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## An Epidemic of Cocaine Associated Deaths in Utah

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**ABSTRACT:** This article describes 15 cocaine associated deaths in Utah in a 3½-month period in early 1984, compared to 6 cocaine associated deaths for all of 1983. Brief case histories of the 15 cases are presented along with data on age, sex, county of death, cause of death, association of the cocaine with the death, cocaine analytical methodology, and a summary of cocaine concentrations in blood and urine. In four of the cases, cocaine by injection was the cause of death, whereas the other cases had cocaine or metabolite detected incidentally. The epidemiology of a single, well-defined cocaine source is described and related to this transient, remarkable increase in cocaine associated deaths.

**KEYWORDS:** pathology and biology, toxicology, cocaine, comparative analysis

### Background

Cocaine is an alkaloid derived from the leaves of *Erythroxylon coca*, a shrub indigenous to Peru and Bolivia [1,2]. It has been used in South America by native Indians since about the sixth century [1], but its modern use is generally associated with Sigmund Freud, who used it and wrote about it in 1884 [3]. Cocaine was not identified as a narcotic and drug of abuse until just before the passage of the Harrison Narcotic Act of 1914, and it has been a regulated drug since that time [1,3]. It is legally used as a topical anaesthetic in ear, nose, and throat (ENT) practice and in bronchoscopy [4]. The illicit use of cocaine has been overshadowed by other drugs such as heroin, sedative-hypnotics, marijuana, and so forth, until the early 1970s when its use increased dramatically [1,3-5]. This increased illicit cocaine usage was first noted in the larger population areas and was in the form of sniffing or snorting. More recently cocaine has reached smaller population centers and has also been taken into the body by smoking ("freebasing"), ingesting, and injecting [1,4-8]. In "freebasing," the cocaine is mixed in an alkaline solution, separated in an ether solution, and dried to the benzoylmethyecgonine amino alcohol base, which is more volatile when smoked than is the hydrochloride salt [1,4,5]. The increase in use of cocaine by freebasing, ingestion, and injection appears to be related to the easier availability and lower cost, as well as the desire for a more rapid and intense euphoria by these routes of administration [4,5]. A study by Perez-Reyes [9] has shown that freebasing causes a more pleasurable and intense feeling than does injection of cocaine. Unfortunately,

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the increased use of cocaine by injection, ingestion, and freebasing has been accompanied by a greater incidence of overdose and death.

Cocaine is a central nervous system (CNS) stimulant which causes euphoria, at first, followed by a mild CNS depression, in low doses [1]. A paranoid psychosis develops in some cocaine users [3, 10, 11], which is believed to be related to the underlying psychic structure of the person, rather than a purely toxic effect of the cocaine [11]. In lethal doses, the CNS stimulation gives way to CNS depression, respiratory failure, and death [1], although a direct cardiotoxic effect may play a role [1, 7, 12]. This latter mechanism is supported in a report by Coleman et al [12], which relates cocaine use to myocardial ischemia and infarction.

Cocaine is methyl benzoylecgonine which is metabolized as norcocaine, benzoylecgonine, and ecgonine methyl ester, although a small amount is excreted in the urine, unchanged [7]. Benzoylecgonine is considered the most important metabolite of cocaine for two reasons: it is the major metabolite, with 35 to 54% of cocaine being degraded in this way [7], and it is metabolized from cocaine by basic hydrolysis or heat in the postmortem or in vitro state [13].

The epidemiology of cocaine usage has not been well described in the literature. This may be because most case reports originate from large population centers where multiple drug dealers cause an "overlap" of drug usage as related to the source. The cocaine users in the literature are fairly well described by age and sex in postmortem [5], probation [6], and emergency room [1, 14] populations. With epidemiology being defined as the distribution (spread) and determinants (causes) of disease [15], then it appears that the epidemiology of the disease, cocaine abuse, is not fully understood.

The general recreational use of cocaine in the State of Utah does not appear to have changed significantly from 1983 to 1984, as judged by the number of positive urine cocaine determinations by the Utah State Health Laboratory in prisoners and probationers. In contrast, there was a marked, transient increase in cocaine associated deaths in early 1984, which was apparently related to a single, identified source.

## Methods and Materials

The toxicology reports of the Utah State Health Laboratory were searched for Medical Examiner cases which had cocaine or its metabolite in any submitted biologic specimens. The Office of the Medical Examiner records were examined in those cases in which there were positive results, and data were extracted for this paper.

Methodology for analysis of cocaine and its metabolite, benzoylecgonine, is as follows:

The identification and quantitation of cocaine and benzoylecgonine is accomplished in two steps. Blood and/or urine samples are screened using radioimmunoassay procedure developed by Roche Diagnostics, Inc. With this assay both cocaine and benzoylecgonine are detected with approximately equivalent sensitivity. A 0.05  $\mu\text{g/ml}$  threshold level was used to avoid "false positives." A gas chromatography-chemical ionization mass spectrometry method was used to confirm and quantitate cocaine and benzoylecgonine [16].

This laboratory determines only the benzoylecgonine metabolite because it is considered the major metabolite of cocaine and because the in vitro conversion of cocaine to benzoylecgonine by postmortem hydrolysis gives a better indication of the cocaine concentration at the time of death.

## Case Histories (1984 Cases)

### Case 1

A 23-year-old white male was found dead face down at his residence. He had a history of previous drug abuse. A large amount of a white powder was found at the scene.

*Case 2*

A 23-year-old white female was working as a barmaid in a small southern Utah town. She was shot and killed in an execution of witnesses to a robbery of the bar. She had no known medical history.

*Case 3*

A 25-year-old white male was a known drug user and dealer. He declared his intention to shoot up all of the cocaine he had and then stop using it. His friends tried to talk him out of this activity, but he proceeded and immediately after the injection fell to the floor and began having convulsions. He was taken to the emergency room, where he expired after 25 min of resuscitative efforts.

*Case 4*

An 18-year-old white male was found unconscious and taken by a roommate to the emergency room where he was pronounced dead.

*Case 5*

A 21-year-old white female was found unresponsive by a friend who had just received a dependent phone call from her. She was taken to the emergency room and pronounced dead on arrival. There was no history of previous drug usage.

*Case 6*

A 20-year-old white female was found unconscious on the bathroom floor of a truck stop and was DOA at a local emergency room. She was found with a hypodermic needle at the scene which, when tested, showed cocaine. There were fresh and old needle tracks on the arms.

*Case 7*

A 36-year-old white female was found dead with stab wounds at home by her son after a family argument with her husband of a few days. There was no history of chronic drug usage.

*Case 8*

A 28-year-old white female was found drowned in a swimming pool. She had been at a party with friends where alcohol and drugs were being used, went for a swim in an indoor pool, and was found dead shortly thereafter in the pool.

*Case 9*

A 24-year-old white female was emotionally depressed and had discussed the possibility of suicide with friends the night before being found dead. Various drugs including cocaine and marijuana were found at the scene.

*Case 10*

A 29-year-old white female with a history of drug abuse was found convulsing in the bathroom and pronounced dead on arrival (DOA) at the emergency room. There were recent vena puncture wounds in the arms.

### Case 11

A 37-year-old Oriental female was found dead in her home with 107 stab wounds of the body. She was a cocaine dealer in the Salt Lake area and large amounts of cocaine were found at the scene.

### Case 12

A 21-year-old white male was found at home having convulsions. He was taken to the hospital where he was pronounced dead in the emergency room. Drug and paraphernalia and heroin powder were found at the scene. There were old and recent vena puncture wounds on both arms.

### Case 13

A 29-year-old white female with previous history of drug abuse was found unresponsive at home by her family members. She died in the emergency room after unsuccessful resuscitation.

### Case 14

A 35-year-old white male was found in a decomposing state in bed in his residence. At the scene, there were "baggies" of cocaine, marijuana, spoons, syringes, and other paraphernalia.

### Case 15

A 28-year-old man was out "3-wheeling" with friends on sand dunes when the vehicle rolled onto him. He was apparently unconscious and initially thought to have had a traumatic death. Postmortem examination revealed severe, focal coronary artery disease as the cause of death, with no significant trauma.

## Results

In 1983, the Office of the Medical Examiner (OME), Utah Department of Health, investigated six cases in which cocaine use was determined by finding the metabolite in the blood. In none of these cases was cocaine the cause of death nor was any cocaine found in the blood. In the 3½-month period from 2 Feb. 1984 through 20 May 1984, there were 15 cocaine associated deaths investigated by the OME, 4 of which were fatal overdoses by cocaine injection.

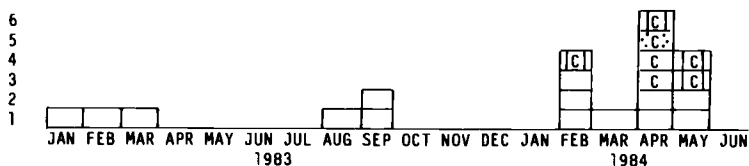
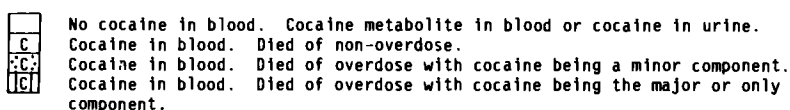
Table 1 shows the concentrations of cocaine, cocaine metabolite, other drugs found, and cause of death in each of the 21 cases, as well as the age, date of death, and county of death given in each of the 15 cases from 1984. Figure 1 shows a bar graph with the occurrence and type of cocaine association in each of the 21 cases, by month, as well as a summary of the 1984 cases by age, sex, and cause of death.

The average age of 26½ years in the present study compares with an average age of 25 in females and 28 in males in an emergency room study [14], under 30 years of age [8] and 27.6 years [5] in 2 postmortem studies, two thirds between the ages of 18 and 25 years in a national survey of cocaine users [17], and the majority between the ages of 21 and 28 in a probation study [6]. However, finding cocaine or metabolite in only 40% males in the present study is in contrast to 78% [14], almost 75% [8], 56% [5], and 85 to 86% [6] males in the above studies.

## Discussion

Cocaine associated deaths are quite unusual in a small population area such as Utah. In the entire year of 1983, there were only six Medical Examiner cases in which evidence of cocaine use was found. In each of these six cases, there was no cocaine found in the blood or urine, but





15 cases of cocaine associated death in early 1984:  
 6 males, 9 females  
 Age range 18 to 37. Mean (S.D.) = 26.51 years (5.9).  
 Cause of death: Overdose cocaine - 4, Overdose other drug(s) - 6,  
 Homicide - 3, Drowning - 1, Vehicular accident - 1.

FIG. 1—Bar graph showing types of cocaine associated deaths by month and a summary of the 1984 cases by age, sex, and cause of death.

benzoylecgonine was found in the blood or urine or other body fluid. In striking contrast, there were 15 cocaine associated deaths in Utah during a 3½-month period in early 1984, with cocaine being found in the blood in 6 cases and injected cocaine causing death in 4 cases. Interestingly, as this is being written in mid-July 1984, there have been no known cocaine associated deaths in Utah in nearly two months.

The reason for this sudden increase and severity of cocaine associated deaths in early 1984 and subsequent cessation of cocaine associated deaths appears to be the result of the establishment and subsequent dismantling of a single, large, illicit cocaine operation in Salt Lake County. This illicit operation had large stores of cocaine in the form of "baggies" and blocks of pure cocaine powder. This operation came to an abrupt halt when the dealer was stabbed 107 times on 27 April 1984 (Case 11). In the subsequent 23 days there were 4 cocaine associated deaths with 2 of these being from cocaine injection. It seems reasonable to conclude that the unusually large number of cocaine associated deaths was related to a single illicit cocaine operation, with the crescendo of cocaine associated deaths relating to the death of the female dealer and concurrent theft of cocaine.

It is impossible to determine which of the 15 cocaine related deaths could be attributed to sources outside the single Salt Lake County source, but using the 6 cases from 1983 as a "background" incidence, there would have been only 1.75 cases during the 3½ months in 1984 from background sources. It is interesting to note that of the 15 1984 cases, 11 died in Salt Lake County, 1 in Weber County (just to the north), and 1 in Cache County (just north of Weber County).

## Conclusion

The epidemiology of a small focus of cocaine associated deaths from a single source is presented and discussed. The determinants of this disease are presented in the form of 15 case histories, associated drugs, cocaine and metabolite levels, and lethal blood cocaine levels. The geographic distribution of this disease is shown to be in a rather narrow range, with 11 of the

15 cases being discovered within about 16 to 24 km (10 to 15 miles) of the presumed source and 2 other cases in adjacent counties. The average age of 26½ years in these 15 cases is consistent with other studies, but the finding of 40% males in the present study is in contrast to 56 to 86% males in other studies. It is hoped that the present study will give an insight into the epidemiology of cocaine abuse.

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