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Intracranial epidural hematomas in the ED

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Editor's Note: *As a major cause of traumatic death and disability, head injuries require timely diagnosis and management. Because survivors of serious head injuries often have varying degrees of permanent disability, head injury litigation is not uncommon. Furthermore, epidural hematomas may present subtly and progress rapidly toward serious brain injury and death. Upon initial presentation, patients with an evolving epidural hematoma may appear relatively intact to such an extent that the inattentive clinician may be lulled into clinical complacency. This issue discusses pitfalls in the diagnosis and management of epidural hematomas and the subsequent legal consequences to the physician who fails to timely diagnose and manage these patients with potentially devastating head injuries. —* ***Richard J. Pawl, MD, JD, FACEP***

Introduction

An otherwise healthy patient presents to the emergency department (ED) of her local hospital after sustaining a moderately severe closed head injury that resulted in her loss of consciousness. Upon presentation to the ED, she is slightly confused but is otherwise normal neurologically. The ED physician chooses to obtain a brain computerized tomographic (CT) scan, revealing a small intracranial epidural hematoma. The patient is admitted and observed for the next several days. A repeat CT scan demonstrates resolution of the hematoma, and the patient is discharged home with mild continuing headaches. At a routine physician evaluation six months later, she has mild continuing headaches but is otherwise without complaints.

Another patient presents to the ED following a mild head injury in which she was struck in the temporal region of her head by a softball. She did not lose consciousness but complains of a headache in the ED. She is otherwise

completely normal from a neurological standpoint. In this scenario, the ED physician chooses not to obtain a skull radiograph or a brain CT scan. The patient is released and allowed to go home unaccompanied by another adult. She subsequently is found several hours later incoherent and somewhat lethargic. She is brought back to the ED where skull radiographs reveal a temporal region fracture. While waiting for a CT scan, the patient dilates a pupil and becomes unresponsive. She is intubated, and her brain CT scan reveals a large intracranial epidural hematoma; she is taken to emergency surgery for evacuation. She gradually regains consciousness and is discharged to a rehabilitation unit in a week. Six months following her head injury, she is essentially normal neurologically, except for some minimal memory loss.

A third patient presents to an ED following a moderately severe closed head injury. This patient was struck about the head and face with a blunt object during a fight. He did not lose consciousness and is somewhat lethargic in the ED, although he can walk and talk and has a nonfocal neurological examination. The ED physician obtains a skull radiograph during evaluation of the patient for fractures. The skull radiograph reveals a fracture in the middle fossa crossing the middle meningeal artery region. The ED physician chooses not to obtain a CT scan, and the patient is placed in the observation ward of the ED. During the next several hours, the nurses note that the patient begins to complain of an increasingly severe headache and begins to slur his words. The nurses also note that the patient is moving one side of his body less than the other side. The nurses do not inform the physicians. After another hour of observation, the patient dilates a pupil and becomes unresponsive. A brain CT scan is ordered but is not performed for another hour; it reveals a large epidural hematoma. Before the patient can be taken to surgery, he develops cardiorespiratory arrest and cannot be revived.

The above scenarios illustrate routine encounters in the ED involving the failure to diagnose and the failure to treat an intracranial epidural hematoma. In the first scenario, no medical negligence occurred; the ED physician's care and treatment of the patient was exemplary. In patients with minor closed head injury, a thin epidural hematoma is commonly present and can be managed with only close observation. In the second and third scenarios, the care and treatment provided by the ED physicians did fall below the standard of care. Moreover, in the third scenario the ED nurses also failed to meet their applicable standard of care. Fortunately, in the second scenario, the patient made an almost complete recovery. However, in the third scenario, as a result of both the ED physicians' and nurses' obvious breaches of the standard of care, the patient ultimately died due to his epidural hematoma.

The most common causes of ED malpractice arise from misdiagnosis, the failure to diagnose, failure to admit, improper or incorrect treatment, and lack of consultation with appropriate specialists.[1] Most failure-to-diagnose cases involve appendicitis, myocardial infarction, meningitis, ectopic pregnancy, and fractures.[1] While not among those entities most commonly misdiagnosed in the ED, an intracranial epidural hematoma may present following an all-too-common ED presentation: a minor to moderate closed head injury. Moreover, the classic presentation of an intracranial epidural hematoma is a patient who has sustained a closed head injury but who presents able to walk and talk. The patient ultimately dies as a result of an expanding epidural hematoma and the resulting brain herniation.[2-9] Therefore, a patient who presents to the ED following even a

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minor closed head injury must be approached in a thorough and careful manner to exclude the potentially devastating sequelae of an expanding intracranial epidural hematoma.

Overview

Head injury is one of the leading causes of death in persons age 20 to 45 years, and therefore, represents a significant national health problem. Moreover, closed head injury is a common aspect of many trauma victims; frequently an ED physician is required to evaluate and treat such a patient prior to consultation with a specialist such as a neurosurgeon. Treatment of a patient suffering from a closed head injury depends upon the severity of the injury as well as the type of injury to the brain and skull.

One of the classic injuries that a patient suffers following a closed head injury is the epidural or extradural hematoma. An epidural hematoma is a collection of blood between the skull and dura caused most frequently by a torn and bleeding middle meningeal artery. Although most ED physicians are acutely aware of the entity, epidural hematomas are actually an infrequent sequela of closed head injuries. In fact, only approximately 2% of admitted patients with head trauma suffered an epidural hematoma.[2-9]

The importance of an early diagnosis of an epidural hematoma, however, cannot be underestimated. Those patients who were normal neurologically or who were slightly lethargic and who underwent early operative intervention demonstrated less than a 5% mortality rate.[2-9] Those patients, however, who underwent surgical evacuation of their hematoma following their lapse into a coma, demonstrated a mortality rate more than 50%.[2-9] Moreover, the stories of patients who presented to the ED walking and talking but who, following their lucid interval, subsequently died are almost legendary.[2-9] Therefore, a missed diagnosis of an epidural hematoma leads to a missed opportunity for an early operative intervention in an otherwise healthy patient. Such a missed opportunity for an early surgical evacuation almost invariably leads to a death or catastrophic neurological outcome and an almost guaranteed lawsuit. In fact, as one author states, "... there is almost no excuse (in the modern era) for missing an epidural hematoma."[2]

The following cases will illustrate instances of failure to diagnose an epidural hematoma in the ED and will present pointers and pitfalls with respect to managing a patient with a real or suspected epidural hematoma from an ED physician's perspective.

Case #1. Hatzman v. Kern Medical Center[10]

Mr. Hatzman, a 15-year-old boy, was riding his bicycle in a Bakersfield, California park. He apparently struck an object in the bike path and fell from his bicycle. Bystanders called emergency medical service (EMS) personnel, who arrived at the scene of the accident with no significant delay. Upon arrival, Mr. Hatzman exhibited normal vital signs and scored a 15 on the Glasgow coma scale. The EMS personnel documented that Mr. Hatzman had suffered a fractured clavicle as well as a head injury. They were unable to ascertain whether the boy had suffered a loss of consciousness following his accident; the ambulance transported him to the Kern Medical Center.

Mr. Hatzman arrived in the Center's ED at approximately 1:45 p.m. on a Sunday afternoon. Upon evaluation, Mr. Hatzman was noted to have normal vital signs as well as a Glasgow Coma Scale of 15. He had no further investigative studies and underwent no further treatment. He was placed in a line-of-sight treatment area close to a nursing station for continued observation. During the next hour and a half, Mr. Hatzman allegedly experienced and reported increasing headaches accompanied by nausea. In addition, he allegedly demonstrated continued vomiting and agitation. At approximately 3:15 p.m., Dr. Chong, an ED physician, formally obtained a history from and performed a physical examination upon the patient. Because of Mr. Hatzman's vomiting, Dr. Chong ordered a brain CT scan to evaluate him for possible intracranial pathology.

Because it was a Sunday, the CT scanner was not available for use until the on-call radiology technician arrived from home, adding 20-40 minutes of delay in obtaining the CT scan. Mr. Hatzman's brain CT scan was performed at approximately 4:30 p.m. and demonstrated a large epidural hematoma associated with acute brain herniation. Mr. Hatzman immediately was taken to the operative suite where a large epidural hematoma was evacuated and his brain decompressed.

Following surgery, Mr. Hatzman continued to suffer from a significantly altered mental state with sig-

nificant neurological and cognitive deficits. He eventually was transferred to Valley Children's Hospital in Fresno, for 24-hour nursing care. Mr. Hatzman failed to regain any significant neurological functioning in the years following his accident.

Mr. Hatzman's parents brought a medical negligence suit against the county and hospital based upon their alleged failure to provide appropriate and timely medical services to their son. The suit was based upon the hospital's and its ED staffs' failure to diagnose and treat the plaintiff's epidural hematoma. The defendants contended that the medical care they rendered to the plaintiff met the applicable standard of care. Damages included the plaintiff's "brain herniation," his cognitive and behavioral problems, his complete disability, and his need for 24-hour care for the remainder of his life.

At trial, the plaintiffs argued that the hospital and its staff breached the applicable standard of care by failing to adequately monitor Mr. Hatzman during the several hours between 1:45 p.m. and 4:30 p.m. They argued that the hospital and its staff failed to respond to Mr. Hatzman's complaints of headache, nausea, vomiting, and his increasing agitation, and failed to obtain a CT scan in a timely manner. Moreover, the plaintiffs argued that the CT scan should have been obtained upon Mr. Hatzman's arrival.

However, the defendants argued that the patient had exhibited a normal Glasgow coma scale score upon admission and had not demonstrated any significant changes prior to his acute decompensation just prior to surgery. The defendants also argued that observation of a head injured patient is an accepted form of treatment, that the minor plaintiff had been placed in direct view of the nursing station, and that a CT scan was not indicated when the minor plaintiff was admitted. Finally, the defendants argued that Mr. Hatzman had not demonstrated a progressive deterioration in neurological status but had acutely decompensated at the time of his CT scan. Moreover, the jury believed that watchful waiting was treatment that met the standard of care in this case.

Discussion

The Hatzman case illustrates several important points regarding the failure to diagnose an intracranial epidural hematoma in an ED setting. The first principle involves the presentation vis-à-vis the clinical history of a patient who presents to the ED with a closed head injury and an evolving epidural hematoma (**Table 1**). The classic presentation of a patient with an evolving epidural hematoma is one in which the patient presents with a lucid interval. In other words, the patient has a closed head injury that results in a transient loss of consciousness immediately following the injury. When seen and evaluated, however, the patient has a normal level of consciousness and a Glasgow coma scale score of 15. During the next several hours, the patient begins to become lethargic and loses consciousness as the hematoma expands. Although the lucid interval supposedly is the hallmark of an epidural hematoma, according to the literature fewer than a third of patients actually present with a lucid interval, and moreover, such a lucid interval is not associated exclusively with epidural hematomas; other traumatic intracranial lesions (e.g., subdural hematomas) can present with a lucid interval.[2-9]

Patients with intracranial epidural hematomas may demonstrate and follow several other clinical histories. Many times patients with an evolving epidural hematoma present with only minor symptoms (e.g., headache, nausea, and vomiting) or, on occasion, no symptoms at all. The speed of progres-

TABLE 1. Clinical Courses of Patients with Intracranial Epidural Hematomas

- Patients who experience no loss of consciousness during their clinical course
- Patients who are rendered unconscious by the initial trauma and who never regain consciousness
- Patients who experience no loss of consciousness following the trauma, but who gradually deteriorate into unconsciousness
- Patients who are rendered unconscious by the initial trauma, regain consciousness, and continue to remain conscious throughout their clinical course
- Patients who are rendered unconscious by the initial trauma, regain consciousness, the lucid interval, and then gradually deteriorate into unconsciousness

Adapted from Samudrala S, Cooper PR. Traumatic intracranial hematomas. In: Wilkins RH, Rengachary SS, eds. *Neurosurgery*. 2ed. New York: McGraw-Hill;1996: 2797-2809.

sion of symptoms varies and depends upon the source of hematoma (i.e., venous or arterial) as well as the location of the hematoma. Those patients with hematomas in neurologically exquisite areas generally progress rapidly, while those in more silent areas may develop large hematomas before any symptoms or signs are present. In patients with temporal hematomas, progression of symptoms and signs generally occurs quickly inasmuch as the hematoma rapidly places pressure upon the adjacent brainstem. In addition, patients with other associated intracranial injuries (e.g., contusions) generally progress more rapidly and demonstrate more severe neurological findings during the course of their progression than those patients who have only an isolated epidural hematoma.[2-9]

Other clinical histories and presentations of patients with intracranial epidural hematomas include those patients who present unconscious upon first evaluation at the scene of the accident and may never regain consciousness. Another clinical picture is that of a patient with an intracranial epidural hematoma who may present awake and alert at the scene of the accident and subsequently decompensate to a state of unconsciousness within a short period. In an interesting scenario, a patient may present with a closed head injury and be evaluated initially by CT imaging. The initial CT scan does not reveal an epidural hematoma. During treatment, the patient subsequently develops neurological deficits and a repeat CT scan reveals an evolving epidural hematoma. This incidence of delayed epidural hematomas following a normal brain CT scan occurs in 10-30% of patients.[2,3,11] The postulated reason for such a significant incidence is because many patients undergo CT imaging within the first 60 minutes of treatment in the ED.[2,3,11] Finally, another clinical presentation of patients with an epidural hematoma is that of a significantly delayed hematoma that develops over days and even weeks following the injury.[2-9,11]

As should be obvious, patients with an intracranial epidural hematoma can and often do present in a multitude of clinical states with a variety of clinical histories. The classic lucid interval is not the most common method of presentation or progression of a patient harboring an epidural hematoma. As a result, ED physicians faced with a patient who has suffered a closed head injury must be aware of the different presentations of an epidural hematoma and be prepared to evaluate a patient in a timely manner who presents not only with neurological signs and symptoms, but also who may develop any progression of neurological signs and symptoms. In a patient with a history of closed head injury, an ED physician must not hesitate to obtain a brain CT scan in any patient who has any evidence of neurological signs or symptoms, particularly if such signs and symptoms are progressive.

Mr. Hatzman would satisfy the criteria for a patient with a closed head injury and evolving neurological symptoms indicating a progressively expanding intracranial epidural hematoma. The standard of care would require an ED physician to obtain an urgent CT scan to evaluate Mr. Hatzman based upon his progressive deterioration.

In Mr. Hatzman's case, confusion existed as to the exact timing of his progression of deficits. If the deficits progressed as the family indicated, an earlier CT scan was required to evaluate Mr. Hatzman prior to his acute decompensation. However, if Mr. Hatzman did not demonstrate progressive neurological signs and symptoms, as the hospital argued to the jury, then a CT scan was not required until his deterioration and close observation was the standard of care. As can be seen by the verdict, the jury believed the hospital's argument that Mr. Hatzman demonstrated an abrupt decompensation and that a CT scan was obtained as urgently as possible. If the jury believed that Mr. Hatzman had demonstrated progressive neurological signs and symptoms in the ED, however, the outcome of the case should have been a verdict for Mr. Hatzman with an associated award for significant monetary damages. Regardless of the outcome, Hatzman illustrates the importance of the clinical presentation of a patient with an expanding intracranial epidural hematoma and the need for urgent evaluation by CT imaging should progressive deficits appear in the patient.

Another issue presented in Hatzman involves the need for close observation of a patient with a possible epidural hematoma by trained health care professionals. Patients with possible hematomas must be placed in an area where they can be observed closely for any neurological changes. Such an area includes an observational unit in the ED with close nursing supervision and frequent checks or, it can mean admission to a neurosurgical floor or even admission to an intensive care unit, if indicated. The need for close observation stems from the need for urgent

evaluation by CT imaging if the patient should deteriorate or show signs of neurological progression. An urgent CT scan provides for an early diagnosis of an expanding epidural hematoma and allows for early surgical evacuation of the hematoma. Moreover, early evacuation of the hematoma while the patient still is in good neurological condition has been shown to provide the best outcome for patients with an epidural hematoma. [2-9,11,12]

Case #2. Evans v. Doctors' Hospital of Pinole[13]

Mr. Evans, a 32-year-old pile-driver foreman with no significant medical history was injured at his construction site. Mr. Evans was directing his crew to assemble a large crane with which they were to drive piles for a new warehouse facility owned and operated by C&H Sugar's refinery. During assembly of the crane, a large fragment of steel fell from the boom tip and struck Mr. Evans in the head. Mr. Evans was wearing his hard hat, but the blow knocked him to the ground where he lay unconscious for several minutes. Mr. Evans was transported by ambulance to the ED of the Doctors' Hospital of Pinole.

Mr. Evans arrived there at approximately 12:30 p.m. and was noted to be awake, oriented, and in pain. Radiographic evaluation of Mr. Evans revealed that he had suffered fractured facial bones, but no further abnormalities were identified. At approximately 1:30 p.m., Mr. Evans was administered a narcotic pain medication intramuscularly. During the next hour, family members noted that Mr. Evans became lethargic, disoriented, and demonstrated slurred speech. The ED physicians attempted to discharge Mr. Evans to home. Mr. Evans' wife, however, refused to take her husband home.

At approximately 3:00 p.m., Mr. Evans was seen and examined by an otolaryngologist who was unable to obtain a history from Mr. Evans. He subsequently admitted Mr. Evans for close neurological observation. He was admitted to a regular ward but was never initially evaluated by the nursing staff. At approximately 4:00 p.m., Mr. Evans suffered a grand mal seizure. Mr. Evans underwent a CT scan revealing a large right-sided, temporal-frontal epidural hematoma associated with a fracture that crossed the middle meningeal artery. Mr. Evans finally was transported to the operating room at approximately 6:30 p.m., approximately two hours following the discovery of his epidural hematoma. By the time Mr. Evans arrived in the operating room, he was obtunded with decerebrate posturing. He recovered function to the point that he was able to assist in his activities of daily living but demonstrated significant organic brain dysfunction including cognitive, memory, motor, visual, and coordination deficits. Following his discharge from rehabilitation, Mr. Evans required 24-hour attendant care.

Mr. Evans and his wife brought a medical negligence suit against the hospital based upon the ED staff's failure to diagnose and treat the plaintiff patient's epidural hematoma in a timely manner, as well as negligently administering a narcotic pain medication to a patient with a closed head injury. The plaintiffs alleged that the defendant negligently failed to obtain a CT scan upon admission of the plaintiff through the ED, that the hospital and the ED staff failed to closely monitor the plaintiff and failed to detect his deteriorating neurological condition, and finally, that the plaintiff's surgical evacuation of his epidural hematoma was delayed by more than two and one half hours. The defendants contended that the care they rendered to the plaintiff met the applicable standard of care. Damages to the plaintiff included his complete disability, his extensive organic brain damage accompanied by significant cognitive, memory, motor, and visual deficits as well as his need for 24-hour attendant care.

During discovery, several facts became apparent that significantly affected the outcome of the case. While in the ED, Mr. Evans supposedly had been under close observation by the ED personnel. The emergency records revealed, however, that Mr. Evans did not receive even routine nursing checks, much less serial neurological examinations. As a result, the ED personnel failed to recognize his progressive neurological deterioration.

Moreover, Mr. Evans had been transferred to a regular nursing ward at the change of shift and had not received an initial nursing evaluation; therefore, Mr. Evans' condition was never observed by any of the ward's personnel. Finally, Mr. Evans had not been transported to the operating room for more than two hours following the discovery of his epidural hematoma. The case settled prior to trial. Mr. Evans received approximately $1.7 million net present cash value for his injuries. This figure translates into approximately $5 million during his life expectancy.

Discussion

The *Evans* case illustrates several important points regarding the failure to diagnose an intracranial epidural hematoma. First, it reinforces the principle that a patient with an epidural hematoma may present in a variety of ways. Mr. Evans suffered a closed head injury that clearly produced a loss of consciousness, but upon presentation to the ED, he was awake and alert. He subsequently deteriorated from the effects of his epidural hematoma.

Mr. Evans would fit the description of a patient with the classic lucid interval. As has been noted previously, however, the classic lucid interval actually is not the norm; in fact, it should be considered the exception rather than the rule. Mr. Evans' presentation was obviously different from Mr. Hatzman's presentation of acute neurological decompensation following several hours of neurological normality. Because of the varying clinical presentations of such patients, the point cannot be emphasized enough that, as one author notes: "every patient with an impact blow to the head should be suspected of having an epidural hematoma, which if not recognized can lead to brain injury and . . . death."[2] In addition, Evans emphasizes the need for every patient with a closed head injury, and especially one with a possible mechanism for development of an epidural hematoma, be observed closely with serial neurological examinations by trained personnel. The failure to closely monitor Mr. Evans — in contrast to the monitoring of Mr. Hatzman in the *Hatzman* case — is a clear breach of the standard of care.

The second principle illustrated by *Evans* concerns the use of narcotic medications in a patient with a closed head injury. The use of a narcotic medication in a patient with a closed head injury itself is not a breach of the standard of care; however, an ED physician must be aware of its effects upon patients and the subsequent effect such use has upon the monitoring of this type of patient. Again, close monitoring of a patient with a closed head injury through serial neurological examinations is necessary to meet the applicable standard of care. In fact, one author has noted that the serial neurological examination is the gold standard in terms of the neurological monitoring of patients with head injuries.[2] Any hindrance to such monitoring must be avoided at all costs, be it untrained nursing staff, lack of nursing staff, or use of medications that impair a patient's mental functioning. As is well known, narcotic medications normally depress a patient's mental status and can cloud any subsequent neurological examination. Therefore, the use of narcotic medications in a head-injured patient should be limited at best. In Mr. Evans' case, the use of a narcotic medication probably did not affect his outcome as much as the actual lack of monitoring or the delay in operative intervention. That is not to say, however, that the use of narcotic medications in a patient such as Mr. Evans should be condoned and that their use would not adversely affect another patient's outcome.[2-9]

The third principle illustrated by Evans concerns the liberal use of CT imaging as an investigative study in patients with closed head injuries in contrast to plain skull radiography. Plain skull radiographs have been shown to be unhelpful in the evaluation of a patient with a closed head injury. In fact, both a multidisciplinary panel and multiple studies have failed to demonstrate the cost effectiveness of skull radiographs in the evaluation of a closed head injured patient. Moreover, skull radiography has no real prognostic value in a head injured patient unless a fracture is demonstrated on the study. CT imaging, on the other hand, is the gold standard for the initial evaluation of a closed head injured patient. A CT scan is the best radiographic study for diagnosing any type of intracranial hemorrhage including an epidural hematoma in the acute trauma setting due to its speed of completion and ease of use.[2-9,11,14,15] In Mr. Evans' case, the standard of care required that he receive a brain CT scan as an initial diagnostic study to evaluate for the possibility of an intracranial abnormality. The failure to perform such a scan as well as the staff's gross failure to provide close monitoring of Mr. Evans were breaches of the applicable standard of care.

Not every patient who presents to the ED with a closed head injury, however, requires evaluation by CT imaging. In fact, many patients seen in the ED with a closed head injury do not require and are not evaluated by CT imaging. Some patients clearly do require CT imaging for evaluation: Any obtunded patient following a closed head injury would require CT imaging for evaluation of their injuries. Moreover, any patient with a Glasgow coma scale score of less than 15 would require evaluation by CT imaging. All patients with any focal neurological deficit, altered mental status, skull fracture, signs of basilar skull fracture, or a history of loss of con-

sciousness following a closed head injury must receive a CT scan to evaluate them for any intracranial abnormality including an epidural hematoma. In fact, such use of CT imaging would help to prevent the most devastating complication in a patient with an epidural hematoma: a failure to make a rapid diagnosis.[2-9,14,15]

Case #3. Urcia v. Kaiser Foundation Hospitals[16]

Brian Urcia was a healthy 13-year-old student who was involved in a fight at school. During the fight, Mr. Urcia was struck in the head by a fist or blunt object. He also was struck on the left side of his face and his head and suffered a questionable loss of consciousness. Mr. Urcia was taken by a Honolulu ambulance to the Kaiser Punawai Clinic, an urgent care clinic designed for nontrauma victims. Mr. Urcia arrived at the clinic with the above history as well as complaining of headache, dizziness, sleepiness, and vomiting. While at the clinic, he continued to complain of headaches and experienced several episodes of vomiting.

Following his initial evaluation at the clinic, no further investigative tests were performed upon Mr. Urcia. Approximately an hour and 40 minutes following his arrival at the clinic, Mr. Urcia was noted to be significantly lethargic, and his left pupil was noted to be dilated. Mr. Urcia subsequently was transported to Queen's Medical Center where he underwent diagnosis and evacuation of a large, left, fronto-temporal parietal epidural hematoma.

Following his surgery and rehabilitation, Mr. Urcia suffered partial spastic quadriparesis, contractures, and generalized muscular weakness. Mr. Urcia suffered multiple mild cognitive deficits, has significant speech deficits, and requires 24-hour care for assistance with activities of daily living.

Mr. Urcia's parents brought a medical malpractice claim against Kaiser Permanente, its Hospitals, and Clinics based upon their alleged failure to diagnose and treat, in a timely manner, their son's epidural hematoma. The defendants contended that the care given to the minor plaintiff met the applicable standard of care for the clinic in which he was first treated. Damages to the minor plaintiff included mild cognitive deficits (although he later graduated from high school) significant motor deficits, as well as significant dysarthria and dysphasia. The plaintiffs contended that their son required 24-hour care and was not employable; the defendants disputed both allegations. Based upon the above facts — particularly the delay in recognizing the seriousness of Mr. Urcia's head injury as well as the delay in transporting him to an adequate medical facility — the case settled prior to trial for a $1.35 million cash payment and a structured settlement of lump sum payments and annual annuity payments, a net present value of approximately $5 million.

Discussion

The *Urcia* case illustrates several important points regarding the failure to diagnose an intracranial epidural hematoma. Again, the case reinforces the principle that a patient with an epidural hematoma may present in a variety of ways. Mr. Urcia presented with a questionable history of a loss of consciousness following a blow to the face and head by a blunt object. Again, Mr. Urcia did not demonstrate the classic lucid interval. He did, however, develop the classic blown pupil on the side of the hematoma. The enlarged pupil indicates herniation of the temporal lobe as a result of the pressure exerted by the expanding epidural hematoma. The herniation of the edge of the temporal lobe places pressure upon the third cranial nerve providing innervation to the ipsilateral pupil. Pressure upon the third cranial nerve leads to dysfunction of the pupil and thus an enlarged or "blown" pupil. A blown pupil is significant because the finding represents a herniation of brain tissue (the temporal lobe) that quickly will impinge upon the brainstem and thus cause a comatose state and significant cognitive deficits. A blown pupil is a harbinger of death and is a true neurosurgical emergency.[2-9]

The second principle illustrated by *Urcia* is, again, the need for close neurological monitoring of a patient with a closed head injury by skilled personnel as well as the need for CT imaging in those patients who meet the criteria for radiological evaluation. Mr. Urcia was transported to a clinic that was not designed to treat patients with traumatic injuries and actually did not treat patients with traumatic injuries including those with head injuries. He received little to no close observational care, and thus, his condition deteriorated as his hematoma expanded. Moreover, Mr. Urcia did not undergo early CT imaging when he met the criteria. With a questionable history of loss of consciousness cou-

TABLE 2. Clinical Characteristics Affecting Outcome in Patients with Intracranial Epidural Hematomas

- Delay in operative evacuation
- Poor neurological condition
- Anisocoria
- Low Glasgow coma motor score
- Increased age
- Associated intracranial lesions
- Large hematoma volume
- Large midline shift

Adapted from Samudrala S, Cooper PR. Traumatic intracranial hematomas. In: Wilkins RH, Rengachary SS, eds. *Neurosurgery*. 2ed. New York: McGraw-Hill;1996: 2797-2809.

pled with his complaints of headache and vomiting, Mr. Urcia clearly met the criteria for investigation by CT imaging upon arrival. Sadly, either or both close observation and early CT imaging would have improved Mr. Urcia's ultimate outcome vis-à-vis earlier surgical intervention. Finally, upon recognition by the clinic personnel that Mr. Urcia had suffered a significant head injury and was demonstrating significant symptoms, the standard of care required that he be transferred emergently to a facility that would have had the resources to properly evaluate and treat his medical condition. By failing to do all of the above, the clinic and its personnel clearly breached the applicable standard of care.

The third principle illustrated by *Urcia* is the fact that early surgical intervention vis-à-vis the surgical evacuation of an intracranial epidural hematoma improves outcome in the patient.[17-21] Mr. Urcia is a member of a subgroup of patients who develop an ipsilateral dilated pupil (a blown pupil) prior to their undergoing surgical evacuation of an epidural hematoma. Therefore, *Urcia* illustrates the results of a delay in surgery for that subgroup of patients. As previously mentioned, the death rate associated with an epidural hematoma is directly related to the patient's level of consciousness at the time of surgery. An awake, neurologically intact patient who undergoes evacuation of an epidural hematoma should have a mortality rate of essentially zero while a patient in a coma will have an operative mortality rate of 40-50%.[2-9,17-21]

In addition, one study indicated that a patient with a motor score of 3 or less on the Glasgow coma scale would have an operative mortality rate of 67%.[22] The better the neurological condition of a patient, the better his ultimate outcome. Since Hutchinson's initial discussion of a series of patients with epidural hematomas, the treatment for epidural hematomas has been emergent surgical evaluation.[23] Studies of hundreds of patients in multiple series during the past decades clearly reveal that the earlier that surgery is performed, the better the outcome for the patient. Moreover, the better the neurological condition of the patient at time of surgery, the better the ultimate outcome of the patient. In fact, those patients who are neurologically normal or display only a slight decrease in level of consciousness should experience an excellent outcome with an almost zero mortality rate. However, those patients in a coma with signs of brainstem compression will have greater than a 50% mortality rate following surgery for their epidural hematoma.[2-9, 17-25]

In one review by Seelig,[22] comatose patients with an epidural hematoma were studied for various clinical characteristics that affected outcome. Following surgical evacuation of the hematomas, the overall mortality rate was 41%, with 4% remaining in a vegetative state.[22] Upon further review, the most reliable predictor of outcome was the patient's Glasgow coma motor score immediately prior to surgery. Those patients with a motor score of 4-6 did well, while patients with scores of 3 or less died or remained in a comatose state.[22] In other words, the better the initial neurological condition, the better the outcome. (**See Table 2**.)

One study evaluated the time interval between onset of pupil dilatation and ultimate outcome. The study evaluated 21 patients; some with blown pupils, but all with lethargy and an acute traumatic epidural hematoma. In this group, 14 patients demonstrated a blown pupil, and in those patients, the mortality rate was three times higher than for those patients without a dilated pupil. The study also evaluated the time between surgery and development of the dilated pupil. In those patients who received surgery for evacuation of their epidural hematoma within 70 minutes of their development of a dilated pupil, none died. Statistical analysis revealed that a delay of 90 minutes between onset of pupil dilatation and surgical evacuation of the epidural hematoma was associated with a greater mortality rate and significantly worse outcome. As a result, the study con-

cluded that reducing the time interval between a blown pupil and surgery to less than 90 minutes was significantly associated with a better outcome.[23] In Mr. Urcia's case, the time between surgical evacuation of his epidural hematoma and blown pupil was just greater than 90 minutes; this delay significantly affected his outcome. Based upon the above breaches of the standard of care as well as the delay in surgical evacuation of the epidural hematoma, the settlement of the claim was justified.

Summary

As seen in these cases, an epidural hematoma in a patient easily may be overlooked or misdiagnosed in the ED setting. The failure to promptly recognize, diagnose, and initiate appropriate neurosurgical treatment can have severe consequences not only regarding patients and their ultimate outcome, but also regarding the ED physician who first evaluates a patient with a closed head injury and an epidural hematoma. The physician and other health care personnel must be aware that a patient with an expanding epidural hematoma may present with a variety of clinical histories, signs, and symptoms. Moreover, the health care provider must be acutely aware that the classic lucid interval is actually the exception rather than the norm.

Upon presentation to the ED, the standard of care for a patient with a possible epidural hematoma requires several steps be taken in the care and treatment. An urgent CT scan must be ordered to evaluate any patient with a history of a loss of consciousness and a head injury mechanism consistent with formation of an epidural hematoma. An emergency CT scan must be ordered to evaluate any patient with a closed head injury who demonstrates any signs and/or symptoms of neurological deterioration. To detect any neurological deterioration, a patient with a closed head injury and possible epidural hematoma must be observed closely and frequently by serial neurological examinations performed by trained health care personnel. Failure to do any of the above constitutes breaches of the standard of care by the health care providers. Finally, time is of the essence regarding the evaluation and treatment of any patient with a possible intracranial epidural hematoma. Failure to institute urgent—even emergent— evaluation and treatment of such a patient will have severe negative consequences for the outcome of the patient and falls below the applicable standard of care. Every minute and every hour of delay matters in the care and treatment of a patient with an expanding epidural hematoma. Therefore, the causation defense that maintains that earlier diagnosis and treatment would have not affected the patient's final outcome is not valid in this modern era of neurosurgery. Failure to follow any of the above guidelines constitutes a breach of the applicable standard of care and therefore, exposes the health care provider to legal liability and the patient and family to a lifetime of neurological disaster. (**See Table 3.**)

TABLE 3. Most Common Causes of Litigation Regarding the Care and Treatment of Patients Presenting to the ED with an with Intracranial Epidural Hematoma

- Failure to obtain a CT scan in a patient with loss of consciousness or possible epidural hematoma
- Failure to closely observe a head-injured patient with serial neurological examinations performed by trained personnel
- Failure to obtain a timely CT scan in a patient who demonstrates neurological deterioration
- Failure to obtain a prompt neurosurgical consultation to provide for the prompt evacuation of the patient's epidural hematoma

Endnotes

1. Louisell DW, Williams H. "ED Malpractice." In: *Medical Malpractice Litigation Guide: Types of Liability and Malpractice*. Newark, NJ: Matthew Bender, 2003. Web: www.lexisnexis.com/bender.
2. Smith MM, Young HF. "Acute Epidural Hematoma," In: Apuzzo MLJ (ed.). *Brain Surgery: Complication Avoidance and Management*. New York, Churchill Livingstone, 1993, pp 1323-1335.
3. Samudrala S, Cooper PR. "Traumatic Intracranial Hematomas," In: Wilkins RH, Rengachary SS (eds.). *Neurosurgery.* 2nd Ed. New York, McGraw-Hill, 1996, pp 2797-2809.
4. Jamieson KG, Yelland JDN. Extradural hematoma: Report of 167 cases. *J Neurosurg* 1968;29;13-23.
5. Phonprasert C, Suwanwela C, et al. Extradural hematoma: Analysis of 138 cases. *J Trauma* 1980:20;679-683.
6. Ford LE, McLaurin RL. Mechanisms of extradural hematomas. *J Neurosurg* 1963:20;760-765.

7. Gallagher JP, Browder EJ. Extradural hematoma. Experience with 167 patients. *J Neurosurg* 1968;29;1-8.
8. Rivas JJ, Lobato RD, et al. Extradural hematoma: Analysis of factors influencing the courses of 161 patients. *Neurosurgery* 1988; 23;44-51.
9. Baykaner K, Alp H et al. Observation of 95 patients with extradural hematoma and review of the literature. *Surg Neurol* 1988;30:339-341.
10. Benjamin G. Hatzman, a minor, by and through his Guardian ad Litem, Anita Hatzman, William Hatzman v. Kern Medical Center; No. 231906-RJA (Superior Court of Kern County, Bakersfield, California, June 25, 2002).
11. Smith HK, Miller JD. The danger of an ultra-early computed tomographic scan in a patient with an evolving acute epidural hematoma. *Neurosurgery* 1991;29:258-260.
12. Mendalow AD, Karmi MZ, et al. Extradural hematoma: Effect of delayed treatment. *Br Med J* 1979;1:1240-1242.
13. Noah Evans ET v. Doctors' Hospital of Pinole; C&H Sugar Company; and CF&B Builders, Inc. ET; No. C 88-0438 (Contra Costa County Superior Court, California, 1990).
14. Servadei F. Prognostic factors in severely head injured adult patients with epidural hematomas. *Acta Neurochirurgica* 1997;139:273-278.
15. Phillips LA. Emergency services utilization of skull radiography. *Neurosurgery* 1979;4:580-585.
16. Brian Rikio Urcia, A minor, by his next best friend, Harriett Tsurako Isa Urcia; and Harriett Tsuruko Isa Urcia, individually; Hisao Yoshitake Urcia, Jason Urcia, and Laureen Urcia, individually v. Kaiser Foundation Hospitals; Kaiser Foundation Health Plan, Inc.; The Hawaii Permanente Medical Group; Kenneth Sunamoto M.D.; and The City and County of Honolulu (Third Party Defendants); No. 79477 (Oahu County District Court, Honolulu, Hawaii, 1987).
17. Bricolo AP, Pasut ML. Extradural hematoma – toward zero mortality. A prospective study. *Neurosurgery* 1984;4:8-11.
18. Servadei F. Prognostic factors in severely head injured adult patients with epidural hematomas. *Acta Neurochirurgica* 1997;139:273-278.
19. Chen TY, Wong CW, et al. The expectant treatment of "asymptomatic" supratentorial epidural hematomas. *Neurosurgery* 1993;32:176-179.
20. Cook RJ, Dorsch NWC, et al. Outcome prediction in extradural hematomas. *Acta Neurochir (Wien)* 1988;95: 90-94.
21. Lobato RD, Rivas JJ, et al. Acute epidural hematoma: An analysis of factors influencing the outcome of patients undergoing surgery in coma. *J Neurosurg* 1988;68:48-57.
22. Seelig JM, Marshall LF, et al. Traumatic acute epidural hematoma: Unrecognized high lethality in comatose patients. *Neurosurgery* 1984;15: 617-620.
23. Hutchinson J. Effusion of blood between bone and dura mater. *Lond Hosp Rep* 1967;4:51-60.
24. Cohen JE, Montero A, Israel ZH. Prognosis and clinical relevance of anisocoria-craniotomy latency for epidural hematoma in comatose patients. *J Trauma* 1996;41: 120-122,.
25. Poon WS, Rehamn SU, et al. Traumatic extradural hematoma of delayed onset is not a rarity. *Neurosurgery* 1992;30: 681-686.

CE/CME Questions

13. The most common presentation of a patient with an intracranial epidural hematoma is one in which a lucid

CE/CME Objectives

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Participants who complete this activity will be able to:

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- explain conditions and practices in which informed consent is required in the ED;
- cite methods of minimizing risk in the ED setting.

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interval occurs during his/her clinical course.
A. True
B. False

14. Intracranial epidural hematomas can be the result of either venous hemorrhage or arterial hemorrhage.
A. True
B. False

15. In approximately 90% of cases, an intracranial epidural hematoma is associated with a fracture that crosses the middle meningeal artery in the middle cranial fossa.
A. True
B. False

16. An excellent defense for failure to diagnose an intracranial epidural hematoma includes that fact that early diagnosis and treatment has no effect upon a patient's ultimate outcome.
A. True
B. False

17. A brain CT scan is the radiographic procedure of choice for diagnosing an intracranial epidural hematoma.
A. True
B. False

18. An ED physician who evaluates a patient with neurological signs and symptoms a week following a closed head injury need not consider an epidural hematoma as a possible diagnosis.
A. True
B. False

19. The standard of care requires that all patients with an intracranial epidural hematoma undergo evacuation of their hematoma on an emergency basis.
A. True
B. False

Answers:

13. B
14. A
15. A
16. B
17. A
18. B
19. B

In Future Issues: Altered mental status in children