

# Shortness of Breath Has You Blue? Here is What to Do!

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# Objectives

- Identify at least 3 clinical manifestations of respiratory insufficiency and/or failure
- List the most common causes of respiratory failure in hospitalized patients
- In addition to medical management, describe when a trial of noninvasive ventilation is appropriate given specific diagnoses/clinical scenarios leading to respiratory failure

# Case Studies

- S: C/O acute SOB, productive cough
  - O: 65 YOM admitted for above, afebrile, 50 pk/yr smoking hx & hx of COPD
  - A: VS HR 105, RR 32, BP 144/72 SpO2 84% RA;
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- S: C/O shortness of breath, getting worse over the course of the day
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  - A: VS HR 68, RR 8, BP 120/62 SpO<sub>2</sub> 78% 2L NC;
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- S: Pt is having a hard time breathing
  - O: 42 YOF admitted for SOB, has metastatic breast CA to lungs, recurrent pleural effusion
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# Shortness of Breath

- 2 components: Gas exchange and ventilatory pump
  - Respiratory failure
  - Shortness of breath
- In hospitalized patients- commonly caused by congestive heart failure, pulmonary embolism, pneumonia, and bronchospasm (asthma and COPD)



# Noninvasive Ventilation

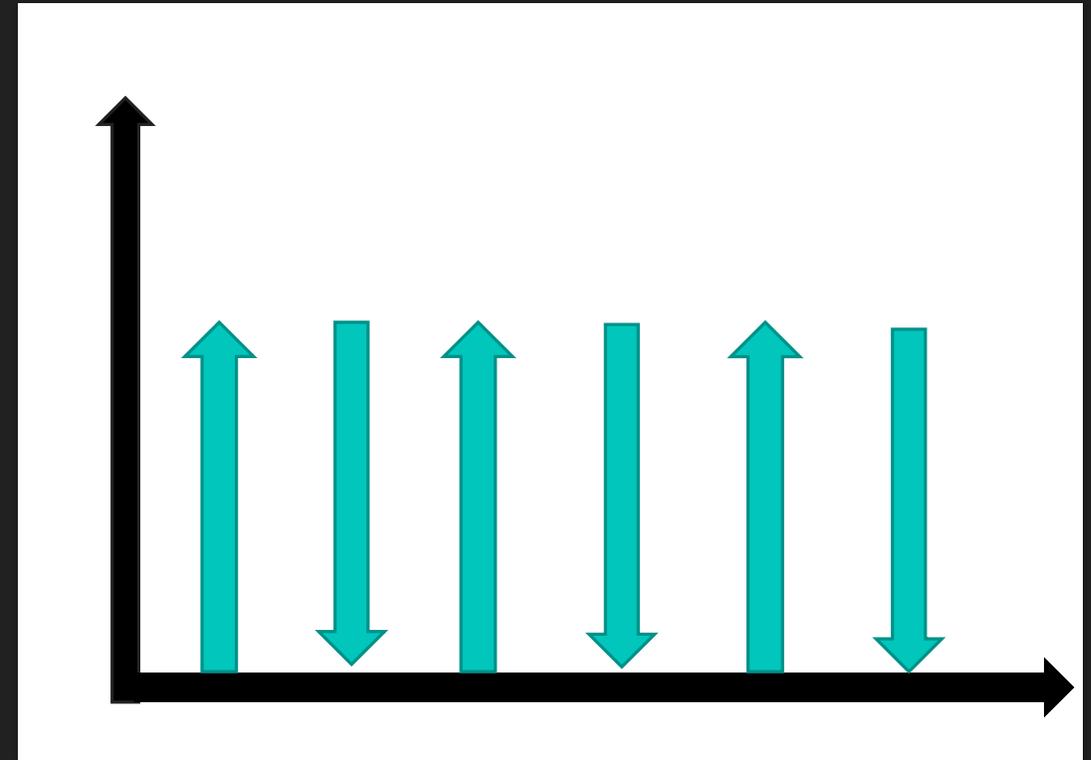
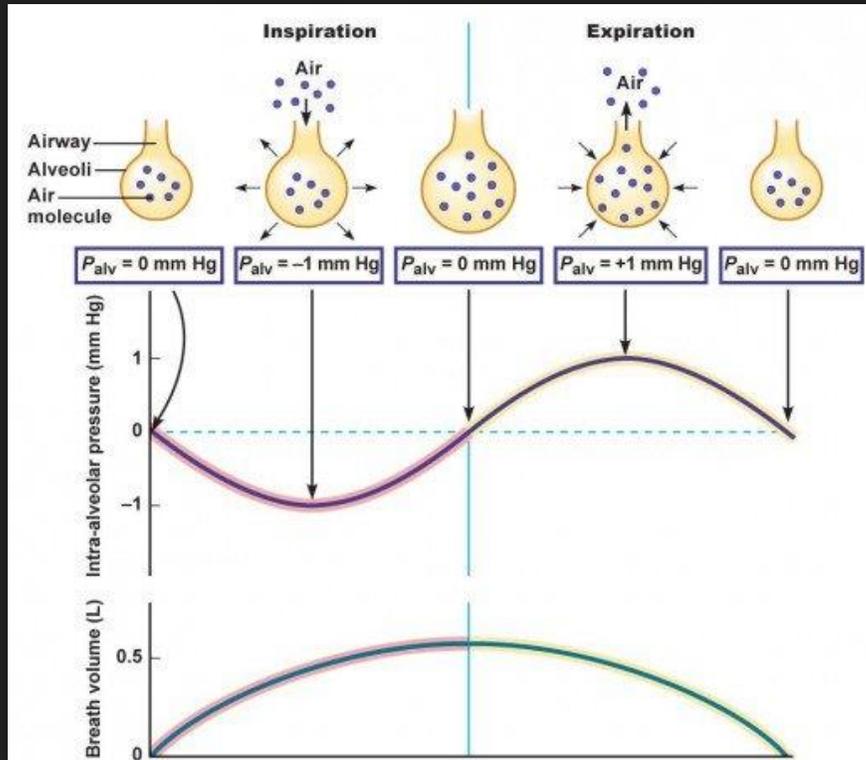
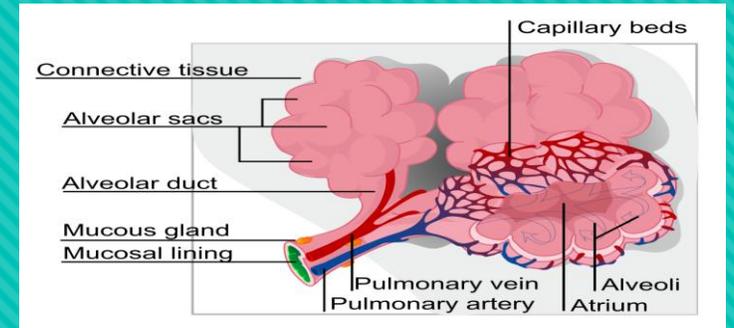
- Definition NPPV
  - Short term
  - Types of masks
  - Benefits
- Types: CPAP, BPAP, etc.
  - Routine indications
  - Acute care settings for ARF



# NPPV Patient Selection

- Terminology
  - “BiPAP” & “BIPAP”
  - BPAP ≈ (?) NPPV
- Contraindications
- Indications
- Determinants of improved outcomes
  - Younger age
  - Lower acuity of illness
  - Able to cooperate
  - Less air leak
  - Moderate hypercarbia ( $\text{PaCO}_2 > 45$ ,  $< 92$ ) and moderate acidemia ( $\text{pH} < 7.35$ ,  $> 7.10$ )
  - Clinical improvements within first 2 hours

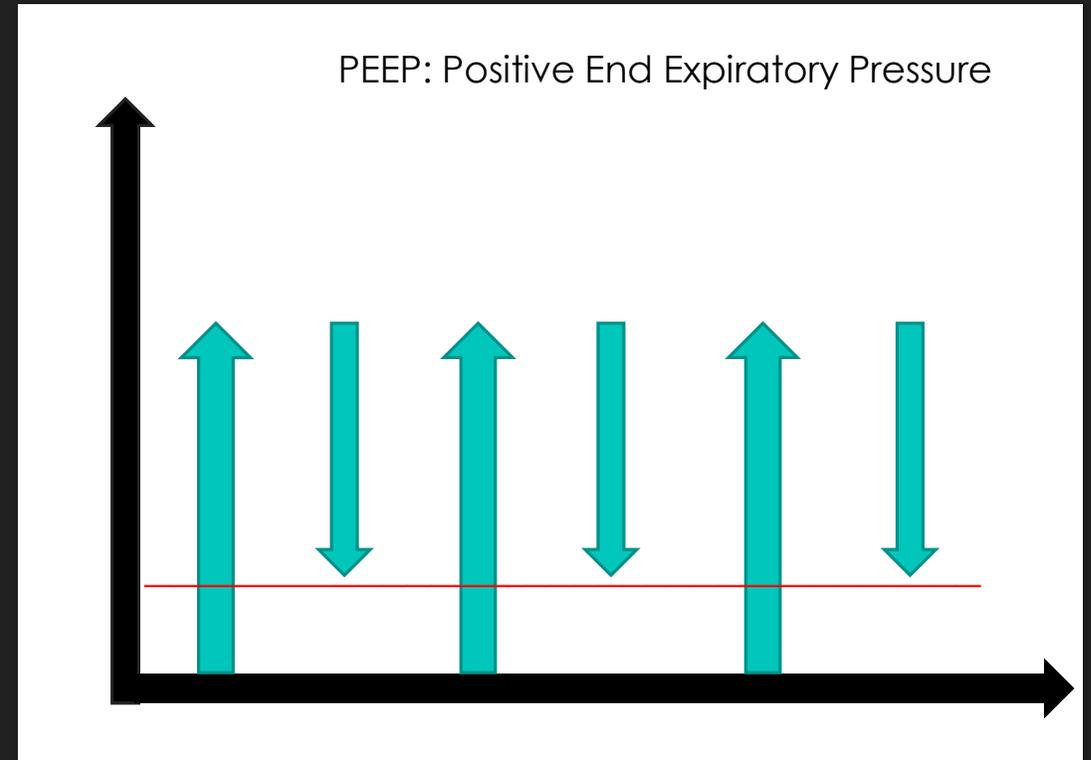
# Unassisted Breathing



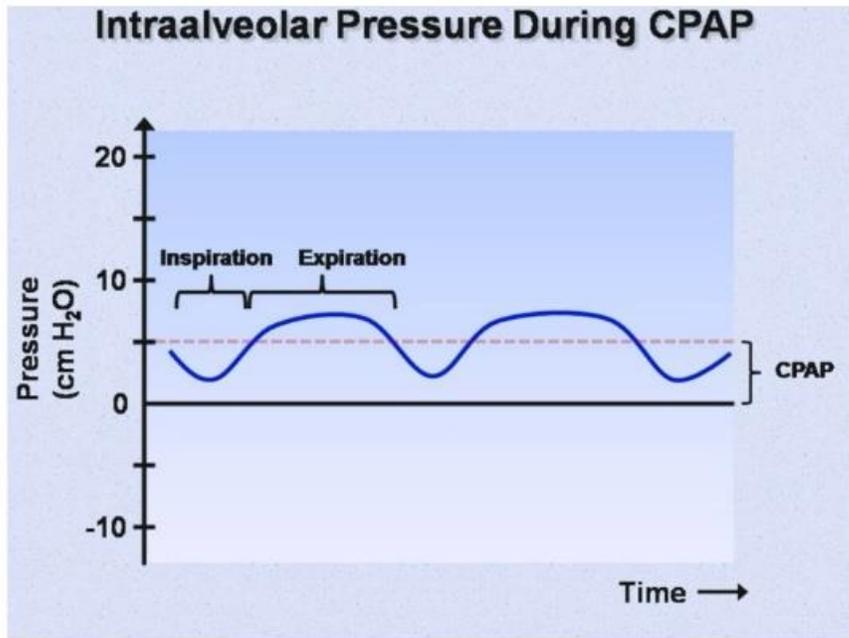
Non-invasive positive pressure ventilation: <https://www.youtube.com/watch?v=H24YhlQbIRM>

Short and simple: CPAP vs BiPAP: <https://www.youtube.com/watch?v=0eQSn8efx4U>

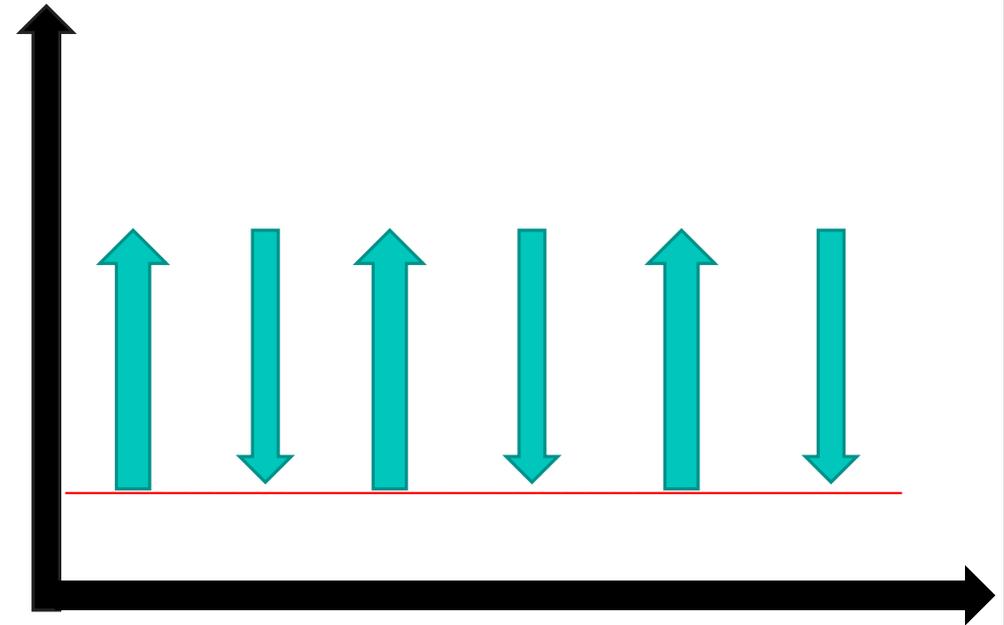
# PEEP



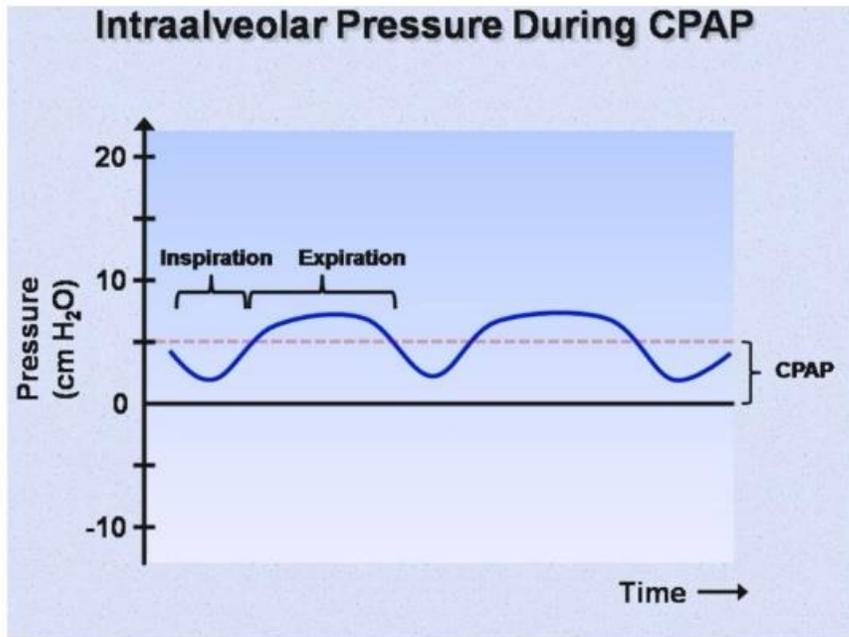
# CPAP



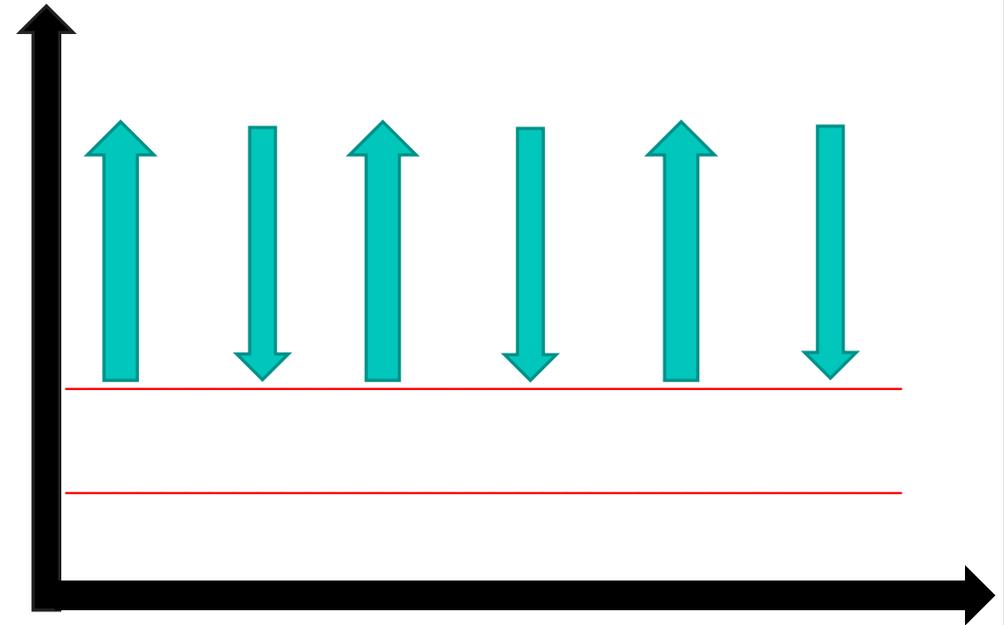
CPAP: Continuous Positive Airway Pressure



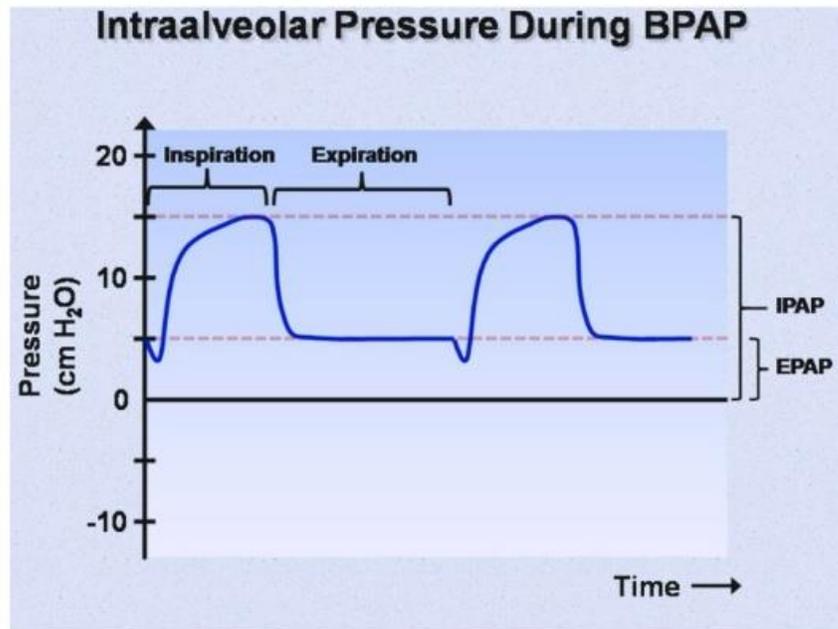
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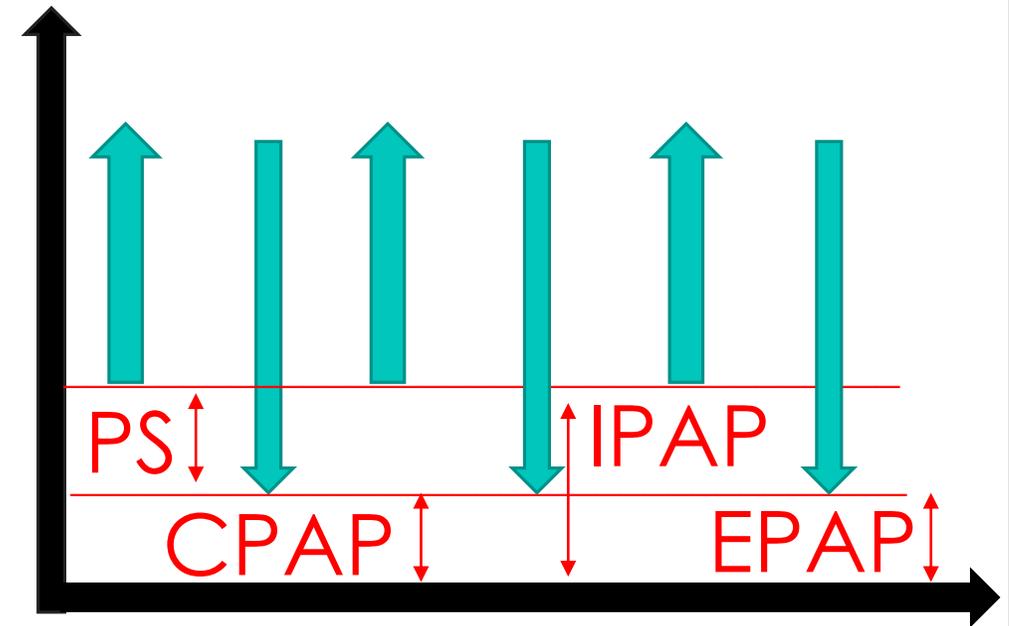
CPAP: Continuous Positive Airway Pressure



# BPAP



BPAP: Bilevel Positive Airway Pressure



# Scientific Evidence- GRADE approach

Strong and conditional recs	Strong recommendation (rec)	Weak recommendation (suggest)
For patients	Most individuals in this situation would want the recommended course of action and only a small portion would not.	The majority of individuals in this situation would want the suggested course of action, but many would not.
For clinicians	Many individuals should receive the recommended course of action. Adherence could be used as a quality criterion or performance indicator. Formal decision aids are not likely needed to help individuals make decisions consistent with their values and preferences.	Difference choices are likely to be appropriate for different patients and therapy should be tailored to the individual patient's circumstances. Those circumstances may include the patient or family's values and preferences.
For policymakers	The recommendation can be adapted as policy in most situations including for the use as performance indicators.	Policy making will require substantial debates and involvement of many stakeholders. Policies are more likely to vary between regions. Performance indicators would have to focus on the fact that adequate deliberation about the management options has taken place.

Berbenetz, N., Wang, Y., Brown, J., Godfrey, C., Ahmad, M., Vital, F., Lambiase, P., Banerjee, A., Bakhaj, A., & Chong, M. (2019). Non-invasive positive pressure ventilation (CPAP or bilevel NPPV) for cardiogenic pulmonary oedema (Review). *Cochrane Database Systematic Reviews* (4). doi:10.1002/14651858.CD005351.pub4.

Rochweg, B., Brochard, L., Elliott, M., Hess, D., Hill, N., Nava, S., Navalesi, P., Antonelli, M., & Brozek, J. (2017). Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure. *European Respiratory Journal*, 50(2):1602426. doi:10.1183/13993003.02426-2016.

# Summary: Non-invasive positive pressure ventilation (CPAP or bilevel NPPV) for cardiogenic pulmonary oedema (Review)

- NPPV for ACPE
  - 24 RCT studies (2664 adult participants)
- NPPV may reduce hospital mortality
- No significant difference between CPAP or BPAP
- Probably reduces ETI
- Little or no influence on AMI compare to SMC
- Uncertain whether NPPV reduces hospital stay
- Bottom line: more benefits than harm from the addition of NPPV to SMC in ACPE

# Summary ERS/ATS Clinical Practice Guidelines: noninvasive ventilation for ARF

- COPD exacerbation
  - Strong recommendation for BPAP for ARF with acute / acute on chronic respiratory acidosis
  - Recommend a trial of BPAP in patients considered to require ETI unless immediately deteriorating
  - Suggest NIV not be used without acidosis
- ACPE
  - Either BPAP or CPAP
  - Suggest NIV be used in pre-hospital setting
- Acute Asthma
  - No recommendation
- Immunocompromised patients
  - Suggest early NPPV (BPAP or CPAP)
- *De novo* respiratory ARF
  - No recommendation
- Patients receiving palliative care
  - Suggest offering NIV
- Pandemic viral illness
  - Unable to offer a recommendation

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# Summary ERS/ATS Clinical Practice Guidelines: noninvasive ventilation for ARF

- Post-operative setting
  - Suggest NIV for post-operative ARF
- Chest trauma
  - Suggest NIV for chest trauma
- NIV following extubation
  - Suggest NIV be used to prevent post-extubation respiratory failure in high-risk patients
  - Suggest NIV not be used in non-high-risk patients
  - Suggest NIV should not be used in patients with established respiratory failure
- Used to facilitate weaning from mechanical ventilation
  - Suggest NIV to wean from IV in patients with hypercapnic respiratory failure
  - No recommendation for hypoxemic patients

# NPPV Initiation

## CPAP

- Useful in situations where hypoxia is the main problem
  - ACPE
  - (OSA, Atelectasis)
- Begin at 4-5cmH<sub>2</sub>O
- Max of 12-15cmH<sub>2</sub>O
  - Monitor RR and SpO<sub>2</sub>

## BPAP

- Used to improve gas exchange
  - Hypercapnic or mixed hypercapnic and hypoxic respiratory failure
- Reduces work of breathing by unloading of respiratory muscles and counteracting autoPEEP
  - Decreased respiratory rate
  - Decreased diaphragmatic work
  - Increased tidal volume
  - Increased minute ventilation
- Start 8-12cmH<sub>2</sub>O IPAP, 3-5 cmH<sub>2</sub>O EPAP
  - Titrate for alleviation of dyspnea, RR, TV (if being monitored), synchrony

# Shortness of Breath



- Questions to ask
- Orders to give

**S**

## **Situation**

a concise statement of the problem

**B**

## **Background**

pertinent and brief information related to the situation

**A**

## **Assessment**

analysis and considerations of options — what you found/think

**R**

## **Recommendation**

action requested/recommended — what you want



# How sick is the patient?

Supplemental O2 should be considered a temporizing intervention while the primary etiology of hypoxemia is diagnosed and treated

	Airway	Breathing	Circulation
Causes of obstruction, inadequate breathing/oxygenation, and inadequate circulation	Trauma, blood, FB, vomitus, central nervous system depression, infection, inflammation	Depressed respiratory drive (CNS depression), effort (muscle weakness, chest wall abnormalities, pain), pulmonary disorders (PTX, aspiration, COPD, asthma, PE, ARDS, pulmonary edema)	Directly involving the heart (ischemia, arrhythmias, valvular disease, CMP, tamponade) vs pathology elsewhere (drugs, hypoxia, electrolyte disturbances, dehydration, sepsis, acute blood loss, anemia)
<b>Look</b>	Cyanosis, altered respiratory pattern and rate, use of accessory muscles, tracheal tug, altered LOC	Cyanosis, altered LOC, altered respiratory pattern and rate, use of accessory muscles, tracheal tug, equality and depth of breaths, oxygen saturation	Reduced peripheral perfusion (pallor), hemorrhage (obvious or concealed), altered LOC, dyspnea, decreased urine op, JVD
<b>Listen</b>	Noisy breathing (grunting, stridor, wheezing, gurgling); silence indicates complete obstruction	Dyspnea, inability to talk, noisy breathing, dullness to percussion, auscultation of breath sounds	Additional or altered heart sounds, carotid bruits
<b>Feel</b>	Decreased or absent airflow	Symmetry of chest movements, position of trachea, crepitus, abdominal distention	Central and peripheral pulses (assessing rate, quality, regularity, symmetry), cool extremities

Respiratory failure- acute /chronic / acute and chronic? Blood gas can tell you this

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- O: 65 YOM admitted for above, afebrile, 50 pk/yr smoking hx & hx of COPD
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- P: RN recommends order for O2 and for you to come see the pt
- What tests are useful to evaluate severity of patient's condition
- Additional questions or orders

# Case 1

- PE: Lethargic but interactive, 2-3 words, moderate distress, barrel chest, + accessory muscle use, faint expiratory wheezes
- ABG: 7.31/74/68/32
- CXR: no infiltrates

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  - If so, what settings might you try?
- Medical therapy / other interventions?

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  - Start BPAP 8-12 IPAP/ 3-5 EPAP
- Medical therapy / other interventions?
  - Inhaled SABA and anticholinergic
  - Systemic steroids
  - Abx
  - Smoking cessation, VTE prophylaxis, nutritional support

# Case 2

- S: C/O shortness of breath, getting worse over the course of the day
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- A: VS HR 110, RR 28, BP 116/68 SpO2 85%  
6L NC
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# Case 2

- PE: Anxious, accessory muscle use+JVD, LE edema, orthopnea, bibasilar crackles
- ABG: 7.46/ 33/ 50/ 25
- CXR: pulmonary edema

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- PE: Anxious, accessory muscle use, +JVD, LE edema, orthopnea, bibasilar crackles
- ABG: 7.46/ 33/ 50/ 25
- CXR: pulmonary edema
- Which oxygenation supplementation device should be used? Candidate for NPPV?
  - Start CPAP 4-5, titrate for SpO<sub>2</sub> >95%
- Medical therapy / other interventions?
  - Diuretics
  - Search for and treat cause
  - VTE prophylaxis, sodium and fluid restriction

# Case 3

- S: Difficult to arouse, low SpO<sub>2</sub> (but it might not be picking up well)
  - O: 72 YOF admitted s/p mechanical fall. POD1 ORIF. PMH significant for OSA (uses CPAP at night), CKD, and hypothyroidism. Had difficult time with pain management during the day
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# Case 3

- PE: Obtunded, briefly reacts to tactile stimuli. Pupils are miotic but reactive. Doesn't appear to be in acute distress, breath sounds are diminished
- ABG:
- CXR:
- Which oxygenation supplementation device should be used? Candidate for NPPV?
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- ABG:
- CXR:
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  - Bag-valve mask ventilation
- Medical therapy / other interventions?
  - Naloxone

# Case 4

- S: Pt is having a hard time breathing
  - O: 42 YOF admitted for SOB, has metastatic breast CA to lungs, recurrent pleural effusion
  - A: VS HR 125, RR 36, BP 106/52 SpO2 90% 10L high-flow NC;
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# Case 4

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- What tests are useful to evaluate severity of patient's condition
  - Additional questions or orders
    - She is DNR and on hospice

# Case 4

- S: Pt has increased WOB and is in moderate distress but adamantly refuses morphine or anxiolytics . Her husband and young son are at the bedside. She says she wants to be conscious and aware for whatever time she has left.
- Which oxygenation supplementation device should be used? Candidate for NPPV?
- Medical therapy / other interventions?



# Additional References

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- Marshall S, Ruedy J. On Call: Principles and Protocols. 5th ed. Philadelphia: Saunders (Elsevier), 2011.

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<b>Numeric Grade</b>	<b>Strength of Recommendation</b>	<b>Interpretation</b>
1	Strong	Do it; Don't do it
2	Weak	Probably do it; probably don't do it
No grade	No rec (insufficient evidence)	Okay to try, an option
<b>Letter Grade</b>	<b>Quality of Evidence</b>	<b>Interpretation</b>
A	High	Further research is very unlikely to change our confidence in the estimate of effect
B	Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
C	Low	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate
D	Very Low	Any estimate of effect is very uncertain

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