Bariatrics

Part 2

RSPT 2258

Obesity and OSA

Definitions

- *Obstructive apnea* = cessation of air flow for at least _____ sec. in the presence of respiratory efforts
- *Hypopnea* = reduction in airflow of at least 30% with a decrease SpO_2 of at least 2% or lasting >10 sec.
- *OSA* = Dx when apneas + hypopneas (AHI) ≥ _____
- Estimated that OSA affects 25% of men and 15% of women in US

OSA

- Characterized by
  - Recurrent upper-airway obstruction
    - Cycles of _____ & _____
    - Increased respiratory effort
    - Frequent arousals

Risk Factors

- Obesity
- Increasing age
- Being male
- Abnormal craniofacial morphology
- Nasal obstruction
- Endocrine abnormalities
- Genetic factors

Cardiovascular Consequences

- Hypertension
  - Mild OSA → 42% ↑ risk within 4 years
- _____ (v-fib)
  - 40% higher in severe OSA
- Heart failure, arrhythmias & stroke
- CAD, AMI
  - Mild OSA → _____ ↑ risk

Noncardiovascular Consequences

- MVA
- Impaired cognitive function
- Depression
- Occupational accidents
- Poor exercise tolerance
- Poor marital relationship

Obesity As a Risk Factor

- Affects structure & function of the upper airway
  - Function of upper airway = phonation, swallowing, breathing
- While breathing, various forces promote airway collapse
  - Intrathoracic _____ pressure
  - Pressure from tissues & bony structures surrounding airways
  - These 2 forces are counterbalanced by the pharyngeal dilator muscles & downward traction from inflated lungs
- Obesity promotes
  - Narrowing of the pharynx due to _____ deposits
  - Reduced airway wall compliance due to _____ deposits

Obesity As a Risk Factor

BMI	Body Characteristics	Obesity Class	Prevalence of OSA
25 – 29.9	Overweight	------	2 – 4%
30 – 34.9	Obesity	I	40 – 60%
35 – 39.9	Obesity	II	
≥ 40	Extreme obesity	III	70 – 90%

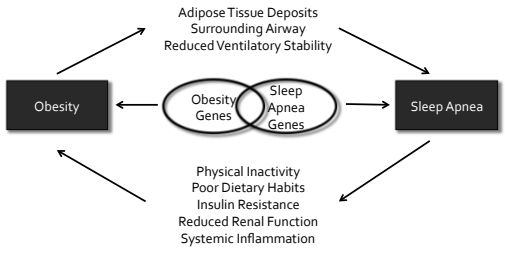
Obesity As a Consequence

- Reduces physical activity & exercise performance
- Reduces energy
- Reduces motivation

Impact of Rx for Obesity

- Dietary Weight Loss
  - Will reduce the AHI but does rarely cures _____ (suggests a multifactor cause)
- Medical Weight Loss
  - Same results
  - Drugs may have adverse effects, i.e. hypertension & arrhythmias
- Bariatric Surgery
  - _____ better cure rate but in most cases, recurred several years later

Summary



Obesity and Pickwickian Syndrome

Pickwickian Syndrome

- Also known as obesity-hypoventilation syndrome
- Well described long before OSA was recognized in 1969

"Damn that boy," said the old gentleman, "he's gone to sleep again."
"Very extraordinary boy, that," said Mr. Pickwick, "does he always sleep in this way?"
"Sleep!" said the old gentleman, "he's always asleep. Goes on errands fast asleep, and snores as he waits at the table."
"How very odd!" said Mr. Pickwick.

Joe, the fat boy, Mr. Wardle's servant
The Posthumous Papers of the Pickwick Club,
Charles Dickens, 1836

Definition

- Characterized by
  - Obesity
  - Sleep-disordered breathing
  - Chronic daytime alveolar hypoventilation
    - $PaCO_2$ > _____ mmHg
    - PaO_2 < _____ mmHg
- Considered as a Dx when other causes of hypo-ventilation have been ruled out

Prevalence

- 1.5 - 4 out of every 1000 adults in US
- Definite correlation between BMI and OHS in patient with OSA
  - 10-20% of patients with OSA have OHA

Morbidity and Mortality

- Quality of Life
  - Patients with OHS are _____
  - Improved with CPAP
  - Lower quality of life than with other respiratory diseases, even if $PaCO_2$ is not as low – probably due to the obesity

Morbidity and Mortality

- Morbidity
  - Not clear if patients with obesity/OHS have higher morbidity than obesity alone – no studies
  - Associated with development of _____
- Mortality
  - No long-term studies
  - 5-year survival rate for untreated OHS – _____

Pathophysiology

- Complex and multifactorial
- Is different than patients with obesity + OSA

Pathophysiology

- Likely due to
  - Increased load on respiratory system
    - Increased upper airway resistance
    - Diaphragmatic fatigue?
    - Increased WOB (decreased compliance)
  - Impaired CNS response to hypoxemia & hypercapnia
  - Presence of sleep-disordered breathing
    - Can be OSA or CSA
  - Impaired neurohormonal responses (leptin resistance)

Diagnosis

- Awake _____ +
- Severity of obesity +
- Impairment of respiratory mechanics (PFT) +
- Severity of _____ +
- CXR to r/o other diseases and chest wall deformities +
- R/O hypothyroidism

Treatment

- Rx of Sleep disordered breathing (CPAP or BiPAP)
- Weight reduction
- Pharmacotherapy
  - Medroxyprogesterone
    - Respiratory stimulant at the hypothalamus level
  - Acetazolamide
    - A carbonic anhydrase inhibitor → metabolic acidosis → increases minute ventilation by 15%
  - Pharmacotherapy has been poorly studied and should not replace PAP therapy

Obesity and Asthma

Prevalence

- Definite correlation between obesity & asthma
  - Asthma can cause obesity
    - Adverse effects of medications
    - Social stigma
    - Decreased exercise tolerance
    - Share risk factors
      - Low socioeconomic status
      - Poor diet
      - Environment
  - Obesity causes asthma?
    - Odds of developing asthma 2.7 times higher if obese

Diagnosis

- More complicated if obese – is SOB due to airway reactiveness or due to restrictive component of obesity?
- Clinically
  - Obesity may worsen asthma due to comorbid conditions
    - Esophageal _____
    - _____

Physiologic Consequences

- Remember, obesity associated with lung restriction
  - Decreased TLC
  - Decreased FRC
- Restriction → reduced airway diameter → breathing at or near closing volume → alters bronchial smooth muscle function → airway hyper-responsiveness

Physiologic Consequences

- Review – 3 hallmark clinical finding in asthma
  - Airflow obstruction responsive to bronchodilators
  - Airway hyper-responsiveness
  - Airway inflammation

Inflammation & Obesity

- Obesity is no longer thought of as simple energy intake > expenditure
- Known that adipose tissue behaves like an active endocrine organ with enhanced inflammatory activity → elevated circulating systemic inflammatory mediators
- Contributes to
  - insulin resistance
  - airway inflammation
  - CAD

Treatment & Control

- Studies have shown
  - Decreased effectiveness of inhaled corticosteroids
    - Poor inhaled delivery or diminished biologic response????
  - Weight loss decreases the prevalence

Obesity and Other Diseases

Obesity As Risk Factor

- Obesity has been proven to be a risk factor for
  - DVT and pulmonary emboli
  - ALI (ARDS)
  - Pulmonary hypertension
  - Cardiomyopathy

Obesity and Airway Management

Airway Management

- Obesity increases risk for
  - Perioperative respiratory complications
  - Airway management problems
    - A BMI > _____ kg/m^2 → 3 x increase in difficult ventilation & 10 x increased incidence in difficult intubation
    - Fat deposition in the pharyngeal wall → smaller pharyngeal space → difficult airway access & mask ventilation
- Key to proper airway management
  - Proper positioning
  - Preoxygenation
  - Intubation devices
  - Knowledge of additional airway tools

Positioning

- "_____ " position (supine) is not best for obese patient
- "_____ " position is better
  - Using pillows, folded blankets, etc., elevate head, neck and chest
  - Could also use a foam pillow or manipulation of bed

Preoxygenation

- Obesity impairs preoxygenation by conventional means prior to intubation due to low FRC
- Improved with use of CPAP of ≥_____cmH_2O for 5 minutes, 100% O_2
- More recently, the use of BiPAP, 17/7, has gained popularity

Mask Ventilation & Intubation

- Accepted definitions
  - *Difficult mask ventilation* = inability of an unassisted HCG to maintain SpO_2 > _____
  - *Difficult intubation* = the need for more than ____ intubation attempts that last for more than _____ minutes
  - *Difficult airway* = the clinical situation in which a conventionally trained HCG experiences difficulty with face mask ventilation and/or difficulty with intubation

Mask Ventilation & Intubation

- No generally accepted indicator of a difficult airway
- Considerations
  - BMI
  - Neck circumference
  - Receding mandible
  - OSA
  - **Mallampati** score

Mask Ventilation & Intubation

- Method of choice
  - Intubation with flexible fiberoptic scope or videolaryngoscope (GlideScope)
  - Rapid sequence intubation with cricoid pressure
    1. Preparation
    2. Preoxygenation
    3. Pretreatment
    4. Paralysis
    5. Pass the tube
    6. Proof of placement
    7. Postintubation management

Preparation

- Assess oropharynx and neck anatomy to anticipate difficult intubation. “Can I bag this patient if I cannot intubate him?”
- Apply 3-lead cardiac monitor, BP monitor, pulse oximeter.
- Secure _____ access.
- Test ET tube and all equipment necessary for intubation.
- Estimate patient’s weight, calculate drug dosages, and draw up into syringes.

Preoxygenate

- 100% oxygen by non-rebreather mask for at least 3 full, deep breaths.
- If ventilation is required, bag gently while cricoid pressure is applied.
- Preoxygenate _____ minutes if situation allows.

Pretreatment

- Administer either midazolam (Versed) or etomidate
  - Midazolam dose is 2 mg for the average size adult
  - Etomidate dose is 0.3 mg/kg, about 20 mg for the average size adult
- If systolic pressure is 80-100 mmHg utilize etomidate or decrease midazolam dose.
- Administer lidocaine 1.5 mg/kg to patients with head trauma or stroke.
- Apply cricoid pressure and hold until patient has been intubated, balloon of ETT has been inflated, position of tube tip has been assured, and ETT has been secured in place.

Paralyze

- Administer succinylcholine1.5 mg/kg IVP (100 mg for average 70kg patient) and wait for paralysis to occur.

Pass the Tube

- Intubate. Discontinue attempt and ventilate with 100% O_2 if:
  - Thirty seconds has passed, and PO_2 falls below _____ or
  - Heart rate falls below _____

Proof of Placement

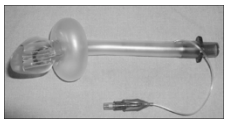
- When successfully intubated, confirm placement by
  - Bilateral breath sounds, and
  - Chest wall rise, and
  - Absense of gastric sounds, and
  - End tidal CO_2 measurement, and
  - Continued PO_2 readings in the high 90's (if this is consistent with the patient's baseline)
- A second qualified person will then confirm correct tube placement.

Postintubation Management

- Secure tube in place to a stable facial structure.
- If intubation is unsuccessful, maintain cricoid pressure and provide BVM ventilation until the paralytic wears off, or consider use of the LMA or Combitube.
- If patient becomes agitated, administer midazolam 1 mg every 1 – 2 min. until patient is calm, BP drops, or max. 10 mg is utilized.

Extraglottic Devices

- Recommended in difficult airway algorithm
  - LMA
  - ILMA
  - ETC (Esophageal Tracheal Combitube)
  - Cobra-PLA
  - King



Extubation

- Daunting task
  - Chances are, intubation of the obese patient was difficult to intubate
    - Re-intubation may be more difficult than the original procedure
  - Obese patient is at a higher risk for post-extubation
- Reverse Trendelenburg position recommended to
  - Optimize ventilation
  - Reduce gastric reflux
  - Access airway if re-intubation needed

Obesity and the ICU

Challenges in the ICU

- Cardiovascular
  - ↑ body mass → significant changes in cardiac performance & structure
    - Blood volume ↑
    - Cardiac output ↑
    - However, CI normal
  - ↑ blood volume → LV dilation & LV hypertrophy → "obesity cardiopathy" → systolic dysfunction
  - Obesity → systemic hypertension → ↑ afterload of LV → LV hypertrophy

Challenges in the ICU

- Respiratory
  - Obesity → altered compliance, resistance, V/Q relationships, respiratory muscle workload, upper airway caliber & tone, ventilatory control

Challenges in the ICU

- Immunologic Changes
  - Adipocytes (cells that compose adipose tissue)
    - Once thought to be storage depots for energy
    - Now know they produce adipokines →
      - Impair immunologic function
      - Cause inflammation
    - Net effect = promotion of insulin resistance, decreased response to systemic infections, increased airway reactivity, altered fibrinolytic (coagulation) activity

Common Disorders in Critically Sick Obese Patients

- Thromboembolic disease
  - PE = leading cause of death after bariatric surgery
  - Hard to diagnose
    - Ultrasound can't penetrate body mass
    - Patient doesn't fit into CT scanner
    - Weight limits of V/Q scanning tables
- Aspiration
  - Obese → higher risk for GERD
  - Histamine H_2 antagonists & proton pump inhibitors may decrease harmful effects of gastric acid aspiration
  - Keep head elevated, Hi-Lo ETT

Respiratory Failure & Weaning

↑ blood volume
systolic dysfunction
↑ chest wall loading
↓ respiratory muscle endurance
upper airway narrowing
alterations in central ventilatory drive

} impair ability to spont breathe

ETT → blunts airway reflexes
Sedation → ↓ pharyngeal muscle tone

All of the above → may result in upper airway obstruction after extubation

Respiratory Failure & Weaning

- Positioning plays a major role in optimizing resp mechanics
  - Reverse Trendelenburg is good

Nursing Care

- Need to be aware of personal prejudices & judgements
- Skin integrity can be problematic
  - Skin is less sensitive to pressure sensing
  - Skin folds → moisture buildup
- Difficulty in turning, limited mobility, decreased vascularity in adipose tissue → skin ulcers
- Specialty beds, wheelchairs, trapezes needed

Nutritional Support

- Obesity and malnutrition can coexist
- Some studies suggest hypocaloric, high-protein feeding
- Accurate metabolic studies is difficult
  - Use actual or ideal body weight???
  - Some use an obesity-adjusted weight

Drug Dosing

- Physiologic changes in obesity → affect drug distribution, binding, and elimination of medications
  - Fat body mass
  - Increased blood volume and cardiac output
  - Alterations in plasma protein-binding
  - Changes in liver & kidney function
- Drug dosing is poorly understood
- Lipophilic drugs (opoids, benzodiazepines, antibiotics) usually require higher doses
- Most corticosteroid regimens are fixed & not based on weight