Spinal cord injury after high-voltage electrical burns

Liubov Adrover Kirienko, Alejandra Monte Soldado, Maria Lluïsa Torrent Bertran M.D., Mireia Ruiz Castilla M.D., Miguel Ángel González Viejo M.D

Physical Medicine and Rehabilitation & Plastic and Reconstructive Surgery Departments of Vall d' Hebron Univesity Hospital, Barcelona, Spain.

Introduction : Spinal cord injury is a rare complication following high voltage electrocution (>1000 volts), that can be immediate or delayed (days-weeks after the accident). In these cases, intramedullary signal abnormalities can be found in a Magnetic Resonance Imaging (MRI), usually described as a hyperintensity signal in T2 sequences, although some patients present normal MRI.

Objective: To describe delayed spinal cord injury characteristics and diagnosis after high-voltage electric shock without vertebral fracture.

Methods: We report 2 cases of patients who received inpatient care at the Burn Unit of Vall d' Hebron University Hospital in Barcelona (Spain), both with spinal cord impairment and no vertebral injury associated, secondary to electrical accident.

Case 1: 17 years old male suffers a high-voltage electrocution after handling an electrical power transformer.

- Medical History: hypersensitivity to metamizol , cannabis active smoker, psychotic disorder on treatment.
- Physical examination: 3rd degree burns in 18% of total surface body area (TBSA) affecting upper and lower extremities with circular ones affecting the arms. Exit point on right forearm and bilateral claw hand deformity.
- Immediate complication: upper limbs muscular necrosis that required bilateral transhumeral amputation.
- Day 10º: acute urinary retention and bilateral lower extremities weakness. Diagnosis by neurological examination: **sensory-motor incomplete Epiconus Syndrome (grade C in ASIA scale).**
- Day 66º: entrance to the Spinal Cord Injury Unit for Rehabilitation Intensive Program.

Case 2: 28 years old male old male suffers a high-voltage electrocution after handling electrical wiring.

- Medical History: heroine ex-consumer.
- Physical examination: 2nd-3rd degree burns in 7% of TBSA affecting face, occiput, both arms and right feet. Entry point on the left hand, exit point on the occiput and left claw hand deformity.
- Immediate complication: left forearm compartment syndrome that required urgent fasciotomy.
- Day 8º: bilateral lower extremities weakness. Diagnosis by neurological examination: **incomplete sensory-motor dorsal spinal cord injury, neurological preserved level D7 (grade C in ASIA Scale).**
- Day 10º: transradial left amputation.
- Day 65º : entrance to the Spinal Cord Injury Unit for Rehabilitation Intensive Program

- **None of the patients had spinal cord damage or vertebral fractures at MRI of dorso-lumbar spine. Medullary MRI was no repeated.**
- **Cranial and spinal CT showed no injury.**
- **Both patients presented alterations of pyramidal path and somatosensory evoked potentials in Neurophysiological exam.**

ASIA Impairment Scale (AIS)

A = Complete. No sensory or motor function is preserved in the sacral segments S4-5.

B = Sensory incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-5 (light touch or pin prick at S4-5 or deep anal pressure) AND no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor incomplete. Motor function is preserved at the most caudal sacral segments for voluntary anal contraction (VAC) OR the patient meets the criteria for sensory incomplete status (sensory function preserved at the most caudal sacral segments (S4-S5) by LT, PP or DAP), and has some sparing of motor function more than three levels below the ipsilateral motor level on either side of the body. (This includes key or non-key muscle functions to determine motor incomplete status.) For AIS C – less than half of key muscle functions below the single NLI have a muscle grade ≥ 3 .

D = Motor incomplete. Motor incomplete status as defined above, with at least half (half or more) of key muscle functions below the single NLI having a muscle grade ≥ 3 .

E = Normal. If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

Using ND: To document the sensory, motor and NLI levels, the ASIA Impairment Scale grade, and/or the zone of partial preservation (ZPP) when they are unable to be determined based on the examination results.

Results: During patients' hospital stay in both, the Burn Care Unit and Spinal Cord Injury Unit, they received Physical and Occupational Therapy treatment in order to avoid skeletal deformities, recover sitting and standing balance, train basic life activities and recover strength and gait capacity. After rehabilitation program, both patients improved in their ASIA spinal cord injury classification grade but still presented important functional sequelae.

Outcome Case 1

After rehabilitation treatment, patient was discharged with final diagnose of **Epiconus syndrome grade D in ASIA scale**, achieving independent gait capacity, but total dependence for daily living activities (ADL's) performance secondary to intolerance of upper limb myoelectric prosthesis.

Outcome Case 2

After rehabilitation treatment, the patient was discharged with final diagnose of **Incomplete sensory-motor spinal cord injury preserved level D7 grade D of ASIA scale**, achieving independent crutch-assisted gait capacity and partial dependence for ADL's performance.

Conclusion: Spinal cord injury following high-voltage electrocution is an infrequent complication but needs an early diagnosis and multidisciplinary approach given the severity of sequels and the immense impact on their functionality, autonomy and participation in the Society .

Sources:

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