Assessing perioperative risk
Chronic Obstructive Pulmonary Disease

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Epworth Healthcare
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Impact of COPD on Postoperative Outcomes: Results From a National Database

Gupta H., et al. 
*Chest.* 2013;143(6):1599-1606

<table>
<thead>
<tr>
<th></th>
<th>COPD</th>
<th>No- COPD</th>
<th>P- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median length of stay</td>
<td>4 days</td>
<td>1 day</td>
<td>P&lt;0.0001</td>
</tr>
<tr>
<td>30 day morbidity</td>
<td>25.8%</td>
<td>10.2%</td>
<td>P&lt;0.0001</td>
</tr>
<tr>
<td>30 day mortality</td>
<td>6.7%</td>
<td>1.4%</td>
<td>P&lt;0.0001</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>1.52%</td>
<td>0.53%</td>
<td>P&lt;0.0001</td>
</tr>
<tr>
<td>AMI (within 6 mo)</td>
<td>2.68%</td>
<td>0.63%</td>
<td>P&lt;0.0001</td>
</tr>
</tbody>
</table>

After controlling for >50 comorbidities & type surgery, COPD was independently associated with:

↑ postoperative morbidity (OR, 1.35; 95% CI, 1.30-1.40; P < .0001)

↑ postoperative mortality (OR, 1.29; 95% CI, 1.19-1.39; P < .0001)
Assessing Risk of Postoperative Pulmonary Complications in COPD

(and broadly)....

1. Surgery related aspects
2. Anaesthesia related aspects
3. Patient related aspects
Surgery related aspects

1. Surgical site

2. Surgical time >3 hours

3. Emergency surgery
Anaesthesia related aspects

Is Spinal or Epidural anaesthesia safer??

Conflicting data

Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials

*Rodgers A, BMJ 2000;321:1493*

Systematic review of all trials with randomisation to intraoperative neuraxial blockade or not (with or without GA)

141 Trials, 9559 patients

Outcome measures: All cause mortality, DVT, PE, AMI, pneumonia, respiratory depression, transfusions, ARF
## Events

<table>
<thead>
<tr>
<th></th>
<th>NB n=4871</th>
<th>No NB n=4688</th>
<th>Odds ratio and 95% CI</th>
<th>Odds reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vascular events</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep vein thrombosis</td>
<td>145</td>
<td>220</td>
<td></td>
<td>44% (10)</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>30</td>
<td>66</td>
<td></td>
<td>55% (15)</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>45</td>
<td>59</td>
<td></td>
<td>33% (17)</td>
</tr>
<tr>
<td>Stroke</td>
<td>19</td>
<td>23</td>
<td></td>
<td>15% (29)</td>
</tr>
<tr>
<td><strong>Bleeding</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perioperative transfusion &gt;2 units</td>
<td>193</td>
<td>280</td>
<td></td>
<td>50% (10)</td>
</tr>
<tr>
<td>Post operative bleed requiring transfusion</td>
<td>31</td>
<td>69</td>
<td></td>
<td>55% (15)</td>
</tr>
<tr>
<td><strong>Infection</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wound infection</td>
<td>29</td>
<td>33</td>
<td></td>
<td>21% (24)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>149</td>
<td>238</td>
<td></td>
<td>39% (9)</td>
</tr>
<tr>
<td>Death from other infective causes</td>
<td>2</td>
<td>10</td>
<td></td>
<td>67% (36)</td>
</tr>
<tr>
<td><strong>Other events</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory depression</td>
<td>26</td>
<td>38</td>
<td></td>
<td>59% (19)</td>
</tr>
<tr>
<td>Renal failure</td>
<td>18</td>
<td>32</td>
<td></td>
<td>43% (22)</td>
</tr>
</tbody>
</table>
Intraoperative prophylactic and therapeutic non-invasive ventilation
Intraoperative prophylactic and therapeutic non-invasive ventilation

COPD/ hyperinflation

- ↑ Intrinsic PEEP
- ↑ load on respiratory mm
- Premature airway collapse
- Respiratory mm at mechanical disadvantage
  - BiPAP = PS / PEEP
  - Respiratory pump failure
  - ↑ PaCO2, acidosis
Intraoperative prophylactic and therapeutic non-invasive ventilation

Cabrini et al, BJA Jan 2014

COPD/hyperinflation

↑ Intrinsic PEEP

↑ load on respiratory mm

Premature airway collapse

Respiratory mm at mechanical disadvantage

BiPAP

PEEPe

= PS / PEEP

Respiratory pump failure

↑PaCO₂, acidosis
Intraoperative prophylactic and therapeutic non-invasive ventilation

*Cabrini et al, BJA Jan 2014*

Reviewed 30 papers, small numbers

Broadly, 2 types of applications:

1. Acute resp failure (CF, neuromuscular)
2. Prophylactic (‘at risk’, incl COPD)
   - Only 3 failures reported
   - Safe, feasible
   - Especially for op in supine position
   - Avoids intubation
   - No RCT, case reports only
Airflow obstruction comes in all shapes and sizes.
Airway wall remodelling (non smoking COPD)

<table>
<thead>
<tr>
<th>Spirometry</th>
<th>Ref</th>
<th>Pre Meas</th>
<th>Pre % Ref</th>
<th>Post Meas</th>
<th>Post % Ref</th>
<th>Post % Chg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
<td>2.35</td>
<td>2.51</td>
<td>107</td>
<td>2.42</td>
<td>103</td>
<td>-4</td>
</tr>
<tr>
<td>FEV1</td>
<td>1.94</td>
<td>1.10</td>
<td>57</td>
<td>1.12</td>
<td>58</td>
<td>2</td>
</tr>
<tr>
<td>FEV1/FVC %</td>
<td>75</td>
<td>44</td>
<td></td>
<td>46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEF25-75%L/sec</td>
<td>2.38</td>
<td>0.45</td>
<td>19</td>
<td>0.52</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>FEF50% L/sec</td>
<td>3.25</td>
<td>0.51</td>
<td>16</td>
<td>0.57</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>PEF</td>
<td>5.58</td>
<td>2.66</td>
<td>48</td>
<td>2.16</td>
<td>39</td>
<td>-19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diffusion</th>
<th>DLCO mL/mmHg/min</th>
<th>20.5</th>
<th>16.4</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL Adj</td>
<td>mL/mmHg/min</td>
<td>20.5</td>
<td>16.4</td>
<td>80</td>
</tr>
</tbody>
</table>
Airway wall remodelling (non smoking COPD)

Stiff pipes rather than holes in the sponge
COPD physiologically results in:

- Dynamic hyperinflation/ Gas trapping
  \(\rightarrow\) V/Q mismatching
  \(\rightarrow\) Diaphragm dysfunction

- Reduction in pulmonary capillary bed
  \(\rightarrow\) V/Q mismatching

- Alveolar hypoventilation

- Increased mucous production

- Pulmonary hypertension
COPD physiologically results in:

- Dynamic hyperinflation/ Gas trapping
  → V/Q mismatching
  → Diaphragm dysfunction

- Reduction in pulmonary capillary bed
  → V/Q mismatching

- Alveolar hypoventilation
- Increased mucous production
- Pulmonary hypertension
Respiratory Function Tests
(For non lung resection surgery)

RFTs (Spirometry, CO diffusing capacity) alone do not predict postoperative risk

Based on limited studies, there is no prohibitive level of pulmonary function

RFTs indicated if:

• Obstructive lung disease requiring optimisation ?reversibility
• Dyspnoea unexplained after clinical evaluation
Patient Related Aspects - COPD

In COPD patients consider:
- Current smoking
- Presence of pulmonary hypertension
- ? Elevated PaCO2
- ? Sputum production/volume
- Overall health status (ASA classification)
- Preoperative ex tolerance
Development and Validation of a Risk Calculator Predicting Postoperative Respiratory Failure
Himani Gupta et al

http://www.surgicalriskcalculator.com/petrfrisk-calculator
Gupta Calculator

Emergency case?
ASA Class?
Preoperative Function?
Procedure?
Sepsis?
<table>
<thead>
<tr>
<th>Question Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure:</td>
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<tr>
<td>Intestinal</td>
</tr>
<tr>
<td>ASA Class?</td>
</tr>
<tr>
<td>Patients with mild systemic disease</td>
</tr>
<tr>
<td>Emergency Case?</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>Functional Status?</td>
</tr>
<tr>
<td>Partially Dependent</td>
</tr>
<tr>
<td>Functional Status</td>
</tr>
<tr>
<td>Sepsis?</td>
</tr>
<tr>
<td>Preoperative Sepsis</td>
</tr>
</tbody>
</table>
Estimated risk probability for Postoperative Respiratory Failure (PRF)

10.68%
Preop Anaesthetic Assessment:

ASA Status: 1 2 3 4 5 E

Chronic bad chest
↓ SaO₂