Inpatient Oxygen Delivery

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Oxygen is life saving in respiratory failure

**BUT** more (hyperoxia) is not better!

- Toxicity from free radical generation causes airway and parenchymal injury
- In premature infants BPD and ROP
- Absorption atelectasis
- Can worsen hypercapnea in patients who chronically retain CO₂
- No longer recommended in ACS without hypoxia

Things to consider

Room air FiO₂ is 21%

Normal minute ventilation about 6 to 8 L per minute at rest. Can rise to 40 to 60 L/min with exertion.

But we breath in a lot faster at rest - normal inspiratory flow rate about 25 to 30 L/min. Peak flow rate 40 to 70 L/min.

The Oxygen Source
The humble nasal cannula

Flow rate up to 6 L/min

Each liter increases FiO2 by about 3% from 21% because most of the air is entrained from the room given the inspiratory flow rate of 25 to 30 L/min.

The high flow nasal cannula

Flow rate up to 15 L/min

The aerosol mask

Variable FiO2 30 to 40%

The non-rebreather

In perfect circumstances provides about 95% FiO2

Can support a MV of 15 L/min

One way valves
The venturi mask
Can provide 35% at 51 L/min
Can provide 50% at 41 L/min

Non-invasive positive pressure ventilation

Newest kid on the block - HHFNC

What about tracheostomies?
Selecting the correct inhaled oxygen concentration on a mechanical ventilator

Prescribing oxygen at the time of hospital discharge

Objectives

1. Outline the process of ordering oxygen
2. Discuss equipment used in the home

Outpatient Oxygen

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• > 1.5 million adults use supplemental oxygen
Oxygen Qualification at rest

- Pulse oximeter ≤ 88% at rest on room air
  - For example:
    - Resting saturation 85% on room air
    - Saturation 90% at rest on 2L/m

Oxygen Qualification with exertion

Pulse oximeter ≤ 88% with exertion

- For example:
  - Resting saturation 90% on room air
  - Saturation 86% with exertion on room air
  - Saturation 92% with exertion on 2L/m

Oxygen Qualification for high flow at rest

- Pulse oximeter ≤ 88% at rest on room air
  - 80% on room air at rest
  - 84% on 2L/m at rest
  - 86% on 4L/m at rest
  - 87% on 6L/m at rest
  - 90% on 8L/m at rest

Oxygen Qualification for high flow with exertion

Pulse oximeter ≤ 88% with exertion

- 80% on room air with exertion
- 82% on 2L/m with exertion
- 84% on 4L/m with exertion
- 86% on 6L/m with exertion
- 88% on 8L/m with exertion
- 90% on 10L/m with exertion
The 6 minute walk test

• This does not qualify for oxygen
• Even if the saturation drops below 88%, this test does not add oxygen without an order for an oxygen titration
• This test measures distance walked in a 6 minute time frame
  • Useful for other circumstances, like transplant evaluation

Oxygen orders

Must include:
1. Oxygen liter flow – 2L/m with exertion and sleep
2. Equipment needed – small portable tanks,-conserving device, portable concentrator, home oxygen concentrator
3. Date of face to face encounter. The face to face encounter must be within the past 30 days.
4. Qualification data
5. Statement of Certification that the patient is under your care, and that You or a Nurse Practitioner or Physician Assistant had a face to face encounter. Based on the findings, the equipment and supplies are medically necessary.
6. Send prescription to a DME (durable medical equipment) company

Definitions

• Concentrator
• Conserving device
• POC – portable oxygen concentrator
• Pulsed flow
• Continuous flow
• DME
• CMN

Variety of Cylinders

• E Cylinder  25 inches tall
• D cylinder  16.5 inches tall
• C Cylinder  11 inches tall
• M-9 Cylinder 15 inches tall
• M-6 Cylinder 12 inches tall
Soda Can  4.83 inches tall
Concentrators are available in a variety of sizes.

<table>
<thead>
<tr>
<th>Oxygen cylinder</th>
<th>Weight</th>
<th>Liter flow</th>
<th>Hours of use</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>E tank</td>
<td>7.9 pounds</td>
<td>2 L/m pulse dose</td>
<td>17.2 hours</td>
<td>Cylinder only $50-100 Added cost for cart and regulator or oxygen conserving device Covered by insurance</td>
</tr>
<tr>
<td></td>
<td>Without a cart or a regulator</td>
<td>2L/m continuous dose</td>
<td>5.7 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3L/m pulse dose</td>
<td>11.5 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3L/m continuous dose</td>
<td>3.8 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen cylinder</td>
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<td>Liter flow</td>
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</tr>
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<td>-----------------</td>
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<td>------------</td>
</tr>
<tr>
<td>D tank</td>
<td>5.3 pounds without a regulator</td>
<td>2L/m pulse dose</td>
<td>10 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2L/m continuous dose</td>
<td>3.5 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3L/m pulse dose</td>
<td>7 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3L/m continuous dose</td>
<td>2.3 hours</td>
<td></td>
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</thead>
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<tr>
<td>Portable oxygen concentrator</td>
<td>Vary, 5-10 pounds</td>
<td>Pulse dose</td>
<td>1.3 - 4 hours</td>
<td>$2000 - $4000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continue dose</td>
<td>1 - 3 hours</td>
<td>Some insurance will not cover</td>
</tr>
</tbody>
</table>
Home Oxygen Therapy for Adults with Chronic Lung Disease

- Evidence based use of oxygen:
  - COPD
- **Strong** Evidence: COPD with resting hypoxemia- Oxygen use is recommended at least 15 hours per day
- **Moderate** Evidence: COPD with exertional hypoxemia- The recommendation favors on oxygen with exertion. This includes activities like going up stairs, carrying objects > 5 pounds, showering, sexual activities.
- **Low** Evidence: COPD with resting saturation of 89%-93%-Oxygen use is not recommended

Closing remarks

- Many things go into ordering oxygen
  - Qualification
  - Patient education
  - Availability of DME facilities and equipment
  - Continuing CMN
  - Patient work status
  - Patient travel status
  - Comorbid conditions