6279.02: ADULT RESPIRATORY DISTRESS

INTRODUCTION

Respiratory distress is one of the most common clinical presentations in pre-hospital care. The etiology may be multifactorial. Successful management requires a broad differential diagnosis, astute assessment skills, knowledge of treatment options, and technical skills including BVM ventilation, application of CPAP (continuous positive airway pressure), intubation, and needle decompression. Care is escalated depending on the severity of the presentation.

Respiratory failure is a syndrome in which the respiratory system fails in one or both of its gas exchange functions (oxygenation and/or carbon dioxide elimination). The process of getting oxygen into the body is called oxygenation. A failure to oxygenate means that a patient will have a low arterial oxygen tension (i.e. a low PaO_2), which is known as hypoxemic respiratory failure, or Type I Respiratory Failure. This type of respiratory failure is the most common and occurs in most acute respiratory conditions such as pulmonary edema or pneumonia.

Type I Respiratory Failure (Failure to Oxygenate)	
Category	**Examples**
Low FiO_2	Empty home oxygen canister, at altitude
Alveolar Hypoventilation	Narcotic overdose
High VQ	Shunt, pulmonary embolism
Low VQ	Asthma, COPD, atelectasis
Increased Diffusion Gradient	CHF, pneumonia, contusion

The other function of gas exchange is to get carbon dioxide out of the body (ventilation). If carbon dioxide is not being expired adequately, carbon dioxide levels increase in the body (i.e. a high $PaCO_2$), leading to the patient becoming somnolent. This is known as hypercapnic respiratory failure or Type II Respiratory Failure. Conditions causing this type of failure include drug overdose (causing hypoventilation), COPD, chest wall abnormalities, and neuromuscular disorders.

Type II Respiratory Failure (Failure to Ventilate)	
Category	**Examples**
Decreased CO_2 Elimination	Inadequate ventilation (either low rate or volume) Adequate ventilation [but increased dead space (e.g. emphysema)]
Increased CO_2 Production	Seizure, sepsis

It is common to have a mix of both Type I and Type II failure (e.g. COPD, narcotic overdose).

Some chronic conditions affecting the respiratory system can be classified as obstructive, where exhaling all the air in the lungs is difficult, therefore at the end of exhalation there is still a significant amount of air in the lungs. Conversely, there are restrictive conditions, usually from stiffness of the lungs or chest wall, weak muscles, obesity or nerve damage. These conditions do not allow for full inspiration during ventilation.

SAFETY

A number of etiologies presenting with shortness of breath can expose the paramedic to various pathogens. During respiratory management, paramedics are in close proximity to the patient's mouth and nose. Both respiratory particles and medications are released into the surrounding environment when treating with any aerosolized medication. These particles can range from the common cold to tuberculosis. Paramedics should use appropriate personal protective equipment such as gloves, goggles and masks. Any others in close proximity to the patient should also be made aware of these safety measures. Provide masks to these people as necessary.

ASSESSMENT

Assessment of respiratory distress begins with the overall general impression of the patient.

Assess the patient's mental status. Restlessness, agitation, and confusion can occur with hypoxia. As the distress increases and the patient nears respiratory failure, lethargy can occur, where the patient's head will begin to bob, and they will appear as if they are about to fall asleep.

Airway

Is there a need for airway protection? This may be evidenced by decreased level of consciousness with snoring respirations, high-pitched sounds over the upper airway (stridor), inability to speak, cough, or other airway protective reflexes.

Are there any signs to suggest obstruction due to foreign body, infection (e.g. epiglottitis or abscess),

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underlying pathology (e.g. tumor), angioedema, or trauma?

When looking at the neck, take note if there appears to be tracheal deviation. This is a sign of a tension pneumothorax and must be treated immediately. Jugular venous distension may be present in tension pneumothorax, cardiac tamponade, or CHF.

Breathing
While assessing breathing, consider the respiratory effort. Is it increased or decreased (is the patient working very hard to breathe, or are they not working hard enough)? Are they using accessory muscles to help them breathe? Are their nares flaring while they breathe? Are they tachypnic or bradypnic? Do they have an abnormal respiratory pattern?

How are they positioned? Patients in respiratory distress often sit straight upright and in more severe cases will sit in the tripod position, where they are leaning forward and supporting their weight with their arms in front of them.

Is the patient speaking comfortably in full sentences or are their sentences shortened due to increased respiratory effort? If the patient is unable to speak or limited to a few words this implies severe respiratory distress.

Observe chest wall movement, and listen to the patients breathing from a distance. You may be able to hear abnormal breath sounds, or a cough while standing in the same room. Auscultate the lungs in a symmetrical pattern, preferably on the back while they are sitting up. If the patient is unable to sit up or you cannot access the patient's back, auscultate the anterior and lateral aspects of the chest. Assess whether there are equal breath sounds bilaterally, the lung sounds are decreased, or whether there are any adventitious sounds. Each point should be auscultated for at least one full respiratory cycle.

Types of Respiratory Sounds
Stridor is a continuous sound heard on inspiration which suggests an obstruction above the vocal cords. It is often heard without a stethoscope.

Wheezes are continuous sounds and classified as high pitch or low pitch (e.g. asthma). They can be anytime during inspiration and/or expiration.

A **quiet chest** can be an ominous sign. The bronchioles can become so constricted that air movement is nearly absent. A pneumothorax may also present with absent lung sounds on the affected side.

Crackles are discontinuous sounds and classified as fine (e.g. CHF) or coarse (e.g. pneumonia). They can be at any time during inspiration and/or expiration.

Crackles are often indicative of CHF, which is often a sign of an underlying problem (e.g. MI, volume overload, arrhythmias). The degree of CHF can be classified using the Killip Classification found in the figure below. The mortality rate increases as you move from Killip I to Killip IV.

Killip Classification for Congestive Heart Failure

Killip I
Signs of CHF such as pedal edema and/or jugular venous distention, but with no adventitious lung sounds.

Killip II
As above, with crackles less than halfway up the posterior chest.

Killip III
As above, with crackles more than halfway up the posterior chest.

Killip IV
Evidence of cardiogenic shock.

Respiratory Pattern
Other abnormal respiratory patterns often reflect serious, underlying non-pulmonary conditions (e.g. herniation in brain, severe cardiac dysfunction).

Abnormal Respiratory Patterns
Kussmaul's respirations – deep, rapid respirations resulting as a corrective mechanism against conditions such as diabetic ketoacidosis.

Cheyne-Stokes respirations – progressively increasing tidal volume followed by declining tidal volume with periods of apnea; seen most often in patients with terminal illness or brain injury.

Apneustic respiration – long, deep breaths stopped during inspiration with periods of apnea; seen with stroke or central nervous system disease.

Central neurogenic hyperventilation – deep, rapid respirations caused by an injury to the brainstem.

Ataxic respirations – repeated patterns of gasping respirations followed by periods of apnea (also known as Biot's respirations); seen with increased intracranial pressure.

Circulation
While assessing circulation, consider the patients general colour, whether they are peripherally warm or cold, as well as their blood pressure. Shock itself may present with respiratory distress. Severe hypoxia can present with cyanosis, though this is often a late finding and indicates severe distress. Tachycardia will often occur during respiratory distress as well. A 12 lead should be obtained on all patients with respiratory distress as a number of cardiac-related etiologies can present with respiratory distress.

Assess for edema in the legs. If edema is found, ask the patient: Is this is normal? Has it changed? Does it get worse throughout the day? Note how far up the limb the edema is and watch for any changes.

Focused History
Attempt to ascertain a more in depth history of the respiratory distress:

- Has this ever happened before?
  - Does the person have a history of a respiratory/cardiac pathology?
  - Have they ever been hospitalized and/or intubated for their condition?
- How long has this been going on?
- Did it start suddenly or gradually?
- Is there any pain?
  - Does the pain change with deep inspiration, palpation, position, or movement?
  - What does the pain feel like?
  - Where is the pain?
- Is there any position that makes breathing easier or more difficult?
- Is there a cough?
  - Is there any sputum? If so, what colour is it?
  - Is there blood coming up with coughing?
- Does the person have a fever?

Recall the etiology may be multifactorial and require management strategies from more than one set of guidelines. See Table 1 for differential diagnoses of respiratory distress.

MANAGEMENT

If any indications of airway compromise exist, they must be managed immediately. Evidence of a tension pneumothorax is also of immediate concern and needle decompression should be used.

Optimizing the patient position is a simple strategy to improve breathing; consider semi- or high-fowlers. For undifferentiated respiratory distress, **oxygen delivery** (**PEP 3 neutral**) may be escalated from nasal cannula to non-rebreather or BVM ventilation depending on the severity of the respiratory distress or hypoxia. If the patient is breathing spontaneously with good effort, BVM may be used to supply oxygen only without mechanical ventilation (squeezing the bag). Using **pulse oximetry** (**PEP 3 neutral**), generally the goal is to maintain O_2 saturations of at least 92%. For COPD, consider **titrated oxygen** delivery (**PEP 1 supportive**) to target O_2 saturations of 88-92%.

If the respiratory effort is absent or ineffective, you may assist ventilation in coordination with the patient's own respirations. BVM technique should be optimized as per Adult Airway Management guidelines. If assisting ventilations, where the patient still has respiratory effort but the rate is too fast, too slow or too shallow, effort should be made to bring the rate into a normal range. A patient with bradypnea can be given one ventilation with each of their own breaths then one in between to essentially

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double their respiratory rate. Someone breathing too quickly can be ventilated every 2nd or 3rd breath in an attempt to decrease their respiratory rate. If respirations are too shallow, providing extra volume by BVM during the inspiratory phase can increase tidal volume. If ventilating a patient with an obstructive condition, ensure enough expiration time is provided so as to not overinflate the lungs.

CPAP should be considered depending on the differential diagnosis and severity of the presentation (**PEP 1 supportive**). Once the mask is sealed on the patient's face, a constant pressure is present. CPAP does not force air into the lungs, rather the continuous pressure forces the bronchioles and alveoli to remain open therefore resulting in increased alveolar surface area and less obstructed breathing. CPAP has been found to reduce endotracheal intubation rates, reduce mortality, and reduce nosocomial infections. In general, CPAP:

- Increases functional residual capacity
- Reduces work of breathing
- Increases oxygen diffusion across alveolar membrane
- Increases alveolar surface area available for gas exchange

CPAP Indications
Age > 16 years old;
Cooperative patient with a patent airway;
Severe dyspnea; AND
at least 2 of the following:
RR >24
SpO_2 <90%
Signs of hypoxia
Adventitious sounds

CPAP Contraindications
GCS <12
SBP <90
Respiratory arrest
Facial trauma
Chest trauma
Vomiting
Tracheostomy
Pneumothorax

If increased airway pressures are required, such as in congestive heart failure or near-drowning but CPAP is unable to be applied due to the patient's level of consciousness, a positive end expiratory pressure (PEEP) valve can be applied to the exhaust port of the BVM when ventilating with or without an endotracheal tube.

Intubation (**PEP 2 neutral**) may be considered depending on the success of the above interventions, level of consciousness, presence of dynamic changes causing progressive airway obstruction (i.e. worsening angioedema), and transport time. See 'Adult Airway Management guideline' for detailed information on intubation.

Consider the differential diagnosis for respiratory distress, and reference the corresponding Short Forms for condition-specific treatment. Remember, the etiology may be mixed and require treatment of more than one possible cause.

Look for signs of shock. Consider following specific shock protocols which include administration of IV fluids. If the patient is felt to be in shock with signs or a history of CHF begin with a smaller bolus of IV fluid and reassess frequently. The bolus may be repeated multiple times, but between boluses the respiratory status (oxygen sats, adventitious lung sounds, level of distress) and response to fluid must be assessed.

Patients with respiratory distress should always have a 12 lead ECG done to help assess for any cardiac involvement.

Medications used in management of respiratory distress

Epinephrine – a sympathomimetic which, in reference to respiratory distress, decreases airway resistance.

Furosemide – a diuretic which inhibits sodium reabsorption therefore leading to an increase in fluid elimination.

Ipratropium (Atrovent) – an anticholinergic which acts as a bronchodilator while also drying up respiratory tract secretions by blocking acetylcholine receptors.

Magnesium Sulfate – an electrolyte, smooth muscle relaxant, and mast cell stabilizer which is beneficial in the management of bronchoconstriction.

Nitroglycerin – a vascular smooth muscle relaxant which reduces peripheral vascular resistance, resulting in increased flow and therefore a decrease in pulmonary edema.

Salbutamol – a sympathomimetic causing bronchodilation and reduced mucus secretion.

TRANSFER OF CARE

Clearly describe the therapies provided.

Indicate if the clinical picture has improved, remained the same, or worsened.

Ensure the 12-lead ECG is received by the ED.

CHARTING

In addition to the mandatory fields, it is important to document the following in the ePCR text fields:

- ✓ The presence or absence of fever with respiratory distress complaint.
- ✓ The presence or absence of chest pain or other associated symptoms.

KNOWLEDGE GAPS

The accurate diagnosis of the exact etiology of respiratory distress can be difficult in the pre-hospital setting.

The treatment of one etiology of respiratory distress can worsen patient outcomes if the correct diagnosis is not made. For example, treating a suspected CHF patient with furosemide can worsen the patient's outcome if the etiology is actually pneumonia.

The optimal use of **furosemide in CHF** (**PEP 2 neutral**) is controversial.

RESEARCH

Any interest in research regarding respiratory distress can be directed to EHS via the following link: http://www.gov.ns.ca/health/ehs/

EDUCATION

Management of respiratory distress is a continuing medical educational competency. In addition to the procedural skills used in managing respiratory distress, clinicians must remain current with contemporary research to ensure appropriate management strategies are employed.

QUALITY IMPROVEMENT

It is important for the paramedic to record the decision-making and process for respiratory management in the ePCR. This will require completion of the various fields in the ePCR, including an appropriate text description in the comment section. Only by appropriate, accurate and complete charting can we build the case for new techniques and strategies.

REFERENCES

http://www.gov.ns.ca/health/ehs/

http://emergency.medicine.dal.ca/ehsprotocols/protocols/toc.cfm

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Table 1 – Differential Diagnoses for Respiratory Distress

Differentials for respiratory distress	Common assessment findings	Auscultation sounds	Typical vital signs	History of	Pre-hospital treatment options
Acute respiratory distress syndrome	Findings are dependent on underlying cause; resistant to treatment (often requires manual respiratory support)	Depends on cause	Tachypnea Tachycardia	Aspiration Chemical exposure Pneumonia Sepsis Trauma	Oxygen PEEP CPAP
Anaphylaxis	Urticaria Swelling Angioedema Nausea/vomiting	Wheezes Decreased or absent in more severe cases Stridor in the upper airway with laryngoedema	Early: Tachycardia Tachypnea Late: Hypotension	Severe allergy	Oxygen Epinephrine Salbutamol Antihistamines
Asthma exacerbation	Cough Prolongation of expiration	Wheezes Decreased or absent in more severe cases	Tachycardia Tachypnea	Asthma	Salbutamol Ipratropium Epinephrine (if severe or near-death) CPAP Magnesium sulfate (if severe or near-death)
Cardiac Ischemia	Chest/abdominal/back pain Changes on 12 lead	Normal	Varied depending on area of ischemia	Angina/MI	ASA Nitroglycerin Morphine Plavix Fibrinolytics
Chronic Obstructive Pulmonary Disease (COPD)	Will depend on underlying condition (emphysema or chronic bronchitis)	Wheezes May be crackles due to mucus plugs	Decreased oxygen saturation from their normal	COPD	Titrated oxygen Salbutamol Ipratropium CPAP
Congestive Heart Failure (CHF)	Peripheral edema Frothy sputum JVD	Crackles	Tachycardia Hyper- or hypo-tension	CHF MI HTN	Nitroglycerin Morphine Furosemide CPAP PEEP

Hemothorax	Signs of shock	Normal except over area where blood is accumulating	Tachycardia Tachypnea Hypotension	Trauma	Normal saline if hypotensive
Hyperventilation Syndrome	Chest pain Numbness and tingling around the mouth, hands and feet Carpopedal spasm Most symptoms are related to the underlying cause	Normal	Tachycardia Tachypnea Increased depth of respirations	Varied, but can include pain or anxiety-related causes	Treat underlying condition and look for other causes
Pneumonia	Respiratory distress Fever Cough Coloured sputum Pleuritic chest pain Abdominal pain	Crackles in the affected lung segment	Tachycardia Tachypnea Possible fever	Respiratory illness Frequent pneumonia	Oxygen CPAP Normal saline (if dehydrated)
Pneumothorax	Subcutaneous emphysema Pleuritic chest pain JVD with tension pneumothorax Tracheal shift in late stages of tension pneumothorax	Absent on affected side	Tachypnea Tachycardia Hypotension with tension pneumothorax	Trauma Spontaneous pneumothorax	Oxygen Needle decompression for tension pneumothorax
Pulmonary Edema	Frothy sputum Cough JVD	Crackles	Hyper- or hypo-tension	Varied, but can be caused by fluid overload or drug overdose	Furosemide CPAP PEEP
Pulmonary Embolism	Respiratory distress Pleuritic chest pain Cough JVD Warm, swollen extremity with pain on palpation or on calf extension	Decreased sounds or wheezes over the affected area	Tachycardia Tachypnea Hypotension Hypoxia	Prolonged immobilization Recent surgery	Oxygen
Toxic Inhalation	Burns on the face or in the mouth/nose Particulate matter on the face or in the mouth/nose	Adventitious sounds of any type possible	Depends on substance inhaled	Exposure to inhaled product	Oxygen Airway management

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PEP 3x3 TABLES for RESPIRATORY DISTRESS

Throughout the EHS Guidelines, you will see notations after clinical interventions (e.g.: **PEP 2 neutral**). PEP stands for: the Canadian **P**rehospital **E**vidence-based **P**rotocols Project.

The number indicates the Strength of cumulative evidence for the intervention. **1 = strong evidence exists**, usually from randomized controlled trials; **2 = fair evidence exists**, usually from non-randomized studies with a comparison group; and **3 = weak evidence** exists, usually from studies without a comparison group, or from simulation or animal studies.

The coloured word indicates the direction of the evidence for the intervention. **Green = the evidence is supportive** for the use of the intervention; **Yellow = the evidence is neutral**; and **Red = the evidence opposes** use of the intervention.

PEP Recommendations for Respiratory Distress Interventions, as of 2012/04/08. See: http://emergency.medicine.dal.ca/ehsprotocols/protocols/toc.cfm for latest recommendations, and for individual appraised articles.

Asthma

Recommendation		DIRECTION OF RECOMMENDATION FOR INTERVENTI		
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)
STRENGTH OF RECOMMENDATION FOR INTERVENTION	1 (strong evidence exists)	• Anticholinergic • Beta Agonist • CPAP/BIPAP • Magnesium Sulfate		
	2 (fair evidence exists)	• Epinephrine • Steroid	• Intubation	
	3 (weak evidence exists)		• Oxygen • Oxymetry Monitoring	

COPD

Recommendation		DIRECTION OF RECOMMENDATION FOR INTERVENTI		
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)
STRENGTH OF RECOMMENDATION FOR INTERVENTION	1 (strong evidence exists)	• CPAP/BIPAP • titrated oxygen	• Anticholinergic	
	2 (fair evidence exists)	• Beta Agonist	• Intubation	• high flow oxygen
	3 (weak evidence exists)		• Oxymetry Monitoring	

Pulmonary Edema(CHF)

Recommendation		DIRECTION OF RECOMMENDATION FOR INTERVENTI		
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)
STRENGTH OF RECOMMENDATION FOR INTERVENTION	1 (strong evidence exists)	• CPAP/BIPAP		
	2 (fair evidence exists)		• Beta Agonist • Diuretic	
	3 (weak evidence exists)		• Narcotic • Nitroglycerin • Oxygen • Oxymetry Monitoring	

Respiratory Distress NYD

Recommendation		DIRECTION OF RECOMMENDATION FOR INTERVENTI		
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)
STRENGTH OF RECOMMENDATION FOR INTERVENTION	1 (strong evidence exists)	• CPAP/BIPAP		
	2 (fair evidence exists)		• Intubation	
	3 (weak evidence exists)		• Oxymetry Monitoring	

*PEP is the **Canadian Prehospital Evidence-based Protocols Project.** Every clinical intervention is given a recommendation based on the strength of available research evidence (1 = randomized controlled trials and systematic reviews of RCTs; 2 = studies with a comparison group; 3 studies without a comparison group or simulation) and direction of the compiled evidence: **supportive** of intervention; **neutral** evidence for intervention; or **opposing** evidence for intervention). See: **http://emergency.medicine.dal.ca/ehsprotocols/protocols/toc.cfm***

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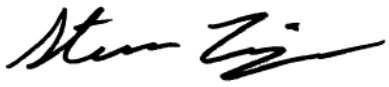
Signature of Program Director 	Signature of Program Document Coordinator 	

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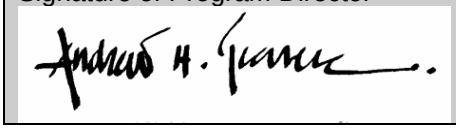
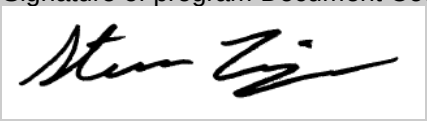
Signature of Program Director 	Signature of program Document Coordinator 	

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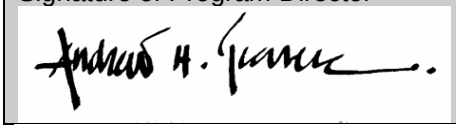
Signature of Program Director 	Signature of program Document Coordinator