CHAPTER 31
PSYCHOTROPIC DRUGS

Psychotropic drugs are substances that affect psychic function, behaviour or experience. They consist of: (1) Antidepressants. (2) Neuroleptics. (3) Hallucinogens.

ANTIDEPRESSANTS

Amphetamine, tricyclic antidepressants and monoamine oxidase inhibitors are important antidepressants.

The toxicity of the antidepressants is due to (1) their anticholinergic effects such as: supraventricular tachycardia, agitation, seizures, coma, hallucinations, and respiratory depression, (2) their ability to block reuptake of norepinephrine at the synapses, resulting in both atrial and ventricular disturbances and hypertension, (3) their quinidine-like membrane depressant effects on the heart by altering sodium influx resulting in conduction delays and myocardial depression, (4) peripheral alpha blockade causing hypotension, and (5) inhibition of sympathetic reflexes centrally.

AMPHETAMINE

Action: Amphetamines increase the synaptic concentration of neurotransmitters dopamine and norepinephrine. They are powerful stimulants of CNS and CVS. It may be taken orally, i.v., smoked or sniffed. The onset of fatigue is delayed and tasks are more easily completed, but there is a loss of judgement and accuracy.

Symptoms: Acute poisoning: (1) Mild: Restlessness, talkativeness, insomnia, tremors, sweating, dilated pupils.

(2) **Moderate:** Hyperactivity, confusion, hypertension, tachycardia, tachyapnoea, vomiting, sweating, hallucinations.

(3) **Severe:** Delirium, hyperpyrexia, convulsions, coma, arrhythmias.

Chronic poisoning: (1) Amphetamine psychosis characterised by: (a) Stereotyped, compulsive behaviour, (b) paranoid personality, (c) delusions, usually persecution, (d) Hallucinations, usually visual, sometimes tactile. (2) Cardiomyopathy. (3) Intracranial haemorrhage.

Treatment: (1) Gastric lavage. (2) Acidification of urine. (3) Symptomatic. (4) Chlorpromazine for amphetamine psychosis.

Fatal Dose: 150 mg. to 2 gm.

P.M. appearances are those of asphyxia.

M.L. imp: Long term use leads to psychological dependence and tolerance.

40% of amphetamine is excreted unchanged in urine. The term liquid gold is slang for urine for amphetamine addicts which is collected and sold.

Derivatives: Methamphetamine, dextroamphetamine, fenfluramine, phentermine, mephentermine, methylphenidate and synthetic amphetamines.

Dangers of misuse are: (1) Overactivity or aggressive behaviour, (2) Paranoid psychosis. (3) Shock and collapse. (4) Risk of suicide during the withdrawal phase.

CYCLIC ANTIDEPRESSANTS

Classification: (1) First generation: Imipramine, amitriptyline, desipramine, doxepin, nortryptiline, protriptyline, trimipramine, (2) Second generation; Amoxapine, maprotiline. (3) Newer agents: Bupropion, trazadone, netazodone, fluoxetine, paroxetine, sertraline.

Action: Inhibition of neurotransmitter reuptake, anticholinergic blockade, a-adrenergic blockade and myocardial depressant effect.

Signs and symptoms: C.N.S.: Depression of mental state and coma, delirium, altered sensorium, generalised, brief and self-limited convulsions, myoclonus, nystagmus, dysarthria and ataxia. **C.V.S.:** Sinus tachycardia, conduction delays, ventricular arrhythmias, depressed inotropy, hypotension, atrioventricular block, bradycardia. **Parasympathetic:** Dry skin and mucosa, ileus, urinary retention, mydriasis and hyperthermia.

Fata Dose: 2 to 5 gm.

Treatment: (1) Stomach wash. (2) Emesis should be avoided. (3) Activated charcoal and cathartic following lavage. (4) Multiple dose activated charcoal.

MONOAMINE OXIDASE INHIBITORS (MAOI)

They include iproniazid, isocarboxazid, phenelzine, pheneprazine, nialamide and tranyicypromine.

Action: They block the action of monoamine oxidase, resulting in alterations of neurotransmitter metabolism.

Signs and symptoms:: Symptoms develop after 12 hours.

Phase-1: CNS excitation. Headache, dilated pupils, tremors, convulsions, hallucinations, confusion, nausea, hyperpyrexia, hypertension followed by hypotension.

Phase-2: CNS and CVS depression: Coma, cardiovascular collapse.

Phase-3: Complications: Haemolysis, rhabdomyolysis, pulmonary oedema, acute renal failure.

Fatal Dose: 2 to 5 mg/kg.

Treatment: (1) Stomach wash. (2) Symptomatic.

PHENCYCLIDINE: It is usually smoked, sniffed or injected (I.V. or S.C.)

Signs and Symptoms: Nystagmus, miosis, ataxia, tremors, dysarthria, tachycardia, hypertension, lethargy, catatonia, coma, agitation, violent tendency, bizarre behaviour, acute psychosis with delusions and hallucinations.

NEUROLEPTICS (TRANQUILISERS): They are antipsychotic agents which therapeutically modify behaviour.

Classification: (1) **Phenothiazines:** (a) **Aliphatic:** chlorpromazine, triflupromazine. (b) **Piperazine:** trifluoperazine, prochlorperazine, perphenazine, fluphenazine. (c) **Piperidine:** thioridiazine, mesoridiazine. (d) **Benzodiazipines:** Diazepam, lorazepam, oxazepam. (2) **Thioxanthenes:** chlorprothixene, thiothixene. (3) **Butyrophenones:** haloperidol. (4) **Indoles:** molindone. (5) **Dibenzoxazepines:** loxapine.

Newer drugs are clozapine, risperidone and remoxipride.

Action: The phenothiazines are anticholinergics and antidopaminergics to varying degrees. Other properties are central and peripheral cholinergic blockade, and adrenergic action secondary to the inhibition of reuptake of catecholamines.

Fatal Dose: 2 to 5 gm.

Symptoms: Myocardial depression, hypothermia or hyperthermia, decreased sweating and salivation, amenorrhoea, miosis, decreased intestinal motility and secretions, agranulocytosis, haemolytic anaemia, ventricular tachycardia, orthostatic hypotension, sedation, seizures, gynaecomastia, corneal opacities, cholestatic jaundice, priapism, laryngospasm, urticaria, dermatitis, photosensitivity and gray-blue pigmentation. There are three acute movement disorders occurring between one to 60 days of initiation of therapy. (1) **Acute dystonia:** oculogyric crisis, jaw, tongue, lip and throat spasms, neck twisting, opisthotonos, facial grimacing and abdominal wall spasm. Symptoms rapidly resolve with parenteral antihistamines, anticholinergics, or benzodiazepines. (2) **Akathisia:** restlessness and inability to sit. (3) **Parkinsonism:** shuffling gait, resting tremor, rigidity, pill rolling, a mask-like expression, fine movements, muscle weakness, and bradykinesia are typical symptoms.

Treatment: (1) Emesis. (2) Gastric lavage. (3) Activated charcoal in repeated doses. (4) Catharsis. (5) Symptomatic.

BENZODIAZEPINES: They are used mainly as antianxiety and muscle relaxant agents. The commonly used preparations are: **Diazepam,** flurazepam chlordiazepoxide, nitrazepam, oxazepam, flurazepam, alprazolam, and lorazepam. They are tranquilisers commonly used to relieve anxiety. Excretion in the urine my continue for several days. Addiction may occur. They enhance the inhibitory actions of the neurotransmitter GABA, located in the brain.

Fatal Dose: 100 to 300 mg/kg body weight. Death is rare.

Signs and Symptoms: Symptoms appear in 1 to 3 hours. Acute poisoning causes vertigo, slurred speech, nystagmus diplopia, dysarthria, ataxia, staggering walk, shallow breathing, sedation and somnolence and coma. If taken alone they are not toxic, but mixed with alcohol or other drugs, they can contribute to death.

Chronic Poisoning: High dose, long term therapy (30 to 40 mg of diazepam daily) may produce withdrawal symptoms when stopped suddenly, such as: **C.N.S:** headache, anxiety insomnia, muscle spasms, tremors, rarely convulsions and psychiatric disturbances. **G.I:** anorexia, vomiting **R.S.:** respiratory depression is rare.

Treatment: (1) Gastric lavage. (2) Activated charcoal. (3) Flumazenil is an imidazodiazipine that selectively blocks the central effects of benzodiazipines by competitive interaction at the benzodiazipine recognition site. It is also useful in poisoning by zolpidem, an imidazopyridine hypnotic. It is given in a dose of 0.2mg/min as infusion to a total of 3.5 mg. If resedation occurs (in 20 to 120

minutes), the dose is repeated.

The withdrawal syndrome from benzodizipines includes fits and psychosis. In addition, anxiety symptoms, such as sweating, insomnia, headache, tremors, nausea and disordered perception such as feelings of unreality, abnormal bodily sensations and hypersensitivity to stimuli may be seen. A long acting drug, such as chlordiazepoxide or diazepam are useful to prevent complications.

Long term use may possibly cause behavioral disinhibition, which may induce a person to hostile acts, aggressive behaviour and verbal indecency. Many of these drugs are capable of causing anterogradea amnesia.

PSYCHEDELICS (Hallucinogens)

Psychedelics are substances that produce an alteration in environmental awareness while the individual maintains the capacity to recognise that what he is experiencing is not real. Such person is usually fully awake, alert and oriented but confronted with varied perceptual abnormalities and varied sensations. Synesthesias are frequent. Hallucinations produced by drugs usually have some environmental stimulus providing the basis for the illusion. The response to a psychedelic is related to the persons mind-set, emotions, or expectations at the time and can be altered by the setting. The person may experience euphoria or dysphoria, can be emotionally labile but usually realises that he is under the influence of a drug.

LSD, mescaline, dimethyl tryptamine (DMT), psylocybin, psylocin, peyote, phencyclidine (PCP) are important hallucinogenic drugs. **Hallucinogenic mushrooms** or "magic mushrooms" contain psilocybin and psilocin and are taken orally, raw or cooked.

Action: They involve various neurotransmitters in the CNS. LSD involves the serotonin system and tropane alkaloids (atropine, scopolamine and hyoscyamine), have anticholinergic effects. There is psychic dependence only and no abstinence syndrome.

Signs and Symptoms: Both sympathetic and parasympathetic symptoms are produced. Sympathetic symptoms may include dilated pupils, tachycardia, tachyapnoea, hyperthermia, diaphoresis, piloerection, dizziness, weakness, hyperactivity, muscle weakness, ataxia, altered mental status and coma. Parasympathetic symptoms include salivation, lachrymation, diarrhoea, nausea, vomiting, bronchoconstriction and hypertension.

During hallucinations sensory perceptions are intensified; colours seem brighter and more clear, sounds seem excessively loud with an exaggeration of detail. The individual feels a sense of depersonalisation and separation from the environment. The person may perceive that he is observing an event as opposed to being involved in one. The person's body image may become distorted, so also the boundaries of objects in the environment. Alternatively, synesthesias or sensory misperceptions occur such as hearing colour or seeing sounds.

Drugs that may alter mood, such as benzodiazepines, barbiturates and amphetamines can produce perceptual changes during withdrawal. Alcohol in excess (alcoholic hallucinosis), or alcohol deprivation (delirium tremens) can cause hallucinations.

LSD (lysergic acid diethylamide): It is a colourless, tasteless, odourless, semi-synthetic compound, the lysergic acid portion of which is a natural product of the ergot fungus Claviceps purpurea. It is a powerful antagonist of serotinin, and can also mimic its action. It is taken orally. Rarely, it may be smoked or injected parenterally. It is absorbed from the gastrointestinal tract and considerable amounts become bound to blood protein. It is rapidly distributed to the body tissues, the highest concentrations appearing in the lungs, liver, kidney and brain. A high proportion of the dose is found in the bile. The dose required to produce psychotropic effects ("take a trip) is 100 to 200 micrograms. The trip usually occurs after half to one hour, peaking after 2 to 6 hours and fading after 12 hours. The effects depend very much on the individual and on the circumstances, with the same user having a bad or good "trip" on different occasions, or even within the same trip. Symptoms are dry mouth, sweating, dilated pupils, mood change, visual hallucinations, alterations in time perception, etc. The drug is mainly used for self-exploration, to experience varied hallucinations and to get out of day-to-day boredom. In the recovery stage there may be apprehension and distraction that is not immediately obvious to onlookers. Tolerance develops in 2 to 3 days with daily dosing but rapidly disappears if the drug is withheld for two days. It is commonly taken as: (1) liquid on sugar, (2) saturated sugar cube, (3) soaked into blotting paper,

(4) capsule, and (5) blue pills.

Adverse effects are: depression, panic attacks, schizophrenic episodes and psychosis.

Fatal Dose : About 14 mg.

The after-effects may persist for days or weeks. At the height of the effects of the drug on the mind, individual becomes violent or panic-stricken and he may attack others (urge to kill) or hurt himself from disregard of reality, and the normal considerations of the safety. The feeling of being able to fly under the influence of LSD can lead users to jump out of windows. In some persons lasting disturbances, depersonalisation, chronic dread, depression, mood swings and paranoid attitudes and belief may be found following repeated exposure to LSD. In the recovery stage, there may be apprehension and distraction, that is not obvious to onlookers. Biological half-life of LSD in man is three hours. It does not cause chromosomal breakage and is not teratogenic.

Repeated use by an addict can lead to permanent psychosis.

Flash-back Phenomenon: This may occur days, weeks or even months after the ingestion of a dose, and the person experiences a recurrence of the emotional and psychological aspects of the previous 'LSD' trip. Flash-back symptoms occur most frequently with abuse of psychotomimetics, such as LSD, STP, tryptamines, mescaline and psilocybin. These delayed recurring symptoms may lead to eccentric behaviour, sucide or even homicide.

Treatment: (1) Low doses of anti-anxiety drugs and benzodiazepines, such as diazepam 10 to 20 mg are the drugs of choice. (2) Prolonged talking known as "talking the person down" which may extend up to 12 to 18 hours. (3) Psychotherapy.

Amphetamine, cocaine and ecstasy can cause psychological dependence but not a major physical withdrawal syndrome.

KHAT (catha edulis) is chewed for its stimulant effect. Cathinone is the main component, which produces effects similar to those caused by amphetamine.

ECSTASY (3,4, methylene-dioxymethamphetamine-MDMA) is a stimulant with hallucinogenic properties. A dose of 75 to 100 mg. produces effects within half to one hour. In addition to the general symptoms of stimulants, trismus (spasm of the muscles of mastication) and bruxism (grinding of teeth) may occur.

Anabolic Steroids taken orally or by injection produce mood swings, aggressive behaviour, depression and paranoia.

Alkyl nitrites (poppers) such as amyl nitrite, are used as euphoric relaxants. Inhalation of the vapour causes headache, dizziness and flushing. Excessive use may produce methaemoglobinaemia.

CHAPTER 32

MISCELLANEOUS POISONS

ANALGESICS AND ANTIPYRETICS

Classification: (1) Salicylates: acetylsalicylic acid, diflunisal. (2) Pyrazolones: Phenylbutazone, oxyphenbutazone. (3) Indoleacidic acids: indomethacin, sulindac, tolmetin. (4) Phenylpropionic acids: carprofen, fenoprofen, ibuprofen, ketoprofen, naproxen. (5) Anthranilic acids: meclofenamate, mefenamic acid. (6) Oxicams: Piroxicam. (7) Phenylacetic acid: diclofenac.

SALICYLIC ACID: Preparations of salicyclic acid include: sodium salicylate, methyl salicylate and aspirin. Sodium salicylate is odourless, white scaly crystals with unpleasant saline taste. Methyl salicylate is colourless liquid with aromatic odour and sweetish taste.

ACETYLSALICYLIC ACID (Aspirin): It is a white, odourless, crystalline powder, having a slight acid taste. It is in popular use as an antipyretic and analgesic.

They are rapidly absorbed from the stomach, and to a slightly lesser extent from the small intestine. Metabolism occurs chiefly in the liver. Excretion is mainly through urine. The half-life is 2 to 4 hours. They cause extreme irritation of G.I. mucosa.

SIGNS AND SYMPTOMS: A large oral dose of the acid or methyl ester causes mild burning pain in the throat and stomach and causes vomiting. There may be a latent period of several hours following these initial symptoms, during which sweating and slight rise of temperature may occur. The early signs are anorexia, apathy and lassitude. There is nausea, vomiting, thirst and occasional diarrhoea. The respiration is at first fast and deep, and later laboured and dyspnoeic. Vertigo, ringing in the ears, deafness and impaired vision are common and headache may be severe. The temperature is usually raised. Irritability, restlessness, confusion, disorientation, delirium, mania, hallucinations, generalised convulsions and coma are seen. In severe poisoning, a primary respiratory alkalosis due to the central stimulating effect of salicylates on respiratory centre with marked hyperapnoea and loss of CO_2 is caused. Later, metabolic acidosis supervenes due to increased excretion of bicarbonate, potassium and sodium. An increased anion gap metabolic acidosis with respiratory alkalosis, ketosis and tinnitus suggests salicylate poisoning. The urine is strongly acid, contains acetone, albumin and frequently a trace of bile due to mild hepatitis. Hypovolaemia and hypokalaemia and hypoprothrombinaemia may occur. The skin is flushed and moist, pupils dilated and the pulse is rapid and irregular. There may be platelet dysfunction (inhibition of aggregation) and prolonged clotting time. Severe dehydration may occur and in the terminal stages hyperpyrexia of 41 to 42° may occur. Blood levels of over 50 mg% are toxic and over 100 mg% fatal.

REYE'S SYNDROME is sometimes seen in children below 15 years on consumption of ospirin. The main features are acute onset of hepatic failure and encephalopathy with residual neurological manifestations.

TREATMENT : (1) Emetics. (2) When a large number of tablets are swallowed, aspirin may form a large dirty grey lump in the stomach, which may not dissolve for a long time. As such stomach should be washed with sodium bicarbonate solution, even after several hours of ingestion. (3) Activated charcoal is useful. (4) Forced alkaline diuresis will increase the plasma clearance rate to as much as 700% above normal. (5) Peritoneal dialysis and haemodialysis are useful. (6) Exchange transfusions in severe cases. (7) Saline catharsis. (8) Alkali therapy if acidosis is present. (9) Vitamin C to control haemorrhage. (10) In idiosyncrasy ACTH and antihistamines. (11) Symptomatic.

Death occurs from acidosis and uraemia with peripheral failure due to shock in the earlier stages or respiratory failure later. About 7 to 8% die. Aspirin can cause sudden cardiac arrest in the absence of any toxic symptoms up to a day or so. Fatal cardiac arrhythmias may supervene.

Idiosyncrasy is seen in 0.2% persons, in whom therapeutic dose produces alarming symptoms which include angioneurotic oedema, urticaria, hypotension, oedema of the mucous membranes with hypersecretion, vasomotor rhinitis, laryngeal oedema, vomiting, excessive salivation, bronchial spasm, cyanosis, maculopapular exanthemata and erythema of the face with oedema of eyelids, haemorrhage in the stomach and intestines due to capillary damage and in severe cases erosion of the mucosa and ulceration.

FATAL DOSE : Sodium salicylate and aspirin: 15 to 20 gm. Salicylic acid 70 to 80 gm. Methyl salicylate: 10 to 20 ml.

FATAL PERIOD : Few minutes to several hours.

TEST : If few drops of ferric chloride are added to the urine containing aspirin, it turns deep purple.

POST-MORTEM APPEARANCES : The pupils are dilated. Skin rashes may be present. The gastric mucosa is congested and sometimes petechial haemorrhages are seen in the mucous and serous membranes. There is generalised congestion of all the ograns. Subpleural and pericardial petechial haemorrhages are seen. Lungs are congested with some oedema and collapse. If the patient survives for few days the myocardium, liver and kidneys are usually soft, dirty in appearance and greasy to touch. Hepatitis may be present. Petechial haemorrhages are seen in various organs.

CHRONIC POISONING: Symptoms are confusion, agitation, lethargy, disorientation, slurred speech, hallucinations, convulsions and coma. There may be tinnitus, loss of hearing, dyspnoea, tachycardia and fever.

THE CIRCUMSTANCES OF POISONING : Aspirin poisoning is almost always suicidal. Because of its bitter taste, large quantities are usually not swallowed accidentally.

PARACETAMOL (Acetaminophen): It is absorbed rapidy from the gastrointestinal tract, and metabolised quickly in the liver. It is a potent hepatic toxin, A small part is converted by a liver enzyme into N-acetyl-p-benzoquinoneimine. Glutathione and other sulphydryl compounds detoxify this substance, but in overdose NABP accumultes and causes severe centrilobular liver necrosis. The simultaneous presence of phenobarbitone or phenytoin in epileptics or the presence of chronic alcoholism greatly worsens the situation. Large doses act on brain stem and cause rapid death. Most deaths are delayed for several days, when liver failure occurs. Toxic doses cause depletion of glutathione, which results in hepatic necrosis.

Fatal Dose : 20 to 25 g.

Fatal Period : 2 to 4 days.

Symptoms : Within a few hours patient experiences anorexia, nausea, vomiting, abdominal pain, diaphoresis, hypotension, tachycardia and dyspnoea. After one to two days, the discomfort disappears. After 2 to 4 days there is vomiting, jaundice, hepatic pain, bleeding, hypoglycaemia, confusion, coma, metabolic acidosis and coarse flapping tremor of hands (asterixis). There may be cardiac arrhythmias, haemorrhagic pancreatitis, disseminated intravascular coagulation, etc. Death usually occurs in 3 to 4 days. Renal failure due to renal papillary necrosis may occur in 24 to 72 hours even in the absence of hepatotoxicity. Death from hepatic failure occurs 4 to 18 days post-ingestion. Paracetamol has replaced barbiturates and aspirin in Britain as favourite method of suicide.

Treatment : (1) Gastric lavage. (2) Activated charcoal. (3) N-acetylcysteine (NAC) is a specific antidote and has maximum efficacy if used within 8 hours. It is given in a dose of 140 mg/kg. body weight. Then, 70 mg./kg. is given every 4 hours until a total of 18 doses over 72 hours period orally. It can also be given i.v. 150 mg/kg in 200 ml of 5% dextrose over 15 minutes, followed by 50 mg/kg in 500 ml of 5% dextrose over 4 hours, and 100 mg/kg in one litre over 16 hours. (4) Methionine is less effective than NAC. It acts by increasing glutathione synthesis. Initial dose is 2.5 gm. orally, repeated every four hours up to a total of ten gm. Do not give activated charcoal as it will bind methionine. (5) Correct acidaemia. (6) Haemodialysis. (7) Symptomatic.

Post-mortem Appearances : They include acute centrilobular hepatic necrosis, acute tubular necrosis in the kidney, myocardial necrosis, and cerebral oedema.

WATER INTOXICATION: Deaths from water intoxication are very rare. Deaths occur due to ingestion of large quantities of water or the administration of large quantities of I.V. fluids, devoid of electrolytes. The victims are usually psychotic. Death occurs due to cardiac arrhythmia produced by electrolyte imbalance.

Postmortem diagnosis should be based on history and low levels of sodium and chlorides in vitreous fluid. Potassium levels are normal or high, as it is rapidly released from the cells of the body after death, even in the vitreous.

INSULIN: It is a white powder with bitter taste.

Symptoms: Weakness, fatigue, vomiting, dizziness, tachycardia, hypotension, anxiety, confusion, blurred vision, drowsiness, cramps, tremors, profuse sweating, tingling, heavy deep breathing maniacal behaviour, delirium, shock, coma and death.

Treatment: (1) Give 10 to 20 g. glucose orally in a solutionh (or a high carbohydrate food). (2) 50 ml. of 50% glucose i.v. Then continuous infusion of 10% glucose.

Skin and underlying tissue from the injection site should be preserved with control skin from another site and refrigerated and sent unfixed for assay.

Serum should be separated, fluoride added and frozen. Vitreous humor, blood and urine should be preserved by fluoride. Immuno-assay and C-peptide assist in distinguishing endogenous from exogenous insulin. Insulin can be recovered from bile by radioimmunoassay.

M.L. Importance: (1) Impairment of ability to drive a vehicle. (2) Homicide is very rare. (3) Hypoglycaemia (non-insane automatism).

NITRATES AND NITRITES: (1) Inorganic nitrates: Sodium nitrate, potassium nitrate, bismuth subnitrate, silver nitrate. (2) Organic nitrates: Nitroglycerin, isosorbide dinitrate, ethyl nitrate, mannitol hexanitrate. (3) Inorganic nitrites: amyl nitrite, isobutyl nitrite, sodium nitrite. (4) Organic nitrites: (a) Bismuth subnitrate in contaminated well water may be converted by intestinal bacteria to nitrites and may cause poisoning. (b) Nitrates in contaminated water in the presence of Bacillus subtilis spores in dried milk powder are transformed to nitrites. Sodium nitrate tastes like and can be mistaken for sodium chloride.

They are available in many houses as medicines. Sodium nitrate is used as a mordant by weavers.

ACTION: Sodium nitrate causes relaxation of smooth muscle, especially of small blood vessels and in toxic doses converts haemoglobin to methaemoglobin by oxidising iron from the ferrous to the ferric state.

FATAL DOSE: Sodium nitrate one to 2 g; nitroglycerine 200 mg; silver nitrate 2 to 10 g.

FATAL PERIOD: Few hours to few days.

SYMPTOMS: Throbbing headache, vertigo, low blood pressure, palpitations, later cold and cyanotic; nausea, vomiting, colick, bloody diarrhoea; syncope, especially when attempting to stand upright; methaemoglobinaemia, cyanosis and anoxia; hyperapnoea and later dyspnoea, slow pulse; disorientation, raised intracranial pressure and intraocular tension; paralysis, coma followed by clonic convulsions; death due to circulatory collapse.

Amyl nitrate and isobutyl nitrates are inhaled (drug abuse) for "getting high". They may be used as an aphrodisiac and to enhance and prolong sexual orgasm and also by some homosexual men to relax anal sphincter.

TREATMENT: (1) Induce emesis with ipecac, if the patient is alert followed by activated charcoal. (2) Gastric lavage with intubation. (3) Magnesium or sodium sulphate or sorbitol. (4) If methaemoglobinaemia is more than 30% inject methylene blue 1 to 2 mg/kg (1% solution) or 50 mg/kg orally, which converts methaemoglobin to haemoglobin. (5) Exchange transfusion for infants and for patients who do not respond within half to one hour and those with met-Hb level of more than 70%. (6) Symptomatic.

NON-STEROIDAL ANTI-INFLAMMATORY DRUGS (NSAID): Classification: (1) Pyrazolones. (2) Propionic acid. (3) Fenamic acids. (4) Heterocyclic acetic acids. (5) Aryl acetic acid. (6) Oxicams. (7) Sulphonanilide.

ACTIONS: Most of these drugs act by inhibiting prostaglandin synthesis.

SYMPTOMS:GIT: Nausea, vomiting, epigastric pain, peptic ulceration. C.N.S.: Drowsiness, lethargy, confusion, vertigo. C.V.S. Hypotension, aplastic anaemia, R.S. Cyanosis, Renal: Acute tubular necrosis, or acute interstitial nephritis. Hepatitis and hepatic necrosis.

FATAL DOSE: Ten to 20 gm or more.

TREATMENT: (1) Gastric lavage. (2)Activated Charcoal. (3) Haemoperfusion in severe cases. (4) Symptomatic.

ANTIHISTAMINICS: The commonly used preparations are : antazoline, (antistine), diphenhydramine (benadryl), alopyramine hydrochloride (synopen), meparamine maleate (anthisan), and promethazine hydrochloride (phenergan). Other preparations are: tripelemamine, chlorpheneramine, cemetidine, ranitidine, nizatidine and famotidine.

SYMPTOMS : In adults CNS depression is the usual dominant reaction characterised by drowsiness, lethargy, fatigue, hypnosis and coma. There is vertigo, ataxia, tinnitus, dilated pupils and blurred vision. The initial sedation is often followed by CNS hyperexcitability; sometimes the excitement is the first evidence of poisoning. This causes tremors, anxiety, insomnia, excitement, delirium and convulsions. Anticholinergic features (mydriasis, hyperthermia and flushing) are seen. Gastrointestinal symptoms are : dry mouth, anorexia, nausea, vomiting, abdominal pain, constipation or diarrhoea. There may be loss of balance, hallucinations, tachycardia, retention of urine and skin rashes. Finally, there is severe central nervous depression, and death results from respiratory failure or cardiovascular collapse.

Poisoning is usually accidental and sometimes suicidal. One gram is fatal.

TREATMENT : (1) Stomach wash. (2) Activated charcoal. (3) Diazepam. (4) Physostigmine 0.5 to 2 mg. i.v. every hour, until reversal of symptoms occur. However, it can produce serious adverse effects. (5) Symptomatic.

AUTOPSY: Signs of asphyxia are found.

CAFFEINE: Caffeine stimulates gastric acid,

pepsin and secretions from small intestine. Large doses can stimulate directly the myocardium to produce tachycardia, arrhythmias and extrasystoles. It increases cardiac output and stroke volume. It decreases fatigue. Adrenaline and noradrenaline secretion is increased. It can increase the basal metabolic rate by about ten percent. It also increases oxygen consumption. It acts as diuretic. Significant amounts of caffeine are present in tea, cola beverages and chacolates.

FATAL DOSE: One to two gm.

Doses of 50 to 200 mg. result in increased alertness, decreased drowsiness, and lessened fatigue. Doses of 200 to 500 mg. may produce headache, tremors, nervousness, irritability and slight increase of blood pressure. At level of one gram (8 to 10 cups of coffee) per day, a combination of physiological and behavioural symptoms like anxiety-like presentation, insomnia, headache and depressive presentation can appear. With ten grams of caffeine, grand mal seizures, and cardiorespiratory arrest may occur.

Withdrawal symptoms are: headache, yawning, nausea, drowsiness, lethargy, rhinorrhoea, irritability, nervousness and depression.

SULPHONAMIDES: It occurs as white crystalline substance which is odourless with slight bitter taste. It has bacteriostatic or bactericidal action. Large doses, or continued use may produce toxic effects and death. In some persons toxic effects may be produced from a small dose due to idiosyncrasy.

SIGNS AND SYMPTOMS: Headache, anorexia, abdominal discomfort, vertigo, nausea, vomiting, visual disturbances, cyanosis or blueness of the skin due to the presence of sulphhaemoglobinaemia or methaemoglobinaemia, skin rashes, peripheral neuritis, oliguria, agranulocytosis, thrombocytopaenia, purpura, delirium, and delusions.

Treatment is only symptomatic.

POST-MORTEM APPEARANCES: The kidneys may show crystals of sulphonamide blocking the tubules. The lungs are congested and oedematous. The stomach, spleen, liver and brain are congested. The bone marrow is aplastic in acute agranulocytosis

FORMALDEHYDE: It is a colourless gas having a strong, pungent, irritating odour. 40% solution in water is known as formalin. It is used as disinfectant, for preservation of museum specimens, in plastic, in dyeing, hardening of celluloid and as a reducing agent. It gives off vapour at room temperature. Commercial formalin contains 37% formaldehyde and 10 to 15% methanol. It is readily absorbed in upper respiratory tract. It is metabolised to formic acid in liver and blood.

FATAL DOSE: 30 to 60 ml.

FATAL PERIOD: One to two days.

SYMPTOMS: Inhalation of vapour causes burning of eyes, lachrymation, coughing, constriction in chest and palpitation. Ingestion produces symptoms similar to strong acid. It can cause contact dermatitis. Chronic exposure can result in allergic contact dermatitis, chronic obstructive pulmonary disease and optic neuritis.

TREATMENT: (1) Wash the stomach witn 0.1% solution of ammonia, as it reacts with formaldehyde to form harmless methenamine. (2) Symptomatic.

POST-MORTEM APPEARANCES: Smell is noted on opening the body. Mucosa of the stomach may be red, inflamed and eroded with extravasation of blood, or it may be hard and tough like leather. The intestines and lungs are congested. The liver may show fatty degeneration and the kidneys may be inflamed.

CHAPTER 33
DELIRIANT POISONS

DATURA FASTUOSA

Two varieties of this plant exist: (1) Datura alba, a white flowered plant, and (2) Datura niger, a deep-purple flowered plant. It grows on waste places all over India. The fruits are spherical and have sharp spines (thorn-apple), and contain up to 500 yellowish-brown seeds. The flowers are bell-shaped. Datura stramonium grows at high altitudes in Himalayas. All parts of these plants including nectar (honey) are poisonous, especially the seeds and the fruit. They contain 0.2 to 1.4% of hyoscine (scopolamine), hyoscyamine, and traces of atropine.

Alkaloids: An alkaloid is a complex substance having a nitrogenous base, and is found in various plants. Chemically, it behaves like an alkali in that it unites with acids to form salts. Its basic quality depends on the pyridine nucleus. In nature they are usually combined with certain acids to form salts. In plants they are not uniformly distributed but are concentrated in different structures, such as the root, bark, leaves, or seeds, which vary with the species. They act mainly on some portions of the central nervous system, each compound having its own individual action. Some of the important alkaloids are atropine, hyoscine, morphine, quinine, strychnine, aconitine, ergotoxine, cocaine, and codeine. The toxicity of different alkaloids varies greatly, aconitine bieng 1,000 times as toxic as quinine. Some synthetic substances, such as amphetamine, heroin, pethidine, methadone, also behave chemically like alkaloids. Some alkaloids, e.g. strychnine, morphine and aconitine are quite resistant to putrefaction, while others, e.g. cocaine decompose rapidly.

Action: The alkaloids atropine, hyoscyamine and hyoscine first stimulate the higher centres of brain, then the motor centres and finally cause depression and paralysis, especially of the vital centres in the medulla. The respiration is first stimulated, then depressed, and the heart centre is stimulated. Peripheral effects are predominant and result from anticholinergic (parasympatholytic) action.

Signs and Symptoms: Contact with leaves or flowers causes dermatitis in sensitive persons. If the seeds are eaten, symptoms appear within half an hour, if a decoction of the seeds is given within a few minutes and if alkaloids are used almost immediately. A bitter taste, dryness of mouth and throat, with difficulty in talking, dysphagia, burning pain in the stomach and vomiting are first noticed. The voice becomes hoarse. The face becomes flushed, conjunctivae congested, pupils widely dilated with loss of accommodation for near vision, developing in temporary blindness, photophobia and diplopia. Light reflex at first is sluggish and later absent. The pollen can cause unilateral mydriasis (cornpicker's pupil). Mental changes include restlessness and agitation and patient cannot recognise relatives or friends. Urinary retention and inability to pass urine occurs. The patient becomes confused, giddy, staggers as if drunk. The skin is dry and hot, the pulse rapid 120 to 140 per minute, full and bounding, but later becomes weak and irregular, and the respirations are increased. The temperature may be raised by 2 or 3 degrees. Hyperpyrexia is caused by atropine, amphetamine, dinitro-orthocresol, suxamethonium, and halothane. Muscle tone and deep reflexes are increased, and there may be muscular spasm or convulsions. A scarlatinal rash or exfoliation of the skin may be seen over most of the body. **Delirium** is restless and purposeless; in its earlier stages it is indicated by excitement, talkativeness and incoherence. The patient may be silent but usually he is noisy, tries to run away from his bed, picks at the bed clothes, (carphologia), tries to pull imaginary threads from the tips of his fingers, threads imaginary needles. Hallucinations of sight and hearing and delusions occur. As intoxication advances this excitement passes off in

Fig. (33–1). Longitudinal section of datura and capsicum seeds.

Table (32–1) Difference between the seeds of datura and capsicum.

	Trait	Datura seeds	Capsicum seeds
(1)	Size:	Large and thick.	Small and thin.
(2)	Shape:	Kidney-shaped.	Rounded.
(3)	Colour:	Dark or yellowish-brown.	Pale-yellow.
(4)	Margins:	Laterally compressed and double-edged at the convex border.	The convex broder is simple and sharp.
(5)	Surface:	Numerous small depressions.	Smooth.
(6)	Smell:	Odourless.	Pungent.
(7)	Taste:	Bitter.	Pungent.
(8)	Embryo:	On longitudinal section embryo is curved outward at the hilum.	Embryo is curved inwards like figure (6).

one to two hours, and the patient passes into deep sleep or coma which may end rarely in death from respiratory paralysis. The patient may remain in this condition for 2 to 3 days but usually distinct improvement occurs in 24 hours.

8 D's: Dryness of mouth, dysphagia, dilated pupils, dry, hot skin, drunken gait, delirium, drowsiness, death due to respiratory failure.

Fatal Dose: 0.6 to one g. (100 to 125 seeds).

Fatal Period: 24 hours.

Treatment: (1) Emetics can be used. (2) Wash-out the stomach repeatedly with a weak solution of tannic acid. (3) Wash-out the lower bowel frequently. (4) Physostigmine one mg., i.v. or i.m., at hourly intervals. In many cases a single dose is sufficient. (5) Pilocrapine nitratre, 5 mg. s.c. is useful, but it does not counteract action of datura on brain. It can be repeated after two hours. (6) Morphine is to be avoided because of the danger of depressing the respiratory centre. (7) Delirium can be controlled by bromides and short-acting barbiturates, but ether or chloroform is more beneficial . (8) Light diet, and free purgation should be carried on for 3 to 4 days to remove the seeds and to increase intestinal motility. (9) Symptomatic.

Post-mortem Appearances: They are not characteristic, but are those of asphyxia. Seeds or their fragments may be found in the stomach and intestines. The stomach may show slight inflammation and the lungs oedema. The seeds resist putrefaction for a long time.

The Circumstances of Poisoning: Crushed or powdered seeds or an extract is used by criminals for stupefying a victim prior to robbery, rape or kidnapping **(Road Poison)**. It is usually given in food or drink, e.g., *chapatis*, curry, sweets, tea, liquor, etc., to travellers in railway stations, choultries, etc. Sometimes, the seeds are mixed with incense wood, and the victim is exposed to the fumes which cause lethargy. The victim soon falls into a deep sleep and later wakes up to find his belongings lost. It is not taken by the suicide. Homicide is very rare. It is sometimes used as an abortifacient. It is believed to have aphrodisiac properties. Accidental cases occur usually in children by eating the fruits. The seeds and leaves are mixed with tobacco or ganja and smoked in a pipe. A decoction of seeds is sometimes added to liquor or toddy to increase the intoxicating property. It is sometimes used as love philter. A person suffering from delirium of datura is not criminally responsible for his acts.

Mydriatic Test: A drop of the solution to be tested is put into the eyes of a cat. The pupils dilate within half hour if datura is present, due to the presence of atropine.

ATROPA BELLADONNA AND HYOSCYAMUS NIGER: The Atropa belladonna, or deadly nightshade is a plant of Europe and Asia. All parts are toxic, more so in maturity. The active principle is mainly l- hyoscyamine. The root contains 82 to 97% of hyoscyamine, 3 to 15% atropine, and up to 2.5% scopolamine. This group of compounds acts by inhibiting the muscarine effects of acetylcholine. They are absorbed from skin and from parenteral sites. They are rapidly detoxicated in the liver. The signs and symptoms, treatment and post-mortem appearances are similar to datura. 120 mg. of atropine or hyoscyamine and 30 mg. of hyoscine are fatal within 24 hours.

CANNABIS SATIVA OR INDICA

It is also known as Indian hemp, hashish, marihuana, pot, dope, grass. The plant grows all

over India, but its cultivation is restricted by law. The female plant is taller, about 4 to 6 metres, and has more darker and luxuriant foliage than the male. The active principles are contained in its resin. The principal constituent of the resin are cannabinol, which has no action, cannabidiol is also inert, but on exposure to heat, it is partly converted to the very active isomeric tetrahydrocannabinols (THC). All parts of the plant, male or female, contain the active material, except stem, root and seeds. It is a CNS stimulant. It is variously known as pot, grass, weed, hash, mary jone, M.J., hashish or bhang. It is a psychoactive drug. THC is metabolised in the liver and excreted in the urine and faeces. It is used in the following forms.

(1) Bhang *(siddhi, sabji):* It is prepared from the dried leaves and fruit shoots. It is used as we use tea to prepare a decoction. It is the mildest and contains 15% of active principle. Fresh bhang is highly intoxicating and narcotic. Bhang kept in storage for two to three years is mildly stimulating and pleasure-giving.

(2) Majoon : It is a sweet prepared with bhang. It increases the appetite and sexual desire.

(3) Ganja : It is prepared from the flower tops of the female plant. It has a rusty-green colour and a characteristic odour. It is mixed and smoked with tabacco in a pipe or *hukka.* It contains 15 to 25% of the active principle. Ganja (pot, grass, weed,maryjone,) also known as marihuana, is used for smoking in cigarettes, which contain 0.3 to 0.6 g. cannabis and are known as **Reefer or Joint.**

(4) Charas or hashish : It is the resin (dope or shit) exuding from the leaves and stems of the plant, and it contains 25% to 40% of the active principle. It is dark-green or brown in colour. It is mixed and smoked with tobacco in a pipe or *hukka.* The smoke is inhaled deeply into the lungs and retained for as long as possible for potent effects. Persons habituated to cannabis, both drinkers and smokers, prefer to smoke or drink in company.

Signs and Symptoms : They appear soon after smoking and last for one to two hours, and within half-an-hour after swallowing and last for 2 to 3 hours. Taken in small dose, the effects are very slight, which usually include euphoria, passivity, heightening of subjective experiences, and disorientation. With moderate doses these effects are intensified by impaired immediate memory function, disturbed thought patterns, lapses of attention, and a subjective feeling of unfamiliarity. High doses produce changes in body image, depersonalisation and marked sensory distortion.

Fig. (33–2). Cannabis Indica.

Symptoms of Intoxication: (a) Psychiatric: (1) Feelings of detachment, clarity, cleverness, disinhibition, depersonalisation, euphoria, elation, relaxation, well-being, dreaminess, sleepiness, self-confidence, jocularity, laughing, silliness, rapidly changing emotions. (2) Thought processes: irrelevant thoughts, altered reality testing, decreased concentration and attention span, altered sense of identity, disorientation. (3) Sensory novelty and increased awareness of stimuli:vivid images, illusions and hallucinations. (4) Feelings of precordial distress and tightness in chest; fear of dying. (5) Altered concepts of time and space. Change in body image, self-confidence, altered sexual feelings. (6) Maladaptive behavioural effects: impaired judgement, failure to meet responsibilities. (7) Speech changes: rapid, impaired, talkative, flighty, poor immediate memory. **(b) Physical:** Increased appetite and thirst, slight nausea, heaviness and pressure in the head, dizziness, dysesthesias, somnolence, paraesthesias, restlessness, ataxia, tremors, dry mouth, tachycardia, urinary frequency, injected conjunctivae. The characteristic odour of cannabis may be perceived if the drug has been smoked, but not if it has been ingested.

Sensitive individuals, particularly persons recovering from a mental illness, may become paranoid after a relatively low dose. The victim

becomes drowsy and passes into deep sleep, and wakes with exhaustion and impaired mental function, and recovery occurs in about six hours. Deaths occur with extreme rarity due to respiratory failure.

Fatal Dose : Charas 2 g.; ganja 8 g.; bhang 10g./ kilo body weight. THC 30 mg/kg.

Fatal Period : Several days.

Treatment : (1) Stomach wash or emesis, activated charcoal and cathartic. (2) 100 ml. of 50% glucose, 2 mg. naloxone, and 100 mg. thiamine i.v. (3) 5 to 10 mg. diazepam, if the patient is violent or aggressive. (4) Assure the patient that he will recover. (5) If flashbacks occur give anti-anxiety and if necessary anti-psychotic drugs, such as haloperidol. (6) Psychotherapy.

Post-mortem Appearances : These are not characteristic, but are those of asphyxia.

Chronic Poisoning : The use of the drug in small quantities even for long period is not harmful. Tolerance and psychological dependence develop. Used in excess, it causes degeneration of the central nervous system and insanity. Chronic use reduces serum testosterone and sperm count, and is associated with gynaecomastia. There is loss of appetite, weakness, wasting, tremors, sleepy facial expression, vacant look, red eyes, impotence and moral and mental deterioration. Rarely they become insane (hashish insanity), and may suffer from auditory and visual hallucinations and delusions of persecution. Heavy marijuana users may develop manic or paranoid psychosis. The person may **run amok,** i.e., he develops a psychic disturbance marked by a period of depression, followed by violent attempts to kill people (impulse to murder). He first kills a person against whom he may have real or imaginary enemity and then kills anyone that comes in his way until the homicidal tendency lasts. Then he may commit suicide or may surrender himself. If the abuse is continued for a considerable time, it may lead to behavioural problems, crime and even mental derangement.

It does not cause physiological dependence or addiction. Cannabis compounds and LSD can be detected in biological specimens by radioimmunoassay procedures. Marijuana is a potential carcinogen.

The Circumstances of Poisoning : Most of the cases of poisoning are due to overindulgence, but there may be accidental ingestion or inhalation. Majun and charas are sometimes used by road poisoners to stupefy persons to facilitate robbery. It is sometimes taken by criminals before committing a criminal act, to strengthen the nerves. It is used as an aphrodisiac and is supposed to increase the duration of coitus.

The experiences of people vary depending on life experiences and personality styles. The environmental and social setting in which it is smoked or ingested as well as the dose can change the effects. It is usually taken only once in a day in the evening when the person feels tired. Ascetics and religious mendicants often take cannabis to overcome hunger and thirst, and believe that it helps in the concentration of mind towards meditation. *Fakirs* often believe bhang frees them from worldly attachments and brings about participation with divine spirit.

COCAINE

It is obtained from the leaves of Erythroxylum coca, which grows in South America, India, Java, etc. It is a colourless, odourless, crystalline substance with bitter taste. It is used as local anaesthetic. It is also known as coke, snow, cadillac and white lady. Crack is prepared by combining cocaine with baking soda and water, which is suitable for smoking.

Action : It desensitises the terminal nerves and causes vasoconstriction at the site of application. It is a powerful stimulant of CNS for a short time, followed by depression. Similar but less marked effect is seen on the spinal cord.

Absorption and Excretion : It is rapidly absorbed from the mucous membranes and from the subcutaneous tissues. The usual routes of intake are by application to the nasal mucous membrane (snorting), and by the i.v. route. It is also smoked. It is rapidly hydrolysed by liver and plasma esterases to ecgonine methyl ester and by non-enzymatic hydrolysis to benzylecgonine. The biological half-life of cocaine is half to one-and-half hours. It appears almost immediately in the urine. It is destroyed in the liver and is excreted in the urine within 24 hours in its metabolised forms. Cocaine, amphetamine and barbiturates can be found in the stomach even when given parenterally. Cannabis interferes with motor skills and judgement, leading to motor vehicle accidents.

Signs and Symptoms : When inhaled, the onset of action is within one to three minutes; when used i.v. or smoked it acts in seconds and peak action is in 3 to 5 minutes; when applied topically to the

nasal mucosa, it peaks in 20 to 30 minutes; when ingested orally it peaks within 60 to 90 minutes. Its action is short, and as such it has to be taken every one-fourth to one hour to maintain a high.

(1) **Stage of Excitement :** There is bitter taste, dryness in the mouth, dysphagia, feeling of well-being and loss of depression and fatigue. The patient may be excited, restless and talkative, but this passes into a calm, dull condition. The pulse is rapid, respirations rapid and deep, pupils dilated, headache, pallor of the skin, cyanosis, sweating, and the temperature is raised. It produces hypertension like amphetamine which may lead to cerebral bleeding. The reflexes are exaggerated, and there may be tremors or convulsions. Occasionally, the patients may have hallucinations and become maniacal. There is often a feeling of tingling or numbness in the hands and feet, and a numb feeling at the place where the drug has touched, e.g. nose and back of throat, when it has been sniffed. With spinal anaesthesia there is an occasional case of post-anaesthetic myelitis, which leads to permanent symptoms of cord degeneration.

(2) Stage of Depression : Within an hour or even less, respirations become feeble, profuse perspiration, collapse, convulsions and death occurs. Death is due to respiratory failure, cardiac failure, or vascular collapse. Sudden death may occur following i.v. injection, and smoking than snorting, due to cardiac arrhythmias due to direct action on myocardium, and cardiopulmonary arrest.

Cocaine produces hypertension which like amphetamine may lead to cerebral bleeding.

Large doses or a "binge" may result in anxiety and panic leading to paranoia. A combination of cocaine and heroin taken by injection is known as **"speedball".**

Fatal Dose : One gm. orally. Procaine is about half as toxic as cocaine; butacaine is twice and dibucaine five to ten times.

Fatal Period : Few minutes to few hours.

Treatment : (1) If it has been taken by mouth, gastric lavage should be performed with warm water containing potassium permanganate, charcoal or tannic acid. (2) If applied to the nose or throat, wash-out the mucous membrane with water. (3) If injected, apply a ligature above the part. (4) Convulsions should be controlled with chloroform or short-acting barbiturates. (5) Amyl nitrite is antidote and is given by inhalation. (6) Airway and circulatory stabilisation. (7) Thiamine 100 mg. i.v. (8) Naloxone hydrochloride 2 mg. i.v. (9) The symptoms should be treated on general lines.

Post-mortem Appearances : There are no specific findings, though there may be intense asphyxial signs. Heart may show foci of scarring which may be the source of fatal dysrhythmias. Cocaine decomposes rapidly. Blood should be preserved by adding fluoride. Brain should be analysed as it does not hydrolyse cocaine into benzolecognine as in blood.

Cocaine can be recovered from recent injection sites, or by swabs from the nasal mucosa.

Cocaine Habit : It is also known as cocainism, cocainophagia or cocainomania. Chronic abusers can tolerate ten grams a day. It causes digestive disturbances, anorexia, salivation tachycardia, tachyapnoea and insomnia. The face is pale, eyes sunken, pupils dilated, and the gaze 'shifty'. The tongue and teeth are black. Over a period of time, the addict loses interest in family, friends, food, sexual activity, etc. and appears emaciated and physically exhausted. Sometimes a manic, paranoid or depressive psychosis develops. Complications include persistent rhinitis, nasal erosions, sinusitis, chronic cough, bronchitis, etc. The sniffing habit leads to ulceration of the nasal septum, but perforation is very rare. Degeneration of central nervous system occurs, and the patient may suffer from hallucinations, convulsions, delirium and insanity. **Magnan's symptom or cocaine bugs** is characteristic, in which there is a feeling as if grains of sand are lying under the skin or some small insects are creeping on the skin giving rise to itching sensation (formication, tactile hallucination) with resultant excoriation, leading to irregular scratches and ulcers.

It is a drug of addiction and causes lowering of moral tone and loss of decency and self-respect. The cocaine substitutes are not habit forming.

The Circumstances of Poisoning : It is rarely used for homicide or suicide. The common names of substances used by addicts are: crack, pasta, bazooka, and speed-ball. Accidental cases occur from addiction, hypodermic injection and from urethral, vesical and rectal injection. It is believed to be an aphrodisiac and to increase the duration of sexual act by paralysing sensory nerves of glans penis. Prostitutes sometimes inject cocaine solution into vagina to produce local constriction.

CHAPTER 34

DRUG DEPENDENCE AND ABUSE

A **drug** is any substance, other than those required for the maintenance of normal health, that when taken into the living organism may modify one or more of its functions (WHO).

Substance dependence arises out of a maladaptive pattern of substance use, leading to a cluster of behavioural, cognitive and physiological phenomenon that develop after repeated intake. It includes a strong desire to take the drug, difficulties in controlling its use, persisting in its use despite harmful consequences, a higher priority given to drug use than to other activities and obligations, increased tolerance, and sometimes a physical withdrawal state.

Substance abuse arises out of a maladaptive pattern of substance use, manifested by recurrent and significant adverse consequences related to the repeated intake of the substance. These problems must occur recurrently during the same 12 months period. The criteria do not include tolerance, withdrawal, or a pattern of compulsive use, and instead include only the harmful consequences of repeated use.

Substance intoxication refers to unwanted physiological or psychological effects that cause maladaptive behaviour. It must produce disturbances in the level of consciousness, cognition, perception, affect, or behaviour that are clinically significant.

Physical or physiological dependence is defined as an alteration in neural systems which is manifested by tolerance and the appearance of withdrawal phenomena when a chronically administered drug is discontinued or displaced from its receptor.

Addiction is defined as a chronic disorder characterised by compulsive use of drugs (craving) resulting in physical, psychological and social harm, and continued use despite evidence of that harm.

Alcohol and tobacco are the commonest substances abused, followed by sedatives and tranquilisers, cannabis, opiates and cocaine. Amphetamines and hallucinogens are less popular.

In India abused drugs are: alcohol, tobacco, cannabis, opiates, sedatives and tranquilisers. Cocaine and hallucinogens are used less commonly.

Drug habituation is a condition resulting from the repeated consumption of a drug, in which there is psychological or emotional dependency on the drug. Caffeine and nicotine are habit-forming drugs. **Drug dependence** includes both the terms 'addiction' and 'habituation'.

If the drug is abruptly withdrawn, a withdrawal syndrome will occur in a physically dependent person. The withdrawal symptoms are usually opposite to the effects of the drug itself. Psychological dependence is a compulsive need for a drug in order to maintain a state of well-being, and it can occur in the absence of physical dependence. Pharmacologically, addiction evolves through the following stages : (1) Habituation. (2) Physical dependence, wherein an altered physiological state exists because of the frequent exposure to the drug. Withdrawal of the drug causes physical and emotional illness, known as the abstinence or withdrawal syndrome. (3) Tolerance to many of the pharmacologic effects of the drug.

Drug abuse is a major medical problem with extensive legal, social, moral, ethical and even political problems. A person made tolerant to a large dose of one narcotic is also cross-tolerant to many of the effects of another narcotic.

Most persons use drugs of dependence with a certain discrimination, and in such cases little harm results. Indiscriminate use of any of these drugs

Table (33–1). Difference between drug addiction and drug habituation.

Trait	Drug addiction	Drug habituation
(1) Compulsion:	Present.	Desire but no compulsion.
(2) Dose:	Tendency to increase.	No tendency to increase.
(3) Dependence :	Psychological and physical.	Some degree of psychological but not physical.
(4) Withdrawal symptoms:	Characteristic symptoms.	None or mild.
(5) Harm:	Both to the individual and society.	If any, primarily to individual.

becomes dangerous, and produces a gradual mental, physical, and moral deterioration of the individual, and sometimes also sexual perversions or crime. To obtain the money for the drug the addict often turns to prostitution or crime. The majority of drug victims are neurotic individuals who are mentally unbalanced. A normal person has no tendency to become a drug addict and is most unlikely to become one, even when all the facilities are avai-lable. Hereditary factors, abnormal mental conditions, frustrations in life, anxiety, chronic tensions, physical inability to do a job, curiosity, etc. are some of the causes of drug addiction. Addicts fall in two groups. (1) Those who originally used the drug for some disease and thus have acquired the habit, and (2) those who use the drug for its narcotic effect alone. The first group are more easily cured than the second. The inability to discontinue the use of drug may be due either to a desire for satisfaction, or an anxiety to avoid the discomfort of withdrawal symptoms, or both. Most drug users appear normal.

Common adulterants for drugs of addiction include quinine, lactose, sucrose, and rarely baking soda, mannitol and magnesium silicate.

According to the Narcotics Control Bureau, there are more than 30 million amphetamine addicts in the World. This is more than the total number of heroin and cocaine addicts put together. Another estimate states that 0.5% of world population is addicted to some form of amphetamine drug today.

Symptoms of Drug Dependency : Loss of appetite and weight; clumsy movements, unsteady gait, tremors; reddening and puffiness of eyes, unclear vision; slurring of speech; loss of interest, sleeplessness, lethargy and passivity; acute anxiety, depression, profuse sweating; mood changes, temper tantrums; depersonalisation and emotional detachment; impaired memory and concentration; preference for solitude, especially spending long hours in the toilet. Acute intravenous narcotism is characterised by the appearance of fulminant pulmonary oedema and immediate collapse and death.

Money and articles disappear from home, and needles, syringes, strange packets, etc. are found at home.

Withdrawal Symptoms : They may begin within 6 to 8 hours following stoppage of the drug or they may be delayed for 24 to 48 hours, depending upon the particular drug being used. The length of period of withdrawal symptoms also varies and can last up to ten days. The intensity of the symptoms depends on the dose and type of the drug used, the duration of addiction, and the suddenness of withdrawal of the drug. Early symptoms are chilliness, sensation of cold, uneasiness, yawning and rhinorrhoea. Later, respirations become laboured, sharp and very rapid. Goose skin, lachrimation, gross tremors and dilated pupils are seen. Anorexia is present in all the stages. The third stage is one of sleep lasting from 8 to 16 hours. Upon awakening, all the previous symptoms become intense. In addition, there is tachyapnoea, fever, hypertension, pain and cramps in the legs and abdomen, perspiration, vomiting and diarrhoea.

Newborns of addicted mothers may show withdrawal symptoms from one to 56 hours after birth and require treatment. The symptoms are hyperactivity, twitchings and convulsions.

In the alleged 'rainbow' parties, multiple drugs are mixed and the experimenter selects several at random, and then is asked to explain or describe the effects of the resulting experience.

Narcotic addicts may be murdered by a **'hot shot'.** This is a dose of narcotic with poison, such as strychnine in it. In such cases, only signs of anoxia and cerebral depression are present. Another method of accidental or homicidal death is by the use of a purer drug than the addict has been using.

Cocaine, cannabis, LSD, amphetamine, and anti-depressants and anti-psychotics do not produce physical dependence. Alcohol, morphine, cocaine and LSD produce psychosis.

Treatment : (1) The person should be removed to an institution, so as to remove him from the association with which the addiction started. (2) Constant supervision to prevent addict from obtaining secret supplies of the drug. (3) Detoxification: This consists of reduction in dosage of drug over a period of one to 3 weeks. (4) Administration of drugs, such as sedatives, benezidrine, hyoscine. (5) Diverting the mind by engaging him physically and mentally in some occupation. (6) Psychotherapy (group, family or individual). (7) Improving general health. (8) Symptomatic. The treatment is successful only in 10 to 25% of cases.

Rehabilitation : Rehabilitation is a continuous process of weaning away the victims of drug dependency. It requires strong family support and follow up to prevent relapse. Social rehabilitation and training for gainful employment are the most important components after weaning addicts away

from drug dependency to prevent relapse.

PSYCHOACTIVE DRUG CLASSIFICATION : (1) Sedatives: : (a) Barbiturates and others. (b) Minor tranquilisers. (c) Alcohol. (2) Stimulants: (a) Amphetamines, methylphenidate. (b) Cocaine. (3) Opiates: (a) Heroin, methadone, morphine, etc. (4) Hallucinogens. (5) Marihuana. (6) Major tranquilisers (chlorpromazine and others). (7) Antidepressants : (a) Tricyclics. (b) Monoamine oxidase inhibitors. (8) Antimania drugs.

TYPES OF DEPENDENCE : The World Health Organisation recognises the following types of dependence.

(1) MORPHINE TYPE : It refers to addiction to morphine, heroin, opium or morphine substitutes, such as methadone. In this type, there is overpowering desire or need to continue taking the drug and to obtain it by any means and by a tendency to increase the dose due to the development of tolerance. Morphine is usually taken by i.v. or i.m. injection, or by sniffing up the nose. In opium abuse, there is always a high degree of cross-tolerance to other drugs with a similar pharmaco-logic action, even if the chemical composition of the opioids is completely different. Tolerance develops at different rates to different effects of opioids, e.g. heroin withdrawal will usually start within 8 hours, progress to a peak and then gradually improve over 48 to 72 hours, whereas withdrawal from methadone may lead to a longer abstinence syndrome. Morphine and pethidine exhibit a high degree of tolerance and physical dependence.

WITHDRAWAL SYMPTOMS: Withdrawal symptoms occur after withdrawal of the drug for more than 12 hours and last about a week. MINOR: Dilated pupils, piloerection, yawning, rhinorrhoea, myalgias and cramps, lachrimation, anorexia, perspiration. MODERATE: Restlessness, insomnia, hypertension, tachycardia, techyapnoea, diaphoresis. MAJOR: Vomiting, diarrhoea, hyperactive bowel sounds, hypotension. Death may be so rapid that the needle may still be found in the vein, when the body is discovered. Death is caused by cardiac arrest following an arrhythmia and ventricular fibrillation. A standard therapeutic regime involving a morphine type drug for 10 to 14 days is sufficient to cause dependence on the drug in the majority of patients.

(2) BARBITURATE TYPE : In this type, the desire to continue the drug is strong, and the tendency to increase the dose is partly due to tolerance. There is a cross-tolerance between these drugs and alcohol, and together they make a powerful and potentially lethal combination. The withdrawal symptoms reach a maximum in 2 or 3 days and subside slowly. Early signs are: tremor, hyperreflexia, diaphoresis, irritability, restlessness, anxiety, tinnitus, nausea, vomiting, paraesthesias, transient hallucinations, confusion, illusions, insomnia, depression, tachycardia, tachyapnoea, hypertension, convulsions. Late signs are: profuse diaphoresis, marked disorientation, persistent hallucinations, extreme agitation, tremors, restlessness, hyperthermia, tachycardia, tachyapnoea, orthostatic hypertension. Barbiturates (downers) may be combined with amphetamines (uppers) in the same 'purple heart' tablet.

Withdrawal symptoms in addiction to alcohol, barbiturates and sedative-hypnotics include: confusion, agitation, tremors, fever, bizarre behaviour and convulsions.

(3) COCAINE TYPE : In this the desire to obtain the drug is overpowering, but tolerance is absent. There is psychodependence on the drug and no withdrawal symptoms. It may cause progressively intensive toxic reactions including paranoid psychosis and its use may be combined with that of heroin or some other morphine-like compound. There is profound mental depression, which may lead to severe mental dysfunction. It produces hypertension which may lead to cerebral haemorrhage.

Crack is prepared by heating cocaine with an alkali, such as bicarbonate, which is more potent.

(4) CANNABIS TYPE : In this the need or desire is present, but there is no tolerance and usually no dose increase. There is psychic dependence only, and no abstinence syndrome. The danger of cannabis is not in itself but in the environment in which it may be used, where there may be danger of addiction to other and more dangerous drugs. A person under the influence of cannabis may injure himself or cause harm to others.

(5) AMPHETAMINE TYPE : This may be combined with barbiturates. Here the need or desire is present, and there is a tolerance to the drug, and a tendency to increase the dose. Dependence is psychic and there is no abstinence syndrome, but continuous use of amphetamines may lead to severe hyperexcitement, hallucinations and psychoses. There is hyperpyrexia and hypertension, which can occasionally precipitate a cerebral or a subarachnoid haemorrhage and a risk of cardiac arrhythmias.

COTTON FEVER : Fever developing due to injection of a water extract of the cotton remaining after the heroin supply is used in a "bag".

DRUG ABUSER'S ELBOW : Myositis ossificans resulting due to repeated needle punctures near the elbow in the I.V. drug abuser.

BODY PACKER AND BODY STUFFER SYNDROMES: Illegal drugs are compressed into cylinders of about 25x12 mm size, heat-sealed in plastic film and wrapped again in multiple layers of latex (candoms, balloons, foil, fingers of rubber gloves, etc.) and swallowed. Drugs such as loparamide may be taken to reduce gut motility. This is done for the purpose of smuggling, termed **"body-packing"**. On arrival at his destination, the courier takes a laxative, retrieves the packets and passes them on to the "pusher" who distributes the drug. Sometimes, packets become unsealed or burst in the small intestine, especially cocaine-filled containers, allowing massive absorption and cause the courier's death from poisoning. Even if the packets do not rupture, osmotic seepage across the latex wrapping allows small amounts of drug to appear in the circulation and urine. Persons arrested swallow illegal drugs for concealing the evidence from authorities. This is termed **"body stuffer"**. Most packets are seen on X-ray, and all are seen with CT scanning or barium contrast studies. Drugs may be concealed in the ears, mouth, nose, vagina or rectum.

Treatment: (1) Diazepam 10 mg. i.v. followed by 5 mg. i.v. every 5 min. until the patient becomes calm. (2) Give glucose, thiamine and multivitamins. (3) Fluid and electrolyte balance. (4) Oxygen.

CASE: A 24 year old male who swallowed 80 capsules containing 270 g of heroin (each capsule had 3 to 4 g.) and was to travel to Maldives, was arrested at Chennai airport.

VOLATILE SUBSTANCE ABUSE: Volatile substance abuse (solvent abuse, glue sniffing) involves the deliberate inhaling of a variety of substances, such as toluene, gasoline (petrol), xylene, benzene, methylene and ethylene chloride, fluorocarbons, carbon tetrachloride, butane, propane, kerosine, isopropane, amyl nitrite, acetone, trichloroethylene, methylene chloride, butyl nitrites, ketones etc., for their psychotropic and hallucinogenic properties. **Huffing** refers to inhaling vapours from a cloth that is saturated with the volatile substance and held over or near to the nose and mouth. **Bagging** refers to inhaling and exhaling into a bag that has been filled with a small amount of a volatile substance. Clinical manifestations depend on the substance abused. Gaseous substances may be introduced directly into the mouth or nose from either a large cylinder or from the small ampoule cylinders. Others are used directly from pressurised aerosol cans, including pain-relieving sprays. **Sniffing** is done by inhaling directly from the neck of a container, such as jerry cans and petro-fillers. The effects vary from a condition resembling alcoholic intoxication, and distortion of perception to actual hallucinations. The person feels powerful dreams, heightened sensation and detachment from reality. The sufferer often behaves totally irrationally, commits antisocial acts and may injure or even kill himself. Later, the abuser will often have complete amnesia for the period of intoxication. Most of the abusers are young, usually male teenagers. There is no physical withdrawal syndrome.

Cause of Death : (1) The major cause of death is due to sudden cardiac arrest, following an arrhythmia. Any sudden "flight or fright" stimulus, even some considerable time after sniffing, has the ability to precipitate ventricular fibrillation and sudden death. (2) Hypoxia and hypercapnoea from persistent rebreathing and toxic effects of the solvent. (3) Plastic bag asphyxia. (4) Aspiration of vomit. (5) Reflex cardiac arrest due to inhalation of gaseous substances. (6) Accidents, such as a fall from a balcony, drowning, etc.

Post-mortem Appearances : There may be reddening or excoriation of the skin around the nose and mouth from the irritant action of the solvent. There may be severe damage of the liver, kidneys, bone marrow and nervous system. The clothing, blood, fat, brain, and lungs should be sent for chemical examination. In suspected cases of inhaled drugs, nasal swabs should be preserved.

Drug Combination : The effects of drug combinations are different from each drug taken singly, and mixtures of drugs are particularly liable to lead to tolerance and habituation.

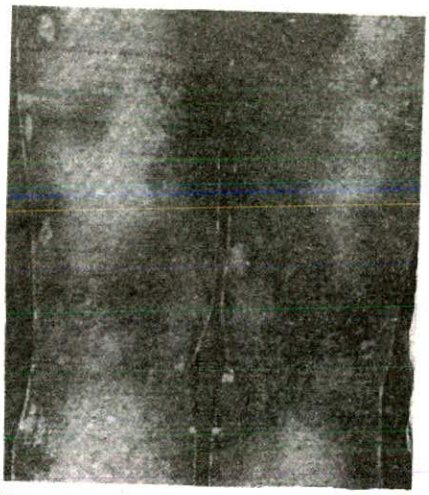
Loss of Tolerance : There is loss of tolerance following withdrawal during hospitalisation or imprisonment. The addict on being released often goes back into his old environment and resumes his addiction, taking the same dose that he did before, which may cause death.

INVESTIGATION OF DRUG ABUSE DEATHS : SCENE: The dead person's clothes should be examined and described for drugs in the pockets or hidden in seams, belt, shoes, money purse, eye-glasses case, jewellery, etc. The body should be examined for caches of drugs that may be in body orifices, taped to the body between buttocks, toes, under the breasts,

or attached to a string tied around a tooth and then swallowed. Rarely, the needle, syringe and tourniquet may be found in place on the body. The tourniquet may contain concealed drug. Sometimes, the clothing and the body may be tampered. The behaviour may indicate drug abuse. Photographs of the scene and surrounding objects should be taken. Psychedelic posters may suggest drug abuse. The surroundings should be searched and any drugs found preserved. A needle and syringe, a cooker, and a source of heat are usually present. The contents of the cooker should be sent for analysis. Tubes of plastic glue or plastic bags indicate death due to a volatile, such as glue (toluene) or solvent. Aerosol cans and balloons indicate "huffing" death.

APPARATUS AND PREPARATION OF DRUGS FOR INJECTION : Illicit narcotics are purchased " on the street" as packets of powders, tablets or capsules containing the alkaloid (usually 4 to 8%), which has been diluted (cut) by quinine, mannitol, lactose, etc. The powder is placed with water in a small receptacle, e.g. bottle cap or spoon (cooker), which is heated until the powder dissolves. The solution is then drawn into a standard or improvised syringe, usually through a bit of cotton to filter out insoluble particles. Belts or elastic bands are used as tourniquets.

AUTOPSY : (A) EXTERNAL : There is often wasting and signs of self-neglect. The body may be extensively tattooed to hide scars. Stains may be found on the tips of fingers, indicating the possible type of pill or capsule handled. Linear needle track scars, often pigmented are usually found overlying fibrosed veins of the antecubital fossae, forearms, and dorsa of the hands in "mainliners". Sometimes, needle tracks are found on scalp, neck, sublingual areas, shoulder, inguinal region, penis, vagina, popliteal area, ankle and foot. Punctate areas of black discolouration (soot tattooing) are caused by deposition of carbonaceous materials along the track of the needle. Such tattooing is called "turkey skin", as it resembles the plucked bird. Customary target areas for subcutaneous or intramuscular injection are the upper arms and thighs. Recent injection sites may show zones of inflammation surrounding or adjacent to a needle puncture site. The inflammatory foci may resolve leaving no trace, or may form abscesses or ulceration. Chronic oedema of the hands, secondary to occlusive thrombophlebitis in the forearms, is seen occasionally in long term addicts. A single fresh needle puncture shows a tiny crusted focus, but may be difficult to identify, but incision through the skin may show a perivenous haemorrhagic track. The subcutaneous heroin users show a higher incidence



Fig(34-1). Multiple scars caused by injection of drugs of dependence.

of abscess. Healing by fibrosis may produce hyperpigmented macules or retracted, circumscribed scars which resemble those from smallpox vaccinations. Additional damage to the skin and subcutaneous tissues results from attempts by the addict to obliterate the track by overlaying it with a cigarette burn or abrading with pumice stone, sandpaper or using escharotic chemicals. Multiple circular sunken atrophic scars (tissue paper scars), suggest skin popping followed by skin infection. The regional lymph nodes may be enlarged. Habitual inhalation of cocaine or heroin (snorting or sniffing) cause perforation of the nasal septum varying in size from a pinhead to several centimetres. They may be round, oval or irregular. Froth may be seen at the mouth and nose.

(B) INTERNAL : G.I. tract may contain pills or capsules. Microscopic examination of sections of stomach under polarised light sometimes shows particles of optically active filter material (e.g. starch, talc, cellulose) adherent to the gastric mucosa in victims of fatal drug ingestion. Needle scars show perivenous fibrosis in the intravenous addict and acute or chronic abscesses, or diffuse subcutaneous scarring in the skinpopper. Microscopic examination often shows foreign material in the scar tissues, e.g., fragments of cloth, cotton, talc or unidentifiable matter with surrounding foreign body giant cell reactions. Repeated injections can give rise to a chronic myopathy which is in part due to chronic infection, but is exacerbated by an auto-immune response to damaged muscle. Histologically, affected areas show fibre necrosis, replacement fibrosis and infiltration by polymorphs and lymphocytes which extends far beyond the area

of the injection. To examine the veins, make a single longitudinal incision of the flexor surface of each arm from mid-biceps to distal forearm. The incised margins are reflected widely to expose subcutaneous tissues and veins. To reduce artefactual haemorrhage, this should be done after throacic viscera have been removed. There may be phlebitis, phlebosclerosis, thrombosis, and recent and resolving perivenous haemorrhage. The vein and surrounding tissue should be preserved for chemical analysis. The most common internal pathologic changes from parenteral drug abuse consist of hepatic lymphadenopathy, and hepatic portal triaditis. Enlarged lymph nodes at the porta hepatis, adjacent to the common bile duct and at the pylorus of the stomach usually measure 3 to 4 cm. Microscopically, such lymph nodes show non-specific hyperplasia. Dense lymphocytic infiltrates involve all of the portal triads, with or without parenchymal pathologic stigmas of viral hepatitis. Typical visceral anatomic findings include the non-specific pulmonary triad of oedema, bronchopneumonia, and aspiration of gastric contents. Froth is present in the upper respiratory tract, which comes out from the nose and mouth. In mainliners, the crystals lodge in pulmonary capillaries, and produce a foreign body granulomatous reaction. Such granulomas erode the walls of capillaries and unite, forming larger granulomas. In extreme cases, the lungs have a multinodular, gritty texture, and microscopic examination under polarised light shows large quantities of talc, strach or cellulose in these lesions. Pulmonary hypertension with right ventricular cardiac hypertrophy occurs due to extensive microcrystalline pulmonary emboli. Most heroin addicts have a few optically active crystals in their pulmonary capillaries. Pleurae may show petechial haemorrhages. The lungs are usually congested and oedematous. Liver may be slightly enlarged or shows evidence of crirrhosis. The heart may show valvular diseases. Pericardial, pleural and pertioneal effusions may be found. The brain may show oedema and focal areas of necrosis involving the globus pallidus and hippocampus due to hypoxia. Hyperplastic changes in the reticuloendothelial system are common. Splenomegaly and portal lymph node hyperplasia are common. The most constant finding in both spleen and portal lymph nodes is the presence of large germinal centres, but the morphological features are not specific. Birefringent material is present in spleen more often than in portal lymph nodes. Lysozyme containing cells are found in the spleen indicating bacterial contamination. The presence of significantly more IgM and IgE containing cells in spleen and portal lymph nodes indicates acute, subacute and chronic antigen stimulation.

COMPLICATIONS OF DRUG MISUSE: Drugs of abuse may be taken by injection (intravenous, subcutaneous or rarely intramuscular), by sniffing into the nostrils, through rectum or vagina, by inhalation, smoking or orally. These different routes may produce different physical lesions.

(1) Self-neglect, malnutrition, dental decay. (2) Complications of injections: The veins in the arms, hands, legs and sometimes abdomen, groin or neck are damaged. Over-use of the same veins produces thrombosis and phlebitis, especially if the substance is irritative or unsterile and pulmonary embolism. The veins become dark in colour, may be hard and cord-like due to thrombosis and fibrosis, and may ulcerate. When healed, there may be white or silvery linear scars in the axis of the limb. Fragments may be injected which lead to micro-emboli in the lungs and liver, where they form granulomas or abscesses. (b) Intra-arterial injection may cause vascular damage and gangrene. (c) Infection: Cellulitis and abscess formation at the injection site, and depressed areas of fat atrophy may be present. Fat necrosis and chronic myositis may be seen. Septicaemia and subacute bacterial endocarditis may occur. (2) Inhalation may precipitate asthma or bronchitis, pneumothorax, pneumomediastinum, and vomiting. (3) Shared syringes and needles can transmit hepatitis B and C, HIV, syphilis and malaria. (4) Acute and chronic liver disease. (5) Kidney problems and amyloidosis. (6) Psychiatric complications. (7) Tuberculosis and pneumonia due to reduced resistance and poor nutrition. (8) They are more commonly involved in various accidents due to impairment of alertness and behaviour. (9) The need to obtain money may lead to squalor, theft and prostitution. (10) Personal violence and murder is more common. (11) Acute myopathy, meningitis, brain and pulmonary abscesses, various neurological abnormalities, acute muscle necrosis with myoglobinuria and renal failure are rare complications. (12) Death can occur due to overdose or from contaminants.

OVERDOSAGE AND HYPERSENSITIVITY: Death can occur rapidly, especially with i.v. use of heroin. Due to hypersensitivity, sometimes a first time user may die rapidly and the needle and syringe may be found in the vein. Death appears to be due to acute left ventricular failure and gross pulmonary oedema. Froth may be seen exuding from the mouth and nose.

CHEMICAL ANALYSIS: The stomach contents, liver, kidneys, lungs, blood, urine, bile, blood vessels, and injection sites should be sent for chemical analysis. Nasal secretions are useful for cocaine, opiates and drugs which are inhaled or "snorted". Blood should

be obtained from a peripheral site, preferably femoral vein, preserved by sodium fluoride and stored at 4°C.

TOXICOLOGIC RADIOLOGY

In cases of ingestion of hydrocarbons, chest X-ray may show basilar infiltrates, perihilar densities, atelectasis, pleural effusion, etc.

RADIO-OPAQUE POISONS are heavy metals, aspirin, acetazolamide, ammonium chloride, busulphan, carbon tetrachloride, chloral hydrate, enteric-coated tablets, iodides, methotrexate, penicillin G & K, phenothiazines, potassium chloride, permanganate, sodium chloride.

DRUG ABUSERS : Heroin or cocaine carriers swallow machine-made condom wrapped, or aluminium-foil wrapped packets (body packers). The abdominal film may show an atypical gas pattern or an unusual number of rounded, cigar-shaped or oblong masses with a complete gas halo. Symptomatic patients may have signs of oesophageal, gastric or small bowel obstruction or an ileus resulting from a large number of bags swallowed or the size or position of a particular bag. Typically, obstruction occurs at the ileo-caecal valve.

X-ray of abdomen of an opioid abuser (esp. methadone) may show marked ileus and severe colonic distension due to faecal retention (pseudo-obstruction). Crack (the volatile alkaloidal form of cocaine) is rapidly absorbed by deep inhalation and leads to the rupture of alveolae and produces pneumothorax, pneumo-mediastinum and/or neck and pre-cervical subcutaneous emphysema.

X-ray of chest of a parenteral drug abuser may show diffuse granulomatous changes due to chronic parenteral abuse, and the concomitant injection of the inert, insoluble ingredients of oral preparations or talc. Septic pulmonary emboli appear as round or wedge-shaped densities that may clear later or cavitate. Aspiration pneumonitis or non-cardiogenic pulmonary oedema also occur.

Chest X-ray may show pulmonary abscesses caused by aspiration pneumonitis or after i.v. injection of toxic organic or inorganic materials or bacteria. Aneurysms and pseudoaneurysms may be seen in mainliners. Injections into the internal or external jugular veins, subclavian veins, femoral artery or vein may produce aneurysms, pseudoaneurysms, intrathoracic haemorrhage, vascular obstructions or arteriovenous fistulae. A necrotising angitis similar to periarteritis nodosa may result from parenteral amphetamine and cocaine associated with microaneurysms, segmental stenoses and thromboses in the kidney, liver, pancreas and small intestine. Intra-arterial injection of amphetamines, cocaine or barbiturates may produce chemical endarteritis.

GLOSSARY

Acid head = Heavy user of LSD.

Bad or bum or freak out trip = An LSD experience in which the drug effects are unpleasant and sometimes frightening. It usually lasts from 8 to 12 hours.

Busted = To be arrested.

Cutting = Mixing a drug, usually a narcotic, with other substances.

Flip = To go psychotic.

Flash-back = A transitory, spontaneous recurrence of drug induced experience in a drug-free state.

Guide = A person who "babysits" for the psychedelic user during a session.

Hangover = Temporary illness usually following recovery from durnkenness.

Mainlining = i.v.injection.

Shooting = i.v.injection.

Pot = Marihuana.

Physical dependence = Physiologic requirement for a drug to prevent symptoms of withdrawal.

Psychological dependence = The mind's need to continue taking a drug (craving) for its pleasurable effects or to avoid discomfort.

Return trip = Reappearance of LSD-like effects long after the last dose of LSD was taken.

Skin popping (joy popping) = i.m injection.

Trip = Effects of LSD.

Psychotomimetic = Psychosis mimicking.

Soft drugs = Amphetamine, barbiturates, cannabis, LSD.

Hard drugs = Opium, heroin, cocaine, methedrin.

CHAPTER 35
SPINAL POISONS

STRYCHNOS NUX VOMICA

Strychnine *(kuchila)* is a powerful alkaloid obtained from the seeds of strychnos nux vomica, and other species of strychnos, which are found in the jungles in India. Fruit is round, hard, slightly rough, glossy-orange, 4 to 5 cm. wide, with jelly-like white or pale yellow pulp. It has 3 to 5 seeds. The seeds of nux vomica contained in the ripe fruit are poisonous. The seeds contain two principal alkaloids; strychnine and brucine one-and-half percent each. The seeds also contain a glucoside, loganin. Strychnine occurs as colourless, odourless, rhombic prisms, having an intensely bitter taste. The bark contains only brucine. The fruit pulp has very low strychnine content. All parts of the tree are toxic. Brucine is allied to strychnine in composition and action. Strychnine is 10 to 20 times more poisonous than brucine.

The seeds are flat, circular discs or slightly convex on one side, concave on the other, two-and-half cm. in diameter, 6 mm. in thickness. They are ash-grey or light brown in colour, have a shining surface and covered with radiating silky fibres. They are very hard, tough and difficult to pulverize. The bark, wood and leaves contain brucine but no strychnine. Strychnine is used as a respiratory stimulant, as a rodenticide and for killing stray dogs.

Absorption and Excretion : All mucous membranes absorb strychnine. Much is taken up by the liver and muscles to be either released again to blood stream or to be destroyed. The release of strychnine from the liver and muscles produces convulsions on second or third day of poisoning, after sedation is discontinued. About 80% is oxidised mainly in the liver. It is excreted slowly by the kidneys and traces in bile, milk and saliva. It may be found in the cadaver up to four years.

Action : It competitively blocks ventral horn motor neurone postganglionic receptor sites in the spinal cord and prevents the effects of glycine (the presumed inhibitory transmitter). Widespread inhibition in the spinal cord results in 'release' excitation. The action is particularly noted in the anterior horn cells. It stimulates the cerebral cortex.

Signs and Symptoms : If swallowed uncrushed, the seeds of nux vomica have no poisonous action, as they are not dissolved in the gastrointestinal tract, and are passed entire in the faeces. When crushed seeds are taken, the symptoms are delayed for an hour or more. If the alkaloid is swallowed, the symptoms occur very rapidly, usually within five to fifteen minutes. Bitter taste in the mouth, sense of uneasiness and restlessness, feeling of suffocation and fear, and difficulty in swallowing occur. The convulsions are preceded by such prodromal symptoms as increased acuity of perception, increased rigidity of muscles, and muscular twitchings. Convulsions are produced due to direct action on the reflex centres of spinal cord, and affect all the muscles at a time. These are at first clonic, but eventually become tonic. During the convulsions, the face is cyanosed and has anxious look, eyes are staring, eyeballs prominent and pupils are dilated. Risus sardonicus results from contraction of the jaws and facial muscles in which the corners of the mouth are drawn back. The mouth is covered with froth, frequently bloodstained. The convulsions are most marked in anti-gravity muscles,

Fig (35–1). Strychnos nux vomica.

Fig.(35–2). Nux vomica seeds.

Table (34–1). Difference between stry nine poisoning and tetanus

	Trait	Strychnine poisoning	Tetanus
(1)	History :	No history of injury.	History of injury present.
(2)	Onset:	Sudden.	Gradual .
(3)	Convulsions:	All muscles of the body are affected at a time.	All muscles are not affected at a time.
(4)	Lower jaw:	Does not start in, nor especially affect the jaw.	Usually starts in, and especially affects lower jaw.
(5)	Muscular condition :	Between fits muscles are completely relaxed.	Between fits muscles are slightly rigid.
(6)	Fatal period :	One to two hours.	More than twenty-four hours.
(7)	Chemical analysis :	Strychnine found.	No poison found.

so that the body typically arches in hyperextension (opisthotonus). In supine position, the body is supported by the heels and head. The legs are adducted and extended, the arms are flexed over the chest or rigidly extended, and the hands are tightly clenched. The head is bent backwards, and the whole of the body becomes rigid, often assuming a bow-like form. Sometimes, the spasm of the abdominal muscles may bend the body forward (emprosthotonus), or to the side (pleurosthotonus). Consciousness is not lost and the mind remains clear till death. The suffering during the spasm is severe, and the patient is conscious of impending danger of death. The duration of convulsion varies from half to two minutes. In between the convulsions the muscles are completely relaxed, and the patient looks well though somewhat exhausted, and the breathing is resumed. The cyanosis lessens, cold perspirations cover the skin; dilated pupils may contract. After 5 to 15 minutes or on slightest impulse, e.g. a sudden noise, a current of air, or gently touching the patient, another convulsion occurs. In fatal cases, the convulsions rapidly succeed one another, and increase in severity and in duration, and death usually occurs after four to five convulsions. The patient cannot breathe because the diaphragm and thoracic muscles are fully contracted. Hypoxia causes medullary paralysis and death. In non-fatal cases the intervals between the convulsions become longer and the spasm less, until these entirely stop within 12 to 24 hours, and recovery takes place in a day or two.

Fatal Dose: 50 to 100 mg; one crushed seed.

Fatal Period : One to two hours.

Treatment: (1) The first step is the effective control of convulsions, i.e., the symptoms treated before the disease. The patient should be kept in a dark room, free from noise and disturbance. Convulsions may be controlled initially with diazepam 0.1 to 0.5 mg/kg. i.v. slowly, and then phenobarbital i.v. If these prove ineffective consider general anaesthesia and/or muscle relaxation immediately by using succinylcholine, curare, gallamine or pancuronium bromide. Inhalation anaesthetics are of little value during convulsion, because of fixation of respiratory muscles and therefore failure of absorption of vapour. Between convulsions, ether may be administered to the point of unconsciousness. (2) Short-acting barbiturates like pentobarbital sodium, or sodium amytal are antidotes to strychnine and should be given in dose of 0.3 to 0.6 g. i.v. (3) Wash the stomach with warm water and dilute solution of potassium permanganate, and then introduce a suspension of activated charcoal to adsorb strychnine, which should be removed later. Tannic acid may be used if charcoal is not available. (4) Acidifying the urine will increase excretion of strychnine. (5) Treat the symptoms on general lines.

Post-mortem Appearances : They are not characteristic. Rigor mortis appears early but is not necessarily prolonged. There may be signs of asphyxia. Extravasated blood may be found in the muscles. Haemorrhages are sometimes found under the peritoneal coat of the stomach. The mucosa of the stomach and duodenum may show patches of ecchymoses or congestion. The lungs, liver, kidneys, brain and spinal cord are congested.

Physiological Test : Injection of an aqueous solution of the suspected material into the dorsal lymph sac of a frog, will produce tetanic convulsions in a few minutes if strychnine is present. Later stimulation of the frog will produce convulsions.

The Circumstances of Poisoning : (1) It is

sometimes used for homicide in the form of alkaloid, or as powdered nux vomica seeds, inspite of bitter taste. (2) Suicide is rare because of the painful death. (3) Accidental deaths are more common, due to an overdose of medicinal preparation, or the poison being given by mistake, or in children by eating the seeds. (4) Sometimes, the seeds are used for killing the cattle, and as arrow poison. (5) Sometimes, it is taken as an aphrodisiac.

PERIPHERAL NERVE POISONS

CURARE: This is found in various species of strychnos. Curarine is the active principle. Its action is entirely peripheral and at the myoneural junction, and blocks the postsynaptic nicotinic acetylcholine receptors in muscles, thus causing a flaccid paralysis of skeletal muscles. It is used in the production of muscular relaxation in patients who are lightly anaesthetised. It is not poisonous when swallowed. It is absorbed through wounds or abrasions. It is used as arrow poison.

SIGNS AND SYMPTOMS : It causes gradual paralysis of limbs followed by paralysis of respiratory muscles, and death from asphyxia. There is headache, vertigo, mydriasis, blurred vision and hypotension due to the liberated histamine. The mental faculties are clear till the end. In large dose, there is a definite central action on the nervous system, which may produce a short phase of excitation with muscular movements and even convulsions, followed by depression with loss of consciousness and respiratory failure.

FATAL DOSE : 60 mg.

FATAL PERIOD : One to two hours.

TREATMENT : Atropine 0.6 to 1.2 mg. followed by neostigmine 5 to 10 mg. i.v. should be given. Physostigmine 3 ml. of 1 : 200 solution i.v. is useful. Artificial respiration should be started.

POST-MORTEM APPEARANCES are those of asphyxia.Most deaths are from its use in anaesthesia. It is used as arrow poison.

CONIUM MACULATUM (HEMLOCK)

The plant contains coniine and seven other alkaloids. Coniine content is highest in the unripe fruit and in the seeds, in the leaves especially at flowering time and in the root particularly during the summer. Hemlock was administered to Socrates, the Greek Philosopher in 399 B.C. as a form of execution.

FATAL DOSE: 60 mg, of coniine

SIGNS AND SYMPTOMS : The fresh leaves have a nauseating taste and unpleasant mousy odour. The odour of the dried leaves is strong and narcotic. Ingestion causes burning in mouth and throat, gastric inflammation, vomiting, diarrhoea, slow respiration, increased and later slow pulse, mental confusion, tremors, ataxia, sometimes blindness, progressive motor paralysis extending upwards from the extremities, coma and death from respiratory paralysis.