Taser International Board Letter to the Editor
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We are members of the TASER International, Inc. Scientific and Medical Advisory Board and wish to comment on the porcine paper of Walter et al published in your journal.1 The authors were able to induce ventricular fibrillation (VF) in one closed-chest small pig with a TASER Electronic Control Device (ECD). Research on ECDs is very welcome and important to society as these devices are rapidly replacing the baton and oleoresin capsicum (pepper spray) as less-lethal tools for the capture and control of resisting criminal suspects.2 They are now used by the majority of law enforcement agencies in the United States3 and the United Kingdom4 and have been applied to over 1.2 million human beings at a current estimated rate of 1040 applications per day. About 35% of officers in the United States now carry an ECD on their belt.3 With over 700 arrest-related deaths (ARDs) per year in the USA alone, we all want to see the safest tools to effect an arrest.5

Swine were anesthetized and given prolonged ECD applications (two each of 40 seconds) while the ventilator was turned off. An immediate hypotensive response was noted. Even a single 40 second application — with an immediate hemodynamic collapse — is not relevant to the clinical situation. If an ECD current and barb placement were somehow able to cause this collapse the fight and resistance would be over. Thus the study scenario is hypothetically related only to a situation in which an officer gave a prolonged application long after the subject stopped resisting. This scenario goes against all training and has never been documented in over 480,000 field uses.

The induction of VF in a small pig is not surprising for two reasons. First, pigs are more sensitive to the induction of VF than other mammals6 possibly due to a particular anatomical feature in which easily excitable Purkinje fibers penetrate across the entire myocardium.7 In the dog and human the Purkinje fibers are confined to an endocardial layer8 while that of the pigs is transmural — penetrating the full myocardium. Thus, myocardial activation proceeds from the endocardium to the epicardium in dogs and humans while it proceeds from the epicardium to the endocardium in swine.9 This is why pigs are more sensitive to external electric currents than are dogs and humans.

Secondly, it has been established for decades that the VF threshold is directly related to the body weight for both utility power and ECD waveforms.6,10-12 This is a material point as the weight of the single induced pig (28 kg) was different from the weights of custodial death subjects (91.3 ± 17.7 kg)13 by almost astronomical statistical levels ($p = 2.3 \times 10\text{-}11$). Thus small swine represent an extremely unrealistic model for the risk of VF from the field application of an ECD. This quasi-anecdotal result of a VF induction in a single pig (out of aggressive attempts in the overall group) actually suggest a very high safety margin in humans as none of the larger pigs were inducible.

Of greater concern is the subtle but incorrect implication that the electrical induction of VF is relevant to the problem of ARDs. Due to the increasing popularity and public awareness of ECDs, the proportion of such deaths that are temporally associated with ECD use is growing. Similarly, the number of such deaths that are portrayed by the media as ECD-related is also increasing. However, the presenting rhythm in these ARDs is rarely VF — it is usually asystole or less commonly — pulseless electrical activity. In

fact, in a recent study of ARDs in which an ECD was used (with collapse within 15 minutes of the ECD use), there were only two reported cases of VF as the presenting rhythm out of 37 cases.17 In these two instances of VF, causes for the development of VF other than the ECD were present. Asystole is the expected rhythm due to the acidosis from the extended struggle and the preceeding hyperkinetic behavior seen in these deaths which are typically linked with excited delirium signs and symptoms. 18-20

In this study the researchers did not induce asystole or PEA.1 Thus there is —at best — only a tenuous scientific link between this report and the issue of human arrest-related deaths in which an ECD was used.

The paper stated that the devices deliver a "power of 0.36 J/pulse." Since the joule (J) is a unit of energy and not power, we presume that the authors meant to state that the "energy" was 0.36 J/pulse but that would still be an exaggeration of 414% as the actual energy delivered per pulse is 0.07 J.21

Finally, we are confused by the wholly erroneous introductory comment that the TASER ECD might deliver far higher output than specified. The cited source for this curious comment is an un-indexed bulletin by a Mr. Ruggieri — published online by his colleague, Mr. Spector. The paper neglected to mention that Mr. Ruggieri, in the same bulletin, concluded that a TASER ECD would have a 50% fatality rate! Your readers are encouraged to scrutinize this bulletin so that they can learn other interesting items proposed by Mr. Ruggieri concerning the dangers of electricity. For example, he implies that cardiomyopathy patients not comb their hair, remove their clothing, or walk across carpeting as the resulting static shock could induce VF and kill them.

While we encourage valid scientific studies regarding ECDs and the unresolved problem of arrest-related deaths — occurring in the absence or presence of ECD use — we remain concerned about the misinformation and innuendo that has been attributed to their use.

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