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CASE REPORT

Postoperative complications in a lamb after major surgery

Enzo Vettorato, Gudrun Schoeffmann, Philippa Beard & R Eddie Clutton
Royal (Dick) School of Veterinary Studies, The University of Edinburgh, Easter Bush Veterinary Centre, Roslin, Midlothian, EH25 9RG, UK

Correspondence: Enzo Vettorato, Royal (Dick) School of Veterinary Studies, The University of Edinburgh, Easter Bush Veterinary Centre, Roslin, Midlothian, EH25 9RG, UK. E-mail: enzovetto@libero.it
Current address: Dick White Referrais, Station Farm, London Road, Six Mile Bottom, Suffolk, CB8 0UH

Abstract

Intoduction Anaesthesia in lambs undergoing experimental surgery may develop problems associated with age-related immune incompetency: a postoperative complication in a 3 week old Scottish blackface lamb after spinal surgery is presented.

Case history and management Both lamb and ewe were in good condition. The ewe was vaccinated against *Clostridium perfringens* and *Clostridium tetani* 5 weeks pre-partum. There were no apparent problems with the lamb's intake of colostrum. Pre-anaesthetic medication was intramuscular medetomidine (10 μg kg^{-1}). Anaesthesia was induced and maintained with sevoflurane in oxygen. Morphine (0.5 mg kg^{-1}), meloxicam (0.6 mg kg^{-1}) and ketamine (1 mg kg^{-1} followed by 10 μg kg^{-1} $minute^{-1}$) were administered intravenously (IV) for perioperative analgesia. Atracurium (0.5 mg kg^{-1} IV, followed by 0.17 mg kg^{-1} injected when the first twitch of the four, train-of four count was palpated) was used to improve muscle relaxation. The lamb's trachea was intubated and the lungs mechanically ventilated to maintain normocapnia. Intrathecal morphine (0.2 mg kg^{-1}), IV meloxicam (0.3 mg kg^{-1}) and edrophonium (0.5 mg kg^{-1}) were administered before recovery. Operative and initial recovery periods were unremarkable. Three hours after surgery the lamb became depressed. Tachycardia (180–250 beats $minute^{-1}$), tachypnoea (30 breaths $minute^{-1}$), poor peripheral perfusion and cold pelvic limb extremities were present mimicking severe pain, and/or hypovolaemic shock. Analgesics – morphine (total dose 1.3 mg kg^{-1}) - and IV fluid therapy boluses – crystalloids (300 mL), colloids (120 mL) and fresh whole blood (60 mL) – failed to ameliorate clinical signs and so the lamb was euthanized 10 hours after surgery. Post-mortem findings supported a possible diagnosis of peracute *Clostridium perfringens* enterotoxaemia.

Conclusion *Clostridium perfringens* enterotoxaemia should be considered when clinical signs of severe pain and/or hypovolaemic shock fail to respond to analgesics and fluid resuscitation in lambs after major surgery.

Keywords anaesthesia, *Clostridium perfringens*, enterotoxaemia, lamb.

Introduction

Problems with anaesthetizing lambs for biomedical research arise from the animals' high metabolic rate, high body water content, low body fat and poorly developed thermoregulatory and cardiovascular reflexes compared with adult sheep (Clutton et al. 1998). Immature hepatic enzyme systems and an incomplete blood-brain barrier aggravate these problems (Jenkins 1986). Restoring body temperature and physical activity, specifically the ability to stand and suck, are imperative in the postoperative period. Depressed sucking activity may irretrievably break the ewe-lamb bond, particularly in sheep

breeds where good mothering is not a characteristic trait (Nowak et al. 2008).

For approximately the first 3 months of a lamb's life, immunity depends on passive immunity conferred by post-partum colostrum imbibition (De la Rosa et al. 1997). This protects most lambs against infectious agents to which their dams have been previously exposed, but depends on the strength of the ewe's immune system and the quantity of colostrum imbibed. Anaesthesia – and more importantly surgery – cause immune suppression in human neonates and may therefore increase morbidity and mortality associated with systemic infections (Kurosawa & Kato 2008).

Clostridium perfringens is an important cause of enteric disease in domestic animals and human beings (Hatheway 1990; Sorger 1996). Five serotypes have been isolated (A to E), with types A, B, C and D being most common in lambs. The clinical signs of infection are dysentery, abdominal pain, collapse and sudden death (Songer 1998). Mortality in unvaccinated flocks can reach 30% (Montgomerie 1961). Treatment of affected individuals is usually ineffective, thus prevention is essential. Administration of antibiotics, e.g. penicillin, is frequently futile once clinical signs have appeared. The main risk factors for field outbreaks are poor management, improperly timed and balanced food rations (in particular, the intake of an excessively energy dense diet), immunosuppression or inappropriate scheduling of dam vaccinations (Songer 1998).

This case report describes a fatal case most probably due to *Cl. perfringens* enterotoxaemia which developed acutely within 10 hours of an otherwise uncomplicated recovery from general anaesthesia and orthopaedic surgery in a lamb. The animal's demise resulted from: 1) a failure to recognize enterotoxaemia as a postsurgical complication in lambs; and 2) the similarity between signs of peracute enterotoxaemia, pain and hypovolaemic shock.

Material and methods

A 3 week old, Scottish blackface ewe-lamb, weighing 12.3 kg, was anaesthetized in the course of a study necessitating major orthopaedic surgery (PIL 60/3832). The animal and its dam were from a group purchased from a commercial flock. Both were acclimatized for 10 days before surgery. Housing was indoors and consisted of two opposite lines of five hurdled pens (1.5 × 2 m) littered with either barley or wheat straw. The lamb and its dam were confined in a single pen: water and hay were available *ad libitum* and the ewe was provided with commercial pellets ration (0.5 kg day^{-1} divided in 2 aliquots). Lambs were allowed to suckle ewes until after pre-anaesthetic medication and immediately before induction of anaesthesia, at which time they were separated. Artificial lighting was maintained from 08:00 until 23:30 each day. Preoperative physical examination indicated that both the lamb and ewe were healthy.

Two days before surgery, the lamb's thoracic wall was clipped, the underlying skin disinfected with povidone-iodine, and the body wall bandaged with elasticated bandage. This measure was taken to acclimatize the ewe to the lamb's anticipated postoperative (visual and olfactory) characteristics in an attempt to prevent rejection.

On the day of the surgery the lamb received an intramuscular (IM) injection of medetomidine (10 μg kg^{-1}, Domitor; Pfizer, UK) and was separated from the ewe 15 minutes later, when profound sedation was present. Anaesthesia was induced using sevoflurane (Sevoflo; Abbott Laboratories, UK) delivered by mask using a Bain breathing system; fresh gas flow was 3 L $minute^{-1}$. After tracheal intubation had been performed under laryngoscopy with a 6.5 mm OD cuffed endotracheal tube, anaesthesia was maintained with sevoflurane carried in oxygen and delivered using a circle system. End-tidal concentration of sevoflurane (FÉSevo) was held at 2.8%. Intermittent positive pressure ventilation (Penlon Nuffield 200 Ventilator, InterMed, UK) was applied throughout the procedure in order to maintain normocapnia (4.8–6.0 kPa) [36–45 mmHg]. After jugular venous cannulation using an 18-gauge cannula, Ringer's lactate solution was infused (10 mL kg^{-1} $hour^{-1}$). Morphine (0.5 mg kg^{-1}, Morphine sulphate injection BP 1%; Martinadale Pharmaceuticals, UK), meloxicam (0.6 mg kg^{-1}, Metacam; Boehringer Ingelheim, UK) and ketamine (1 mg kg^{-1}, followed by a constant rate infusion of 10 μg kg^{-1} $minute^{-1}$, Vetalar V 10%; Pharmacia & Upjohn, UK) were administered intravenously (IV) before surgery began. Neuromuscular blockade was achieved with atracurium (0.5 mg kg^{-1} IV, Tracrium; GlaxoSmithKline, UK) and monitored by counting the responses to train-of-four stimulation (Bard Biomedical, MA, USA) of the common peroneal nerve. Additional atracurium doses (0.17 mg kg^{-1} IV) were given whenever the first twitch of the train-of-four count returned. A 22-gauge cannula was

