


1-6-2015

Adult Tracheal Stenosis Causes and Therapies

Colin Huntley, MD
Thomas Jefferson University

Follow this and additional works at: <https://jdc.jefferson.edu/otograndrounds>

 Part of the [Otolaryngology Commons](#)

[Let us know how access to this document benefits you](#)

Recommended Citation

Huntley, MD, Colin, "Adult Tracheal Stenosis Causes and Therapies" (2015). *Department of Otolaryngology - Head and Neck Surgery Presentations and Grand Rounds*. Presentation 35. <https://jdc.jefferson.edu/otograndrounds/35>

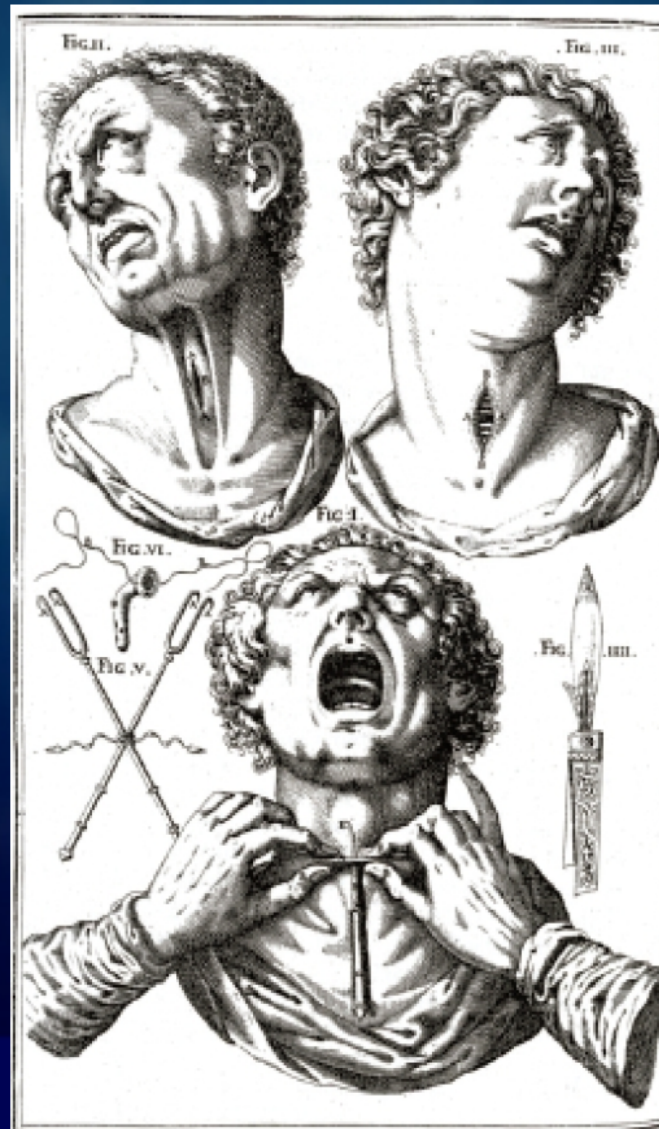
This Article is brought to you for free and open access by the Jefferson Digital Commons. The Jefferson Digital Commons is a service of Thomas Jefferson University's [Center for Teaching and Learning \(CTL\)](#). The Commons is a showcase for Jefferson books and journals, peer-reviewed scholarly publications, unique historical collections from the University archives, and teaching tools. The Jefferson Digital Commons allows researchers and interested readers anywhere in the world to learn about and keep up to date with Jefferson scholarship. This article has been accepted for inclusion in Department of Otolaryngology - Head and Neck Surgery Presentations and Grand Rounds by an authorized administrator of the Jefferson Digital Commons. For more information, please contact: JeffersonDigitalCommons@jefferson.edu.

Adult Tracheal Stenosis Causes & Therapies

Colin Huntley, MD

**Thank you;
Dr. Spiegel
Dr. Boon**

History of Tracheotomy



History of Tracheotomy

- 3600 BC
 - Egyptian tablets depict tracheotomy
- 2000 BC
 - Rig Veda, Hindu medicine text
- 1550 BC
 - Eber's Papyrus
 - Egyptian text references an incision in the throat



History of Tracheotomy

- 400 BC
 - Alexander the Great allegedly used his sword to open the trachea of a choking soldier.
- Asclepiades - 100 BC
 - credited by Galen as first to perform elective trach

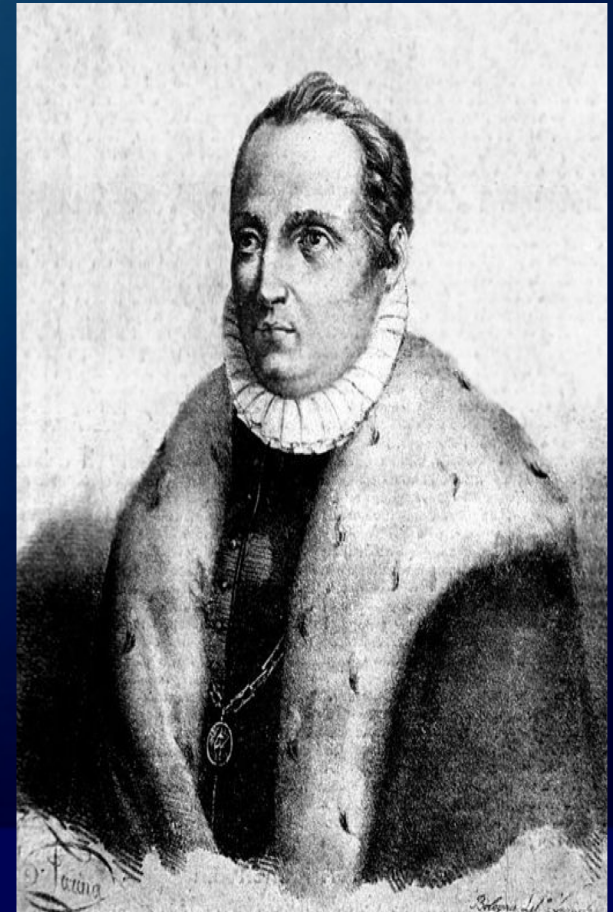


History of Tracheotomy

- Hippocrates condemned tracheotomy for fear of carotid artery damage.
- Caelius Aurelianus - 400 AD
 - “senseless, frivolous, and even criminal invention of Asclepiades.”
- Dante - 400 AD
 - “a suitable punishment for a sinner in the depths of the Inferno”

History of Tracheotomy

- 1500-1825
 - reports of only 28 successful tracheostomies.
- Antonia Brasavola - 1546
 - documented successful tracheostomy
 - performed for laryngeal abscess
- Sanctorius (1561-1636)
 - Advocated leaving cannula in place to allow for healing.
- George Martine (1702-1743)
 - Developed inner cannula



History of Tracheotomy

- George Washington
 - 1799 died of acute epiglottitis
- 1820's
 - Tracheostomy becomes accepted as legitimate procedure
- Pierre Bretonneau - 1826
 - published use of trach to help treat diphtheria
- Trousseau - 1850's
 - reported hundreds of trachs performed under his supervision
 - 73% mortality rate

History of Tracheotomy

- Chevalier Jackson (1865-1958)
 - modernized techniques and indications
 - warned of complications of “high trach”
- Wilson - 1932
 - advocated prophylactic trach in patients with polio



Tracheal Stenosis

- Etiology
- Signs/Symptoms
- Workup
- Treatment Modalities
- Case

Pediatric Etiology

Congenital

- Stenosis/Web
- Complete Tracheal Ring
- Tracheomalacia
- Vascular Ring
- Esophageal duplication

Inflammatory

- Tracheobronchitis
- Croup
- Bacterial Tracheitis

Neoplastic

- Mediastinal Tumors
- Thyroid
- Papilloma
- Hemangioma

Trauma

- Foreign Body
- Prolonged Intubation

Adult Etiology

Idiopathic

Acquired

- Intubation
- Tracheostomy
- Trauma

Benign

- Papilloma
- Hamartoma
- Paraganglioma
- Tracheopathia
osteocondroplastica

Systemic

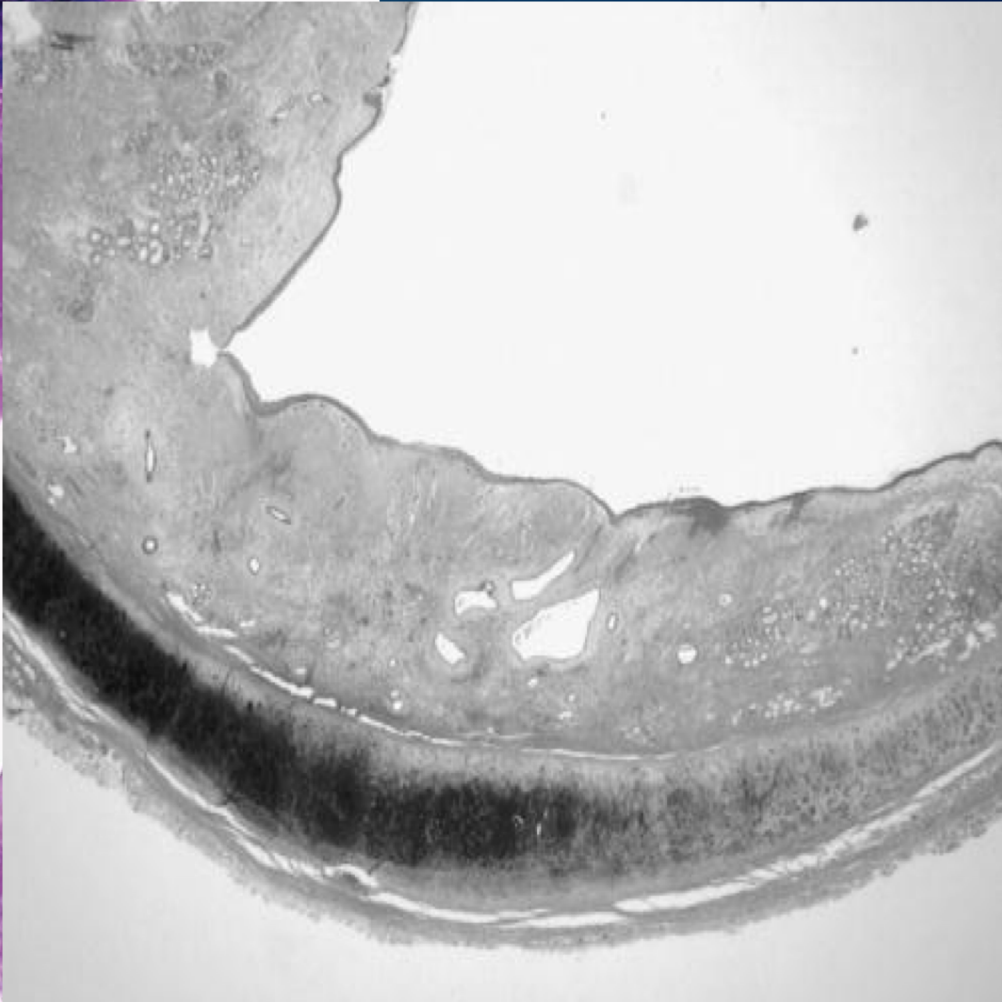
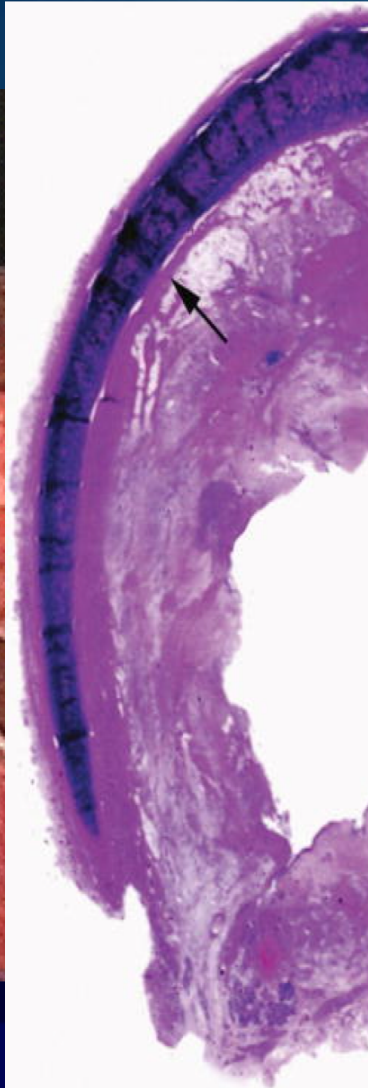
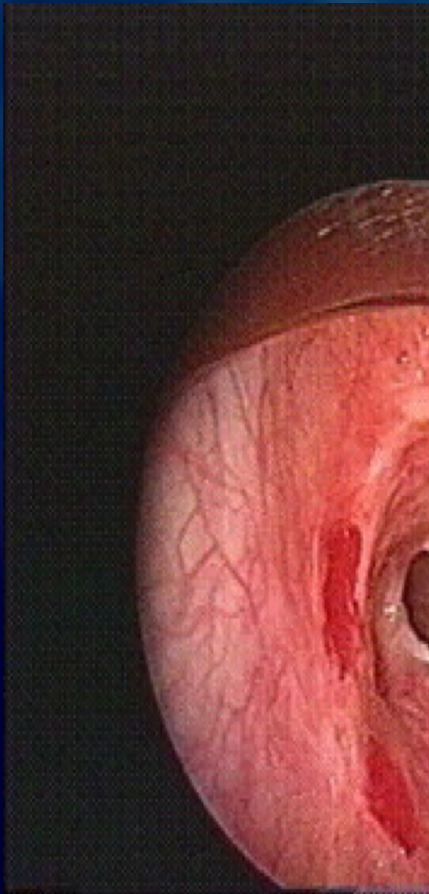
- Relapsing
polychondritis
- Amyloidosis
- Sarcoid
- Wegener's
- Infection

Malignant

- Squamous Cell
- Adenoid Cystic
- Mucoepidermoid
- Mets

Adult Etiology

Idiopathic



Adult Etiology

Acquired

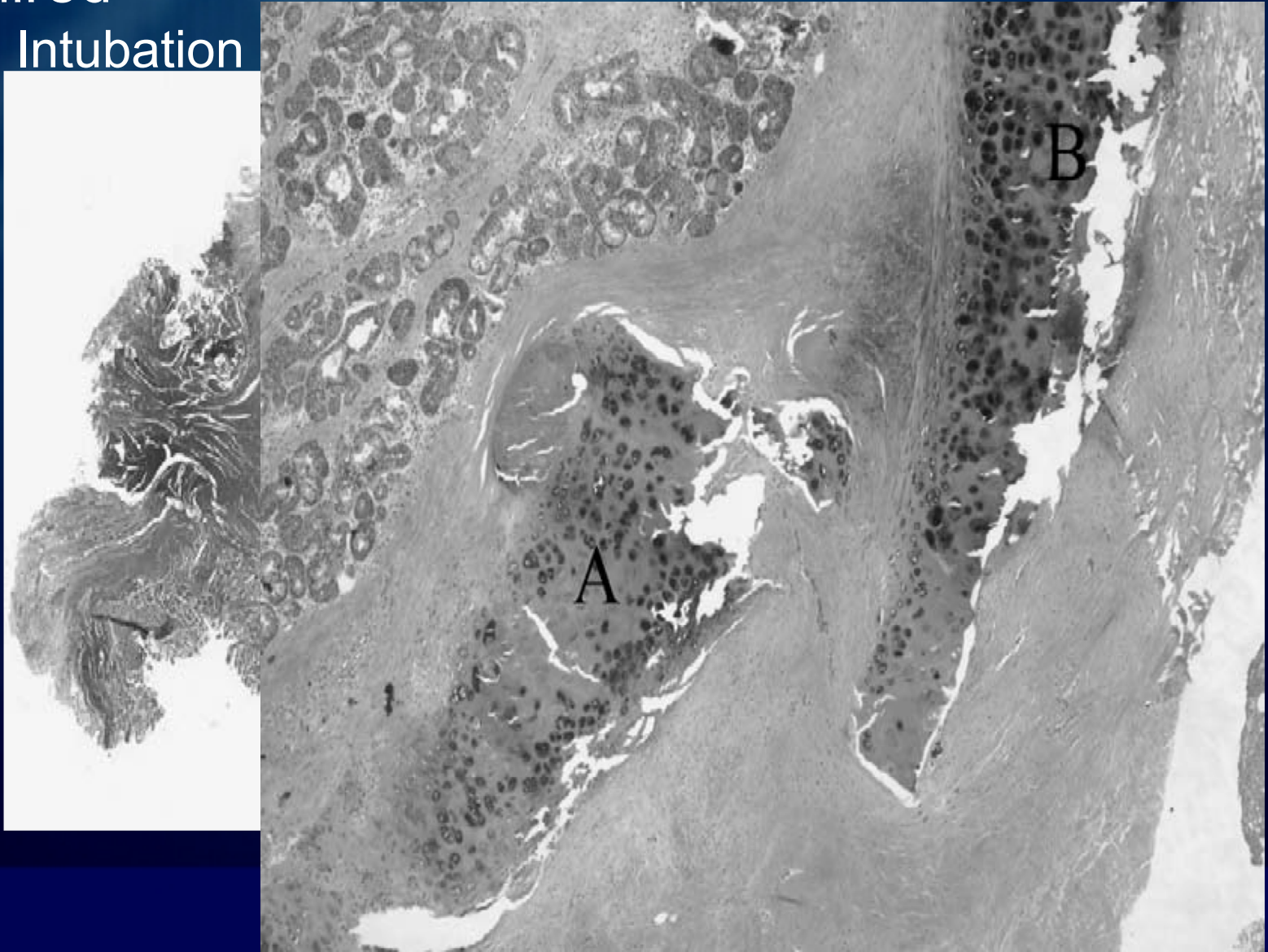
- Intubation
- Tracheostomy
- Trauma

Adult Etiology

Acquired

- Intubation

-
-



Adult Etiology

Benign

- Papilloma
- Hamartoma
- Paraganglioma
- Tracheopathia
osteocondroplastica

Malignant

- Squamous Cell
- Adenoid Cystic
- Mucoepidermoid
- Mets

Infectious

- Bacterial Tracheitis
- Tuberculosis
- Rhinoscleroma
- Fungal

Systemic

- Relapsing
polychondritis
- Amyloidosis
- Sarcoid
- Granulomatosis with
Polyangiitis
(Wegener's)

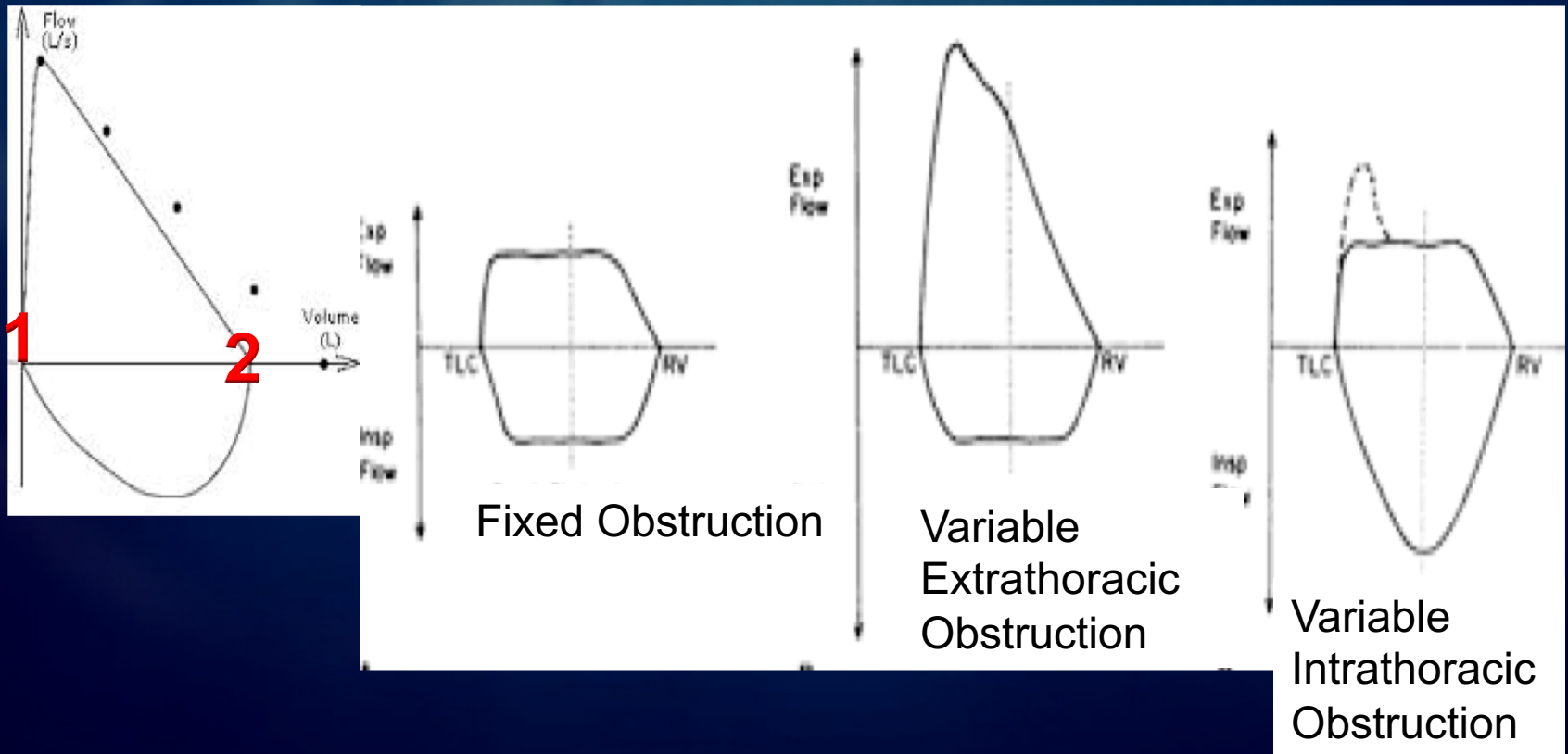
Signs/Symptoms

- Dyspnea on Exertion
- Cough
- Wheeze
- Stridor
- Acute Respiratory Distress

Work-Up

- Detailed H&P
- Pulmonary Function Tests
- Radiologic Imaging
- Bronchoscopy

Flow Volume Loops



Imaging

- CT
- Virtual endoscopy
- MRI
- Bronchography/Fluoroscopy
- Bronchoscopy

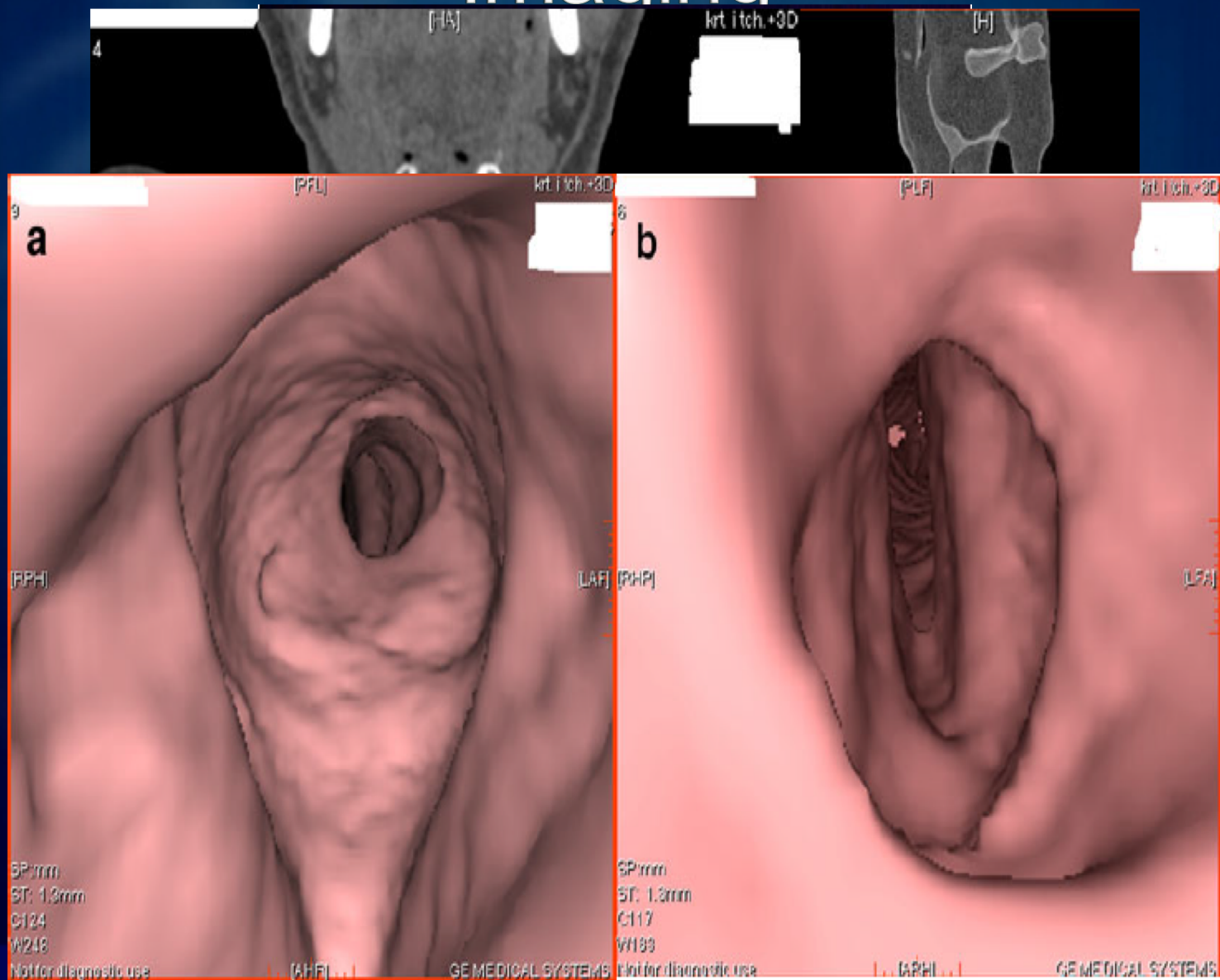
Imaging

Evaluation of tracheal stenosis: comparison between computed tomography virtual tracheobronchoscopy with multiplanar reformatting, flexible tracheofiberoscopy and intra-operative findings

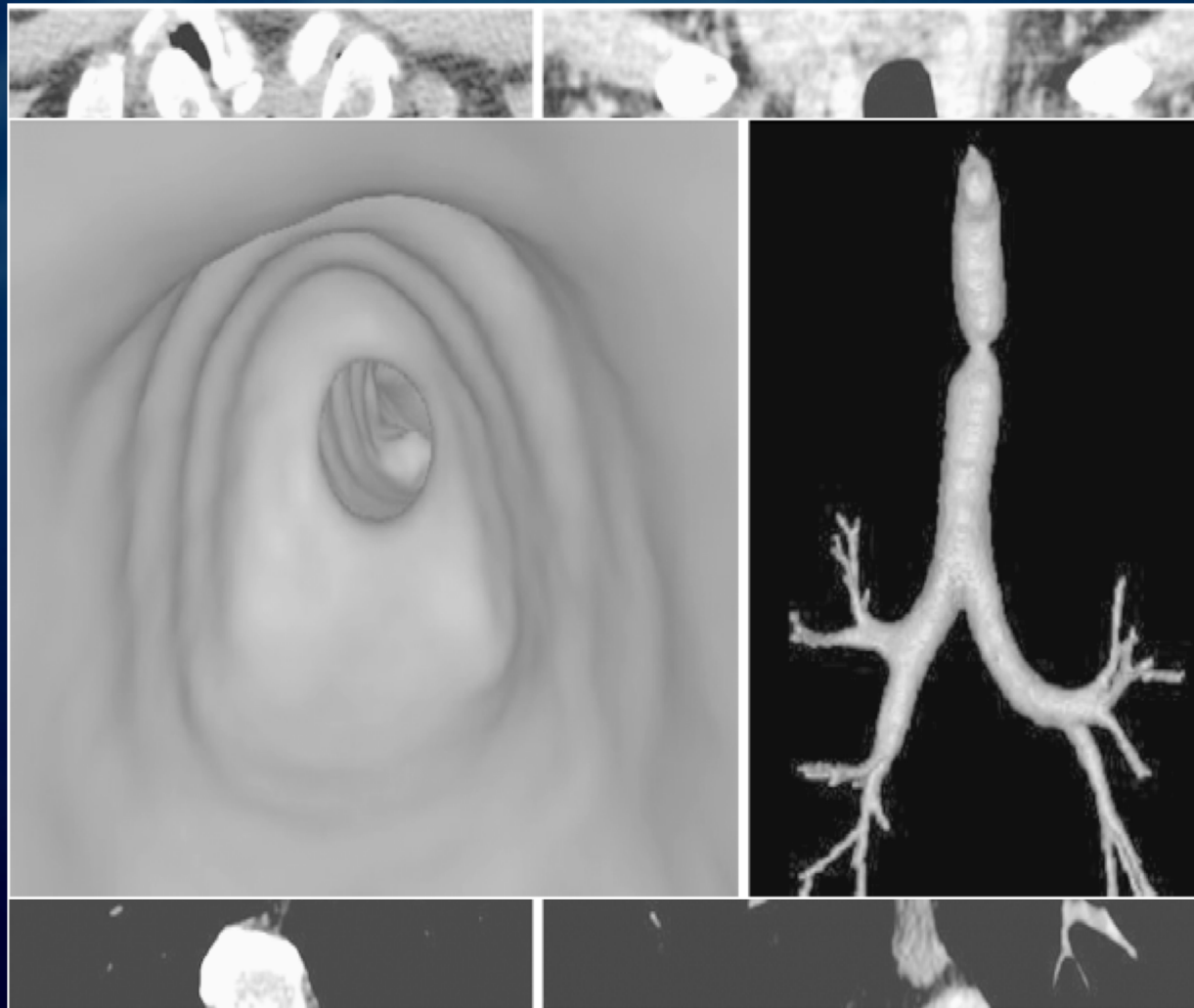
Table 1 Estimation of stenosis grading with patients with tracheal stenosis
Table 2 Analysis of the length of planned resection segment of trachea and correlation of postoperative findings with FT, coronal and sagittal reformatted CT of 37 patients with tracheal stenosis

Estimation of stenosis grading (N = 37)	Estimation of length of planned resection segment (N = 37)	FT (%)	Coronal reformatted CT (%)	Sagittal reformatted CT (%)
Correctly graded stenosis	Length of planned resection segment	32/37 (86.5)	35/37 (94.6)	35/37 (94.6)

Imaging



Imaging



Treatment Modalities

- Endoscopic
- Tracheal Stenting
- Interposition Grafting
- Tracheal Resection

Treatment Modalities

- Endoscopy
 - Micro DL
 - General Anesthesia
 - Flexible Bronchoscopy
 - Sedation

Treatment Modalities

- Endoscopy
 - Cryoablation
 - Electrocautery ablation
 - Laser ablation

Treatment Modalities

- Endoscopy
 - Cryoablation

Endoscopic Therapies and Stents for Benign Airway Disorders: Where Are We, and Where Are We Heading?

Hiran C. Fernando, MBBS, FRCS, John T. Sherwood, MD, and William Krimsky, MD

Table 1. Success Rates of Thermal and Mechanical Therapies for Benign Airway Strictures

Modality	Success Rate
Mechanical dilation alone	20% to 24% [13]
Laser and mechanical dilation	90% (<30 mm); 20% (\geq 30 mm) [16]
Contact cryotherapy	10% to 80% [18–20]

Treatment Modalities

- Electrocautery Ablation
 - monopolar or bipolar cautery

Treatment Modalities

Philippe Monnier · Mercy George
Marie-Laure Monod · Florian Lang

The role of the CO₂ laser in the management of laryngotracheal stenosis: a survey of 100 cases

Table 4 Comparison (grade by grade) of preoperative and postoperative degrees of stenosis ($n = 100$)

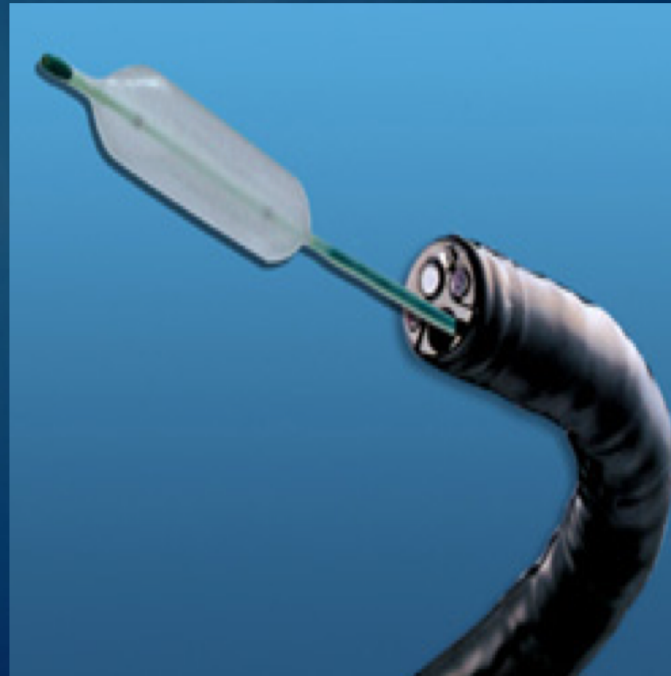
Preoperative Degree of stenosis	Postoperative results			
	$\leq 20\%$	Grade I $\leq 50\%$	Grade II $\leq 70\%$	Grade III $\leq 99\%$
Grade I: 12	11	1	0	0
Grade II: 41	19	20	2	0
Grade III: 47	6	9	19	13

Treatment Modalities

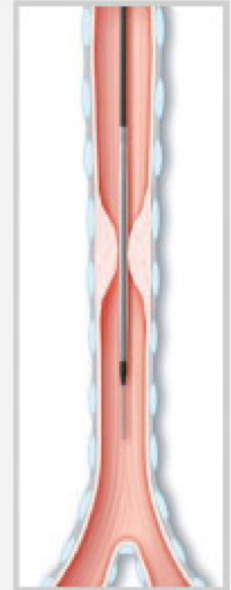
- Laser
 - CO₂
 - ND-YAG
 - Diode

Treatment Modalities

- Laser
 - Radial incisions
 - Dilation
 - Balloon
 - Rigid Dilators

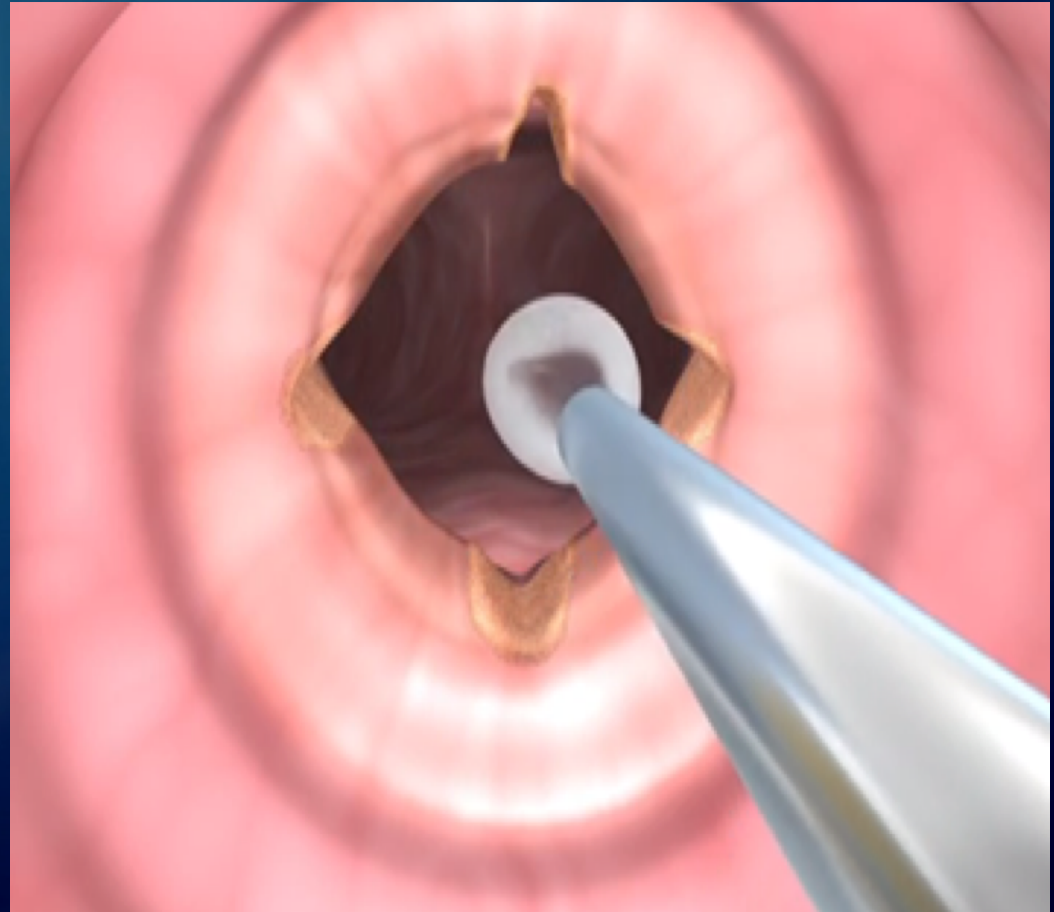


1



Treatment Modalities

- Laser
 - Radial incisions
 - Dilation
 - Balloon
 - Rigid Dilators



Treatment Modalities

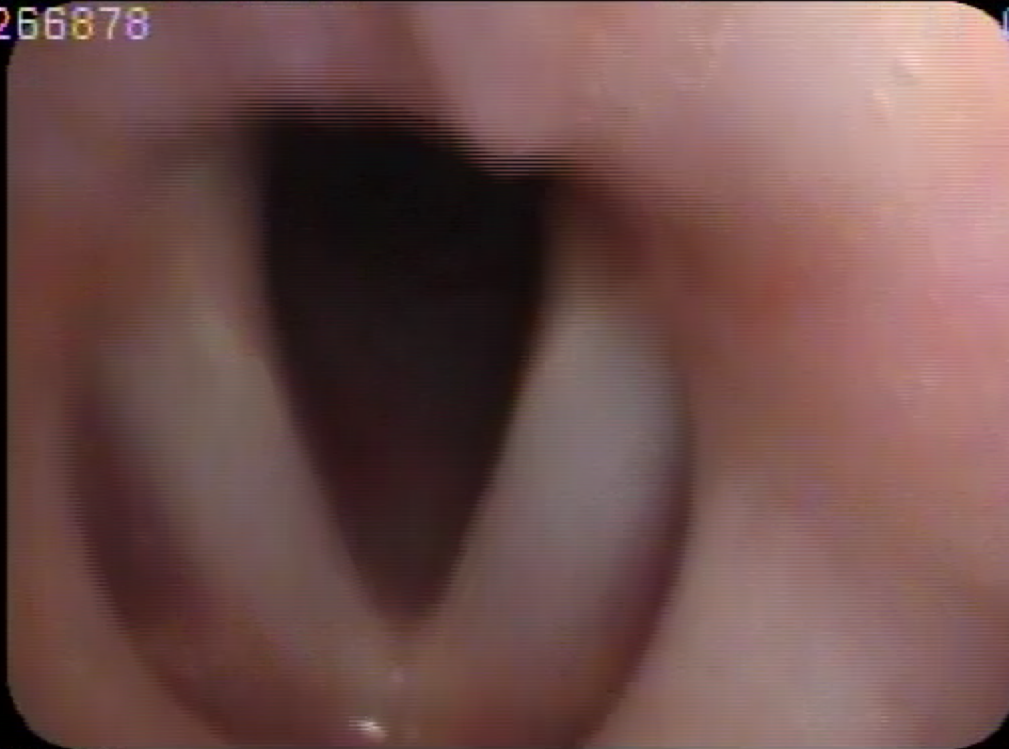
REBECCA RICHARDS

41 F 11/11/2014

04266878

08:19

1



COMMENT
Facility

DR BOON

Treatment Modalities

REBECCA RICHARDS

41 F

11/11/2014

04265878

21:17:29

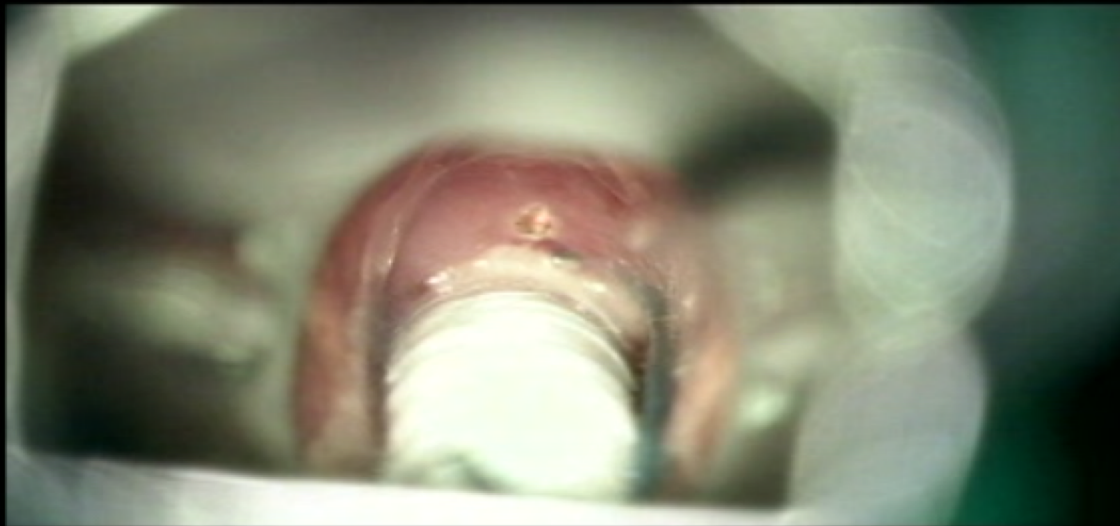
1



COMMENT
Facility

DR BOON

Treatment Modalities



Treatment Modalities

- Mitomycin C

Endoscopic treatment of laryngeal and tracheal stenosis—has mitomycin C improved the outcome?

ILYA PEREPELTSYN, MD, and STANLEY M. SHAPSHAY, MD, FACS, Boston, Massachusetts

Table 2. Tr

Table 3. Pairwise comparisons

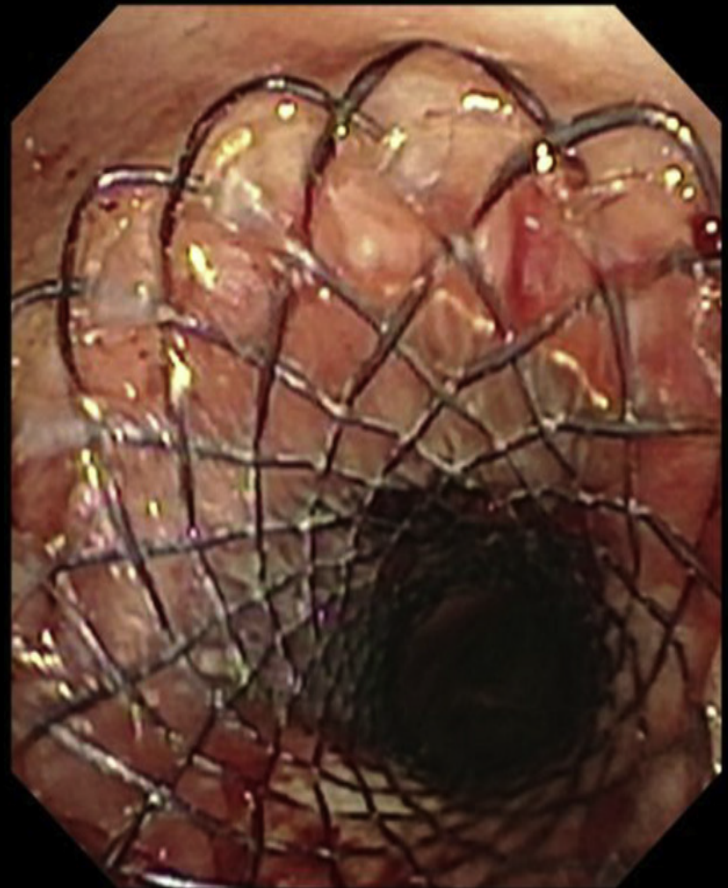
	Comparison	chi-square	P-value	with successful outcome
CO ₂ laser				15%
CO ₂ with s	CO ₂ with mitomycin C vs. CO ₂ only	10.813	$P = 0.001$	18.2%
CO ₂ with r	CO ₂ with mitomycin C vs. CO ₂ with steroid	6.307	$P = 0.015$	75%
	CO ₂ with steroid vs. CO ₂ only	0.078	$P > 0.2$	

Treatment Modalities

- Tracheal Stents
 - Expandable Metal Stents
 - Nonexpandable Silicone Stents
 - Expandable Silicone Stents
 - T-Tube

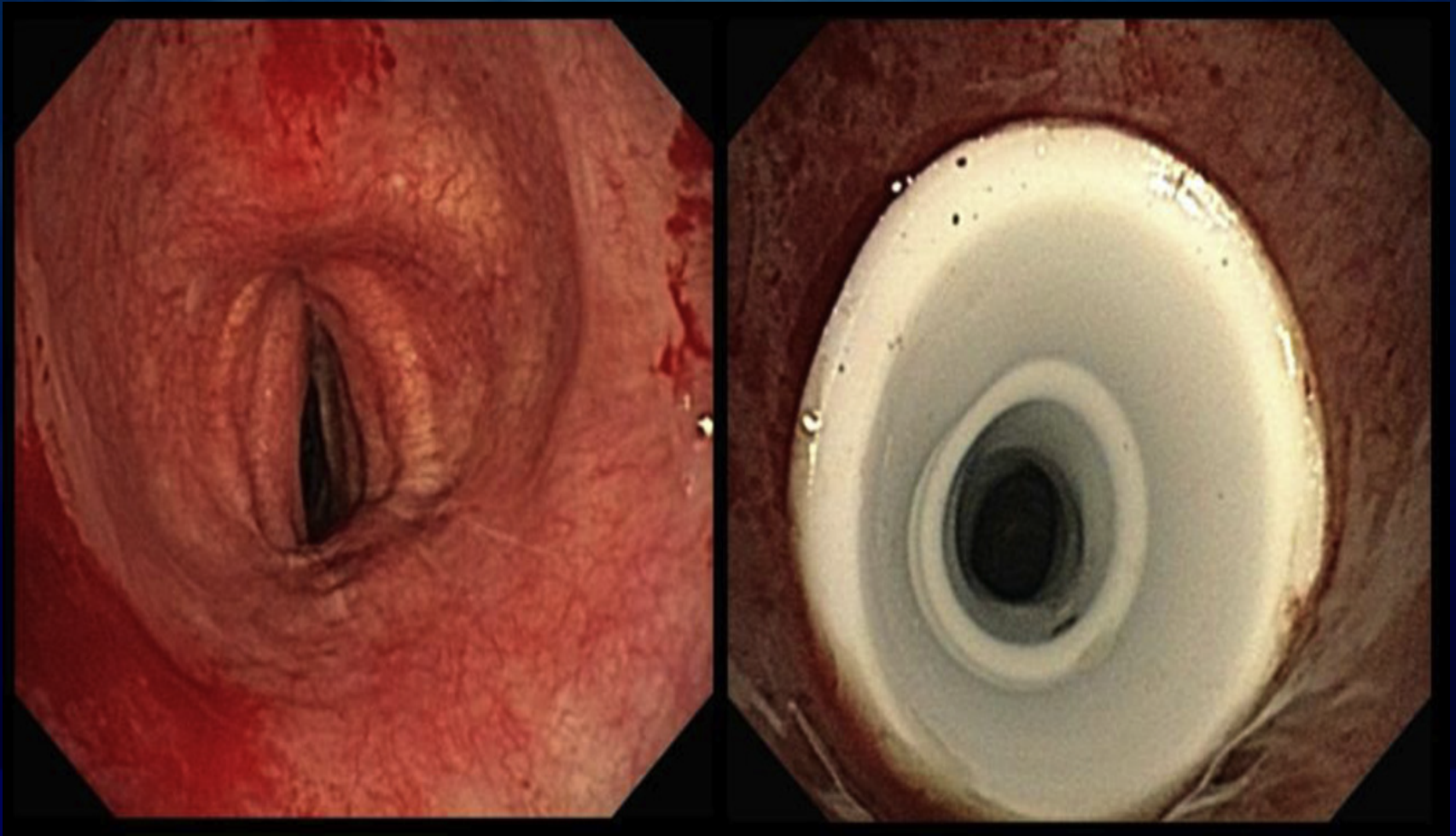
Treatment Modalities

- Tracheal Stents
 - Expandable Metal Stents



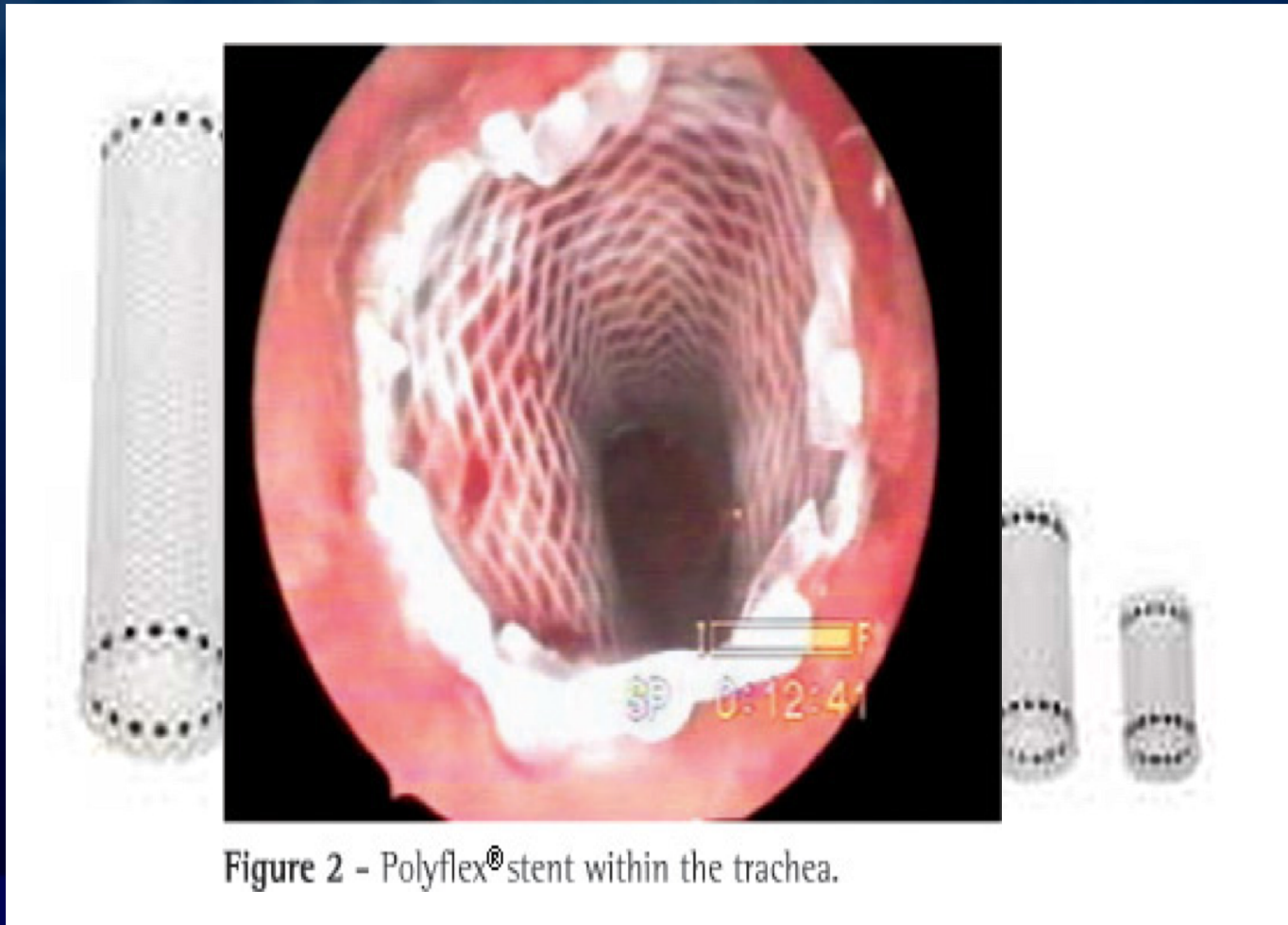
Treatment Modalities

- Nonexpandable Silicone Stent



Treatment Modalities

- Expandable Silicone Stent



Treatment Modalities

Management of Tracheobronchial Stenoses With Endoprostheses: Experience With 103 Patients and 11 Models

Olivier Merrot, MD; Guillaume Buiret, MD; Arnaud Gleizal, MD; Marc Poupart, MD; Jean-Christian Pignat, MD

TABLE I.
Etiologies of Airways Disorders.

Indications	Patients, % (n)
External compression	25.2 (26)
Tracheoesophageal fistula	15.5 (16)
Tracheal cancer	5.8 (5)
Posttracheotomy	15.5 (16)
Tracheomalacia	7.8 (8)
Pulmonary graft	9.7 (10)
Post-intubation	5.8 (6)
Tracheal resection anastomosis	5.8 (6)
Other benign causes	3.9 (4)
≥2 causes	5.8 (6)

n = number.

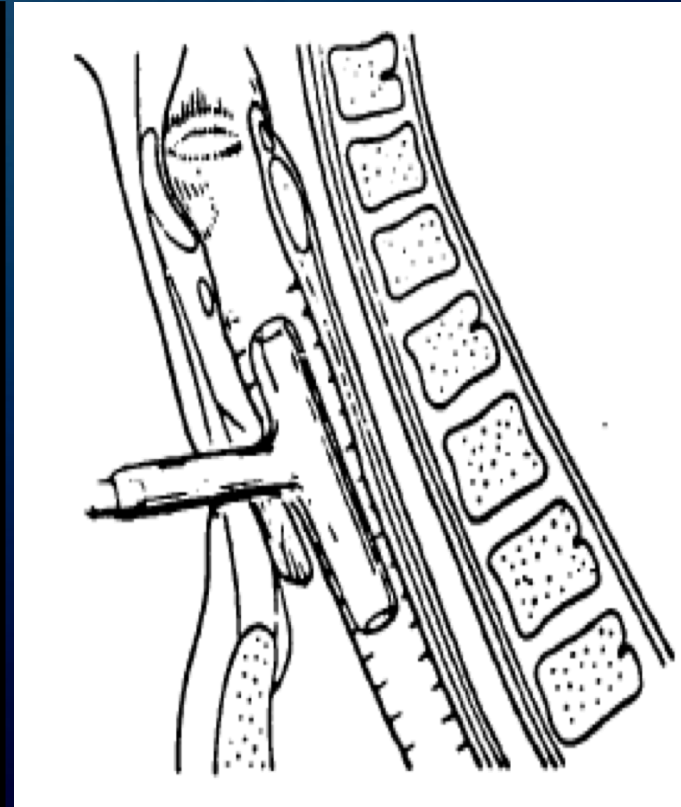
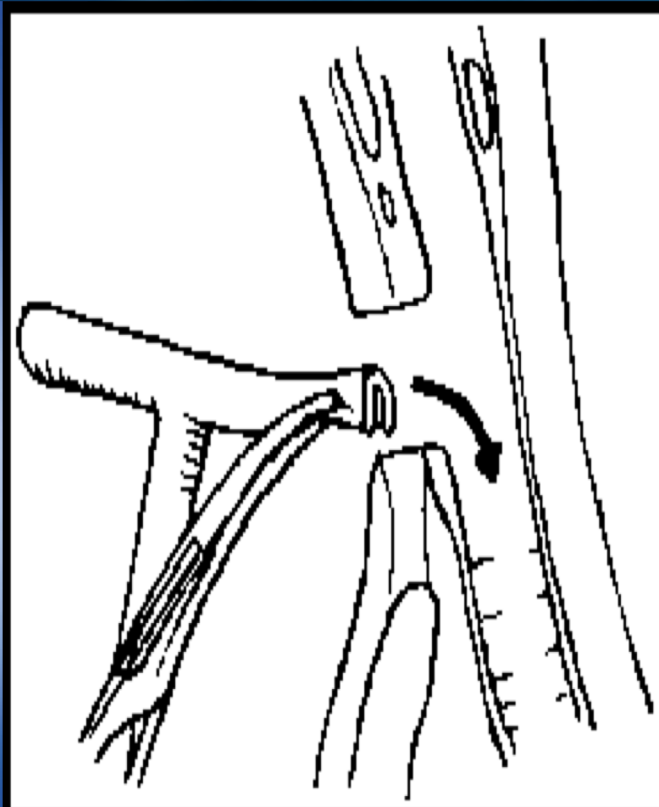
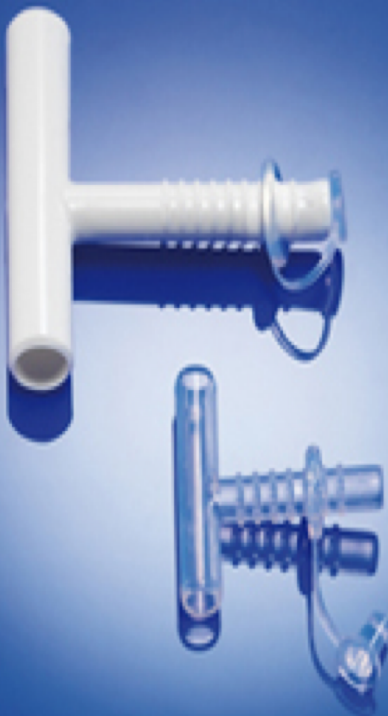
TABLE II.
Distribution of the First Stenting Attempt According to Etiology.

Etiology	Prosthesis Type			Total
	Covered Expandable	Uncovered Expandable	Unexpandable	
Extrinsic compression	8	3	15	26
TEF	8	0	7	15
Tracheotomy	9	2	5	16
Intubation	4	1	1	6
Tracheomalacia	4	2	2	8
Pulmonary graft	3	2	5	10
Tracheal resection-anastomosis	4	0	2	6
Tracheal cancer	4	0	2	6
Other benign causes	2	0	2	4
≥2 etiologies	4	1	1	6
Total	50	11	42	103

TEF = tracheoesophageal fistula.

Treatment Modalities

- T Tube

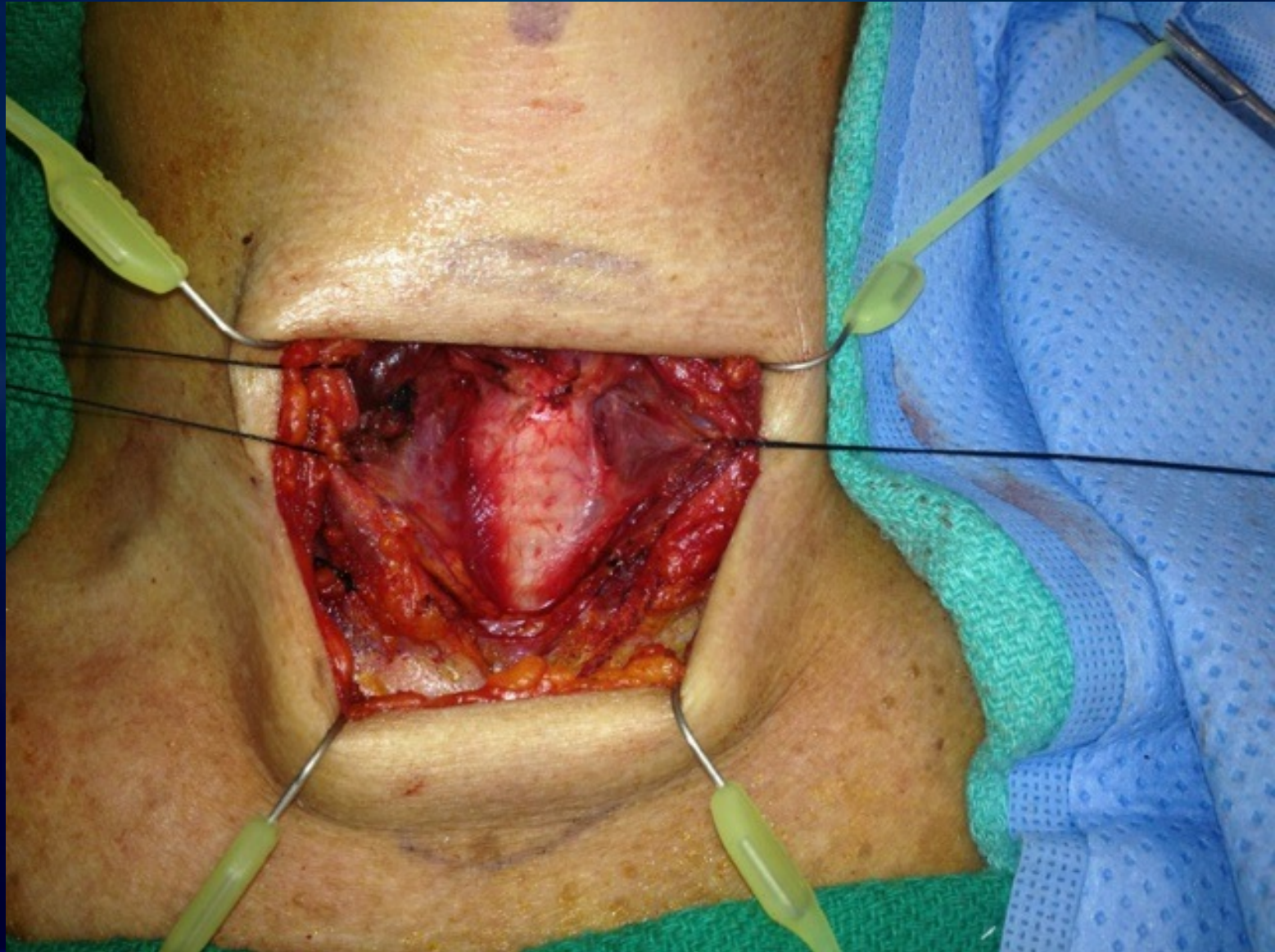


Treatment Modalities

Tracheal Resection

- Resection of Stenosis and Primary Anastomosis
 - Considered Treatment of Choice for high grade stenosis
 - Success rate 71-95%
 - Goal is to remove the stenosis and obtain a tension free anastomosis

Treatment Modalities



Treatment Modalities



Treatment Modalities



Treatment Modalities



Treatment Modalities



Treatment Modalities



Treatment Modalities

POSTINTUBATION TRACHEAL STENOSIS

Treatment and results

Hermes C. Grillo, MD, Dean M. Donahue, MD (by invitation),
Douglas J. Mathisen, MD, John C. Wain, MD (by invitation), and
Cameron D. Wright, MD (by invitation), *Boston, Mass.*

Table III. *Results of surgical treatment of postintubation tracheal stenosis*

	<i>No. of patients</i>	<i>Good</i>		<i>Satisfactory</i>		<i>Failure</i>		<i>Death</i>		<i>Reoperation</i>	
		<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>
Initial operation	503	427	84.9	27	5.3	19	3.8	12	2.4	18	3.6
Reoperation	18	13	72.2	4	22.2	1	5.6	0	—	—	—
Overall	503	440	87.5	31	6.2	20	3.9	12	2.4	—	—

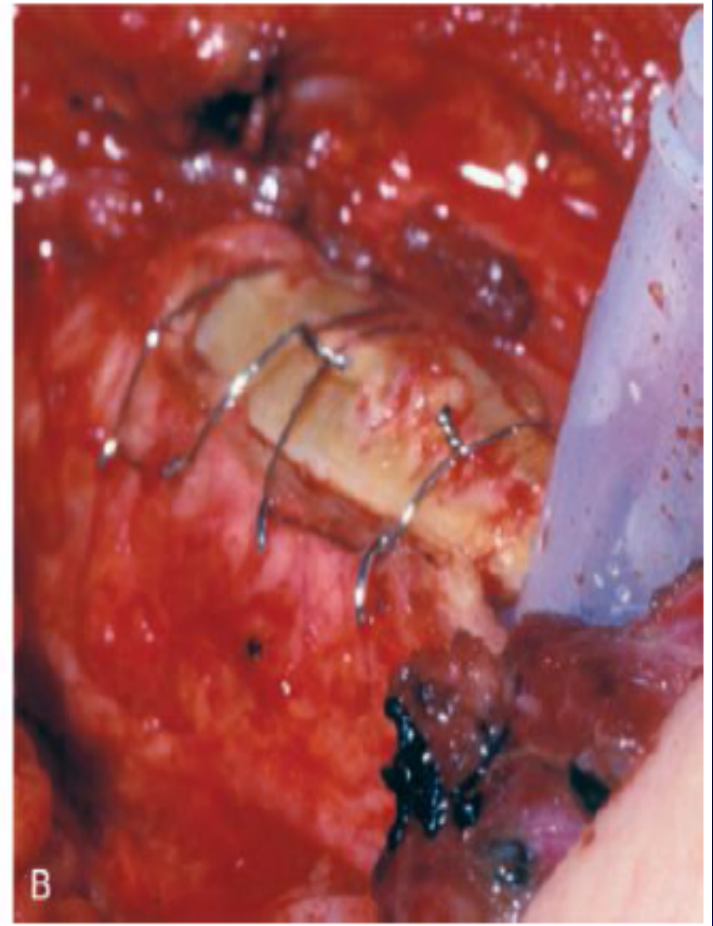
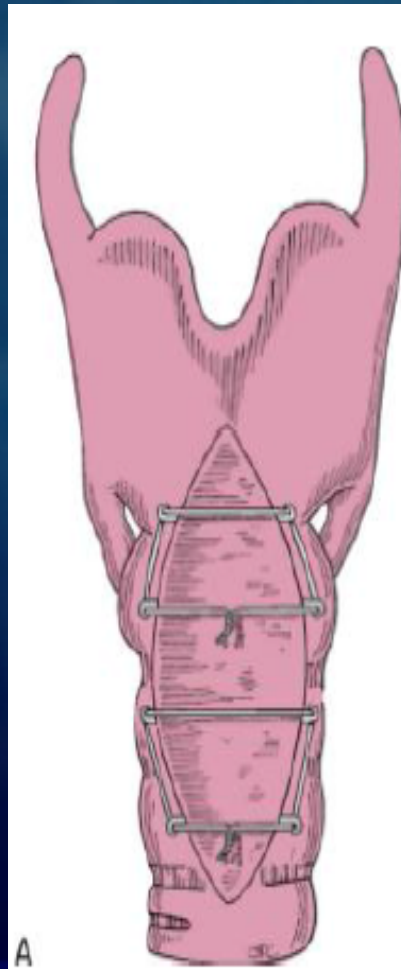
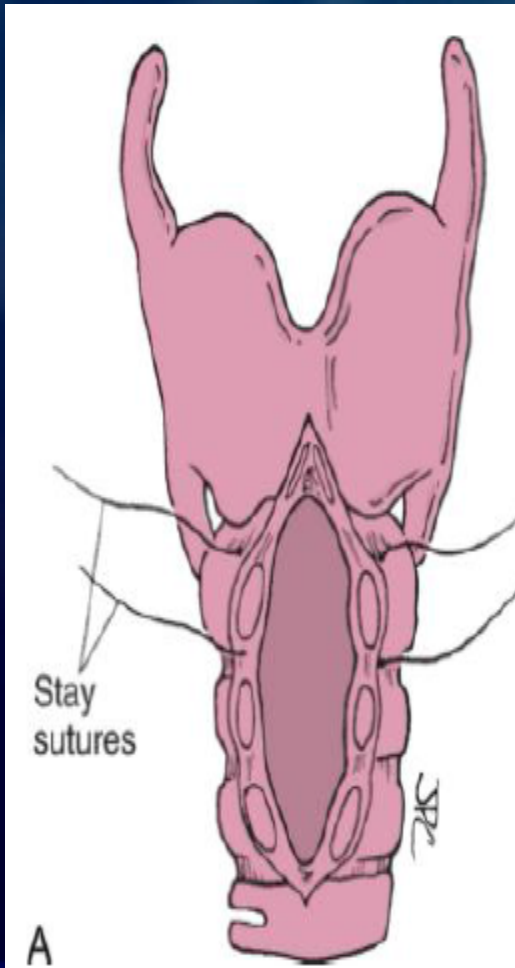
Treatment Modalities

Does Successful Segmental Tracheal Resection Require Releasing Maneuvers?

Albert L. Merati, MD, Anthony A. Rieder, MD, Nalin Patel, MD,
Debra L. Park, PHD,* and Doug Girod, MD, Milwaukee, Wisconsin and
Kansas City, Kansas

Treatment Modalities

Tracheoplasty

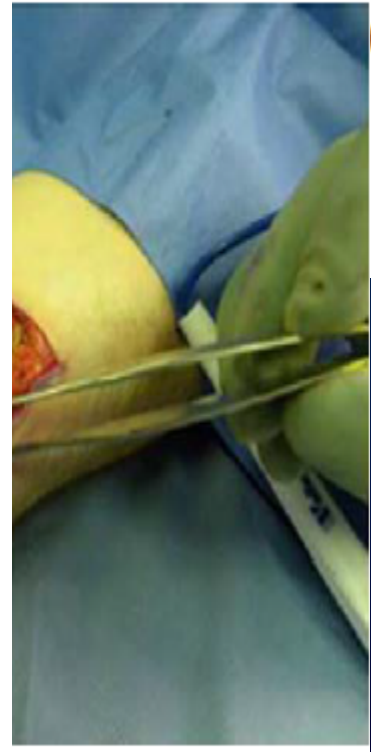
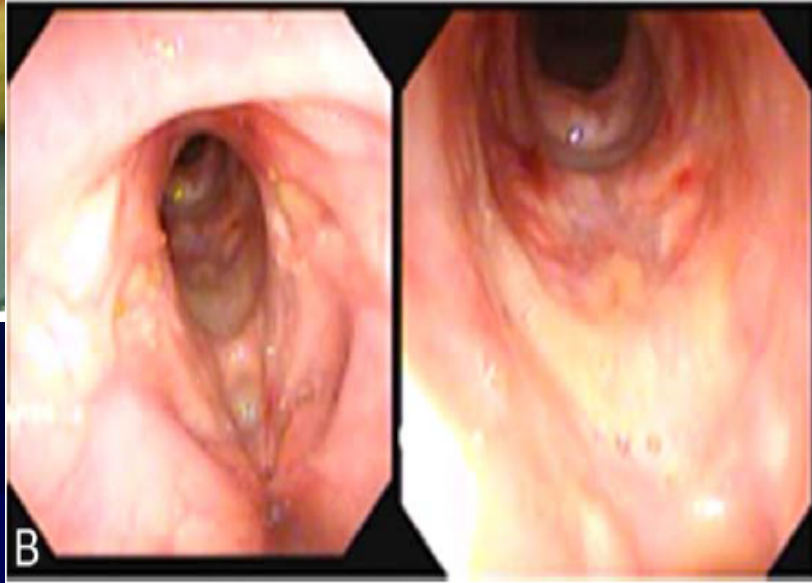
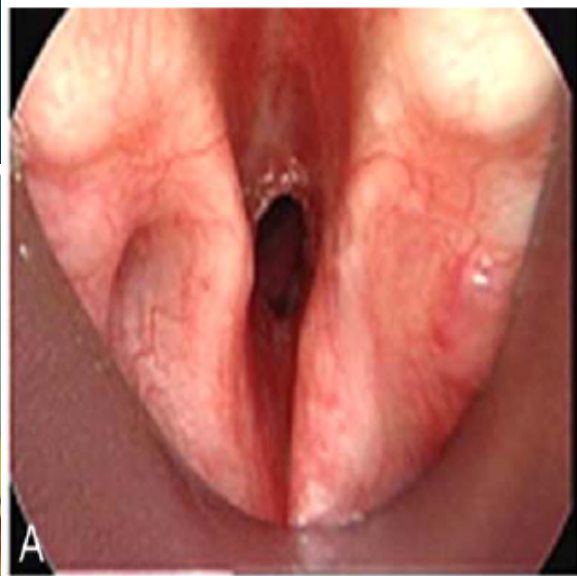


Treatment Modalities

Tracheoplasty

Comp

Kara Y. D

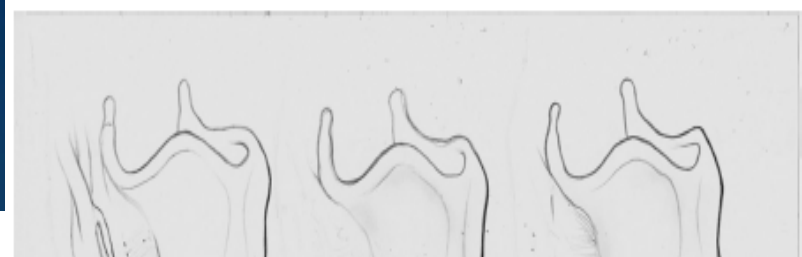


eries

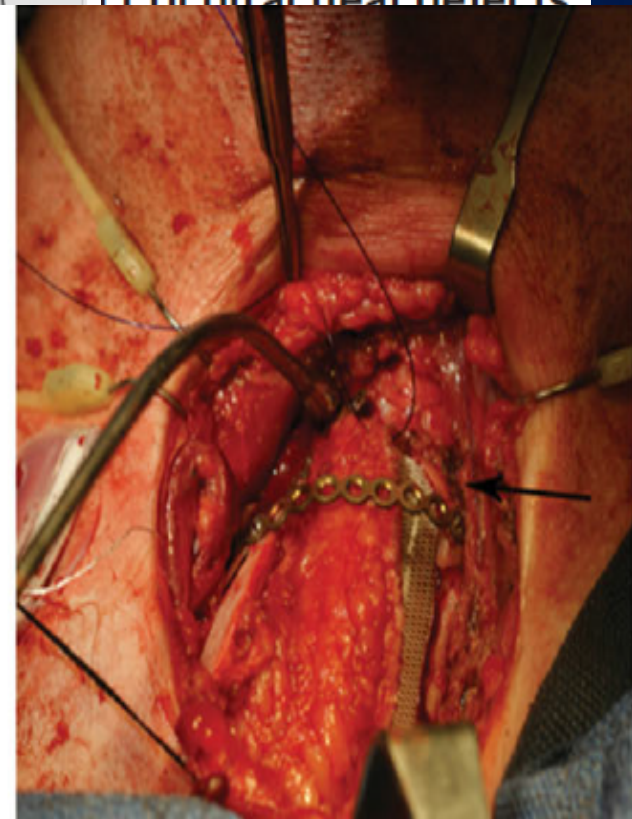
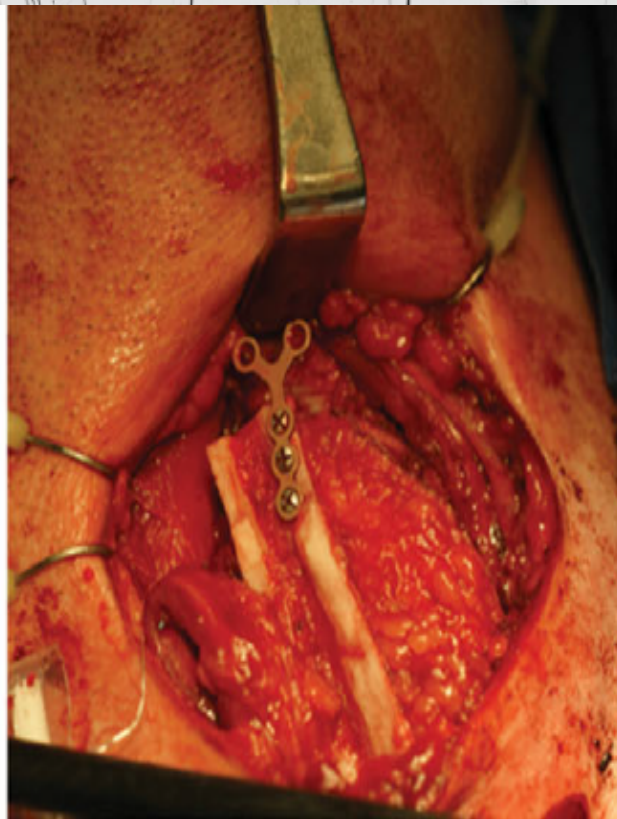
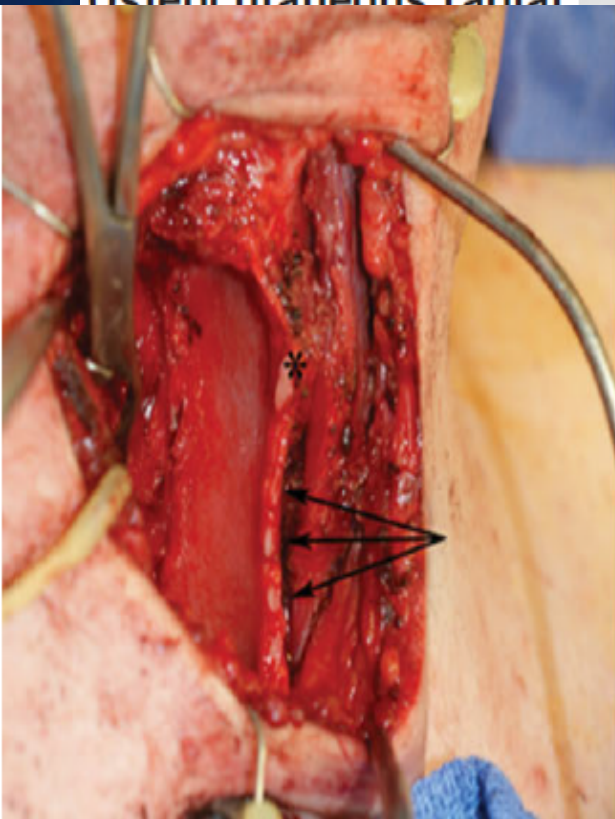
Treatment Modalities

Tracheoplasty

Osteocutaneous radial

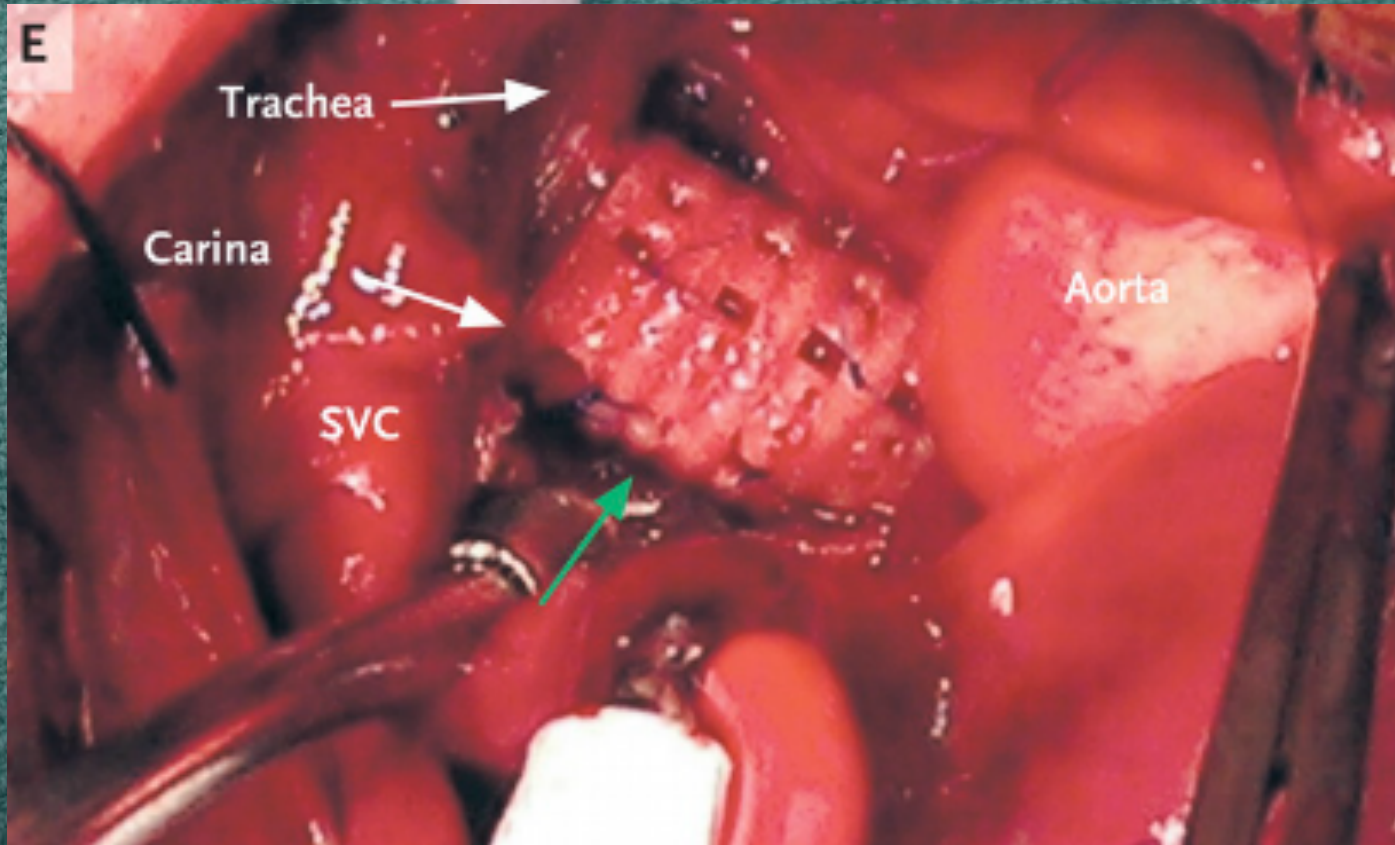


Cricotracheal defects



defect, 7 = radius bone, 8 = fascia of radial forearm flap, 9 = radial artery, and 10 = common carotid artery.

On the Horizon



Case

HPI: 28 yom who was hospitalized in 2007 after MVA. During that admission he underwent percutaneous tracheostomy. He subsequently was weaned off the ventilator, but unable to be decannulated.

PMH: None

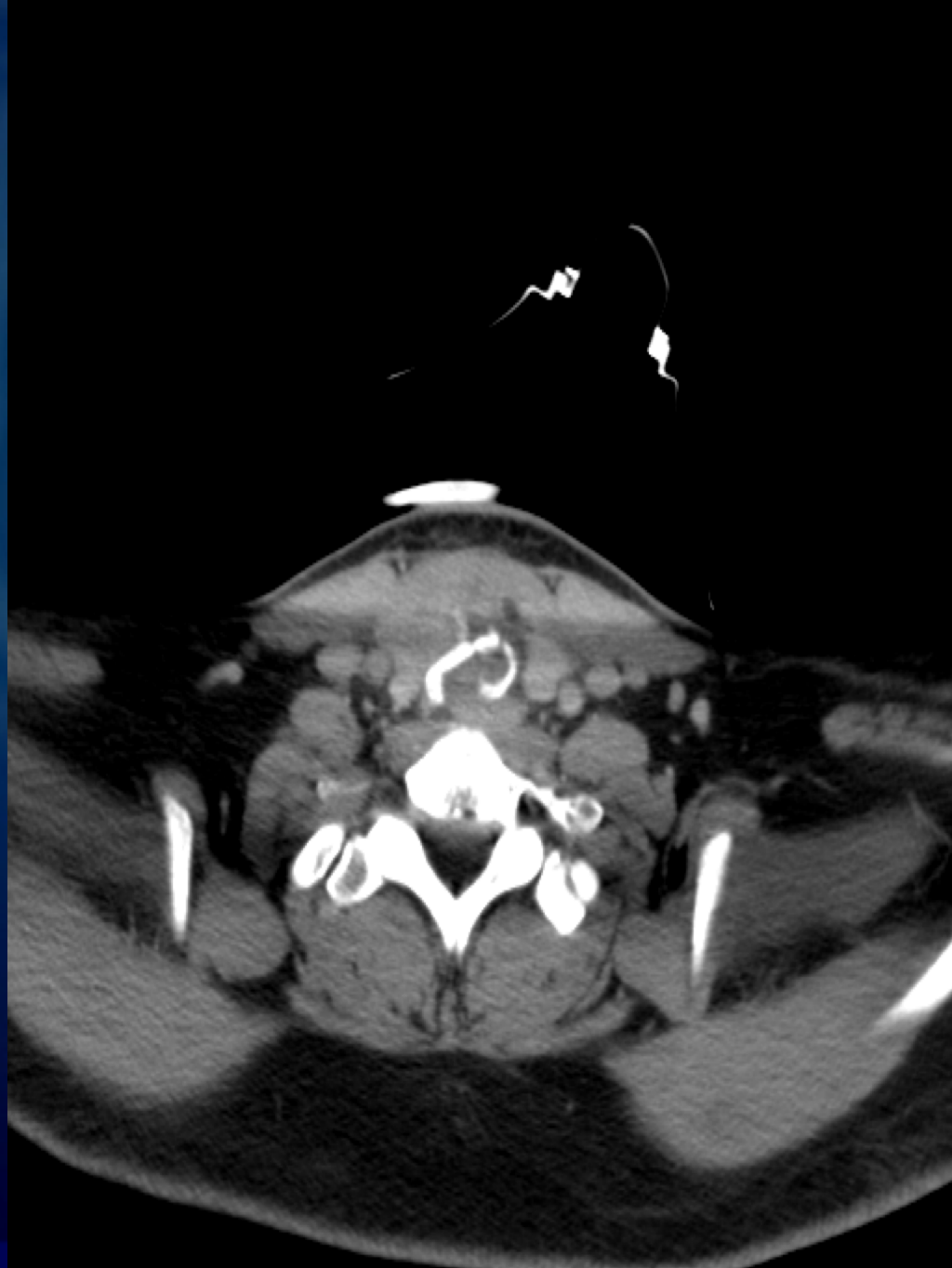
PSH: None

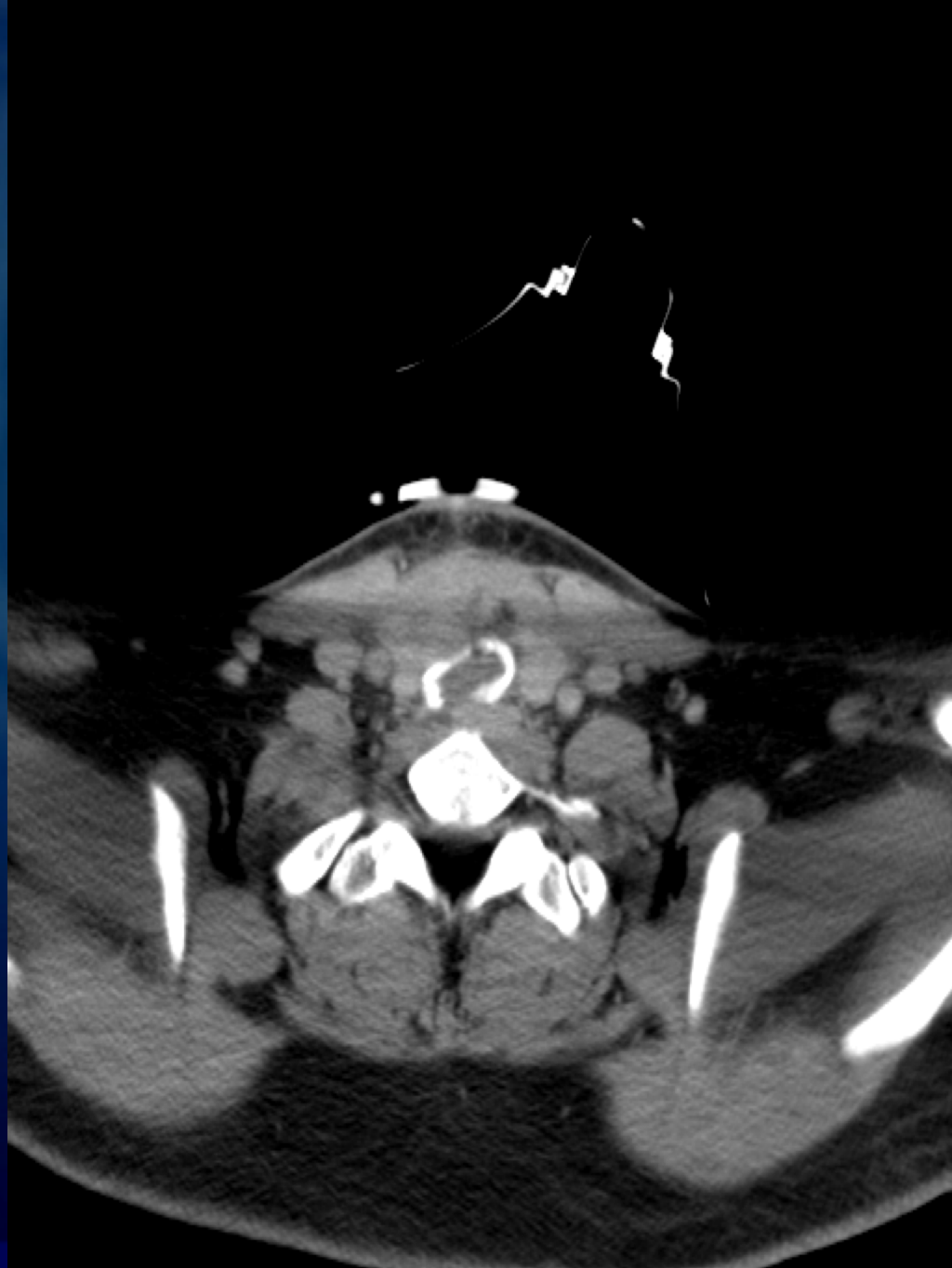




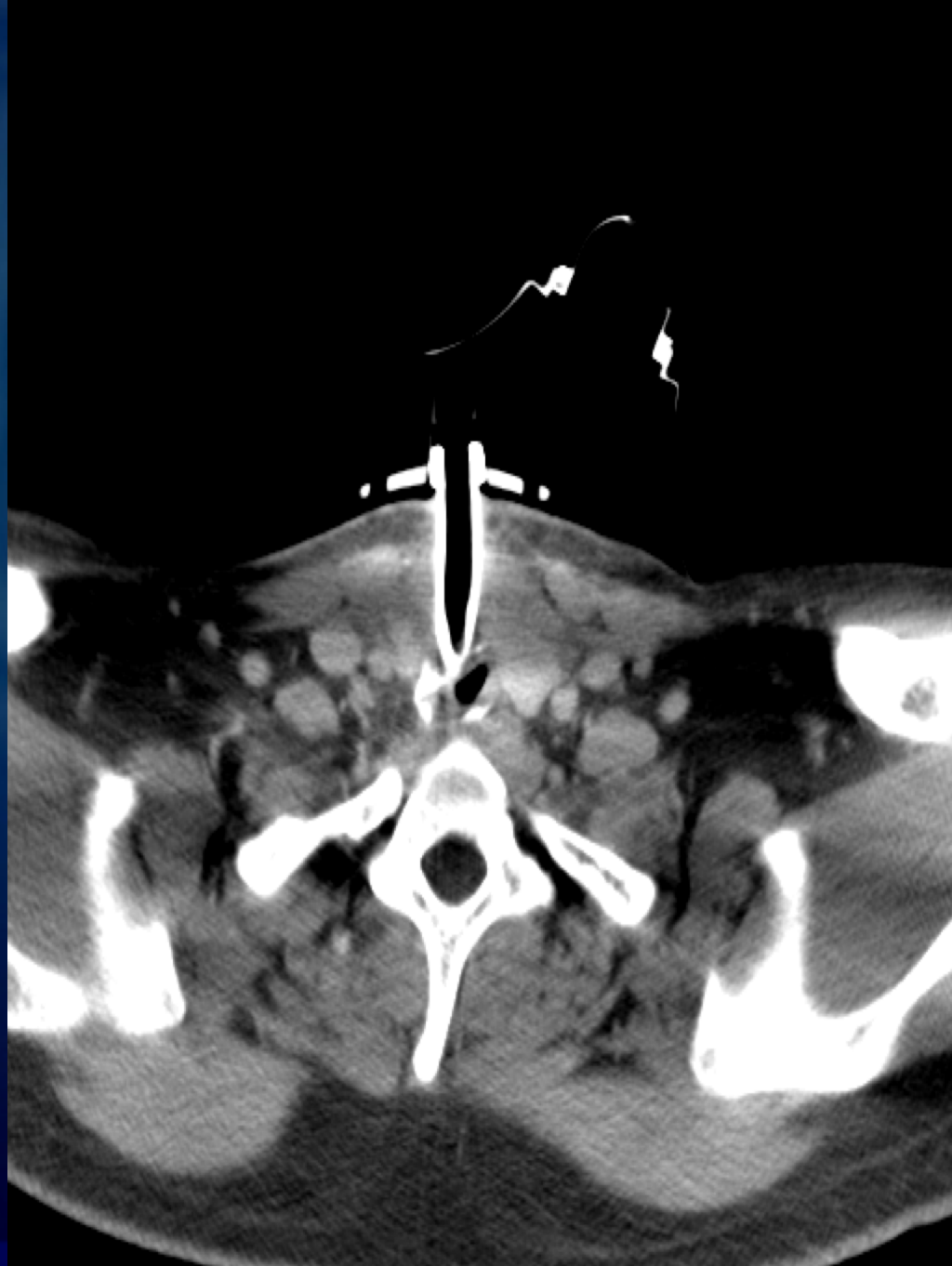


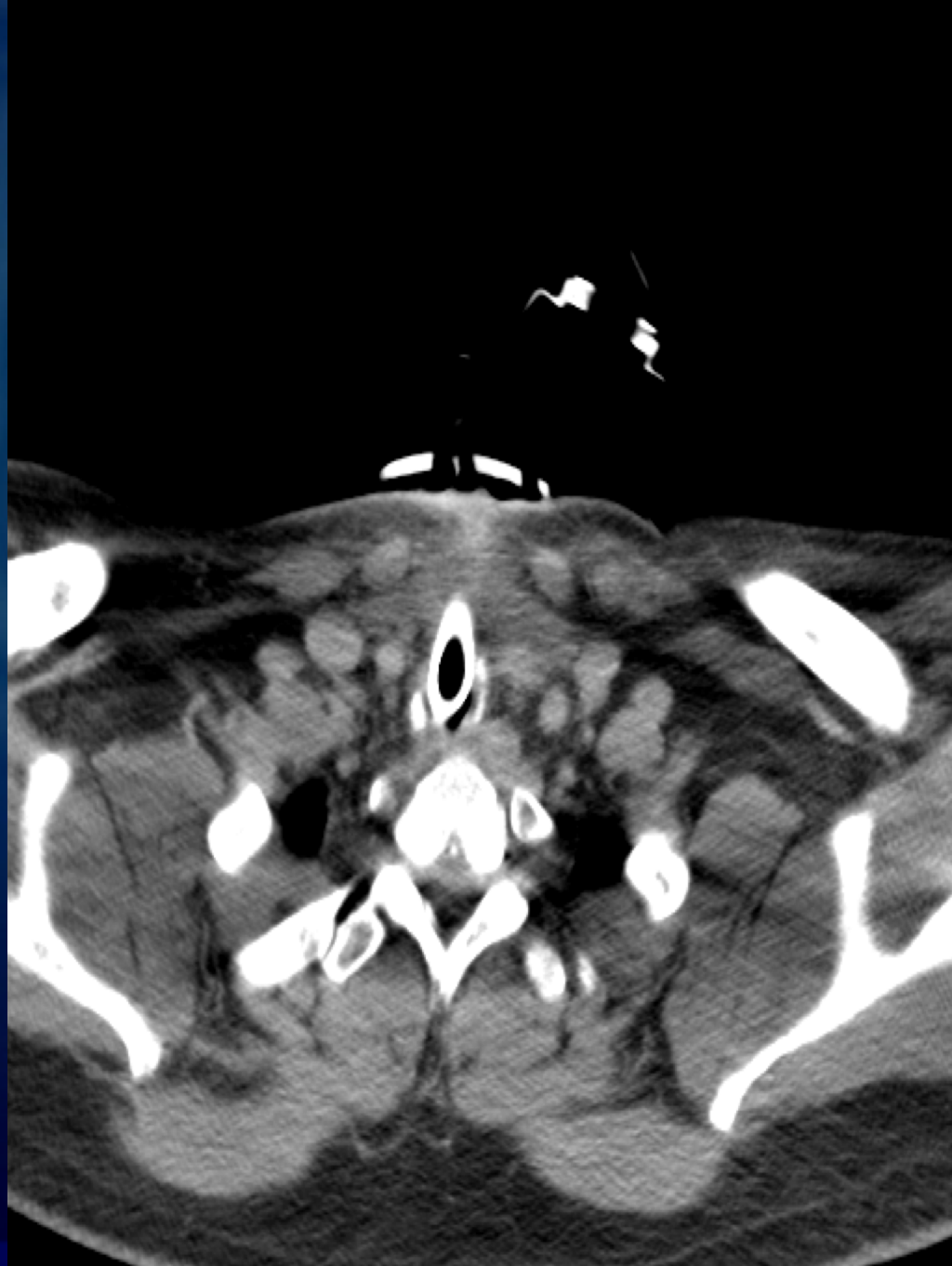




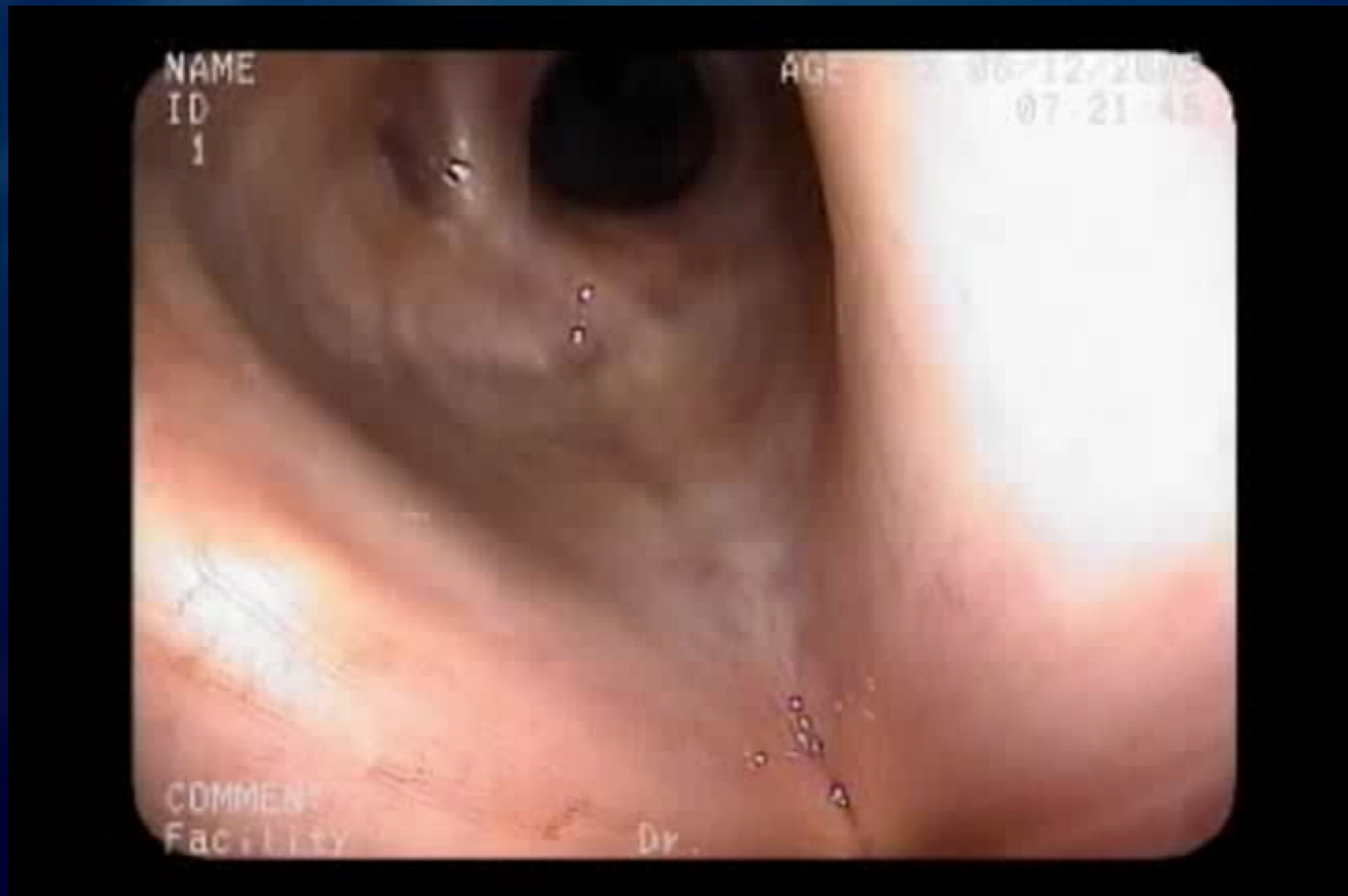








Case



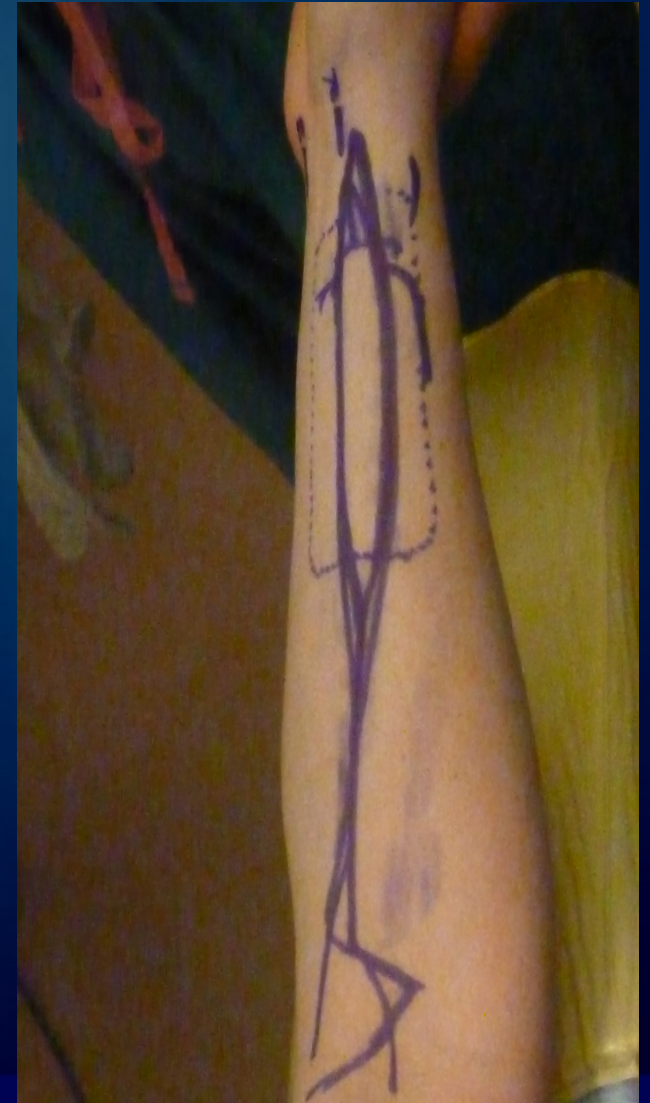
Case

- Dx of Tracheal Stenosis made
- Multiple Laser Bronchoscopies with Dilation
- Unable to be decannulated
- Tracheal reconstruction with septal cartilage graft and T-tube - March 2008
- Multiple Laser Bronchoscopies with Dilation over ensuing year
- Tracheoplasty with costal cartilage graft - July 2009
- Recurrent Stenosis, but able to remain decannulated

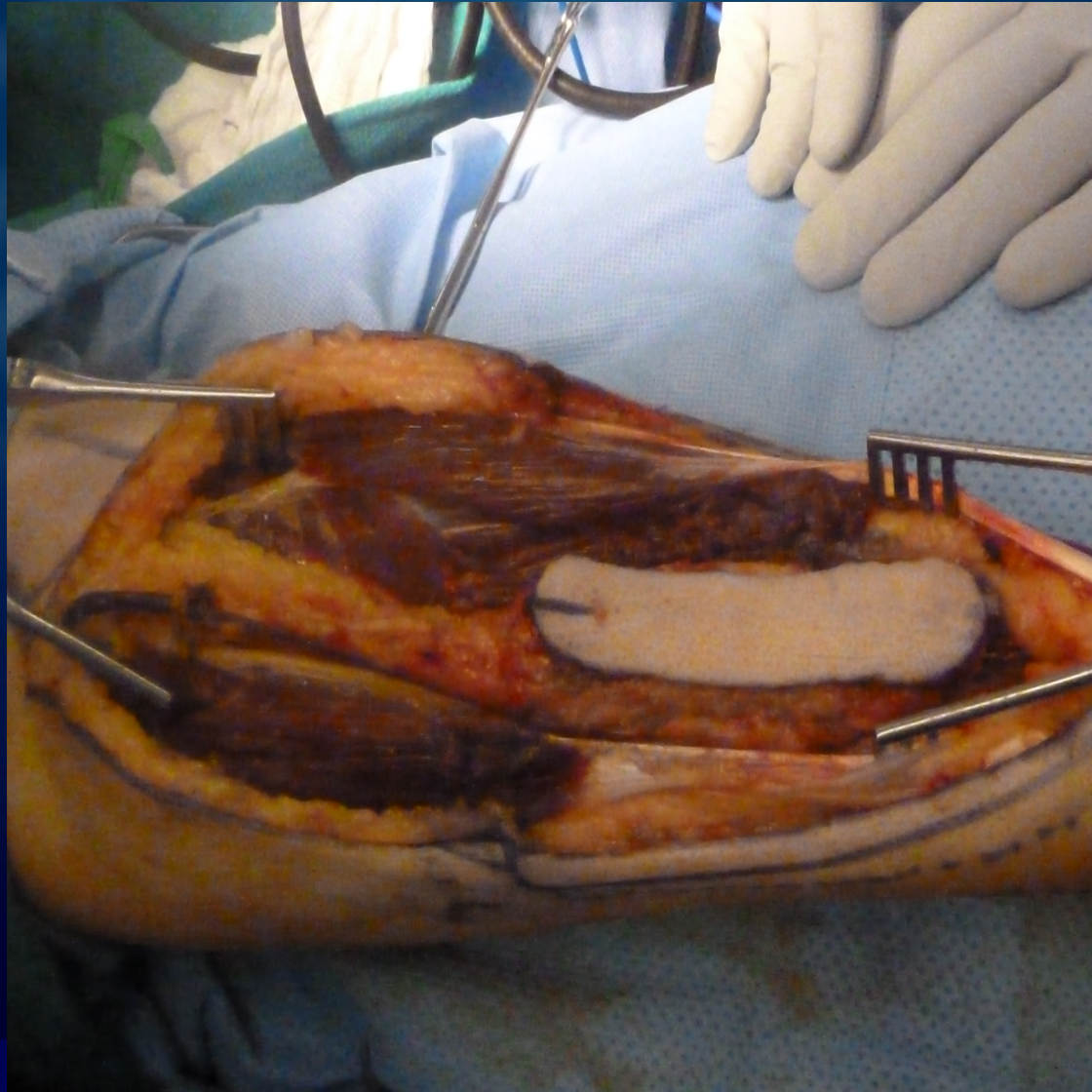
Case

- January 2012 Rigid bronch and T-Tube
- Revision Tracheoplasty January 2013
 - Airway skeletonized; Larynx - 9th ring
 - Previous graft/Stenotic area excised
 - Osteoadipofacial Radial Forearm Free Flap Harvested
 - Bone contoured w a drill
 - Flap sutured to remaining trachea
 - Epidermis removed and remaining soft tissue used as intraluminal lining
 - T-tube placed

Case



Case



Case



Case



Case

- T-tube progressively shortened over ensuing procedures
- July 2013 T-tube replaced w #4 Shiley Tracheostomy Tube
- Decannulation 1 week later
- Subsequent bronchoscopy w balloon dilation procedures have shown progressively less granulation and have been decreasing in frequency

Case

HADIK, DOMINIC
03529797
1

AGE M 10/30/2014
08:23:45



COMMENT
Facility

DR. SPIEGEL

Thank You

References

- Morshed K, Trojanowska A, Szymański M, Trojanowski P, Szymańska A, Smoleń A, Drop A. Evaluation of tracheal stenosis: comparison between computed tomography virtual tracheobronchoscopy with multiplanar reformatting, flexible tracheofiberoscopy and intra-operative findings. *Eur Arch Otorhinolaryngol*. 2011 Apr;268(4):591-7.
- Monnier P, George M, Lonod M, Lang F. The role of CO2 laser in the management of laryngotracheal stenosis: a survey of 100 cases. *Eur Arch Otorhinolaryngol*. 2005 Aug;262(8):602-8.
- Fernando HC, Sherwood JT, Krinsky W. Endoscopic therapies and stents for benign airway disorders: where are we, and where are we heading? *Ann Thorac Surg*. 2010 Jun;89(6):S2183-7.
- Perepelitsyn I, Shapshay SM. Endoscopic treatment of laryngeal and tracheal stenosis-has mitomycin C improved the outcome? *Otolaryngol Head Neck Surg*. 2004 Jul;131(1):16-20.
- Merrot O, Buiret G, Gleizal A, Poupart M, Pignat JC. Management of tracheobronchial stenoses with endoprotheses: experience with 103 patients and 11 models. *Laryngoscope*. 2008 Mar;118(3):403-7.

References

- Grillo HC, Donahue DM. Postintubation tracheal stenosis. *Chest Surg Clin N Am*. 1996 Nov;6(4):725-31.
- Merati AL, Rieder AA, Patel N, Park DL, Girod D. Does successful segmental tracheal resection require releasing maneuvers? *Otolaryngol Head Neck Surg*. 2005 Sep;133(3):372-6.
- Grenier PA, Beigelman-Aubry C, Brillet PY. Nonneoplastic tracheal and bronchial stenoses. *Thorac Surg Clin*. 2010 Feb;20(1):47-64
- Bacon JL, Patterson CM, Madden BP. Indications and interventional options for non-resectable tracheal stenosis. *J Thorac Dis* 2014;6(3):258-270.
- Al-Khudari S, Sharma S, Young W, Stapp R, Ghanem TA. Osteocutaneous radial forearm reconstruction of large partial cricotracheal defects. *Head Neck*. 2013 Aug; 35(8):E254-7.
- Detwiler KY, Schindler JS, Schneider DS, Lindau R. Complex adult laryngotracheal reconstruction with a prefabricated flap: a case series. *Head Neck*. 2013 Dec; 35(12):E376-80.