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Evaluation of euthanasia of sheep with intravenous saturated salt solutions to enable the collection of whole, intact brains

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Abstract

Captive bolts or firearms are unsuitable for euthanasia of livestock when an intact brain is required for diagnostics. Injectable barbiturates can be used, but this method carries risk of poisoning animals eating the carcase. Intravenous saturated salt solutions have been used to euthanase heavily sedated ruminants and are cheap, readily available and not a risk to scavenging animals. However, there is concern that they may be painful or cause distress to animals that are not unconscious. This study aimed to determine the suitability of saturated salt solutions, in combination with xylazine, as a method of euthanasia of ruminants using a sheep model. Thirty-two sheep were sedated with xylazine (0.4 mg kg^{-1} IM) and euthanased with an intravenous overdose of pentobarbitone (PENT; n = 10), saturated potassium chloride (KCL; n = 11) or saturated magnesium sulphate (MGS; n = 10). Time until end of rhythmic breathing and cardiac arrest, and movement events were recorded. Conscious perception of pain was evaluated by measuring cortical brain activity by electroencephalography (EEG). There was no evidence of perceived pain or unpleasant sensory experience for any treatment as indicated by P50, P95 and P_{tot}, and so all methods were deemed humane. Time until transient EEG was comparable for all treatments. Time until onset of isoelectric EEG was prolonged for KCL. Animals euthanased with KCL consistently exhibited severe reflex movements during infusion (eg kicking, convulsion). No severe movement events were observed in animals euthanased with MGS, hence, physiological and movement data support the preferential use of MGS over KCL.

Keywords: *animal welfare, electroencephalogram, intravenous euthanasia, magnesium sulphate, potassium chloride, ruminant*