Encephalopathy, Metabolic

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Risk

- 3.4– 11% of medical ICU admissions
- 12–33% of multiple-organ dysfunction pts

Perioperative Risks

- With predisposing conditions (e.g., hepatic insufficiency), risk of developing or exacerbating metabolic encephalopathy
- Increasing severity of preexisting encephalopathy

Worry About

- Worsening hepatic insufficiency causing hepatic encephalopathy
- Diabetics becoming hypoglycemic or with DKA/hyperosmolar coma
- Postop hyponatremia
- Deteriorating renal insufficiency leading to uremic encephalopathy
- Preexisting encephalopathy may be exacerbated by anesthetics (e.g., benzodiazepines) in hepatic encephalopathy
- Postpartum, especially with preeclampsia, eclampsia; PRES
- Undiagnosed sepsis, hypothermia, high fever, CNS-acting drugs, including overdose
- CNS cause: Brainstem CVA, meningitis, occult head trauma, encephalitis, brain tumor

Overview

- Altered sensorium, stupor, or coma without any other explanation in the setting of a metabolic disturbance.
- Process affects global cortical function by altering brain biochemistry.
- Distinguished from structural lesions by a nonfocal neurologic exam.
- EEG shows diffuse background slowing, triphasic waves in hepatic encephalopathy.
- Increased spontaneous motor activity: Restlessness, asterixis, myoclonus, tremors, rigidity.

Etiology

- Hypoglycemic encephalopathy: Most commonly caused by accidental or deliberate overdosing with insulin or oral hypoglycemic agents or prolonged ethanol intoxication
- Hepatic encephalopathy: Acute or chronic hepatic insufficiency, Reye syndrome
- Uremic encephalopathy: Renal failure. After dialysis, disequilibrium syndrome caused by acute fluid and electrolyte shifts
- Encephalopathy due to fluid and electrolyte abnormality: Hyperosmolar state, hyponatremia (acute decrease to <120 mEq/L), hypernatremia, hypercalcemia associated with hypoparathyroidism (<4 mEq/L)
- Pulm encephalopathy: Combination of hypoxia and hypercarbia
- Drug overdose; sepsis; severe acute pancreatitis

Usual Treatment

- Uremic encephalopathy: Dialysis.
- Hepatic encephalopathy: Lactulose (oral or rectal), neomycin.
- Hypoglycemic encephalopathy: IV glucose.
- Septic encephalopathy: Treatment of underlying infection.
- Hyperosmolar/hypoosmolar state: Slow and careful restoration of electrolyte balance.
- Pulm encephalopathy: Quickly improve ventilation and oxygenation, mechanical ventilation.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
RESP	Sudden elevation $PaCO_2$(>65 mm Hg)	COPD, drug overdose	Hypoventilation, periodic breathing, papilledema	Pulse oximetry and end-tidal capnography, or ABG
GI	Hepatic insufficiency	Liver disease, cirrhosis, alcoholism, portosystemic shunt	Asterixis, jaundice, ascites	AST, ALT, bilirubin, ammonia PT (INR)
ENDO	Diabetes	Use of insulin or oral hypoglycemic agents	Blood glucose	
	Apathy Thyrotoxicosis	Hyperthyroidism	Tachycardia Fever, sweating	T_4, T_3
	Hypothyroidism	Hypothyroidism	Hypothermia Pretibial edema	TSH
	Hypercalcemia	Hyperparathyroidism Malignancy		Serum Ca^{2+}, PTH
	Hypernatremia Hyponatremia	Dehydration, diabetes insipidus SIADH, water intoxication		Serum Na^+
RENAL	Uremia Prerenal azotemia	Renal disease, ingestion of nephrotoxins (e.g., drugs)	Asterixis	BUN/Cr, serum lytes Toxicology screen
CNS	Altered sensorium, stupor, coma, seizures	Rule out head trauma	Nonfocal neurologic exam, altered mental status	EEG, CT Lumbar puncture
MS	Multifocal myoclonus, rigidity		Myoclonus, asterixis, rigidity, tremors	

Key References: Ravin PD: Metabolic encephalopathy. In Irwin RS, Rippe JM, editors: *Intensive care medicine*, ed 7, Philadelphia, PA, 2012, Wolters Kluwer/Lippincott Williams & Wilkins, pp 1760–1768; Kiamanesh D, Rumley J, Moitra VK: Monitoring and managing hepatic disease in anaesthesia, *Brit J Anaesth* 111(S1):i50–i61, 2013.

Perioperative Implications

Preoperative Preparation

- Assess and document preop mental status and neurologic function.
- Uremic encephalopathy: Preop dialysis, if possible.
- Hyperthyroidism, hypothyroidism: Initial treatment, if possible.

Monitoring

- Routine.
- In hyperosmolar states, uremia and liver failure with ascites may need central monitoring.

Preinduction/Induction

- Benzodiazepines should be avoided in hepatic encephalopathy. Propofol can be used.
- Increased potential for aspiration; consider rapid sequence.

Maintenance

- Carefully titrate anesthetics to avoid overdosing.
- Careful attention should be paid to intravascular volume status, blood glucose, and lytes.
- During and after TURP and hysteroscopy, sodium concentrations and volume status should be monitored.
- Correction of hypernatremia and hyponatremia should be gradual.
- In renal and hepatic failure, appropriate drugs and doses should be used. Long-acting drugs should be avoided. May be increased bleeding.
- Diabetics: Monitor intraop blood glucose to avoid hypoglycemia. Too rapid correction of hyperglycemia can lead to cerebral edema.

Extubation

- Extubate only if the pt is able to protect airway and maintain adequate ventilation.

Anticipated Problems/Concerns

- Poor mental status at the conclusion of surgery may require continued intubation.
- Hyponatremia is a cause of postop metabolic encephalopathy.