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The EM Educator Series

The EM Educator Series: The Bad Combination of Aspiration Pneumonia and ARDS

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Cases:

#1: A 46-year-old male with diagnosed septic shock requiring intubation is requiring more oxygen. Chest x-ray demonstrates diffuse infiltrates.

#2: A 79-year-old female is brought from the nursing home for fever and coughing. The staff are concerned she may have aspirated some food. Her current temperature is 38.4 C.

Questions for Learners:

1) What's the difference between aspiration pneumonitis and pneumonia?
2) When should you consider aspiration pneumonia? How about ARDS?
3) What are risk factors for aspiration pneumonia? ARDS?
4) What are the bugs associated with aspiration pneumonia? What antibiotics are recommended?
5) Do you treat aspiration pneumonitis?
6) Why do patients decompensate in ARDS? What are ventilator considerations in critically ill patients regarding ARDSnet?
7) How is ARDS diagnosed? What about management?

Suggested Resources:

- ✓ Articles:
  - LITFL – Aspiration Pneumonitis and Aspiration Pneumonia
  - Radiopaedia – Aspiration pneumonia
  - emDOCs.net – Acute respiratory distress syndrome (ARDS): who's at risk and ED-relevant management
  - LITFL – Acute Respiratory Distress Syndrome (ARDS)
  - Intensive Network – ARDS: An Evidence-Based Update
  - EM Clinics of North America – Early Treatment of Severe Acute Respiratory Distress Syndrome

Answers for Learners:

1) What's the difference between aspiration pneumonitis and pneumonia?

- Aspiration pneumonitis, or Mendelson syndrome, is chemically induce inflammation of the lungs as a result of aspiration of gastric contents.
- Aspiration pneumonia is infection of the lungs following aspiration by micro-organisms colonising the GI tract.

⇨ Distinguishing from aspiration pneumonitis may be difficult, and the distinction is controversial

2) When should you consider aspiration pneumonia? How about ARDS?

Aspiration may be clinically silent, or it may present with dyspnea, cough, or fever. The clinical and radiographic features depend on the aspirated volume, pH, and chronicity.

CLINICAL FEATURES

- Aspiration may range from asymptomatic to severe respiratory failure
- Respiratory symptoms and signs include cough, wheeze, crackles, dyspnoea, soiling of the airway, tachypnoea, tachycardia decreased lung compliance (increased airway pressures), hypoxia and cyanosis
- Even in the absence of infection a SIRS response may occur, including raised WBC, fever, tachycardia and hypotension

Most of the times, ARDS does not develop or is not identified until patients are mechanically ventilated in the ICU. However, we may still encounter ARDS in the ED in critical patients who have been boarded in the ED for a long period, in patients who have bounced back from a recent observation period, in patients who have been discharged after a trauma, or in patients who failed to seek healthcare earlier in their disease course.

3) What are risk factors for aspiration pneumonia? ARDS?

Aspiration Pneumonia:

- Patient factors
    - full stomach (fasting guidelines: 2 hr – clear fluids, 4 hr – breast milk, 6 hr – food)
    - opioid use
    - pain
    - pregnancy
    - increased BMI
    - distended abdomen – mass, ascites, bowel obstruction
    - GORD
    - decreased level of consciousness
    - gastric mass (malignancy)
    - DM
    - oesophageal motility disorders
    - anxiety
    - chronic neurological conditions – bulbar palsy from CVA, MS, MG, myotonic dystrophy
    - scleroderma
- Anaesthetic

    - anaesthesia with an unprotected airway (induced unconsciousness)
    - instrumentation of airway with inadequate depth of anaesthesia
    - paralysis
    - head down positioning
    - inadequate cricoid pressure
    - use of other airways other than cuffed endotracheal tube
    - opioids
    - use of inhalational agent (N2O)
- Surgical
    - laparoscopic insufflation of abdomen
    - bowel or visceral manipulation
    - pain

Common risk factors (direct and indirect) of ARDS:

- Direct lung injury: pneumonia, gastric aspiration, pulmonary contusion, near drowning, inhalation injury
- Indirect lung injury: sepsis, shock, acute pancreatitis, burns, crush injury, fat embolism, and massive transfusion

4) What are the bugs associated with aspiration pneumonia? What antibiotics are recommended?

- First line antibiotics:
    - benzylpenicillin + metronidazole or clindamycin
- If aerobic gram –ve bacilli suspected (alcoholic patients)
    - metronidazole + ceftriaxone/cefotaxime/piperacillin-tazobactam/ticarcillin+clavulanate
- Once defervesce -> amoxicillin-clavulanate or clindamycin po
- 7 days of total therapy usually adequate

5) Do you treat aspiration pneumonitis?

Supportive care, but more importantly, prevent aspiration risk for future!

IMMEDIATE

- minimised further aspiration
- if awake -> suction and place in recovery position
- if breathing spontaneously -> recovery position
- if unconscious and apnoeic
- secure airway (ETT)
- suction until airway clear
- 100% O2
- CPAP

SUBSEQUENTLY

- empty stomach with NG tube
- CXR – diffuse infiltrate (often in RLL) – on table CXR
- bronchoscopy +/- lavage
- chest physiotherapy

- ICU referral if appropriate
- ?corticosteroids – may dampen down inflammation but don't effect outcome
- ?antibiotics not indicated unless aspiration of infected material is a particular concern or has other risk factors (see above)

This applies particularly to patients receiving sedation or induction of anaesthesia:

- Adequately starved patients
- Prophylactic anti-emetic use
- Adequate analgesia
- RSI (pre-oxygenation, suction readily available, induction with cricoid pressure, suxamethonium, no bag-mask ventilation)
- If bag-masking required – use small shallow breaths (LOS pressure 20 cmH2O)
- Low threshold for use of a cuffed endotracheal tube
- Prokinetics pre-induction and extubation (high risk times)
- Extubating at risk patient once return of laryngeal reflexes apparent
- Use of agent like remifentanil and propofol so patients can wake quickly and clear headed with intact laryngeal reflexes
- Minimise opioid use
- No N2O

6) Why do patients decompensate in ARDS? What are ventilator considerations in critically ill patients regarding ARDSnet?

ARDS can be misdiagnosed since there are many conditions that may present as acute hypoxemic respiratory failure with bilateral alveolar infiltrates. The differential diagnoses for ARDS include cardiogenic pulmonary edema, severe multilobar pneumonia, acute exacerbation of pulmonary fibrosis, diffuse alveolar hemorrhage, idiopathic acute eosinophilic pneumonia, dissemination of lymphoma/leukemia, and several others. Since ARDS is a diagnosis of exclusion, aside from history and exam findings, certain diagnostic tests may be required before the correct diagnosis is reached. This may include ECHO, right heart catherization, flexible bronchoscopy, and/or lung biopsy, completed in the ICU.

In the ED, the primary focus is supportive care, with several other treatments:

- Supplemental O2
- Treat the underlying condition (pneumonia, sepsis, etc.)
- Tempered diuresis – non-cardiogenic pulmonary edema takes much longer to respond to treatment than cardiogenic CHF, so avoid being overly aggressive with diuresis, as this may worsen underlying shock and increase likelihood of multi-organ failure4
- Conservative fluid management strategy – for ARDS patients not in shock, the goal to obtain zero fluid balance
- Be cautious when using non-invasive positive pressure ventilation – the benefit of NIPPV in the initial management of ARDS remains controversial. An observational cohort study by Dr. Rana has shown that there is a high failure rate of the initial NIPPV therapy in medical critically ill patients (underlying shock, metabolic acidosis and severe hypoxemia) with ARDS/ALI, and it shows that NIPPV is associated with twice the mortality rate.
- Consider intubation

Mechanical ventilation

- Use low tidal volume (6-8 mL/kg)* to avoid barotrauma
- Avoid excessive oxygen exposure (clinical goals: FiO2 < 0.40, SpO2 > 88-90%, PaO2 > 55-60 mmHg)
- Maintain head of bed elevation while mechanically ventilated to reduce the risk of developing pneumonia
    - * Ideal body weight (not actual body weight) should be used to calculate ventilator tidal volume.

Volume-targeted mode

1. Inspired oxygen concentration (FIO_2)
    - Start with $FIO_2 = 1.0$
    - Goal: $FIO_2 < 0.40$ with an $SpO_2\% > 88\%–90\%$, ($PO_2 > 55–60$ mmHg)
2. Tidal volume
    - 6–8 ml/kg
3. Frequency or respiratory rate
    - 8–12 breaths/minute
4. Positive end expiratory pressure (PEEP)
    - Initial value depends on FIO_2 required to meet oxygenation goal
    - For $FIO_2 = 1.0$, set PEEP = 18–24 cm H_2O and titrate down as possible
5. Inspiratory pressure alarms/limits
    - Peak inspiratory pressure <40 cm H_2O
    - Plateau pressure <35 cm H_2O
6. Inspiratory flow rate
    - 40–80 L/minute
7. Pressure support
    - Used in conjunction with spontaneous breathing modes
    - Pressure set to achieve normal V_T (6–8 mL/kg)
8. Practise "permissive hypercapnia" to keep tidal volume low if necessary
    - Accept PCO_2 50–70 mmHg and if necessary titrate pH to > 7.20 with bicarbonate
9. Monitor cardiac output and oxygen delivery success

Hodder, R. *Open Access Emergency Medicine* 2012:4 p.66

7) How is ARDS diagnosed? What about management?

Acute respiratory distress syndrome (ARDS) is a condition of acute inflammatory lung injury that causes non-cardiogenic pulmonary edema by increasing alveolar capillary permeability. The thickened diffusion barrier leads to decreased lung compliance, inefficient gas exchange, increased physiological dead space, and subsequently hypoxemia.

Diagnosis criteria for ARDS – Berlin definition (all 4 components must be present):

a. Acute onset (1 week or less)
b. Hypoxemia (PF ratio* < 200 mmHg with a minimum of 5 cmH2O PEEP (or CPAP))
c. Pulmonary edema (bilateral opacities on CXR)
d. Non-cardiogenic (not caused by cardiac failure)

*PF (PaO2/FiO2) ratio is the ratio of arterial oxygen partial pressure to fractional inspired oxygen. PaO2 value can be obtained from ABG, and FiO2 is 0.21 at sea level (room air) or depends on supplemental O2.1

ARDS severity (mortality) can be categorized into mild, moderate, severe based on PaO2/FiO2 ratio.

ARDS Severity	PaO2/FiO2*	Mortality**
Mild	200 – 300	27%
Moderate	100 – 200	32%
Severe	< 100	45%
*on PEEP 5+; **observed in cohort		

https://lifeinthefastlane.com/ccc/acute-respiratory-distress-syndrome-ards-definitions/

See above question for management details.