FA 519 : Oxygen Administration for First Aid

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Taskforce: First Aid
COI Disclosure
(specific to this systematic review)

Wei-Tien Chang COI #301
- Commercial/industry: No
- Potential intellectual conflicts: No

Michael Nemeth COI #
- Commercial/industry: No
- Potential intellectual conflicts: No

Chih-Hung Wang COI #
- Commercial/industry: No
- Potential intellectual conflicts: No
**Consensus on Science**

- There is no study that directly addresses the first aid use of oxygen for breathing difficulty or complaints of chest pain.

- In a large LOE 3 retrospective case study, underwater divers experiencing decompression injury required fewer decompressions and had a greater likelihood of complete recovery if first aid included normobaric oxygen.

- One small LOE 4 case series reported less ST-segment elevation in patients who received oxygen by face mask at 15 L/min and who were admitted to the CCU for acute transmural myocardial infarction than in those who did not receive oxygen.

- In I LOE 2 randomized controlled trial conducted before the introduction of reperfusion therapy in 200 patients admitted to the hospital with a suspected AMI, there was no reduction in frequency of VT or in mortality when oxygen was provided at 6 L/min for 24 hours.
There is no evidence for or against the routine use of oxygen as a first aid measure for victims experiencing shortness of breath or chest pain.

Oxygen may be beneficial for first aid in divers with a decompression injury.
Population: 
- adults and children who exhibit symptoms or signs of shortness of breath, difficulty breathing or hypoxia outside of a hospital

Intervention: 
- administration of oxygen

Comparison: 
- no administration of oxygen

Outcomes: 
- Survival with Favorable neurological/functional outcome at discharge, 30 days, 60 days, 180 days AND/OR 1 year (9-critical)
- Survival only at discharge, 30 days, 60 days, 180 days AND/OR 1 year (8-critical)
- Shortness of breath (5-important)
- Time to resolution of symptoms (5-important)
- Therapeutic endpoints (e.g. oxygenation and ventilation) (4-important)
Inclusion/Exclusion & Articles Found

**Inclusion Criteria:** first aid, emergencies, EMS, out-of-hospital, pre-hospital, dyspnea, shortness of breath, breathlessness, difficulty breathing, wheezing, respiratory distress, respiratory insufficiency, anoxia, cyanosis, asthma, emphysema, drowning, near drowning, carbon monoxide poisoning, in-flight emergencies, diving, decompression sickness, altitude sickness, paraquat lung oxygen, oxygen therapies, oxygen inhalation therapy

**Exclusion Criteria:** animal studies, letters, editorial, comments, case reports

The search yielded a total of 1,857 studies (PubMed 1188, Embase 601, Cochrane 188). Of these, four studies were included for bias assessment, but 3 were excluded later.

One paper was included later from the references of C2010, and two papers were added from the references of “Guideline for Emergency Oxygen Use in Adult patients” from the British Thoracic Society.

A total of 4 papers were finally evaluated.
2015 Proposed Treatment Recommendations

- We suggest administration of oxygen to advanced cancer patients who exhibit symptoms or signs of shortness of breath, difficulty breathing or hypoxia outside of a hospital (weak recommendation, low quality of evidence).

- We suggest administration of oxygen to patients with decompression injury (weak recommendation, very low quality of evidence).

- There is no evidence for or against routine administration of oxygen to patients with shortness of breath, difficulty breathing or hypoxia.

- Values and preferences statement: In making this recommendation we place a high value on the importance of administering oxygen to patients presenting not only with dyspnea but also with signs of hypoxia, in which oxygen saturation could be improved with the administration of oxygen.

- It is also necessary to mention that several international guidelines suggest against the routine administration of oxygen unless oxygen saturation is below 94%.
### Risk of Bias in Studies

#### RCT bias assessment

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Design</th>
<th>Total Patients</th>
<th>Population</th>
<th>Industry Funding</th>
<th>Allocation: Generation</th>
<th>Allocation: Concealment</th>
<th>Blinding: Participants</th>
<th>Blinding: Assessors</th>
<th>Outcome: Complete</th>
<th>Outcome: Selective</th>
<th>Other Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bruera E</td>
<td>1993</td>
<td>RCT</td>
<td>14</td>
<td>Terminal cancer with dyspnea and hypoxemia</td>
<td>No</td>
<td>High</td>
<td>High</td>
<td>Unclear</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Philip J</td>
<td>2006</td>
<td>RCT</td>
<td>51</td>
<td>Advanced cancer with dyspnea</td>
<td>No</td>
<td>High</td>
<td>High</td>
<td>Unclear</td>
<td>Unclear</td>
<td>Unclear</td>
<td>Unclear</td>
<td>Unclear</td>
</tr>
</tbody>
</table>

#### Non-RCT bias assessment

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Design</th>
<th>Total Patients</th>
<th>Population</th>
<th>Industry Funding</th>
<th>Eligibility Criteria</th>
<th>Exposure/Outcome</th>
<th>Confounding</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longphre JM</td>
<td>2007</td>
<td>Non-RCT</td>
<td>2231</td>
<td>Decompression injury</td>
<td>No</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Unclear</td>
</tr>
<tr>
<td>Wijesinghe M</td>
<td>2011</td>
<td>Non-RCT</td>
<td>233</td>
<td>Acute exacerbation of COPD</td>
<td>No</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
3. No randomization but a crossover study design
4. The population is terminal cancer patients with dyspnea and hypoxemia. No clear description of the study setting. The study may not be performed out of the hospital.
5. The population is advanced cancer patients with dyspnea. The study included outpatients and inpatients.
7. After allowing for carry-over and period effects, no significant difference was noted (P = 0.662, improvement in VAS score: air = 8.7, oxygen = 10.5) (CI is not estimable because SD is not available)
4. The population is terminal cancer patients with dyspnea and hypoxemia. No clear description of the study setting. The study may not be performed out of the hospital.

5. The population is advanced cancer patients with dyspnea. The study included outpatients and inpatients.

8. A significant difference was noted in the mean increase of SpO$_2$ (air: 0.94%, oxygen: 5.43%, P < 0.001) (CI is not estimable because SD is not available).
1. The included patients were those treated by ambulance service rather than by first aid.
2. The number of included patients was small (n=250) and the confidence interval was relatively wide.
3. Only OR of the multivariate analysis is demonstrated. No detailed data are available.
4. The study did not use multivariate analyses to control possible confounding factors. The outcome, complete relief of decompression illness, did not necessarily include symptoms of dyspnea only.

<table>
<thead>
<tr>
<th>Quality assessment</th>
<th>Ne of patients</th>
<th>Effect</th>
<th>Quality</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Composite of death, requirement for invasive or non-invasive positive pressure ventilation, or respiratory failure (Wijesinghe 2011, 618)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Retrospective observational studies</td>
<td>not serious not serious serious^{1} serious^{2} none</td>
<td>181/250 (72%) 52/250 (21%)</td>
<td>OR 1.4 (0.6 to 2.9) NA^{6}</td>
</tr>
</tbody>
</table>

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</tr>
</thead>
<tbody>
<tr>
<td><strong>Complete relief of decompression injury after first recompression (Longere 2007, 43)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Retrospective observational studies</td>
<td>Serious^{3} none</td>
<td>700/1045 (67%) 688/1186 (58%)</td>
<td>OR 1.5 (1.2 to 1.8)</td>
</tr>
</tbody>
</table>
For the critical outcome of “composite of death, requiring assisted ventilation, and respiratory failure” we have identified very low quality evidence (downgraded for risk of bias, indirectness and imprecision) from one retrospective observation study (Wijesinghe 2011, 618) enrolling 232 patients with acute exacerbation of chronic obstructive pulmonary disease not showing benefit to oxygen administration (OR 1.4, CI 0.6-2.9).
For the important outcome of “shortness of breath” we have identified low quality evidence (downgraded for inconsistency and indirectness) from one RCT (Bruera 1993, 13) enrolling 14 terminal cancer patients with dyspnea and hypoxemia showing benefit to oxygen administration (mean difference in VAS score 20.5 lower, CI 27.6 lower to 13.5 lower), and low quality evidence (downgraded for inconsistency and indirectness) from one RCT (Philip 2006, 541) enrolling 51 advanced cancer patients with dyspnea not showing benefit to oxygen administration (P = 0.662, improvement in VAS score: air = 8.7, oxygen = 10.5).
For the important outcome of “oxygen saturation” we have identified moderate quality evidence (downgraded for indirectness) from two RCTs, one (Bruera 1993, 13) enrolling 14 terminal cancer patients with dyspnea and hypoxemia (mean difference in oxygen saturation 8.6% higher, CI 7.0% higher to 10.3% higher) and one (Philip 2006, 541) enrolling 51 advanced cancer patients with dyspnea (mean increase in oxygen saturation: air 0.94% vs. oxygen 5.43%, P < 0.001), showing benefit.
Proposed Consensus on Science Statements

For the important outcome of "complete relief of decompression injury after first recompression", we have identified very low quality evidence (downgraded for risk of bias and indirectness) from one retrospective observation study (Longpere 2007, 43) enrolling 2231 patients with decompression injury from a registry database showing benefit to oxygen administration (OR 1.5, CI 1.2 to 1.8).

We did not identify any evidence to address the outcomes of "survival", "survival with favorable neurological outcomes", or "time to resolution of symptoms".

In this review we focus only on the conditions other than chest pain. Oxygen administration for chest pain or acute coronary syndrome is reviewed by the ACS group in a separate PICO question.
We suggest administration of oxygen to advanced cancer patients who exhibit symptoms or signs of shortness of breath, difficulty breathing or hypoxia outside of a hospital (weak recommendation, low quality of evidence).

We suggest administration of oxygen to patients with decompression injury (weak recommendation, very low quality of evidence).

There is no evidence for or against routine administration of oxygen to patients with shortness of breath, difficulty breathing or hypoxia.

Values and preferences statement: In making this recommendation we place a high value on the importance of administering oxygen to patients presenting not only with dyspnea but also with signs of hypoxia, in which oxygen saturation could be improved with the administration of oxygen.

It is also necessary to mention that several international guidelines suggest against the routine administration of oxygen unless oxygen saturation is below 94%.
Knowledge Gaps

- Is oxygen beneficial to all patients with dyspnea arising from diverse aetiologies?
- Is oxygen potentially harmful to patients with specific aetiologies that present with shortness of breath or difficulty breathing?
- What is the optimal flow rate for first aid provider to administer oxygen?
- Should patients with dyspnea from different aetiologies receive oxygen at the same flow rate?
- Is there optimal range of oxygen flow rate to administer for certain aetiologies?
- Can the first aid providers differentiate the aetiologies of dyspnea that may need specific oxygen administration strategy?
- Is it safe for the first aid provider to administer oxygen based on the patients’ medical histories?