

Perioperative Implications**Monitoring**

- Temp
- A-line
- CVP +/- PAC
- UOP
- ABG

Airway

- Lung-protective ventilation: TV 6-8 mL/kg of ideal body weight; PEEP 8-10 cm H₂O
- Judicious IV fluid (CVP <10)

Maintenance

- Correct metabolic derangements (acidosis, hypoxemia, and hypercarbia) and electrolyte abnormalities (hypernatremia and hyperglycemia).
- Evidence suggests volatile anesthetics are best for long-term organ outcome.

- Restore intravascular volume, replacing DI urinary losses and evaporative losses.
- Consider vasopressin to support hemodynamics and control polyuria (Vasopressin 1 U IV bolus, 2.4 U/h IV infusion).
- Use other vasopressors as necessary to maintain adequate organ perfusion (norepinephrine and dopamine).
- "Lung-protective" ventilatory strategy: TV 6 to 8 mL/kg of predicted body weight; PEEP 8 to 10 cm H₂O.
- Maintain SBP >100 mm Hg, MAP >70, HR 60 to 120 bpm, and CVP 4 to 8 (<10) mm Hg.
- Insulin infusion to maintain serum glucose <180 mg/dL.
- Consider hormone replacement with thyroxine or T3 infusion (thyroid hormone (tetraiodothyronine) 20 lg IV bolus, 10 mcg/h IV infusion) and corticosteroids (methylprednisolone 15 mg/kg IV q24h).

- Transfuse for Hgb <7 or 8 g/dL.
- Correct coagulopathy with clotting factors or platelets if evidence of ongoing bleeding.
- Maintain skeletal muscle paralysis.
- Keep normothermic.

Extubation

- Not done
- Ventilation discontinued when aorta cross-clamped

Adjuvants

- Heparin per procurement team

Anticipated Problems/Concerns

- Increased HR and BP on incision do not obviate the criteria for brain death.
- Removal of CVC or PAC during heart procurement may be requested.
- Lung recruitment maneuver may be requested with the lungs held open with 10 cm H₂O continuous airway pressure before lung procurement.

Brain Injury, Traumatic

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Risk

- Incidence in USA: 1.7 million TBIs per year as of 2010, resulting in more than 280,000 hospitalizations and over 50,000 deaths.
- TBI is responsible for about 30% of all deaths due to injury.
- TBI, primarily from falls, has increased more than 50% in geriatrics from 2001 to 2010.

Perioperative Risks

- Brain herniation
- Coagulopathy, DIC
- Metabolic derangement

Worry About

- Occult cervical spine injury
- Other preexisting medical conditions

- Neurogenic pulm edema
- Subclinical seizures

Overview

- TBI is a major cause of death and disability with increasing rates among senior citizens.
- Care is focused on avoiding secondary injury to the brain.
- Normal saline without glucose should be used instead of colloid or albumin. Hypertonic saline can be used with appropriate caution.
- Brief moments of hypocapnia may occur to urgently lower ICP, otherwise normocapnia.
- Avoid hyperthermia. There is no consensus on therapeutic hypothermia.

- Antiseizure prophylaxis with phenytoin to levetiracetam for high-risk pts.

Etiology

- External trauma causing brain contusion, laceration, diffuse axonal injury, or hematoma.
- Spontaneous bleeding from cerebral vessels may occur, subarachnoid or intracerebral.
- GCS ≤8 is severe TBI; 9 ≤GCS ≤12 is moderate TBI.

Usual Treatment

- Emergent decompressive craniectomy usually occurs in TBI from a stroke.
- Keep ICP <20 by elevating HOB and extraventricular draining of CSF.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Facial fractures; cervical spine injury, oropharyngeal injury	Mechanism of injury	Periorbital or mastoid ecchymosis; epistaxis; blood or vomitus in mouth	CT head; skull X-ray
RESP	Neurogenic pulm edema	Sudden onset of dyspnea	Tachypnea, tachycardia, pink frothy sputum	ABG, CXR
CV	Neurogenic stunned myocardium	ECG changes	Cardiac dysrhythmias, decreased CO	Cardiac enzymes, TEE
METAB	Hyponatremia/hypernatremia Hypoglycemia/hyperglycemia	Mental status changes Changes in urine output		Blood lytes, glucose
CNS	Seizures	Decreased mental status, failure to improve with treatment	Seizure activity may be subclinical	EEG

Key References: Wijayatilake DS, Jigajinni SV, Sherren PB: Traumatic brain injury: physiological targets for clinical practice in the prehospital setting and on the neuro-ICU, *Curr Opin Anaesthesiol* 28(5):517-524, 2015; Sharma D, Vavilala MS: Perioperative management of adult traumatic brain injury, *Anesthesiol Clin* 30(2):333-346, 2012.

Perioperative Implications**Preoperative Preparation**

- Early intubation if GCS <8 or cannot maintain airway.
- Evaluate other injuries.
- Mannitol (0.25-1 g/kg body weight) if ICP >20 mm Hg and no severe hypovolemia.
- FFP, platelets, and 2 units PRBC typed and crossed.

Monitoring

- Arterial line is mandatory.
- Consider CVP.
- ICP monitor.
- Urine output.
- Consider monitoring cerebral oxygenation, blood flow, or metabolism if available.

Airway

- Manual in-line stabilization.
- Avoid nasal intubation.

Preinduction/Induction

- Aspiration risk; use a rapid sequence induction; use succinylcholine if concerned about difficult airway and sugammadex is not available.
- Avoid hypoxia (PaO₂ <60 mm Hg or SpO₂ <90) and hypercarbia.
- Avoid hypotension (SBP <90 mm Hg).

Maintenance

- Keep pt normocarbic, normoglycemic, and normothermic.
- Maintain cerebral perfusion pressure between 50-70 mm Hg by either lowering ICP, raising

MAP, or both. Keeping CPP >70 can increase risk of ARDS.

- Low-dose inhaled agents or propofol for maintenance.

Extubation

- Consider extubation if airway reflexes are intact and can maintain PaCO₂ 35-45 mm Hg.
- Avoid coughing or agitation.

Postoperative Period

- Avoid significant hypertension to prevent rebleeding.
- Keep head of bed elevated at 30 degrees and set ICP monitor appropriately.
- Continue to follow blood chemistry and coagulation.
- Deep sedation to reduce cerebral metabolism, if needed.

Anticipated Problems/Concerns

- Frequently these pts are taking meds that affect platelets or coagulation in addition to having a traumatic injury that increases the risk of a

coagulopathy or DIC. Be aggressive to avoid progressive hemorrhagic injury.

- Adverse changes in neuro function may occur. Be alert for posttraumatic hydrocephalus or new bleeding.

- Potential for seizures, SIADH, and DI.
- Neurogenic pulm edema can occur within minutes of the CNS injury or be delayed 12–24 h.
- Concern with neurogenic stunned myocardium.

Bronchiectasis

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Risk

- Incidence in USA <1:10,000 hospital admissions.
 - Cystic fibrosis is the single largest cause of bronchiectasis in industrial nations.
 - A subgroup of Native Americans of Alaskan decent has a four-fold increase in the incidence of bronchiectasis over the general population. Ciliary deformities have been shown in a Polynesian population.
- No gender prevalence.
- Socioeconomic prevalence: Inbreeding and primitive health care, particularly lack of immunization and poor treatment of childhood bronchitides, increase the prevalence.
- Occasionally seen in children:
 - Bronchial cartilage deficiency (Williams-Campbell syndrome)
 - Tracheobronchomegaly (Mounier-Kuhn syndrome)
 - Inherited immunoglobulin deficiencies, impaired phagocytosis, and complement deficiency
 - α_1 -Antitrypsin deficiency
- Occasionally seen in adults with acquired γ -globulin deficiency:
 - Cystic fibrosis
 - RA
 - Pulm ciliary dyskinesias (Kartagener syndrome)

Perioperative Risks

- Spillage of infected secretions from bronchiectatic regions to normal lung leads to pneumonitis and retention of secretions

- Risk from bacteremia, after manipulation
- Risk of secondary acute resp failure
- Massive hemoptysis
- Pneumothorax

Worry About

- Exacerbation of asthma
- Amount of sputum produced and its nature
- Fever and hemoptysis: Acute pulm infection
- Right heart function
- Check frequency of cough and daily sputum volume; culture and smear for composition; check body temp and WBC count for acute infection
- Exercise tolerance will indicate associated impairment or disability
- Postop pulmonary decompensation

Overview

- Abnormal widening or dilatation of one or more branches of the bronchial tree, generally caused by permanent damage or destruction to the corresponding segments muscular wall, resulting in a decreased elasticity; widened segments commonly fill with purulent secretions; mucosa is swollen and inflamed and may be ulcerated with granulation tissue exposed; and extensive collateral flow occurs in these chronically inflamed bronchi (3–12% of CO).

Etiology/Pathogenesis

- Exact etiology for acquired form remains unclear but often involves necrotizing infection in tracheobronchial wall. Five mechanisms may predispose pts:
 - Bacterial, viral, or fungal bronchopulmonary infections, including TB, pertussis, and measles
 - Bronchial obstruction
 - Immunodeficiency states, including IgG deficiency, IgA deficiency, and leukocyte dysfunction
 - Hereditary defects in ciliary-mucosal clearance, including Kartagener syndrome, α_1 -antitrypsin deficiency, and cystic fibrosis
 - Miscellaneous disorders, including recurrent aspiration, inhaled irritants, Young syndrome, and bronchiolitis obliterans following heart-lung transplantation

Usual Treatment

- Medical therapy: Postural drainage, chest physiotherapy, antibiotics for cultured infection, bronchodilators, and steroids for symptomatic treatment
- Surgical therapy: Resection indicated for uncontrolled hemoptysis; or lobar closely confined disease, age >20 y; bronchopulmonary lavage under GA with divided airway (double-lumen tube)

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Sinusitis	Postnasal drip Stiffness, headache	Translucency	X-ray, US, bright lights
CV	Clubbing, cyanosis CHF (cor pulmonale) Kartagener syndrome	Exercise tolerance Pulm Htn, edema Chronic sinusitis	Situs inversus	ABG Loud P ₂ Right heart studies Immotile spermatozoa
RESP	Bronchiectasis	Cough with sputum Hemoptysis Wheezing	Rhonchi CXR: 93% tram lines; 7% normal	Smear, culture, high-resolution CT, bronchogram Bronchoscopy PFTs
HEME	Immunodeficiency Infection	IgG, IgA, WBC Guided antibiotic therapy		
CNS	Brain abscess	CT/MRI		

Key References: O'Brien C, Guest PJ, Hill SL, et al.: Physiological and radiological characterization of patients diagnosed with chronic obstructive pulmonary disease in primary care, *Thorax* 55:635–642, 2000; Nikolaizik WH, Warner JO: Aetiology of chronic suppurative lung disease, *Arch Dis Child* 70(2):141–142, 1994.

Perioperative Implications**Monitoring**

- Routine for majority of cases
 - Consider PA catheter for cor pulmonale or CHF
 - Arterial line for longer/invasive procedures.

Airway

- Careful frequent suctioning and humidification of inspired gases

Induction

- Consider preop pulmonary optimization: Chest physiotherapy and bronchodilator treatment.
- May consider increase steroids if on chronic therapy.

- Consider regional anesthesia when possible.

Maintenance

- Routine

Extubation

- Depends upon degree of pulm and cardiac dysfunction.
- Consider extubation and immediate recovery in sitting position.