TASERS and EMS

Separating Truth from Fancy

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www.rayfowler.com


www.utsw.ws


DALLAS FIRE RESCUE
26R
DALLAS FIRE RESCUE
75R
DALLAS FIRE RESCUE
DALLAS FIRE
RESCUE


PARAMEDICS
MID
GEORGIA
34
11M34

The Objective Questions:

1.What is a TASER all about?

2. Is it "safe" for "consumers"?

3. What do WE do with "consumers" who have been "tased"?

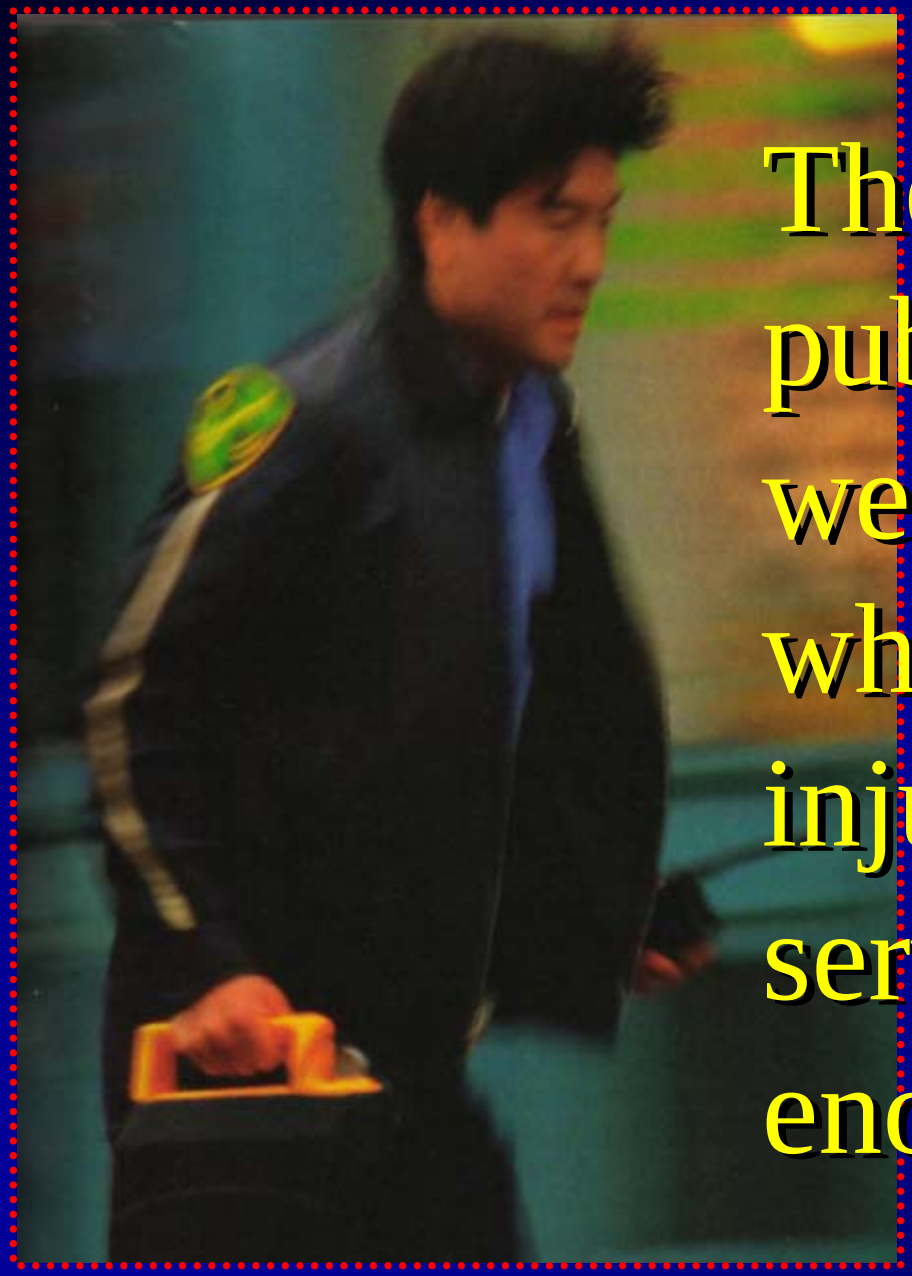

DALLAS
FIRE DEPT.

How do we best protect life and property when those we serve may be impossible to control

Do we HAVE to get hurt to do our jobs?

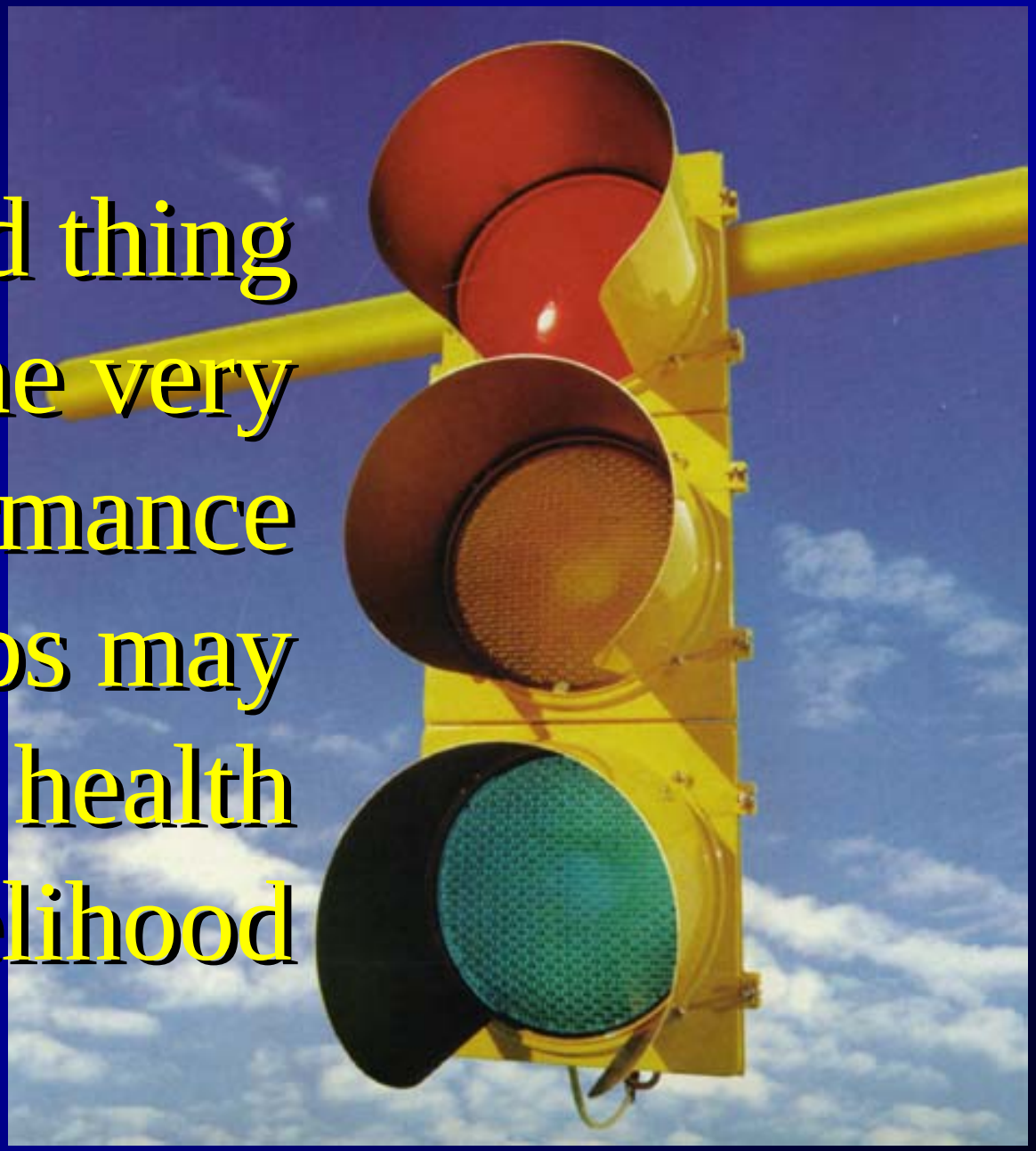
…is it required by our oath to serve?

Video 1
Crazy Guy in Jail



The number of public health and welfare providers who have been injured during service is enormous

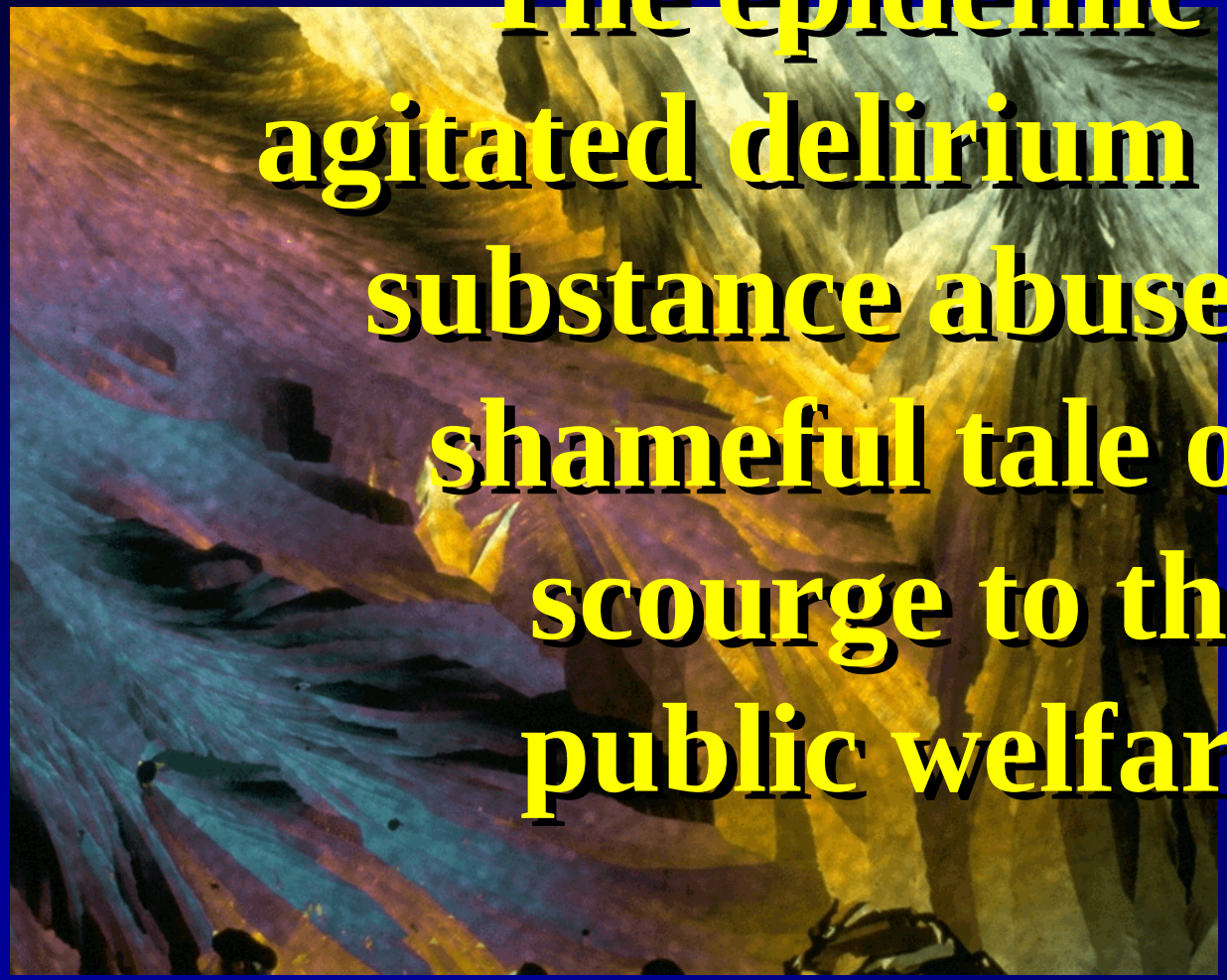
It is an odd thing that the very performance of our jobs may threaten our health and livelihood



Not unlike, interestingly, what will happen if a pandemic influenza outbreak ever comes to our country, and medics have to respond to the scene of patients with illnesses that could be fatal to the medics

We are now called out to manage the unmanageable

"Toxic Resistance"



The epidemic of agitated delirium due to substance abuse is a shameful tale of a scourge to the public welfare

Delirium

A question for you…

- Does a citizen who has broken the law and become non-compliant with public safety lose personal freedom?
- Does that individual risk facing progressive escalation of attempts to stop that person from fleeing?
- If a person becomes psychotically agitated with “uppers”, does that person assume a risk to health by being restrained?

Video 2
Guy with knife

Another question?

Is it in your job description that you HAVE to be at risk to become Hepatitis C infected by a psychotic cocaine overdose while holding him down to start an I.V.?


L
42H

Let’s review the essential aspects of the TASER

DEVELOPMENT

Began in the Early ’70’s
with (relatively) primitive technology

Further study ensued
over the last 20+ years

How much current?

The Basic Goal

Find a technology that would immobilize any patient at any time with a minimal amount of harm

Depolarizing Current

High frequency electrical currents tend to stay near the surface of a conductor.

Hence, the output of the Advanced Taser is believed to stay near the surface of the body in the skin and muscle tissue and does not penetrate into the internal organs.

This is known as
a Faraday shield.

The electrical delivery
of the Taser,
and thus its injury potential,
are likely to be different
from other conventional modes
of electrical injury.

The threshold for ventricular fibrillation is thought to be around 50-100 mAmps

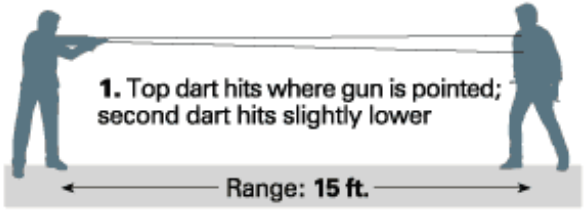
The maximum intensity of a U.S. household current is 240 Amps

So, the design
had to be
carefully done

SHOCKING SELF DEFENSE

The use of Tasers by thousands of law enforcement agencies has already drawn controversy. Now, a new version of these devices that deliver jolts of electricity instead of bullets is being sold to civilians.

HOW IT WORKS



2. The civilian version can shoot in three consecutive 10-second bursts of 26-watt electricity. The police version fires a 5-second burst. Both make the target's muscles contract and overwhelms the nervous system. Most people collapse.

Physical effects

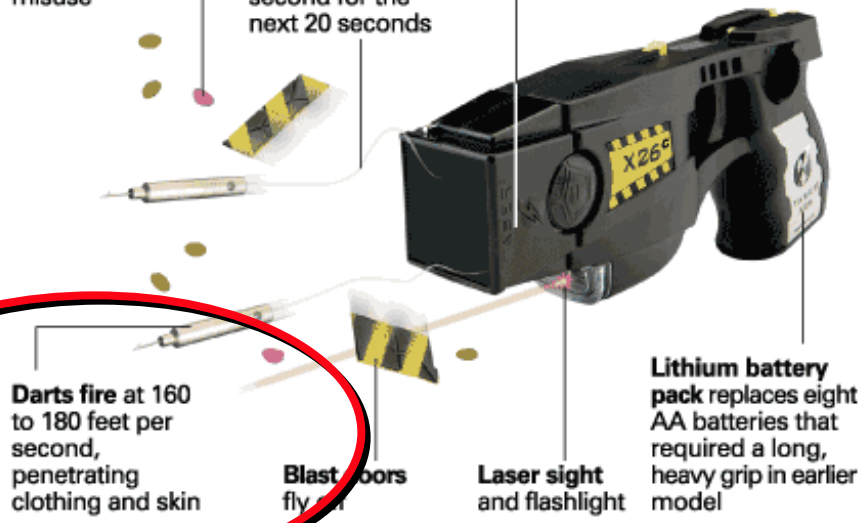
- Works by "electro-muscular disruption" a contraction of muscles throughout the body
- Causes temporary incapacitation but is said to have no permanent effect
- Darts do not have to penetrate flesh to work

TASER X26C

Length: 6 in.

Width: 1.3 in. **Weight:** 7 oz.

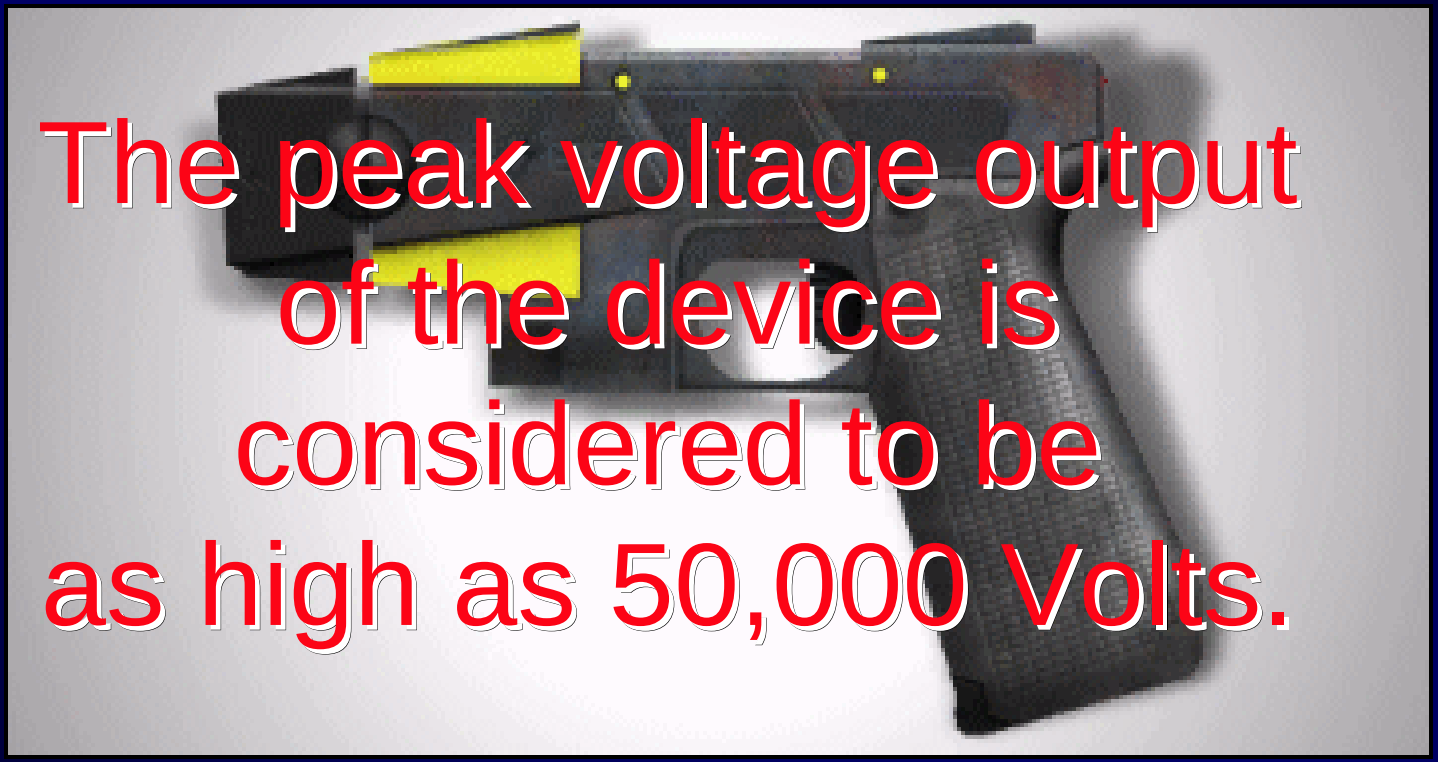
- **Cost:** $999



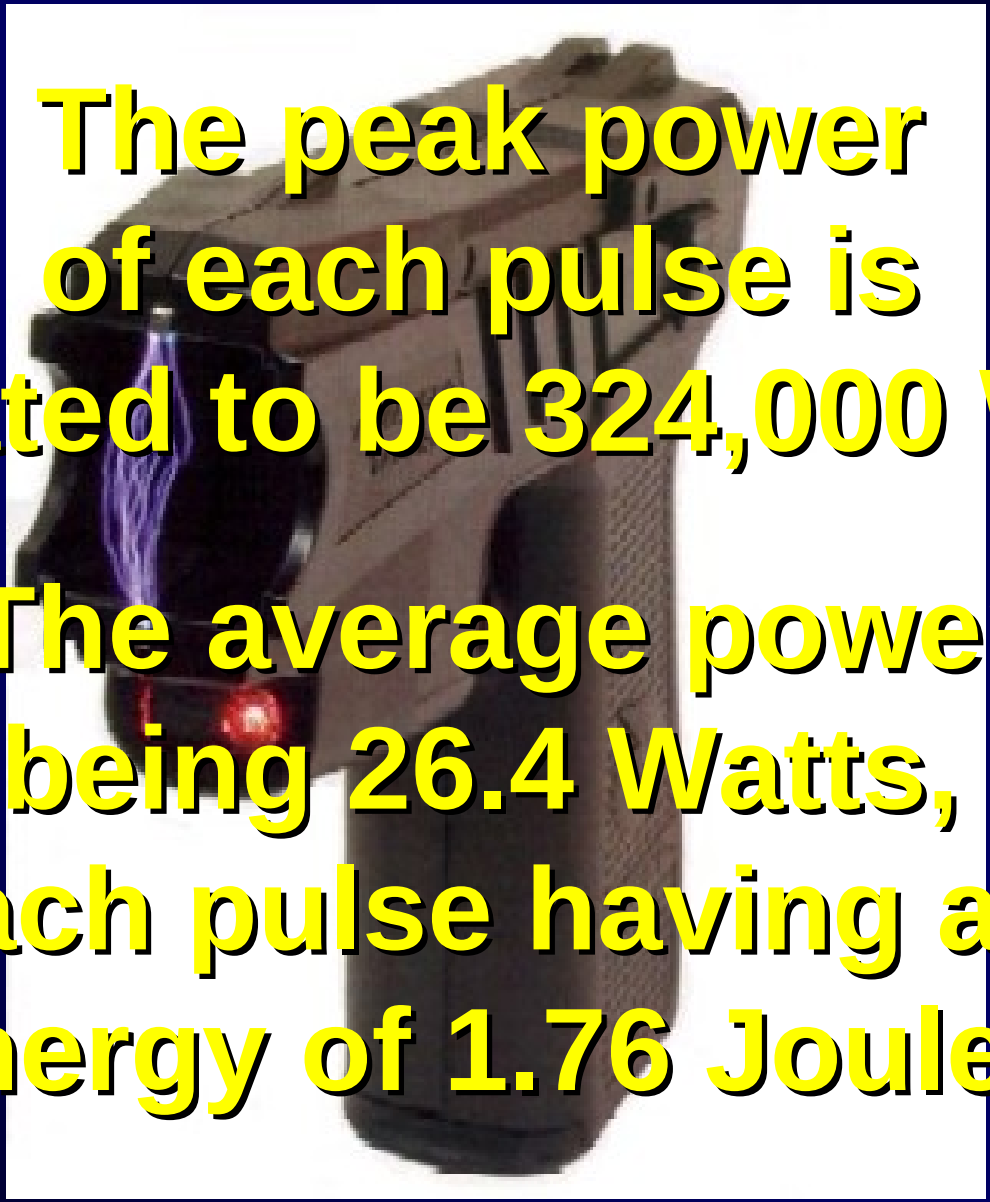
Source: Taser International

Times graphic

The M26 Advanced Taser delivers a sequence of approximately half sine wave current pulses, each having a peak amplitude average of 2.1 milli Amps and a duration of about 11 microseconds



The peak voltage output of the device is considered to be as high as 50,000 Volts.



The peak power of each pulse is estimated to be 324,000 Watts.

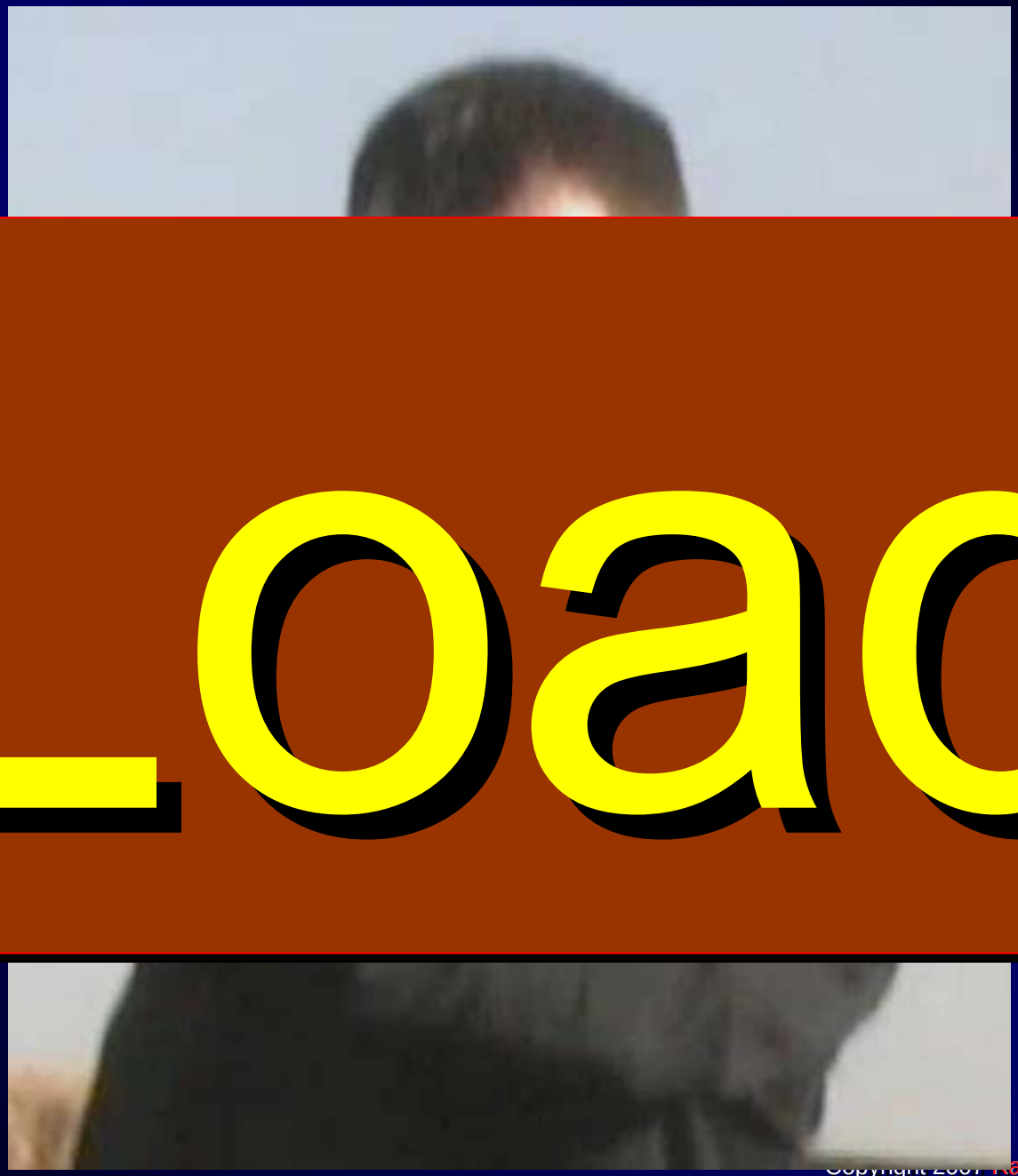
The average power being 26.4 Watts, each pulse having an energy of 1.76 Joules.

The differences in the two numbers a)

0.07 Joules per pulse, under load

it is only 0.07J per pulse.

50,000 volts
but
only 0.07 joules
against load



Load

A Taser is technically “DC”.

Pulses are sent at 19 per second

typical 60 Hz for AC)

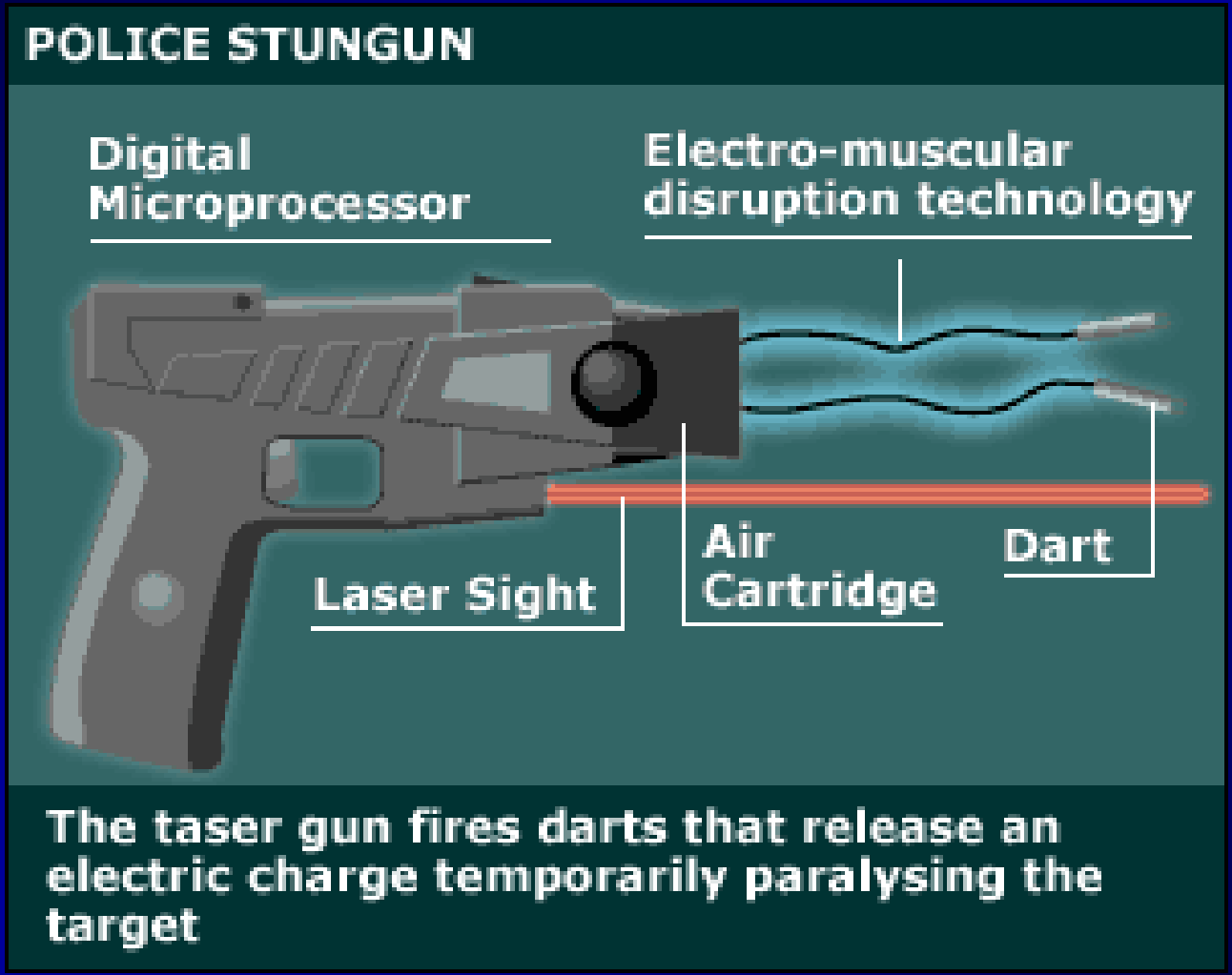
0.07 Joules/pulse

x 19 pulses/second

Defib delivers
400 times the energy
of a Taser

200 joules/0.4 seconds

= 500 Joules/second


POLICE STUNGUN
Digital Microprocessor
Electro-muscular disruption technology
Laser Sight
Air Cartridge
Dart
The taser gun fires darts that release an electric charge temporarily paralysing the target

⚠ WARNING

Electronic Control Device

- Can temporarily incapacitate target.
- Can cause injury.
- Obey warnings, instructions and all laws.
- Comply with current training materials and requirements.
- See www.TASER.com.

Specifications

1. Output characteristics[8]:
   Wave form: Complex shaped pulse
   Pulse rate: 19 PPS
   Pulse duration: 100 microseconds
   Peak open circuit arcing voltage: 50,000 V
   Peak loaded voltage: 1,200 V
   Current: 2.1 mA average
   Energy per pulse:
     Nominal at main capacitors: 0.36 joules
     Delivered into load: 0.07 joules
   Power rating:
     Nominal at main capacitors: 7 watts
     Delivered into load: 1.3 watts
2. Power source: Digital Power Magazine (DPM)[7]
3. Temperature range: -4 °F [-20°C] to: 122 °F [50 °C]
4. Relative humidity: 15% to 80%
5. Housing: High impact polymer
6. Patent: U.S. D508,277 D504,489 and other patents pending

DEPLOYMENT WARNINGS

To minimize the risk of injury during or from deployment, follow these guidelines:

Deployment Safety Procedures

Avoid Weapons Confusion. Handguns have been confused with TASER devices. Learn about the differences in physical feel and holstering characteristics between the TASER device and your handgun. This will allow you to confirm device identity under stressful situations. Follow agency's equipment carrying guidelines and training.

Select Preferred Target Areas. The preferred target areas are the subject's torso (center mass) or legs. Avoid intentionally aiming a TASER device at the head or face without justification.

Avoid Sensitive Areas. Significant injury can occur from TASER device deployment into sensitive areas of the body such as the eyes, throat, or genitals—avoid intentionally targeting these areas without justification.

Avoid Known Pre-Existing Injury Areas. When practical, avoid deploying a TASER device at a known location of pre-existing injury (e.g., avoid targeting the back for persons with known pre-existing back injuries, avoid targeting the chest area on persons with a known history of previous heart attacks, etc.). These injuries may be provoked by such deployment.

Beware—TASER Device Can Ignite Explosive Materials, Liquids, or Vapors. These include gasoline, other flammables, explosive materials, liquids, or vapors (e.g., gases found in sewer lines, methamphetamine labs, and butane-type lighters). Some self-defense sprays use flammable carriers such as alcohol and could be dangerous to use in immediate conjunction with TASER devices.

Reload and Deploy. If a TASER device application is ineffective in achieving the desired effect, consider reloading and redeploying or using other force option(s), according to approved training and policy.

Plan Deployment Backup. No weapons system, tool, or technique is effective 100% of the time. Consider acceptable options, alternatives, and backup plans in case of ineffective deployment when deploying, activating, or otherwise using a non-lethal weapon, including TASER devices.

Control and Restrain Immediately. Begin control and restraint procedures as soon as it is reasonably safe to do so in order to minimize the total duration of exertion and stress experienced by the subject. User should avoid touching the probes and wires and the areas between the probes during TASER electrical discharge.

Deployment Health Risks

Sudden In-Custody Death Syndrome Awareness. If a subject is exhibiting signs or behaviors[2] that are associated with Sudden In-Custody Death Syndrome,[3] consider combining use of a TASER device with immediate physical restraint techniques and medical assistance.

What leads people to the point where they get tased?

Video 3
Drunk on Road

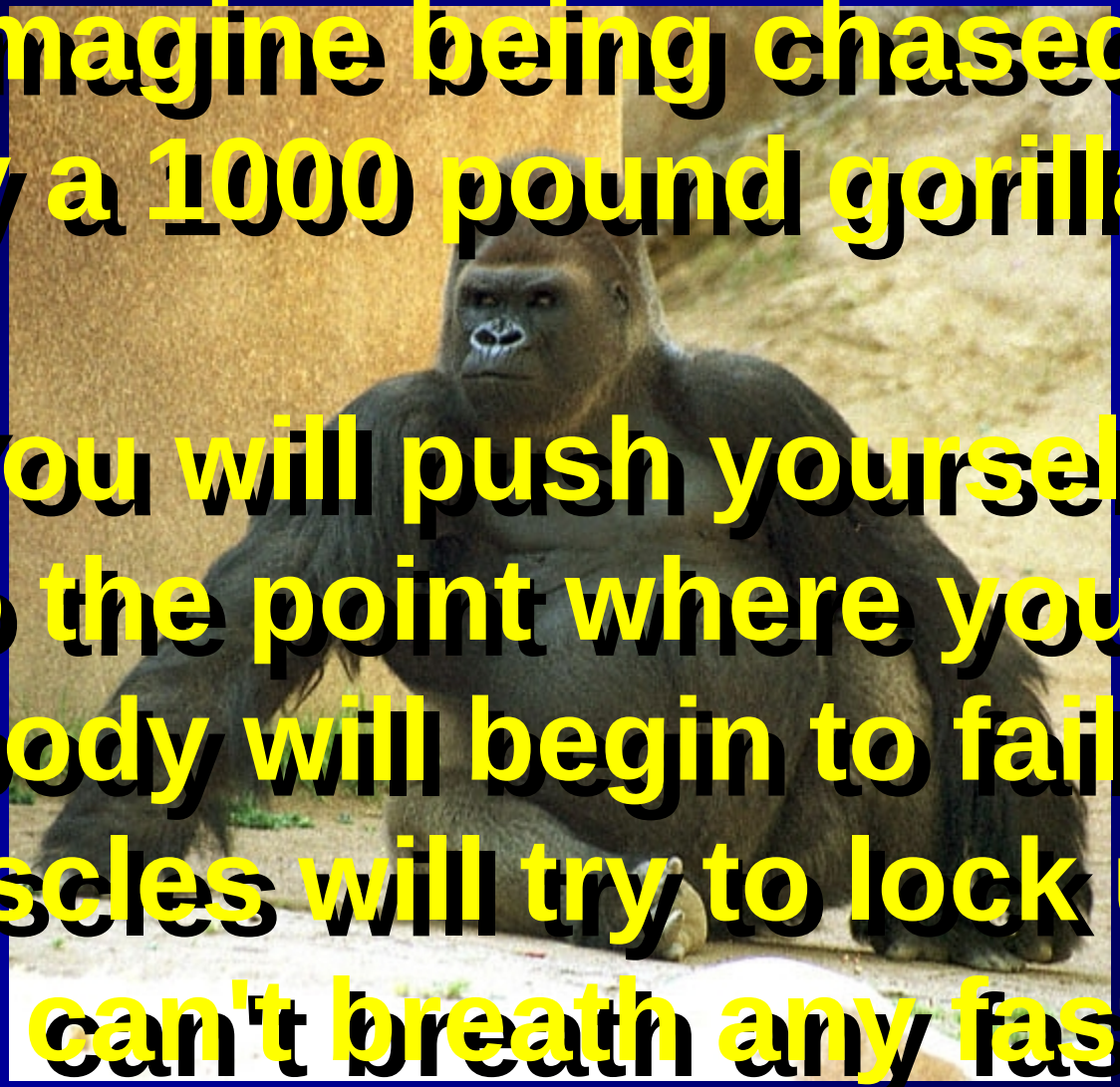
People in excited delirium
lose all feedback mechanisms
that tell them to
slow down and relax.

Picture the amount of activity you expend when you go out to run to exercise.

You get to a point where you say "OK, this is fast enough" and don't push yourself.

Then picture if you are chasing a suspect.

You will push yourself past this point, until you are physically exhausted, then you will stop (or at least slow down).



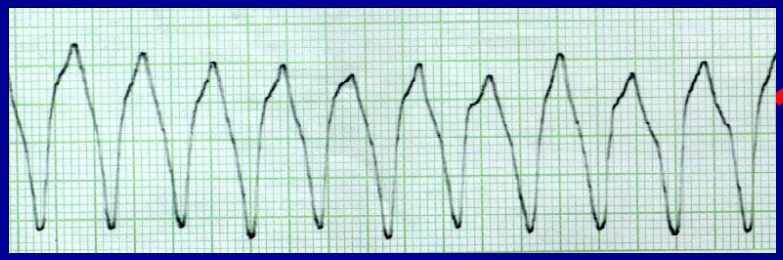
Imagine being chased by a 1000 pound gorilla.

You will push yourself to the point where your body will begin to fail, muscles will try to lock up, you can't breath any faster.

Take a sedentary person, overweight, and then run him WILDLY PLUS a bunch of hits from an epinephrine inhaler

Arrhythmias

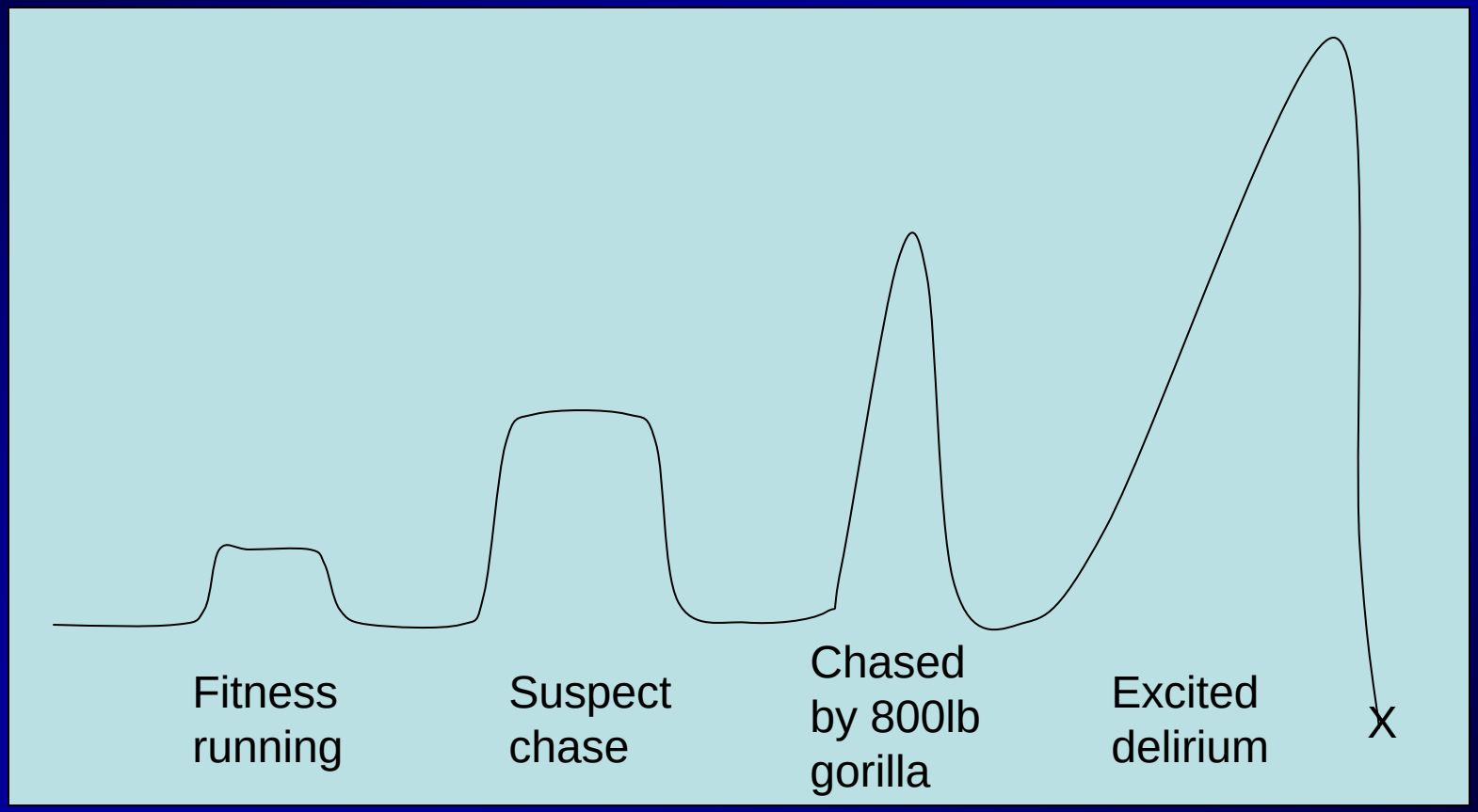
And, possibly sudden death....



The people doped on cocaine or meth don't even realize when they hit this point.

But, they reach this point gradually.

Activity level



This causes unexpected electrolyte changes.

The danger comes in when they get placed in custody.

They go from this
extreme energy expenditure
to nothing,
causing (theoretically)
massive electrolyte shifts
that result in cardiac arrest.

Maybe a better approach is to let them keep their activity up…

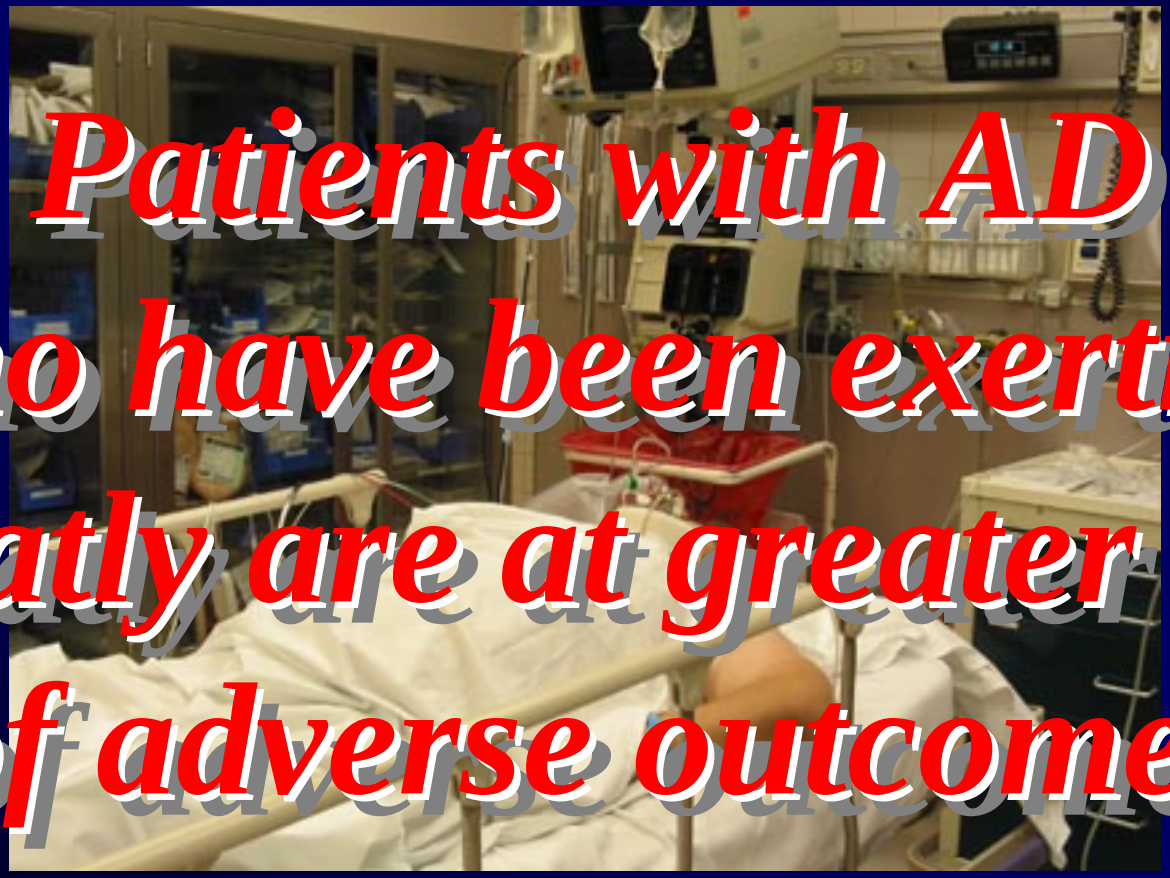
…and bring it down slowly.

Jeff Metzger, MD, FACEP
Senior EMS Fellow
UT Southwestern

Video 4
Gal in Jail

Do our obligations change in any way to a patient that has been “tased”?

In many cases, yes…



Patients with AD who have been exerting greatly are at greater risk of adverse outcomes

What must be performed on ALL Tased Patients?

An Initial Assessment

Scene Survey/Mechanism/# pts.

⇓

LOC/Airway/Cspine

⇓

Respiratory Rate and Labor

⇓

Pulses R & Q, N & W
Skin CMT/CRT/External Bleeding

⇓

Neck appearance, JVD, Trachea

⇓

Chest appearance, BS, HT

⇓

Quick survey of abdomen, pelvis, extremities, and back

Scene Survey/Mechanism/# pts.

↓

LOC/Airway/Cspine

↓

Respiratory Rate and Labor

↓

Pulses R & Q, N & W
Skin CMT/CRT/External Bleeding

↓

Neck appearance, JVD, Trachea

↓

Chest appearance, BS, HT

↓

Quick survey of abdomen, pelvis, and extremities

Reveals threats to Basic Physiology

. . .the vital elements of the Primary Survey

What all could be wrong?

Signs of Shock

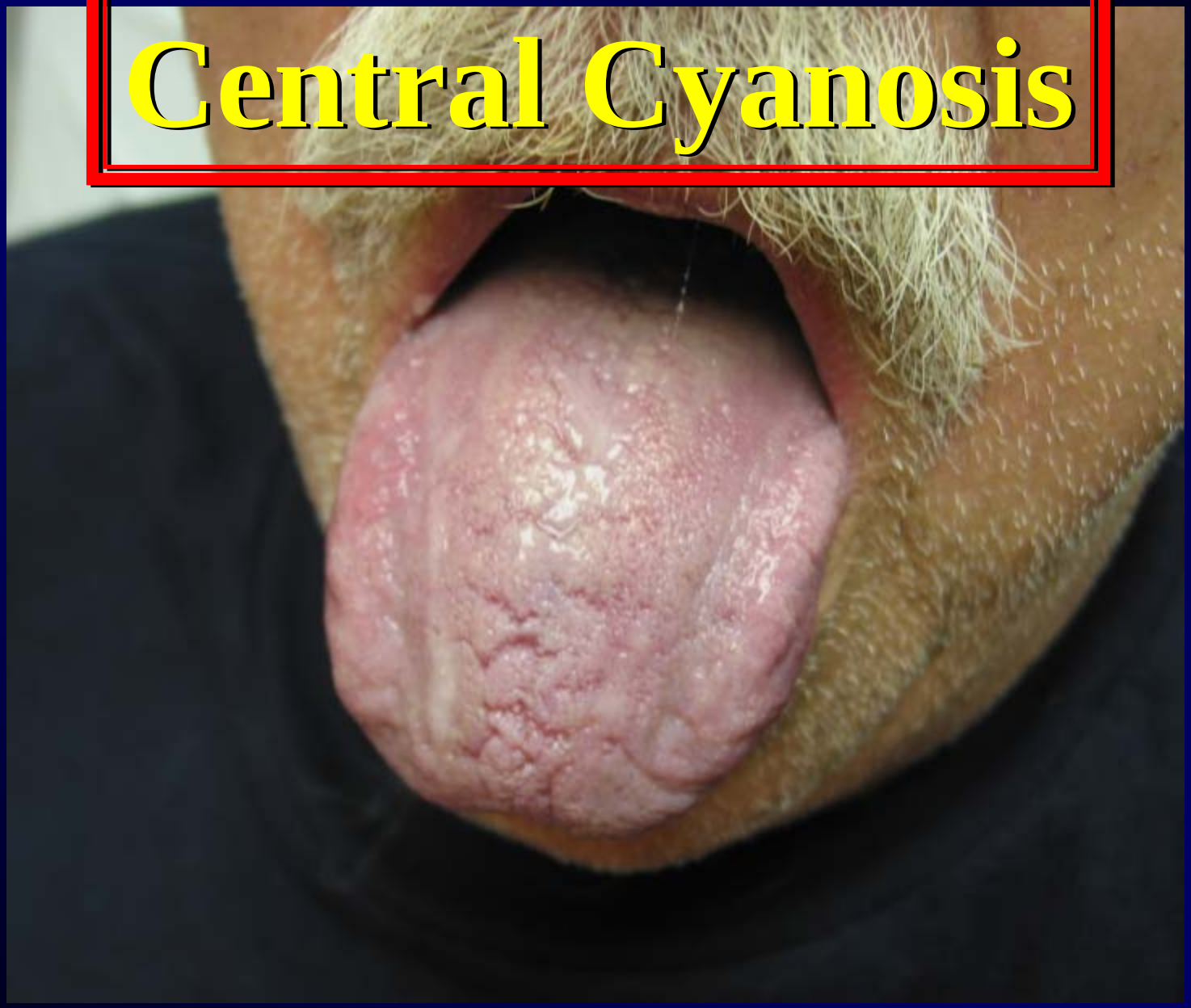
Early ⇒

- Weak, thirsty, lightheaded
- Pale, then sweaty
- Tachycardia
- Tachypnea
- Diminished urinary output

Late ⇒

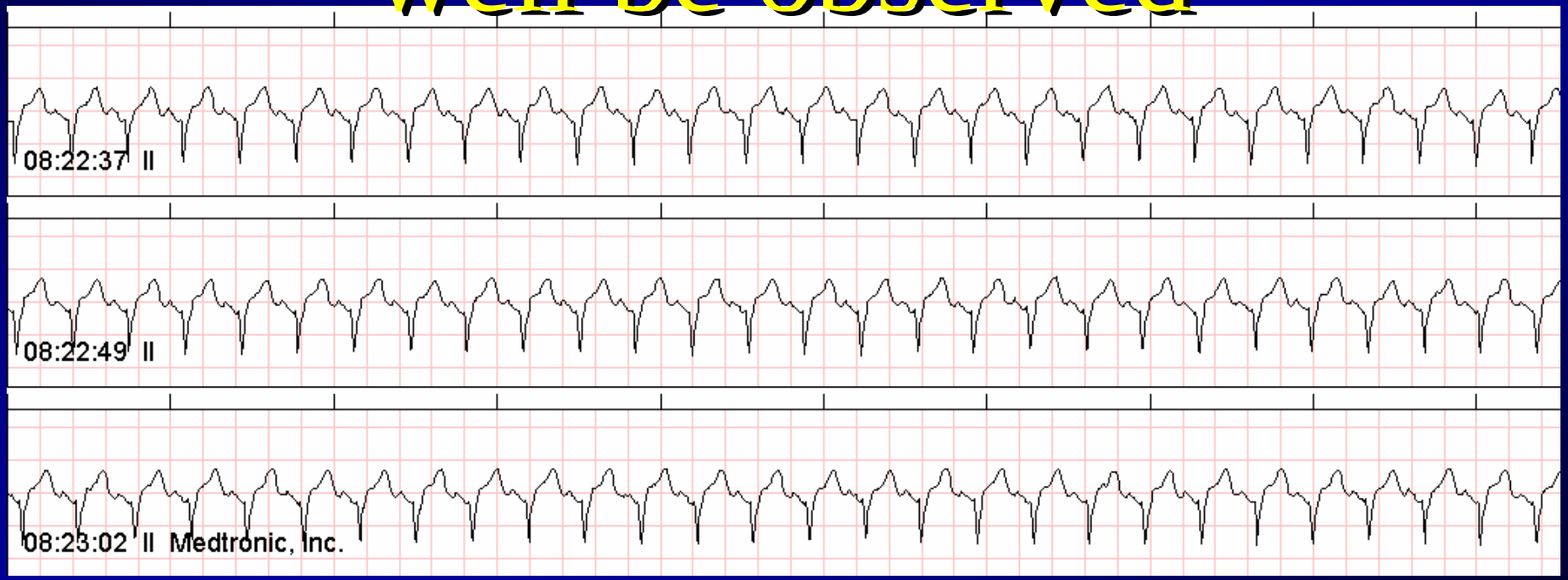
- Hypotension
- Altered LOC
- Cardiac arrest
- Death

Central Cyanosis

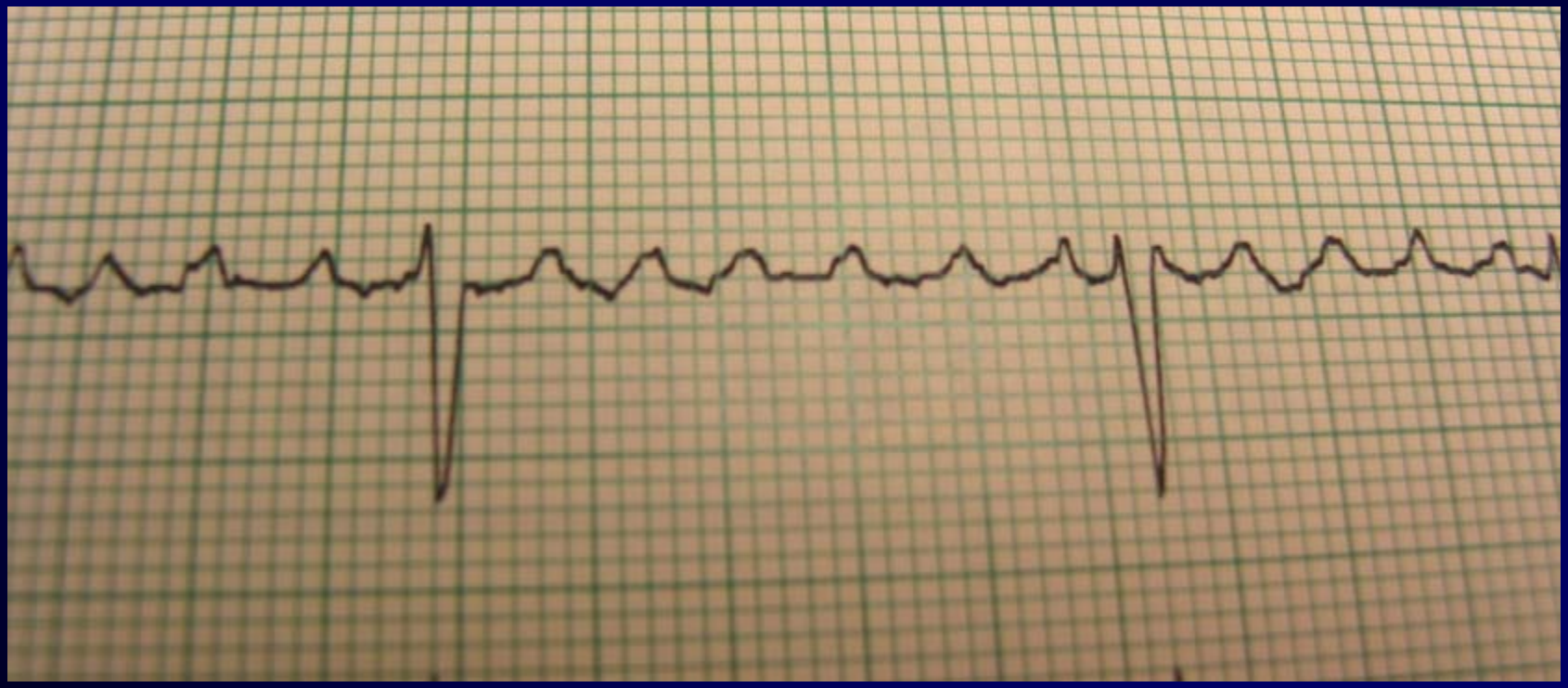


Rhythm Strip Interpretation

A Tachycardia may well be observed



…or tachyarrhythmias



1: Heart Rhythm. 2006 Mar;3(3):339-41.

Comment
Heart R

Effect of a ... ator.

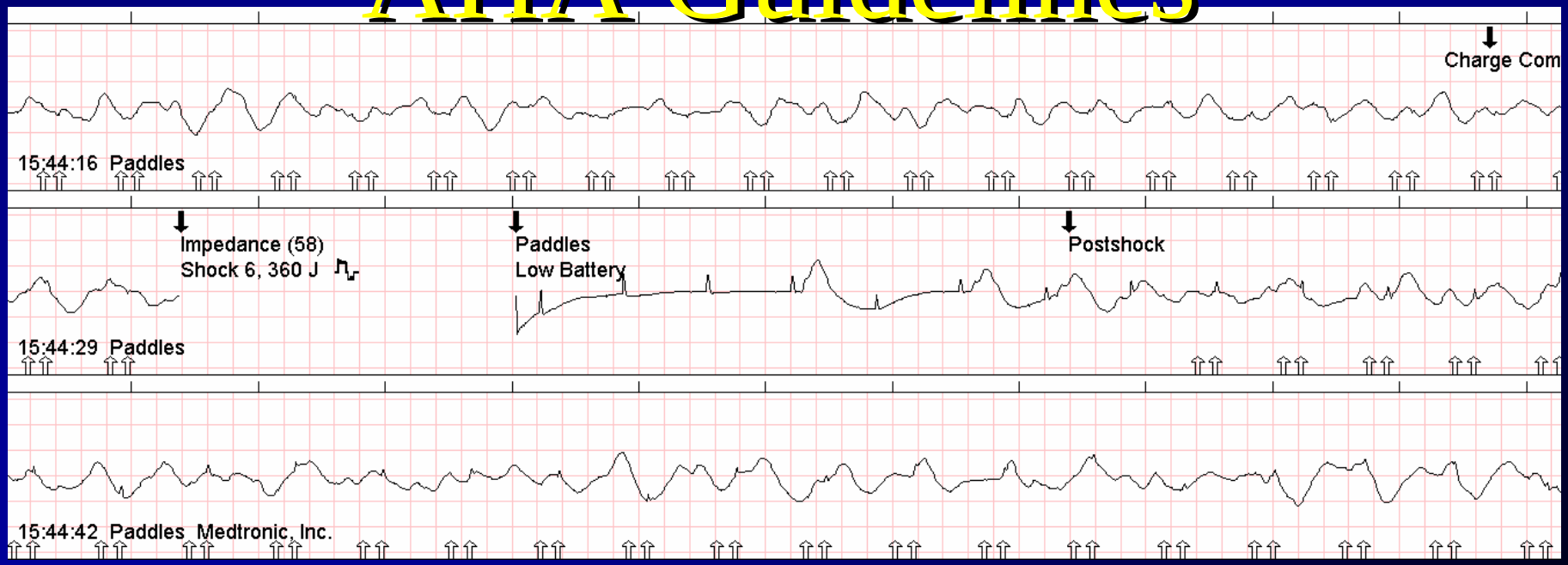
Haegeli L

Royal Jubile ... a V8R 1J8.
laurenthaeg

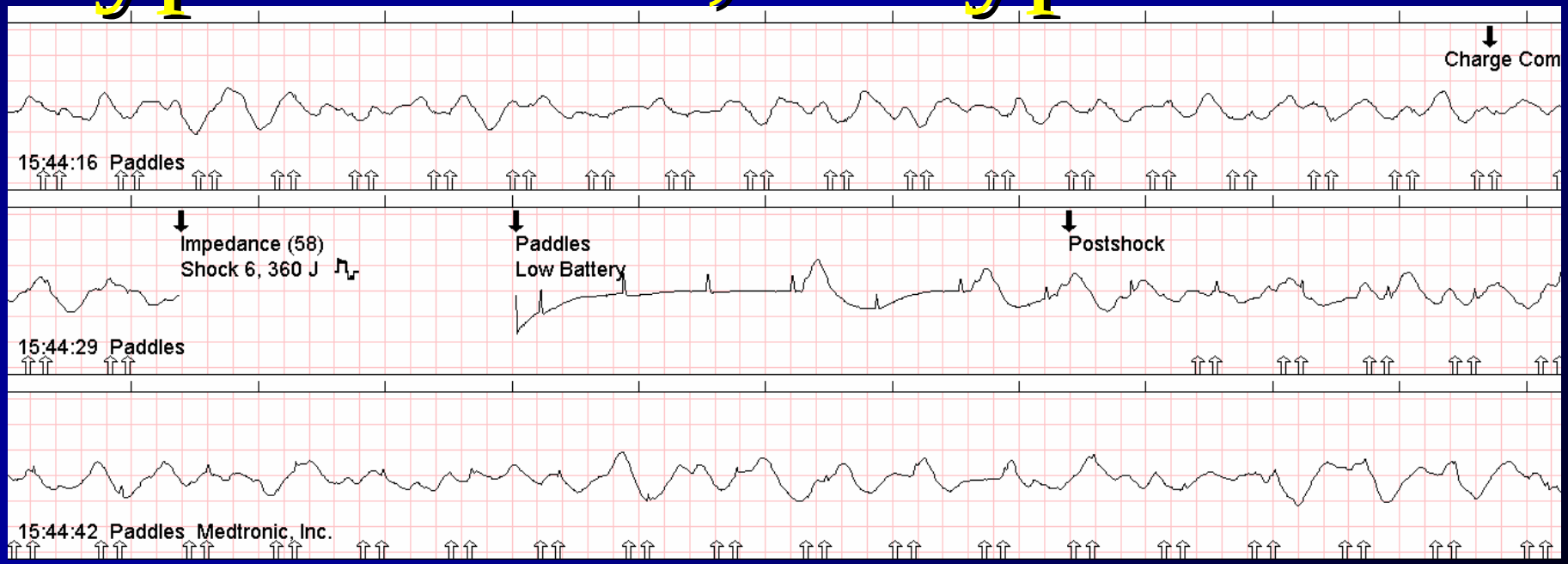
PMID: 165

May induce arrhythmia

A patient in arrest would require immediate resuscitation utilizing AHA Guidelines



…keeping in mind the possibilities of severe metabolic acidosis, hyperkalemia, or hypothermia



Adult volunteers

No significant change in electrolytes, BUN, creatinine

Increase in bicarb and CK levels at 16 and 24 hrs, increase lactate after event that was gone at 16 hrs, elevated troponin 0.6 in one

A dart to the heart produces ventricular fibrillation in pigs…

…only a TINY probability in humans

The ACC has stated that the pig model is insufficiently similar to humans to extrapolate the results

The NEW ENGLAND JOURNAL of MEDICINE

CORRESPONDENCE

◂ Previous Volume 353:958-959 September 1, 2005 Number 9 Ne

Ventricular Fibrillation after Stun-Gun Discharge

Since this article has no abstract, we have provided an extract of the first 100 words of the full text and any section headings.

To the Editor: The question of the safety of the use of "stun guns" by law-enforcement agencies has been raised in the news.[1] Deaths after discharges from such devices (Tasers) have been reported, although no definite causative link between death and the use of a stun gun has been made.[2,3]

An adolescent was subdued with a Taser stun gun and subsequently collapsed. Paramedics found the adolescent to be in ventricular fibrillation (Figure 1A) and began performing cardiopulmonary resuscitation within two minutes after the collapse. After four shocks and the administration of epinephrine, atropine, and . . . *[Full Text of this Article]*

October 2006 PEC

Taser-related deaths

75 cases, 37 with autopsy

- *All men, 18 – 50 y/o*
- *54% CV disease*
- *Illegal drugs 78%*
- *Agitated delirium 76%*
- *Taser-related death in 25% though restraints played role*

Physiology

Oxygen -> lungs -> alveoli -> blood

Oxygen

muscles + organs

Oxygen

cells

Oxygen
+
Glucose

energy

CO_2

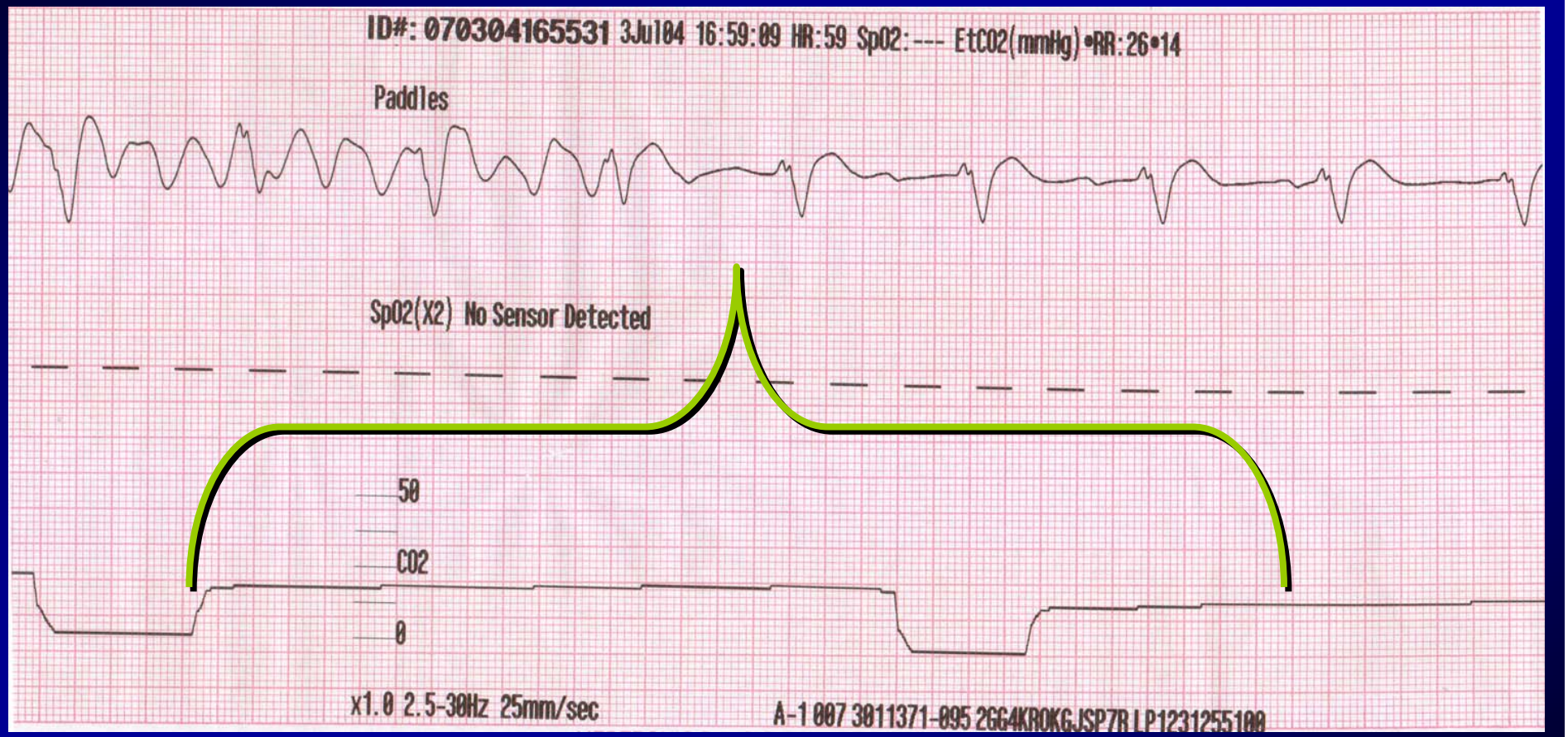
blood

CO_2

lungs

CO_2

breath


ID#: 070304165531 3Jul04 16:59:09 HR:59 SpO2:--- EtCO2(mmHg) •RR:26•14
Paddles
SpO2(X2) No Sensor Detected
50
CO2
0
x1.0 2.5-30Hz 25mm/sec
A-1 007 3011371-095 2GG4KROKGJSP7RLP1231255100

1: Forensic Sci Int. 2006 Aug 10;161(1):20-30. Epub 2005 Nov 14.

Acidosis, lactate, electrolytes, muscle enzymes, and other factors in the blood of Sus scrofa following repeated TASER exposures.

Jauchem JR, Sherry CJ, Fines DA, Cook MC.

Air Force Research Laboratory, Human Effectiveness Directorate, Directed Energy Bioeffects Division, Brooks City-Base, Texas 78235, USA. james.jauchem@brooks.af.mil

Repeated exposure to electro-muscular incapacitating devices could result in repetitive, sustained muscle contraction, with little or no muscle recovery period. Therefore, rhabdomyolysis and other physiological responses, including acidosis, hyperkalaemia, and altered levels of muscle enzymes in the blood, would be likely to occur. Experiments were performed to investigate effects of repeated exposures of TASER International's Advanced TASER X26 on muscle contraction and resultant changes in blood factors in an anaesthetized swine model. A total of 10 animals were used. Six swine were exposed for 5 s, followed by a 5-s period of no exposure, repeatedly for 3 min. (In five of the animals, after a 1-h delay, a second 3-min exposure period was added.) The remaining four animals were used for an additional pilot study. All four limbs of each animal exhibited contraction even though the electrodes were positioned in areas at some distances from the limbs. The degree of muscle contraction generated during the second exposure period was significantly lower than that in the first exposure series. This finding was consistent with previous studies showing that prolonged activity in skeletal muscle will eventually result in a decline of force production. There were some similarities in blood sample changes in the current experiments with previous studies of muscular exercise. Thus problems concerning biological effects of repeated TASER exposures may be related, not directly to the "electric output" per se, but rather to the resulting contraction of muscles (and related interruption of respiration) and subsequent sequelae. Transient increases in hematocrit, potassium, and sodium were consistent with previous reports in the literature dealing with studies of muscle stimulation or exercise. It is doubtful that these short-term elevations would have any serious health consequences in a healthy individual. Blood pH was significantly decreased for 1h following exposure, but subsequently returned toward a normal level. Leg muscle contractions and decreases in respiration each appeared to contribute to the acidosis. Lactate was highly elevated, with a slow return (time course greater than 1 h) to baseline. Other investigators have reported profound metabolic acidosis during restraint-associated cardiac arrest. Since restraint often occurs immediately after TASER exposure, this issue should be considered in further development of deployment concepts. On the basis of the results of the current studies, the repeated use of electro-muscular incapacitating devices in a short period of time is, at least, feasible, with the caveat that some medical monitoring of subjects may be required (to observe factors such as lactate and acidosis).

1: J Am Coll Cardiol. 2006 Aug 15;48(4):805-11. Epub 2006 Jul 25.

Comment in:
J Am Coll Cardiol. 2007 Feb 13;49(6):731-2; author reply 732-3.

Effects of cocaine intoxication on the threshold for stun gun induction of ventricular fibrillation.

Lakkireddy D, **Wallick D**, **Ryschon K**, **Chung MK**, **Butany J**, **Martin D**, **Saliba W**, **Kowalewski W**, **Natale A**, **Tchou PJ**.

Cleveland Clinic Foundation, Cleveland, Ohio, USA.

OBJECTIVES: This study sought to assess cocaine's effects on Taser-induced ventricular fibrillation (VF) threshold in a pig model. BACKGROUND: Stun guns are increasingly used by law enforcement officials to restrain violent subjects, who are frequently intoxicated with cocaine and other drugs of abuse. The interaction of cocaine and the stun gun on VF induction is unknown. METHODS: We tested five adult pigs using a custom device built to deliver multiples of standard neuromuscular incapacitating (NMI) discharge that matched the waveform of a commercially available electrical stun gun (Taser X-26, Taser International, Scottsdale, Arizona). The NMI discharges were applied in a step-up and step-down fashion at 5 body locations. End points included determination of maximum safe multiple, minimum VF-inducing multiple, and ventricular fibrillation threshold (VFT) before and after cocaine infusion. RESULTS: Standard NMI discharges (x1) did not cause VF at any of the 5 locations before or after cocaine infusion. The maximum safe multiple, minimum VF-inducing multiple, and VFT of NMI application increased with increasing electrode distance from the heart. There was a 1.5- to 2-fold increase in these values at each position after cocaine infusion, suggesting decreased cardiac vulnerability for VF. Cocaine increased the required strength of NMI discharge that caused 2:1 or 3:1 ventricular capture ratios at all of the positions. No significant changes in creatine kinase-MB and troponin-I were seen. CONCLUSIONS: Cocaine increased the VFT of NMI discharges at all dart locations tested and reduced cardiac vulnerability to VF. The application of cocaine increased the safety margin by 50% to 100% above the baseline safety margin.

PMID: 16904553 [PubMed - indexed for MEDLINE]

Barb Removal:

Paramedics are qualified (as are most people)

Beware of face, hands, feet, and genitalia

1: Cl

Perfora

Chen S

This rep
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PMID: 1

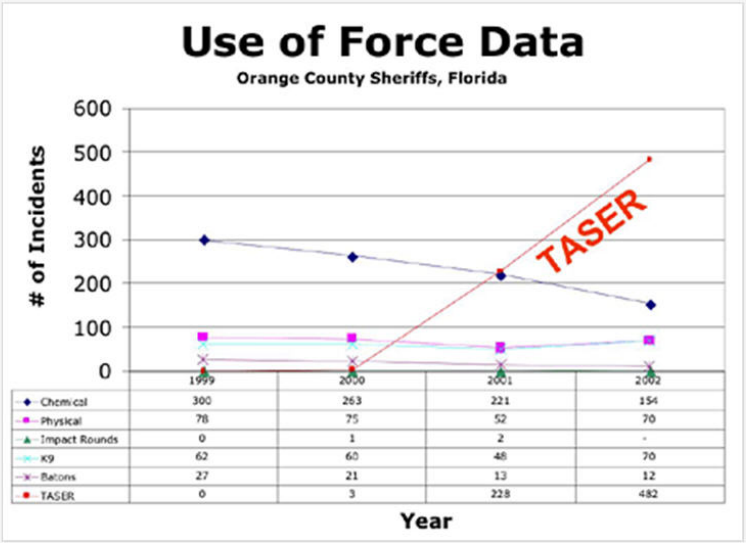
Taser dart to the eye produces a terrible result

"Vitreoretinopathy"

Be careful to avoid the eyes

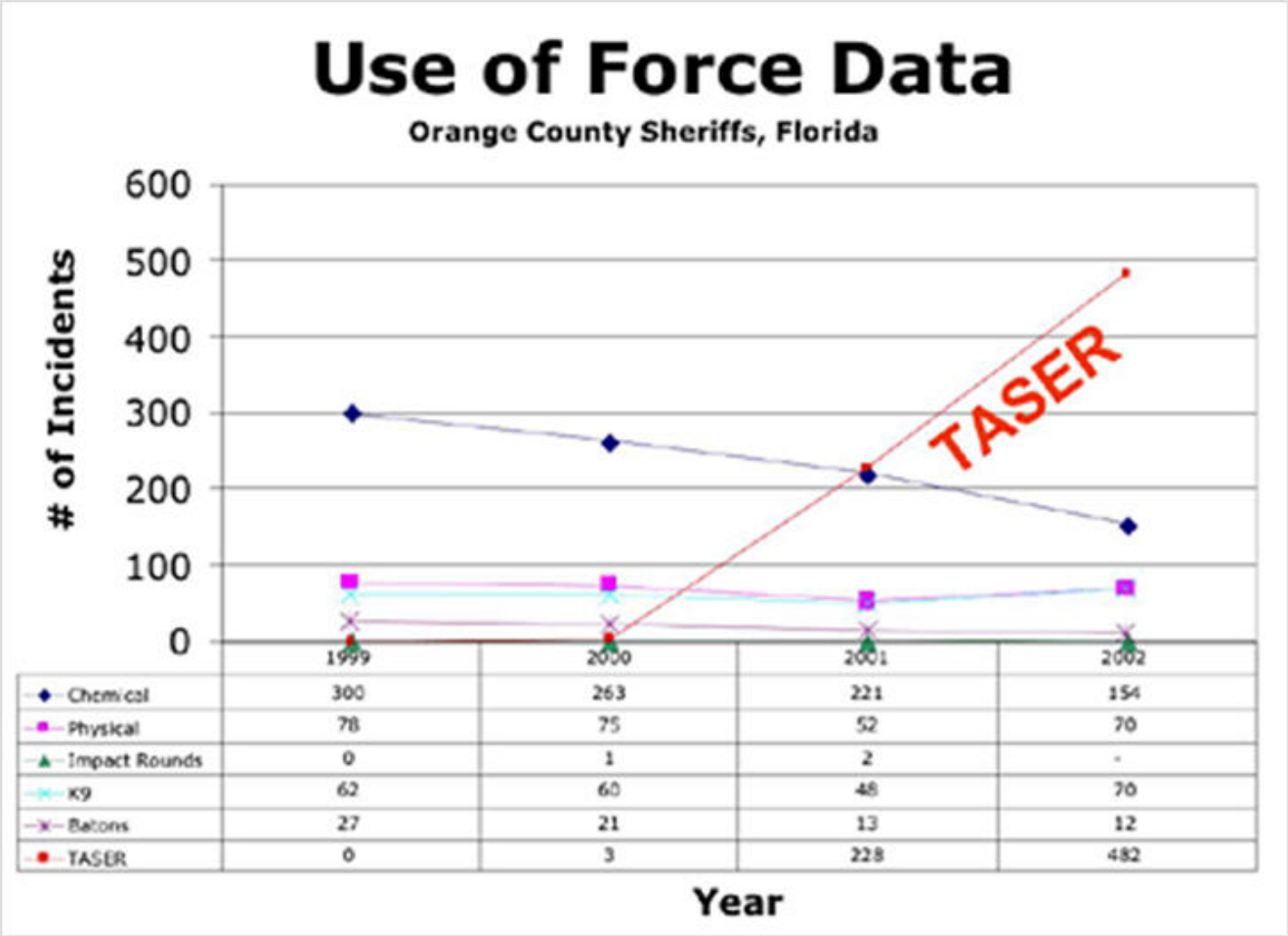
At what point is the sedated A.D. patient safe to be around?

Safety for Public Safety



	1999	2000	2001	2002
Chemical	300	263	221	154
Physical	78	75	52	70
Impact Rounds	0	1	2	-
K9	62	60	48	70
Batons	27	21	13	12
TASER	0	3	228	482

BENEFITS—Deputies at the Orange County Sheriffs Office in Florida have found the TASER® energy weapon to be so effective, they deploy TASER devices over 3 times more often than chemical sprays. In fact, since the TASER devices were first deployed, pepper spray deployments have dropped by 50%, and lethal force incidents have fallen by 78%.



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1: J Clin Forensic Med. 2006 Jul;13(5):229-41. Epub 2006 Jan 25.

Dramatic lowering of Officer injury rates with TASER over spray and baton

CS spray and baton use. Subject injury rates were lower in M26 deployment than in deployment of CS spray, batons or police dogs. We suggest that the M26 should be made more widely available to police officers in the UK.

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Is that a reasonable way to judge a portion of the impact of the implementation of these devices?

Absolutely

Video 5
Dog

Video 6
Bull

GET YOUR OWN PERSONAL TASER

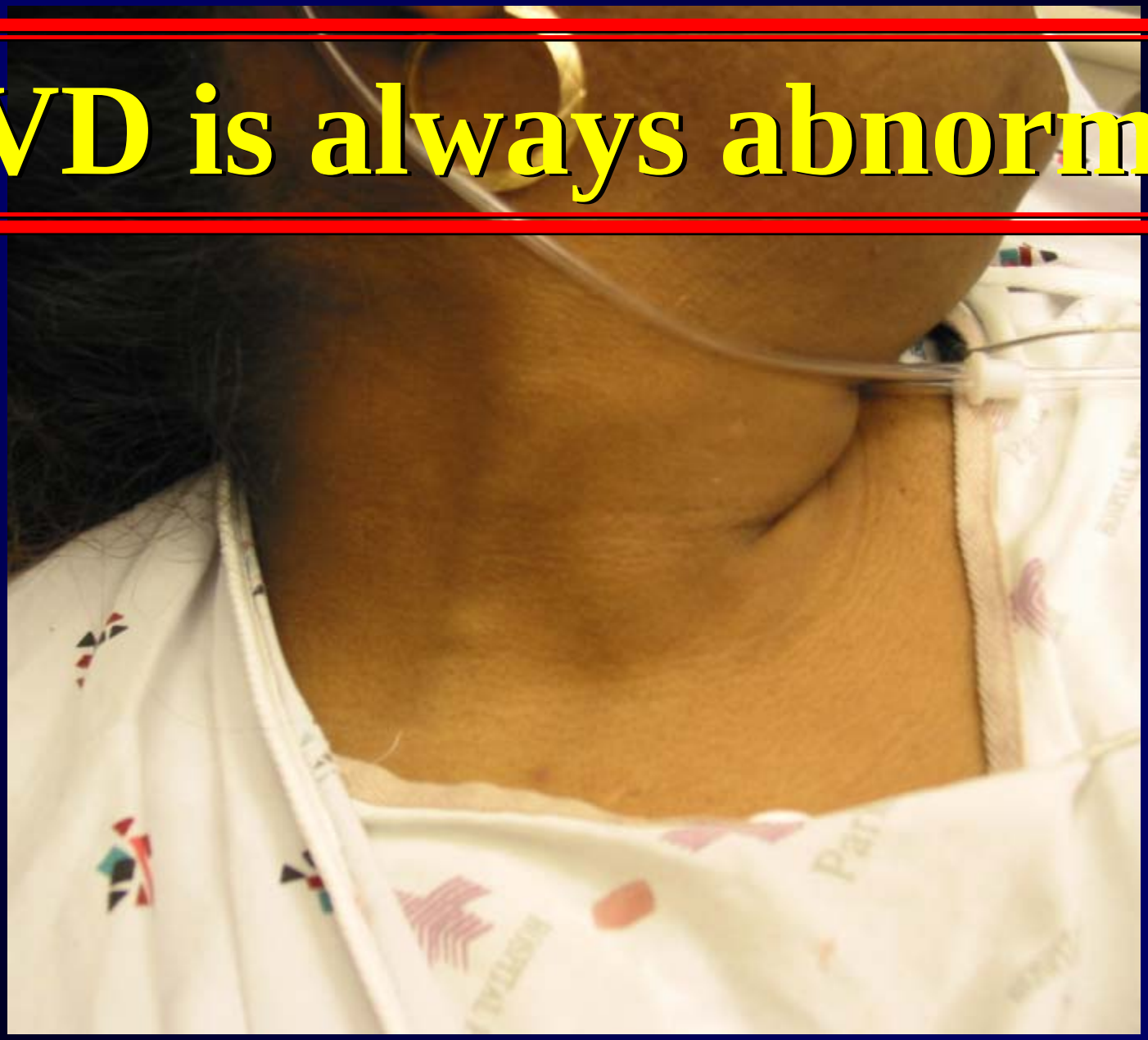
The wo tronics
convention Las Vegas

Typically co hing things
like the la mputers
and c nt or
com ucts.
Bu s a
high-tech -defense.

Be suspicious for occult or obvious injury

…or obvious things

JVD is always abnormal



Synthesis

Our care is challenging

The requirement for professionalism in EMS continues to Grow

The scope and breadth of your practice will be limited only by your imagination

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