Hennepin County
Medical Center

Serum Biomarker Effect of Prolonged TASER® XREP Device Exposure

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Introduction

The TASER® XREP is a wireless electronic control device (ECD) designed to incapacitate persons from a distance. It is designed for use by law enforcement officials to be fired from a 12-gauge shotgun and may prove to be useful as an intended, non-lethal means of controlling a suspect from a safe distance. This distance would likely result in fewer injuries to both peace officers and suspects since the greatest number of injuries occurs during close-quarters combative situations.

Prior ECD technology was limited to handheld devices such as the TASER X26 ECD that uses tether wires for current conduction. Handheld ECD research has not demonstrated danger with human application but the XREP effect on human biomarker physiology has not been previously studied. The XREP circuit and waveform, while similar to the handheld ECDs, is not identical and there have been no prior studies of the XREP device examining its effect on human physiology using serum biomarker monitoring.

Additionally, the intended duration of the XREP is for a prolonged period of time (some period longer than 5 seconds). This time duration is intended to give law enforcement officers the ability to close the distance between themselves and the suspect and to take them safely into custody.

The objective of this study was to examine the serum biomarker effect of the XREP ECD when applied for its intended, prolonged duration in humans.

Methods

After undergoing informed consent, volunteers were recruited at various TASER ECD training courses. All volunteers were either law enforcement or corrections professionals. No volunteers were excluded and all had medical history and demographic data collected by questionnaire for future descriptive purposes.

The volunteers underwent a XREP application of variable duration between 15 and 45 seconds. The duration was randomly selected by a programmable logic computer attached to a factory standard XREP device circuit. Application was made by attached skin electrodes placed in electrode gel on various surfaces of the thorax.

Venous blood was collected before and shortly after exposure. Samples were analyzed for markers of muscle injury and acidosis. Data were analyzed using descriptive statistics and compared between time points using Wilcoxen sign rank tests.

Results

78 subjects (74 males, 4 females) with a median age of 41 years (range 32 to 50) volunteered. Mean exposure duration was 16.7 seconds and one subject completed 45 seconds. Median initial pH was 7.36 (IQR 7.33 to 7.88, range 7.30 to 7.43) and decreased to a median of 7.34 (IQR 7.30 to 7.37, range 7.20 to 7.46)(p=0.01). Median pCO2 decreased from an initial 50.2 (IQR 48.2 to 53.6, range 37.3 to 64.1) to 47.2 (IQR 43.4 to 52.7, range 26.1 to 71.5)(p=0.01).

Serum bicarbonate decreased from 28.2 (IQR 26.8 to 29.7, range 20.6 to 32.4) to 26.0 (IQR 24.7 to 27.1, range 18.6 to 31.1)(p<0.01). pO2 increased from 24.0 (IQR 20-29, range 11-40) to 34.0 (IQR 27-43, 13-43)(p<0.01). Lactate increase from 1.63 (IQR 1.15 to 2.02, range 0.5 to 4.39) to 4.19 (IQR 3.11 to 5.18, range 1.1 to 8.5)(p<0.01). Serum potassium decreased from 3.9 (IQR 3.6 to 4.1, range 3.1 to 4.8) to 3.7 (IQR 3.5 to 4.0, range 3.2 to 4.9)(p=0.01).

Conclusions

The TASER XREP ECD is a new technology projectile that will be used to control dangerous, agitated or potentially violent persons in the community. It will allow greater law enforcement and suspect safety because of its ability to help control individuals from a great distance. This is the first investigation into the physiologic effect that this ECD will have on humans with regard to serum biomarkers.

	Before XREP Application	60-Seconds Post XREP Application	p Value Significance
Venous pH (median)	7.36	7.36	p = 0.01
Venous pCO_2 (median)	50.2	50.2	p = 0.01
Venous HCO_3 (median)	28.2	28.2	p < 0.01
Venous Lactate (median)	1.63	1.63	p < 0.01
Venous K^+ (median)	3.9	3.9	p = 0.01

Prolonged XREP ECD application caused small but statistically significant changes in measured serum biomarkers. These small changes would likely result in limited clinical significance. It appears that the XREP ECD represents an adequate risk/benefit ratio if used for its intended purpose.