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RESEARCH PAPER

Peri-anaesthetic and anaesthetic-related mortality risks in great apes (Hominidae) in zoological collections in the UK and Ireland

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Abstract

Objective To estimate the risk of death and identify the major risk factors for peri-anaesthetic mortality in great apes (Hominidae) that underwent anaesthesia in zoological collections in the UK and Ireland between 1 January 1990 and 30 June 2005.

Study design confidential, retrospective cohort study.

Animal population The study population comprised all great apes from 16 zoological collections in the UK and Ireland that were anaesthetised during that period.

Methods All available anaesthetic records were collected. Outcome at 7 days post-anaesthesia was recorded as alive, dead or euthanased. The risk of peri-anaesthetic mortality was calculated. Multivariable analysis of potential risk factors was performed.

Results A total of 1182 anaesthetic records were collected and analysed. Sixteen peri-anaesthetic deaths occurred, resulting in a peri-anaesthetic mortality risk of 1.35%. Twenty percent of deaths (3/15) occurred during maintenance and 80% (12/15) occurred post-anaesthetic but within 7 days. A subjective assessment suggests at least five anaesthetic-related deaths occurred; in other words an anaesthetic-related mortality risk of 0.42% (5/1182) or above. In the multivariable analysis, health status and age were significantly associated with peri-anaesthetic mortality. Animals assessed as 'sick' pre-anaesthetic were associated with a 26-fold (95% CI 5.55–122.32) increased risk of death compared with animals with a good health status. Animals aged over 30 years were associated with a 30-fold (95% CI 3.44–261.85) increased risk of death, compared with adults aged between 10 and 30 years.

Conclusions and clinical relevance This study has shown that great ape anaesthesia appears to carry a high risk of mortality. Sick and aged patients are at an increased risk of death and particular care should be exercised during their anaesthesia. Standardisation and completeness of anaesthetic records across zoological collections would assist greatly in further studies.

Keywords anaesthesia, great apes, Ireland, mortality, risk, UK.

Introduction

Few studies into the risk of peri-anaesthetic mortality in captive great apes (Hominidae) have been conducted, and these have focused on collections in the USA (April et al. 1982; Robinson & Lambert 1986; Wells et al. 1990). None have attempted to identify risk factors in peri-anaesthetic or anaesthetic-related mortality.

Ever since the first reported anaesthetic death (Anonymous 1847), anaesthetic-related mortality in humans has been investigated in attempts to minimise risk. Lunn & Mushin (1982), reported that 0.6% of human patients died within 6 days of surgery but only 0.01% of all deaths were directly attributable to anaesthesia. A review of the literature by Arbous et al. (1998), estimated that the risk of anaesthetic-related mortality in humans was between 0.05–10 per 10 000 administered anaesthetics (0.0005%–0.1%) (Bodlander 1975; Eichhorn 1989; Lunn & Devlin 1987; Cohen et al. 1992a,b). Almost certainly, the large variation in this estimate reflects the inherent difficulty in defining 'anaesthetic mortality' (Jones 2001) and the different study designs employed.

In the UK there is no legal requirement to report anaesthetic mortality in veterinary practice; therefore, the collection of meaningful data is difficult. However, a number of surveys have been undertaken, notably in companion animals and horses.

Clarke & Hall (1990) surveyed over 40 000 dog and cat anaesthetic records and reported a mortality of 0.23% and 0.29%, respectively, although these figures included animals with disease; making it difficult to interpret purely anaesthetic-related mortality. Identified factors associated with an increased anaesthetic-related mortality risk in small animals include: anaesthetic overdose leading to hypoxia; equipment failure; cardiovascular collapse; hypothermia; inadequate or no pre-medication; complications of tracheal intubation in cats; and xylazine and associated cardio-pulmonary arrest (Dodman 1977; Clarke & Hall 1990; Dodman & Lamb 1992; Dyson & Maxi 1998).

The complicated nature of anaesthesia in horses has generally been attributed to their cardiopulmonary physiology, large body mass and temperament (Thurmon et al. 1996). The Confidential Enquiry into Perioperative Equine Fatalities (CEPEF) reported an overall death rate of 1.9%, which fell to 0.9% if animals undergoing abdominal surgery were excluded. Most deaths occurred as a result of cardiac arrest or post-operative cardiovascular collapse (Johnston et al. 2002).

Recorded perioperative mortality risks in domestic species compare poorly with those in humans. Anecdotal clinical opinion suggests that peri-anaesthetic mortality in great apes is higher than in companion animals. As institutions that aspire to maintain self-sustaining captive populations, zoological collections have a responsibility to ensure mortality risks are minimised. This could not be more critical than in great apes: all species are endangered and the disruption to social groups by the loss of an individual is significant; animals can be long-lived in captivity; and their educational importance as flagship species is evident. The determination of a peri-anaesthetic mortality risk in great apes, and identification of any associated factors, would be a useful starting point in attempts to reduce anaesthetic risk in these species.

Materials and methods

All 21 known zoological collections, holding great apes since 1 January 1990, in the UK and Ireland were approached for access to their anaesthetic records. The following information was extracted from each anaesthetic record where available and appropriate – zoological collection; species; age; sex; body weight; physical condition; indication for anaesthesia; urgency of procedure; health status; season of the year; anaesthetic regime and duration, including pre-anaesthetic medication, induction, maintenance and reversal agents; endotracheal intubation, oxygen supplementation; presence of a dedicated anaesthetist; supplementary monitoring; IV fluid administration; end of procedure body temperature; outcome of anaesthesia up to 7 days post-anaesthesia; time of death in relation to anaesthesia; and anaesthetic complications where they occurred.

Anaesthetic outcome at 7 days was recorded as alive, dead or euthanased. For the purposes of the study 'overall mortality' was used to describe all anaesthetics in which the outcome was death or euthanasia. 'Peri-anaesthetic mortality' was used to describe all outcomes of death, excluding euthanasia. Any death where it was not possible to exclude anaesthesia as a component of mortality was described as 'anaesthetic-related'. It was recognised that an anaesthetic procedure might induce complications, such as brain damage, subsequently necessitating euthanasia, and thus a euthanasia case could still fall within the definition of 'anaesthetic-

