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Evaluation of brainstem disruption following penetrating captive-bolt shot in isolated cattle heads: comparison of traditional and alternative shot-placement landmarks

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Abstract

Currently recommended landmarks for captive-bolt euthanasia of cattle often result in failure to penetrate the brainstem. The purpose of this study was to evaluate the ability to disrupt the brainstem by placing the shot at a higher position on the head. Intact heads from euthanased animals or natural mortalities were used for this study. Heads were grouped as adult (> 2 years), young (6–24 months) and neonate (< 1 month) and randomly assigned to either the LOW group (the intersection of two lines drawn from the medial canthus to the top of the opposite ear) or the HIGH group (midline halfway between the top of the poll and an imaginary line connecting each lateral canthus). Each head received a single shot from a CASH penetrating captive bolt with bolt length and power load selected based on manufacturer's recommendations. Computed tomography images of each head were evaluated independently by two veterinary radiologists. Brainstem disruption was assumed to occur if the bolt passed caudal to the presphenoid bone and deep to the third ventricle and was within 1.5 cm of midline. Brainstem disruption occurred in 16/18 adult HIGH and 7/14 adult LOW heads, 13/16 young HIGH and 11/19 young LOW heads, and 11/11 neonate HIGH and 14/14 neonate LOW heads. The higher shot location landmarks used in this study increased the probability of disrupting the brainstem when adult cattle were shot with a penetrating captive bolt which should reduce the risk of regaining sensibility. Reliable brainstem disruption is a precondition for considering penetrating captive bolt as a single-step euthanasia method. Further research is needed to determine if this method will reliably ensure a humane death.

Keywords: *animal welfare, brainstem, captive bolt, cattle, euthanasia, shot placement*