RESP-2310: MECHANICAL VENTILATION

Cuyahoga Community College

Viewing: RESP-2310 : Mechanical Ventilation

Board of Trustees:
June 2020

Academic Term:
Fall 2020

Subject Code
RESP - Respiratory Care

Course Number:
2310

Title:
Mechanical Ventilation

Catalog Description:
Theory and application of mechanical ventilation techniques with emphasis on mechanical ventilator characteristics, physiologic effects, patient set-up and evaluation, maintenance of oxygenation, weaning techniques, ventilation safety and nutritional concerns. Discussion on ventilator management and the medicolegal issues involving life support systems.

Credit Hour(s):
4

Lecture Hour(s):
3

Lab Hour(s):
3

Other Hour(s):
0

Requisites

Prerequisite and Corequisite
RESP-2210 Introduction to Mechanical Ventilation, and concurrent enrollment in RESP-2950 Respiratory Care Field Experience II.

Outcomes

Course Outcome(s):
Demonstrate accurate and safe set up of both invasive and non-invasive mechanical ventilators to a patient's specific pulmonary disease.

Objective(s):
1. Utilize technical knowledge of various devices and methods to maintain adequate arterial oxygenation and tissue perfusion.
2. Discuss the various responses to complications, both physiologic and mechanical, associated with mechanical and supportive ventilation methods and devices.
3. Discuss the most appropriate and current ventilator management approach to patients exhibiting acute respiratory failure.
4. Discuss current concepts specific to the medicolegal issues involved in withholding and discontinuing life-support systems.

Course Outcome(s):
Analyze ways in which ventilator associated pneumonia can be minimized.

Objective(s):

1. Relate possible sources of VAP to mechanical ventilation.
2. Discuss the most appropriate and current management approaches to minimize VAP.
3. Implement patient care strategies to minimize VAP.

Course Outcome(s):

Interpret patient data to develop ventilation and oxygenation support strategies.

Objective(s):

1. Demonstrate set up of both invasive and non-invasive mechanical ventilators to a patient's specific pulmonary state using appropriate volumes, rates, flows, and alarm settings.
2. Discuss the most appropriate and current ventilator management approaches, citing pros/cons and similarities/differences in modes, support limits, and flow patterns.
3. Distinguish Type-1 and Type-2 respiratory failure and options for treatment.
4. Discuss current concepts specific to the medicolegal issues involved in withholding and discontinuing life-support systems.
5. Utilize patient information and technical knowledge of mechanical ventilation to initiate and maintain ventilatory support in a variety of pulmonary disorders.
6. Discuss the most appropriate and current ventilator management approach to patients exhibiting Type-1 vs Type-2 respiratory failure.
7. Compare and contrast the types of ECMO.

Course Outcome(s):

ExamCompose mechanical ventilator settings to promote optimal physiologic and mechanical functions of the cardiopulmonary systems.

Objective(s):

1. Relate operational triads calculations to the set/delivered measurements of flow, pressure, volume via various modes of ventilation.
2. Utilize patient data and technical knowledge of mechanical ventilation to initiate optimal ventilatory support in a variety of pulmonary disorders.
3. Discuss the various responses to complications, both physiologic and mechanical, associated with mechanical and supportive ventilation methods and devices.
4. Analyze patient responses to mechanical ventilation.
5. Identify and correct ventilator setting to correct for complications and/or hazards associated with mechanical ventilation.
6. Identify and correct ventilator setting to respond to changes in patient conditions.
7. Examine the effects of positive pressure on major organ systems, and minimize the risk of decreased cardiac output
8. Differentiate various disease profiles given hemodynamic values.
9. Initiate strategies to assist in optimizing hemodynamic values.
10. Evaluate end tidal carbon dioxide (ETCO2) tracings as normal vs abnormal and possible causes for abnormal tracings.

Course Outcome(s):

Interpret patient data as it relates to a successful weaning procedure from mechanical ventilation.triads as they affect mean airway pressure, and patient synchrony.

Objective(s):

1. Relate the potential benefits and risks of nutritional support and their effects on respiratory function.
2. Evaluate and determine appropriate weaning protocol for a weaning trial.
3. Select and assemble equipment for weaning trials patient situation.
4. Evaluate a patient’s status for weaning trials, including nutritional level, acid-base status, oxygenation status, patient data (radiologic, vital signs, bedside physiologic measurements).
5. Evaluate weaning trial data.
6. Recommend the appropriate therapy given a patient scenario: continuation of trial, discontinuation of trial, patient extubation given a patient scenario.

Course Outcome(s):

Compose initial ventilator settings on neonates and pediatric patients.

Objective(s):

1. Given a patient scenario, initiate mechanical ventilator to deliver the appropriate ventilation and oxygenation.
2. Utilize patient information and technical knowledge of mechanical ventilation to maintain adequate ventilation and oxygenation following changes in patient condition.
3. Compare and contrast goals of ventilation and oxygenation between adult and neonatal cases.

Course Outcome(s):

Compare the pathologies and treatments associated with obstructive sleep apnea (OSA) and central sleep apnea (CSA).

Objective(s):

1. Distinguish causes of central apneas and obstructive apneas.
2. Evaluate therapies applications for central and obstructive apneas given a patient scenario.
3. Determine when to use CPAP vs Bi-Level PAP in the treatment of OSA.

Course Outcome(s):

Select appropriate equipment and medications used when assisting with advanced procedures: bronchoscopy and thoracotomy insertion and maintenance.

Objective(s):

1. Demonstrate an understanding of the basic equipment function, indications, contraindications, and diagnostic value of performing a bronchoscopy.
2. Determine the indication for a bronchoscopy given a patient scenario given a patient scenario.
3. Discuss the role of the respiratory therapist during a bedside bronchoscopy of a mechanical ventilated patient.
4. Describe what medications a respiratory therapist might administer during specific hazards/complications associated with a bronchoscopy.
5. Describe the indications for a thoracotomy tube.
6. Explain the procedure of inserting a thoracotomy tube and drainage system.
7. Compare the fluid movement seen in spontaneous breathing vs positive pressure ventilation.
8. Explain basic equipment function.
9. Discuss indications and contraindications for a bronchoscopy.
10. Explain the diagnostic value of performing a bronchoscopy

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Methods of Evaluation:

1. Quizzes
2. Examinations
3. Comprehensive final examination
4. Laboratory quizzes
5. Laboratory competencies

Course Content Outline:

1. Causes of Type-I and Type-II respiratory failure.
    a. Type I Respiratory failure
        i. Chronic obstructive pulmonary disease (COPD)
        ii. Pneumonia
        iii. Pulmonary edema
        iv. Pulmonary fibrosis
        v. Asthma
        vi. Pneumothorax
        vii. Pulmonary embolism
        viii. Pulmonary arterial hypertension
    b. Type II Respiratory failure
        i. Chronic obstructive pulmonary disease (COPD)
        ii. Chest-wall deformities
        iii. Neuro-muscular abnormalities
        iv. Central depression of the respiratory center (e.g. heroin overdose)
2. Indicators of ventilatory support

   a. Indicators
      i. Bradypnea or apnea with respiratory arrest
      ii. Acute lung injury
      iii. Acute respiratory distress syndrome
      iv. Tachypnea (respiratory rate >30 breaths per minute
      v. Vital capacity less than 15 mL/kg
      vi. Minute ventilation greater than 10 L/min
3. Positive end expiratory pressure (PEEP) and/or continuous positive airway pressure (CPAP) can assist in decreasing shunt
4. Initial range for tidal volume and frequency given:
   a. Asthma
   b. Acute respiratory distress syndrome (ARDS)
   c. Chronic obstructive pulmonary disease (COPD)
   d. Normal
   e. Neuromuscular
5. Minimize adverse pulmonary effects of positive pressure ventilation
6. Volume controlled modes vs. pressure controlled modes
7. Cardiovascular effects of positive pressure are, and how they can be minimized
8. Effects of positive pressure on the following systems:
   a. Central nervous system (CNS)
   b. Renal
   c. Liver
9. Complications of positive and negative pressure ventilation
10. Causes of ventilator-associated, nosocomial pneumonia
11. The “Rule of thumb” when faced with a ventilator malfunction
12. Operational triads:
   a. Patient synchrony
   b. Mean airway pressure (MAP)
   c. Calculations
      i. flowrate given tidal volume and inspiration time
      ii. tidal volume given flowrate and inspiration
      iii. cycle time given rate and/or inspiration and expiration
      iv. inspiration/expiration (i:e) ratio given times for inspiration and expiration
      v. minute ventilation given tidal volume and rate
13. Initial mode, tidal volume, and frequency ranges for the following disorders:<
   a. Normal
   b. Acute respiratory distress syndrome (ARDS)
   c. Chronic Obstructive Pulmonary Disease (COPD)
   d. Asthma
   e. Post-op
   f. Myocardial infarction (MI)/Congestive Heart Failure (CHF)
   g. Neuromuscular
   h. Head trauma
   i. Unilateral
   j. Bronchopleural (BP) Fistula
14. Recommended alarm settings
   a. Low Vt
   b. Low Ve
   c. High Ve
   d. High pressure
   e. Low pressure
   f. Low positive end expiratory pressure (PEEP)
   g. Fraction of inspired oxygen (FI02)
15. Optimal PEEP
   a. Oxygen delivery
   b. Blood pressure
   c. Mixed venous oxygen
   d. Saturation of mixed venous oxygen
   e. Arterial & venous oxygen difference

   f. Cardiac output
   g. Cardiac index
   h. Static compliance
   i. Lower inflection point
16. Goals and indications of Non-Invasive Positive Pressure Ventilation (NPPV)
   a. Indications for NPPV
   b. Complications of NNPPV
   c. NPPV interfaces and possible complications of each
   d. Machine tidal volume variations using NPPV
   e. Initial set up for NPPV using:
      i. Mode
      ii. Inspiratory positive airway pressure (IPAP)
      iii. Expiratory positive airway pressure (EPAP)
      iv. Breaths per minute (BPM)
17. High risk patients for malnutrition
   a. Affects too much protein, carbohydrate or fat can have on a patient
   b. Reasons to use enteral nutrition and parenteral nutrition
   c. Effects malnutrition has on the respiratory system
   d. Nutritional guidelines applications to patients frequently seen by the respiratory care practitioner
18. Initial neonatal/pediatric ventilator settings
   a. Differences between neonatal ventilator differs from adult ventilators
   b. Noninvasive assessment techniques used in neonatal mechanical ventilation
19. Waning techniques and characteristics of each
   a. Define the term, “Terminal Weaning (TW)”
20. Sleep apnea (OSA) vs. central sleep apnea (CSA)
   a. Pathologies which cause OSA and CSA
   b. Long term consequences of untreated/uncontrolled OSA
   c. Use continuous positive airway pressure (CPAP) vs. Bi-level positive airway pressure (PAP) in the treatment of OSA
21. ARDSnet Trial
   a. Tidal volume
   b. Highest ventilator rate
   c. Plateau pressure goals
22. Ventilator associated pneumonia (VAP)
   a. Causes of VAP
   b. Interventions which may decrease VAP
23. Bronchoscopy
   a. Equipment components
24. Indications for performing bronchoscopy
25. Contraindications to bronchoscopy
   a. Relative
   b. High risk
   c. Absolute
1. Procedure
   a. Patient preparation
   b. Premedication
   c. Anatomy of lung segments
   d. Bronchial lavage
      i. Therapeutic
      ii. Diagnostic
   e. Endoscopic features
   f. Biopsy specimens
      i. Brush biopsy
      ii. Forceps biopsy
      iii. Transbronchial biopsy
   g. Diagnostic results
      i. Identification and staging of cancer
      ii. Identification of diffuse lung disease
      iii. Location of source of hemorrhage
   h. Complications of bronchoscopy

1. Thoracotomy tubes
    a. Indications for insertion
        i. Post operative conditions
        ii. Trauma
        iii. Pneumothorax/hemothorax
        iv. Pulmonary disorders
    b. Chest tube insertion technique
    c. preparation of equipment
    d. Catheter insertion
    e. Catheter placement
    f. Securing tube
    g. Evacuation and drainage systems
        i. Unidirectional systems
        ii. Drainage systems
    h. Water seal
        i. Drainage bottle
        ii. Vacuum bottle
        iii. Clamping the chest tube
    i. Technique for removal of chest tube
        i. Evaluation of readiness
        ii. Procedure and precautions

Resources

Cairo, J.M., Pilbeam, S.P. (2020) *Mosby's Respiratory Care Equipment*, St. Louis: Elsevier.

Cairo, J.M. (2016) *Pilbeam's Mechanical Ventilation: Physiological and Clinical Applications*, St. Louis: Elsevier .

Kacmarek, R.M., Stoller, J.K., Heuer, A.J. (2020) *Egan's Fundamentals of Respiratory Therapy*, St. Louis: Elsevier .

Hess, D.R. et. al. *Respiratory Care Principles and Practice*. 4th. New York: McGraw Hill, 2019.

Resources Other

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Top of page

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