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SHORT COMMUNICATION

Pilot study of long-term anaesthesia in broiler chickens

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Abstract

Objective To provide stable anaesthesia of long duration in broiler chickens in order to perform a terminal caecal ligated loop procedure.

Study design Prospective experimental study.

Animals Seven clinically healthy broiler chickens (*Gallus domesticus*) aged 27–36 days, weighing 884–2000 g.

Methods Anaesthesia was induced and maintained with isoflurane in oxygen. All birds underwent intermittent positive pressure ventilation for the duration. End-tidal carbon dioxide, peripheral haemoglobin oxygen saturation, heart rate and oesophageal temperature were monitored continuously. All birds received intraosseous fluids. Butorphanol (2 mg kg^{-1}) was administered intramuscularly at two hourly intervals. Euthanasia by parenteral pentobarbitone was performed at the end of procedure.

Results Stable anaesthesia was maintained in four chickens for durations ranging from 435 to 510 minutes. One bird died and one was euthanized after 130 and 330 minutes, respectively, owing to surgical complications and another died from anaesthetic complication after 285 minutes.

Conclusions and clinical relevance Long-term, stable anaesthesia is possible in clinically healthy chickens, provided complications such as hypothermia and hypoventilation are addressed and vital signs are carefully monitored. There are no known previous reports describing monitored, controlled anaesthesia of this duration in chickens.

Keywords anaesthesia, avian, chicken, ligated loop, monitoring.

Introduction

Much is written in clinical texts and the literature about recommendations for safe anaesthesia in avian patients, but little has been published concerning long-term anaesthesia. Fedde (1978) reviewed many of the agents used in avian anaesthesia, including phenobarbitone, which provided anaesthesia of 24 hours' duration. However, few details are given regarding the stability or monitoring of anaesthesia in these reports.

We report the results of a pilot study in which long-term anaesthesia was required for a caecal ligated loop experiment studying bacteriophage therapy for *Campylobacter jejuni* (Connerton et al. 2011). The procedure was based on that reported by Van Deun et al. (2008), but with the objective of longer-term anaesthesia followed by euthanasia rather than recovery.

Materials and methods

Animals

A total of seven 1-day-old male broiler (Ross 308) chickens were obtained from a commercial hatchery

and reared in a biosecure environment until the day of procedure, when the birds were between 27 and 36 days of age, in accordance with the Home Office code of practice for the housing and care of animals used in scientific procedures. Birds were group housed until 20 days of age and were individually caged thereafter. Feed and water were available *ad libitum* with a 12 hour light/dark cycle. All birds were considered to be healthy at the preanaesthesia clinical examination.

This study was carried out in accordance with UK and EU legislation. All procedures were approved by the Local Ethics Committee of the University of Nottingham and performed under Home Office licence.

Anaesthetic protocol

Feed was withdrawn on the morning of the procedure, the birds were weighed and their crops palpated to confirm no ingesta were present. While restraining birds manually with a towel, anaesthesia was induced via a mask attached to an Ayre's T-piece circuit through which isoflurane (5%; IsoFlo; Abbott, UK) was delivered from an agent-specific vaporizer. Once anaesthetized, each bird was intubated with an uncuffed orotracheal tube (Portex; Smiths Medical, UK) with internal diameter 2.5–4 mm, depending on bird size. Anaesthesia was maintained with isoflurane in oxygen and intermittent positive pressure ventilation was performed using a pressure-limited ventilator (SAV03; Vetronic Services, UK). The trigger point was set to achieve normal inspiratory depth and the expiratory time was adjusted to maintain an end-tidal carbon dioxide ($P_E'CO_2$) target of 35–45 mmHg (4.7–6.0 kPa). Depth of anaesthesia was assessed using cardiovascular parameters and reflexes and isoflurane vaporizer settings were varied between 2.5% and 3%. Each bird was positioned in dorsal recumbency between warm water-filled gloves on an electronic heat mat and foam wedge at a head-up angle of approximately 10°. Heart rate (HR) and peripheral haemoglobin oxygen saturation (SpO_2) were measured with a VM 2500 veterinary CO_2/SpO_2 monitor (Viamed, UK) with the pulse oximeter probe placed on a wing web or between toes. The $P_E'CO_2$ and ventilation rate (f_R) were measured on the same unit. A flexible thermometer probe attached to a monitoring console (Minimon 7138B; Kontron, UK) was introduced oesophageally to approximately the level of the heart. Body temperature, SpO_2, $P_E'CO_2$, HR and f_R were monitored continuously and recorded every 15 minutes.

A 21 g hypodermic needle was inserted into the medullary cavity of the tibiotarsus to deliver lactated ringers (Vetivex 11; Dechra, UK) solution at 10 mL kg^{-1} $hour^{-1}$.

Butorphanol (Torbugesic; Pfizer, UK) was administered intramuscularly, into the superficial pectoral or thigh, at a single dosage of 1 mg kg^{-1} in the first bird and 2 mg kg^{-1} every 2 hours in the subsequent six birds.

Surgical procedure

A midline coeliotomy was performed with parasternal flap extension to allow exteriorization of the intestines and caeca for ligation, sampling and injection. Further sampling was performed every 1–2 hours for a total of 6 hours. Between samplings the viscera were returned to the body cavity and the body wall was temporarily apposed.

All birds were euthanized at the end of the procedure with an overdose of parenteral pentobarbitone.

Results

Ages, weights and monitored parameters are shown in Table 1. Birds 2, 3, 5 and 7 survived for the duration required for the experiment. Bird 1 died following a surgical complication during the coeliotomy. In response to the application of towel clamps to temporarily appose the body wall after returning the viscera to the abdominal cavity, the bird became tachycardic and the isoflurane concentration was increased, but the bird died very soon thereafter. The technique was refined by using stay sutures to achieve apposition and avoiding direct coelomic irrigation with lavage fluid in subsequent surgeries. Bird 4 was euthanized after 330 minutes following detection of caecal thromboemboli. We believe this occurred following a potential torsion event after viscera were returned to the body cavity. Care was taken to avoid this in subsequent procedures.

Bird 6 died unexpectedly after 285 minutes of anaesthesia; this was noted as a sudden drop in $P_E'CO_2$ followed by loss of pulse oximeter trace and palpable heartbeat. No change in monitoring parameters were noted prior to this occurrence.

Despite reducing airway pressure on entry of the body cavity and attempting to pack off with