An evidence-based COPD bundle of care in ED?

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COPD in ED
Chronic obstructive pulmonary disease (COPD)

- A lung disease characterised by airflow limitation that is not fully reversible, is progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases
- Diagnosis based on history of smoking or other exposure and FEV1/FVC <0.7
- Small airways narrowing and emphysema are the common conditions that result in COPD (NB Asthma/COPD Overlap)
Acute exacerbation of COPD (AECOPD)

- A change in the patient’s baseline dyspnoea, cough and/or sputum that is beyond normal day to day variation, is acute in onset and may warrant additional treatment or hospital admission
Definitions

Care Bundle

– A set of evidence-based practices that, when performed collectively and reliably, have been proven to improve patient outcomes
Background

COPD

- Affects one in six people over 45
- In Australia it is the 3rd leading cause of disease burden
- The second leading cause of avoidable hospital admissions
- Three out of four with COPD don’t know they have it
Background

• COPD-X Australian guidelines for COPD
  – Comprehensive, updated quarterly
  – Lung Foundation/TSANZ cobranded
  – A committee of representatives conduct literature quarterly with 4 website updates per year from 2015
The COPD-X Plan

C: Confirm diagnosis
O: Optimise function
P: Prevent deterioration
D: Develop support network and self-management
X: Manage eXacerbations

http://www.copdx.org.au/
C: Confirm Diagnosis

- Cough, sputum production, dyspnoea
- Consider COPD in all smokers and ex-smokers over the age of 35 years
- Consider COPD in all patients with other smoking-related diseases
- Confirm diagnosis with spirometry – demonstrate airflow limitation is not fully reversible

C: Spirometry

- Gold standard for diagnosing, assessing and monitoring COPD\(^1\)
- Airflow limitation that is not fully reversible defined as $\text{FEV}_1/\text{FVC} < 0.7$ and $\text{FEV}_1 < 80\%$ predicted after bronchodilator\(^1\)
- % of predicted $\text{FEV}_1$ used to determine severity\(^1\) and reflects prognosis\(^2\)

C: Spirogram

## C: Assess Severity

<table>
<thead>
<tr>
<th>Severity</th>
<th>Spirometry</th>
<th>Clinical</th>
</tr>
</thead>
</table>
| **Mild** | FEV\(_1\) 60–80% predicted | Few symptoms, chronic (usually) cough/sputum production  
No effect on daily activities  
Breathless on moderate exertion |
| **Moderate** | FEV\(_1\) 40–59% predicted | Chronic cough/sputum production  
Breathlessness on the flat, increasing dyspnoea  
Increasing limitation on daily activities |
| **Severe** | FEV\(_1\) < 40% predicted | Severely impaired QoL and daily activities  
Dyspnoea on minimal exertion  
Life-threatening exacerbations/complications |

COPD. Australian and New Zealand management guidelines and the COPD handbook.  
Acute exacerbations of COPD (AECOPD)

Costly

– every day ~1,000 COPD patients occupy hospital beds
– decline in HRQOL
– more rapid loss of lung function
– mortality
– economic terms (hospitalisations, medications, time off work, carer costs)
– readmission rates significant
AECOPD

• The trigger is often unknown
• Respiratory infections  
  – Viral, bacterial
• Heart failure, arrhythmia  
• Systemic infection, fever
• Anaemia
• Anxiety
• Pulmonary emboli
• Anything that increases metabolic rate
AECOPD

– *Differential diagnosis*: asthma/asthma & COPD overlap (ACOS)/pneumonia/ heart failure/obesity/pulmonary emboli/combination of one or more

– Ideally prior spirometry will confirm FEV1/VC<0.7 but often not done prior

– Study examining ICD code AECOPD admitted through ED at Austin-20 % did not have COPD!¹

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¹ Zhang B, Lanteri C, Nolan G, Barnes M, McDonald CF. *Reliable spirometry can be performed during hospital admission in acute exacerbations of COPD*. Thoracic Society of Australia and New Zealand Annual Scientific Meeting, Darwin. (2013 March) Respirology 2013:18(S2) 57
AECOPD

Assessment

• Medical History
  – Severity of COPD based on previous spirometry
  – Duration of worsening or new symptoms
  – Number of previous episodes/hospitalisations
  – Comorbidities
  – Present treatment regimen
  – Previous ICU admission/use of NIV
AECOPD

Assessment: Signs of severity

- Use of accessory respiratory muscles
- Paradoxical chest wall movements
- Worsening or new onset central cyanosis
- Development of peripheral oedema
- Haemodynamic instability
- Deteriorated mental status

NB. Determining severity of AECOPD complicated depends upon
1. Severity of underlying COPD
2. Acute changes induced by exacerbation itself
AECOPD

Investigations which may be useful

– Pulse oximetry useful for tracking and/or adjusting supplemental oxygen
– ABGs important if suspect respiratory failure
– Chest X Ray – useful to exclude alternative diagnosis
– ECG - may aid in diagnosis of coexisting cardiac disease
– FBE: WCC, anaemia
– Sputum exam
– Biochem: electrolyte disturbances, hyperglycaemia
Management of severe but not life-threatening exacerbations

- Assess severity of symptoms, blood gases, chest X Ray
- Administer supplemental oxygen as appropriate and monitor SpO2
- Bronchodilators
- Corticosteroids
- Antibiotics for infection
- Consider NIV
- At all times: close monitoring with regular observations, monitor fluid balance and nutrition, identify and treat associated conditions
Indications for NIV

• Respiratory acidosis (pH <7.35 and/or pCO2>45 mmHg)

• Severe dyspnoea with clinical signs suggestive of respiratory muscle fatigue, increased work of breathing or both such as use of accessory muscles, paradoxical motion of abdomen, intercostal retraction
Data Points for COPD Project

- CXR
- Bronchodilators
- Signs of infection - antibiotics if so
- Systemic corticosteroids
- Controlled oxygen therapy
- Assess for respiratory failure
- NIV if pH<7.3

Care bundle
Evidence base for care bundle?

- Use of a care bundle in the ED for AECOPD: a feasibility study\(^1\)
  - Care bundle of 10 items to be delivered both within ED and within first 24 hours of admission
  - Study (n=51) in Ireland
  - Pre post study design

McCarthy C. Int J of COPD 2013
## COPD acute management bundle

### Patient presents to ED/AMU/MAU

<table>
<thead>
<tr>
<th>Action</th>
<th>Time completed or reason for variation</th>
<th>Signed</th>
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<tbody>
<tr>
<td>Administration of O₂</td>
<td>On presentation</td>
<td></td>
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<tr>
<td>(FiO₂ 2L via nasal cannula or 28% via mask)</td>
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<tr>
<td>Maintain Spo₂ of &gt;88% &lt;92%</td>
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<tr>
<td>Check arterial blood gas and repeat if FiO₂ increase is required or hypercapnia. If in respiratory failure with pH &lt;7.35 consider initiation of non-invasive ventilation/transfer to appropriate unit</td>
<td>Within 30 minutes of presentation</td>
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<tr>
<td>Administer nebulised Beta 2 agonists and/or anticholinergics</td>
<td>Within 30 minutes of presentation</td>
<td></td>
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<tr>
<td>Oral prednisone 40 mg (30 mg if 60 kg or less)</td>
<td>Within 2 hours of presentation</td>
<td></td>
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<tr>
<td>Review laboratory results</td>
<td>Within 2 hours of presentation</td>
<td></td>
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<tr>
<td>Review chest X-ray</td>
<td>Within 2 hours of presentation</td>
<td></td>
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<tr>
<td>Administer antibiotics po amoxicillin or clarithromycin or doxycycline</td>
<td>Within 4 hours of presentation</td>
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<tr>
<td>If new infiltrate treat as pneumonia (see pneumonia bundle)</td>
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<tr>
<td>Consider COPD outreach (complete inclusion/exclusion criteria)</td>
<td>Within 4 hours of presentation</td>
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<tr>
<td>Ted stockings or LMWH for prophylaxis (if admitted)</td>
<td>Within 8 hours of admission</td>
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<tr>
<td>Refer to respiratory team/nurse</td>
<td>Within 24 hours of admission</td>
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</tr>
<tr>
<td>If patient is currently smoking or an ex-smoker &lt;3 months refer to smoking cessation service If appropriate refer to AHP (physio, OT, dietetics, SW, etc)</td>
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</tr>
</tbody>
</table>
Results of using care bundle

– Following implementation, delivery of care improved
– Mean bundle score out of 10 improved from 4.6 to 7
– Decreased unnecessary IV steroids
– Appropriate oxygen therapy increased from 76% to 96%
– Improvement in VTE prophylaxis 54% to 73%
– No change in LOS/30 day readmission
– Larger prospective studies needed? Care bundle or increased awareness?
CXR-Y/N?

• Consensus based COPD-\(X^1\), GOLD ✓ (Evidence Level IV)
• 16% show abnormal findings (other than COPD)
• Findings have therapeutic consequences
• Rule OUT other causes for presentation:
  – Pneumonia
  – Cardiac failure
  – Pneumothorax

Bronchodilator therapy

- Short-acting beta agonists mainstay of therapy: if not rapid response add anticholinergic
- No placebo-controlled RCTs
- Little difference in efficacy, often given in combination
- Concern about LAMA on board if using ipratropium-no studies to assess efficacy/safety
- MDI+spacer v nebs (acute asthma studies, stable COPD).
- Nebs may be more convenient for sicker patients
- No studies as yet on LABA/LAMA for acute management of AECOPD
Signs of infection

• AECOPD are characterised by worsening dyspnoea and/or cough and increase in sputum volume and/or purulence
• Bacteria isolated in 50% but many pts persistently colonised with *Haemophilus influenzae*, *Moraxella catarrhalis* or *Strep pneumoniae*
• Sputum not cultured routinely as results do not direct treatment
• If patient has change in colour/volume of sputum in association with fever and or raised WCC – treat for infection
Effect of antibiotics on AECOPD: treatment failure

Level One evidence for benefit in very severe exacerbations

Antibiotic use during AECOPD (5 studies involving 557 patients) compared with placebo:

- **reduced treatment failures** (additional antibiotics within first 7 days or unchanged or deteriorated symptoms within 21 days) by **46%** (RR, 0.54; 95% CI, 0.32 to 0.92)

Antibiotics in AECOPD

• “...antibiotics reduce treatment failures in patients who are hospitalised for ....COPD exacerbation, and to a lesser extent in outpatients. Mortality is only reduced by antibiotics in patients with very severe exacerbations who need treatment in the intensive care unit. The rather small and inconsistent effects of antibiotics on treatment failure suggest that antibiotics are effective in some patients but not in all..... Future high-quality studies should explore how antibiotic therapy may be targeted towards patients who benefit by using clinical signs (e.g. purulent sputum) or biomarkers at the time when patients present to the primary care doctor or emergency department.”
• IV antibiotics are only required if there is
  – impaired mental state
  – inability to swallow safely
  – CXR evidence of pneumonia
• Sputum culture is not recommended routinely unless there is lack of response 
or repeated bacterial infections within several months
Controlled oxygen therapy after initial nursing assessment – Y/N?

- AECOPD often associated with hypoxaemia
- SpO2 should always be considered in clinical context, and appropriate clinical judgement rather than complete reliance on oximetry readings should provide the basis of effective patient management
- Blood gases indicated if patients moderate to severe disease or SpO2 (RA) <90% (acidosis, hypercapnia)
- No RCTs of 21% oxygen vs controlled oxygen flow in ED for hypoxaemia while treatment progresses
- If SpO2 <90% at baseline-do blood gases first, if 90 +% at baseline on RA, may not be needed and nor may oxygen
Caution

• A high dose of O2 in COPD with chronic hypercapnia may lead to a further rise in pCO$_2$ due to:
  – Reduced ventilatory drive
  – Worsening V/Q mismatch due to high PO$_2$ in parts of the lung overcoming hypoxic vasoconstriction
  – Haldane effect
    • O2 displacing CO$_2$ from Hb
Controlled oxygen therapy

• Concern about over oxygenation of patients with AECOPD from several retrospective studies led to cluster randomised RCT in Hobart
• High flow oxygen 8-10L/min via mask v controlled oxygen to achieve SpO2 88-92% in all suspected AECOPD attended by ambulance
• Titrated oxygen reduced mortality compared with high flow by 78% in COPD
• More is not necessarily better!

Austin M et al. BMJ 2010;341:c5462
Controlled oxygen therapy

- Consider patient history—are they on LTOT?
- If so—will be hypoxaemic
- Low flow oxygen—generally no more needed
- If higher flow required to maintain SpO2 88-92%, consider alt/additional diagnoses
- If SpO2< 90% blood gases always indicated
- Low flow oxygen (0.5-2L/min) appropriate—"less is more"
Indications for non-invasive mechanical ventilation (NIV)

• At least one of the following
  – Respiratory acidosis (arterial pH<7.35) and/or pCO2>45mmHg
  – Severe breathlessness with clinical signs suggestive of respiratory muscle fatigue, increased work of breathing or both
• use of accessory muscles, paradoxical motion of the abdomen, intercostal retraction
NIV in hypercapnic respiratory failure

• NIV for acute hypercapnic respiratory failure has revolutionised management of AECOPD
• Clear evidence base in AECOPD with hypercapnia and respiratory acidosis
• ↑ pH, ↓ respiratory rate, work of breathing, breathlessness, intubation rates (and complications of MV), ↓ LOS (Evidence Level 1)
Systemic Corticosteroids: yes/no?

- Cochrane meta-analysis\(^1\)
- 16 studies, n=1787 CS v placebo
- Reduce severity of AECOPD
- Shorten duration of exacerbations
- Decrease LOS by 1-2 days
- Improve lung function, breathlessness, ABGs within 3 days in non-ICU
- Level 1 evidence for benefit

\(^1\) Walters JAE et al. Systemic corticosteroids for acute exacerbations of chronic obstructive pulmonary disease (Review). Copyright © 2014 The Cochrane Collaboration
Systemic corticosteroids: oral/iv?

• Oral v IV no difference in benefits (4 studies, n=298)
• 4x incr in sugar with CS, worse with IV
• Recent study: 5 days 40mg non-inferior to 2 weeks, no tapering required¹ (caveats)

• So……

• Oral CS unless patient vomiting or otherwise intolerant of oral

Conclusions

• Acute exacerbations of COPD: significant morbidity, mortality, personal and health care costs
• Significant evidence base for management
• ED Care bundles may have a role—as yet to be determined