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 fatalities, although there has been no proven cause and effect relationship.
- Previous studies in resting adult volunteers demonstrated transient increases in heart rate and delayed decreases in cardiac conduction time following CEW exposure. However, all observed laboratory changes were consistent with existing literature for transient changes seen following moderate exercise.
- The studies in resting adult volunteers did not demonstrate any clinically significant changes in laboratory parameters that would implicate CEW as a contributing factor to in-custody deaths. 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 prospective, controlled, randomized, double-blind comparison of adult volunteers in a laboratory setting.
- The protocol was approved by the Honolulu County Medical Center (HCMC) and written informed consent was obtained from all subjects.
- All subjects had been blood sampled at the beginning of the study. Both CEW subgroups 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% as measured by breathalyzer. After achieving this level, all subjects had a second blood sample drawn.
- CEW subgroups were exposed to a 15 second continuous discharge from a TASER X26. Those subjects then had another set of blood draws immediately after the CEW exposure. The CEW control subgroup underwent an identical breathalyzer draw at this time.
- All subjects were then observed, with no further alcohol administered until they were ready for their discharge with a pre-arrested, non-drinking, responsible partner.
- All subjects had a final set of blood samples drawn approximately 24 hours after completion of the alcohol/CEW exposure. T2.
- Blood samples were analyzed for markers of alcohol at all times (T1, T2, T3 and T4) and T5.
- Comparisons between groups were made using repeated Student's and within groups using paired Student's.

RESULTS

<table>
<thead>
<tr>
<th>Laboratory Results</th>
<th>Mean (VLD), VNO - values not obtained (CEW = 2, Control n = 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEW pH</td>
<td>7.36 (0.04)</td>
</tr>
<tr>
<td>Control pH</td>
<td>7.15 (0.06)</td>
</tr>
<tr>
<td>CEW Lactate</td>
<td>0.19 (0.03)</td>
</tr>
<tr>
<td>Control Lactate</td>
<td>0.15 (0.03)</td>
</tr>
<tr>
<td>CEW Triglycerides</td>
<td>282.32 (60.62)</td>
</tr>
<tr>
<td>Control Triglycerides</td>
<td>284.10 (24.26)</td>
</tr>
<tr>
<td>CEW Creatinine</td>
<td>0.00 (0.01)</td>
</tr>
<tr>
<td>Control Creatinine</td>
<td>0.01 (0.01)</td>
</tr>
</tbody>
</table>

Comparisons of IABP Values

- 22 subjects were enrolled in the CEW group and 4 subjects were enrolled in the Control group.
- IABG levels for the two groups were not significantly different with CEW = 0.32 mg/dl and Controls = 0.41 mg/dl.
- Comparison between groups for all laboratory values at T1 and T5 showed no significant differences.
- For the CEW group, paired comparisons of laboratory values for T2 and T3 demonstrated a significant decrease in pH and lactate with a rise in Lactate. Although the values in these parameters moved in the same direction in the control group, the changes did not reach statistical significance because of the small number of subjects in that group.
- For the CEW group, paired comparisons of laboratory values for T4 and T5 demonstrated a significant decrease in pH and rise in Lactate. The change in Bicarbonate was not significant.
- No significant differences were found for all laboratory values at T4 and T5 showed no significance difference.
- Paired comparisons within each group for Triglycerides at T3 and T4 showed no significant differences.
- No subjects demonstrated any testing injury from alcohol consumption in CEW exposure at 24 hours after the study.

DISCUSSION

- Intoxicated adults exposed to prolonged CEW discharge demonstrated transient increase in measures of acidosis. The observed increases were small and consistent with results of moderate exercise.
- There was no change in markers of cardiac injury.
- Alcohol intoxication itself caused small changes in measures of acidity. Alcohol does not appear to influence the effects of CEW exposure as compared to other studies of nonintoxicated and intoxicated 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 in intoxicated subjects could be a cause for in-custody deaths.

Due to ethical considerations, this study not only used a small randomized control group but also had a small number of subjects in each group.

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