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RESEARCH ARTICLE

IMPLICATION OF SUBSTANCE ABUSE ON ANAESTHESIA

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ABSTRACT

Substance abuse is of global public health concern. The United Nations Office on Drug and Crime in Nigeria indicates that 14.4% (14.3 million) of people aged between 15-64 years abuse drugs. This is of particular concern to the anaesthetist as illicit drug use has multi systemic effects which if not properly managed can jeopardize the chances of a successful surgery or critical care. Anaesthetists come into contact with patients who are under the influence of these drugs for various indications. They can present for elective/emergency surgeries, they could present in situations requiring basic and advanced life support due to complications from their life styles, or from other critical situations such as road traffic accidents requiring intensive care. The aim of anaesthesia is to determine the possible effects of illicit drug use on the various body systems, determine the presence and extent of complications due to illicit drug use, to optimize the patient as much as possible prior to sugery and to choose an anaesthetic technique with the least detrimental effect on the patients' condition. All these will aid the anaesthetic team to develop a safe care plan for the successful management of this category of patients.

INTRODUCTION

Substance abuse may be defined as self administration of drug(s) that deviate(s) from accepted medical or social use which if sustained can lead to physical and psychological dependence (1). Drug abuse is of global health concern and illicit drug use is not limited to a particular socio-economic strata or geographical location. The burden of drug abuse in Nigeria is still high with a prevalence of about 14.4% which is greater than the world global average of 5.5% despite the existing drug laws, policies, and strategies for prevention. (2, 3) In 2017, there were 585,000 deaths due to drug use, globally. (4). Anaesthetists come into contact with patients who are abusing drugs for various indications which includes emergency and elective surgeries, basic and advanced life support and Intensive care. They can present during the acute phase of intoxication or while being managed for addiction. Some present with life threatening withdrawal symptoms. (5, 6)The care of this patient is challenging for the anaesthetists as illicit drug use affects every system of the body (5). Commonly abused drugs in Nigeria include alcohol, tobacco, cigarettes, cannabis in its various forms, cocaine, amphetamine, heroin, diazepam, opioids, (like heroin, morphine, codeine, tramadol), volatile substances like household cleaning agents, paints, gum and petroleum substances(3).

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The combination of clinical manifestations of drug abuse, the pathophysiological effects of anaesthethic agents, the effect of the drugs being abused on anaesthetic technique, the pharmacologic interactions between the drugs of abuse and anaesthetic medication and pre existing medical conditions in these patients may increase anaesthetic challenges peri-operatively and during critical care. (5, 6) Drugs of abuse that cause or potentiate sedation reduces the minimum alveolar concentration (MAC), while CNS stimulants increase MAC.

Predicting the subsequent drug interaction or interplay between drugs of abuse and anaesthetic agents is difficult and unpredictable. (5, 7) Patients diagnosed with illicit use of drugs may present with other challenges such as difficulty with giving a detailed clinical history, difficulty in obtaining informed consent as they may not have the mental capacity to digest or interprete vital information adequately, difficulty with establishing intravenous access especially in those that are chronic intravenous drug abusers. The prevalence of transmissible diseases such as sexually transmitted diseases, hepatitis (B and C) and human immunodeficiency virus (HIV) is higher in this cohort of patients. (5, 7). This article highlights the systemic effect of commonly abused drugs in our environment, the implication on anaesthesia and how to avoid adverse events subsequent to substance abuse during the peri-operative anaesthetic care of these patients.

COMMON DRUGS OF ABUSE AND THEIR IMPLICATIONS ON ANAESTHESIA ALCOHOL: Alcohol is one of the commonest drugs of addiction (3). Patients with a history of alcohol abuse may present in the acute intoxication phase, the physiological dependent phase which is manifested as withdrawal symptoms or they may present with clinical features of chronic alcohol abuse. (8) Acute alcohol intoxication increases the risk of pulmonary aspiration significantly due to depressed laryngeal reflexes, increased gastric fluid volume and acidity. Patients in the withdrawal phase may present with autonomic instability, hypertension, cardiac arrhythmias, heart failure, nausea, vomiting, confusion, agitation, hallucinations and seizures. Pregnancy can be complicated by intra uterine growth retardation and fetal distress. (2, 8) The withdrawal symptoms can be managed with the administration of benzodiazepines or alpha-2-adrenoceptor agonists. However large doses of these agents should be administered with caution in the gravid patients to avoid increasing the risk of neonatal respiratory depression. (8, 9) Chronic alcohol abuse is associated with increased risk of liver diseases like cirrhosis, hypoalbuminemia, coagulopathy, cardiomyopathy and altered drug metabolism. (2,8)

Anaesthetic Implication: The administration of general anaesthesia in these patients may require rapid sequence induction technique with appropriate dose adjustments of intravenous induction drugs to avoid severe cardiorespiratory depression. In patients with acute alcohol intoxication, the minimum alveoli concentration (MAC) is reduced while in patients with chronic alcohol abuse, MAC is increased. Chronic use of alcohol may be associated with resistance to anti depressant agents. (5,8)/ Halothane is arrythmogenic and has also been implicated in liver failure thus should be avoided in patients with cardiac arrhythmias and liver cirrhosis (2,5). Regional anaesthesia can be safely administered in patients with a history or alcohol abuse. However, caution is exercised in patients who are being treated with disulfiram and in those who develop polyneuropathy. (5, 10) Skin preparation with alcohol-containing solutions should be avoided in disulfiram treated patients to prevent increasing serum acetaldehyde leading to diaphoresis, palpitations, facial flushing, nausea, vertigo, tachycardia and hypotension. Furthermore, sudden unexplained hypotension could reflect inadequate stores of norepinephrine due to disulfiram-induced inhibition of dopamine β-hydroxylase. (10) Therefore, high index of suspicion, pre-operative preloading or coloading with vasopressors such as phenylephrine or ephedrine is recommended when regional anaesthesia is the technique of choice in the patient diagnosed with alcohol abuse, especially those on disulfiram treatment to avoid adverse consequences of sympathetic blockade. (5,10)

TOBACCO CIGARETTES: Cigarette smoke is divided into two phases, the gaseous phase and the particulate phase. The gaseous phase consists mainly of nitrogen, oxygen, carcinogens such as hydrocyanic acid and hydrazine, cilio-toxins, and irritants such as acetaldehyde, ammonia, acrolein, formaldehyde, and carbon monoxide which impair oxygen transport. The particulate phase consists of nicotine, carcinogens such as tar and polynuclear aromatic hydrocarbons and tumor accelerators such as indole and carbazole.

The effects of these substances in both phases of cigarette smoke in chronic users are multisystemic. (11) On the cardiovascular system, nicotine stimulates the adrenal medulla to secrete adrenaline a vasopressor, resets the carotid body and aortic receptors, stimulate the autonomic ganglia, thereby increasing the sympathetic tone. All these increase the blood pressure, heart rate, and peripheral vascular resistance with a subsequent increase in the myocardial contractility and an increase in oxygen consumption by the cardiac fibres. Thus, the demand for oxygen is increased. Simultaneously, the increase in the coronary vascular resistance leads to a decrease in the coronary blood flow, resulting in a decrease in the supply of oxygen despite the increase in demand initially highlighted above. Nicotine also increases intracellular calcium during ischemia which further worsens myocardial cell damage. (12, 13) The half life of nicotine is about an hour. Following the smoking of a stick of cigarette, the pressor response lasts for about 30 minutes. Hence, three to four hours of abstinence results in significant improvement of the myocardial oxygen supply and demand ratio. (14) Another compound from cigarette smoke with a significant effect on the cardiovascular system is Carbon monoxide. Carbon monoxide combines with hemoglobin in the blood to form carboxyhemoglobin (COHb). In nonsmokers, the concentration of COHb is about 0.3 to 1.6%.

With environmental pollution, the concentration of COHb detected in nonsmokers does not exceed 1.9%. In chronic smokers, the concentration of COHb in the blood rises to 5 to 15%.(15) The amount of COHb present in the blood of smokers depends on the duration and frequency of smoking, the content of nicotine in the brand of cigarette smoked, and the method of smoking. The affinity of carbon monoxide for hemoglobin (Hb) is 200 times that of oxygen. (16) Thus, the amount of Hb available for combining with oxygen is significantly reduced. The oxyhemoglobin dissociation curve thus shifts to the left due to its high affinity for Hb thus making it difficult for tissues to extract oxygen from the hemoglobin leading to tissue hypoxia. (15, 16)The oxyhemoglobin curve changes from a sigmoidal to a more hyperbolic curve due to the carboxyhemoglobin and the depletion of 2, 3-diphosphoglycerate by carbon monoxide. (17) Carbon monoxide also binds with cytochrome oxidase and myoglobin and inactivates mitochondrial enzymes in the cardiac muscle. (12,18) The result is a decrease in the intracellular oxygen transport and usage and a negative inotropic effect. These mechanisms lead to chronic tissue hypoxia. The body compensates for this defect with an increase in red blood cells production which improves oxygen availability at the expense of increased plasma viscosity. There is also an increase in the production of Hb, white blood cells, platelets and increased platelet reactivity. All these further increases blood viscosity and the risk of thromboembolic phenomenon. Although there is an increased incidence of arterial thromboembolic disease in smokers, there is no increase in the incidence of deep vein thrombosis. The half life of carboxyhemoglobin depends mainly on pulmonary ventilation. With breathing at rest, the half life is about 4-6 hours compared with a half life of one hour with exertion due to rapid breathing. In 100% oxygen, its half life is reduced to 40-80 minutes, and with hyperbaric oxygen, it is further reduced to 23 minutes. (17, 18, 19)Thus abstinence from smoking for about 12 hours will reduce the concentration of carbonmonoxide in the blood significantly.

(20,21) Chronic hypoxia to the cardiac muscle and the increase in incidence of thrombo-embolic disease causes smokers to be at a 70% greater risk of coronary artery disease compared with nonsmokers, and the postoperative mortality in smokers is higher than in nonsmokers (20). On the respiratory system, mucus secretions in the airway increases as a result of the presence of irritants in cigarette smoke. The mucus becomes hyperviscous, with altered elasticity. Pulmonary surfactant is decreased, ciliary activity is impaired, epithelial lining of the lung is disrupted with an increase in pulmonary epithelial permeability. This loss of epithelial integrity allows irritants to penetrate the epithelium more easily and stimulate the subepithelial irritant receptors, resulting in increased reactivity (21) Laryngeal and bronchial reactivity is increased with small-airway constriction, causing an increased closing volume. An increase in pulmonary proteolytic enzymes or elastolytic enzymes causes loss of elastic lung recoil and emphysema. The risk of lung infection is increased. Twenty-five percent of smokers suffer from chronic bronchitis, occurring five times more often than in nonsmokers. The incidence of chronic obstructive airway disease is also higher than in nonsmokers. (22) Pulmonary function test shows an obstructive pattern in chronic smokers with chronic obstructive airway disease. In asymptomatic smokers, the spirometric pulmonary function tests are within normal range but their closing volumes are significantly increased, exhibiting small-airway disease with airflow limitation and defective alveolar ventilation. (21) With abstinence from smoking, ciliary activity begins to recover within 4-6 days. The sputum volume takes 2- 6 weeks to return to normal. There is some improvement in tracheobronchial clearance after 3 months. It takes 5-10 days for laryngeal and bronchial reactivity to settle. There is improvement in small-airway narrowing after 4 weeks. (21, 22). In chronic smokers, the forced expiratory volume-/second (FEV-1) is significantly reduced. Thus following subarachnoid block extending above the 10^{th} thoracic dermatome (T10) in chronic smokers with features of small airway constriction, patients are instructed to frequently take deep breaths and cough during the period of the block to prevent the accumulation of secretions in small airways (21).

Other effects of tobacco smoking includes the increased secretion of antidiuretic hormone (ADH) by the kidneys leading to dilutional hyponatremia, inducing the liver microsomal enzymes thereby increasing the metabolism of some drugs. In chronic smokers, larger doses of benzodiazepines are required to produce a similar sedative effect as in nonsmokers despite the pharmacokinetics of the drugs not exhibiting a significant difference in smokers and nonsmokers. It is probably due to the decreased response of end organs rather than being due to increased metabolism. There is no effect on thiopentone, lignocaine, or corticosteroids. Tobacco smoke makes the gastroesophageal sphincter incompetent. Thich allows reflux, with accompanying risks of pulmonary aspiration. (23) The incompetence in the gastroesophageal sphincter however begins within 4 minutes of beginning to smoke and returns to normal within 8 minutes after the end of smoking. Usually patients are unable to smoke up to 8 minutes prior to surgery. Thus, in contrast to previous beliefs, there is no increased risk of acid pulmonary aspiration in smokers. (19, 23). Chronic smokers exhibit a lower threshold to pan thus requiring more analgesics for pain management.

Fentanyl and pentazocine are metabolized faster in smokers. Phenylbutazone metabolism is increased. Acute withdrawal from smoking may result in increased anxiety, sleep disturbances, and irritability. (21, 23)

ANAESTHETIC IMPLICATIONS

Smokers should be instructed to abstain from smoking for 6- 8 weeks prior to elective surgery and abstain for 12-24 hours before emergency surgery to negate effects of nicotine and COHb. Lung infections such as chronic bronchitis should be well treated prior to surgery. The use of bronchodilators, breathing exercises and chest physiotherapy in symptomatic smokers is essential. (21) It is essential to assess the Arterial blood gas analysis for baseline Partial pressure of oxygen and partial pressure of Carbon di oxide. Careful choice of anaesthetic technique is important. Local or regional anaesthetic techniques are preferred to General Anaesthesia to avoid peri-operative complications like bronchospasm.(5) Premedications such as parasympatholytic agents like glycopyrolate to dry secretions, anxiolytic agents such as midazolam for withdrawal symptoms are necessary. Nebulized 4% lignocaine is needed to prevent respiratory problems during anesthesia and adequate preoxygenation at induction to reduce carbon monoxide concentration is essential. The use of intravenous lignocaine to prevent laryngospasm during intubation is effective. Anaesthetists should avoid patient manipulation under light planes of anesthesia, which may result in coughing, breath holding, laryngospasm, or bronchospasm. Desflurane, a respiratory irritant should be avoided as it stimulates the respiratory irritant receptors in chronic smokers and thereby the sympathoadrenal system, resulting in higher blood pressure and tachycardia. The minute volume should be increased above that used for nonsmokers to maintain the same PaCO2. (5, 21) If monitoring with pulse oximeters, some degree of overestimation of oxygenated hemoglobin saturation (SaO2) is expected as most oximetrers cannot differentiate between oxyhaemoglobin and Carboxyhaemoglobin, COHB. The use a CO-oximeter to measure oxygen saturation is preferred. The electrocardiogram should be monitored especially in those having coronary heart disease since ventricular arrthythmias may occur during anesthesia. Neuromuscular block is monitored using a peripheral nerve stimulator. After long surgeries, patients should not be extubated under light anesthesia because it may result in cough, breath holding, laryngospasm, or bronchospasm. Post operatively, oxygen therapy is continued in the recovery room, and on the ward, adequate analgesia is ascertained for pain relief and to alley anxiety from abstinence from smoking. Symptomatic smokers will benefit from breathing exercises and chest physiotherapy. (22) Peri-operative critical incidents are more prevalent among smokers compared with non smokers (22)

Smokeless tobacco: Smokeless tobacco comes in the forms of snuff, locally known as taba, quid (khaini), guraku and chewing tobacco. Smokeless tobacco has a higher concentration of nicotine than smoking tobacco. (2)The abuse of smokeless tobacco can lead to oral submucosal fibrosis (OSMF). OSMF typically affects the buccal mucosa, lips, retromolar areas, soft palate and occasionally the pharynx and oesophagus. Finally, results in progressive inability to open the mouth, pain, burning sensation and dysphagia 14, 15.

Chewing of tobacco results in lesions, primarily in the mandibular mucobuccal folds. With chronic use, these lesions may become malignant.

ANAESTHETIC IMPLICATION: Anaesthetists should have a high degree of suspicion and carefully examine the airway. They should anticipate a difficult airway in these patients. (24, 25).

OPIOIDS: Commonly abused opioids includes tramadol, pentazocine, heroin, codeine (such as seen in cough syrup**).** These drugs are usually abused through the oral, inhalational and injectable routes for their analgesic and euphoric effects.(7) A patient can be addicted in less than 14 days depending on frequency of dosing and dose of the drug consumed. Opioid abuse causes physical addiction, psychological dependence, rapid development of tolerance to opioids, altered pain perception such as development of allodynia and hyperalgesia and narcotic abstinence syndrome. Several medical complications are associated with chronic opioid abuse which includes cellulitis, superficial skin abscess, multiple skin infections, pneumonia, septic thrombophlebitis, hepatitis, autoimmune deficiency syndrome (AIDS), endocarditis, peptic ulcer disease that can be complicated by perforation, tetanus, boutulinism and malnutrition. In utero, it can cause intrauterine growth restriction (IUGR), fetal distress, and neonatal opioid withdrawal. In situations of acute overdose, patients can presnt with respiratory depression, pulmonary edema, and miotic pupils, seizures and unconsciousness. (5, 26) Acute opioids withdrawal syndrome can be seen about 4–6 hours after the last dose of opioids and peaks at about 48–72 hours resulting in increased sympathetic system activity and patient presents with symptoms such as restlessness, insomnia, mydriasis, tachycardia, tachypnea, hypertension, dysphorea and unconsciousness (5, 26).

ANAESTHETIC IMPLICATIONS: Patients addicted to Opioids can be maintained on opioid in the perioperative period. (27). However, opioid agonist antagonists such as pentazocine are not recommended as these drugs could cause profound acute withdrawal reactions. The ability to protect the airway may be compromised and the risk of aspiration greatly increased. The symptoms of withdrawal from opioids may be treated with clonidine, or diphenhydramine. Clonidine attenuates opioid withdrawal symptoms by replacing opioid mediated inhibition with alpha-2 agonist-mediated inhibition of the central nervous system. (28, 29). Opioids shift the concentration effect (also known as dose response) relationship curve of some anaesthetic agents such as benzodiazepines, propofol and volatile anaesthetics to the left. This augments their neuro depressant effect by blunting nociception induced arousal thereby potentiating the risk of unconsciousness in opoid abusers (26). These patients have difficult peripheral and central venous access. They pose a challenge to both regional and general anaesthetic techniques as they are prone to sepsis, coagulopathies, hemodynamic instability, liver dysfunction, malnutrition, and reduced intravascular fluid volume. For patients with neurological deficits or HIV induced demyelination, neuroaxial blocks will be relatively contraindicated. (5, 30) Opioid addicted patients experience exaggerated pain post operatively as there is reduced production of endogenous opioid peptides leading to development of a low pain threshold from reduced tolerance and there is also altered pain perception such as allodynia and hyperalgesia seen with chronic opioid use.(5, 26) Appropriate dose adjustments of anaesthetic medications should be considered in these patients especially in those with reduced intravascular fluid volume, malnutrition or liver disease. Acute opioid abuse decreases anaesthetic requirements thus minimum alveoli concentration (MAC) is reduced while chronic opioid administration leads to cross tolerance to central nervous system depressants that may manifest as decreased analgesic responses to inhaled anaesthetic agents such as nitrous oxide. Thus in chronic opioid abuse MAC is increased. Opioid overdose may cause respiratory depression and loss of the airway leading to increased risk of aspiration pneumonitis. Inadequate intravascular fluid volume secondary to chronic infections, fever, malnutrition, adrenocortical insufficiency may all precipitate peri-operative hypotension especially during neuroaxial blocks.(26, 30) These patients will benefit from a multimodal approach of postoperative pain relief which includes continuous regional analgesia with local anaesthetics, neuraxial opioids, transcutaneous electrical nerve stimulation, peripheral nerve blocks and skin infiteration techniques. (5, 27)

VOLATILE/SOLVENT SUBSTANCES: Commonly inhaled volatile substance are glue, gum, paint thinner, gasoline, household cleaning agents, correction fluids etc They are usually abused for their low cost and easy availability. They can be inhaled via the nasal route (sniffing), or inhaled by mouth (huffing), or by bagging which involves breathing in and out of a paper or plastic bag filled with a volatile agent. Solvents produce euphoric effects. They also have responses similar to sub-anaesthetic concentrations of volatile anaesthetics and CNS depression similar to alcohol intoxication. Although physical dependence is rare but psychological dependence and tolerance may occur. (31, 32)
Toluene is the main component of most volatile substance of abuse and it is responsible for most clinical toxicity seen. The effect is either from acute intoxication or from organ system dysfunction as a result of chronic persistent abuse. It is associated with a non anion gap distal and proximal tubular metabolic acidosis. (33) Toluene enhances relaxation and pleasant hallucination for about 2 hours. It is associated with bautonomic cardiac dysfunction, ventricular fibrillation, and myocardial infarction (34, 35).

Gasoline is another addictive inhalant. It contains a complex mixture of organic solvents. It produces a euphoric period followed by a violent excitement. Deodorants containing volatile nitrites, such as amyl nitrite, butyl nitrite, and related compounds are abused as euphoriants, enhancers of musical appreciation, and aphrodisiacs among older adolescents and young adults. Their use can cause visual field defects, severe hypotension with compensatory tachycardia and vasoconstriction, mild to life threatening methemoglobinemia can occur with profound tissue hypoxia, bronchial irritation with respiratory depression, vomiting and diarrhea with subsequent electrolyte imbalances. Chronic gasoline abuse may cause irritability, tremor, insomnia, muscle spasms, loss of memory, cerebral and cerebellar atrophy, peripheral neuropathy, pulmonary hypertension, restrictive lung defects or reduced diffusion capacity, acute rhabdomyosis and haematuria. (36, 37). Solvent abuse has been associated with severe cardiovascular and respiratory depression and the interaction with halogenated hydrocarbons may induce life-

threatening dysrhythmias, renal and liver toxicity and sudden death. Altered perception of sensory stimuli, loss of coordination, headache, nausea, vomiting, renal and liver toxicity and sudden death have been recorded with solvent abuse (5, 36). Diagnosis of volatile substance abuse is difficult as regular routine screening do not detect these volatile agents. Detection is based mainly on clinical diagnosis thus a high index of suspicion is required by medical professionals. (37). However, complete blood counts, coagulation studies, liver and renal function tests may identify possible complications. (38) In cases of acute intoxication with volatile agents, general anesthesia is preferred. (33, 37)

HALLUCINOGENS: Hallucinogens are psychoactive agents with a tendency to cause alterations in thought, mood and perception thus changing an individuals perception of reality. They can be classified as psychedelics, dissociatives or delirants. The commonly abused hallucinogenic substances are phenylcyclidine (PCP also known as angel dust, hog, love boat, peace pill), lysergic acid diethylamide (LSD also known as acid, dots, mellow yellow), ketamine (also known as k hole, kitkat, special k), mescaline, psilocybin, bath salts, salvia divinorum, dimethyltryptamine, gamma hydroxybutyric aci and 3, 4- methylenedioxymethamphetamie (MDMA; Ecstasy). Hallucinogens saturates the brain with serotonin, a neurotransmitter responsible for mood regulation, body temperature, sleep cycle, sensory perception thereby affecting normal brain function.(5, 39) The abuse of hallucinogens activates the sympathetic nervous system causing an increase in body temperature, dry mouth, tachycardia, arrhythmias, hypertension, anxiety, paranoia, panic attacks, hallucinations, and dilated pupils. Chronic use of hallucinogen may cause serotonin not to be produced by the body. Hallucinogens are associated with high incidence of psychological dependence but little or no physical dependence or withdrawal symptoms. (39, 40).

ANAESTHETIC IMPLICATIONS: Hallucinogens have an extensive mechanism of action being agonists, partial agonist and antagonist at different serotonin, dopaminergic and adrenergic receptor sites. Anaesthetic medications that can stimulate the sympathetic system or cause central nervous system excitation should be administered with caution during the acute phase of hallucinogenic substance abuse because of the effect of these substances earlier listed. It is important to note that PCP is an analogue of ketamine. (39, 40) Hallucinogens can potentiate and prolong the analgesic and respiratory depressants effects of opioids. They can inhibit the activity of plasma cholinesterases responsible for the metabolism of suxamethonium thereby prolonging the effects of suxamethonium. Postoperative hallucinations and panic attacks have been reported in patients undergoing general anaesthesia and these can be managed with benzodiazepines such as diazepam. (39, 40) Halothane has the tendency to potentiates the arrhythmogenic effects of hallucinogens hence it is better avoided. Regional anesthesia may precipitate profound refractory hypotension due to sympathectomy in hallucinogen abusers especially in the acute phase of abuse and ephedrine should be used with caution as it has both direct and indirect mechanism. (39, 41)

COCAINE: Cocaine is a tropane alkaloid and a CNS stimulant. It has several routes of abused which includes oral, nasal, intravenous and rectal routes. Cocaine blocks the presynaptic reuptake of sympathomimetic neurotransmitters such as norepinephrine, serotonin, and dopamine. (42, 43) This prolongs the dopaminergic activity in the limbic system and cerebral cortex causing the euphoric effect for which it is abused. It also stimulates the sympatho-adrenal axis which can result in intense vasoconstriction that can compromise blood flow to vital organs. These can result in irreversible brain damage, myocardial infarction, renal failure, etc. It can also cause nasal mucosa ulceration, anxiety, restlessness, tachycardia, hypertension, ventricular arrhythmias, asthma, pulmonary hemorrhage, thrombocytopenia, and decrease in plasma cholinesterase enzyme levels (44).

ANAESTHETIC IMPLICATION: The nasal mucosa should be examined for crusts and signs of ulcerations. Needle marks and sclerosis of peripheral veins from chronic injections should be assessed. The respiratory system should be examined to exclude cocaine-induced asthma and a careful cardiovascular and central nervous system examination is important. (44) The metabolism of cocaine occurs primarily through plasma and hepatic cholinesterase, and patients with pseudocholinesterase deficiency are at increased risk for cocaine toxicity. Less than 5% of ingested co-caine is excreted unchanged in the urine. (45). Preoperative investigations to assess complete blood cell count, renal and liver function, platelet count, to rule out thrombocytopenia; Electrocardiography identifies rhythmic abnormalities or myocardial ischaemia; chest radiography to rule out any pulmonary or cardiac involvement and abdominal radiography to detect pseudo-obstruction (46). General or regional anaesthetic techniques in the patient abusing cocaine may be associated with serious complications. Sympathomimetic anaesthetic agents or techniques must be used with extreme caution to avoid myocardial ischaemia and cardiac dysrhythmias. Beta-blockade also predisposes to cocaine induced coronary vasoconstriction. (44)Esmolol has been reported to be of benefit in these patients for its cardiostability however it may not readily available in resource poor settings. ketamine should be administered with extreme caution in these patients because it can markedly potentiate the cardiovascular toxicity of cocaine. Cocaine and suxamethonium are metabolized by plasma cholinesterase hence the use of suxamethonium may result in prolonged muscle paralysis. An increased anaesthetic requirement for volatile anaesthetic vapour may be necessary in the acutely intoxicated patient. The temperature rise and sympathomimetic effects associated with cocaine abuse can mimic malignant hyperthermia (MH), and it may be difficult to differentiate between the two conditions (42, 43). When regional anaesthesia is considered, patient may be aggressive; there may be altered pain perception, cocaine induced thrombocytopenia; and ephedrine resistant hypotension may be occur. Low doses of phenylephrine titrated to the effect is usually preferred compared to ephedrine. Pronounced abnormalities in endorphin levels and changes in both mu and kappa opioid receptor densities resulting from cocaine addiction which may result in abnormal perception of pain despite adequate spinal/epidural anaesthesia sensory levels (47)

Marijuana (Cannabis). Cannabis is a psychoactive substance derived from the cannabis plant. It is commonly known as weed, igbo. Oja, gbana, nkaya, wee-wee.kpoli and abana. It is usually smoked as a cigarette for its intense feeling of euphoria and relaxation.

Table. Showing a summary of the pathophysiological effects of drugs of abuse related to anaesthesia and their management

Substance	Cardiac	Respiratory	Digestive	Neurological	Coagulopathy	Management
Depressants e.g Alcohol	Autonomic instability	Depressed airway reflexes, ARDS	Gastritis, stomach and oesophageal ulcers	Depression, seizures	High risk	Manage withdrawal symptoms. Regional blocks preferred
Cannabis	Raised SNS later PNS overrides, arrhythmias	Oropharyngeal oedema, bronchospasm, prolongs the effect of suxamethonium	Voracious appetite then reduced intestinal motility thus delaying gastric emptying	Hallucination, Psychosis	Nil	Regional block preferred. If GA, consider TIVA, Prophylactic dexamethasone
Sedatives e.g Benzodiazepines, barbiturates	Depressed cardiac function, autonomic instability	Depressed	Reduced gastric motility	Depression, seizures; risk of sepsis in IV users	Increased risk of DVT	Manage Withdrawal symptoms. Regional block preferred
Opioids	SNS stimulation with withdrawal	Depressed	Nausea, Vomitting, reduced gastric motility	Depression, Increased risk of sepsis in IV users	High risk for DVT and thromboembolism	Regional block preferred. Multimodal analgesia required
Cocaine	SNS stimulation	Asthma, pulmonary haemorrhage, prolongs effect of suxamethonium	PUD, Pyloric and duodenal perforations, Haemorrhage	Euphoria, disrupts pain perception, seizures, psychosis	High risk	Regional preferred Prophylactic dexamethasone
Amphetamine	Stimulate SNS	Difficulty breathing	Nausea, vomiting, diarrhea, Constipation	Anxiety, seizures, cerebral haemorhage	High risk	regional
Hallucinogen	SNS stimulation	Breathing difficulties	Nausea and vomiting	Somatosensory symptoms, psychosis	High risk	Regional block preferred

The high fat solubility of cannabis causes delayed elimination hence complete elimination of the drug takes about 30 days after a single dose. It stimulates the sympathetic system while depressing the parasympathetic system. The clinical presentation includes anxiety, tachycardia, confusion, depression, shortened memory span, violent behavior, dulled reflexes and hallucinations, and even seizures. In pregnant women, it predisposes to IUGR and low neonatal birth weight. . Chronic abuse of cannabis leads to increased tar deposits in the lungs with impaired pulmonary defense mechanism and reduced pulmonary function. This predisposes patients to sinusitis and bronchitis (49)

Anaesthetic implications: The use of anaesthetic agents with central nervous system effect should be avoided in the acute phase of marijuana abuse. Marijuana may potentiate the sedative effects of CNS depressants. Studies have shown cross tolerance of marijuana with barbiturates, opioids, benzodiazepines, and phenothiazines. (50) The resultant tachycardia from the sympathomimetic effect of cannabis should be controlled preoperatively with beta blockers like landilol, labetalol or esmolol 35. Additive effects of marijuana and volatile anaesthetic agents can result in pronounced cardiovascular system depression during general anaesthesia.(51) Sympathomimetic agents such as ketamine, pancuronium, ephedrine and positive inotropic agents like atropine should be avoided. Peri-operative complications such as bronchospasm secondary to airway irritability by the marijuana smoke has been reported although marijuana is a bronchodilator. (48, 49)

Amphetamines: Methylamphetamine (Ice) is particularly popular as a stimulant for its potency and ease of absorption. It is usually abused orally, by snorting, smoking, absorption across mucous mem-branes such as vaginal mucosa. (7, 52) Amphetamines stimulate the release of catecholamines from presynaptic vesicles, resulting in euphoria, increased cortical alertness and energy, dry mouth, appetite suppression and high body temperature. The symptoms of acute amphetamine intoxication, includes, hypertension, arrhythmias, tachycardia, dilated pupils, hyperreflexia, proteinuria, and confusion. Chronic abuse of amphetamines results in depletion of body stores of catecholamines, which may be manifested as anxiety, weight loss, memory loss, somnolence, or psychotic state. Anxiety, delusional behaviours and hallucination can be treated with haloperidol or droperidol. Phenothiazines are contraindicated and may cause a rapid drop in blood pressure or seizure activity. Acute intoxication with amphetamines requires the MAC of inhalational agents to be reduced while chronic use requires the MAC to be increased (5, 52). Hyperthermia should be actively managed by cooling intravenous fluids, applying ice packs and reducing theatre temperature. Other supportive treatment will include optimizing the blood pressure and treating arrhythmias, which may respond to sedation. (40, 52)

ANAESTHETIC IMPLICATIONS

Avoid the use of halothane during general anaesthesia as it may sensitize the myocardium to endogenous catecholamines thus provoking arrythmias. Acute intoxication with amphetamine increases the minimum alveolar concentration of volatile anaestheticagent[43] while chronic intake decreases the MAC dose for general anaesthetic. Neuroaxial blocks may predispose to profound hypotension. The response of amphetamine abusers to drug treatment of hypotension is largely unpredictable.(5, 53)

CONCLUSION

The management of patients on substance abuse poses a challenge to the Anaesthetists in the peri-operative period as the effects of these drugs are multisystemic and unpredictable. The aim of the Anaesthetic team is to develop a robust anaesthetic care plan that will consider the phase of drug abuse,

determine the presence of complications, optimize patient and offer an anaesthetic technique with the least detrimental effect to ensure a safe surgical outcome**.**

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