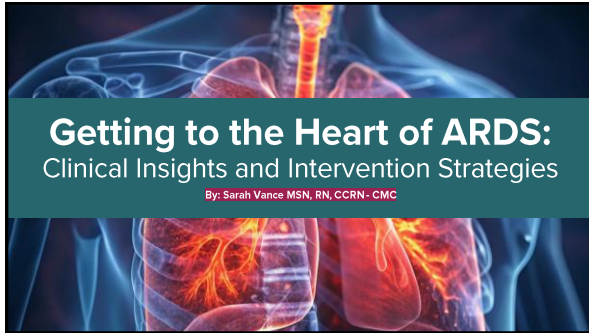




1

Objectives

- Describe the pathophysiology of ARDS and its impact on pulmonary and cardiac function.
- Identify early clinical signs and diagnostic indicators of ARDS.
- Explain evidence-based clinical strategies to optimize respiratory support while minimizing complications.
- Discuss key nursing responsibilities and considerations in the assessment, monitoring, and interdisciplinary management of patients with ARDS.

2

Acute Respiratory Distress Syndrome (ARDS)

"Acute, diffuse, inflammatory form of lung injury associated with a variety of etiologies."

- Acute onset
- Noncardiogenic pulmonary edema
- Refractory hypoxemia
- Non-compliant or "stiff" lungs
- Intrapulmonary shunting

3

ARDS Causes



Direct vs. Indirect

- 1 Pneumonia
- Sepsis
- Aspiration pneumonitis
- Pulmonary contusion

4

ARDS Causes

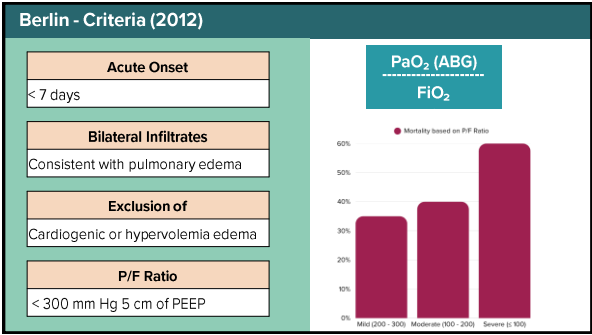
What are other causes of acute respiratory distress syndrome (ARDS)?

5

ARDS Causes

DIRECT	VS	INDIRECT
- Pneumonia - Viral, bacterial, fungal - Aspiration - Chest trauma - Near-drowning - Pulmonary edema - Inhalation of toxic gases/vapors - Pneumonitis - Radiation - Pulmonary embolism - Fat, amniotic - Pulmonary contusion		- Sepsis - Shock or prolonged hypotension - Multisystem trauma - Blood transfusions - Burns - Cardiopulmonary bypass - Disseminated intravascular coagulopathy (DIC) - Acute pancreatitis - Diabetic coma - CNS injury - Drug overdose - Abdominal trauma

6



7

Knowledge Check

Your patient's ABG is the following on 60% FiO₂:

7.49 / PaCO₂ 30 / PaO₂ 72 / HCO₃ 25

1. What is the ABG interpretation?
2. What is the P/F ratio?

PaO₂ (ABG)
FiO₂ (decimal)

Mild:

- P/F ratio 200 - 300

Moderate:

- P/F ratio 100 - 200

Severe:

- P/F ratio ≤ 100

8

The Global Definition

Criteria for Specific ARDS Categories related to Oxygenation status

• If ABG not available can use SpO₂ : FiO₂ as surrogate as long as SpO₂ has adequate waveform and value is < 97%

Nonintubated ARDS	Intubated ARDS	Limited Resources
• P/F ratio < 300 mm Hg • SpO₂ : FiO₂ < 315 on: ▪ HFNC with > 30 L/min ▪ or NIPPV/CPAP with PEEP > 5 cm H₂O	• Severity based on P/F ratio on at least PEEP of 5 cm H₂O. • Mild: ◦ P/F ratio 200 - 300 ◦ SpO₂ : FiO₂ 235 - 315 • Moderate: ◦ P/F ratio 100 - 200 ◦ SpO₂ : FiO₂ 200 - 235 • Severe: ◦ P/F ratio ≤ 100 ◦ SpO₂ : FiO₂ 100 - 148	• SpO₂ : FiO₂ < 315 PEEP nor minimum flow rate of O₂ is needed for the diagnosis in a resource-limited settings.

9

Pathophysiology



 **Direct pulmonary or indirect extrapulmonary insult**

- 1 Exudative phase:** 7 - 10 days
- 2 Proliferative phase:** 10 days to 2 - 3 weeks
- 3 Fibrotic phase:** > 3 - 4 weeks

10

Pathophysiology

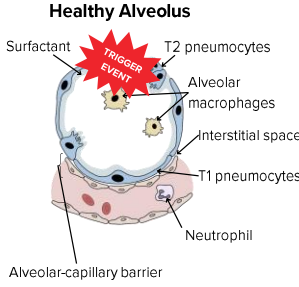
Type 1 pneumocytes:

- Gas exchange

Type 2 pneumocytes:

- Produce surfactant
- Epithelial repair
- "Defenders"
- Mobilize alveolar fluid

Healthy Alveolus

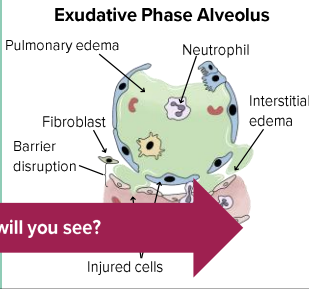


11

Pathophysiology

- Diffuse alveolar damage
- Reduced lung compliance
- Intrapulmonary shunting
- Refractory hypoxemia
- Pulmonary hypertension

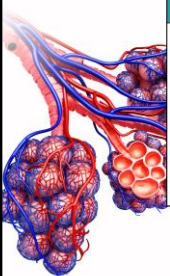
Exudative Phase Alveolus



What clinical s/s will you see?

12

Clinical Sign and Symptoms



Early	Late
• Tachycardia • Tachypnea • Hypoxemia • Dyspnea • $\uparrow$ PaCO₂ • Anxiety, agitation • Clear lungs	• Cyanosis • Tachycardia • Tachypnea/bradypnea • Refractory hypoxemia • $\uparrow$ PaCO₂ • Obtunded, comatose • Bilateral rales • $\uparrow$Pplat / Ppeak • Ventilator dyssynchrony • Right heart failure

13

Overall Management of ARDS



Overall goals:

- Reduce shunt fraction
- Increase O₂ delivery
- Decrease O₂ consumption
- **Avoid additional/further injury**

Treat underlying cause

14

Lung Protective Ventilation

Tidal Volume • 4 - 6 mL/kg x PBW	 Prevent volutrauma / barotrauma
Plateau Pressure (Pplat) • Pplat $\leq$ 30 cm H ₂ O	
Driving Pressure • Driving pressure < 15 cm H ₂ O	
Permissive Hypercapnia • pH 7.30 - 7.45 ; RR $\leq$ 35	

15

PEEP Titration (ARDSnet Protocol)

- Prevent atelectrauma & ↑ O₂ needs
- Limits O₂ toxicity
- **Goal:** PaO₂ 55 - 80 mmHg or SpO₂ 88 - 95%
- PEEP ≥ 12 associated with decreased mortality in patients with moderate-severe ARDS
- **WATCH HEMODYNAMICS!**

PEEP Titration:

FiO ₂	0.3	0.4	0.5	0.5 - 0.8	0.8	0.9	1.0
PEEP	5 - 14	14 - 16	16 - 18	20	22	22	24

Chart adapted from ARDSnet Study, JACO.org

16

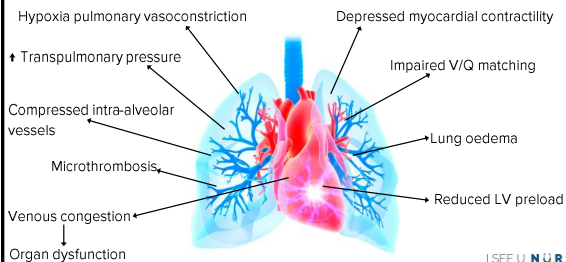
ARDS Management

- **Avoid fluid overload**
 - Dynamic measurements
 - CRRT?
 - Diuretics
- **Steroids**
 - Within 14 days of moderate to severe ARDS
- **Monitor right heart involvement**
 - May need + inotropes



17

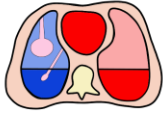
The Right Heart Dysfunction in ARDS



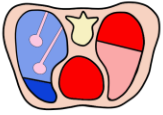
18

Prone Therapy

Supine



Prone



P/F ratio < 150 on FiO₂ ≥ 0.6 + PEEP ≥ 5 cm H₂O

- Redistributes pressure within the thorax.
- Greater expansion of dorsal lung fields.
- Increased alveoli recruitments.
- Improved V/Q mismatching
- Improvement in secretion drainage.

19

PROSEVA trial

28-Day Mortality

Supine: 32.8%	Supine: 41%
Prone: 16%	Prone: 23.6%

Multicenter, prospective, RCT

466 adults with severe ARDS

≥ 16 hours prone vs supine

Initiated within ~ 36 hrs onset

THE NEW ENGLAND JOURNAL OF MEDICINE
Prone Positioning in Severe Acute Respiratory Distress Syndrome
Gao X, et al. N Engl J Med. 2018;378:1301-1311.

I SEE U NURSE
WITH REASON RATION

20

The Four P's of Prone Positioning

- 1 Prepare**
- 2 Protect**
- 3 Position**
- 4 Post**

Absolute Contraindications

- Neck or spinal trauma & instability.
- ICP >30 mmHg or CPP <60 mmHg
- Multiple fractures or traumas (unstable pelvis, femur, face)
- Acute shock
- Anterior → burns / chest tubes / open wounds
- Recent tracheal surgery or sternotomy within 2 weeks

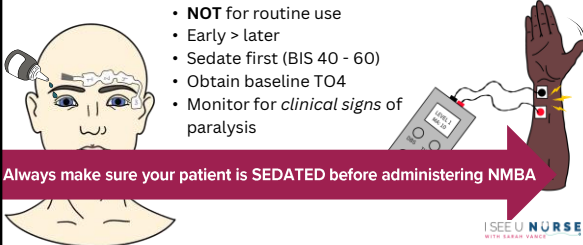
21

Neuromuscular Blocking Agents

P/F ratio < 100; refractory vent dyssynchrony

- **NOT** for routine use
- Early > later
- Sedate first (BIS 40 - 60)
- Obtain baseline TO4
- Monitor for *clinical signs* of paralysis

Always make sure your patient is **SEDATED** before administering NMBA



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WITH MY EYES

22

Advanced Modes of Invasive Mechanical Ventilation

BiLevel / APRV / Bi-Vent



- Rescue modes of ventilation
- Inverse I:E ratio
- **Spontaneous breathing**
- **Monitor Vt & MVe**
- P high with T high →
 - Recruit alveoli
- P low with T low →
 - Ventilation

23

Inhaled Pulmonary Vasodilators

Nitric Oxide (iNO) / epoprostenol (Velitri)

- **Not** shown to reduce mortality/morbidity
- *IF* response → usually within 24 hrs
 - P/F ratio improved by 10-20%
- Wean medication **SLOWLY**
- Do not abruptly discontinue
- Monitor for rebound pulmonary HTN



24

V-V ECMO



Veno-Venous Extracorporeal Membrane Oxygenation

- Failed conventional management
- Contraindication to prone therapy
- Early → < 7 days in ARDS course
- Support oxygenation & manage CO₂
 - P/F ratio < 80 mmHg for > 6 hours
 - pH < 7.25 & PaCO₂ ≥ 60 mmHg for > 6 hours

25

Resources:

http://www.ardnet.org/files/ventilator_protocol_200807.pdf

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26

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27