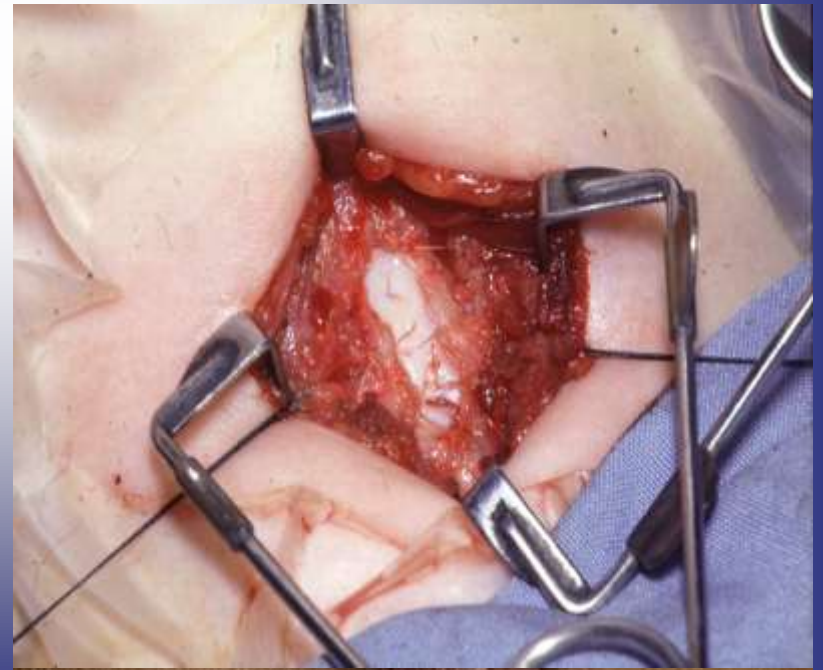
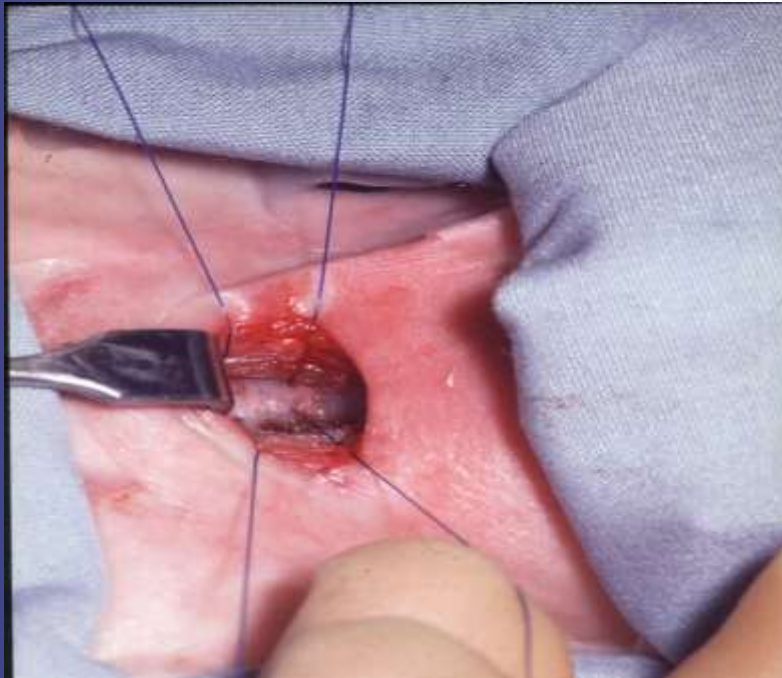
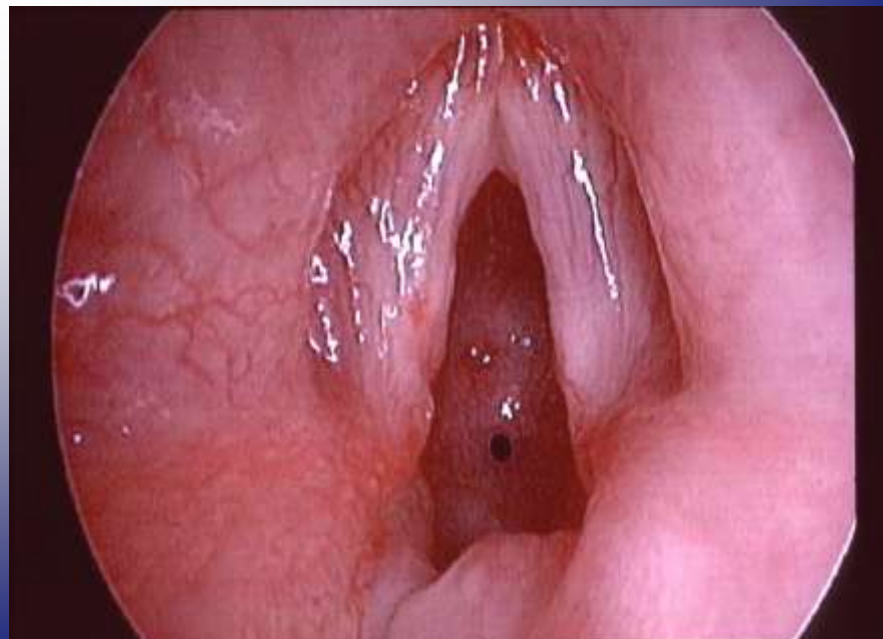
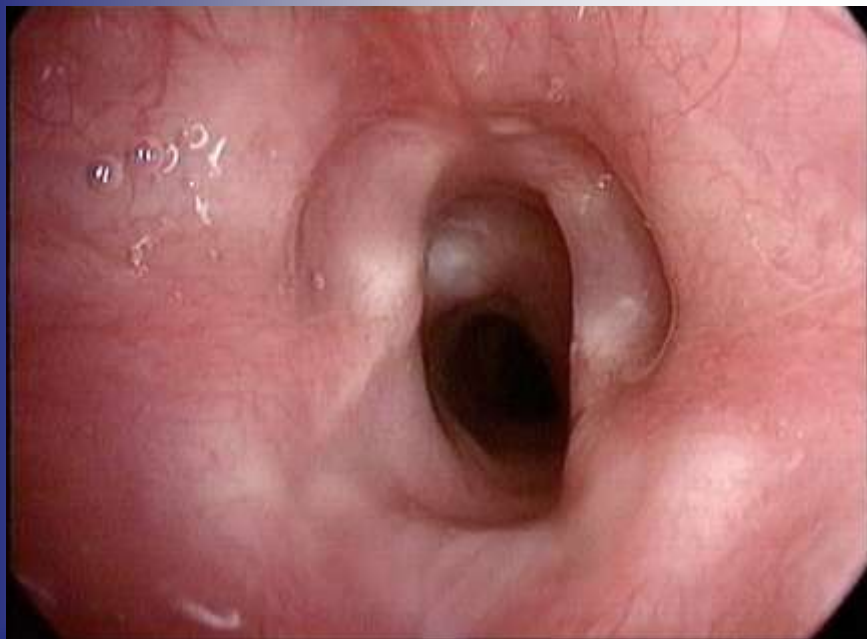
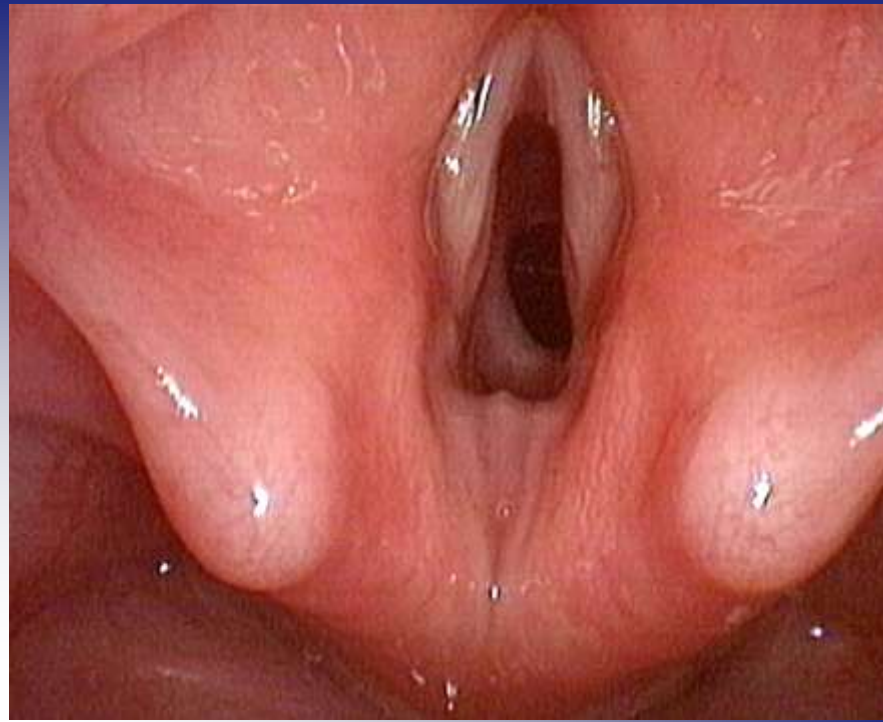
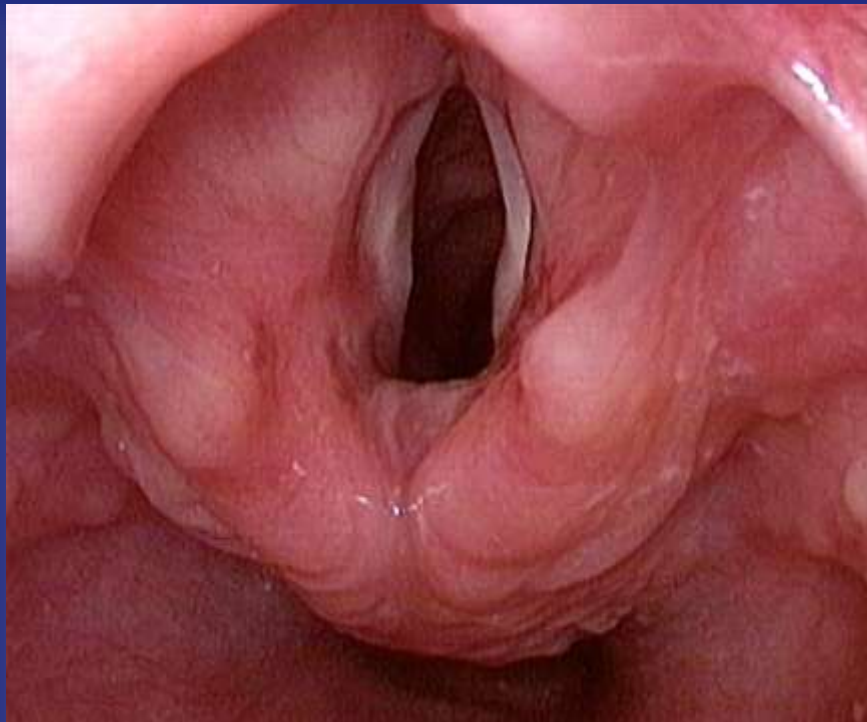


MEDICAL TREATMENT







Management decisions in established disease

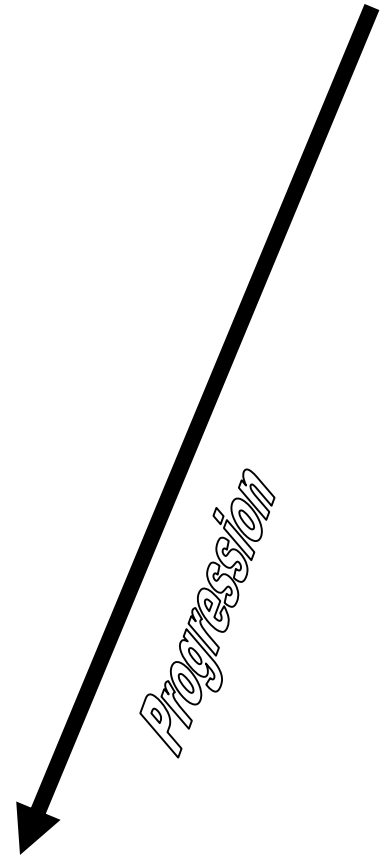
WAIT

Laser/dilatation/stent/T-Tube

Single stage LTR

Tracheotomy and interval LTR

Cricotracheal resection



Evidence Base



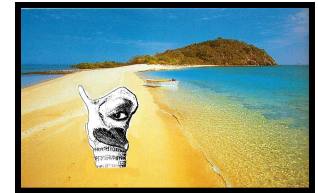
Evidence Base

?

Developing stenosis

- Laryngeal Rest
- Medical
- Tubes
- Cricoid split

Laryngeal rest



- Avoid reintubation and elect to leave child intubated for 2 weeks
- Hans Hoeve
 - personal communication
 - Unit policy
- John Graham 6/10 cases
 - J Laryngol Otol 1994 Jun;108(6):474-8

[Back](#)

Medical management

- Steroids

- Animal experiments

- Anti-reflux treatment

- Walner et al. 2000 Gastroesophageal reflux in patients with subglottic stenosis.
- Little et al 1985 Effect of gastric acid on the pathogenesis of SGS

- Antibiotics

- Supance 1983. Antibiotics and steroids.. Canine model

Endotracheal tubes

- Shouldered/straight
 - 4 Thames regional neonatal group
- Oral/nasal
 - Donn 1985
- Length of intubation
 - conflicting both clinical/pathophysiologic

Cricoid Split

- Anterior only or with posterior split
- Age appropriate tube or one larger
- Duration of intubation
- Wait for leak?
- ?Repeat split

- *Cotton/Richardson/Lusk/Potsic/Seid/Ochi*

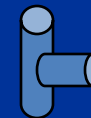
Basic Options for Mature Stenosis



Laser [Mitomycin C](#)



[T-Tube](#)



[LTR with stent](#)



[Single stage LTR](#)



[Crico-tracheal](#)

[resection](#)



Laser

- Cotton
 - Laryngeal stenosis following carbon dioxide laser in subglottic hemangioma. Report of three cases.
Ann Otol Rhinol Laryngol. 1985 Sep-Oct;94(5 Pt 1):494-7
- Pankratenko AD, Onufrieva EK.
 - Long-term outcome of endoscopic CO2 laser surgery of cicatricial laryngostenosis in children.
 - Vestn Otorinolaringol 1997;(4):16-9 183 children

[Back](#)

Mitomycin C

- Healy

Mitomycin: effects on laryngeal and tracheal stenosis, benefits, and complications.

Ann Otol Rhinol Laryngol. 2001 Jan;110(1):1-6

14/15 showed benefit

Antineoplastic antibiotic - acts as an alkylating agent by inhibiting DNA and protein synthesis

T-Tube

- Calhoun Near-fatal complication of tracheal T-tube use.
- Volrath Surgery of acquired LTS in childhood.
Experiences and results from 1988 to 1998
10/10 success
- Froehlich Treatment of severe pediatric LTS in five children
5/5 had restenosis long term

Conventional LTR

- **Cotton** Acta Otorhinolaryngol Belg. 1995;49(4):367-72
800 cases
- **GOS** Ann Otol Rhinol Laryngol 1992 Jul;101(7):595-7
110 CASES

Single stage

- Lusk Auricular cart 75%
- Richardson Single vs split 22 CHILDREN 50vs80%
- Saunders Single vs 2 stage 69 patients less procedures
- Cotton Review of 200 cases

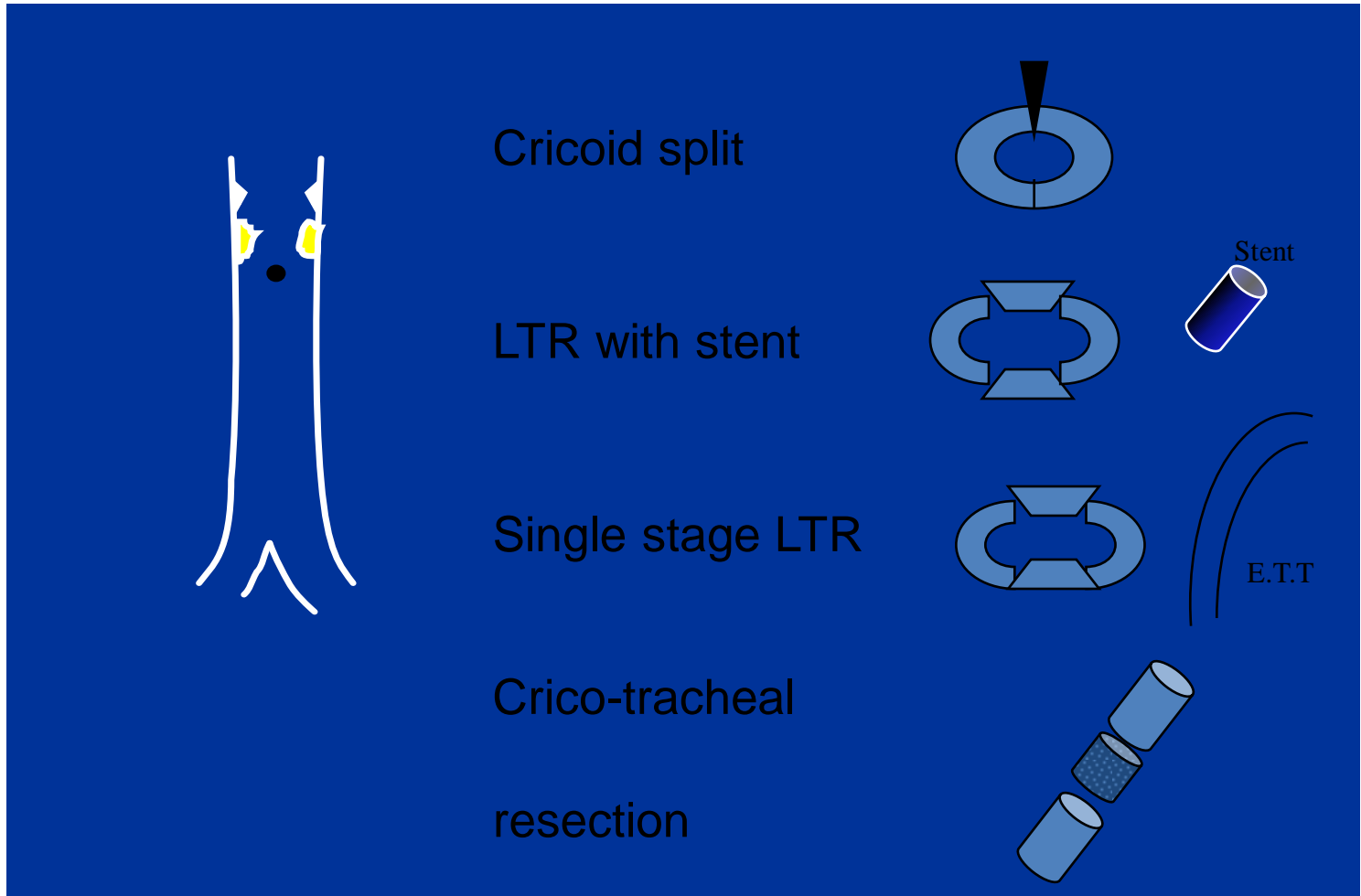
Otolaryngol Head Neck Surg 2000 Oct;123(4):430-4

[Back](#)

Cricotracheal resection

- **Monnier** Int J Pediatr Otorhinolaryngol 1999 Oct 5;49 Suppl 1:S283-6
36/38 Success in severe stenosis
- **Cotton** Ann Otol Rhinol Laryngol. 1997 Nov;106(11):891-6
14 patients
- **Triglia** Int J Pediatr Otorhinolaryngol 2001 Apr 6;58(1):17-25
8/16 as single stage

Basic Options for Paediatric Laryngotracheal Reconstruction



Cricoid Split

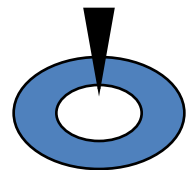
Cricoid Split

**Premature infant fails
extubation because of
laryngotracheal stenosis**

Cricoid Split

50-70% success

Extubation



Cricoid Split - Indications

Mild soft subglottic stenosis/edema (Grade I-II)

Over 1.5 kg

No cardio-respiratory compromise

No significant reflux

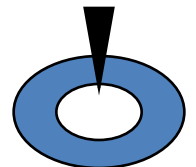
No other complicating factors

Micrognathia

Sepsis

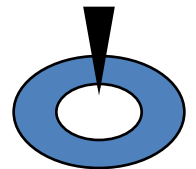
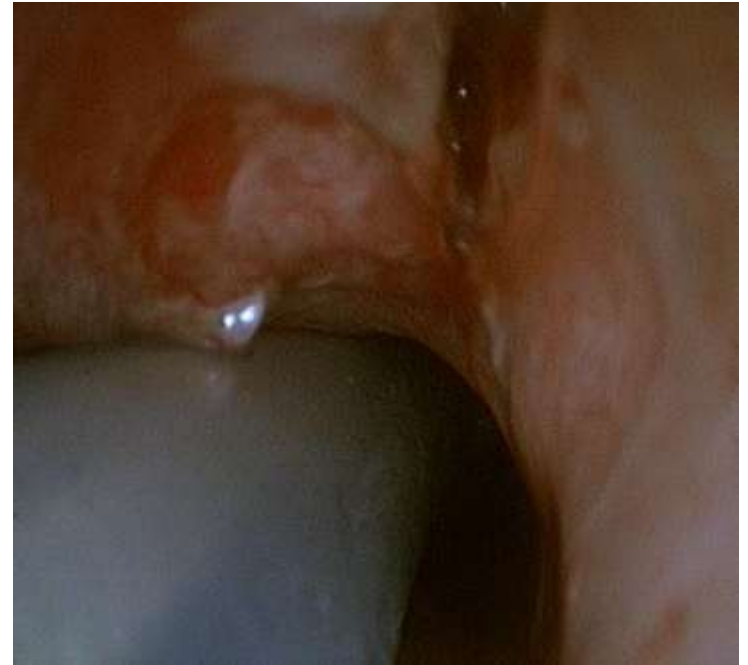
Tracheobronchomalacia

etc.




Cricoid Split

“Decompression”



Cricoid Split - Procedure

Initially intubated with a small tube

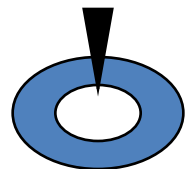
Anterior split: 1° tracheal ring, cricoid and  thyroid

? Posterior split

Reintubated with age appropriate tube:

check length

Drain to prevent surgical emphysema



Cricoid Split - Postoperative care

Intubated for 5-7 days. Not paralysed or ventilated

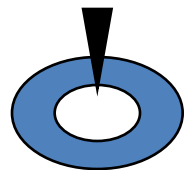
Antibiotics

Exubate under steroid cover

Dexamethasone 0.25mg/kg then 0.1mg/kg QDS

Reintubate with care if needed

Split can be repeated



Critical factors in choice of procedure for ESTABLISHED stenosis

Endoscopy findings

Degree of stenosis (Grade I-IV)

Distance from tracheotomy/glottis

Length

Anterior/posterior

Complicating factors

Inter-arytenoid scar, cricoarytenoid fixation

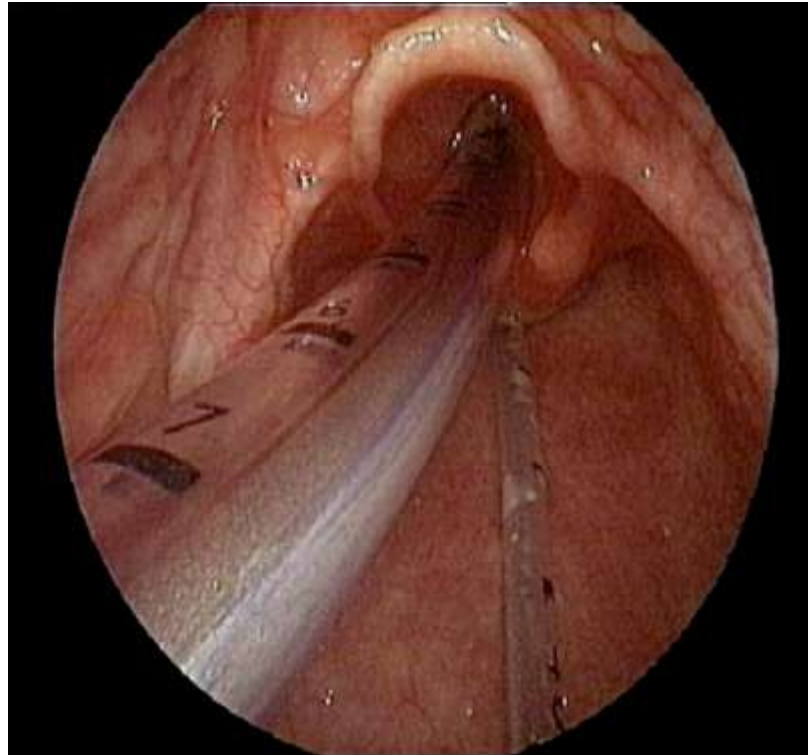
Supra stomal collapse

Glottic webs

Age/weight/general health

Presence of tracheostomy

Staging-Sizing using ET tube



Staging

Classification of Stenosis With Actual Endotracheal Tube Size:										
Patient age		ID=2.0	ID=2.5	ID=3.0	ID=3.5	ID=4.0	ID=4.5	ID=5.0	ID=5.5	ID=6.0
Premature	No Detectable Lumen	no obstruction 40	no obstruction							
0-3/12		58	30	no obstruction						
3/12-9/12		68	48	26	no obstruction					
9/12-2		75	59	41	22	no obstruction				
2		80	67	53	38	20	no obstruction			
4		84	74	62	50	35	19	no obstruction		
6		86	78	68	57	45	32	17	no obstruction	
		89	81	73	64	54	43	30	16	no obstruction
		Grade IV			Grade III		Grade II		Grade I	







Staging

Grade I 0 - 50%

Grade II 50 - 70%

Grade III 70 - 99%

Grade IV 100%

Classification	From	To
Grade I	 No Obstruction	 50% Obstruction
Grade II	 51% Obstruction	 70% Obstruction
Grade III	 71% Obstruction	 99% Obstruction
Grade IV	No Detectable Lumen	

LTR with
Stent

Conventional LTR with stent

Premature infant fails extubation because of laryngotracheal stenosis



Tracheostomy



Serial endoscopies



LTR with stent



Remove stent + further endoscopies



Decannulation

50-80% success,
depending on grade
of stenosis



LTR with stent - Indications

Severe stenosis grade III-IV

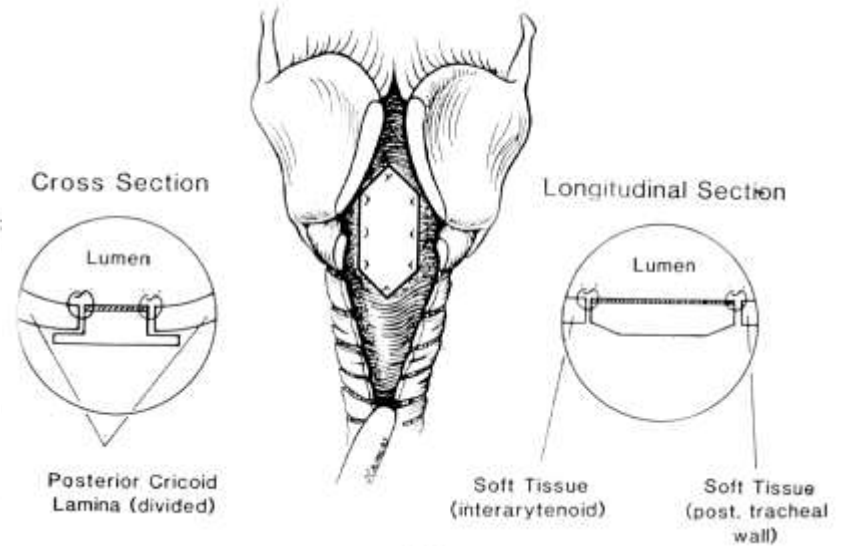
Complicating medical conditions

Child/parent not keen on ITU

Still need to optimise medical conditions
especially reflux



“Augmentation”



LTR - Procedure

Laryngofissure exposing the whole length of the stenosis, opening stoma if necessary

Posterior split until cricoid plates separate

Posterior graft: square

Anterior graft: grooved or as a "T"



Conventional LTR - Post operative care

Removal of stent via larynx

Rescope ? Laser

KTP to stomal granulation, careful check for collapse



Conventional LTR - Post operative care

Decannulation

ward

surgical

cartilage support to stoma (single stage)

TCF excision



Single stage
LTR

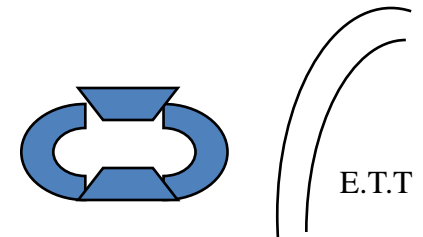
Single stage LTR

**Premature infant fails
extubation because of
laryngotracheal stenosis**

Single stage laryngeal reconstruction

70-90% success

Extubation



Single stage LTR - Indications

Failed extubation

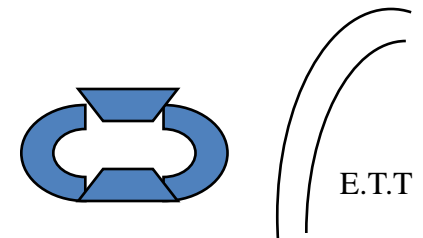
>2 kg

“Healthy” as for cricoid split

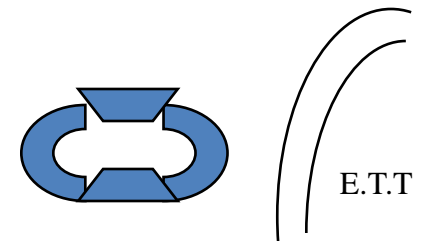
Recurrent croup

Progressive stridor

Patients with tracheostomy



“Augmentation in favourable patients”



Techniques - with an existing tracheotomy

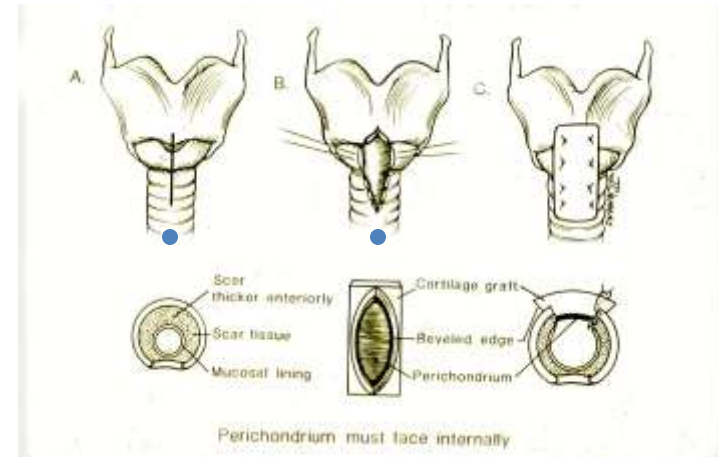
Laryngofissure

Position posterior graft if required

Tracheotomy tube removed

Endotracheal tube inserted

Anterior graft(s) for stenosis
and to close/support
tracheotomy stoma



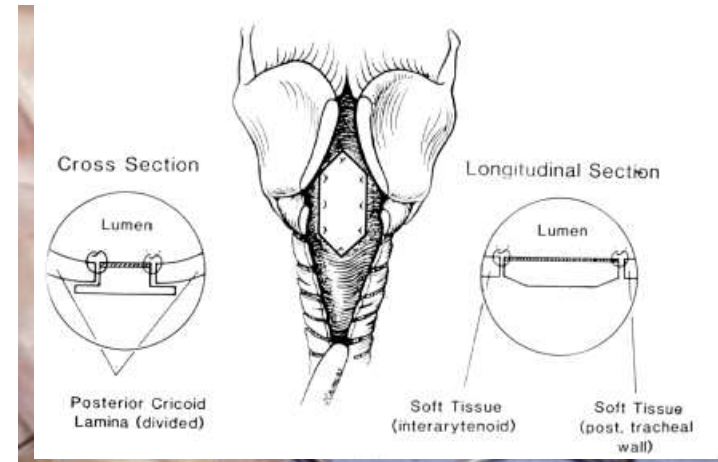
Techniques - without an existing tracheotomy

(extended) Laryngofissure

Position posterior graft if required

Correct size endotracheal tube inserted

Anterior graft



Single stage technique - post op

Check tube length

Leave intubated 7- 10 days

Minimal paralysis

Check for airleak

Any reintubation needs to be very
gentle

Rescope, reintubate and downsize at
?1/52



Reintubation technique

Requires great co-operation with
anesthetist

Hand held anaesthetic
laryngoscope

7200A telescope on video

Tube warmed (one size smaller)

Boogie placed through nose and
into larynx using 7200A to
protect graft

Tube guided over boogie again with
7200A



Cricotracheal resection

Cricotracheal resection

Grade III-IV

Usually as a single stage

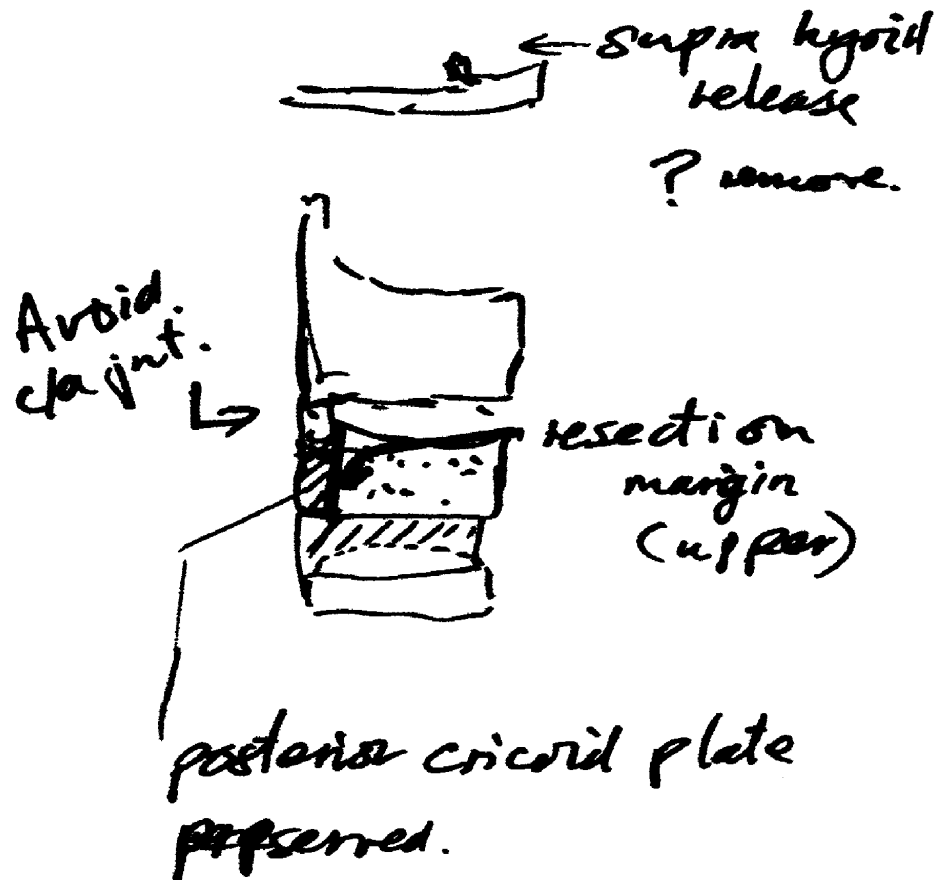
Upper excision below cords

- preserve posterior cricoid

- cricoid plate drilled to reduce stenosis

Lower excision sloping up

Cricotracheal resection

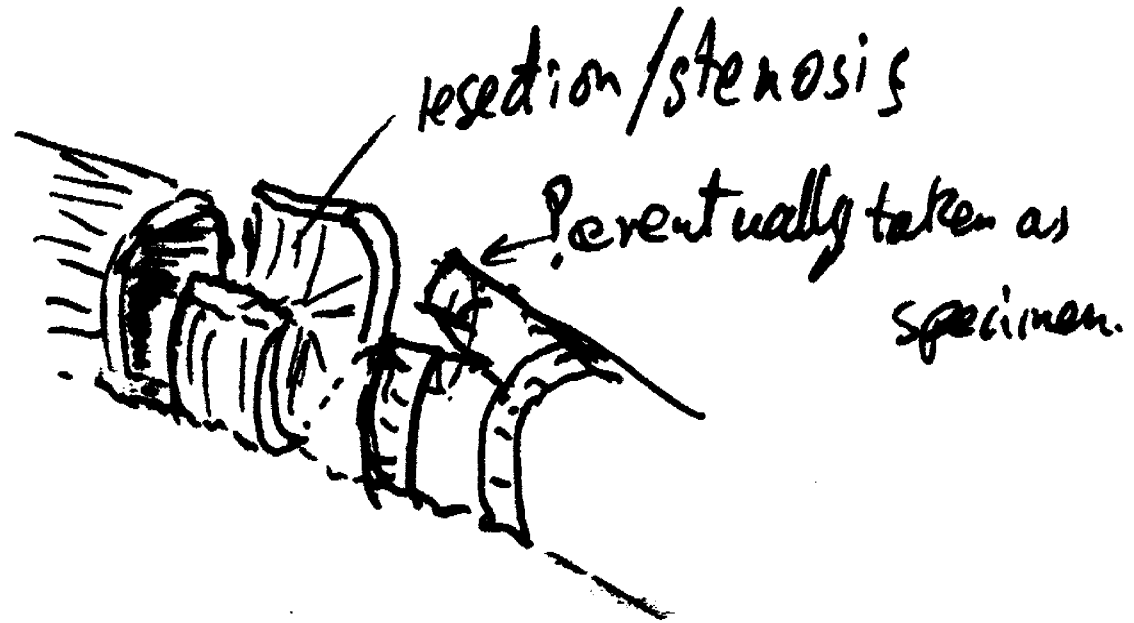


Cricotracheal resection

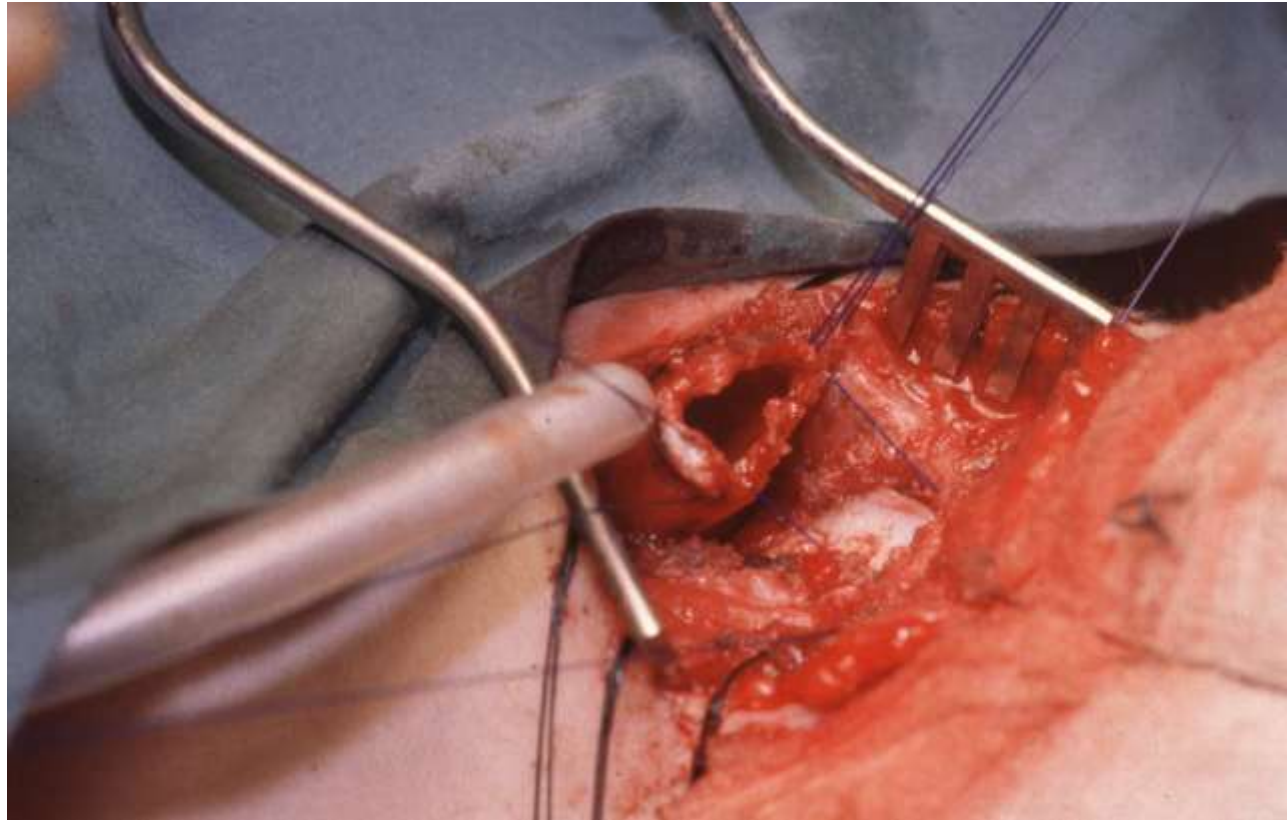
limit
vertical
extent to
that of
stenosis



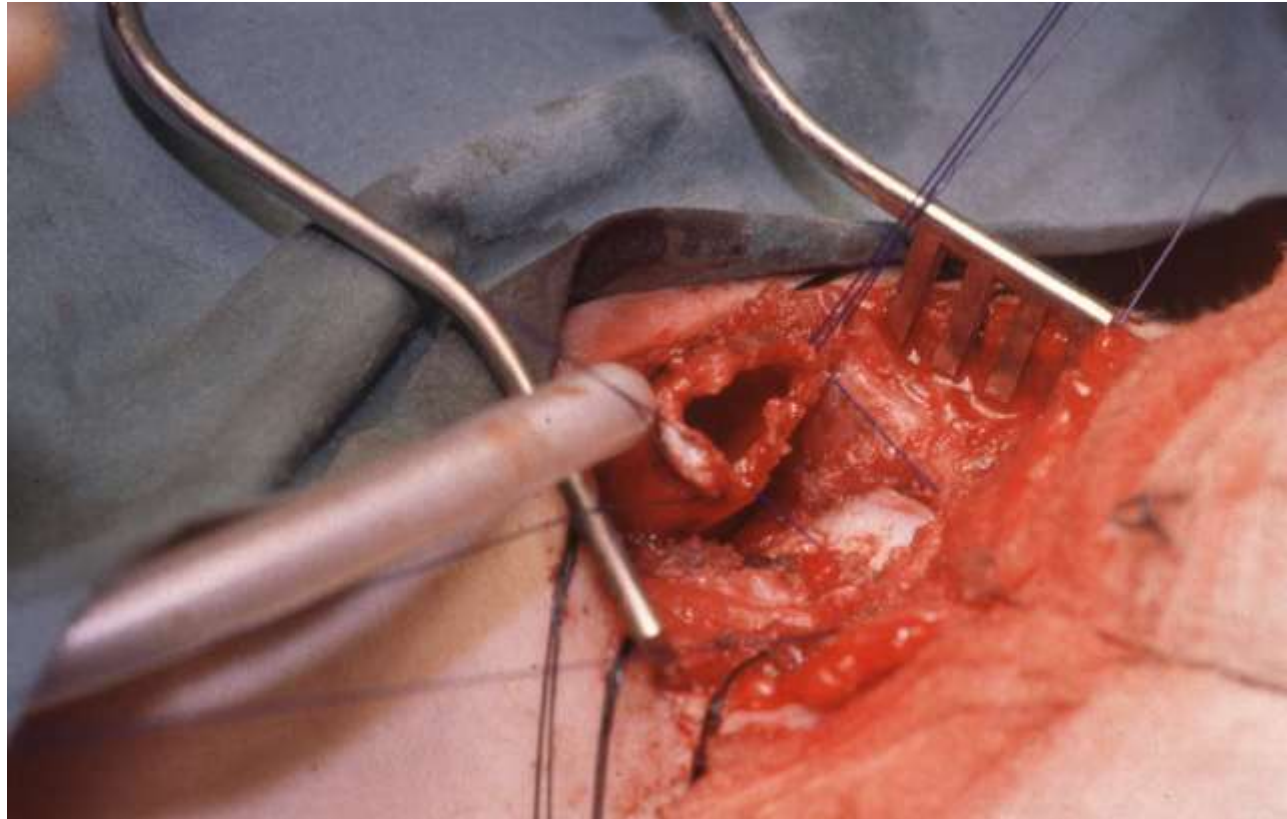
Cricotracheal resection



Cricotracheal resection



Cricotracheal resection



Cricotracheal resection

Tension sutures laterally to protect anastomosis

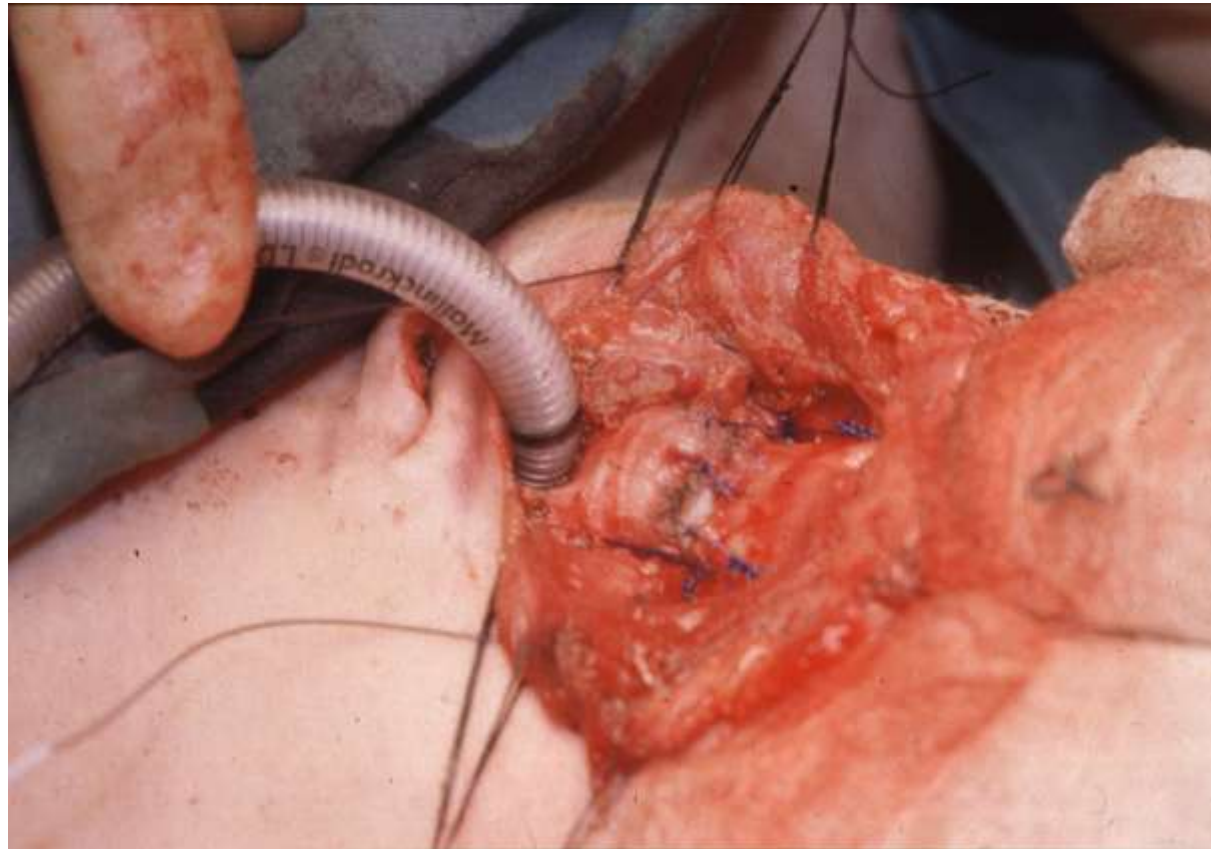
Chin sutures to prevent extension

Intubate for 7-10 days

Scope prior to extubation and downsize



Cricotracheal resection



suture.

LTR and CTR- Summary

Avoid tracheotomy if safe to do so

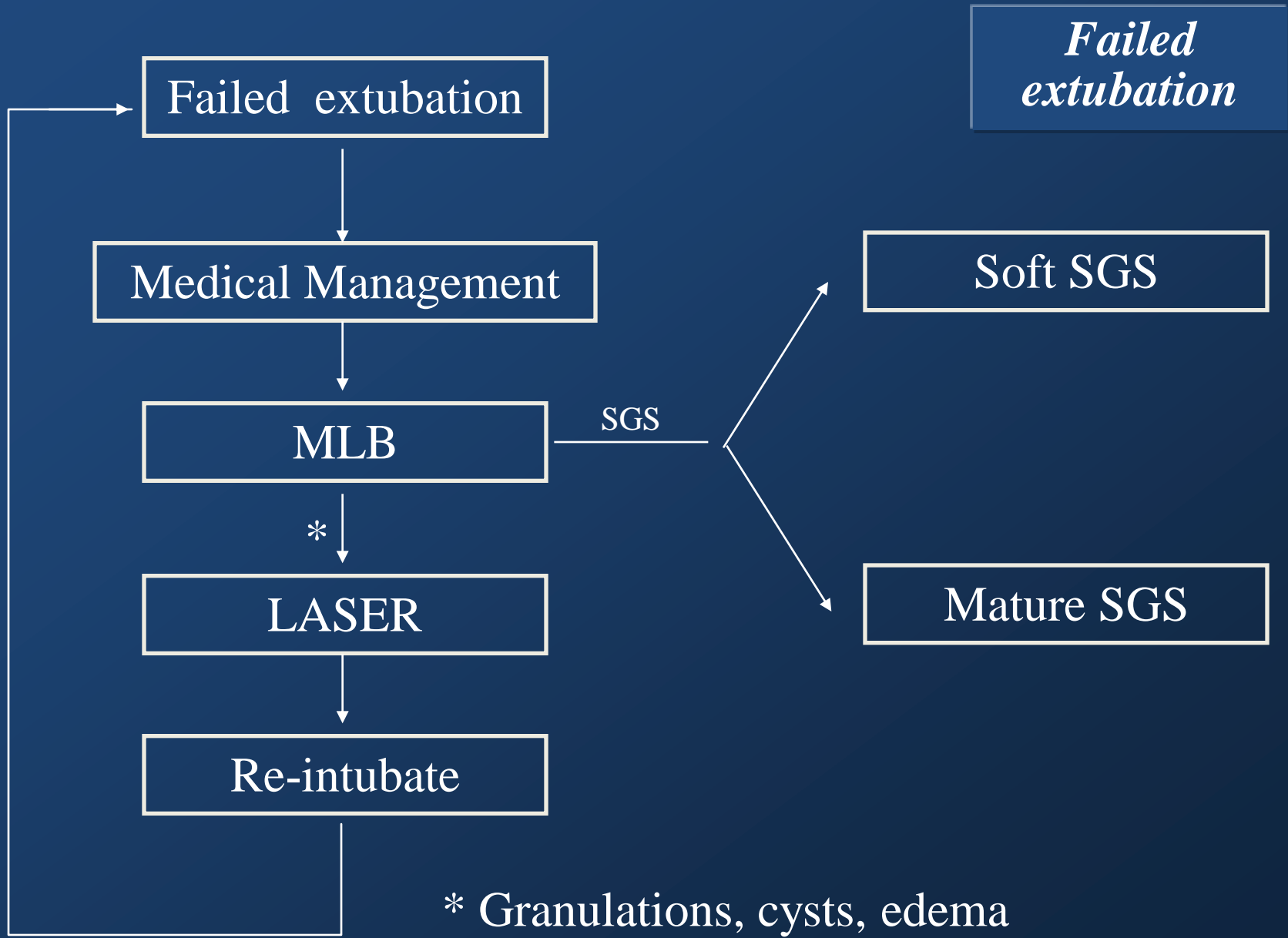
refer before tracheotomy

Single stage is more demanding but if successful

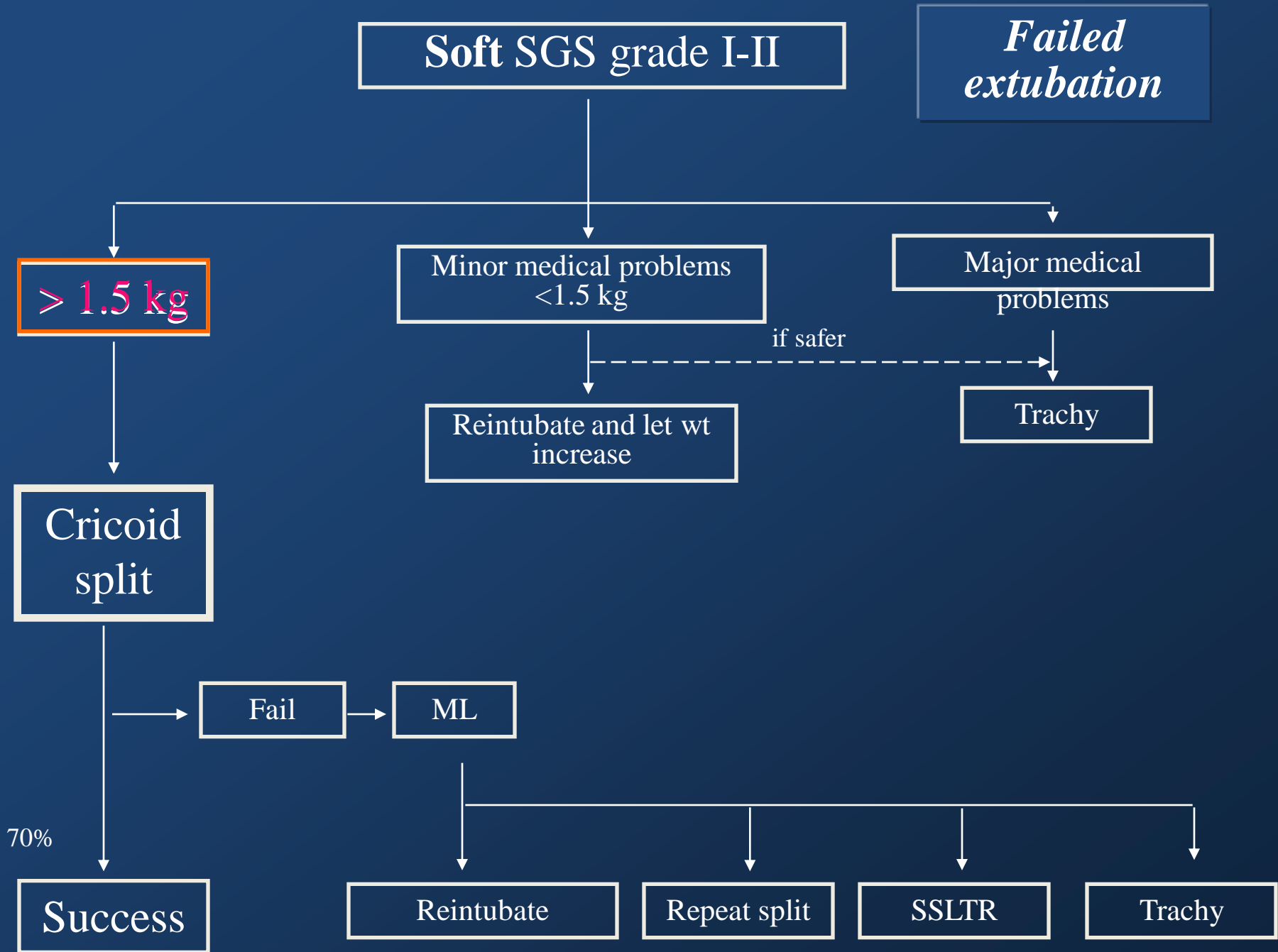
has a number of advantages

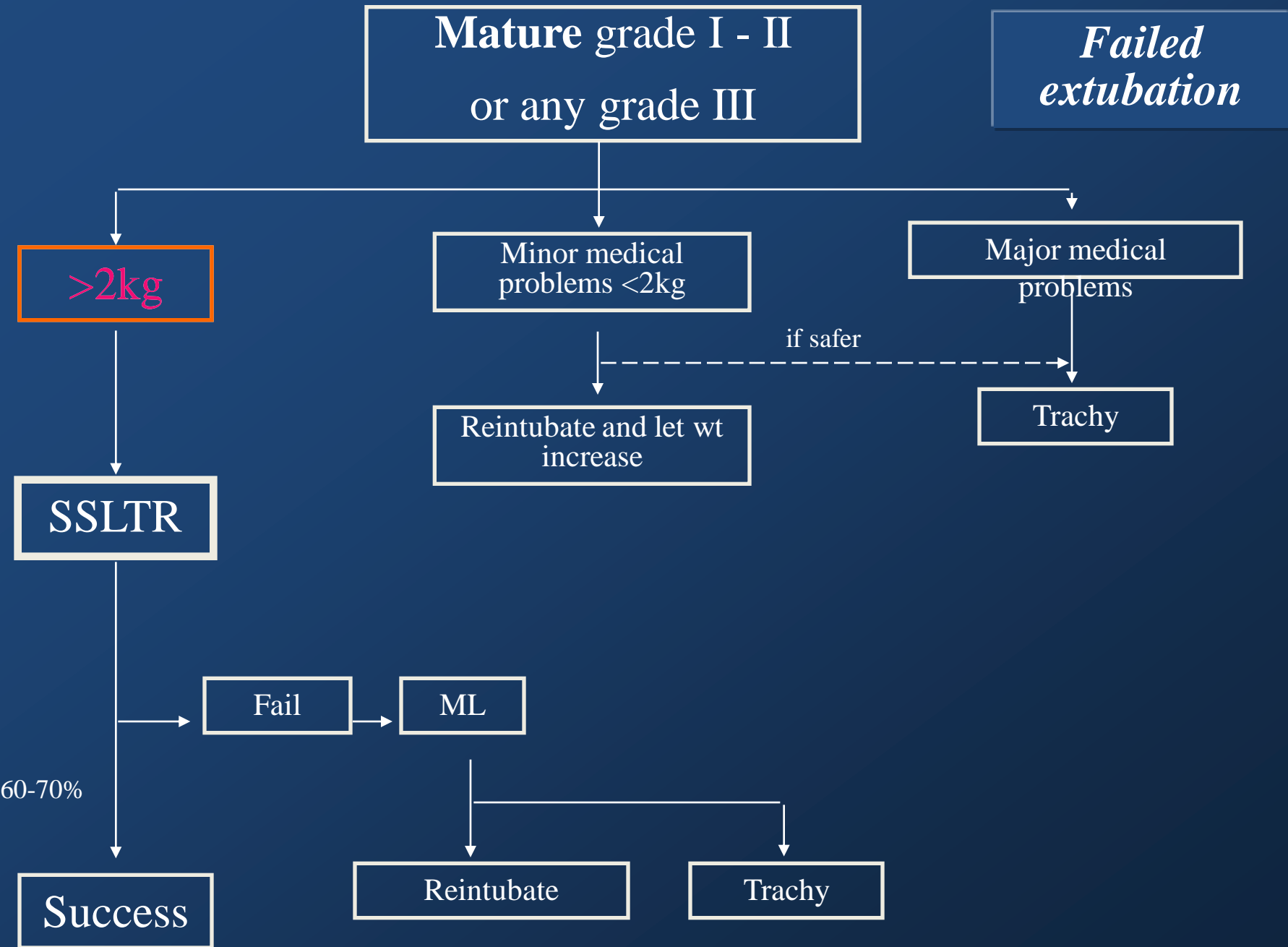
Not all patients suitable for single stage

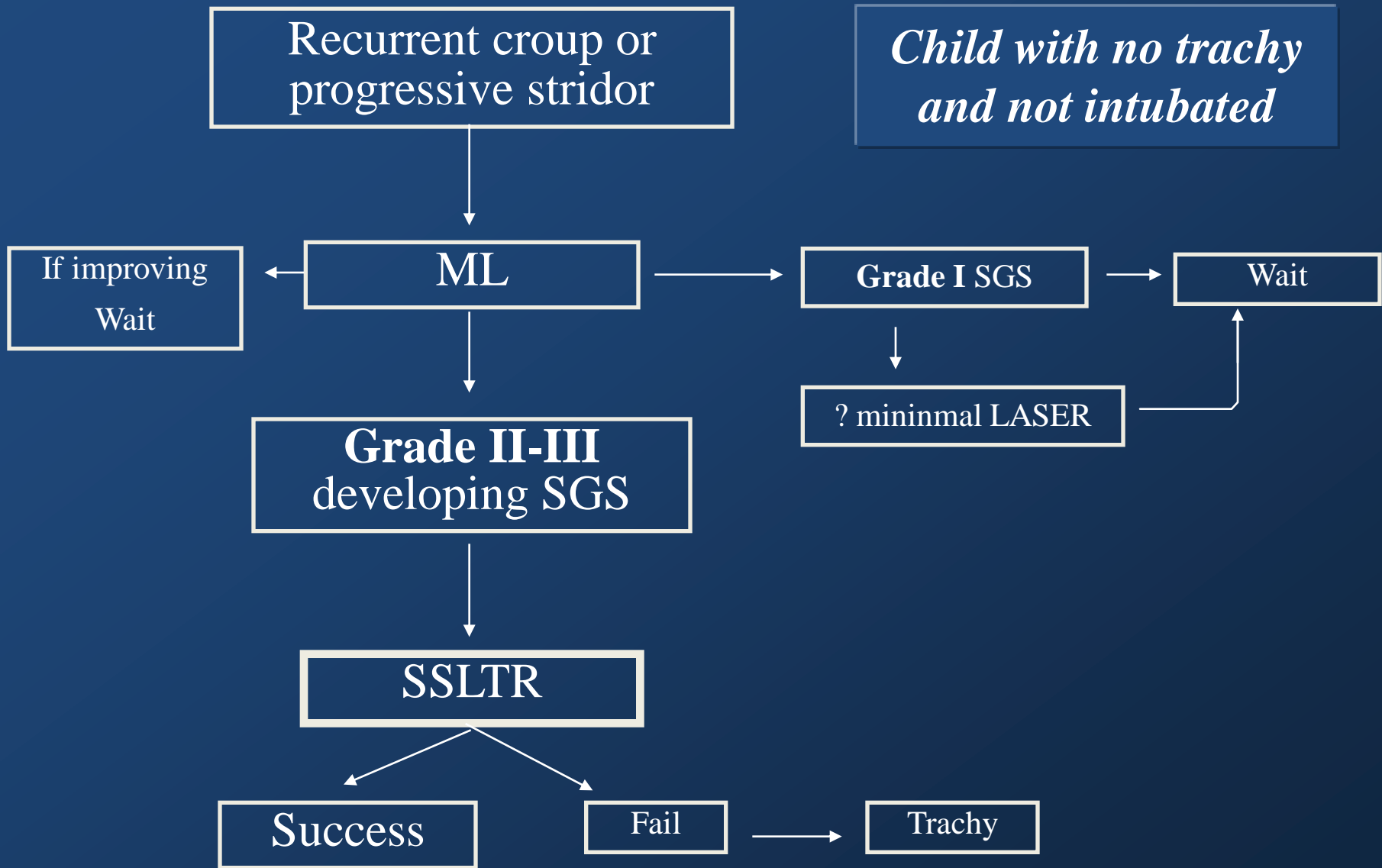
Cricotracheal resection



* Granulations, cysts, edema

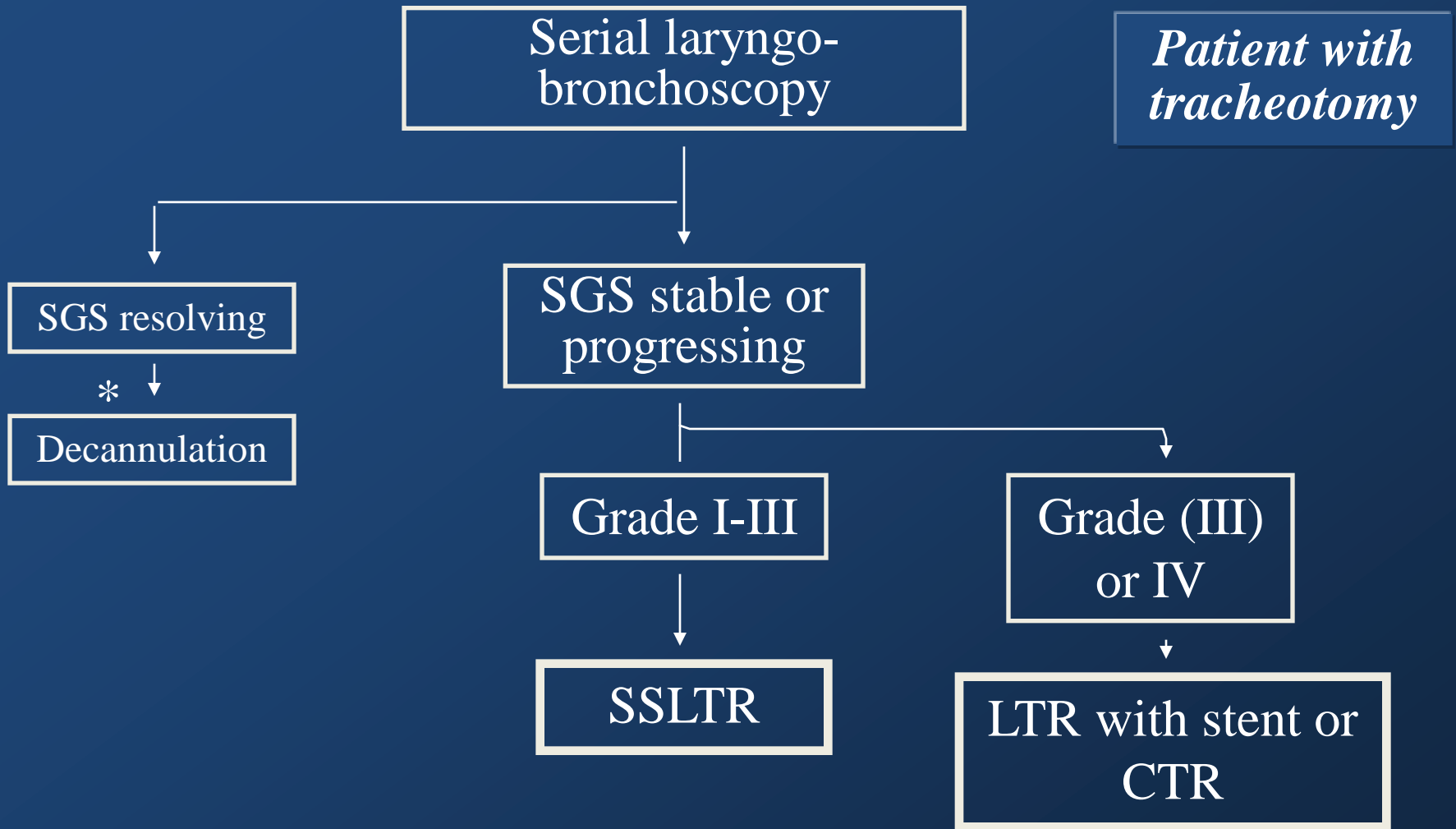






Child with no trachy and not intubated

90 -100%



* ?Try decannulation in grade I stenosis even if not improving



?