How to Pass Gas in Public:
The Latest Look at Oxygen Administration
Non Rebreathers are for Sick People....

Nasal cannulas are for little old ladies who think they are.
**When & why do we administer oxygen?**

<table>
<thead>
<tr>
<th>Call Type</th>
<th>Perceived Benefit</th>
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<tbody>
<tr>
<td>Acute Myocardial Infarction</td>
<td>Belief that oxygen will relieve symptoms</td>
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<tr>
<td>Stroke</td>
<td>Prevention of undesired effects of hypoxemia</td>
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<td>Cardiac Arrest</td>
<td>Palliative / Comfort care</td>
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<td>COPD</td>
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<td>CHF/Pulmonary Edema</td>
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<td>Trauma</td>
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<td>Pregnancy</td>
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<td>Sickle Cell Crisis</td>
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<td>Breathlessness</td>
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<td>Carbon Monoxide Poisoning</td>
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Oxygen is a powerful drug that is commonly delivered pre-hospital without indication and in variable and unknown concentrations. Oxygen can be monitored by pulse oximetry, typically with a goal of reversing hypoxemia. However, oxygen is rarely titrated in pre-hospital care once hypoxemia has been reversed. Hyperoxia is a common finding upon hospital arrival in those patients who are administered oxygen in pre-hospital care. In fact, hyperoxia can be as common as hypoxemia.

*However, oxygen is also often delivered on the presumption of need* based on disease state (head injury, stroke, myocardial infarction, etc.) to alleviate breathlessness and to prevent hypoxemia in sick patients at risk. These presumptions are not based on evidence that oxygen is useful in these situations, but rather the belief that the oxygen will provide relief of symptoms or prevent untoward effects of hypoxemia. However, oxygen delivery to patients without hypoxemia can lead to worsening outcomes in the presence of hyperoxia.

*The only evidence-based indication for oxygen therapy is hypoxemia confirmed by oximetry, blood gas analysis, or physical observation.*

Effects of Hyperoxia in Cardiac Emergencies:

1960 Study giving patients 100% O2 for 10 minutes:

- Increased vascular resistance of the left anterior descending artery by 23%
- Decreased Cardiac Output by 17%

Comparable study with patients undergoing cardiac catheterization were administered 100% O2 for 15 minutes:

- Increased myocardial perfusion resistance by an impressive 41%.
- Coronary blood flow was decreased by 29%

Alexander D Cornet, Albertus J Kooter, et al., The Potential Harm of Oxygen Therapy in Medical Emergencies, Critical Care. 2013, 17:313
Effects of Hyperoxia in Stroke Patients:

- **Vasoconstriction of the Carotid and downstream cerebral arteries:**
  - 100% O2 administration for 10 - 15 minutes resulted in a 20 - 30% decrease in cerebral blood flow.

- **Increased presence of Oxygen Free Radicals:**
  - Reactive Oxygen Species, often called free radicals, is an atom with one or more unpaired electrons. When formed in cells, damage occurs to the cell creating concerns of potentiating ischemia or reperfusion injury.\(^1\)

- **Higher incidence of Mortality:**
  - Non-hypoxic patients who received O2 via nasal canula were noted to have a higher rate of mortality (40% versus 17% without), resulting in the study being termination prior to its completion.

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Effects of Hyperoxia in Cardiopulmonary Resuscitation:

*Hypoxia still is a challenge in cardiac arrest patients as well as the significant challenges in measuring oxygen saturation make titration of oxygen administration an ongoing challenge.

- **Higher Mortality**
  - A 2010 study of over 6300 patients showed that post-resuscitation Hyperoxia (>300mmHg) to be associated with higher in hospital mortality as compared to those with normoxia.

- **Poor Neurological outcome**
  - Additionally, there is evidence that patients surviving initial resuscitation may be managed more safely with 30% oxygen versus 100% oxygen, resulting in lower levels of neuron-specific enolase.
Effects of Hyperoxia in Respiratory Patients:

- **COPD**
  - Carbon Dioxide Retention
  - Hypercapnic Adicosis due to ventilation/perfusion mismatch
  - Mortality significantly lower in those patients who received titrated oxygen

- **CHF / Pulmonary Edema**
  - Hypoxemia continues to be a presenting factor in these patients
  - Hyperoxygenation has limited value in the fluid filled lung.
  - CPAP continues to provide optimal care resulting in less intubations and better patient outcomes.

- **Pneumonia**
  - Hypoxemia has greater mortality and morbidity rate
  - Suggested 92% Spo2 may be a good threshold for titrated O2 therapy

- **Asthma**
  - O2 administration should only be used when hypoxemia is evident
  - Studies suggest high inspired oxygen can lead to hypercapnia similar to what is seen in COPD patients
Effects of Hyperoxia in Septic & Hemorrhagic Shock Patients:

- The peripheral vasoconstriction induced by Hyperoxia could be hypothesized as being beneficial. To date, no studies have shown benefits of Hyperoxia.

- Hyperoxia may compromise hemodynamics.
Effects of Hyperoxia in General Medical Patients:

- **Pregnancy**
  - No supported evidence that pregnancy alone requires prophylactic oxygen administration.

- **Sickle Cell Crisis**
  - Oxygen administration has not been shown to affect the duration of a pain crisis, or useful in patients with acute chest syndrome with normoxemia.

- **Shortness of Breath - etiology unknown**
  - Treatment of patients who are hypoxic is indicated
Effects of Hyperoxia in Carbon Monoxide Poisoning Patients:

Research has shown that delivery of high concentrations of oxygen to patients with carbon monoxide poisoning is indicated.

Half life of carboxyhemoglobin is 4-5 hours on room air, breathing 100% oxygen reduces this to a half life of 40 minutes.
Conclusions:

There are obvious potential dangers with routine use of high dose oxygen administration.

Oxygen therapy, as with all other drugs administered pre-hospital, should be delivered through evidence based theory that supports the necessity of the drug administration.

Pulse Oximetry should be utilized as the means of supporting your decision.

Oxygen administration is no longer “one size fits all”, titration based on patient presentation and clinical findings are paramount.

Most studies are supporting maintaining saturation levels around the 94 percentile.
Last Thoughts:

Oxygen is life-saving in the face of hypoxemia. The relatively common belief that oxygen is non-toxic over short exposures, logistical challenges, and training issues in pre-hospital care have resulted in routine excess oxygen use: excess not only in dose but in indications for conditions. At present, oxygen should be titrated to alleviate hypoxemia and prevent hyperoxemia, with treatment of carbon monoxide poisoning being the exception.
Passing Gas in Public (or Oxygen Administration) should always be titrated to effect