# The immediate postoperative recovery of surgical patients

**Author :** Vet Times

**Categories :** RVNs

**Date :** October 1, 2011

**SUMMARY**

The recovery period is a high-risk time for mortality. This is clearly shown by Brodbelt (2006), who demonstrates that the percentage of deaths in recovery is higher than that of pre-medication, induction and maintenance periods. The study identified the recovery period as the period of greatest risk during anaesthesia, with most deaths occurring within three hours after the procedure. Clarke and Hall (1991) highlighted 1: 434 dogs and 1: 340 cats to have died due to anaesthetic-related deaths. Comparing these two studies, figures for dogs have improved markedly, but those for cats less so. In contrast, postoperative mortality in human medicine is far lower at 1: 12,641 (Lagasse, 2002) The studies performed conclude that the recovery period in veterinary patients is high risk and it is of upmost importance to ensure that close monitoring of the patient is continued.

**Key words**

recovery, mortality, monitoring, analgesia

**THE Confidential Enquiry into Perioperative Small Animal Fatalities (CEPSAF; Brodbelt and et al, 2006) examined perioperative small animal fatalities.**

The authors defined anaesthetic-related deaths as perioperative deaths within 48 hours following termination of the patient's procedures, except where death was due solely to inoperable surgical or pre-existing medical conditions. Blood and Studdard (1998) define the recovery period as the

return to normal after illness or a period of devitalisation including general anaesthesia and surgery, including the patient's requirements for close monitoring to ensure that its return to normal is uneventful. This is supported by Holden's (1999) view on the recovery period ending, when a full level of consciousness is present and physiological values have normalised.

A total of 117 centres took part in CEPSAF, which included 98,036 dogs, 72,178 cats and 8,209 rabbits. A total of 163 dog, 189 cat and 114 rabbit-related deaths were identified during the study, providing an overall risk of anaestheticrelated death as 1: 600 dogs, 1: 381 cats and 1: 72 rabbits. The study outlines age, weight, health status, procedural urgency, complexity and duration as valuable factors to aid in the assessment of anaesthetic risks and enable identification of patients' requirements for intensive perioperative management. A previous study, performed in the UK by Clarke and Hall (1991), highlighted 1: 434 dogs and 1: 340 cats to have died due to an anaesthetic-related death. Figures for dogs have improved markedly, but those for cats less so. In contrast, a human study between 1992 and 1994 performed by Lagasse (2002) had highlighted 1: 12,641 deaths within 48 hours with anaesthetist contribution. The studies performed conclude that the recovery period in patients is of uppermost importance to ensure that monitoring is continued – the aim is preventing risks during this period – and that it is not overlooked. Part one of this article will discuss the areas of the recovery period that may be improved to decrease mortality in patients, and also improve any nursing care implemented.

## Factors affecting recovery time

Several factors can influence an animal's recovery time. Hamilton (2003) suggests that animal breed, weight, type of anaesthetic agent used, length of anaesthesia, animal temperature and any underlying systemic diseases can be contributing factors.

Seymour and Gleed (1999) explain that both obesity and extreme thinness may interfere with normal drug disposition in the body, and hypothermia increases the risk of morbidity and mortality of patients.

In addition, Hamilton (2003) concludes that dolichocephalic and brachycephalic breeds are predisposed to factors that can influence anaesthesia and recovery time. Systemic illnesses that can also have effects on the recovery period in patients include hyperthyroidism, heart disease, renal disease, diabetes, skin disease, anaemia and dehydration.

When recovering patients from anaesthesia, these factors should ideally be considered to aid minimisation of risk and ensure a smooth recovery.

## Monitoring

The recovery period begins when the final suture is placed (Holden et al, 1999).

Monitoring equipment ndash; such as an electrocardiographs (ECG), pulse oximetry, capnography, blood pressure, temperature probes and oesophageal stethoscopes – re commonly used on patients undergoing general anaesthesia.

Careful monitoring of these vital parameters is considered important, so that any changes can be recognised early. This is equally applicable during the recovery period. During anaesthesia, observations may be recorded on a graph and ideally continued in the early stages of recovery, so that trends can be noted and any problems recognised so that early intervention can be performed.

## Capnography

Capnography measures the carbon dioxide ($CO_2$) concentrations in expired gas. The data can be displayed in wave form, and the $CO_2$ level at the end of expiration is displayed in numerical format. This is referred to as end tidal carbon dioxide ($ETCO_2$). Capnography may be used to assess adequacy of ventilation until the point of extubation.

## Blood pressure

Blood pressure is the pressure of the blood against the wall of the arteries, and occurs as a result of two forces.

One force is created by the heart as it pumps blood into the arteries and through the circulating system. The second force is from the arteries themselves, as they resist the flow of blood. Methods of monitoring blood pressure include two non-invasive techniques – Doppler and oscillometric technique.

The Doppler technique measures systolic pressure. A small transducer containing piezoelectric crystal is used to transmit and receive ultrasound signals. The technique includes a probe positioned over a peripheral artery, with a pressure cuff placed proximal to the probe. The cuff is inflated using a sphygmomanometer device until the pulse is no longer audible. The cuff is then slowly deflated, and a systolic reading is obtained when arterial blood flow is audible again. The area should be clipped, sprayed with surgical spirit and have ultrasound gel applied over the artery to enhance the signal. This technique can be used on all patients.

Oscillometric technique calculates the systolic, mean and diastolic pressure of blood flow, and includes a machine that provides set interval inflations and deflations of a pressure cuff. The cuff should be placed over a palpable artery, either in the fore or hindlimb. The width of the cuff should be approximately 40 per cent of the circumference of the limb; this aids in selecting a suitable size for a particular patient. The position of the limb is also important – if the limb is raised above the level of the heart or hanging below the patient’s body, inaccurate readings may be seen. This technique can be used on cats and dogs, but inaccuracies may be seen in small animals.

## Arterial blood pressure monitoring

Arterial blood pressure monitoring, known as an invasive technique, is the most accurate method for measuring a patient's blood pressure – and it is also considered the gold standard for it (Grant, 2006).

A catheter is placed into a peripheral artery in dogs or the femoral artery in cats. The catheter is connected to a manometer placed at the level of the heart, or to an electrical transducer, which displays a waveform. This technique continuously measures systolic, mean and diastolic pressure.

All techniques for blood pressure measurement are applicable in the recovery period. The particular method used will reflect the severity of the patient's condition.

## Pulse oximetry

Pulse oximetry measures the percentage of arterial oxygen saturation of haemoglobin.

Haemoglobin is the medium by which oxygen is transported through the body. A measurement is taken by placing a probe containing two light sources across a well-perfused area of tissue – for example, the tongue, pinna, prepuce and vulva. This technique is non-invasive and provides continuous monitoring. Moistening the site of application can sometimes improve readings with a damp swab. When used in recovery, it is important to remember that movement by the animal will affect the readings. The pulse oximeter also displays pulse rate, which should be within 5bpm of that taken by pulse palpation if oxygen saturation is to be relied upon.

## Temperature

The aim is to maintain normothermia in anaesthetised patients. During anaesthesia, an animal's ability to control body temperature is reduced due to the effects of anaesthetic drugs that cause depression of the central nervous system.

Exposure to cold surfaces, surgical site preparation using cold scrub solutions and inhalation of cold dry gases to the lungs can also have a dramatic effect on reducing body temperature.

A patient's body temperature can be measured using an oesophageal probe, which will provide continuous monitoring, or a digital rectal thermometer. If it is evident that a patient's body temperature is impaired, then supplementary heat should be provided. However, it is best practice to prevent impairment of body temperature, and maintenance procedures should ideally begin once anaesthesia is induced or before induction.

An efficient way to provide supplementary heat is with the use of a forced warm air blanket. This

provides a continuous supply of warm air that is concealed inside a blanket. This is an excellent way to maintain body temperature both in theatre and in recovery. The patient can either be placed on top or underneath the blankets. Another device for successful prevention of hypothermia or treatment of hypothermia is use of a warming matt.

Shivering, a common effect of hypothermia, increases oxygen demand at a time when oxygen delivery to the tissues may be impaired by the cardiopulmonary depressant effects of anaesthesia and any other perioperative events (Holden, 1999).

## Respiration

In dolichocephalic and mesocephalic dogs, the endotracheal tube (ET) can be left in place until the swallowing reflex has returned. However, in brachycephalic breeds, the ET tube may be left in place until the patient will no longer tolerate it. This is to minimise the risk of any upper airway obstruction during the recovery period. The cuff may be left inflated until just prior to extubation to reduce the risk of aspiration of any fluids. In cats, numerous research materials discuss when the ET tube is removed – they propose either when cats' ears, tail or limbs begin to twitch, or when the swallowing reflex returns. However, delays in removing the tube may lead to irritation or spasm of the larynx. Observing chest movements, respiration rates and character can be important, especially in the early stages of recovery, due to the possibility of respiratory impairment from certain anaesthetic drugs. Removal of the endotracheal tube should ideally be timed so that the patient breathes out following extubation. This can assist the patient with removing any secretions that may have built up around the larynx and trachea. Following extubation, the patient's neck and head are extended and its tongue is pulled forward to ensure that the airway remains patent.

## Cardiovascular

Auscultation of the heart, along with palpation of a peripheral pulse, should be frequently assessed during recovery. Peripheral pulses should be assessed, primarily over central pulses, as these pulses would be among the first to alter in pulse character if the patient was potentially developing circulatory collapse.

Capillary refill time is the time required for the mucosa layer, which has been blanched by finger pressure, to return to a normal pink colour. The normal mucous membrane colour in dogs is pinker than that in cats. Failure to return promptly is an indication of peripheral circulatory compromise. Brick red mucosa may indicate sepsis and infection, cyanotic (grey/blue tinge) mucosa indicates hypoxia and pale-coloured mucosa may indicate anaemia, haemorrhage and shock. Hypotension (mean arterial pressure less than 60mmHg) may be seen during anaesthesia. This value is cited in many anaesthesia books, although there is no true value to adhere to. In addition, hypertension (mean arterial pressure more than 150mmhg) may occur. In these circumstances, an increase or decrease in perfusion status to major organs can occur, causing damage.

Blood pressure is, therefore, best monitored in the early stages of recovery. As the anaesthetic agent wears off, unresolved hypotension should resolve, assuming no further complications are apparent. Hypertension has not been documented in the recovery period.

## Analgesia

As nurses, one of our responsibilities is to ensure that patients do not suffer. Pain assessment plays an important role in nursing care, which includes adequate pain relief before, during and after any non-surgical or surgical procedure. Good patient handling will also reflect good pain management and help to minimise stress and anxiety. The signs of pain are:

- mydriasis
- vocalisation
- decreased appetite
- inappetence
- increased heart rate
- increased respiratory rate
- depression
- arrhythmias
- posture
- hypertension
- hypotension
- pale mucous membranes
- restlessness

Complications of inadequate pain relief include:

- decreased appetite – weight loss and weakness, impaired respiratory function
- decreased wound healing
- decreased recovery from general anaesthesia – central and peripheral sensitisation
- decreased patient movement – causing oedema hypostasis and urine and faecal retention

Pre-emptive analgesia is where pain relief is administered before pain stimulus has occurred, so that peripheral and central sensitisation may be reduced. A combination of opioids and NSAIDs may also be used in patients to provide a synergistic effect using multimodal analgesia, with the occasional use of local anaesthetics. Opiates alter a patient's perception of pain, NSAIDs reduce peripheral wind up and local agents inhibit the transmission of the nociceptive pathway (**Figure 2**).

It is reasonable to assume that if a stimulus is painful to people, is damaging or potentially damaging to tissue and induces escape and behavioural responses in an animal, it must be considered painful to that animal (Hellyer et al, 2000). Critically ill patients may not be able to display signs of pain, and yet that doesn't mean they are non-painful. Weary et al (2006)

highlighted speculation that neonates have limited ability to feel pain, and actually suggest that painful experiences early in life can accentuate sensitivity to painful stimuli at older ages.

Article reviewed by Matthew Gurney, BVSc, CertVA, DipECVAA, MRCVS

//

## References


- Brodbelt D (2006). *The confidential enquiry into perioperative small animal fatalities*, Thesis, RVC and AHT.
- Clarke KW and Hall LW (1991). *Veterinary Anaesthesia*, Baillière-Tindall, Sidcup.
- Grant D (2006) *Pain Management for Veterinary Nurses*, Blackwell, UK.
- Hamilton J and Welsh E (2003). Nursing the patient in recovery, *Anaesthesia for Veterinary Nurses*, Wiley-Blackwell, UK.
- Holden D, Seymour C and Gleed R (1999). Postoperative care, *BSAVA Manual of Small Animal Anaesthesia and Analgesia*, BSAVA, Gloucester.
- Lagasse RS (2002). Anaesthesia: model or myth? A review of published literature and analysis of current original data, *Anaesthesiology* **97**: 1,609.
- Seymour C and Gleed R (1999). Preoperative assessment, *BSAVA Manual of Small Animal Anaesthesia and Analgesia*, BSAVA, Gloucester.
- Studdert VP and Blood DC (1988). *Comprehensive Veterinary Dictionary*, Baillière-Tindall, Sidcup.
- Hellyer PW, Robertson SA and Fails AD (2000). Pain and its management. In Tranquilli WJ and Thurmon JC (eds), *Lumb and Jones Anesthesia and Analgesia* (4th edn), Blackwell, USA: 31-61.
- Weary DM, Neil L, Flower FC and Fraser D (2006). Identifying and preventing pain in animals, *Applied Animal Behaviour Science* **100**: 64-76.