

## Challenge # 1: Oxygen Delivery Matching

Match each respiratory device (in the left-hand column) with the amount of flow it should be connected to (in the right-hand column).

1	 Pediatric & Adult Nasal Cannula	A	10-15 L/min
2	 Simple Face Mask	B	1-4 L/min (max 6 L/min for older patients)
3	 Venturi Mask	C	2-60 L/min *Dependent on patient's size
4	 Non-rebreather	D	6-10 L/min
5	 High Flow Nasal Cannula	E	2-12 L/min *Match flow with corresponding color-coded attachment

## Challenge # 2: Bubble CPAP

Bubble CPAP is a respiratory device that creates continuous positive pressure by placing the expiratory system into a column of liquid. The flow of air into the liquid (sterile water) causes bubbling to occur in the chamber. This mechanism creates small airway pressure oscillations that are transmitted to the baby's chest for recruitment. Bubble CPAP also reduces work of breathing by increasing functional residual capacity, improving lung compliance, and decreasing airway resistance.

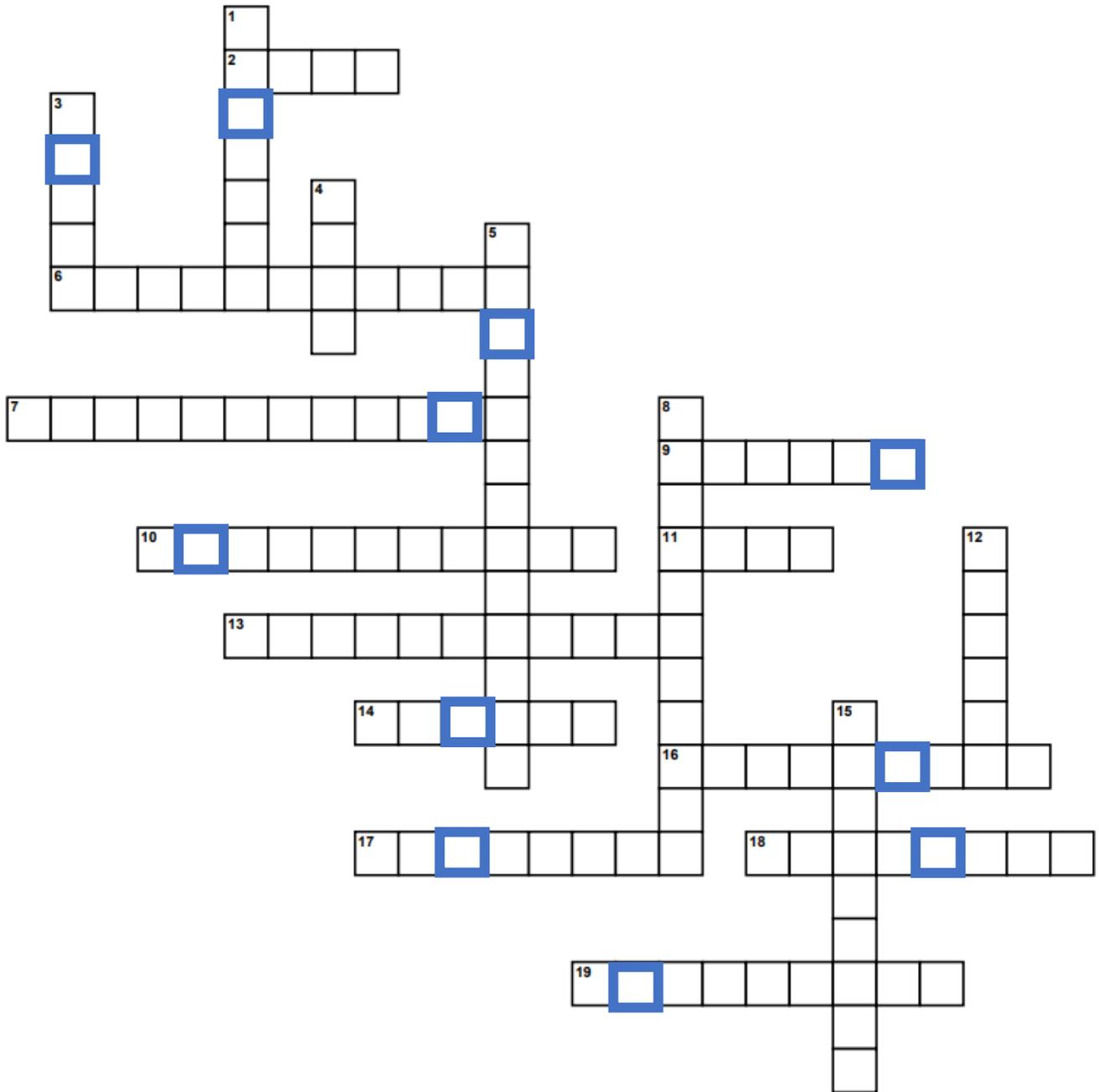
1. How much PEEP is the patient in the picture receiving?
  - a. 3 cmH<sub>2</sub>O
  - b. 4 cmH<sub>2</sub>O
  - c. 5cmH<sub>2</sub>O
  - d. 6 cmH<sub>2</sub>O
2. This type of tube is recommended for gastric decompression.
3. It is essential to ensure a CPAP seal at the nares, to prevent interruptions in positive pressure support. There are \_\_\_\_ sizes of nasal prongs, along with stabilization devices (headbands).
4. The prongs should be fitted to the nares without directly putting pressure on the \_\_\_\_\_



5. Acceptable assessment of bubble CPAP includes (select all that apply):
  - a. Intermittent bubbling
  - b. Continuous bubbling
  - c. Confirming FIO<sub>2</sub> and oxygen flow meter rate
  - d. Confirming only oxygen flow meter rate, this delivery cannot account for FiO<sub>2</sub> changes
  - e. Applying Allevyn or a Sween cream to the nasal septum
  - f. Evaluating the tightness of the stabilization headband to prevent misshaping of the head.
  - g. Evaluate patency of the nares for poor airflow.
  - h. Evaluate any alarms for poor pressure support or no bubbling.

**Challenge # 3: Crossword Puzzle**

Across	Down
2. _____ mode of oxygen delivery is typically dosed at 2 L/kg/min in patients younger than 24 months of age.	1. Oxygen consumption in the neonate will increase or decrease with any deviation from the neutral _____ environment.
6. This term is measured in VTi and VTe, measuring the amount of air between inhalation and exhalation. Typically ranges between 8-10 ml/kg. (two words).	3. When measuring pre & post ductal oxygen saturations, a pulse oximeter should be placed on the _____ hand and a foot.
7. Injury to the _____ (usually the left) can occur during surgeries involving the dissection of the branch pulmonary arteries and manipulation of the aortic arch or superior vena cava. This typically results in paradoxical movement and diaphragmatic palsy. (two words)	4. A mode of ventilation in which very small tidal volumes are delivered at high rates to promote lung protection and atelectrauma.
9. Administer this to promote pulmonary vasodilation.	5. Nitric Oxide binds to hemoglobin to produce _____. These levels should be monitored during administration because it alters the effectiveness of oxygen released to the body tissues.
10. This syndrome is a result of untreated congenital heart defects that leads to pulmonary hypertension.	8. A vascular ring can potentially cause _____ of the trachea.
11. Single ventricle patients aim to have a _____ of around 35-40 mmHg on ABG. This range combats pulmonary over-circulation and a Qp: Qs mismatch.	12. When using this mode of ventilation, the amplitude is known to control the distance the diaphragm travels from its resting position and can be visually assessed through a “_____” in the chest.
13. This therapy can be used in patients with pulmonary hypertension or severe right ventricular dysfunction because it acts to relax the vascular smooth muscle and increases pulmonary blood flow. (two words)	15. Positive pressure ventilation _____ RV preload.
14. This therapy is prescribed in a ratio (70:30). It changes turbulent flow into laminar flow, which lets the gas pass through constricted airways to decrease WOB.	
16. Positive pressure ventilation has this effect on intrathoracic pressure.	
17. This therapy increases pulmonary vascular resistance.	
18. _____ breathing is a normal condition in neonates categorized by brief pauses in breathing (<10 seconds), followed by rapid, steady breathing.	
19. Following a Fontan procedure for tricuspid atresia, any increase in intrathoracic pressure will not only affect venous return, but also _____ pulmonary vascular resistance. Due to the passive PBF, positive pressure ventilation may be detrimental to these patients.	



Unscramble the highlighted letters to identify the challenge code word: \_ \_ \_ \_ \_

## Challenge # 4: Ventilation & PVR Management Matching

Match each patient with the appropriate intervention or mode of ventilation.

1. Your patient's x-ray shows severe atelectasis in the bilateral lower lungs. This can lower lung \_\_\_\_\_, due to the reduced lung volume and increased pressure needed to inflate the alveoli.
2. Your patient is post-operatively intubated and has a mode of ventilation that has less effect on venous return and cardiac output. This mode helps to compensate for small changes in the patient's disease process and allows for auto-weaning as your patient improves.
3. Which mode of ventilation does not directly control tidal volumes?
4. Your post-cath patient has just been extubated and on immediate assessment, you notice an inspiratory stridor. What would be your next intervention?
5. The pre-operative interrupted aortic arch neonate is consistently hypotensive and progressing to cardiogenic shock. Which therapy is needed to promote distal arch perfusion with right-to-left shunting across the PDA?
6. Your post-operative tetralogy of fallot infant is experiencing significant right sided dysfunction after repair. Which adjustment is needed for this patient's course?
7. Infant size nasal cannulas can deliver a maximum of 2 L/min. If your patient needs to be escalated with \_\_\_\_\_, call Respiratory to assist with a different NC size or HFNC.
8. In patients with univentricular disease processes, too much of this therapy can lead to severe pulmonary over-circulation. It can be utilized more liberally in patients with two functional ventricles.
9. This mode of ventilation will often be used in conjunction with another mode.
10. This mode of ventilation measures electrical activity of the diaphragm to determine the level of pressure support needed with each breath. Typical level ranges from 0.5-5 cmH<sub>2</sub>O/microvolts.

\_\_\_ **Nitrogen/Hypoxic Mix:** treatment for induced hypercarbia and hypoxia to affect blood shunting.

\_\_\_ **SIMV:** patient receives intermittent mandatory breaths that are prompted by the ventilator but are synchronized with the patient's own breathing efforts.

\_\_\_ **Compliance:** stiffness of the lungs

\_\_\_ **Pressure Control:** pressure fixed throughout inspiration and flow will decrease throughout inspiration.

\_\_\_ **FiO<sub>2</sub>:** percentage or concentration of oxygen inhaled by a person. Adjust to compensate for desaturations.

\_\_\_ **Racemic Epinephrine:** treatment of upper airway obstruction.

\_\_\_ **Oxygen Flow:** rate at which oxygen is delivered to a patient. Adjust to compensate for increased WOB.

\_\_\_ **NAVA:** allow for improved patient-ventilator synchrony and reduces risk of associated lung injuries.

\_\_\_ **PRVC:** ventilator adjusts peak inspiratory pressure to target a tidal volume (airway pressure is fixed throughout an inspired breath but can vary between breaths).

\_\_\_ **Nitric Oxide:** utilized for treatment of increased PVR to assist with pulmonary blood flow

**Challenge # 5: X-ray Scenario & Intervention Matching**

Match the x-ray & scenario description with the expected nursing follow-up action. (You are *not* interpreting the X-ray. Each scenario describes a provider-identified or report-identified finding you might encounter. Your job is to match it with the appropriate nursing action, which is within nursing scope).

1



ET tube appears advanced into the right mainstem bronchus

Case courtesy of Jeremy Jones, Radiopaedia.org, rID: 23852

2



Right upper lobe opacification with volume loss in keeping with right upper lobe atelectasis. ET tube tip is just above carina. Left upper limb PICC tip over right atrium. NG tube tip in stomach.

Case courtesy of Abdelazziz Ibrahim, Radiopaedia.org, rID: 93368

3



Prominent pulmonary vasculature (active congestion) without pleural effusions or convincing consolidation.

Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 7445

4



Left hemidiaphragm is markedly elevated. Cardiomegaly. Aortic valve replacement & sternotomy wires noted.

Case courtesy of Henry Knipe, Radiopaedia.org, rID: 31783

A

Perform focused respiratory and fluid status assessments; optimize positioning; monitor I/O and oxygen needs; follow diuretic orders; and notify the provider of any worsening signs.

B

Perform a focused respiratory & cardiovascular assessment; monitor for increased work of breathing, asymmetry in chest movement & changes in oxygen needs. Ensure post-cardiac surgery precautions are followed, and notify the provider of any changes or concerns related to respiratory effort or cardiac status.

C

Assess breath sounds & symmetry, verify securement and tube markings, ensure ventilator parameters are stable, and notify the provider, RT, & Charge RN for ETT repositioning.

D

Implement or increase pulmonary hygiene measures per orders (repositioning, CPT, suctioning as indicated), assess breath sounds and ventilation tolerance, ensure appropriate ventilator settings are followed, and notify the provider of any change in respiratory status or failure to improve.

Resources:

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