TASERS and STUN GUNS

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Intentional Electric Shock Devices

- “Less than Lethal” weapons
- Stun guns
- Tasers
- Cattle prods, Electric fences, Man traps
- Conducted Energy Weapons (CEWs)
- Etc....
Effects of Electricity on Body

• Physiological effects
  – Sensation
  – Motor & cardiac function
  – Nerve function

• Thermal - burns

• Miscellaneous
  – Light, sound
  – Electromagnetic fields
Characteristics of Electrical Contact

- Voltage
- Current – depends on voltage and impedance
- Frequency and waveform
- Duration
- Method of contact or application
Patterns of Current Flow

- Resistance at “entry” points if skin is intact
- Interior of body is low resistance – “rubber bladder of salt water”
- Current follows internal structures
- High voltage sparks can easily penetrate skin
Sensation of a Shock

- Threshold depends on contact site
- Highly dependent on frequency
- Pain perceived when current changes – even low currents are painful if in pulses
- Variable perception of pain – difficulty of conducting experiments because of subjective effects
Muscle Function

• Twitches with each pulse or switching point – “Galvanism”
• Rapid pulses at about 10 Hz or more blend into sustained action - Tetanic spasm
Cardiac Function

• Ventricular Fibrillation is main cause of death in electrocution

• Anatomical distribution of current – “Heart current factor”

• AC or impulses
  – Synchronisation with cardiac cycle
  – Low threshold for VF during repolarisation
Nerve Function

• Difficult to distinguish clinically from direct effects on muscle
• Temporary blocking after a shock causing reversible paralysis
• Shocks to brain cause unconsciousness and convulsions - ECT
Hand held weapons

- Stun Guns – usually applies to contact devices designed to inflict pain or local spasm
- TASERS – trade name for “Thomas A Swift’s Electric Rifle”
- Tasers evolved from Stun Guns and can be used without cartridge in “drive stun” mode in a similar way
Electric Shock Weapons

• Low power – pain only
• High power – muscle paralysis – “Electro-muscular disruption”
• Unusual to get enough energy to affect consciousness, even in head shocks
• High voltage sparks can penetrate clothing – firm contact not necessary
Stun Gun

* 1 Small ECG square = 40 mS = 16000 times 2.5 uS
Cellular Phone Stun Gun
Purchase it for Only $69.99 and Receive This Talon Mini For FREE

Now you can carry a stun device without it being noticed. Disguised as one of the most common personal accessories, the Cellular Phone Stun Gun provides excellent protection from would-be attackers.

A Stun Gun That Looks EXACTLY Like A Cell Phone
Stun Gun – Prod style
Clyde never suspected the local pigeons would have Tasers
TASERS

- Battery powered pistol shaped device
- Removable cartridge with compressed nitrogen propellant & ID material
- Laser aiming
- Darts on end of 4.5M of wire
- Limited application time
- Data logged
- Taser-Cam
Taser X26
Taser Waveforms
Taser Safety

• Few peer reviewed scientific epidemiological studies
• Manufacturers deny it is dangerous
• 1991 LA study of deaths after police use of Tasers in Los Angeles
  – Low power device
  – 13/16 associated with stimulant drugs
Taser Safety

- Studies on animals
- Cardiac effects
- Biochemical disturbances
- Deaths usually associated with drug use or pre-existing cardiac disease
- Usually minimal trauma from barbs
- Litigation by manufacturer

- 75 Deaths assoc with Tasers 2001-4
- All male aged 18-50
- 37 Autopsy reports
  - CVS disease 54%
  - Positive tox 78%; of those, stimulants 86%
  - Diagnosis of “Excited delirium” in 75%
  - Taser implicated in COD in 27%
Taser Safety – what we are learning

• Many possible adverse outcomes BUT still safer than firearms!!
  – Burns – rare when used properly
  – Trauma to sensitive areas – eyes, genitalia
  – Falls
  – Sparks set off flames in petrol sniffer
  – Pregnancy – one report of miscarriage
Review article

Acute pathophysiological influences of conducted electrical weapons in humans: A review of current literature

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Abstract

Conducted electrical weapons (CEWs) deliver short high-voltage, low current energy pulses to temporarily paralyze a person by causing muscular contraction.

The narrative of this article is a methodical analysis on adverse pathophysiological changes within the central nervous system, cardiovascular, neuroendocrine, sympatho-adrenergic and musculoskeletal system which can occur after application of conducted electrical weapons on human subjects. The results are based on wide-ranging literature analysis and source studies. The majority of the recent scientific publications on humans classify the health risks of an appropriate use of the CEWs device as minor. However, there still is an uncertainty about possible side-effects of these devices. Therefore medical supervision with human application is advised.

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Neuromuscular incapacitation devices or conducted electrical weapons (CEWs) are becoming more popular among law enforcement personnel. Commonly used CEWs are the TASER® X26 devices. Such stun guns deliver rapid pulses of high-voltage and low current, which generate involuntary neuromuscular stimulation with incapacitation of the opponent. Ever since CEWs have been introduced in 1970 [1] there have been concerns about the safety of these weapons. Possible associations between CEWs and in-custody deaths have been discussed by various research groups [2-6]. According to data collected by Amnesty International there have been 466 deaths following the use of TASER conducted electrical weapons since 2001 and 14 so far in 2011 [7,8].

These concerns are not only important to emergency physicians or forensic pathologists, but are also an essential topic of general medicine. Even though the pathophysiological influence of electronic control devices on human subjects has widely been discussed in recent literature, up until now, no scientific consensus on the detailed electrophysiological mechanism of action and possible causes of death could be found.

Even though some animal studies point out certain potential risk factors after an exposure to CEWs, such as increased hematocrit, acidosis or lack of effective respiration [9-13], these
**Study of Deaths Following Electro Muscular Disruption**

www.nij.gov
The use of Taser weapons by New South Wales Police Force

A special report to Parliament under section 31 of the Ombudsman Act 1974.

November 2008
Excited Delirium

- Unexpected deaths in police custody – often associated with restraint
- Physical exertion, violent & bizarre behaviour, insensitive to pain
- “Superhuman strength” followed by sudden collapse
- Stimulant drugs often involved
- Controversial issue – anti-Taser lobby
Pathogenesis

• Autopsy often not conclusive
• Multifactorial causes of death
  – Positional asphyxia
  – Hyperstimulation from drugs
  – Exhaustion – depleted energy reserves
  – Hyperthermia
  – Lactic acidosis
  – Catecholamine induced arrhythmias
  – Stress induced Takotsubo cardiomyopathy
  – “acute exhaustive mania”
Preventive Strategies

- Recognise potential – police training
- Paramedics in situ if possible
- Avoid restraint, especially in prone position
- Bring subject to sitting position if practicable
- Role of sedation & life support
Issues raised by coroners & ombudsman

- Training of police
- Multiple use of Tasers & OC spray
- Management of Restraint asphyxia
- Limiting use of Drive-stun mode
- Strict operational criteria for use of Tasers
- Notification & monitoring of critical incidents
CASE STUDY

• 30 y.o. male, 198 cm; PH bipolar disorder
• Agitated behaviour at a bar – police called
• Brought down by Taser from a distance
• “Subdued” with further shocks to head!!!
• Cuffed – found to be unresponsive
• No reports of neck pressure
• PM - large heart, coronaries not blocked, otherwise normal
• Cause of death – “Excited delirium”
Limitations to Operational Use

• Both darts need to hit target
• Limited range – 4.5 M
• Single use cartridge takes a few sec to reload, putting officer at risk in stressful situation
Advances in Tasers & similar devices

- Multi-shot cartridges
- Taser shotgun round
- Marketed in US for personal & family protection
Celebrity Taser
The End!