Miami Dade College

Course Description

RET2284 | Principles of Mechanical Ventilation | 2.00 credits

A continuation of RET 2275. A concentrated course of study which focuses on the theoretical operation, application and procedures related to critical care and mechanical ventilation. Prerequisites: RET 2275, 2275L; corequisite: RET2284L.

Course Competencies

Competency 1: The student will describe the basic terms and concepts of mechanical ventilation by:

1. Defining ventilation, external and internal respiration
2. Describing how intrapleural and alveolar pressure changes during spontaneous ventilation
3. Defining the terms transpulmonary pressure, transrespiratory pressure, transairway pressure, transthoracic pressure, elastance, compliance, and resistance
4. Describing the relationship between gas flow and pressure gradients
5. Identifying the formulas for calculating compliance and resistance
6. Describing how changes in lung compliance affect the peak pressure measured during inspiration with mechanical ventilator
7. Describing the changes in airway condition that can lead to increased resistance
8. Calculating airway resistance given the peak inspiratory pressure, plateau pressure, and flow rate
9. Defining and calculating a time constant
10. Comparing several time constants, and describing how different time constants will affect volume distribution during inspiration
11. Describing negative and positive pressure ventilation
12. Defining peak inspiratory pressure, baseline pressure, positive end-expiratory pressure, and plateau pressure

Competency 2: The student will describe the various methodologies by which a mechanical ventilator delivers a breath by:

1. Comparing pressure, volume, and flow delivery in volume-controlled breaths and pressure-controlled breaths
2. Defining and describing the various “Trigger Variables”, e.g., time, patient (pressure, flow, volume), manual
3. Defining and describing the various “Limit Variables”, e.g., pressure, volume, flow, maximum safe pressure
4. Defining and describing the various “Cycle Variables”, e.g., pressure, volume, flow, time
5. Calculating volume loss to tubing compliance
6. Describing the difference between “spontaneous breaths” and “mandatory breaths”
7. Describing the effect on the volume delivered and inspiratory time if a ventilator reaches the set maximum pressure limit during volume ventilation
8. Identifying the effects of a critical ventilator circuit leak on pressure readings and volume measurements
9. Defining the effects of inflation hold on inspiratory time
10. Describing two methods of applying continuous pressure to the airways that can be used to improve oxygenation in patients with refractory hypoxemia

Competency 3: The student will describe the various assessment and measurements used to determine the need for mechanical ventilation by:

1. Differentiating between acute respiratory failure (ARF) and respiratory insufficiency
2. Describing three categories of disorders that may lead to respiratory insufficiency or ARF
3. Describing hypoxemic (Type
4. acute respiratory failure
5. Describing Hypercapnic (Type II) acute respiratory failure

6. Describing the physical signs of respiratory distress
7. Comparing normal values for VC, MIP, MEP, FEV1, peak expiratory flow, VD/VT ratio, P(A-a) O2, and PaO2/PAO2 ratio with abnormal values that indicate the need for ventilatory support
8. Describing the respiratory, cardiovascular, and neurologic conditions seen in both hypoxemic and hypercapnic respiratory failure

Competency 4: The student will describe the modes of mechanical ventilation found on continuous mechanical ventilators utilized in Respiratory Care by:

1. Describing the following modes of continuous mechanical ventilation: · Continuous Mandatory Ventilation Controlled ventilation Assisted ventilation · Volume-Targeted Continuous Mandatory Ventilation · Pressure-Targeted Continuous Mandatory Ventilation · Intermittent Mandatory Ventilation · Spontaneous Modes of Spontaneous breathing or Continuous Positive Airway Pressure or Pressure Support Ventilation
2. Describing the advantages and disadvantages of volume-controlled and pressure-controlled ventilation
3. Describing the functions of trigger, cycle, and limit variables as they are used in volume-controlled continuous mandatory ventilation, pressure-controlled continuous mandatory ventilation, volume-controlled intermittent mandatory ventilation, pressure-controlled intermittent mandatory ventilation, and pressure support ventilation

Competency 5: The student will demonstrate the procedures for initiating mechanical ventilation by:

1. Identifying the mode(s) of ventilation needed to provide full or partial ventilatory support
2. Calculating ideal body weight (IBW) based on a patient's height
3. Calculating an appropriate tidal volume based on IBW and being able to identify if the selected tidal volume is "safe" for the patient
4. Estimating the minute ventilation based on the IBW
5. Calculating the appropriate respiratory rate based on the estimated minute ventilation and tidal volume
6. Describing an appropriate flow rate and pattern
7. Describing the rationale for initial FIO2 setting according to pathophysiology
8. Describing the appropriate initial PEEP setting
9. Defining I:E ratio and its principle determinates, e.g., peak flow, inspiratory time, etc.
10. Describing how to set appropriate alarm limits based on ventilator settings

Competency 6: The student will define the various graphics produced by mechanical ventilators and the significance in assessing the patient-ventilator interface by:

1. Identifying and describing scalars (pressure, flow, and) generated by the patient-ventilator interface
2. Identifying and describing the various ventilator variables (e.g., triggers and limits) as displayed on pressure, flow, and volume scalars
3. Identifying and describing various ventilator parameters (e.g., peak inspiratory pressure, plateau pressure) using pressure, flow, and volume scalars in various modes of ventilation
4. Identifying ventilator variable and parameters and their values from flow-volume and pressure-volume loops
5. Utilizing scalars and loops to detect changes in lung compliance and airway resistance, inappropriate sensitivity settings, inadequate inspiratory flow, auto-PEEP, leaks in the ventilator circuit, active exhalation in various modes of ventilation

Competency 7: The student will describe the procedures related to a patient/ventilator assessment and the significance of this data by:

1. Defining the term "patient/ventilator assessment".
2. Identifying criteria that are assessed on a patient on continuous mechanical ventilation.
3. Describing the method of monitoring peak airway pressure, tidal volumes, static and dynamic compliance, I:E ratio, respiratory rate of the patient, and the mechanical ventilator.
4. List and describe the parameters of a ventilator and a patient utilized with continuous mechanical ventilation in terms of their importance and frequency.

5. Describing the parameters commonly monitored on a patient undergoing continuous mechanical ventilation.
6. Describing the parameters commonly monitored on the mechanical ventilator when utilized during continuous mechanical ventilation.
7. Describe the clinical data that are assessed for determining effective ventilation and oxygenation and how corrective action is taken if necessary.
8. Identifying the effects of positive pressure generated by the mechanical ventilator on key body systems.

Competency 8: The student will describe the procedures related to patient monitoring and the mechanical ventilator utilized during the weaning process by:

1. Describing the basis and applications of the recommendations of the 2002 Weaning and Discontinuation of Ventilatory Support Consensus Conference (available at: http://www.rcjournal.com/cpgs/ebgwdvscpg.html).
2. Identifying criteria are assessed in evaluating a patient's ability to be weaned from continuous mechanical ventilation.
3. Describe the significance of breathing patterns and use of accessory muscles during the weaning process.
4. Describe the significance of parameters measured on the patient that are considered "indicators" for discontinuing continuous mechanical ventilation.
5. Describing procedures related to the discontinuation of continuous mechanical ventilation.
6. Describe the role of the respiratory care practitioner during the weaning process and the discontinuation of continuous mechanical ventilation.

Learning Outcomes:

1. Communication
2. Computer / Technology Usage
3. Critical Thinking
4. Information Literacy
5. Numbers / Data