VANDERBILT UNIVERSITY
MEDICAL CENTER

Oxygen Therapy in Sideline Emergencies

R. Warne Fitch, MD
Associate Professor Emergency Medicine
Associate Professor Orthopedics
Vanderbilt Head Team Physician

February 19, 2023

VANDERBILT SPORTS MEDICINE

- I have no financial disclosures

Oxygen

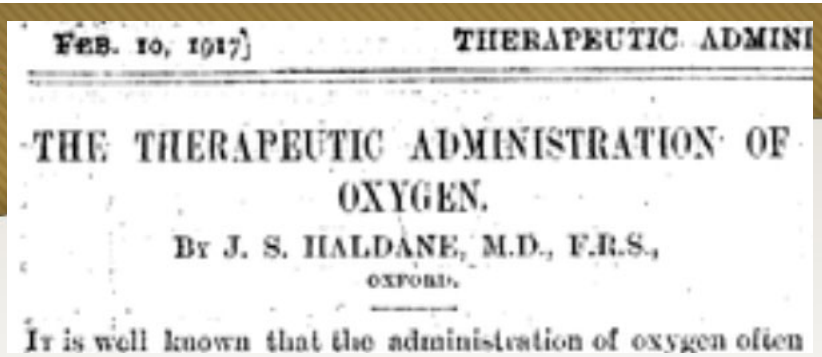
- Bottom line: We need oxygen to survive
- Required for normal cellular metabolism
- Without oxygen brain damage begins after only 4 min and death can occurs within 10 min

VANDERBILT UNIVERSITY MEDICAL CENTER

What is Oxygen Therapy?

- Use of supplemental oxygen as medical treatment
- Room Air 21% FiO_2
- Oxygen therapy can increase FiO_2 to 100%

VANDERBILT UNIVERSITY MEDICAL CENTER


Feb. 10, 1917.] THERAPEUTIC ADMINI

THE THERAPEUTIC ADMINISTRATION OF OXYGEN.

By J. S. HALDANE, M.D., F.R.S., Oxford.

It is well known that the administration of oxygen often

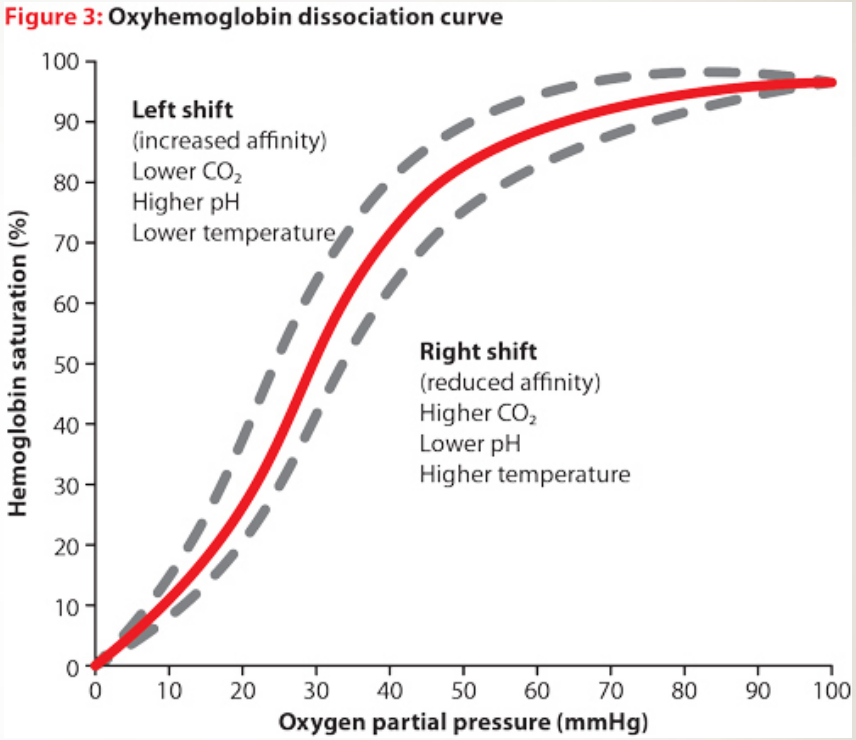
- 1890 used by Dr. Blodgett for pneumonia pt
- 1917 Dr.Haldane published landmark article
- Most common hospital treatment in the developed world
- Acute indication is hypoxemia
  - low blood oxygen levels
    - SaO2 (ABG)
    - SpO2 noninvasive (pulse ox)

Pulse Oximeter

- Portable device used to measure O2 Saturation
- Measures the amount of light absorbed by oxygen carrying hemoglobin in the red blood cells SpO2

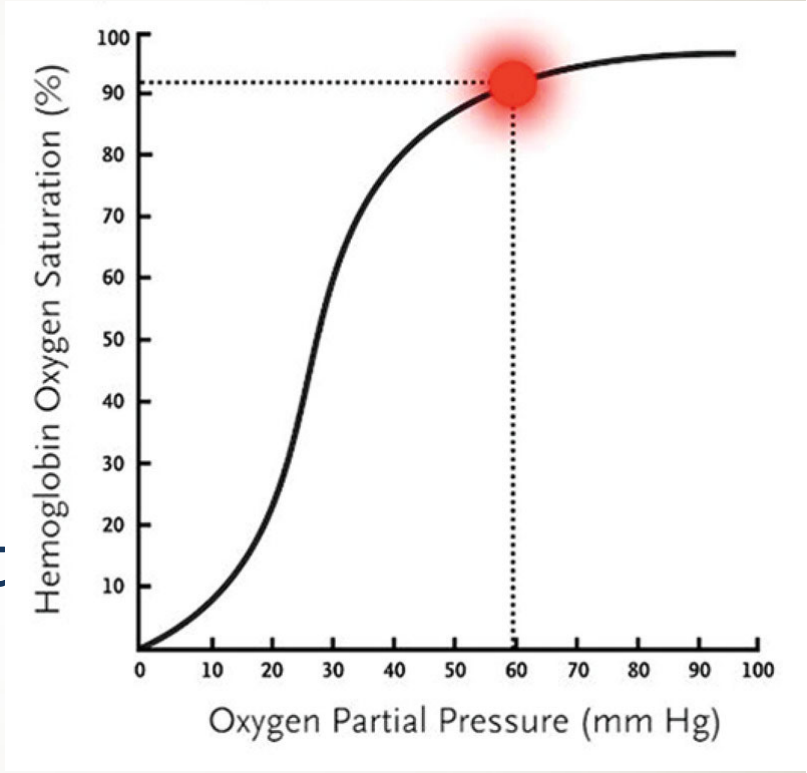
Oxyhemoglobin Dissociation Curve

- O2 transported bound to Hgb
- Defines the point oxygen can be released from hemoglobin to be used by cells



Oxygen-Hemoglobin Dissociation Curve

- PaO2 > 60mmHg O2 sat does not change much
- PaO2< 60mmHg slope of curve becomes steeper reflecting sharp decrease in O2 saturation and insufficient delivery to tissues



Causes of Hypoxemia

- Several factors needed to continuously supply cells and tissues in body with O2
- Must be enough O2 in air you are breathing
- Lungs must be able to inhale O2 and exhale CO2
- Must be able to circulate oxygenated blood from lungs to tissues

Hypoxemia Causes

- Ventilation-Perfusion (V/Q) mismatch
- Diffusion Impairment
- Hypoventilation
- Low environmental oxygen
- Right to left shunting

VANDERBILT UNIVERSITY MEDICAL CENTER

Hypoxemia Signs and Symptoms

- Tachypnea
- Tachycardia
- Cyanosis
- Grunting
- Nasal flaring
- Retractions
- Wheezing
- Stridor

- Confusion/AMS
- Dizzyness
- Chest pain
- Diaphoresis

VANDERBILT SPORTS MEDICINE

Signs of impending respiratory failure

- Altered mental status
- 2-3 word sentences
- Severe dyspnea
- Cyanosis
- Low respiratory rate, volume, fatigue

VANDERBILT UNIVERSITY
MEDICAL CENTER

What do we need to provide Oxygen Therapy?

VANDERBILT UNIVERSITY MEDICAL CENTER

Equipment needed

- Portable O2 tanks
- Oxygen regulator
- Key
- Flow meter
- Connector tree
- Tubing
- A delivery device

Portable O2 Tanks

- Several different sizes
- Want convenience of portability, but higher flow rates will deplete the tanks quickly

O2 regulator

- Check parts and pressure routinely pre/post use

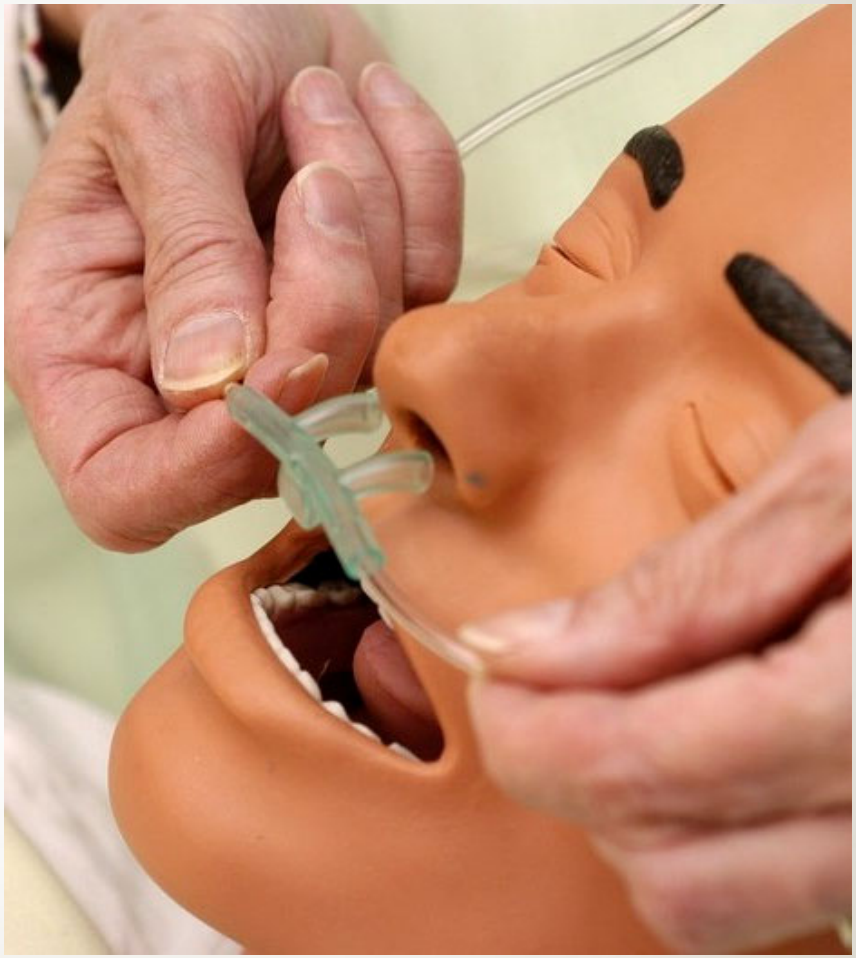
VANDERBILT UNIVERSITY
MEDICAL CENTER

Delivery Devices

VANDERBILT SPORTS MEDICINE

Nasal Cannula

- Simple
- Flow rate 1-6 L/min
- FiO2 levels 24-44%
- Can be considered in awake, more stable pts
- Advantages:
  - easy to use, pt can talk
- Disadvantages:
  - Not as effective if blocked nostrils, mouth breathing



VANDERBILT UNIVERSITY MEDICAL CENTER

Simple facemask

- Fits over mouth and nose
- Contains exhalation ports through which patient exhales CO2
- Flow minimum 6-10L
- Provides moderate O2 concentrations FiO2 35-50%

VANDERBILT SPORTS MEDICINE

VANDERBILT UNIVERSITY MEDICAL CENTER

Non-rebreather facemask

- Mask attached to a reservoir bag
- Series of one-way valves on exhalation ports
- Patient breathes in through reservoir bag and exhales CO_2 out exhalation ports
- Flow rate 10-15L/min
- Delivers 60-80% FiO_2

VANDERBILT SPORTS MEDICINE

VANDERBILT UNIVERSITY MEDICAL CENTER

Monitor Your Treatment

- Pulse Ox
- Waveform
- Patient:
  - Comfort
  - Symptoms
  - Vitals

Indication for Use of Airway Management

1. Failure to oxygenate
2. Failure to ventilate
3. Failure to maintain a patent airway

VANDERBILT UNIVERSITY MEDICAL CENTER

Bag Valve Mask

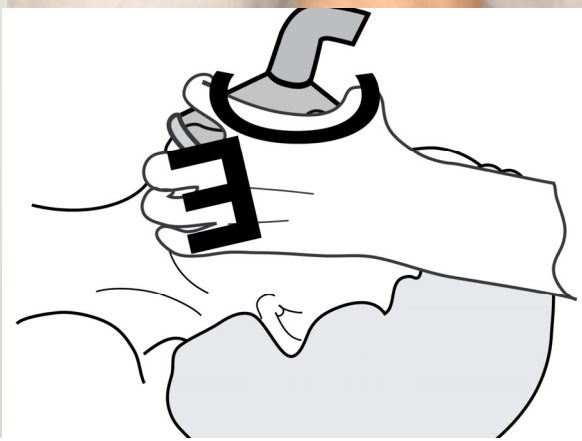
- Used in emergency situations for respiratory arrest or respiratory failure
- Assists with ventilation and oxygenation
- Can be attached to O2 source
- At 15L/min provided FiO2 100%

VANDERBILT SPORTS MEDICINE

VANDERBILT UNIVERSITY MEDICAL CENTER

Bag Valve Mask

Single Rescuer



Two Rescuer

Figure 2. The two-handed C-E technique.

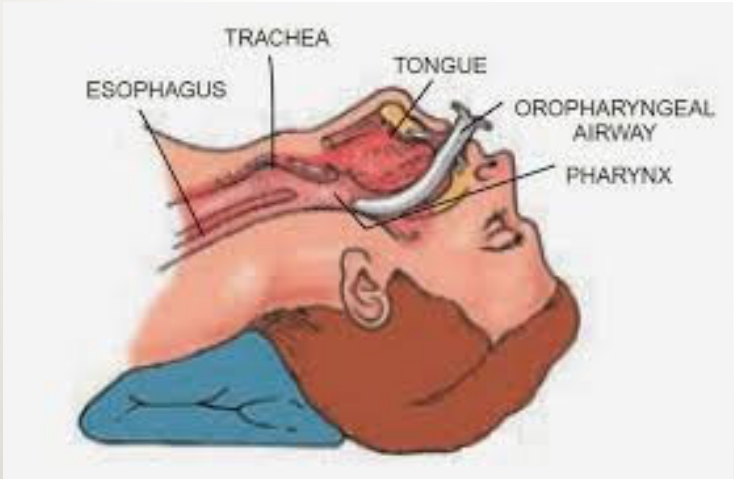
Airway Adjuncts

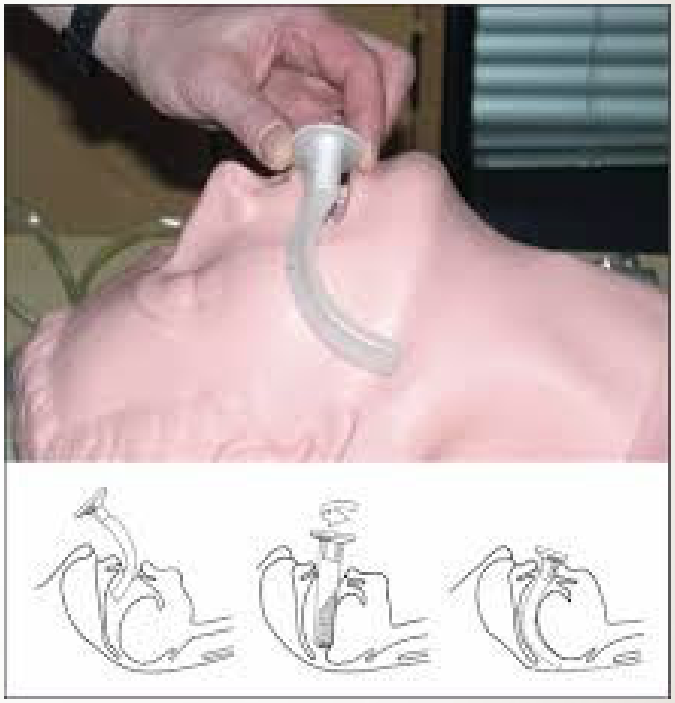
Nasal pharyngeal

- Inserted into nasal passage down into posterior pharynx
- Helps minimize tongue obstruction
- Can be used in awake patient
- Should not be used in facial trauma

Airway Adjuncts

- Oropharyngeal Airway
- Helps keep tongue out of the way
- Patient cannot have a gag reflex





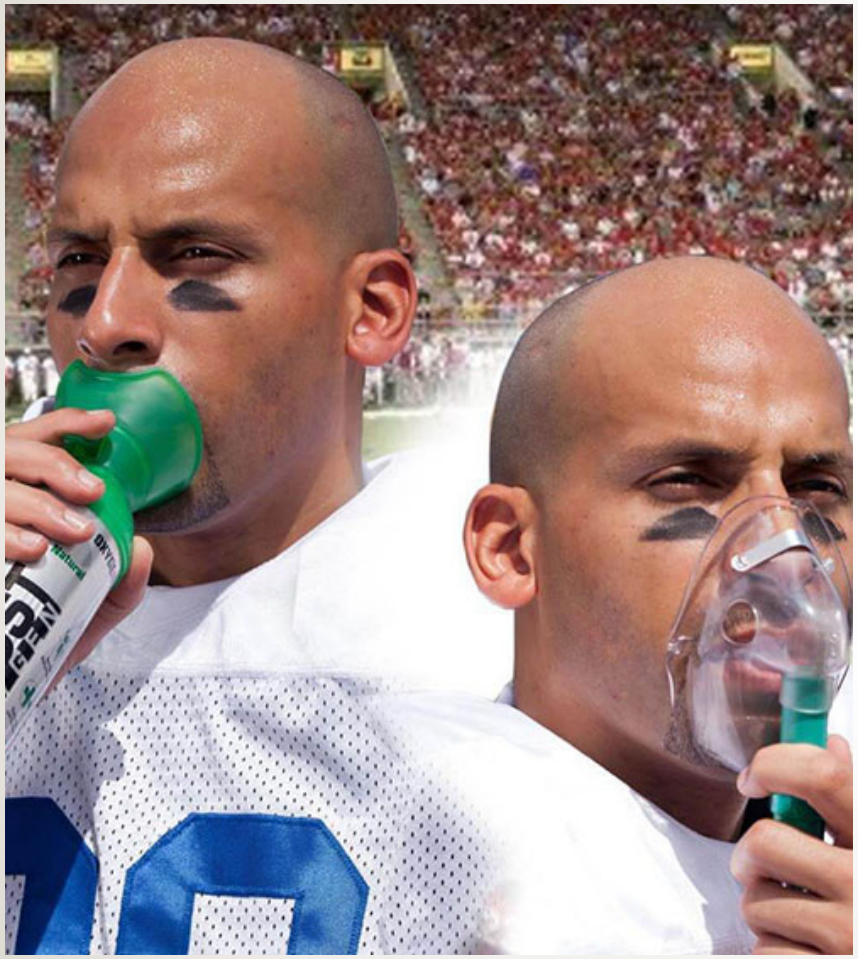
Suction

- Should be large bore Yankauer
- Battery powered
- Worth having a backup
  - Suction and battery

VANDERBILT UNIVERSITY
MEDICAL CENTER

Scenarios

Tired Athletes



- Limited data
- Several studies show no benefit
- Few studies show may increase time to exhaustion
- May decrease recovery to normal O2 saturation 49 sec to 36 sec in rowers

VANDERBILT UNIVERSITY MEDICAL CENTER

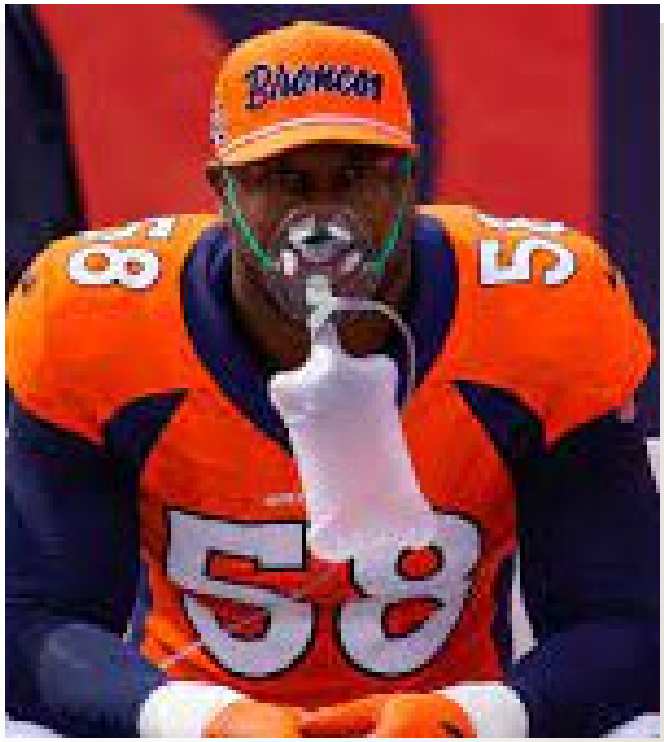
Athletes at High Altitude

Morteza Khodaee, MD, MPH,*† Heather L. Grothe, MD,† Jonathan H. Seyfert, MD,† and Karin VanBaak, MD†

Blood Oxygen Saturation By Altitude

Altitude (feet)	Arterial O_2 Saturation Without Supplemental O_2	Atmospheric Pressure (mmHg)
0	96%	760
5,000	95%	632
7,500	93%	575
10,000	89%	523
12,500	87%	474
14,000	83%	446
16,500	77%	403
20,000	65%	349
25,000	Below 60%	282

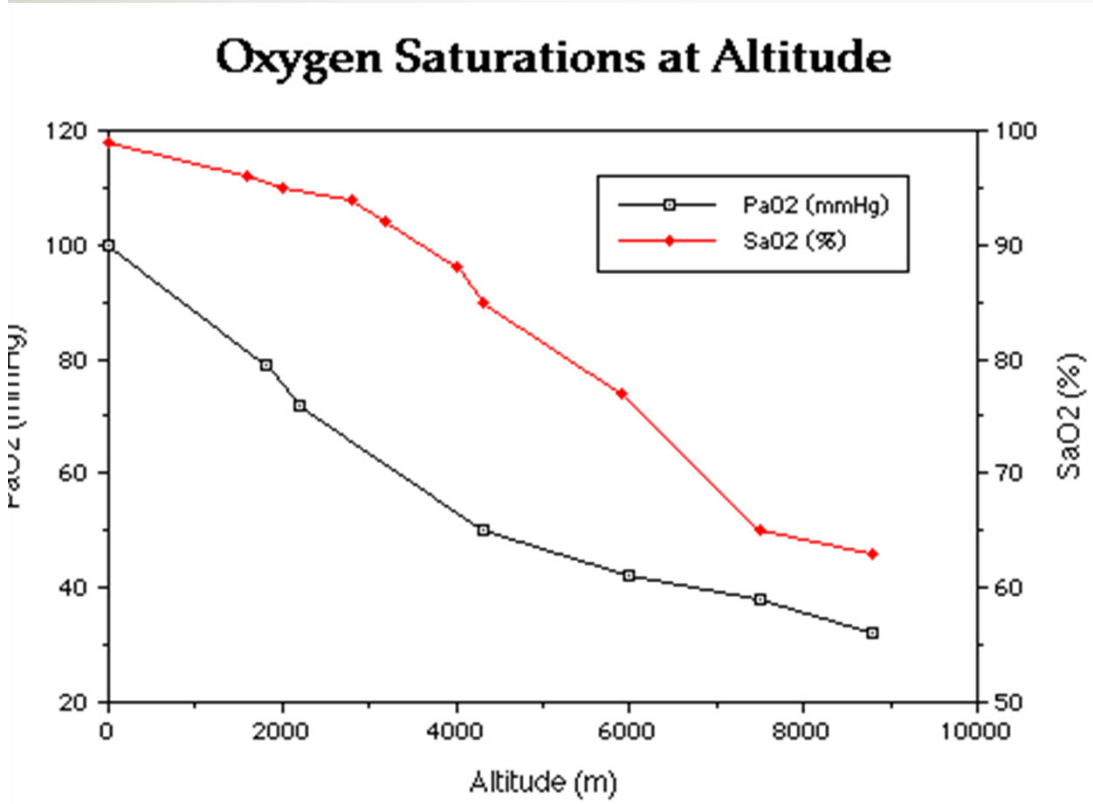
"The Pilot: An Air Breathing Mammal," Mehler, Stanley R. MD, Human Factors Bulletin, Flight Safety Foundation, 1981.

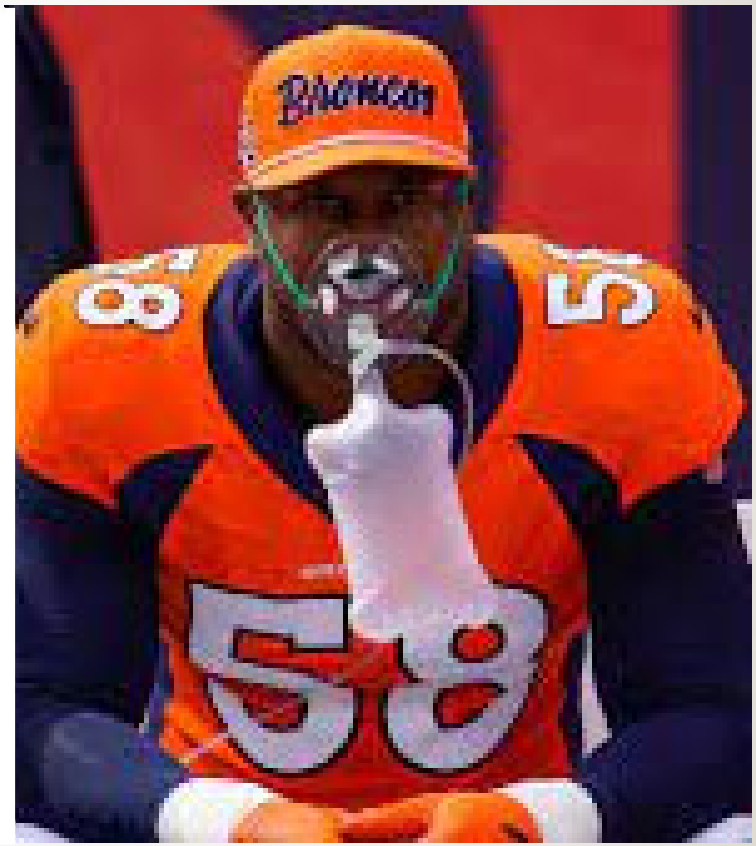


VANDERBILT UNIVERSITY MEDICAL CENTER

Athletes at High Altitude

Morteza Khodaee, MD, MPH,*† Heather L. Grothe, MD,† Jonathan H. Seyfert, MD,† and Karin VanBaak, MD†



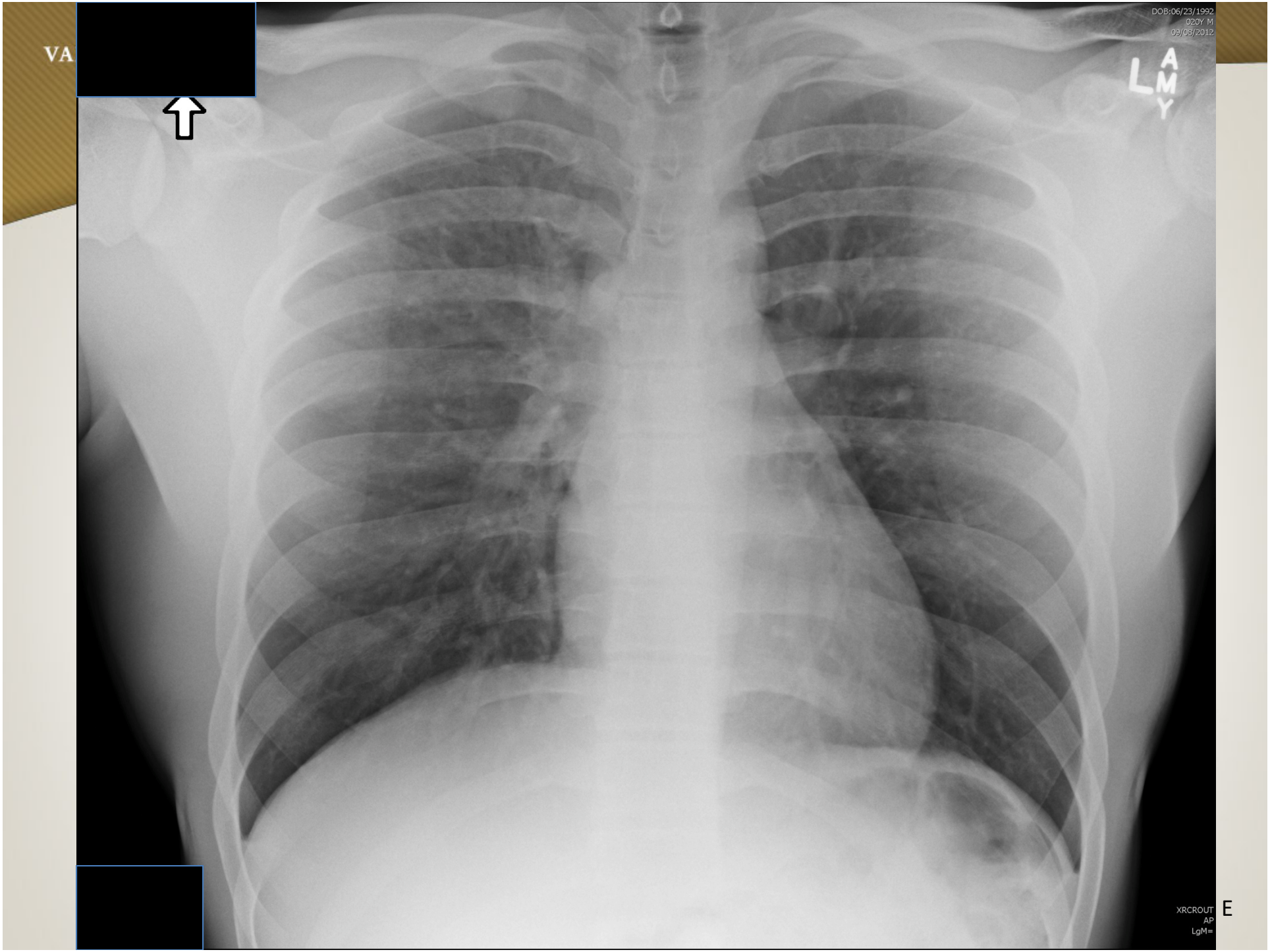


Sickle Trait Athletes

- Athletes with sickle cell trait can have cells sickle presenting with symptoms
- Risks include:
  - Strenuous exercise
  - Severe dehydration
  - High altitude
- Treatment: IVF, O2 supplementation

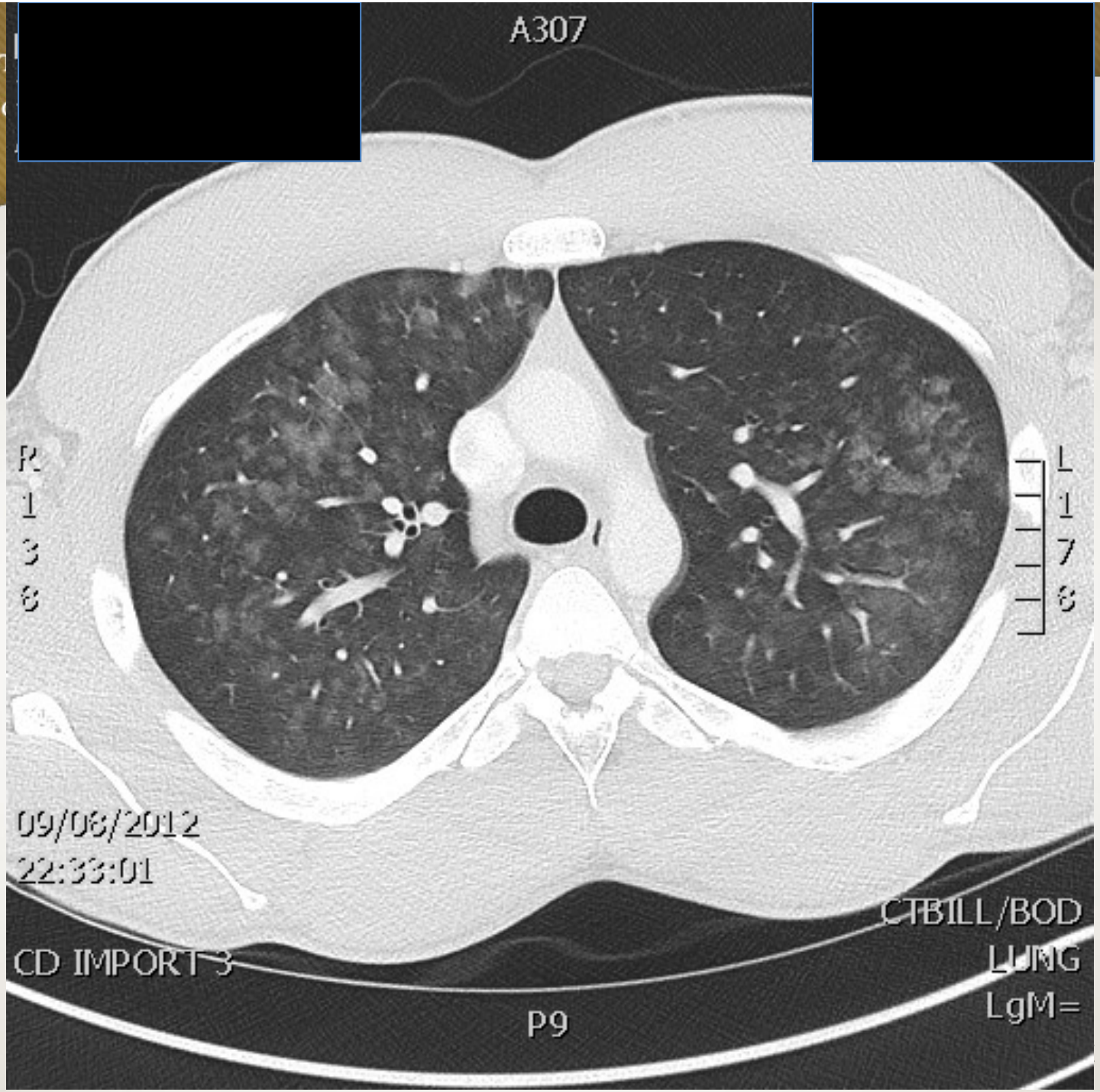
Northwestern vs Vanderbilt

- 4th quarter
- 20 yo health FB player falls after missed tackle and coughs up blood
- c/o SOB
- Multiple rounds of hemoptysis
- Pulse Ox 92%


VA
DOB:06/23/1992
020Y M
09/08/2012
L A M Y
XRCROUT
AP
LgM=

VANDERBILT

MEDI



DICINE

VANDERBILT UNIVERSITY MEDICAL CENTER

Cardiac Arrest

- Get on the chest!
- Minimize time off compressions!
- BLS/ACLS
  - 30:2 with BVM 15L/min
  - Some discussion about compression only CPR…
- If advanced supraglottic or ETT in place
  - 10 breaths/min with continuous chest compressions
  - FiO2 100%

Summary

- Oxygen therapy is a critical treatment in emergencies
- Oxygen equipment should be available including monitoring devices
- Medical staff should practice delivery set up and options with EAP training
- There are no absolute contraindications for administration of supplemental oxygen