Defending Non-Firearm Arrest-Related Death Incidents

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Introduction

There are significant differences between the scientific and causal issues with a firearm and a *non-firearm* arrest-related death (ARD). This comes as a surprise to many defense attorneys as they tend to believe that their officers actually did something to contribute to the death. In a firearm ARD there is generally no question of causation as the officer's bullets are usually found in the subject's body. In those cases, the defense force standards usually revolve around the seminal cases *Tennessee v Garner (1985)*, *Graham v Connor (1989)*, *Scott v. Harris* (2007), and their progeny.

Under 42 U.S.C. § 1983 qualified immunity principles, in a Fourth Amendment seizure (force) context, law enforcement officers are protected from civil liability, unless they are plainly incompetent or knowingly violate the law. Officers can be found liable when they violate a federal statutory or constitutional right, and the unlawfulness of their conduct was clearly established at the time of the incident. "Clearly established" means that, at the time of the officers' conduct, the law was sufficiently clear that every reasonable officer would know and understand that what they were doing was a violation and beyond debate. The rule's contours must be so well defined that it is clear to a reasonable officer that the conduct was unlawful in the situation he confronted. The criminal counterpart to 42 U.S.C. § 1983 is 18 U.S.C. § 242, which raises the officer's conduct to "willful", rather than "knowing."

With a *firearm* ARD there is typically no fact or expert issues of causation, other than details such as bullet trajectories and locations of injuries. While plaintiffs are supposed to prove that officers were plainly incompetent or knowingly violated the clearly established law, they often argue only that officers did something that appeared to be dangerously wrong. Conversely, in *non-firearm* ARD cases, there is usually no officer action that can be scientifically linked to the subject's death

The lingering existence of various non-firearm ARD causation theories, such as electrocution or asphyxia, is prolonged by an unspoken — and unsupported — hypothesis: that an ARD must be caused by officers' mistakes since the theory often advanced is that ARD subjects are presumed clinically "normal" and would not have died absent the actions of law enforcement. This is simply not so. For example, Williams studied 300 U.S. non-firearm ARDs and found that 55% of the subjects had (largely "subclinical" or previously undiagnosed) heart disease at autopsy.[1] The dominating reality is that healthy and sober members of society do not tend to resist the lawful commands of law enforcement: statistical data from two U.S. studies illustrated that 79% of force recipients have a history of mental illness or substance abuse, 66% have a documented history of mental illness, and 71% have drugs in their urine.[2,3] A large Canadian forceful-seizure study found that 82% of the subjects were being affected by alcohol, drugs, or emotional disturbance.[4] Although alcohol and drug intoxication have obvious risks for sudden death, the risks of emotional disturbance are often overlooked. In an autopsy study of 110 sudden unexpected cardiac deaths, after extreme physical or psychological stress, Krexi found that 53% had a "negative" autopsy (no pathological findings) and a morphologically normal heart (appearing normal to the pathologist's naked eye).[5] Interestingly, she also found that only 11 members (10%) of the cohort had any law enforcement contact.

Additionally, other plausible mechanisms of ARDs are often not revealed until the defense funds expensive genetic testing commonly referred to as a "molecular autopsy" in the case of an otherwise negative autopsy.[6-8] The non-firearm ARD rate is about 1 death in 1000 force incidents, which is remarkably low considering the co-morbidities found in about 90% of subjects.[8] In U.S. jails the death rate is 1 in 671 inmates.[9] In fact, these fatality rates are comparable with that of general anesthesia. Such deaths are also very uncommon as there is about 1 use of force in 1100 officer-civilian encounters, which yields less than 1 ARD per 1 million officer-civilian encounters, With the advent of the Conducted Electrical Weapon (CEW), this temporal death rate has fallen by 2/3 to about 1/3000 uses of force.[10]

The reality is that the defendant officers (in most incidents) actually did nothing to materially contribute to the subject's death beyond what they had to do to control the subject to fulfill their duties. Yet, instances of bad case law resulting from courts allowing unqualified "experts" to give causation opinions without basic knowledge of biomedical science (aka biophysics) sometimes lead to more erroneous findings against officers. Such experts are rarely fluent in the peer-reviewed scientific literature. This lack of understanding also in some cases drives incorrect cause of death opinions from the local medical examiner (ME).

Non-Firearm Arrest-Related Death: What Is Known and Unknown

Why do some people die resisting law enforcement officers? In many incidents we may never know. As observed, the majority of the subjects are found to have visible (structural) heart disease at autopsy. A large fraction of them also have invisible genetic abnormalities that made them prone to a fatal arrhythmia at time of stress. Other unrecognized contributors may require highly specialized experts, such as a cardiac pathologist, medical toxicologist, or neurologist.

Multiple studies show that 30-50% of sudden death in young people is unexplained by a conventional autopsy.[5,11] In these unexplained cases, a genetic abnormality is later seen about 27% of the time.[12] Eckart found that 35% of military recruit non-traumatic training deaths (1 death in 7692 recruits) were unexplained.[5,13] The Eckart numbers are impressive considering that the subjects were young, drug and alcohol free, and undergoing the same well-documented exercise routines as their colleagues who did not die.

In contrast to the objective scientific facts, plaintiffs' theories are often rather simple and designed to appeal to the lay emotions, unscientific intuitions, or false equivalencies of the jury. Unfortunately, this unscientific rhetoric can appeal to the emotion of MEs and judges as most deal with one such case in their careers. The most common plaintiffs' theories are sometimes informally known as "killer knees" and "tasecution." The "killer knee" theory suggests that the prone restraint of the subject prevented breathing, so the subject was asphyxiated. This fallacy has been refuted by numerous studies but keeps appearing every few years under a different name. The "tasecution" theory is that the officer electrocuted the subject with his CEW; the moniker comes from the bestselling brand of the 7 manufacturers. This theory is really just an urban myth. Although electrical weapons have indirectly contributed to deaths by causing falls and igniting fires, as of this writing, they have never been conclusively established to have electrocuted anyone.[14-16]

Killer Knees: Flavors of Asphyxia

Compression (aka mechanical) asphyxia is a real phenomenon and has resulted in many deaths. This is not controversial. Compression or crush asphyxia has caused death from soft-drink (soda) vending machine tipping, building collapse, vehicle accidents, crowd collapse, and trench cave-ins.[17,18] A fully-loaded soda vending machine weighs up to 500 kg (1100 lbs.), with most of the mass in the top, and such a load can kill an adult human. Most of the published fatal chest compression cases involve the mass of a car or tractor typically over a ton (> 1000 kg) compressing the torso.

What is largely debunked now, is the misapplication of this to ARDs. In the U.S. alone there are about 800 cases of non-firearm ARDs annually and in some cases the subject expired after officers used controlling pressure on the back during and after restraint.[19] Hence, there has been a *legal* debate about the potential for officers to be able to cause fatal compression asphyxia with their body weights and downward pressure. Note: there is no *scientific*

debate. The opinion differences are between the scientific researchers and a minority of MEs that cling to their intuitions, and often point to unreliable case reports and case series.



Figure1. The human chest can handle a surprising amount of weight.

Historical records exist of judicial "pressing" or the application of chest mass for arraignment or execution.[20] These records of judicial pressing show that about 270 kg (600 lbs.) is required to cause death. A biomechanical ribcage model predicts that an adult male requires at least 260 ± 26 kg (572 ± 57 lbs.) of static chest mass to cause flail chest, which could cause a true compression fatality. In the law enforcement context, this is highly unlikely as there is simply insufficient real estate for 2 or 3 officers to stand on someone's back. Do not confuse this *chest-weight* issue with *abdominal weight* which might be more dangerous.

Prone and Positional Asphyxia

People have died from positional asphyxia. Perhaps the most common form of this is people trapped upside down in a car for long periods of time.[21,22] This concept also has been carried over and misapplied in an attempt to blame the prone position for ARDs.[23]

There have been multiple large epidemiological studies covering 1000s of forceful seizures that have shown no increased risk with prone restraint.[4,24] In fact, researchers are now arguing that the prone position is *preferred* as it leads to increased control and decreased subject and officer injury risks. Figure 2 depicts a study in which volunteers were restrained in a prone position while breathing thru instrumentation. There was no clinically significant reduction in breathing capability.[25]

Parkes studied breathing by seated individuals forced to lean forward.[26] The only clinically significant respiratory reduction was with *obese* subjects — forced to lean forward — as their abdominal mass interfered with diaphragmatic breathing. This is the only true possibility of a positional asphyxia problem with restraint.



Figure 2. Maximally restrained prone subjects with 225 lbs. on the back.

Junk Science Under Different Names

There are generally 3 intuitively appealing and often accepted false asphyxia theories for ARDs: compression asphyxia, restraint asphyxia, and positional (prone) asphyxia. They are basically 3 flavors of the same fundamental theory and they are all soundly refuted by the greater weight of the accepted peer-reviewed literature.[4,24,27-32]

Some continue to preach the anachronistic myth that prone positioning interferes with breathing. No matter how many studies have refuted this, it continues to be brought up. Of course, experts that raise this issue, do so without citations to methodologically reliable scientific literature as none support this outdated hypothesis.

Some experts sometimes preach, without objective evidence, "the straw that broke the camel's back." Meaning, the officers did all of this force to the subject, then put their weight on him, and this was the "straw that broke the camel's back" causing the subject's death. This is nothing more than the *post hoc ergo propter hoc* (Latin: "after this, therefore because of this") informal logical fallacy that is methodologically unreliable in establishing general or specific causation.

"Positional asphyxia" or "restraint asphyxia," the theories most frequently alleged, are terms often used synonymously for ARDs. The ARD theory of "positional asphyxia" was first promoted by Reay from 1988 to 1993.[33-35] A group at the University of California San Diego (UCSD) then did a number of laboratory studies which tended to refute the notion of positional asphyxia.[36-38] After the UCSD papers, Reay recanted his earlier positions and the term was replaced with the apparently more blameworthy phrase "restraint asphyxia," which is often used in exactly the same way, and should be considered to have the same meaning.[37-40]

UCSD continued to study and refute various flavors of ARD "asphyxia" theories.[39,41,42] In 2007, Michaelwitz (UCSD) investigated the ventilatory and metabolic demands in healthy adults who had been placed in the prone maximal restraint position (PMRP or "hogtied").[25] Maximal voluntary ventilation (MVV) was measured in seated subjects in the PMRP (hogtied), and when prone with up to 102 kg (225 lbs.) of weight on their backs. MVV with full weight on their backs was 70% of the seated value meaning that they maintained essentially all of their reserve and still had a 24:1 safety margin compared to the amount of ventilation required to survive.

In 2014, Sloane measured the ventilatory and cardiovascular parameters in 10 intensely exercising (85% of VO_2 max) *obese* volunteers who were placed in PMRP after exercising and then studied while in different positions for 15 minutes: seated with hands behind the back, prone with arms to the sides, and PMRP position.[28] Cardiovascular parameters (oxygenation, stroke volume, inferior vena cava diameter, cardiac output, and cardiac index) were measured. There was no evidence of hypoxia or hypoventilation during any of the monitored 15-minute position periods.

More recently, the authors of this paper showed that it takes about 260 kg (572 lbs.) of chest weight to kill someone (180 kg or 400 lbs. with very-long durations), while the typical force of an officer's knee is 33 kg (72 lbs.)[43-46]

Field experience is consistent with the above clinical studies. In 2012, Hall published her epidemiological study using data from a large Canadian police organization with 1269 uses of force (out of 1.6 million total police-public interactions).[47] The final resting position was almost evenly split with 48 in prone positions and 52% in a non-prone position. There was 1 death, and that occurred in a subject *not* in the prone position. The authors concluded "prone positioning was common and was not associated with death." In 2015, Hall published her further study reporting 4828 consecutive force events (3.25+ million consecutive police-public interactions) in 7 police agencies in 4 cities, concluding that their data supported the human laboratory data that the prone position has no clinically significant effects on subject physiology.[4] Ross and Hazlett (2016) conducted a prospective study examining 1085 violent arrests (out of 876,503 calls for service, resulting in 110,173 arrests) occurring over a 1-year period in 17 different law enforcement jurisdictions across the U.S.[24] Officers placed all of the subjects in the prone position for 1-5 minutes; forcible measures were used to get them prone in 71% of cases. Handcuffs were used in 96% of the incidents and were first applied when the subject was prone in ¼ of the incidents. Hobble restraints were used in about ¼ of the incidents. No deaths were recorded during the study and only 1 fracture occurred. The authors concluded "the use of prone position with violent arrestees is a safe restraint method."

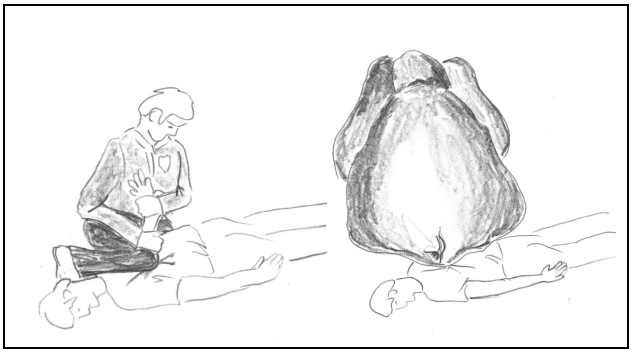


Figure 3. Reality vs Plaintiffs' Picture of Prone Restraint

Positional asphyxia, as the term is often used in court today, is a scientifically invalid hypothesis because it is unsupported by any experimental data. Those who inappropriately accept the theory of positional or restraint asphyxia in the law-enforcement context assume that prone positioning is clearly harmful, even though all of the available peer-reviewed methodologically reliable evidence suggests the opposite. It also stands refuted by the fact that about 50 million Americans sleep on their

stomachs (prone). Contrary to the myth of the "recovery" position, the best thing for patients in respiratory arrest is the prone position; this has been demonstrated in numerous clinical studies.[48-54] This is an example of a disconnect between the law and science.

It is extremely unlikely that an individual's body weight, alone could kill a prone subject unless the subject was quite small and the struggle required unusual restraint force.

There are outlier cases that sometimes lead to troublesome case law. An example is *Abdullahi v. City of Madison*, 423 F.3d 763 (7th Cir. 2005), where the 7th Circuit assessed the reasonableness of officers' actions in response to a violent subject who had gotten into a fight with a good Samaritan and was subsequently violent towards officers. The officers took the subject to the ground, where an officer held the subject's right thigh and ankle, and a second officer placed his knee and shin on the subject's back and shoulder area. The officer applying pressure on the subject's back acknowledged that he continually increased the pressure on the subject's back until he stopped arching his back upward. Thereafter, officers were able to handcuff the subject in the prone position. Officers soon realized that the subject was nonresponsive and ultimately died 2.5 minutes after the officers had taken him to the ground. Testifying physicians all agreed that the subject died of crushing trauma to the chest and neck along with a collapsed left lung.

A critical issue in the case turned on the amount of force the officer applied to the subject's neck and back. The Court found that in taking the evidence in the light most helpful to plaintiff, given the evidence that the officer used enough force to crush the chest cavity, collapse his left lung and inflict severe trauma on the neck, there was a genuine issue of material fact concerning how much force the officer used.

With body-worn cameras (BWCs), we expect fewer such cases as there will be minimal mystery as to exactly what happened and for how long.

The "Recovery Position" Myth

A recurring plaintiffs' allegation is that the use of the so-called "recovery" or left-sided decubitus (LLD) position would have saved a decedent's life. This position has been long-taught in basic life-support courses for an unconscious but breathing patient; even that application is controversial and regardless it has little to do with the ARD. This erroneous belief is based on a 140-year old anecdote. British physician Robert Bowles claimed he healed a 67-year old female unconscious stroke patient by rolling her on her left side.[55,56] After Bowles published this in 1881, it caught on but has received minimal scientific research support. A proposed benefit of the LLD position is that an unconscious patient will be less likely to aspirate possible vomit. Yet, a recent study suggested that the LLD position be dropped since it makes it harder to monitor a subject's breathing and this delays resuscitation.[57]

"Left Lateral Decubitus" is a mouthful so the simple lay-term "recovery" position was adopted for first-responder training. This unfortunately led some to falsely believe that there actually is some sort of *recovery* occurring during this positioning. There is not. This anatomical position only reduces the risk of airway blockage from vomiting. There is no evidence that ventilation or respiration is improved versus a prone or supine position. In fact, pulmonary function tends to be compromised with the LLD.[58,59] Hemodynamic function may also be compromised in those with heart failure.[60] Despite the mistaken belief that the LLD position somehow magically improves outcomes, subjects often contemporaneously die in this position. Contrary to the myth of the "recovery" position, the optimal position for patients in respiratory arrest appears to be the prone position.[48-54] It is truly impressive that this ancient anecdote from 140 years ago continues to contaminate our use-of-force litigation.

Electrocution

There are currently 7 brands of electrical weapons sold world-wide, but the dominant brand used in the U.S., Canada, and the United Kingdom is the TASER® brand manufactured by Axon Enterprise, Inc. formerly TASER International, Inc. All present TASER brand CEWs deliver less than 2 watts (W) of power which is significantly less than the 5-7 W allowed by the Underwriters Laboratories (UL) electric fence standard, such that CEW-induced electrocution is not expected.[61] The UL limit depends on the stimulus pulse width and is 5 W for a 100 microsecond (μs) pulse (applies to the X26P CEW) but 7 W for the shorter 45 μs pulse of the

newer T7 CEW. Modern CEWs even satisfy the more conservative IEC (International Electrotechnical Commission) and European (Cenelec) 2.5 W limit.[62-64] Note: there are CEWs sold in other countries that do not satisfy the electric fence standards.[65] Were a CEW ever to be reliably proven to have caused death by electrocution, millions of miles of electric fences would likely need to be removed from gardens and agricultural businesses worldwide

There is also an electrical standard designed specifically for the CEW: ANSI CPLSO-17.[66] It requires certain minimum outputs for incapacitation effectiveness and has maximum limits for cardiac-stimulation safety. All modern, (since 2003) TASER brand CEWs satisfy this standard.

The typical effects of various AC (alternating) currents are shown in Table 1. The 1.8 milliampere (mA) of pulsed DC (aggregate) current (for the TASER® X2 CEW) is equivalent to 16 mA of AC which is substantially lower than the 40 mA IEC safety limit for households including children.[67] Present CEWs — sold in North America — thus satisfy all relevant electrical safety standards in the world.[68,69]

Table 1. AC Currents and Their Typical Effects.

AC Current (mA)	Effect
1500	Nerve Damage
1000	
500	Cardiac Arrest Probable
200	
100	Cardiac Arrest Possible
50	Interference w Breathing
20	
16	Modern CEW (AC Equivalent)
15	Male No-let-go threshold
10	Muscle Contractions Begin
5	Pain Sensation
1	Hand Perception

A limitation, with applying electrical safety standards, is they are largely based on *external* skin contact. While the heart is very well shielded by the thoracic cage, (see **Error! Reference source not found.**) it is very close to the skin in the 4th or 5th left intercostal (between ribs) spaces with a distance as little as 10 millimeters (mm) from the heart (right ventricle) to the skin surface in a very thin adult.[70-72]

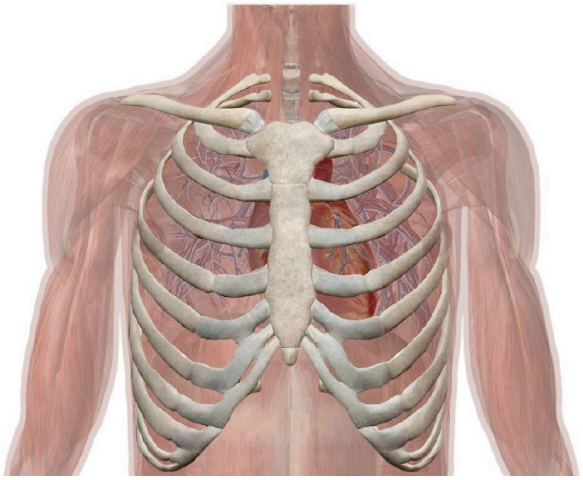


Figure 4. Human chest medical illustration.

Hence, the electrical safety standards set an upper bound of ≈ 10 mm for the DTH (dart to heart distance) for electrocution. Therefore, a CEW dart penetrating the skin directly over the right ventricle in a very thin subject, could theoretically electrocute even while satisfying these safety standards if the dart was nearly touching the ventricular epicardium. For this reason, the relevant animal and human testing focuses on the critical DTH for the tip of the CEW dart.

Animals to Anecdotes

Some very small swine have had VF induced (be electrocuted) with a CEW probe very close to the heart.[73] These studies demonstrate that the theoretical risk of electrocution is confined to very small or very thin humans. Walcott et al. showed that swine are 3 times as sensitive to electrical current as humans.[74] The largest swine which was electrocuted by a CEW, was reported by Valentino et al and weighed 36 kg.[75] The levels of dangerous currents scale with body mass just like most drug dosages. Thus, the best evidence suggests that the risk of CEW electrocution is limited to humans with a body mass under 21 kg (46 lbs.).

The critical DTH in humans (≈ 4 mm) is also far less than that in swine for the same reasons.[76] Because of the human anatomy, this is very unlikely in a normal adult but theoretically possible in very small children. A prospective study of CEW usage in minors (by age) found no complications beyond probe punctures.[77]

Human Cardiac Clinical Studies.

There have been 66 humans monitored continuously during a discharge with precordial CEW probes. There was no VF induction but a single case of asymptomatic cardiac pacing in 2009 that the subject was unaware of and suffered no injury. That was with an experimental prototype CEW which was never manufactured.[78-80] (There are many more published clinical studies that did not involve probes directly over the heart during monitoring.)

Creative Plaintiffs' Theories

Since modern CEWs satisfy all relevant world electrical safety standards, plaintiffs have become creative in their causation arguments.

A common theory is that the safety standards do not apply since there were many trigger pulls of the CEW. This is easily refuted by going to the standards which generally do not provide any time limits.[81] Over a century of electrocution research has established that electricity almost always kills in seconds, if at all. It does not build up like poison.[82]

A related causation theory holds that the safety standards do not apply since the decedent had drugs on board. This is easily refuted by going to the standards which do not recognize any adjustments for illegal drugs.[81] Electricity is a stand-alone cause of death and does not combine with drugs like a soup recipe.[82]

There have also been proposed hypotheses for electrocution that do not involve the induction of VF including fatal acidosis induced by muscle contractions and induced respiratory arrest.[83] Over a century of electrocution research has never demonstrated a single death from electrically-induced acidosis from muscle contractions. The acidosis theory was popular in the late 1800s but Jones questioned this based on witnessed human accidents in 1895.[84] Oliver and Bolam then did animal experiments which showed that electrocution was due to an immediate cardiac arrest(1898 paper).[85] Fatal acidosis *from respiratory arrest* was demonstrated by Cunningham in the 1890s in dogs but only with 10 minutes of continuous currents just below those required for VF.[86] This is irrelevant to CEWs since they do not cause respiratory arrest.[87-91]

A more curious hypothesis was that the muscle contractions could cause a delayed death from rhabdomyolysis and subsequent acute kidney failure. This has been refuted with numerous clinical studies showing no meaningful increases in myoglobin or creatine kinase.[92] A death from rhabdomyolysis would also take several days.

Table 2. Diagnosis of electrocution by CEW. Each criterion must be satisfied.

Criterion:	**Notes:**
Presenting rhythm is VF.[93]	Asystole and PEA are not inducible.[93]
DTH is ≤ 4 mm.[96]	The critical DTH is 5.8 ± 2.1 mm in swine.[96]
No documented pulse after CEW application.	When a pulse is detected, this has a 95% accuracy.[97,98]
Cessation of normal breathing within 60 seconds of CEW application.[99,100]	
Cessation of agonal breathing within 6 minutes of CEW application.[100,101]	Commonly referred to as "dying gasps" and not confused with normal breathing.
If defibrillation (up to 3 shocks) is attempted within 10 minutes (or 14 minutes with CPR) it is successful.[95]	Electrically-induced VF is defibrillated with a 90% success rate at 10 minutes with any chest compressions.[95]

Diagnosing a CEW Electrocution

Objective criteria can be given for an electrocution diagnosis in a CEW-involved incident as shown in Table 6. This has proven very helpful in dealing with plaintiffs' experts.

There are 3 basic electrocardiogram (EKG) rhythms with a cardiac arrest. The emergency-medical services' (EMS) run sheets will record this. While VF can be induced with electrical stimulation, asystole (flat line) and PEA (pulseless electrical activity) are not electrically inducible.[93]

With any chest compressions, defibrillation has a ≥ 90% success rate up to 10 minutes of electrically-induced VF — with 3 or fewer shocks.[95] Hence, the failure of prompt defibrillation exculpates an electrical cause for VF.

The best evidence suggests that electrocution in a human would require that the tip of the dart be within ≈ 4 mm (1/6 in) of the epicardium (outer part of the heart). This is not an issue with the drive-(contact or touch) stun as no dart penetrates the skin and gets sufficiently close to the heart. A probe in the sternum is considered too far away as the sternum is an insulator in adults.[71,94]

After a cardiac arrest, normal breathing ceases in 12–60 seconds.[99,100] However, some subjects will also have "agonal" breathing (dying gasps) for a maximum total of 6 minutes.[101]

Electrocution Anecdotes

There exist 12 published case reports suggesting electrocution by a CEW.[102-107] Case reports generally provide extremely weak evidence of causality because they are particularly prone to bias and are incomplete, uncontrolled, retrospective, and lack operational criteria for identifying when an adverse event has actually occurred.[108,109] This is especially true regarding the CEW since the vast majority of these were generated in litigation.[110] A total of 9 of these 12 reports involved a single retired cardiologist working as an expert for a California use-of-force plaintiffs' attorney.[104,105,110] However, in the interest of a complete analysis we will consider these case reports here.

To begin with, the demonstrated risk of even *alleged* electrocutions is vanishingly low. Only 7 of the anecdotes presented in VF. Another 2 can be eliminated as they included an incident with missed probes and another incident with a palpable pulse afterwards. Even if the 5 alleged electrocutions were legitimate, this would suggest a theoretical risk of 5 per 4 million or 1 in 800,000. See Table 3 for the 5 remaining possible cases.

Electrocution can be diagnostically eliminated in the above cases by:

1. DTH ≥ 20 mm (vs. 4 mm): 5/5
2. Failure of prompt defibrillation: 5/5
3. Breathing > 1 minute:[99,100] 3/5 (2 Unknown)

Table 3. Reported VF cases from CEW use.

Age/ Race	DTH (mm)	Breathing (minutes)	Failure of Prompt Defibrillation	Cardiac Pathology
25 B	> 20	UNK	Y	Hypertrophy, fibrosis
48 C	No penetration	UNK	Y	Long QT
17 B	Right side	4	Y	Hypertrophic cardiomyopathy
17 B	50	4	Y	None on autopsy
16 B	55	8	Y	Arrhythmogenic right-ventricular cardiomyopathy

All of the alleged VF case reports were analyzed and reported in 2013 by the Canadian Council of Science.[111] Their peer-reviewed report was produced by a deliberative panel that included numerous Canadian and U.S. experts on electrical weapons and ARD, and was extensively peer-reviewed. This panel stated, "in the field, there has not been a conclusive case of fatal ventricular fibrillation caused solely by the electrical effects of a CEW", and dismissed the controversial expert witness case series.[104] The Canadian Council report was very direct:

> The study by Zipes is particularly questionable since the author had a potential conflict of interest and used eight isolated and controversial cases as part of the analysis.

In summary, the risk of CEW-induced VF remains a theoretical concern with an extremely low probability. The risk appears to be confined to a very small or thin subject with a fully penetrating dart nearly touching the right ventricle. To date, no reported electrocution anecdote has withstood careful scrutiny.[92,112]

Your Local Medical Examiner

In about 1/3 of the cardiac arrests in the young (including athletes) the ME cannot find an anatomical cause (they have a negative autopsy). Suggestion: Do not automatically blame officers just because you cannot find an obviously bad heart. Many sudden deaths are due to genetic electrical abnormalities such as QT prolongation, which is something

the ME will not find by simply cutting the body open. Many refer to this genetic testing as the "molecular" autopsy, because the abnormality causing death is at the molecular level, not visible even with a microscope.[6]

When the Budget Does not Cover Science

Multiple studies have found that 20-30% of decedents with normal appearing hearts had lethal cardiac genetic mutations.[113-115] Note: the molecular autopsy is expensive (≈ $8000) and almost certainly the ME has no way to pay for it out of a typical $600 autopsy budget. Yet without this testing, the autopsy is incomplete, leaving the ME or coroner unable to accurately complete the certificate. Many, if not most, MEs are unaware of these genetic abnormalities, so they might fudge their report by including some useless temporality verbiage, such as "died while fighting with police" or died after the use of an electrical weapon (even though the shock was administered 15 minutes earlier and electrocution would cause death within seconds). As a foreseeable consequence, officers have been sued or criminally charged – so agencies should offer to pay for this testing.

Another problem is lethal cardiomyopathy (disease of the heart muscle) is typically only visible with extensive tissue samples under a microscope. Forensic pathology residencies do not require any special training in heart disease, or an ME may write off obvious cardiac abnormalities because they are simply ignorant of their significance or did not notice them with the naked eye. For example, an enlarged heart greatly increases the probability of sudden cardiac death, but not all MEs appreciate that or even know how to properly examine the heart. A cardiac pathologist consult is highly recommended with an ARD.

Manner of Death

The Manner of Death (MOD) opinion (fatuously called a 'ruling") began with 1194 English law. If the person died by suicide, the inheritance tax was 100%, while an accidental or natural death meant the inheritance tax was 0%. If it was a homicide, then the crown got 100% of the murderer's estate. The Crown's inheritance-tax ruler was the "crowner," which became the "coroner." The MOD is selected from the following causes:

1. Natural
2. Accidental
3. Undetermined
4. Homicide
5. Suicide

Unfortunately, most courts do consider a MOD opinion to be a "ruling" and is non-appealable in most states. There appears to be no appreciation of the arbitrary nature of the application of this hangover from an 800-year old English inheritance tax law. Multiple studies of MOD opinions, often by MEs themselves, show that they are quite subjective and variable.[116-121] The MOD can be biased by the years of experience, residence, and even the religion of the ME. If the decedent was naked, the ME is more likely to opine that the death was a homicide.[122]

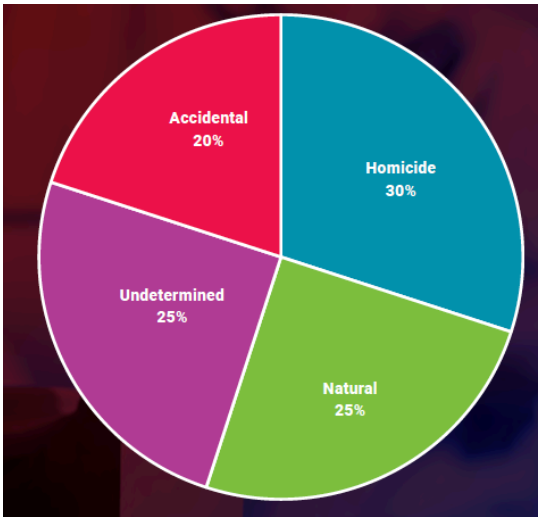


Figure 5. Non-Firearm ARD MOD rulings.

Trying to determine a MOD for an ARD victim — without a molecular autopsy — is not much different than trying to diagnose a heroin overdose without drug testing. In both cases, the ME is being asked to rule with an incomplete autopsy. For these reasons, many MEs are uncomfortable and simply unqualified to make these rulings, especially by methodologically reliable means to appropriate degrees of scientific certainty. However, they are required by law to do so in most states. Darrell Ross has reported on the non-firearm ARD MOD rulings and found that they are indeed fairly arbitrary and random.[123] This is seen in Figure 5.

Each and every MOD opinion can be somewhat rationalized:

1. **Natural:** The guy had a bad heart from years of drug abuse and it finally gave out with the excitement of being seized. This could just as well have happened during sex or while climbing the stairs.
2. **Accidental:** The guy did not realize that this "recreational" dosage of cocaine or meth would kill him therefore it is an accident.
3. **Homicide:** Officers touched him, or were present, therefore it was death "at the hands of another." (Weird how the paramedics, medical doctors, or nurses are never criminally charged under similar circumstances.)
4. **Undetermined:** There are so many pathological insults going on that we cannot pick out a single MOD. (This is often the honest answer.)
5. **Suicide:** Rarely ruled in ARDs.

Drug dealers get breaks that officers do not. Consider a California court ruling which can be paraphrased as follows:

1. Consider a chronic cocaine user with multiple cardiac abnormalities who has a plaque rupture completely occluding a coronary artery and dies during a dream. The ME can call it a *natural* death, even though it was ultimately caused by the chronic cocaine use.

2. On the other hand, if the cocaine user, goes to a party, accepts a few lines of cocaine, which leads to a cardiac arrest, it is an *accidental* death. It was not considered *homicide* even though another person was responsible for the death.

Just in case you thought things could not really be this arbitrary, consider the NAME (National Association of Medical Examiners) guidelines 16 and 21 for MOD with police versus physician involvement: [124]

16. Deaths due to positional restraint induced by law enforcement personnel or to choke holds or other measures to subdue may be classified as Homicide. In such cases, there may not be intent to kill, but the death results from one or more intentional, volitional, potentially harmful acts directed at the decedent (without consent, of course). Further, there is some value to the homicide classification toward reducing the public perception that a "cover up" is being perpetrated by the death investigation agency.

21. Deaths resulting from grossly negligent medical care (such as inducing anesthesia without resuscitative equipment/supplies available) may be classified as Accident unless there is clear indication of intent to do harm, in which homicide might apply. The criminalization of medical malpractice is of great concern to both the legal and medical professions, and whether or not medical acts of commission or omission meet a legal definition of negligent or other homicide is better left to others more familiar with the legal issues involved.

Note that #16 states that the now-debunked "positional restraint" myth can be used to classify an ARD as a homicide. Consider #16 and #21 together and what they are saying: if an officer's mistake leads to a death, then we should lean toward homicide for PR reasons. However, we do not want to "criminalize" a fellow physician's inept mistake, even though medical error is the third leading cause of death in the U.S.[125] Depending on the ME's office, their feelings toward police, and pressure from local activists and press, the MOD ruling is roughly equally likely to be any of the 4 main rulings. This would be an amusing academic exercise to discuss except that sometimes a prosecutor assumes that there is some scientific basis to such a ruling and the officer is criminally charged.

Do not automatically assume that an ME's cause-of-death "ruling" is accurate, objectively derived, methodologically reliable, or to an appropriate degree of scientific certainty. Be especially skeptical if the ruling involves "asphyxia" in some flavor. Understand that the MOD ruling is largely arbitrary when it comes to an ARD. With an ARD, your law-enforcement agency should insist that the ME submit blood for full genetic screening and offer to pay for it. If genetic testing has not been done, and the NAME recommendations are followed, officers could be wrongfully charged with crimes.
Your agency should also put some money aside to pay for cardiac pathology, medical toxicology, and neurology consults. Law enforcement agencies should also try to educate their local prosecutors, and their investigators, well in advance of an ARD to reduce the risk of a politically motivated prosecution.

If your local ME's office is one of the 30% that rules ARDs are homicides, your agency should have an ARD-competent consulting forensic pathologist — not a "media" pathologist — ready to "assist" whenever you have an ARD.[126-129] The local ME should be informed of this in advance and

that alone may improve the quality of the "official" autopsy report.

Circuit Complications

The 5th Circuit does not have a problem with prone restraint and has "explained that 'merely restraining a person in a prone position . . . cannot be characterized, in itself, as deadly force.'" *Sanders-Burns v. City of Plano*, 594 F.3d 366, 382 n.14 (5th Cir. 2010) (quoting *Gutierrez v. City of San Antonio*, 139 F.3d 441, 451 (5th Cir. 1998).

Sadly, while rare, there are circuit courts that have fallen for the junk science of positional asphyxia and the "recovery" position. In fact, officer indoctrination of this unscientific theory was used against them in the 10th Circuit's decision in *Weigel v. Broad*, 544 F.3d 1143 (10th Cir. 2008). There, a police car driven by Officer Henderson was struck by a car driven by the subject, Weigel. As the men were walking toward the patrol car to commence field sobriety tests, Weigel jumped in front of a van that was traveling down the highway and it appeared he was attempting to commit suicide. The van's side mirror struck Weigel in the chest before he was finally cuffed. Even handcuffed, he continued to struggle, so a civilian who stopped to assist the officers lay across the back of Weigel's legs. Another officer on the scene applied pressure to Weigel's upper body with his hands and knees, while Henderson sat on top of Weigel's upper thighs and buttocks. A second civilian passerby stopped and tied Weigel's feet with a plastic cord. After Weigel's hands were cuffed and feet were bound, Henderson returned to his patrol car to warm his hands. Despite the fact that Weigel had "quit struggling," the others remained on top of Weigel and he died. The ME's opinion was that the cause of death was "mechanical asphyxiation caused by inhibition of respiration by weight applied to the upper back."

A sharply divided panel of the 10th Circuit denied the officers' motions for summary judgment premised on their qualified immunity defense. The court placed significance on the fact that the officers and their civilian assistants continued sitting on top of Weigel and applying pressure to his back while he lay in the prone position even after Weigel "quit struggling." Also, critical to the majority opinion's determination was the fact that Henderson and his fellow officer had received training on so-called positional asphyxia in the months leading up to their interaction with Weigel. Especially insulting to the court, the 10th Circuit had rendered a decision that it found controlling on the issue roughly a year prior to Weigel's death, Henderson acknowledged receiving a copy of that very case law, and that opinion was apparently the reason for the extensive . . . training on positional asphyxia that Henderson and his colleague received. *Cruz v. City of Laramie*, 239 F.3d 1183 (10th Cir. 2001). Finally, a majority of the panel (the concurring opinion and the dissent) agreed that any force used on Weigel up until the point his feet were bound together — including Weigel's placement in the prone position and the pressure being applied to his upper body was reasonable and, therefore, not unconstitutional.

The 1st Circuit is not as clear. In *McCue v. City of Bangor*, 838 F.3d 55, 64 (1st Cir. 2016) the court stated "Exerting significant, continued force on a person's back 'while that [person] is in a face-down prone position after being subdued and/or incapacitated constitutes excessive force.'" Since the peer-reviewed literature now shows that the force of 1 or 2 officers' knees is not clinically *significant*, they may not have a problem with such prone restraint.

The 6th Circuit is even more confusing. In *Champion v. Outlook Nashville*, Inc., 380 F.3d 893, 903 (6th Cir. 2004) the court held: "Creating asphyxiating conditions by putting substantial or significant pressure, such as body weight, on the back of an incapacitated and bound suspect constitutes objectively unreasonable excessive force." If a knee can be considered "body weight" then the 6th Circuit has bought into an unscientific myth.

Most court decisions involving electrical weapons are more supportive. Fortuitously, the U.S. courts of appeals are generally consistent with the science surrounding the CEW and they do not explicitly support the myth of electrocution:

The 11th Circuit has described the use of a CEW as "nonlethal" force in addressing excessive force claims against officers. See *Smith v. LePage*, 834 F.3d 1285, 1295 (11th Cir. 2016). Although a CEW has a "unique capability to cause high levels of pain without long-term injury, 'we have not categorized the [CEW] as an implement of force whose use establishes, as a matter of law, more than de minimis injury.'" *Hollingsworth v. City of St. Ann*, 800 F.3d 985, 990-91 (8th Cir. 2015).

The 11th Circuit has also stated that the use of a CEW is "moderate, non-lethal force." *Buckley v. Haddock*, 292 Fed. Appx. 791, 795 (11th Cir. 2008). Plaintiff has alleged only that the use of a CEW on him rendered him weak and unable to walk straight. He has not alleged any more serious injury or lasting effects from the use of the CEW on him.

In a 9th Circuit decision, a dissenting opinion quoted a National Institute of Justice study that CEWs are a safe use of force alternative. *See Mattos v. Agarano*, 661 F.3d 433 (9th Cir. 2011) (Kosinski, C.J., concurring in part, dissenting in part). "The [CEW] is a safe alternative: It's effective at a range of fifteen to thirty-five feet, so officers can use it without engaging in personal combat. And a study by six university departments of emergency medicine found that 99.7% of those "Tased" by police suffer no injuries or, at most, mild ones.[130] The NIJ concluded that [CEW] deployment "has a margin of safety as great or greater than most alternatives," and carries a "significantly lower risk of injury than physical force."

See also: *Sandberg v. City of Torrance*, 456 Fed.Appx. 711, 713 (9th Cir. 2011) (referring to use of CEW as "use of non-deadly force"), and: *Marquez v. City of Phoenix*, 693 F.3d 1167, 1176 (9th Cir. 2012), *as amended on denial of reh'g* (Oct. 4, 2012), *cert. denied*, 133 S. Ct. 1468 (U.S. 2013) ("We are not convinced that the use of an X26 [CEW] involves deadly force.").

Table 4. Use-of-Force/ARD Incident Timeline Considerations.

***Pre*-Event**	**During Event**	**Immediate Aftermath**	**Investigation**	**Actions**
Policies: - "Legal" standard - Need to "KNOW" - Can "Reference" - Definitions - Special Purpose Procedures Training Custom FTO Guidance Study/Memory Aids Reference Aids	What LEO: - Records - Remembers - Can apply - Procedures - Outcomes - Temporal Outcomes: - "Motorola Memory" - Reporting	Contacts Supervisor Response Executive Response LEOs' statements Objective Timeline Objective evidence Recordings Synced	Investigations: - incident - medical examiner - criminal: - local - task force - state - federal - special interest - outside investigators - other	Criminal (federal) Criminal (state) Criminal (other) Inquest Civil Internal discipline Special interests Media Community

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Tactics

Ross studied 1250 federal and state excessive force cases from 1991-2016. There were 312 death cases (including 8 fatal head injuries) with the rest having claims of injury or simply due to the annoyance and pain. In the death cases, the court granted a defense MSJ in 63% (n=195) and denied it in 37% (n=117). MSJs on failure to train were granted in 88%.[131]

ARDs are very rare and occur, on average, < 1 per career for all involved, including officers, EMTs, emergency physicians and medical personnel, supervisors, trainers, investigators, executives, MEs, prosecutors, government executives and decision makers. In addition to being very rare in occurrence, the breadth, depths, and complexities of science related to ARDs is extensive and almost encyclopedic. As IMLA attorneys are often involved in law enforcement policies, training, post-incident event management, and litigation, they should consider an ARD event from multiple perspectives and time frames:

There are many pitfalls and landmines in dealing with, investigating, and litigating ARDs. As assistive checklists and study guides, the authors provide several reference sources here: http://www.ecdlaw.info/ref.pdf.

Some of the key aspects include:

1. pre-incident policy, training, and guidance, including clearly established law, study and memory aids;

2. pre-incident coordination and training with other first-responder agencies and potential decision makers;
3. upon incidence occurrence, immediately properly identifying all incident-specific possible concepts, issues, objective evidence, resources, information, and documents;
4. consistently avoiding creating fact or conflicting issues, conflated standards of care, and inappropriate false equivalencies;
5. appropriately considering human factors;
6. applying only correct standards of care to correct degrees of certainty;
7. expeditiously generating comprehensive objective annotated timeline and forensically properly syncing all recorded media;
8. generating appropriately comprehensive efficient reports for each level of reporting need;
9. thoroughly educating decision makers and limiting potential decision errors and their consequences at every opportunity, especially "*before*" decisions rendered; and
10. limiting the critics' inappropriate, unscientific, unfounded, and unsupported issues and arguments at every turn.

In litigation first, as plaintiffs have the burden of proof, put them to their proof that the officer was "plainly incompetent" and knowingly violated "clearly established law" at every stage of the litigation, starting with a motion to dismiss the complaint. Next, research, synopsize, and generate extensive very well organized, fully annotated disclosures effectively covering all case-specific issues, concepts, science, human factors, and controlling law and jury instructions. Thoroughly educate all parties on every aspect of the science, using methods that engender ease of full understanding and explanation. Build and disclose the initial aspects of the case to (1) limit plaintiff's case at every opportunity, (2) neutralize unknowledgeable experts, (3) present the science to the judge, (4) educate the jury, (5) early full-disclosure to fully construct the record for potential appeal.

The science is almost 100% on the defense side in a case of a non-firearm ARD. The plaintiffs will likely not be able to find admissible experts that can support their causation theories with methodologically reliable science to a reasonable degree of scientific certainty with peer-reviewed scientific literature. *Daubert* exclusions and other limiting motions are likely in order yet are often underutilized in such litigations. However, it is up to the defense to engage the resources to optimally manage the pre-incident, post-incident, and aftermath of the event.

Causation: Avoid Leaping to False Conclusions

There are two basic types of causation:

(1) *general causation* (a specific stimulus "*can*" cause a result), often more correctly applied as the specific stimulus "*can*" cause the result under the circumstances of this incident, and
(2) the *specific causation* (in this instance, the specific stimulus "*did*" cause the subject's injury).

Causation is to be established by the greater weight of the generally accepted scientific and medical knowledge. The determination of causation shall be methodologically reliable to a reasonable degree of appropriate certainty. Media accounts, case reports and case series, Wikipedia, and the like, are not sufficiently reliable to establish causation. This can work to your benefit if the plaintiff's counsel attempts to inappropriately rely on Wikipedia for a CEW electrocution theory. That Wikipedia section appears to be written by anti-police activists and has served to completely confuse the counsel.

For an allegation of electrocution (however phrased) go down the list of required diagnostic factors as given in Table 2 for deposing the plaintiff's causation experts. Be prepared to refute the common speculations regarding poison buildup and soup-type drug effects.[82] For an allegation of asphyxia (however phrased) go thru the refuting scientific studies when deposing the Plaintiff's causation experts.[4,8,24,25,27-29,31,37-39,41,44-47,49-54,132-138]

In a recent deposition, the plaintiff's counsel was truly amazed to learn that there was not a single scientific paper supporting his prone-restraint asphyxia hypoxia theory. Ask the plaintiffs' experts to produce all such papers that they think support their position.

Disclosures

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assumes no responsibility for the policies or positions presented in the report or for the presentation of its contents. MWK and MAB are frequent expert witnesses. MWK sits on the Axon corporate and scientific advisory boards. MAB is an Axon employee and Legal Advisor to the Axon Scientific and Medical Advisory Board.

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