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Title: Unexpected death related to restraint for excited delirium: A retrospective study of deaths in police custody and in the community.
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Abstract: Examines the records of 21 cases of unexpected death in people with excited delirium by the Office of the Chief Coroner for Ontario between 1988 and 1995. Details on eyewitness testimony, findings during postmortem examinations, clinical history; Details on the events surrounding the deaths; The issue of excited delirium and cocaine use.
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UNEXPECTED DEATH RELATED TO RESTRAINT FOR EXCITED DELIRIUM: A
RETROSPECTIVE STUDY OF DEATHS IN POLICE CUSTODY AND IN THE COMMUNITY

This article has been peer reviewed.

Abstract

Background: Some people in states of excited delirium die while in police custody. Emerging evidence suggests that physical restraint in certain positions may contribute to such deaths. In this study the authors determined the frequency of physical restraint among people in a state of excited delirium who died unexpectedly.

Methods: The authors reviewed the records of 21 cases of unexpected death in people with excited delirium, which were investigated by the Office of the Chief Coroner for Ontario between 1988 and 1995. Eyewitness testimony, findings during postmortem examinations, clinical history, toxicological data and other official documents describing the events surrounding the deaths were analysed. Specific reference was made to documented eyewitness testimony of restraint method, body position and use of capsicum oleoresin (pepper) spray. Because cocaine was detected in the blood of some of these people during the postmortem examination, the role of cocaine in excited delirium was examined by comparing the cocaine levels in these cases with levels in 2 control groups: 19 people who died from acute cocaine intoxication and 21 people who had used cocaine shortly before they died but who had died from other causes.

Results: In all 21 cases of unexpected death associated with excited delirium, the deaths were associated with restraint (for violent agitation and hyperactivity), with the person either in a prone position (18 people [86%]) or subjected to pressure on the neck (3 [14%]). All of those who died had suddenly lapsed into tranquillity

shortly after being restrained. The excited delirium was caused by a psychiatric disorder in 12 people (57%) and by cocaine-induced psychosis in 8 (38%). Eighteen people (86%) were in police custody when they died. Four (19%) had been sprayed with capsicum oleoresin, and heart disease was found in another 4 at autopsy. The blood level of cocaine in those whose excited delirium was cocaine induced was similar to levels found in recreational cocaine users and lower than levels found in people who died from cocaine intoxication.

Interpretation: Restraint may contribute to the death of people in states of excited delirium, and further studies to test this hypothesis are recommended. Meanwhile, law enforcement authorities and others should bear in mind the potential for the unexpected death of people in states of excited delirium who are restrained in the prone position or with a neck hold.

Observations over the last 15 years have led forensic experts to recognize a new syndrome of unexpected death that may be preventable. The syndrome was first observed in 1982 when investigators in Seattle described the sudden death of people in states of acute psychiatric agitation and hyperactivity who were being restrained by law enforcement officers using neck holds.¹ It has since become apparent that some acutely excited, agitated and violent people, in states of so-called "excited delirium," are at risk of dying unexpectedly when restrained (e.g., by law enforcement officers or hospital personnel).¹⁻³ Positional or postural holds are the restraints most frequently associated with unexpected death in susceptible people with excited delirium. These holds are used to subdue; those being restrained are positioned prone on the floor with their wrists or ankles bound (e.g., with handcuffs). The most extreme example of prone-position restraint is "hog-tying," in which the person is positioned prone with ankles and wrists bound together at the back of the torso.² The concept of "positional asphyxia" due to restraint arose when it was recognized that being in the prone position could severely restrict breathing and compromise cardiac function in an agitated person.^{3,4} Other variants of positional asphyxia are well recognized and include restrictive positioning of the body in severely intoxicated people who become unconscious.⁵

Important elements in death from positional asphyxia include the proximate cause of the excited delirium and risk factors that may predispose a person to unexpected death. Initial studies¹⁻³ focused on acute psychiatric illness, but cocaine-induced psychosis has also been implicated. In addition, other types of incapacitation, including the use of the lacrimatory agent capsicum oleoresin spray (commonly known as pepper spray), have been associated with the unexpected death of people with excited delirium, particularly people with heart disease.⁶

In this study we examined the frequency of positional or postural restraint in cases of unexpected death of people with excited delirium. The role of cocaine in some of these deaths was also examined with reference to appropriate control groups. The potential association of excited delirium and positional asphyxia with unexpected death has special implications for physicians who may encounter people in such situations.

Methods

Selection of cases

We examined the records from the Office of the Chief Coroner for Ontario for cases of unexpected death associated with excited delirium that occurred between 1988 and 1995; there were 21 such cases. The retrospective diagnosis of excited delirium was made by examining official documents describing the events immediately before the deaths and, in many cases, eyewitness accounts describing the person's behaviour in the hours before death. All 21 people exhibited well-described characteristics of excited delirium,^{2,7,8} including bizarre or hyperactive behaviour, paranoia, shouting, thrashing, ranting and performing feats of apparently "superhuman" strength. Eyewitness accounts indicated that the people were in a variety of situations and circumstances when they became agitated, ranging from causing disturbances in public places to behaving bizarrely (e.g., swinging from electrical power cables and attacking streetcars) to resisting arrest. The documents were studied to determine whether those who died had been restrained, their position at the time of death, whether they were in police custody, whether pepper spray had been used and whether they had a history of drug abuse or psychiatric illness. In all 21 cases, full external and internal postmortem examinations had been performed, along with comprehensive toxicological analyses of cardiac blood collected after death; these findings were also examined.

Postmortem analysis of blood levels of cocaine

The excited delirium was thought to be cocaine induced in 8 (38%) of the 21 cases. Postmortem blood levels of cocaine and benzoylecgonine (a metabolite of cocaine) were available for 6 of these; the other 2 had survived for a short time in hospital, which rendered postmortem cocaine levels less meaningful. To assess the relevance of these findings, we compared them with postmortem blood levels of cocaine in 2 control groups, one consisting of 19 people who had died of either intentional or accidental cocaine intoxication and the other consisting of 21 people who either were murdered or committed suicide by means other than cocaine intoxication but who had used cocaine shortly before death.

Results

Of the 21 people in whom unexpected death was associated with excited delirium, 20 (95%) were men. The mean age was 33 years (Table 1). All of the deaths were associated with restraint, either in the prone position (18 people [86%]) or with pressure applied to the neck (3 people [14%]; Table 2). Eight (44%) of the 18 people who were restrained in the prone position also suffered chest compression from the body weight of the 1 to 5 people restraining them. All 21 people had suddenly lapsed into tranquillity shortly after being restrained (for violent agitation and hyperactivity). In 12 cases (57%) the excited delirium resulted from a psychiatric disorder, and in 8 (38%) it was the result of cocaine-induced psychosis. Eighteen of the deaths (86%) occurred while the people were in police custody. Pepper spray had been used in 4 cases (19%). During autopsy, hypertensive or atherosclerotic heart disease was found in 4 people (19%), but there were no cases of life-threatening injury. Nineteen people (90%) died

at the time of restraint and could not be resuscitated; 2 people (10%) were resuscitated but remained in a deep coma in hospital for several days before they died; in these cases the excited delirium was related to cocaine intoxication. In 5 people petechial hemorrhage was seen during the postmortem examination, but only 2 of these had conjunctival petechiae; both had suffered neck compression. In the other 3 people, subpleural and epicardial petechiae were seen; one of these had suffered neck compression and the others had been restrained in the prone position.

Excited delirium and cocaine use

The mean cocaine level in the 6 people with cocaine-induced excited delirium in this study was similar to that of recreational users but much lower than that of people who died of cocaine intoxication (Table 3). The blood level of benzoylecgonine in people with cocaine-induced excited delirium fell between the levels for recreational users and those who died of cocaine intoxication (Table 3).

Interpretation

The most striking finding of this study was that all of those who died unexpectedly during or after an episode of excited delirium had been physically restrained. In most cases the excited delirium was due to a pre-existing psychiatric illness; however, in a significant number, it was a consequence of recent cocaine use. In the latter cases, the cocaine levels were similar to those found in people who were murdered or had committed suicide and had used cocaine shortly before death (i.e., cocaine was not a cause of death). This suggests that the levels of cocaine associated with recreational use may be sufficient to cause excited delirium. The blood level of benzoylecgonine was higher in people with cocaine-induced excited delirium than in recreational users. Because the elimination half-life of benzoylecgonine is much longer than that of the parent compound, cocaine, this finding is consistent with a recent cocaine "binge."

To adequately investigate and ultimately prevent these deaths, the association between cocaine-induced excited delirium and physical restraint must be recognized. In a recent study⁷ from Dade County, Fla., of sudden death related to cocaine-induced excited delirium, the blood levels of cocaine and benzoylecgonine were similar to those reported here. In addition, the investigators found that police custody was the most important factor determining sudden death of people with excited delirium; those affected were usually restrained. Despite this finding, the investigators concluded that restraint or positional asphyxia was not a factor in the deaths. Similarly, another study described 7 people with cocaine-related excited delirium, all of whom died while being restrained;⁸ the cocaine levels in these people were similar to the levels observed in our study. Again, restraint was not considered a factor in the deaths; the researchers postulated that cardiac arrhythmias from the excited delirium were the cause. Nevertheless, the possibility that positional asphyxia contributes to unexpected death in people in states of excited delirium cannot be ignored.

Other factors may contribute to restraint-related death in people with excited delirium: pre-existing heart disease, obesity (particularly in

those with a large abdominal pannus) leading to restricted ventilation in the prone position, and exposure to pepper spray. Exposure to pepper spray was associated with sudden death in 2 people with excited delirium who had underlying cardiac or pulmonary disease.⁶ In our study the hypertensive or atherosclerotic heart disease found in some people might have predisposed them to unexpected death. As well, a few people were exposed to pepper spray.

Our findings indicate that many deaths related to excited delirium are associated with restraint in the prone position. Acute excited delirium resulting from psychiatric illness or cocaine use was the most important underlying cause. It may be that the greater oxygen requirement of people with excited delirium predisposes them to rapid anoxic death if they are restrained. Because our study was retrospective and did not include controls, we could not establish a definitive causal link between unexpected death and restraint in people with excited delirium. However, an anoxic mechanism is biologically plausible, and the results of our study combined with those previously reported suggest that the hypothesis of restraint-related asphyxia associated with excited delirium needs careful consideration. We suggest further study to determine whether the unexpected death of people with excited delirium may be due, in part, to restraint practices.

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Reprint requests to: Dr. Michael S. Pollanen, Forensic Pathology Unit,
Office of the Chief Coroner for Ontario, 26 Grenville St., Toronto ON
M7A 2G9; fax416314-4060

Table 1: Characteristics Of 21 People With Excited Delirium Who Died
Unexpectedly After Being Restrained (Ontario, 1988-1995)

KEY

- A = Sex; no. Men
 B = Sex; no. Women
 C = Mean age, yr (and SD)
 D = Circumstances surrounding death; no. (and %);
 In police custody*
 E = Circumstances surrounding death; no. (and %);
 Subdued with pepper spray
 F = Circumstances surrounding death; no. (and %);
 Had heart disease**

Cause of excited delirium	A	B	C	D	E	F
Psychiatric illness@	12	0	35 (11)	10 (83)	4 (33)	2 (17)
Cocaine-induced psychosis	7	1	31 (7)	7 (88)	0	2 (25)
Toxic effects of other drugs@@	1	0	17	1 (100)	0	0
Total	20	1	33 (10)	18 (86)	4 (19)	4 (19)

Note: SD = standard deviation.

*Either in prison or while under arrest.

**Hypertensive or atherosclerotic heart disease.

@Includes one person with multiple drug intoxication (pseudoephedrine and dexamethorphan) and another with a history of cocaine use but no evidence of cocaine use just before death.

@@Combined effects of alcohol, morphine, diazepam, acetaminophen and marijuana.

Table 2: Methods Used To Restrain The 21 People

Method of restraint	No. (and %) of people
Prone	
With chest compression	4 (19)
With handcuffs	4 (19)
With handcuffs and ankle shackles*	6 (29)
With chest compression, handcuffs and ankle shackles	4 (19)
Pressure applied to neck	3 (14)

*Includes 2 people who were "hog-tied."

Table 3: Postmortem Blood Levels Of Cocaine And Benzoyllecgonine In People With Cocaine-Induced Excited Delirium And 2 Control Groups

Group	No.	Compound; mean blood level (and SD), mg/dL	
		Cocaine	Benzoyllecgonine
Cocaine-induced psychosis*	6	0.04 (0.03)	0.50 (0.50)
Recreational cocaine use@	21	0.04 (0.04)	0.24 (0.16)
Cocaine intoxication@@	19	0.97 (1.60)	1.70 (1.30)

*People who died suddenly in a state of cocaine-induced excited delirium (this study).

@People who either were murdered or committed suicide by means other than cocaine intoxication but who had used cocaine shortly before death (source: data from Office of the Chief Coroner for Ontario).

@@People who died of either intentional or accidental cocaine intoxication (source: data from Office of the Chief Coroner for Ontario).

ILLUSTRATION

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By Michael S. Pollanen, PhD; David A. Chiasson, MD; James T. Cairns, MD; James G. Young, MD

Dr. Pollanen is Adjunct Professor of Forensic Sciences and a medical student at the University of Toronto and Consultant, Office of the Chief Coroner for Ontario, Toronto, Ont.; Dr. Chiasson is Chief Forensic Pathologist for Ontario, Dr. Cairns is Deputy Chief Coroner for Ontario, and Dr. Young is Chief Coroner for Ontario, Office of the Chief Coroner for Ontario, Toronto, Ont. This email was generated by a user of EBSCOhost who gained access via the account. Neither EBSCO nor are responsible for the content of this e-mail.