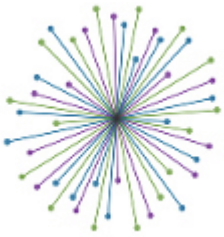

BestBETs for Vets

Supporting veterinary clinicians in making evidence-based decisions

In rabbits does an endotracheal tube or v-gel result in better unassisted ventilation?

Clinical Scenario

You are a veterinary surgeon anaesthetising a healthy pet rabbit for a routine midline spay. To secure the rabbit's airway you have the choice of using an endotracheal (ET) tube, with an array of different sizes available, or three different sizes of v-gel® (small, medium or large). You sometimes struggle to place an ET tube in rabbits because you do not perform this skill often, and using a mask worries you because the airway is not secured. Your nurse tells you that she does not trust v-gels® and that she does not think they are safe because they cause cyanosis of the tongue and often become misplaced. However, another vet in your practice tells you that v-gels® are quicker and easier to place compared to ET tubes and that they seem to be just as safe and allow good ventilation, but they havent used v-gels® enough to be sure. You wonder whether using v-gel devices results in better unassisted ventilation than using ET tubes in rabbits....

3-Part Question (PICO)

In [rabbits undergoing general anaesthesia], does using a [v-gel airway device versus an endotracheal tube] result in [better airway management under the conditions of unassisted ventilation]?

Search Strategy

MEDLINE(R) In-Process & Other Non-Indexed Citations and MEDLINE(R) 1946 to Present using the OVID interface

(rabbit.mp. OR rabbits.mp. OR cuniculus.mp. OR lapine.mp. OR Oryctolagus.mp. OR exp rabbits/ OR exp Cuniculidae/ OR exp Lagomorpha/)

AND

(anaesthesia.mp. OR anesthesia.mp. OR anaesthetic.mp. OR anesthetic.mp. OR exp Anesthesia, General/ OR exp Anesthesia/ OR exp Anesthetics, Inhalation/)

AND

(supraglottic.mp. OR supraglottic airway devices.mp. OR SAD.mp. OR SGAD.mp. OR v-gel.mp. OR exp Glottis/ OR exp Respiration, Artificial/ OR exp Laryngeal Masks/)

AND

(endotracheal tube.mp. OR tracheal.mp. OR ET.mp. OR intratracheal tube.mp. OR exp Intubation, Intratracheal/ OR exp Airway Management/ OR exp Trachea/)

CAB Abstracts 1910 to Present using the OVID interface

(rabbit.mp. OR rabbits.mp. OR cuniculus.mp. OR lapine.mp. OR Oryctolagus.mp. OR exp rabbits/ OR exp Cuniculus/ OR exp Oryctolagus/ OR exp Oryctolagus cuniculus/)

AND

(anaesthesia.mp. OR anesthesia.mp. OR anaesthetic.mp. OR anesthetic.mp. OR exp inhaled anaesthetics/ OR exp anaesthetics/ OR exp anaesthesia/)

AND

(supraglottic.mp. OR supraglottic airway devices.mp. OR SAD.mp. OR SGAD.mp. OR v-gel.mp. OR endotracheal tube.mp. OR tracheal.mp. OR ET.mp. OR intratracheal tube.mp. OR exp ventilation/)

Search Outcome

MEDLINE

- **120** papers found in MEDLINE search
- **117** papers excluded as they don't meet the PICO question
- **0** papers excluded as they are in a non-English language
- **1** papers excluded as they are review articles/in vitro research/conference proceedings
- **2 total relevant papers from MEDLINE**

CAB Abstracts

- **98** papers found in CAB search
- **91** papers excluded as they don't meet the PICO question
- **0** papers excluded as they are in a non-English language
- **5** papers excluded as they are review articles/in vitro research/conference proceedings
- **2 total relevant papers from CAB**

Total relevant papers

2 relevant papers from both MEDLINE and CAB Abstracts

Summary of Evidence

Engbers et al. (2017), Canada.

Title:	Comparison of a supraglottic airway device (v-gel®) with blind orotracheal intubation in rabbits.
Patient group:	15 New Zealand white rabbits, aged from 3 to 12 months, with 12 males and 3 females. The rabbits were obtained from the Animal Resource Center of the University of Calgary (surplus stock) which originated from a commercial supplier. Only 13 rabbits were included after exclusions. The animals were housed in a controlled environment and had a controlled diet. They were deemed healthy based on physical exam (ASA 1).

Study Type: Randomised controlled trial

Outcomes:

Primary outcomes:

- Airway device placement times, and the number of attempts made to place the device. A capnograph was used to determine acceptable placement.
- CT scan checked the positioning of the v-gel, to determine the narrowest region of the upper airway and if the v-gel contributed to this and the cross-sectional area of the narrowest point was measured. The luminal cross-sectional area was measured for the endotracheal tube (ETT) tube group.
- Post-mortem examinations and histopathology carried out to assess for trauma caused by the airway devices using set scoring criteria.
- Testing for leaks was carried out by increasing peak inspiratory pressures in 5 cmH2O increments (up to 20 cmH2O), until a leak was heard (or 20 cmH2O achieved).

Secondary outcomes:

- Arterial blood sample collected 30 minutes after airway device placement to analyse blood gases and electrolytes (pH, PaO2, PaCO2, BE, HCO3, SaO2, Na, K, iCa, haematocrit, haemoglobin).
- Baseline CT scan prior to device placement and then again after device placement.
- Occurrences of lingual cyanosis or airway obstruction (audible wheeze during respiratory cycle or irregular capnograph trace)
- Arterial blood samples only carried out on the last 9 rabbits
- Some rabbits did not have CT scans due to unavailability of the CT scanner

Key Results:

- Unable to place an ETT in two rabbits, these were subsequently withdrawn from the study. The number of attempted device placements did not differ between groups (v-gel - 1 attempt n = 4, 2 attempts n = 3; ETT - 1 attempt n = 4, 2 attempts n = 2).
- ETT group had significantly more damage to tracheal mucosa and submucosa than v-gel group (p=0.03, Confidence Interval (CI) 0-3.3).
- One rabbit in the v-gel group had a loss of capnograph trace, indicating respiratory obstruction. The airway device was therefore retracted until the capnograph trace returned and the study resumed.
- Rescue intubation was not performed in any rabbits and there were no reports of tongue cyanosis in any rabbits.
- No significant difference between groups for HR (p=0.32), RR (p=0.22), expired CO2 (p=0.74) or for median peak systolic BP (p=0.45, CI -11.9 to 2.1).
- No significant differences for the following variables were observed between the groups: pH, PaO2, PaCO2, BE, HCO3, SaO2, Na, K, iCa, hematocrit, hemoglobin.
- Hypercapnea was present in both treatment groups, generally higher with v-gels but not statistically significant. v-gel; 65.1 (54.0–75.1) mmHg, ET; 51.8 (41.2–67.8) mmHg.

Study Weaknesses:

- Small sample size with no evidence given of sample size or power calculations performed, so it is possible that Type II statistical error may have occurred (no statistical difference shown between groups even if a difference exists).
- From the description in the paper, it appeared that each device group had a different investigator placing the airway devices (e.g. one person placed all the v-gels and one person placed the ETT). The impact of this is difficult to assess and could lead to biased results.
- The authors state that the rabbits were block randomized into 2 groups (initally n=8 for both

groups, with final numbers being n=7 in v-gel and n=6 in ETT groups). No further details were given about how the randomisation was carried out.
- Arterial blood samples were not taken from all rabbits, only the last 9 rabbits (v-gel n = 4 and ETT n = 5). Additionally, CT scans were not carried out on all of the rabbits. Two rabbits, both from the ETT group, did not have a CT scan due to unavailibility of the CT scanner, which could introduce imprecision into the results.
- Mostly aggregated results were presented for most outcomes; with only 13 rabbits included in the study it would have been beneficial to include raw results for each animal. Figures 4-8 do give some individual animal details for the primary outcomes.
- There was not much interpretation in the discussion section about the blood gas, electrolyte or physiological parameter (e.g. HR, RR) results. Most of the focus in the discussion was on the primary outcomes of the research (ease of placement and tracheal mucosa damage) with less on the secondary outcomes.

Attachment:

Evidence appraisal (/soe_attachments/576/4157-Engbers et al. 2017 Critical Appraisal_Final 27.08.21.pdf)

Comolli et al. (2020), America

Title:	Comparison of endoscopic endotracheal intubation and the v-gel supraglottic airway device for spontaneously ventilating New Zealand white rabbits undergoing ovariohysterectomy.
Patient group:	Fourteen healthy adult, 12-month-old, female New Zealand rabbits undergoing ovariohysterectomy, purchased from a commercial laboratory animal supplier. The mean and standard deviation body weight was 2.57 +/- 0.15kg. The animals were in temperature and light controlled housing and had a controlled diet. They were deemed healthy based on physical exam.
Study Type:	Randomised controlled trial

Outcomes:

- Time from injection to induction.
- Number of airway device placement attempts and the number of position adjustments needing to be made (based on side stream capnograph waveform).
- Airway device placement times
- Gross laryngeal evaluations via endoscope before and after the airway device placement.
- After humane euthanasia laryngotracheal microscopic histopathology was carried out to look for signs of trauma and damage caused by the airway devices (inflammation, haemorrhage, necrosis using a scoring system). Severity scores given for areas in larynx and trachea.
- Arterial blood gas measurements at 0, 30, 60 and 90 minutes after catheterization: pH, paO2, PaCO2, total carbon dioxide (TCO2), bicarbonate (HCO3), base excess (BE), and hematocrit (HCT).
- Necessity to increase the isoflurane concentrations to maintain the surgical plane of anaesthesia (recorded every 5 minutes and was based on reflexes and physiological parameters).
- Measurements taken every 5 minutes: heart rate, ECG, peripheral capillary oxygen saturation (SpO2), direct arterial blood pressure, respiratory rate, end tidal CO2 (ETCO2) and a rectal temperature.

Key Results:

- All supraglottal airway devices (SGAD) were placed on the first attempt whilst two animals required three attempts for successful endoscopic endotracheal intubation (EEI) placement; however the difference was not statistically significant.
- Time required for EEI placement was slightly though statistically significantly longer (median 48 seconds, range 20-126 sec) versus SGAD placement (median 6 seconds, range 2-20 sec).
- No statistically significant differences were seen between the two airway devices on any blood gas values (P>0.05; Table 1) except for paCO2 (mmHg) with higher values seen for animals in the v-gel group (p=0.045); this became statistically significant at the 90 min mark.
- ETCO2 levels did not reflect this change in PaCO2.
- The mean ETCO2 levels were 33.25 +/- 11.62mmHg (4.43+/- 1.55 kPa) for EEI and 38.53 +/- 13.58mmHg (5.14 +/- 1.81 kPa) for the SGAD group.
- 5 out of 7 rabbits in the SGAD group needed to have the isoflurane vaporizer setting increased, whereas only 3 out of the 7 rabbits in the EEI group needed the setting increased; this difference was not statistically significant.
- The mean respiratory rates at time of blood collection were 24.6 +/- 12.9 breaths per minute (EEI) and 33.6 +/- 14.4 breaths per minute (SGAD) groups.
- All rabbits in the SGAD group needed the airway device to be adjusted at least once and up to four times. Only one rabbit in the EEI group needed adjustment of the endotracheal tube.

Study Weaknesses:

- Small sample size with no evidence of sample size or power calculations being performed, so it is possible that Type II statistical error may have occurred (no statistical difference shown between groups even if a difference exists).
- This study was undertaken as a supplemental study to another study focused on comparing postoperative constant rate intravenous infusion of lidocaine and buprenorphine. It is difficult to ascertain if the rabbits used in this study are the same as those used in the concurrent study, or whether the rabbits received the same intravenous preparations for the current study.
- There was no detail provided on how the block randomisation was performed, the authors state that the rabbits were block randomized into 2 groups of seven animals for each intervention, no detail was provided as to how this was executed.

- Primarily aggregated results were presented for most outcomes; with such few rabbits included in the study, it would have been good to have individual parameter results from the small numbers of animals included in this study (e.g. blood gas assessment), particularly baseline characteristics of each group.
- There is little discussion about the blood gas analysis results; the authors focus mostly on damage caused by the devices in the discussion section.
- A side stream capnograph was used. Using a mainstream capnograph may be more sensitive.
- The study was supported in part by Docsinnovent, manufacturers of the v-gel device.

Attachment:

Evidence appraisal (/soe_attachments/576/4163-Comolli et al. 2020 Critical Appraisal_Final 27.08.21.pdf)

Comments

No studies found used a population of rabbits comparable to the population you might encounter in general practice. All papers used New Zealand White rabbits, which are a large breed. Small brachycephalic rabbit breeds are commonly seen in general practice and so placement and ventilation issues may vary with these breeds.

Both papers acknowledge the importance of providing intermittent positive pressure ventilation (IPPV) when using supraglottic airway devices like the v-gel to prevent hypercapnia, yet neither of them study the effects of IPPV on PaCO2.

Both of the papers appeared to lack a sample size calculation and involved small numbers of animals, so to answer the PICO question with enough confidence to apply the findings to a clinical setting, further studies assessing ETCO2 and blood gas analysis (PaCO2 and PaO2) with appropriate sample sizes are required.

Only ventilation was investiagted in this PICO question, other safety parameters would also need to be factored into clinical decisons.

Bottom line

Both ET tubes and v-gels appear to provide adequate unassisted ventilation in rabbits. It is highly recommended that a capnograph is used with both airway devices to monitor for ventilation changes, especially if using a v-gel during longer surgeries, and after re-positioning the patient.

References

Comolli J, Schnellbacher R, Beaufrere H, Blas Machado U, Quandt J, Mayer J, Divers S, (2020). Comparison of endoscopic endotracheal intubation and the v-gel supraglottic airway device for spontaneously ventilating New Zealand white rabbits undergoing ovariohysterectomy. *Veterinary Record* **187:** e84-84, https://doi.org/10.1136/vr.105746.

Engbers S, Larkin A, Rousset N, Prebble M, Jonnalagadda M, Knight C, Pang D, (2017). Comparison of a supraglottic airway device (v-gel®) with blind orotracheal intubation in rabbits. *Frontiers in Veterinary Science* **4**: https://doi.org/10.3389/fvets.2017.00049.

About this BET

First author:
Hayley Bruce
Second author:
Marnie Brennan
Institution:
School of Veterinary Medicine and Science, The University of Nottingham, UK

CEVM, School of Veterinary Medicine and Science, The University of Nottingham, UK

Search last performed:
2021-08-16 00:29:59
Original publication date:
2021-08-27 00:29:59
Last updated:
2021-08-26 00:29:59