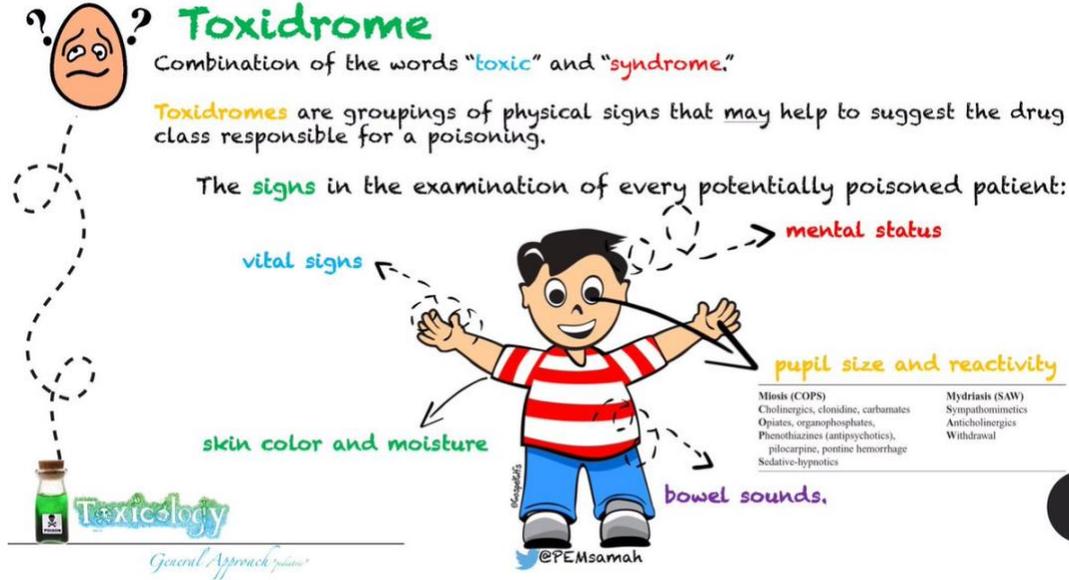


TOXIDROMES

DAN MUSE, MD

TOXIDROMES



TOXIDROMES is the ability to recognize an overdose by the clinical signs and symptoms and not necessarily by the drugs taken. In some cases, we have witnesses, containers or paraphernalia available which can make the diagnosis easier to make. However, in many cases we only have the person who has overdosed and the decision on how to treat the person depends on signs and symptoms.

Let's take a toxidrome we are all unfortunately very familiar with; Opioids. In an opioid overdose, the clinical triad is a depressed mental status, diminished or no respirations and pinpoint pupils. In this case naloxone seems like a sure bet to reverse the overdose.

Environmental clues should also be considered as well. Beside the clinical signs, you may encounter other information, which can further assist in making the appropriate clinical decision. There may be needles, a powdery substance and track marks on the arm. The location is also another clue. Certain parks and establishments may be known as places where people use heroin. For whatever reason, Dunkin Donuts, or as they are referred to as "Junkie Dunkie", are very popular places to shoot up. Maybe we should change the slogan to "America shoots up at Dunkins"! Alternatively if you got called to a "rave" and found a person hyperactive, sweating and psychotic, it is a good chance that the person is on a stimulant and most likely 'Molly'.

PART I: CLASSIC TOXIDROMES

SYMPATHOMIMETICS

SYMPATHOMIMETIC DRUGS are accelerators on the body. They cause the vitals to increase. Mentally and physically, the person feels more alert and hyperactive. However a threshold can be crossed where in a toxic state the person suffers from overstimulation resulting in arrhythmias, vascular injury, hyperthermia, agitation and psychosis. With Ecstasy/Molly, there is also the complication of hyponatremia that results in part from the excessive water intake.

Sympathomimetic Syndrome

MATHS

- **M**ydriasis
- **A**gitation
- **T**achycardia
- **H**ypertension - **H**yperthermia
- **S**eizures - **S**weating



SYMPATHOMIMETICS

	SYMPTOMS	TOXIC SEQUELAE
Heart Rate	Elevated	Arrhythmias: SVT, Ventricular Tachycardia
Blood Pressure	Elevated	Hypertensive: Dissection, Heart Attack, CNS Bleed
Respiratory	Elevated	
Temperature	Elevated	Hyperthermia: Seizures, Vascular Collapse, Rhabdomyolysis
Pupils	Mydriasis	
Skin	Wet	Severe Sweating and fluid loss.
CNS	Hyperactive	Confusion, Psychosis, Seizure

DRUGS OF ABUSE

We are all familiar with these drugs and they all have similar effects.

COCA PLANT

- **COCAINE:** Cocaine is a stimulant processed from the Coca plant. It results in euphoria, and a hyperactive state. Prolonged use can cause psychosis and physically can result in heart attacks and strokes.
- **CRACK COCAINE:** is the left over tar that has very high concentrations of the cocaine. This “rock” is smoked.

KAT PLANT

- **BATH SALTS:** (Cloud Nine, Lunar Wave, Vanilla Sky) Bath Salts are cathinones or stimulants related to the Khat plant. They are sold on line and in stores as “cleaning” agents and will have “not for human consumption” on the labels. They can cause euphoria or paranoia with psychosis and violent behavior.

AMPHETAMINES

- **MDNA:** (Ecstasy, Molly) MDNA is a synthetic drug that is a stimulant similar to amphetamines and cocaine. They can cause hyperactive states and hallucinations. Like cocaine and amphetamines, MDNA can result in overstimulation of the body resulting in injuries to the heart and brain. Hyponatremia is oftentimes associated with it due in part to the excessive amounts of water that one will drink while on these drugs. These drugs are constantly being chemically reinvented. This means that new forms are produced and are not illegal until the DEA can obtain some and make it an illegal substance.
- **METHAMPHETAMINE:** (Crystal Meth, Hillbilly Heroin) This is an inexpensive highly addictive drug that leaves permanent brain damage. It causes intense euphoria that dissipates quickly. Addicts spend they life chasing that first high. It is inexpensive and the main ingredient is pseudoephedrine that is mixed with other toxic chemical. Virtually all the chemicals can be purchased in the automotive and camping section of Walmart

EXCITED DELIRIUM

EXCITED DELIRIUM was first noted in 1849. Patients were noted to become agitated and manic while feeling very warm. Shortly thereafter, they would suffer a respiratory collapse and death. Studies did show a connection with stimulants. A study from the Mayo Clinic estimated that about 10% of the cocaine deaths were associated with Excited Delirium. Although not well understood, it is thought to result in a surge at the dopaminergic receptors causing an elevated temperature, delirium and an adrenergic surge. Always be cognizant and vigilant of this syndrome in anyone who is agitated and warm. Remember that the respiratory collapse can come on quickly. For that reason, keep the person on their back and have their face exposed so that you can appropriately monitor their breathing.

MANAGEMENT

Management of sympathomimetics is geared toward the symptoms and complications. Due to the plethora of potential complications from overdosing on these drugs, management can go from treating arrhythmias, myocardial infarctions, psychotic breakdowns and altered mental status due to a head bleed or even hyponatremia. And of course there is the potential trauma and excited delirium to deal with.

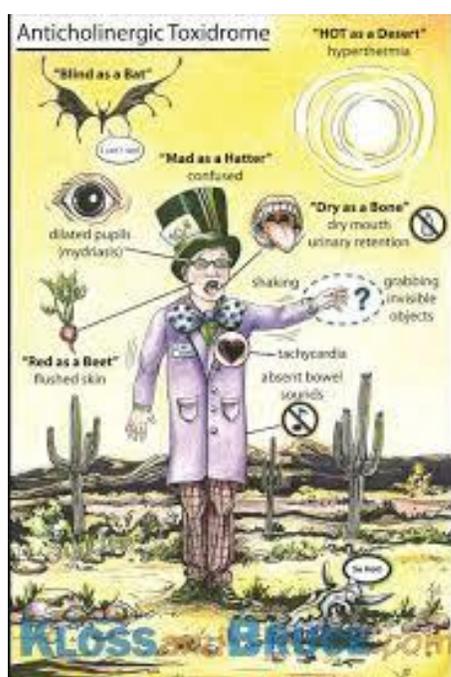
ANTICHOLINERGIC

ANTICHOLINERGIC drugs are typically not abused. They are however very common over the counter medications since they make up the majority of antihistamines and decongestants. The toxic effects are usually due to an overdose making them a common component of overdoses associated with home medications.

The drugs at toxic levels will elevate the temperature and heart rate. Blood pressure is variable and there is little change in the respiratory rate. Symptomatically, the patient is dry, confused, flushed, and warm.

ANTICHOLINERGICS

	SYMPTOMS	TOXIC SEQUELAE
Heart Rate	Elevated	Arrhythmias: SVT, Ventricular Tachycardia
Blood Pressure	Variable	Can become hypotensive secondarily
Respiratory	Unchanged	
Temperature	Elevated	Hyperthermia: Seizures, Vascular Collapse, Rhabdomyolysis
Pupils	Mydriasis	
Skin	Dry	
CNS	Usually Somnolent	Confusion, Psychosis, Seizure



Toxicity of Anticholinergics

- Anticholinergic overdose syndrome is characterized by: Hyperthermia, delirium, dry mouth, tachycardia, ileus, urinary retention. Seizures, coma and respiratory arrest may occur.
- Tx—activated charcoal, Atropine, cooling agents (ice bags, cooling blankets, tepid baths).

DRUGS OF ABUSE

Most of the anticholinergics are over the counter or prescribed. The recreational use is not that great but they are frequently seen with suicide attempts, along with accidental ingestions due to the easy accessibility.

ANTI-HISTAMINES:

Benadryl, Atarax and Cogentin all are antihistamines. Benadryl is a common additive to sleep aids such as Tylenol PM or Advil PM. The “PM” is Benadryl (diphenhydramine). CALADRYL, which is Calamine Lotion and Benadryl is used for

pruritic rashes such as poison ivy. The Benadryl is added to relieve the itch. Large areas of the body can get covered and the Benadryl can then easily penetrate the excoriated skin resulting in anticholinergic toxicity. Atarax (hydroxyzine) is essentially an alternative to Benadryl. Cogentin is almost exclusively used to curb dystonic reactions caused by antipsychotic medications such as Haldol.

ANTISPASMODICS:

Most anticholinergic antispasmodics are used for intestinal and urinary spasm. Bentyl (GI) and Ditropan (urinary) are two of the more common medications.

DECONGESTANTS:

Many decongestants are also antihistamines. Allegra (fexofenadine), Claritin (loratidine), Zyrtec (cetirizine) are just a few decongestants with anticholinergic properties. Other decongestants such as Sudafed (Phenylephrine) have properties better classified as stimulants. They work primarily by vasoconstriction causing a diminishment in the congestion by reducing the inflammatory swelling.

ANTIPSYCHOTICS:

The older and newer antipsychotic medications have varying degrees of anticholinergic properties. Amitriptyline (Elavil) was one of the most commonly prescribed medications for depression and was also one of the most lethal when taken at high doses.

ANTICHOLINERGIC DRUGS

ATROPINE

ANTIPSYCHOTIC

Amitriptyline (Elavil)
Chlorpromazine (Thorazine)
Clomipramine (Anafranil)
Clozapine (Clozaril)
Desipramine (Norpramin)
Doxepin (Adapin, Silenor, Sinequan)
Imipramine (Tofranil)
Nortriptyline (Pamelor)
Olanzapine (Zyprexa)
Paroxetine (Brisdelle, Paxil)
Perphenazine (Trilafon)
Protriptyline (Vivactil)
Thioridazine (Mellaril)
Trifluoperazine (Stelazine)
Trimipramine (Surmontil)

ANTI-HISTAMINES

Benzotropine (Cogentin)

Chlorpheniramine (Actifed, Allergy & Congestion Relief, Chlor-Trimeton, Codeprex, Efidac-24 Chlorpheniramine, etc.)

Cyproheptadine (Periactin)

Dexchlorpheniramine

Diphenhydramine (Advil PM, Aleve PM, Bayer PM, Benadryl, Excedrin PM, Nytol, Simply Sleep, Sominex, Tylenol PM, Unisom, etc.)

Hydroxyzine (Atarax, Vistaril)

MUSCLE RELAXANTS

Cyclobenzaprine (Amrix, Fexmid, Flexeril)

Orphenadrine (Norflex)

BOWEL AND BLADDER ANTISPASMODICS

Dicyclomine (Bentyl)

Fesoterodine (Toviaz)

Hyoscyamine (Anaspaz, Levsin, Levsinex, NuLev)

Oxybutynin (Ditropan, Oxytrol)

Tolterodine (Detrol)

ANTIEMETICS

Prochlorperazine (Compazine)

Promethazine (Phenergan)

MOTION SICKNESS

Meclizine (Antivert, Bonine)

Scopolamine (Transderm Scop)

MANAGEMENT

Like sympathomimetics, treatment of anticholinergics is symptom driven.

Physostigmine has been used in severe overdoses, but these are very rare. Control of arrhythmias, fever and hallucinations are the primary concerns. Benzodiazapines can play a role for alleviating the hallucinations. Hydration is very important since the patient will become “dry” and febrile.

CHOLINERGICS

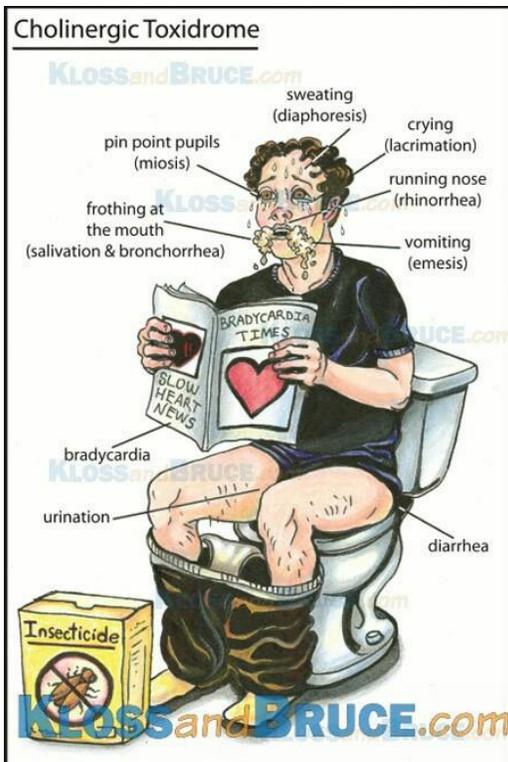
It would only make sense that cholinergic drugs would have the opposite effect of anticholinergics. Instead of a tachycardia the person becomes bradycardic and pupils constrict. Symptoms are profound and essentially in a severe overdose the person pours out bodily fluids from every orifice in the body.

CHOLINERGICS

	SYMPTOMS	TOXIC SEQUELAE
Heart Rate	Bradycardia	Arrhythmias: SVT, Ventricular Tachycardia
Blood Pressure	Variable	Can become hypotensive secondarily
Respiratory	Unchanged	Lungs fill up with secretions.
Temperature	Unchanged	
Pupils	Miosis	
Skin	Wet	
CNS	Agitated	Confusion, Seizure

The classic findings are due to profound fluid evacuation from the body: **SLUDGE** (**S**alivation, **L**acrimation, **U**rination, **D**iarrhea, **G**astric **E**mesis)

Insecticides (organophosphates) are the primary source of cholinergic toxicity in this country. Needless to say, they are not very palatable and the cause usually comes from accidental exposure. One group that can be very susceptible is small children. These chemicals may be mixed and shelved in containers such as 2-liter soda bottles. Little kids see them and think it is alright to drink. Due to their small body mass, even a little gulp can generate toxicity. And of course, cholinergic drugs such as Sarin Gas are always a concern with terrorists! Ultimately, death occurs because the person drowns in their own secretions.



CHOLINERGIC TOXIDROME – Common Mnemonic	
SLUDGE	DUMBBELLS
S alivation	D iarrhea
L acrimation	U rination
U rination	M iosis
D iarrhea	B radycardia
G I distress	B ronchorrhea
E mesis	E mesis
	L acrimation
	L ethargy
	S alivation

@Saudi_Pharma

MANAGEMENT

Airway, Airway Airway! The cholinergic drugs cause a profound release of bodily fluids. Those that will kill the quickest are the ones that deprive the body of the ability to breath. Salivation but more importantly bronchorrhea, or the release of fluid in the bronchi flood the lungs and deprive the body of oxygen. Treatment is to use an anticholinergic to reverse the effects. Atropine, an anticholinergic along with Pralidoxime (2-PAM) are used together to reverse the effects of organophosphate poisoning and nerve gas poisoning.

OEMS PROTOCOL: Organophosphate & Nerve Agent Poisoning

Atropine: 2 to 6 mg IM/IV/IO every 5 minutes as needed

Atropine and Pralidoxime Auto-Injector (DuoDote) Nerve Agent Kit:

- Patients experiencing: apnea, convulsions, unconsciousness, flaccid paralysis administer 3 DuoDote and 1 atropine (10 mg) auto-injectors.
- Patients experiencing: dyspnea, twitching, nausea, vomiting, sweating, anxiety, confusion, constricted pupils, restlessness, weakness administer 1 DuoDote.

OPIOIDS

We are presently in the midst of an opioid epidemic. Over thirty thousand people die each year in the United States due to opioid overdoses. In Massachusetts more die from opioids than from motor vehicle accidents. The triad for the overdose is pinpoint pupils, slow shallow breathing/apnea and altered mental status/coma.

OPIOIDS

	SYMPTOMS	TOXIC SEQUELAE
Heart Rate	Variable	
Blood Pressure	Variable	Can become hypotensive secondarily
Respiratory	Diminished/stops	Stops breathing.
Temperature	Unchanged	
Pupils	Miosis	
Skin	Unchanged/blue	
CNS	Depressed/Coma	Brain death due to anoxia

FENTANYL AND CARFENTANIL have changed the rules of how opioid overdoses are managed. The strength of both drugs demand larger doses of Narcan/naloxone. As well, the strength of any given bag is variable making lethal overdoses more prevalent.

- Fully synthetic (can be made in a lab)
- Fentanyl: 80-100 times more potent than heroin

- Carfentanil: 10,000 times more potent than morphine and 100 times more potent than fentanyl.



Comparing the size of lethal doses of heroin, fentanyl, and carfentanil. The vials here contain an artificial sweetener for illustration. (New Hampshire State Police Forensic Laboratory)

DRUGS OF ABUSE

- | | |
|-------------|-------------|
| • Heroin | Hydrocodone |
| • Codeine | Oxycodone |
| • Demerol | Tylox |
| • OxyContin | Tylenol 3 |
| • Percocet | Morphine |
| • Percodan | Vicodin |
| • Codeine | Demerol |
| • Morphine | Darvocet |
| • Fentanyl | Dilaudid |
| • Methadone | Opium |

As well, Fentanyl is being mixed with other drugs especially Cocaine. It is also be pressed into pills and sold as oxycodone.

MANAGEMENT

Management of an opioid overdose focuses on the respiratory status. In the worse case scenario, opioids cause hypoxic deaths by stopping the persons respiratory drive. Therefore providing or assuring that the person is getting oxygen is the primary initial responsibility. The more definitive treatment is administering the antidote naloxone.

OEMS PROTOCOL: Opioid Overdose
 NALOXONE:

- 0.4 – 4 mg IV/IM/IN.
- If no response, may be repeated as needed

SEDATIVE/HYPNOTICS

ALCOHOL, BENZODIAZEPINES AND BARBITURATES form our group of sedative/hypnotics. The sedative/hypnotics are a group of different classes of drugs that essentially depress the bodily functions. You could argue that opioids should or could be classified in this category. While that does have some validity based solely on the overall symptoms, the opioids also have a specific toxidrome that keeps them separate. The overall toxic effect of the drugs focuses on mental status changes. The intoxication, especially alcohol can mimic head injuries, and due to the somnolence and ataxia that is produced trauma is a significant byproduct. The drugs are oftentimes mixed with others leading to higher levels of toxicity especially when mixed with opioids.

SEDATIVE/HYPNOTICS

	SYMPTOMS	TOXIC SEQUELAE
Heart Rate	Unchanged	
Blood Pressure	Decreased/Unchanged	
Respiratory	Decreased/Unchanged	
Temperature	Decreased/Unchanged	
Pupils	Mydriasis/Unchanged	
Skin	Unchanged	
CNS	Depressed/Coma	Hypoxia especially when mixed with opioids. Traumatic injuries

Nystagmus is another finding associated with some of the sedative hypnotics.

Sedative/Hypnotic Toxidrome

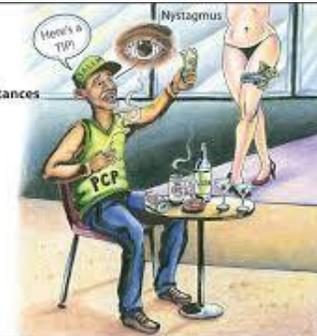
<p>Signs/Symptoms</p> <ul style="list-style-type: none"> • Slurred speech • Hallucinations • Confusion • Coma • Respiratory depression • Low blood pressure • Pupil dilation or constriction • Blurred vision • Dry mouth • Decreased temperature • Staggering walk 	<p>Examples</p> <ul style="list-style-type: none"> • Barbiturates <ul style="list-style-type: none"> – Phenobarbital • Benzodiazepines <ul style="list-style-type: none"> – Diazepam (Valium) • Alcohol • GHB (a date-rape drug or "liquid x")
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SALEM TIP Mnemonic

Nystagmus Causing Substances

Sedative/hypnotics / Solvents

- Alcohol
- Lithium
- Ethylene Glycol
- Methanol
- Tegretol
- Isopropanol
- PCP / Phenetoyn



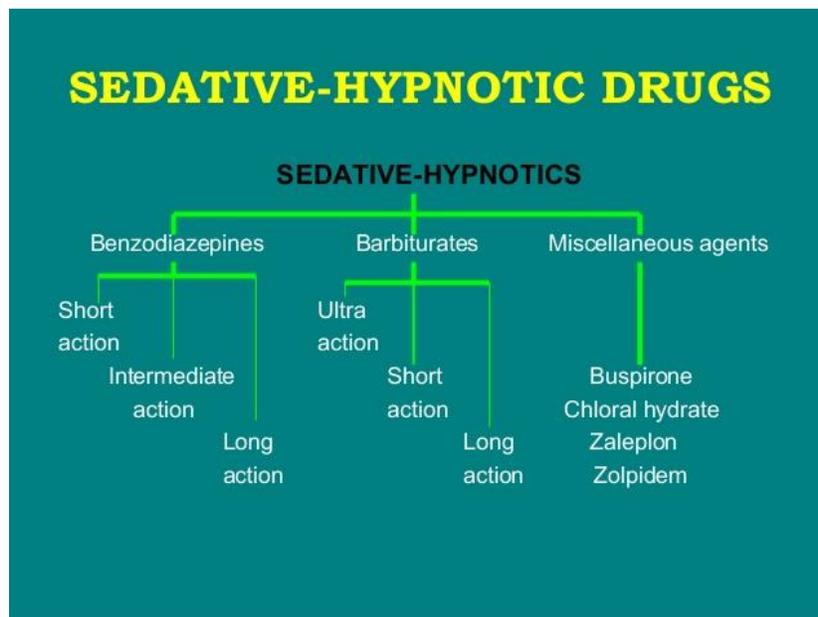
DRUGS OF ABUSE

Sedative/Hypnotics are widely abused both as prescriptions and recreationally. Since they are all “depressants”, the propensity to mix them can lead to catastrophic outcomes.

ALCOHOL: This is still the most abused drug and the most deadly over a lifetime. It is associated with high levels of trauma and is the great mimicker to head injuries.

BENZODIAZEPINES: Valium, Ativan, Xanax, Clonazepam, Versed. All the benzodiazepines have an abusive quality and are often mixed with other drugs. Pure benzodiazepine overdoses can depress the respiratory drive but rarely will stop a person from breathing. However, even a little of something else such as alcohol or narcotics along with the benzo’s will curtail a person’s respiratory drive.

BARBITUATES: These are sedative drugs that are used primarily for sedation and seizure control. The effects are similar to benzodiazepines. Again, combining them with other drugs makes them far more deadly.



MANAGEMENT

Management of all these drugs is supportive. Use of these agents is associated with trauma and they all are the “great mimickers” of other issues such as hypoglycemia, head trauma, postictal states to name a few. So, if you suspect it is a “sedative/hypnotic” overdose, do your due diligence and make sure it is not a something else.

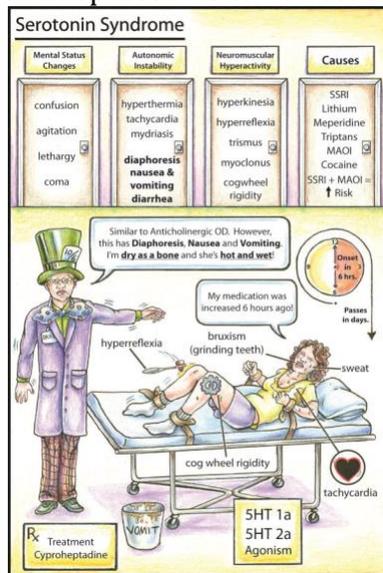
SEROTONIN SYNDROME

SEROTONIN SYNDROME occurs when high levels of serotonin accumulate in the person's body. Serotonin is a chemical that allows the brain cells to communicate with one another. Whole classes of drugs are used to increase the levels of serotonin since low levels are thought to play a role in depression. Excessive nerve cell activity can occur at high levels which can result in adverse conditions and even death. Levels accumulate when the medications are adjusted or several medications are taken that increase the serotonin levels. Moderate symptoms actually look like withdrawals with severely high levels resulting in seizures and high fevers.

SEROTONIN SYNDROME

	SYMPTOMS	TOXIC SEQUELAE
Heart Rate	Elevated	Arrhythmias
Blood Pressure	Elevated/Unchanged	Decomposition and hypotension
Respiratory	Elevated/Unchanged	
Temperature	Increased/Unchanged	AMS and Seizures
Pupils	Mydriasis/Unchanged	
Skin	Sweating	
CNS	Depressed/Coma	Headaches, tremors and seizures. Coma

Primary causes of Serotonin Syndrome are the antidepressants SSRI's (Serotonin Reuptake Inhibitors). These medications treat depression by increasing the levels of serotonin in the body. Other medications can also singularly or in combination raise serotonin levels. Lastly opioids, certain anti-nausea medications and other antidepressants can affect the serotonin levels

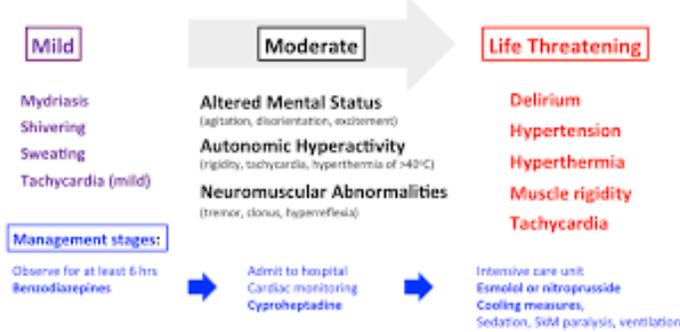


Drug	Drug Combinations
MAOIs	MAOI alone MAOIs with SSRIs or SNRIs or TCAs or opiates Methylene blue with paroxetine or clomipramine Phenelzine with meperidine Tranlycypromine and imipramine
SSRIs	SSRI alone SSRIs with MAOIs or SNRIs or TCAs or opiates or triptans Fluoxetine with carbamazepine or phentermine or fentanyl
SNRIs	SNRIs with MAOIs or TCAs or opiates or triptans Venlafaxine alone Venlafaxine with lithium or calcineurin inhibitors Venlafaxine with mirtazapine and tramadol Venlafaxine with amitriptyline and meperidine Venlafaxine with mirtazapine or tranlycypromine Venlafaxine with methadone and fluoxetine Venlafaxine with methadone and sertraline Venlafaxine with tramadol and trazodone and quetiapine
Other Antidepressants	Buspirone with SSRIs Mirtazapine alone Mirtazapine with SSRIs Trazodone with amitriptyline and lithium
Opiates	Opiates with MAOIs or SSRIs or SNRIs or triptans Tramadol alone Tramadol with mirtazapine and olanzapine
Over-the-Counter Cold Remedies	Dextromethorphan with SSRIs or amitriptyline or chlorpheniramine Dextromethorphan with risperidone and amitriptyline
Atypical Antipsychotics	Olanzapine with lithium and citalopram Risperidone with fluoxetine or paroxetine
Antibiotics	Ciprofloxacin with venlafaxine and methadone Fluconazole with citalopram Linezolid with SSRIs or tapentadol
Other	L-tryptophan with SSRIs

MAOI, monoamine oxidase inhibitor; SNRI, serotonin-norepinephrine reuptake inhibitor; SSRI, selective serotonin reuptake inhibitor; TCA, tricyclic antidepressant.

MANAGEMENT

Symptoms & Management in Serotonin Syndrome:



The most important part of management is recognizing the syndrome. It can be mistaken for withdrawals or anticholinergic syndrome. Ultimately the management is to allow the body to deplete the stores of serotonin and to support the person by addressing the symptoms. However, the risk of not recognizing the syndrome may mean that medications to treat the symptoms may actually elevate the serotonin levels.

PART II: NOT SO CLASSIC BUT YOU NEED TO KNOW ABOUT

HALLUCINOGENS AND DISSOCIATIVE AGENTS

Hallucinogens and Dissociative Agents are both recreational and prescribed medications that are abused. Toxicity to hallucinogens result in hallucinations which by itself is non-lethal. However, the perceptual change is real to the person and can result in a traumatic event. It is safe to say that it would not bode well if someone is on the 21st floor and the perceptual distortion is that he can fly. Dissociative Agents creates a detachment between the person's brain and body. In this case, they often become psychotic but have not sense of pain. They also can develop super human strength. When working in Chicago, four police officers brought in a gentleman half naked on PCP who was throwing manhole covers across the alley in the air. It is also important to remember that psychosis is not exclusive to this group of drugs but is in fact a potential presentation of many other toxidromes.

HALLUCINOGENS AND DISSOCIATIVE AGENTS

	SYMPTOMS	TOXIC SEQUELAE
Heart Rate	Elevated	
Blood Pressure	Increased/Unchanged	
Respiratory	Increased/Unchanged	
Temperature	Increased/Unchanged	
Pupils	Mydriasis	
Skin	Wet/Unchanged	
CNS	Agitated, Psychosis	High risk for significant trauma

DRUGS OF ABUSE

HALLUCINOGENS:

- DMT: Chemical found in some Amazonian plants. Can be manufactured
- LSD: D-lysergic Acid Diethylamide: Found in fungus that grows on rye and other grains. Favorite of the Grateful Dead Crowd
- PEYOTE: Mescaline: Small spineless cactus. Also synthetic.
- PSILOCYBIN: Found in types of mushrooms in Southern USA, Mexico and South America

DISSOCIATIVE AGENTS:

- **KETAMINE:** Is a dissociative anesthetic and an extremely versatile drug having a role in respiratory issues, sedation, “chemical restraint”, pain management and even treating depression. When abused it causes a sense of detachment along with amnesia and psychosis. Due to its sedative properties, it is also used as a “date rape” drug.
- **PCP (Phencyclidine):** Is similar chemically to Ketamine. It is a strong dissociative anesthetic that was noted to cause delirium and mania. Due to its significant side effects, it was taken off the market. Recreationally, it results in a detached state that is combined with acute psychosis and blunted pain sensation. When using PCP, the person may exhibit phenomenal strength and complete lack of pain sensation. They have been known to break their own limbs when resisting arrest and still continue to resist.
- **DEXTROMETHOPHAN:** Is primarily used as an active ingredient in cough syrups as a cough suppressant. At higher doses, it acts as a dissociative agent resulting in euphoria, restlessness, and perception distortion.

MANAGEMENT

Management is supportive. In part, you need to protect yourself and also protect the patient. Dissociative agents may result in newfound strength along with total disregard for pain. Patient may hurt themselves along with those trying to restrain them. ***IF YOU SUSPECT A DISSOCIATIVE AGENT, DO NOT USE KETAMINE TO SEDATE THE PERSON. YOU WILL BE ADDING FUEL TO THE FIRE.***

CYANIDE

CYANIDE is a chemical that today is found in foods and industrialized products. It is extremely versatile and capable of entering the body through ingestion, inhalation or the skin. The effect of cyanide on the body is determined by the amount of the exposure. In fact, lower levels of toxicity can cause secondary complications such as strokes and heart attacks.

Cyanide interacts with the body by blocking the ability of the part of the cell called the mitochondria from utilizing oxygen. Red cells can transport the oxygen, but the oxygen can't be released and used by other cells. Without oxygen, the body goes into an anaerobic state resulting in acidosis, cellular hypoxia and death.

Due to the body's ability to carry oxygen but not use it, the skin will oftentimes have a "Cherry Red" look to it and supposedly there will be the smell of almonds.

CYANIDE

	SYMPTOMS	TOXIC SEQUELAE
Heart Rate	Elevated	Will decompensate to bradycardia
Blood Pressure	Increased	Will decompensate to hypotension
Respiratory	Increased	Pulmonary Edema
Temperature	Unchanged	
Pupils	No effect	
Skin	Unchanged	Cherry Red Flushing/Cyanosis
CNS	Agitated,	Headaches, Seizures, Coma

MANAGEMENT

Hydroxocobalamin, a B12 precursor is considered the standard for treatment of cyanide poisoning. It binds with the cyanide to form cyanocobalamin that is an inert chemical and gets excreted in the urine. One of the bigger sources of cyanide is building materials. The cyanide gets released as a gaseous form when the materials are burned. The effects can be immediate or delayed. Studies have shown that people treated for cardiorespiratory conditions and who had been recently exposed to a fire had elevated cyanide levels. ***THEREFORE, ANY PERSON WHO HAS A CARDIOPULMONARY EMERGENCY WITHIN 48 HOURS OF BEING INVOLVED IN A FIRE SHOULD BE TREATED OR AT LEAST CONSIDERED FOR TREATMENT WITH HYDROXOCOBALAMIN***