

Validation of a poll shot captive bolt as a single step method of euthanasia of cattle

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Introduction

Euthanasia should occur with minimal pain and distress for the animal and the person administering the procedure. The AVMA Guidelines for Euthanasia lists a frontal shot as the recommended anatomical location for both penetrating captive bolt and gunshot euthanasia. However, in many situations access to the frontal site is not possible or may cause excessive distress to the animal. The objective of this study was to validate the effectiveness of a penetrating captive bolt when positioned behind the poll as a single step method for humane euthanasia of cattle.

Materials and methods

This study was approved by Iowa State University Institutional Animal Care and Use Committee (IACUC #18-330). Seventeen cattle ranging in age from neonates to mature cows deemed eligible for euthanasia were enrolled in the study. Cattle were restrained, ECG leads were attached, and a baseline ECG was obtained. A penetrating captive bolt was placed in the recess directly behind the animal's poll on midline and directed toward the base of the tongue. Clinical assessment included determining the presence/absence of: corneal and palpebral reflexes, righting reflex, vocalization, regular respiration, involuntary spinal reflex, and rhythmic heartbeat. Clinical scores were recorded every minute until clinical death (heartbeat unable to be auscultated). The ECG was recorded from time of baseline until flatline was observed for at least 2 minutes or for length of paper recording (20 minutes). Following determination of clinical death and cessation of ECG recording, the brain was removed and tissue damage along the bolt trajectory was evaluated by a boarded anatomic pathologist. Tissue destruction scores (0 = none, 1 < 25%, 2 = 25-50%, 3 > 50% damage) were based on gross examination of the medulla, pons, cerebellum and midbrain.

Results

In total, 17 animals were euthanized with the poll shot method. All correctly targeted animals were rendered immediately unconscious (collapse, no vocalization, regular respiration or righting reflex). All but one animal achieved clinical death in 12 minutes or less. In all animals that were properly shot, the palpebral and corneal reflex, righting reflex, vocalizations and respirations were absent immediately after the poll shot was administered. A normal heart rhythm was detected for a median time of 8 minutes (range 2 to 12), and median time to clinical death (no heartbeat) was 9 minutes (range 7-17). The mean time to ECG flatline was 13.6 minutes (median 12, range 10-19).

The cerebellum and medulla, responsible for movement coordination and central control of cardiopulmonary function, had the most tissue damage with mean scores of 2.9 and 2.1, respectively. All animals had greater than 25% damage to the cerebellum and 10 of the 14 animals had greater than 50% damage to the medulla, which was transected in these animals. Only 1 animal of the 17 euthanized with poll shot had a damaged obex, however, the mild degree of tissue disruption did not preclude BSE screening.

Significance

This study demonstrates that poll shot euthanasia is an effective one-step method for cattle. The immediate loss of respiration, righting reflex, vocalizations and palpebral and corneal reflexes indicate that animals immediately lost sensibility and none of these attributes was regained. Thus, a properly placed poll shot meets criteria for a humane euthanasia method. Clinical assessment and time to death were comparable to a previous investigation of frontal shot efficacy performed by our research group using similar assessment criteria. However, the degree of assessed brain tissue damage was higher for the poll shot technique. Proper placement and angle are critical to achieving effective euthanasia; as with all approved euthanasia modalities, operators should be trained to follow proper techniques and be prepared to administer a secondary step, if necessary.

