

## CASE REPORT

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### Delayed Traumatic Intracerebral Hematoma (DTICH) and the Determination of the Manner of Death. A Case Report and Review of the Literature

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**ABSTRACT:** The concept of a traumatic incident resulting in death when there has been a prolonged interval between the two events raises questions for medical examiners. A case is presented in which a 33-year-old man was found dead in his locked home. Although there was no evidence of foul play at the scene, the death was subsequently found to be directly related to an episode of head trauma sustained in an altercation approximately 1½ months before. The fatal lesion was a large intraparenchymal hematoma in the right frontal lobe of the brain which had developed in an area of contusion identified by computerized tomography (CT) scan while he was hospitalized following the trauma. The literature regarding delayed traumatic intracerebral hematoma (DTICH) is reviewed and its relevance to cases coming under the jurisdiction of a medical examiner is discussed.

**KEYWORDS:** pathology and biology, criminalistics, hematoma, injuries, death, delayed traumatic intracerebral hematoma (DTICH)

Trauma resulting in death when there has been a significant interval between the two events almost always raises significant medical-legal and procedural questions. This is especially true when, as in the case presented here: (1) the primary event and death are separated by an extended period of time, (2) the deceased is not under direct medical supervision after the injury, and (3) the terminal event may have many of the hallmarks of a natural disease process.

#### Case Report

A 33-year-old computer program designer was found dead lying next to his bed in his locked home after not being seen for 3 days. Partially full antibiotic and prescription pain

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medication containers were on the nightstand. The body had early decompositional changes. Although there was no evidence of foul play at the scene, law enforcement authorities questioned whether the death may have been related to a head injury which, according to a relative, had been sustained approximately 1½ months before. At the time of that incident, the decedent was reportedly involved in an altercation in and around a local bar.

At autopsy, the only significant finding was a large intraparenchymal hematoma in the right frontal lobe of the brain which had ruptured into the subdural space causing subdural hematoma. The question of causation then arose. Was this death a result of entirely natural causes (that is, stroke)? Could such an event have been precipitated by a hypertensive episode caused by prescription or abused medications? Or was it due to the delayed effects of the previous head injury (DTICH), which in this case would make the manner of death homicide?

Investigation of the case simultaneously proceeded in several directions. A careful neuropathologic examination was conducted with a neuropathologist on the fixed brain and complete toxicological studies were pursued, in addition to the routine histologic and toxicologic studies. Interviews with relatives, friends, and physicians whose names were on the prescription bottles led to the location and retrieval of medical records. Review of police records and further police investigation resulted in documentation of the altercation which had led to the head trauma in addition to providing pertinent information pertaining to the mechanism of the injury. This multioriented approach provided the following story.

Approximately six weeks before his death, the deceased was involved in an altercation during which he sustained head trauma requiring him to be hospitalized. Although the exact mechanism of injury was somewhat sketchy, he apparently was either hit and fell backward, striking his head, and/or he sustained direct trauma to the front and top of his head by a heavy object (reportedly a car door). During his hospitalization, a computerized tomography (CT) scan documented a right frontal cortical contusion. Although therapy during his three-day hospital stay appeared appropriate and at least partially effective, there was little or no followup (as a result of financial constraints).

Information gleaned from relatives and friends indicated that, even though he was not hospitalized, he was unable to pursue his usual work, had severe headaches, visual abnormalities, and was unable mentally to function at his usual level. Because of his near invalid status, relatives knew his actions and encounters during the time between hospitalization and death, and could effectively rule out any significant intervening trauma.

The neuropathologic examination of the brain, although hampered by decompositional changes, was able to document that the area of intracerebral hemorrhage was localized in the area of the cortical contusion seen by CT scan and was also the apparent source of rupture into the subdural space. Microscopically, the brain tissue was essentially replaced by foamy macrophages consistent with an area of contusion of several weeks duration. The specific absence of arteriovenous malformation, aneurysm, or other abnormalities in the area of hematoma was also documented.

## Discussion

Episodes of head trauma with a subsequent but delayed catastrophic event were described originally in 1891 by Bollinger in Germany in a classic article entitled, in part, "Über traumatische Spat-Apoplexie" [1]. The criteria he identified then are still applicable. They are: (1) absence of previous vascular disease, (2) definite history of trauma, (3) asymptomatic (or lucid) interval, and (4) subsequent apoplectiform episode. The concept had sporadic recognition in the literature, predominantly in the form of case reports which dealt with varying time intervals between injury and hematoma formation. A review article in 1970 [2] correlated and examined the similarities of 24 previously reported cases with regard to age of patients (80% under 40 years of age), length of the asymptomatic interval (33% less than 7

days, 80% less than 30 days, and 96% less than 90 days), and surgical or autopsy findings when available. This article stressed that without an accurate history, it could be almost impossible to differentiate posttraumatic lesions from spontaneous intracerebral hemorrhage.

With the onset of CT technology, DTICH gained renewed interest. Early sporadic case reports, which included delayed, intracerebral, intracerebellar, and extracerebral hematomas, primarily addressed the lack of hematoma on initial CT scan in contrast to those demonstrated at a later time [3-6].

Two comprehensive studies published in 1984 were conducted in Shizuoka, Japan [7] and Cambridge, United Kingdom [8]. Although these studies differ somewhat in their methods and criteria, the concept is clear and guidelines (revised to include CT information) are established. The Japanese study examined 25 cases of traumatic intracerebral hematomas from 775 patients admitted with acute head injury. All of the 25 cases had multiple serial CT scans in addition to extensive clinical information. The British study involved 15 cases, all of whom had at least an admitting CT scan and were classified on the basis of an admitting neurological examination as to severity of condition. The parameters of each of these studies and a comparison of the 2 are included in Table 1. Note that the age groups are different and, therefore, the mechanisms of injury are different. In the Japanese series, patients were more youthful with injuries predominantly motor vehicle related, and hence, at least moderately severe. In the Cambridge study, patients were frequently elderly, often sustaining a backward fall leading to an occipital coup and frontal contracoup injury. Therefore, nearly all had frontal or temporal hematomas; frequently, the injury was considered relatively trivial.

The differences between these two studies seem to relate more to the criteria for inclusion or exclusion of cases in the respective study and to the sensitivity of the CT scanning equipment rather than actual differences in the entity itself. In both studies, it was clear that the patient experienced a documented head injury which, although not necessarily severe, was usually significant enough to result in hospitalization. Although a skull fracture may or may not have been associated with the injury, an initial CT scan almost always showed a cortical contusion (apparently depending upon the sensitivity of the instruments used) but no deeper

TABLE 1—*The parameters and a comparison of two comprehensive studies published in 1984.*

Parameters	Japan (Ninchoji et al. [7])	Cambridge, (Young et al. [8])
Number	25	15
Ages/years	9 months to 83 (average: 46 years)	8 to 82 (9 cases $\geq$ 60 years)
Interval between injury and diagnosis of DTICH	8 to 72 h (18/25 = 72%) 7 to 12 days (7/25 = 28%)	8 h to 4 days (peak = 48 hours)
Location	variable	14/15 frontal or temporal
Incidence of multiple hematomas	yes (numbers not stated)	4/15
Initial injury (by CT scan)	12/25 "obvious" contusions seen on CT scan	all with previous contusion on CT scan
Severity of injury	moderately severe—mostly MVA related (all injuries with head in motion)	trivial to severe
Associated skull fractures	21/25	8/15
Mortality	11/25 (44%)	7/15 (46%)

intraparenchymal lesion. The patient displayed a period of lucidity or minimal symptomatology followed either by a catastrophic event or an insidious but significant decrease in the neurologic status. A repeat CT scan demonstrated the intracerebral hematoma.

In both of these studies which extended over several years, the features described became more clearcut as the technology improved. More recent studies have focused on whether other factors might contribute to or precipitate this entity, such as disseminated intravascular coagulation (DIC) [9,10] or associated delayed extradural lesions [11]. Some studies have addressed the developmental processes leading to traumatic intracerebral hematomas [12], or the timing and operative options available for these lesions [13]. In spite of advanced technology and understanding, the mortality to date is still high.

As the entity becomes more frequently recognized clinically, especially when the patient is still hospitalized or under the direct supervision of a physician, it will be brought to the attention of medical examiners with the diagnosis established or at least suspected. However, when the death occurs after the patient has left the hospital or is not under direct medical supervision (and especially if the time interval is prolonged), the traumatic event and its relationship to death becomes less clear. It is in these cases that the medical examiner is presented with a more difficult problem. The traumatic causation may not be recognized initially if there is not a thorough investigation or the proper questions are not asked.

Although a death in a young person such as in our case would nearly always be thoroughly investigated and an autopsy conducted, similar circumstances surrounding the death of an older individual might be presumed to be natural, and an investigation might not be conducted. This is a potentially serious problem when one realizes that 60% of DTICH cases presented in the Cambridge series were in older people and were related to falls or other injuries creating significant contracoup-type trauma. These deaths would commonly be presented to the medical examiner as a "stroke" which would not be considered a suspicious event in an elderly person. Recognition of this entity with appropriate investigation is therefore emphasized as correct certification of the manner of death may have significant monetary ramifications in addition to the emotional or statistical considerations.

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