Measures to improve outcomes after surgery

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• No conflict of interest to disclose
Problems

• Severity of surgical trauma
• Effect of other treatment modalities
• Limited physiological reserve
• Smoking
• Comorbidities
• Age
Measures to improve outcomes after surgery for lung cancer

• Multidisciplinary treatment
• Minimising of invasiveness of surgical procedures
• ERAS protocols
• Reference centres
Multidisciplinary treatment

• Multidisciplinary oncological treatment
  - systemic treatment
  - radiation therapy
  - surgery

• Tumour Boards
  - including: pathologist, radiologist, anaesthesiologist
Multidisciplinary treatment
- comorbidities

• Cardiac
• Pulmonary
• Renal
• Endocrine
• Gastroenterological
• Urological
• Gynecological
Minimising of invasiveness

- VATS (4-port, 3-port, uniportal)
- RATS
- Limited thoracomies
- Sublobar resections
VATS

- Reduction of postoperative complications
- Less acute and chronic pain
- Reduction of the loss of pulmonary function
- Improved compliance with adjuvant chemotherapy regimens
- Comparable or better 5-year survival

Downey et al., ISMICS Consensus Statement, 2007; Whitson et al., Ann Thorac Surg 2008; Yan et al., J Clin Oncol, 2009
RATS

• Potential advantages due to:
  - 7 degrees of freedom of movement
  - magnification of operative field
  - adjustment of the scale of movement

• But:
  - high cost
  - no proven advantage over VATS
Minimising of invasiveness of surgical approach

Traditional, 25 cm-long postero-lateral thoracotomy

VS.

VATS
Minimising of invasiveness of surgical approach

Uniportal VATS vs. mini-thoracotomy

Courtesy of Prof. G. Varela, University of Salamanca
Minimising of invasiveness
Salamanca-type thoracotomy
Minimising of invasiveness
parenchyma sparing resections

• Sleeve-resections

Price Thomas, J R Coll Surg Edinb, 1955
Minimising of invasiveness
parenchyma sparing resections

• Sublobar resections
  - segmentectomies
  - bisegmentectomies
  - lingula-sparing left upper lobectomy
Enhanced Recovery Protocol

• Conception of Enhanced Recovery after Surgery (ERAS), or fast-track surgery, was introduced in 1990s (Kehlet and Wilmore, Ann Surg, 2008)

• ‘series of evidence-based practices, serving to optimise the patient before surgery, minimise the physical and psychological stress associated with the procedure and promote restoration of function’ (UK Dept. of Health, 2010)
Enhanced Recovery Protocol

• Aims
  - shortening of hospital stay
  - optimisation of use of hospital resources
  - reduction of complication rate
  - speeding up restoration of normal activity
Enhanced Recovery Protocol

- Preoperative preparation
- Intraoperative strategies
- Postoperative care
Enhanced Recovery Protocol
- preoperative preparation

• Pre-optimisation
  - Anaemia - diagnosed and treated
  - Nutrition – screening and nutritional support
  - Smoking – support to stop
  - Medical therapy - optimisation
  - Physiotherapy - pulmonary rehabilitation

Jones at al., Anaesthesia, 2013; Loop, Cur Opin Anesthesiol, 2016
Enhanced Recovery Protocol
- preoperative preparation

• Preoperative assessment
  - Pre-operative clinic: detailed assessment to facilitate same-day admission and reduce unnecessary cancellations
  - Risk calculation: to facilitate appropriate allocation of resources
  - Education: detailed information regarding hospital stay, the recovery process and discharge for patients and their families

Jones at al., Anaesthesia, 2013; Loop, Cur Opin Anestesiol, 2016
Enhanced Recovery Protocol
- preoperative preparation

• Admission
  - Same-day admission: to minimise hospital stay
  - Fasting: minimise ‘nil-by-mouth’ and consider carbohydrate beverage 2 h preoperatively
  - DVT prophylaxis: anti-embolism stockings or mechanical devices

Jones at al., Anaesthesia, 2013; Loop, Cur Opin Anestesiol, 2016
Enhanced Recovery Protocol
- intraoperative strategies

• Anaesthesia
  - Choice of agents: use of short-acting agents
  - Ventilation: limited tidal volumes
  - Fluids: avoidance of fluid overload
  - Normothermia: use of warming devices
  - Atrial fibrillation: prophylaxis in at-risk patients
  - Tracheal extubation: at the end of surgery

Jones at al., Anaesthesia, 2013; Loop, Cur Opin Anestesiol, 2016
Enhanced Recovery Protocol
- intraoperative strategies

• Surgery
  - Approach: minimally invasive
  - Drains: one chest tube preferred

• Analgesia
  - Technique: paravertebral analgesia preferred over epidural

Jones at al., Anaesthesia, 2013; Loop, Cur Opin Anestesiol, 2016
Enhanced Recovery Protocol

- postoperative care

- DVT prophylaxis: heparins
- Nausea/Vomiting: pharmacological prevention
- Analgesia: paravertebral preferred
- Drain: non-suction preferred, early removal
- Mobilisation: as soon as possible
- Physiotherapy: kinetic therapy and incentive spirometry
- Nutrition: early enteral nutrition

Jones at al., Anaesthesia, 2013; Loop, Cur Opin Anestesiol, 2016
## Reference centres

<table>
<thead>
<tr>
<th>Source</th>
<th>Database</th>
<th>Results</th>
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<tbody>
<tr>
<td>Bach, NEJM, 2001</td>
<td>SEER, USA n = 2118</td>
<td>↓ complications, ↓ mortality</td>
</tr>
<tr>
<td>Birkmeyer, NEJM, 2003</td>
<td>Medicare, USA n = 400 000</td>
<td>↓ complications, ↓ mortality</td>
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<tr>
<td>Bilimoria, J Clin Oncol, 2008</td>
<td>Cancer Data Base, USA n = 243 000</td>
<td>↓ complications, ↓ mortality</td>
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<tr>
<td>Yung, An Thorac Surg, 2007</td>
<td>National, Taiwan n = 4800</td>
<td>↓ mortality</td>
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## Reference centres

<table>
<thead>
<tr>
<th>Lung resections per year</th>
<th>Hospital Mortality</th>
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<tr>
<td>1-15</td>
<td>7.2</td>
</tr>
<tr>
<td>16-30</td>
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<td>31-50</td>
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<tr>
<td>51-75</td>
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<td>&gt;180</td>
<td>2.4</td>
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</table>

Passlick B. Requirements for a thoracic oncology centre. Multidisciplinary conference in Thoracic Oncology, Lugano, 2011
Reference centres
Danish experience

The Netherlands
18 mln. inhabitants
55 Thoracic Surgery Units
i.e. 1 Unit/0.37 mln

Denmark
5.5 mill. inhabitants
Past: 12 Thoracic Surgery Units, i.e. 1/0.45 mln
Now: to 4 units, i.e. 1/1.37 mln
Reference centres in Denmark

• Waiting list guarantees for evaluation and treatment of cancer
• 28 days for work up
• 14 days for surgery
• Recommendations for unit size
• Multimodality setting/treatment
• Data registration and national audits
<table>
<thead>
<tr>
<th>Period</th>
<th>Mortality (%)</th>
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<td>2000-2004</td>
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<tr>
<td>2005-2009</td>
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<td>2010</td>
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<td>2011</td>
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</table>

Reference centres in Denmark

30-day mortality for lobectomy

Courtesy of Dr R. Petersen, Rigshospitalitet, Copenhagen
Reference centres in Denmark
survival after pulmonary resection

7.2.5.1 Figur Overlevelse 1, 2 og 5 år fordelt på indberettede per år

Courtesy of Dr R. Petersen, Rigshospitalitet, Copenhagen
Reference centres in Denmark

Types of resections

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<tr>
<th></th>
<th>2000-2004</th>
<th>2005</th>
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<td>Eksplorativt indgreb</td>
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<td>4/3</td>
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<td>Kile- og segmentresektion</td>
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<td>12</td>
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<tr>
<td>Lobekomi</td>
<td>58/65</td>
<td>72/72</td>
<td>75/75</td>
<td>77/77</td>
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<tr>
<td>Pneumonektomi</td>
<td>20/11/14</td>
<td>11/8</td>
<td>7/5</td>
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</tbody>
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**Types of resections:**
- Eksplorativt indgreb
- Kile- og segmentresektion
- Lobekomi
- Pneumonektomi

Courtesy of Dr R. Petersen, Rigshospitalitet, Copenhagen
Reference centres

• European Guidelines on Structure and Qualification of General Thoracic Surgery (European Society of Thoracic Surgeons, European Association for Cardio-Thoracic Surgery and the European Board of Thoracic Surgery)

• Guidelines for clinical competence, the institution, surgeons, theatres, ICU, ward, other facilities, education and number of cases.

Brunelli et al., Eur J Cardiothorac Surg, 2014
Thank you for your attention!