

Increased airway pressure

An increase in PIP of more than 5 cm H₂O; or a PIP greater than 40 cm H₂O. Requires simultaneous diagnosis and treatment. Potentially life threatening emergency!

ANESTHETIC CONSIDERATIONS:

1. Etiology

- Breathing Circuit -
- ETT – obstructed, kinked, endobronchial
- Decreased pulmonary compliance – extrinsic or intrinsic
- Medication related (high dose opioids, anaphylactic reaction, MH, inadequate NMB)

2. Prevention

- Careful pre-operative checks
- ETT placement
- Anesthetic plan to prevent bronchospasm, atelectasis, accumulation of airway secretions
- Possible pretreatment with small doses of NDMR prior to bolus opioids

3. Manifestations

- High PIP alarm (VC) and low MV (PC)
- Decreased compliance with BMV or manual ventilation
- Low or absent EtCO₂
- Drop in SpO₂
- Tachycardia
- Possible profound hypotension

4. Management

- Possible emergency situation, simultaneous diagnosis and treatment
- Increase FiO₂ to 100%, notify surgical team, ask for help
- Algorithmic approach from machine to patient / patient to machine, excluding possible causes

ANESTHETIC GOALS:

- Simultaneously diagnose and treat a potentially life threatening emergency.
- Prevention and detection of early manifestations and sequelae

ETIOLOGY

A. Breathing Circuit

- manual breathing selected with APL closed
- stuck expiratory, inspiratory or APL valves
- PEEP valve malpositioned in inspiratory limb
- kinked /misconnected hose in circuit or scavenging
- failed check valve / regulator = high pressure gas in circuit
- O₂ flush depressed / stuck on
- faulty pressure gauge or alarm (or alarm settings low)

B. ETT

- kinked tube
- endobronchial, esophageal or submucosal intubation
- mucous, secretions or foreign body obstructing tube
- cuff herniated over end of tube
- dissection of tube lumen

C. Decreased Pulmonary Compliance

- Parenchyma
 - A. bronchospasm
 - B. pulmonary edema
 - C. aspiration
 - D. atelectasis
- Pleura
 - A. Pleural effusion
 - B. Pneumothorax
- Extrinsic/Chest Wall
 - A. raised intra-abdominal pressure
 - B. reduced chest wall or diaphragmatic compliance (e.g. kyphoscoliosis)

D. Drug-related

- inadequate muscle relaxation
- narcotic-induced chest wall rigidity
- malignant hyperthermia

TYPICAL SITUATIONS

- at induction / intubation
- following position change or tube manipulation
- light anesthesia
- after addition of extra circuit components
- change in surgical conditions (abdo insufflation, entering pleural cavity, etc.)

MANAGEMENT

- potential emergency requiring simultaneous treatment and assessment
- increase the FiO₂ to 100%, notify surgical team, ask for help
- verify the PIP, assess compliance with manual bag ventilation
- disconnect Y-piece at ETT and recheck patient pulmonary compliance with ambu bag
 - if pressure remains high → patient problem
 - if pressure falls → circuit problem
 - ventilate with backup and consider TIVA to maintain anesthetic state
 - call for help in investigating source of increased pressures within circuit
- auscultate bilaterally for symmetry, breath sounds, wheezes, rales, crackles
 - if asymmetry:
 - consider endobronchial tube → examine and reposition ETT
 - consider pneumothorax → assess BP and HR, palpate trachea, percuss chest
 - if wheezing or silence:
 - consider bronchospasm → deepen anesthetic as tolerated, ventolin, epinephrine
 - if rales / crackles:
 - consider pulmonary edema → PEEP, lasix, morphine, NTG...
- exclude ETT obstruction by passing suction catheter
 - if passes freely → occlusion unlikely
 - if marked obstruction:
 - deflate cuff and recheck
 - extubate (consider over exchange catheter)
 - mask / LMA ventilate to increase SaO₂ then reintubate
 - consider FOB examination if difficulties
- exclude other causes
 - malignant hyperthermia
 - light anesthesia, inadequate muscle relaxation, opioids
 - change of position, surgical retraction, abnormal anatomy

COMPLICATIONS

- barotrauma
- hypotension, cardiovascular collapse with raised intrathoracic pressure and decreased preload
- hypoxemia

REFERENCES:

Crisis Management in Anesthesiology
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