

Electrical Torture

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Overview

- Case
- Background and brief history of electrical torture
- Principles of electricity
- Mechanisms of injury

Case

Mr. D is a 38-year-old Dioula-speaking man from the Ivory Coast presenting to clinic to establish care. He reports chronic headaches and flank pain. He attributes his pain to an episode of torture when he was imprisoned for 4 days and beaten on the head with the butt of a gun. During his imprisonment, he was also stripped off his clothing, sprayed down with water, and repeatedly shocked on the flanks with an electrical device.

Physical Exam

VS: normal

Neuro: normal

HEENT: normocephalic but with mild tenderness at the right occiput. Old scarring of the left tympanic membrane.

Skin: no burns or scarring on the flanks

Case Questions

- What is the prevalence of electrical torture in immigrants and refugees?
- What are the immediate signs and symptoms of electrical torture?
- What long-term effects can be attributed to this?

Background

Brief History of Electrical Torture

1888: Thomas Edison endorses the use of the electric chair as a mode of capital punishment



1888

1940s

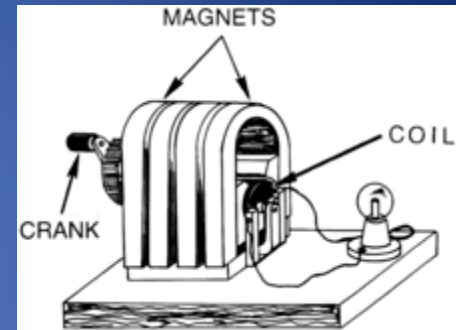
1990s

1930s

1950s

Brief History of Electrical Torture

- 1940s: “magneto” or “dynamo”



1888

1940s

1990s

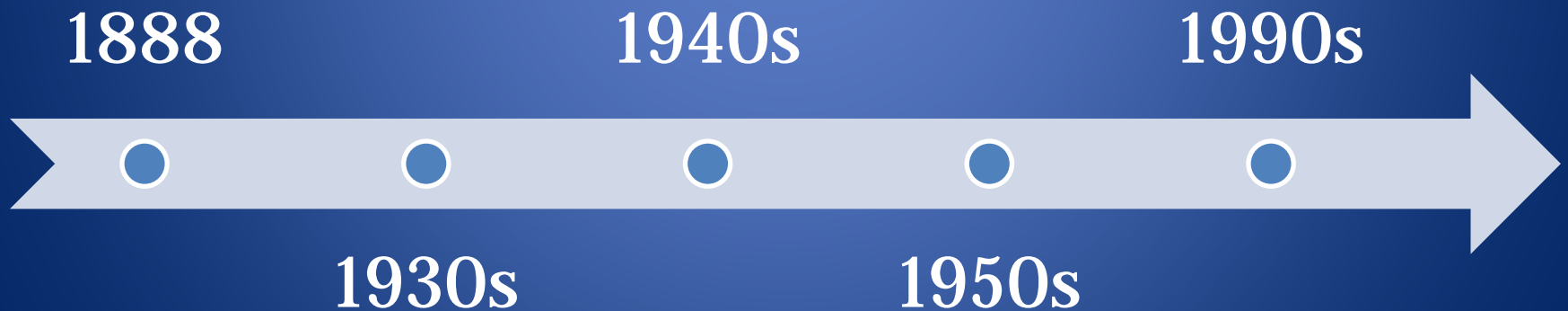
1930s

1950s

Notes: hand-cranked device which allowed its use where outlets weren't available.
Used in Algeria, Vietnam, France

Brief History of Electrical Torture

- 1950s: non-lethal electrical devices were patented in the US



Types of Electrical Injury: Electrical Weapons



Taser: - hook and wire system fired using compressed gas

<http://www.womenonguard.com/images/taser-m18-deployment.jpg>

Stun gun- handheld device. <http://static.ddmcdn.com/gif/stun-gun-ch.jpg>

How common is electrical torture?

- 1984 series of 104 torture survivors, mostly Chilean: 50/104 reported electrical torture
- 1997 “Electroshock torture and the spread of stun technology” published in the Lancet after Amnesty International reported widespread use of electrical torture
- Currently reported in numerous countries including Afghanistan, Burma, Colombia, DR Congo, Haiti, Iraq, Somalia, Syria

100+ companies market hand-held devices, almost half of them in the US. US approved the export of taser guns to Saudi Arabia and stun guns to Venezuela. France→North Africa. A German supplier publishes its catalogue in Russian and Arabic.

Sequelae of Electrical Torture

Principles of Electricity

- $V=IR$
- V (voltage in volts): 110V US homes, 10 million V in lightning strikes
- I (current in amperes): primary determinant of injury
- R (resistance in ohms) depends on area of contact, pressure applied, moisture present

Sequelae of Electrical Torture

Mostly extrapolated from other types of electrical injury

- Lightning
- Occupational
- Home
- Law enforcement weapons

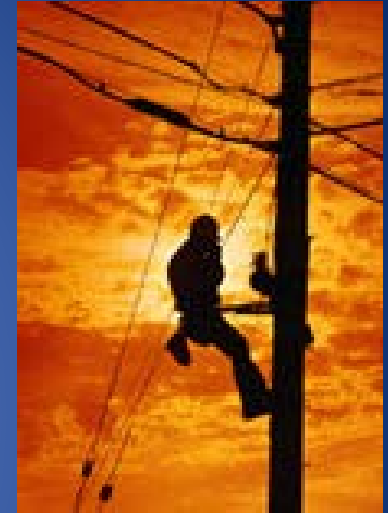
Types of Electrical Injury: Lightning

- Relatively uncommon: 300 injuries and 100 fatalities annually in the US
- Typical victim is a healthy man in his mid-30s participating in an outdoor recreational activity in the spring or summer (male:female ratio 4.5:1)
- High voltage but lasts from 1/10 to 1/1000 of a second
- Generates a shock wave that often results in mechanical trauma



Types of Electrical Injury: Occupational and Home

- Occupational: mostly construction and electrical workers (vast majority are male)
- 2nd leading cause of occupation-related deaths in the US
- 100,000 V in high-tension power lines
- Home: mostly children (2:1 male:female ratio) in contact with electrical cords or outlets
- 110 V in North America, 220 V in Europe and Asia



<http://www.cdc.gov/niosh/topics/electrical/images/powerline.jpg>

<http://www.myfrugalbabytips.com/2012/08/frugal-child-safety-cord-holders.html>

Types of Electrical Injury: Law Enforcement Weapons

- Used by US law enforcement since 1970s
- High voltage (50,000V), low current, short-duration (<1/1000 of a second) but pulsatile stimulators
- Designed to cause involuntary muscle contraction, pain and exhaustion
- Degree of effect depends on duration of discharge and distance between electrodes

Types of Electrical Injury: Law Enforcement Weapons

- 1986 series of 218 patients shot by police with a Taser
 - 1.4% mortality rate: all 3 patients had high PCP levels
 - 38% minor injuries: contusions, abrasions, lacerations
 - 1% mild rhabdomyolysis, also unclear if due to PCP
 - 0.5% testicular torsion

Electrical Torture

- Differs from other types of electrical injury in its repeated application and design to inflict immediate and severe pain
- Minimal data exist but anecdotal reports from Amnesty International suggests the following effects
 - Immediate: severe pain, loss of muscle control, convulsions, loss of consciousness, involuntary urination and defecation
 - Long-term: muscle stiffness, impotence, scarring, PTSD

Mechanisms of Injury: Neurologic

Time Course	Sequela
Immediate and transient	Loss of consciousness Autonomic dysfunction Keraunoparalysis (transient paralysis with blue, pulseless extremities due to vascular spasm)
Immediate and prolonged/permanent	Post-hypoxic encephalopathy: cognitive deficits, motor weakness, ataxia Intracranial hemorrhage Myelopathy Peripheral nerve injury Neuropsychiatric problems: resembles TBI
Delayed	Reports of ALS and Parkinsonism following lightning strikes
Secondary effects due to fall or blast effect	Traumatic brain injury Spinal cord injury

Mechanisms of Injury: Derm

- Burns: degree of external injury can underestimate the severity of internal injury
- Areas of reddening may persist for weeks
- Small, circular burns may occur from sparking at the electrodes, can result in hyperpigmentation
- Occasionally clips are used and can cause small lacerations when pulled off





Mechanisms of Injury: MSK

- Fractures from muscle contraction or secondary to falls
- Compartment syndrome
- Rhabdomyolysis
- Osteonecrosis

Notes: Bone has the highest resistance to current so generates the most heat

Mechanisms of Injury: CV, Resp

- Arrhythmias
 - Asystole with DC or lightning
 - Ventricular fibrillation with AC
- Respiratory arrest
- Vascular damage
 - Delayed arterial thrombosis
 - Aneurysm formation and rupture
 - Electrical coagulation of small vessels

Mechanisms of Injury: Other

- Renal: pigment-induced kidney injury from rhabdo
- Ophtho: cataracts, hyphema, vitreous hemorrhage
- ENT: tympanic membrane rupture

Evaluation

- Immediate care: ACLS and trauma evaluation
- Long term care
 - Neurologic effects
 - EMGs
 - Brain imaging
 - Neuropsychiatric testing
 - Musculoskeletal
 - Imaging to evaluate for fractures, osteonecrosis
 - Dermatologic
 - Close physical exam, documentation of scars
 - ENT
 - Close physical exam, referral to ophtho and ENT

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