Self-assessment

This section is designed to test your knowledge of selected topics in this issue of the journal. The correct answers are given on the next page.

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SINGLE BEST ANSWER

1 A 30-year-old male is admitted to the intensive care unit following a 5-day history of cough with sputum and breathlessness. He has no past medical history. He is ventilated with 100% oxygen and PaO_2 is 8.2 kPa. Chest X-ray demonstrates significant bilateral opacification. ECHO is normal. Which of the following ventilation strategies may reduce mortality in this scenario?

- **A.** ☐ Prone ventilation
- **B.** ☐ Airway pressure release ventilation
- **C.** ☐ High frequency oscillatory ventilation (HFOV)
- **D.** ☐ Extracorporeal membrane oxygenation
- **E.** ☐ Application of positive end-expiratory pressure (PEEP) of 16 cmH2O

2 A 38-year-old female presents to the emergency department with overdose of a drug which has been prescribed for her chronic pain and depression. She is suspected to have consumed the drug about 6 hours ago. She is agitated, confused has dilated pupils and raised temperature. Which of the following are true about the diagnosis and management of this patient?

- **A.** ☐ Alkalinization of the urine with intravenous sodium bicarbonate is useful
- **B.** ☐ Gastric lavage should be routinely performed in all patients
- **C.** ☐ N-acetylcysteine is a specific antidote that can be administered
- **D.** ☐ Phenytoin is highly effective in the management of convulsions
- **E.** ☐ ECG may show a narrowing of QRS interval

MULTIPLE CHOICE QUESTIONS

3 Extracorporeal support of the respiratory system

Extracorporeal life support may be provided in severe respiratory failure associated with which of the following conditions?

- **A.** ☐ Uncompensated hypercapnia with pH <7.20
- **B.** ☐ Severe community acquired pneumonia
- **C.** ☐ Fibrotic lung disease
- **D.** ☐ Life limiting COPD
- **E.** ☐ Lung injury score >3

4 Surgical diathermy and electrical hazards: causes and prevention

Which of the following are true regarding the properties and hazards of surgical diathermy?

- **A.** ☐ The cutting effect is achieved by using an intermittent sine wave of low voltage.
- **B.** ☐ Modern diathermy generators use an isolated circuit with output voltages referenced to the generator itself
- **C.** ☐ Burns may occur during laparoscopy due to capacitive coupling
- **D.** ☐ Viruses may be transmitted in the surgical smoke generated by the diathermy
- **E.** ☐ Bipolar diathermy never causes electromagnetic interference

5 Community acquired pneumonia (CAP)

Which of the following are true regarding the treatment and prognostication of community acquired pneumonia ?

- **A.** ☐ Addition of flucloxacillin to the antimicrobial regimen is suggested if there was history of recent viral illness
- **B.** ☐ The use of specific procalcitonin algorithms does not decrease mortality or morbidity
- **C.** ☐ There is significant reduction in antibiotic duration using procalcitonin guidance
- **D.** ☐ British Thoracic Society guidelines suggest a 7—10 day course of antimicrobial therapy in all forms of CAP
- **E.** ☐ British Thoracic Society guidelines recommend routine use of steroids in severe CAP

6 Disinfection, sterilization and disposables

Which of the following are true regarding the various techniques used for disinfection and sterilization ?

- **A.** ☐ Steam sterilization (autoclave) uses pure, dry, saturated steam at a temperature of 121^0 C for 15 min
- **B.** ☐ Gamma radiation is used to sterilize reusable medical equipment
- **C.** ☐ Prion proteins are reliably removed from medical devices by conventional decontamination techniques
- **D.** ☐ Chlorhexidine is a disinfectant that destroys mycobacteria
- **E.** ☐ Bacterial spores are destroyed by prolonged exposure to hydrogen peroxide

ANSWERS

1. Correct Answer: A. Acute respiratory distress syndrome (ARDS) is represented by an acute deterioration in gas exchange associated with alveolar inflammation, increased pulmonary vascular permeability and oedema, in the context of normal cardiac function. Recognizing the underlying cause of ARDS and multi-organ failure is paramount. Despite early recognition and treatment, the inflammatory state driving ARDS and impairing oxygenation can persist, leading to difficulty in providing mechanical ventilation. In this situation it is important to minimize further lung injury by ensuring lung protective ventilation is delivered. The role of mechanical ventilation in ARDS is not to provide "normal" gas exchange but to ensure gas exchange is "safe".

In order to satisfy a diagnosis of ARDS the following criteria must be met: (i) PaO_2/FiO_2 ratio <39 kPa (despite the application of a positive end expiratory pressure greater than 5 cmH_2O); (ii) pulmonary oedema not explained by cardiac failure; (iii) bilateral opacification on chest imaging and occurring within 1 week of clinical insult.

Adopting prone position ventilation aims to improve ventilation-perfusion matching, recruitment of dorsal lung units, reduced mediastinal lung compression and facilitate improved sputum clearance. A recent randomized controlled trial - Prone Positioning in Severe Acute Respiratory Distress Syndrome (PROSEVA) - demonstrated improved oxygenation in patients who received early prone ventilation sessions with an associated mortality benefit. Airway pressure release ventilation (APRV) is essentially ventilation with an inverse I:E ratio, providing high levels of PEEP throughout the ventilator cycle. Routine use of APRV cannot at present be recommended as this was a single centre study and APRV has numerous potential side effects which include haemodynamic collapse as a result of reduced venous return or acute cor pulmonale and alveolar rupture leading to subcutaneous emphysema, pneumomediastinum and pneumothorax. Following the OSCAR and OSCILLATE studies, the use of HFOV can no longer be recommended. These were both large multi-centre randomized controlled trials which revealed no survival advantage. Furthermore, the OSCILLATE trial demonstrated an increase in mortality associated with HFOV. Extracorporeal life support (ECLS) includes the use of extracorporeal membrane oxygenation (ECMO) or extracorporeal carbon dioxide removal (ECCOR). The use of ECLS is traditionally thought of as a rescue therapy for refractory hypoxaemia despite mechanical ventilation. However, the use of ECLS to facilitate ultra-low tidal volumes, allow a reduction in mean airway pressures and provide further protection from ventilator-induced lung injury is currently under research. PEEP maintains alveolar recruitment and thus maximises the surface area available for gas exchange. The application of PEEP also prevents atelectrauma, improves lung compliance, maintains functional residual capacity and improves ventilation-perfusion matching. A meta-analysis of three randomized controlled trials (RCTs) demonstrated a survival benefit for patients with moderate or severe ARDS when a PEEP of 13 cmH_2O was compared to a PEEP of 8 cmH_2O. In a recently published study assessing lung recruitment and titrated PEEP however, application of PEEP at 16 cmH_2O in conjunction with a recruitment manoeuvre led to a worse outcome than routine PEEP target of 12 cmH_2O.

2. Correct Answer: A. This patient is highly suspicious of consuming amitryptilline which is a tricyclic antidepressant and also used for chronic pain. Patients typically present with agitation, confusion, dry mouth and skin, mydriasis, tachycardia, hyperthermia and urinary retention. Sodium bicarbonate has been traditionally used as an antidote. Glucagon can also be used. The main symptoms are due to effects on nicotinic muscarinic and serotonergic receptors. Seizures are a common presenting feature of drug ingestion or withdrawal. Benzodiazepines should be used as a first line treatment. Phenytoin should be avoided as this may worsen Na^+ channel blockade. Gastric decontamination with activated charcoal is a recognized immediate manageement option, which has been in use for a number of years. While it is a very effective form of reducing gastric absorption of poisons, activated charcoal is limited in its use due to timing of ingestion and risks in those with reduced consciousness. Its peak effect is within 1 hour of ingestion, at which time it is uncommon for people to present.

3. Correct answers: A, B, E

4. Correct answers: B, C, D

5. Correct answers: A, B

6. Correct answers: A, E