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
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
- E.T.T Stent
Laser

• Cotton

• Pankratenko AD, Onufrieva EK.
Mitomycin C

- Healy
  Mitomycin: effects on laryngeal and tracheal stenosis, benefits, and complications.
  14/15 showed benefit
  Antineoplastic antibiotic - acts as an alkylating agent by inhibiting DNA and protein synthesis

Back
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**  
  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

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

  8/16 as single stage
Basic Options for Paediatric Laryngotracheal Reconstruction

- Cricoid split
- LTR with stent
- Single stage LTR
- Crico-tracheal resection
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

<table>
<thead>
<tr>
<th>Classification of Stenosis With Actual Endotracheal Tube Size:</th>
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<tbody>
<tr>
<td>Patient age</td>
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<tr>
<td>Premature</td>
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<td>0-3/12:</td>
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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

Resection/stenosis

Eventually taken as specimen.
Cricotracheal resection
Cricotracheal resection
Cricotracheal resection

Tension sutures laterally to protect anastamosis

Chin sutures to prevent extension

Intubate for 7-10 days

Scope prior to extubation and downsize
Cricotracheal resection
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
Failed extubation

Medical Management

MLB

LASER

Re-intubate

* Granulations, cysts, edema

Failed extubation

Soft SGS

Mature SGS
Soft SGS grade I-II

Minor medical problems <1.5 kg
- Reintubate and let wt increase

Major medical problems
- Trachy

Failed extubation

Cricoid split

> 1.5 kg

Fail → ML

Success

70%

ML

Reintubate → Repeat split → SSLTR → Trachy
Mature grade I - II or any grade III

Minor medical problems <2kg

- if safer

- Reintubate and let wt increase

- Trachy

Mature grade I - II or any grade III

Minor medical problems <2kg

Failed extubation

Major medical problems

SSLTR

>2kg

Success

Fail

ML

60-70%

Reintubate

Trachy
Recurrent croup or progressive stridor

Child with no trachy and not intubated

If improving
Wait

ML

Grade I SGS
Wait

Grade II-III developing SGS

Grade I SGS

? minimal LASER

SSLTR

Success

90 -100%

Fail

Trachy
Serial laryngobronchoscopy

- SGS resolving
  - Decannulation

- SGS stable or progressing
  - Grade I-III
    - SSLTR
  - Grade (III) or IV
    - LTR with stent or CTR

* Try decannulation in grade I stenosis even if not improving