2C OR NOT 2C: A Discussion of Designer Drugs

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Disclosure

- No Financial Relationships to Disclose
Objectives

- Discuss Designer Drugs Along with the Effects and Toxicities
- Discuss Potential Treatment Options for Toxicity Associated with Designer Drugs
Designer/Street Drugs

- Heroin
- Methamphetamines
- Synthetic Cathinones
- Synthetic Cannabinoids
- 2C Agents
- Ecstasy/Molly
- Piperazine Derivatives
Designer Drugs

- Slight Changes to Chemicals to Produce a Different Chemical Structure
- “Legal” Drugs
- Cheaper Alternative to Prescription Drugs
- Easy Access
Heroin

- Opioid Drug Derivative of Morphine
- Developed by Bayer as a “Non-addictive” Alternative to Morphine
- More Addictive than Morphine
Heroin and Opiates

- Analgesia
- Euphoria
- Flushing of the skin
- Dry mouth
- Relaxation
- Confusion
- Disorientation
Heroin and Opiate Toxicity

- Bradycardia
- Hypotension
- Depressed Mental Status (Coma)
- Depressed Respiratory Rate (Failure)
- Seizures
Heroin Kinetics

- **Route** – Injection or Smoked
- **Onset** – 10 Seconds (IV) to 10 minutes (IM)
- **Peak** – 5-15 Mins
- **Half-Life** – 2-6 Hours Depending on Renal Function
Heroin and Opiate Treatments

- Ensure Patient’s Ability to Breath
  - Monitor Depth and Rate of Ventilation
  - Oxygen
  - Intubation
- Naloxone (Narcan)
  - Goal Adequate Ventilation (RR - at least 12)
  - Spontaneous Ventilation – Give 0.04-0.05mg and Titrate
  - Apneic - 0.2-1mg and Repeat as Needed
  - Cardiopulmonary Arrest Secondary to Opioid Overdose – Minimum 2mg
  - If Patient Receives Over 5-10mg, may Consider Alternate Cause
- Available OTC in Most States
Methamphetamine

- Developed for Nasal Congestion and Asthma
- Used During WW2 as a Stimulant
- Later Used for Weight Loss and ADHD
- Remains a C-2 Prescription
Methamphetamine Effects

- Norepinephrine, Epinephrine and Serotonin are Displaced and re-uptake is Inhibited
- Adrenergic Reaction - Hypertension, Tachycardia, Hyperthermia and Vasospasms
- Serotonin – Mood Altered and Change in Response to Hunger and Thirst
- Dopamine – Drug Seeking Behavior and Psychiatric Changes
Methamphetamine

- Route - Oral, Smoked, Nasal, IM, IV
- Onset – Seconds (Smoking/Injection), 5 mins (Nasal), 20 mins (Oral)
- Peak – 30 mins (Injection), 2-3 hours (Oral)
- Half-Life – 12-34 hours
- Duration – Over 24 hours
Methamphetamine Effects

- Stimulation
- Anorexia
- Euphoria
- Hallucinations
- Dilated Pupils
- Choreiform Movements
- Vomiting
- Diarrhea
Methamphetamine Acute Toxicity

- Severe Agitation
- Psychosis
- Seizures
- Symptoms associated with mortality
  - Coma
  - Shock
  - Temp > 39C
  - Acute Renal Failure
  - Metabolic Acidosis
  - Hyperkalemia (K+ 5.6 or greater)
Methamphetamine Complications

- Cardiovascular
  - Cardiac Ischemia
  - MI
  - Cardiomyopathy
- Pulmonary
  - Pulmonary Edema
  - Pneumothorax
  - Pneumonia
Methamphetamine Complications

- Thermal Burns
- Chemical Burns
- Infection (Cellulitis, Sepsis)
- Rhabdomyolysis
Synthetic Cathinones

- AKA Bath Salts
- Sold as Bath Salts, Plant Food, Incense and more
- Class Phenethylamine
- Originate from *Catha Edulis* (Khat) Leaves
- Developed as Appetite Suppressant in 1928
- Emerged In US in 2010
- Sold with warning “Not for Human Consumption” to Avoid Violating US Controlled Substances Act
Synthetic Cathinones

- Three Main Cathinones
  - Methylenedioxypyrovalerone (MDPV)
  - Mephedrone
  - Methylone
- Cause the Release of Neurotransmitters
Synthetic Cathinones

- **Route**: Oral (Powder, Capsule, Tablet), Gingival, Nasal, IV, IM, Rectal
- **Onset**: 15-30 minutes (MDPV); 30-45 minutes
- **Duration**: 2-48 hours (MDPV); 2-12 hours
- **Metabolism**: Hepatic
- **Elimination**: Renal
Synthetic Cathinones

- Euphoria
- Heightened Senses
- Increased Energy
- Talkativeness
- Openness
- Agitation
- Hallucinations
- Fluid and Electrolyte Changes
Synthetic Cathinones Toxicity

- Cardiovascular Effects
  - Chest Pain
  - Palpitations
  - Tachycardia
  - Hypertension
- Hyperthermia
Synthetic Cathinone Toxicity

- Neurological
  - Agitation
  - Combativeness
  - Hallucination
  - Confusion
  - Paranoia
  - Myoclonus/Seizure
Synthetic Cannabinoids

- Developed in the 1960s to Maximize Analgesia and Anti-Inflammatory Properties While Eliminating Psychotropic Effects
- Over 100 Synthetic Cannabinoids
- Herbal Blends with a Mixture of Plant Matter and Chemical Grade Synthetic Cannabinoid
  - Plant Material may include Rosehip, Baybean, Lousewort, Pink Lotus, Red Clover, Honeyweed and Many More
- Limited Literature Regarding Effects
- Marketed as “Legal” Marijuana or “Legal” High
- Sold as Incense or Potpourri as “Not for Human Consumption”
Synthetic Cannabinoids

- Seven Main Categories Based on Chemical Structure
  - CB1 Receptor (CNS) – Psychoactive Effects
  - CB2 Receptor (Periphery) – Immunomodulatory Effects
- Lack Cannabidiol
  - Anxiolytic
  - Antipsychotic Properties
Synthetic Cannabinoids

- Variations in Synthetic Cannabinoids and Herbals
- Smoked, Oral or Snorted
- Case Report
  - Onset – Minutes
  - Duration – 1 Hour
- Effects will Vary Based on Amount of CB1 and CB2 Agonism
  - Reports of 2-800X effect of THC
  - Effects More Intense, Longer Lasting or Paradoxical Effects
Synthetic Cannabinoid Symptoms

- Positive Feelings
- Euphoria
- Increased Appetite, Eye Redness
- Nystagmus
- Anxiety, Paranoia, Agitation, Delusions
- Tachycardia
- Diaphoresis
Synthetic Cannabinoid Toxicity

- Psychosis (Hallucinations, Delirium, Paranoia, Aggression)
- Hypertension
- Hyperthermia
- Palpitations, Cardiac Ischemia, MI
- Seizures and Dystonias
- Rhabdomyolysis
- Acute Kidney Injury
- Pulmonary Injury
2C Agents

- Phenethylamine Structure Contains 2 Carbons Between Amino Group and Benzene Ring
- Similar to Mescaline
- Publication of PiHKAL in 1991, Lead to Increased Popularity
2C Agents

- Serotonin and Alpha-Adrenergic Receptors
- Agonist or Antagonist Based on Chemical Structure
2C Agents

- Available as Powder, Capsule or Liquid
- Oral
  - Onset 1-3 Hours
  - Duration 5-7 Hours
- Snorting
  - Onset 5-15 Minutes
  - Duration 2-4 Hours
- Effects may last 1-7 days
2C Agent Effects

- Hallucination
- Stimulation
- Euphoria
- Empathy
- Hyperthermia
- Hypertension
- Tachycardia
- Agitation
- Respiratory Depression
2C Toxicity

- Unpleasant Hallucinations
- “Excited” Delirium
  - Delirium with Agitation
  - Violence
  - Hyperactivity
  - Hyperthermia
- May Result in Sudden Cardiopulmonary Arrest
MDMA (Ecstasy/Molly)

- Methylene dioxy methyl amphetamine (MDMA)
- Molly – Pure (Molecular) MDMA
- Originally Used as Appetite Suppressant
- Later Used for Psychotherapy and Marriage Counseling
- Stimulates Serotonin Receptors
- Party Drug
MDMA

- Oral, Snort, Injected, Smoked
- Onset - 20-40 Minutes
- Duration - 6 Hours
- Hangover May Last 48 Hours
Piperazine

- Developed for the Treatment of Roundworms and Tapeworms
- Marketed as “Party Pills” or “Legal Ecstasy”
- 1-Benzylpiperazine (BZP)
  - Weak Amphetamine Effects
  - Releases Dopamine
  - Inhibits Reuptake of Dopamine, Serotonin and Norepinephrine
- 1[3-Trifluoromethylphenyl]piperazine (TFMPP)
  - Acts on Serotonin Receptors
  - Not Used Alone
Piperazine

- Powder and Pills
- Onset – 2 Hours
- Duration – 6-8 Hours
- BZP – Minimal Metabolism
- TFMPP – Metabolized by CYP2D6, 1A2 and 3A4
MDMA Effects

- Euphoria
- Empathy/Increased Feelings of Personal Intimacy
- Heightened Senses
- Hallucination
- Teeth/Jaw Clenching
- Muscle Tension
- Blurred Vision, Dilated Pupils or Nystagmus
- Dehydration
- Depression
MDMA Toxicity

- Hyperthermia (107-110F)
- Hypertension, Tachypnea, Tachycardia
- Loss of Consciousness
- Seizures
- Renal Failure
Patient Work-Up

- History From Patient or People Accompanying Patient
- Labs
  - Electrolytes, Renal Panel, Blood Glucose, ABG
  - Serum Lactate
  - CBC
  - CPK
  - Blood Alcohol
  - Liver Enzymes
  - Clotting Times
Patient Work-Up

- 12 Lead EKG (With Chest Pain)
- Chest Radiology (Pulmonary Symptoms)
- Chest and abdominal CT
- Drug Screen
Treatment

- Manage Airways
  - Pulse-Oximetry
  - Supplemental Oxygen
  - Intubation/Sedation – Succinylcholine Contraindicated

- Severe Agitation
  - Preferred - IV Benzodiazepines - Lorazepam 2-4mg IV or Diazepam 5-10mg IV may repeat every 10 minutes PRN
  - Second Gen. Antipsychotics – Ziprasidone 10mg IM
  - Droperidol 2.5-5mg IV/IM or Haloperidol 10mg IV/IM
  - Avoid Physical Restraints
Treatment

- Hyperthermia
  - Benzodiazepines
  - Intubation
  - Cooling Blankets
  - Chilled IV Fluids
- Hypertension
  - Nitroprusside, Nitroglycerin or Phentolamine
  - Caution with beta blockers
- Hypovolemia
- Acidemia – Sodium Bicarbonate 50-150meq
Treatment

- Cardiac Arrest
- Shock – Norepinephrine
- Seizures - Benzodiazepines
- Hyperkalemia – Calcium and Insulin with Dextrose
- Rhabdomyolysis – Fluids and Manage Electrolytes
- Acute Kidney Injury
- Pulmonary – ARDS, Pneumothorax, Asthma
Other Considerations

- No Specific Antidote in Most Cases
- Coingestion
- Designer Drugs May Have Different Potency and Duration
- Activated Charcoal – Typically not Useful (Risk of Aspiration)
- Hemodialysis
- Antipyretics have no Role
- Rapid Sequence Intubation – Propofol, Midazolam and Etomidate (Avoid Ketamine)
- BDZ – IV preferred, IM Effect may be Delayed 10-20 mins
- Poison Control (1-800-222-1222)
Summary

- Naloxone For Respiratory Symptoms With Heroin or Opioid Overdose
  - Dose Based on Patient’s Status
  - Treatment Goal is 12 Breaths per Minute
- No Antidotes for Other Designer Drugs
- Maintain Airways
- Benzodiazepines Preferred Drug for Anxiety, Seizures and Hyperthermia
Summary

- Maintain Fluid Balance and Electrolytes
- EKG for Chest Pain
- Chest X-Ray for Pulmonary Symptoms
References

- Dean BV, Stellpflug SJ, 2C or Not 2C: Phenethylamine Designer Drug Review. J Med Toxicol 2013; 9(2) 172-178
Questions