Effect of an Electronic Control Device Exposure on a Methamphetamine Intoxicated Animal Model

Jeffrey D. Ho, MD1,2; Donald M. Davies, MD3; Jon B. Cole, MD1; Robert F. Reardon, MD1; Julie C. Hattigter, BS1; Karen S. Tervey, BA1; Daniel G. Falvey, BS1; James R. Miner, MD1
1Dept. of Emergency Medicine, Hennepin County Medical Center, Minneapolis, MN
2Dept. of Emergency Medicine, Lompoc Valley Medical Center, Lompoc, CA
3Meeker County Sheriff’s Office, Meeker County, MN
4Santa Barbara Public Health Department, Santa Barbara, CA

Introduction

Because of the prevalence of methamphetamine abuse worldwide, it is not uncommon for subjects in law enforcement encounters to be methamphetamine intoxicated. Methamphetamine has been present in arrest-related death cases in which an electronic control device was used. This is the first study on the use of electronic control devices in an animal model of methamphetamine intoxication.

Methods

16 Dorset sheep (26-78 kg) received 0.0 mg/kg (control animals, n=4), 0.5 mg/kg (n=4), 1.0 mg/kg (n=5), or 1.5 mg/kg (n=4) of methamphetamine hydrochloride as a slow intravenous bolus during continuous cardiac monitoring. The animals received the following exposures in sequence:

a) 5-second continuous exposure;

b) 15-second intermittent exposure;

c) 30-second intermittent exposure;

d) 40 second intermittent exposure.

Darts were inserted to depth (9 mm) for each exposure at the sternal notch and the cardiac apex. Cardiac motion was determined by thoracotomy (smaller animals, <38.5 kg) or echocardiography (larger animals, >68 kg).

Results

All animals demonstrated signs of methamphetamine toxicity with tachycardia, hypertension, and atrial and ventricular ectopy in the 30-minute period immediately after administration of the drug. Smaller animals (n=8, <32 kg, average 29.4 kg) had supraventricular dysrhythmias after the exposures. Larger animals (n=8, >68 kg, average 72.4 kg) had only sinus tachycardia after exposure. One of the smaller animals had frequent episodes of ventricular ectopy after all but one exposure including a run of delayed-onset, non-sustained eight-beat multi-focal ventricular tachycardia that spontaneously resolved. This animal had significant ectopy prior to the exposures as well.

Thoracotomy performed on three smaller animals demonstrated cardiac rate capture during the exposure consistent with previous animal studies. In the larger animals, none of the methamphetamine-intoxicated animals demonstrated capture. Two control sheep showed evidence of capture similar to the smaller animals. No ventricular fibrillation occurred with capture.

Conclusions

In smaller animals, electronic control device exposure exacerbated atrial and ventricular irritability, but this effect was not seen in larger animals.

References