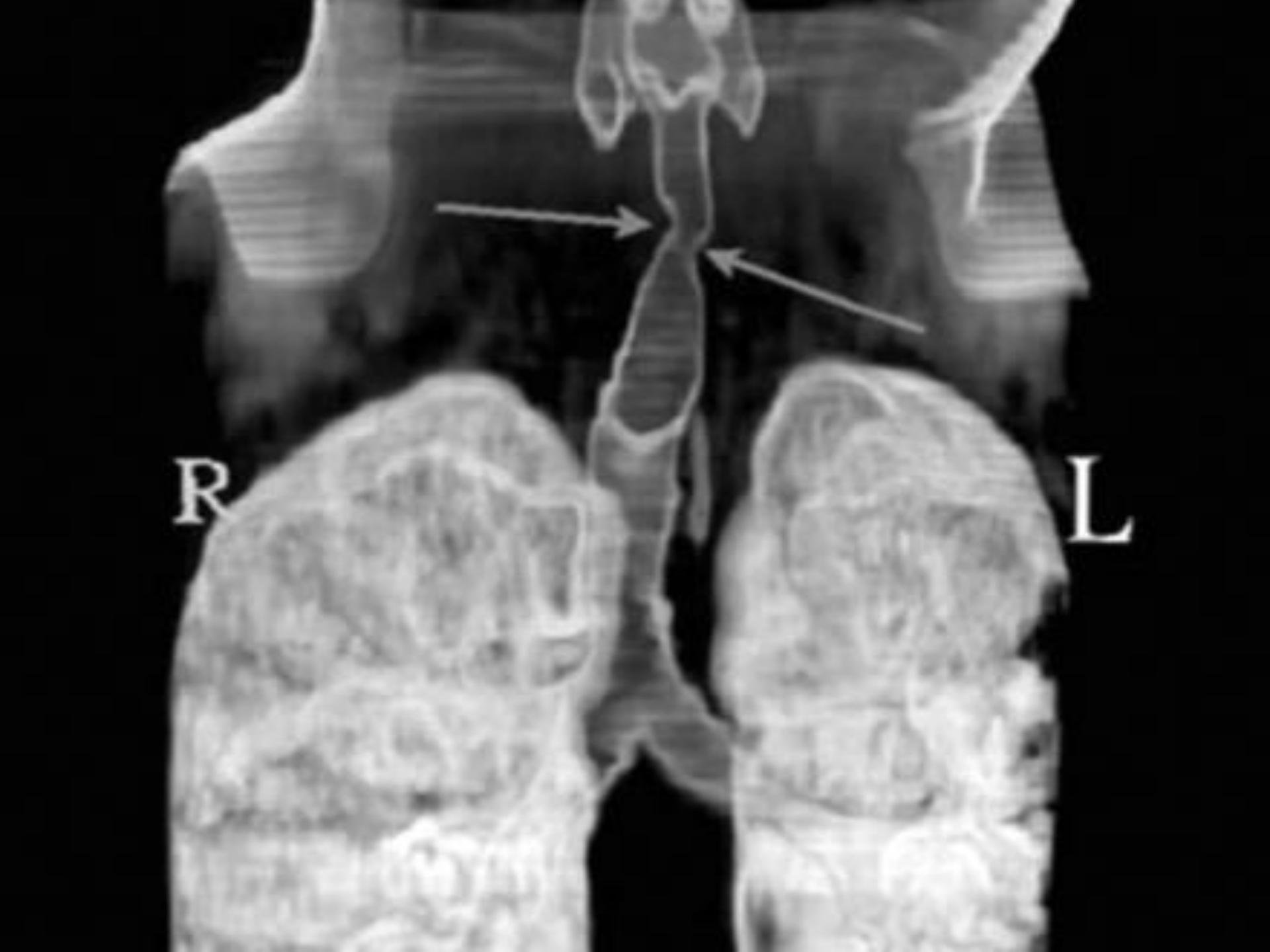
TRACHEAL STENOSIS IN CHILDREN

DR DOAN THI BAO THUY
RESPIRATORY DEPARTMENT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CONTENT

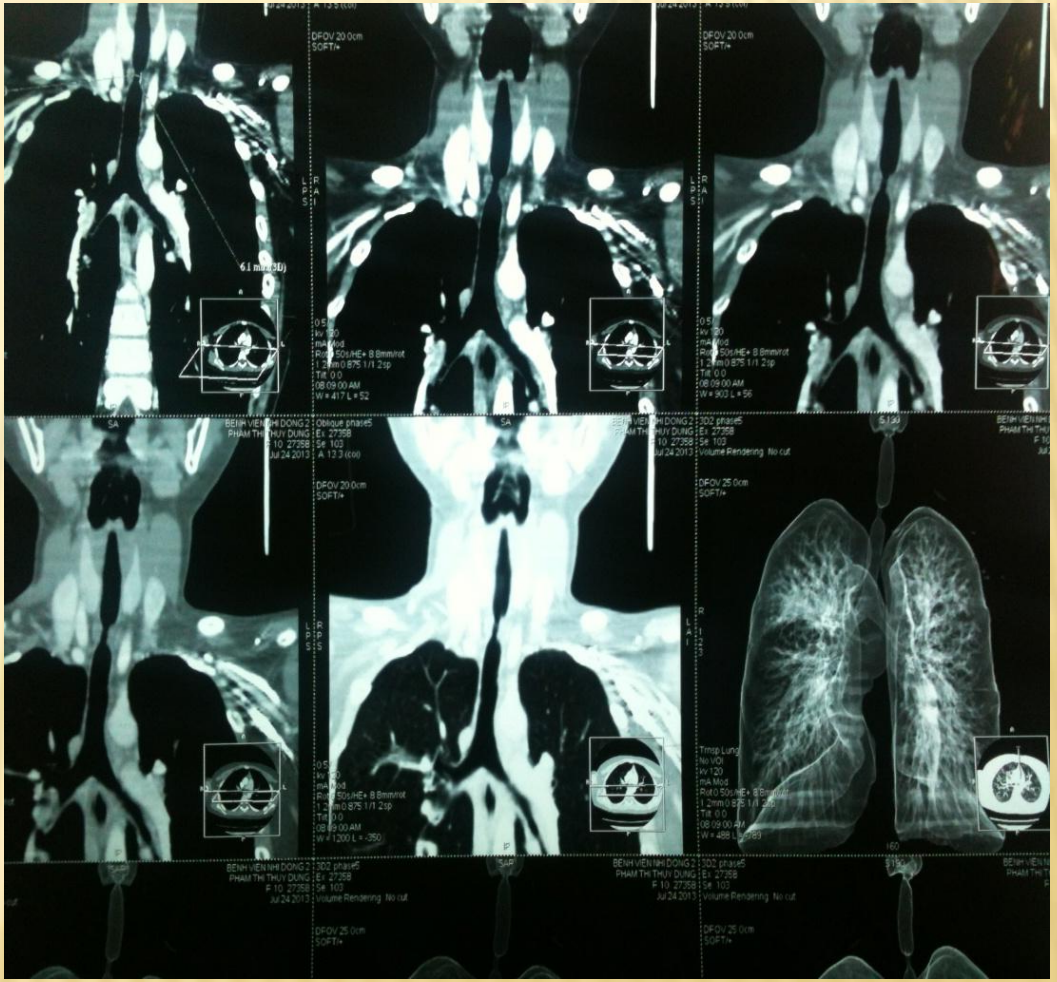
- Cases report
- Introduction
- Causes
- Diagnosis
- Classification
- Management
- Evident based medicine
- Conclusion

CASES REPORT

CASE AQUIRED TRACHEAL STENOSIS

- Patient's name: Pham Thi Thuy D, Female, 10 Years old
- Stridor and difficult breathing.
- Diagnosis: Tracheal stenosis, aquired after surgery
- Surgery management: resection tracheal with end-to-end anastomosis
- The operation was successful

- CT scan: the tracheal stenosis, middle one third of the trachea . D min 3,6mm, L (TS) 6mm
- Bronchoscopy, narrow more than 80% of diameter



CASE CONGENITAL TRACHEAL STENOSIS

- Patient's name: Bui Yen L, female, 10 months
- Persistant wheeze
- Diagnosis: Congenital tracheal stenosis
- Surgery management: slide tracheoplasty
- The operation was successful

CASE CONGENITAL TRACHEAL STENOSIS

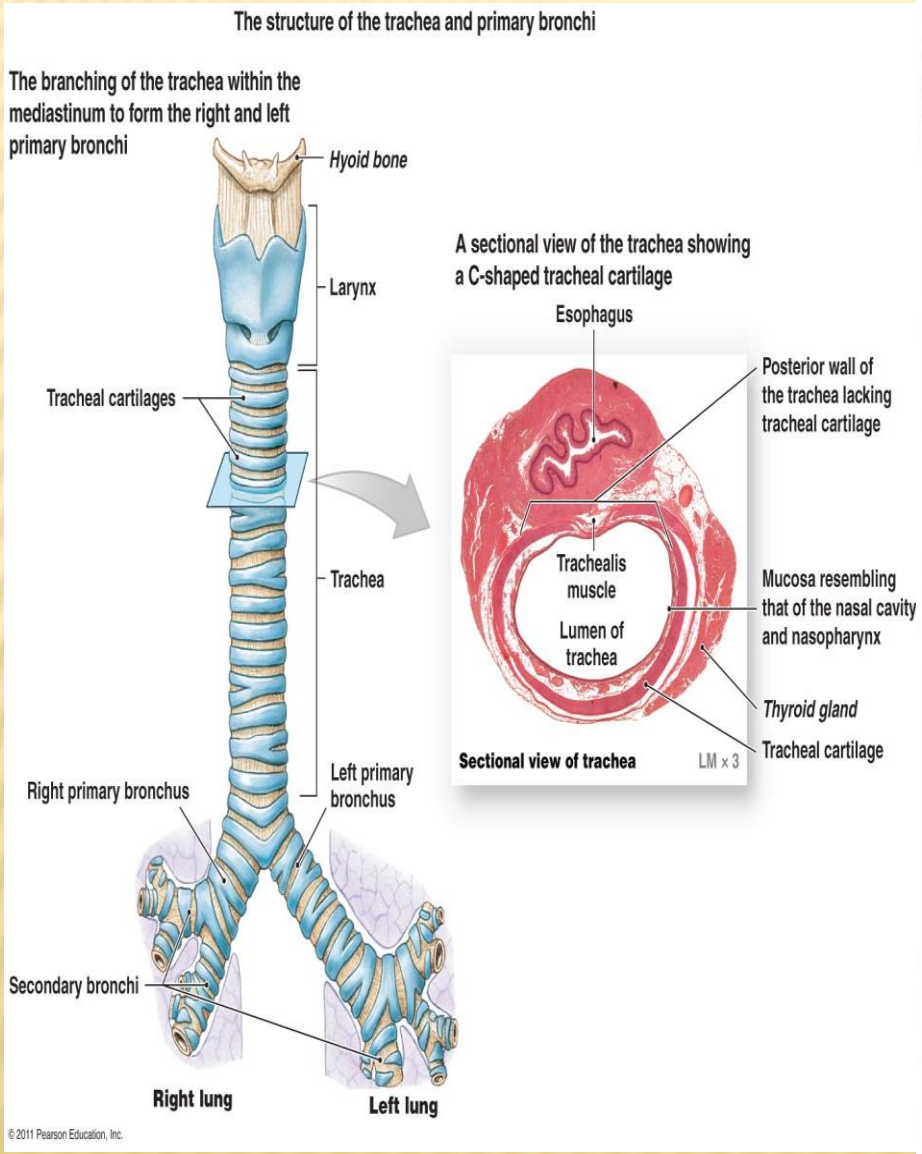
- CT scan: the tracheal stenosis in middle-lower of the trachea . D min 2,5mm, L (TS) 15mm, vascular ring
- Bronchoscopy: stenosis in middle one third of the trachea

INTRODUCTION

- Tracheal stenosis (TS): narrowing of the trachea
- Congenital or acquired
- Increase acquired TS: increased survival of low-birth-weight infants and increased use of intubation
- Congenital TS: rare, – 1/64,500 (USA-2012) not clear, mortality rate 44-79%

INTRODUCTION

- In Respiratory Department
- 33 cases of abnormal airway (10/2010 →8/2013)
- 19/33 cases TS
- 17 congenital cases, 2 aquired cases
- 50% (8/17cases congenital) is associated with cardialvascular anomalies
- Rate of M/F : 1.25/1



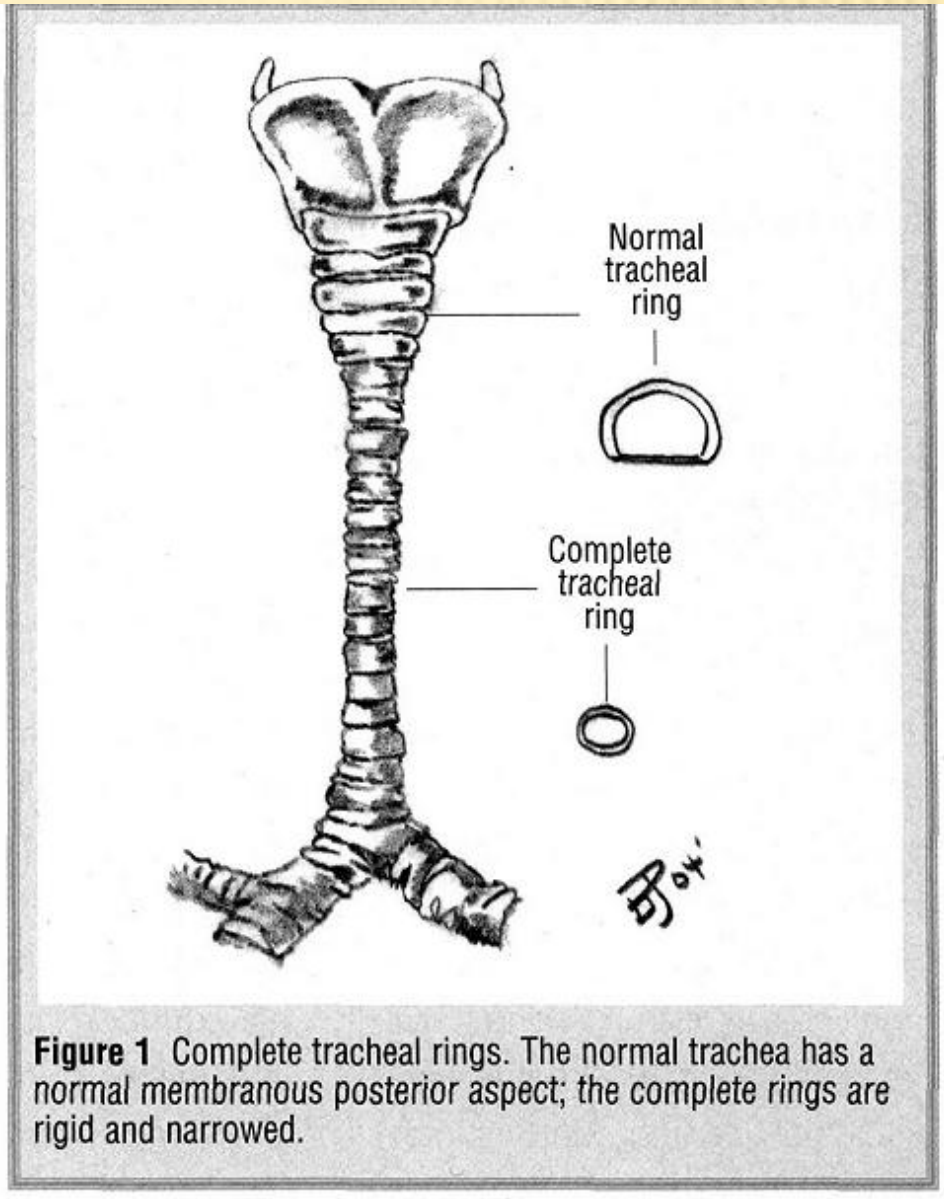
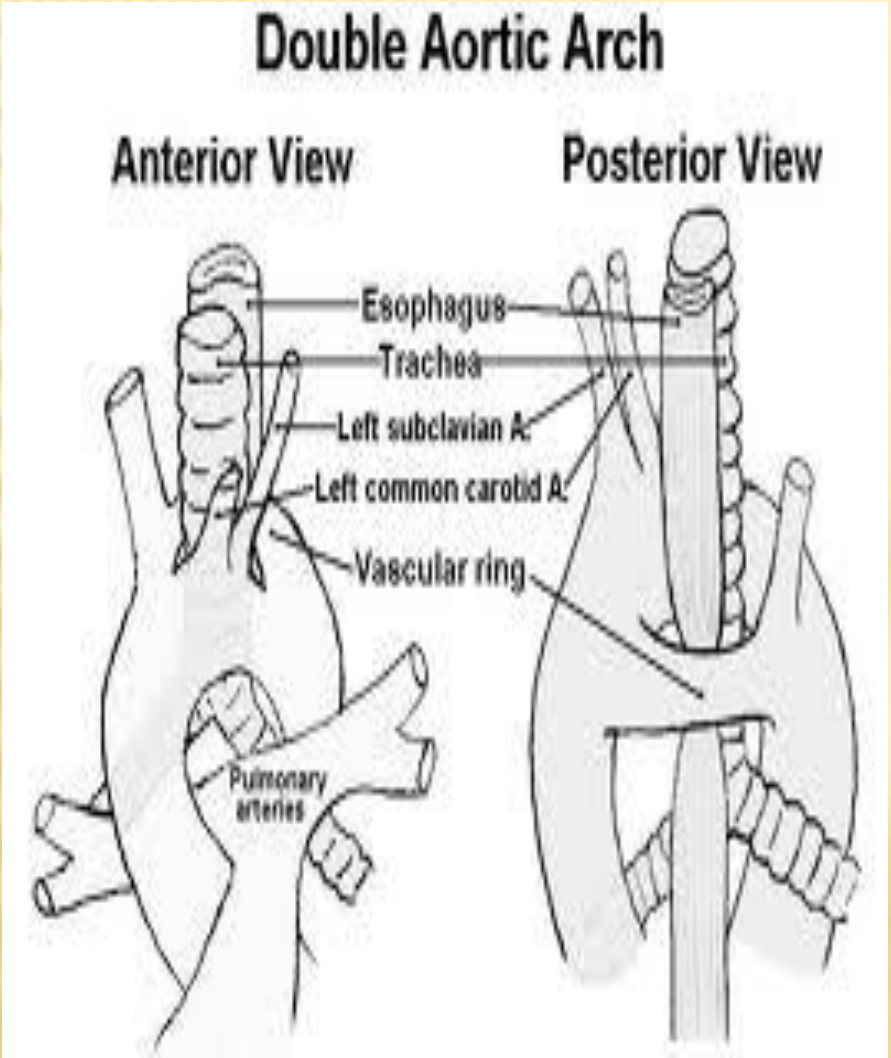
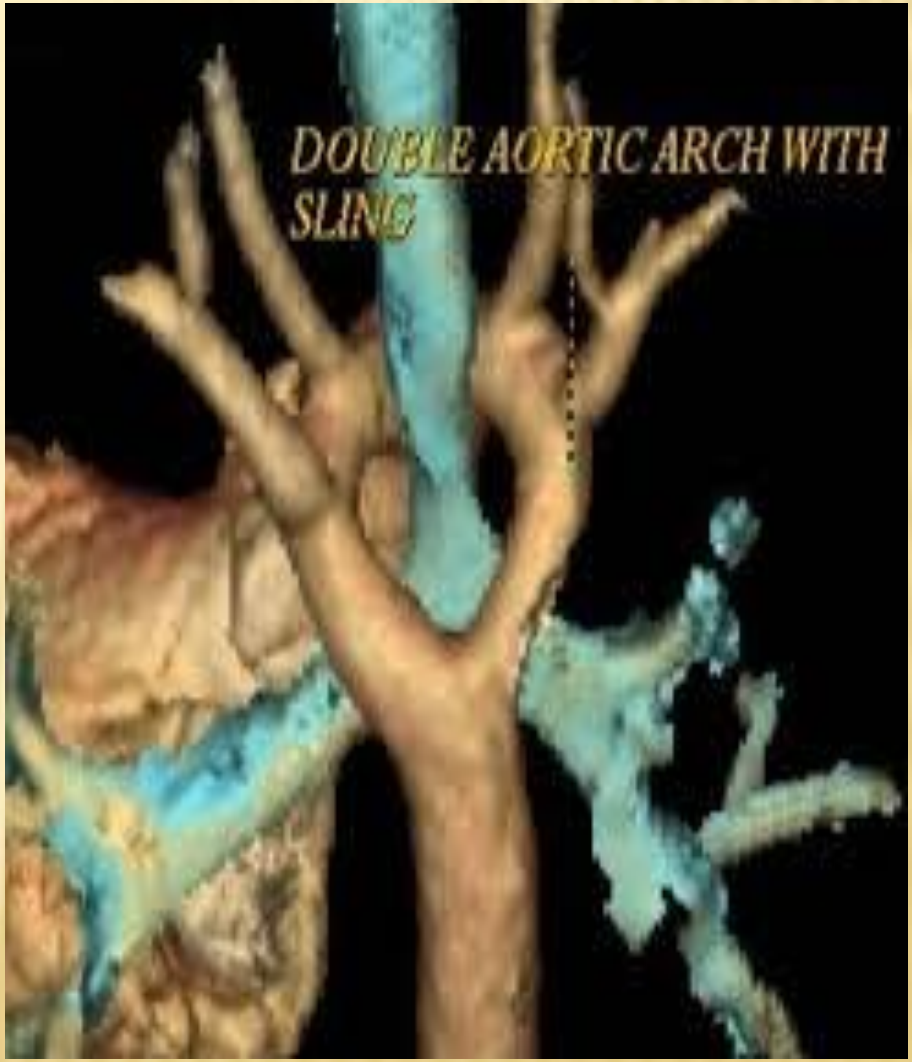


Figure 1 Complete tracheal rings. The normal trachea has a normal membranous posterior aspect; the complete rings are rigid and narrowed.

CAUSES

- **Acquired tracheal stenosis**
  - Endotracheal intubation
  - Tracheostomy
  - Radiotherapy
  - Past surgery
  - Gastroesophageal reflux
- **Congenital tracheal stenosis** associated with pulmonary, cardiovascular and gastrointestinal malformations (50% of all cases TS)


Double Aortic Arch
Anterior View
Posterior View
Esophagus
Trachea
Left subclavian A.
Left common carotid A.
Vascular ring
Pulmonary arteries


DOUBLE AORTIC ARCH WITH SLING

DIAGNOSIS

Symptoms

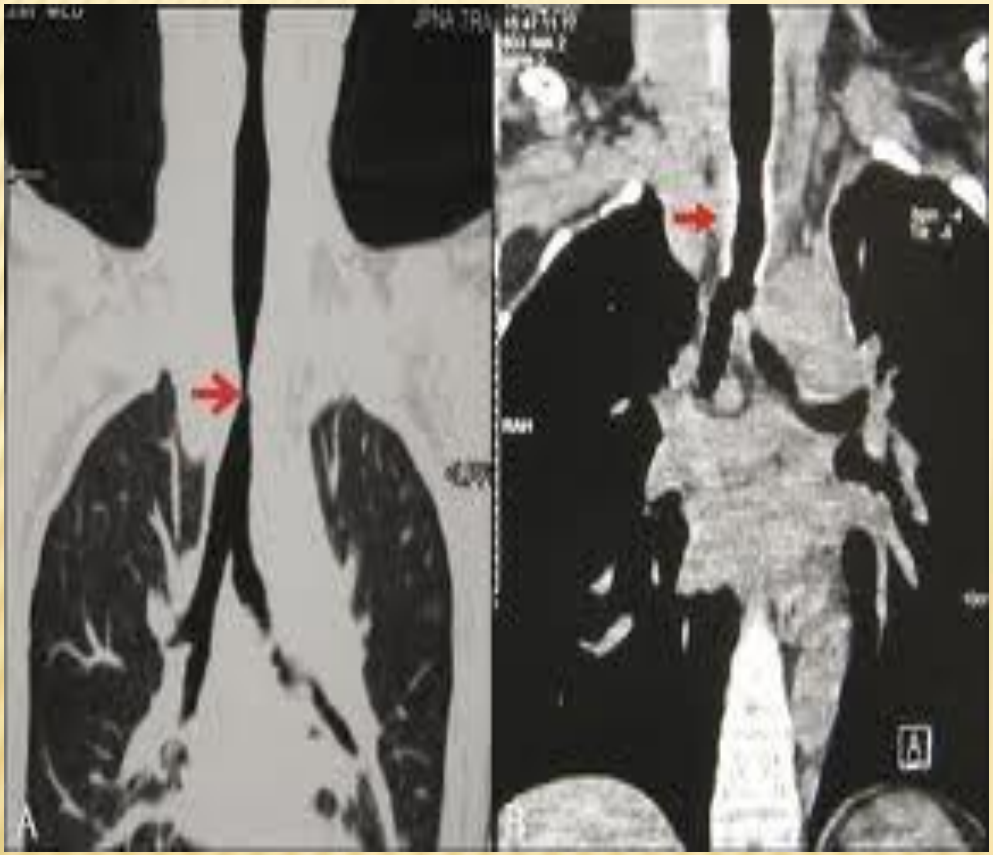
- Stridor
- Recurring pneumonia
- Wheezing

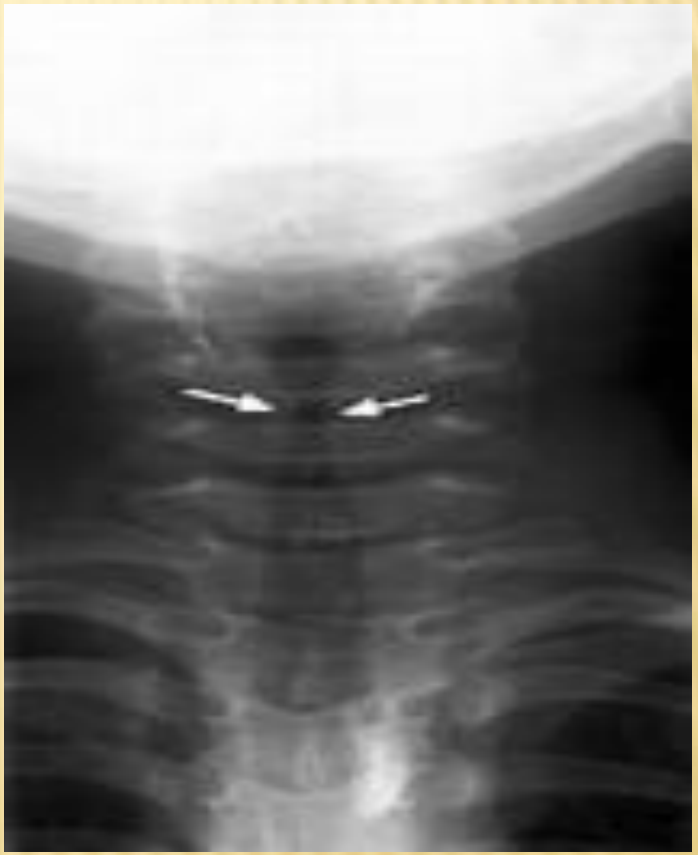
Imaging studies:

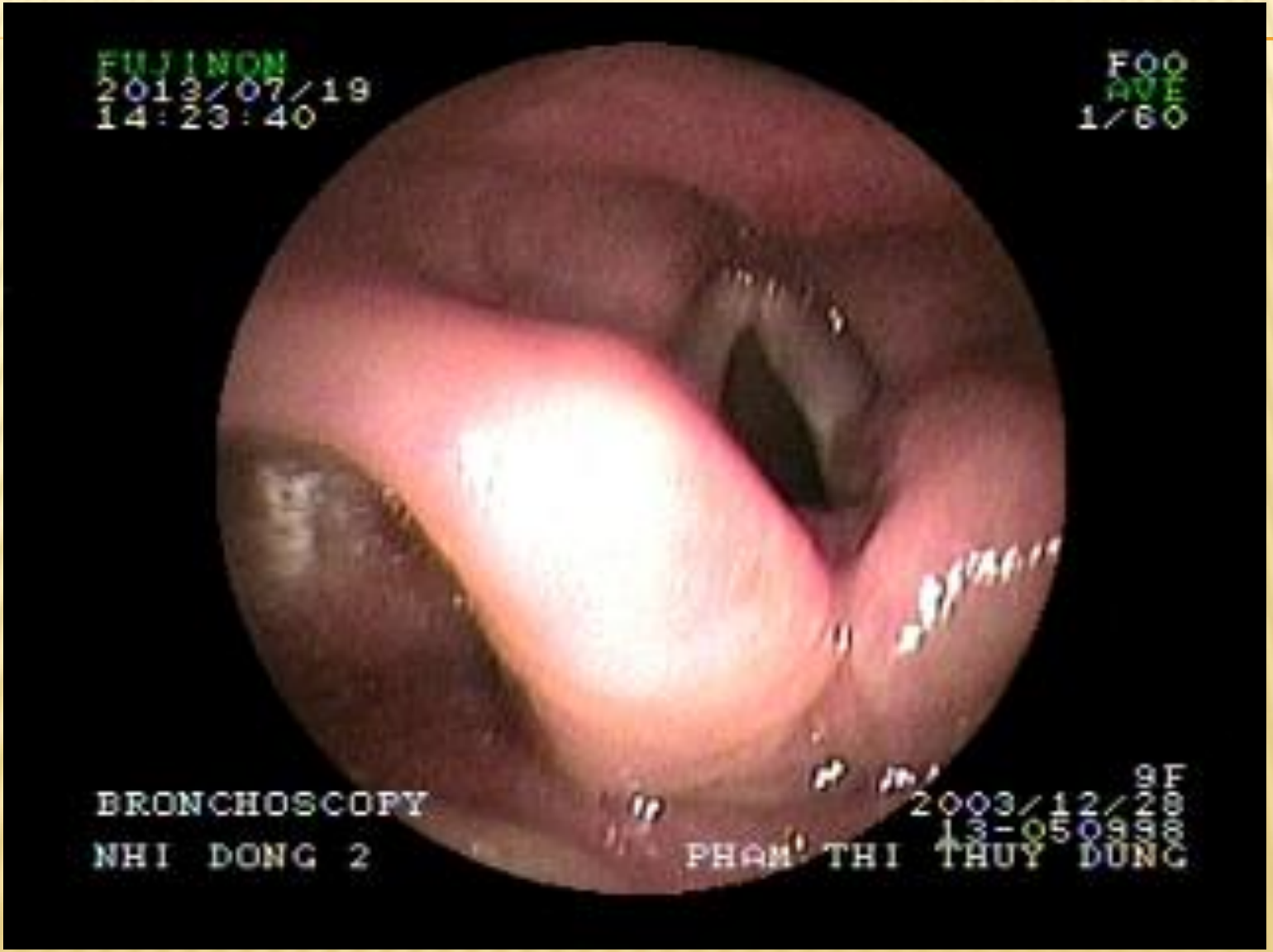
- Imaging, X-rays and CT or MR imaging.

CT or MRI is recommended (*)

- Microlaryngoscopy and bronchoscopy**:** diagnose the degree and length of TS



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GRADING

- **Review Myer-Cotton staging system**

+ Grade I lesions have less than 50% obstruction

+ Grade II lesions have 51% to 70% obstruction

+ Grade III lesions have 71% to 99% obstruction

+ Grade IV lesions have no detectable lumen or complete stenosis(*)

GRADING

The location of the stenosis is divided into 5 regions: (*)

- Upper one third of the trachea
- Middle one third of the trachea
- Lower one third of the trachea
- Right main bronchus
- Left main bronchus (Freitag et al 2007)

MANAGEMENT

PROGNOSIS

- Respiratory status
- The site and degree of the stenosis
- The age and co-morbidities of patient
- Previous treatments and failures.

MANAGEMENT

Treatments:

- Observation treatmeant: milder forms, airway grows, improve over time.
- Endoscopic treatments: Laser excision, stents placement, Balloon dilation
- Tracheal resection
- Tracheoplasty: slide, patch

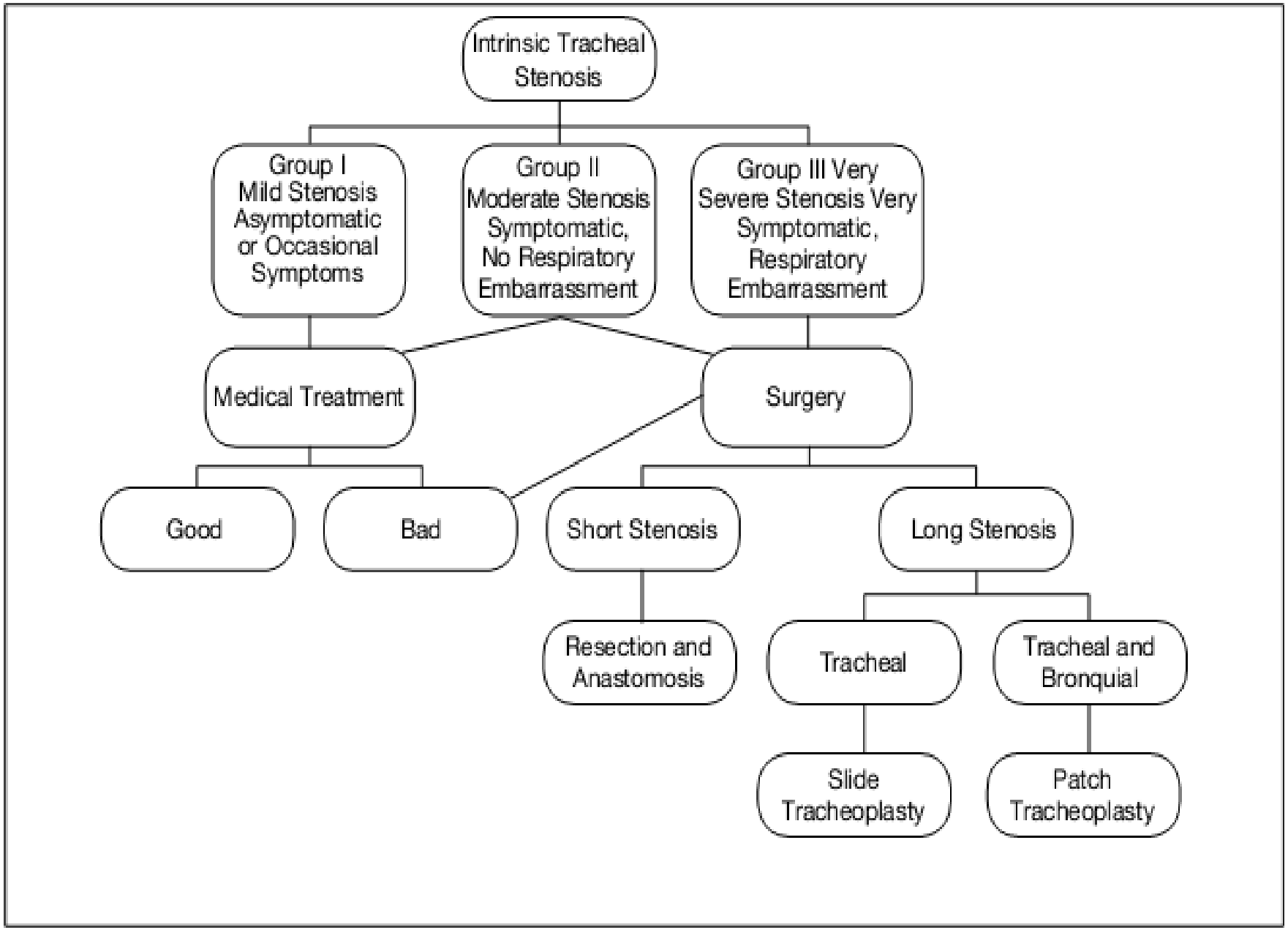
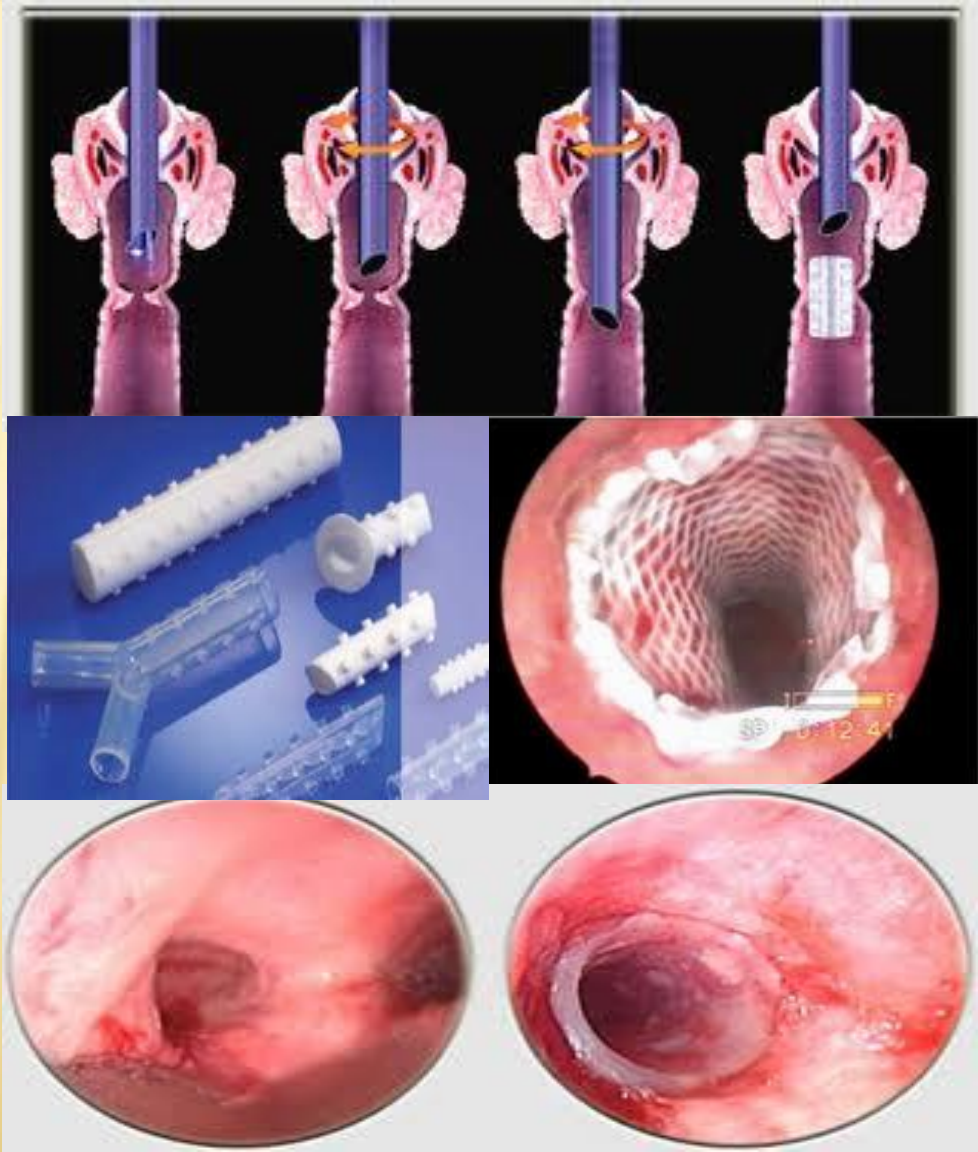


Figure 10. Intrinsic tracheal stenosis: management algorithm

ENDOSCOPIC MANAGEMENT

- **Laser therapy:** burn off the tissue or tumor, causing the narrowing
- **Stents placement**: prevent reclusion /severely stenotic airways. Stents for external obstruction and tracheo-esophageal fistulas

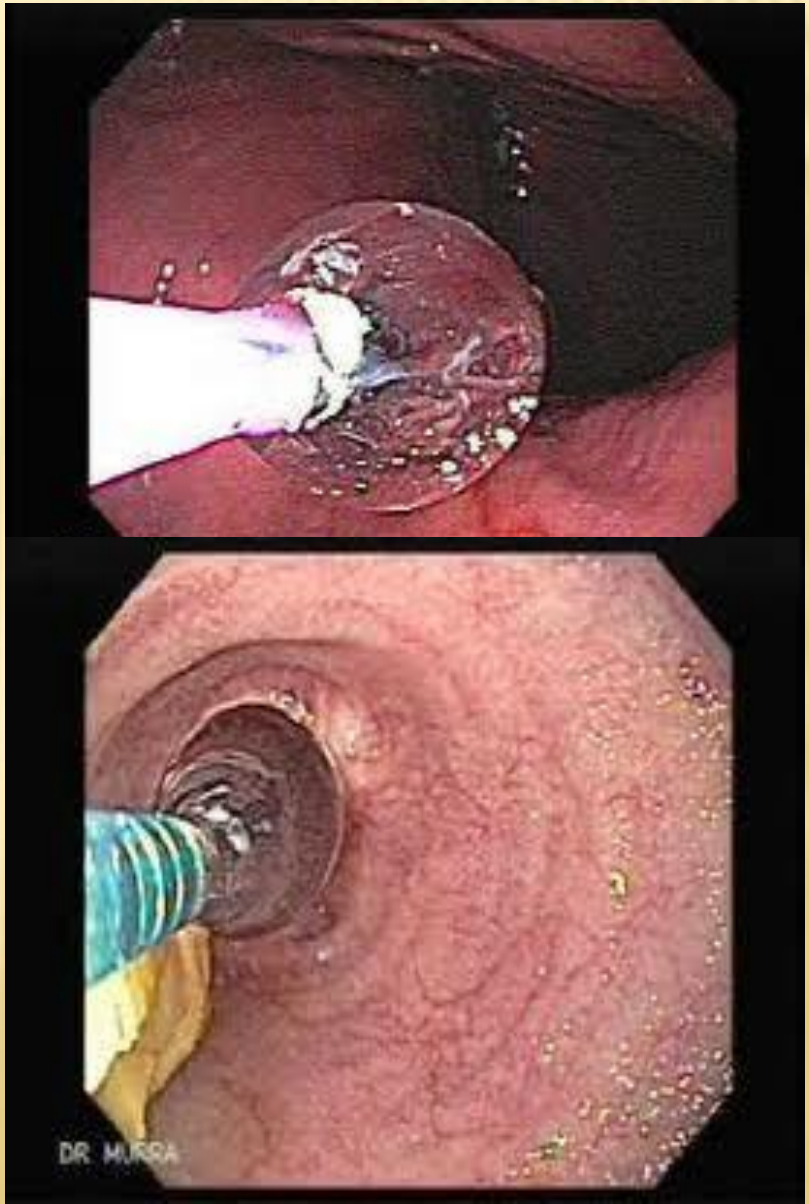


ENDOSCOPIC MANAGEMENT

Balloon dilation.

In less severe cases

Balloon is inflated narrow and open the airway more

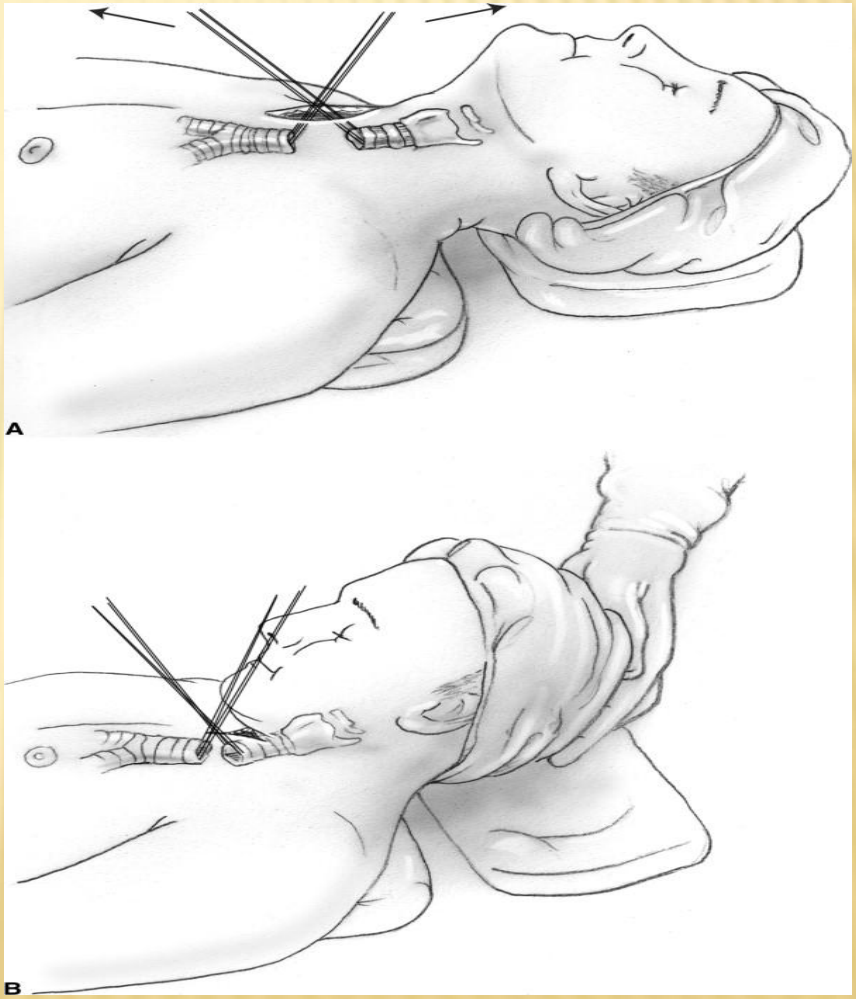


SURGERY MANAGEMENT

Tracheal Resection

Scarring within the trachea

Removing a scarred portion of the trachea and end-to-end anastomosis

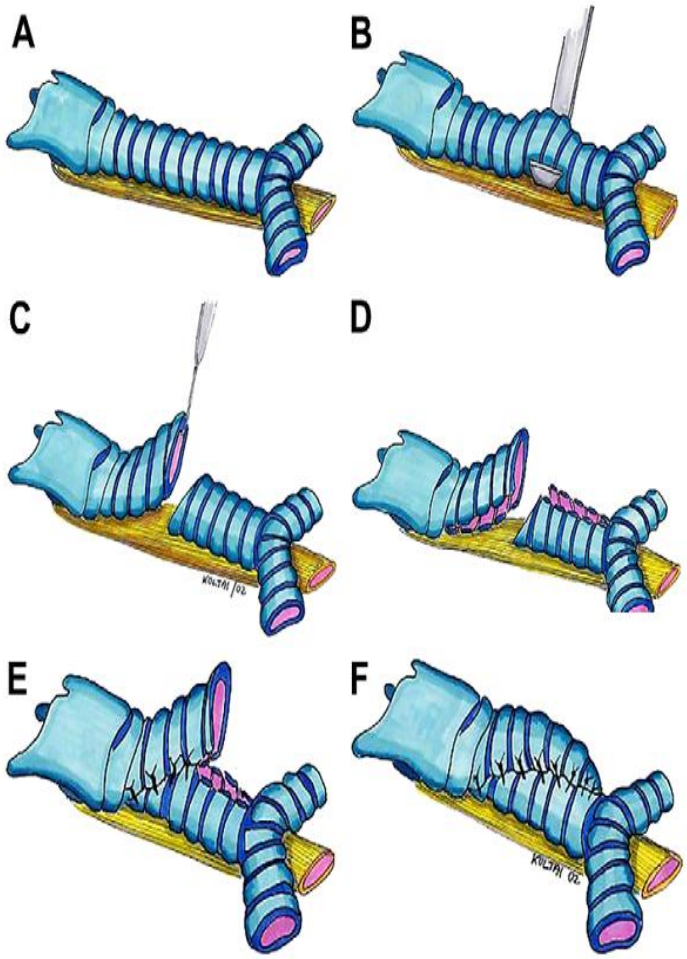


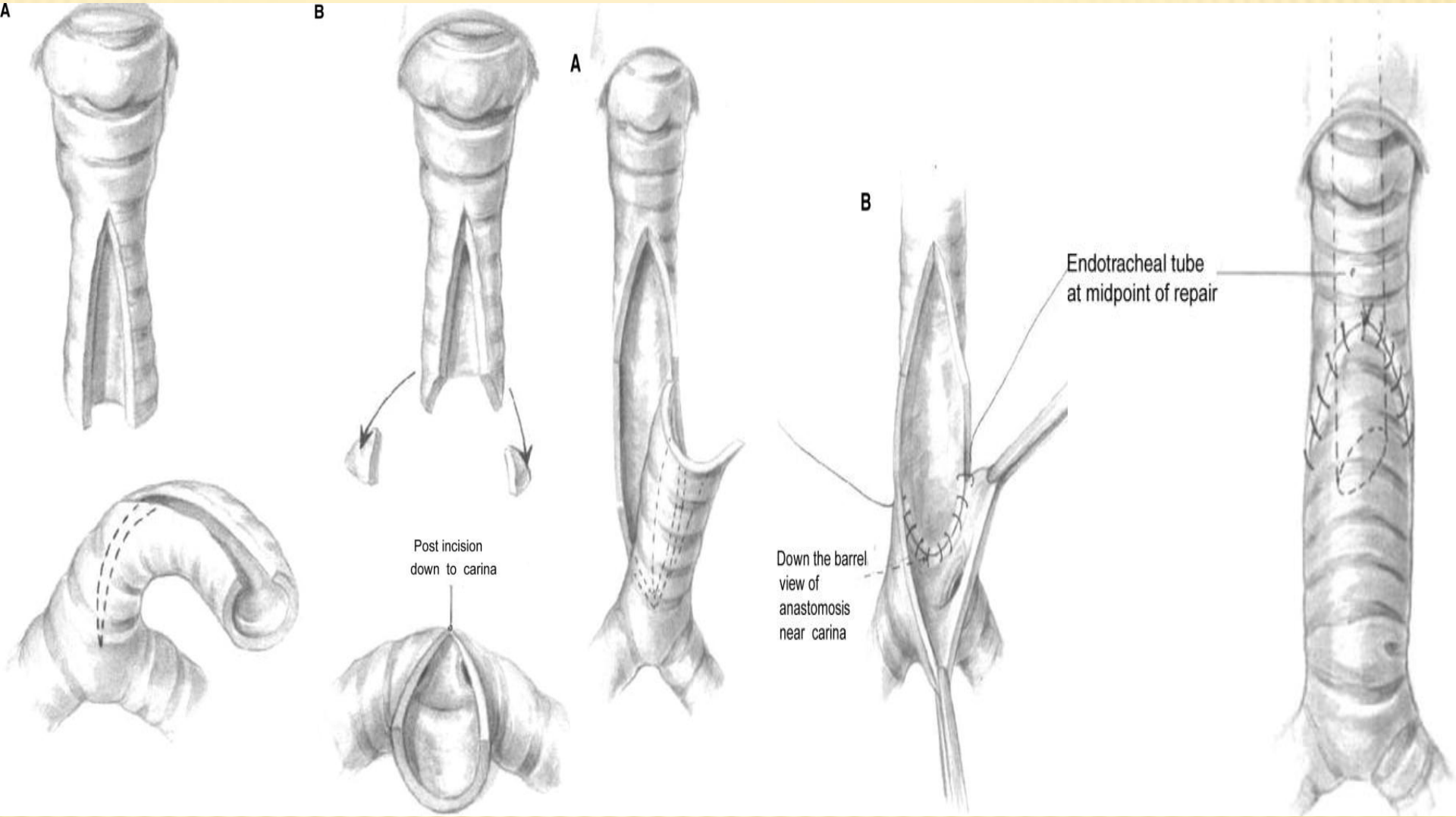
MANAGEMENT

Tracheoplasty

Slide tracheoplasty

- long-segment tracheal stenosis
- Cut the narrow part of the trachea horizontally. Two sections are slide together and sutured so that they overlap, providing a wider tracheal airway.

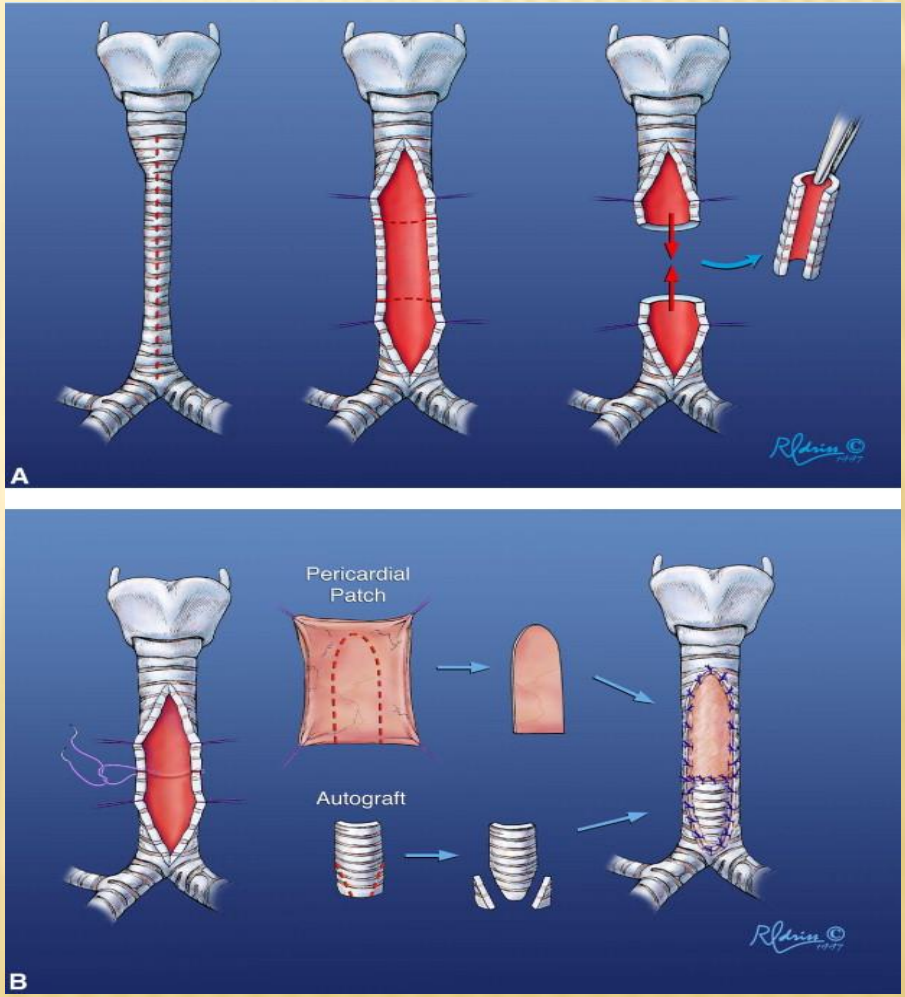




SLIDE TRACHEOPLASTY

SURGERY MANAGEMENT

- A vertical incision is made anterio rly, spanning onl y the stenos is but includ-ing the carina or bro nchi if nece ssary. The patch then is sutured over the
- an terior gap, broaden ing the trache al lumen



EVIDENT BASED MEDICINE

Journal of Pediatric Surgery (2006) 41, 1203–1207

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Original articles

The role of conservative management in congenital tracheal stenosis: an evidence-based long-term follow-up study

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Abstract

Background/Purpose: Surgery has been the management of choice for severe congenital tracheal stenosis (CTS). The role of conservative management of CTS however is not clear. The aim of this study is to characterize the natural history of CTS, review the radiologic evidence of tracheal growth, and evaluate the clinical outcome and selection criteria of conservative management of CTS.

Methods: A retrospective study was carried out on 22 consecutive children with symptomatic CTS admitted into a single institution between 1982 and 2001. The patients were categorized into operation (n = 11) and observation (n = 11) groups. Six patients of the observation group were followed up with serial computed tomography scan. Their tracheal growth was compared with that of healthy children of the same age.

Results: The mortality rates of observation and operation groups were 9% and 27%, respectively, although the latter group consisted of more severely affected patients. The pathologic categorization of the CTS influenced the survival rates ($P = .046$, χ^2), with the long segment type having the worst prognosis (67%). Serial computed tomography scans of 6 conservatively managed patients revealed that all stenotic tracheas continued to grow ($P = .039$, 2-tailed paired Student's t test). Of the 6 stenotic tracheas, 5 grew at a faster-than-normal rate, and the stenotic tracheal diameters approached those of normal diameters by the age of 9 years.

Conclusions: The management of patients with symptomatic CTS should be individualized. A selected group of patients with CTS can be safely managed nonoperatively.

Table 1 The demographic data and the mortality rates

	Observation group (n = 11)	Operation group (n = 11)
Sex ratio (male-female)	9:2	11:0
Average age at presentation (y)	1.5	0.4
Average follow-up duration (y)	9.9	11.3
Cardiac anomalies	64% (7/11)	9.1% (1/11)
Mortality rate		
Segmental (n = 8)	0% (0/6)	0% (0/2)
Funnel-shaped (n = 11)	0% (0/4)	29% (2/7)
Long segment (n = 3)	100% (1/1)	50% (1/2)
Overall (n = 22)	9.1% (1/11)	27.3% (3/11)

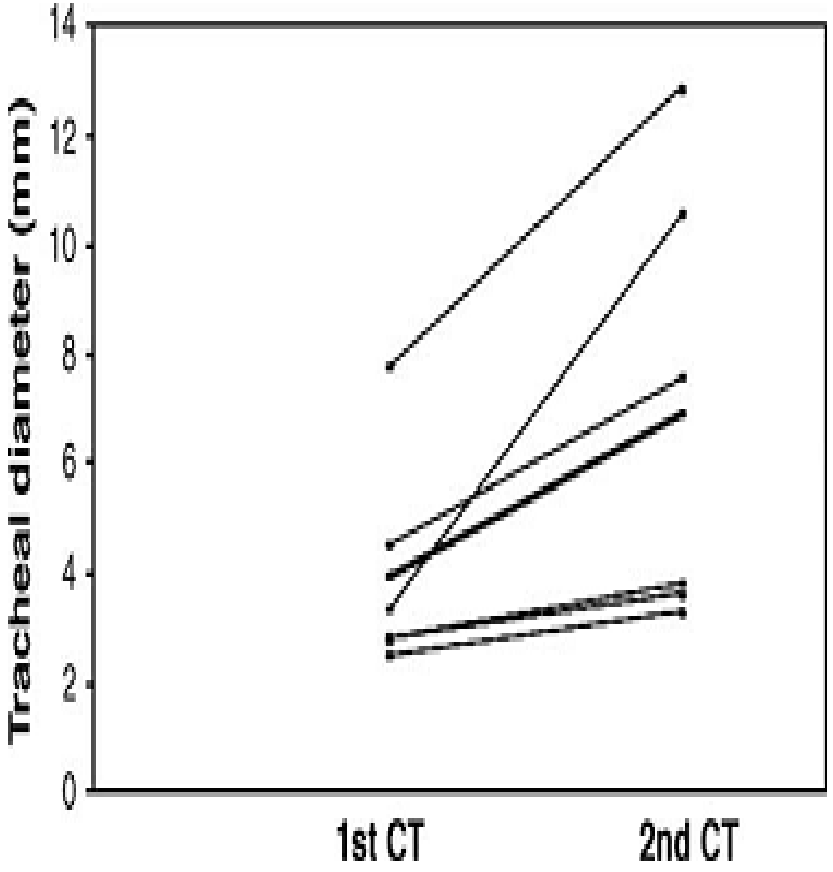

Fig. 2 The first and the second CT measurements of the tracheal diameters of the 6 conservatively managed patients are shown. The means (first CT, 3.9 ± 2.0 mm; second CT, 6.9 ± 4.1 mm) and their change are displayed in thick lines. The mean of second measurements was significantly greater as compared with the first ($P < .039$).

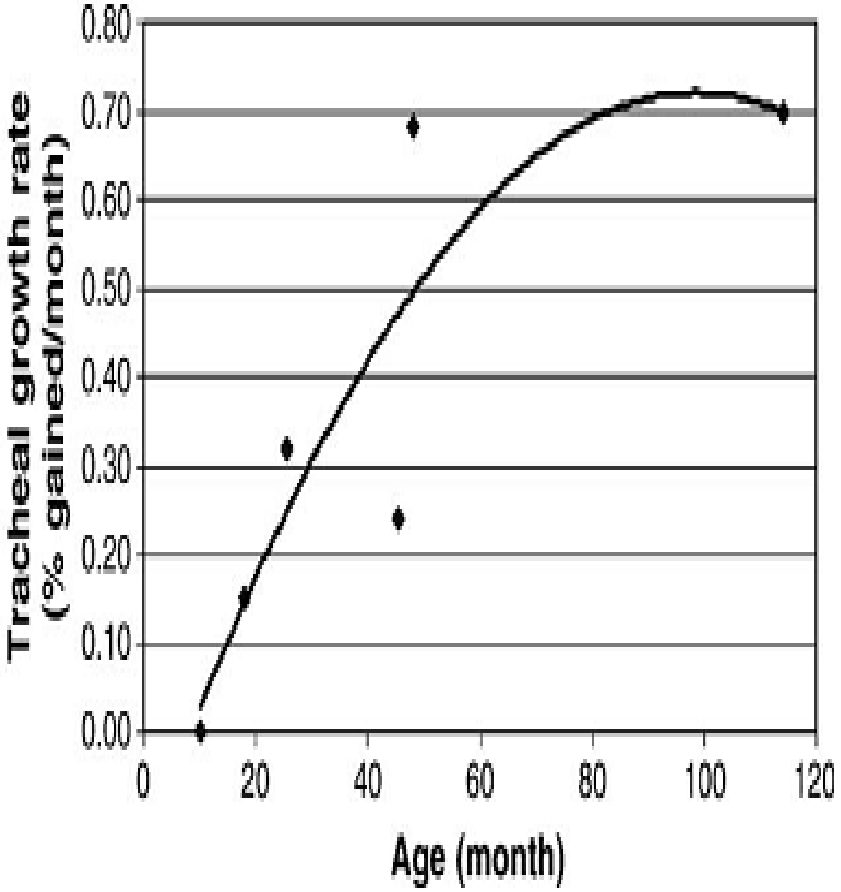

Fig. 4 The tracheal growth rates of the 6 conservatively managed patients. Five patients demonstrated faster than normal rate of growth. The polynomial trend line ($y = -9E{-}05x^2 + 0.0174x - 0.1376$) was significant ($R^2 = 0.7692$).

Journal of Pediatric Surgery (2013) 48, 1676–1681

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Balloon dilation in the management of severe airway stenosis in children and adolescents☆,☆☆

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Received 12 August 2012; revised 14 December 2012; accepted 18 December 2012

Abstract

Background/Purpose: Children and adolescents with airway stenosis pose a clinical challenge. Recently, balloon dilation has been described, primarily for the treatment of early, immature, less severe airway stenosis. We describe our experience with 8 children and adolescents managed with balloon dilation, including severe, mature subglottic and tracheal stenosis.

Methods: This is a case series of 8 children and adolescents with acquired subglottic and tracheal stenosis treated by the primary author with balloon dilation between August 2006 and April 2010 at an academic tertiary care center. In the four patients who were tracheotomy-dependent at the time of presentation, suprastomal stents or Montgomery T-tubes were used. In 1 patient with 99% subglottic stenosis (SGS), balloon dilation and stenting were used to create a lumen prior to laryngotracheal reconstruction (LTR).

Results: All 4 patients with tracheotomy were decannulated. The remaining 4 patients were successfully managed without tracheotomy.

Conclusions: Mature, severe laryngeal and tracheal stenosis in pediatric patients can be successfully managed with balloon dilation. In the most severe cases with prior tracheotomy, stenting is necessary. Balloon dilation with stenting can also facilitate LTR. In patients without prior tracheotomy, tracheotomy and stenting can often be safely avoided with appropriate postoperative management.

Table 4 Summary of demographic data and outcomes.

Case	Diagnosis	Age	Sex	Tracheostomy	Age, character of SGS	# Balloon dilations	Stent type	Other treatments	Time to decannulation or last intervention (months)	Follow-up (months)	Complications
1	grade III SGS	17 m	F	yes	mature (13 m); severe, thick, circumferential	6	suprastomal	Radial incision of stenosis × 1, CO2 × 1, MMC × 6	13	1	loss of tracheostomy tube
2	grade III SGS, esophageal atresia without fistula	7 m	M	no	acute (3 w); thin, weblike	3		CO2 × 1, MMC × 4	2	12	
3	grade III SGS, left TVC paralysis	3 y	F	yes	mature (2.5 y); severe (99%), thick (1 cm)	4	Montgomery T-tube	CO2 scar excision × 3, CO2 L posterior cordectomy, L partial arytenoidectomy × 3, A/P LTR, MD × 3, MMC × 9	37	25	
4	grade III SGS	3 m	F	no	acute (2 w); thin	1		MMC × 1	0	4	
5	laryngeal web/ burn injury	4 y	M	yes	mature (6 w); thick	1	suprastomal	MD × 3, MMC × 3	10	1	
6	tracheal stenosis, tracheal granuloma, left TVC paralysis (trauma)	17 y	M	no	mature (2 m); severe; thick (1 cm)	2		MMC × 2	8	18	
7	tracheal stenosis, tracheal tear, tracheal granuloma (trauma)	10 y	M	no	acute (2 w); severe (2.7 mm); thick (length of cricoid)	1		CO2 × 4, gold laser × 1, MMC × 4	10	51	
8	grade III SGS, tracheal stenosis (trauma)	17 y	M	yes	mature (4 m); severe (99%); thick (1 cm)	3	Montgomery T-tube	CO2 × 1, MD × 1, MMC × 5	12	27	

A: anterior; SGS: subglottic stenosis; CO2: carbon dioxide laser; MD: microdébridement; MMC: mitomycin-C; TVC: true vocal cord; m: months; w: weeks, y: years; LTR: laryngotracheal reconstruction; P: posterior.

Journal of Pediatric Surgery (2013) 48, 293–296

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Long-term outcomes of congenital tracheal stenosis treated by metallic airway stenting

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Received 3 November 2012; accepted 12 November 2012

Abstract

Aim: Congenital tracheal stenosis is an obstructive airway lesion that often presents as a life-threatening emergency. We had introduced the balloon dilatation and placement of the expandable metallic airway stent as a therapeutic option, and this study aimed to clarify the long-term outcomes in pediatric patients.

Methods: A retrospective review of five infants in whom balloon expandable metallic airway stents (10–40 mm long and 6–8 mm in diameter) were inserted in 1997 to 2000 was conducted.

Results: There was an immediate improvement of respiratory obstruction in all five infants (aged 7 days to 12 months) with four weaned from ventilation. One child died after 9 months of palliative treatment. In all inflammation and granulation tissue developed over the stents, but this could be managed by scraping or balloon compression. Metallic stents have been in place a mean of 12 years (range 6 months to 13 years) after insertion without other complications. Four children are alive and well with their stents in place. Recently, an attempt to remove the stent was done in two patients who showed dyspnea on exertion. They underwent tracheoplasty following successful complete removal of metallic stent using cardiopulmonary bypass.

Conclusion: Use of expandable metallic airway stents following balloon dilatation can be left for long periods to relieve tracheal obstruction. Development of granulation tissue is a major treatable complication. Removal of the stent was safely completed by open surgical intervention using a cardiopulmonary bypass. The airway stent may provide an important therapeutic option in selected cases with congenital tracheal stenosis.

Table 1 Long-term outcome of Palmaz stent ($n=5$).

Case no.	Age at insertion (months)	Stent size length × diameter (mm)	Other anomalies	Follow-up	Current status
1	5	20 × 6	Down's syndrome, duodenal atresia, gastric rupture	9 months	Died
	6	30 × 6			
	10	20 × 6			
2	12	30 × 6	Pulmonary artery sling	13 years	Alive and well (awaiting removal)
		40 × 6			
3	3	40 × 8	Hypoxic encephalopathy	13 years	Alive and well (tracheostomy in stent)
4	2	40 × 7		13 years	Alive and well (stent removed)
5	11	20 × 6		13 years	Alive and well (stent removed)

Patterns of Management of Congenital Tracheal Stenosis

By Juan L. Antón-Pacheco, Indalecio Cano, Araceli García, Antonio Martínez, Jesús Cuadros, and Francisco J. Berchi

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Background/Purpose: Stenosing airway disease, including congenital and acquired lesions, is rare in the pediatric age group. Untill recently, the outlook for patients with congenital tracheal stenosis (CTS) was dismal because medical management was the only way of treatment. Surgical and endoscopical techniques developed in the last years have improved the prognosis. This report reviews the short and long-term outcomes of a single-institution experience in the management of CTS in children, comparing different treatment modalities.

Methods: From 1991 to 2002, 13 cases of CTS have been managed in the authors unit. Respiratory symptoms varied from mild stridor on exertion to severe distress. Bronchoscopy established the diagnosis in all cases. According to clinical and endoscopical features, patients have been classified into 3 groups. The following data have been studied in each case: sex, age at diagnosis and treatment, anatomic type, associated anomalies, treatment modality, complications, outcome, and time of follow-up.

Results: Seven girls and 6 boys have been included in this study. Age at diagnosis ranged from 3 days to 7 years (median, 8 months), and 77% showed associated anomalies. Four patients presented mild or no symptoms and have been treated expectantly. The other 9 patients have been operated on because of persistent or severe symptomatology. The following procedures have been performed: costal cartilage tracheoplasty (n = 5), tracheal resection (n = 3), slide tracheoplasty (n = 2), endoscopical dilatation (n = 3), and laser resection (n = 1). Three patients required 2 or more procedures, and there were 3 early deaths, all after costal cartilage tracheoplasty. Overall mortality rate in the series is 23%. Follow-up is complete in all survivors (n = 10) ranging from 6 months to 10 years (mean, 4.7 years).

Conclusions: Selection of the type of treatment depends on the patient's clinical status and the anatomic pattern of the stenosis. In symptomatic cases of short-segment stenoses the authors prefer tracheal resection with end-to-end anastomosis; for long-segment stenoses, slide tracheoplasty is the procedure of choice.

J Pediatr Surg 38:1452-1458.

INDEX WORDS: Tracheal stenosis, congenital airway anomalies, tracheal surgery, bronchoscopy.

POSTOPERATION MANAGEMENT

System or category	Intervention/management strategy
Central nervous system	Use of a sedation scale to optimize ventilation and oxygenation Provision of nonpharmacological comfort measures by pediatric intensive care unit nurses
Respiratory system	Ventilation and oxygenation goals set by healthcare team and individualized on the basis of patient's physiological needs Vigilant monitoring of patient's airway Familiarization with multiple airway adjuncts and of ventilator modes and types Teaching of patient's family started early
Cardiovascular system	Hemodynamic monitoring and support started early in hospital course Additional therapies used according to presence of associated cardiac anomalies
Fluids, electrolytes, and nutrition	Early enteral feedings used whenever possible Use of long-term nutritional support adjuncts, including placement of a gastrostomy tube, as needed
Hematology	Blood products used when optimization of oxygenation needed Coagulopathies corrected when applicable
Infectious disease	Antibiotics administered only when clinically indicated
Development	Therapies started early to address physical, occupational, and speech/swallowing needs

SUMMARY

- Conservative and endosopy management, also has been established for milder cases.
- Each patient has individualized institution to choose an approriate treatment.
- RESPIRATORY DEPARTMENT now apply bronchoscopy for diagnose more TS case.

THANK YOU FOR YOUR ATTENTION.