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MEDICAL CENTER EMERGENCY MEDICINE

Does the TASER Cause Electrical Changes in Twelve Lead ECG Monitoring of Human Subjects

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Introduction: Previous data from the Police Executive Research Forum (PERF) report that the average time from Taser activation to death in those individuals who died in custody following a Taser activation was 63 minutes. However, there is concern by some that the Taser activation could have an immediate effect on cardiac conductivity, such as prolonging the QT interval, and placing the individual at risk for a sudden cardiac event. Our preliminary work used a three lead to monitor the heart before, during and after a Taser activation and demonstrated no dysrhythmias. Attempts to calculate accurate QT, PR and QRS intervals were challenging as the interval durations could not reliably be determined from the single strip monitoring. Thus the present study was designed to utilize 12-lead ECG monitoring to determine if a shock exposure from a Taser® X-26 results in changes in cardiac conduction in healthy police volunteers.

Objectives: As the Taser uses high-voltage electricity to incapacitate subjects, we sought to evaluate cardiac rhythm changes during a Taser activation.

Methods: This prospective study was performed on 32 healthy volunteer subjects receiving a shock from the Taser X-26. The subjects had a baseline 12 lead ECG performed immediately before and within 1 minute post Taser activation. One minute post Taser activation was considered clinically relevant as most reported deaths following Taser use occur after 1 min, and thus any electrocardiographic changes, such as QT prolongation, should be captured if present. Primary endpoints included evaluation of changes in cardiac rhythm, morphology, and interval duration. Descriptive statistics and paired t-test comparisons are reported (p<0.05) (SPSS).

Results: In all 32 subjects an interpretable 12 lead ECG was obtained prior to and after the Taser activation, except for one post-Taser ECG (PR interval indeterminate).

Results (cont): The average age was 33 and BMI 26.5kg/m2. The average duration of Taser shock was 2.1 (SD=1.0) seconds and ranged from 1 to 5 seconds. Overall, there was a significant increase in mean heart rate (2.4; 95% CI=0.0, 4.9; p<0.05) and decrease PR interval (-6.5; 95% CI=-9.7, -3.3; p<0.001). When stratified by gender, the only significant change was a decrease in PR interval in men (p<0.01). When stratified by BMI, a significant increase in heart rate and decreases in PR and QT intervals are noted (4.0; 95% CI=1.3, 6.7 for HR, -6.0; 95% CI=-11.3, -0.7 for PR interval and -18.8; 95% CI=-33.2, -4.3 for QT Interval) among normals. In all cases, none of the subjects had a QTc pre- or post Taser activation that exceeded 0.44 seconds. None of the statistically significant differences between ECG measures were clinically relevant.

Means and the differences between the pre and post 12 lead ECG measures for 32 healthy volunteers who were exposed to a Taser® X-26 activation.

Measure	Pre ECG	Post ECG	Mean Difference (95% CI)
Heart Rate	67.2	69.7	2.4 (0.0, 4.9)*
PR Interval[a]	151.1	144.6	-6.5 (-9.7, -3.3)**
QRS Duration	94.5	94.1	-0.4 (-1.8, 0.9)
QT Interval	385.6	377.2	-8.4 (-18.0, 1.2)
QTc Interval	402.7	399.4	-3.2 (-7.6, 1.1)

*p<0.05 **p<0.001
[a]One post taser activation PR Interval measure unavailable
SD, Standard Deviation; CI, Confidence Interval

Limitations: We were not able to continuously monitor the subjects with a 12 lead monitor before, during and after the Taser activation due to limitations of the monitor. Therefore, we were not able to monitor individuals immediately after the Taser activation. Changes that resolved within the first minute, could have missed by the time we obtained the ECG. However, given the epidemiology of deaths following Taser activations, most occur well beyond the one minute interval, thus if a dysrhythmia was responsible, we feel confident that we would have captured any changes in intervals by the one minute ECG.

Additionally our subjects were generally healthy and free from chronic disease, which may not mimic the population of patients who have cardiac arrests after a Taser activation. Another limitation is that the duration of the Taser activation did not exceed a single five second activation and many even were of shorter duration than five seconds.

Conclusions: There were no cardiac dysrhythmia, interval or morphology changes in human subjects who received a Taser shock on evaluation of a 12 lead ECG performed immediately before and after Taser activation.

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