# Catecholamines In Simulated Arrest Scenarios

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## Introduction

The mechanisms of death in many arrest-related deaths (ARDs) are unclear. Law enforcement devices or tactics are often scrutinized in these unexplained cases. Unexplained ARDs have occurred after the use of electronic control devices (ECDs). The primary concern has been direct cardiac arrhythmia's induced by the delivered electrical charge.

Some authors have opined that the temporal relationship between ECD use and ARDs may be related to an acute stress cardiomyopathy induced by high circulating catecholamines, rather than an immediate electrically-induced arrhythmia. In this study, we compared the stress response during several simulated use of force encounters.

**TASER X26**

## Methods

This was a prospective, observational study of human subjects. The subjects were a convenience sample of law enforcement officers (LEOs) receiving a training exposure, or TASER International, Inc. (TASER) employees. Subjects were randomized to one of five groups:

1) A 150 meter sprint, simulating flight from LEOs,
2) 45-seconds of hitting and kicking a heavy bag, simulating physical combat with LEOs,
3) A 10-second TASER® X26™ ECD exposure,
4) A K-9 training exercise of approximately 30-seconds, or
5) An Oleoresin Capsicum (O.C.) exposure to the face.

Subjects had an intravenous catheter placed by a physician or paramedic prior to the test. Baseline catecholamines (epinephrine, norepinephrine, dopamine, and total) were drawn at that time. Subjects then participated in their assigned task. Catecholamines were drawn immediately (within 30-seconds) after the task and every two-minutes for 10-minutes. In addition to catecholamines, pH and lactate were drawn at baseline and every two-minutes for 10-minutes.

## Results

60 subjects completed the testing. The median age was 35 years old (range of 19 to 67), 85 percent were male, and the median body mass index was 27.8. For total catecholamines, there was no difference between the groups at baseline and the median pre-task was 474 (range 241 to 1348, IQR 269 to 824).

Immediately after the task, the highest median was the heavy bag group at 3621 (range 1359 to 11669, IQR 3177 to 4891). The next highest was the sprint group at 2070 (range 1466 to 3606, IQR 1794 to 2518). The K-9 group was next at 1503 (range 803 to 2001, IQR 1299 to 1642). The ECD and O.C. groups were last at 1038 (range 653 to 1363, IQR 955 to 1089) and 1032 (range 545 to 1233, IQR 736 to 1085). These differences persisted for all time points.

Fractionated results followed the same pattern. The pH was the lowest and lactate the highest for the heavy bag group, followed by the sprint group. The results are displayed graphically in the figures.
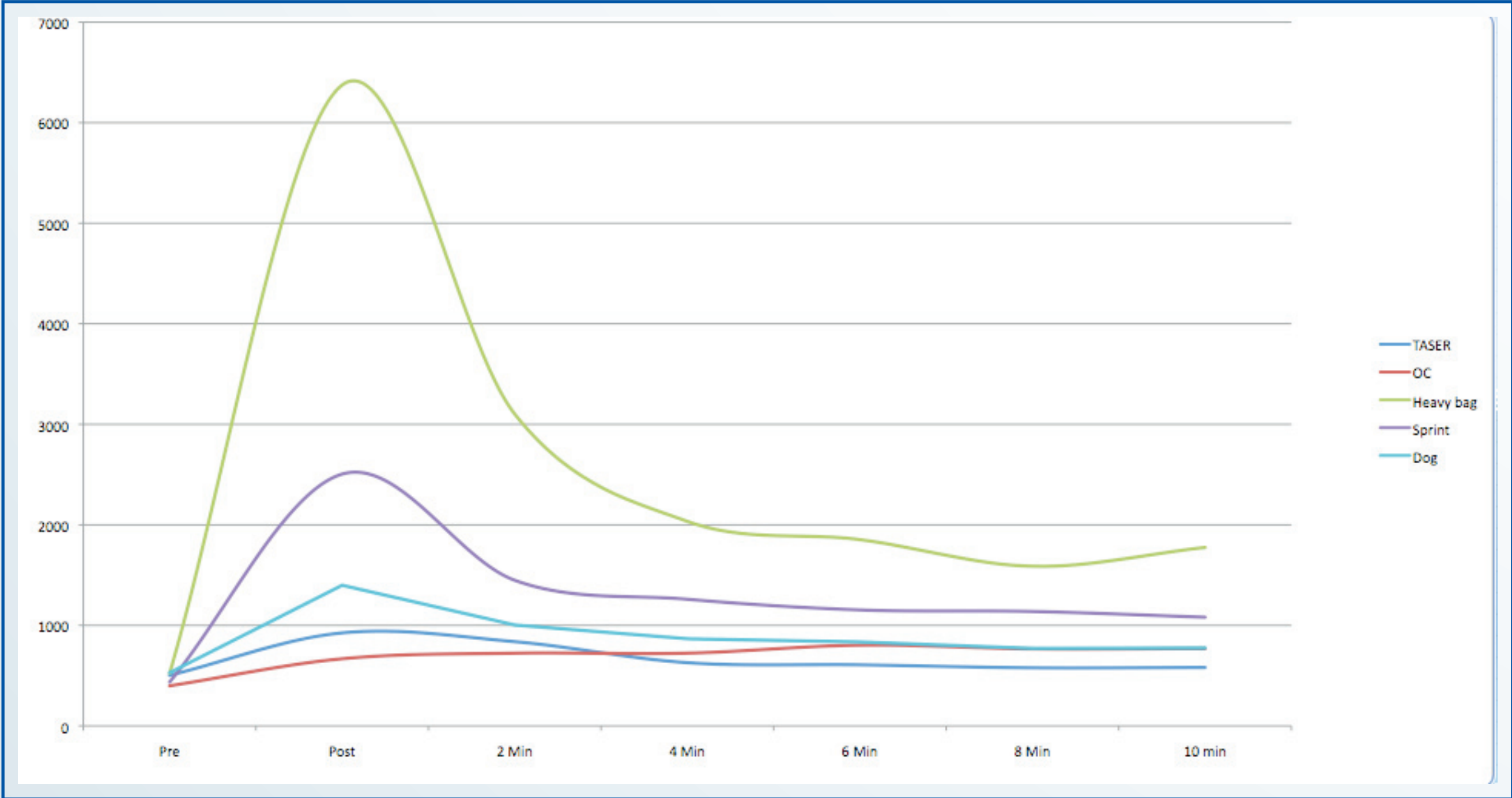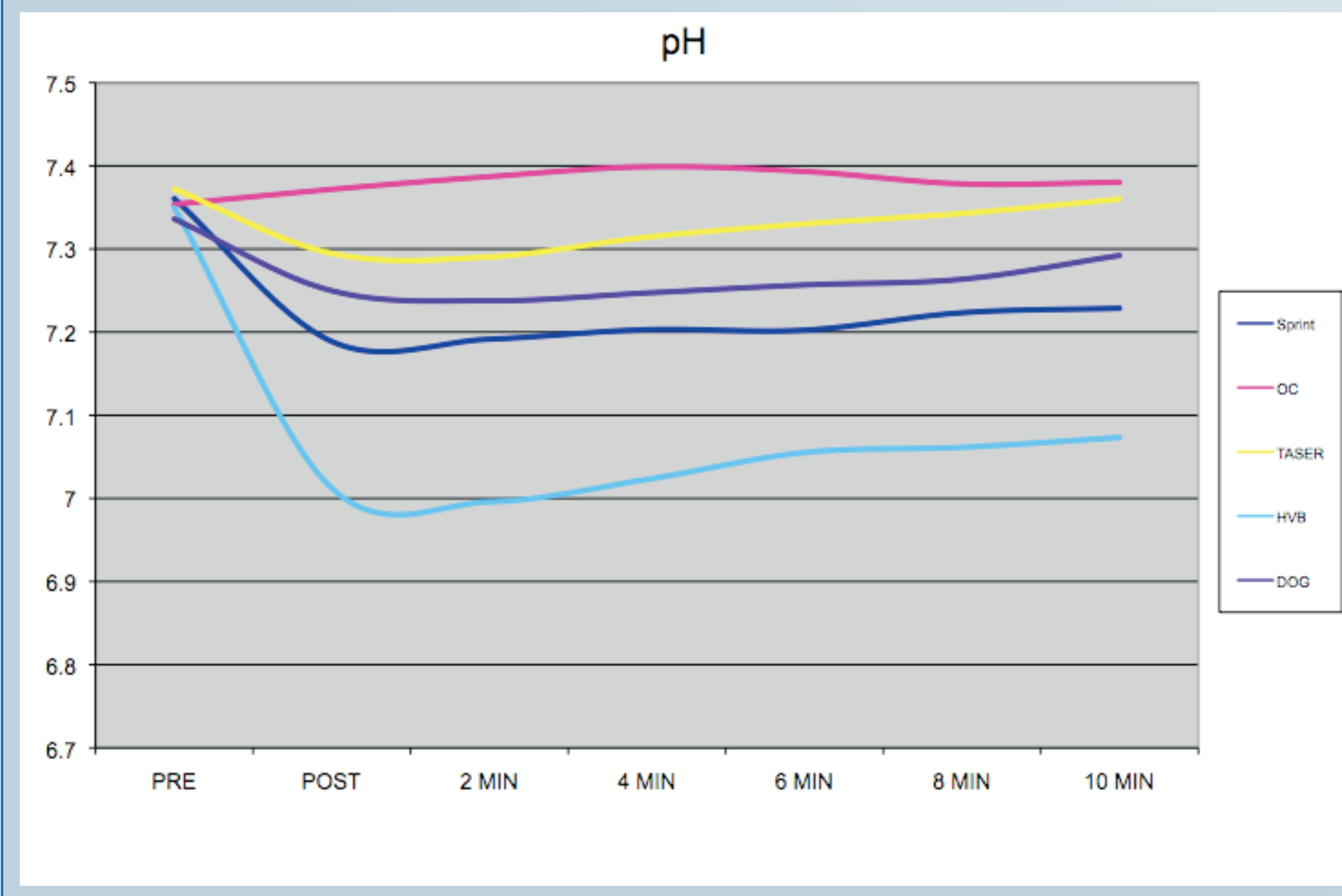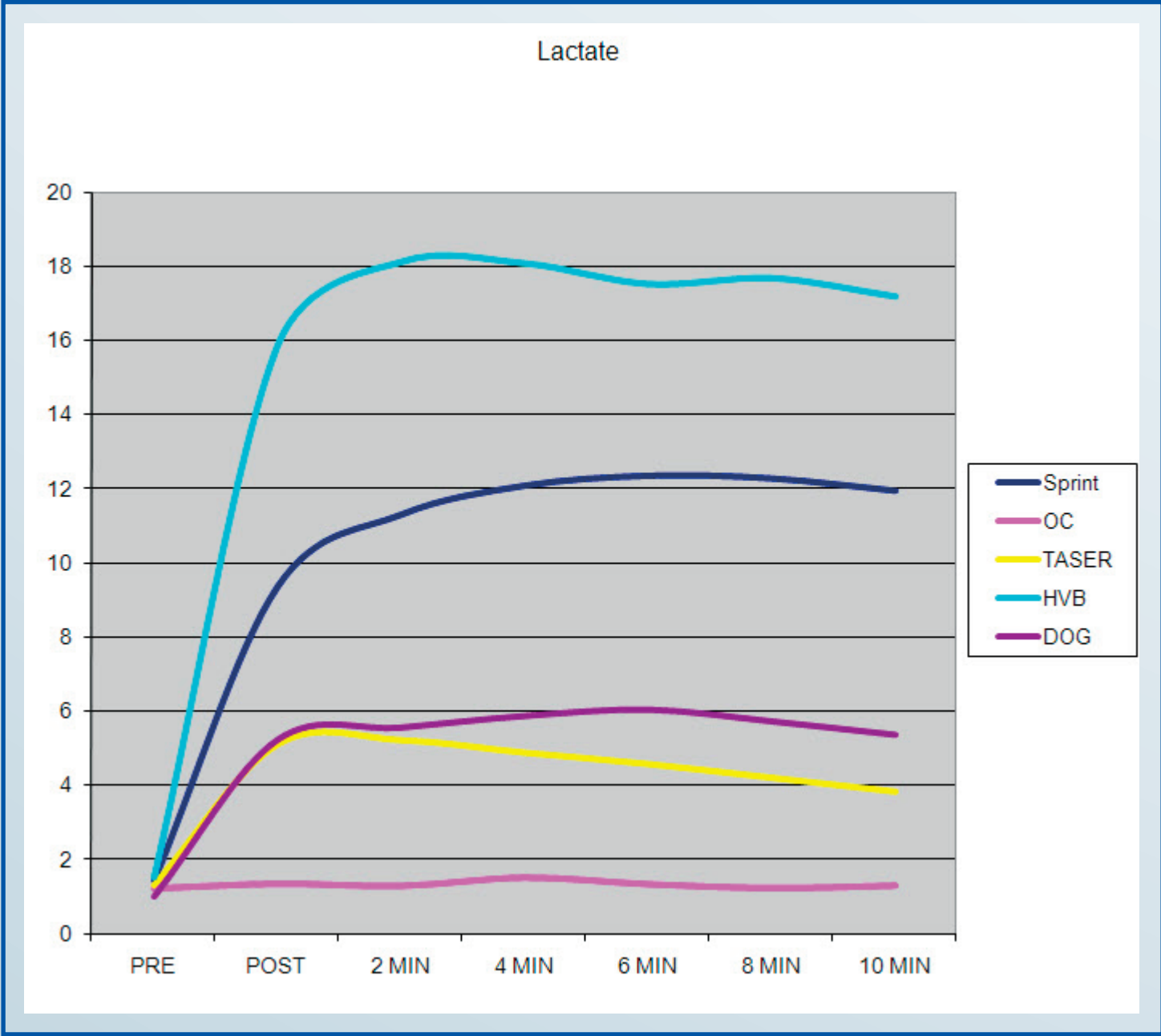


**EPI Graph**

## Conclusions

The comparison of use of force encounters demonstrated that the ECD was one of the least activating of catecholamines while the simulated combat was one of the most activating. The simulated combat also lowered the pH the most out of all the tasks.

These results combined suggest that fighting with LEOs may be the most detrimental from a physiologic standpoint. The authors recommend further study in this area to assist LEOs in determining the best tactics and devices to utilize in arrest scenarios that have higher likelihood of being associated with an ARD.



**pH Graph**



**Lactate Graph**