UNIVERSITY of CALIFORNIA, SAN DIEGO
MEDICAL CENTER EMERGENCY MEDICINE

Cardiovascular and Metabolic Effects of the TASER on Human Subjects

GM Vilke, C Sloane, KD Bouton, S Levine, TS Neuman, EM Castillo, FW Kolkhorst, TC Chan
from the Department of Emergency Medicine, University of California, San Diego
and the School of Exercise and Nutritional Sciences, San Diego State University

Introduction: The National Institute of Justice reports that 9800 United States law enforcement agencies currently authorize the TASER device which is being carried by over 225,000 officers. Additionally, they report that over 120,000 U.S. citizens also have a TASER device. Although the actual number of uses is unknown, they have reported that the TASER has been used on over 150,000 volunteers during training and in over 100,000 "real-life" police confrontations. Although the effect of the TASER is poorly studied, it is generally regarded as safe and has been approved by the U.S. Consumer Product Safety Commission for the current indication for which it is being used. Most of the data supporting the product's approval by the U.S. Consumer Product and Safety Commission was based on theoretical calculations and not on the basis of animal or human studies.

Objectives: The purpose of this study was to examine the effects of a single TASER exposure on cardiovascular (CV) and blood parameters in human subjects.

Methods: Prospective study on human volunteers receiving a 5 s TASER activation. Baseline CV measurements and blood samples were taken prior to TASER exposure and for 60 min afterwards. CV measurements included systolic (SBP) and diastolic (DBP) blood pressures, and heart rate. Blood measures included venous calcium, sodium, and potassium levels, and arterialized capillary samples for pH, bicarbonate and lactate. Data were analyzed using repeated measures ANOVA (alpha = 0.05) with 95% CI.

Results: Data were collected on 32 men and women law enforcement officers (38.4 ± 7.7 yr; 196.8 ± 33.1 lb; Table 1). Measures for SBP, bicarbonate, lactate and pH were different overall (Table 2; p <0.05). SBP decreased linearly from borderline prior to TASER (139.7 mmHg at baseline) to normal (123.2 mmHg at 60 min) (decrease = 16.5, CI_{95} = 12.7, 20.3). There were no differences in any other measure (p >0.05). Results of the blood measurements are in Table 2.

Table 1. Subject Characteristics and baseline measures (n = 32)

Characteristic	Mean ± SD	Range
Age (yr)	38.4 ± 7.7	25 – 57
Weight (kg)	89.3 ± 15.0	65.8 – 125.2
Height (m)	1.79 ± 0.08	1.65 – 1.96
Body mass index (weight/height^2)	27.8 ± 3.3	22.4 – 34.6

Table 2. Effects of TASER Exposure on Blood Parameters (mean (SD); n=32)

Measure	Baseline	1 min	10 min	30 min	60 min
pH*	7.45 (0.0)	7.42 (0.0)*	7.43 (0.0)	7.43 (0.0)	7.44 (0.0)
Bicarbonate (mEq/L)*	23.9(2.2)	22.7(2.0)*	22.9(1.8)*	23.9(1.7)	23.8(1.6)
Lactate (mmol/L)*	1.4 (0.5)	2.8 (0.7)*	2.4 (0.6)*	1.5 (0.5)	1.3 (0.5)
Ca^{2+} (mg/dl)	9.8 (0.4)	9.8 (0.4)	9.8 (0.4)	9.8 (0.4)	9.8 (0.4)
Na^{+} (mEq/L)	138.3 (3.8)	137.8 (3.9)	138.4 (4.2)	137.8 (4.0)	138.3 (3.9)
K^{+} (mEq/L)	4.2 (0.6)	4.1 (0.6)	4.2 (0.6)	4.2 (0.6)	4.2 (0.6)

*different from baseline value (p <0.05)

Conclusions: There were no clinically significant or lasting statistically significant changes in cardiovascular, electrolyte or pH levels in human subjects after a 5 s TASER activation.

Limitations: Our subjects were generally healthy and free from chronic disease, and duration of the TASER activation in our study did not exceed a single 5-s activation, whereas individuals in the field often receive multiple shocks. Our subjects were also not under the influence of illicit stimulant drugs or in a state of agitated delirium.

Acknowledgements: The authors would like to thank the support and assistance of the San Diego County Sheriff's Office. Funding for this study was from the National Institute of Justice of the Department of Justice