

HEART FAILURE

Estimated Time: 45 minutes • Debriefing Time: 40 minutes



Scan to Begin



Patient Name: Hector Fernandez

SCENARIO OVERVIEW

Students are called to the Emergency Department to prepare for the arrival of a patient from a local nursing home who is in acute respiratory distress/failure. They receive report from EMT/Paramedics at the beginning of the scenario. He needs to be placed on the BIPAP immediately and ABG's need to be drawn. After ABG's have resulted, a decision is made to intubate the patient. Students will assist with the intubation. This scenario includes videos of both right and left Modified Allen's test for students to assess prior to ABG puncture.

LEARNING OBJECTIVES

1. Perform a focused respiratory assessment
2. Recognize and respond to abnormal findings
3. Evaluate objective and subjective data
4. Implement and follow evidence-based standards and protocols
5. Safely manage non-invasive mechanical ventilation
6. Assist provider in medical procedures
7. Demonstrate appropriate communication
8. Document accurately

CURRICULUM MAPPING

WTCS RESPIRATORY THERAPY PROGRAM OUTCOMES

- Apply respiratory therapy concepts to patient care situations
- Demonstrate technical proficiency required to fulfill the role of a respiratory therapist
- Practice respiratory therapy according to established professional and ethical standards

RESPIRATORY DISEASE

- Analyze signs, symptoms, etiology, pathogenesis and treatment for cardiovascular diseases/disorders

RESPIRATORY AND CARDIAC PHYSIOLOGY

- Interpret blood gas data
- Evaluate fluid and electrolyte balance

RESPIRATORY THERAPEUTICS II

- Perform arterial puncture

RESPIRATORY PHARMACOLOGY

- Examine the pharmacodynamics of anesthetics, muscle blockers, analgesics, sedatives, hypnotics, and tranquilizers

RESPIRATORY AIRWAY MANAGEMENT

- Demonstrate the use of manual resuscitators
- Assess the need for artificial airways
- Apply basic artificial airways
- Apply advanced artificial airways
- Demonstrate skill of secretion removal

RESPIRATORY LIFE SUPPORT

- Apply non-invasive mechanical ventilation
- Evaluate patient response to mechanical ventilation

RESPIRATORY CLINICAL PRACTICE

- Apply standard precautions
- Assess vital signs
- Perform pulse oximetry
- Apply non-invasive positive pressure ventilation
- Perform arterial puncture
- Assist with intubation

SIMULATION LEARNING ENVIRONMENT & SET-UP

PATIENT PROFILE

Name: Hector Fernandez

DOB: 09/06/19XX

Age: 62

MR#: 41219

Gender: Male

Height: 175 cm (5'10")

Weight: 86.4 kg (195#)

Allergies: penicillin (hives)

Admitting Diagnosis: Right lower extremity cellulitis and CHF

Medical History: congestive heart failure, coronary artery disease, anterior MI with stenting – 4 years ago, chronic atrial fibrillation, hypertension, chronic renal insufficiency, COPD, OSA, restless leg syndrome, hypothyroidism, diabetes mellitus 2, chronic constipation

Surgical History: R TKR – 15 years ago

Code Status: Full

Ethnicity: Hispanic

Spiritual Practice: Catholic

Primary Language: Spanish

Secondary Language: English

EQUIPMENT/SUPPLIES/SETTINGS

Environment

- Inside room: Patient in bed, as close to fowlers position as possible
- Inside or outside room: Hand sanitizer and/or sink
- Outside room: Computer or form(s) for documentation

Patient

- Hospital gown
- No moulage
- ID band present with QR code

Monitor Settings

- Simulator vitals: HR 108, RR 32, BP 138/92, Temp 37.1, Sat = 93 % on 15 lpm non-rebreather mask

Supplies

- General
 - Respiratory Equipment
 - BiPAP machine and supplies
 - Equipment to obtain an ABG
 - Intubation equipment
 - Oropharyngeal airways
 - Resuscitation Bag and Mask
 - Oral and endotracheal suction supplies
 - Medications (realistic labels are available by scanning QR Codes)
 - Succinylcholine (200 mg/10 ml) – 10 ml injection solution
 - Etomidate (20 mg/10 ml) – 10 ml single-dose vial
 - Propofol (1% - 10 mg/ml) – 100 ml single-patient infusion vial

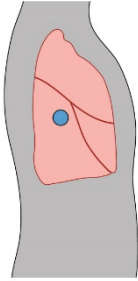
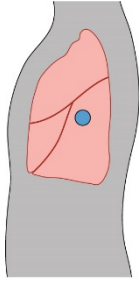


QR CODES

START 	PATIENT 	REPORT 	PATIENT ID 
PATIENT IV 	RIGHT LEG 	LEFT LEG 	BIPAP 
LEFT ALLEN'S 	RIGHT ALLEN'S 	FACILITATOR 	

CHEST QR CODES

Cut along the dotted lines. Fold along the solid line to create a bi-fold of the diagram and QR code.



			
ANTERIOR 2	ANTERIOR 3	ANTERIOR 6	ANTERIOR 7
			
			
POSTERIOR 0	POSTERIOR 1	POSTERIOR 4	POSTERIOR 5
			

	
RIGHT AXILLARY 1	LEFT AXILLARY 1
	

TEACHING PLAN

PREBRIEF

The facilitator should lead this portion of the simulation. The following steps will guide you through Prebrief.

- Scan the **QR Code: “Scan to Begin”** while students are in Prebrief.
- “Meet Your Patient” (on iPad) and explain how the iPad works in the simulated learning environment including:
 - Explain how to use the iPad scanner and QR codes. Remind students that there are multiple QR codes in the simulation, but they should only scan them if they think it will provide data necessary for their assessment and evaluation of the patient.
 - For some scenarios, it may be helpful to tell students where the QR code are located. For others, you may want students to “find” the QR codes during their assessments. This is your choice.
 - Describe how a QR code sound will work in the scenario. For the most authentic sound experience, student should use ear buds or the ARISE “stethoscope” for all QR codes with the following symbol: . Example: **QR Code: Chest Anterior 1** 
 - As the facilitator, you should be aware that throughout the simulation some QR codes are necessary to the programming of the iPad content. Directions for which QR codes are required (to be scanned) in each state are listed under each state of the documentation below. The QR codes are also in **BOLD** type.
 - Level tab – This tab “tells” the content in the iPad to change to what is needed for the next state of a simulation. It is used a few times in this scenario after the provider is notified to display new orders (those just given over the phone) and lab results, etc...
 - Medication QR Codes – The student(s) must scan **QR Code: Patient ID** prior to scanning any medication. That scan is valid for 2 minutes and then it “times out.” The student(s) will need to scan **QR Code: Patient ID** again to give more medications.
 - MAR Hyperlinks – On the MAR all medications are underlined and hyperlinked to DailyMed, which is a medication reference housed by the

National Library of Medicine. Students can click on these links during the simulation for up-to-date medication content, labels, and package insert information.

- Discuss the simulation “Learning Objective(s)” (on iPad) as well as any other Prebrief materials
- Get “Report” on iPad
 - Possible Facilitator Questions
 - What are your priorities for this patient?
- View “Patient” picture on iPad
 - Possible Facilitator Questions
 - Given this image, can you make any conclusion about Hectors’ condition?
- Advance to the “Patient Profile” screen (on iPad). This will act as a simulated patient chart.
- Students can view the tabbed content on the iPad (see below) prior to entering the patient’s room and throughout the simulation as needed.
 - Facilitator Note: As the patient is arriving directly to the ER, the students could start in the patient’s room with report. In addition, the iPad does not have any data with the exception of a BiPAP Protocol which could be reviewed with students at this time.

H&P

No reports available.

ORDERS

No reports available.

MAR

No reports available.

DAILY RECORD

No reports available.

VITALS

The iPad shows the “enterable” vitals screen.

VENTILATOR FLOWSHEET

The iPad shows the “enterable” ventilator flowsheet.

PROGRESS NOTES

No reports available.

LABS-DIAGNOSTICS

No reports available.

IMAGING

No reports available.

PROTOCOLS

The iPad displays the “Adult BiPAP Protocol – Acute.” See Appendix A for a printable version.

LEVEL 1

The iPad reads, “The iPad is at Level 1.”

SCANNER

Use this to scan available QR Codes.

EXIT

The iPad reads, “Are you sure you want to exit? All data will be lost.”

- If “No” is selected, the iPad will return to the tabbed content.
- If “Yes” is selected, the iPad will let the student(s) exit and prompt them to complete an embedded 3-5 minute survey.

STATE 1

PATIENT ASSESSMENT, BIPAP INITIATION & ABG'S

- Patient Overview
 - The patient is on a NRB when he arrives in the ED. He needs to be placed on BiPAP immediately and ABG's need to be drawn. Students should also perform a patient assessment. The patient is not able to talk much since he is exhausted and/or on the BiPAP.
- Expected Student Behaviors
 - Perform appropriate hand hygiene and infection control
 - Introduce themselves and verify the patient (can scan **QR Code: Patient ID**)
 - Accurately obtain vital signs and interpret for an adult patient
 - Students can enter vitals on the iPad, but they are not tied to any iPad programming.
 - Perform a focused respiratory assessment
 - Inspection – Students will not find any abnormalities in the chest exam. When the extremities are evaluated, bilateral pitting edema and Right-lower extremity cellulitis is found. (Scan **QR Code: Right Leg** & **QR Code: Left Leg**)
 - Palpation – Students will not find any abnormalities in the chest exam.
 - Percussion – Students will not find any abnormalities in the chest exam.
 - Auscultation – Scan **QR Code: Chest** □
 - There are ten QR codes to apply to the chest – see above Chest QR Code chart for locations
 - Students will hear the following breath sounds:
 - Crackles are noted in all lung locations.
 - Patient History

- If students ask questions about the patient history, Hector is too tired to answer much. Can maybe answer a few “Yes” or “No” questions. Responses do not matter as the students should recognize that the patient’s answers may not be accurate secondary to his condition.
 - Safely perform a radial ABG
 - Facilitator Note: This should be done as part of the included BiPAP protocol, but you can have someone call or state that an ABG is needed per MD order. An actual ABG order is written on the Provider Orders that become available in State 2.
 - Facilitator Note: There is a video of a right Modified Allen’s test (**QR Code: Right Allen’s**) and a left Modified Allen’s test (**QR Code: Left Allen’s**).
 - Students can scan either or both QR Codes to evaluate for collateral circulation prior to the ABG puncture.
 - Safely apply non-invasive ventilation
 - There is an “Adult BiPAP Protocol – Acute” located in the Protocol tab on the iPad.
 - If needed, an image of a BiPAP is available by scanning **QR Code: BiPAP**
 - Recognize and respond to abnormal findings
 - Document accurately
 - This can be documented on the provided enterable ventilator flowsheet located on the iPad in the Ventilator Flowsheet tab.
- Technician Prompts
 - Patient is exhausted and only able to answer some “Yes” or “No” questions. Responses do not matter as the students should recognize that the patient’s answers may not be accurate secondary to his condition.
 - Patient response can include:
 - If he is on the BiPAP, your voice should be very muffled to add realism to the scenario.
- Facilitator Questions
 - Analyze the vital signs: are they within normal limits?

- Analyze the findings from the pulmonary exam: do you have any concerns?
 - How should you respond to Hector's LOC?
 - Why is it necessary to perform a Modified Allen's test?
 - How do you know that BiPAP is effective for this patient?
 - What side effects can you expect for the BiPAP?
- Tabbed iPad Prompts and Content

LEVEL 1/2

- When the Level 1 tab is tapped, the iPad reads, "The iPad is at Level 1."
- The Level 1 tab will automatically change to a Level 2 tab after **QR Code: Facilitator** is scanned.
- When the Level 2 tab is tapped, the iPad reads, "The iPad is at Level 2."

STATE 2

ABG RESULTS & PROVIDER NOTIFICATION

- Patient Overview
 - State 2 begins with the iPad making a “dinging” sound and a plaque that reads “Labs have resulted.” ABG results (as well as other labs) are now available for review by tapping on the Labs tab. In addition, Provider Orders and the MAR are available (see below). Students should interpret the ABG’s and make adjustments to the BiPAP settings per the provided protocol. Once adjustments are made, students should update the provider. Students should interpret the ABG’s and call the provider as they are indicating intubation may be necessary. Students should also titrate the BiPAP per protocol until the decision to intubate is made.
- Expected Student Behaviors
 - Interpret ABG results
 - Titrate BiPAP settings per protocol
 - Demonstrate appropriate communication with the provider
 - Students should suggest intubation.
 - Document accurately
 - Ensure students document changes on the ventilation flowsheet.
- Technician Prompts
 - The patient is asleep on BiPAP.
 - The technician can play the role of the provider in person or via telephone.
 - Ensure students give an accurate update in SBAR format.
 - Provide the following orders:
 - “Prepare the patient for intubation.”
 - “I am entering the needed orders in the computer now.”
- Facilitator Questions
 - Interpret the lab results: What is of primary concern for this patient and why?

- Do the lab results lead you towards a certain diagnosis? If so, what would that be and why?
- How does the given medication (furosemide) correlate to the lab results and the patient condition?
- How does a protocol aid your treatment of the patient?
- Tabbed iPad Prompts & Content
 - The scenario advances to Level 3 after students tap on the Level 2 tab and answer “Yes” to the question, “Have you notified the provider?”

ORDERS

Provider Orders

Date	Time	Order
Today	now	Emergency Department Orders
		Continuous telemetry and SpO2 monitoring
		Obtain current weight
		Insert Foley catheter for strict I & O
		Obtain accurate home medication history
		STAT Labs: CBC with differential, Chem 7, Magnesium, BNP, Liver Enzymes, CK & Troponin, INR
		STAT portable chest x-ray: respiratory failure
		STAT ECG
		STAT bedside echocardiogram
		STAT Respiratory Therapy Consult
		STAT BiPAP per protocol, O2 to keep SaO2 > 90%
		STAT ABG
		80 mg furosemide IV, STAT
		K+ replacement protocol-----Dr. Hospita, MD

MAR**Medication Administration Record**

Scheduled		
Continuous Infusion		
PRN		
Discontinued		
Furosemide 80 mg IV, STAT	Discontinued	Last Given
	10 minutes ago	10 minutes ago

LABS-DIAGNOSTICS**Laboratory Results**

CBC with Differential			
	Today – 10 minutes ago	Units	Reference Range
WBC	11.8	x10 ³ uL	F: 4.7-10.3/M: 4.5-10.5
RBC	3.6	x10 ⁶ uL	F: 4.0-4.9/M: 4.0-4.9
Hgb	9.9	g/dL	F:10.9-13.3/M:11.0-13.3
HCT	30.2	%	F: 33.0-39.6/M: 32.7-39.3
MCV	76.7	fL	F: 78.5-90.4/M: 76.5-90.6
MCH	25	pg	25-33
MCHC	30	g/dL	31-37
RDW	12.3	%	F: 11.6-13.4/M: 12.0-14.0
Platelet	182	x10 ⁹ uL	F: 183-368/M: 194-364
MPV	7.5	7.4-0.4	7.4-10.4
Neutro	72	38-68	38-68
Lymph	25.7	25-54	25-54
Mono	0.3	0-0.8	0-0.8
Eos	1	1-5	1-5

Baso	1	0-2	0-2
------	---	-----	-----

Chem 7 with Magnesium

	Today – 10 minutes ago	Units	Reference Range
Glucose	162	mg/dL	Fasting 70-150
BUN	32	mg/dL	10-25
Creatinine	3.2	mg/dL	F: 0.4-1.4/M: 0.5-1.5
Sodium	134	mEq/L	135-145
Potassium	3.8	mEq/L	3.5-5.3
Chloride	108	mEq/L	98-108
Carbon Dioxide	28	mEq/L	23-27
Magnesium	1.7	mEq/L	1.5-2.5

Liver Enzymes

	Today – 10 minutes ago	Units	Reference Range
ALT	53	U/L	7-55
AST	36	U/L	8-48
ALP	102	U/L	45-115
Albumin	4.8	g/dL	3.5-5.0
Total Protein	6.9	g/dL	6.3-7.9
Bilirubin	0.9	mg/dL	0.1-1.2

BNP

	Today – 10 minutes ago	Units	Reference Range
BNP	2450	pg/mL	< 75 years old = <125

			> 75 years old = <450
--	--	--	-----------------------

CK & Troponin

	Today – 10 minutes ago	Units	Reference Range
CK	330	U/L	M: 52-336/F: 38-176
Troponin	0	ng/mL	<0.1

INR

	Today – 10 minutes ago	Units	Reference Range
INR	2.4	seconds	< 1.1

Arterial Blood Gas (ABG)

	Today – 10 minutes ago	Units	Reference Range
pH	7.16		7.35-7.45
PaCO ₂	82	mmHg	35-45
PaO ₂	68	mmHg	80-100
HCO ₃	28	mmol/L	22-26
Base Excess	-2	mmol/L	0+/-3
SaO ₂	94	%	
Site = ® Radial	Modified Allen's test = √		% O ₂ = 100

LEVEL 2/3

- When the Level 2 tab is tapped, the iPad displays a plaque the reads, “Have you notified the provider?”
 - If “No,” the iPad returns to the iPad tab menu.
 - If “Yes,” the iPad reads, “The iPad is at Level: 3.”

STATE 3

INTUBATION ASSIST

- **Patient Overview**
 - Student must prepare to assist the Provider with intubation. If not already done, students should titrate the BiPAP per protocol to achieve maximum results until the patient is intubated. New Provider Orders and MAR (see below) reflect the needed orders for the procedure.
- **Expected Student Behaviors**
 - Perform an Intubation Assist procedure
 - Student should gather and assemble all supplies needed for the intubation and ensure an RN is present with the ordered medications.
 - Demonstrate appropriate communication with the provider during the procedure.
 - Document accurately
- **Technician Prompts**
 - The patient is asleep on BiPAP and then sedated/paralyzed for the procedure.
 - The technician or facilitator can play the role of the provider who actually performs the intubation.
 - Optional: a student could play the role of the provider and actually intubate to practice those skills. This would provide an opportunity to evaluate the skills of both students and provide feedback.
 - The technician or facilitator should play the role of the RN in order to give meds and help monitor the patient during the procedure.
- **Facilitator Questions**
 - Explain the medications used for induction.
 - What initial mechanical ventilator settings are appropriate for this patient and why?
 - How will you monitor the patient during this procedure?

- Differentiate hypoxemic and hypercapneic respiratory failure.
- Tabbed iPad Prompts & Content
 - The iPad advance to “Exit” after **QR Code: Facilitator** is canned.

ORDERS

Provider Orders

Date	Time	Order
Today	15 minutes	Emergency Department Orders
	ago	Continuous telemetry and SpO2 monitoring
		Obtain current weight
		Insert Foley catheter for strict I & O
		Obtain accurate home medication history
		STAT Labs: CBC with differential, Chem 7, Magnesium, BNP,
		Liver Enzymes, CK & Troponin, INR
		STAT portable chest x-ray: respiratory failure
		STAT ECG
		STAT bedside echocardiogram
		STAT Respiratory Therapy Consult
		STAT BiPAP per protocol, O2 to keep SaO2 > 90%
		STAT ABG
		80 mg furosemide IV, STAT
		K+ replacement protocol-----Dr. Hospita, MD
Today	now	STAT intubation for hypercapneic respiratory failure
		STAT Succinylcholine IV Push 1.5 mg/kg – once for intubation
		STAT Etomidate IV Push 0.3 mg/kg – once for intubation
		Post intubation: Propofol IV infusion @ 50-100 mcg/kg/minute
		– titrate to achieve appropriate level of sedation (see adult ICU
		sedation protocol)
		STAT portable chest x-ray post intubation for tube placement
		Mechanical Ventilation per RT
		ABG's 30 minutes post placement on ventilator

		Place OG tube
		Consult Pulmonology-----Dr. Hospita, MD

MAR**Medication Administration Record**

Scheduled		
STAT Succinylcholine IV Push 1.5 mg/kg – once for intubation	Due Today	Last Given
STAT Etomidate IV Push 0.3 mg/kg – once for intubation	Due Today	Last Given
Continuous Infusion		
Propofol IV infusion @ 50-100 mcg/kg/minute – titrate to achieve appropriate level of sedation (see adult ICU sedation protocol)		Started
PRN		
Discontinued		
Furosemide 80 mg IV, STAT	Discontinued	Last Given
	10 minutes ago	10 minutes ago

LEVEL 3/EXIT

- When the Level 3 tab is tapped, the iPad reads, “The iPad is at Level 3.”
- The Level 3 tab will automatically disappear when **QR Code: Facilitator** is scanned.
- When the Exit tab is tapped, the iPad reads, “Scenario objectives have been met. Are you sure you want to exit the game?”
 - If “No” is selected, the iPad will return to the tabbed content.
 - If “Yes” is selected, the iPad will let the student(s) exit and prompt them to complete an embedded 3-5 minute survey.

DEBRIEF

Nothing needed from the iPad.

QUESTIONS

1. How did you feel this scenario went?
2. What were the main issues you had to deal with when caring for Hector?
3. Review understanding of learning objective: Perform a focused respiratory assessment.
 - a. What concerns did you find during your physical assessment and evaluation?
 - b. Is this what you would expect in a patient with congestive heart failure? Why or why not?
 - c. If you could “do over” any part of Hector’s assessment, what would it be and why?
4. Review understanding of learning objective: Recognize and respond to abnormal findings.
 - a. What abnormal findings did you encounter in this scenario?
 - b. How did you respond to those abnormal findings?
 - c. Were the findings what you expected? Why or why not?
5. Review understanding of learning objective: Evaluate objective and subjective data.
 - a. What abnormal findings did you find in the vital signs and/or physical assessment? How did you respond to these findings?
 - b. Explain how an ABG is affected by different therapeutics including oxygen, nebulizer administration, certain hyperinflation techniques, CPAP/BiPAP, etc...
6. Review understanding of learning objective: Implement and follow evidence-based standards and protocols
 - a. How did the protocol in today’s scenario help you in caring for Hector?
 - b. How are evidence-based standards developed and why are they important?
7. Review understanding of learning objective: Safely manage non-invasive mechanical ventilation
 - a. Describe how non-invasive mechanical ventilation works in CHF.

- b. When is the decision made to switch from non-invasive to invasive mechanical ventilation?
 - c. If you could “do over” any part of the BiPAP initiation and management, what would it be and why?
 8. Review understanding of learning objective: Assist provider in medical procedures.
 - a. What can “go wrong” when intubating a patient and how do we prepare for those circumstances prior to the procedure and/or remedy them if they occur?
 - b. If you could “do over” any part of the intubation assist, what would it be and why?
 9. Review understanding of learning objective: Demonstrate appropriate communication.
 - a. Were the communication techniques you used with Hector effective? Why or Why not?
 - b. If Hector was unable to speak English, how would you have adapted you communication techniques?
 - c. If you could “do over,” how would you change your communication with Hector?
 - d. How did you update the provider after you interpreted the ABG’s and titrated the BiPAP?
 10. Review understanding of learning objective: Document accurately.
 - a. What is important to document in your assessments and interventions?
 - b. If something is done in error, how is this documented? (Relate this back to the ABG and how if it was drawn on a nebulizer at 7 lpm O₂ and not the 4 lpm O₂ that is documented on the lab results, that is inaccurate and an error.)
 - c. How can you correct errors in the chart?
 11. Summary/Take Away Points
 - a. “Today you cared for a Hispanic patient who was experiencing an exacerbation of his known congestive heart failure. What is one thing you learned from participating in this scenario that you will take with you into your respiratory therapy practice?” (Each student must share something different from what the others’ share.)

Note: Debriefing technique is based on INASCL Standard for Debriefing and NLN Theory Based Debriefing by Dreifuerst.

SURVEY

Print this page and provide to students.

Students, please complete a brief (2-3 minute) survey regarding your experience with this ARISE simulation. There are two options:

1. Use QR Code: Survey

Note: You will need to download a QR Code reader/scanner onto your own device (smartphone or tablet). There are multiple free scanner apps available for both Android and Apple devices from the app store.

This QR Code will not work in the ARIS app.



2. Copy and paste the following survey link into your browser.

https://ircvtc.co1.qualtrics.com/SE/?SID=SV_6Mwfv98ShBfRnBX

APPENDIX A

ADULT BIPAP PROTOCOL - ACUTE

1. POLICY

- a. The Respiratory Therapist (and Provider) will determine BiPAP settings based on each patient's ideal body weight, diagnosis, and clinical condition. Clinical data will be used to determine appropriate changes to these settings.

2. PURPOSE

- a. The purpose of this policy is to facilitate the emergent application, management, and weaning/discontinuation of BiPAP therapy.

3. SCOPE

- a. These BiPAP guidelines support an interprofessional approach to patient care allowing the Respiratory Therapist to make timely adjustments to the BiPAP and better manage the patient's immediate clinical demand as his/her condition changes.
- b. This protocol applies to patients who are 16 years old or greater.

4. INCLUSION CRITERIA

- a. Candidates for BiPAP can include COPD exacerbation, acute pulmonary edema, congestive heart failure, immunosuppressed patients, and weaning failure (COPD). Other considerations include hypercapnic respiratory failure in neuromuscular disease or chest wall deformity, asthma exacerbation, post-extubation failure, obstructive sleep apnea, and postoperative respiratory failure.
 - i. Moderate to severe dyspnea, accessory muscle use, paradoxical breathing, respiratory rate $>25/\text{min}$
 - ii. Moderate to severe acidosis and hypercapnia ($\text{pH} < 7.35$, $\text{PaCO}_2 > 50$ mmHg)
 - iii. Moderate to severe hypoxemia ($\text{PaO}_2 < 60$ mmHg, $\text{PaO}_2/\text{FiO}_2 < 200$)

5. CONTRAINDICATIONS (Exclusion Criteria)

- a. The following conditions are contraindications for BiPAP therapy:
 - i. Apnea
 - ii. Untreated pneumothorax or pneumomediastinum

- iii. Decreased LOC that prevents the patient's ability to protect his/her own airway
- iv. Inability to maintain a patent airway or adequately clear secretions
- v. Non-compliant patient.

6. PRECAUTIONS (Possible Exclusion Criteria)

- a. The following conditions are of concern and a risk versus benefit analysis must be performed prior to the initiation of BiPAP and during the management of the therapy:
 - i. Hemodynamic instability
 - ii. Risk for aspiration of gastric content
 - iii. Bullous lung disease
 - iv. Pre-existing pneumothorax or pneumomediastinum
 - v. Acute sinusitis, otitis media, or epistaxis
 - vi. Recent facial, oral or skull surgery, esophageal surgery, or trauma to those areas.
 - vii. Acute upper GI bleed

7. GENERAL GUIDELINES

- a. Ordering Adult BiPAP Protocol
 - i. The protocols will be initiated by Provider order.
 - ii. Any order not covered by the protocol should be written on the order sheet.
 - iii. The attending Provider may discontinue the protocol at any time.
- b. Arterial Blood Gases
 - i. An ABG should be obtained prior to initiation, if possible, and 30 minutes post initiation.
 - ii. An ABG can be obtained during BiPAP management if there is a change in the patient's respiratory condition or LOC.
 - iii. The Provider must be notified with all ABG results.

8. INITIATION & MANAGEMENT

- a. Determine the appropriate patient interface. Generally, a full face mask is the interface of choice.
- b. Select patient settings. The following guidelines are for initiation only and adjustments will need to be made based on patient response and/or condition.
 - i. Mode: Spontaneous-timed, if alternate mode needed, consult with Provider.
 - ii. IPAP: 10-16 (max 25) cmH₂O
 - iii. EPAP: 4-6 (max 10) cmH₂O
 - iv. FiO₂ titrated to keep SpO₂ > or = to 90%
 - v. Initially start with lower settings and titrate to levels that reduce work of breathing and allow a reduction in FiO₂. This will improve patient tolerance and cooperation.
- c. Titrate initial settings as follows:
 - i. Initially start with lower settings and titrate to levels that reduce work of breathing and allow for a reduction in FiO₂. This will improve patient tolerance and cooperation.
 - ii. Titration is based on patient assessment including: general appearance, blood pressure, heart rate, breath sounds, SpO₂, ventilating pressures/volumes, and ABG results
 - iii. To improve ventilation, increase IPAP in increments of 2-3 cmH₂O every 5 minutes until a max of 25 cmH₂O is reached.
 - iv. To improve oxygenation:
 - 1) Increase EPAP in increments of 2 cmH₂O until a max of 10 is reached keeping pressure support ventilation > 5 cmH₂O.
 - 2) Increase FiO₂
 - 3) When increasing EPAP, increase IPAP by same amount of pressure to maintain the same level of pressure support.
 - v. Ensure the patient is comfortable with minimal WOB and/or acceptable leak.
 - vi. If the patient is not comfortable, assess for the following:
 - 1) Work of breathing: titrate settings to improve distress
 - 2) Optimize tidal volume >6-7mL/kg

- 3) Adjust rise time and inspiratory time
 - 4) Leak: re-adjust mask or change mask size
 - 5) Consider lower pressures
- d. Evaluate ABG results looking for improvement.
- i. If not within normal limits or shows no improvement over pre-BiPAP ABG's and/or patients clinical condition has not improved, titrate settings until maximum settings are reached.
 - ii. If max settings are reached with no improvement, the Provider must be contacted for further orders (i.e. intubation).
- e. Skin Integrity
- i. Patients on continuous non-invasive ventilation must have the mask removed for 5-10 minutes every four hours around the clock at which time the skin is inspected for redness or irritation.
 - ii. Any patient anticipated to be on continuous NIV for greater than 10hrs, must have silicone dressing applied.
 - iii. If pressure redness or irritation develops, apply silicone dressing to the bridge of the nose.
 - iv. If pressure necrosis appears to be developing, the nurse and Provider must be notified.
- f. The Provider must be contacted at any time if the patient assessment reveals worsening patient condition. Clinical conditions requiring notification include:
- i. IPAP > 25 cmH₂O
 - ii. EPAP > 10 cmH₂O
 - iii. RR > 30 bpm
 - iv. SpO₂ < 92%
 - v. Worsening ABG
 - vi. Hemodynamic instability
 - vii. Change in LOC
- g. If there is no physiologic improvement within 2 hours of initiation, intubation and mechanical ventilation should be considered.

- h.** Document within 15 minutes of initial application and perform a complete assessment every 30 minutes x 2 then every 4 hours and as needed.

9. WEANING

- a.** Reversal or sufficient resolution of underlying cause of respiratory failure is the most important factor in complete liberation from BiPAP.
- b.** With a rapidly reversible problem (i.e. cardiogenic pulmonary edema), simple discontinuation of NPPV is generally all that is required.
- c.** For other causes of respiratory insufficiency/failure, periodic breaks from BiPAP should begin when:
 - i.** FiO₂ has been decreased to 35-40%
 - ii.** IPAP <18 cmH₂O
 - iii.** EPAP <12 cmH₂O
 - iv.** Patient is able to sustain effective spontaneous ventilation
- d.** Break periods allow for expectoration, oral intake, improved humidification, and/or time for reperfusion of skin pressure points. The number and duration of breaks should gradually increase until the patient is able to maintain adequate oxygenation and ventilation with their normal work of breathing.
- e.** Break periods continue as long as the patient is clinically stable and maintaining adequate oxygenation on <60% O₂.

10. DISCONTINUANCE

- a.** Place patient on oxygen therapy
- b.** Monitor SpO₂ and work of breathing
- c.** BiPAP can be removed from the patient's room 24 hours after the last use or sooner if the patient's condition has improved significantly.

BiPAP can be reinstated without an additional Provider order within 24 hours of being removed from a patient's room, unless otherwise ordered.

CREDITS

BiPAP Protocol adapted from RES Non-Invasive Positive Pressure Ventilation Guideline from

[http://www.aast.org/Assets/5e4309dd-c952-4a56-b2c9-](http://www.aast.org/Assets/5e4309dd-c952-4a56-b2c9-7060670a7573/635376719195570000/non-invasive-positive-pressure-ventilation-guideline-3-26-14-june-2014-pdf)

[7060670a7573/635376719195570000/non-invasive-positive-pressure-ventilation-guideline-3-26-14-june-2014-pdf](http://www.aast.org/Assets/5e4309dd-c952-4a56-b2c9-7060670a7573/635376719195570000/non-invasive-positive-pressure-ventilation-guideline-3-26-14-june-2014-pdf) and BiPAP/CPAP Protocol from

<http://desmondallen.com/Parent/Archived%20Articles/Advance%20RCP/BiPAP%20Protocols.htm>

CXR image from: https://commons.wikimedia.org/wiki/File:Pulmonary_oedema.jpg

Lung sounds used with permission from Thinklabs Medical, LLC, Centennial, CO at

www.thinklabs.com

Medication information from National Library of Medicine: Daily Med at

<http://dailymed.nlm.nih.gov/dailymed/> Pitting Edema picture from

https://en.wikipedia.org/wiki/Heart_failure

Pitting Edema picture with cellulitis from

https://commons.wikimedia.org/wiki/File:Pitting_Edema2008.jpg

REFERENCES

- American Heart Association (2016). Get with the Guidelines: Heart Failure. Retrieved from http://www.heart.org/HEARTORG/Professional/GetWithTheGuidelinesHFStroke/Get-With-The-Guidelines---HFStroke_UCM_001099_SubHomePage.jsp
- Cleveland Clinic. (2017). B-type Natriuretic Peptide (BNP) Blood Test. Retrieved from <https://my.clevelandclinic.org/health/articles/b-type-natriuretic-peptide-bnp-bloodtest>
- Colucci, MD, W. (April 2017). Treatment of Acute Decompensated Heart Failure: Components of Therapy. Retrieved from https://www.uptodate.com/contents/treatment-of-acute-decompensated-heart-failure-components-of-therapy?source=search_result&search=chf&selectedTitle=3~150
- Fonarow, MD, G. C. & Weber, DO, J.E. (2004). Rapid Clinical Assessment of Hemodynamic Profiles and Targeted Treatment of Patients with Acutely Decompensated Heart Failure. *Clinical Cardiology*, 27 (Supplement V). Retrieved from https://deepblue.lib.umich.edu/bitstream/handle/2027.42/107535/4960271702_ftp.pdf?sequence=1
- Hyzy, MD, R. (April 2017). Noninvasive Ventilation in Acute Respiratory Failure in Adults. Retrieved from https://www.uptodate.com/contents/noninvasive-ventilation-in-acute-respiratory-failure-in-adults?source=search_result&search=noninvasive%20positive%20pressure%20ventilation&selectedTitle=1~150
- Joint Commission (2016). Specifications Manual for Joint Commission National Quality Measures. Downloaded from: <https://manual.jointcommission.org/releases/TJC2016A/AdvancedCertificationHeartFailure.html>

Mayo Foundation for Medical Education and Research. (1995-2017). Test ID: CK. Retrieved from <http://www.mayomedicallaboratories.com/test-catalog/Clinical+and+Interpretive/8336>

Nohria, A., Lewis, E., & Stevenson, L. (2002). Medical Management of Advanced Heart Failure. *Journal of the American Medical Association*, 287 (5), 628-640. Retrieved from <http://jamanetwork.com/journals/jama/fullarticle/194604>

Stella, L. (2013). Understanding Measures for Heart Failure Treatment, *American Nurse Today*, 8(2). Retrieved from <https://americannursetoday.com/understanding-core-measures-for-heart-failure-treatment/>

Tleyjeh, MD, I., Burdette, MD, S., & Baddour, MD, L. Cellulitis. *Antimicrobe*. Retrieved from <http://www.antimicrobe.org/e1.asp>

WebMD, Inc. (2017). Hemoglobin A1c (HbA1c). Retrieved from http://www.emedicinehealth.com/hemoglobin_a1c_hba1c/page2_em.htm#what_are_normal_levels_of_hba1c_hemoglobin_a1c_chart

Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE Jr, Drazner MH, Fonarow GC, Geraci SA, Horwich T, Januzzi JL, Johnson MR, Kasper EK, Levy WC, Masoudi FA, McBride PE, McMurray JJV, Mitchell JE, Peterson PN, Riegel B, Sam F, Stevenson LW, Tang WHW, Tsai EJ, Wilkoff BL. (2013) ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2013;128:e240–e327. DOI: 10.1161/CIR.0b013e31829e8776



This work by the Wisconsin Technical College System TAACCCT IV Consortium is licensed under a Creative Commons Attribution 4.0 International license.

Third party marks and brands are the property of their respective holders. Please respect the copyright and terms of use on any webpage links that may be included in this document.

This workforce product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The U.S. Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. This is an equal opportunity program. Assistive technologies are available upon request and include Voice/TTY (771 or 800-947-6644).