Perioperative Implications

Monitoring

- Temperature (hypothermia).
- ECG (arrhythmias, ischemia); consider IM antimuscarinic drug to treat bradycardia from inhalational induction with sevoflurane, avoid hypercarbia and hypoxia to prevent PHTN.

Airway

- Have variety of devices available (e.g., oral and nasal airways, laryngeal mask, glidescope, fiberoptic) to manage airway obstruction.
- Avoid neck extension during laryngoscopy if possible.
- Smaller endotracheal tube may be necessary for narrowed subglottic space.

Vascular Access

- Allow more time for IV placement.
- Meticulously avoid injected air.

Patient Management

- Soft, warm, kind pt approach along with caregiver known to pt to help with initial management; warm, quiet OR

Anticipated Problems/Concerns

- Refractory hypoxia if R-to-L shunting develops
- Bradycardia with inhalational induction
- Resistance to separation from caregiver
- Life-threatening upper airway obstruction with difficult vascular access
- Spinal cord ischemia with neurologic damage

Drug Abuse, Lysergic Acid Diethylamide

Alan David Kaye | Burton D. Beakley

Risk

- "Hallucinogen" with primary effects of heightened or distorted mood, thought, and sensory perception. The hallucinogen class includes LSD, mescaline, phencyclidine, and psilocybin. These drugs cause tolerance and psychological drug dependence but not physical drug dependence or withdrawal.
- Initially marketed as an anesthetic agent; people began using it for recreational and spiritual purpose in the 1960s. LSD is still illegally used as a major hallucinogen worldwide.
- LSD use peaked in the late 1960s, and use has been declining since. The National Survey on Drug Use and Health reports more than 200,000 people using LSD for the first time yearly.
- LSD-related hospital visits remain low compared with those related to other major illicit drugs. In 2011, Drug Abuse Warning Network reported more than 1 million emergency department visits for nonalcohol illicit drug use; of these only 4819 were related to LSD.
- LSD is semisynthetic and produces psychedelic effects, including distortion of time and perceptions of colored visual patterns and abnormal movements. Psychological effects include dysphoria, euphoria, and changes in emotion and moods. LSD also causes multiple physical effects, including dilation of the pupils, salivation, dry mouth, loss of appetite, nausea, blurred vision, perspiration, hyperglycemia, Htn, tachycardia, and hyperthermia. The mechanism of action of LSD is thought to be predominantly by serotonin neurotransporter interactions. Hallucinogen persisting perception disorder, also known as flashbacks, and psychosis are two long-term effects that can be exacerbated by other drugs, such as sertraline, fluoxetine, and marijuana.

Perioperative Risks

- Acute intoxication produces a sympathomimetic effect, including mydriasis, increased body temperature, systemic Htn, tachycardia, anxiety, agitation, vomiting, aspiration, apnea, and unrecognized injuries.
- May prolong succinylcholine neuromuscular blockade and delay metabolism of ester local anesthetics (speculated inhibition of plasma cholinesterase).
- May potentiate analgesics.

Worry About

- Systemic: Htn, tachycardia, hyperthermia, hyperglycemia, salivation, nausea, vomiting, seizures, and apnea
- Serotonin syndrome: Triad of altered mental status, neuromuscular abnormalities, and autonomic hyperactivity
- Psychiatric: Hallucinations (visual, auditory, and tactile), labile mood, acute panic attacks, agitation, and hypertonia

Overview

- LSD is a semisynthetic odorless and colorless product of lysergic acid, a natural substance from the parasitic rye fungus *Claviceps purpurea*. It is also found naturally in several species of morning glory and Hawaiian baby woodrose plants.
- LSD is physiologically well tolerated; severe symptoms from recreational use are uncommon. Only in the setting of large ingestion (>400 mcg) has life-threatening toxicity occurred due to cardiovascular collapse and hyperthermia.
- There is high degree of psychological dependence but no evidence of physical dependence or withdrawal symptoms when acutely discontinued.
- Classified under Schedule I of the Controlled Substance Act.
- Psychological effects begin in 30–60 min and may last 8–12 h.

Etiology

- LSD displays both agonist and antagonist properties at the serotonin (5-HT) receptors, which are similar structurally with dopamine D2 receptors and have clinically related overlap.
- The most common route of exposure is via oral with rapid GI absorption.
- LSD is not associated with a physical or psychological addiction. Long-term use can result in persistent psychosis and hallucinogen persisting perception disorder ("flashbacks").

Usual Treatment

- Supportive reassurance; transfer pt to calm, quiet area with minimum external stimuli.
- Benzodiazepines seem to be the most effective agents for treating LSD psychosis and visual disturbances. If psychotic features persist after appropriate benzodiazepine treatment, then neuroleptics can be used as adjunct treatment.
- Rare cases require hemodynamic control, intubation, and ventilatory and supportive care.

Assessment Points

System	Effect	Assessment by Hx	PE
HEENT			Dilated, reactive pupils
CV	Sympathetic nervous system stimulation	Palpitations Sweating	Htn Tachycardia
RESP	No consistent changes	Diaphoresis	Tachypnea, apnea
ENDO	Hyperglycemia Mild hyperthermia		Elevated body temperature
CNS	Euphoria Anxiety, labile mood Tremors Visual hallucinations and illusions Synesthesia Distorted sense of time	Hx of drug ingestion	Altered mental status Hypertonia

Key References: Abraham HD, Aldridge AM, Gogia P: The psychopharmacology of hallucinogens, *Neuropsychopharmacology* 14(4):285–298, 1996; Passie T, Halpern JH, Stichtenoth DO, et al.: The pharmacology of lysergic acid diethylamide: a review, *CNS Neurosci Ther* 14(4):295–314, 2008.

Perioperative Implications

Preoperative Preparation

- Rule out associated traumatic injury.
- Hemodynamic control.
- Aspiration prophylaxis.
- Sedation if agitation is severe; benzodiazepines as first line treatment.

Monitoring

- Temperature
- Neuromuscular blockade

Airway

- Aspiration risk

Preinduction/Induction

- Salivation and N/V may justify the decision to utilize rapid sequence induction.
- Ketamine should be avoided, which may have synergic effects with LSD.
- Succinylcholine should be avoided.
- Exaggerated response to endogenous and exogenous catecholamines.

Maintenance

- Maintain normothermia.

Extubation

- At risk for aspiration.
- Continue supportive reassurance.

Adjuvants

- May have exaggerated response to sympathomimetic agents
- Potential for serotonin syndrome in pts taking concomitant serotonin precursors/agonist (SSRI, SNRI)
- Theoretical potential for ester local anesthetic toxicity due to inhibition of plasma cholinesterase activity
- Theoretical potential for prolongation of succinylcholine neuromuscular blockade due to inhibition of plasma cholinesterase activity

Anticipated Problems/Concerns

- Avoid injuries associated with agitation.
- Possible concomitant drug and/or alcohol use by pt.

Drug Overdose, Rat Poison (Warfarin Toxicity)

Michelle Braunfeld

Risk

- Major risk is hemorrhage, especially CNS or GI.
- Incidence: Risk of hemorrhage in 1–7.4% of pts chronically anticoagulated. Risk is dose-related and proportional to PT prolongation. Risk of hemorrhage doubles as INR increases from 2.0–2.9 to 3.0–4.4. It further quadruples as INR increases from 3.0–4.4 to 4.5–6.9. Age is associated with increased sensitivity to warfarin and increased incidence of bleeding complications.
- Rx for DVT, cerebral vessel atherosclerosis, prosthetic heart valves, mitral stenosis, and atrial fibrillation.

Perioperative Risks

- Bleeding
- Drugs that potentiate anticoagulant effects: Antibiotics (especially metronidazole, sulfonamides, cephalosporins), NSAIDs, phenytoin, cimetidine, barbiturates, alcohol

Worry About

- Bleeding complications of invasive procedures.
- Drug interactions.
- Transient protein C deficiency preceding effect on procoagulant levels at initiation of warfarin therapy leading to thrombotic complications.
- True poisoning with rodenticides (so-called superwarfarins) may result in prolonged clotting abnormality with abnormal PT values weeks to months post event because of the enormously long half-lives of these drugs.

Overview/Pharmacology

- Vitamin K antagonist.
- Cleared by hepatic and renal transformation and excretion. $T_{½}$ is approximately 40 h. Duration of action is 2–5 d.
- Onset of effect is delayed by 8–12 h because of time required to clear already synthesized clotting factors. For similar reasons, peak effect of a dose occurs 48 h post-administration.

Drug Class/Mechanism of Action/Usual Dose

- Blocks vitamin K–mediated carboxylation of factors II, VII, IX, X (procoagulants); protein C, protein S (anticoagulants).
- Carboxylation of coagulation factors oxidizes vitamin K. The vitamin K epoxide must be reduced to become active again. Coumarin anticoagulants block reduction of the epoxide. Thus large and/or repeat doses of vitamin K are needed for large overdoses or for long-acting forms.
- Chronically taken for systemic anticoagulation for DVT, CVA, prosthetic valves, and atrial fibrillation.
- Usual doses: Loading regimen varies, but maintenance dose is 2.5–10 mg/d.
- Alternatives: Other oral anticoagulation agents include the direct thrombin inhibitor, dabigatran, and the Xa inhibitors rivaroxaban and apixaban. Although these drugs all have the advantage of standardized dosing and none need lab monitoring, they also do not have established antidotes.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEME	Abnormal levels of factor II, IV, IX, X, and protein C, protein S	Easy bruising, prolonged bleeding time	Ecchymoses	PT

Key References: Holbrook A, Shulman S, Witt D, et al.: Evidence-based clinical practice guidelines: antithrombotic therapy and prevention of thrombosis, ed 9.: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines, *Chest* 141(Suppl 2):e152S–e184S, 2012; Frumkin K: Rapid reversal of warfarin-associated hemorrhage in the emergency department by prothrombin complex concentrates, *Ann Emerg Med* 62(6):616–626, 2013.

Perioperative Implications

Possible Drug Interactions: Preoperative

- Increased effect: Antibiotics, NSAIDs, oral hypoglycemic, diazepam, cimetidine, diuretics, and phenytoin.
- Decreased effect: Methylxanthines, rifampin, antihistamines, corticosteroids, and barbiturates.
- Relatively minor surgical procedures may be performed without reversal of warfarin anticoagulation.
- Major surgical procedures warrant discontinuation of drug 1–3 d preop, with a target PT within 20% of nanoliter range. If discontinued, the need for bridging with low-molecular-weight heparin prior to surgery should be considered.
- For urgent surgery, pt may be given 10–20 mL/kg of FFP and 5–10 mg of vitamin K IV, with additional amounts of both given as needed.
- For emergent surgery, life-threatening bleeding, or the pt who cannot tolerate the volume of FFP for reversal, a four-factor PCC (KCentra in USA) is approved for use by the FDA. If a four-factor PCC is not available, evidence suggests effectiveness of a three-factor PCC (Bebulin, Profilnine, or FEIBA in USA) plus rVIIa or FFP. The value of rVIIa alone to reverse warfarin is unclear because, although it can normalize INR, the correlation of INR to clinical bleeding is not defined in that setting. This is because the PT is more sensitive to levels of VII and X than II or IX, and there is insufficient literature to evaluate a clinical effect. Regardless of what means are chosen, the need for repeat dosing should be considered and vitamin K IV should also be given since the effect of warfarin greatly exceeds the half-lives of these concentrates

Possible Drug Interactions: Adjuvants/Regional Anesthesia/Reversal

- Regional block: Relatively contraindicated without reversal of anticoagulation
- Peripheral block: Relatively contraindicated without reversal of anticoagulation

Anticipated Problems/Concerns

- It should always be kept in mind that the pt is chronically anticoagulated for an underlying thrombotic condition or risk. This should be balanced against the decision to reverse anticoagulation.
- All factor concentrates carry an inherent risk of thrombosis simply by their ability to disturb the balance of procoagulant and anticoagulants. Although such products as KCentra attempt to mitigate that by including heparin, antithrombin, protein C, and protein S, this is no guarantee against pathologic thrombosis.
- Because it contains heparin, KCentra is contraindicated in pts with a history of HIT.
- Hypothermia will potentiate anticoagulant effect.