

Case Study On Care Of Patient With Acute Central Airway Obstruction (CAO)

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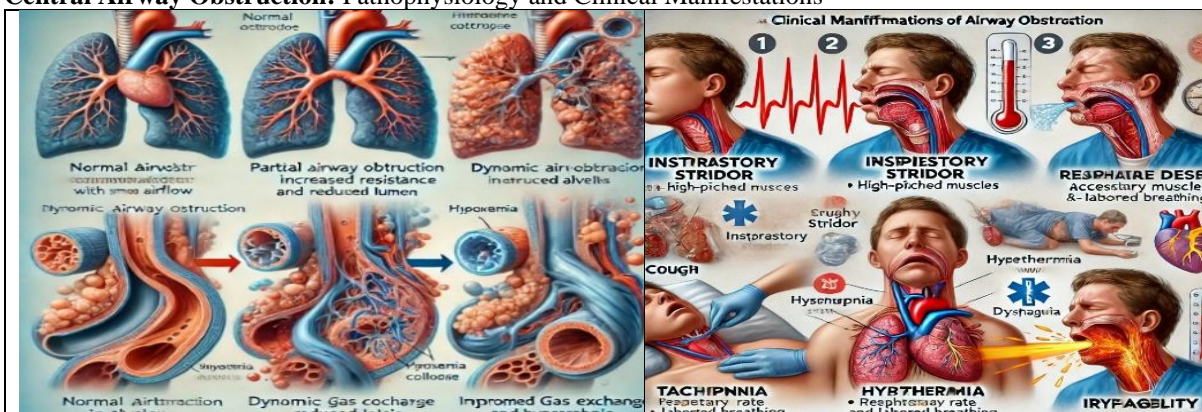
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I. Introduction

Acute Central Airway Obstruction (CAO) is a critical condition that can lead to severe respiratory distress or failure if not managed promptly. It is characterized by a blockage or narrowing of the central airways, including the trachea and main stem bronchi. The incidence of post-intubation and post-tracheotomy tracheal stenosis (PITS and PTTS, respectively) ranges from 10% to 22% but only 1%–2% require treatment. At present, PITS and PTTS are recognized entities, with an incidence of 4.9 cases per million inhabitants. Procedures like rigid and flexible bronchoscopy are used for symptom relief, tumor debulking, dilation, stent placement, or removal of foreign bodies. Recent studies emphasize the role of advanced techniques such as cryotherapy, laser ablation, and stenting, particularly in cases of malignant CAO (Tepper & D'Angelo, 2022; Sow et al., 2021).

Central Airway Obstruction: Pathophysiology and Clinical Manifestations



Picture 01: A visual representation of the progression of airway obstruction pathophysiology.

Picture 02: The clinical manifestations of airway obstruction.

Pathophysiology of Airway Obstruction

- Increased Airflow Resistance:** Obstruction narrows the airway, increasing resistance to airflow.
- Greater Effort for Ventilation:** The patient needs to exert more effort to breathe, both during inspiration and expiration.
- Elevated Intrathoracic Pressure:** Increased pressure during breathing stresses the airway walls.
- Airway Collapse:** Weakened or compromised airway structures may collapse under prolonged pressure.
- Impaired Gas Exchange:** Reduced oxygenation and inefficient removal of carbon dioxide occur.
- Progression to Respiratory Failure:** If unresolved, the condition leads to life-threatening respiratory failure requiring urgent medical intervention

Clinical Manifestations of Airway Obstruction

- Inspiratory Stridor:** High-pitched sound during inspiration due to upper airway narrowing.
- Respiratory Distress:** Labored breathing with the use of accessory muscles.
- Coughing:** Reflexive attempt to clear the obstructed airway.
- Tachypnea:** Increased respiratory rate as the body struggles to maintain oxygenation.
- Hyperthermia:** May occur due to inflammation or infection.
- Dysphagia:** Difficulty swallowing due to airway compression.
- Irritability:** Often a result of oxygen deprivation and discomfort.
- Observed Symptoms in the Patient:** Stridor for two days. Acute shortness of breath on the day of admission.

II. Case Description

Patient Details and Current Condition:

- The patient, a 13-year-old girl, presented with severe stridor (high-pitched wheezing sound due to airway narrowing) and acute shortness of breath for two days, necessitating urgent medical attention. Stridor is a hallmark symptom of airway obstruction, which can quickly become life-threatening without prompt intervention.

Current Diagnosis and Cause of Obstruction:

- Diagnosis: Acute central airway obstruction, caused by post-intubation granulation tissue.

III. Clinical Information Treatment & Management

She has no known allergies. On admission, the patient reported a pain score of 3/10, which worsened during swallowing, particularly in the throat. She is unmarried and has a history of a viral respiratory tract infection. The patient's relevant past medical history includes a diagnosis of **fulminant viral myocarditis**, a severe condition characterized by inflammation of the heart muscle. This condition progressed to **cardiogenic shock**, where the heart was unable to pump enough blood to meet the body's needs. Additionally, she experienced **multi-organ dysfunction syndrome (MODS)**, a serious condition involving the failure of multiple organ systems, requiring intensive care.

On Admission Physical Examination:

Detailed Assessment and Examination

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| 1. Vital Parameters | 4Abdominal Examination |
| Heart Rate: 110 beats/min (tachycardia) | Abdomen soft, non-tender with no abnormal findings |
| Respiratory Rate: 20 breaths/min (within normal range) | 5. Functional Screening |
| Temperature: 97.6°F | Patient could perform all Activities of Daily Living (ADLs) with assistance |
| SpO ₂ : 97% on room air | 6. Lifestyle History |
| Blood Pressure: 120/70 mmHg | No history of smoking or alcohol intake |
| 2. General Examination | 7. Psychological Assessment |
| No signs of cyanosis, jaundice, edema, increased JVP, clubbing, or pallor | The patient appeared anxious, likely due to respiratory distress and the nature of the condition |
| Thin built, with a documented weight loss of 3 kg in the last three months | 8. Medication Reconciliation |
| Chest: Bilateral crepitation present | No home medications reported |
| Stridor audible, indicating upper airway obstruction | 9. Provisional Diagnosis |
| Heart: S1 and S2 present, no murmurs detected | Acute Upper Airway Obstruction |
| 3. Neurological Examination : Glasgow Coma Scale (GCS): 15/15 , | Endo bronchial Polyp likely contributing to airway obstruction |

Comprehensive Plan of Care: Airway Management and Perioperative Support

1. Intubation and Ventilation

Assessment:

Monitor vital signs (SpO₂, HR, BP, RR) and ABG values.

Evaluate respiratory status continuously.

2. Bronchoscopy and Polyp Removal

Assessment:

Monitor pre- and post-procedure vitals, SpO₂, and lung sounds.

Ensure NPO status and assess for gag reflex recovery.

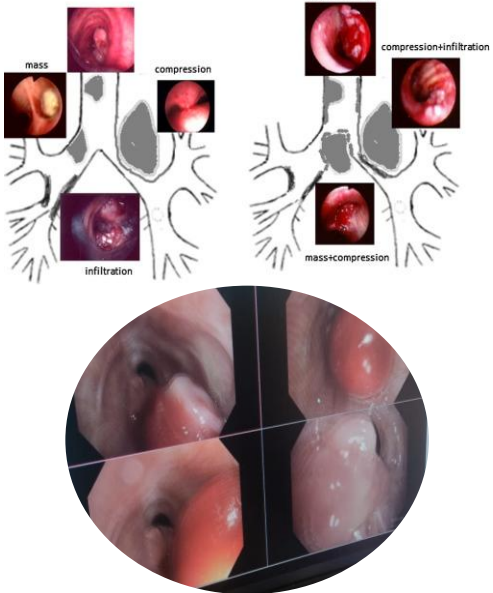

3. VV ECMO (Veno-Venous Extracorporeal Membrane Oxygenation) Peri-Procedure

Assessment:

Record baseline vitals, ABG, and coagulation profile.

Check cannula sites for patency and complications.

IV. Investigations

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|  <p>Bronchoscopy Picture 03</p> | <p>Chest X-Ray: No significant findings noted in</p>  <p>Chest X Ray. Picture 04</p> |
| <p>Bronchoscopy Report: Obstruction is noted in the central airway, possibly involving the trachea or main stem bronchi.</p> <p>Rigid bronchoscopy at bedside - To observe airway inspection and assessment of the lesion (picture 03) or foreign body, removal of secretions, and therapeutic dilatation.</p> <p>The findings are consistent with central airway obstruction, likely caused by a mass or lesion. The characteristics of the lesion suggest further evaluation to determine its nature (benign vs. malignant). Performed a contrast-enhanced CT scan or MRI of the chest to evaluate the extent of the obstruction and rule out extra luminal compression.</p> | <p>ABG pH: 7.26 (Academia)</p> <ul style="list-style-type: none"> • PCO2: 51.6 mmHg (Hypercapnia - likely respiratory component) • PO2: 442.3 mmHg (High, consistent with ECMO support) • HCO3: 22.7 mmol/L (Normal) <p>Blood investigation</p> <ul style="list-style-type: none"> • Hb: 8.5 g/dL (Low - mild anemia) • Na: 137.6 mmol/L (Normal) • K: 3.35 mmol/L (Mild hypokalemia) • Calcium: 1.07 mmol/L (Low, hypocalcemia) |

V. Pre-Procedure Work-Up: Day 01

| Pre-Anesthesia Check-Up | Pre-Operative verifications | Time out | Sign Out |
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| <ol style="list-style-type: none"> Blood Pressure: 138/74 mmHg Pulse Rate: 128/min Respiratory Rate: 30/min ASA American Society of Anesthesiologists Classification: II Mallampati Score: I Hemoglobin: 10 g/dL Blood Sugar: 132 mg/dL Blood Urea: 30 mg/dL Creatinine: 0.7 mg/dL Platelet Count: 2.17 Lacs/mm³ ECG: Sinus Tachycardia ABG: Arterial Blood Gas Hb: 8.5 g/dL (Low - mild anemia) Na: 137.6 mmol/L (Normal) K: 3.35 mmol/L (Mild hypokalemia) Calcium: 1.07 mmol/L (Low, hypocalcemia) Glucose 100 FiO2 100% | <ul style="list-style-type: none"> <input type="checkbox"/> Fasting: The patient adhered to fasting guidelines (usually 6-8 hours for solids and 2 hours for clear liquids). <input type="checkbox"/> Medication Management: Current medications were reviewed and adjusted as necessary. Certain medications (e.g., anticoagulants) were discontinued as per guidelines. <input type="checkbox"/> Infection Prevention: Prophylactic antibiotics were administered if indicated, and antiseptic skin preparation was ensured. <input type="checkbox"/> Anaesthesia Evaluation: A pre-anesthesia assessment was conducted, and necessary equipment and medications were prepared. | <ul style="list-style-type: none"> <input type="checkbox"/> Patient Identification: The patient's identity was verified using at least two identifiers (e.g., name and UHID). <input type="checkbox"/> Surgical Site Confirmation: The surgical site was confirmed, ensuring it matched the marked site. <input type="checkbox"/> Procedure Review: The specific procedure to be performed was confirmed to avoid any mix-ups. <input type="checkbox"/> Equipment Check: Necessary equipment and instruments were checked to ensure they were available and functional. <input type="checkbox"/> Team Confirmation: Every member of the surgical team (surgeon, anaesthesiologist, nurse, etc.) confirmed their understanding of the planned procedure. | <ul style="list-style-type: none"> <input type="checkbox"/> Instrument Count: Confirmed all instruments, sponges, and supplies were accounted for. <input type="checkbox"/> Specimen Labelling: Ensured any specimens were correctly labelled and documented. <input type="checkbox"/> Postoperative Plan: Reviewed the postoperative plan, including pain management and antibiotics. <input type="checkbox"/> Postoperative Follow-Up: Scheduled follow-up appointments and necessary tests. <input type="checkbox"/> Documentation: Completed and signed all relevant surgical documentation. <input type="checkbox"/> Patient Status: Communicated the patient's status and any immediate concerns to the recovery team. |

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| 19. PEEP 6 | | | |
| 20. Mode of Ventilation PRVC | | | |
| 21. Respiratory Rate 20 breaths/Minute | | | |
| 22. SPO2 99% | | | |

Nursing Diagnosis and Interventions:

1. **Ineffective Airway Clearance related to obstruction:**

o **Interventions:**

- Monitored airway for signs of obstruction (stridor, decreased breath sounds).
- Ensured airway patency via bronchoscopy and suctioning.
- Administered oxygen therapy (FiO₂ adjustments) to maintain SpO₂.

2. **Risk for Infection related to invasive procedures:**

o **Interventions:**

- Monitored for infection signs (fever, elevated WBC count).
- Administered prophylactic antibiotics.
- Followed infection control protocols during procedures.
- Provide care and maintained care Bundle (VAP Bundle, SSI Bundle and CAUTI bundle)

3. **Impaired Gas Exchange related to central airway obstruction:**

o **Interventions:**

- Monitored ABGs to assess oxygenation and ventilation.
- Gradually reduced FiO₂ per ECMO weaning protocol.
- Administered sodium bicarbonate for metabolic acidosis.

4. **Acute Pain related to throat discomfort:**

o **Interventions:**

- Assessed pain levels and administered IV Fentanyl.
- Provided emotional support and relaxation techniques.

5. **Risk for Hemodynamic Instability related to ECMO support:**

o **Interventions:**

- Monitored vital signs closely.
- Adjusted medications (Noradrenaline) for hemodynamic stability.
- Monitored for bleeding or complications from ECMO.

I. **Post-Procedure Progress and Supportive Measures: Day 2**

Nursing Actions and Responsibilities in Post-ECMO Management and Hemodynamic Stabilization.

1. **ECMO Weaning Initiated**

o **Nursing Actions:**

- Monitored the patient's vital signs closely during ECMO weaning.
- Maintained readiness for immediate intervention.
- Assessed arterial blood gases (ABG) frequently to evaluate respiratory status.

2. **Arterial Blood Gas Analysis Performed**

- o Findings: Mild acidosis (pH 7.33), low PCO₂ (28.1 mmHg), elevated PO₂ (249.9 mmHg), low HCO₃⁻ (16.6 mEq/L), and high lactate (12.60 mmol/L).

o **Nursing Actions:**

- Reported abnormal values to the physician.
- Assisted with corrective interventions, including electrolyte adjustments.

3. **Sodium Bicarbonate Infusion Administered (100 ml IV)**

o **Nursing Actions:**

- Monitored the infusion rate and site for complications.
- Observed for signs of metabolic alkalosis and ensured patient safety.

4. **Tranexamic Acid Infusion Monitored (5 ml/hr)**

o **Nursing Actions:**

- Assessed for bleeding cessation and monitored coagulation parameters.
- Maintained accurate intake/output records.

5. **Fluids Administered (300 ml NS Bolus, 50 ml/hr Maintenance)**

o **Nursing Actions:**

- Maintained fluid balance charts.
- Monitored for signs of fluid overload, including edema and respiratory distress.

6. **Pain Management Provided (Inj. Paracetamol 1 gm Stat, Inj. Fentanyl 50 mcg Stat, 20 mcg/hr Infusion)**

o **Nursing Actions:**

- Assessed and documented pain levels regularly.
- Monitored for sedation or respiratory depression during fentanyl infusion.
- 7. **Heparin Administered (5000 IU Stat)**
 - **Nursing Actions:**
 - Monitored and maintained ACT levels within the target range (180-220 seconds).
 - Assessed for signs of bleeding or clot formation.
- 8. **Noradrenaline Infusion Initiated (3-5 mcg/kg IBW/min)**
 - **Nursing Actions:**
 - Titrated the infusion to maintain MAP >70 mmHg.
 - Monitored for adverse effects such as hypertension or arrhythmias.
- 9. **Gastrointestinal Protection Initiated (Inj. Pantoprazole OD)**
 - **Nursing Actions:**
 - Administered the medication as prescribed and observed for signs of GI bleeding.
- 10. **Antibiotic Therapy Administered (Inj. Ceftriaxone 2 gm Loading Dose, Adjusted to 1 gm)**
 - **Nursing Actions:**
 - Ensured timely administration of antibiotics.
 - Monitored for any allergic reactions.
- 11. **Electrolyte Correction Provided (Syrup POTKLOR 15 ml)**
 - **Nursing Actions:**
 - Monitored potassium levels and observed for symptoms of hyperkalemia or hypokalemia.
- 12. **Symptomatic Treatment Provided (Inj. Ondansetron 8 mg SOS)**
 - **Nursing Actions:**
 - Administered ondansetron for nausea as needed and evaluated its effectiveness.
- 13. **Anemia Managed (Two Units PRBC Administered)**
 - **Nursing Actions:**
 - Monitored hemoglobin levels pre- and post-transfusion.
 - Observed for and managed any transfusion reactions.
- 14. **Tranexamic Acid Infusion Discontinued (11 AM)**
 - **Nursing Actions:**
 - Assessed for recurrence of bleeding and ensured patient stability.
- 15. **Inotropes Discontinued (12 AM)**
 - **Nursing Actions:**
 - Ensured hemodynamic stability after inotrope discontinuation.
- 16. **VV ECMO Decannulation Completed Successfully**
 - **Nursing Actions:**
 - Assessed for bleeding and monitored the decannulation site.
 - Evaluated hemodynamics and oxygenation post-decannulation.
- 17. **Post-Decannulation Monitoring**
 - **Nursing Actions:**
 - Maintained continuous observation for complications.
 - Provided supportive care to promote recovery.
- II. Post-Procedure Care Day 3:**
 - Patient showed significant improvement with stable hemodynamics.
 - No further episodes of bleeding.
 - Continued maintenance fluids.
 - Ongoing supportive therapy with PPI and antibiotics.
 - Overall, a comprehensive and dynamic management approach effectively stabilized the patient's condition.
 - She allowed Oral Feed and Discharged the Child.

VI. Post Procedure Nursing Diagnosis And Interventions

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| 1. Risk for Altered Hemodynamics related to blood loss and peri-procedure hypotension | Administered Noradrenaline infusion to maintain MAP >70 mmHg. Infused 300 ml NS bolus, followed by maintenance fluids at 50 ml/hr. Transfused two units of PRBC to correct anemia. |
| 2. Acute Pain related to surgical procedures and ECMO insertion | Administered Inj. Paracetamol 1 gm stat and Inj. Fentanyl 50 mcg stat, followed by a continuous infusion of 20 mcg/hr. Regularly assessed the pain score and adjusted analgesics accordingly. |
| 3. Risk for Electrolyte Imbalance related to fluid shifts and ECMO therapy | Administered Syrup Potklor 15 ml to correct potassium levels. Monitored ABG reports and serum electrolytes for abnormalities. Infused Sodium Bicarbonate (100 ml IV) to correct metabolic acidosis (pH 7.33, HCO ₃ ⁻ 16.6). |

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| 4.Risk for Gastrointestinal Disturbance related to stress and medication side effects | Initiated PPI therapy with Inj. Pantoprazole (OD) for gastrointestinal protection. Administered Inj. Ondansetron 8 mg SOS for nausea. |
| 5.Risk for Anxiety related to critical illness and invasive procedures | Provided reassurance and clear information to the patient and family about the treatment plan and progress. Administered sedative medications (e.g., IV Fentanyl infusion) to reduce discomfort and anxiety. Encouraged family support when appropriate. |
| 6.Risk for Knowledge Deficit related to postoperative care and recovery process | Educated the family on signs of complications, follow-up care, and medication management. Provided written instructions regarding diet, fluid intake, and prescribed medications. Clarified concerns and answered queries about recovery expectations. |

VII. Discharge Advice:

The patient was instructed on their discharge advice, which included a comprehensive medication regimen. They were advised to continue taking Proton Pump Inhibitors (PPIs) for gastric protection, antibiotics to manage any infections, and analgesics as needed for pain relief. If electrolyte imbalances were detected, electrolyte supplements were prescribed to help restore balance. For their diet, the patient was guided to follow a balanced, nutritious diet with sufficient fluid intake. They were specifically told to avoid spicy, oily, or heavy foods initially and to focus on soft, easily digestible foods to aid their recovery. Regarding activity, the patient was advised to gradually resume daily activities. They were cautioned against heavy lifting or strenuous exercise for the next three months to allow proper healing. Breathing exercises were also recommended to help with respiratory function and overall recovery. The patient was educated on recognizing warning signs that required immediate medical attention, such as difficulty breathing, chest pain, high fever, or severe abdominal pain, to ensure timely intervention if any complications arose. Lifestyle recommendations included avoiding smoking and alcohol consumption. They were encouraged to adopt stress management techniques and maintain good sleep hygiene to support both physical and mental well-being. Finally, the patient was informed that if anxiety or stress persisted during recovery, seeking counselling support was advised to help manage emotional challenges during this healing period. By following the prescribed plan, the patient would be on the path to a full recovery, with both physical and psychological aspects taken into consideration.

VIII. Outcome And Conclusion

The prognosis of ECMO patients with central airway obstruction depends on the underlying cause, timing of intervention, and management of complications. Reversible causes such as mucus plugging, foreign body aspiration, or treatable tumors often lead to favorable outcomes, with survival rates of 60–70% when ECMO is initiated early to stabilize gas exchange before severe hypoxia or cardiac arrest. In contrast, patients with malignant or complex airway obstructions requiring prolonged ECMO support face a guarded prognosis, with survival rates ranging between 20–40%. Complications like bleeding, infections, thromboembolism, circuit malfunctions, and hypoxic brain injury significantly impact outcomes. Effective management of these complications—such as maintaining optimal anticoagulation levels, adhering to aseptic techniques, timely detection of circuit issues, and early ECMO initiation—can improve survival and reduce long-term morbidity. Research studies consistently highlight that a multidisciplinary approach and structured protocols are critical in addressing complications and improving patient outcomes, emphasizing the importance of early intervention and meticulous care. A remarkable story of resilience unfolded as a 13-year-old girl overcame severe Central Airway Obstruction (CAO), surviving not just once but twice with the aid of Extracorporeal Membrane Oxygenation (ECMO). Her journey serves as a testament to the power of advanced medical care, teamwork, and the human spirit. This case highlights the importance of early intervention, cutting-edge medical technology, and an unwavering commitment to patient-centered care. The successful treatment and recovery of this young girl underscore the need for expertise and excellence in managing complex cases, inspiring hope for families and healthcare providers alike.

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