

CLINIQUIZ

Acute respiratory distress syndrome

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A victim of polytrauma has been operated for fixation of fractures of both femurs and left humerus. He is shifted to surgical intensive care unit and transfused with 6 to 7 units of blood. On 3rd postoperative day, he develops sudden shortness of breath with tachycardia and tachypnoea. On examination, his HR is 144/min, BP 104/60 mmHg, Resp. rate: 42/min and SpO₂: 96%. Chest X-ray reveals haziness and opacities in both of the lung fields, while ABG's reveal pH: 7.21, PaO₂: 46 mmHg, PaCO₂: 38mmHg, HCO₃⁻: 14mmHg. A presumptive diagnosis of Acute Respiratory Distress Syndrome (ARDS) is made and ventilatory support is initiated after endotracheal intubation.

(Please select one correct option)

Q. 1: All of the following are common causes of ARDS except?

- Sepsis
- Pulmonary contusion
- Aspiration pneumonia
- Pneumonia

Q. 2: Which of the following is not a presenting feature in the early stages of ARDS?

- Hypocapnia
- Hypoxemia
- Decreased lung compliance
- Interstitial edema

Q. 3: Which of the following is not used for evaluating the severity of ARDS?

- PaO₂/FiO₂ < 300
- PaO₂/FiO₂ < 200
- Radiographic infiltrates
- Pulmonary artery occlusion pressure (POAP) > 18 mmHg

Q. 4: The following is not associated with increased mortality in a patient with ARDS?

- Advanced diabetes mellitus
- Chronic alcohol intake
- HIV disease
- Organ transplantation

Q. 5: Which of the following statement is correct?

- Presence of alveolar type-III procollagen peptide is associated with increased mortality
- Mortality is higher in cases with ARDS due to pulmonary causes as compared to non-pulmonary causes
- Features of ARDS are confined to the lung initially
- COPD is the most common cause of direct lung injury leading to ARDS

Q. 6: Which of the following statement is correct regarding ARDS:

- All patients go through three pathophysiological phases of ARDS (exudative, proliferative and fibrotic phases)
- Prognosis is not age related
- Full respiratory recovery is expected in most survivors after 12 months
- Echocardiography can help to identify lung injury

Q. 7: Which of the following statement regarding management strategy in ARDS is incorrect?

- Prone positioning provides temporary improvement in oxygenation
- Conservative fluid management reduces extravascular lung water
- Steroids given in acute phase decrease inflammation and severity of ARDS
- Administering nitric oxide provides long term improvement in oxygenation

Q. 8: Which of the following is incorrect regarding mechanical ventilator support in ARDS?

- Volume/pressure control mode should be instituted after taking the patient on ventilatory support
- Improving lung compliance can be identified by falling peak pressure
- Recommended ventilator settings include tidal volume of 6-8 ml/kg, PEEP 8-12 cm H₂O and FiO₂ of 80-100% for first few hours
- Pressure control (PC) ventilation has been shown to increase lung injury compared to volume control (VC) mode

Q. 9: All of the following ventilator settings have been shown to improve outcomes in patients with ARDS except:

- Decreasing inspiratory flow rate if breath stacking or patient-ventilator dyssynchrony occurs

- b. Inverse ratio ventilation with I:E ratio 2:1 to 3:1
- c. Adjusting ventilator settings to deliver low tidal volumes of 6-7 ml/kg
- d. Setting peak inspiratory pressures to < 30 cm H₂O

Q. 10: Which of the following is not true regarding perflourocarbons (PFC)?

- a. PFC have a high surface tension to compensate for deficient surfactant
- b. They have a density higher than body fluids
- c. They have anti-inflammatory properties in the alveolar space
- d. They provide liquid PEEP in dependent lung

ANSWERS

Ans. 1(b): Head Injury, inhalational injury, near drowning, fat embolism, reperfusion injury, pancreatitis, burns, trauma, drug overdose and transfusion of blood products are a few rare causes of ARDS.

Ans. 2(b): Hypoxemia does not occur early in ARDS as patient compensates for decreasing O₂ levels by increasing respiratory effort leading to hypocapnia. As disease progresses over next 6-48 hrs, rising tachycardia, tachypnoea, ventilation-perfusion mismatch, lung water, crepts and crackles lead to deterioration in condition.¹

Ans. 3(d): The European Society of Intensive Care Medicine (endorsed by the American Thoracic Society and the Society of Critical Care Medicine) developed the Berlin Definition in 2012. A draft definition proposed 3 mutually exclusive categories of ARDS based on degree of hypoxemia: mild (PaO₂/FIO₂ ≤ 300 mm Hg), moderate (PaO₂/FIO₂ ≤ 200 mm Hg), and severe (PaO₂/FIO₂ ≤ 100 mm Hg) and 4 ancillary variables for severe ARDS: radiographic severity, respiratory system compliance (≤40 mL/cm H₂O), positive end-expiratory pressure (≥10 cm H₂O), and corrected expired volume per minute (≥10 L/min). The diagnosis of the ARDS is predominantly made on a clinical basis, and pulmonary artery catheters or PAOP no longer have a major role in the diagnosis and management of ARDS.^{2,3}

Ans. 4(c): Increased mortality is observed in immunocompromised patients suffering from ARDS. As an HIV positive case has enough immunocomptence in

early phase, the risk of increased mortality has not been reported in trials.⁴

Ans. 5(a): Alveolar type III procollagen peptide is a marker of pulmonary fibrosis and progression to fibrotic phase of ARDS. No difference in mortality was noted either due to direct or indirect cause in a large cohort study. Release of cytokines and inflammatory mediators initiate systemic manifestations leading to hypotension, tachycardia and myocardial depression. Pneumonia is the most common cause of direct lung injury leading to ARDS.

Ans. 6(c): All patients do not undergo the three phases of ARDS. Prognosis is poor in patients who are staged in fibrotic phase, elderly or immunocompromised. Echocardiography helps to exclude left atrial hypertension, required for diagnosis of ARDS.

Ans. 7(d): Prone positioning improves alveolar recruitment and oxygenation in basal zones of lung. The conservative fluid strategy has shown to reduce lung water and improves oxygenation index, lung injury score and the number of ventilator free days. Routine use of corticosteroids is not advocated, especially in the acute phase of ARDS, due to infection potentiating and myopathy related issues. Steroids have shown to reduce the severity of inflammations and hence fibrosis in fibrotic stage, though no reduction in mortality was observed in any stage of ARDS. Nitric Oxide provides short term increase in oxygenation, but presently is not recommended based on clinical evidence against efficacy of therapy.^{1,5}

Ans. 8(d): Alveolar recruitment leads to decrease in lung resistance, which leads to a fall in peak pressure (i.e. pressure required to open the alveoli) on observing ventilator trends. PC mode has shown to decrease lung injury compared to VC mode.

Ans. 9(b): If breath stacking or patient-ventilator dyssynchrony occurs, inspiratory flow rate and the level of sedation should be increased.³

Ans.10(a): PFC's are biologically stable, inert, twice as dense as water and settle down in dependent portions of the lung where they improve oxygenation. The surface tension of PFC is remarkably low (12-18 dyne/sec) because of low intermolecular forces, which aids in alveolar recruitment.⁶

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