PULMONARY EDEMA & WATER INTOXICATION

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MANAGEMENT OF CRISES DURING ANESTHESIA AND SURGERY. PART XI: PULMONARY EDEMA & WATER INTOXICATION.

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PULMONARY EDEMA/ARDS

Pulmonary edema is a potential cause of hypoxia in the perioperative patient. The accumulation of excessive alveolar fluid results in hypoxia due to interference with diffusion across the alveolar capillary membrane. Frothy (sometimes blood-stained) sputum may be expectorated or observed in the endotracheal tube. The abnormal accumulation of fluid in the interstitial or alveolar spaces of the lung can be explained on the basis of a disturbance in the normal Starling equation. It involves changes in hydrostatic or oncotic pressure across the alveolar membrane or in the permeability of the alveolar membrane such that fluid moves across from the capillaries into the alveolar space.

SIGNS
- Respiratory distress/tachypnoea
- Desaturation
- Increased inspiratory pressure
- Pink frothing sputum up ETT, LMA (diagnostic)
- Crepitations or bronchospasm

PRECIPITATING FACTORS
- Fluid overload
- Non cardiogenic:
  - Post airway obstruction
  - Anaphylaxis
  - Neurogenic
  - Sepsis
  - Pulmonary aspiration
  - Multiple organ failure
- Cardiogenic

EMERGENCY MANAGEMENT
- Titrate inspired oxygen concentration against SpO2
- Head up tilt/sit up
- If self ventilating/apply CPAP
- Intubate if necessary
- IPPV and PEEP if intubated
- Consider drug therapy: morphine/GTN/frusemide
FURTHER CARE
Consider and investigate likely cause
Review perioperative fluid balance/renal function
Non-cardiogenic: consider post airway obstruction
  Allergy/anaphylaxis
  Aspiration
  Sepsis
  Multiple organ failure, eg major trauma, pancreatitis
  Renal - renal function tests
Cardiogenic:
  ECG
  Cardiac enzymes
  Echocardiogram
  Chest X-ray
Consider admission to high dependency area/ICU

Notes:
Success in the management of the initial physiological upset is essential, however it was considered that the use of this specific sub-algorithm would be required once the initial diagnosis of pulmonary oedema was made4-7:
(1) Hypoxia, pink frothy sputum, increased airway pressures, respiratory distress, crepitations or wheeze.
(2) Fluid overload was judged to be the cause in half of incidents.
  Most of these had pre-existing conditions making them more susceptible to overhydration: age >70, cardiovascular disease or hypertension, renal failure and chronic airflow limitation.
(3) Few of incidents were judged to be post upper airway obstruction. Some were judged to be cardiogenic in origin, eg. valvular heart disease, ischemia/infarction, cardiac failure, arrhythmia. CPAP is important specific therapy for pulmonary edema (in addition to treatment for hypoxia).
(4) Preload reduction:
  Morphine 1 mg IV doses,
  GTN infusion 50 mg in 500 ml, begin with 0.1 ml/kg/hr
Fluid reduction:
  Frusemide 0.5 mg/kg IV if fluid overload (place urinary catheter)
If hypotensive:
  Adrenaline infusion: start with 0.00015 mg/kg/min
  Adrenaline: for easy adult dosing, Titrate against heart rate and blood pressure

References
WATER INTOXICATION

Water intoxication is also known as water poisoning or hyperhydration. Excessive water drinking may result in a drop of blood sodium levels\(^1\). Drinking as little as 2 liters of water per hour for few successive hours can result in water intoxication\(^2\). Irrigation of closed spaces of the body may lead to extensive perioperative fluid and electrolyte shifts. The transurethral resection of prostate (TURP) syndrome is characterized by a spectrum of symptoms ranging from asymptomatic hyponatremia, to many symptoms and signs. A similar syndrome has been described in women underwent transcervical endometrial ablation (TCEA)\(^5,6\).

The occurrence of this “water intoxication” syndrome is determined by a combination of surgeon, patient, and factors in the procedure itself. Asymptomatic hyponatremia can occur in over 50% of TURPs, while clinically detectable TURP syndrome may become obvious in 2% of resections\(^7\). As the results of this syndrome can be serious, early detection and proper management are vital\(^8\).

**Symptoms and signs**\(^3,4,8\).

*In Awake patient:*
- Confusion, sedation, drowsiness
- Nausea, vomiting
- Chest pain
- Convulsions
- Coma

*In anesthetized patient:*
- Hyponatremia
- ECG changes
- Hypotension or hypertension
- Bradycardia
- Bronchospasm
- Desaturation
- Delayed recovery from anesthesia

**Precipitating factors and management**\(^8\).
- Closed cavity irrigation
- Prolonged operative time
- Administration of large amount of hypotonic fluids

**Emergency management:**
- Inform the surgeon
- Stop irrigation and surgery
- Increase FiO\(_2\)
- Monitor blood gases
- Urgent infusion of sodium, potassium or blood
- Normal saline with Frusemide 0.5-1 mg/kg. IV
- Mannitol 0.25 g/kg.
- In convulsions, use hypertonic saline and anticonvulsants

**Further care:**
- Continue ECG and SpO\(_2\) monitoring
- Maintain fluid balance
- Keep monitoring electrolytes, osmolarity, blood gases
- Do central venous line or pulmonary artery catheter
- Admission to the ICU
Notes
CNS symptoms occur early so should be aware about them
Circulatory overload can be manifested as hypoxia during general anesthesia
ECG monitoring of V5 is important to see the ST segment
Using hypertonic saline rapid correction can cause central pontine myelinolysis
The commonest management strategies reported involved administration of frusemide, normal saline, and IPPV

References