

Stephen J. Cina,^{1,2} M.D.; Judy L. Koelpin¹;
Clay A. Nichols,^{1,2} M.D.; and Sandra E. Conradi,^{1,2} M.D.

A Decade of Train-Pedestrian Fatalities: The Charleston Experience

REFERENCE: Cina, S. J., Koelpin, J. L., Nichols, C. A., and Conradi, S. E., "A Decade of Train-Pedestrian Fatalities: The Charleston Experience," *Journal of Forensic Sciences*, JFSCA, Vol. 39, No. 3, May 1994, pp. 668-673.

ABSTRACT: Although the cause of death is rarely in doubt in train-pedestrian fatalities, the manner of death is often unclear. The distinction between accident and suicide can only be made after careful evaluation of the history, scene investigation, autopsy findings, and toxicologic data. A retrospective analysis of 25 consecutive train-pedestrian fatalities investigated by our office between 1982 and 1992 is reported.

The victims were predominantly healthy, young males. All but one person died at the scene. The cause of death was massive blunt trauma in 88% of the cases. In one case, the sole injury was decapitation. A tissue or blood ethanol level greater than 99 mg/dL was detected in 80% of the cases. A total of 60% of the cases involved persons likely to have been sitting or lying across the railroad tracks; all but one of these victims were intoxicated. The manner of death was determined to be accidental in 92% of our cases.

Decapitation by a moving train is an injury highly suggestive of suicide. Massive blunt trauma, especially in the setting of ethanol intoxication, was highly associated with accidental death. Toxicologic analysis is essential in discriminating willful suicide from alcohol-induced incapacitation resulting in accidental death. Homicide, disguised as an accident or suicide, must be ruled out in all cases. Accurate determination of the manner of death is an important issue regarding civil litigation and dispersal of insurance benefits.

KEYWORDS: pathology and biology, train, railway, accidental death, ethanol

The American railroad system is extensive; in 1988 approximately 340 million people traveled by train in the United States [1]. From the passenger's perspective, railway travel is much safer than automobile travel (0.02 vs 1.19 deaths per 10⁸ passenger miles, respectively) [1]. The pedestrian, however, stands a far greater chance of survival if struck by a car rather than by a train. The kinetic energy (KE) imparted by a moving object, such as a train, to a stationary object, a person, is dependent upon the mass (*m*) and the velocity (*v*) of the object in motion according to $KE = 0.5 \times mv^2$. The mass of

Received for publication 13 Aug. 1993; revised manuscript received 24 Sept. and 1 Nov. 1993; accepted for publication 1 Nov. 1993.

Abstract submitted for presentation at the American Academy of Forensic Sciences Meeting, February 1994, San Antonio, TX.

¹Deputy Medical Examiner, Forensic Science Investigator, Deputy Chief Medical Examiner, and Chief Medical Examiner, respectively, Charleston County Medical Examiners' Office, Charleston, SC.

²Resident in Anatomic Pathology, Assistant Professor of Pathology, and Associate Professor of Pathology, respectively, The Department of Pathology and Laboratory Medicine, the Medical University of South Carolina, Charleston, SC.

a train combined with the velocities they can attain results in an enormous amount of kinetic energy being transferred to the body of a pedestrian when struck, even by a glancing blow. This explains the massive blunt force injuries commonly noted in train-pedestrian fatalities. The metal wheels of a train are also capable of inflicting lethal sharp force wounds. Although most train-pedestrian fatalities are accidental, the massive tissue damage that follows train-human collisions has been used to obscure homicidal injury [2]. Suicidal decapitations by train have been reported but are rare [3-5].

Train-pedestrian deaths can be conveniently grouped as to those occurring at rail-highway crossings and those that occur elsewhere along the tracks. In the United States, during the years 1982 to 1989, 327 fatalities took place at public crossings (motor vehicle accidents excluded) while 6058 pedestrians were killed while trespassing on railroad tracks away from crossings [1]. This report describes a series of 25 consecutive train-pedestrian fatalities investigated by the Charleston County Medical Examiners' Office between 1982 and 1992.

Materials and Methods

This is a retrospective study of twenty-five train-pedestrian fatalities investigated by the Charleston County Medical Examiners' Office between 1982 and 1992 (Table 1). Deaths following automobile-train collisions and work-related fatalities were excluded.

TABLE 1—Summary of 25 train-pedestrian fatalities: 1982-1992.

Age	Race	Sex	EtOH ^a	Injury ^b	Manner ^c	Comment ^d
25	B	M	146br	Bl,av Br	A	Laying,w,r
56	B	M	107Li	Cr,av Br	A	Laying,w
23	W	M	323bl	Bl,av Br	A	Laying,w
17	W	M	175Vi	Mult tr	U	Laying
46	B	M	532bl	Mult tr	A	Laying
20	B	M	0	Bl	A	Fell
22	W	M	243Vi	Bl,Hem	A	Laying,w,m
27	W	M	251bl	Mult tr	A	Sitting,w
20	B	M	123Vi	Mult tr	A	Laying,w
46	B	M	0	Hem,x	A	Laying,sch
21	B	M	103Li	Mult tr,av Br	A	Laying,w
22	W	N	155bl	Mult tr	A	Sitting,w
24	W	M	144bl	Mult tr,av Br	A	Sitting,w
25	B	M	99Li	Mult tr	A	Running
31	W	M	327Vi	Mult tr	A	RR worker
26	W	M	201bl	Hem	A	Laying,m,w
22	W	M	211bl	Bl,hem	A	Sitting,w
44	B	M	0	Amp,hem	A	HIV,sch
37	B	M	331bl	Dec,mult tr	A	—
22	W	M	213Vi	Cr, evisc	A	Laying,w
25	W	M	234Vi	Mult tr	A	Fell
23	W	M	—	Sepsis	A	In-hospital
36	B	M	165bl	Mult tr	A	Running
32	B	F	661Li	Mult tr	A	Pulled, running
42	B	M	0	Dec	S	+ cocaine.

^amg/dl; br = brain, bl = blood, Li = liver, Vi = vitreous.

^bBl = blunt trauma, cr = crush, av br = avulsed brain, hem = hemorrhage, dec = decapitation, multi tr = multiple trauma, amp = amputation, evisc = evisceration, x = transection of thorax.

^cA = accident, S = suicide, U = undetermined, P = pending.

^dIndicates lying or sitting on tracks (w = witnessed), running or being pulled across tracks, or falling onto tracks while climbing onto train. m = moved at whistle, r = retarded, sch = schizophrenic.

The Charleston County Medical Examiners' Office, based in Charleston, South Carolina, serves as a major forensic referral center for the Eastern portion of the state. The cases examined in this study include five fatalities occurring within Charleston County and twenty cases from other counties in South Carolina.

Results

Demographic Data

The victims were predominantly young (mean age 29, range 17 to 56) and male (96%). The sole female decedent was killed as she was being pulled across the railroad tracks by her intoxicated boyfriend. Thirteen decedents were white and twelve were black. Most victims were blue-collar workers; one railroad employee was struck by a train and killed while off-duty.

Previous Physical/Mental Illness

One of the decedents was infected by the human immunodeficiency virus (HIV). Two men had been treated for schizophrenia. One decedent was mildly mentally retarded. Approximately half of the victims had histories suggestive of ethanol abuse.

Location of Incident, Activity of Victim

Only one person was killed at a highway-railroad crossing. The remainder were struck and killed on the tracks between crossings. A total of 60% of the decedents most likely were sitting or lying on the tracks prior to being struck; this was, in fact, the case in twelve of the witnessed deaths. Only two of these people responded to the train's warning whistles; one was struck while trying to get up to avoid the train. The remaining ten victims were motionless prior to their lethal injury. They appeared to be "asleep," "dazed," or otherwise unresponsive. Three persons were killed trying to run across the tracks ahead of a train while intoxicated.

Time of Day, Month

A total of 80% of the victims were struck and killed between 11:00 PM and 6:00 AM Eastern Standard time. Deaths were reported during every month except for March. A total of 36% of these fatalities occurred during the months of July and August.

Drug/Ethanol Use by Victims

A total of 80% of the decedents had a blood, vitreous, or tissue ethanol level equivalent to or greater than a blood ethanol level of 99 mg/dL. Seventeen of eighteen persons killed while lying or sitting on the tracks, or trying to run across the path of the train, had ingested ethanol. Cocaine (0.114 $\mu\text{g}/\text{mL}$ blood concentration) and benzoylecognine (2.97 $\mu\text{g}/\text{mL}$ blood concentration) were detected in our single case of suicidal decapitation. All other drug screens were negative.

Types of Injury Incurred

One decedent was transversely decapitated. One victim was critically injured on the tracks and died in-hospital due to sepsis. The remaining victims suffered combinations of massive blunt and sharp trauma injuries. Cutaneous and visceral lacerations, cerebral

avulsion, multiple amputations, and eviscerating injuries were present in both persons lying or sitting on the tracks and those who were standing. Persons struck while lying down also incurred thoracic transections and decapitating injuries. Human remains were often dispersed over as much as a mile of railroad track distal to the point of injury. Tissue was retrieved from the underside or front of every train known to cause the fatal injuries. Extensive mutilation of the head necessitated identification by fingerprints in five cases and dental records in one other. Although both high- and low-speed accidents resulted in massive tissue disruption, subtotal fragmentation was more characteristic of high-speed accidents.

Manner of Death

A total of 92% of these fatalities were considered to be accidental. A suicide note was found in the pocket of the decapitated victim; this, combined with the history, supported suicide. The manner of death in one case remains undetermined.

Discussion

Several trends are easily recognized from this series. Young, intoxicated men trespassing on railroad tracks are most likely to be the victims in train-pedestrian fatalities. This is in contrast to a previously reported series that recognizes that children and youths are most likely to be the "individuals killed afoot while on railroad property" [2]. Our data also suggests that most train-pedestrian fatalities (96% in this series) occur away from train-highway crossings. This is in concert with national statistics [1]. Pedestrians struck by trains usually suffer massive blunt and sharp force injuries. Cerebral avulsion, amputations, evisceration, and subtotal fragmentation may be seen, reflecting the massive amount of kinetic energy imparted to a human body struck by a train. Although quite rare compared to automobile-pedestrian accidents, train-pedestrian collisions more often result in a fatal outcome.

We agree with the data generated from the Dade County, Florida experience in that "many railway accident victims are sadly lacking in common sense" [6]. This is clearly evident in the numerous fatalities (48% of our cases) resulting from sitting or sleeping on the railroad tracks while intoxicated. Closely rivaling this blatant display of misjudgment is the tendency for some pedestrians to try to race across the path of an oncoming train while under the influence of alcohol. Given ethanol's ability to impair "critical judgement" (90 to 250 mg/dL blood alcohol level [BAL]), cause disorientation and confusion (180 to 300 mg/dL BAL) and to induce stupor at high levels (>270 mg/dL BAL) [7], our office considers train-pedestrian fatalities accidents rather than suicides if the history and toxicologic data support recent ethanol use.

Although ethanol was found in the blood or tissues of 19 of 23 decedents who died accidental deaths, it was absent in three of the remaining cases. An ethanol level was not obtained on the fourth victim who died in-hospital. One of the three aforementioned deaths was deemed accidental because the victim fell onto the tracks while climbing on a stalled train, which subsequently ran him over. In the final two cases, the victims had been previously diagnosed as schizophrenic. The psychotic nature of this disease may result in a distorted perception of reality in those afflicted, perhaps predisposing some to accidental death. Schizophrenics are also at an increased risk of suicide compared to the general population (10 to 13% vs. 1% lifetime risk) [8]. A detailed history and careful consideration of the nature of the decedent's injuries should enable the medical examiner to elucidate the most probable manner of death in these cases. One of the schizophrenics in this study was infected with HIV; he died at the scene following exsanguination from an amputated lower extremity. Our investigation concluded that a true suicidal effort

would have resulted in a more immediately lethal injury. These three deaths were ruled accidental only after careful history taking revealed no evidence of suicidal ideation or previous suicide attempts. The literature suggests that the only lethal injury strongly indicative of a train-pedestrian suicide is a transverse decapitation in an otherwise intact body [3–5]. This study supports that conclusion; only one person in our series died following decapitation without other blunt or sharp force injury. A suicide note and an Amtrak schedule (with the train's arrival time circled) was found in his pocket. This suicide was the only case in which illicit drugs played a factor. The concentration of benzoylceognine was considerably higher than the cocaine level in the blood of this victim. It is possible that this decedent may have been "coming down" from a cocaine high and entering a postdrug depressive state [9].

A complete postmortem examination, performed in the majority of our cases, failed to yield any evidence suggestive of homicide. We feel it is essential, however, to approach every train-pedestrian fatality with an open mind. The massive injuries seen in train-pedestrian accidents are well-known to medical examiners; the extensive mutilation of a body struck by a train can also be envisioned by a murderer. Homicide, particularly by means of blunt trauma, may be extremely difficult to detect following mutilation of a body by a passing train. Since train-pedestrian collisions usually result in instantaneous death, extensive bleeding into the scalp, cranial vault, and brain may suggest premortem blunt trauma. If the skin cannot be adequately reconstructed to facilitate identification of premortem homicidal injury, radiographs should be taken to detect foreign bodies (for example, bullets). Lastly, since most bodies struck by a train are often quickly discovered, the presence of well-developed rigor and/or livor mortis in the recovered tissues would suggest that the victim had died several hours prior to being struck by a train.

Eighty percent of train-pedestrian fatalities occurred between 11:00 PM and 6:00 AM. Given the strong association with alcohol consumption noted above, this temporal relationship can be predicted. A significant number of our victims may have fallen into an alcohol-induced stupor while lying on the tracks; this would explain their failure to respond to the train's warning signals. This scenario reinforces the point that the majority of people witnessed to be lying across the train tracks are probably not suicidal.

The recent German literature suggests that accurate determination of the manner of death in railway fatalities is essential in the application of insurance law [5]. This is also true in the United States. In this era of civil litigation, it is incumbent upon the forensic pathologist to determine the manner of death to the best of his or her ability. It may be necessary, however, to leave the manner pending further investigation or to judge the manner undetermined based on the available evidence.

Conclusions

The manner of death may be difficult to determine in a train-pedestrian accident. In the absence of historical or physical evidence suggestive of suicide or homicide, we consider these deaths to be accidental, albeit the victim is often at fault. Toxicologic evidence of recent ethanol consumption is closely associated with accidental deaths. The ubiquity of life insurance policies and the omnipresent spectre of civil litigation have made accurate determination of the manner of death increasingly important.

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Address requests for reprints or additional information to
Stephen J. Cina, M.D.
Dept. of Pathology and Laboratory Medicine
Medical University of South Carolina
171 Ashley Ave.
Charleston, SC 29425
Phone (803) 792-3500
Fax (803) 792-3537