

CSI Rochester: You be the Judge

Eric A. Pfeifer, M.D

Coroner's Office, Olmsted County

Loralie J Langman, PhD, DABFT

Toxicology and Drug Monitoring Laboratory, Mayo Clinic, Rochester, MN

DISCLOSURE

Relevant Financial Relationship(s)

None

Off Label Usage

None

Scene

Police were called to the scene of a 26-year-old man, who was acting “disturbed,” and threatening people with a knife.

On scene, the man was observed to agitated, taking his shirt off with one hand, and shouting almost incoherently.

He had physically assaulted another individual who required medical attention, but his injuries were not life threatening.

Drug Screen

Volatile alcohols
GC-FID

Drugs of Abuse Screening
immunoassay

Prescription And Over The Counter Drug Screen
liquid-liquid extraction
GC/MS

Toxicology

PM Blood

Volatile alcohols

ethanol	Not Detected
methanol	Not Detected
isopropanol	Not Detected
acetone	Not Detected

Toxicology

PM Urine

Prescription And Over The Counter Drug Screen

No drugs identified

Toxicology

PM Urine

Drugs of abuse

Drug	Result	Cut-off (ng/mL)
amphetamines	Negative	1000
barbiturates	Negative	200
benzodiazepines	Negative	200
cannabinoids	Negative	20
cocaine metabolite	Positive	300
opiates	Negative	300
phencyclidine	Negative	25

Cocaine Trivia

Cocaine is a naturally occurring alkaloid found within the leaves of a shrub, *Erythroxylon coca*, and is one of the most potent of the naturally occurring CNS stimulants.



The earliest reported use of cocaine dates back to times when the ancient inhabitants of Peru used the leaves for religious ceremonies.

Cocaine was first isolated from the coca leaf in 1859.

<http://www.emedicine.com/Med/topic3116.htm>
<http://upload.wikimedia.org/wikipedia/commons/1/15/Coca.jpg>

Cocaine Trivia

Its first use as a local anesthetic was reported in 1884.

In the late 19th century, Sigmund Freud proposed cocaine for the treatment of depression, cachexia, and asthma.



<http://www.emedicine.com/Med/topic3116.htm>
http://en.wikipedia.org/wiki/Image:Sigmund_Freud-loc.jpg

Cocaine Trivia

In 1885, John Styth Pemberton registered a cocaine-containing drink in the United States.



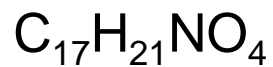
<http://www.emedicine.com/Med/topic3116.htm>

<http://cocaine.org/coca-cola/john-pemberton.jpg>

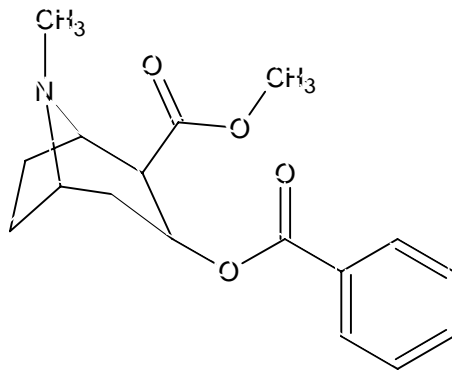
<http://thelongestlistofthelongeststuffatthelongestdomainnameatlonglast.com/images2/coke1.JPG>

Cocaine

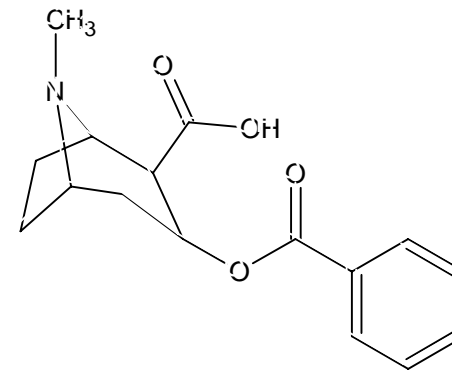
methyl (1*R*,2*R*,3*S*,5*S*)-3- (benzoyloxy)-8-methyl-8-azabicyclo[3.2.1]octane-2-carboxylate (benzoylmethyl ecgonine)



Mol Weight = 303.353 g/mol



cocaine



benzoylecgonine

<http://en.wikipedia.org/wiki/Cocaine>

Baselt, RC. *Disposition of Toxic Drugs and Chemicals in Man*, 7th Edition Ed, 2005, Foster City, CA.

Toxicology

Confirmations/Quantitations

Urine	concentration	method
cocaine	490 ng/mL	GC-MS
benzoylecgonine	6700 ng/mL	GC-MS

Blood	concentration	method
cocaine	120 ng/mL	GC-MS
benzoylecgonine	830 ng/mL	GC-MS

Cocaine Induced Psychosis

Cocaine induced psychosis (AKA excited delirium or agitated delirium) is characterized by:

- severe hyperthermia (104-108F)
- extreme strength
- extreme agitation
- bizarre and violent behaviour
 - fighting, breaking things
 - causing injury to themselves and others

Death may occur due to these injuries, but more frequently death occurs suddenly after agitation has ceased.

Scene

He would not respond to officers requests to put down the weapon, and continued making threatening movements with the weapon toward other people.

The man was struck with a police baton in the lower extremity which was ineffective in subduing the individual.

An officer un-holstered a TASER and discharged the unit at the man, who fell immediately, and was subdued by three officers, who put him in restraints.

When the officers put him in the back of the Police car, he man made some whimpering noises

Scene

They drove to the Police station where he was found unresponsive in the back of the Squad car.

EMS technicians who arrived at the scene detected a pulse but no breathing.

Resuscitative efforts were attempted, but the man died at the scene in police custody.

Autopsy

The estimated temperature of the deceased person was 102 F.

The autopsy showed a young man, slightly obese, with a few linear contusions on the posterior thighs, consistent with baton injury.

Autopsy

Perforated nasal septum

Small cut wound on his right flank

There were no petechial hemorrhages anywhere on the body

Two TASER barbs were still lodged in his jacket and skin of his back

Autopsy

A neck dissection showed no evidence of strap muscle hemorrhage cartilagenous nor bony neck fractures.

Other than the aforementioned physical trauma, he had no other evidence of recent trauma, and no physical trauma that was lethal.

Internally, the organs were all essentially grossly normal but minimal significant coronary atherosclerosis.

Cocaine - Toxicology

Although chronic cocaine use may result in toxicity in a variety of organ systems, cardiovascular diseases are most commonly associated with sudden death due to cocaine.

- coronary artery disease with or without myocardial infarction
- dilated cardiomyopathy
- contraction band necrosis as a result of catecholamine toxicity
- valvular heart disease
- aortic dissection

Cocaine Induced Psychosis

Toxicology results have similar cocaine:benzoylecgonine ratios and concentrations to those found for other accidental cocaine toxicity deaths.

Cocaine - Mechanism of Action

Cocaine causes an acute dopamine release and inhibits dopamine reuptake in the synapse (GG)

→ increased dopamine concentrations at critical brain sites

However, cocaine also blocks both norepinephrine (NE) and serotonin (5-HT) reuptake, and chronic use of cocaine produces changes in these neurotransmitter systems

reductions in the neurotransmitter metabolites 3-methoxy-4-hydroxyphenethyleneglycol (MOPEG or MHPG) and 5-hydroxyindoleacetic acid (5-HIAA).

Cocaine - Mechanism of Action

Although chronic cocaine use may result in toxicity in a variety of organ systems, cardiovascular diseases are most commonly associated with sudden death due to cocaine.

Coronary artery disease with or without myocardial infarction; dilated cardiomyopathy and contraction band necrosis as a result of catecholamine toxicity; valvular heart disease, and aortic dissection have all been attributed to complications of cocaine abuse.

Cocaine - Mechanism of Action

Chronic cocaine administration alters the DA transporter in the mesolimbic regions of the brain.

Increased densities in the DA transporter have been observed post-mortem in the brain of cocaine abusers and *in vivo* in acutely abstinent cocaine users.

Cocaine Induced Psychosis

Cocaine induced delirium may be due to an inability of the DA transporter to upregulate.

In these subjects, increased DA receptor densities are not observed, and it is postulated that the lack of increased receptor sites results in insufficient DA reuptake leading to excessive DA concentrations in the synapse.

Cocaine Induced Psychosis

The extreme hyperthermia in these subjects may be related to a decrease of DA-2 receptors in the hypothalamus responsible for decreasing body temperature

DA-1 receptors are not affected.
responsible for increasing body temperature

Cocaine Induced Psychosis

An upregulation of κ_2 opiate receptors has been observed in the amygdala due to Cocaine Induced Psychosis
subtype of the receptors reported to produce psychosis in phencyclidine intoxication

Cocaine Induced Psychosis

In Cocaine Induced Psychosis the stress from restraint may result in catecholamine surges on an already sensitized myocardium resulting in a terminal arrhythmia.

In these cases autopsy findings are relatively non-specific.

Cocaine Induced Psychosis

Unfortunately, by time the police have usually intervened and the restrained individual dies in police custody.

At autopsy, minor injuries, especially head injuries that may occur during attempts to restrain a subject, frequently result in over-interpretation and litigation.

Following this presentation, the attendee will be able to:

- Awareness of the controversy of cocaine induced psychosis
- Describe cocaine induced psychosis
- Describe the importance of collaborative efforts of the medical examiner's office and toxicology laboratory in determining cause and manner of death