Anesthesia for traheal and main bronchial resections with reconstruction

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Institute of Pulmonology „Marius Nasta”
Bucureşti
„The father of modern-day tracheal surgery"
Prevention and management of complications following tracheal resections—lessons learned at the Massachusetts General Hospital

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Tracheal surgery has developed and evolved over the last 50 years, becoming an integral part of the clinical practice of modern thoracic surgeons. Today, surgeons can safely and effectively operate on most patients suffering from post-intubation tracheal stenosis, tracheal tumors and other pathologies that result in an abnormal shape and function of the central airways. The Massachusetts General Hospital (MGH) in Boston witnessed first-hand the birth and growth of tracheal surgery under Dr. Hermes Grillo, becoming a reference center and accumulating one of the largest institutional experiences in the world. This vast

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908 patients in 28 years
Postoperative mortality 1.2%
Overall complications 18%
Anastomotic complications 8%

A retrospective review of 60 tracheal stenoses of various etiologies (2001-2008)

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<th>Lesion</th>
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Malignant airway disorders

- Primitive neoplasia – 31 patients (6 carinal resection and reconstruction)
- Secondary malignant tumors
  Thyroid invasion – 21 (thyroidectomy and tracheal resection)
  Metastatic – 3
- Lung cancer – 25 (pneumonectomy or superior lobectomy with carinal resection and reconstruction)
- Reintervention 1
- Deaths 4 (1.4%)
Site of lesions

- **Tracheal**
  - Proximal (subglotic)
  - Medial
  - Distal

- **Carinal**

- **Carinal + sleeve resections** (lobectomy or pneumonectomy)
Proximal and medial benign
Other benign. Median and distal
Post Traumatic Main Bronchial Stenosis

30 days postop
Bronchial Stenosis after Tuberculosis
Tracheal Hemangioma

1. After bronchoscopic resection
2. After surgical resection
Metachronous NSCLC of Carina 5 Years after Left Pneumonectomy
Distal chystic adenoma
Thyroid Cancer Invading The Trachea
Tracheal Metastasis After Lung Resection for NSCLC
Anesthesia: Ventilatory challenges

- Trachea: main way in achieving normal ventilation during anesthesia

- Tracheal stenosis prevent ventilation during anesthesia induction

- Tracheal resection temporary prevent ventilation through ETT inserted between the vocal cords

- Equipment and special skills of the medical team
Preoperative anesthetic evaluation

- Respiratory (spirometry, pletismography, blood gases, flux volum curves, etc)

- Imagistic (Rx pulmonary, CT with reconstruction, MRI, Bronchoscopy)

- Cardio-vascular (current or more complex if pathology present or suspected)
Flux-volumes curves in tracheal stenosis

a/ Fix obstruction  b/ Extratoracic obstruction  c/ Intratoracic obstruction
Patient monitoring

- ASA recommended: ECG, Pulsoximetry, NIV AT, capnography
- Acido-basic equilibrium and blood gases: arterial cateter
  \[ \text{PaO}_2 \]
  \[ \text{PaCO}_2 \]
  \[ \text{Blood Ph} \]
- More complex if indicated (central catheter, echocardiography)
- Fibrobronhoscopy
Anesthesia

**PLANNING IS ESSENTIAL**

- **Patient**: type of lesions, symptoms, co-morbidities, preoperative assessment
- **Severity (degree) of stenosis**
- **Surgical**: resection proposed, patient position
- **Anesthetic**: ventilatory strategy
  - Initial bronchoscopic dilatation? Emergency?
  - Sequence of intubation. ETT type
  - HFJV possible or probable
  - Risks and Vulnerabilities. Prevention
Two mandatory conditions
Needs available equipment and medical skills
Choosing the most adequate the mode of ventilation

Anesthesiologist-surgeon-bronchoscopist co-op

How we do it?
Anesthesia

- General anesthesia
- Associated with loco-regional techniques (thoracic epidural, paravertebral block) in thoracotomies for lower trachea or carinal resections with pneumonectomy
- Choosing most adequate ventilation mode CV, HFJV, successive modes, apneea periods(!)
Tracheal stenosis

- Ventilatory strategy varies depending on the level of the stenosis:

- **INDUCTION**
  - Mask preoxigenation
  - Possible rigid bronchoscopic dilatation before ETI
  - Tracheostomy in tight tracheal stenosis (emergency, no time for bronchoscopic intervention!)
  - In lower tracheal stenosis: ETI above the stenosis with or without prior bronchoscopic dilatation

! Colaps of superior airways during anesthetic induction: farmacologic, tracheomalacia or tumoral compression!
High and medium tracheal stenosis: first step

Avoid muscle relaxants if possible!

1. Transstenotic intubation with ETT flexometalic, long and with diameter 4 - 6mm

or

2. High frequency jet ventilation (HFJV) with the catheter through ETT above the stenosis

or

3. Tracheostomy

or

4. Laringeal mask? (rare)
1. Transstenotic intubation with ETT flexometalic, long and with diameter > 6mm
2. High frequency jet ventilation (HFJV) with the catheter through proximal ETT above the stenosis.
3. Tracheostomy
4. Laryngeal mask (LMA)

- Tigh and long stenosis
- Usually extrinsic stenosis (eg tyroid)
- Ventilation without ETT

Akai T et al, Laringyal mask and tracheal stenosis, Anesthesiology, 1993 (letter)
Intra-anesthetetic ventilation: second step

Continue surgery with ventilation through the transstenotic flexometalic ETT

or

Ventilation through distal intubation of trachea or a main bronchus with a second circuit ("cross-field") inserted by the surgeon

or

Continue surgery around the HFJV catheter
Ventilation through the distal intubation of tracheae or a main bronchus with a second circuit (cross-field) inserted by the surgeon
Or continue surgery…

HFJV catheter through flexometalic ETT supra-stenotic inserted
HFJV

- HFJV catheter inserted through initial ETT
- Frequency de 100-140 RR/min
- General intravenous anesthesia
- After final tracheal anastomosis jet catheter is thrown out and ventilation continue with initial ETT
Third step: Ventilation through the oro-tracheal ETT (before end of surgery)
Post intubation stenosis

surgical resection

Ioan Cordos, Radu Stoica, Ruxandra Ulmeanu 2006

Ioan Cordos, Radu Stoica, Ruxandra Ulmeanu 2008
Distal Trachea

1. Traheal resection proximal to the lesion: ETT (Left DLT?)
2. "Cross-field" left main bronchus intubation or
3. Alternative HFJV! (until PPA ligature)
4. Carinal resection and Pneumonectomy (short apneea period!)
5. Tracheal anastomosis to main right or left main bronchus (around HFJV catheter)
6. Ventilation through initial ETT
7. Extubation in OR in cervical approach
Resection with reconstruction of the carina (sequence of ventilation)

- Left selective intubation with DLT
- HFJV of the left lung through the DLT
- DLT ventilation with bronchial cuff in tracheal position
Eso-tracheal fistula. Tracheal resection

Subglotic stenosis

Eso-tracheal fistula
Eso-tracheal fistula. Tracheal resection 2

- Rigid bronchoscopy with widening of the stenosis (from 5mm to 9mm) on HFJV
- ETT above tracheostomy
- „Cross-field” ventilation distal to the fistula
- Finally: after tracheal resection, anastomosis and ventilation through the initial ETT
Eso-tracheal fistula. Tracheal resection 3

- Initial ventilation: tracheostomy

- Flexometalic oro-tracheal tube inserted above tracheostomy

- “Cross field ventilation”

- Finally: after tracheal resection, anastomosis and ventilation through oro-tracheal tube
Lower tracheal and carinal resection

PATIENT DATA
- 39-year old patient
- Smoker and professional exposure to metal dust and toxic chemicals
- Admission for low effort dyspnea, cough, suffocation fear.
- Normal FVC value with reduced FEV1 shows airway obstruction
- Lower tracheal stenosis, last 6 cartilages above the carina
- Endoluminal tracheal mass with large base of implantation, between cartilages 3 and 5 above the carina
- Post-op HP findings show tracheal adenoid cystic carcinoma

CT AND BRONCHOSCOPIC ASPECTS
The more distant the stenoses are...

Difficulties and ventilation challenges are greater!!
“...Resection and reconstruction of trachea in the hand of a competent surgeon has good results in more than 93% of cases, with a rate of recurrence of 3.9% and a mortality rate of 2.4%...”

Take away...

- Be well prepared: logistics and skills...
- Most important challenges: ventilation in any moment and hypoxemia...
- Try to recover from anesthesia in the OR
  And...
Don’t forget: it’s a team work with perfect coordination!