Rhabdomyolysis – Detail

[1]What is rhabdomyolysis?	Rhabdomyolysis is a disease of skeletal muscle that entails the destruction of muscle tissue.[2] This breakdown of muscle results in the release of muscle cell contents (myoglobin and creatine kinase [CK]) into the bloodstream. Rhabdomyolysis can cause hyperkalemia (high potassium) if tissue destruction is large as in severe crush injuries. Rhabdomyolysis can lead to renal failure, serious injury and death. See the Electrolytes fact sheet.
What are common causes of rhabdomyolysis?	Trauma, drugs, heat stroke, burns, sufficiently strong delivered electrical injury, and physical exertion. When muscle loading in exercise exceeds a certain limit, muscle cell permeability changes and CK leaks into the bloodstream.
How does rhabdomyolysis relate to a TASER® Electronic Control Device (ECD) exposure?	Because a TASER ECD exposure can cause strong muscle contraction, this can result in the breakdown of muscle tissue.
What is the evidence-based conclusion regarding a TASER ECD exposure and rhabdomyolysis?	It is reasonable to expect some elevation in markers of skeletal muscle injury consistent with participation in an athletic event; however, this elevation is not believed to be important in the sudden in-custody death phenomenon. Rhabdomyolysis does not cause injury for days after the inciting event and in the event of severe rises in CK, the clinical course is deteriorating renal function that can be treated with dialysis if needed.
The evidence:	
Prospective Human Studies	(Ho 2006[3]) Mild but expected elevation in markers of skeletal muscle injury consistent with participation in an athletic event (mean creatine kinase elevation of 57.2 U/L at 24 hours post-ECD exposure).

Rhabdomyolysis – Detail

	(Vilke 2007 [4]) There were no clinically significant or lasting statistically significant changes in cardiovascular, electrolyte, lactate, or pH levels in human subjects after a 5-second [TASER ECD] activation. (Vilke 2007[5]) A 5-second exposure of a [TASER] X-26 to healthy law enforcement personnel does not result in clinically significant changes of physiologic stress. (Moscati 2007[6]) Intoxicated adults with prolonged CEW [conducted electrical weapon] exposure demonstrate small transient increases in measures of acidosis and no change in markers of cardiac injury. The increased acidosis was not clinically significant and self corrected.
Retrospective Human Studies	(Bozeman 2007[7]) One subject out of 962 subjects in field-ECD deployments with rhabdomyolysis and not clearly associated with the ECD exposure. (Ordog 1987[8]) Possible complications associated with [ECD] wounds included contusions, abrasions, and lacerations (38%); mild rhabdomyolysis (1%); and testicular torsion (0.5%). Although 48% of [ECD exposed] patients required hospitalization, all but one was for a preexisting injury or toxic or psychiatric problem. We conclude that [ECDs] are relatively safe when compared to shooting with more conventional weapons.
Animal Studies	(Lakkireddy 2006[9]) Cocaine increased the required strength of NMI [neuromuscular incapacitation (ECD)] 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. (Dennis 2007[10]) No significant difference in myoglobin levels between exposed and control swine after 80-second ECD exposures. (Jauchem 2007[11]) No significant increase in CK or Myoglobin with 3 minute [TASER ECD] exposure in swine.

	(Valentino 2007[12]) There was no evidence of acute arrhythmia from MK63 [ECD] discharges. No clinically significant changes were seen in any of the physiological parameters measured here at any time point. Neuromuscular function was not significantly altered by the MK63 discharge. In this animal model, even lengthy MK63 discharges did not induce muscle or nerve injury as seen using EMG, blood chemistry, or histology. (Esquivel 2007[13]) Repeated exposures to a conducted electrical weapon result in respiratory acidosis, metabolic vasodilation, and an increase in blood lactate level. These effects were transient in this study, with full recovery by 4 hours post exposure. The Stinger™ S-400 [ECD] appears to have no serious adverse physiologic effects on healthy, anesthetized swine.
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