

Traumatic Asphyxial Deaths Due to an Uncontrolled Crowd

James R. Gill, MD, and Kristen Landi, MD

Abstract: Nine people died of traumatic asphyxia due to an uncontrolled crowd at a community basketball game in New York City in 1991. We reviewed the circumstances, postmortem findings, and the causes of death. The majority of people had petechiae of the conjunctivae and face consistent with chest compression. There were minimal superficial blunt injuries and no fractures or acute intoxications. These deaths are often incorrectly attributed to blunt force injuries, while the cause typically is asphyxia due to chest compression.

Key Words: forensic science, forensic pathology, traumatic asphyxia, fatality

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Traumatic asphyxia occurs when ventilation is compromised due to external forces. It may be seen with building collapses, motor vehicle collisions, avalanches, and “week-end” car mechanics who inexpertly raise a car to work under it.^{1–8} It also may occur in uncontrolled large crowds in enclosed or restricted areas.^{9,10} The physical findings are few and include petechiae and plethora above the level of the heart. In 1837, Olliver d’Angers described these findings (a “mask ecchymotic”) in people “trampled” to death by crowds in Paris.¹¹

In 1979, 11 people died of traumatic asphyxia at a rock concert in Cincinnati, Ohio. Poorly managed entrances and festival seating, which is first-come, first-serve general admission, were blamed. In 2003, 21 people died in the Epitome/E2 Chicago nightclub when hundreds of people raced to the exit following the use of a chemical spray during an altercation. In 1990, 1426 people died of traumatic asphyxia in a pedestrian tunnel at Mecca during a Muslim pilgrimage.

These deaths often are attributed mistakenly to blunt impacts from trampling. The autopsy, however, typically finds inconsequential blunt injury but does find signs of traumatic asphyxia. We reviewed the autopsy findings and causes of death of 9 such fatalities.

On December 28, 1991, a charity basketball game involving rap celebrities was scheduled to occur at a college in New York City. The basketball facility had an occupancy rating for 2730 people. The event was widely publicized, and approximately 5000 people came to the event. There was limited official crowd control, with 66 police officers and 23 college security guards outside the gymnasium. At one point, the inner admittance doors were locked, and a surge of several hundred people tried to get down the single stairwell that entered the gymnasium. The 4 steel doors at the bottom of the stairs were closed, and the people in the stairwell were trapped and compressed. Once the doors were opened, victims were carried into the gym.

A 67-page report by the Mayor’s Office of the City of New York concluded that “almost all of the individuals involved in the event demonstrated a lack of responsibility” (*A Failure of Responsibility*, Report to the Mayor on the Tragedy at City College, Milton Mollen, January 1992). The report cited the lack of coordinated and adequate crowd control, poor communication between the organizers and security coordinators, failure of the college to follow its own security policies, including a lack of control on ticket sales, and the crowd’s lack of responsibility and control.

The described events indicated that people “were crushed by the sheer pressure of bodies pressing against each other rather than through the trampling that might have taken place in a stampede.”¹² As one survivor related when he found there was nowhere to turn and he was finding it hard to breathe:

“I thought to myself, ‘If I don’t hurry up and get through the door, I am going to faint.’ My arm was pinned against my body and I couldn’t move it, but I had one hand free and I grabbed a hold of the door hinges and pulled myself through. It was like you were underwater and you came above and got air.”¹³

MATERIALS AND METHODS

The Office of Chief Medical Examiner investigates all unexpected, violent, and suspicious deaths in New York City.

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From the New York City Office of Chief Medical Examiner and Department of Forensic Medicine, New York University School of Medicine, New York, New York.

Reprints: James R. Gill, MD, Deputy Chief Medical Examiner, Bronx County, Office of Chief Medical Examiner, 520 First Avenue, New York, NY 10016. E-mail: gill@ocme.nyc.gov.

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Toxicologic testing is performed routinely on autopsied decedents and on select external examinations.

All case files were reviewed, including the autopsy, toxicology and scene investigation reports, and photographs. Select data concerning age, race, sex, injuries, circumstances, medical history, toxicology results, findings of petechiae, and cause of death were extracted.

Autopsy blood specimens were collected with the addition of sodium fluoride and stored at 4°C. All toxicologic testing was performed by the Forensic Toxicology Laboratory at the Office of Chief Medical Examiner.

RESULTS

The cause of death of all 9 decedents was asphyxia by chest compression. The manner of all deaths was accident. Six decedents were pronounced dead at the scene, 2 upon arrival to the emergency department, and one 4 days later following admission to the hospital, with a diagnosis of anoxic encephalopathy. The single hospital death had fixed pupils in the ambulance and later was declared dead by neurologic criteria.

All but 2 decedents had numerous petechiae of the head and neck region (see Table 1). The decedent (#9) who was hospitalized for 4 days did not have petechiae at autopsy. Another decedent (#2) also did not have petechiae but did have a markedly congested (“nutmeg”) liver. This decedent had no blunt injuries, a past medical history of asthma, and a 520-g heart at autopsy (body weight = 290 lb). There was no hyperinflation or mucus plugging of the lungs at autopsy. Seven of the 9 decedents had slight external blunt injuries (scattered abrasions and contusions). No decedent had a fracture, and only 1 had internal injury (a superficial liver laceration with approximately 200 mL of hemoperitoneum). The majority of abrasions and contusions involved the face (forehead, nose, eyebrow). There were no neck injuries.

One decedent tested positive for benzoylcegonine in the urine. No ethanol or drugs of abuse were detected in the blood or urine of any other decedent. Facial plethora was not evident in any decedent.

DISCUSSION

People who succumb in these scenarios typically die (“standing up”) in a vertical position. Survival or death is determined by the person’s orientation with respect to the compressive force of the crowd. When force is applied front to back or vice versa, chest expansion is compromised. When force is applied side to side, chest expansion is not compromised. Survivors of such incidents have described this positional dyspnea. This same compression prevents a fall to the floor. Victims do not collapse to the floor until after the crowd density and pressure have been relieved.

As Table 1 illustrates, people who die in these circumstances are not just the frail and small of stature. The heights

and weights of these decedents have a broad distribution. Ethanol and drug intoxications played no physiologic role in these deaths. The pattern of blunt injuries in these deaths is similar to those seen with unprotected collapses (ie, due to sudden loss of consciousness or death). These blunt injuries are slight and typically occur over bony prominences with a planar distribution.

Petechiae result from chest compression rather than asphyxia *per se*.¹⁴ Compression of the chest interferes with venous return of blood to the heart. Impaired venous return in combination with continued arterial supply causes venous and capillary engorgement, leading to rupture of small vessels, particularly in areas with little adjacent connective tissue support (eg, the conjunctivae and eyelids).¹⁴

Two decedents did not have petechiae. One was the woman who was hospitalized for several days with a diagnosis of anoxic encephalopathy. One explanation for the absence of petechiae is that they may fade over time with continued circulation. No petechiae were described in the hospital records; however, this does not exclude their presence. The second decedent had evidence of right heart compromise (a nutmeg liver), cardiac hypertrophy, and a history of asthma. He had no blunt injuries. His cause of death was also certified as asphyxia due to chest compression because of the compelling circumstances and the supportive liver pathology. It is possible that his cardiac hypertrophy and reactive airway disease were contributory conditions.

Some people who die of traumatic chest compression may not have petechiae.^{4,10} This may be seen with chest compression that is great enough to impair the left heart function as well as the right. Increased cephalic venous pressure will not develop in this scenario because even though the venous return is impaired, the input arterial pressure is also compromised. Sklar et al⁴ described the autopsy findings in 24 deaths due to traumatic asphyxia. Petechiae of the skin, subconjunctival hemorrhage, and purple facial coloration were noted in 58% of the decedents. At least 2 of these 3 findings were noted in 88% of these victims. Another possible explanation for the absence of petechiae in these deaths is a patent foramen ovale. A patent, though functionally closed, foramen ovale may act as a high-pressure release valve that interrupts the impending vascular disparity. This also may explain why it is uncommon to see bulbar and conjunctival petechiae in overlaying of infants.^{15–20}

Some have speculated that for the signs (plethora and petechiae) of traumatic asphyxia to be present, one must have at least 2 processes occur simultaneously.⁶ The first is the crushing force that increases intrathoracic pressure, which is transmitted to the right heart and superior vena cava. The second is the simultaneous closure of the glottis that augments the increase in venous backpressure.⁶ The glottic closure has been attributed to the “fear response” in which in anticipation of the traumatic event, reflex glottic closure may

TABLE 1. Characteristics of Decedents

Case	Age, Years;	Race, Sex	Height, Inches/ Weight, Pounds	Petechiae		Blunt Injury	Disease	Place of Death	Toxicology Results
				Extent	Distribution				
1	20 BM		72/135	Numerous	Palpebrae, face, larynx	Scattered abrasions	None	Gymnasium	Negative
2	28 BM		75/290	None	None	None	Chronic asthma/cardiac hypertrophy	Gymnasium	Negative
3	15 BM		67/105	Numerous	Palpebrae, conjunctivae, face	Scattered contusions, liver laceration, 200-mL hemoperitoneum	None	Gymnasium	Negative
4	26 BF		63/130	Numerous	Palpebrae, conjunctivae, face	Scattered abrasions and contusions	None	Gymnasium	Urine: BE
5	24 BM		71/225	Numerous	Palpebrae, conjunctivae	None	None	Gymnasium	Negative
6	20 BF		63/120	Numerous	Face, conjunctivae, larynx	Scattered abrasions	None	Gymnasium	Negative
7	19 BF		67/165	Numerous	Palpebrae, conjunctivae	Abrasions	None	Emergency department	Negative
8	17 BM		70/150	Numerous	Larynx	Scattered abrasions/contusions	None	Emergency department	Negative
9	20 BF		69/155	None	None	Abrasions	Anoxic encephalopathy and bronchopneumonia	Hospital (inpatient)	Negative

occur to “brace against the impending force.”⁶ Glottic closure is not required to cause the signs of traumatic asphyxia.¹⁴ There is no need to invoke a “fear response” in the pathogenesis of these signs.

As the New York City Mayoral Report of the incident concluded, the responsibility for the deaths is shared by those involved in managing, securing, and attending these events. The organizers of these events need to control ticket sales and exercise tighter control of security. The security personnel/police need to anticipate and recognize crowd control problems early and respond quickly with reinforcements. The fire department should also be involved, particularly with events that have overcrowding. Finally, the crowd must demonstrate a sense of responsibility and respect other people and understand the potential risks in these poorly controlled circumstances.

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