DO YOU SMELL WHAT I SMELL – INHALANT ABUSE
By Jeff Solheim MSN RN CEN TCRN CFRN FAEN

- Why do people use inhalants?
  - Substances are generally absorbed by the alveolus, transported to the brain where they cross the blood-brain barrier and are distributed into the central nervous system, specifically lipid-rich tissue (lipophilic).
  - Causes displacement of oxygen in the alveoli causing euphoria, dizziness, giddiness and light-headedness. The inhalants then go to the brain (lipophilic tissue) where they act as central nervous system depressants increasing the risk of bradycardia and bradypnea.
  - Effects only last a few minutes, therefore abusers frequently seek to prolong the high by inhaling repeatedly over the course of several hours.

- Types of inhalants
  - An inhalant is a liquid that vaporizes at room temperature
  - Aerosols (sprays that contain propellants and solvents) Examples include spray paints, deodorant, hair sprays, vegetable oil spray, fabric protector spray, computer-electronics cleaning spray, air freshener, analgesic sprays.
  - Gases (includes medical anesthetics as well as gases used in household or commercial products) Examples include ether, chloroform, halothane, nitrous oxide, butane lighters, propone tanks, refrigerants
  - Nitrites (dilate blood vessels and relax muscles) Examples include cyclohexyl nitrite, isoamyl (amyl) nitrite, isobutyl nitrite
  - Everyday substances. Examples include acrylic paints, adhesives, propellants, aerosols, stain removers, degreasers, dry-cleaning agents, nail polish removers, gasoline, glues, paint thinners, room fresheners, lighter fluid, shoe polish, and correction fluids.

- Methods of inhalation
  - Sniffing – inhaling directly from the original container
  - Huffing – placing a rag soaked in an inhalant over the nose and mouth and inhaling
  - Bagging – inhaling from a paper or plastic bag
  - Bagging has a higher concentration of inhalant compared to huffing and huffing has a higher concentration of inhalant compared to sniffing.
  - Glading – inhalation of air fresheners
  - Dusting – inhalation of computer cleaning aerosols
  - Spray substances directly into the mouth
  - Place substances on sleeves, collars or other items of clothing and sniffing over time.
  - Heating volatile substances and inhaling the vapors emitted.
  - Inhaling from balloons filled with nitrous oxide.

- Who undertakes inhalant abuse?
  - May start as young as five years of age but peaks around 14 years of age
  - 75% of first-time users are under the age of 18.
  - 100 – 125 deaths per year in the US attributed to inhalant abuse
  - Most common in geographically isolated areas and with socially disadvantaged populations (strongest use among American Indian and Eskimo population)
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- Common risk factors
  - Impoverished living conditions
  - Single-parent families
  - Familial abuse and drug use
  - Abuse of other substances
  - Academic background (poor grades, dropped out of school)
  - History of criminal behavior or incarceration
  - History of depression and antisocial attitudes
  - Abuse of other substances

- Physiological effects of inhalants
  - Central nervous system
    - Incoordination
    - Delirium
    - Agitation
    - Hallucinations
    - Central nervous system depression (dizziness, blurred vision, headache, stupor, lethargy, ataxia, coma)
    - Respiratory depression
    - Seizures
  - GI effects
    - Nausea and vomiting
    - Abdominal pain
    - Hematemesis
  - Pulmonary effects
    - Laryngospasm
    - Pulmonary aspiration with consequent chemical pneumonitis
  - Cardiac effects
    - Dysrhythmias (sinoatrial slowing, escape junctional or ventricular rhythms) exacerbated by exercise, emotional stimuli, caffeine intake, physical activity, tobacco use.
    - Pregnancy – unborn child may be born with fetal solvent syndrome (similar to fetal alcohol syndrome).
    - Most common causes of death from inhalants due to asphyxia, ventricular fibrillation, cardiac arrrhythmias, cerebral edema or hyperpyrexia.

- Long term effects
  - Long-term toxicity in up to 65% of non-sporadic users (spastic motor neuropathy, cognitive dysfunction, personality changes, problems with hearing and sense of smell, cerebellar dysfunction, Parkinson’s disease, optic neuropathy)

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Sudden sniffing death – inhalants sensitize the myocardium to epinephrine. The patient may also be hypokalemic, hypophosphatemic and acidotic from renal damage due to inhalant abuse. This can lead to ventricular tachycardia or fibrillation with little autopsy findings.
Specific substances

- Amyl nitrite/butyl nitrite
  - Effects: euphoriant, enhances musical appreciation, aphrodisiac
  - Sudden sniffing death syndrome
  - Suppressed immunologic function
  - Injury to red blood cells
  - Headaches, syncope and lightheadedness
  - Profound hypotension and cutaneous flushing followed by vasoconstriction and tachycardia.
  - T-wave inversion and ST depression
  - Increased intraocular pressure
  - Bronchial irritation
  - Methemoglobinemia (ingestion)

- Benzene
  - Causes euphoria followed by violent excitement
  - Coma can result from prolonged or rapid inhalation
  - Bone marrow injury with impaired immunologic function
  - Increased risk of leukemia
  - Reproductive system toxicity
  - (Lead based gas can cause lead toxicity)

- Butane/propane
  - Sudden sniffing death
  - Serious burn injuries (because of flammability)

- Fluorocarbons (Freon)
  - Sudden sniffing death syndrome
  - Respiratory obstruction and death (from sudden cooling/cold injury to airways)
  - Pulmonary irritation
  - Bronchial constriction
  - Cough
  - Dyspnea
  - Chest tightness
  - Pulmonary edema
  - Eye, nose and throat irritation
  - Liver damage
  - Cryogenic effects on tissue (freezes skin with more than 3 – 5 seconds exposure)
  - May cause complications such as compartment syndrome and amputation of digits

- Nitrous oxide
  - Altered perception and motor coordination
  - Loss of sensation
  - Limb spasms
  - Blackouts caused by blood pressure changes
  - Depression of heart muscle functioning
  - Hexane death (due to lack of oxygen to the brain).
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- Toluene
  - Desired effects (euphoria, sense of relaxation, visual and auditory hallucinations
    (often frightened with outbursts of antisocial behavior)
  - Long term users may become stuporous, in a tranquilized state.
  - Liver and kidney damage (renal tubular acidosis, metabolic acidosis,
    hypokalemia, muscle weakness, rhabdomyolysis)
  - Brain damage (loss of brain tissue mass, impaired cognition, gait disturbance,
    loss of coordination, loss of equilibrium, limb spasms, hearing and vision loss)
  - Long term use can lead to withdrawal, hypokalemia, metabolic acidosis

- Trichlorethylene
  - Sudden sniffing death syndrome
  - Cirrhosis of the liver
  - Reproductive complications
  - Hearing and vision damage

- Methylene chloride – after metabolization, can cause carbon monoxide poisoning

- Carbon tetrachloride – can cause severe liver damage

- Hydrazine
  - Anemia (due to hemolysis)
  - Renal dysfunction
  - Liver dysfunction (hypoglycemia, hyperglycemia)
  - CNS manifestations (encephalopathy and seizures)

- Care of the inhalant abuse patient
  - Presentation
    - Obvious smell on the patent
    - Substance remains on the skin
    - Glue sniffer’s rash
    - Dysrhythmias
  - Decontaminate
    - Remove contaminated clothing
    - Dermal exposure treated immediately with soap and water
    - Ocular exposure: copious irrigation with tepid water
    - Treat in a well-ventilated area
  - Monitoring
    - Initiate IV access
    - Oxygen administration
    - Initiate pulse oximetry and cardiac monitoring
    - Maintain a quiet calming environment
  - Protect the airway
  - Breathing
    - Consider intubation
    - Cautiously treat bronchospasms
      - Aerosolized beta-agonists may induce arrhythmias
      - Systemic steroids may be used as an alternative.
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- Circulation
  - Dysrhythmias
    - Adenosine for SVT
    - Lidocaine or phenytoin for ventricular tachycardia
    - Defibrillation for ventricular tachycardia and ventricular fibrillation
    - Atropine for bradycardia
    - Transcutaneous and transvenous pacemaker for bradycardia.
    - Epinephrine not recommended – beta-blockers preferred
  - Hypotension
    - Supine patient position
    - IV fluid boluses
    - Use catecholamine pressors with caution
- Neurological
  - Treat agitation, delirium and convulsions with benzodiazepines
  - Haldol for psychosis (lowers seizure threshold)
- Recommended diagnostic tests
  - Liver profile tests
  - Urinalysis
  - Serum electrolytes
    - Potassium
    - Calcium
    - Phosphorus
  - Blood Urea Nitrogen
  - Creatinine
  - Complete blood count
  - Toxicological analysis seldom helpful
  - Metabolic acidosis with hyperchloremia or anion gap
  - Methemoglobinemia (nitrites)
  - Elevated carboxyhemoglobin (methylene chloride)
  - Chest radiography
- Substance specific management
  - Alkyl nitrites
    - Methylene blue 1 – 2 mg/kg over 5 minutes for methemoglobinemia levels above 30%, repeat every 30 – 60 minutes as necessary to a maximum of 7 mg/kg
  - Methylene chloride
    - 100% non-rebreather for elevated carboxyhemoglobin levels (consider hyperbaric chamber)
  - Flourocarbons
    - Soak frostbitten area in lukewarm water for 20 – 30 minutes after exposure
    - Do not apply heat or ice
    - Apply a light coating of bland ointment (e.g. petroleum jelly) followed by a light bandage.
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- Carbon tetrachloride
  - N-acetyl-cysteine for hepatic injury and necrosis
  - Charcoal hemoperfusion and hyperbaric chamber may be required.
- Gasoline
  - Check lead levels – elevated lead treated with Edetate calcium disodium (EDTA)
- Consider psychiatric evaluation and treatment
- Lamotrigine works to reduce withdrawal