Mendelson's Syndrome

Description
In 1946 Curtis Lester Mendelson wrote an article entitled “The aspiration of stomach contents into the lungs during obstetric anaesthesia”, in the American Journal of Obstetrics and Gynaecology. [1] The finding of 66 cases out of 43,000 pregnancies equates to an incidence of about 1 in 660 pregnancies. [2] Today the incidence is much lower but it still represents the most common cause of maternal anaesthetic death. Prevention of aspiration remains the most important aim and there appears to be consensus around the world that preventative measures should be used more. [2, 3]

Pathophysiology [2]
If aspirated material is sufficiently acid (pH lower than 2.5) and there is sufficient volume then the symptoms of aspiration can ensue. The chemical pneumonia produced is caused by the parenchymal inflammatory reaction mediated by cytokines.

Epidemiology
The incidence has been quoted as between 1 in 3,000 and 1 in 6,000 anaesthetics. [4] Although the incidence has been dropping due to improved anaesthetic practice, there are concerns that the obesity epidemic may increase the risk (see 'Conditions or circumstances increasing risk', below). [5]

Presentation
Patients who develop Mendelson's syndrome become very ill 30-60 minutes after aspiration. The signs and symptoms appear during or very shortly after anaesthesia. The aspiration or regurgitation may not have been noticed by the anaesthetist. There may have been difficulty with intubation. It is likely that only a small quantity of gastric juice is required to cause the syndrome. It has been postulated that as little as 25 ml of acid gastric juices may be required. [2]

Early signs include:
- Cyanosis.
- Tachycardia.
- Massive pulmonary oedema.
- Bronchospasm, which occurs often (unlike with amniotic fluid embolism).
- Hypotension.
- Hypovolaemia with haemoconcentration (the reactive transudation of fluid into the lungs contributes to this).

Later, cardiac failure may develop and accompanying this there may be:
- Increased pulmonary artery pressure.
- Reduced static lung compliance.
- Falling arterial oxygen.
- Metabolic acidosis, which is severe (usually develops later).
- Infection (this is not usually a feature).
- CXR shows consolidation within the first two days. Air space shadowing is bilateral, usually perihilar but asymmetric. The consolidation seen on X-ray usually begins to resolve by the third day. [6]
Differential diagnosis

- Amniotic fluid embolism.
- Pulmonary embolus (see separate article Venous Thromboembolism in Pregnancy).
- Other causes of shock and circulatory collapse include:
  - Abruptio placentae.
  - Heart disease.
  - Other pulmonary diseases including asthma, pneumothorax.
  - Subarachnoid haemorrhage.
  - Malignant hyperthermia - very rare.

Investigations

These may include:

- FBC.
- Arterial blood gases.
- Microbiology work-up (including blood culture, culture of aspirate and sputum).
- CXR.
- Ultrasound for effusion.
- CT scan of chest in all cases.

Other procedures which are used or may be considered are:

- Bronchoscopy (although often more for therapeutic rather than investigative purposes, as liquid aspirate disperses rapidly).
- Tracheal aspiration for sampling.
- Pulmonary artery catheterisation.
- Mechanical ventilation.

Conditions or circumstances increasing risk

Any condition producing loss of consciousness prior to anaesthesia increases the risk of aspiration. Protection of the airway is essential using measures such as putting the patient in the recovery position. Nasogastric tubes increase risk of aspiration and reduce the efficacy of Sellick's manoeuvre. They should be removed prior to induction. Difficult intubations will increase the risk of aspiration. In summary, conditions which increase the risk of aspiration include:

- Gastrooesophageal reflux.
- Any condition producing loss of consciousness prior to anaesthesia (eg, seizures).
- Endotracheal intubation.
- Protracted vomiting.
- Nasogastric tubes.
- Obese patients (difficult intubations, reduced oesophageal tone, reduced gastric emptying in those who have associated gestational diabetes).

Smoking does not appear to be a risk factor.

Management

- If anaesthesia-associated regurgitation is witnessed and aspiration seems likely, the head should be turned laterally and the oral and pharyngeal cavity suctioned. The patient's bed should be raised by 45° with the head up.
- 100% oxygen should be administered.
- A nasogastric tube should be considered in order to facilitate gastric decompression to prevent further regurgitation.
- Bronchoscopy with lavage is not performed routinely but may be considered if there is clear radiographic evidence of lobar collapse or major atelectasis.
- Intermittent positive pressure ventilation is essential if patients are to survive, and transfer to an intensive therapy unit for this is mandatory.
- Supportive measures. A variety of other measures may help, including:
  - Good fluid management.
  - Drugs: bronchodilators, diuretics, heart failure therapy, etc.
  - Physiotherapy, including techniques to promote drainage.
  - Treatment of other complications if and when they arise.

- Antibiotics are not indicated unless aspiration pneumonia develops, in which case selection should depend on identification of the organism.
- There is no evidence to support the use of steroids.

Complications

Many are possible but they include:
Acute respiratory distress syndrome (ARDS).
Bacterial pneumonia.
Empyema.
Bronchopleural fistula.
Diffuse interstitial pulmonary fibrosis.\[10\]

**Prognosis**

The mortality can be as high as 60%. It can lead to ARDS and other complications with high morbidity and mortality.\[10\]

**Prevention**

Preventative measures may be applied in labour (particularly in patients at risk of having a caesarean section), before caesarean section and postpartum (for example, with anaesthesia for retained placenta) and include:

- Avoidance of general anaesthesia where possible, particularly for high-risk patients - for example, by use of regional anaesthesia, epidurals, etc.\[5\]
- Oral alkalis in labour to reduce pH of stomach contents. Different drugs and preparations have been used alone or in combination, with the aim of raising pH above 2.5 and reducing volume of gastric contents below 25 ml. It is assumed that this will reduce the risk of aspiration. Drugs used include:
  - Magnesium trisilicate: this was used a lot in the past but concerns were expressed about aspiration of particulate antacids and it is used less often.\[11\]
  - Sodium citrate: this is used more often in labour and before caesarean section. It is effective at elevating gastric pH but not at reducing gastric volume.\[4, 11\]
  - H2 inhibitors: a Cochrane review supported the use of H2 inhibitors such as ranitidine or cimetidine and found that they were more effective when combined with antacids.\[12\]Ranitidine given parenterally has an onset of action of one hour, is as effective as cimetidine given by the same route but lasts longer and causes fewer side-effects.\[13\]A meta-analysis concluded that H2 inhibitors were more effective in reducing gastric acid volume and gastric pH than proton pump inhibitors.\[14\]
  - Metoclopramide: this is traditionally given IV during a caesarian anaesthetic but evidence for its effectiveness in reducing the risk of gastric aspiration is poor.\[4\]
Good anaesthetic technique including:
- Rapid Sequence Induction (RSI).[^1]
  - The patient should be on a tilting trolley, with suction to hand.
  - Oxygen should be given for three minutes followed by the administration of an induction agent.
  - Cricoid pressure (Sellick's manoeuvre) should be performed. The aim is to compress the oesophagus between the cricoid ring cartilage and the sixth cervical vertebral body thus preventing reflux of gastric contents. The force should be enough to close the oesophagus without distorting the airway.
  - The rapidly acting muscle relaxant, succinylcholine, should be given.
Identifying patients likely to be difficult to intubate. Patients can be identified according to certain characteristics - eg, short neck, history of sleep apnoea, previous difficult intubation, etc. A clinical scoring system has been devised.\[15\]

- Compliance with and training in a 'failed intubation procedure'.
- Identification of patients at risk of aspiration.\[16\]

Further reading & references

2. D MLewy; Pre-operative fasting - 60 years on from Mendelson, Continuing Education in Anaesthesia, Critical Care and Pain, 2006
8. Thiagarajan N; Smoking and Anaesthesia, 2011.
9. Reisiner L; Evidence-Based Practice of Anaesthesiology, 2009.
10. Yunen J; The 5-Minute ICU Consult; 2011.

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