
ADDICTION AND ANAESTHESIA

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Abstract

Significant numbers of patients are seen for surgery and anesthesia with a history of chronic substance abuse. However, little is known about how these substances influences anesthetic physiology and pharmacology.

Abuse of substances may involve a socially acceptable drug (e.g., alcohol, tobacco), a medically prescribed drug (e.g., diazepam), or an illegal substance (e.g., cocaine). Knowledge of a patient's substance abuse prior to administration of analgesia or anesthesia may prevent adverse drug interactions, predict tolerance to anesthetic agents, and/or facilitate the recognition of drug withdrawal.

As the neurobehavioral effects of cocaine may increase the likelihood that a user will receive violent fatal injuries and is more prone to have emergency surgery, so we stressed here on this substance. Cocaine abuse is associated with multi-target organ involvement, including the cardiovascular, respiratory, neurologic, and hematological systems. Its use during pregnancy is also an independent contributor to the risk of placental abruption, preterm labor and stillbirth.

Introduction

Addiction could be defined as a chronic disorder characterized by the compulsive use of a substance, resulting in physical, psychological, or social harm to the user, and continued use despite that harm.

Clinical picture may vary from drug to other, generally patient may have euphoria, apathy, psychomotor retardation, impaired judgment, drowsiness, slurred speech and impaired attention or memory. Other clinical features are; elevation in mood, a sense of increased energy and alertness, anxiety

and irritability, prolonged sleep, general fatigue, lassitude, and depression, hallucinations, delusions, and paranoid feelings, confused and disorganized thinking.

Treatment involves detoxification, monitored abstinence, intensive education, exposure to self-help groups, and psychotherapy¹.

Substances that could be abused are so many; ALCOHOL is the most used and abused psychoactive chemical. SEDATIVES, HYPNOTICS AND ANXIOLYTICS such as Benzodiazepines and barbiturates are useful medications with a potential for abuse and dependence. There is no sharp line that can be drawn between appropriate use, abuse, habituation, and addiction. The

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abuse can start in the context of medical treatment for anxiety, medical disorders, or insomnia. Physical dependence can develop to low doses over several years or high doses over a few weeks. Intoxication, withdrawal, withdrawal delirium, and amnesic disorder are similar to those found with alcohol. OPIOIDS; In the late 1960s the use of heroin increased in the United States. The existence of opioid addiction among physicians, nurses, and health care professionals is many times higher than any group with a comparable educational background. COCAINE AND AMPHETAMINES are psychoactive stimulant, as a person at first feels increased physical strength, mental capacity, and euphoria. The mixture of another CNS depressant drug such as an opioid, or alcohol can be used to decrease irritable side effects. Cocaine is inhaled, smoked, or injected intravenously. PHENCYCLIDINE is an anesthetic initially manufactured for animal surgery. The drug may be smoked or snorted. Phencyclidine is still epidemic in certain eastern American cities. HALLUCINOGENS are drugs that cause hallucinations. Anticholinergics, bromides, antimalarials, opioid antagonists, cocaine, amphetamines, and corticosteroids can produce illusions and hallucinations. The most available in the United States is lysergic acid diethylamide (LSD). CANNABIS is an India hemp plant that has been used for medicinal purposes for centuries. Marijuana is a varying mixture of the plant's leaves, seeds, stems, and flowering tops. Hashish consists of the plant's dried resin. Marijuana remains the most commonly used illegal drug in the United States. an estimated 66 million Americans had tried marijuana at least once in their lifetime. Chronic smoking of Marijuana and hashish has long been associated with bronchitis and asthma. Smoking effects pulmonary functioning even in young people. INHALANTS include substances with diverse chemical structures used to produce a state of intoxication. Gasoline,

airplane glue, aerosol (spray paints), lighter fluid, fingernail polish, typewriter correction fluid, a variety of cleaning solvents, amyl and butyl nitrate. Hydrocarbons are the most active ingredients in these substances. NICOTINE Approximately fifty million Americans currently smoke tobacco. Nicotine produces a euphoric effect and has reinforcing properties similar to cocaine and the opioids²⁻⁴.

Multiple substances could be used at the same time. Among patients with addiction to multiple substances, the combination of cocaine and alcohol (ethanol) is the most common⁵.

Most of fatally and non-fatally injured trauma victims are abusers of alcohol, marijuana, cocaine, opiates and benzodiazepines⁶.

Some medical problems may be associated with chronic substance abuse including; cellulites, superficial skin abscesses, septic thrombophlebitis, tetanus, endocarditis, with or without pulmonary embolism, aspiration pneumonia, AIDS, adrenal dysfunction, hepatitis, positive and false positive serology and transverse myelitis⁷.

Cocaine

The increasing use and abuse of cocaine in Western cultures is an issue of great national and international concern⁸. Five million Americans are regular users of cocaine, 6,000 use the drug for the first time each day and more than 30 million have tried cocaine at least once⁹.

Cocaine is an alkaloid (benzoylmethylecgonine, C₁₇H₂₁NO₄) derived from the leaves of erythroxylon coca plant, indigenous to Peru, Ecuador and Bolivia¹⁰.

Cocaine produces prolonged adrenergic stimulation by blocking the presynaptic uptake of sympathomimetic neurotransmitters including norepinephrine, serotonin and dopamine¹¹. The euphoric effects of cocaine also result from

prolongation of dopaminergic activity in the limbic system and the cerebral cortex^{12,13}. Other mechanisms by which cocaine produces prolonged adrenergic stimulation include blockade of catecholamine-binding mechanisms, allowing free catecholamine to continue to stimulate the sympathoadrenal axis¹⁴. Smoking crack cocaine results in very effective transmucosal absorption and high concentrations of plasma cocaine. Cocaine has a low molecular weight and high lipid solubility, which allows easy diffusion through lipid membranes. The cardiovascular effects of cocaine occur predominantly secondary to increased levels of plasma catecholamines¹³. Hypertension, tachycardia, malignant arrhythmias, myocardial ischemia and infarction are all life-threatening cardiovascular complications of catecholamine accumulation following acute cocaine intake. Mechanisms of cocaine induced myocardial ischemia and/or infarction include thrombosis, vasospasm, or both, and direct myocardial depression¹⁵.

Several recent experimental studies have demonstrated that cocaine has a direct negative inotropic effect which may lead to acute left ventricular dysfunction and pulmonary oedema. Cocaine inhalation may also result in direct alveolar damage which may lead to pulmonary oedema. Vasoconstriction of the pulmonary vascular bed following cocaine inhalation may result in "epithelial or endothelial cell damage" and precipitate alveolar haemorrhage or oedema. Alternatively, the alveolar epithelium may be directly injured by the inhalation of a toxic substance with subsequent involvement of the alveolar basement membrane¹⁶.

Cocaine use in humans has also been suggested to cause severe thrombocytopenia among adult cocaine abusers. This may be severe enough to cause prolonged bleeding, and is unrelated to the route of cocaine administration. Cocaine-induced thrombocytopenia may be due to

suppression of the bone marrow or induction of platelet-specific antibodies. A higher prevalence of syphilis and human immunodeficiency virus (HIV) infection has been found among cocaine-using parturient when compared to parturient not using cocaine. The association of these diseases with drug use is partially explained by needle sharing, which is common among addicts. However, the association between cocaine abuse and HIV is supported even after controlling for intravenous drug abuse. The phenomenon may be explained in part by increased sexual activity, as well as by a decrease in immunologic activity seen in cocaine abusers¹⁷.

Approximately one third of deaths after cocaine use were the result of drug intoxication, but two thirds involved traumatic injuries resulting from homicides, suicides, traffic accidents, and falls^{18,19}.

System findings associated with stimulant use²⁰:

Cardiovascular:

Increased heart rate, Increased force of contraction, Increased blood pressure (systolic), Peripheral vasoconstriction, Atrial and ventricular dysrhythmias.

Pulmonary:

Increased respiratory rate, Dyspnea

Neurological:

Dilated pupils, Increased deep tendon reflexes, Manic behavior, Tremors, Seizures

GIT & Hepatobiliary effect:

Esophagitis, Gastritis, Pancreatitis, Liver cirrhosis.

Haematological:

Thrombocytopenia, Leukopaenia, Anaemia.

Skin & musculoskeletal:

Spider angiomas, Myopathy, Osteoporosis.

Endocrine & Metabolic:

Decreased plasma testosterone except in cocaine, Hypomagnesaemia, Ketoacidosis, Hypoglycaemia, Hypoalbuminaemia.

Initial management related to possible drug intoxication or use²¹:

Assessment

Patient Information History: Initial presentation, Chief complaint, Drug abuse

Physical examination

General survey: Possibility of drug use, Burns on face and/or facial hair, Needle tracks, Needle marks, Behavior: stimulated/depressed, Pupil size and reaction, Nose bleeds.

Systems survey: Cardiac, Pulmonary, Neurological, Gastrointestinal, Renal, Hematological.

Toxicology Results: Serum and urine screens

Interventions

ABCs (airway-breathing-circulation),

Fluid replacement.

Naloxone, Possible gastric lavage,

Possible activated charcoal

Cardiovascular response

Monitor cardiac rate, rhythm, BP

Hypertension: Nitroprusside

Hypotension: Fluids, vasopressors

Dysrhythmias: anti arrhythmic drugs

Congestive heart failure: Diuretics, inotropes, vasodilators

Pulmonary

Oximetry, Oxygen therapy, chest x-ray for diagnosis, Airway protection and maintenance

Mechanical ventilation

Neurological

CNS stimulation/depression: Calm quiet environment

Seizure activity: Diazepam, airway protection

Hyperthermia: Ice bath, Ice lavage

Initial care of an admitted addict:

Sudden cardiac death has frequently been attributed to underlying cardiac disease or massive drug overdose. Coronary artery disease, cerebral aneurysm or atrioventricular malformation, and pseudocholinesterase deficiency have been mentioned as factors contributing to sudden cardiac death²². Agents, including

procaine, phencyclidine (angel dust), amphetamines, quinine, talc, and strychnine, and the concurrent use of other drugs, such as heroin, also have been cited as precipitating causes²³. Mixing cocaine with alcohol, a common combination, raises the risk of sudden cardiac death to 20-fold²⁴.

Stimulant abuse may result in congestive heart failure, severe ischemia, myocardial infarction, and/or dysrhythmias. Cocaine also interferes with the arterial baroreflex function, which can contribute to congestive heart failure²⁵, and renal failure may occur secondary to the heart failure. Treatment goals are aimed at the etiology of the congestive heart failure. If symptomatic hypotension develops, inotropic support with a combination of dopamine and dobutamine may be indicated. Pulmonary edema should be treated with diuretics and vasodilators.

If the patient is admitted in an agitated, stimulated state, initial assessment needs to focus on the fundamental ABCs (airway-breathing-circulation). The basic approach to a potential drug overdose is a combination of thiamine, 50% dextrose, and naloxone, along with possible gastric lavage and administration of charcoal, if it is thought the drug was ingested²⁶.

Maintenance of airway and breathing may necessitate oxygen by nasal cannula or facemask or intubation and mechanical ventilatory assistance in the event of respiratory depression or severe hypoxia. Circulatory management involves IV lines, monitoring, and managing hypertension and dysrhythmias according to ACLS guidelines. Propranolol hydrochloride and esmolol can lower heart rate and blood pressure, but careful administration is necessary to prevent further decreases in myocardial contractility.

For seizure activity, 2.5 to 5.0 mg of diazepam is usually given²⁷ although cross-tolerances in these patients may necessitate larger doses. Seizures not controlled by diazepam may be treated by

secobarbital or general anesthesia. Seizures may be secondary to a neurologic focus or to hyperthermia. Preventive measures against hypoxia, hyper- or hypotension, and hypercapnia must be instituted to avert further increases in intracerebral pressure. If congestive heart failure is also present, positive inotropics, diuretics, and vasodilators. IV nitroglycerin may reduce preload and increase oxygen supply to the myocardium, also improving function.

Anaesthesia for an addict

Patients with substance abuse could be classified to acute abuse patients and chronic abuse patients. Elective procedures should be postponed for acutely intoxicated patients and those with significant withdrawal. When surgery is deemed necessary in patients with physical dependence, perioperative doses of abuse substance should be provided or specific agents given to prevent withdrawal.

Anaesthetic drugs requirement

Anaesthetic requirement in substances such as opioids, barbiturates, benzodiazepines, phencyclidine and alcohol is decreased in acute abuse and increased in chronic abuse. In substances such as cocaine and amphetamines acute abuse, there is an increased requirement of anaesthetic drugs, with a decreased requirement in chronic cases for amphetamines and non in chronic cocaine abusers²⁸.

Smoking

This is associated with increased cardiovascular and respiratory pathology in proportion to the 'pack-year' history (number of packs of 20 per day multiplied by the number of years of smoking). Smokers have an increased incidence of post-operative pulmonary complications, especially after upper abdominal surgery where the incidence of clinically significant respiratory tract infection is about 70%, five times higher than non-

smokers. Blood levels of carbon monoxide in heavy smokers are increased 3 fold up to 15% in some cases, resulting in a reduction in oxygen carrying capacity equivalent to the loss of 2 g dl⁻¹ of Hb. Should the patient be advised to stop smoking prior to surgery? To significantly reduce the incidence of postoperative chest infection after upper abdominal surgery takes 3 to 6 months abstinence. This would only be feasible in compliant patients with non-urgent surgery but is nevertheless a worthwhile goal to achieve. Acute cessation of smoking (for 12 hours or more) is also beneficial as it reduces carbon monoxide levels (half life 60 minutes) and is equivalent, in terms of blood oxygen carriage, to a one or two unit blood transfusion!

Alcohol and drug abuse

High alcohol intake and long-standing sedative or analgesic therapy increases requirements of drugs used in anaesthesia, usually by hepatic enzyme induction. Studies have shown markedly increased opioid requirements for postoperative pain relief in opioid addicts. Knowledge of this preoperatively will allow a suitable dose strategy to be devised. Alcohol should be discontinued a month before major abdominal surgery.

Cocaine and Anaesthesia

Anesthesiologists become involved in the care of cocaine abusing patients either in emergency situations, or in more controlled situations, such as the request for labour analgesia. Preoperative evaluation identifying the cocaine user during the preoperative assessment presents a special challenge to the anesthesiologist. Patients who are suspected of abuse need a thorough evaluation, including an electrocardiogram and possibly echocardiography for evidence of valvular disease. In cases of severe cardiovascular cocaine toxicity, general stabilization and hemodynamic control should precede induction of anesthesia²⁹. When regional anesthesia is selected, combative behavior, altered pain

perception, cocaine-induced thrombocytopenia, and ephedrine-resistant hypotension may be encountered³⁰. Low doses of phenylephrine titrated to effect usually restore blood pressure to normal. Several cases of cocaine-induced thrombocytopenia have been reported so platelet count should be obtained before instituting a regional anesthetic in a cocaine-abusing patient³¹.

In general endotracheal anesthesia, cardiac arrhythmias, hypertension, and myocardial ischemia may be encountered. Stimulation with the laryngoscope blade at the time of intubation may result in severe hypertension in the cocaine-intoxicated patient. To limit the risk of this complication, pharmacological control of blood pressure prior to induction is recommended³². Propranolol is contraindicated in cocaine-intoxicated patients because of the potential for unopposed alpha-adrenergic stimulation following beta blockade. Although esmolol may provide effective control of tachycardia and hypertension, beta blockade has also been shown to enhance cocaine induced coronary vasoconstriction³³. The short elimination half-life of esmolol may offer some advantage if beta blockade is deemed necessary. Intravenous hydralazine has recently become a standard drug therapy for the treatment of hypertension in cocaine-addicted patients³⁴. The mechanism of action of this drug includes vasodilation and a decrease in systemic vascular resistance, leading to reflex tachycardia, which may not always be desirable in the patient who is already tachycardic from cocaine intake. Labetalol, a combined non-selective beta and alpha-adrenergic blocker rapidly restores blood pressure without affecting heart rate and has been recommended by many in cocaine toxicity³⁵.

Administration of the potent volatile anesthetic agents may produce cardiac arrhythmias and increase systemic vascular resistance in cocaine intoxicated

patients³⁶. Halothane has been found to sensitize the myocardium to the effects of catecholamines and therefore should be avoided. When ketamine is used in cocaine abusing patients, caution is indicated, since ketamine may stimulate the central nervous system and potentiate the cardiac effects of cocaine by further increasing catecholamine levels³⁷. Cocaine has been reported to alter the metabolism of succinylcholine, possibly due to competing metabolism by plasma cholinesterases. A prolonged block from succinylcholine in a cocaine-abusing patient, presumably secondary to a depletion of cholinesterase involved in cocaine metabolism³⁸. However, succinylcholine in standard doses can be used safely in cocaine-abusing patients, should general anesthesia become necessary³⁹.

Cigarette smoking increases vasoconstriction of the coronary arteries through an alpha-adrenergic mechanism similar to that of cocaine⁴⁰. Recent studies have demonstrated that concomitant cigarette smoking substantially exacerbates the deleterious effects of cocaine on myocardial oxygen supply and demand⁴¹.

During general anaesthesia, hyperpyrexia (to 41°C) and sympathomimetic activity of a cocaine overdose can mimic malignant hyperthermia. Halothane may, potentially, lower the minimal dysrhythmic dose of epinephrine. Ketamine also markedly potentiates the cardiovascular toxicity of cocaine. Chronic cocaine exposure resulted in a reversible increase in isoflurane MAC⁴².

Interaction with psychotropic drugs is unpredictable. Tricyclic antidepressant which blocks monoamine re-uptake, e.g., amitriptyline, has been shown to have a protective effect on mortality only when administered either ten days or one day before a lethal dose of cocaine was given to experimental animals. Phenzazine (monoamine oxidase inhibitor) has been implicated in causing a delayed excitatory

reaction of convulsion and hyperpyrexia⁴³. Multi-drug interactions may additionally complicate anesthetic management of poly-substance-abusing patients. Care should be taken in postoperative period as there may be a horrible pain and withdrawal.

Anesthetic considerations in caesarian section

Rapid sequence induction and laryngoscopy, commonly used in parturients, may be associated with hypertension and tachycardia more frequently among recent cocaine users. This phenomenon may be related to increased anesthetic requirements after acute cocaine exposure, as demonstrated by a dose-dependent increase of halothane minimum alveolar concentration in the dog⁴⁴.

Elevated catecholamine levels secondary to both inadequate anesthesia and the presence of cocaine in the blood may result in cardiac dysrhythmias during halothane administration. Ketamine should be used with caution in these patients because it can markedly potentiate the cardiovascular toxicity of cocaine. Finally, the temperature rise and sympathomimetic effects associated with cocaine can also mimic malignant hyperthermia²⁹.

Given the high incidence of fetal asphyxia, anesthesiologists may be frequently called upon to assist in the resuscitation of these infants. Because many of the exposed mothers and infants

will not be identified in a spot urine test, anesthesiologists must have a high index of suspicion for intrauterine cocaine exposure. A history of absence of prenatal care, alcohol use, premature rupture of membranes, and positive syphilis serology should suggest the possibility of maternal cocaine abuse⁴⁵. The presence of a known obstetrical complication associated with maternal cocaine abuse (i.e., placental abruption, preterm labor, precipitate delivery, stillbirth) may also indicate cocaine exposure.

Preoperative evaluation of these infants should consider all the reported organ system abnormalities. Physical examination may reveal an irritable infant with poor motor ability, hypotonia, and low birth weight. A careful airway evaluation should be performed with the possibility of partial ankyloglossia in mind. Because of the documented increased rate of cardiac anomalies among these infants, a cardiology consult should be considered. In addition, preoperative electrocardiogram is of special importance because of the cardiac conduction defects, dysrhythmias, and transient ventricular tachycardia that may be associated with intrauterine cocaine exposure⁴⁶. In choosing an induction technique, the anesthesiologist should consider the reported elevated arterial blood pressure and diminished cardiac output and stroke volume in the first day of life⁴⁷. Elevated catecholamine levels in these infants may lead to dysrhythmias if halothane or local anesthetics with epinephrine are used.

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