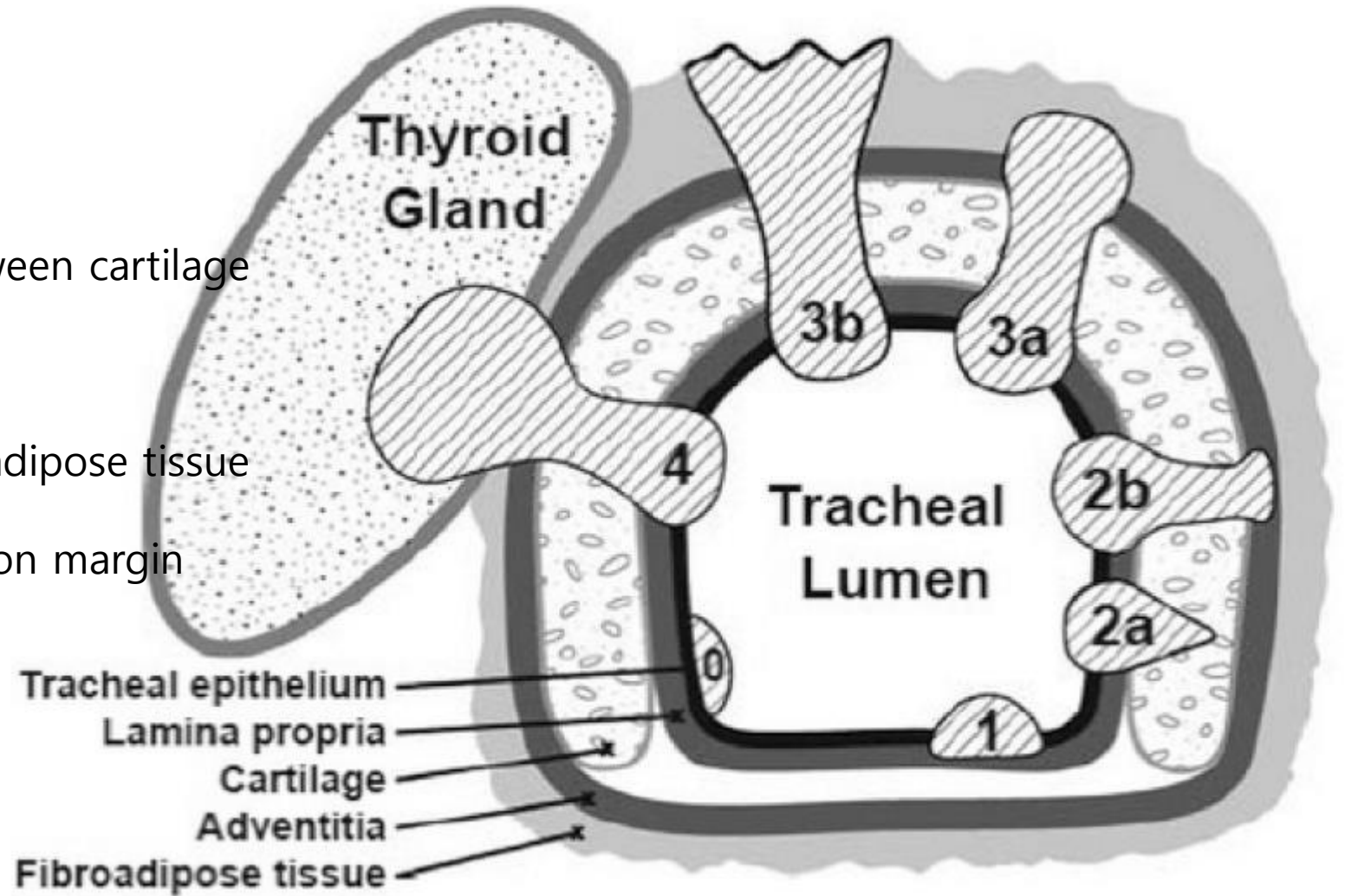
Squamous Cell Carcinoma

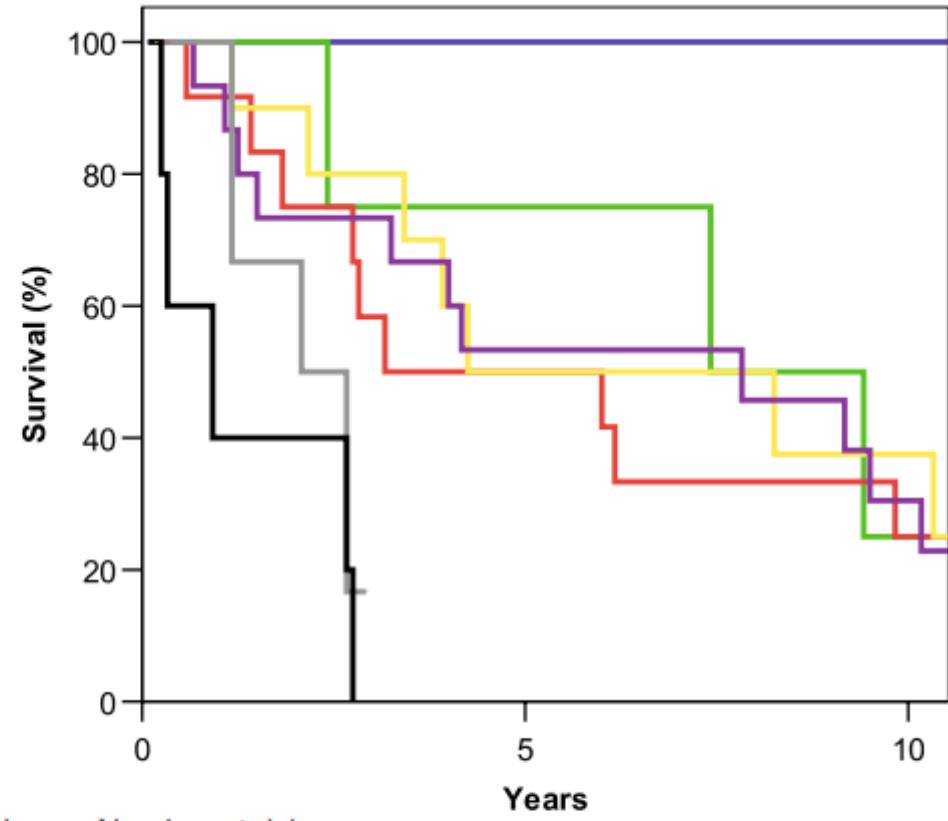
- Rapidly invasive and progressive
- Risk factor: smoking
- 10% : multifocal





- 0: carcinoma in site
- 1: infiltrating lamina propria
- 2a: abutting or extending between cartilage
- 2b: invading through cartilage
- 3a: invading peritracheal fibroadipose tissue
- 3b: abutting soft tissue resection margin
- 4: invading into thyroid gland



C

Depth of invasion	Number at risk	Years	
Level 0	2	2	1
Level 1	5	3	1
Level 2a	14	6	3
Level 2b	11	5	3
Level 3a	16	8	4
Level 3b	6		
Level 4	5	0	

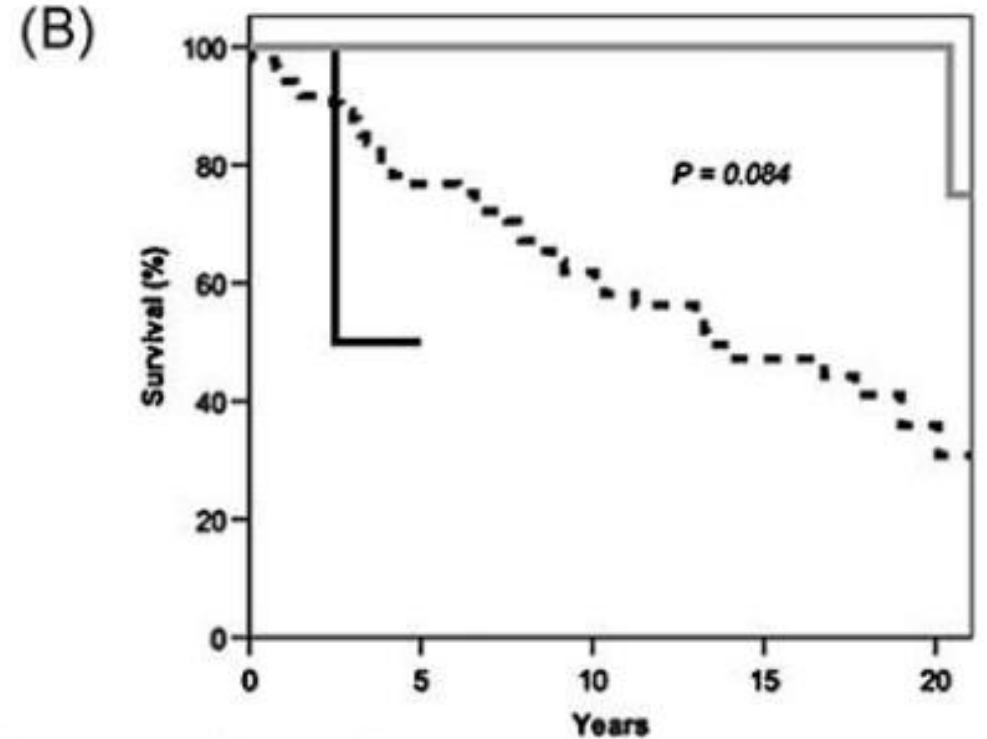
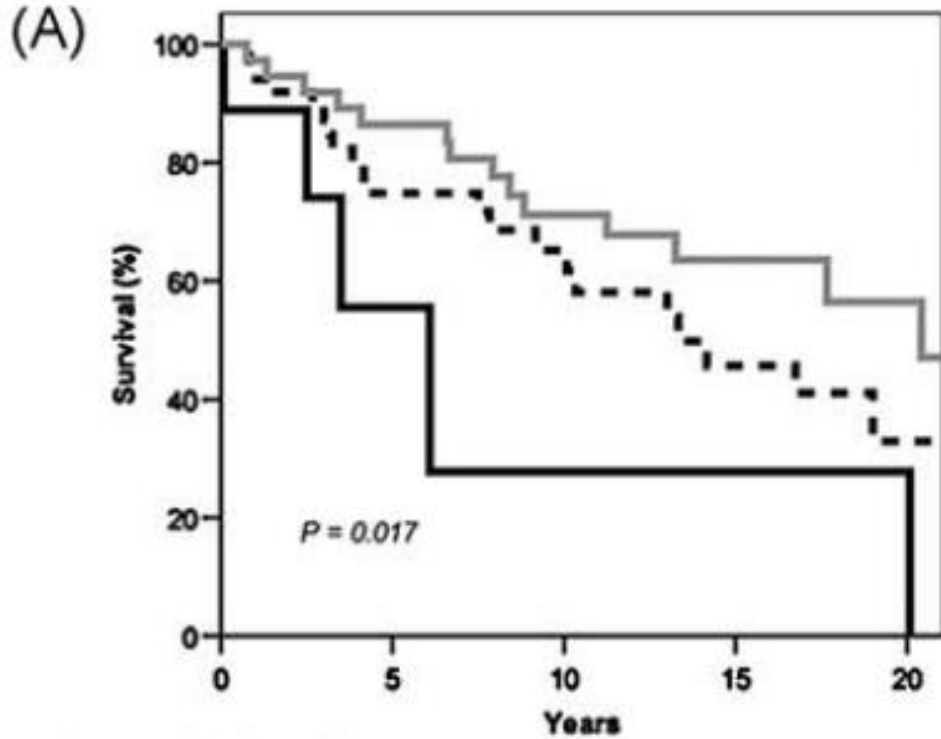
Adenoid Cystic Carcinoma

- Previously called cylindroma
- Slowly advancing salivary gland tumor
- Late recurrence after 10~15 years
- Disease progression along nerve (perineural invasion)
- Polyphoid lesion >> infiltrative plaques



<https://radiopaedia.org/>

Djakovic Z *Acta Clin Croat* 2019;58:777-9.

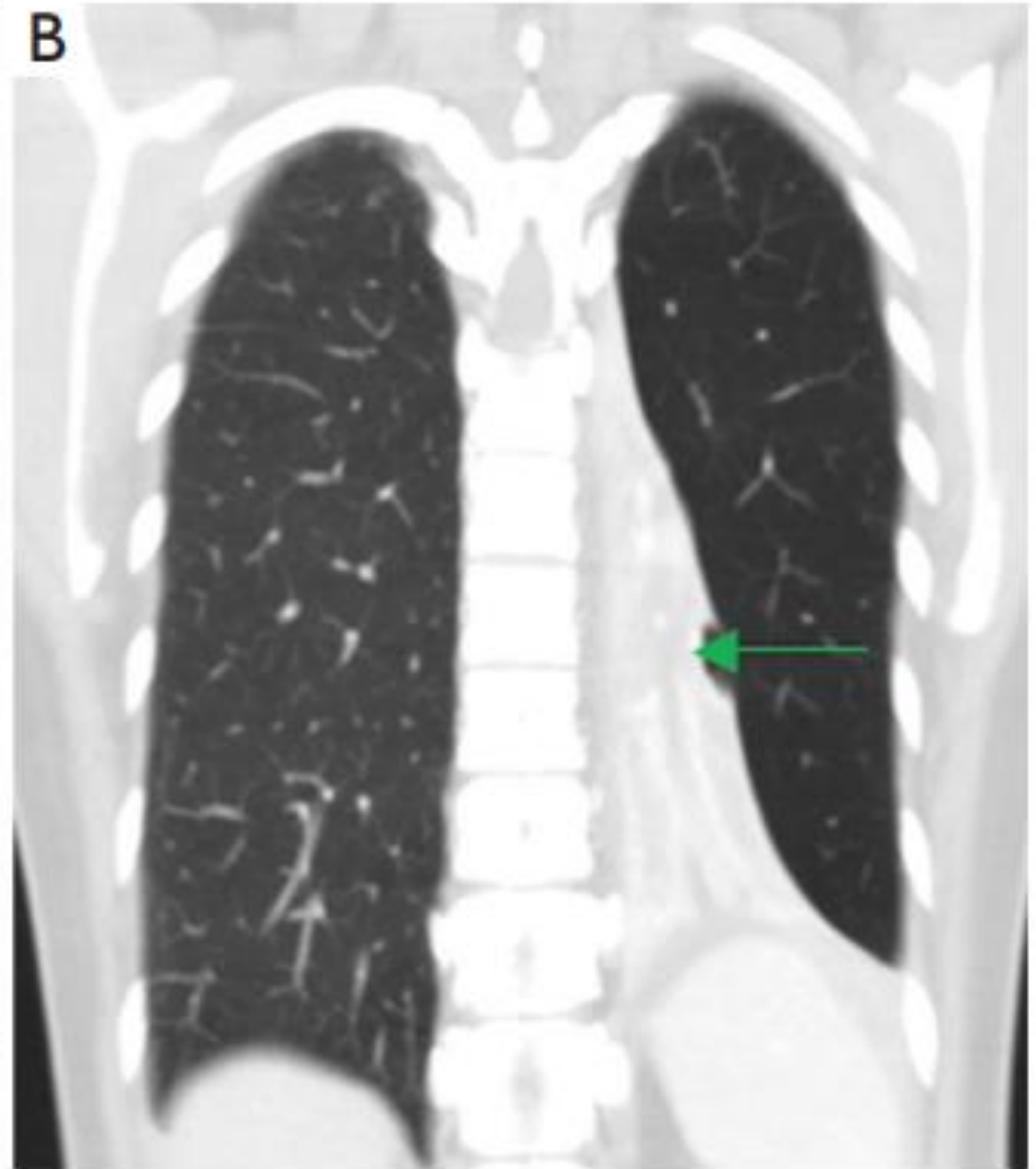
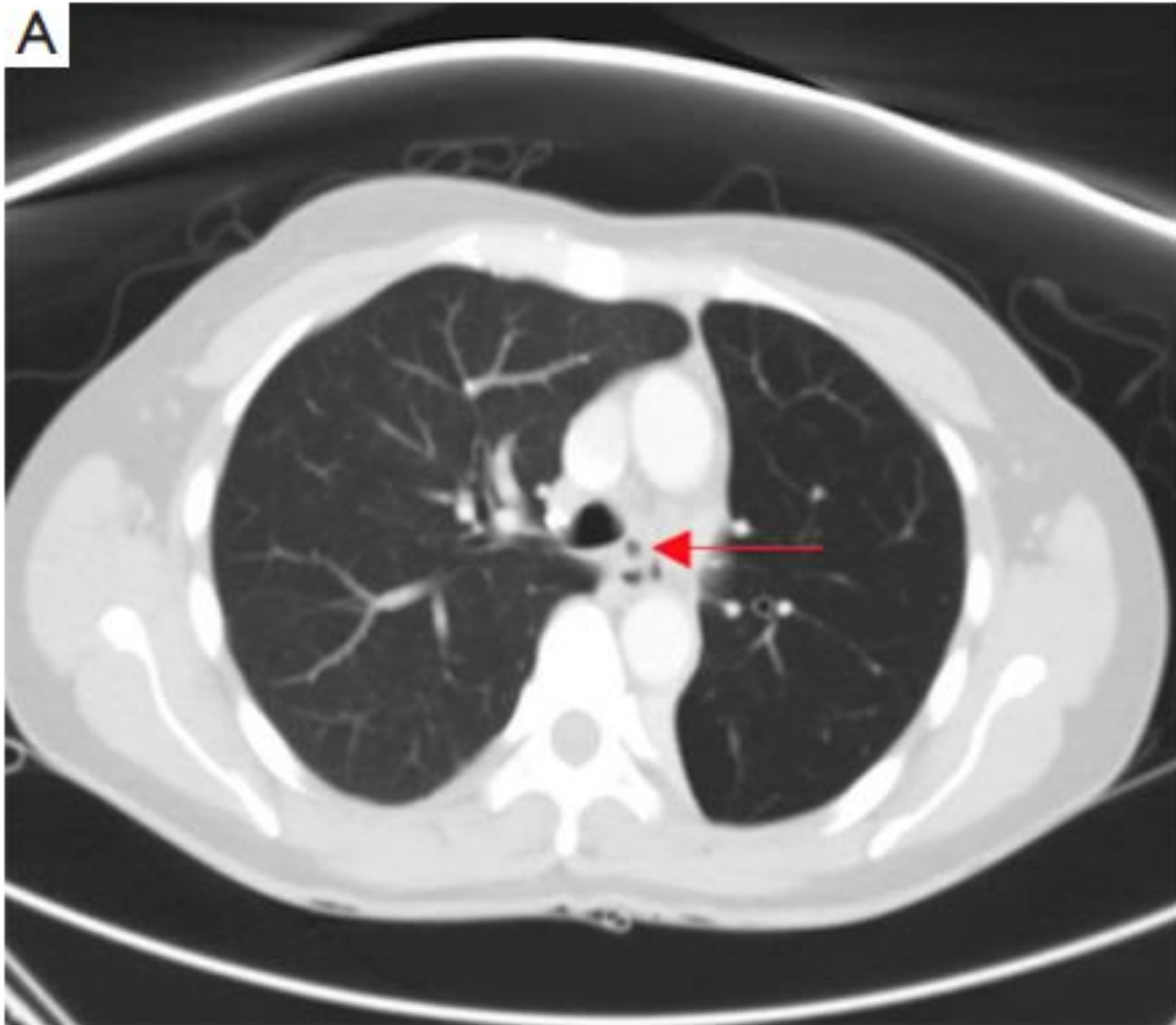


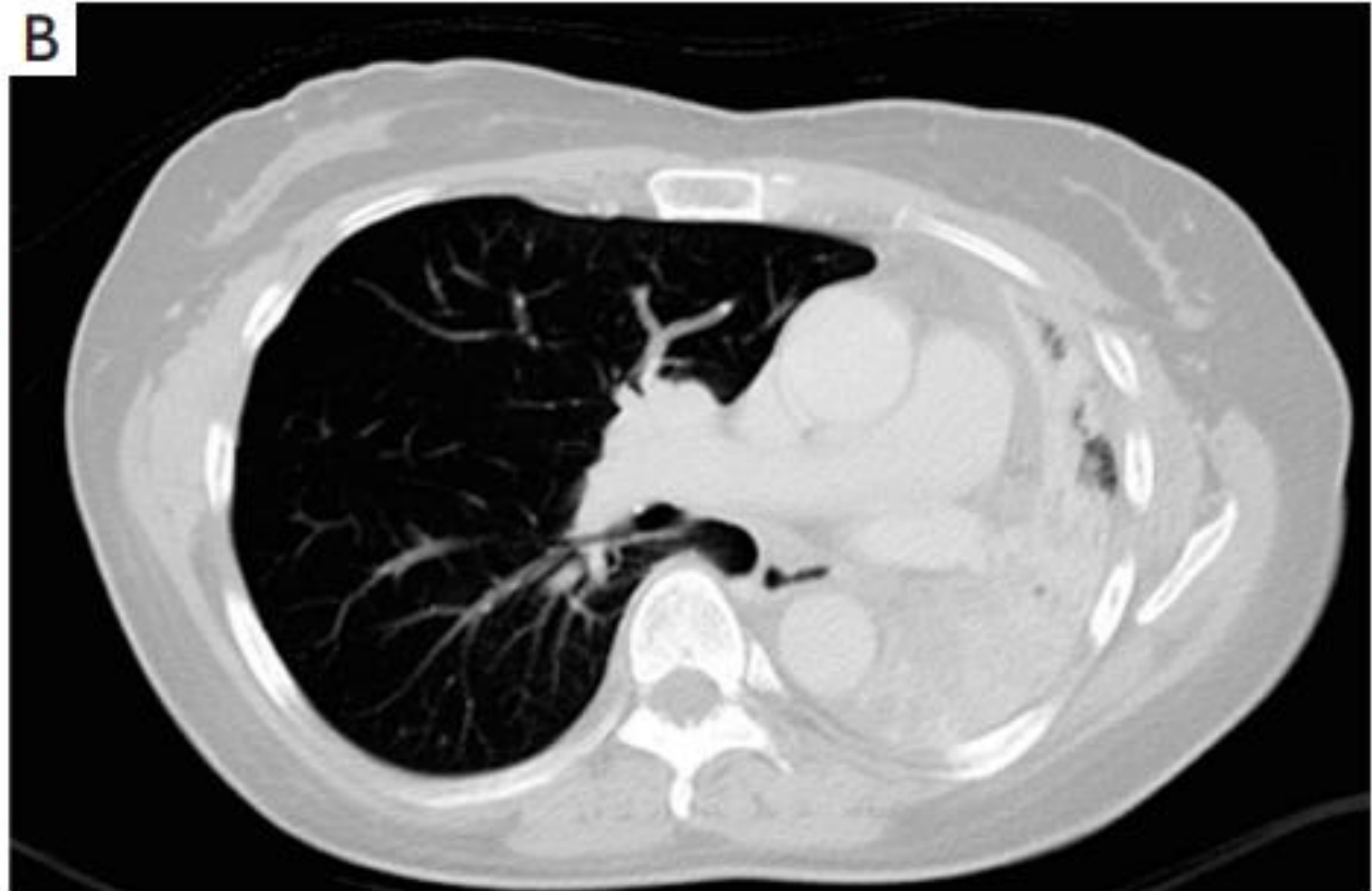
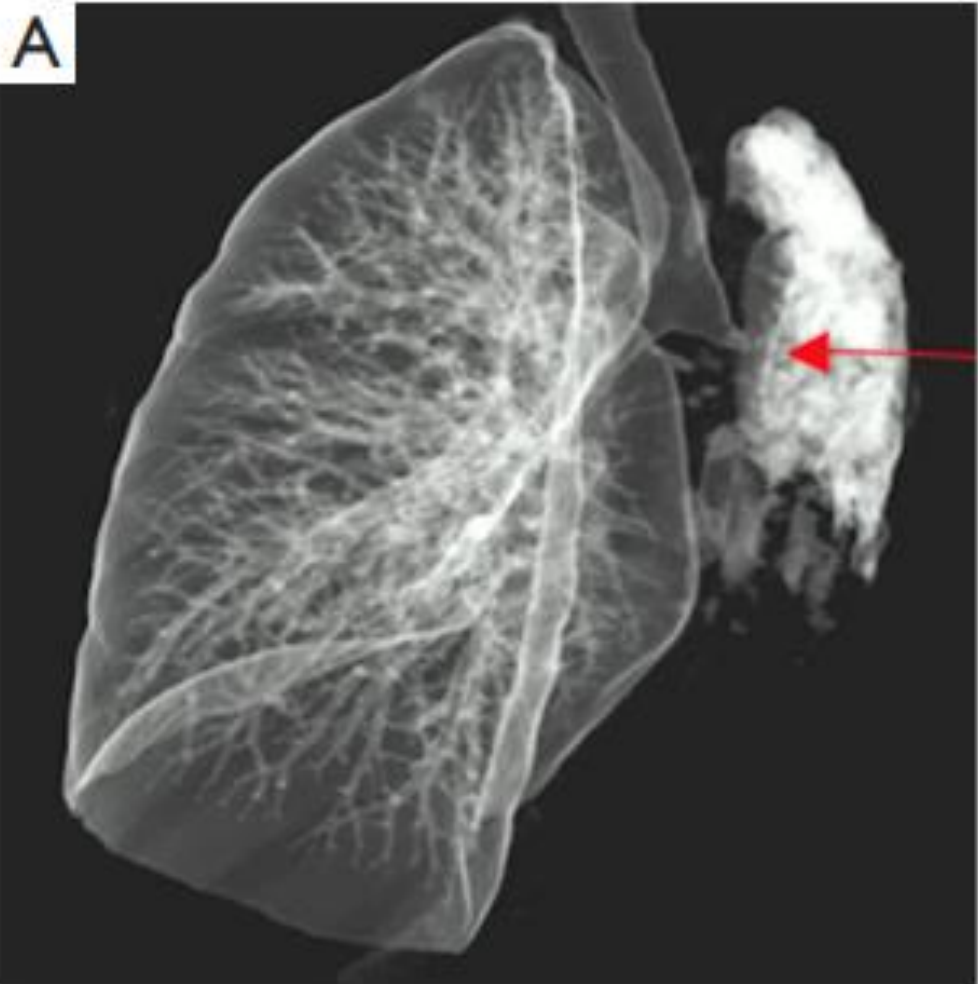
Airway margins	Number at risk				
█ Gross positive	9	2	1	1	1
█ Micro positive	59	27	19	11	4
█ Negative	40	31	21	10	6

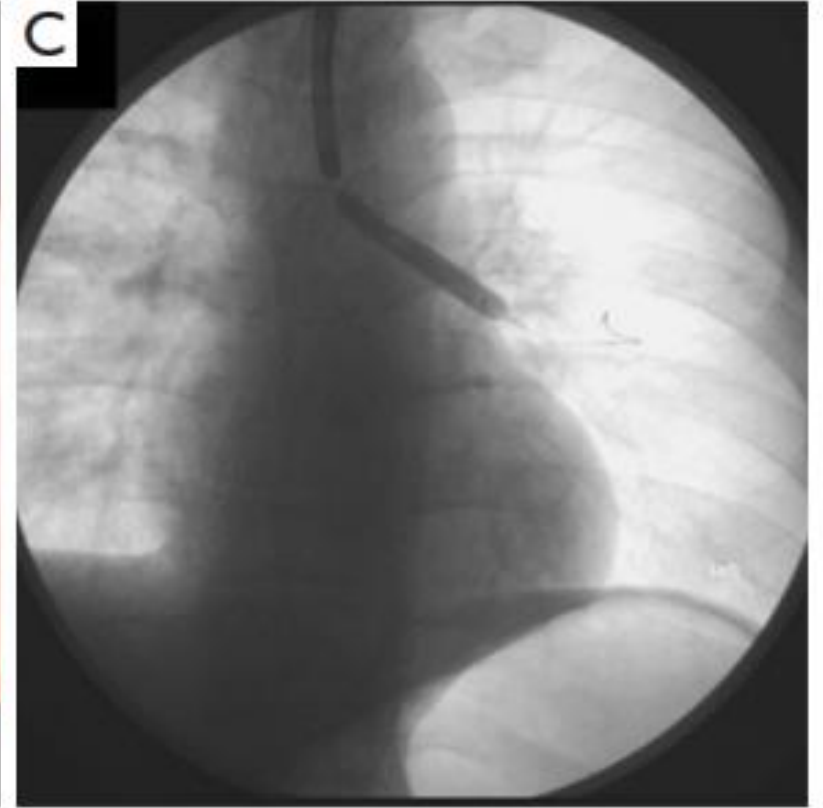
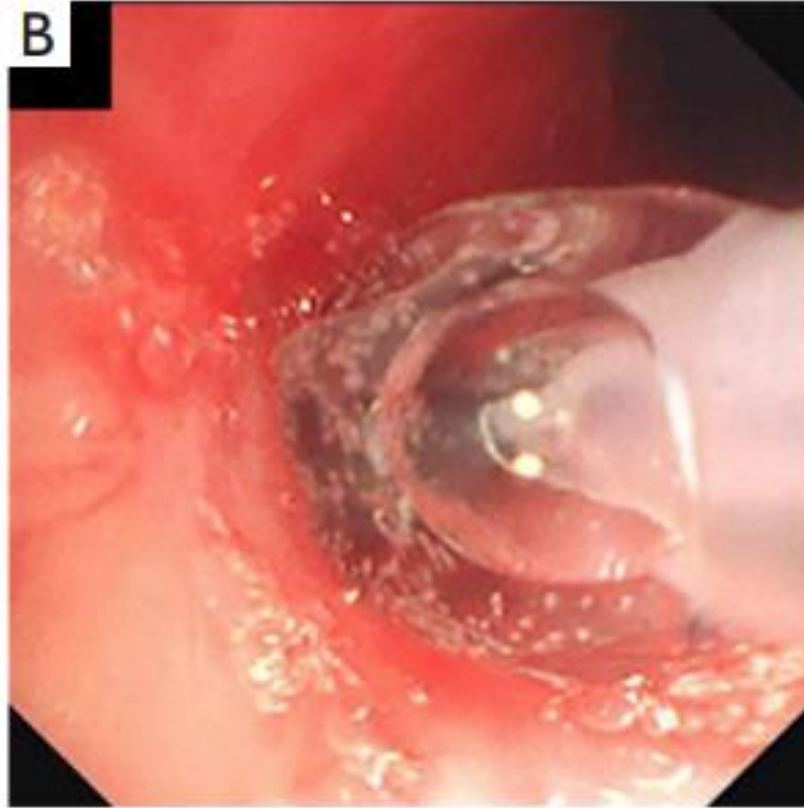
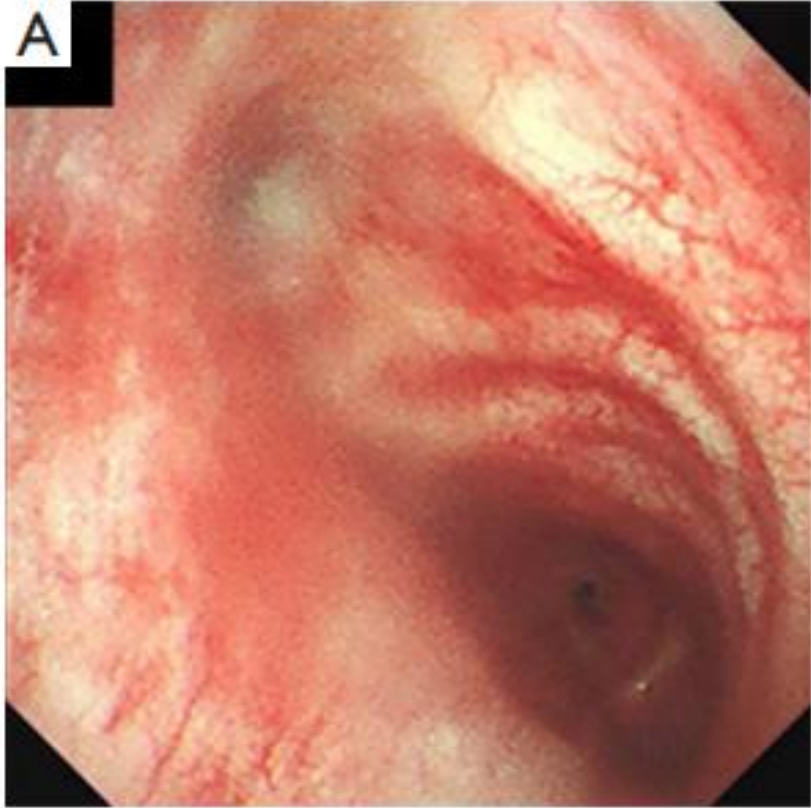
Radial margins	Number at risk				
█ Gross positive	3	0			
█ Micro positive	95	52	34	17	7
█ Negative	10	8	7	5	4

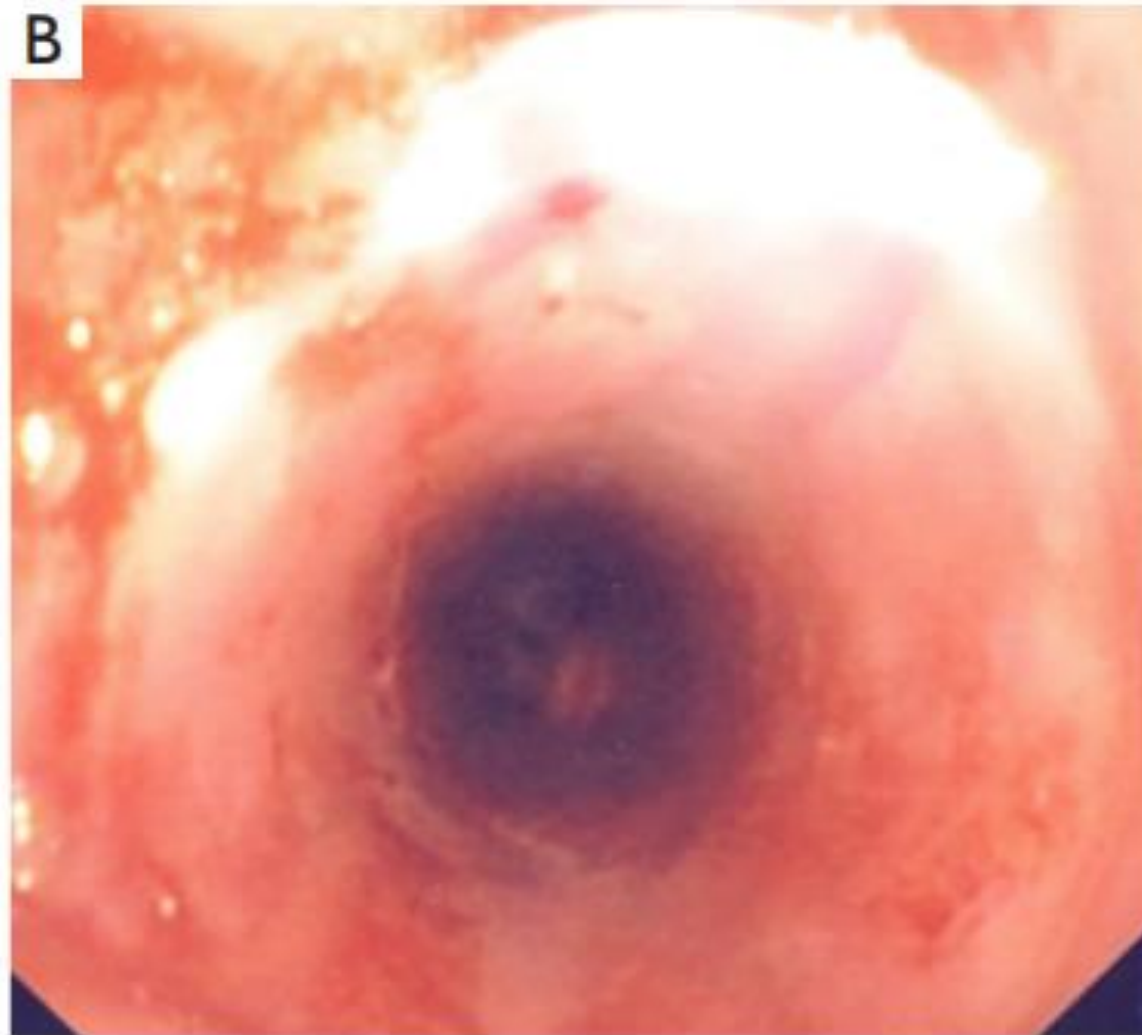
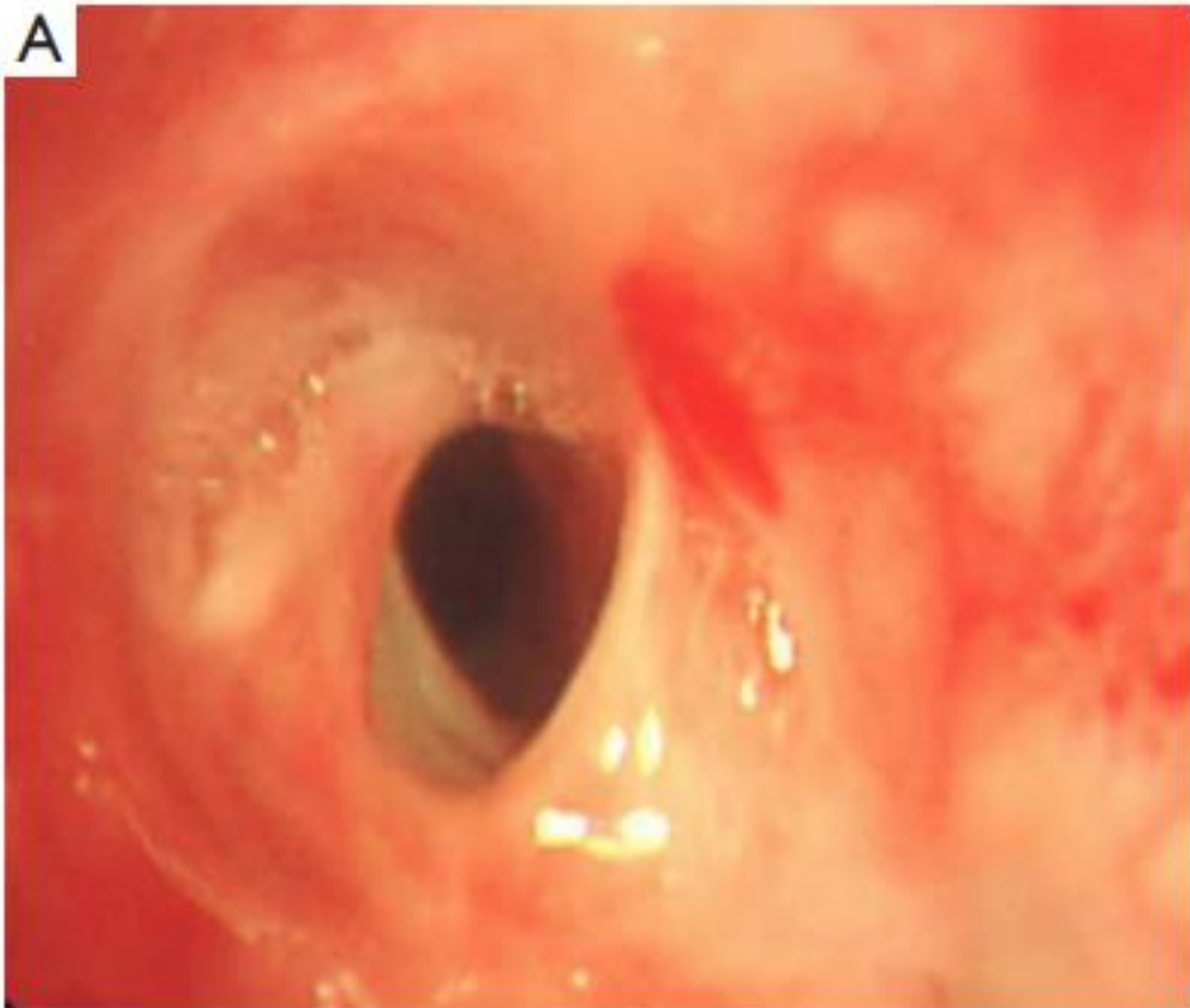
Tuberculosis

- Rare cause
- Response to antituberculosis : good
- Stenosis sequelae : ~20%, multifocal lesion
 - ➔ Bronchoscopic intervention >> surgery



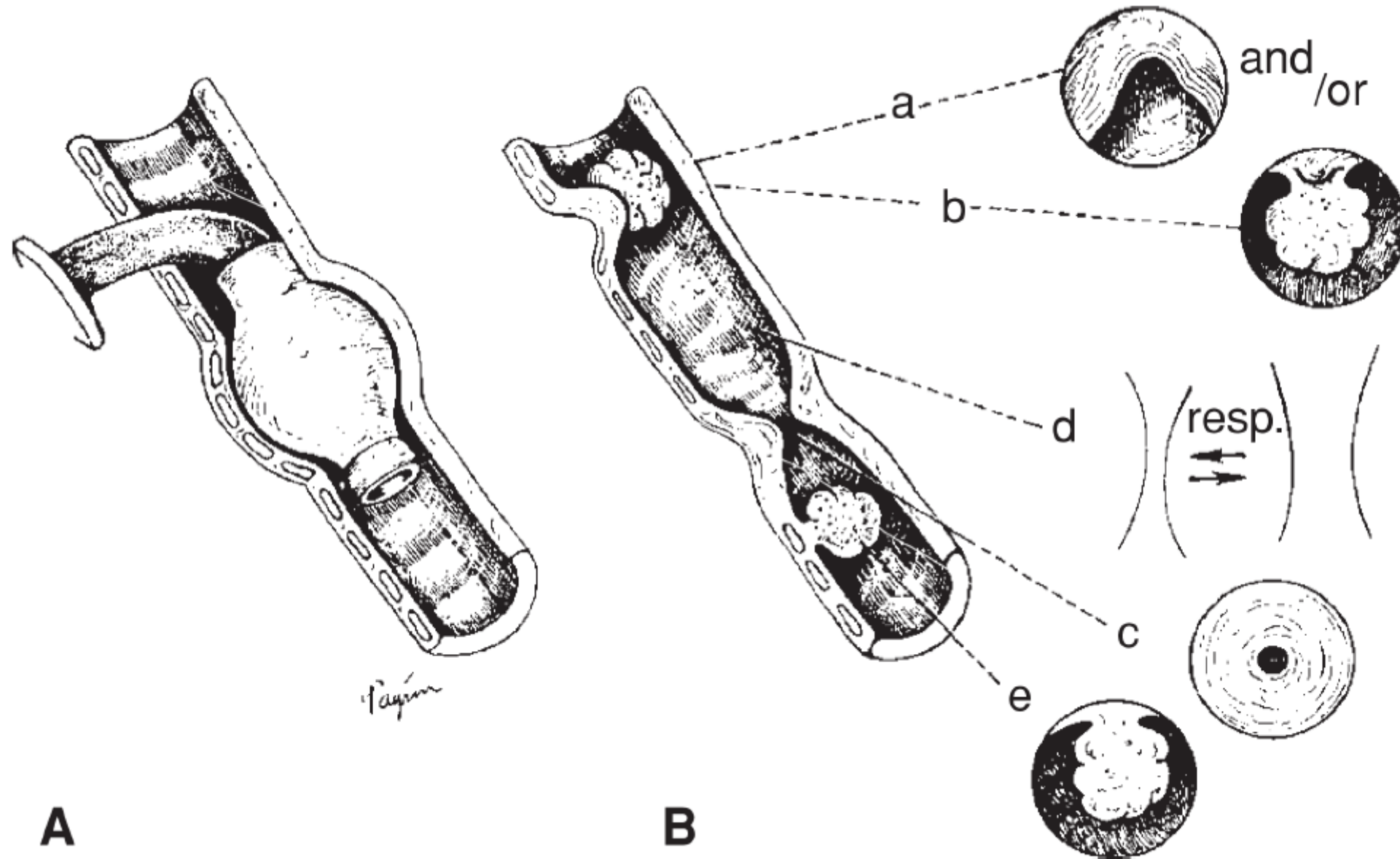


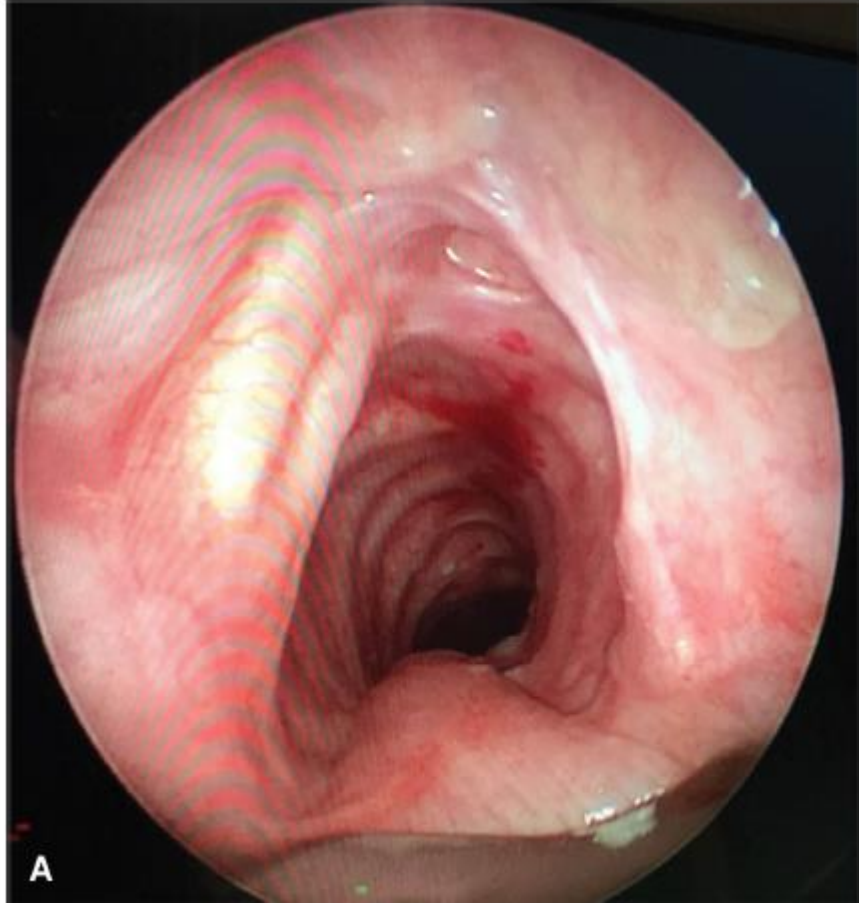




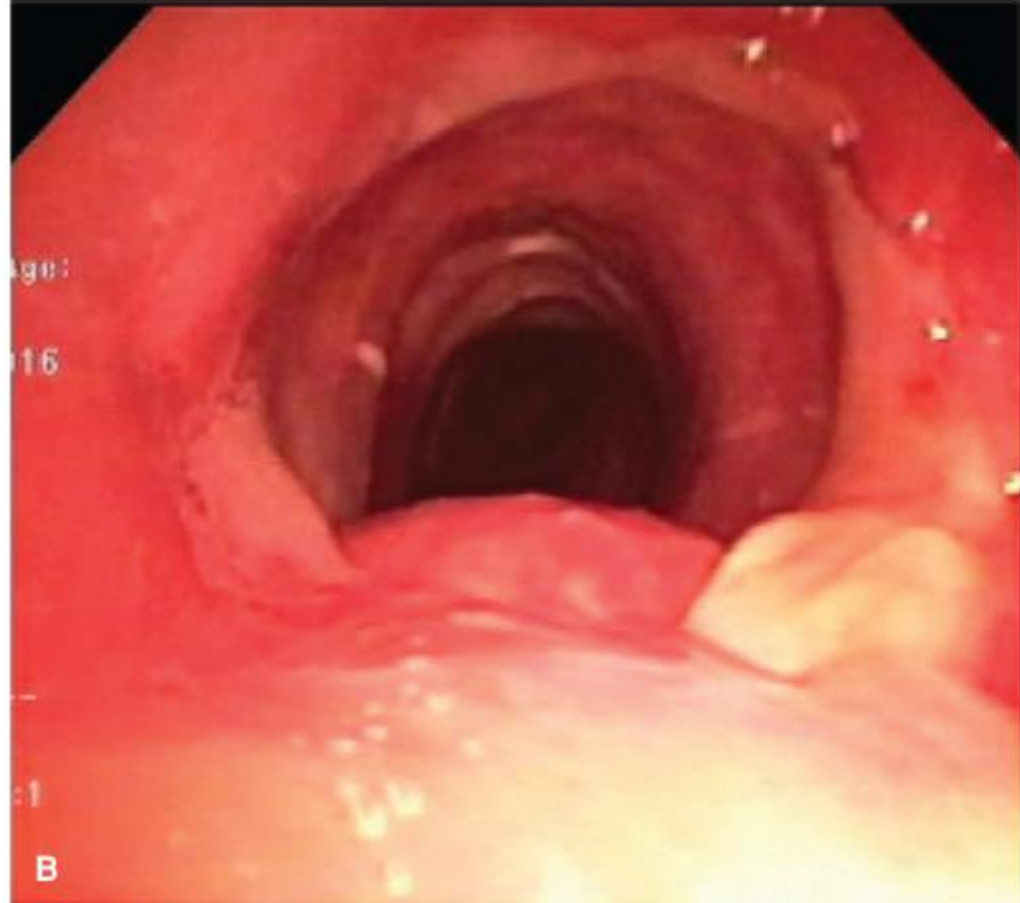
Postintubation and Posttracheostomy Injury

- Intubation tube after 48 hours -> laryngeal level injury
(glottic edema, vocal cord granulomas, erosion, granulation tissue, stenosis)
- More than one lesion
- Symptom developed within 2 years.
 - ➔ caution to incorrect diagnosis such as asthma



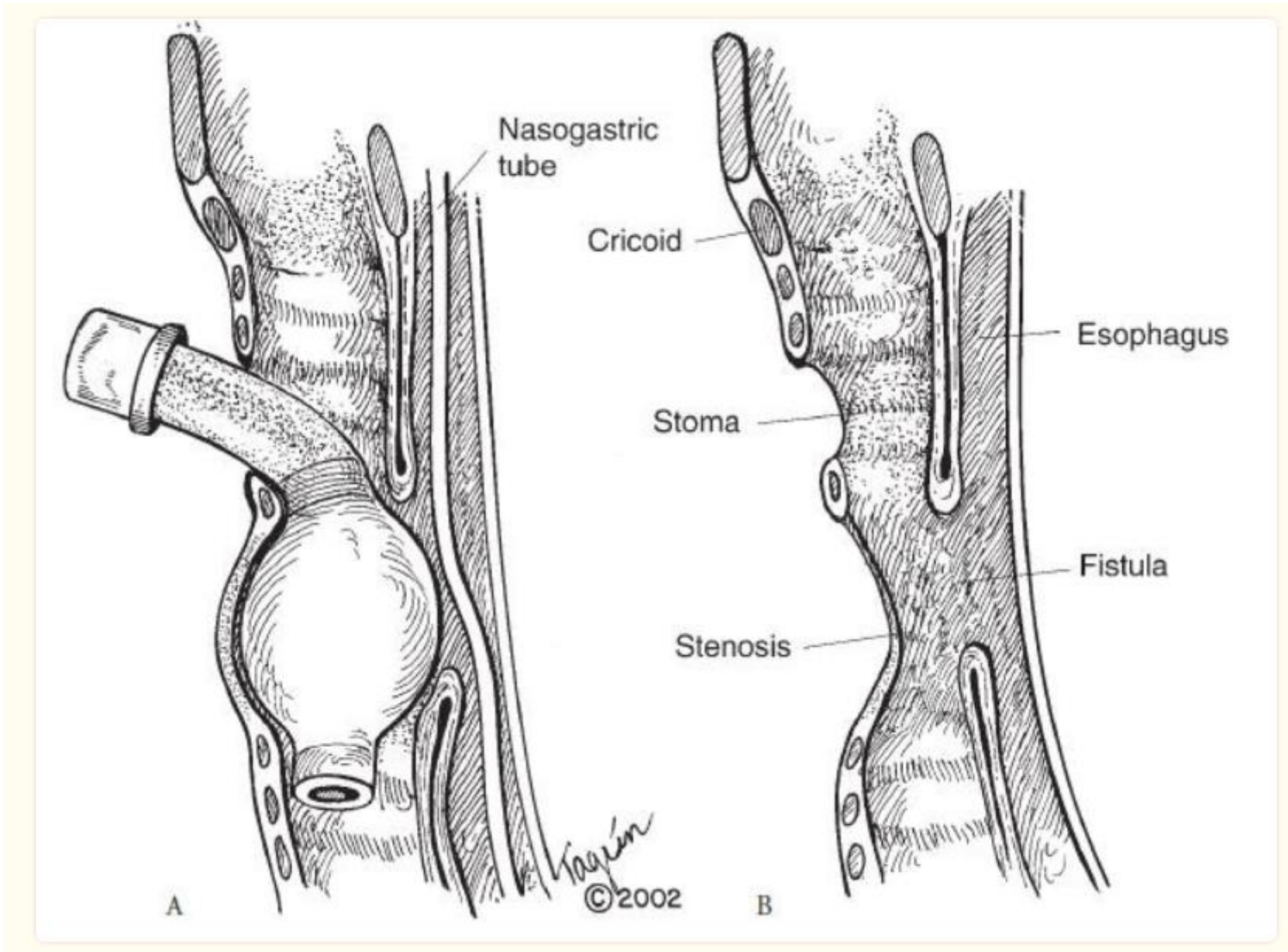


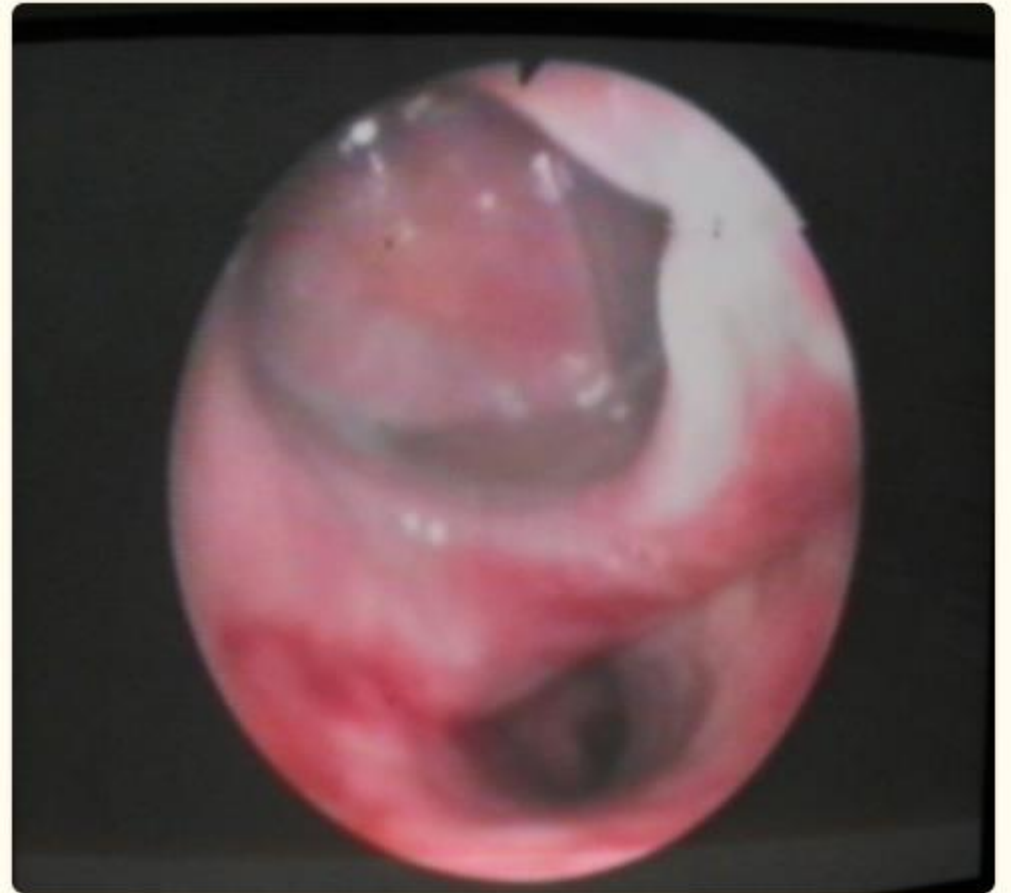
A-frame deformity



Tracheoesophageal Fistula

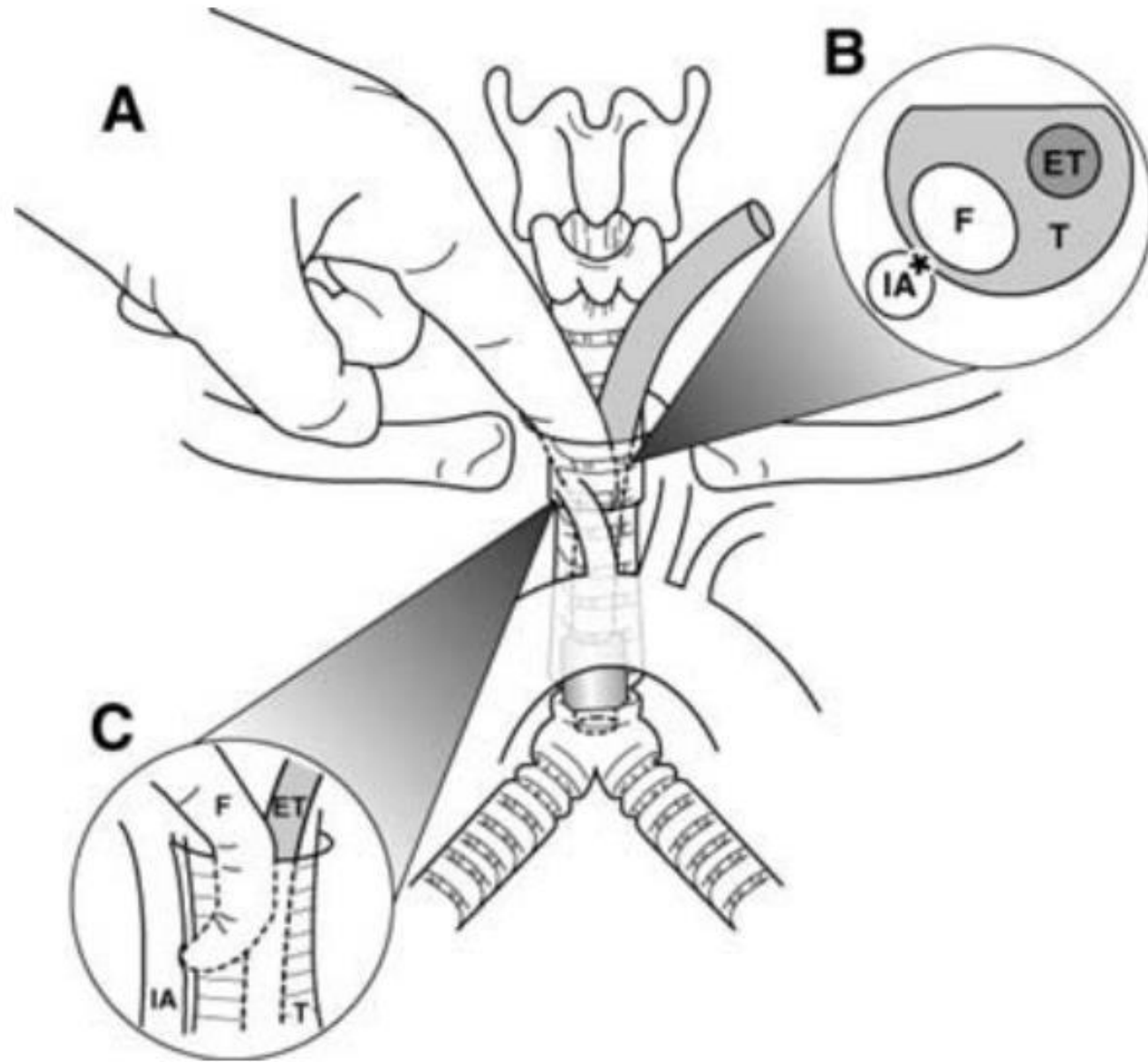
- T-tube + L-tube insertion status
- Sx: mediastinitis, pneumonia, gastric secretion in the trachea, acute gastric distention





Tracheoinnominate Fistula

- Angulation of a tube tip, high pressure cuff or inferior border of low-placed tracheostomy stoma
- Massive initial bleeding or herald bleed (DDx erosion of mucosa)
- 25% of patients → operating room
- 50% of patients with operation survivor within 2 months

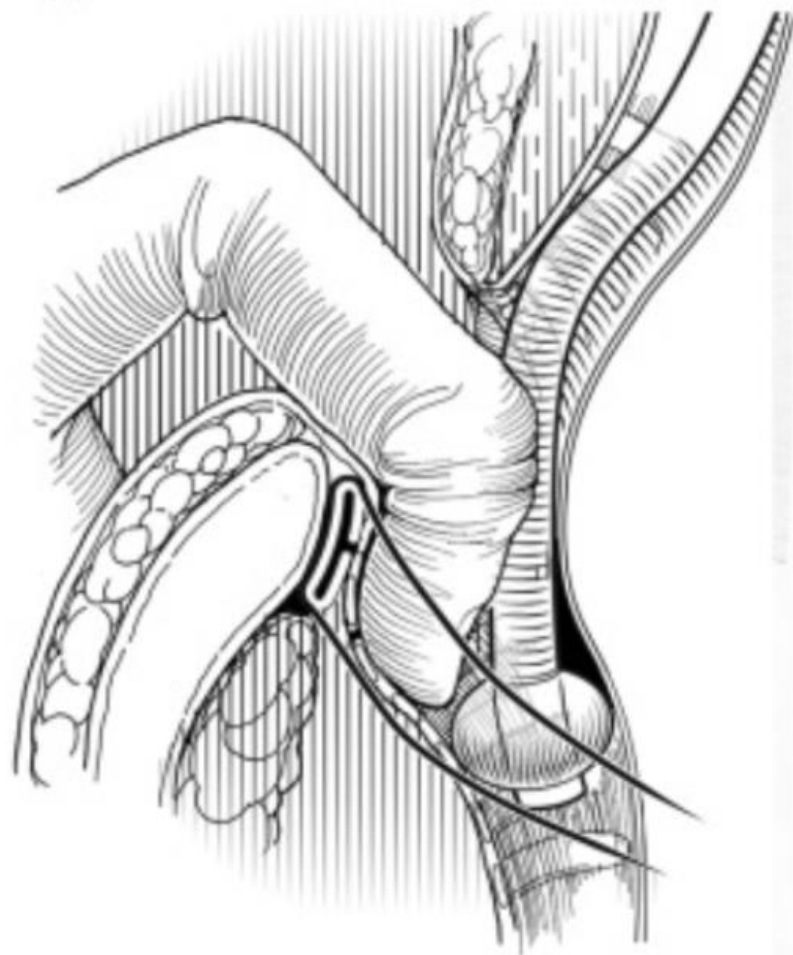
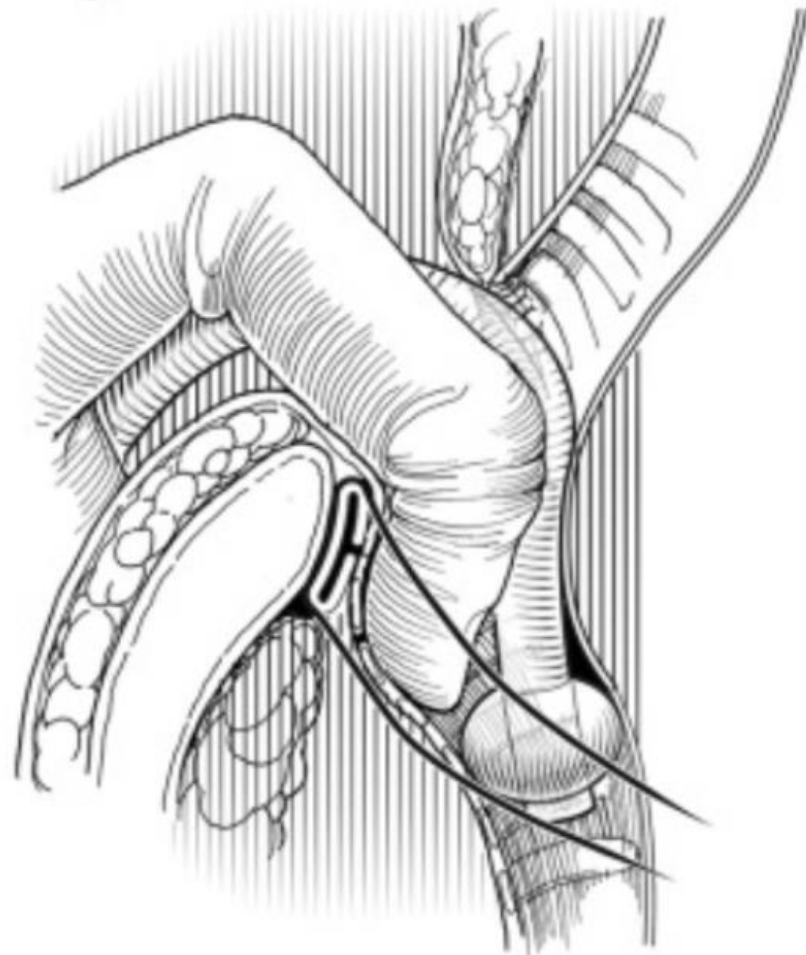


A

Trachea

Innominate/
subclavian a.

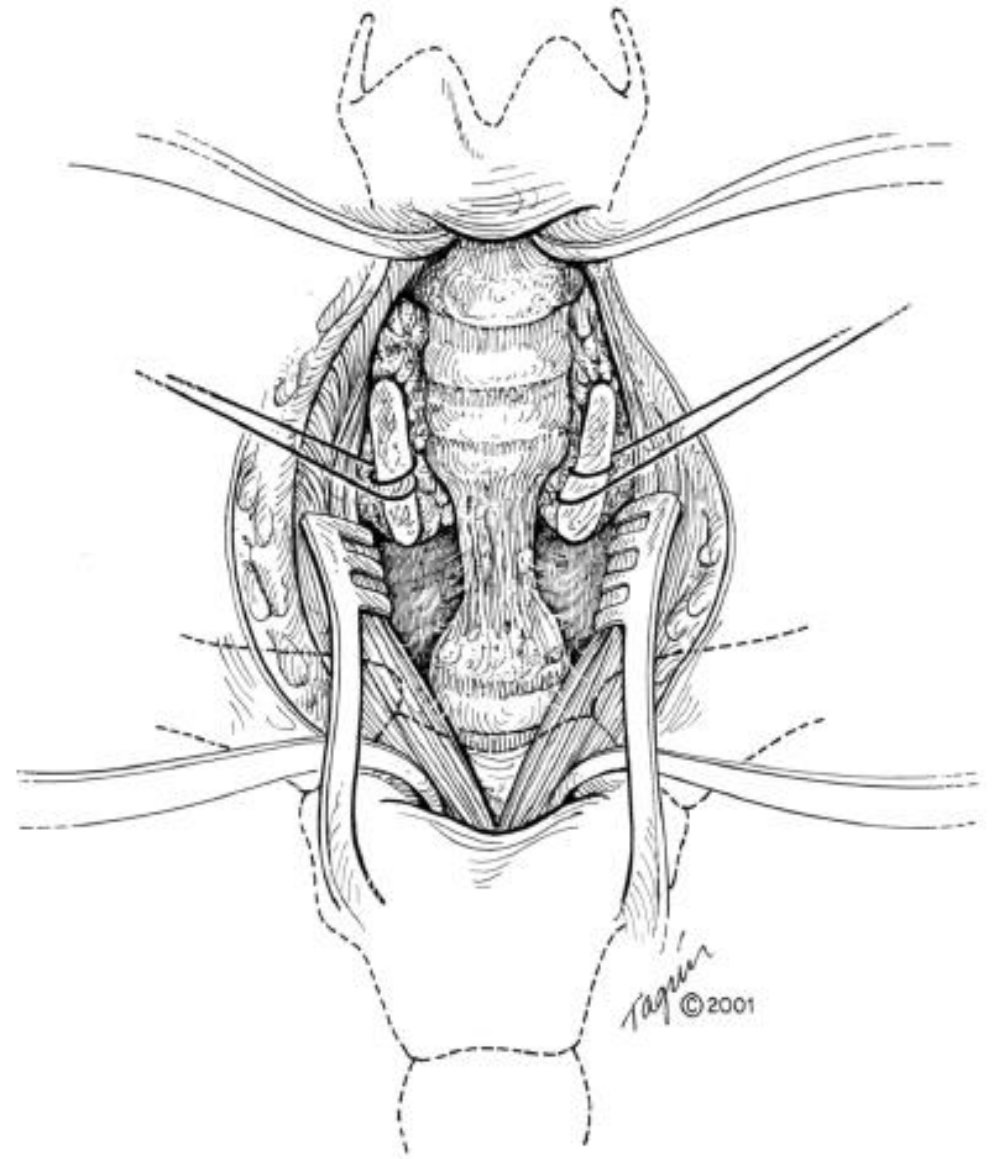
Sternum

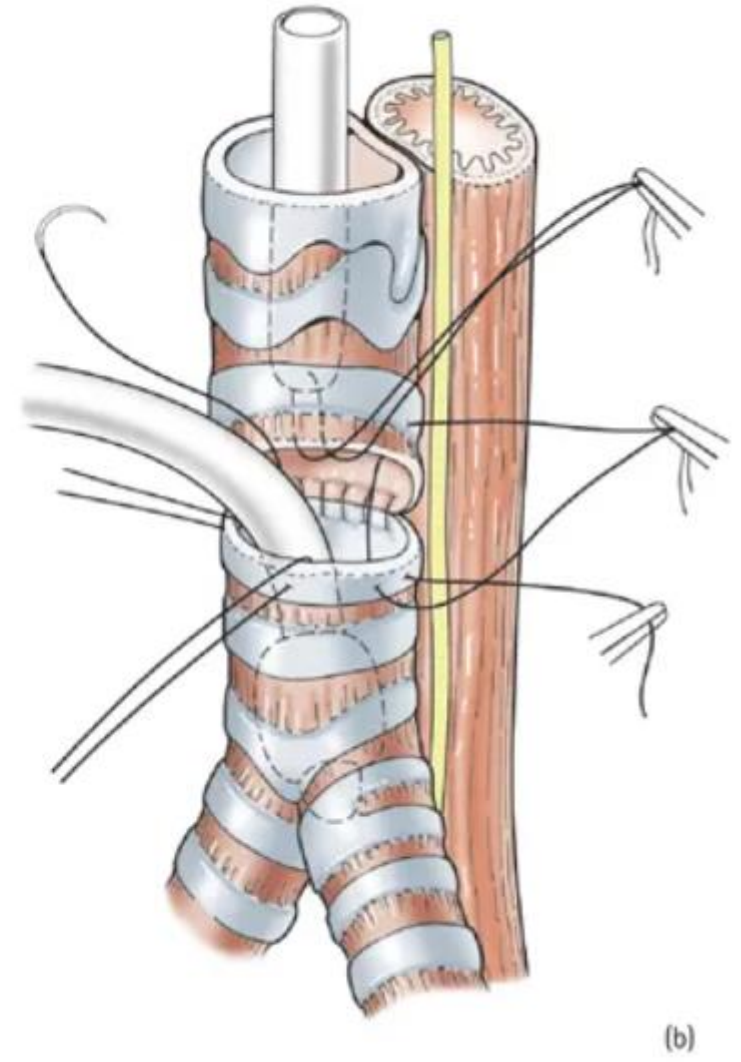
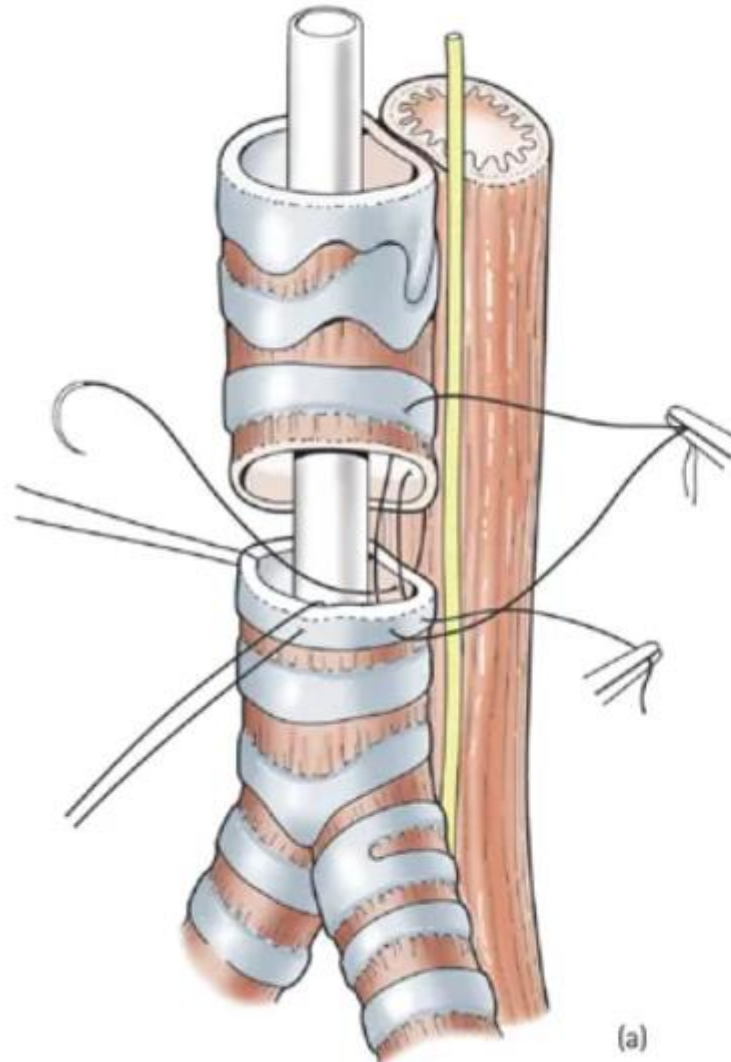
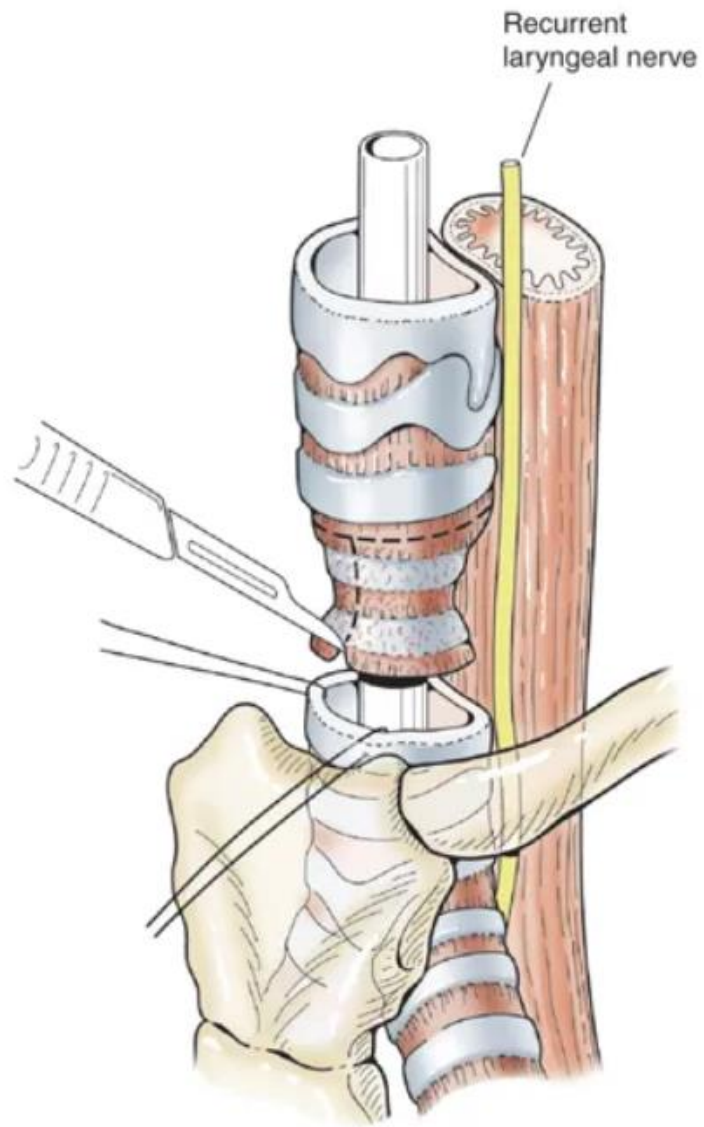
Flex**B****C**

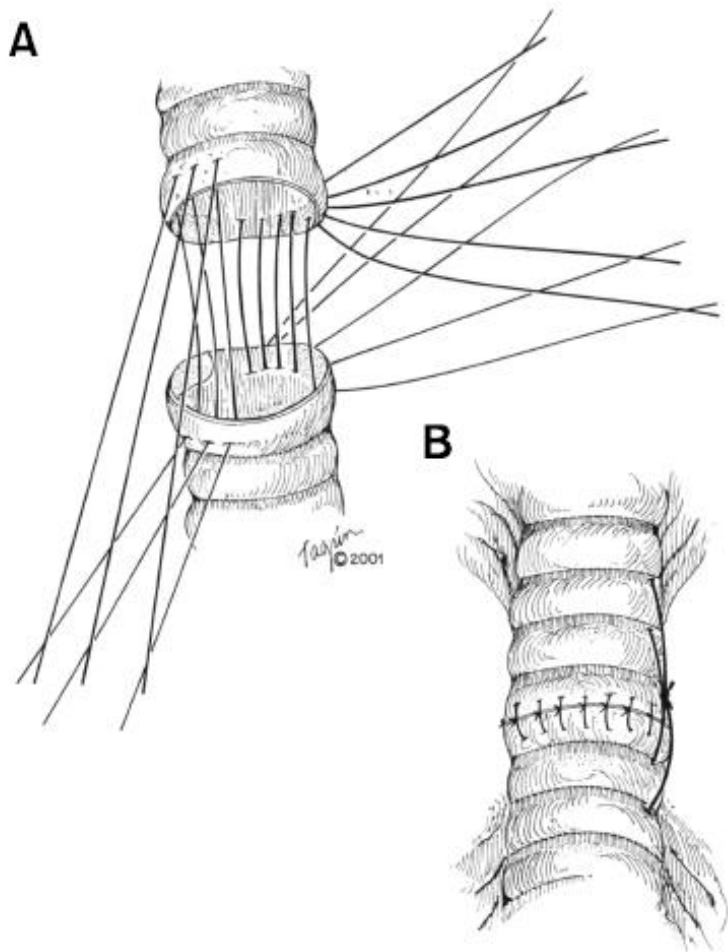
Trachea Segmental Resection

- Resection length: less than 4cm of trachea~half of trachea(rarely succeed)
- Risk of anastomotic tension: incomplete mobilization, fixed cervical kyphosis
- Horizontal collar incision, median sternotomy (if necessary)
- In critical stenosis, VV ECMO might be considered before general anesthesia.

- Anterior and posterior dissection
- Lateral dissection: injured segment+2-4 ring
- If necessary, laryngeal release or hilar release is performed.







Chin stitch

Table 1 Results of tracheal resection according to reason for tracheal resection

Variable	Overall (n=901) (%)	PITS (n=589) (%)	TEF (n=21) (%)	ILTS (n=83) (%)	Tumor (n=208) (%)	P value
Stay (d)						<0.001
Median	8	8	10	7	8	
Interquartile range	7–11	7–11	16–21	7,8	7–11	
Complications (No.)	164 (18.2)	109 (18.5)	6 (28.6)	8 (6.6)	41 (19.7)	0.11
Anastomotic complications (No.)	81 (9.0)	65 (11.0)	3 (14.3)	2 (2.4)	11 (5.3)	0.009
Death (No.)	11 (1.2)	8 (1.4)	1 (4.8)	0	2 (1.0)	0.02
Result (No.)						0.04
Good	853 (95.0)	553 (95.2)	18 (90.0)	82 (98.8)	200 (97.1)	
Tube	37 (4.2)	28 (4.8)	2 (10.0)	1 (1.2)	6 (2.9)	

PITS, post-intubation tracheal stenosis; TEF, tracheoesophageal fistula; ILTS, idiopathic laryngotracheal stenosis.

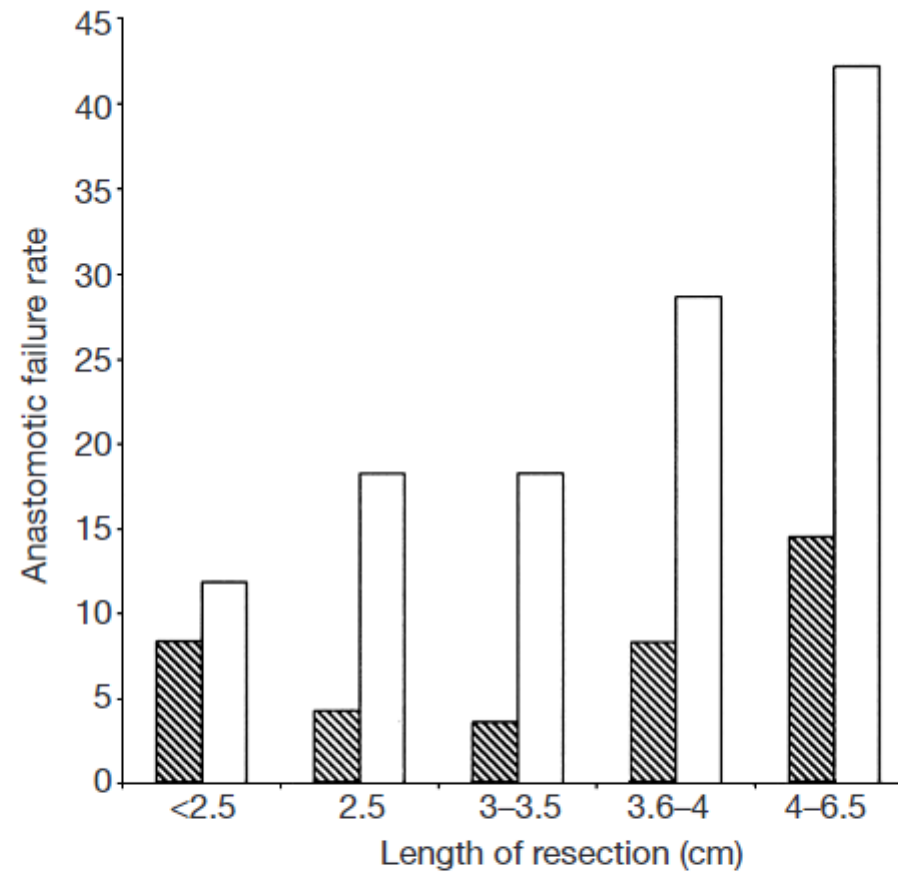
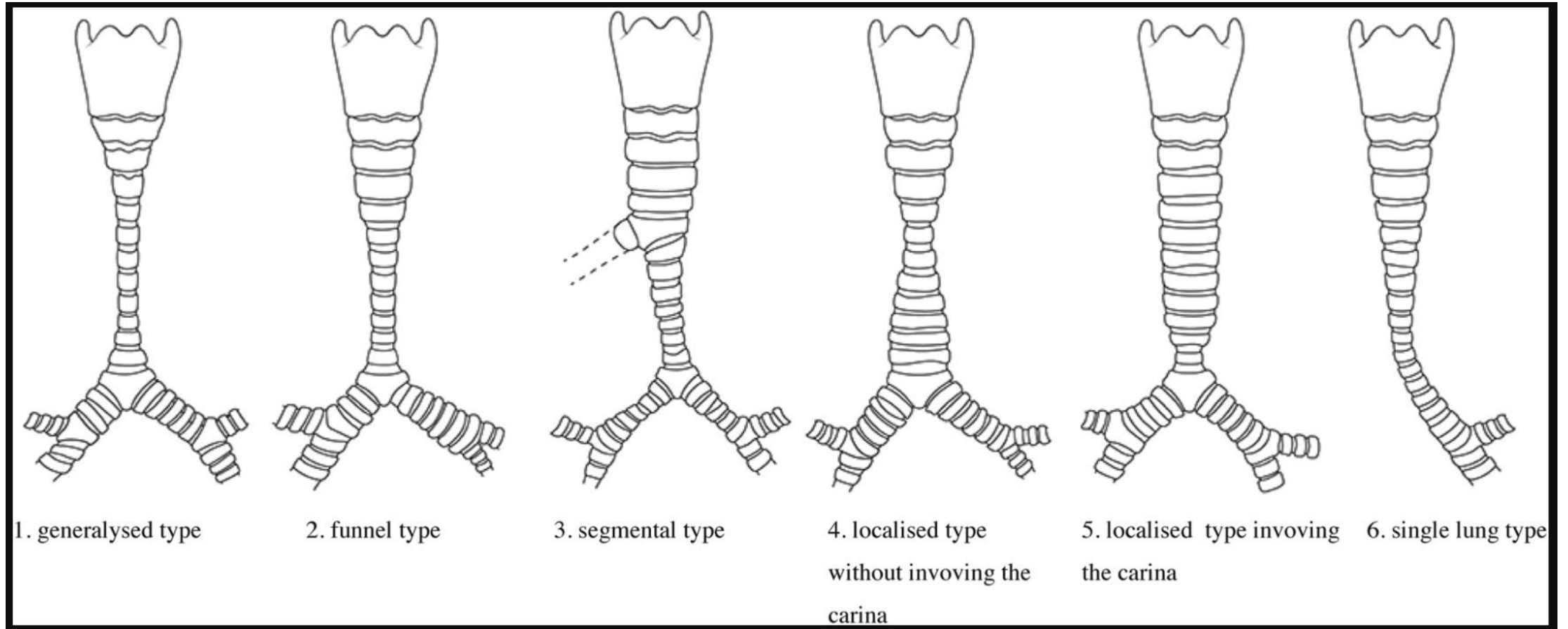


Figure 1 Anastomotic complication rate as function of length of resection in patients undergoing first resection (n=800, diagonally striped bars) and reoperation (n=101, solid bars). Lengths are presented as quintiles [Reprinted with permission (1)].

Congenital Tracheal Stenosis



Slide tracheoplasty

