

Vehicular-related Traumatic Asphyxial Deaths – *Caveat Scrutator*

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Summary. A study of vehicular-related traumatic asphyxial deaths was performed on the case files of the Office of the Medical Examiner of Metropolitan Dade County in Miami (FL, USA) during the years from 1980 to 1984. A total of seven cases are presented in some detail. A discussion ensues, including a review of the literature, concerning this diagnosis and the caution a forensic pathologist must take in certifying such a death with so few anatomic findings.

Key words: Accidents, traffic – Traumatology, asphyxia – Asphyxial death

Zusammenfassung. Es wurde eine Studie über Todesfälle durch kraftfahrzeugbedingte Todesfälle durch traumatische Asphyxie durchgeführt. Diese Studie basiert auf dem Aktenmaterial des Büros des „Medical Examiner“ des „Metropolitan Dade County“ in Miami, Florida (USA) und erfaßt die Jahre von 1980 bis 1984. Insgesamt werden sieben entsprechende Fälle kasuistisch dargestellt. Die Diskussion, unter Einbeziehung der Literatur zu dieser Diagnose, geht darauf ein, daß der forensische Pathologe Vorsicht walten lassen muß, wenn er eine Todesursache mit derartig wenig anatomischen Zeichen feststellt.

Schlüsselwörter: Unfälle, Straßenverkehr – Traumatologie, Asphyxie – Asphyxie, traumatisch

With the advent of motor vehicles, fatalities resulting from their usage have risen in modern society. Motor vehicle-related fatalities are a frequent occurrence in any busy medical examiner or coroner's office. Usually, these cases have obvious causes of death with multiple blunt traumatic injuries. However, occasionally a person can die from being "pinned," "crushed" in a vehicle, or just being in an awkward position to breathe. Such asphyxial deaths are known to the clinician [1–15] and in railway-related fatalities, but there are few reports in the forensic literature of motor vehicle accidents concerning these cases. This

study was performed to present the findings in these types of cases. Caution is recommended to all forensic pathologists who investigate traffic cases, since traumatic asphyxial deaths can have few anatomic findings and one can easily “miss” a case, thereby incorrectly certifying the cause and manner of death.

Material and Methods

Metropolitan Dade County is a community of 5,180 km² (2,000 square miles) and a 1984 estimated population of 1,800,000. It is a traditional resort and retirement area encompassing Miami, Florida. The Office of the Medical Examiner is empowered by statutory law to investigate those deaths of a violent, unnatural, or unexpected means that occur within the county. Some 3,500 cases are investigated annually and of these 2,800 cases are autopsied. During the years from 1980 to 1984, an estimated 1930 vehicle-related fatalities occurred within the county and were investigated by the Office of the Medical Examiner. For this study, all cases in which the cause of death was asphyxial in nature were collected for review. These seven cases are presented.

Case Reports

Case 1 (M.E. no. 80-1741)

Mr. T., a 32-year-old white man, was the driver of a “pick-up truck” traveling southbound on I-95 (Interstate) roadway’s exit ramp. He failed to manipulate a curve, and the vehicle left the roadway. It overturned and the decedent was “crushed.” It is estimated that the decedent had been “crushed” for 9 min before Fire Rescue units arrived. Cardiopulmonary resuscitative efforts were without avail.

At autopsy, small linear contusions were noted over the anterior aspect of the forehead. Contusions were also noted on the neck and the back. However, no rib, skull, or long bone fractures were observed.

Petechiae were observed in the conjunctivae and the subgaleal space. No subconjunctival hemorrhages were to be seen. Grossly, the brain and lungs were normal along with the rest of the internal viscera. Toxicologically, the blood ethanol level was 0.08%, and the Urine Emit drug screen revealed a “trace” amount of salicylates.

Case 2 (M.E. no. 80-2885)

Mr. F., a 19-year-old white man, was a driver of a “compact” automobile traveling northbound on State Roadway 826. The vehicle left the roadway and went onto the grassy area next to the “shoulder” of the road. It then went back on the roadway, went across three lanes of this “divided” highway, and struck the median wall. The decedent was “pinned” in an overturned vehicle. It is estimated that the victim was “pinned” for 9 min before police arrived. He was dead at the scene.

At autopsy, this moderately obese male (i.e., height 70 in., weight 250 pounds) had a few scattered abrasions exteriorly. There were a few palpebral conjunctival hemorrhages, and petechiae were observed on the epiglottis. A few scattered peri-esophageal and prevertebral hemorrhages were noted. The scalp was avulsed, and a fracture of the C6,7 cervical vertebrae was noted. No rib and long bone fractures were observed. Internally, there were pulmonary congestion and edema. There was slight subarachnoid hemorrhage of the left lateral parietal lobe of the brain along with slight uncus herniation. The abdominal organs were congested. Histologically, the lung was congested and edematous with inspissation of epithelial cells.

Macrophages and rare polymorphonuclear leukocytes were seen in alveoli. *No* bone marrow emboli were seen. The heart was normal as were the pancreas and small bowel. The tongue was unremarkable. Slight fatty change of the liver was noted. Congestion and subarachnoid hemorrhage of the cortex of the brain were seen.

Toxicologically, the blood ethanol level was 0.07%, the carboxyhemoglobin level 4.5%, and the blood methaqualone level 4.3 mg/l.

Case 3 (M.E. no. 81-549)

Mr. H., a 26-year-old white man, was a driver of a truck who “drifted” off the roadway. The victim attempted correction, but the vehicle slid and rolled onto the left side, ejecting the victim. The truck fell on the victim crushing him. It is estimated that the victim was “pinned” under the truck for 5 min before being pronounced dead at the scene.

At autopsy, cyanosis of the upper thorax and face was observed exteriorly along with petechiae of the eyes, lower lip, and mouth. No subconjunctival hemorrhages were observed. Multiple rib fractures were observed including fractures of the left first to tenth ribs. Furthermore, fracture of the C3–C4 cervical vertebrae were observed. Internally, a few scattered hemorrhages were observed in the lungs. The rest of the viscera were unremarkable. Histologically, examination of the lung revealed congestion and hemorrhage but *no* bone marrow emboli. The liver was histologically unremarkable. Toxicologically, the blood ethanol, the carboxyhemoglobin, and the Urine Emit drug screen were negative.

Case 4 (M.E. no. 81-954)

Mr. P., a 26-year-old white man, was a pedestrian standing between two vehicles that had had a minor collision. A third vehicle struck these vehicles and dragged the victim 60 feet. The victim was pinned under the car for 15 min. Cardiopulmonary resuscitative efforts were without avail.

At autopsy, abrasions and lacerations were noted on the face. Multiple petechiae were noted in the eyes. No subconjunctival hemorrhages were noted. Abrasions were observed on the torso. The right femur was fractured as was the ramus pubis and sacroiliac area. Multiple rib fractures were present including fracture of the left clavicle, the left first rib medial to the sternum. The left eighth and ninth ribs posteriorly, and the left ninth and tenth ribs anterior-laterally. Internally, petechiae were observed on the larynx, and there were mesenteric contusions. The rest of the viscera were unremarkable.

Histologically, the lungs were normal with *no* bone marrow emboli. There was severe fatty change of the liver. Examination of the brain, including cortex, hippocampus, and cerebellum, was normal with *no* anoxic changes noted.

Toxicologically, the blood ethanol level and the Urine Emit drug screen were negative.

Case 5 (M.E. no. 81-3658)

Mr. H., a 28-year-old black man, was riding in the rear of a “dump truck” loaded with rused roofing materials. The driver of the dump truck lost control of the vehicle, causing it to roll over and trap the victim underneath. He was buried underneath the truck for 5 min. Cardiopulmonary resuscitative efforts were without avail.

At autopsy, multiple abrasions were observed on the body. Multiple petechiae were observed in the eyes, which were hyperemic, in the epiglottis, in the larynx, and on the surface of the liver. No fractures were observed. There were slight contusions of the lungs and the brain grossly was edematous (i.e., brain weight 1,060 g, height 69 in., body weight 137 pounds). The other viscera were unremarkable.

Histologically, the heart, liver, and the cortex of the brain were normal. The lung was congested, and pigment-laden macrophages were observed. No bone marrow emboli were observed.

Toxicologically, the blood ethanol level and the Urine Emit drug screen were negative.

Case 6 (M.E. no. 83-2194)

Mr. P., a 64-year-old white man, was the driver of a late model truck which was traveling westbound on West 138 Street. The victim failed to manipulate a curve in the road and went off the road, "flipping over." He was ejected, due to not wearing seat belts, and the truck fell on top of him. The truck "pinned" his neck for several of minutes. When police arrived, he was dead at the scene.

At autopsy, abrasions on the chest were noted. The sternum was fractured at the junction of the manubrium and the body of the sternum. The right second rib was fractured. Subcutaneous emphysema over the right side of the chest was noted. The lungs were contused. The right eye's conjunctiva was swollen, but no petechiae were observed. No subconjunctival hemorrhages were observed. No long bone fractures were observed.

Histologically, there was slight congestion of the lung along with fibrosis and pigment-laden macrophages in alveoli. No bone marrow emboli were observed. There was slight fatty change of the liver, patchy fibrosis of the heart, and atherosclerosis of the coronary artery.

Examination of the hippocampus revealed calcific corpora amylacea-like material. However, no anoxic changes were observed. Toxicologically, the blood ethanol level was 0.02%, the carboxyhemoglobin level was 0.5%. The Urine Emit drug screen was negative.

Case 7 (M.E. no. 84-3114)

Mr. B., a 30-year-old white male, was a driver in a car traveling southbound on I-95 Interstate roadway. The vehicle left the roadway at the Golden Glades Interchange and struck a large truck, which was stopped on the side of the road. The victim's vehicle spun around, overturned, and was struck by a third vehicle. The victim was "pinned" under the steering wheel. He was not wearing seat belts and was known to be a heavy alcohol drinker. The victim was trapped in the vehicle, against the steering wheel, in an "upside down" position for approximately 15 min prior to Fire Rescue arrival. He was pronounced to be dead at the scene.

At autopsy, multiple petechiae on the scalp, frontal air sinuses, and conjunctivae were observed. No subconjunctival hemorrhages were observed. The left fourth, fifth, sixth, and seventh ribs were fractured, and there were slight contusions of the lungs. Elsewhere, no other fractures were observed, and the internal viscera, including the brain, were unremarkable.

Toxicologically, the blood ethanol level was 0.26%, the carboxyhemoglobin level was 4%, and the Urine Emit drug screen was negative.

Discussion

Vehicular-related traumatic asphyxial deaths are rare in Dade County. During the 5-year period of this study, only seven cases of 1,930 motor vehicle fatalities, or 0.36%, were noted. However, despite such rarity, it is useful to study them so that these types of cases are not overlooked by the forensic pathologist.

Before any conclusions or implications can be made, one must first realize the limitations of this study. First, only fatalities are studied. Those cases in which a motor vehicle accident occurred and the participants subsequently survived, are by jurisdiction not medical examiner cases. Such traumatic injuries and their treatment are best discussed by trauma surgeons and other clinicians. Secondly, as mentioned previously, these cases are rare in Dade County. However, with these seven cases, several implications can be ascertained.

The implications of this study are twofold – theoretical and practical. Theoretically, one can compare these cases, with their anatomic findings, to other cases reported [1–15]. Evidently, the *masque ecchymatique* [10] and

subconjunctival hemorrhages [6–15], are not that commonly seen in the cases presented here (see case 3). Petechial hemorrhages in the conjunctiva are noted (see cases 1–5, 7) but can be absent (see case 6).

The reason for the absence of the subconjunctival hemorrhage in these dead victims *versus* the living victims reported in other studies [4–15] may be that a sufficiently high blood pressure and pulse are needed for this to be present once the traumatic incidence has occurred. Certainly, in the cases presented here (see cases 1–7), death occurred within several minutes. This was documented by witnesses and Fire Rescue personnel who observed how long the victim was “crushed” or “pinned” in the automobile wreckage.

It is relevant to point out to the reader that in each of these seven cases, the victim died an asphyxial death. Other injuries present were insufficient by themselves to cause death. This *refutes* an earlier concept [11] that other injuries in these cases are lethal, whereas the asphyxia is not.

Other studies on asphyxial deaths in railway accidents can be compared to these cases with respect to pathologic findings. Briefly, while other experts [1–3] have shown bone marrow embolism to occur in cases of traumatic asphyxia; this study (cases 2–6) shows that bone marrow embolism does *not* always occur in an asphyxial death. However, this study (cases 1–5, 7) does note petechial hemorrhages as others have noted [1]. Furthermore, pulmonary congestion and edema, to a variable degree, are seen in the cases in this study (cases 1–7) as other studies have reported [1–15]. Some experts [1] have reported serum catecholamine levels. However, such analyses are beyond the scope of this retrospective study.

Practical implications are also forthcoming from this study. First, as with all aspects of forensic pathology, the prosecutor must have a thorough knowledge of the scene circumstances of the incident of trauma. This is especially important if the prosecutor is confined to the morgue and must rely on other agencies to describe how the incident occurred, the location of the victim, and the position of the victim (case 7), along with what Fire Rescue intervention has been performed and the time the victim may have been “pinned” or “wedged.” Secondly, hospital Emergency Room records are important for the prosecutor to review, prior to the autopsy, for an understanding of what medical or surgical intervention has been performed. Thirdly, at autopsy, a careful examination for cyanosis and petechiae is essential. However, even without these anatomic findings, one can still die of traumatic asphyxia given proper scene circumstances (e.g., awkward position for breathing of victim or crushing of victim) and the lack of an adequate explanation of the cause of death. Truly, care must be exercised in establishing this diagnosis.

Given these implications, the role for future work in this field must be noted. First, the author encourages forensic scientists in other countries to write concerning their experience with such cases. Secondly, those authors who have written on the subject may wish to reassess their findings (*vis-à-vis* bone marrow/fat embolism) and whether or not they are actually reporting artifact of cardiopulmonary resuscitative efforts. Thirdly, clinicians and trauma specialists should study newer ways to ameliorate this condition. It is obvious that much new work needs to be done concerning this phenomenon of traumatic asphyxia.

In summary, this article has presented several cases of motor vehicle-related traumatic asphyxial deaths. The implications from this study are both theoretical and practical. Essentially, such cases should be approached with great care, since very few pathologic findings may be evident for the medical examiner, truly, *caveat scrutator*.

References

1. Hambeck W, Pueschel K (1981) Death by railway accident: Incidence of traumatic asphyxia. *J Trauma* 21:28–31
2. Brinkmann B (1978) Zur Pathophysiologie und Pathomorphologie bei Tod durch Druckstauung. *Z Rechtsmed* 81:29–96
3. Brinkmann B, Koops E, Oeser J, et al. (1978) Todesfälle durch Eisenbahnunglück (Hamburg 1975). *Beitr Gerichtl Med* 36:339–405
4. Jones M, James E (1976) The management of traumatic asphyxia: Case report and literature review. *J Trauma* 16:235–238
5. Haller JA, Donahoo JS (1971) Traumatic asphyxia in children: Pathophysiology and management. *J Trauma* 11:453–457
6. Moore JD, Mayer JH, Gago O (1972) Traumatic asphyxia. *Chest* 62:634–636
7. Williams J, Minken S, Adams J (1968) Traumatic asphyxia – Reappraised. *Ann Surg* 167:384–392
8. Fred HL, Chandler FW (1960) Traumatic asphyxia. *Am J Med* 29:508–517
9. Reichert FL, Martin JW (1951) Traumatic asphyxia: Experimental and clinical observations with a report of a case with concomitant paraplegia. *Ann Surg* 134:361–368
10. Dwek J (1946) Ecchymotic mask. *J Int Coll Surg* 9:257–265
11. Conwell HE (1927) Traumatic asphyxia: Report of four cases. *J Bone Joint Surg [Am]* 9:106–110
12. Hever GJ (1923) Traumatic asphyxia; with especial reference to its ocular and visual disturbances. *Surg Gynecol Obstet* 36:686–696
13. Green TM (1922) Traumatic asphyxia. *Surg Gynecol Obstet* 35:129–131
14. Despard D (1909) Traumatic asphyxia, with report of a case. *Ann Surg* 49:751–761
15. Beach HHA, Cobb F (1904) Traumatic asphyxia. *Ann Surg* 34:481–494

Received August 21, 1985