



Update in Toxicology 2019

Thapanawong Mitsungrern, M.D.
Emergency Physician, Toxicologist
Department of Emergency Medicine,
Faculty of Medicine, Khon Kaen University

Today's Scope

- Toxicity from plant cannabis and synthetic cannabinoids
- New suicidal trend (Charcoal-burning suicide)

Management of Toxicity from Cannabis (plant marijuana) and Synthetic Cannabinoids



Thapanawong Mitsungnern, MD, FTCEP
Department of Emergency Medicine,
Faculty of Medicine,
Khon Kaen University
Thapanawong@kku.ac.th



Thailand Government decriminalized cannabis from illegal drug → legalized medicinal cannabis (Feb 2019)

Legalized cannabis 2019

- Recreational use
- Medicinal use

Scope

- The Differences between Cannabis and Synthetic Cannabinoids
- The Management of Toxicity from Cannabis (Plant Marijuana)
- The Management of Toxicity from Synthetic Cannabinoids

The differences between CANNABIS vs SYNTHETIC CANNABINOIDS

Cannabis

A type of Weed

Kingdom: Plantae

Clade: Angiosperms

Clade: Eudicots

Clade: Rosids

Order: Rosales

Family: Cannabaceae

Genus: Cannabis L.



Male
cannabis



Female
cannabis



Synthetic Cannabinoids (SCs)



- SCs are sold under common names like **K2**, **Spice**, and synthetic marijuana
- SCs are the **designer drugs** that are sprayed onto plant matter
- Sold as herbal smoking blend, herbal incense
- Often labeled “not for human consumption”

Example:

1. *Cannabis sativa* L.
2. *Cannabis indica* Lam.
3. *Cannabis ruderalis* Janisch

Common name: Hemp

The differences between CANNABIS vs SYNTHETIC CANNABINOIDS

Cannabis

- Found 4000+ years ago
- Medical use in china 2000+ years ago
- Agonist of the cannabinoid-1 (CB1) receptors (psychoactive effect: high)
- The most potent substance to CB1 receptor in cannabis: THC

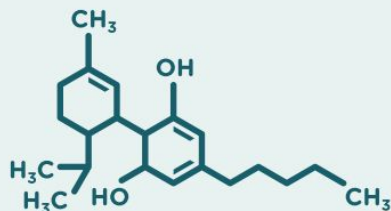
Hallucinogen

Synthetic cannabinoids (SCs)

- Saled on early 2000s
- First laboratory analysed since 2008
- Greater agonist and affinity of the CB1 receptor (CNS stimulants)
- Drug designs: similar structure to THC
- Several synthetic cannabinoid families
- Classified by base structures
 - CP-xxx
 - WIN-xxx
 - JWH-xxx
 - UR-xxx
 - PP

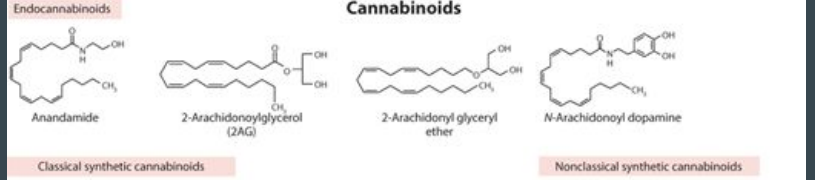
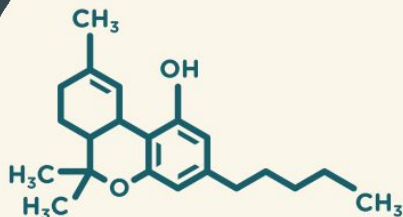
New waves of the CNS stimulant
3x mortalities in 2014-2015!!

Chemical structures of substances in Cannabis vs SCs



CBD
CANNABIDIOL

THC
TETRAHYDROCANNABINOL



AKB48

Yui Yokoyama (TEAM A)

Juri Takahashi (TEAM B)

Nana Okada (TEAM A)

Mion Mukaichi (TEAM A)

Yui Oguri (TEAM B)

Miu Shitao (TEAM B)

Ryugu Taniguchi (TEAM B)

Nickname of SCs

2NE1

XLR-11: NASA Rocket engine liquid fuel

Health hazards

Cannabis

- Death from trauma that caused by overdose (indirect)
- Chronic problem: Addiction, brain development, behavior, psychiatric disorders
- Cannabinoid Hyperemesis Syndrome (CHS)
 - Cyclical vomiting, abdominal pain
 - Refractory to conventional antiemetic drugs
 - Symptoms are better by hot shower or bathtub, topical capsaicin
 - Unnecessary endoscopy and surgery

Synthetic Cannabinoids (SCs)

- Death from the toxicity of substances
- Fake marijuana (sold as a real marijuana; market share)
- Increased violences, criminals in society and hospital from toxic psychosis/agitated delirium
- More addictive than marijuana

Now situation (Cannabis oil in Srinagarind hospital)

Case 1: CA breast stage 2 → Delirium from marijuana oil (exclude other precipitating causes)

Case 2-3: Activate stroke fast track from ataxia and dysarthria

Case 4-5: dry mouth, restlessness, palpitation, tachycardia, severe dizziness, skin: not wet/not dry (need to rule out sympathomimetic or anticholinergic toxidrome), urine marijuana test: positive, amphetamine negative

Case 6: Illness (palpitation and unsteadiness) after eating friend's cookies and almost did car accident because symptoms started during car driving back (30 minutes post-ingestion)

All cases

- came to emergency room and initially covered history of ingestion.
- sublingually used marijuana oil that bought from online shop or received from friend/relatives.
- related on high socioeconomic status (high price per bottle)

Route of exposure

1. Inhalation
2. Ingestion

Purposes of exposure

1. Unintentional
2. Intentional
 - a. Recreational use/abuse
 - b. Medical/therapeutic
 - c. Self harm (rare)

Inhalation



Marijuana cigarette



Marijuana cigarette



Marijuana vaping

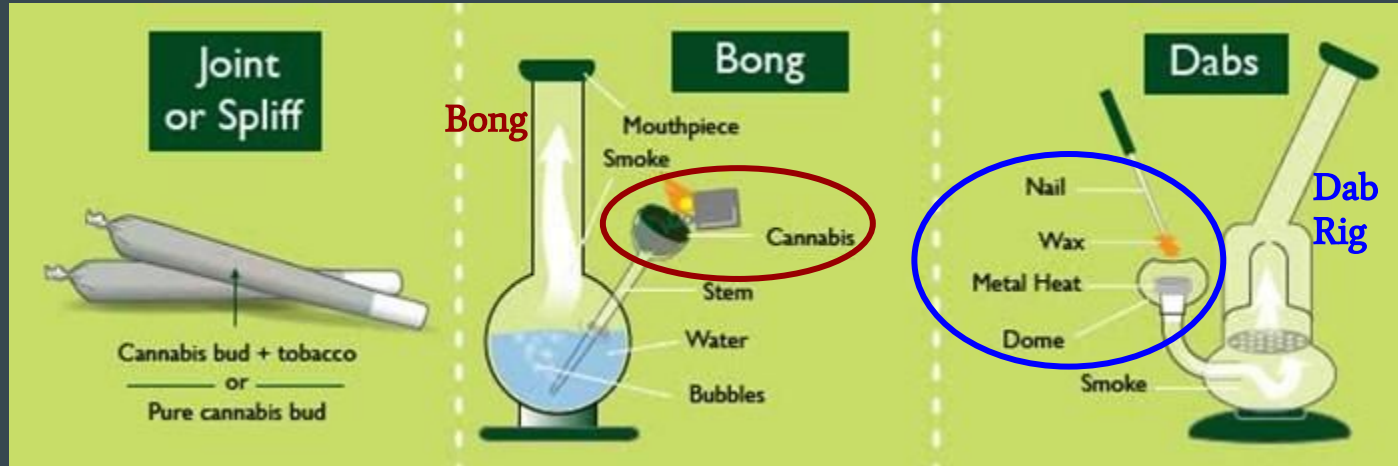


Marijuana dabbing



Marijuana bong

The differences between BONG vs DABs



Dry weed
Bowl
Lighter need
Humidified by water
Bong

Wax
Nail
Metal heat
No need water, Filter before inhalation
Dab rig

INGESTION



Bakes



Cookies

Dinners



Brownies

Jelly bears



Energy drinks



Chocolates

Tea, Beers, Cocktails, etc.



Coca Cola??

Effects of Using Cannabis

INHALATION

(smoking/vaping/dabbing)



Felt in seconds to minutes
Lasts up to 6 hours +

INGESTION

(eating/drinking)

Felt in 30 minutes to 2 hours
Last up to 12 hours +

Break

Cannabis is toxic plant to animal.

Keep it away from your pet!!

Cannabis Toxicity can be caused from:

Second Hand Smoke



KEEP POT OUT OF PAWS' REACH!

Devonian VETERINARY Clinic

Symptoms of Toxicity

- Lethargic
- Incontinence
- Loss of Balance
- Breathing Problems
- Lower Blood Pressure
- Abnormal Heart Rhythms

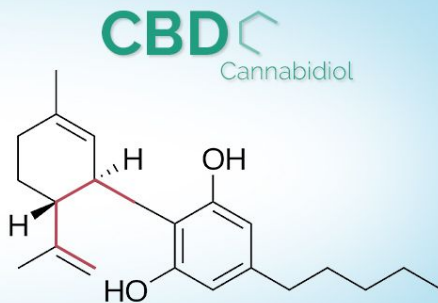
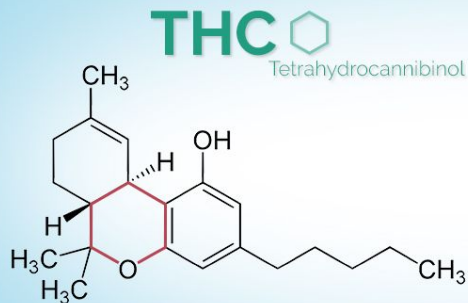
Ingestion of Cannabis Itself



Ingestion of Cannabis Products



Visit: <https://www.petpoisonhelpline.com/pet-safety-tips/marijuana-toxicity-pets/>



The Management of Cannabis (Plant marijuana) toxicity

Toxicology

- THC stimulates CB receptors throughout the body
 - CB receptors in pain pathway (Brain & spinal cord)
 - Central CB receptors: Antiemetic properties
 - Peripheral CB receptors: modulate immune function via cytokine release

Self reports ranking the need of the local ED visit after drug abuse

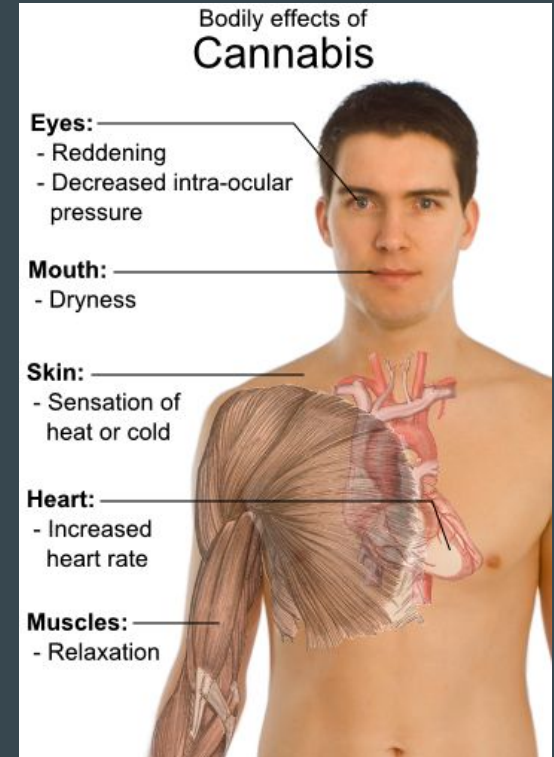
1. Mushrooms: 0.2%
2. Cannabis: 0.6%
3. LSD: 1.0%
4. Cocaine: 1.0%
5. Amphetamine: 1.1%
6. MDMA: 1.2%
7. Alcohol: 1.3%
8. Synthetic cannabinoids: 3.2%
9. Methamphetamine: 4.8%

2017 Global Drug Survey

Acute toxicity of Cannabis (Plant marijuana)

Mild to moderate toxicity

- somnolence, euphoria, alterations of senses and time perception, depersonalization, loss of social inhibition, giddiness, and mood alterations.
- Higher levels of intoxication result in **decreased motor coordination**, lethargy, muscle jerking, and ataxia.
- ***Inhalational exposure*** may result in pulmonary irritation, including sore throat, rhinitis, coughing and bronchitis



Acute toxicity of Cannabis (Plant marijuana)

Severe toxicity

- In children, there are reports of significant altered mental status, mydriasis, hypotonia and even coma.



Marijuana butt



Marijuana hashish;
the resin of the female cannabis
plant



Marijuana food products

Acute toxicity of Cannabis (Plant marijuana)

Severe toxicity

- In young man
 - died from **trauma** due to erratic behavior after ingesting edible marijuana cookie 3.5 hours post-ingestion
 - **Dabbing**: This method can produce a rapidly absorbed highly concentrated form of THC that is usually smoked. It is sometimes also known as "wax", "budder", "dabs" and "oil"
 - Teenager; **agitation, seizure-like activity, hypertension, and hyperthermia** after dabbing



Legalized marijuana linked to a sharp rise in car crashes

NBC news: California Highway Patrol officers investigate the scene of a multi-car crash



Cannabis Dabbing



Cannabis wax
(nickname: honey)
Purified, High
concentrated THC

Chronic use

CANNABINOID HYPEREMESIS SYNDROME (CHS):

- Paradoxical, cyclic vomiting syndrome has been reported in individuals (more frequently observed in men) that chronically use marijuana.

Real case (Bangkok): A young man presented with significant weight loss and intermittent intractable severe vomiting that not response to IV antiemetic drugs and physician took 7 years to diagnose CHS after many times work-up with GI medicine and surgeon (CT whole abdomen, Endoscopies was negative) about cyclical vomiting. The urine marijuana is positive.

Pathophysiology of CHS

transient receptor potential
vanilloid 1 (TRPV1) agonist

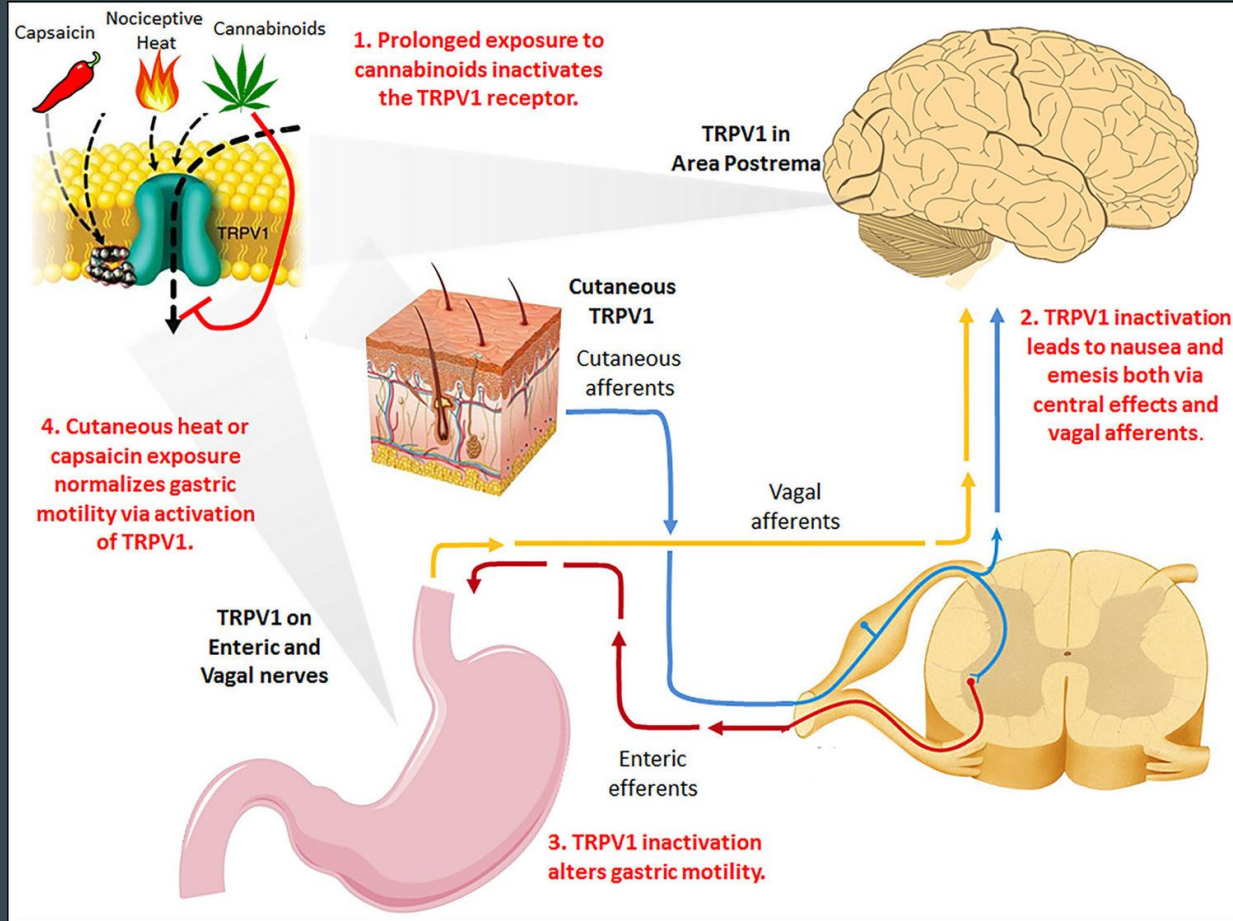


Figure 1: proposed mechanism of CHS; TRPV1 is expressed in area postrema of the medulla, along gastric enteric and vagal nerves, and on cutaneous receptors in the dermis and epidermis. Prolonged exposure to cannabinoids inactivates TRPV1, potentially resulting in central nausea, altered gastric motility, and abdominal pain. Exposure to nociceptive heat, such as with compulsive hot-water bathing, may transiently augment cutaneous TRPV1 firing and restore gastric motility, temporarily mitigating symptoms. Use of another TRPV1 agonist, capsaicin, may also provide relief. Cessation of marijuana use gradually leads to normalization of TRPV1 function and fully ameliorates symptoms.

ACG Case Rep J. 2018 Jan 3;5:e3.
doi: 10.14309/crj.2018.3. eCollection
2018.

**Successful Treatment of
Cannabinoid Hyperemesis
Syndrome with Topical Capsaicin.**

Triphasic phases of CHS

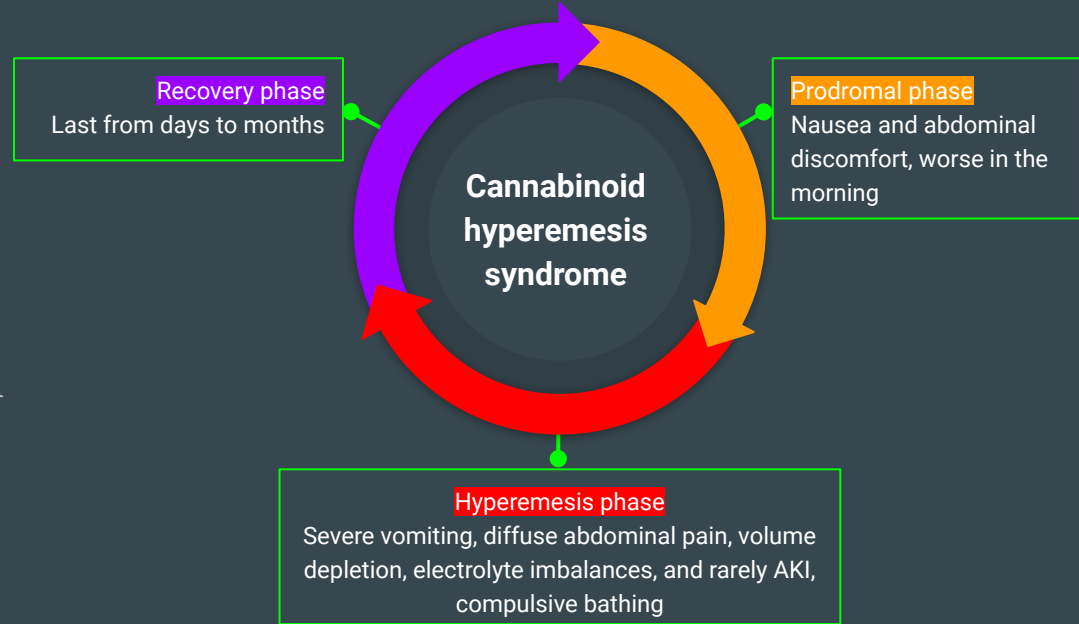
Prodromal phase

Hyperemesis phase

Recovery phase

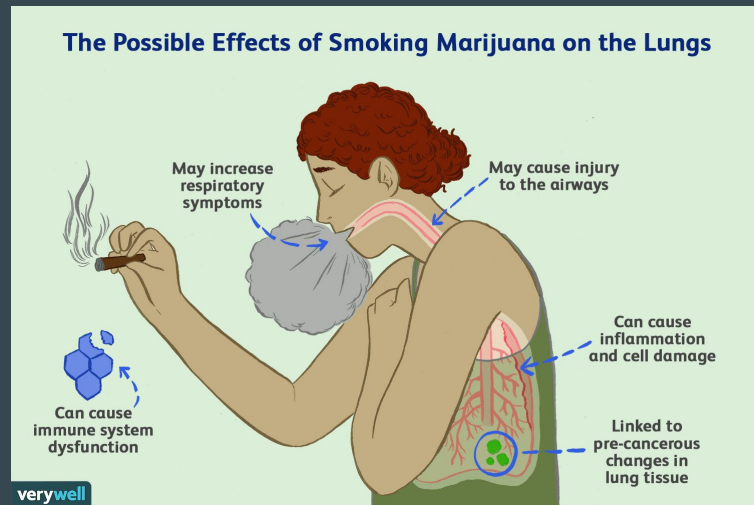
Treatment of CHS

- Quit cannabis
- IV antiemetic and adequate IV rehydration
- Case report of topical capsaicin to treat CHS
- CHS Symptoms persist last up hours to months
- Take hot shower or bathtub



Carcinogenicity

- Marijuana smoking **may increase the risk of cancers** of the **mouth, neck, and lungs**, although it is difficult to experimentally study the carcinogenic potential of marijuana in humans. Obtaining a study sample of persons who consistently use marijuana over a long period of time who are not exposed to other carcinogens (eg, tobacco smoke) and can be evaluated over many years is problematic.



Monitoring

A) **No specific laboratory studies** are needed in most patients. Confirmatory testing at most facilities involves the use of a urine enzyme immunoassay, which may detect metabolites for up to several days after an acute exposure to weeks after chronic marijuana use. However, urine concentrations do not correlate with toxicity.

B) **Prescription use of dronabinol (THC) can be distinguished from plant material** use by testing for *THCV (delta-9-tetrahydrocannabivarin)*, which only exists in the marijuana plant, but this is not done routinely.

C) Specific THC concentrations are not readily available or useful.

D) Other adjunctive tests may be necessary depending on the patient's symptoms. Obtain a serum glucose and electrolyte concentrations for altered mental status. Obtain a baseline ECG and continuous cardiac monitoring for tachycardia or altered cardiac rhythm.

Laboratory tests/monitoring

- **Urine enzyme immunoassay**
 - Positive test imply prior usage or sidestream smoke
 - Positive test
 - single marijuana cigarette smoking possible detection for several days
 - Casual use of marijuana were positive for 2-4 wks post-exposure

Xenobiotics or Conditions Reported to Produce Inaccurate Screening Test Results for Tetrahydrocannabinol (THC)

Urine screening for marijuana (immunoassay)

False Negative ^a		False Positive
Bleach (NaOCl)	Niacin	Dronabinol
Citric acid	Potassium nitrite (KNO ₂)	Efavirenz
Detergent additives	Table salt (NaCl)	Ethacrynic acid
Dettol	Tetrahydrozoline	Hemp seed oil
Dilution	Vinegar (acetic acid)	Nonsteroidal antiinflammatory drugs
Glutaraldehyde	Water	Promethazine
Lemon juice		Riboflavin

^aXenobiotics “possibly” producing false-negative urine test results are usually added to a urine sample, not ingested.

Treatment “ABCDE DDEAD”

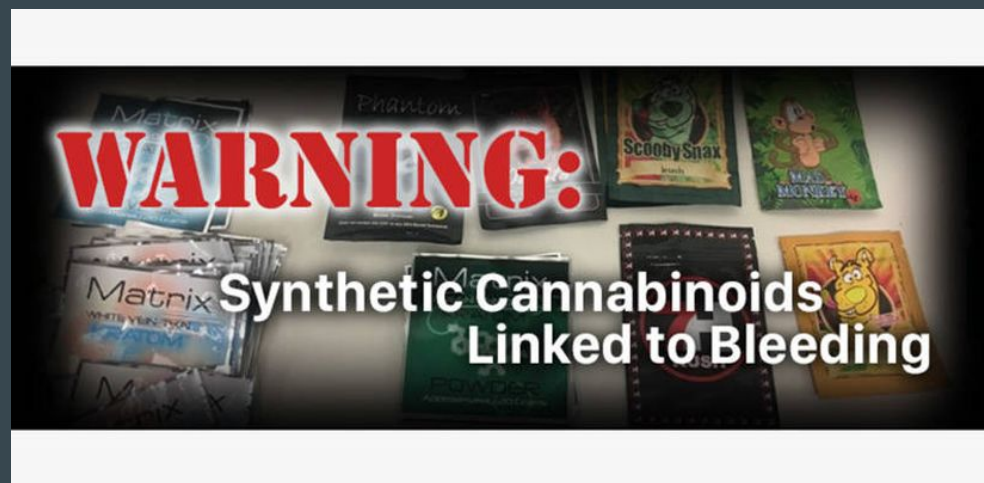
- Support respiratory and cardiovascular function
- Airway (A)
 - ETI if comatose
- Breathing (B)
 - In inhalational exposure: Observe RR, SpO₂, B2 agonist inhales if bronchospasm
- Circulation (C)
 - Hypotensive episode; use trendelenburg position for postural hypotension, rarely need IV loading
 - Cardiac arrhythmias: Atrial fibrillation
- Disability (D)
 - Agitation, coma; ETI
 - Seizures → BZPs,
- Extracauses of life threatening conditions (E)
 - Severe delirium → BZP
- Diagnosis (D)
 - History + Physical Exam + Investigation
urine screening for marijuana: positive
- Decontamination (D)
 - Not need GI decontamination (lavage, SDAC, and WBI)
 - Rarely be benefit in cannabis (rarely found serious complication)
- Enhanced elimination (E)
 - No role of blood removal, MDAC, and urine alkalization
- Antidote and specific treatment (A)
 - There is no antidote
- Disposition (D)
 - Next page

Patient disposition

Oral exposure

- Admission criteria
 - Prolonged symptoms/ concerns for social situation (e.g. young child) should be admitted to the hospital
 - Rarely necessitate an ICU admission
 - Criteria for discharge; clear improvement and adequate safeguards in the home environment for young children
- Home criteria
 - Most adult with minimal to moderate symptoms can be managed at home
 - Children with inadvertent marijuana exposure (plant material, medical marijuana edibles containing marijuana) should be evaluated in a healthcare facility
- Consult criteria
 - Child abuse team should be involved in children cases, toxicologist can be contacted for any questions or concerns
- Observation criteria
 - Any patients with self-harm attempt using marijuana or any exposed child should be sent to the healthcare facility for evaluation.
 - Patients should be observed until they are clearly improving or asymptomatic which normally should not be more than a few hours.

Break



The Management of Synthetic Cannabinoids (SCs) toxicity

Toxicology

- SCs (THC homologs) → stimulate CB1 and CB2 receptor
- Cannabis like effects
- 28 x greater potency than THC

SYNTHETIC CANNABINOIDS USE CAN
BE HARMFUL TO YOUR **HEALTH**

**POISON
Help**
1-800-222-1222

2,695
calls to poison control
centers for harmful exposure
from these drugs in 2016²

28,531

ER visits in 2011 were
linked to synthetic
cannabinoids³



30% of these
visits involved females,
and **70%** involved males³

78%

of ER visits were among
adolescents and young
adults ages 12-29³

²The American Association of Poison Control Centers, 2016. <http://www.aapcc.org/alerts/synthetic-cannabinoids/>
³Substance Abuse and Mental Health Services Administration, 2014. <https://www.samhsa.gov/data/files/default/files/SR-1378/SR-1378.pdf>



For more information, visit:
drugabuse.gov/publications/drugfacts/synthetic-cannabinoids

Acute toxicity

MILD TO MODERATE TOXICITY

- alterations in mood and perception, xerostomia, reddened conjunctiva, and an increase in pulse rate, similar to marijuana (THC).
- Hyperemesis, similar to marijuana, has been observed in a patient following excessive use.
- Other effects reported that may not follow the current pattern of exposure to THC compounds have included hypertension, agitation, tremors, paranoia, hallucinations and, rarely, hypokalemia.
- The onset of effects after inhalation is rapid and gradually resolves.

SEVERE TOXICITY:

- Severe agitation, hyperthermia, recurrent seizures, SVT, rhabdomyolysis (infrequent) and psychosis have been reported.
- STEMI has been reported in several adolescents, and can occur in patients with normal coronary arteries.
- Acute renal injury has been reported among teenagers after smoking a new synthetic cannabinoid referred to as XLR-11. Acute renal failure and significant rhabdomyolysis occurred in a young adult following an episode of persistent hyperemesis after using a synthetic cannabinoid product.
- The type and amount of THC homologs, contained within herbal products, can vary considerably.
- There is a possibility of severe overdose due to batch-to-batch variability within the same product. In addition, there is very little known regarding the herbal mixtures used as the delivery vehicle; the herbs themselves may also have additive psychoactive properties.

Case reports of ADULTERATED SYNTHETIC CANNABINOID PRODUCTS:

- Spring 2018: US poison center reported they found many cases **presented with coagulopathy and bleeding** after smoking synthetic cannabinoids.
- Blood products were required in some cases with **FFP** being the most likely product.
- No specific synthetic cannabinoid was identified during this outbreak.
- *Confirmatory testing identified 3 different anticoagulants (ie, brodifacoum, difenacoum and bromadiolone); brodifacoum was the most common.*



Laboratory/Monitoring

- A) No specific laboratory studies are needed in most patients. Obtain specific laboratory studies based on symptoms observed in the patient, since the constituents of many of these products may contain multiple chemicals unrelated to the reported synthetic cannabinoid consumed.
- B) **THC homologs** are not structurally related to delta-9 tetrahydrocannabinol, the active ingredient in marijuana and are, therefore, **undetectable via routine toxicologic screening methods (ie, urine)**.
- C) **Monitor fluid and electrolyte status** in symptomatic patients. Mild hypokalemia and severe vomiting have been rarely reported following inhalational exposure to these compounds.
- D) **Obtain a baseline ECG and institute continuous cardiac monitoring** for tachycardia or altered cardiac rhythm.

Treatment “ABCDE DDEAD”

- Support respiratory and cardiovascular function
- Airway (A)
 - ETI if comatose
- Breathing (B)
 - In inhalational exposure: Observe RR, SpO₂, B2 agonist inhales if bronchospasm
- Circulation (C)
 - Hypotensive episode use trendelenburg position for postural hypotension, rarely need IV loading
 - Cardiac arrhythmias: Atrial fibrillation
- Disability (D)
 - Violence, agitation, seizures, coma; ETI
 - Repeated seizures → BZPs, phenobarbital, propofol, *avoid phenytoin*
- Extracausas of life threatening conditions (E)
 - **Hyperthermia**; external cooling by mist and fan
 - **Rhabdomyolysis** and AKI
 - **Coagulopathy** (rodenticide contaminate); FFP
- Diagnosis (D)
 - History + Physical Exam + investigation **urine screening for marijuana : Negative**
- Decontamination (D)
 - Not need GI decontamination (lavage, SDAC, and WBI)
 - Rarely benefit in cannabis (rarely found serious complication)
- Enhanced elimination (E)
 - No role of blood removal, MDAC, urine alkalization
 - **Role of hemodialysis** in Uremia, refractory acidosis & hyperkalemia
 - **Role of urine alkalization** in severe rhabdomyolysis
- Antidote and specific treatment (A)
 - There is no antidote
- Disposition (D)
 - Next page

Patient disposition

1) HOME CRITERIA:

- Most adult cases with minimal to moderate symptoms can be managed at home if a responsible adult is present. The vast majority of exposures are recreational in nature and do not require any medical intervention, however **referral for substance abuse treatment** may be indicated.

2) OBSERVATION CRITERIA:

- Any patient with a **self-harm attempt or any exposed child** (as exposures may be considered a form of child neglect or abuse) should be sent to a healthcare facility for evaluation. Patients should be observed until they are clearly improving or asymptomatic, which normally should not be more than a few hours.

3) ADMISSION CRITERIA:

- Any patients with **prolonged symptoms or concerns for a patient's social situation** (eg. young child) should be admitted to the hospital, and depending on the severity of their symptoms, may rarely necessitate an ICU admission. However, most patients exposed do not exhibit severe toxicity. Criteria for discharge includes clear improvement or resolution of symptoms and adequate safeguards in the home environment for young children.

4) CONSULT CRITERIA:

- **Social work or child abuse teams** should be involved in cases involving children. **Toxicologists and poison centers** can be contacted for any questions or concerns.

Abstinence syndrome

- Abrupt discontinuation of chronic use can cause profuse sweating, tremors, palpitations, insomnia, headache, depression, diarrhea, nausea, and vomiting.
- Treat with benzodiazepines

Take home points

- ★ Cannabis toxicity is not serious, except in children, or dabbing.
- ★ Cannabis use can be caused fatal trauma due to the delayed onset of action, involving with motor coordination, unsteadiness, and level of consciousness.
- ★ Common symptoms in cannabis toxicity are palpitation, dry mouth, ataxia, behavior changes. The supportive treatment is mainstay.
- ★ Synthetic cannabinoids toxicity is very serious and are classified as CNS stimulants, not hallucinogens.
- ★ The violence control are the first priority, seizures and hyperthermia need to detect and promptly treat, the supportive treatment is key.

CANNABIS

กัญชา

ธุรกิจ 

การเมือง 

TT ารแพทย์

Charcoal-burning suicide

Charcoal-burning suicide

แก๊งจอดซอยเปลี่ยวกลางดึก ข้ามวันพบพ่อแม่ลูก 3 ศพ จุดเตารมควันดับสลดคารก

13 ส.ค. 62 (19:16 น.) ความคิดเห็น 16



Add @Sanook.com



SU REGIONAL

นำศร่า หนุ่มแวนเปิดเพลงรักเพลงเดียววนซ้ำๆ ก่อนจุดเตาถ่านรมควันฆ่าตัวตายคาแก๊ง

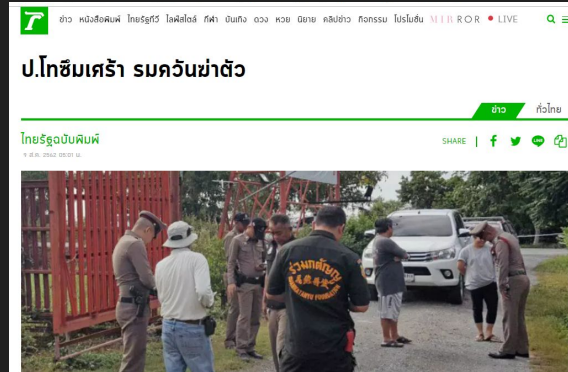
19 ส.ค. 62 (06:52 น.) ความคิดเห็น 3



Add @Sanook.com



SU REGIONAL



หน้าแรก ข่าวเดลิเวียส์ ข่าวทั่วไป

อาลัยครูสมจิตจากใบ เต่าถ่านรมควันฆ่าตัวตายในรถ

ครูหนุ่มโสดโรงเรียนดังสระแก้ว ใช้เต่าถ่านรมควันในรถกระบะฆ่าตัวตาย เพื่อนครูและนักเรียนต่างอาลัย ยังไม่ฟันสาเหตุมาจากอะไร

ศุกร์ที่ 26 เมษายน 2562 เวลา 15.55 น.



เดลิเวียส์ Dailynews @Dailynewswhit @dailynews_jg www.dailynews.co.th

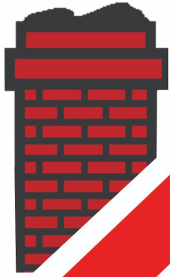


These situations that you should think about *CO poisoning!!*





Chimneys



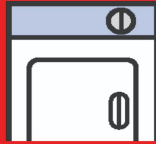
Fire Place



Stove Top



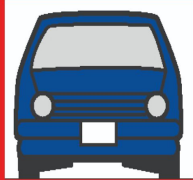
Furnace



Cloths Dryer



Hot Water Heater



Attached Garage

Common Household Locations That
May Leak Carbon Monoxide (CO)

Family members develop
headache in the same **house**
simultaneously

In winter season, very low ambient temperature

- Many people develops CO poisoning due to leakage of CO from many sources.
- Need **CO detector device** establishing in the house.

CARBON MONOXIDE (CO) POISONING



**CAN'T BE
SEEN**



**CAN'T BE
SMELLED**

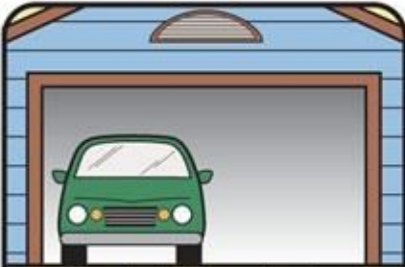


**CAN'T BE
HEARD**



**CAN BE
STOPPED**

Potential Sources of Carbon Monoxide



Car Left Running in Attached Garage



Portable Generators



Corroded or Disconnected Water Heater Vent Pipe



Portable Kerosene or Gas Heaters



Loose or Broken Vent Pipes



Improperly Installed Kitchen Range or Vent



Operating a Grill Indoors or in Garage

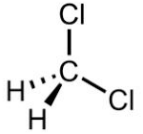


Gas or Wood-Burning Fireplace

Atypical exposure that make CO poisoning in human:

Ingestion a kind of solvent called “methylene chloride” or “dichloromethane (DCM)”

Use as paint and epoxy remover, solvent



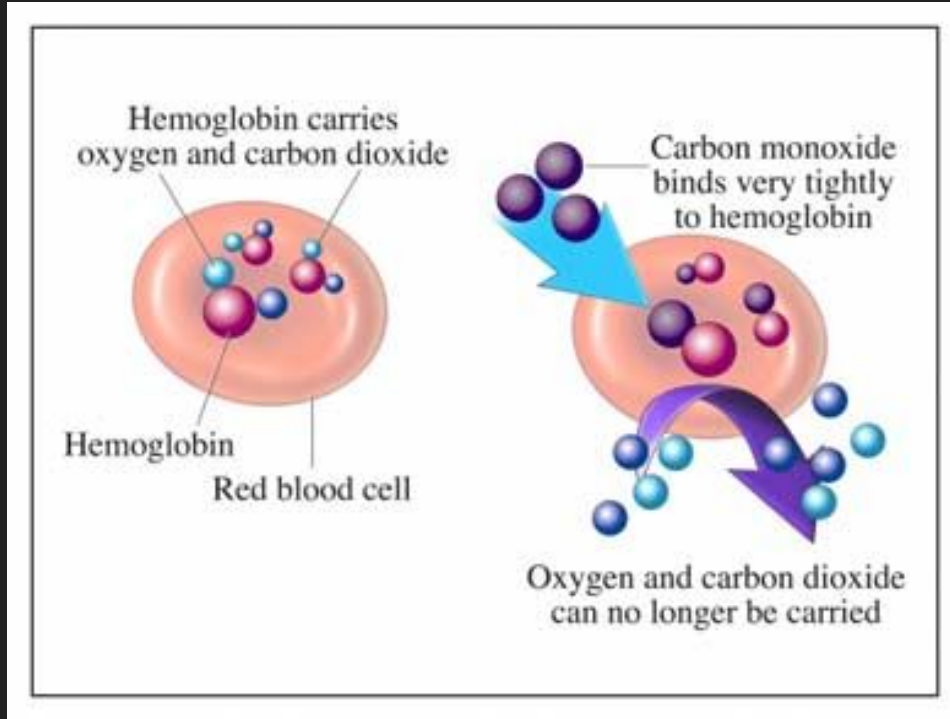
ใช้เป็นน้ำยาลอกสี ตัวทำละลาย

อาชีพเสี่ยง: ช่างไม้ นักเคมี จนท.ห้อง lab

WARNING



Mechanism of Toxicity



CO generate from incomplete combustion

Carbon monoxide (CO) has stronger affinity to Hb than oxygen about 250 times.

All tissue hypoxia

S&S: hypoxic symptoms

CARBON MONOXIDE POISONING

WHAT ARE THE SYMPTOMS?



HEADACHES



NAUSEA



DIZZINESS



BREATHLESSNESS



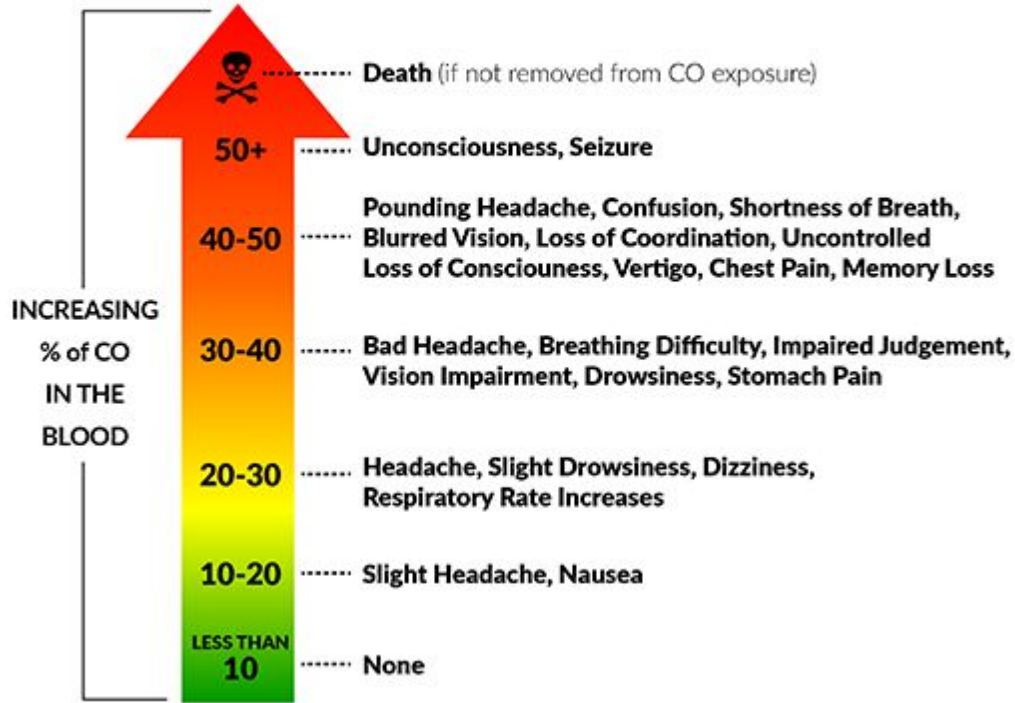
COLLAPSE



LOSS OF CONSCIOUSNESS

Typical Symptoms of Carbon Monoxide Poisoning

Only a guide, people may experience symptoms differently



Apply this scheme when you don't know COHb level.

- Loss of consciousness and Coordination → 40-50% COHb level
- Impairment of vision and judgement 30-40%COHb level
- Drowsiness, dyspnea → 20-30% COHb level
- Mild headache, nausea → 10-20% COHb

ปวดหัว
10%

ซึม/หอบ
20%

ตา/ตัดสินใจ
30%

หมดสติ
40%

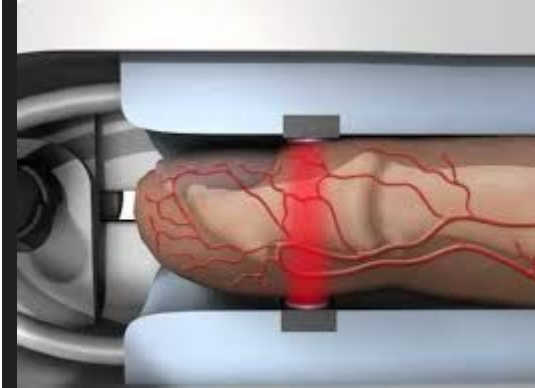
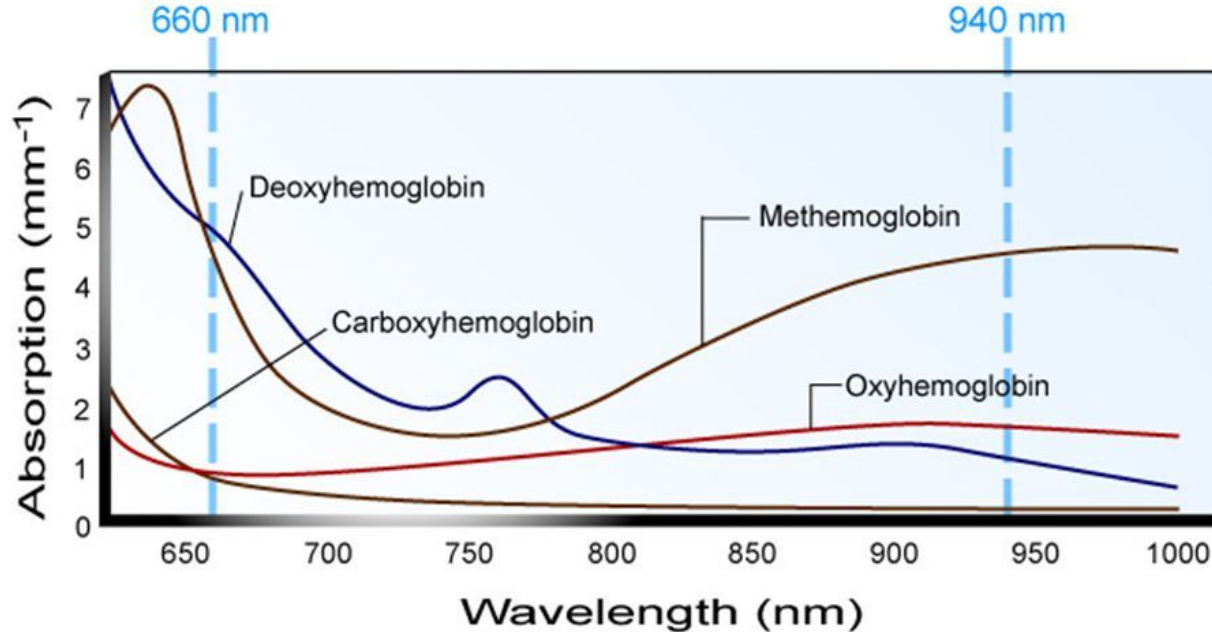
ตาย
50%

How to cope with charcoal burning suicide

- Recognize CO poisoning
 - Prehospital: pulse CO-oximetry
 - Inhospital: CO-oximetry (blood gas machine)



Pulse oximetry: cannot detect CO poisoning



CO level

Human

- Non smoker <2.5 %
- Smoker: <5%

The antidote for CO poisoning is **OXYGEN**

Treat until COHb level less than 5%

***Cherry red skin
is a late sign!***

***Cannot use for
diagnosis***

Management of CO poisoning

- Remove the patient from exposure and give oxygen 100% by non-rebreather mask or ET tube as soon as possible
- Early intubation in case of inhalation injury
- Prehospital pulse CO-oximetry in case of suspected CO poisoning (e.g. fire accident, CO leakage in house, charcoal burning suicide)
- Prehospital CPAP may be required
- Consider hyperbaric oxygen treatment (HBOT) in severe cases

Carbon Monoxide and half-life elimination for blood

Method of O ₂ therapy	Elimination half-life
Room air	240-360 minutes (4-6 hours)
Oxygen 100%	80 minutes (1.33 hours)
Hyperbaric oxygen	22 minutes

In case of fire accident

- Burn
 - Inhalation injury
 - CO poisoning
 - CN poisoning
 - Methemoglobinemia
-
- *Need many equipments and antidotes*



Equipments and drugs

- O₂ therapy: mask with bag
- Endotracheal intubation and mechanical ventilator
- Bronchodilator
- Pulse CO-oximetry or CO-oximetry
- Cardiac monitoring
- ABG machine
- 7.5%NaHCO₃ IV
- Crystalloid IV fluids
- Refer to hyperbaric therapy, if indicated for CO poisoning
- Antidote kit of Cyanide: 3%Sodium nitrite, 25%Sodium thiosulfate or Hydroxocobalamin
- Methylene blue for methemoglobinemia



Hyperbaric therapy: CO poisoning

Potential indications

1. history of a loss of consciousness
2. metabolic acidosis
3. age more than 36 years
4. pregnancy
5. carboxyhemoglobin level greater than 25% and
6. cerebellar dysfunction



Sodium nitrite

Indication

- Symptomatic cyanide poisoning with high suspicious, Not for all smoke inhalation victims
- Hydrogen sulfide poisoning

Contraindications

- Preexisting with metHb level >40%
- Severe hypotension
- Concurrent CO poisoning



Sodium thiosulfate

Indications

- Acute cyanide poisoning or suspected
- Cisplatin overdose

Give alone or combination with nitrite or hydroxocobalamin

Contraindication

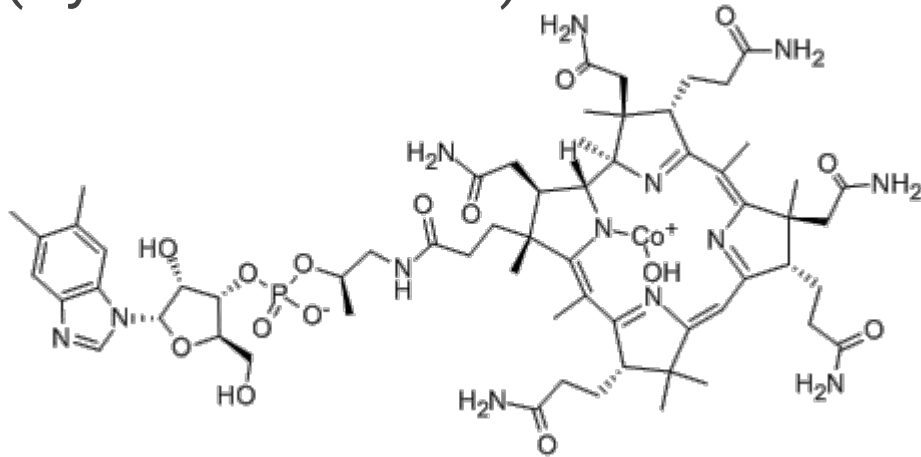
- None



In case of pregnancy with CO poisoning

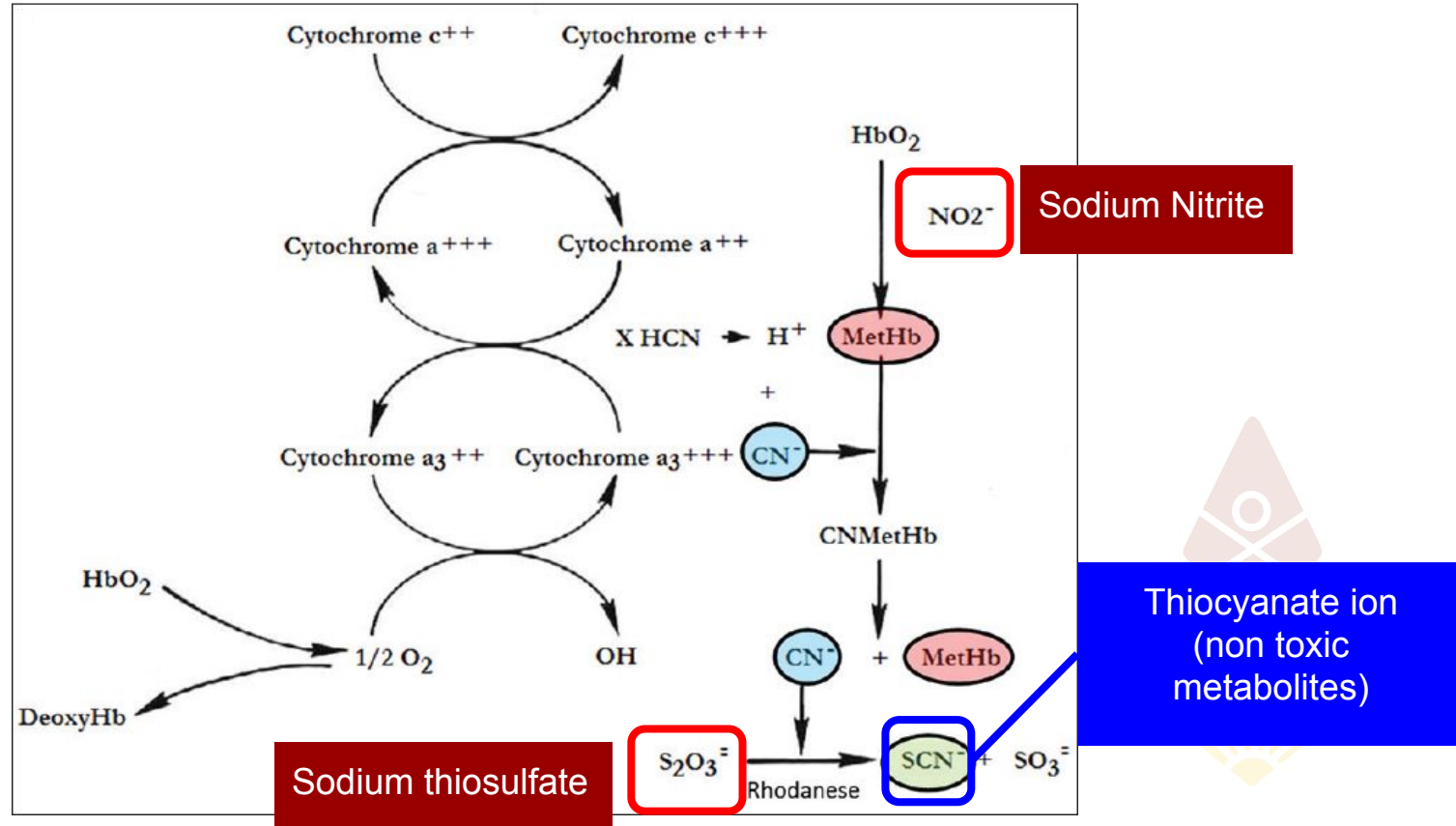
Prefer hydroxocobalamin over nitrite
hydroxocobalamin

- Pregnancy category C
- Similar with vitamin B12 (Cyanocobalamin)



1. One 250-mL glass vial containing 5 g of lyophilized hydroxocobalamin for injection
2. 1 Sterile transfer spike
3. 1 Sterile intravenous infusion set
4. 1 Quick-use reference guide
5. 1 Package insert

Mechanism of cyanide antidote



Antidote app in mobile phone
Antidote request in Thai
Call to Thai poison control centers



