Overview

- IgE anaphylaxis (type I immediate hypersensitivity reaction): Adverse response of host; mediated by antibodies, the antigen bridges with two IgE on the surface of basophils and mast cells; can be reproduced if foreign substance is reinjected. However, IgG reactions with complement may manifest similarly.
- Anaphylactoid reactions or histamine release: Describes a clinically indistinguishable syndrome probably involving similar mediators but not mediated by IgE antibody and not necessarily requiring previous exposure to the inciting substance, associated with vancomycin, benzylisoquinolinium-derived muscle relaxants, but term should be avoided.

Etiology

- Clinical history of allergy or perianesthetic allergic reaction considered to put pt at increased risk for a reaction from neuromuscular blocking agents and induction agents

Usual Treatment

- Preventive therapy with corticosteroids and antihistamines is of unproven value.
- Severe allergic therapy: Stop antigen, maintain the airway with 100% O_2 and intubate if necessary; discontinue all anesthetic drugs, volume expansion, epinephrine (5 to 10 µg IV boluses as starting doses and titrate upward), antihistamines, β-sympathomimetic in case of bronchospasm, arginine vasopressin and/or norepinephrine for refractory shock, phosphodiesterase inhibitors for RV dysfunction, airway evaluation prior to extubation, ICU observation.

Assessment Points

System	Effect	PE	Test
CV	Hypotension, tachycardia, dysrhythmias Pulm Htn Cardiac arrest	BP	ECG PA pressure
RESP	Dyspnea, sneezing Coughing, wheezing Laryngeal edema Fulminant pulm edema Acute respiratory failure	Chest exam	CXR PA cath $ETCO_2$ ABGs
DERM	Urticaria, flushing Perioral, periorbital edema	Skin exam	

Key References: Levy JH, Adkinson Jr NF: Anaphylaxis during cardiac surgery: implications for clinicians, *Anesth Analg* 106:392–403, 2008; Sampson HA, Muñoz-Furlong A, Bock SA, et al: Symposium on the definition and management of anaphylaxis: summary report, *J Allergy Clin Immunol* 115(3):584–591, 2005.

Perioperative Implications

Preoperative Preparation

- Prick tests, intradermal testing: Anesthetic drugs (NM blocking agents)
- Most of the allergic reactions are unexpected. In case of established allergy, those drugs or latex should be strictly avoided.

Monitoring

- Routine.
- If major anaphylaxis occurs, consider pulm and radial arterial catheterization to guide therapeutic interventions.

Airway

- None, except specific care for the asthmatic pt

Preinduction/Induction/Maintenance/Extubation

- Slow injection of drugs, use burette for antibiotics. Avoid histamine-releasing drugs in high-risk pts.

Anticipated Problems/Concerns

- For each pt who has a periop allergic reaction, consider evaluation 1 mo after with skin testing, antigen-specific IgE level dosage (ELISA).
- Measure tryptase if there is an anaphylactic reaction within 1 to 2 h of reaction, then 24 h later to support diagnosis.
- Latex allergy should be considered. Healthcare workers are at greater risk, and Hx has to be evoked at the preanesthetic evaluation.

Alpha$_1$-Antitrypsin Deficiency

Paul S. Myles

Risk

- One of the most common inherited disorders (1 in 2500 in case of European ancestry; uncommon in Asians)
- Less than 10% of individuals with AAT deficiency are currently identified.
- AAT deficiency is the most common genetic cause of liver disease in neonates and children.
- About 1% to 5% of pts with COPD have AAT deficiency.
- Approximately 15% of adults with AAT deficiency develop liver cirrhosis.

Perioperative Risks

- Dynamic hyperinflation (air-trapping or auto-PEEP) with positive pressure ventilation, leading to hypotension and CV collapse
- Resp failure
- Hepatic impairment
- Poor wound healing (panniculitis)

Worry About

- Missed or incorrect (e.g., asthma) diagnosis
- Liver cirrhosis
- Glomerulonephritis and nephrotic syndrome
- Gastrointestinal complications incl ascites
- Panniculitis
- Vascular disease

Overview

- AAT is secreted in the liver as the most abundant of the serine protease inhibitors (serpins), with over 100 genetic variants of AAT identified.
- Panacinar pulm emphysema is the most common manifestation, and is the major cause of disability and death.
- Most commonly presents with slowly progressive dyspnea in mid-life, typically 2 to 3 decades earlier than do smokers with emphysema and normal AAT levels.
- Some pts present with otherwise unexplained hepatic dysfunction.
- Cigarette smoking greatly accelerates the progression of emphysema in AAT deficiency.
- AAT deficiency may present early after birth as neonatal jaundice and hepatitis, in infancy as cholestatic jaundice, or in children as liver cirrhosis or failure.
- AAT deficiency is the most common condition requiring liver transplantation in children.

Etiology

- Autosomal recessive disorder; the most common form is associated with allele Z, or homozygous PiZ (ZZ).
- Emphysema results from the unimpeded neutrophil elastase destruction of the lung alveolar basement membranes.
- Liver disease results from the accumulation of unsecreted AAT protein within the hepatocyte.
- Nonsmokers with the homozygous Z phenotype have minimal symptoms and an almost normal life span.
- Serum levels of AAT in the deficiency states are 10% to 15% of normal levels.
- Emphysema develops in most (but not all) individuals with serum levels less than 9 µmol/l; levels greater than 11 µmol/l seem to be protective.

Usual Treatment

- Treatment of emphysema: smoking cessation, preventive vaccinations, bronchodilators, supplemental oxygen when indicated.
- Replacement ("augmentation") therapy with purified AAT or synthetic elastase inhibition to prevent progression of emphysema.
- End-stage lung or liver disease is treated with transplantation.
- Approximately 12% of all lung transplants are performed for emphysema secondary to AAT deficiency.
- Alternative treatments for emphysema include lung volume reduction surgery or endobronchial valves.
- Emerging therapies include recombinant AAT augmentation/leukoprotease inhibitors, retinoic acid receptor agonists, and gene therapies.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
PRENATAL				Amniocentesis Chorionic villus sampling
HEENT	Sinusitis	Sinus congestion		X-ray or CT scan
RESP	Emphysema Recurrent infection		Barrel chest Limited chest excursion Reduced air entry	CXR CT scan Spirometry (especially decreased FEV_1) ABGs Gas transfer
CV	Sinus tachycardia Cor pulmonale			
GI	Chronic hepatitis Liver cirrhosis Inflammatory bowel disease Reflux	Unintended weight loss		LFTs
HEME	Polycythemia			Hb, Hct
METAB	Fatigue			6-min walk test Serum AAT Genotyping Immunoelectrophoresis Radial immunodiffusion Nephelometry Thin-layer isoelectric focusing

Key References: American Thoracic Society, European Respiratory Society: American Thoracic Society/European Respiratory Society Statement: standards for the diagnosis and management of individuals with alpha-1 antitrypsin deficiency, *Am J Respir Crit Care Med* 168(7):818–900, 2003; Myles P, Weeks AM: Alpha 1-antitrypsin deficiency: circulatory arrest following induction of anaesthesia, *Anaesth Intensive Care* 20(3):358–362, 1992.

Perioperative Implications

Preoperative Preparation

- Thorough pulm evaluation.
- General anesthesia can be tolerated in most pts with an FEV_1 of ≥1.0 L.
- Consider local, regional, or neuraxial anesthesia.

Monitoring

- Routine, but consider arterial line in case of major surgery (to monitor hyperinflation-induced hypotension).
- Lung ultrasound can be used to rule out pneumothorax.

Induction

- Adjust positive pressure ventilation to prolong expiration time, with an I:E ratio ≥3.
- Avoid high PEEP.

Maintenance

- Permissive hypercapnia

Postoperative Period

- Opioid-sparing analgesic regimen.
- Avoid hepatotoxins; use caution with acetaminophen.
- Titrated oxygen therapy to avoid hyperoxic hypoventilation.
- High-dependency or critical care admission.
- Monitor for concomitant liver and kidney dysfunction.
- Consider AAT augmentation therapy.

Amniotic Fluid Embolism

Ryan Palacio | Mohammed M. Minhaj

Risk

- Risk factors include: advanced maternal age (>35 y); cesarean delivery; placenta previa; meconium; intrauterine fetal demise; placental abruption; meconium staining of the amniotic fluid; chorioamnionitis; and macrosomia.
- True incidence is unknown but estimated to occur in 2 to 8 per 100,000 deliveries.

Perioperative Risks

- Amniotic fluid embolism accounts for approx 6% of maternal deaths in USA.
- Mortality was once as high as 61% to 86%, but more recent registries have reported mortality between 11% and 44% of pts.
- Morbidity is also high as it is suggested that up to 60% of pts have persisting neurologic deficits.

Worry About

- Hypoxia.
- Hypotension/cardiopulmonary collapse.
- Heart failure (can have both right and left ventricular failure).
- DIC: Occurs in nearly all survivors of the initial catastrophic event.
- Hemorrhage: 40% of amniotic fluid embolism-associated deaths are due to hemorrhage.
- Altered mental status.
- Seizures.
- ARDS.
- Acute pulm Htn.

Overview

- Amniotic fluid going to central circulation.
- There are three necessary conditions:
  - Amniotomy (breach in the barrier between the intact fetal membranes that isolate amniotic fluid from the maternal circulation).
  - Laceration of endocervical or uterine vessels or site of placental attachment.
  - Traditionally it was thought that a pressure gradient (intrauterine pressure > CVP or uterine venous pressure) was needed, but the presence of an electrochemical gradient can provide the means for mediators of AFE to inflict damage.
- Immunologic factors also likely to be involved, and complement activation may play a role in the pathophysiology of AFE (e.g., SIRS).

Etiology

- Postulated mechanism of action: Powerful contractions force amniotic fluid into the maternal circulation through a defect in the fetal membranes, placenta, or elsewhere.
- Diagnosis based on clinical symptoms and diagnosis of exclusion of other potential etiologies. No uniform diagnostic criteria exist nor are there specific laboratory findings pathognomonic for AFE. Fetal cells in maternal pulm circulation are not a reliable marker.
- AFE can also occur up to 48 h postpartum and in rare cases following intrauterine surgery or blunt abdominal trauma.

Usual Treatment

- Usually supportive to maintain oxygenation, circulatory support, and correct coagulopathy
- Delivery of fetus as soon as is practical; may require operative or cesarean delivery
- Employ left uterine displacement to prevent aortocaval compression
- Cardiopulmonary resuscitation, often requiring intubation with 100% O_2/PEEP. Case reports of successful outcomes with employment of inhaled nitric oxide, CPB and/or ECMO have been reported in the literature.
- Risks/benefits of uterotonic agents should take into account clinical picture of hypotension and/or hemorrhage considerations.
- Pressors and inotropes will often be required.
- Replacement of clotting factors if pt develops DIC. Clotting factors can also be replaced with recombinant factors in addition to traditional blood product transfusion.