Published death rates related to anaesthesia in healthy and sick animals are higher than they should be.

The Confidential Enquiry into Perioperative Small Animal Fatalities, from Brodbelt et al, Veterinary Anaesthesia and Analgesia (2008), showed the extent of death rates in both healthy and sick animals. The study identified the rates to be as follows:

**Anaesthetic related Death Rates in Healthy Animals:**
- 1 in 137 Rabbits
- 1 in 895 Cats
- 1 in 1849 Dogs

**Anaesthetic related Death Rates in Sick Animals:**
- 1 in 14 Rabbits
- 1 in 71 Cats
- 1 in 75 Dogs

Anaesthetic-related death rates in healthy humans have been reported to be as low as 1 in 25,000.

Endotracheal intubation has been identified as a risk factor that increases death rate in cats (Brodbelt DC, Pfeiffer DU, Young L et al. (2007) Risk factors for anaesthetic-related death in cats: results from the confidential enquiry into perioperative small animal fatalities (CEPSAF). Br J Anaesth 99, 617–623.)

In order to reduce anaesthesia related death rates The American Animal Hospital Association (AAHA – www.aahanet.org/Library/Anesthesia_Guidelines.aspx) has set out findings and guidelines in their document *Anaesthesia Guidelines for Dogs and Cats* for veterinary surgeons to consider and to implement as best practice. Highlights of these guidelines are as follows:

- **AAHA reports that anesthesia related complications are responsible for a significant number of The American Veterinary Medical Association (AVMA) Professional Liability Insurance Trust (PLIT) insurance claims.**
- **The AVMA PLIT has indicated that intubation related tracheal tears are a significant issue when anesthetizing cats.**
- **With emergency procedures fasting is not possible thus attention to airway management is critical – every patient should be treated as if their stomach was full.**
- **Mask or chamber inductions can cause stress, delayed airway control and environmental contamination due to gas leakage, so adequate room ventilation is required to minimize exposure to personnel.**
- **Use the largest diameter endotracheal tube that will easily fit through the arytenoid cartilages without damaging them; this will minimize resistance and the work of breathing.**
- **Lubricate the endotracheal tube before intubation to reduce friction.**
- **Over inflation of endotracheal tube cuffs causes tracheal trauma.**
- **Observation of tidal volume is only subjective and it is very difficult to distinguish between normal and abnormal tidal volumes.**
- **Hypoventilation is an expected effect of general anesthesia that can be quantified using capnography.**
- **Trained, observant team members are critical to reduce mortality rates.**
- **47% of Canine and 60% of Feline anaesthetic deaths reported occur in the post period. A lack of information gives rise to unexplained underlying causes of deaths, however the AAHA position on this is ‘Increased monitoring and early diagnosis of physiological changes and earlier intervention may reduce the risk of anaesthetic deaths’.**
- **US veterinarians are advised to follow the American College of Veterinary Anesthesiologists (ACVA – www.acva.org) Small Animal Monitoring Guidelines (2009): Position Statement. The goal of this is to use the guidelines to reflect importance of vigilant monitoring to improve the level of care for veterinary patients.**

The **v-gel** airway management system has been designed to address and eliminate the following: upper airway and trachea trauma, tracheal perforation, damage to the arytenoid cartilages, high airway resistance, subjective vital sign measurement and elimination of cross infection risks.

Docsinnovent brings human anesthesia techniques and standards of airway management to help to reduce veterinary anesthesia morbidity and mortality rates.
Airway resistance
Endotracheal tubes locate inside the trachea. This decreases the cross-sectional area available for the patient to breathe through. Resistance to airflow in a single tube is inversely related to the diameter of the tube to the 4th power ($R = \frac{1}{d^4}$ where $R =$ airway resistance and $d =$ airway diameter). This means that halving the airway diameter will increase the airway resistance by 16 times.

The v-gel® supraglottic airway device eliminates this problem as it does not enter the trachea and maintains the airway without narrowing airway diameter. The v-gel® devices reduce airway resistance which reduces the workload on the patient’s breathing. This in turn should assist in reducing airway related anaesthetic morbidity and mortality.

The extent of how significant the issue is seen by the pressure drop graphs below. (Gas flow through the tubes = 10 l/min and pressure drop values are measured in mbar.) v-gel®s make breathing easier and reduce workloads for your patients.

![Graph to show pressure drop across cat airway devices. Higher pressure drop = greater resistance to airflow](image1)

![Graph to show pressure drop across rabbit airway devices. Higher pressure drop = greater resistance to airflow](image2)

The softness of the v-gel® and the anatomical design avoids pharyngeal, laryngeal and tracheal trauma

v-gel® supraglottic airway devices are significantly softer than endotracheal tubes and therefore massively reduce the risk of iatrogenic upper airway trauma. Intubation has been identified as a factor which increases death rate in feline anaesthesia (Brodbelt DC, Pfeiffer DU, Young L et al. (2007) Risk factors for anaesthetic-related death in cats: results from the confidential enquiry into perioperative small animal fatalities (CEPSAF). Br J Anaesth 99, 617–623)

Airway management using v-gel®s is safer as the v-gel® devices do not touch the trachea, arytenoid cartilages, or larynx and they are made from super soft materials. Due to this softness and lack of trauma, they also give excellent quality of recovery, without coughing or stridor.

The graph shows material hardness (measured from zero to 100, where 0 = super softness and flexible and 100 = totally hard and rigid) of the sections of v-gel® and endotracheal tubes in contact with the pharynx/upper airway. The v-gel® is significantly softer than endotracheal tubes and is clearly the device with the lowest trauma risk and the highest comfort to result in the best possible post-operative quality of recovery.

...I also found the recovery of the cat from anaesthesia much less traumatic, with no coughing, laryngeal trauma or spasm and found that many were more willing to eat post recovery than previously noted with the standard ET tube… Stephanie Pickup, RVN, Kynoch Vets, Bracknell, UK

Insertion times
Test results show median v-gel® insertion times to be 2.5 seconds in cats and 8 seconds in rabbits (time taken to achieve a patent airway and a trace on a capnograph). This can be achieved without having to use additional equipment beyond that needed to check that the pharynx is clear of foreign material.
Laryngeal spasm

Managing an airway using a v-gel® device will not cause, but does not prevent laryngeal spasm.

The majority of laryngeal spasm cases are caused by intubation stimulation or trauma. However, there are other causes of laryngeal spasm, including, but not limited to:

- intraoperative pain and consequent sudden reduction in anaesthetic depth
- use of other devices within the airway such as endoscopes or flushing catheters
- application of topical laryngeal agents
- hypocalcaemia

If laryngeal spasm was to occur for another reason during a v-gel® anaesthetic, the choice of action lies with the clinician in charge. Ventilation through the semi closed glottis to deepen the plane of anaesthesia, endotracheal intubation or tracheostomy could be considered. If laryngeal spasm was to occur during an intubated anaesthetic, it would only be apparent on extubation or during recovery (which is when the majority of fatalities occur).

Monitoring

Monitoring is key as flagged by AAHA ‘Increased monitoring and early diagnoses of physiological changes and earlier intervention may reduce the risk of anaesthetic deaths’ and AVCA Small Animal Monitoring Guidelines (2009): ‘Position Statement, The goal of this is to use the guidelines to reflect the importance of vigilant monitoring to improve the level of care for veterinary patients’.

Cleaning of endotracheal tubes:

Most ‘veterinary’ endotracheal tubes are actually designed for human use. They are designed and engineered for single use only in order to avoid cross infection. Most of these tubes are made from PVC resin (which is naturally very rigid) with plasticisers added to make the material softer and more flexible.

We studied PVC endotracheal tubes using various spectrographic techniques. This study found that plasticisers were migrating out of the tube material during each cleaning process and that the PVC resin itself was becoming dehydrochlorinated. This changes the mechanical properties of the plastic, making it harder and more brittle. It also accounts for the yellow colouration commonly seen in re-used endotracheal tubes. These changes are likely to increase the risk of upper airway trauma. It cannot therefore be recommended to re-use PVC endotracheal tubes.

Avoid patient trauma and cross infection risks by using PVC endotracheal tubes only once, as they are designed to be used. Use low trauma risk v-gel®s instead for improved patient safety.
Testimonies

... I regularly intubate within seconds single handed and am still finding it hard to believe that I have done it correctly – it's that easy!...
Jenny Thompson DipAVN (surg) RVN MBVNA Head Nurse – Companion Care Sheffield

... I was very interested and impressed with v-gel®... It is a small price to pay for an increase in their survival of operations.
Kath Wilson Rabbit owner, Aylesbury, UK

I have been using v-gel®s to maintain anaesthesia in companion animals since 2009... I would not go back to using endotracheal tubes.
Ivan Crotaz BVetMed MRCVS General practitioner, rabbit first and second opinion practitioner UK.

I have been using the v-gel®s in rabbits for over two years during the development of this product... The v-gel® provides a unique option for veterinarians to secure an airway, without the practical demands of endotracheal intubation, nor the risks of tracheal and glottal trauma...
Kevin Eatwell BVSc (Hons) DZooMed (Reptilian) Dip ECZM (Herp) MRCVS Lecturer in Exotic Animal and Wildlife Medicine Exotic Animal and Wildlife Service Royal (Dick) School of Veterinary Studies, Edinburgh, UK.

The v-gel® brings rabbit anesthesia to the next level. After some practice, open airway access in rabbits is now available to everyone...
Nico Schoemaker, DVM, PhD, Dip ECZM (small mammal & avian), Dip, ABVP-avian & Yvonne van Zeeland, DVM, MVR, resident ECZM (avian); Division of Zoological Medicine; Utrecht University, The Netherlands

With the all new v-gel® we have the opportunity of a free airway in cats, without the disadvantages of intubation...
Robert Sap, University of Utrecht, The Netherlands

... I think they are very easy to install, very secure with the airway because they don`t come in contact with the trachea and allow me to do all kinds of surgeries, abdominal, thoracic ... I work with animal welfare groups and I have to do many surgeries a day. Before, in my anaesthetic protocols, I did not put tubes in the trachea to animals, but with the v-gel®s, I intubate all patients and that increases the security of surgery.

v-gel® is going to revolutionise rabbits` anaesthesia... v-gel® is quick and easy to place and it provides the security of an animal intubated. It could be used during anaesthesia and cardiopulmonary resuscitation as well. There are no more excuses today to use face masks any more, which will significantly decrease anaesthesia risks for rabbits.
Charly Pignon, DVM, Head of the Exotics Medicine Service, Ecole Nationale Vétérinaire Alfort, France