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Author's Response

Sir,

My response to Dr. Dawes et al.'s letter (1) follows (owing to the U.S. Air Force Research Laboratory's approval process required of authors, the response could not be submitted to the *Journal of Forensic Sciences* in a timely manner).

It is encouraging, from a safety standpoint, that Dawes et al. (1) found no significant increase in hematocrit (Hct) after short-term electronic control device (ECD) applications (less than three repeated exposures or a total time of exposure of no more than 15 sec) to healthy subjects. Dawes et al. also published results of a study in which they found no change in Hct after 30-sec exposures of human subjects to the TASER C2 device (2). As Moscati et al. (3) noted, an ECD could be applied "for a longer continuous discharge. However, this issue is operator dependent and completely independent of the weapon itself" (p. 586). If law-enforcement officers use the minimal amount of force reasonably necessary to safely approach and handcuff a subject in question, any risk from such devices will be minimized.

More "extreme" (i.e., repeated or long-duration) ECD applications may occur in limited situations (4). Previous recommendations relating to ECD use, from independent investigators, have been limited to exposure durations of 15 sec or less (5). TASER International stated in a 2011 warning notice (6), "Minimize repeated, continuous, or simultaneous exposures" (p. 4). A Canadian organization recommended "using as few cycles as possible and avoiding continuous cycles exceeding 15–20 sec" (7, p. 31). Several other organizations and investigators have also warned against multiple applications or continuous cycling of ECDs (8,9).

Cronin and Ederheimer (10) noted that "multiple and continuous activations" of ECDs "may increase the risk of death" (p. 7). Consideration of potential detrimental effects (including changes in Hct) of ECDs may be even more critical in situations involving drug usage by subjects. For example, a human subject with a heroin overdose had a reported Hct of 57 (11). Cocaine can cause splenic contraction in humans, with a rapid release of red blood cells (12).

Why did Hct increase in our experiments of pigs but not in Dawes et al.'s (1,2) experiments of human subjects? In all of our previous studies of ECDs, apnea was present during the exposures (13). In contrast, it is likely that the human subjects in the studies of Dawes et al. (1,2) were able to consciously force themselves to breathe adequately (which may not occur in all subjects in law-enforcement situations). The spleen of humans may expel red blood cells owing to apnea (14) (including apnea of very short time periods, e.g., only 15 sec [15]), thereby raising Hct.

Some aspects of muscle-contraction responses to ECD applications may be similar to changes during acute exercise (16). Because of these similarities, knowledge of previous studies of exercise/muscle contraction may be relevant to responses during ECD applications. Although much of the literature I cited was related to effects of "exertional changes" on Hct, similar effects of ECD-induced "violent involuntary muscular contraction" (descriptive term used by Giaconi et al. [17]) should not be eliminated from consideration. Some detrimental effects associated with increased Hct are dependent on the intensity and duration of muscle contraction (18). For experimental studies, Institutional Review Boards must ensure human subjects' safety, which could be jeopardized during long-duration or repeated ECD exposures. On the basis of our previous animal research (including results related to Hct [19]), it may be reasonable to limit the number and duration of ECD applications during law-enforcement situations. This concept may have been summed up best in a previous news article (20) (quote from D. DiPino, a police chief): "You don't just keep pulling the trigger... That's where training comes in."

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James R. Jauchem,[1,*] Ph.D.
[1]Senior Research Physiologist, Directed Energy Bio-Effects Division, 711th Human Performance Wing, U.S. Air Force Research Laboratory, 4141 Petroleum Road, Bldg 3260, Fort Sam Houston, TX 78234-2644.
E-mail: james.r.jauchem.civ@mail.mil

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