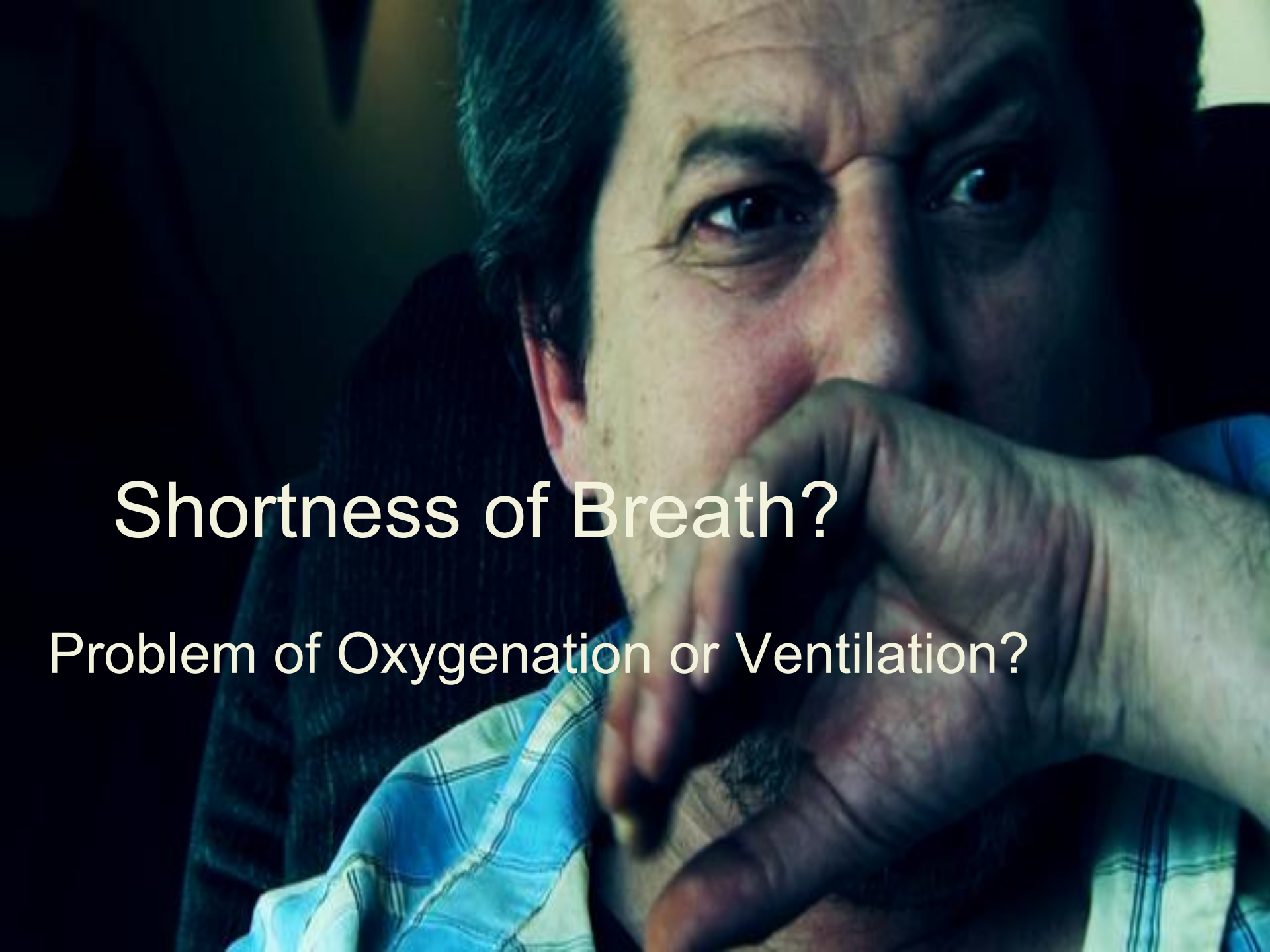
Richard Beebe MS RN NRP CIC/RF

A Little Oxygen Never Hurt Anyone – Or Did It?

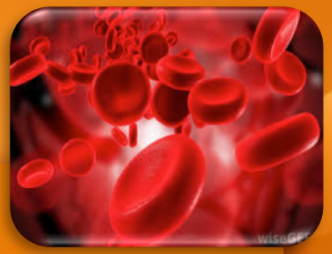

Shortness of Breath?
Problem of Oxygenation or Ventilation?


Oxygenation
Ventilation
Goal
Directed

Preventable Death!

Hypoxia?

Oxygen Saturation and Pulse Ox Lag



Hypoxia versus Hypoxemia

Classifications	PaO_2 (rule of thumb)
Normal	80-100 mm Hg
Mild hypoxemia	60-80 mm Hg
Moderate hypoxemia	40-60 mm Hg
Severe hypoxemia	<40 mm Hg

Oxygen

- Oxygen therapy has always been a major component emergency care
- Health care providers **believe** oxygen alleviates breathlessness

Oxygen

We began giving oxygen because it seemed like the right thing to do…

Documented benefits:

- ✓ Hypoxia
- ✓ Nausea/vomiting
- ✓ Motion sickness

Effects of sudden hypoxia

(Removal of oxygen mask at altitude or in a pressure chamber)

- Impaired mental function; onset at mean SaO2 64%
- No evidence of impairment above 84%
- Loss of consciousness at mean saturation of 56%
  - absence of breathlessness when healthy resting subjects are exposed to sudden severe hypoxia
  - mean SpO2 of airline passengers in a pressurised cabin falls from 97% to 93% (average nadir 88.6%) with no symptoms and no apparent ill effects

Akero A et al Eur Respir J. 2005;25:725-30
Cottrell JJ et al Aviat Space Environ Med. 1995;66:126-30
Hoffman C, et al. Am J Physiol 1946;145:685-692

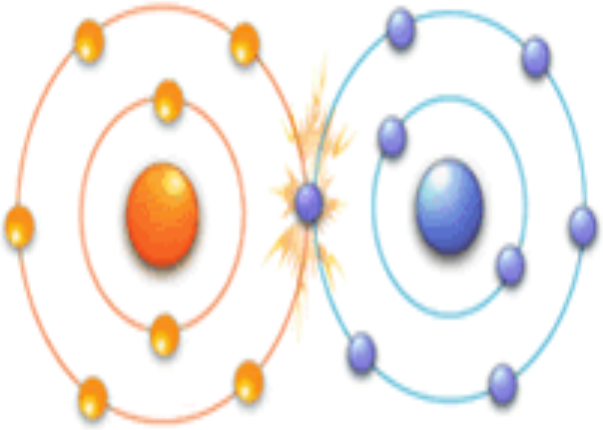
"Normal" nocturnal SpO_2

- Healthy subjects in all age groups routinely desaturate to an average nadir of 90.4% during the night (SD 3.1%)* (Gries RE et al Chest 1996; 110: 1489-92)

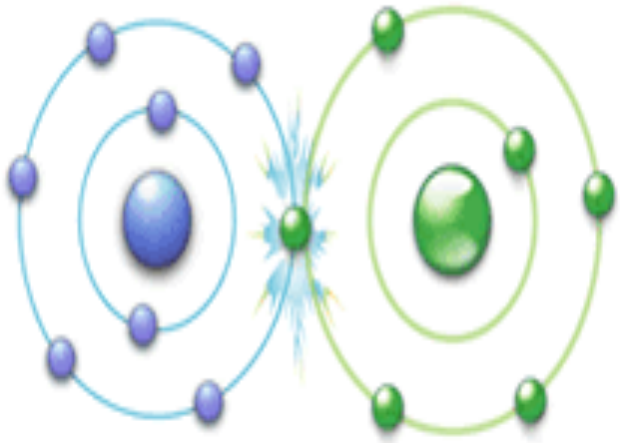
**Therefore, be cautious in interpreting a single oximetry measurement from a sleeping patient. Watch the oximeter for a few minutes if in any doubt (and the patient is otherwise stable) as normal overnight dips are of short duration.*

The Chemistry of Oxygen

- Oxygen is highly reactive; it has 2 unpaired electrons
- Molecules/atoms with unpaired electrons are extremely unstable and highly-reactive
- Referred to as “free radicals”

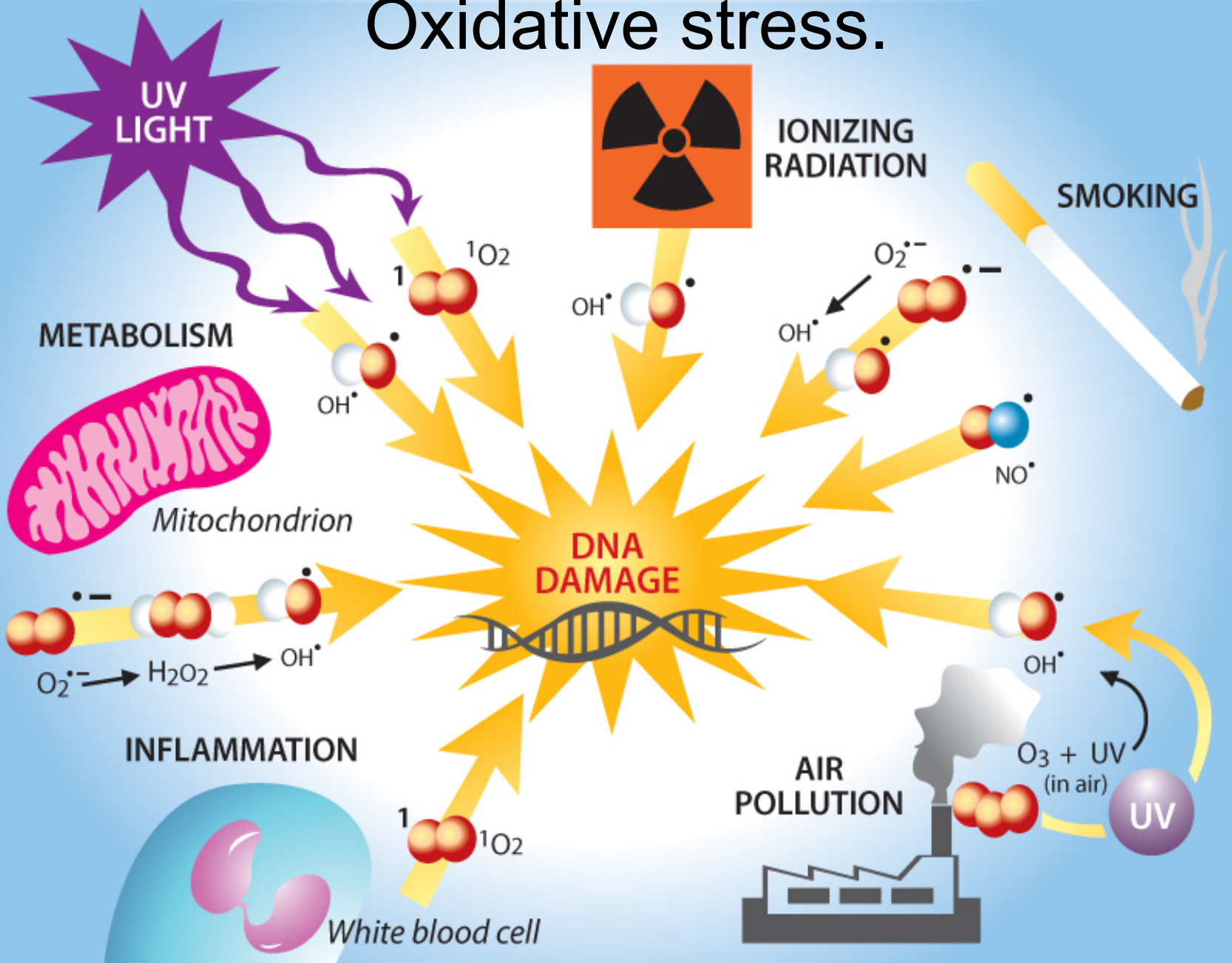


Free radical steals an electron from another molecule.



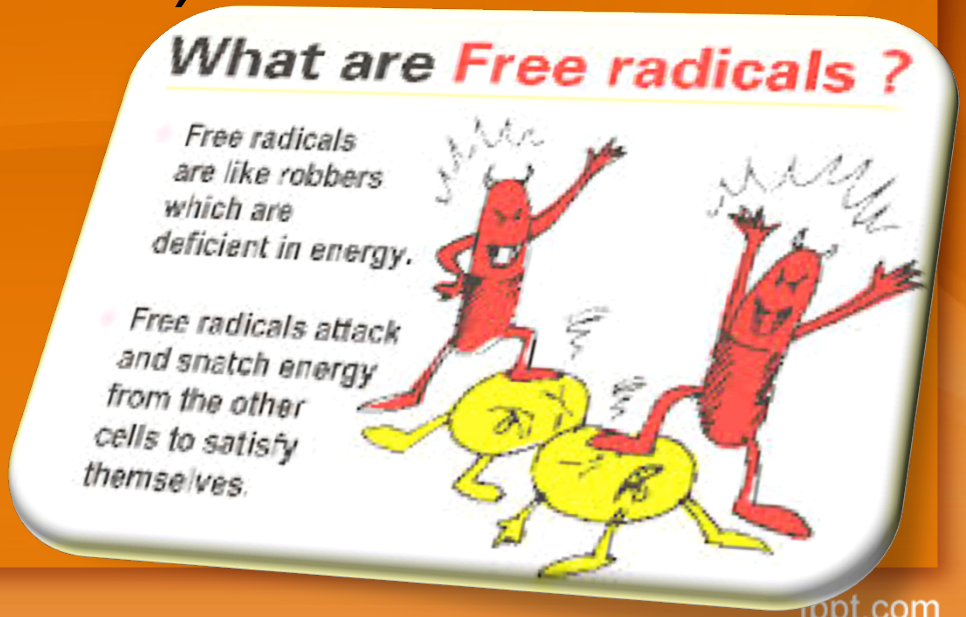
Antioxidant stabilizes the molecule by giving an electron.

Oxidative stress.



Oxygen Free Radicals

- Develop during reperfusion—not during hypoxia (when O_2 enters damaged area) Flooding ischemic cells with oxygen worsens oxidative stress (proportionate)



Effects of supplemental oxygen administration on coronary blood flow in patients undergoing cardiac catheterization

Patrick H. McNulty,[1] Nicholas King,[1] Sofia Scott,[1] Gretchen Hartman,[1] Jennifer McCann,[1] Mark Kozak,[1] Charles E. Chambers,[1] Laurence M. Demers,[2] and Lawrence I. Sinoway[1]

Departments of [1]Medicine and [2]Pathology, Pennsylvania State College of Medicine, Milton S. Hershey Medical Center, Hershey, Pennsylvania

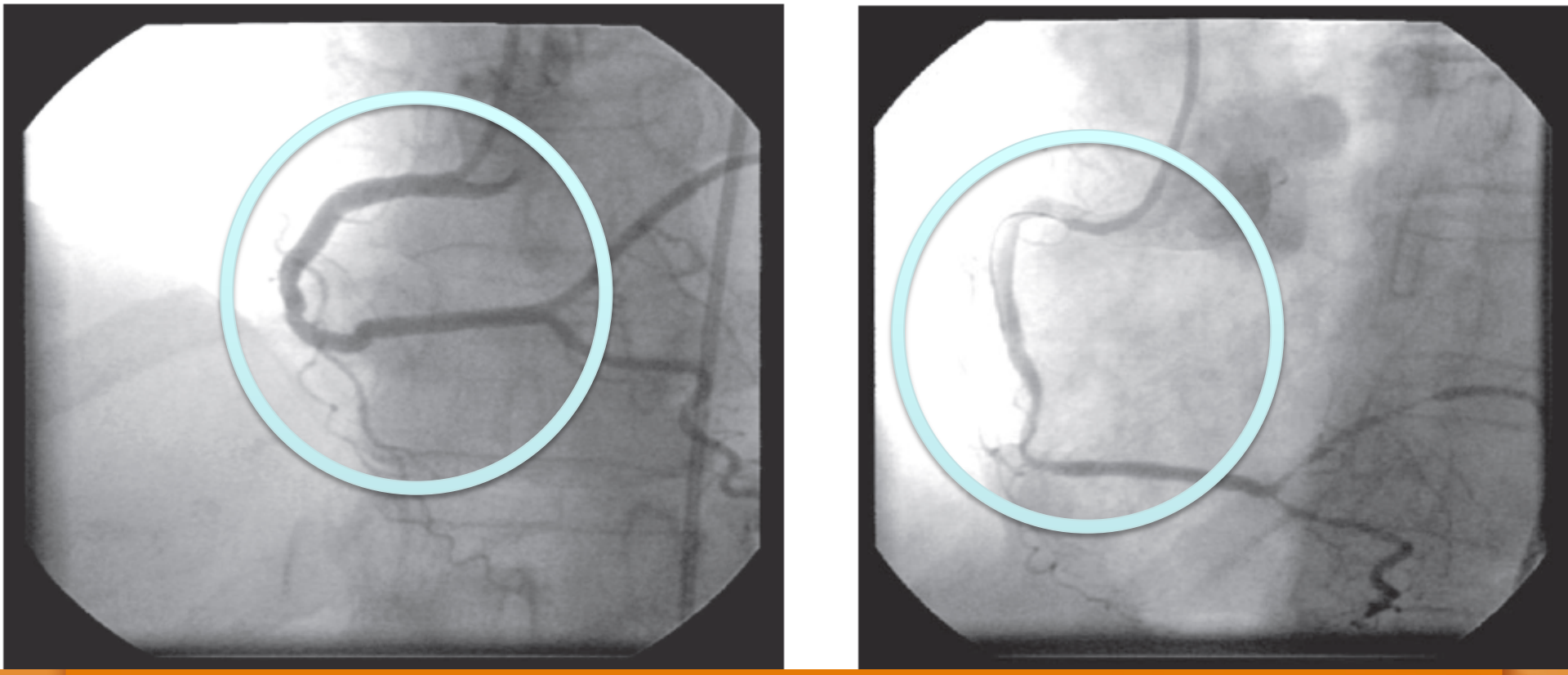
Submitted 23 June 2004; accepted in final form 5 October 2004

Within 5 minutes of 100% O_2 (vs. RA):

- ↑ coronary resistance ~ 40%
- ↓ coronary blood flow (CBF) ~ 30%
- Blunted Coronary Blood Flow response to Ach
- Marked ↓ NO

McNulty PH, et al. Effects of supplemental oxygen administration on coronary blood flow in patients undergoing cardiac catheterization. Am J Physiol Heart Circ Physiol. 2005; 288: H1057-H1062.

Right Coronary Catheterization



McNulty PH, et al. Effects of supplemental oxygen administration on coronary blood flow in patients undergoing cardiac catheterization. Am J Physiol Heart Circ Physiol. 2005; 288: H1057-H1062.

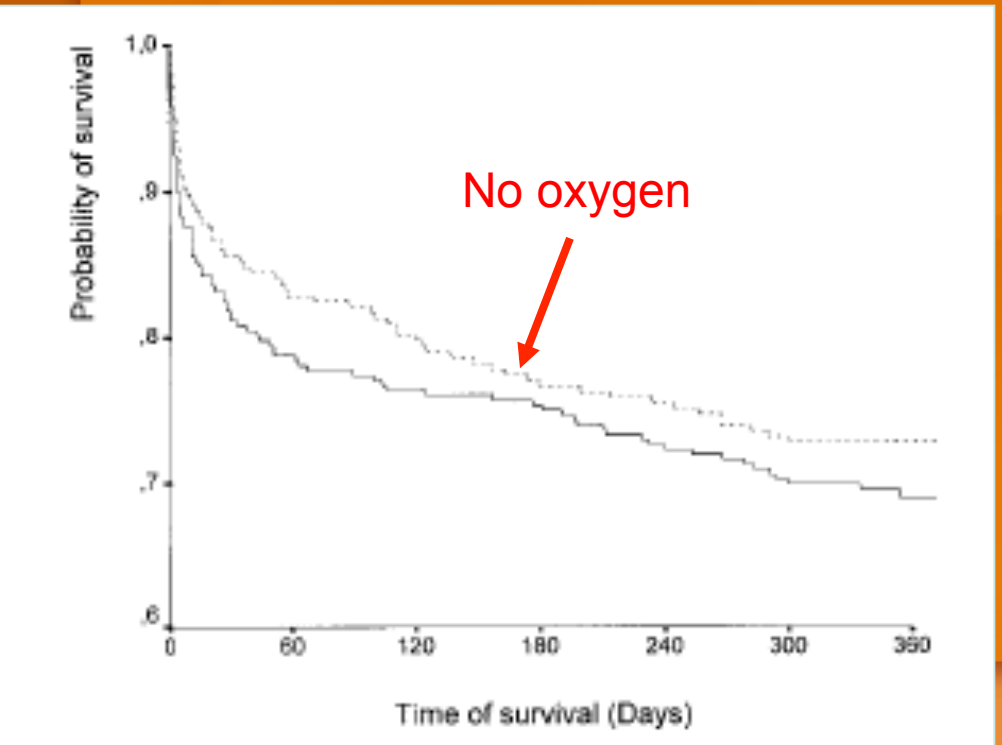
Cardiac Arrest Survival Vanderbuilt Univ – TH post ROSC

- 170 patients - highest PaO_2 during 24° TH (32-34°C):
  - Survivors had significantly lower PaO_2 (198) vs non-survivors (254)
  - Higher PaO_2 ↑ risk death (OR 1.439)
  - Favorable neuro outcomes (CPC 1-2) also linked to lower PaO_2
  - Higher PaO_2 ↓ neuro outcomes (OR 1.485)

Janz et al. Hyperoxia is associated with increased mortality in patients treated with mild therapeutic hypothermia after sudden cardiac arrest. Crit Care Med 2012; 40(12): 3135-3139.

Stroke

	Minor or Moderate Strokes		Severe Strokes	
Variable	Oxygen	Control	Oxygen	Control
Survival	81.8%	90.7%	53.4%	47.7%
SSS Score	54 (54-58)	57 (52-58)	47 (28-54)	47 (40-52)
Barthel Index	100 (95-100)	100 (95-100)	70 (32-90)	80 (47-95)



Ronning OM, Guldvog B. Should Stroke Victims Routinely Receive Supplemental Oxygen? A Quasi-Randomized Controlled Trial. *Stroke*. 1999;30:2033-2037.

Stroke

- "Supplemental oxygen should not routinely be given to non-hypoxic stroke victims with minor to moderate strokes." - AHA 1994
- "Further evidence is needed to give conclusive advice concerning oxygen supplementation for patients with severe strokes."

Ronning OM, Guldvog B. Should Stroke Victims Routinely Receive Supplemental Oxygen? A Quasi-Randomized Controlled Trial. *Stroke*. 1999;30:2033-2037.

BMJ

RESEARCH

Effect of high flow oxygen on mortality in chronic obstructive pulmonary disease patients in prehospital setting: randomised controlled trial

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ABSTRACT

Objectives To compare standard high flow oxygen treatment with titrated oxygen treatment for patients with an acute exacerbation of chronic obstructive pulmonary disease in the prehospital setting.

Design Cluster randomised controlled parallel group trial.

Setting Ambulance service in Hobart, Tasmania, Australia.

pressure −33.6 (16.3) mm Hg; P=0.02; n=29) than were patients who received high flow oxygen.

Conclusions Titrated oxygen treatment significantly reduced mortality, hypercapnia, and respiratory acidosis compared with high flow oxygen in acute exacerbations of chronic obstructive pulmonary disease. These results provide strong evidence to recommend the routine use of titrated oxygen treatment in patients with breathlessness

BMJ

RESEARCH

405 diff breathers randomized:

- NRBM (n=226)
- NC to SpO_2 88-92% (n=179)

Titrated O_2 reduced mortality:

- all patients 58%
- COPD patients 78%

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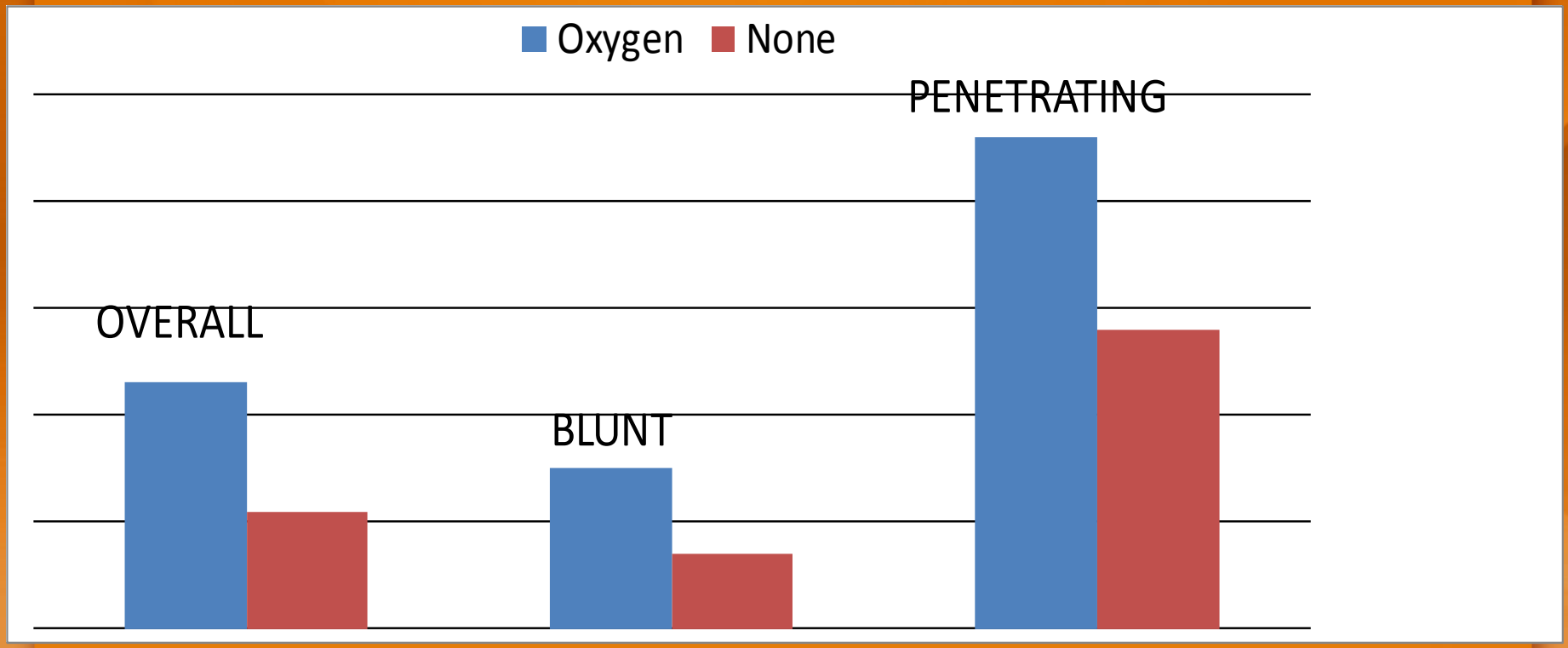
Trauma Mortality

- Charity Hospital (1/1➔9/30/2002):
- 5,549 trauma patients by EMS



Stockinger ZT, McSwain NE. Prehospital Supplemental Oxygen in Trauma Patients: Its Efficacy and Implications for Military Medical Care. *Mil Med*. 2004;169:609-612.

Neonates

- 1,737 depressed neonates:
  - 881 resuscitated with room air
  - 856 resuscitated with 100% oxygen
- Mortality:
  - Room air resuscitation: 8.0%
  - 100% oxygen resuscitation: 13.0%
- Room air superior to 100% oxygen for initial resuscitation

Rabi Y, Rabi D, Yee W: Room air resuscitation of the depressed newborn: a systematic review and meta-analysis. *Resuscitation* 72:353-363, 2007

Davis PG, Tan A, O'Donnell CP, et al: Resuscitation of newborn infants with 100% oxygen or air: a systematic review and meta-analysis. *Lancet* 364:1329-1333, 2004

Oxygen Therapy Summary

AHA 2010 Guidelines: 94-98%

Collaborative Oxygen Protocol:

maintain > 95%

- Routine administration can be harmful (oximetry 1st)
- Hyperoxia may decrease target organ perfusion (when given needlessly) – use lowest level possible

Wijesinghe M, Perrin K, Ranchord A, Simmonds M, Weatherall M, Beasley R. Routine use of oxygen in the treatment of myocardial infarction: systematic review. Heart. 2009;95:198–202.

True and Trusted!

40% at 6 LPM

Mission Critical