Medical Complications of Substance Abuse

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(borrowed in part from Dr. Scott Mackler)

Outline:

- Medical complications related to
  - Caffeine
  - Tobacco
  - Alcohol
  - Inhalants
  - Anabolic steroids
  - Cannabinoids
  - Amphetamines

Outline:

- Medical complications related to:
  - Barbiturates
  - Benzodiazepines
  - Cocaine
  - Psychedelics/Anesthetics
  - Opiates/Opioids

Question 1

- A baby is born with low birth weight, microcephaly, small eyes, upturned nose and a smooth, undeveloped philtrum. He fails to thrive and develops seizures. Which of the following was he likely exposed to during pregnancy?

a) Cocaine
b) LSD
c) Alcohol
d) Methamphetamine
e) Inhalants

Question 2

- Which of the following is typically not seen with Wernicke's encephalopathy?

a) Ataxia
b) Ophthalmoplegia
c) Confusion
d) Hyperthermia
e) History of alcohol dependence

Question 3

- A 43 year old male presents to the ER with chest pain, hyperthermia, hypertension and seizures. His family reports that he had been excessively using an illicit substance lately. Acute toxicity with which of the following may have caused these symptoms?

a) Inhalants
b) Alcohol
c) Barbiturates
d) Benzodiazepines
e) Methamphetamine

Question 4

- The mechanism of action by which MDMA primarily acts is:

a) increased serotonin release and inhibition of reuptake

b) increased dopamine release and inhibition of reuptake

c) increased acetylcholine release and inhibition of reuptake

d) decreased serotonin release and inhibition of reuptake

e) decreased dopamine release and inhibition of reuptake

Question 5

- Which of the following, when abused can potentially cause polycythemia?

a) Alcohol
b) LSD
c) Anabolic steroids
d) Inhalants
e) PCP

Medical Complications: Factors to Consider

- The drug
- The contaminants, dissolving agents, and paraphernalia
- The infectious pathogens
- The host
- The route
  - emphasis on parenteral routes

Medical Complications: The Drug -

- Desired pharmacologic effects
  - many have/had legit medical uses
  - Supposedly ‘recent’ U.S. trend: abuse of prescription drugs rather than illicit/impure ‘street drugs’
- Undesired pharmacologic effects
  - example: constipation from opioids
- Overdosage
- Withdrawal

The Drug – Classifications

- Caffeine
- Tobacco
- EtOH
- Inhalants
- Performance-enhancing agents (anabolic steroids; growth hormone; erythropoietin)

The Drug – Classifications, contin.

- Cannabinoids
- Amphetamines
- Barbiturates
- Benzodiazepines
- Cocaine
- Psychedelics/Anesthetics
- Opiates/Opioids

Medical Complications: Caffeine

- A trimethylxanthine
  - acts as phosphodiesterase inhibitor
- Therapeutic uses do exist
  - apnea of prematurity
  - migraine treatment
- Side-effects (selected)
  - anxiousness
  - tachycardia, arrhythmias
- Withdrawal syndrome
  - headache, irritability

Medical Complications: Tobacco

- www.cdc.gov/tobacco/overview/Fast_Facts.htm - 12/1/06 - “Cigarette smoking remains the leading preventable cause of death in this country and is responsible for an estimated 438,000 deaths per year, or about one of five deaths. An estimated 38,000 of these deaths are the result of secondhand smoke exposure.”

Medical Complications: Tobacco

- Epidemiologic links to numerous cardiovascular processes – abdominal aortic aneurysm, atherosclerosis, cerebrovascular disease, coronary heart disease (Surgeon General's Report, 2004)

Medical Complications: Tobacco

- Epidemiologic links to numerous pulmonary processes, low bone density, peptic ulcer disease
- Epidemiologic link to low birth weight and sudden infant death syndrome (Surgeon General's Report, 2004)

Medical Complications: Tobacco

- Epidemiologic links to numerous neoplasms – oral, laryngeal, lung, esophageal, stomach, pancreatic, renal, bladder, cervix, and acute myeloid leukemia (Surgeon General's Report, 2004)

Medical Complications: Alcohol

- Refer to specific EtOH lecture
- cdc.gov/mmwr - 9/24/04 - "Excessive alcohol consumption is the third leading preventable cause of death in the United States."
- Next 3 slides cut and pasted from www.cdc.gov/alcohol/factsheets/general_information.htm)

Medical Complications: Alcohol

- In 1997, about 40% of all crimes (violent and non-violent) were committed under the influence of alcohol (Bureau of Justice Statistics, 1998).
- In 1997, 40% of convicted rape and sexual assault offenders said that they were drinking at the time of their crime (Greenfield, 2000).

Medical Complications: Alcohol

- Two-thirds of victims of intimate partner violence reported that alcohol was involved in the incident (Bureau of Justice Statistics, 1998).
- Approximately 72% of rapes reported on college campuses occur when victims are so intoxicated they are unable to consent or refuse (Weschler, 2004).

Medical Complications: Alcohol

- Nearly one-half of the cases of child abuse and neglect are associated with parental alcohol or drug abuse (Grant, 2000).
- Approximately 23% of suicide deaths are attributable to alcohol (Smith, 1999).

Medical Complications: Alcohol

- Pancreatitis –
  - acute (abdominal pain, vomiting, pancreatic necrosis, pseudocyst formation). Dx – elevated serum amylase and lipase.
  - chronic (chronic abdominal pain, malabsorption due to exocrine failure, hyperglycemia due to islet cell failure)

Medical Complications: Alcohol

- Hepatic toxicity – proposed mechanisms:
  - reactive oxygen species (ROS) -> reduced levels of antioxidants -> oxidative stress -> cell injury
  - acetaldehyde and oxygen radicals -> interact with cellular proteins and macromolecules -> hybrid compounds ('adducts') -> impedes the function of the original proteins
  - the adducts may also induce harmful immune responses

Medical Complications: Alcohol

- Alcoholic hepatitis –
  - acute inflammation of the liver, often after period of heavy EtOH use
  - abdominal symptoms, sometimes fever
  - lab -> incr hepatic transaminases
    - AST(SGOT) > ALT(SGPT) (maybe by ~2x)
    - increased bilirubin

Medical Complications: Alcohol

- Hepatic steatosis
  - deposition of fat within liver parenchyma.
    - Vs. 'NASH' (non-alcoholic steatohepatitis).
  - can cause hepatic inflammation, elevated liver-associated tests which then generate more testing, anxiety, etc.

Medical Complications: Alcohol

- Cirrhosis
  - eventual fibrosis, portal hypertension, leading to numerous potential complications
    - esophageal varices
    - ascites
    - coagulopathy due to diminished clotting factor synthesis
    - hepatocellular carcinoma

Medical Complications: Alcohol

- Alcohol use in the setting of hepatitis C virus (HCV) infection can accelerate the progression toward cirrhosis

- Gastritis – inflammation of the gastric mucosa

Medical Complications: Alcohol

- Pregnancy
  - Fetal Alcohol Syndrome
    - broad range of physical, cognitive, and behavioral disabilities
    - neuroimaging -
      - reduced size of basal ganglia
      - reduced size of the cerebellum
      - impaired development or agenesis of the corpus callosum

Medical Complications: Alcohol

- Withdrawal syndromes
  - agitation
  - delirium tremens (‘D.T.’s)
- Epidemiologic association with cancers of the mouth, throat, esophagus, liver, prostate, and in women, breast

Medical Complications: Inhalants

- Nitrous oxide, nitrites –
  - mechanism:
    - vasodilation, increase in heart rate
    - smooth muscle relaxation
  - mainly used in context of sexual activity
    - potential interaction with PDE-inhibitors (e.g. sildenafil) -> severe hypotension
- Nitrous oxide
  - whipped cream canisters
- Amyl nitrite, isobutyl nitrite, butyl nitrite
  - 'poppers' – implicated in AIDS circa 1983

Medical Complications: Inhalants

- Volatile compounds -
  - mechanism: CNS depression
  - model glue (toluene)
  - butane
  - spot remover (trichlorethylene)
  - correction fluid

Medical Complications: Inhalants

- Acute toxicity:

  129 inhalant abuse deaths were reported to a national data system in 1999
  - cardiac dysrhythmias
  - 'sudden sniffing death syndrome'
  - interference with oxygenation
  - seizures
- Chronic toxicity:
  - peripheral neuropathy
  - hepatic injury (esp. hydrocarbons)
  - behavioral and cognitive impairment

Medical Complications: Performance enhancers

- Anabolic steroids
  - atherogenic lipid changes
  - increased coronary vessel reactivity
  - hepatic tumors
  - mania, aggression
- Growth hormone
  - edema
  - elevated glucose
- Erythropoietin
  - polycythemia, hyperviscosity

Medical Complications: Cannabinoids

- Marijuana
- Hashish
- Dronabinol (Marinol)
- Nabilone (Cesamet)
- Mechanism:
  - endogenous cannabinoid receptors

Medical Complications: Cannabinoids

- Acute toxicity:
  - uncommon to require medical care for acute toxicity
  - potential side-effects
    - drowsiness, dizziness
    - tachycardia
    - dysphoria
    - Visual hallucinations; psychosis
  - past issue of paraquat spraying (anti-*Cannabis* herbicide) -> acute pulmonary toxicity)

Medical Complications: Cannabinoids

- Chronic toxicity:
  - pulmonary symptoms (cough etc.)
  - concern regarding carcinogenesis
  - accelerated hippocampal neuron loss?
  - increased work-related injuries, absenteeism
- Pregnancy/in utero exposure:
  - subtle findings in childhood testing - deficits in problem-solving skills, memory, and the ability to remain attentive

Medical Complications: Amphetamines

- CNS stimulants, includes (crystal) methamphetamine, methylphenidate
- Cardiovascular complications
  - relate mainly to alpha- and beta-adrenergic agonist properties
- Neurobehavioral complications
  - relate mainly to dopaminergic (over)release and nerve terminal injury at the synapse

Medical Complications: Amphetamines

- Acute toxicity:
  - systemic
    - hyperthermia
  - cardiovascular
    - tachycardia (beta)
    - hypertension (alpha and beta)
    - myocardial infarction

Medical Complications: Amphetamines

- Acute toxicity, contin.
  - Neurologic
    - seizures
    - example: hemorrhagic stroke risk from OTC sympathomimetic amine - PPA

      "... we estimate that 1 woman may have a stroke due to phenylpropanolamine for every 107,000 to 3,268,000 women who use products containing phenylpropanolamine as an appetite suppressant within a three-day window .." NEJM 12/21/00

Medical Complications: Amphetamines

- Chronic toxicity:
  - Cardiovascular
    - dilated cardiomyopathy (reduced ventricular function)
  - Neurobehavioral
    - memory/learning impairment
    - anxiety, paranoia, psychosis
    - formication – sense of bugs crawling
    - anorexia

Medical Complications: Amphetamines

- Chronic toxicity, contin:
  - Dermatologic
    - burns from fires during home manufacturing
  - Infectious
    - 'party and play' (PnP) – behavioral disinhibition leading to transmission of HIV etc.

Medical Complications: Amphetamines

- Pregnancy
  - limited human data
  - confounded by exposure to other drugs
  - suggestion of increased rates of
    - premature delivery
    - placental abruption
    - fetal growth retardation
    - heart and brain abnormalities

Medical Complications: Barbiturates

- Sedative-hypnotics, includes pentobarbital, secobarbital, phenobarbital, thiopental
- Complications relate to the inhibition of neuronal depolarization
  - potentiating, prolonging, and mimicking GABA, the inhibitory neurotransmitter
  - blocking glutamate receptors

Medical Complications: Barbiturates

- Acute toxicity:
  - narrow therapeutic index – small increment in dose can yield toxicity
  - depression of the respiratory drive(s) - neurogenic and hypoxemic
- Chronic toxicity:
  - tolerance; withdrawal syndrome
  - neonatal withdrawal

Medical Complications: Benzodiazepines

- Sedative-hypnotics, includes diazepam, oxazepam, clonazepam, lorazepam, alprazolam, flunitrazepam (Rohypnol)
- Neurobehavioral complications
  - mostly relate to potentiation of GABA

Medical Complications: Benzodiazepines

- Acute toxicity:
  - uncommon to require medical care for acute toxicity
  - anterograde amnesia
  - confusion (esp. elderly pts)
- Chronic toxicity:
  - rebound insomnia
  - withdrawal syndrome

Medical Complications: Cocaine

- Powder, freebase, crack
- Blocks reuptake of norepi and norepi by the preganglionic neuron
  - thus excess signal to the postganglionic neuron
  - sympathomimetic
    - alpha- and beta-adrenergic

Medical Complications: Cocaine

- Acute cardiac complications:
  - increased myocardial oxygen demand
    - via increased heart rate, systemic arterial pressure, and LV contractility
  - coronary artery vasoconstriction
    - incr alpha-adrenergic stimulation
    - incr endothelin production
    - decr nitric oxide production
    - incr platelet activation
    - accelerated atherosclerosis

Medical Complications: Cocaine

- Acute cardiac complic, contin:
  - cocaine-assoc chest pain
    - In 2000, 175,000 U.S. E.R. visits
  - myocardial ischemia
    - tx: O2, aspirin, nitroglycerin, benzodiazepines
    - avoid: beta-blockers
  - myocardial infarction (MI)
    - supposed 24-fold increase in MI risk within first hour after cocaine use

Medical Complications: Cocaine

- Acute cardiac complic., contin.:
  - arrhythmia
  - aortic dissection
    - tx: beta-blockers
    - avoid: aspirin
- Chronic cardiac complications
  - accelerated atherosclerosis
  - dilated or hypertrophic cardiomyopathy (from chronic sympathetic stimulation)

Medical Complications: Cocaine

- Respiratory Tract:
  - Nasal septal perforation
  - 'Crack lung'
    - Acute – hypersensitivity reaction with fever
    - Chronic - unclear diagnosis
    - tobacco use a possible confounder

Medical Complications: Cocaine

- Acute neurologic complications:
  - seizures
    - at high doses
  - intracranial hemorrhage
    - aneurysmal
      - (could -> subarachnoid bleed)
    - hypertensive
      - (could -> intracerebral bleed)

Medical Complications: Cocaine

- Acute systemic complications:
  - hyperthermia
    - hypermetabolic state
    - dopaminergic pathways ?involved
    - impaired heat dissipation
      - impaired sweating and vasodilation
    - impaired behavioral response to heat
    - mimics fever, creating need for eval

Medical Complications: Cocaine

- Acute systemic complications, contin.:
  - rhabdomyolysis
    - muscle ‘breakdown’
    - may be consequence of hyperthermia
    - renal failure from ‘muscle pigment’ may develop

Medical Complications: Cocaine

- Pregnancy
  - cocaine crosses placenta
  - fetal plasma esterase activity low vs. adult
  - maternal
    - hypertension
    - decreased uterine blood flow
    - spontaneous abortion
    - placental abruption

Medical Complications: Cocaine

- Pregnancy, contin.
  - increased risk of fetal growth retardation, premature delivery
  - reports of increased risk of congenital malformations
  - neonatal irritability
  - controversy re: longer-term neurobehavioral problems ('crack babies')

Medical Complications: Psychedelics/Anesthetics

- Different chemical compounds, ‘club drugs’
  - LSD; mescaline; psilocybin
  - phencyclidine
  - ketamine
  - ecstasy versions
    - chemical
    - liquid
    - herbal

Medical Complications: Psychedelics/Anesthetics

- LSD; mescaline
- Hallucinogenic tryptamines
  - psilocybin
  - 5-methoxy-N,N-diisopropyltryptamine
    - 'foxy'
- Acute toxicity:
    - MVA/accidents
    - anxiety/panic – 'bad trip'
- Chronic toxicity:
    - depression/paranoia/psychosis
    - 'flashbacks'

Medical Complications: Psychedelics/Anesthetics

- Phencyclidine (pcp, angel dust)
  - former human and animal anesthetic
    - side effects led to its non-use
    - hallucinations, psychological issues
  - interaction with several neurotransmitter systems
  - Acute toxicity:
    - confusional or aggressive state
    - "...when possible, 4 or 5 burly aides are superior to mechanical restraints…" (text)

Medical Complications: Psychedelics/Anesthetics

- Ketamine – dissociative anesthetic
  - relative of phencyclidine
  - liquid, powder
  - cortex and limbic system, not RAS
  - increase hrt rate, cardiac output, BP
- Ecstasy versions
  - chemical
  - liquid
  - herbal

Medical Complications: Psychedelics/Anesthetics

- Chemical ecstasy
- MDMA (3,4-methylenedioxymethamphetamine)
  - increased serotonin release and inhibition of reuptake
  - Toxicities:
    - hyperthermia, seizures, rhadomyolysis, fluid/electrolyte imbalance
      - 'rave' setting
    - hepatic injury
  - cardiovascular effects
    - incr HR, BP, myocard O2 consumption

Medical Complications: Psychedelics/Anesthetics

- Liquid ecstasy – GHB
  - GHB – gamma-hydroxybutyric acid
  - precursors (also industrial solvents)
    - 1,4-butanediol
    - gamma-butyrolactone
  - interaction with GABA receptors
  - anesthetic -> bodybuilding drug -> recreational drug -> date-rape drug -> now FDA approved for narcolepsy

Medical Complications: Psychedelics/Anesthetics

- Liquid ecstasy – GHB
  - reported toxicity includes:
    - confusion, hallucination
    - coma, from which pt may rapidly awaken
    - respiratory depression (esp with concurrent EtOH)
    - fulminant hepatic failure requiring transplantation

Medical Complications: Psychedelics/Anesthetics

- Herbal ecstasy – ephedra, ma huang
  - ephedra alkaloids
    - ephedrine – beta-agonist (old asthma tx)
    - pseudephedrine, phenylpropanolamine, others
    - 'ephedra-free'
      - bitter orange -> synephrine
  - sympathomimetic effects
  - reported toxicity includes
    - myocardial infarction, sudden death
    - stroke

Medical Complications: Opiates/Opioids

- Opium, laudanum, paregoric, morphine, codeine, oxycodone, hydrocodone, hydromorphone, levorphanol, meperidine, propoxyphene, fentanyl, pentazocine, nalbuphine, methadone, buprenorphine
- Other opioids and relatives:
  - loperamide, diphenoxylate
  - dextromethorphan
  - non-opiate cousins such as tramadol

Medical Complications: Opiates/Opioids

- heroin a.k.a. Heroin, cough med (diacetyl morphine, Bayer 1898)
  - unit of sale – 'bag'
  - white heroin
    - Afghanistan/Asia
  - brown heroin
    - Iran
  - black heroin
    - Mexico
- Opioid target: receptors in locus ceruleus and elsewhere

Medical Complications: Opiates/Opioids

- Acute toxicity:
  - mainly relates to overdose
  - CNS depression to coma
  - reduced rate of respiration
  - reduced brainstem responsiveness to rising CO2
  - impaired pontine/medullary regulation of breathing rhythm

Medical Complications: Opiates/Opioids

- Chronic toxicity:
  - dependence
  - risk of pneumonia
  - prolonged Q-T interval on EKG
    - high-dose methadone
  - constipation
  - risks related to IDU (injection drug use)
- Withdrawal
- Pregnancy
  - neonatal abstinence syndrome
  - potential confounding issues re: low birthweight, small head circumference etc.

The Contaminants, Dissolving Agents, and Paraphernalia -

- Inert/particulate matter
  - sugar, flour, quinine, starch
  - example: talc (white powder)
    - lodges in alveolar capillaries
    - development of ‘talc granulomas’; appear as small nodules on CXR
  - example: soil; shredded paper dyed with shoe polish (in black tar heroin) -> microbes

The Contaminants, Dissolving Agents, and Paraphernalia -

- Other unexpected medications
  - example: lidocaine powder
  - example: acute reactions to heroin in 5 eastern states, 2005 – initially thought to be cyanide contaminant, later identified as clenbuterol, a veterinary beta-agonist

The Contaminants, Dissolving Agents, and Paraphernalia -

- Other medications, cont.
  - rodenticides or pesticides (cholinesterase inhibitors) used to potentiate effects of cocaine, with resultant bleeding
  - fentanyl-laced heroin, Detroit -> Chicago ~9/05, to Phila. by mid-2006. Deaths nationwide: >100

The Contaminants, Dissolving Agents, and Paraphernalia -

- Non-sterile water
- Contaminated ‘cookers’, needles, syringes, cotton
  - aluminum neurotoxicity – case report from boiling methadone solution in an aluminum pot (NEJM 3/16/06)
- Endotoxin
  - ‘cotton fever’
    - possibly from endotoxin of *Enterobacter agglomerans* colonizing cotton plants

Medical Complications: The Pathogens -

- Bacteria
  - Host saliva –
    - Licking dull needles or vein sites
    - Streptococci
  - Host skin
    - *Staphylococcus aureus*
      - the most significant bacterial species in IDU
    - Streptococci
  - Drug and diluents
    - Gram-negative aerobes
      - *Pseudomonas aeruginosa* from water used to dilute powder/crushed tabs
    - Anaerobes e.g. Clostridia

Medical Complications: The Pathogens -

- Mycobacteria (M. tuberculosis)
  - the milieu, not in the drug
- Fungi
  - *Candida albicans* and other species – skin, drug
    - *C. albicans* from lemon juice used to dissolve brown heroin
- Parasites
  - *Plasmodium* sp.
    - Egypt, 1928
    - Vietnam, 2002

Medical Complications: The Pathogens -

- Viruses -
- blood-borne vs. sexual transmission
  - HIV
  - HBV - hepatitis B virus
  - HCV - hepatitis C virus
  - HDV - hepatitis D superimposed on HBV
  - GBV-C - a flavivirus
  - HTLV-I and II - human T-cell lymphotropic virus I and II

Medical Complications: The Pathogens -

- Organisms can be inhaled or inoculated into a site and create infection there
- Organisms can be carried hematogenously (via the bloodstream) to other remote sites and create infection elsewhere

Medical Complications: The Host -

- May be malnourished or living in poor conditions
- Vitamin deficiencies may be present
- The humoral immune system may be polyclonally activated
  - elevated IgM and IgG

Medical Complications: The Host -

- Depressed cell-mediated immunity may exist
- Antibiotics may have been used before presentation
  - predisposing to colonization with resistant strains of bacteria
- May have concurrent psychosocial morbidities, homelessness, etc

Medical Complications: The Route -

- Not limited to the well-known routes
  - can inject cocaine, snort heroin
- Oral (p.o)
- Nasal insufflation (intranasal/snort)
  - sinusitis
  - epidemiologic association of HCV infection with sharing straws used for snorting cocaine

Medical Complications: The Route -

- Smoking or inhalation
  - 'huffing', 'bagging' etc.
  - 'hotboxing' in a car
    - transmission of *M. tuberculosis*
- Transrectal
  - 'keistering', 'booty bumping'
  - acute overdose from broken condom-fulls of substances being smuggled by 'mules'
  - rectal methamphetamine (annals int med 7/4/06)

Medical Complications: The Route -

- IDU – 'injection drug use'
  - development of injection equipment circa 1855
    - intravenous (IVDU)
    - intramuscular (IM)
    - subcutaneous (SC)
      - a.k.a. 'skin-popping'
      - 'shooter's patch'

Consider the IDU Ritual

- Compare substance abuse setting vs. hospital, or trained home health setting
- Procure -
  - substance (usually in powder or pill form)
    - heroin unit of sale - ‘bag’
  - liquid diluent
  - cooker
  - heat source
  - cotton/filter
  - works (needle/syringe)
  - makeshift tourniquet
- Skin preparation
- Locate/enter vein or desired tissue

Medical Complications: Injection/Infection

- Eye/ear/nose/throat:
  - endophthalmitis – infection of the ocular cavity (vitreous)
    - endogenous endophthalmitis – seeded hematogenously (via IDU or other unrelated bacteremia)
      - *Staphylococcus aureus*
      - *Candida* species
    - differs from 'exogenous' endophthalmitis – stick/paperclip etc. into eye, or ocular surgery complication

Medical Complications: Injection/Infection

- Bloodstream:
  - air embolism – injection/entry of air into the vascular system
  - bacteremia/fungemia – transient or sustained circulation of bacteria or yeast (can be a hallmark of endocarditis as well - next slide)
    - *Staph. aureus*
    - *Pseudomonas aeruginosa*, others

Medical Complications: Injection/Infection

- Cardiac:
  - endocarditis - organism in blood develops a nidus of infection on heart valve or other endocardial structure.
  - usually a predisposing valvular abnormality (congenital or acquired)
  - IDU (especially intravenous) can over time create damage to valves, especially TV, PV (but also MV, AoV)

Medical Complications: Injection/Infection

- Cardiac, contin.:
  - infective endocarditis (IE) - can categorize
    - by presentation
      - acute bacterial (ABE)
      - subacute bacterial (SBE)
    - by location
      - R-sided (TV, PV) vs. L-sided (MV, AoV)
      - native (NVE) vs. prosthetic (PVE)
    - by organism
      - bacterial vs. fungal
      - 'culture negative'

Medical Complications: Injection/Infection

- Cardiac, contin:
  - most common organism - *Staph. aureus*
    - increasingly beta-lactam resistant (MRSA)
  - Tx: prolonged antibiotic therapy (weeks), almost always IV
  - valve-replacement surgery sometimes indicated
    - quasi-ethical debate re: performing if ongoing IDU, since high risk of developing future PVE
  - previous endocarditis is a risk factor for future episodes (if survives the first episode)

Medical Complications: Injection/Infection

- Peripheral vascular:
  - arterial occlusion/vasospasm
    - inadvertent intraarterial injection e.g. cocaine
  - vasculitis
    - rare - cocaine, amphetamines
  - loss of medically-useful venous access due to overuse

Medical Complications: Injection/Infection

- Peripheral vascular, contin.:
  - septic thrombophlebitis
    - infected vein wall/clot
    - often accompanied by fever, bacteremia
  - mycotic aneurysm
    - seeding of vessel wall or vaso vasorum ->
    - infection and weakening of arterial wall -> 'mushroom-like' ('mycotic') aneurysmal dilation

Medical Complications: Injection/Infection

- Pulmonary:
  - Cigarette use associated with ~four-fold increased risk of invasive pneumococcal disease (meningitis, bacteremia) (NEJM 3/9/00)
  - Pneumothorax – air introduced from environment (or by lung puncture) during attempted injection into jugular vein

Medical Complications: Injection/Infection

- Renal:
  - sclerosing glomerulonephritis,

    a.k.a. ‘heroin nephropathy’
    - inflammatory process in glomeruli, presumably an immunologic reaction to circulating drug or contaminants

Medical Complications: Injection/Infection

- Gastrointestinal:
  - splenic abscess
    - complication of bacteremia
  - hepatitis b, c, delta –
    - acute liver failure
    - cirrhosis
    - hepatocellular carcinoma

Medical Complications: Injection/Infection

- Dermatologic:
- 'Track marks'
  - carbon particles (?and hemosiderin), scarring
- Soft tissue infection
  - cellulitis – infection of skin and subcutaneous tissues
  - abscess – from skin-popping or IV use
    - example: 'speedball' = cocaine + heroin
    - local tissue ischemia from cocaine-induced vasoconstriction, plus microbes from unsterile agent/procedure -> risk for abscess

Medical Complications: Injection/Infection

- Dermatologic, contin.:
- Soft tissue infection, contin.
  - fasciitis – infection of superficial or deep fascia
  - soft-tissue pathogens:
    - gram positives (staph/strept)
      - rise in methicillin-resistant *Staph. aureus* (MRSA) among non-hospitalized persons
    - aerobic gram negative rods
      - from environment/water
      - *Pseudomonas*, *Serratia*, *Proteus*, etc.

Medical Complications: Injection/Infection

- Dermatologic, contin.: soft tissue pathogens
  - anaerobes
  - clostridial skin/subcut infectn
  - skin-popping black tar heroin
  - *C. tetani* - tetanus
  - *C. botulinum* – wound botulism
  - *C. perfringens* - gas gangrene
  - *C. sordellii* - shock-like syndrome
  - *C. novyi* – local infection and circulatory collapse

Medical Complications: Injection/Infection

- Musculoskeletal:
- Hematogenous route more likely the cause than direct inoculation
  - sternoclavicular joint involment after using jugular vein
- (Pyo)Myositis – focal infection within skeletal muscle
  - usually *Staph. aureus*

Medical Complications: Injection/Infection

- Musculoskeletal, contin.:
- septic arthritis – infection of joint space
  - *Staph. aureus* most common
  - *Pseudomonas*
  - *Candida* species
- osteomyelitis – infection of bone
  - *Staph. aureus* most common

Medical Complications: Injection/Infection

- Neurologic:
- Vertebral osteomyelitis
- Spinal epidural abscess
  - *Staph. aureus* most common in IDU
  - may result in paraplegia or paralysis
- Brain abscess
  - usu. subsequent to bacteremia/endocarditis
- Clostridial syndromes
  - see dermatologic

Medical Complications: Conclusion

- Interplay of drug, contaminants, microbes, host (including concurrent psychiatric diagnoses), and route
- Numerous psychosocial morbidities and controversies not discussed today
  - pts seeking Rx for controlled subst.
  - leaving hospital AMA (against medical advice)
  - effect on employability, STD's, MVA's
  - consider what % of violent crime (urban or otherwise) relates to use, sale, or procurement of EtOH or substances of abuse
  - needle exchanges

Question 1

- A baby is born with low birth weight, microcephaly, small eyes, upturned nose and a smooth, undeveloped philtrum. He fails to thrive and develops seizures. Which of the following was he likely exposed to during pregnancy?

a) Cocaine
b) LSD
c) Alcohol
d) Methamphetamine
e) Inhalants

Question 2

- Which of the following is typically not seen with Wernicke's encephalopathy?

a) Ataxia
b) Ophthalmoplegia
c) Confusion
d) Hyperthermia
e) History of alcohol dependence

Question 3

- A 43 year old male presents to the ER with chest pain, hyperthermia, hypertension and seizures. His family reports that he had been excessively using an illicit substance lately. Acute toxicity with which of the following may have caused these symptoms?

a) Inhalants
b) Alcohol
c) Barbiturates
d) Benzodiazepines
e) Methamphetamine

Question 4

- The mechanism of action by which MDMA primarily acts is:

a) increased serotonin release and inhibition of reuptake

b) increased dopamine release and inhibition of reuptake

c) increased acetylcholine release and inhibition of reuptake

d) decreased serotonin release and inhibition of reuptake

e) decreased dopamine release and inhibition of reuptake

Question 5

- Which of the following, when abused can potentially cause polycythemia?

a) Alcohol
b) LSD
c) Anabolic steroids
d) Inhalants
e) PCP

Answers

- 1: C
- 2: D
- 3: E
- 4: A
- 5: C