

ED Legal Letter

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Spineless approach to trauma patients may strike a raw nerve

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Every year in emergency departments (EDs) in the United States, more than 1 million patients are treated for blunt trauma that potentially involves spinal injury.¹ Of these patients, 1%-6% will suffer cervical spine (c-spine) fractures, and 2%-3% will sustain thoracic or lumbar fractures. Tracking from the National Spinal Cord Injury Database (NSCID) indicates that 11,000 new spinal cord injury (SCI) cases occur every year, with the vast majority occurring in male patients ages 16-30 years.² Motor vehicle accidents are responsible for the most injuries (39%), followed by acts of violence, falls, and injuries from sporting events. Beginning in the early 1970s, SCI trends have shown a proportional decrease in motor vehicle and sports-related injuries and a proportional increase in acts of violence, particularly gunshot wounds.^{3,4}

The societal cost of SCI is enormous. Although patients living with SCI represent a minority of the total disabled population (approximately 183,000-230,000 persons are disabled by SCI), the total years of impairment is high because SCI primarily affects young, productive, and otherwise healthy adults. The average direct lifetime cost for a 25-year-old patient who suffers a SCI resulting in paraplegia is \$730,277, while the cost for the same patient who suffers a high tetraplegia (C1-C4) is \$2,185,667. These figures do not include any indirect costs such as losses in wages, fringe benefits, and productivity (average \$49,312 annually). In addition, persons with SCI sustained at any level (motor function at any level, paraplegic, high tetraplegic, or ventilator-dependent) have a decreased life expectancy compared to individuals without spinal cord lesions.³

ED physicians must recognize that spinal fractures and SCI represent potentially devastating conditions that require prompt and appropriate care in the ED to minimize long-term consequences. ED physicians must remain hypervigilant to the possibility of these injuries in any patient with a traumatic mechanism of injury. A rapid, yet thorough, approach to these patients will ensure that they are treated properly and receive the best possible outcome. This issue of *ED Legal Letter* will explore a variety of different situations and mechanisms causing spinal fractures and SCI, as well as discuss a directed approach to diagnosing and managing these injuries.

Case No. 1: Prehospital Spine Injury Management

In *Weeda v. District of Columbia*,⁵ a passenger was injured when a car in which he was riding overturned. Three college students were returning to their

school in suburban Maryland after drinking substantial amounts of alcohol at about 1:30 a.m. While speeding, the driver attempted to make an illegal left turn and lost control of the car. It skidded, collided against a metal traffic pole, flipped over on its side, and came to rest leaning against the pole. The passenger/plaintiff in this case, Weeda, who had been sitting in the rear, was wedged between the front and back seats, his legs pointing upward and his head hanging outside the left rear window just above the pavement. The driver also was trapped, his head hanging out the window on the same side of car. The third front seat passenger managed to extricate himself by climbing out on the upper side.

Soon thereafter, the city fire department and two emergency ambulance crews were sent to the scene of the accident. A rescue worker named Paxton, an emergency medical technician (EMT), and crewman in charge of the first ambulance to arrive, found Weeda conscious and moving about. Despite the precarious position of the car, which limited access to the plaintiff and created the risk of crushing his head, Paxton applied a cervical collar to Weeda's neck. The tilting car was stabilized by blocks placed by firemen, and then the roof was removed. The examination, performed by another rescue worker named Podell, revealed that Weeda was unable to move his arms or legs.

Subsequent examination at the hospital disclosed fractures of the high cervical vertebrae with concurrent injury to the spinal cord. Despite prolonged treatments, including surgery, his quadriplegic condition was not corrected, and he remains permanently tetraplegic.

Although he admitted that he was injured in the accident, Weeda claimed that he became quadriplegic because of the alleged negligence of the emergency medical service (EMS) rescue squad during their extrication of him from the car. In the suit against the District, which alleged negligence on the part of the firemen, Weeda conceded that the vertebral fractures were incurred by the impact of the car against the traffic pole, but attributed his SCI to the asserted negligence of the rescue squad in handling him after the accident occurred. It was his contention at trial that, prior to the emergency personnel's arrival, he had good function in his arms and legs. Furthermore, he argued that the crippling damage to the spinal cord would have been prevented had the rescue team taken the precaution of strapping a short spinal board to his back before

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removing him from the wrecked automobile.

Such a precaution was set forth in a standard protocol regarding spinal injuries for the D.C. Emergency Ambulance Force, which provided in pertinent part: "... most important, splint the patient before moving. Effective splinting markedly relieves the patient's pain and stabilizes the injured spine so that nerve damage from the movement of bony fragments is much less likely . . . avoid abnormal or excessive motion. Be sure that the injured person is transported on a long back-board or special stretcher without bending or twisting the spine in any direction. If the head of an individual with a c-spine fracture is allowed to move a single motion may cause paralysis or death."

Podell testified that he first examined Weeda while he was still trapped inside the car, and in doing so, extended his hand and asked appellant to squeeze it. Plaintiff squeezed his hand "with both of his hands, one at a time." Podell also asked Weeda to move his legs and he complied. According to Podell, these responses indicated that Weeda had full sensory-motor capability and that his central nervous system was intact. Nevertheless, suspecting that Weeda had sustained a back injury, Podell decided that Weeda's body should be immobilized by affixing a short spine board. He went back to his ambulance to pick up such a device, but was blocked on his return by firemen who had surrounded the car.

After the roof of the car had been pulled back, Podell testified that he watched Weeda be removed from the wreckage without the use of the short spinal board or any back support, and saw his body "rotate" and his head move a "significant number of inches." Weeda then was placed on a long spine board and deposited in Podell's ambulance. Although the long spine board did provide some support, Podell testified there was no support to the lateral side of the head, nor was the head secured to the board with any of the normal methods for doing so.

In the ambulance, Podell reported, the injured man could no longer move his limbs.

Expert medical testimony by a neurosurgeon and an emergency medicine physician supported the contention that it was medically probable an event occurred between the first and second examinations resulting in the plaintiff's quadriplegia. That alleged event was spinal movement occurring during the patient's extrication due to inadequate spinal immobilization. One expert stated categorically that "if a splint had been applied, he would

not have become quadriplegic."

The bulk of the evidence that the defendant District offered was intended to prove that 1) the testimony of Podell deserved no credence and hence destroyed the foundation for the opinions of the plaintiff's medical experts; 2) the physical position of the plaintiff in the wrecked and tilted car when the paramedics arrived put Weeda in danger of a crushed skull should he have been strapped to a short spinal board had the car completely toppled over, or of aggravated injury to his back once the car was propped up; and 3) the injury to the spinal cord that caused paralysis was the result of the violent impact suffered by the plaintiff when the careening vehicle struck a light pole, and thus rendering his condition irretrievable by the rescue squad.

Podell's version of what happened at the scene was contradicted in crucial respects by other witnesses who participated in the rescue operation. Two other rescuers testified that Podell was never in close contact with the occupants of the wrecked car before it was propped up by the firemen and was not even on hand later to assist in lifting Weeda from the accident. In addition, other rescuers described the virtual impossibility of attaching a short spine board to appellant's back without having to bend his body at a time when its position was compressed inside the tilted vehicle. The District firemen stated they were aware of the danger of an aggravating injury if the plaintiff twisted his neck, and therefore held the patient's head in traction midline immobilization while extricating.

To establish that paralysis was attributable to the automobile accident and not to any act, omission, or negligence by its firemen, the defendant District of Columbia called its own expert. The defense neurosurgeon stated that he was of the opinion that appellant's paralysis was due to the accident itself and would have occurred regardless of any act by the rescue team. Interestingly, despite Weeda's belief that prejudicial evidence of intoxication was permitted to be heard by the jury, the trial court verdict for the defendant was affirmed on appeal.

Case No. 1 Discussion

There is no doubt that if all the facts as described by Podell were accepted as true, the defendant District and the firemen would have been found negligent in their treatment of Weeda. However, the jury did not accept the testimony of EMT

Podell as an accurate reflection of what happened at the scene.

While there was conflicting testimony about the examination done prior to the extrication, the District firemen admitted that they did not follow their protocols for spinal immobilization, stating that they “held the head in traction” rather than applying a spine board as required by protocol. In the prehospital setting, most states have adopted a “willful and wanton” standard to be applied rather than ordinary negligence standards. “Willful” generally means that the prehospital provider must have acted knowingly, deliberately, or intending the result.⁶ This difficult burden has become an essential protection for prehospital providers, making it more difficult for plaintiff attorneys to prove negligence regarding prehospital care.

It has been estimated that 40% of c-spine injuries are complicated by an SCI, and work performed in the early 1980s indicates that 25% of these injuries are sustained from an improper prehospital evaluation, extrication, or transport of the patient.^{7,8} Spinal injury precautions start with prehospital personnel. It is essential that spinal immobilization protocols and procedures be developed and followed rigorously. The goal of spinal immobilization is to maintain the head in a neutral position with zero degree of movement in all directions.⁹ This is accomplished in the prehospital arena using a stepped process. The first and most critical intervention involves the placement of a properly fitting, rigid, four-point supporting cervical extrication collar (e.g., the Stifneck collar [Laerdal Medical Group, Wappingers Falls, NY]). Next, the patient should be placed into a cervical extrication splint (e.g., a short spinal board or the Kendrick extrication device [KED] [MediXchoice, El Cajon, CA]) for the extrication process, especially when the patient is lodged in a confined environment. The patient then should be placed onto a full-body spine board or a factory-designed, full-body immobilizer. To secure the patient to the spine board, lateral neck stabilizers (e.g., medium-density foam rubber blocks or the Bashaw cervical immobilizer device [CID] [Bashaw Medical, Inc., Pensacola, FL]) and straps should be used.¹⁰

Protocols are not enough. Education and hands-on training of prehospital personnel on immobilization techniques need to be instituted. Time should be taken in a busy ED to educate EMTs and paramedics

about the necessity of proper spinal immobilization procedures. ED physicians and prehospital providers should suspect c-spine injury in every patient with a traumatic mechanism and in patients found with significantly depressed levels of consciousness (that cannot be attributed to a nontraumatic cause), until proven otherwise.

Case No. 2: The Intoxicated Patient

A patient brought a medical malpractice action against his physician, alleging permanent injury resulting from negligent medical treatment following a single-car accident.

In *Yuscavage v. Jones*,¹¹ it was recorded that shortly after 8 p.m. on June 26, 1989, Darryl Jones lost control of the car he was driving, and it left the road. The vehicle skidded more than 200 feet, rolled over, and came to rest upside down. Jones was extricated from the wreckage, subsequently was immobilized with a cervical collar and long spine board, and transported to the emergency room at Baldwin County Hospital. On the initial assessment by the paramedics in the field, he had no movement or sensation in his arms and legs, but by the time he arrived at the hospital, he had regained motor function and sensation.

Within 20 minutes of the patient’s arrival, the treating physician ordered the removal of the neck collar and spine board, based upon results of the patient’s neurological and x-ray examinations, which the physician interpreted as normal. The physician then ordered the patient’s release from the hospital. However, when two attempts to discharge the patient failed because he *could not stay on his feet*, the patient remained in the ED until a neurologist could examine him.

A neurologist eventually examined the patient approximately *seven hours* after his admission to the emergency room and transferred him to the Medical Center of Central Georgia, where he was diagnosed as having a central cord syndrome (CCS). Later, the patient was admitted to the Shepherd Spinal Center in Atlanta for one month. The patient regained full use of his legs, but the neurological impairment to his arms and hands was permanent.

At trial, expert witnesses testified that the patient most likely sustained an injury to the ligaments of his c-spine during the automobile collision, causing some instability of the c-spine. These experts

opined that if the patient had been properly immobilized, his recovery probably would have been complete. However, the premature removal of the spinal immobilization devices and ensuing movement subjected him to a secondary injury to his spinal cord. The permanent impairment to his arms and hands was alleged to have resulted from that secondary injury.

In this case, the results of a blood alcohol test, intended to show that the patient was intoxicated, were excluded as irrelevant. Interestingly, the investigating officer testified that he observed 31 empty beer cans in the patient's car. While results of the blood alcohol test at 10:30 p.m. (2 1/2 hours after the accident) revealed a blood alcohol level of only 0.06%, the patient admitted to the officer that he had been drinking heavily and ultimately pleaded guilty to the offense of driving while intoxicated. The physician argued that the blood test results should have been admitted to explain the patient's behavior, and that his behavior hindered an accurate diagnosis. The court rejected this argument.

During the opening statement, the physician's attorney suggested that the patient's claim of having fallen during the attempts to discharge him from the emergency room was concocted after he commenced this action. In response, the patient presented the testimony and incident reports of the emergency room nurse clinical coordinator and one of the nurses who assisted in the attempted discharge of the patient. Their incident reports were prepared during or immediately following the patient's ED visit. One report refers to a complaint by the patient's mother that he had fallen, and the other report actually describes a fall. During the trial, both nurses testified without objection about all material facts contained in those reports.

The jury returned a verdict in favor of plaintiff for \$1.4 million, which was affirmed on appeal.

Case No. 2 Discussion

All patients suffering a potential spinal injury require a complete neurological examination. Intoxicated patients with potential cervical injury or head injury must be examined when functionally sober prior to discharge to avoid missing potential injuries. In this case, the blood alcohol level was not as high as expected, as it was only two hours after the accident when the blood sample was drawn for testing. The 31 empty beer cans found

on scene must have been due to poor housekeeping. The blood alcohol level in this case could not possibly explain the paralysis following the initial exam. If the blood alcohol level does not correlate with clinical findings, emergency physicians must look for another cause. When in doubt, order c-spine films. (See "Management of the Intoxicated Patient in the Emergency Department," ED Legal Letter January 1998, page 9, for a complete discussion on evaluation and management of the intoxicated patient.)

Interestingly, the prehospital providers, who did not apply proper spinal immobilization until after extricating the patient, were very fortunate that they were not included in this lawsuit. Perhaps the "willful and wanton" standard scared off the plaintiff's attorney. This patient had a temporary paralysis in the field that had resolved when he arrived in the ED. This case illustrates the necessity of reading the prehospital run reports. The information contained in them can be very helpful in the treatment and diagnosis of patients and can be very harmful when used against the physician in court. Prehospital providers should be required to give either a written or verbal report to the accepting nurse or emergency physician prior to leaving the ED.

The delay of seven hours for a neurology consultation exceeds any accepted time for an emergency consultation. Generally, hospital bylaws recommend emergency consults be performed within a specified time (usually one hour), the Emergency Medical Treatment and Active Labor Act (EMTALA) mandates timely consults (although leaves it up to the hospital to determine the time), and some state laws (New Jersey) specify times for acceptable ED consultation.

The patient in this case suffered an acute CCS. The acute CCS is characterized by a disproportionately greater upper extremity motor impairment when compared to the lower extremities.¹² While CCS mostly has been reported in older patients with cervical spondylosis and cervical hyperextension mechanism, this injury also has been associated with a wide variety of injury mechanisms and associated factors. The means of injury is thought to result from posterior pinching of the spinal cord by a buckled ligamentum flavium, or by anterior spinal cord compression from osteophytes.¹³ This injury mechanism preferentially affects the central portion of the spinal cord more than the peripheral

portion, and as the centrally located portions of the corticospinal and spinothalamic tracts provide function to the upper extremities, these are affected to a greater degree.¹⁴ Upon neurologic examination, motor impairment in the upper extremities is more profound than in the lower extremities, especially in the musculature of the hands. Sensory losses are variable, and include losses of pain and temperature, as well as light touch and position sense, below the level of the injury.¹¹

While the overall prognosis for CCS is good, most patients will not regain fine motor function in their upper extremities. ED treatment should begin with c-spine immobilization and attention to the routine advanced trauma life support (ATLS)-guided trauma care. Since 1990, emergency care for patients with acute SCI in the United States has included high-dose methylprednisolone initiated within the first eight hours of injury. NASCIS has demonstrated that infusion of high-dose methylprednisolone results in improved motor and sensory function in patients with complete and incomplete spinal cord lesions.^{15,16} The recommended guidelines for steroid administration for SCI are: 1) treatment must be initiated within eight hours of injury; 2) methylprednisolone 30 mg/kg IV bolus over 15 min; 3) a 45-minute pause; and 4) a methylprednisolone maintenance infusion of 5.4 mg/kg/hour for 23-48 hours.^{12,13} Recently, the results and general applicability of the NACIS trials have been questioned.¹⁷ In addition, the use of high-dose steroid therapy in the critically injured trauma patient is not without risk, such as an increased susceptibility to infection and sepsis.¹⁸ Currently, treatment with high-dose corticosteroid therapy still should be considered strongly for patients with known or suspected SCI.¹⁹

Case No. 3: Incomplete Spinal Cord Injury

In *Lastrapes v. Ohio Department of Mental Health*, 23-year-old John Lastrapes voluntarily admitted himself to the Cleveland Psychiatric Institute (CPI) on Oct. 11, 1985, complaining of severe depression. The admitting physician, Dr. Vinod Sharma, a psychiatrist, diagnosed the plaintiff as suffering from paranoid schizophrenia with suicidal tendencies. The plaintiff was placed in the crisis unit and treated with the antipsychotic drug fluphenazine. He responded favorably to his treatment until Oct. 21, when he apparently smoked

marijuana. During the next three days, the plaintiff became combative and aggressive. On Oct. 24, Lastrapes kicked out a window on the ward as part of a failed escape attempt. Because of this behavior, the staff periodically placed the plaintiff in full restraints in a locked seclusion room.

On Oct. 25, at about 7 p.m., the plaintiff was observed running down the hallway in a full sprint. Using his head as a battering ram, Lastrapes struck a locked door with considerable force, rebounding back onto the floor. The plaintiff's collision was not witnessed by the nursing staff, but upon hearing the collision, the nurse turned and saw him fall to the floor. Staff members found the plaintiff lying on his back on the floor, with his feet next to the door; they observed no cuts or bruises on the plaintiff's face or head. He was not examined by a physician immediately after the incident and some dispute exists whether the attending physician was even called. Although Lastrapes was conscious, he did not respond to inquiries about the incident and did not attempt to get up. He was then carried back to his room and restrained.

At 9 p.m. that evening, the plaintiff said he could not use his hands, although he was observed eating and drinking. At 10 p.m., Lastrapes told the therapeutic program worker, Robert Jasper, that he "wanted to die" and that he was "paralyzed." The patient continued to display a normal range of motion in his extremities as he made these statements. The following morning at 10:30 a.m., Dr. Brar, the covering attending psychiatrist, came onto the unit for her regular morning rounds and was informed of the plaintiff's collision with the door. Dr. Brar examined Lastrapes and observed his ability to sit up and use both hands to eat and drink. While Dr. Brar's examination was not complete, she observed plaintiff's using a full range of motion and believed he had not sustained injury during his incident with the door.

The patient remained in bed most of the day and indicated that he was weak. At about 5 p.m. on the same day, the plaintiff stated that he was tired and weak; at that time he appeared lethargic and disoriented to the staff. By 7 p.m., an examination by the nurse revealed that the plaintiff had become quadriplegic. Dr. Sharma was called, and after being informed of the previous evening's events, immediately ordered the plaintiff moved to the adjoining Cleveland Metropolitan Hospital

for further evaluation. c-spine x-rays revealed a broken vertebra at the C-6 level. Lastrape's quadriplegia was determined to be permanent and irreversible as a result of severe spinal cord damage.

Plaintiffs' experts testified that plaintiff's injury was sustained over time as a result of the continuous and forceful contact of the broken bone fragments against the spinal cord, brought about by plaintiff's post-injury movements; they felt the plaintiff's quadriplegia was both reversible and preventable up until the time the plaintiff became completely quadriplegic, sometime between 5 p.m. and 7 p.m. on Oct. 26. Pursuant to their testimony, any culpable failure to diagnose or treat the plaintiff's injury prior to that time may be characterized as causal negligence.

By contrast, defendant's expert testified that the moment the plaintiff struck the door with his head, paraplegia and eventual quadriplegia were unpreventable and irreversible, and that Lastrape suffered a "compressed central cord syndrome" as a result of the severe impact and compression of the entire spinal column. The court questioned the validity and evidence of the defendant's expert opinion.

The trial court concluded that the proper standard of care in this case, to be exercised by a physician who knew, or had reason to know, that plaintiff had suffered a head and neck injury, was to undertake a complete neurological examination, including a sensory pin prick test, followed by complete immobilization of the patient and obtaining of a c-spine x-ray. Continuing, the court concluded that if c-spine x-rays had been ordered in this case, the plaintiff would not have suffered irreversible quadriplegia. The record is replete with evidence to support the trial court's conclusion as to the correct standard of care; however, the issue of the defendants' conduct falling below the standard of care is based upon if CPI knew, or had reason to know, that the plaintiff had suffered a serious head and neck injury prior to his complete quadriplegia.

In this respect, the parties focused on the conduct of Dr. Brar during her 10:30 a.m. visit with the plaintiff. Dr. Brar performed a cursory neurological examination that yielded negative results. Plaintiff attorneys claimed that Dr. Brar was negligent for failing to even consider the plaintiff's subjective complaints, and failing to do a complete neurological examination, including x-rays. The plaintiff further alleged that Dr. Brar knew, or

should have known, that the plaintiff had suffered a serious head and neck injury. The trial court disagreed with plaintiff's contention. The court sympathized with the difficulty in the examination of mental patients and extracting truth from fiction in both their history and physical examination.

Plaintiffs argue that this created a "double standard" of care, one for "normal" patients and one for "mentally ill" patients and that such a standard is not only unsupported by the evidence but also is extremely prejudicial to the plaintiff. While the appellate court agreed with plaintiffs that a "double standard" of care is untenable, they disagreed with plaintiffs' reading of the trial court's opinion. When taken in context, the court's opinion suggests only that a particular patient's mental state is one of many surrounding circumstances to consider in determining the reasonableness of a physician's course of treatment.

In short, the trial court did not conclude that the cursory neurological examinations performed by the staff were sufficient, or that the failure to order x-rays was excusable, simply because plaintiff was a mental patient. Rather, based on the testimony in the record, the trial court concluded that under these circumstances no reasonable basis existed to believe that plaintiff had suffered a SCI. On appeal, the verdict of the trial court for the defendant was affirmed.

Case No. 3 Discussion

In short, this was a gift for the defendant physician and hospital. Thankfully, the patient's mental capacity helped defend this case. The image that this case depicts of a psychotic patient sitting up eating breakfast with both hands stating, "I'm paralyzed," obviously helped the trial court in finding for the defendants. Although this case is somewhat unique in that it occurred in a psychotic individual, it also illustrates the difficulties with the physical examination in patients with an incomplete SCI. A complete physical exam, (including a thorough neurological examination) absolutely is necessary for individuals with a potential SCI, but often is nondiagnostic. Due to the overwhelming consequences attached to a missed spinal injury, physicians often have utilized a liberal standard for c-spine x-rays. However, the criteria for ordering these studies and the actual x-rays required has been based on a wide and often conflicting variety of recommendations.¹⁷ Recently, a prospective,

multi-center trial involving 21 academic and non-academic medical centers and a total population of 34,069 patients was undertaken to finally answer which patients should receive c-spine x-rays. The National Emergency X-Radiography Utilization Study (NEXUS) trial demonstrated that in patients with a potential c-spine injury, c-spine x-ray films could be avoided and *no injury was present* if all five of the following criteria were present: 1) no midline cervical tenderness; 2) no focal neurologic deficit; 3) normal alertness; 4) no intoxication; and 5) no painful distracting (sensitivity for *no injury* of 99%, negative predictive value of 99.8%).²⁰

Even if a c-spine series is obtained, an injury may not always be apparent, and computed tomography (CT) imaging of the c-spine in high-risk patients is essential. In one study of 202 head injured patients, CT scanning identified 28 c-spine fractures, and plain x-rays identified only 11 (39%).²¹ Several experts have contended that a “zero-tolerance” philosophy for missed c-spine injury should be adopted by physicians and several caveats should be considered in the trauma patient with negative c-spine plain films: 1) never settle for inadequate films; 2) never ignore subtle findings; and 3) always be suspicious in the patient with *persistent* and *significant* neck pain and “normal” plain films.¹⁷

Case No. 4: Pediatric Spinal Injury

In *Porter v. Lima Memorial Hospital*,²² the automobile in which Liesl Fitzenrider was traveling in Dec. 1, 1979, spun out of control, bumped another car, and slid off the roadway. Liesl, then an infant 3 months of age, was thrown to the floor of the car while in the arms of her mother, Rachel Fitzenrider (now Rachel Porter), who brought suit on her daughter’s behalf. Rescue squad personnel examined Liesl at the accident scene and found nothing seriously wrong with her. A rescue squad member then held Liesl in his arms while Liesl and her mother were transported to defendant Lima Memorial Hospital (Lima Hospital, Lima, OH), the hospital nearest the scene of the accident.

An RN took Liesl’s vital signs, and recorded them on the medical chart. She reported them to Dr. Iqbal Singh, upon his arrival, for examination and treatment. At this point, the only observable sign of injury found on the child was a small

bruise or hematoma on the right side of Liesl’s head. Dr. Singh found all of Liesl’s extremities functioning normally and ordered several laboratory tests and numerous x-rays. He did not, however, order any spinal x-rays or immobilization, and failed to diagnose any spinal instability. After reviewing the x-rays and lab tests, Dr. Singh discharged Liesl and provided her mother with written instructions concerning her head injuries.

After Dr. Singh discharged Liesl, she and her mother remained at the hospital while awaiting a ride home. During a period of more than two hours, Liesl apparently displayed no additional signs of serious injury that were observed by her mother. Mrs. Porter did report to one of the nurses at Lima a short period of irregular breathing. The nurse examined Liesl, determined that nothing was wrong, and returned Liesl to her mother stating, according to the mother, that babies just breathe funny. When she reached her home, the mother noted that Liesl’s condition was worsening and she then took Liesl to Defiance Hospital, where doctors determined, for the first time, that Liesl’s legs were not moving. They ordered numerous x-rays and lab tests, and eventually diagnosed a subluxation at her first and second lumbar vertebrae, which resulted in Liesl’s paralysis from the waist down.

The plaintiff charged attending physician Singh and the Lima Hospital ED staff with negligence in allowing Liesl’s initial spinal injury to degenerate and cause paralysis. The experts who testified in the trials apparently agree that Liesl suffered paralysis sometime after Dr. Singh’s examination and before her arrival, hours later, at Defiance Hospital. The experts agreed that Dr. Singh was the primary person who could have prevented the spinal injury by diagnosing Liesl’s unstable spine before it became critically injured. Dr. Singh already had settled his medical malpractice case for \$2.5 million.

Proximate cause was the crucial issue upon which Lima Hospital’s asserted liability depended. There was evidence that both Dr. Singh and the Lima Hospital nurses breached a duty of care. The pertinent question is whether the nurses’ conduct proximately caused Liesl’s paralysis. There was some difficulty of proof because of an inexplicable delay of nine years before this suit was commenced. The plaintiff had alleged a breach of duty

Risk Management Points

- Always assume any trauma patient has a spinal injury until proven otherwise.
- A thorough physical examination, including a complete neurological evaluation, should be performed and clearly documented on every patient with a suspected spinal injury.
- In the prehospital setting, suspected spinal injury patients require complete spinal immobilization during and after extrication, as well as during transportation.
- Difficult patients, such as the intoxicated or demented patient, require a lower threshold for ordering cervical spine films.
- Suspected spinal trauma patients not fulfilling NEXUS low-risk criteria require a complete cervical spine x-ray series.
- Patients with a negative plain cervical spine x-ray series and significant persistent pain and/or a strong suspicion of injury, require further radiographic studies and/or specialty consultation.
- High-dose corticosteroid therapy always should be strongly considered and started within eight hours of injury in any patient with a suspected or known SCI.
- Pediatric patients present with different representations of spinal injury as compared to adults, due to differences in anatomy and injury mechanisms.

in four respects: 1) failure to repeat the vital signs and to report this to Dr. Singh; 2) failure to take Liesl's blood pressure; 3) failure to notify Dr. Singh about the baby's short period of abnormal breathing; and 4) failure to immobilize Liesl. The court concluded that the plaintiff provided insufficient evidence on proximate causation relating to the second and third allegations.

The trial court noted that after the accident, Liesl was not immobilized while being transported to Lima. Dr. Singh did not direct that she be immobilized at any time while examining, testing, and treating her, but notes that she was moving her extremities. Liesl demonstrated no signs of paralysis while he was examining her, and this would seem to eliminate any failure to immobilize and, therefore, was not the proximate cause of the paralysis. The experts on both sides generally agreed that the Lima nurses had no independent duty, apart from a doctor's instructions, to immobilize the infant.

The plaintiff won a \$4.2 million dollar verdict in an initial trial, but the trial judge, while denying

Lima Hospital's motion for a judgment notwithstanding the verdict, ordered a new trial. During the second trial, the jury found Lima Hospital not liable for plaintiff's tragic injuries. Both parties appealed.

The appellate court decided after carefully examining the voluminous testimony of the experts in both sides, as did the district judge who heard or reviewed that testimony, that the finding that the Lima Hospital nurses proximately caused the paralysis was against the manifest weight of the evidence. Consequently, the appellate court held that the trial judge did not abuse his discretion in granting a new trial.

During the second trial, the judge allowed Dr. James E. Wilberger, a well-qualified pediatric neurosurgeon, to give proximate cause testimony over plaintiff's objections. Dr. Wilberger testified that even if the nurses had repeated the vital signs and told Dr. Singh about the abnormal breathing, Dr. Singh could not have diagnosed the spinal injury. Because the additional knowledge, in his opinion, would not have permitted a diagnosis of spinal injury, Dr. Wilberger concluded that the nurses' failure to inform Dr. Singh of the vitals and the breathing difficulty was not a cause of the paralysis. The appellate court concluded that the district court did not commit error and agreed that the evidence presented at trial did not support a finding that Lima Hospital was negligent.

Case No. 4 Discussion

It should be noted again that, in this case, no one — not prehospital personnel, the ED nurse, nor even the ED physician — ever immobilized this child. Trauma patients must be immobilized prior to the ED physician performing a complete history and physical exam. Patients can present ambulatory to the ED with cervical fractures. Ambulatory patients presenting to triage should be immobilized immediately. There are numerous cases similar to the ones discussed here, in which paralysis was not immediate and delay in immobilization led to litigation. In this case, the ED physician settled his lawsuit for \$2.5 million dollars. This case should be unsettling to all ED physicians for two reasons. First, the lawsuit against the hospital did not commence for nine years. Second, malpractice insurance coverage policies generally fall below the monetary award rendered to patients with SCI who are misdiagnosed.

When the ED physician performed a neurologic exam, the child had no neurologic deficit. While not clear in this case, presumably the 3-month-old had no spinal tenderness or deformity. The physician ordered x-rays, and since he did not suspect a spinal injury, did not order any spinal films. What would any reasonable emergency physician do differently? Nothing.

In another pediatric spinal injury case, Neal Wardell fell on the school playground in Burlington, WY, during recess on May 13, 1987.²³ The 7-year-old child struck the back of his neck on a rock. Injured and complaining of pain and weakness in his arms and legs, Neal was immobilized and brought by ambulance to West Park Hospital in Cody, WY.

At the hospital, Dr. Peters, an emergency room physician, along with an orthopedic surgeon, examined Neal. The diagnostic process included a range of motion test. At some point, Neal was permitted to walk and use the bathroom. However, Neal's neurologic function continued to diminish, and the doctors ordered him transferred, by helicopter, to St. Vincent Hospital in Billings, MT. The next day, as his condition deteriorated, the treating physician in Billings transferred him to Children's Hospital in Denver, CO. Neal left that hospital a tetraplegic with permanent injury to the seventh cervical vertebra. These cases illustrate the difficulty in the evaluation of pediatric spinal injuries.

The incidence of pediatric spinal injury is rare, representing 2%-5% of all spinal injuries, with less than 1% occurring in patients younger than age 12.^{17,24} Most SCI in children occur from MVAs or as the result of a fall.²² However, these injuries often are challenging to diagnose, as pediatric spinal injuries present much differently than typical adult patterns. There is a predisposition for upper c-spine injuries, due to anatomical differences such as an increased elasticity of the cervical ligaments, a horizontal orientation of facet joints and uncinata processes, a higher center of gravity, and an anatomic fulcrum of the spine that is centered at C2 and C3.²⁵ Several anatomical factors also predispose pediatric patients to an increased risk of occipito-atlanto-axial segment injury.¹⁷ Fractures below the level of C3 account for only about 30% of injuries among children younger than age 8, whereas they account for 85% of adult spinal injuries.²³ Complicating the x-ray evaluation in pediatric patients, several normal

anatomic features of the pediatric c-spine can be easily mistaken for an acute injury pattern, such as the age dependent pseudosubluxation of C2 on C3.^{22,23}

SCI without radiographic abnormality (SCIWORA) is just what its name describes — a syndrome characterized by SCI with no radiographic abnormality. These injuries are most common in the pediatric population, accounting for 4%-67% of all spinal injuries. It is felt these injuries are due to the increased elasticity of the pediatric skeleton and ligaments as compared to the spinal cord itself.^{17,22,23} Approximately 50% of children with a SCIWORA injury will have a delayed onset of paralysis, and therefore vague initial neurological symptoms are important clues to injuries.²⁶

The exact indications for the radiographic evaluation of children with potential spinal injuries are still evolving. In one study, using the criteria of history of trauma to the neck, limitation of neck mobility, the complaint of neck pain or tenderness, or an abnormal neurological examination was 98% sensitive in identifying 59 c-spine injuries in 206 children.²⁷ However, these criteria require prospective validation. Although children younger than age 13 were excluded from the NASCIS study, it currently is recommended that high dose corticosteroids be initiated at a similar weight-based dosing regimen to adults if there is any evidence of a neurologic deficit.²⁸ Any child with a suspected SCI should be evaluated by a neurosurgeon on an emergent basis.

Conclusions

SCI and its resultant complications represent a serious, and often preventable, form of neurologic disability. When mismanaged, spinal injuries result in high-dollar malpractice awards, as most injuries occur in a young and otherwise healthy patient population. Physicians and medical staff should adopt a policy of always suspecting and ruling out spinal injury in those patients at risk for these injuries. Maximum spinal precautions during the prehospital phase of care, including proper extraction and immobilization techniques, ensure a safe transport to a setting of definitive care. (*See Table, "Risk Management Points," p. 69.*) Upon arrival, physicians should perform a physical exam that includes a complete neurologic examination, and further evaluate the spine radiographically if

established criteria are fulfilled. Pediatric patients represent a unique subpopulation of trauma patients and require a detailed examination to evaluate for spinal injury. If an SCI is suspected, NASCIS criteria high-dose corticosteroid therapy is warranted, as well as emergent neurosurgical evaluation.

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CME Questions

22. Which of the following statements regarding spinal injury is *true*?
 - A. Spinal cord injury patients represent a majority of the disabled population.
 - B. Spinal cord injury patients are similar to the general population in life expectancy.
 - C. Approximately 100,000 new spinal cord injury cases occur each year.
 - D. Spinal cord injury is particularly devastating because it affects mainly a young, otherwise healthy and productive population.
23. Which of the following statements regarding the prehospital management of spinal injury is *false*?
 - A. Up to 25% of spinal cord injury are sustained from improper prehospital evaluation, extrication, or transport of the patient.
 - B. The first and most critical intervention in spinal immobilization involves the placement of a properly fitting rigid cervical collar.
 - C. When a patient is lodged in a confined environment, the Kendrick extrication device should not be used for extrication.
 - D. All prehospital personnel should be educated on proper spinal immobilization techniques.

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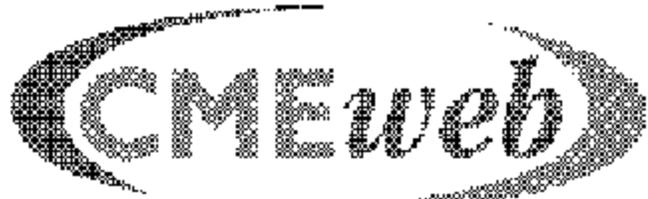
- identify high-risk patients and use tips from the program to minimize the risk of patient injury and medical malpractice exposure;
- identify a "standard of care" for treating particular conditions covered in the newsletter;
- identify cases in which informed consent is required;
- identify cases which include reporting requirements; and
- discuss ways in which to minimize risk in the ED setting.

24. Which patient, according to NEXUS criteria, does *not* require a cervical spine x-ray evaluation?
- A. A 19-year-old, otherwise healthy, highly intoxicated, unrestrained, male driver involved in a high-speed motor vehicle accident, presenting stuporous but with no complaints of neck pain
 - B. A 39-year-old iron worker who sustained a 20-foot fall from a scaffolding and suffered an open femur fracture, but complains of no spinal tenderness
 - C. A 67-year-old female driver impacted in the rear of her vehicle at a moderate rate of speed and complaining of "weak and numb hands" bilaterally
 - D. A 42-year-old, otherwise healthy and alert male driver involved in a driver's side "T-bone" collision with a complaint of nonradiating, lateral, left-sided only neck pain
25. Regarding corticosteroid use for spinal injury, which of the following statements is *true*?
- A. High-dose methylprednisolone therapy should be initiated only after a spinal cord injury is proven by a definitive study.
 - B. Ideally, methylprednisolone therapy should be started within the first eight hours of injury.
 - C. A bolus of 30 mg/kg of methylprednisolone IV is sufficient therapy.
 - D. Methylprednisolone therapy carries no risk of adverse effects.

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