

# Brain vs. Spinal Cord: A Directed Case Study in CNS Injury

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Dr. Green and Dr. Carter were nearing the end of the first year of their medical residency in the emergency department of County General Hospital. It had been a long year and a long week. They had been on duty for the last 12 hours and things were not slowing down.

“What are your plans for the weekend, Ken?” Dr. Green asked.

“Sleep, what else?” Dr. Carter replied.

“I hope things slow down a bit,” Dr. Green said to himself.

Suddenly, a call came over the radio. Paramedics were bringing in a young man with injuries sustained in a diving accident. A minute later, the doors to the department burst open and the paramedics wheeled in a young man.

“What gives?” Dr. Green asked.

The senior paramedic, Jim Morrison, reported that the patient was swimming at the local quarry and did a forward flip into the water, striking some submerged rocks.

“Which part of his body struck the rocks?” asked Dr. Carter.

“He was in a hyperflexed-tucked-position when he hit the rocks, lacerating the right side of his head and neck and upper back. The patient indicated he had severe pain upon impact and loss of sensation and movement in his arm and leg. He may have lost consciousness, but he’s not sure. He also complains of a severe headache, dizziness, and nausea. When we arrived at the scene we immobilized, stabilized and transported him immediately,” Jim explained.



Looking at the patient, Jim continued. “His name is Mike Smith, and he’s 22 years of age. His vital signs include slightly lowered blood pressure (100/70), heart rate of 75 beats per minute, respiration normal, and he is conscious and alert.”

As the patient was being prepped for examination, Dr. Carter and Dr. Green discussed how they should approach their evaluation. Dr. Carter started by saying, “After seeing the head wound and the amount of blood loss, and hearing his complaints, I want to confirm my suspicion that this patient has a brain injury.”

Dr. Green disagreed: “I think that the other signs and symptoms indicate a spinal cord injury, and that’s what we should investigate.”

The following table summarizes the findings of the evaluation, which included a physical exam, x-rays, magnetic resonance imaging (MRI), and neurological tests.

**Table 1. Summary of Diagnostic Testing for Mike Smith**

**Sensory Testing**

- Decreased sensation to touch, pressure, and vibration in the right upper/lower extremities
- Decreased temperature discrimination (cold vs. warm) in the left upper/lower extremities

**Motor Testing**

- Decreased strength and movement of the right upper/lower extremities during muscle testing
- Decreased strength and movement of left abdominal muscles
- Absence of triceps and biceps reflexes in the right upper extremity
- Abnormal response of patellar, Achilles (hyper) reflexes in the right lower extremity
- Positive Babinski sign on the right foot
- Abnormal cremasteric reflex in the right groin region

**General Examination**

- Abnormal pupil response of right eye (constriction)
- Other vital signs within normal limits
- Cognitive testing normal (counts backward from 100 by 7s; knows name, date, place)

**x-Ray and MRI Examination**

- No fractures present in the skull
- Fracture in the 7<sup>th</sup> cervical vertebra
- Significant swelling present in the spinal canal in the C7-T2 region
- Spinal cord appears to be intact

**Questions**

1. Based upon the findings presented, which doctor made the correct initial prediction?
2. Based upon previous knowledge of brain function, what results from the testing were consistent with a brain injury?
3. Based upon previous knowledge of spinal cord function, what results from the testing were consistent with a spinal cord injury?
4. Based upon previous knowledge of CNS function, what results could be consistent with both types of injury?
5. Assuming the incorrect diagnosis true, predict how the findings would be different.

Image Credit: Detail (horizontally flipped) from *The Swimming Hole* by Thomas Eakins, 1884–85, oil on canvas, Amon Carter Museum, Fort Worth.

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