Acute Respiratory Failure

Supplementary Educational Material

Table of Contents

Outline

0047 Causes of Acute Respiratory Failure

1. Increased work of breathing
2. Refractory hypoxemia
3. Airway protection (intubate, No NIPPV)
4. Apnea/ Hypopnea (intubate, no NIPPV)

A. 0212 Increased work of breathing
   a. Tachypnea, Tachycardia and Diaphoresis
      i. 0225: tachypnea- types
         1. Rapid and shallow chest rise- BAD; they are having lower tidal volumes,
         2. Good chest rise and rapid breathing
      ii. 0405 Tachycardia and Diaphoresis
         1. High catecholamine surge
         2. Verge of some catastrophe
   b. 0252 Neuromuscular weakness
      i. Myasthenia Gravis (crisis), spinal muscle atrophy, Guillain Barre Syndrome, Myopathy, prolonged MV
   c. 0255 Bronchospasms
      i. Asthma, COPD, Anaphylaxis
   d. 0306 Worsening Compliance (C= V/P)
      i. Pulmonary (edema, pneumonia, contusion, atelectasis)
      ii. Thorax (pneumothorax, effusion, burns)
      iii. Abdomen(ascites, acute compartment syndrome)
   e. 0327 Miscellaneous
      i. Upper airway obstruction
      ii. 0333 Increased metabolic demands
         1. For the most part will have different chest rise
         2. Large tidal volumes & rapid breathing
         3. Severe metabolic acidosis-> trying to get rid of CO2
         4. Shock-> trying to increase metabolic supply

B. 0426 Refractory Hypoxemia: SHUNT
   a. 0444 Adequate Perfusion with Inadequate ventilation (i.e. good blood supply but poor gas exchange)
      i. Intrapulmonary shunt
      ii. 0454 Alveolar Junk: water, pus (pneumonia), blood (pulmonary contusion), collapsed (atelectasis)
   b. 0512 Shunt Physiology
      i. 0518 Oxygen crosses the alveolar gradient and is picked up by oxygen as it leaves the right side of the heart to enter the left side of the heart
      ii. 0550: Pulmonary edema with fluid impeding gas exchange, now oxygen is not moving across the alveoli into the capillaries.
         1. 0608 These patients need positive pressure ventilation.
         2. 0615 Positive pressure ventilation (CPAP, BiPAP or intubation) will increase the surface area for gas exchange.
      iii. 0643 Evaluation of shunt physiology
         1. 0713 As more alveoli are involved in shunt physiology, or more alveoli are involved in shunt physiology upwards of about 50%, then as more FiO2 is added, we can see that there is no increase in PaO2 meaning no gas exchange. This patient has refractory hypoxia & > 40-50% of their lung is involved in shunt physiology.
         2. 0748 First place them on 15L of 100% non-rebreather which is about 70% FiO2=> no response then greater of equal to 40% shunt (blood, water, pus, collapsed) => need positive pressure ventilation

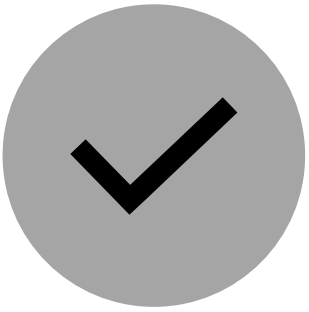
C. 0802 Inability to Protect Airway
   a. 0809 The pooling of secretions in the airway
   b. 0825 Ability of patient to lift their head off the bed
   c. 0842 Gag and cough reflexes do not accurately predict ability to protect the airway
   d. 0854 GCS <8
      i. Rule says: GCS <8 then intubate (rhymes)
      ii. Problem is that some patients are chronically neurologically devastated

D. 0934 Respiratory Arrest or Hypoventilation
   a. 0943 Apnea/ Alveolar Hypoventilation (↑ Alveolar CO_2→ Displaces O_2)
      i. Cardiac arrest, CNS injury, TBI, Hypoglycemia, Drug Overdose, Shock (decreased cerebral perfusion)
   b. 1009 Any reversible causes? D50, Narcan, Flumazenil
      i. 1015 Hypoglycemia: Check FSBS and give glucose (or can just give glucose)
      ii. 1023 Opiate overdose:
         1. Narcan- o.4 mg/ml
         2. Dilute 9 ml: 1 ml with Narcan=> 1 ml= 40 mcg per 1 cc
      iii. 1036 Benzodiazepine Overdose
         1. Flumazenil 0.2 mg Q60 seconds, max 3 mg / 1 hour
         2. DO NOT reverse benzodiazepines unless you know the patient's history and exactly what medications/drugs they have taken

Manual

Learning objectives 0038

NAME THE CAUSES OF ACUTE RESPIRATORY FAILURE



BE ABLE TO DESCRIBE SHUNT PHYSIOLOGY

Manual

Causes of Acute Respiratory Failure 0047

1. Increased work of breathing
2. Refractory hypoxemia
3. Airway protection (intubate, No NIPPV)
4. Apnea/ Hypopnea (intubate, no NIPPV)

Increased work of breathing 0212

Tachypnea, Tachycardia, and Diaphoresis

Tachypnea: - types

- × Rapid and shallow chest rise- BAD; they are having lower tidal volumes
- × Good chest rise and rapid breathing

Tachycardia and Diaphoresis

- × High catecholamine surge
- × Verge of some catastrophe

Categories

A. Neuromuscular weakness
    a. Myasthenia Gravis (crisis), spinal muscle atrophy, Guillain Barre Syndrome, Myopathy, prolonged MV, Myotonic dystrophy, ALS
B. Bronchospasms
    a. Asthma, COPD, Anaphylaxis
        - Remember patients with COPD and asthma do not have trouble with inspiration. They have trouble with expiration.
C. Worsening Compliance (C= V/P)
    a. Pulmonary (edema, pneumonia, contusion, atelectasis, blood)
    b. Thorax (pneumothorax, effusion, burns)
    c. Abdomen (ascites, acute compartment syndrome)
D. Miscellaneous
    a. Upper airway obstruction
E. Increased metabolic demands
    a. For the most part will have different chest rise
    b. Large tidal volumes & rapid breathing
    c. Severe metabolic acidosis-> trying to get rid of CO_2
        - This is why intubation of a patient with severe metabolic acidosis is bad. You have to make sure you are giving them the same minute ventilation- since tidal volume is limited to 4-8 ml/ kg of ideal body weight, which means a fast-respiratory rate.
    d. Shock-> trying to increase metabolic supply

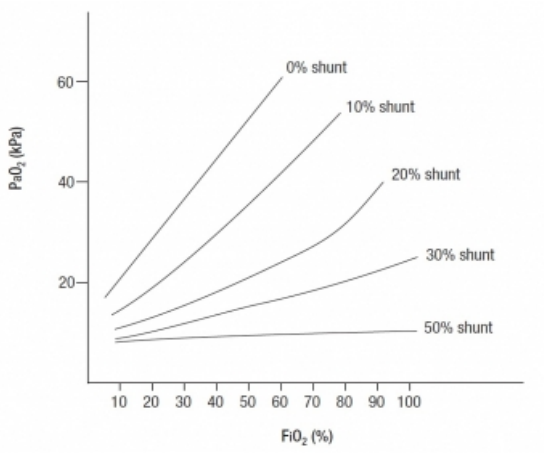
Refractory Hypoxemia: SHUNT 0426

- × Adequate Perfusion with Inadequate ventilation (i.e. good blood supply but poor gas exchange)
- × Intrapulmonary shunt

Alveolar Junk: water, pus (pneumonia), blood (pulmonary contusion), collapsed (atelectasis)

Shunt Physiology

- × Oxygen crosses the alveolar gradient and is picked up by oxygen as it leaves the right side of the heart to enter the left side of the heart
- × Something is in the alveoli and impeding gas exchange (example- fluid from pulmonary edema), now oxygen is not moving across the alveoli into the capillaries.
- × These patients need positive pressure ventilation.
    - Positive pressure ventilation (CPAP, BiPAP or intubation) will increase the surface area for gas exchange.



Evaluation of shunt physiology

As more alveoli are involved in shunt physiology, upwards of about 50%, then as more FiO_2 is added, we can see that there is no increase in PaO_2 meaning no gas exchange. This patient has refractory hypoxia and > 40-50% of their lung is involved in shunt physiology.

First place them on 15L of 100% non-rebreather which is about 70% FiO_2=> no response then greater of equal to 40% shunt (blood, water, pus, collapsed) => need positive pressure ventilation.

Inability to Protect Airway 0802

1. The pooling of secretions in the airway
2. Ability of patient to lift their head off the bed
   - × this also shows they are neurologically able to follow commands
3. Gag and cough reflexes do not accurately predict ability to protect the airway
4. GCS <8
   - × Rule says: GCS <8 then intubate (rhymes)
   - × Problem is that some patients are chronically neurologically devastated

Typically require intubation, but there are exceptions

Glasgow Coma Scale		
Response	Scale	Score
Eye Opening Response	Eyes open spontaneously	4 Points
	Eyes open to verbal command, speech, or shout	3 Points
	Eyes open to pain (not applied to face)	2 Points
	No eye opening	1 Point
Verbal Response	Oriented	5 Points
	Confused conversation, but able to answer questions	4 Points
	Inappropriate responses, words discernible	3 Points
	Incomprehensible sounds or speech	2 Points
	No verbal response	1 Point
Motor Response	Obeys commands for movement	6 Points
	Purposeful movement to painful stimulus	5 Points
	Withdraws from pain	4 Points
	Abnormal (spastic) flexion, decorticate posture	3 Points
	Extensor (rigid) response, decerebrate posture	2 Points
	No motor response	1 Point
Minor Brain Injury = 13-15 points; **Moderate Brain Injury** = 9-12 points; **Severe Brain Injury** = 3-8 points		

Respiratory Arrest or Hypoventilation 0934

Apnea/ Alveolar Hypoventilation (↑ Alveolar CO_2→ Displaces O_2)

- × Cardiac arrest, CNS injury, TBI, Hypoglycemia, Drug Overdose, Shock (decreased cerebral perfusion)

Any reversible causes? D50, Narcan, Flumazenil

- × Hypoglycemia:
  - Check FSBS and give glucose (or can just give glucose)
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- × Benzodiazepine Overdose
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  - DO NOT reverse benzodiazepines unless you know the patient's history and exactly what medications/drugs they have taken