The Management of the COVID-19 Patient with Respiratory Failure

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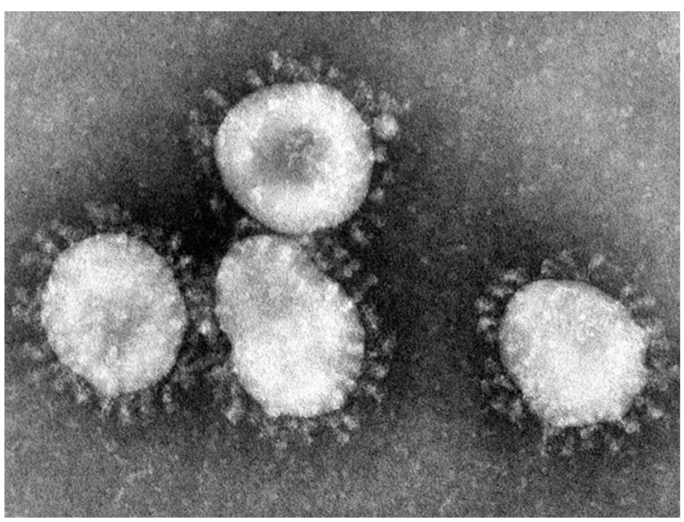
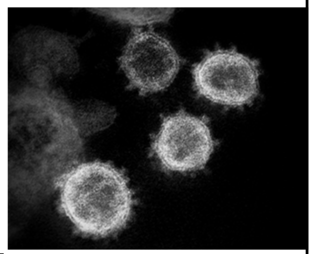


Coronaviruses

- Hosts: humans, other mammals, birds
- Frequent cause of the common cold
  - Accounts for 5-10% of adult URIs
- Typical symptoms: fever, cough, sore throat
- Can cause viral pneumonia or bronchitis
- Primarily occur in winter and early spring
- Spread by aerosol droplets and contact with secretions
- No effective vaccines or approved anti-virals
  - Investigational anti-virals available for compassionate use



Credit: NIAID-RML

COVID-19

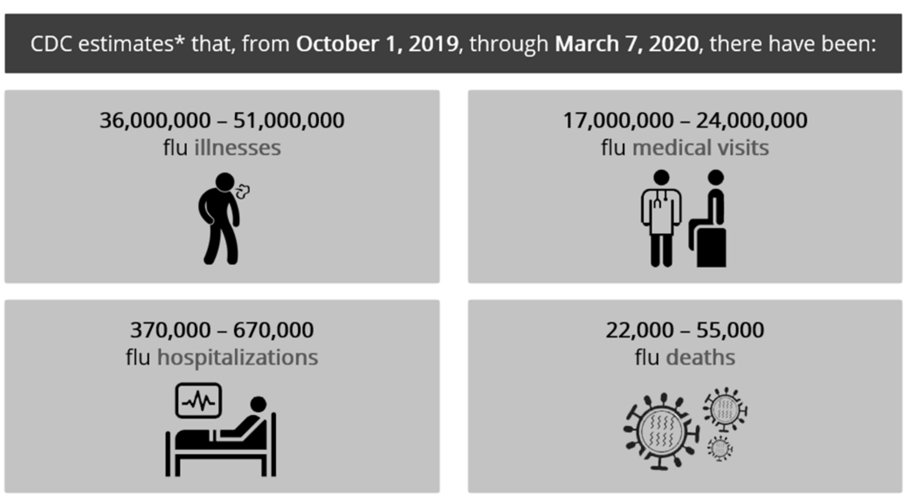
- Virus = SARS-CoV-2
- Originated in Wuhan, China November 2019
- Coronavirus strains causing severe illness:
  - SARS*
  - MERS*
  - COVID-19 *

*These strains do NOT present like the common cold and present with flu-like symptoms

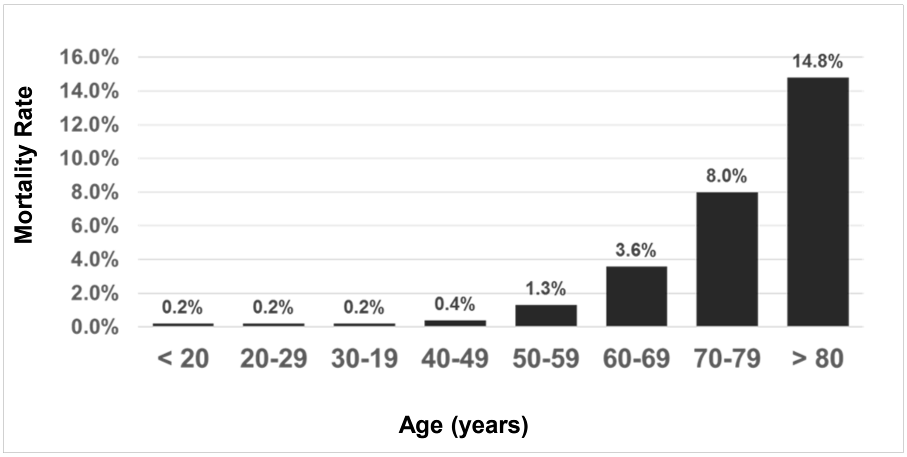
Mortality Rates Of Viral Outbreaks

- **1918 – 1919 Influenza 10%**
- **2002 – 2004 SARS 10%**
- **2014 – 2017 MERS 37%**
- **2019 – 2020 COVID-19 3.7%**

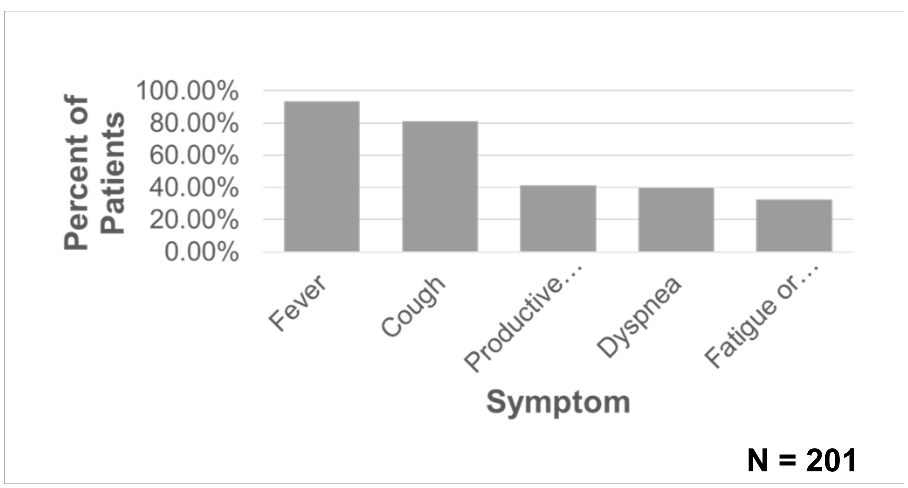
Influenza 2019-2020 Season



COVID-19 mortality by age

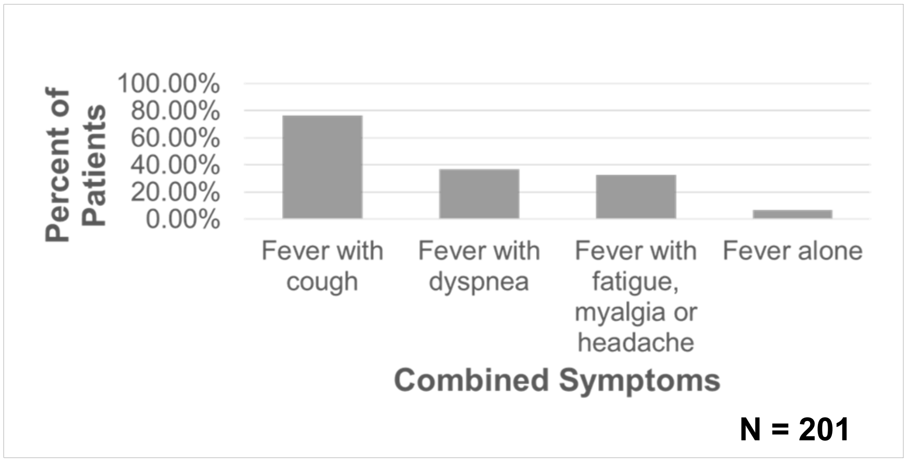


Common Presenting Symptoms



JAMA Intern Med. doi:10.1001/jamainternmed.2020.0994

Symptoms at Presentation



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Median Timeline of Disease Progression

Onset of Illness	7 days	8 days	9 days	10.5 days
	Hospital Admission	Dyspnea	ARDS	Mechanical Ventilation ICU Admission

Huang C et al Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506. doi: 10.1016/S0140-6736(20)30183-5

Risk Factors for Respiratory Failure: Wuhan Jinyintan Hospital, China

- **84 of 201 patients (42%) developed ARDS**
  - ✓ **44 of 84 patients (52%) died**
- **Average hospital stay – 13 days**
- **71% discharged (6.5% still hospitalized at time of writing)**

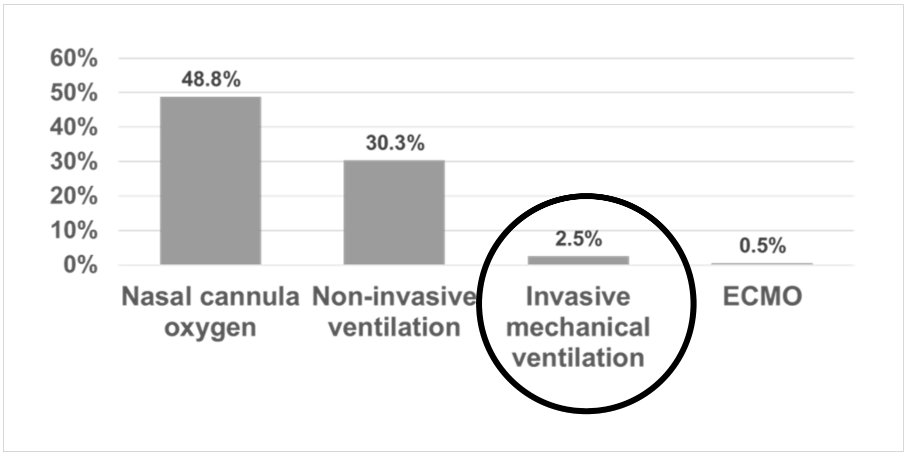
***JAMA Intern Med*. doi:10.1001/jamainternmed.2020.0994**

Risk Factor for Respiratory Failure: Wuhan Jinyintan Hospital, China

- **ARDS risk factors:**
  - **Older age**
  - **Neutrophilia**
  - **Elevated LDH or D-dimer**
- **High fever at presentation was a risk for ARDS but was also associated with a lower mortality**

***JAMA Intern Med*. doi:10.1001/jamainternmed.2020.0994**

Respiratory Management: Wuhan Jinyintan Hospital, China



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Clinical Characteristics of Hospitalized Patients: Zhongnan Hospital of Wuhan University, China

- 138 patients
  - 40 of these were healthcare workers
- Median age = 56 years
  - ICU median = 66 years
  - Non-ICU = 51 years
- Symptoms:
  - Fever (98.6%)
  - Fatigue (69.6%)
  - Cough (59.4%)
- Chest CT: bilateral patchy or ground glass infiltrates in all patients

JAMA 2020; 3231061-9

Clinical Characteristics of Hospitalized Patients: Zhongnan Hospital of Wuhan University, China

- 36 patients (26.1%) of patients required ICU care; of these:
  - ARDS (61.1%)
  - Arrhythmia (44.4%)
  - Shock (30.6%)
- Median time intervals:
  - Symptom onset to dyspnea: 5 days
  - Symptom onset to hospitalization: 7 days
  - Symptoms onset to ARDS: 8 days
- Average hospital stay = 10 days
- Average mortality = 4.3%

JAMA 2020; 3231061-9

Clinical Characteristics of Hospitalized Patients: Zhongnan Hospital of Wuhan University, China

- ICU respiratory management:
  - 11.1% heated high flow oxygen
  - 41.7% non-invasive ventilation
  - 47.2% intubation and mechanical ventilation
    - 4 of these switched to ECMO
- 36% of patients required vasopressors
- 2 patients required dialysis

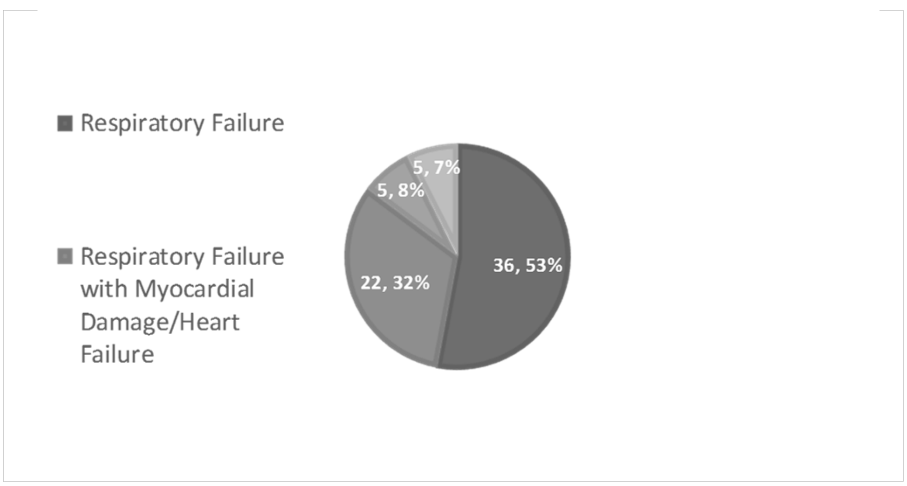
JAMA 2020; 3231061-9

Patients Needing ICU Care

- Older persons (mean age is about 60 years old)
- Co-morbid disease
  - Diabetes
  - Cardiac disease
  - Hypertension
- Most common reason for needing ICU = ARDS

JAMA. Published online March 11, 2020. doi:10.1001/jama.2020.3633

Cause of Death due to COVID



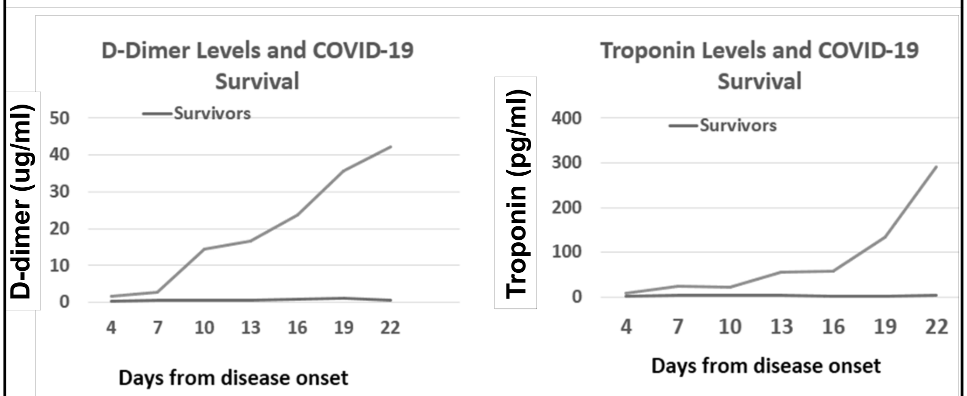
Ruan Q, Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China. Intensive Care Med. 2020 Mar 3. doi: 10.1007/s00134-020-05991-x. [Epub ahead of print]

Risks for mortality in COVID-19 infection

- Older age
- Co-morbidities
  - Hypertension
  - Diabetes
  - Heart disease
- Persistent lymphopenia
- Rising D-dimer
- Rising LDH
- Rising troponin

www.thelancet.com Published online March 9, 2020
https://doi.org/10.1016/S0140-6736(20)30566-3

Risks for mortality in COVID-19 infection



www.thelancet.com Published online March 9, 2020 https://doi.org/10.1016/S0140-6736(20)30566-3

ICU Utilization: Italian Lombardi ICU Network

Day 1 to Day 14: sharp and steady increase in ICU admissions

10% of all +COVID-19 patients required ICU admission (n=556/3420)

As of March 7, **16%** of hospital admissions required ICU admission (n=359/2217)

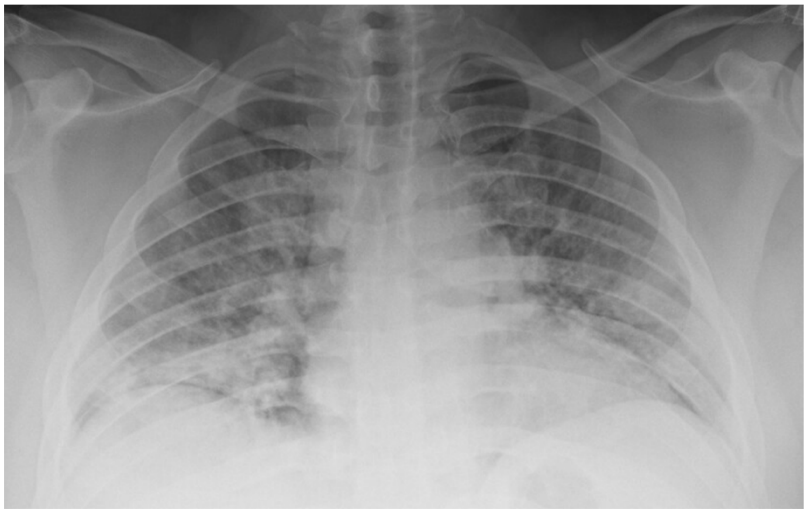
Grasselli, G et al. Critical Care Utilization for the COVID-19 Outbreak in Lombardy, Italy. JAMA. Published online March 13, 2020. doi:10.1001/jama.2020.4031

CT Findings In COVID

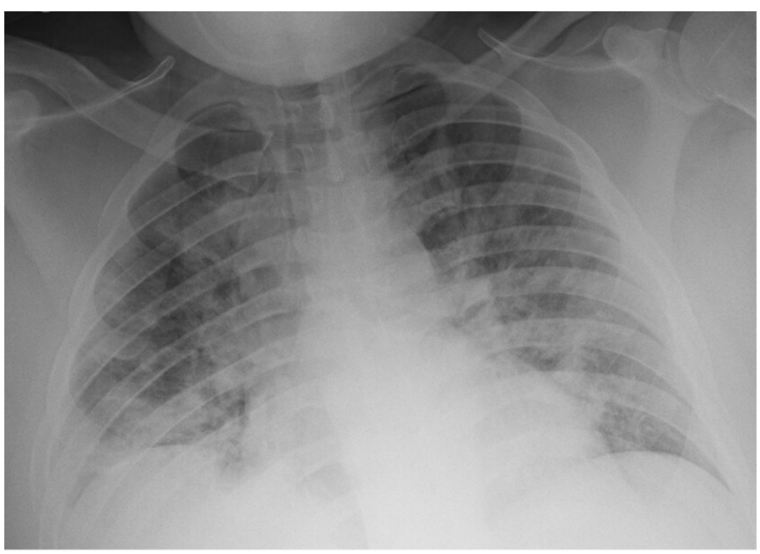
- **17 patients admitted to West China - Guang'an Hospital of Sichuan University**
  - **Average 4 days symptoms prior to admission**
- **Findings:**
  - **70% ground glass opacities**
  - **30% ground glass + consolidative opacities**
- **Location:**
  - **82% bilateral**
  - **18% unilateral**
- **88% had both upper & lower lobe involvement**
- **There were no**
  - **Pleural effusions**
  - **Tree-in-bud infiltrates**
  - **Cavities**

Zhang S, Li H, Huang S, et al. High-resolution CT features of 17 cases of Corona Virus Disease 2019 in Sichuan province, China. Eur Respir J 2020; in press (https://doi.org/10.1183/13993003.00334-2020)

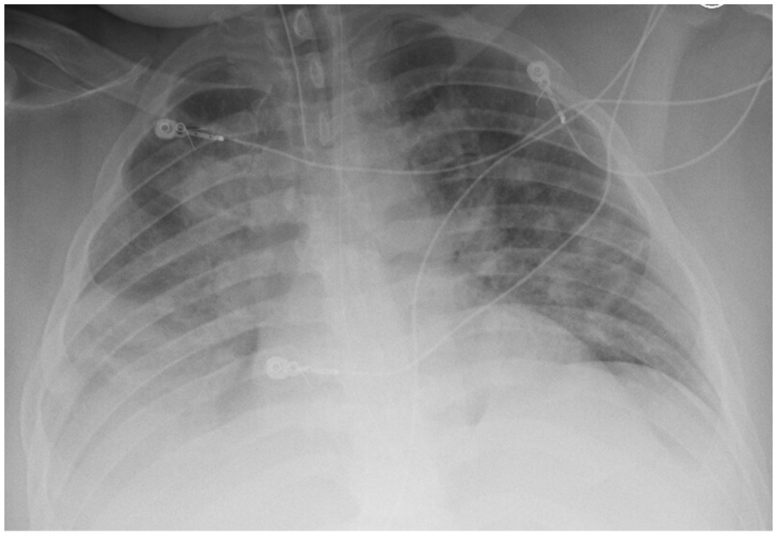
Day #1

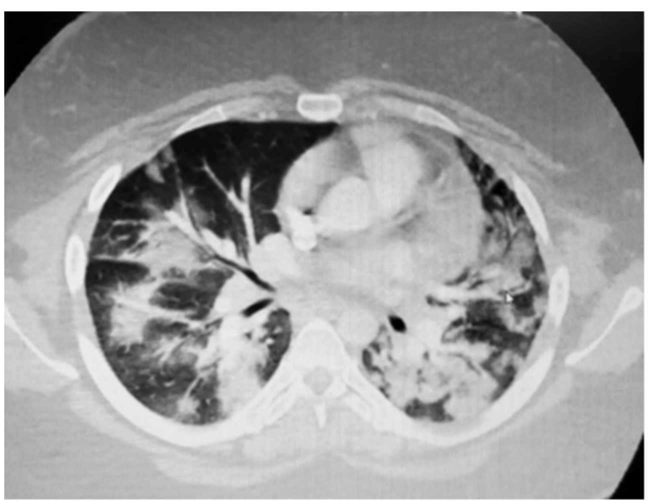


Day #2



Day #3





Management of Respiratory Failure in COVID19

- Certain procedures and therapies may result in aerosolization of the virus

- Consider avoiding
  - High flow nasal cannula (>6LPM O2)
  - Heated high flow nasal cannula
  - Non-Invasive Positive Pressure Ventilation (unless closed exhalation circuit)
  - Nebulizers, intrapulmonary percussive ventilation, percussive chest physiotherapy, and Metanebs
  - Bronchoscopy

Management of Respiratory Failure in COVID19

- If feasible, consider early intubation in patients requiring >6LNC
  - Reduces aerosols. Also, temporizing measures may delay intubation
- Experienced intubator
- Rapid Sequence Intubation (RSI) with paralytic.
- Video Laryngoscopy may allow operator more distance from airway
- Bougie may increase first pass success
- PPE: N95, contact, and droplet precautions
- Airborne Infection Isolation Room

Management of Critical Illness

- Hemodynamic supports as needed, keep MAP ≥ 65
  - 1st line in septic shock: norepinephrine
  - 2nd line: vasopressin
  - 3rd line: epinephrine
- Judicious fluid resuscitation in hypoxic respiratory failure
- Evaluate for organ dysfunction: Urine output/ creatinine, liver function testing and echocardiogram,
- Consider impact of testing on hospital decontamination; will bedside or point of care testing suffice?

Don't Miss The Mimics

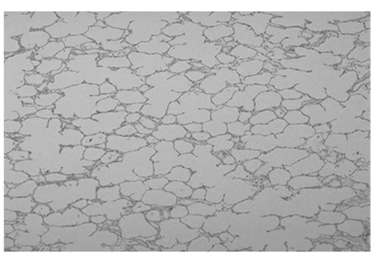
Cardiogenic pulmonary edema

- Physical exam: S3 or S4, elevated JVP, moist crackles?
- Elevated BNP level?
- Cardiac echo?

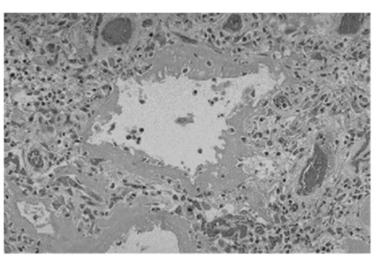
Other forms of pneumonia

- Influenza
- Bacterial pneumonia
- If they present with sepsis, start antibiotics immediately

Respiratory failure in COVID-19 is due to ARDS



Normal (low power)



ARDS (high power)

Fluid Balance across the Lung

Movement of fluid across each compartment can be predicted by "Starling's Law"

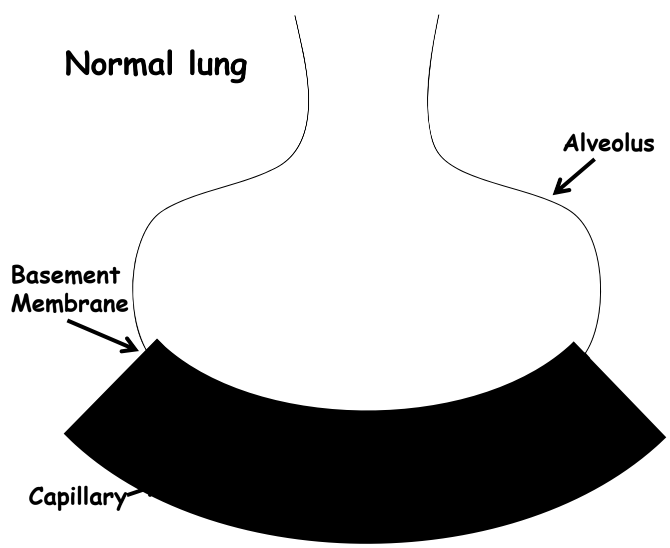
Starling's Law can be completely derived by Ω's Law (V=IR) I = Conductance (Pressure Gradient)

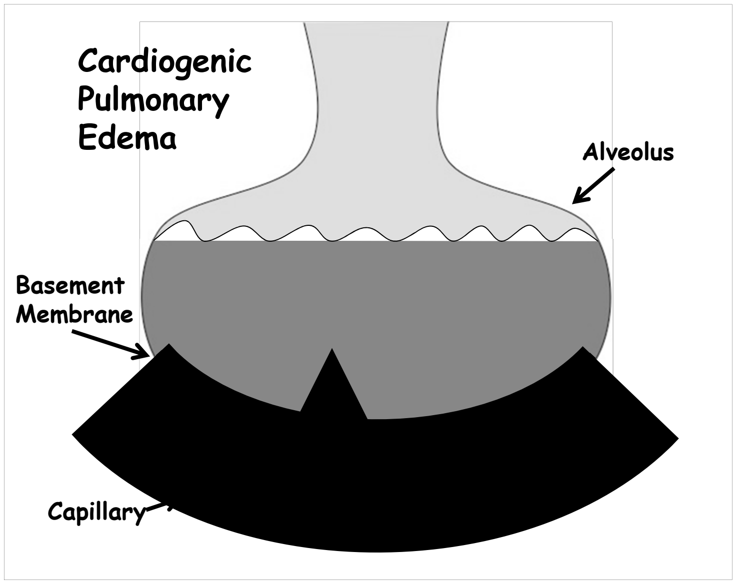
Hydrostatic — Oncotic

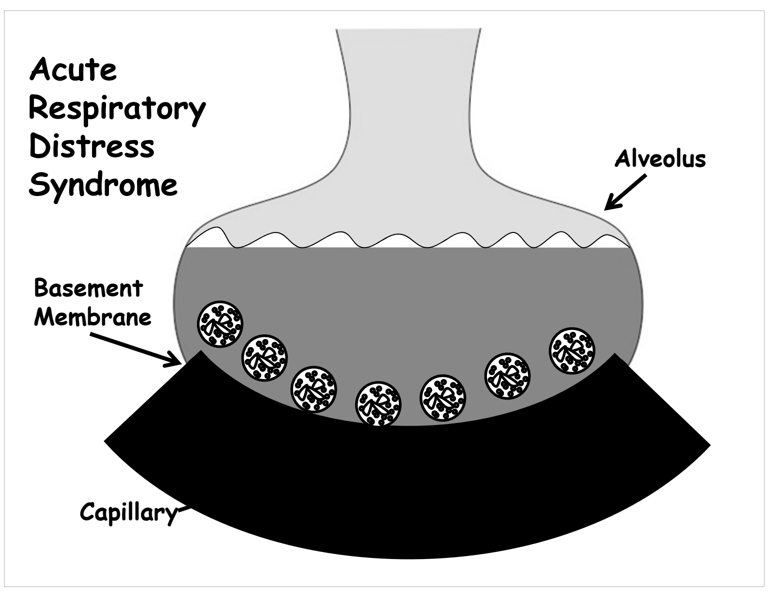
$$Jv = Kfc[(P_{pc} - P_T) - \sigma(\Pi_P - \Pi_T)]$$

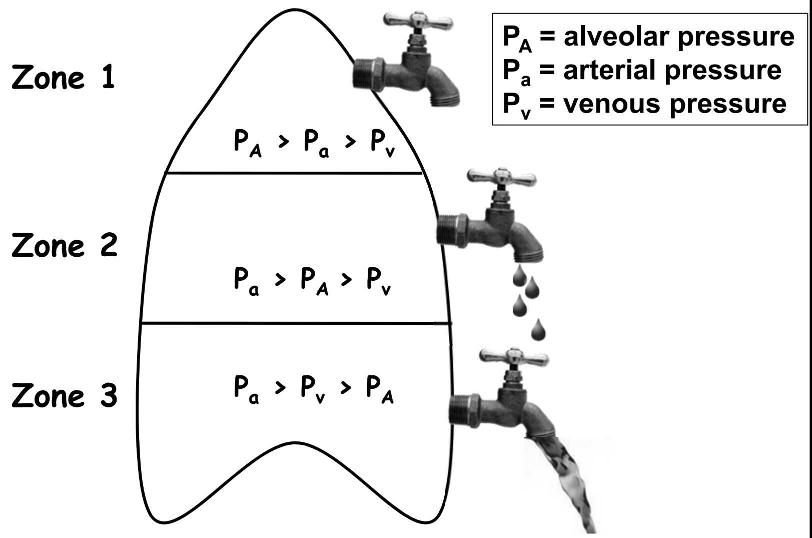
- Jv: Flux of volume
- Kfc: Permeability (filtration) Coefficient for H_2O
- P_{pc}: Pulmonary Capillary Hydrostatic Pressure
- P_T: Tissue Hydrostatic Pressure
- σ: Reflection coefficient 1.0 means all reflected
- Π_P: Plasma Oncotic Pressure
- Π_T: Tissue Oncotic Pressure

Normal lung

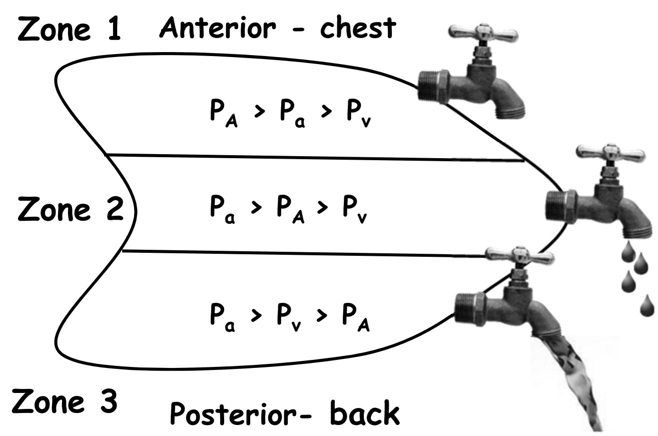



Cardiogenic
Pulmonary
Edema
Alveolus
Basement
Membrane
Capillary

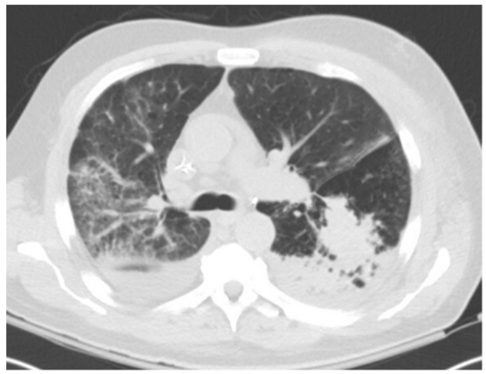

Acute
Respiratory
Distress
Syndrome
Alveolus
Basement
Membrane
Capillary



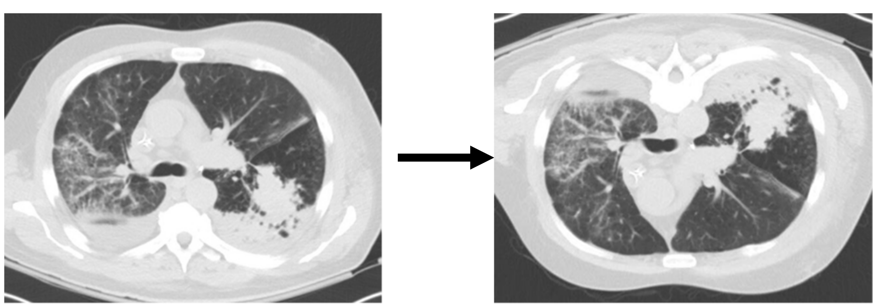
Effect of lying down supine



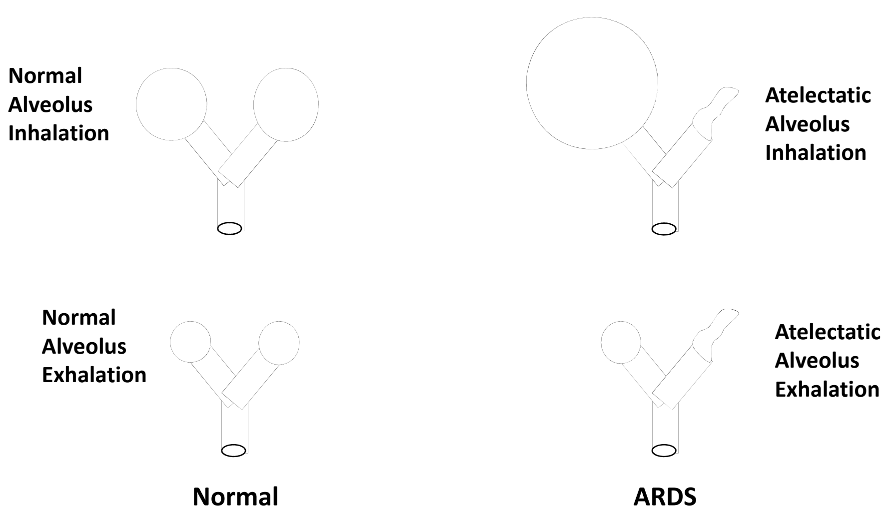
In ARDS, the dependent parts of the lung are often the worst

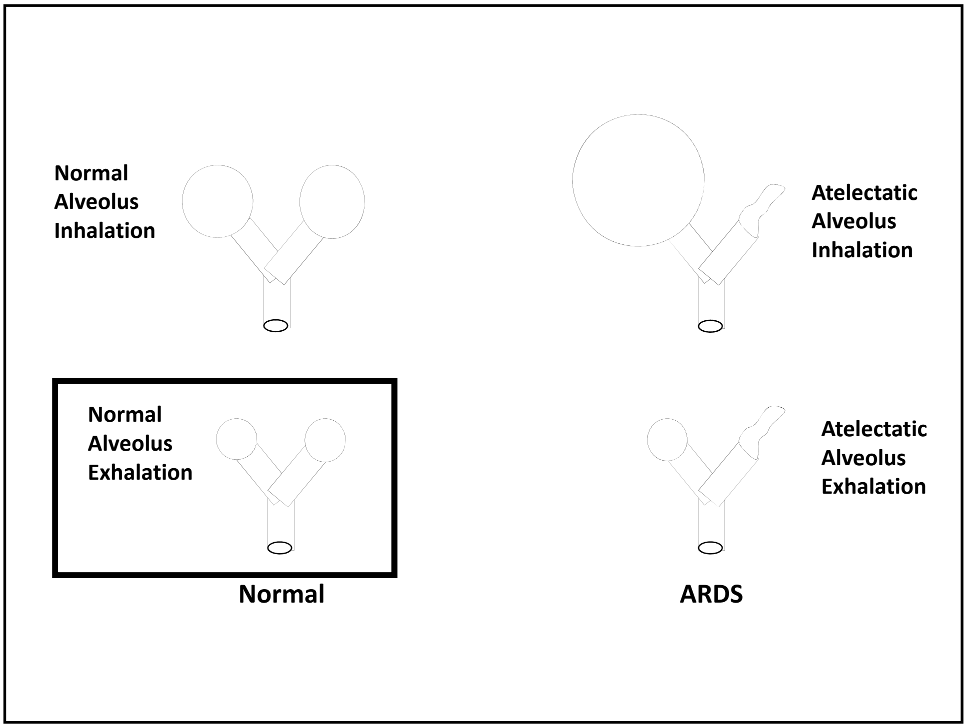


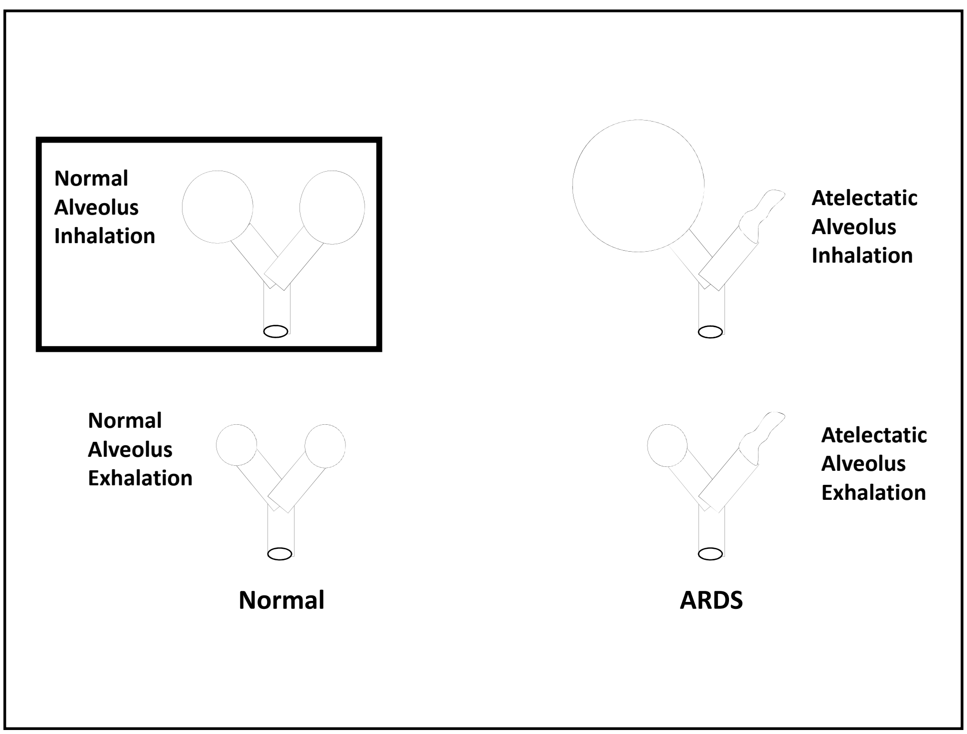
So, what if you could flip the patient over?

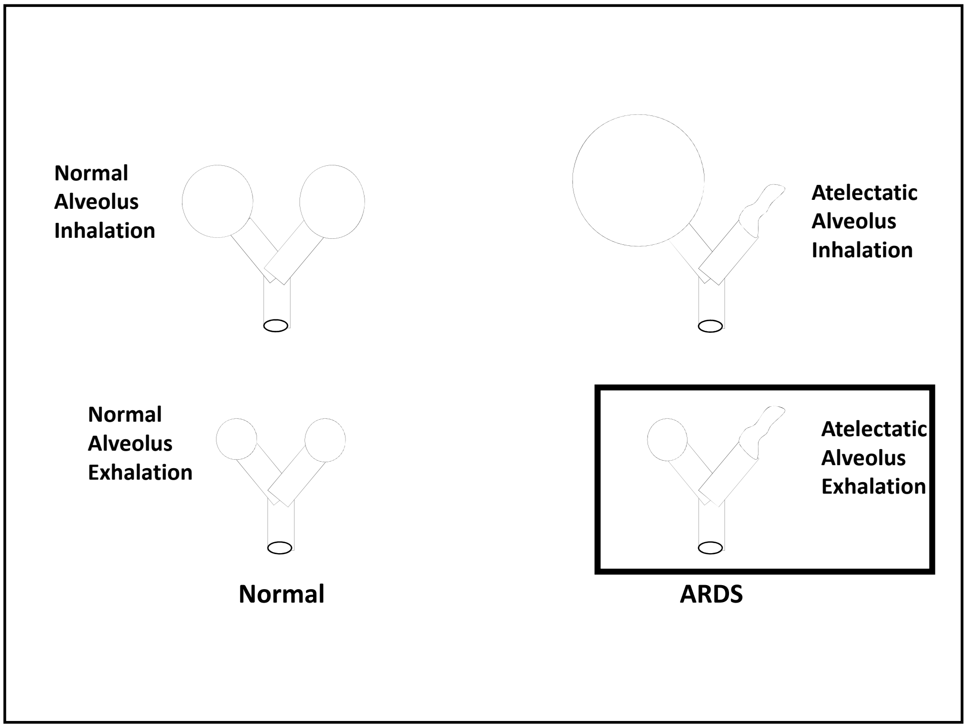


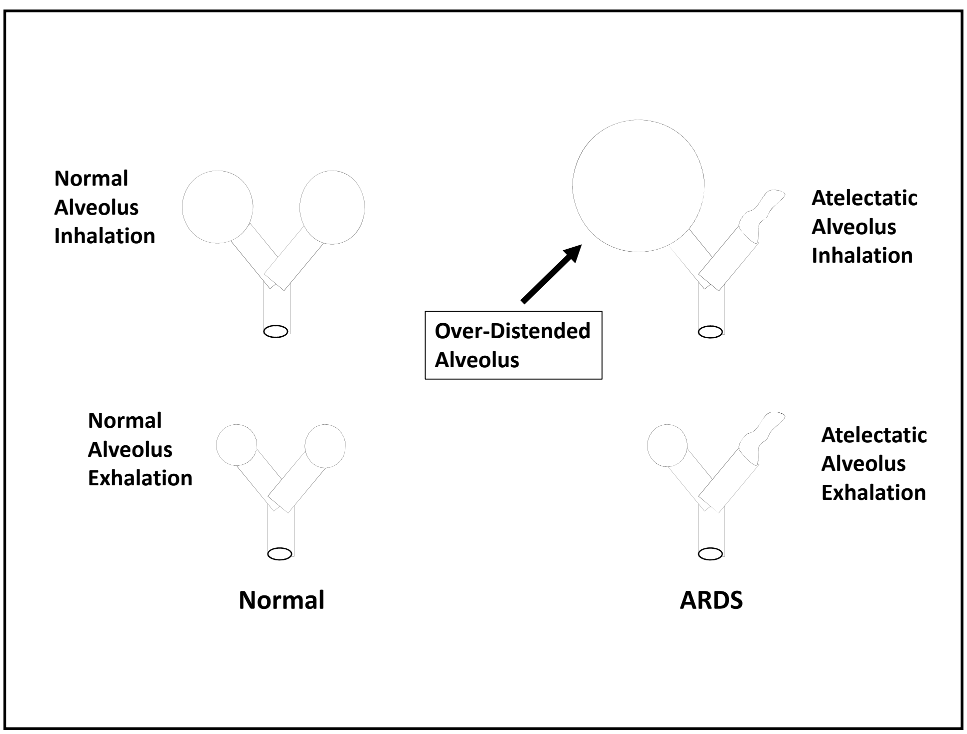
The treatment of ARDS is PEEP

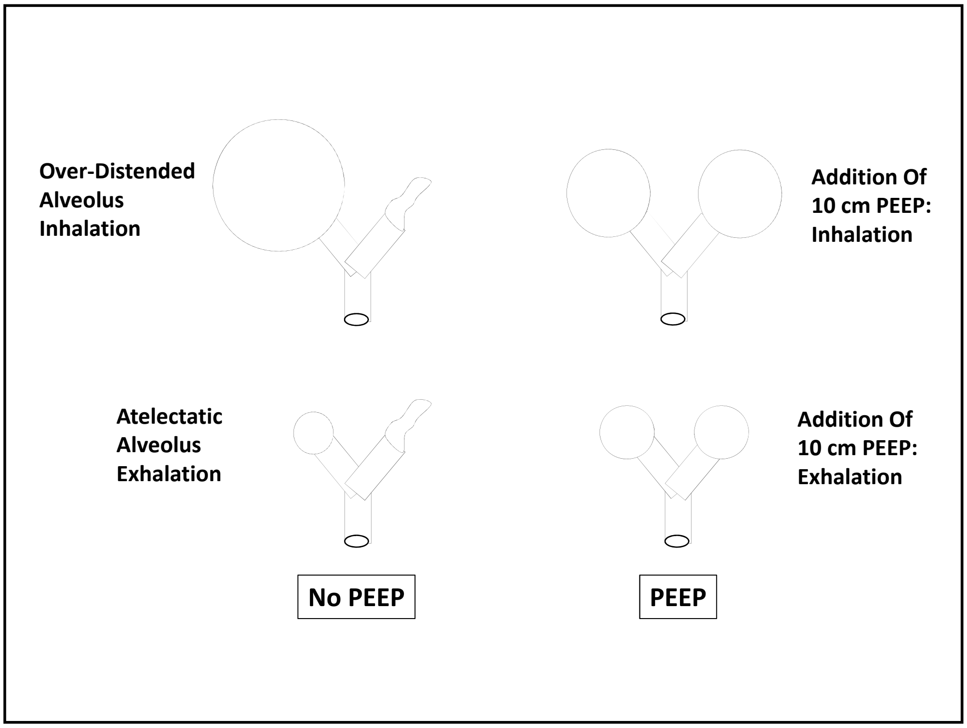


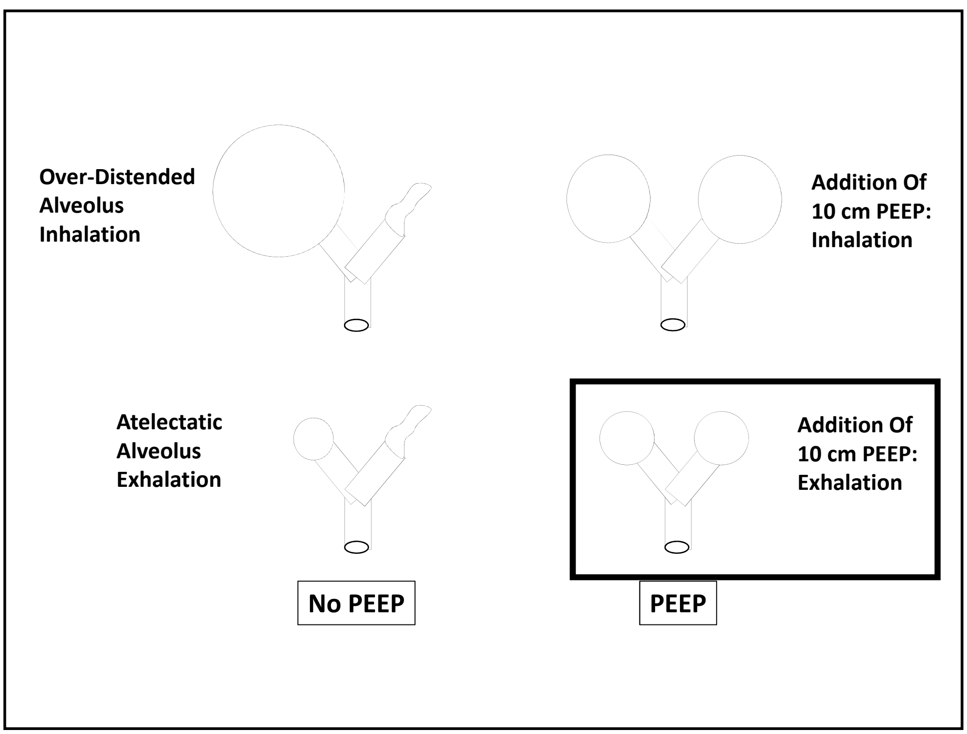

Normal
Alveolus
Inhalation
Atelectatic
Alveolus
Inhalation
Normal
Alveolus
Exhalation
Atelectatic
Alveolus
Exhalation
Normal
ARDS

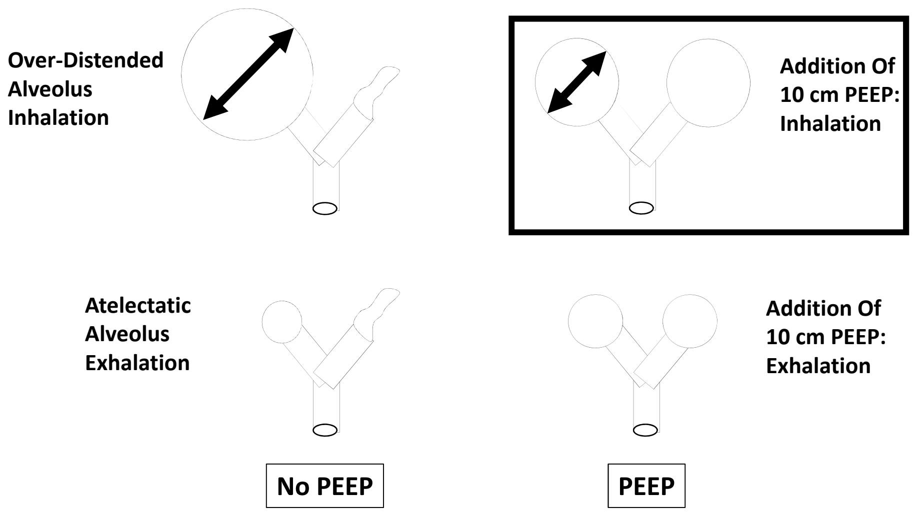

Normal
Alveolus
Inhalation
Atelectatic
Alveolus
Inhalation
Normal
Alveolus
Exhalation
Atelectatic
Alveolus
Exhalation
Normal
ARDS


Normal
Alveolus
Inhalation
Atelectatic
Alveolus
Inhalation
Normal
Alveolus
Exhalation
Atelectatic
Alveolus
Exhalation
Normal
ARDS


Normal
Alveolus
Inhalation
Atelectatic
Alveolus
Inhalation
Over-Distended
Alveolus
Normal
Alveolus
Exhalation
Atelectatic
Alveolus
Exhalation
Normal
ARDS

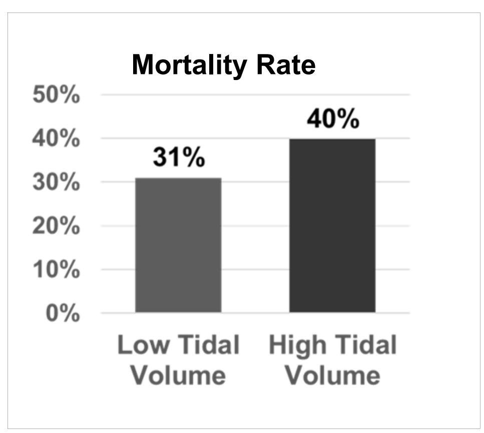

Over-Distended
Alveolus
Inhalation
Addition Of
10 cm PEEP:
Inhalation
Atelectatic
Alveolus
Exhalation
Addition Of
10 cm PEEP:
Exhalation
No PEEP
PEEP


Over-Distended
Alveolus
Inhalation
Addition Of
10 cm PEEP:
Inhalation
Atelectatic
Alveolus
Exhalation
Addition Of
10 cm PEEP:
Exhalation
No PEEP
PEEP



How The Mortality Rate Of ARDS Was Reduced By 22%

- High Volume Group
  - Starting Vt = 12 ml/kg
  - Kept plateau pressure < 50 cm
- Low Volume Group
  - Starting Vt = 6 ml/kg
  - Kept plateau pressure < 30 cm



N Engl J Med 2000; 342:1301-1308

COVID-19 Do's and Don'ts

DO:

- DVT prophylaxis
- GI prophylaxis
- 30-45 degree bed elevation
- Vasopressors for MAP < 65
- Enteral nutrition within 24-48 hours

DON'T:

- Routinely use corticosteroids
- Over-sedate patients
- Routinely use paralytics
- Use hypotonic crystalloids or colloid solutions for shock

WHO guideline: *Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected*

The disaster that you drill for is not the disaster that you get

Planning for ICU surge capacity

- Are there other hospital locations that can be converted to ICU?
  - Step-down units
  - Surgical post-op recovery areas
  - Cath lab recovery areas
  - Endoscopy rooms and recovery areas
  - Operating rooms
- Are there other staff that can be deployed for ICU care?
- Can you acquire additional ventilators?
- Do you have additional dialysis capacity?

The Management of the COVID-19 Patient with Respiratory Failure

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Mechanical ventilation topics

1. Ventilators
   a) Modes
   b) Oxygenation and ventilation
   c) Settings
2. ARDS
   a) Low tidal volume ventilation
   b) Prone positioning
3. Refractory hypoxemia
4. Liberation from the vent

Ventilator modes

Assist Control

SIMV

Pressure Support

Ventilator modes

Assist Control

SIMV

Pressure Support

No set rate

Ventilator modes

Set respiratory rate

Assist Control

SIMV

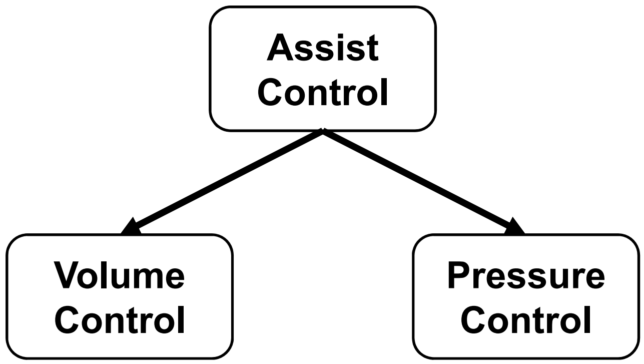
Pressure Support

Full support each breath

Full support on ventilator-initiated breaths

Partial support on patient-initiated breaths

Ventilator modes



Ventilator modes

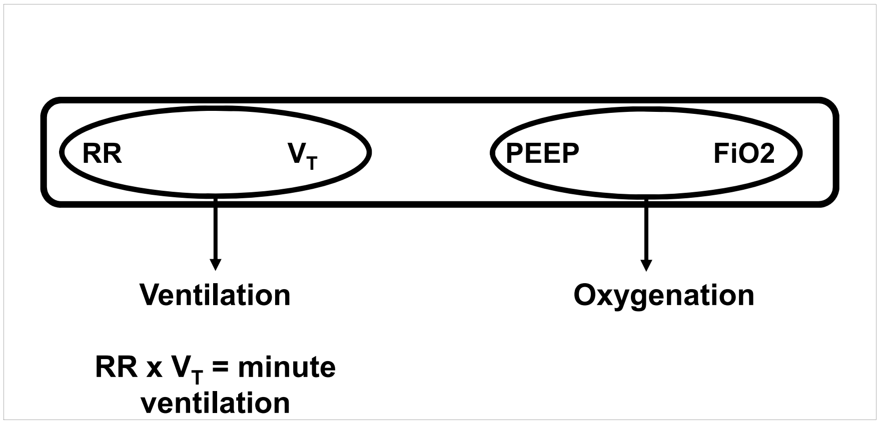
Assist Control - Volume Control

RR	VT	PEEP	FiO2

Assist Control - Pressure Control

RR	DP*	PEEP	FiO2

Ventilation and Oxygenation



Inspiratory time and expiratory time

- I:E ratio = how much time spent in inspiration vs expiration

↑ I:E	↓ I:E
↑ Oxygenation ↓ Ventilation	↑ Ventilation ↓ Oxygenation

Inspiratory time and expiratory time

- **I:E ratio = how much time spent in inspiration vs expiration**
  - **Normal = 1:1.5 or higher**

- **Ways to control this depending on ventilator and mode**
  - **I-time (seconds)**
    - **usually 1-1.5 sec**
  - **Flow rate (L/min)**
    - **usually 60-120 L/min**

I-time	RR	Inspiration	Expiration	I:E ratio
1.5 sec	20	30 seconds	30 seconds	1:1
1 sec	20	20 seconds	40 seconds	1:2

Picking and changing settings

1. **Match their initial needs**
2. **Adjust as needs change**
3. **Avoid iatrogenic damage**

Picking and changing settings

1. Match their initial needs
2. Adjust as needs change
3. Avoid iatrogenic damage

Initial settings- hypoxemic respiratory failure with or at risk for ARDS

Assist Control - Volume Control

RR	V_T	PEEP	FiO2
16-24 bpm	6-8 mL/kg PBW	5-10 cmH_20	100%

Assist Control - Pressure Control

RR	DP	PEEP	FiO2
16-24 bpm	15 cmH_20	5-10 cmH_20	100%

Initial settings - obstructive lung disease (COPD or asthma)

Assist Control - Volume Control

RR	V_T	PEEP	FiO2
10-14 bpm	8 mL/kg PBW	0-5 cmH_20	100%

Assist Control - Pressure Control

RR	DP	PEEP	FiO2
10-14 bpm	15-20 cmH_20	0-5 cmH_20	100%

Initial settings- metabolic acidosis (DKA, AKI, shock, toxins)

Pressure Support

RR	PS	PEEP	FiO2

Example: **Initial values of pH 7 / $PaCO_2$ 14 with HCO_3 5 mmol/L**

+ "normal" assist control settings

→ ineffective ventilation and worsening acidosis

Initial settings- metabolic acidosis (DKA, AKI, shock, toxins)

Pressure Support

RR	PS	PEEP	FiO2
⊘	10-5 cmH_20	5-10 cmH_20	100%

Example: **Initial values of pH 7 / $PaCO_2$ 14 with HCO_3 5 mmol/L**

+ "normal" assist control settings

→ ineffective ventilation and worsening acidosis

Picking and changing settings

1. **Match their initial needs**
2. **Adjust as needs change**
3. **Avoid iatrogenic damage**

Monitors & Goals

- Blood gas
  - pH
  - $PaCO_2$
  - PaO_2
- Pulse oximetry
  - SpO_2

- Oxygenation
  - PaO_2 ~60 mmHg
  - SpO_2 ~90%
- Ventilation
  - pH 7.2-7.45 >>
  - $PaCO_2$
    - permissive hypercapnia except with increased intracranial pressure

Adjusting for oxygenation or ventilation

	RR	V_T	PEEP	FiO_2
PaO_2 too low			⇧	⇧
PaO_2 too high			⇩	⇩
pH too low pH 7.1 / $PaCO_2$ 70	⇧	⇧	***hypoventilating so increase minute ventilation**	
pH too high pH 7.5 / $PaCO_2$ 30	⇩	⇩	***hyperventilating so decrease minute ventilation**	

Picking and changing settings

1. Match their initial needs
2. Adjust as needs change
3. Avoid iatrogenic damage

Issues to avoid with mechanical ventilation

- Volutrauma
- Auto peeping

Volutrauma

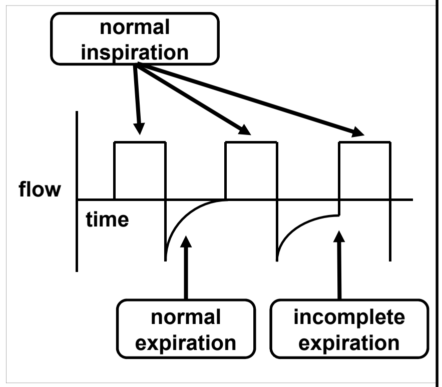
- Also known as overdistention of alveoli
- More important contributor to ventilator induced lung injury than barotrauma
  - Recommend conservative tidal volumes
  - Specifically low tidal volume ventilation with ARDS

Auto peeping

- Also known as “dynamic hyperinflation” or “breath stacking”
- What it is:
  - When not enough time to exhale before a new breath is delivered
- Why it is bad:
  - Not appropriately ventilating
  - Thoracic over-inflation can lead to cardiovascular compromise

Auto peeping

- How to tell:
  - Ventilator flow waveform
  - Expiratory hold maneuver
- What to do:
  - Decrease respiratory rate
  - Lower I:E ratio
    - Shorter inspiration time and longer expiration time



Mechanical ventilation topics

1. Ventilators
   a) Modes
   b) Oxygenation and ventilation
   c) Settings
2. ARDS
   a) Low tidal volume ventilation
   b) Prone positioning
3. Refractory hypoxemia
4. Liberation from the vent

ARDS definition

Imaging	Bilateral opacities		
Etiology	Not fully explained by heart failure or volume overload		
Timing	≤ 1 week since onset or insult		
Severity: (with PEEP ≥ 5)	**Mild ARDS**	**Moderate ARDS**	**Severe ARDS**
PaO_2/FiO_2 ratio	200-300 mmHg	100-200 mmHg	< 100 mmHg

$\frac{PaO_2}{FiO_2}$ $\frac{150}{0.5}$ $\frac{PaO_2}{FiO_2}$ $\frac{50}{1.0}$

ARDSnet

NIH NHLBI ARDS Clinical Network
Mechanical Ventilation Protocol Summary

1. **Diagnose ARDS**
2. **Set up ventilator with low tidal volume ventilation**
   - **6 mL/kg PBW, as based on sex and height**
3. **Adjust V_T and RR to reach pH and plateau pressure goals**
4. **Adjust PEEP and FiO_2 to reach oxygenation goal**

NIH NHLBI ARDS Clinical Network
Mechanical Ventilation Protocol Summary

OXYGENATION GOAL: PaO_2 55-80 mmHg or SpO_2 88-95%

Use a minimum PEEP of 5 cm H_2O. Consider use of incremental FiO_2/PEEP combinations such as shown below (not required) to achieve goal.

Lower PEEP/higher FiO2

FiO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO_2	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

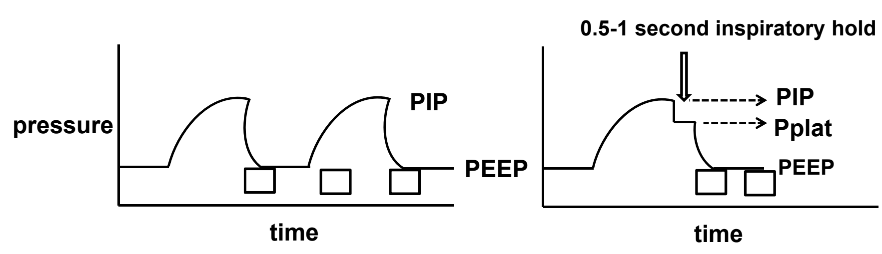
Higher PEEP/lower FiO2

FiO_2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
PEEP	5	8	10	12	14	14	16	16

FiO_2	0.5	0.5-0.8	0.8	0.9	1.0	1.0
PEEP	18	20	22	22	22	24

Plateau pressure

- **Plateau pressure goal ≤ 30 mmHg**
- **Measure Pplat every 4 hours and with changes in PEEP or V_T**



Plateau pressure

- **If Pplat > 30:**
  - **decrease V_T by 1 mL/kg incrementally (minimum = 4 mL/kg)**
- **If Pplat < 25 and V_T < 6 mL/kg:**
  - **increase V_T by 1 mL/kg until Pplat > 25 or V_T 6 mL/kg**
- **If Pplat < 30 and breath stacking or dyssynchrony:**
  - **increase V_T by 1 mL/kg incrementally to 7-8 mL/kg if Pplat remains ≤ 30**

ARDSnet

NIH NHLBI ARDS Clinical Network
Mechanical Ventilation Protocol Summary

INCLUSION CRITERIA: Acute onset of

1. $PaO_2/FiO_2 \le 300$ (corrected for altitude)
2. Bilateral (patchy, diffuse, or homogeneous) infiltrates consistent with pulmonary edema
3. No clinical evidence of left atrial hypertension

PART I: VENTILATOR SETUP AND ADJUSTMENT

1. Calculate predicted body weight (PBW)
   Males = 50 + 2.3 [height (inches) - 60]
   Females = 45.5 + 2.3 [height (inches) -60]
2. Select any ventilator mode
3. Set ventilator settings to achieve initial V_T = 8 ml/kg PBW
4. Reduce V_T by 1 ml/kg at intervals ≤ 2 hours until V_T = 6ml/kg PBW.
5. Set initial rate to approximate baseline minute ventilation (not > 35 bpm).
6. Adjust V_T and RR to achieve pH and plateau pressure goals below.

OXYGENATION GOAL: PaO_2 55-80 mmHg or SpO_2 88-95%
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PEEP	5	8	10	12	14	14	16	16

FiO_2	0.5	0.5-0.8	0.8	0.9	1.0	1.0
PEEP	18	20	22	22	22	24

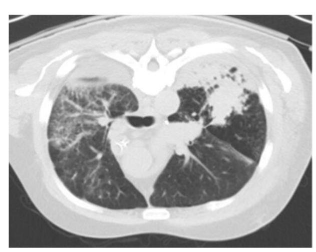
PLATEAU PRESSURE GOAL: ≤ 30 cm H_2O
Check Pplat (0.5 second inspiratory pause), at least q 4h and after each change in PEEP or V_T.
If Pplat > 30 cm H_2O: decrease V_T by 1ml/kg steps (minimum = 4 ml/kg).
If Pplat < 25 cm H_2O and V_T< 6 ml/kg, increase V_T by 1 ml/kg until Pplat > 25 cm H_2O or V_T = 6 ml/kg.
If Pplat < 30 and breath stacking or dys-synchrony occurs: may increase V_T in 1ml/kg increments to 7 or 8 ml/kg if Pplat remains ≤ 30 cm H_2O.

Other therapies for ARDS

- Prone positioning
- ECMO

Prone positioning

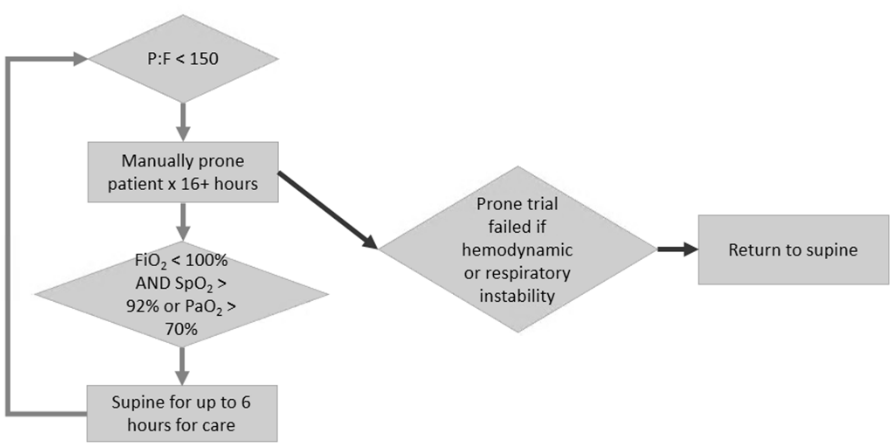
- Early prone positioning in severe ARDS has mortality benefit
  - Consider early on in patient's course if P:F < 150
- How it works:
  - ↓ compression of left lung by the heart
  - ↓ dependent atelectasis from interstitial edema
  - Allows more lung regions to be functional
  - Improves V/Q mismatch



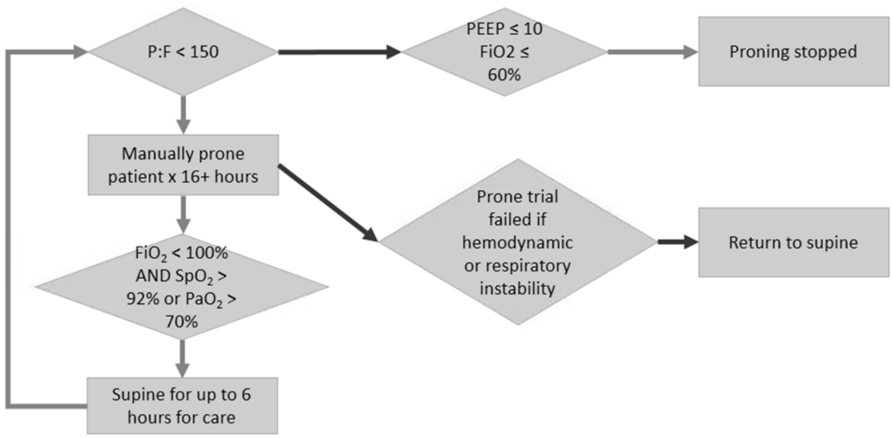
Prone positioning - contraindications

- **Absolute contraindication:**
  - **Open wound of neck, chest, or abdomen**
- **Relative contraindications:**
  - **Hemodynamic instability**
  - **Elevated intracranial pressure**
  - **Recent trauma or surgery**
    - **Unstable fractures**
    - **Face/neck 15 days**
    - **Sternotomy 30 days**
  - **Pregnancy**
  - **>20% BSA burns**
  - **Requiring impending surgery/procedure**

Prone positioning – logistics



Prone positioning – logistics



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Refractory hypoxemia

- Prone positioning
- ECMO
- Inhaled epoprostenol or nitric oxide
- Neuromuscular blockade

Caution against nebulized medications with confirmed COVID-19 or PUI

Neuromuscular blockade

- 2010 ACURASYS trial → mortality benefit
- 2019 ROSE trial → no mortality benefit compared to lighter sedation

- Bottom line:
  - Not needed for all ARDS patients
  - Still useful for significant vent dyssynchrony OR refractory hypoxemia

- If used:
  - Ensure adequate continuous sedation and analgesia
  - Ensure DVT prophylaxis

Mechanical ventilation topics

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The ICU Liberation Bundle = ABCDEF bundle

- A = assess, prevent, manage pain
- B = both SAT + SBT
- C = choice of analgesia and sedation
- D = delirium: assess, prevent, and manage
- E = early mobility and exercise
- F = family engagement and empowerment

SAT + SBT

- **Daily to determine if eligible for extubation**

SAT		
Criteria: • No active seizures, withdrawal, myocardial ischemia, elevated ICP	Performance: • Hold all continuous sedation	Failure: • Anxiety, agitation, pain • RR > 35 • SpO_2 < 88% • Acute arrhythmia

SBT		
Criteria: • SpO_2 ≥ 88% • PEEP ≤ 8 • FiO_2 ≤ 50% • Hemodynamically stable	Performance: • 30-60 minutes of minimal vent support	Failure: • RR > 35 or < 8 • SpO_2 < 88% • Respiratory distress • Mental status change • Acute arrhythmia

SAT + SBT

- **Daily to determine if eligible for extubation**

SAT		
Criteria: • No active seizures, withdrawal, myocardial ischemia, elevated ICP	Performance: • Hold all continuous sedation	Failure: • Anxiety, agitation, pain • RR > 35 • SpO_2 < 88% • Acute arrhythmia

Resume sedation at ½ dose

SBT		
Criteria: • SpO_2 ≥ 88% • PEEP ≤ 8 • FiO_2 ≤ 50% • Hemodynamically stable	Performance: • 30-60 minutes of minimal vent support	Failure: • RR > 35 or < 8 • SpO_2 < 88% • Respiratory distress • Mental status change • Acute arrhythmia

Resume prior vent settings