



Physiologic Effects of Prolonged Conducted Electrical Weapon Discharge on Intoxicated Adults

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INTRODUCTION

- ◆ Conducted Electrical Weapons (CEW) have been used by law enforcement officers to help subdue agitated, intoxicated and/or violent individuals in situations where deadly force is not appropriate.
- ◆ In rare instances, such individuals have died while in custody. In the absence of other obvious potentially fatal injuries, CEW application has been theorized to have contributed to the in-custody death, although there has never been any proven cause and effect relationship.
- ◆ Previous studies in resting adult volunteers demonstrated transient elevations in serum lactate with delayed elevations in CK and myoglobin following CEW exposure. However, all observed laboratory changes were consistent with existing literature for transient changes seen following moderate exertion.
- ◆ The studies in resting adult volunteers did not demonstrate any clinically significant changes in laboratory parameters that would implicate CEW as contributors to in custody death. However, actual use of CEW in a field setting is typically not on resting adults and it is possible that agitation, intoxication or more prolonged CEW exposure could cause more significant metabolic changes.
- ◆ The objective of this study was to demonstrate the physiologic effects of prolonged CEW exposure on intoxicated adults.

METHODS

- ◆ The study was a prospective, controlled, non-blinded comparison of adult volunteers in a laboratory setting.
- ◆ The protocol was approved by the Hennepin County Medical Center IRB and written informed consent was obtained from all subjects.
- ◆ All subjects had baseline blood obtained at the beginning of the study; T₁. Both CEW subjects and controls were then allowed to consume mixed drinks containing alcohol in a controlled setting to achieve a targeted blood alcohol level of 0.08 mg/dl as measured by breathalyzer. After achieving this level, all subjects had a second blood sample obtained; T₂.
- ◆ CEW subjects then were exposed to a 15 second continuous discharge from a TASER® X26. These subjects then had another set of bloods drawn immediately after the CEW exposure; T₃. Control subjects did not undergo CEW exposure nor have another set of labs drawn at this time.
- ◆ All subjects were then observed, with no further alcohol administered, until they were judged safe for discharge with a pre-arranged, non-drinking, responsible partner.
- ◆ All subjects had a final set of blood samples drawn approximately 24 hours after completion of the alcohol/CEW exposure; T₄.
- ◆ Blood samples were analyzed for markers of acidosis at all times (pH, lactate and bicarb) and for troponin at T₁ and T₄.
- ◆ Comparisons between groups were made using unpaired T-tests and within groups using paired T-tests.

RESULTS

Laboratory Results: Mean (STD), VNO - values not obtained; CEW n = 22, Control n = 4

	T1	T2	T3	T4
CEW pH	7.40 (0.02)	7.37 (0.04)	7.32 (0.07)	7.39 (0.02)
Control pH	7.38 (0.08)	7.37 (0.05)	VNO	7.41 (0.02)
CEW Lactate	0.95 (0.28)	1.98 (1.13)	4.19 (1.73)	1.37 (0.44)
Control Lactate	1.64 (1.54)	2.40 (1.84)	VNO	1.39 (0.59)
CEW Bicarb	28.32 (2.46)	26.62 (2.80)	25.77 (2.72)	29.27 (2.39)
Control Bicarb	29.00 (2.45)	24.50 (3.70)	VNO	28.25 (2.36)
CEW Troponin	0.00 (0.01)	VNO	VNO	0.01 (0.02)
Control Troponin	0.01 (0.01)	VNO	VNO	0.00 (0.01)

Comparisons of Lab Values

Study Group	Time	Lab Result	P value
CEW vs Control	T ₁	pH	> 0.5
CEW vs Control	T ₁	Lactate	> 0.4
CEW vs Control	T ₁	Bicarb	> 0.6
CEW vs Control	T ₁	Troponin	> 0.8
CEW vs Control	T ₂	pH	> 0.9
CEW vs Control	T ₂	Lactate	> 0.6
CEW vs Control	T ₂	Bicarb	> 0.3
CEW vs Control	T ₄	pH	> 0.3
CEW vs Control	T ₄	Lactate	> 0.2
CEW vs Control	T ₄	Bicarb	> 0.4
CEW vs Control	T ₄	Troponin	> 0.7
CEW	T ₁ vs T ₄	Troponin	> 0.5
Control	T ₁ vs T ₄	Troponin	> 0.7
CEW	T ₁ vs T ₂	pH	< 0.001
CEW	T ₁ vs T ₂	Lactate	< 0.0005
CEW	T ₁ vs T ₂	Bicarb	< 0.002
Control	T ₁ vs T ₂	pH	> 0.5
Control	T ₁ vs T ₂	Lactate	> 0.08
Control	T ₁ vs T ₂	Bicarb	< 0.03
CEW	T ₂ vs T ₃	pH	< 0.003
CEW	T ₂ vs T ₃	Lactate	< 0.0001
CEW	T ₂ vs T ₃	Bicarb	> 0.1

RESULTS

- ◆ 22 subjects were enrolled in the CEW group and 4 subjects were enrolled in the Control group.
- ◆ EtOH levels for the two groups were not significantly different with CEW = 0.12 mg/dl and Controls = 0.11 mg/dl.
- ◆ Comparisons between groups for all laboratory values at T₁ and at T₂ showed no significant differences.
- ◆ For the CEW group, paired comparisons of laboratory values for T₁ and T₂ demonstrated a significant drop in pH and Bicarb with a rise in Lactate. Although the values in these parameters moved in the same directions in the control group, the changes did not reach significance because of the small number of subjects in this group.
- ◆ For the CEW group, paired comparisons of laboratory values for T₂ and T₃ demonstrated a significant drop in pH and rise in Lactate. The change in Bicarb was not significant.
- ◆ Comparisons between groups for all laboratory values at T₄ showed no significant differences.
- ◆ Paired comparisons within each group for Troponin at T₁ and at T₄ showed no significant differences.
- ◆ No subjects demonstrated any lasting injury from alcohol consumption or CEW exposure at 24 hours after the study.

DISCUSSION

- ◆ Intoxicated adults exposed to prolonged CEW discharge demonstrated transient rises in measures of acidosis. The observed increases were small and consistent with studies of moderate exertion.
- ◆ There was no change in markers of cardiac injury.
- ◆ Alcohol intoxication itself caused small changes in measures of acidosis. Alcohol does not appear to potentiate the effects of CEW exposure as compared to other studies of nonintoxicated resting and exercising adults.
- ◆ All changes in laboratory values had returned to baseline by the next day without any specific treatment.
- ◆ The results of this study are contrary to the idea that CEW exposure even when prolonged and on intoxicated adults could be a cause for in-custody deaths.
- ◆ Due to ethical considerations, this study could not exactly replicate the field situation in which individuals exposed to CEW may have higher levels of alcohol and/or intoxication with other drugs.

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