Management of Acute Respiratory Failure: A Case Report

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Abstract

In an Intensive Care Unit, acute respiratory distress syndrome (ARDS) is a serious condition. Non-cardiogenic pulmonary oedema was the prior name for it. It is caused by a variety of illnesses that cause lung injury, but sepsis is the most common cause. It causes interstitial and alveolar oedema, diffuse alveolar damage, refractory hypoxemia, and ventilation perfusion mismatch by damaging the alveolar capillary membrane. Dyspnoea with diffuse infiltration on chest X-ray is a typical clinical symptom. Low tidal volume, high positive end expiratory pressure (PEEP), and low plateau pressure are all used to treat ARDS. Prone placement improves patient perfusion and thereby increases the PaO/FiO ratio. To treat ARDS, doctors are increasingly turning to high frequency oscillation ventilation (HFOV).

Key words: Acute respiratory failure, Arrhythmias, ABG and ECG.

The sudden onset of hypoxia and bilateral pulmonary oedema caused by increased alveolocapillary permeability is known as acute respiratory distress syndrome (ARDS). Respiratory failure happens when the capillaries, or tiny blood vessels, surrounding air sacs can't properly exchange carbon dioxide for oxygen. The condition can be acute or chronic. The two types of acute and chronic respiratory failure are hypoxemic and hypercapnia. Both conditions can trigger serious complications and the conditions often coexist.

Etiology: There are various causes of acute respiratory failure.

- Obstruction – people with COPD or asthma.
- Injury to spinal cord or brain, if the brain can't relay message due to injury or damage, the lungs can't continue to function properly.
- An injury to the ribs or chest can also hamper the breathing process.
- Acute respiratory distress syndrome is characterised by having low oxygen in the blood.
- Sepsis.
- Pneumonia.

Diagnostic Evaluation

ARDS is confirmed through various investigations.

History Collection:

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The patient's history will disclose any active or passive lung injury, as well as any worsening dyspnea.

Physical Examination:

For ARDS, there are no specific physical examination findings. Wheezing and tachycardia will be present in the patient. The patient will be febrile and hypotensive if ARDS occurred as a result of sepsis. Lung auscultation will demonstrate bilateral crackles and reduced airflow.

Arterial Blood Gas Analysis (ABG)

Partial pressure of oxygen (PaO2) and fraction of inspired oxygen (FiO2) ratio will be lower in the blood gas results.

X-ray of the Chest

On chest X-ray, diffuse, patchy interstitial and alveolar infiltrates can be seen.

Broncho-Alveolar Lavage (BAL)

It aids in distinguishing pulmonary eosinophilia. ARDS is diagnosed when neutrophils are present.

Cardiovascular Echography

The echocardiography will most likely be normal. The left ventricle ejection fraction is within acceptable limits. It's done to make sure the patient doesn't have a heart condition.

Management

General management, mechanical ventilation, prone positioning, and treatment with extracorporeal and intracorporeal gas exchange are all part of the medical management.

The main medical care entails determining and treating the cause, such as sepsis caused by intravascular lines, urinary catheters, draining abscesses, and necrotic tissue debridement. If blood transfusions are the reason, these must be discontinued. Temperature, pulse rate, respiration rate, ABP (arterial blood pressure), CVP (central venous pressure), and PPV (pulse pressure variation) should all be constantly watched. Based on the culture and sensitivity findings, antibiotics should be begun. Deep vein thrombosis (DVT), hospital-acquired infections (HAI), and pressure ulcer prevention should all be implemented.

Mechanical Ventilation

Mechanical ventilation is the next critical aspect of ARDS care. Protective lung ventilation methods have been shown in numerous studies to reduce patient mortality. The tidal volume in mechanical ventilation is normally fixed between 6 and 8 ml/kg, although it should be less than 6 ml/kg for these patients to avoid ventilator-associate lung injury (VALI) or ventilator-induced lung injury (VILI) (The Acute Respiratory Distress Syndrome Network, 2000). The tidal volume is computed using the patient's expected weight. The patient's predicted weight is determined by his or her height and gender. For men, the formula is 50 + 0.91 (height -152.4 cm) and for women, the formula is 45.5 ±0.91 (height -152.4 cm). To prevent alveolar collapse, stabilise alveoli, and increase functional residual capacity. Positive end expiratory pressure (PEEP) should be 10 to 15 cm H_2O. (FRC). IPP should be less than 30 cm H_2O. To prevent alveolar collapse and raise FRC, inverse ratio ventilation (IRV) is used. The ratio can be set at 2:1 or 3:1 depending on the patient's state, but it requires sedation with neuromuscular blockade to prevent the patient from resisting the ventilator.

Bi-level positive airway pressure (BiPAP) and airway pressure release ventilation (APRV) are two more forms of ventilation that can be used. The higher and lower pressures can be set at pre-determined time intervals in APRV mode, which enhances ventilation perfusion matching. In BiPAP mode, you can adjust the inspiratory and expiratory pressures to avoid alveolar collapse PCV (pressure control ventilation) can be regulated to keep the inspiratory plateau pressure constant. If the patient does not improve with normal ventilation, the emerging tendency is to use high frequency oscillatory ventilation (HFOV).

Prone Positioning

Increased perfusion to the non-consolidated areas of the lung can be achieved by lying prone. It also makes secretion removal easier. Before proning, the patient must be sedated and paralysed, which can take anywhere from 30 minutes to 40 hours.

Gas exchange (extracorporeal and intracorporeal)

If all previous methods have failed, this is the last resort. It's also known as a membrane/fibre oxygenator or an artificial lung. Extracorporeal gas exchange is an accepted rescue therapy for severe acute respiratory distress syndrome (ARDS) in select patients. Extracorporeal carbon dioxide removal is also being investigated as a preventative, preemptive, and management platform in patients with respiratory failure other than severe ARDS.

We describe a case of severe ARDS secondary to COVID-19 viral pneumonia which progressed to multisystem end-organ dysfunction.

Case Report

An elderly female of 60 years old was admitted in medical/surgical ICU under MRD No.1470 benefitted under PMJAY under case no. JK468156 with golden card No. PDJHYUGDI on 07/02/22 as the case of acute respiratory failure. She was having weight of 59 kg.

Medical history: The patient was brought to GMC Anantnag Kashmir, with the complaint of breathlessness, hypertension, fever, tachycardia, type 2 diabetes mellitus. She was admitted in Intensive Care Unit.

Assessment

The condition is marked by the onset of dyspnoea and hypoxia, which increases over hours to days, sometimes necessitating mechanical breathing and intensive care unit treatment. The goal of the history is to figure out what caused the sickness in the first place. When interviewing patients who are able to communicate, they frequently report of mild dyspnoea at first, but the respiratory distress quickly increases, getting serious and need ventilatory support to prevent hypoxia within 12 to 24 hours. In the instance of pneumonia or sepsis, the cause may be evident. In other circumstances, however, interviewing the patient or families about recent exposures may be crucial in determining the causal substance. Findings related to the respiratory system, such as tachypnea and greater struggle to breathe, will be part of the physical examination. Systemic symptoms, such as central or peripheral cyanosis due to hypoxemia, tachycardia, and altered mental status, may also be present depending on the severity of the illness. Patients have low oxygen saturation despite receiving 100 percent oxygen. Auscultation of the chest frequently reveals rales, particularly bibasilar rales, but they are also heard throughout the chest.

Nursing Management

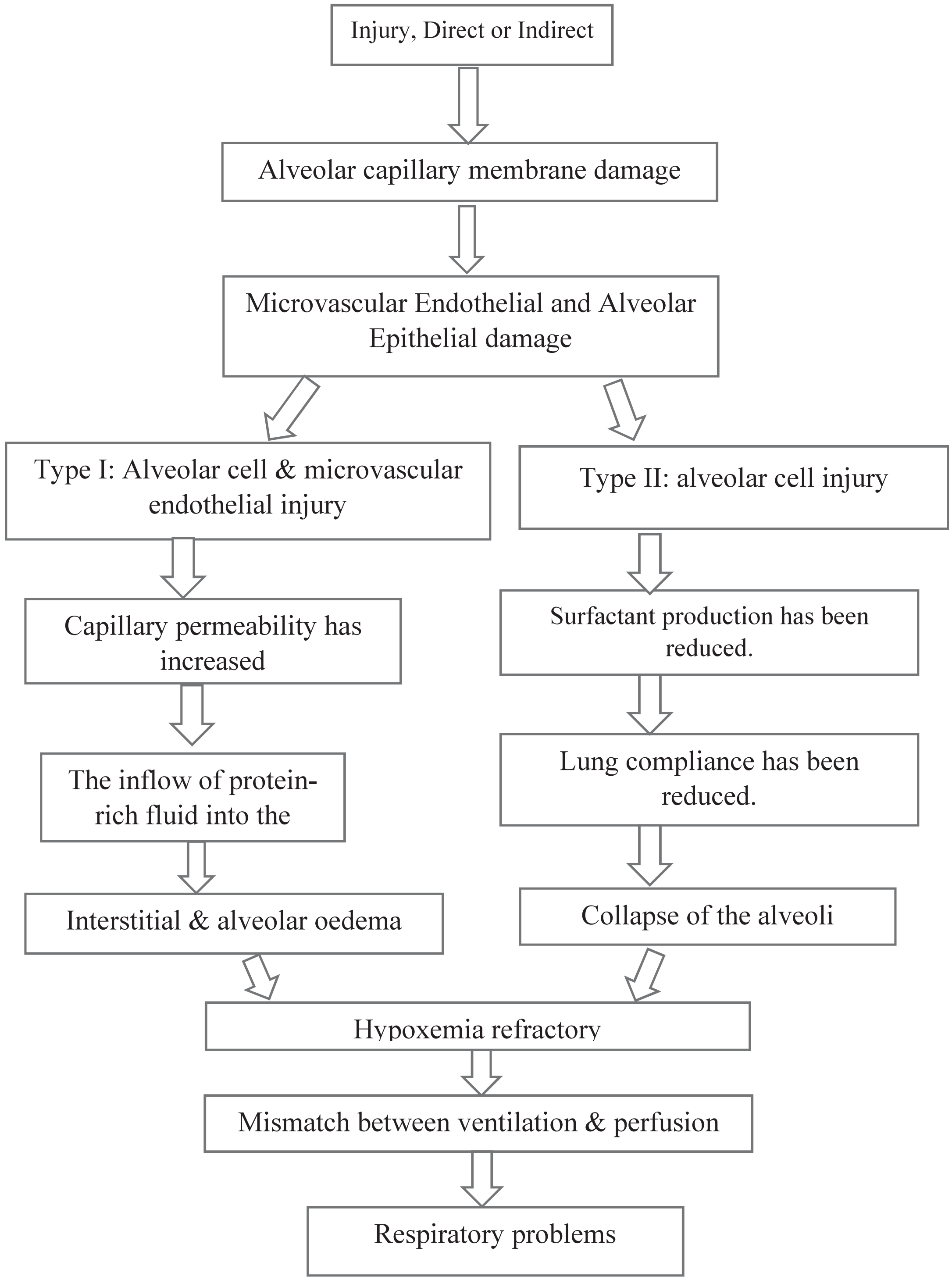
A case report is used to discuss the nursing management of a patient with ARDS.

Mrs A, a 60-year-old woman who had been

complaining of severe abdominal pain, breathlessness, palpitation, restlessness, irritation, fever, hypertensive, diabetes with low oxygen saturation, tachycardia, tachypnea and blue discoloration of nails & lips was admitted in Medical Intensive Care Unit (ICU).

The nursing process approach is used to discuss Mrs A's nursing care.

Pathophysiology



1. Nursing diagnosis: Reduced energy and respiratory muscle exhaustion are linked to an abnormal breathing pattern.

Expected outcome: During auscultation, she maintains an effective breathing pattern as shown by normal respiratory rate (RR) and breath sounds.

Interventions: The breath sounds were evaluated for aberrant lung sounds, as well as the respiratory rate, rhythm, depth, and use of accessory muscles for breathing. The RR was 32/min at first, and she was breathing through the sternocleidomastoid and trapezus muscles. Auscultation revealed crackles. Metabolic acidosis was discovered using ABG. Her SpO_2 level was at 90 percent. Maintaining and adjusting ventilator settings was based on ABG readings. She was first attached to a mechanical ventilator via an endotracheal tube. She was on pressure support in synchronized intermittent mandatory ventilation (SIMV) mode with 50 percent FiO_2, 22 cm H_2O pressure support, and 10 cm H2O PEEP. She was later weaned off the ventilator and was able to maintain a normal breathing rhythm. Total Parenteral nutrition was started at 20 ml/hr and then raised to 80 ml/hr to meet her calorie requirements.

Evaluation: Her breathing pattern was effective, as shown by normal breath sounds and a respiratory rate of 24 b/m, SpO_2 of 100 percent, without any mechanical ventilation.

2. Nursing diagnosis: Poor airway clearance due to trachea-bronchial secretion pooling Expected outcome: Her airway is clear, as shown by equal air input on both sides and the absence of secretions.

Interventions: The colour, quantity, and consistency of secretions were evaluated. Sputum was thick, plentiful, and white in color. Bilateral equal air entry and bi-basilar crackles were heard on auscultation. To release secretions, performed chest physiotherapy was performed and Salbutamol 5 mg nebulizsation for 6 hours was administered. Closed suctioning was used to remove secretions every two hours or whenever necessary. To mobilise the secretions, positions were changed every 2 hours. For appropriate hydration, a 40ml/hr 0.9 percent normal saline infusion was given.

Evaluation: She had a patent airway, as shown by bilateral equal air admission and the absence of thick profuse secretions during auscultation.

3. Nursing diagnosis: Altered nutritional pattern less than body requirements relate to the lack of understanding about a balanced diet and an increased metabolic requirement.

Expected outcome: Nutritional status of patient was improved by showing demonstrating tolerance to total parenteral nutrition (TPN).

Interventions: Body weight was measured, and serum albumin levels and lymphocyte counts were sent for testing. The patient weighed 55 kg, stood 165 cm tall, and had a serum albumin level of 1.6 gm per ml. Because she has T2DM, her blood sugar was checked every two hours and was above 220 gm/dl. She received a continuous insulin infusion. TPN was given to the patient at a rate of 30 ml/hr during the first 24 hours of every prescription to keep the patient's albumin level from dropping too low. To avoid vomiting, Inj. Ondem 8 mg was administered every 12 hours.

Evaluation: The nutritional status of patient was improved as well evident from TPN tolerance and maintenance of blood sugar level.

4. Nursing diagnosis: Potential complications related to prolonged mechanical ventilation and impaired tissue integrity.

Expected outcome: Maintenance of tissue integrity as evidenced from absence of bedsore and increased granulation tissue.

Interventions: Assessed the sign of complication, provided proper skin care to decrease the chances of bedsore. Provided mouth care to prevent complications of neglect. Assessed the tissue integrity. Changed the position 2 hourly to prevent tissue damage and Discomfort. Facilitated with air mattress to prevent bed sore.

Evaluation: The skin integrity of patient was maintained as evidenced by no rashes, redness, warmth, bedsore and normal blood pressure, temperature, respiration and CBC level.

5. Nursing diagnosis: Impaired gas exchange due to perfusion ventilation mismatch.

Expected outcome: Maintains good gas exchange as evidenced by a P/F ratio more than 300 and a SpO2 greater than 90 percent.

Interventions: At first, the P/F ratio was 146, and the SpO2 was 90 percent, SaO2 was 88 percent, PaO2 was 73 mm of Hg. Maintain ET cuff pressure at 25 cm Hg to avoid air leakage. By keeping PEEP at 10 cm of H2O, the alveoli are opened, allowing for better gas exchange. She was prone for 24 hours in order to induce gas exchange. Following prone placement, her P/F ratio improved to 192, then 400.

Evaluation: She was maintaining good gas exchange, with a P/F ratio of 400 and a SpO2 of 98 percent.

Care of Coordination

ARDS is a devastating lung condition that can lead to death. Because of the hypoxia, clients with ARDS may require respiratory support. In most cases, management is in the ICU with a multidisciplinary medical team. ARDS has consequences that go beyond the lungs. Pressure sores, venous thrombosis, multi-organ dysfunction, weight loss, and poor overall performance are all common side effects of prolonged mechanical breathing. Because ARDS affects so many organs in the body, it is critical to take a holistic approach to treatment. These patients will require dietary assistance, chest physiotherapy, sepsis treatment, and maybe haemodialysis. Many of these patients spend months in the hospital, and even those who survive suffer significant hurdles due to muscle loss and cognitive impairments (due to the disease). There is substantial evidence that an interdisciplinary team approach improves outcomes by facilitating communication and ensuring timely action. The following should make up the team and their responsibilities:

Intensivist is responsible for managing the ventilated patient as well as other ICU-related issues such as pneumonia prevention, DVT prevention, and stomach stress management. Nutritional support is sought from a dietitian and nutritionist. The ventilator settings will be managed by a respiratory therapist. Antibiotics, anticoagulants, and diuretics, among other prescriptions, will be managed by a pharmacist. Lung diseases are managed by a pulmonologist. Nephrologist to look after the kidneys and, if necessary, oversee renal replacement therapy. Nurses must keep an eye on the patient, shift them into beds, and educate the family. A physical therapist will help the patient exercise and regain muscle function. Maintaining the tracheostomy and weaning with the help of an endotracheal nurse. Stress, anxiety, and other emotional disorders will be evaluated by a mental health nurse. After assessing the patient's financial status, (s)he needs transferring to rehabilitation centre, Spiritual care and ensuring proper follow-up.

Conclusion

Protective pulmonary oxygenation will reduce the immune system's inflammatory response and lethality associated with ARDS. Prone positioning improves lung perfusion. Caring for an ARDS patient is difficult and gratifying for critical care nurses.

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