Veterinary
Anaesthesia and Analgesia
Formerly the Journal of Veterinary Anaesthesia

Veterinary Anaesthesia and Analgesia, 2014, **41**, 243–248 doi:10.1111/vaa.12124

RESEARCH PAPER

Development, implementation and impact of simple patient safety interventions in a university teaching hospital

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Abstract

Objective To determine the incidence of anesthesia patient safety incidents at a university teaching hospital, develop interventions to address the most common incidents, and determine the effectiveness of these interventions.

Study design Pre-post intervention observational.

Animals Four thousand, one hundred forty dogs and cats anesthetized by the anesthesia service.

Methods The study was divided into two 11.5 month periods. During each period, incidents were logged (e.g. closed adjustable pressure limiting (APL) valve, esophageal intubation, and medication error). At the end of the first period, four countermeasures were incorporated into the service's protocols: 1) prior to any drug injection, the individual would read out aloud the drug name, patient name, and route of administration; 2) use of a uniquely colored occlusive wrap over arterial catheters; 3) a check box on the anesthesia record labeled "Technician Confirmed Intubation"; 4) a check box on the anesthesia record labeled "Technician Checked OR (operating room)". The number of patient safety incidents during period 1 and period 2 were compared using Fisher's Exact Test.

Results During Period 1, there were 74 incidents documented in 2028 patients (3.6%) including 25 medication errors, 20 closed APL valves, and 16 of esophageal intubation. During Period 2, there were 30 incidents documented in 2112 patients (1.4%) including 14 medication errors, 5 closed APL valves, and 4 of esophageal intubation. The proportion of events during Period 2 was significantly smaller than during Period 1 ($p < 0.0001$).

Conclusions and Clinical relevance Implementation of four simple interventions was associated with a significant decrease in the number of incidents.

Keywords anesthesia, checklist, incident, risk.

Introduction

Patient Safety Incidents, defined as any deviation from usual medical care causing injury to the patient or posing a risk of harm, are uncommon in people undergoing anesthesia but do occur and may cause substantial harm (Haller et al. 2011). Human error has been identified in 51–77% of anaesthesia-related deaths (Haller et al. 2011). These incidents include incorrect drug administration, incorrect operation, malfunction of anesthetic machines and equipment, insufficient pre-operative assessment and airway and ventilator problems. The frequency at which such incidents occur in veterinary anesthesia has not yet been reported, and a group recently agreed that critical incident reporting in horses is a key consideration for veterinary medicine (Hartnack et al. 2013).

Checklists have been used in other industries, most notably aviation, to reduce complex systems to a series of simple steps which can be more easily handled by individual operators (Weiser et al. 2010). In 2008, the World Health Organization published guidelines recommending several practices to ensure the safety of patients undergoing surgery. Subsequently, the "Safe Surgery Saves Lives" program developed a surgical checklist to apply the principles of checklists used in aviation to the processes of surgery. After implementation, surgical fatality decreased from 1.5% to 0.8% (Haynes et al. 2009). In spite of the evidence in favor of checklists in medicine, there are obstacles to implementation. Obstacles include anxiety about a new process, the hierarchy of medicine whereby the attending clinician cannot be criticized by nurses, logistics (including a perceived lack of time), duplication of existing processes, and relevance for the individual hospital (Mahajan 2011). Methods used to overcome these obstacles include having a local champion of the checklist, appropriate organizational leadership, a safety scorecard, and training (Mahajan 2011).

The purpose of this study was to determine the incidence of anesthesia incidents at a university teaching hospital, develop an intervention including a checklist to address the most common incidents, and determine the effectiveness of the intervention. The hypothesis was that a number of simple interventions would reduce the proportion of incidents.

Materials and methods

At the study institution, the patients are evaluated by the senior veterinary students assigned to the anesthesia service (anesthesia student). Cases are discussed and approved by the supervising anesthesiologist. An anesthesia student performs an initial calculation of the drugs for the patient, and the technician who draws the drugs double-checks the calculations. Handling of patients and performance of anesthesia are for the most part performed by an anesthesia student with the support of anesthesia technicians and clinicians. Most patients are given premedications intramuscularly (IM). Patients who have an intravenous (IV) catheter already in place are usually given premedications by the IV route in the anesthesia preparation area. Premedications given by IM injection are usually administered to patients in the ward and patients are transferred to the anesthesia preparation room 30–60 minutes after premedication in order to have an IV catheter placed by the anesthesia student. After an IV catheter is placed, anesthesia is induced with injectable agents and the trachea of the patient intubated by an anesthesia student. The endotracheal tube position is established by external palpation of the proximal tip of the tube at the thoracic inlet and then secured to the muzzle or behind the ears using IV tubing. A Doppler ultrasound flow detector is placed for blood pressure monitoring and IV fluid therapy is begun. Further monitoring equipment is placed as indicated for the patient. At that time point, surgical preparation begins, including hair shaving and a non-sterile cleaning of the skin. Most surgical patients are given cefazolin 22 mg kg^{-1} IV every 90 minutes by the anesthesia student, with the first dose administered during surgical preparation or after positioning in the operating room (OR). After surgical preparation in the anesthesia preparation room, the patient is disconnected from the anesthesia machine and transferred to the OR on a gurney [trolley]. In the OR, the patient is transferred to the operating table and connected to a different anesthesia machine which remains in the OR. Patient positioning is performed by the OR nurses while the anesthesia student re-connects the monitoring devices and IV fluids. At the end of surgery, the patient is disconnected, moved back into the anesthesia preparation room onto a gurney, and connected to a different anesthesia machine. Once any procedures (e.g. radiographs, bandaging) are completed, the maintenance anesthetic agent is discontinued. If the patient is on inhalant agents, they remain connected to the anesthetic machine for at least 10 minutes. The recovery from anesthesia takes place either in the anesthesia preparation room or, after disconnection from oxygen, in the intensive care unit (ICU). Once the patient is swallowing, the endotracheal tube is removed. Patients that are recovered in the anesthesia preparation room are typically transferred with a gurney to a cage in ICU, but are sometimes carried over by hand.

The study was designed as a pre-post intervention observational study at a university teaching hospital in the United States. The study included cats and dogs anesthetized by the anesthesia service at the institution. The study was divided into two periods. Period 1 was from January 1 to December 15 of 2011 and Period 2 was from January 1 to December 15 of 2012. During each period, anesthesia