Non-chemical techniques for inducing analgesia prior to velveting: I. Electronic-analgesia

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Abstract

The effectiveness of Electronic Analgesia (EA) for providing pain relief during velveting was investigated. A commercial EA device was tested on 26, 2- to 3-year-old red deer stags in its standard format, and after various modifications to the electrode design and placement in combination with modifications to the type and intensity of the electrical current delivered. The level of analgesia induced by EA was highly variable between animals and was not improved by any of the modifications to the device. In no instance was there complete analgesia, and in most cases there was mild pain relief only. While EA has the potential to induce analgesia, the current technology does not provide sufficient levels of analgesia for it to be considered as a suitable alternative to local anaesthetic for velvet removal.

Introduction

Electronic analgesia (EA) is used to provide pain relief in human dentistry (Crool & Simonsen, 1994). It has been proposed that a similar technique, using a modified device, "Vet-EA" is an effective method of pain control for use during velvet removal (Burgio, 1998). As there are no published scientific studies on the effectiveness of EA in deer we conducted a study using the standard "Vet-EA" device to determine the potential of EA for inducing analgesia in velvet. This experiment demonstrated that the standard equipment provided moderate pain relief only. Thus, subsequent studies were undertaken using a variety of modifications to the "Vet-EA" to determine if the degree of analgesia induced could be improved further. This report outlines the results from the complete series of experiments.

Methods

Experiment 1 - Standard "Vet-EA" device

Seventeen, 3-year-old red deer stags were used. The antlers were at an optimal stage for velvet removal. The animals were restrained physically during application of the analgesic treatments and velvet removal. The EA equipment consisted of a battery operated unit that was set up as recommended by the manufacturer. That is, the current modulation was set at M, pulse width at 260 microsec (maximum), pulse rate at 120Hz, and the pulse amplitude was increased from 0 to 60mA (denoted as 1 to 7 on the unit) over 3-4 minutes, after the electrodes had been connected to the animal. Three different variations of the electrode placement or type were tested: unilateral (attached to either side of one antler only); bilateral (two sets of electrodes used simultaneously and attached as for the unilateral placement); modified electrodes, consisting of two bare copper wires - one was wrapped around the (shaved) velvet above the cutting site and the second was wrapped around the (shaved) pedicle.

Apart from the treatment using bilateral electrodes, the EA was applied to one side only, alternating left and right on successive animals, and local anaesthetic, as a control treatment, consisting of 10-25 ml of lignocaine hydrochloride applied as a ring block, was used on the control side.

The degree of analgesia induced by the treatments was quantified by comparing the differences in magnitude of a mild electrical stimulus (ES) (1-2 sec duration) required to induce a standard withdrawal response prior to and following the use of an analgesic procedure (Matthews et al 1992). An increase in current magnitude required to elicit a response following treatment indicated partial analgesia, whereas absence of a withdrawal response at the highest current magnitude indicated complete analgesia. In addition, the behavioural responses of the animals, as the "Vet-EA" current was applied, were recorded. At no time were the ES and the EA switched on together; that is, there was no possibility that the ES interfered with the induction of any analgesia.

Experiment 2 - Modified "Vet-EA" device

Nine 2-year-old stags were used. The standard "Vet-EA" device was modified to enable a greater degree of fine control over the magnitude of the applied current, particularly at the initial settings, and to allow at least a doubling in the magnitude of the applied voltage and current.

As in Experiment 1, a variety of electrode types and placements were tested (bilateral, unilateral and modified) using the standard EA settings (see Experiment 1). In addition, the effect of varying the pulse width, in combination with the unilateral and modified electrodes, on degree of analgesia was evaluated. Lignocaine hydrocloride (20-30ml) was applied to the contralateral antler, except for the bilateral electrode placement condition, as a control treatment.

The degree of analgesia was quantified as described in Experiment 1.

Analyses

The differences between EA and control treatments or between pre- and post-analgesic measurements were assessed for statistical significance using ANOVA.

Results

Experiment 1

The mean intensity setting attained using EA was 4.6, with a range of 3.5 - 6.0. Almost all stags showed eye twitching, and eye watering, eye bulging, swelling behind the eye, and flattening of the ear was also seen. Twelve of the 17 stags jumped at least once during EA.

There were no systematic differences between electrode configurations with the EA treatment, thus the data were combined for the purposes of analysis. The mean minimum level of ES required to elicit the standard withdrawal response was 13 mA (SEM ± 2.1) for baseline tests and 17 mA (SEM ± 1.8) for tests after EA (values adjusted for baseline responses) and there was a significant difference between these pre- and post-treatment means ($p<0.05$).

Only two out of the 16 stags recorded showed any response in the analgesic tests after treatment with local anaesthetic, and neither of these attained the standard withdrawal response. The mean maximum level of ES given which did not elicit a response after treatment with local anaesthetic was 62 mA (sem 3.9). There was a clear difference between EA treatments and local anaesthetic in the degree of analgesia that was induced.

Experiment 2

All animals showed strong avoidance responses to applications of EA at higher currents and pulse widths. At the lowest pulse widths (less than 60 microsec) at low currents there were no aversive responses.

There were no systematic differences between electrode configurations in response to EA, thus the data were pooled for analysis. All stags reacted to ES after application of EA. The mean level of ES required to elicit the standard response was 11 mA (SEM ± 1.5) prior to EA and 20.1 mA (SEM ± 4.9) after EA treatment. This difference was significant ($p<0.05$). All stags were fully analgesic after treatment with local anaesthetic. The mean maximum level of ES given which did not elicit a withdrawal response after treatments with local was 51.2 mA (SEM ± 2.6).

Discussion

The level of analgesia induced by EA was highly variable between animals. In no instances was there complete analgesia, and in most cases there was a very mild level of analgesia only. This was in sharp contrast to the consistency and completeness of analgesia achieved with the majority of animals given local anaesthetic. None of the modifications to either the electrode configuration (placement and/or design) or current delivery procedure lead to improvements in the level of analgesia attained following EA treatment. The level and frequency of avoidance responses to applications of the EA also gives cause for concern. While EA has the potential to provide analgesia, with the present devices it does not provide sufficient levels of pain relief to be considered as an adequate alternative to the use of local anaesthetic for velveting. Further modifications to the electrode configuration and/or current parameters may lead to improvements in the level of analgesia that can be achieved with EA.

References

Burgio, P.A 1998. Electronic anaesthesia. a fast new method of pain control for cutting velvet antler and tapping the ear *The North American Deer Farmer* Spring 1988, p 21

Crool, T.P, Simonsen, R.J, 1994 Dental electronic anaesthesia for children: Technique and report of 45 cases *Journal of Dentistry for Children* March-April 1994 97-104

Matthews, L.R., Ingram, J R, Cook, C J, Bremner, K J, Kirton, P. 1992 Induction and assessment of velvet analgesia. *Proceedings of a Deer Course for Veterinarians* Deer Branch NZVA 9: 69-76