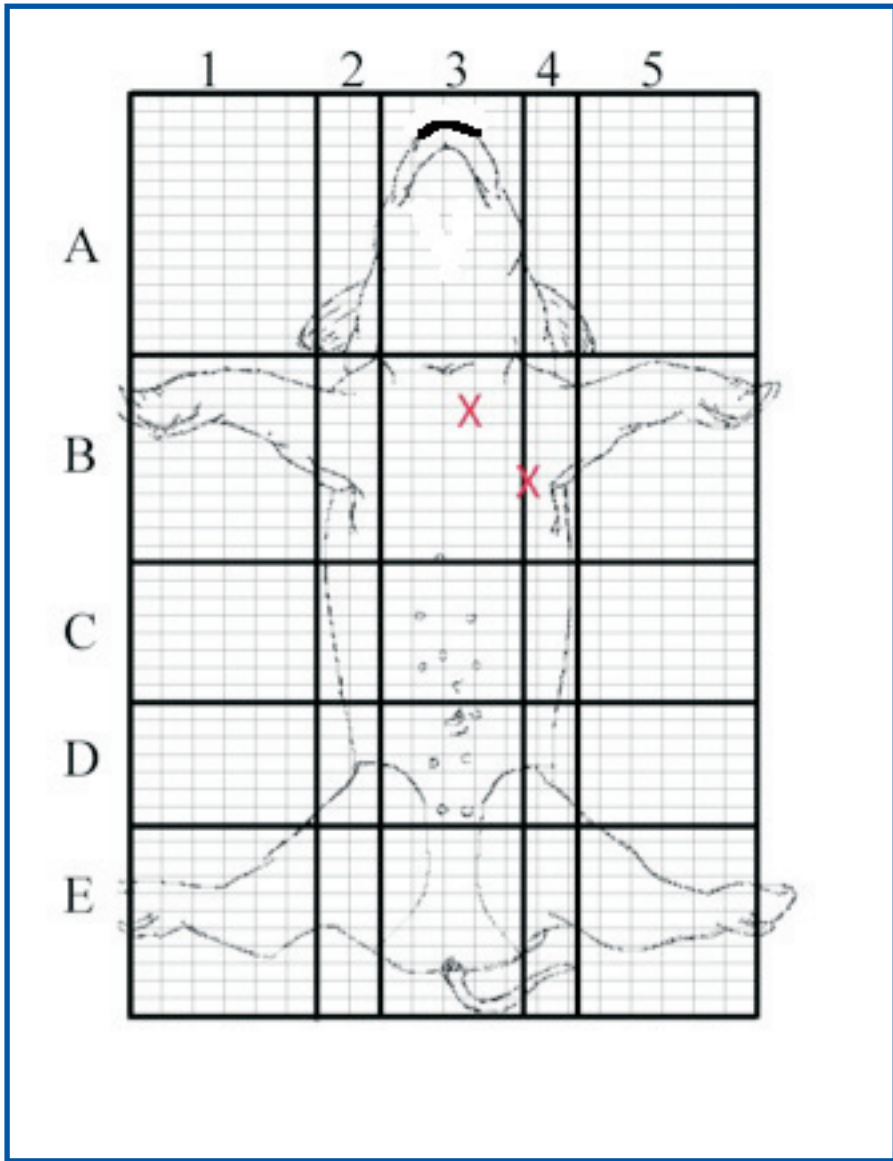


Introduction

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.

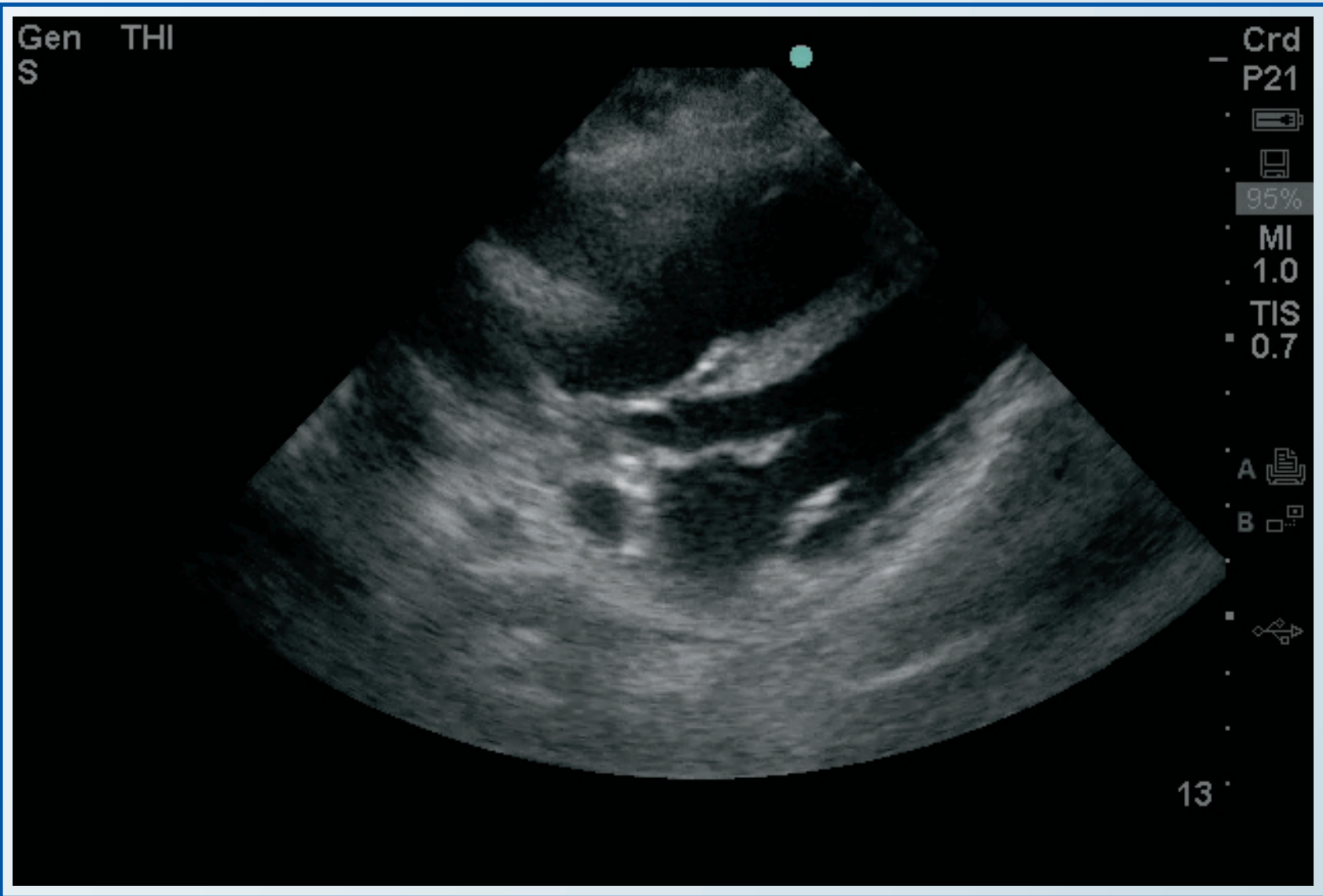


Methods

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-sec intermittent exposure;
- c) 30-sec intermittent exposure;
- d) 40 sec 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) 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.

Animal	Methamphetamine Dose	Weight	Skin to Heart Distance	Pre-exposure Heart Rate	Post Methamphetamine Heart Rate	Post 5-second ECD Exposure Heart Rate	Post 15-second ECD Exposure Heart Rate	Post 30-second ECD Exposure Heart Rate	Post 45-second ECD Exposure Heart Rate	Notes
1	0	31 kg	23 cm	68		102	163	119	155	Control; PACs post 30-second exposure; capture
2	0	30 kg	24 cm	84		125	145	87	85	
3	0	72 kg	30 cm	55		190	191	273	151	Capture
4	0	74 kg	34 cm	76		77	77	240	180	
5	0.5 mg/kg	27 kg	21cm	75	147	144	140	130	138	
6	0.5 mg/kg	68 kg	35 cm	77	142	195	145	134	137	
7	0.5 mg/kg	78 kg	34 cm	69	160	101	95	120	112	Ectopy post methamphetamine
8	0.5 mg/kg	27 kg	22 cm	80	115	110	104	99	95	Ectopy post methamphetamine
9	1.0 mg/kg	32 kg	21 cm	103	202	155	159	186	191	Delayed ventricular ectopy post ECD exposures
10	1.0 mg/kg	32 kg	21 cm	85	179	109	124	151	142	SVT post 30 second exposure
11	1.0 mg/kg	68 kg	31 cm	68	199	212	130	134	110	
12	1.0 mg/kg	68 kg	29.5 cm	82	230	196	170	168	102	
13	1.5 mg/kg	78 kg	46 cm	91	220	200	207	220	208	Ectopy post methamphetamine
14	1.5 mg/kg	73 kg	38 cm	77	220	163	173	112	149	
15	1.5 mg/kg	26 kg	20 cm	92	194	155	159	134	160	SVT post 30 second exposure; capture
16	1.5 mg/kg	30 kg	22 cm	80	174	167	163	150	157	Ectopy post methamphetamine; intermittent capture

Conclusions

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

References

- Di Maio TG and VJM Di Maio. Excited delirium syndrome cause of death and prevention. 1st ed. Boca Raton, FL: Taylor & Francis Group, 2006.
- Walter RJ, Dennis AJ, Valentino DJ, et al. TASER X26 discharges in swine produce potentially fatal ventricular arrhythmias. Acad Emerg Med, 2008;15:66-73.
- Ho JD, Dawes DM, Reardon RF, et al. Echocardiographic evaluation of a TASER X26 application in the ideal human cardiac axis. Acad Emerg Med, 2008;15:838-844.
- Lakkireddy D, Wallick D, Ryschon K, et al. Effects of cocaine intoxication on the threshold for stun gun induction of ventricular fibrillation. J Am Coll Cardiol, 2006;48:805-811.
- Chan, Theodore C., Vilke, Gary, M. Chapter 8 CEW Research Models Animal and Human Studies, pg. 109-118, TASER Conducted Electrical Weapons: Physiology, Pathology, and Law