

# The TASER<sup>®</sup> Device: Human Research Update

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# Professional Qualifications

- Emergency Medicine Physician
- Minnesota Peace Officer
- Academic Medical Researcher

# Disclosure

- Consultant to TASER International (Non-Employee)
- Personal Shareholder (No Options)
- Partial Funding of some research projects from TASER International
- Conflict Management Plan through the Minneapolis Medical Research Foundation
- Conflict Management by Scientific Peer Review

# Objectives

- **Frame the Issue**
  - The perception of *“Why people die after TASER exposure”*.
  - 2 Primary Reasons for this perception
    - **Misunderstanding electricity**
    - **Misapplication of logic**
- **Present the Human Research on TASER devices**
- **Answer any questions**

# Why do people die after arrest?

- **Historic Precedent**

- **Custodial Sudden Death has been documented since mid-1800.**
  - **Bell: *J of Insanity*, 1849;6:97-127.**
- **Pepper Spray, Hogtying, etc.**
- **Custodial Sudden Deaths occur when no TASER, Pepper Spray, Hogtie, Neck Restraint, Prone Positioning has been used.**
  - **Are we focusing on the correct problem?**

- **Public Focus on TASER in Modern Society**

- **Misunderstanding electricity**
- **Misapplication of logic**

# Misunderstanding Electricity

- Electricity = Danger
- Wall Sockets
- Overhead Power Lines
- Electricity as a form of Capital Punishment

# Misunderstanding Electricity

- If Electricity causes a cardiac arrest, it does so in a very predictable fashion. Ventricular Tachycardia (VT), Ventricular Fibrillation (VF) result.
- Why then, are the cases of sudden custodial death documented as rhythms other than VF or VT upon paramedic arrival? (They are typically Pulseless Electrical Activity or Asystole)
- Why then, does history have documentation of sudden custodial death cases before the invention of the TASER in rhythms other than VF or VT?

# Misapplication of Logic

- The "*Post Hoc Fallacy*"
  - "*After this, therefore because of this.*"
  - Assumes events close in time have a cause/effect relationship
  - Scientific process is needed to either validate or refute
- Example: Rooster crowing associated with the sun rising





# TASER Research

- TASER devices are not toys
- They are not therapeutic medical devices
- They should be evaluated in the context of their use
- Start with the question of *"What happens if. . .?"*
  - Not with the question of *"Can I cause this. . .?"*

# Animal Research

- Animal models can point towards certain directions but interpret the results with caution
- Animal models are not great human substitutes.
  - Animals are anatomically different
  - Most are smaller in mass than a human
  - Some animal research has had concerning conclusions
  - These conclusions are reached in artificial environments
  - Human study in these areas have shown opposite conclusions

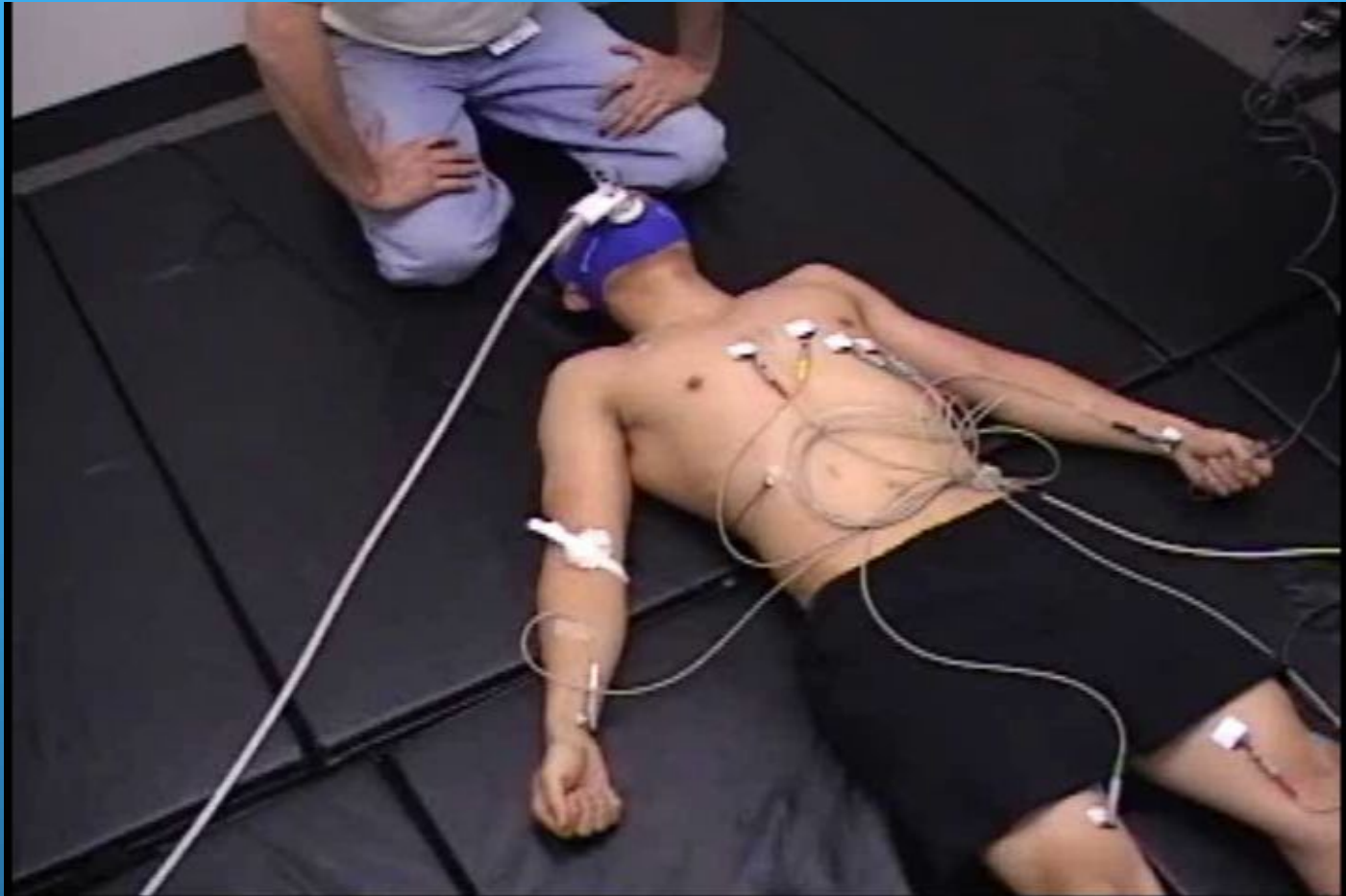
# Existing Human Evidence

- TASER International has estimated over 675,000 voluntary training exposures with no deaths
- What similarities exist in my studies?
  - Health/Age/Gender
  - Stature
  - Probe Position



# Human Research

- Ho J, et al: Cardiovascular and physiologic effects of conducted electrical weapon discharge in resting adults. *AcadEmerg Med*, 2006.
  - No significant findings
- Ho J, et al: Respiratory effect of prolonged electrical weapon application on human volunteers. *AcadEmerg Med*, 2007.
  - 15 second exposure
  - People breathe faster during exposure



Minute ventilation Before = 13.2, pH Before = 7.4  
Minute ventilation During = 18.7  
pH After = 7.4

# Human Research

- Ho J, et al: Prolonged TASER use on exhausted humans does not worsen markers of acidosis. *Am J Emerg Med*, 2007-2008 In Press.
  - 15 seconds on acidotic, exhausted adults
  - No worsening of acidosis that is already present
- Ho J, et al: Impact of conducted electrical weapons in a mentally ill population. *Am J Emerg Med*, 2007.
  - Review of TASER use during mental illness encounters.
  - TASER use 45% of time instead of justifiable deadly force

# Human Research

- Ho J, et al: Absence of electrocardiographic change following prolonged application of a conducted electrical weapon in physically exhausted adults. *AcadEmerg Med*, 2007 supplement.
  - No EKG changes found after exposure
- Moscatti R, Ho J, et al: Physiologic effects of prolonged conducted electrical weapon discharge in ethanol intoxicated adults. *AcadEmerg Med*, 2007 supplement.
  - Alcohol consumption causes respiratory slowing
  - No changes when TASER is used on intoxicated humans



# Human Research

- Dawes D, Ho J, et al: Effect of prolonged discharge from a conducted electrical weapon on human core temperature. *J Forensic Sci*, 2008 In Press.
  - No elevation in core temperature found



# Human Research (Drive Stun)

- Ho J, et al: Prolonged TASER drive stun exposure in humans does not cause worrisome biomarker changes. *PrehospEmerg Care*, 2008 Supplement.
  - Drive stuns do not markedly change physiology
- Ho J, et al: Confirmation of respiration during trapezial conducted electrical weapon application. *AcadEmerg Med*, 2008.
  - Dynamic demonstration that breathing occurs

Gen

Abd  
P17




100%  
1  
0

MI  
0.7

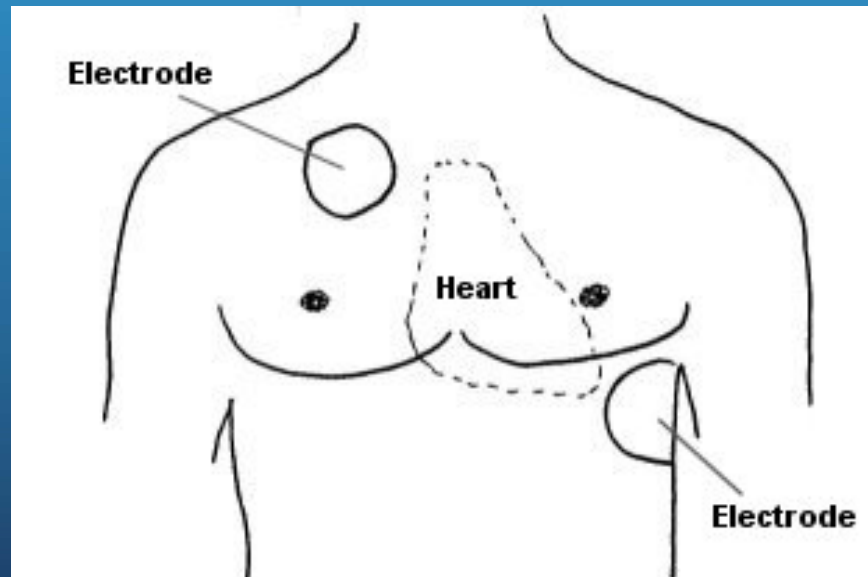
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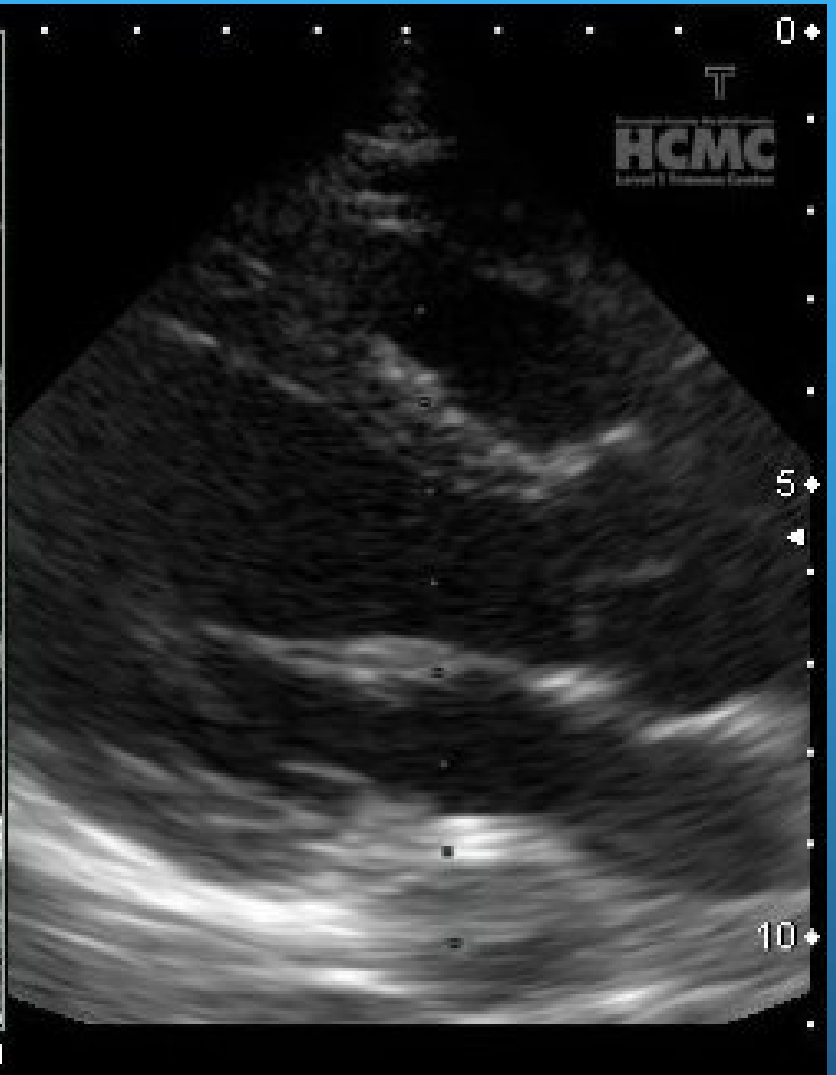
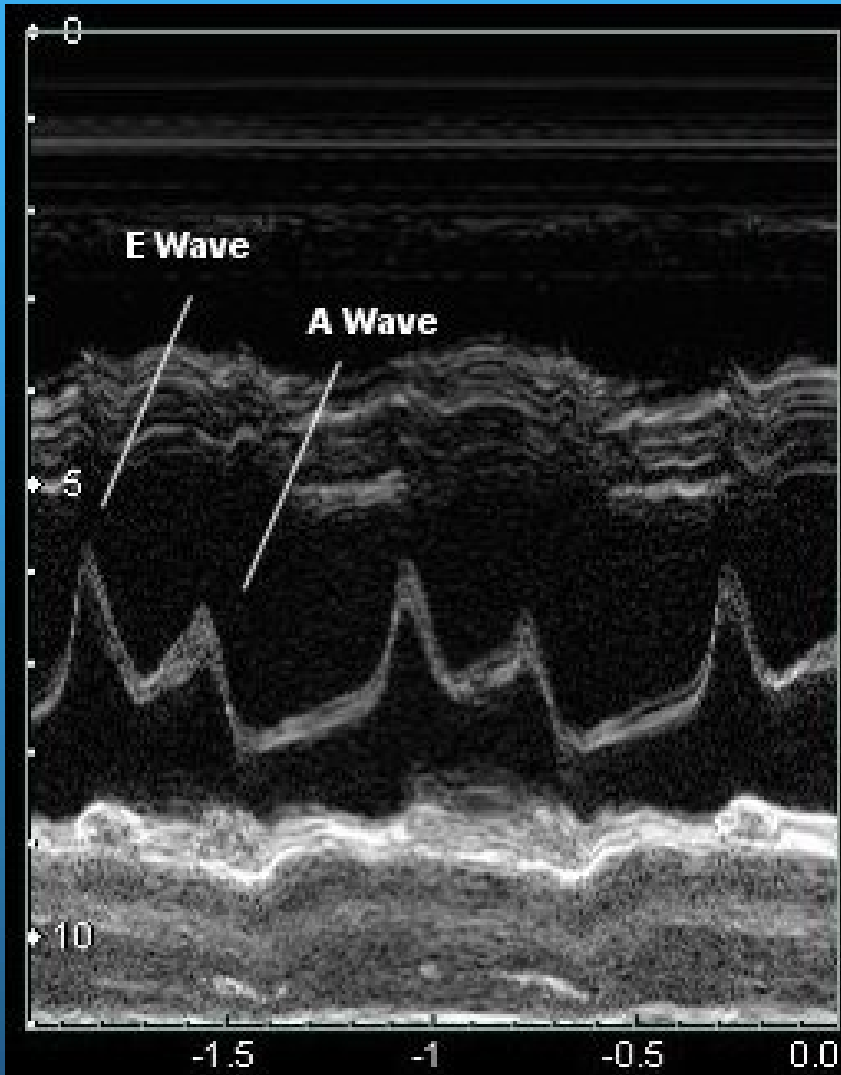
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 = diaphragm

# Human Research

- Ho J, et al: Echocardiographic evaluation of a TASER X26 application in the ideal human cardiac axis.  
*AcadEmerg Med*, 2008 In Press.
  - Replicates 3 concerning swine studies
  - No evidence of cardiac rhythm problem in humans





# Human Research

- Current Work:
  - XREP work on humans
  - C2 work on humans
  - X26 methamphetamine study
  - X26 human studies examining various physiology parameters under various stress factors

# Future Research Example



VS.



VS.



Grappling and Pepper Spray exposure appear to be more stressful than TASER

# Validation Studies

- Chan et al. Respiratory and Ventilatory Effects of the TASER on Human Subjects. *AcadEmerg Med* , 2007;14 (Suppl 1):191-192.
- Sloane et al. Serum Troponin I Measurement of Subjects Exposed to the TASER X-26. *AcadEmerg Med*, 2007:14 (Suppl1):103-104.
- Vilke et al. Cardiovascular and Metabolic Effects of the TASER on Human Subjects. *AcadEmerg Med*, 2007:14 (Suppl1):104-105
- Vilke et al. Does the TASER Cause Electrical Changes in Twelve Lead ECG Monitoring of Human Subjects. *AcadEmerg Med*, 2007:14 (Suppl1):104.
- Sloane et al. Cardiac Monitoring of Human Subjects Exposed to the TASER. *J Emerg Med*, 2007;33:113-117.
- Barnes Jr DG, et al. Cardiac effects of the TASER conducted energy weapon. *Ann Emerg Med*, 2007;48 (supplement):S102.
- Bozeman WP, et al. Injury profile of electrical conducted energy weapons. *Ann Emerg Med*, 2007;50 (supplement):S565.



# Conclusions

- Beware of faulty logic
- The current body of human research does not support a connection between the TASER device and sudden death through any mechanism that is known to modern medicine

# Questions?

