

Oxygen: Is there a problem?

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Case 1

- 79-year-old female, diabetic, morbidly obese
- Admitted with 'LVF'
- Overnight 'Reduced GCS ?cause'
- 15l NRB in situ
- ABG showed pH 6.9, pCO₂ 15.9kPa
- Woke up when oxygen stopped!
- Oxygen prescribed with target SpO₂ 88-92%, documented in notes
- Following morning on AMU GCS 3/15 and 15l NRB back in situ!
- Not a candidate for NIV; RIP

Case 2

- 75-year-old male, cervical myelopathy (cord compression due to OA)
- Admitted with reduced GCS
- pH 7.1, pCO₂ 9.6kPa (respiratory acidosis)
- Improved with controlled O₂ 24-28%
- Treated for pneumonia
- Became drowsy again with rising pCO₂ and low RR
- Miotic (small) pupils
- Covered in fentanyl patches
- Improved once patches removed and naloxone given

Case 3

- 86-year-old female from RH, osteoporosis
- Admitted with pneumonia
- Asked to see on AMU because of 'fitting'
- Hypotensive, myoclonic jerks, bounding pulse
- On 10L O₂ via NRB since admission
- ABG showed pH 7.23, pCO₂ 12.9kPa
- Minimal improvement with reduced FiO₂
- Not a candidate for HDU or NIV on W24
- RIP

Oxygen: there is definitely a (big) problem...

Published national audits have shown;

- Doctors and nurses have a poor understanding of how oxygen should be used
- Oxygen is often given without any prescription
- If there is a prescription, it is unusual for the patient to receive what is specified on the prescription
- Monitoring of oxygen administration is often poor

OXYGEN IS DANGEROUS (NPSA alert 2009)

BTS Guideline 2009: Emergency Oxygen Use in Adult Patients

- Prescribing by target oxygen saturation
- Keeping SpO₂ within 'normal' limits
- Target SpO₂ 94-98% for most patients (92-98% if >70)
- Target SpO₂ 88-92% (pO₂ 6.7-10kPa) for those *with* or *at risk of* hypercapnic (high CO₂) respiratory failure

Aims of emergency oxygen therapy

- To correct or prevent potentially harmful hypoxaemia
- To alleviate breathlessness (only if hypoxaemic)

Increasing FiO_2 (inspired oxygen concentration) is only one element of increasing overall O_2 carrying capacity of blood;

- Protect airway
- Enhance circulating volume and cardiac output
- Correct severe anaemia
- Avoid or reverse respiratory depressants e.g. morphine
- Treat underlying cause e.g. LVF, asthma

Indications for Emergency O₂ Therapy

1. SpO₂ <94% (<88% if risk of hypercapnia)
2. Critical illness e.g. septic shock, major trauma, anaphylaxis, acute LVF
3. Carbon monoxide poisoning

Exposure to high O₂ concentrations can be harmful...

- Risk of hypercapnia (high CO₂) in selected patients
 - some patients with chronic hypercapnia are dependent on hypoxaemia to maintain respiratory drive
- Constriction of coronary arteries
 - high O₂ levels INCREASED mortality in survivors of cardiac arrest
- Constriction of cerebral arteries
 - high O₂ levels INCREASED mortality in non-hypoxic patients with mild-moderate stroke

Patients at risk of hypercapnic (type 2) respiratory failure

1. COPD (not all patients with COPD, elevated HCO_3^- on ABG is a useful clue to chronic CO_2 retention)
2. Morbid obesity (OHS and OSA)
3. Neuromuscular weakness (MND, myasthenia)
4. Chest wall deformity (kyphoscoliosis)
5. Reduced conscious level
6. Morphine and other respiratory sedatives

A Word of Warning...

- Patients with high CO₂ levels have very little room for oxygen in their alveoli
- **DO NOT SUDDENLY REMOVE OXYGEN IN SEVERELY HYPERCAPNIC PATIENTS**
- risk of life-threatening alveolar hypoxaemia
- Reduce oxygen to 35% initially and titrate down further if required



Oxygen is a drug and should be prescribed on EP (unless an emergency).....

You wouldn't give any other drugs without a prescription would you?



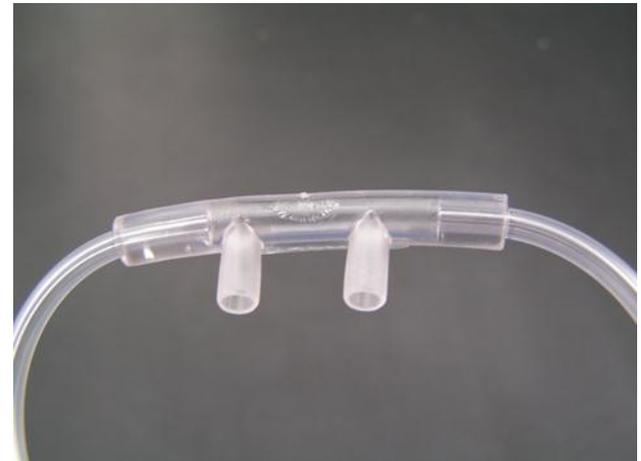
Critically ill patients – high concentration reservoir mask or NRB

- Deliver 60-80% oxygen at 10-15l/min
- Short-term use only for critically unwell patients



Most other patients – nasal cannulae

- 2-6L/min gives *approximately* 24-50% oxygen
- concentration of oxygen actually delivered depends on:
 - **oxygen flow rate**
 - **tidal volume**
 - **respiratory rate**
- patients with COPD often have **low tidal volumes** and **rapid respiratory rates** so they tend to breath disproportionately more oxygen than air with each breath
- Comfortable, easily tolerated
- No risk of re-breathing
- Low cost product



Patients at risk of hypercapnic (type 2) respiratory failure – venturi masks

- Fixed performance masks i.e. deliver a fixed concentration of oxygen
- Less affected by tidal volume and RR (useful in COPD)
- Increasing flow does not increase FiO_2 beyond that stated on mask
- Accurate at 24-40%
- 60% venturi delivers $\sim 50\%$ FiO_2





34% set to
12 litres

39% set to
14 litres

35% set to
8 litres

40% set to
8 litres

60% set to
15 litres

Monitoring and Titration

- Monitor oxygen saturations frequently/continuously
- Titrate flow rate and/or device up or down **until target O₂ saturation is achieved**
- **ALWAYS** use minimum flow rate required and seek to wean off oxygen as soon as stable
- **NEVER** leave patients on high-concentration O₂ for prolonged periods without repeating ABGs

Acute Medicine Oxygen Audits 2009 & 2011

Standard	Compliance '09	Compliance '11
Oxygen should be prescribed on the drug chart in all cases where it is administered	8%	12%
Arterial Blood Gases (ABGs) should be performed in all patients receiving emergency oxygen therapy	61%	65%
Oxygen should not be given to patients who are not hypoxaemic	48%	35%
Oxygen should be prescribed to achieve target saturations of 88-92% for those at risk of hypercapnoeic respiratory failure	67%	67%
All patients receiving emergency oxygen therapy should have their saturations (SpO ₂) monitored	92%	82%
All patients receiving oxygen therapy should be within their target range for oxygen saturation	N/A	59%
Action should be taken to correct oxygen saturations in all patients who are outside of their target range	N/A	43%

How Can We Improve?

- Education and awareness is key
 - Has to be nurse-led and delivered (can't rely on doctors...)
 - Every time you see a patient on oxygen ask **3 key questions**;
- 1. Does this patient need oxygen?**
 - check SpO₂ on air
 - only give oxygen if patient is outside of their target range
 - if in doubt, ask!
 - 2. Is oxygen prescribed on EP?**
 - ask doctor to prescribe it if not
 - 3. Are target saturations being achieved?**
 - titrate oxygen up or down until target SpO₂ is achieved

Key Points

- Oxygen is a drug
 - if it's not prescribed DON'T GIVE IT (unless an emergency situation)
 - like most drugs, oxygen has the potential to kill
- Consider risk of CO₂ retention (not just COPD patients, remember opiates)
- Select best device (nasal cannulae for most, venturi for at risk patients)
- Continuous monitoring of SpO₂ advised in most patients
- Titrate O₂ up or down to achieve target SpO₂ 94-98% (88-92% if high risk)
- Avoid hyperoxaemia
- Wean down oxygen at the earliest opportunity once stable
- NEVER leave patients on high-concentration O₂ (NRB) for prolonged periods

Any Questions?