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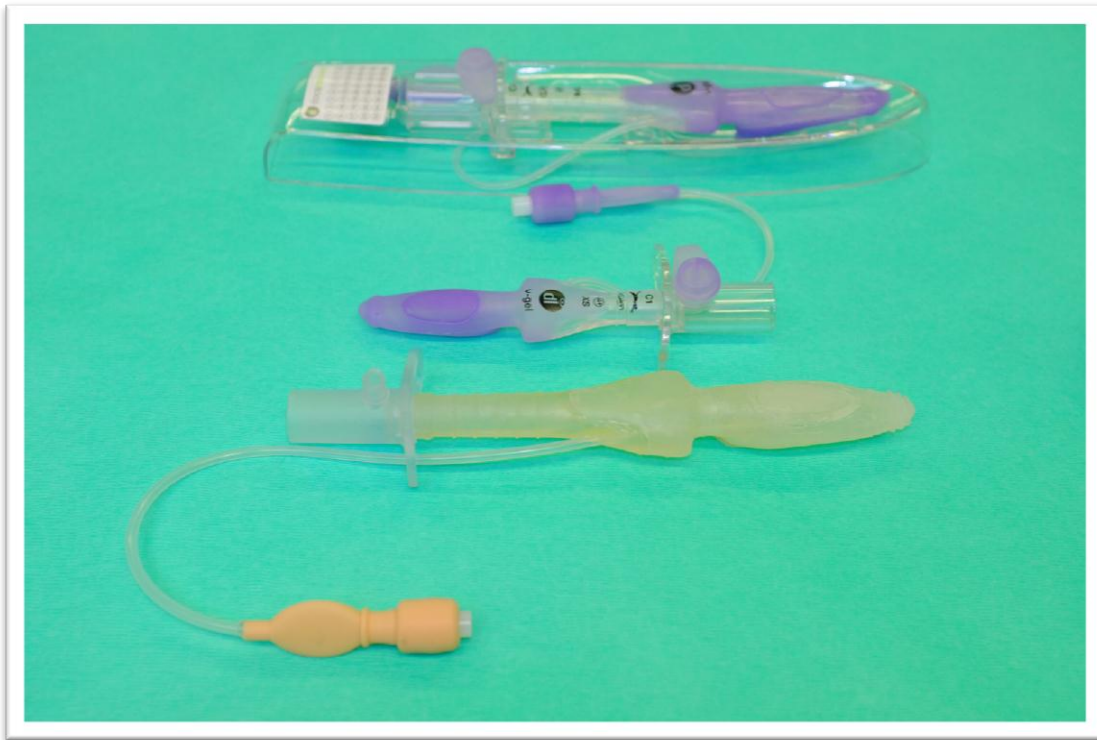
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[V-GEL STUDY]

[A comparison between the V-gel supra-glottic airway mask and the commonly used cuffed endotracheal tube in spontaneous breathing cats under isoflurane anesthesia.]

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Abstract

This randomized clinical study compares the use of the endotracheal tube (golden standard) with the new laryngeal mask, the V-gel, in spontaneous breathing cats under isoflurane anesthesia, in respect to isoflurane leakage, ease of use and irritation of the upper respiratory system after surgery.

Material/Methods: All cats were admitted for spaying or castration and were classified as ASA-1 or ASA-2 patient. Ten cats in the V-gel group and eleven cats in the ET-group. The cats premedicated with 20 µg/kg of dexmedetomidine and 15 µg/kg buprenorphine IM. Induction started with propofol, dosed to effect. For analgesic purposes the cats received 0.2 mg/kg metacam before surgery and 0.05mg/kg/day metacam per os by their owners, the first four days following surgery.

The following variables were measured:

- Required dose of propofol necessary for intubation or placing the V-gel;
- Time between induction and recording of a first capnogram in seconds;
- Detection of leakage of isoflurane to the environment measured with the Miran 205B Type Saphiree 100 isoflurane analyzer;
- Post-operative discomfort of the upper respiratory system, subjectively scored by the researcher during the recovery.
- Post-operative discomfort of the upper respiratory system, subjectively scored with the owner 24 hours after surgery, by means of a questionnaire.

The variables were tested by the Student-T-test and the discomfort was being tested by the Chi-Square test. The level of significance was set to $P < 0.05$.

Results: There was no significant difference when comparing the required dose propofol, ET-group (8.29 ± 2.37 mg) and V-gel group (6.61 ± 2.93 mg). There was a significant difference regarding the time between induction and first reading on the capnometer. Where the V-gel group had a shorter induction time (52.59 ± 30.47 sec.) compared to the ET-group (117.27 ± 27.47 sec.). Both groups showed some leakage of the isoflurane, V-gel group (9.89 ± 10.47 mg/m³) and ET-group (9.65 ± 15.09 mg/m³), but no significant difference was found. During recovery six cats from the ET-group were found with an upper airway stridor. According to the Chi-Square test, there were statistically significant fewer cats with an upper airway stridor in the V-gel group (Chi-Square test=7.636364; $p=0.005720$; $df=1$). The discomfort scored by the owners showed no significant difference between both groups.

Conclusion: The V-gel is easy to use and a good alternative for endotracheal intubation in spontaneous breathing cats under isoflurane anesthesia.

Samenvatting

Dit onderzoek vergelijkt de endotracheale tube (gouden standaard) met een nieuw larynxmasker, de V-gel, bij spontaan ademende katten tijdens isofluraan anesthesie. Er is gekeken naar de isofluraan lekkage, de gebruiksvriendelijkheid en eventuele post-operatieve irritatie van de voorste luchtwegen de eerste vierentwintig uur na de operatie.

Materialen/methoden: De katten zijn willekeurig verdeeld over de twee groepen. Tien katten in de V-gel groep en elf katten in de Endotracheale Tube groep (ET-groep). De katten werden aangeboden voor sterilisatie/castratie en behoren allemaal tot ASA 1 of ASA-2 classificatie. Alle katten werden gepremediceerd met 20 µg/kg dexmedetomidine IM en 15 µg/kg buprenorfine IM. Inductie vond plaats met propofol, gedoseerd op effect. Als pijnstilling kregen de katten een injectie met 0,2 mg/kg metacam voor de operatie en de eigenaren kregen 0,05 mg/kg metacam mee naar huis, wat ze vier dagen oraal moesten geven.

Tijdens het onderzoek werden de volgende punten vergeleken:

- Dosis propofol nodig voor intubatie of het plaatsen van de V-gel.
- Tijd vanaf inductie tot eerst zichtbare capnogram in seconden.
- Maximale isofluraan lekkage in de omgeving gemeten door een Miran 205B Type Sapphire 100 isofluraan analyzer.
- Post-operatieve irritatie van de voorste luchtwegen van de katten, subjectief beoordeeld door de onderzoeker tijdens de recovery.
- Post-operatieve irritatie van de voorste luchtwegen van de katten, subjectief beoordeeld door de eigenaar door middel van een vragenlijst.

De eerste drie punten werden getoetst met de Students-T-test en het post-operatieve discomfort werd getoetst met de Chi-kwadraat test. Significantie niveau gezet op $P < 0.05$. Resultaten: Er was geen significant verschil tussen beide groepen wanneer de gebruikte dosis propofol werd vergeleken, ET-groep (8.29 ± 2.37 mg) en V-gel groep (6.61 ± 2.93 mg). Bij de tijd tussen inductie en eerste capnogram is er wel een significant verschil gevonden in het voordeel van de V-gel groep (52.59 ± 30.47 sec.), ET-groep (117.27 ± 27.47 sec.). Bij beide groepen was er sprake van enige lekkage van isofluraan, maar ook hier is het verschil niet significant, V-gel (9.89 ± 10.47 mg/m³) en de ET-groep (9.65 ± 15.09 mg/m³). Tijdens de recovery werd er een voorste luchtweg stridor gehoord bij zes katten uit de ET-groep. Volgens de Chi-Square test zijn er statistisch significant minder katten met een voorste luchtweg stridor in de V-gel groep dan in de ET-groep. (Chi-Square test=7.636364; $p=0.005720$; $df=1$). De irritatie van de voorste luchtwegen, beoordeeld door de eigenaren, toonde geen significant verschil tussen beide groepen.

Conclusie: De V-gel is goed te gebruiken als vervanging voor de endotracheale intubatie bij spontaan ademende katten tijdens isofluraan inhalatieanesthesie.

Background of the Study

In veterinary anesthesia cuffed endotracheal tubes are often used to deliver volatile anesthetics. These tubes are placed through the glottis and the vocal cords (see appendix 1 fig. 4 and 5) into the trachea. After passing the vocal cords, a cuff is inflated to secure the airway. Passing a tube in between the glottis and vocal cords and leaving it in the tracheal lumen can cause complications. Some are related to vagal reflexes, like laryngospasm and bradycardia, due to the stimulation of the vocal cords. Other complications can be a stridor, dyspnea or upper airway obstruction, because of swelling of the structures due to manipulation of the tube [6]. The feline airway is small and more sensitive to trauma, laryngospasm and edema than that of dogs and as such, the process of intubation, (if not properly performed) could increase the risk of complications [1].

Research has been done on the supra-glottic airway masks (or laryngeal mask airway (LMA)), which do not penetrate into the trachea and are therefore less invasive [5][7]. The first LMAs were intended for human use, these LMAs were inflatable masks, the classic-LMA and the proseal-LMA. The classic-LMA has inflatable edges on the ventral side of the elliptical mask (appendix 1 fig. 6) [7]. The proseal-LMA is a newer version of the classic-LMA, it is made of the same substance, but has a gastric tube that provides a connection to the esophagus and stomach, which the classic-LMA does not have [3]. The classic LMA has also been used for anesthesia in the Veterinary field [6][7]. When inserted properly, these masks are situated with the opening of the elliptical mask above the epiglottis with the tip in the esophagus, the convex side is on the dorsal side of the oropharynx (appendix 1 fig. 5). The LMA does not

make contact with the vocal cords or tracheal mucosa. Therefore, there is no need to eliminate airway reflexes during insertion of the LMA. [6]

Complications seen with these inflatable airway masks are mucosal lesions, venous compression and nerve injury, because of the increased pressure on the soft tissues associated with the inflation. It is also possible that the device moves out of the esophagus when it gets inflated. [2]

Because of the disadvantages of the classical LMA a new supra-glottic airway mask, the so-called V-gel, is introduced for veterinary anesthesia. Like the LMA it has an elliptical mask, this mask is made of silicone material but it is narrower in width and does not have the inflatable edges. Instead, there is a smaller cuff positioned on the dorsal side of the mask (see appendix 1 figure 8). When the cuff is inflated, the mask is pushed to the ventral side of the throat, towards the glottis. The smaller cuff exerts less compression on the surrounding structures. In theory this should lead to less disadvantages and still provide a secure airway seal for inhalation anesthesia.

In this study the clinical applicability of the V-gel, the airway security obtained with the V-gel and possible reduction in post-operative discomfort due to intubation with the V-gel will be investigated in healthy male and female cats brought to the University clinic for neutering.

Material and methods

Animals

Twenty-one non-castrated cats, male and female, with ASA-1 or ASA-2 classification were admitted for castration. All cats had approximately the same age and weight (see table 2). The owners were informed about the research and gave their written consent.

Procedure

The cats were randomly allocated to one of the two experimental groups. Group one got intubated with a cuffed endotracheal tube (ET-group) whereas the other group received the V-gel supra-glottic mask (V-gel group). Eleven cats were allocated to the ET-group and ten cats were allocated to the V-gel group.

Cats were premedicated with 20 µg/kg of dexmedetomidine IM and 15 µg/kg buprenorphine IM. As additional analgesia all cats received 0.1 mg/kg meloxicam prior to surgery.

Approximately twenty minutes after the administration of the premedication, anesthesia was induced with propofol IV, given slowly to effect. The effect was achieved when the muscular tone had disappeared. The animals were intubated with either the endotracheal tube or the V-gel. Anesthesia was maintained by isoflurane in oxygen/air (FiO₂ targeted at 30% oxygen) delivered by a Mapleson-D T-piece. During surgery, the depth of anesthesia was controlled to the anesthetist's judgment by changing the end tidal-isoflurane (ET-iso).

During anesthesia the cats were kept warm with a hot-water blanket and/or forced heated air (bairhugger). IV-fluids (sterofundin ISO) were given at a rate of 5 ml/kg/h.

Post-operative analgesia was provided by the buprenorphine and meloxicam given in the pre-medication and meloxicam given per os by the owners (0.05 mg/kg PO at the four following days after surgery).

The total dose of propofol required (in milligrams) for endotracheal intubation or V-gel placement and the time (in seconds) between induction and a first reading on the capnometer were recorded and documented.

Monitoring during anesthesia consisted of ECG, inspired and expired oxygen fraction, inspiratory and end-expiratory isoflurane concentrations. Body temperature (rectal temperature) was measured before and after the surgery.

Both anesthesia and surgery were performed by two experienced surgeons and an experienced anesthetic.

During the maintenance phase all monitoring parameters were recorded in an electronic patient chart every minute. In addition environmental isoflurane concentrations (mg/m^3) were recorded, at a fixed distance of 2cm from the animal's head, by a Miran 205B Type Saphiree 100 isoflurane analyzer.

At the end of surgery the cats were directly disconnected from the anesthesia machine and extubated; without waiting for coughing or swallowing reflexes. The total time of the maintenance phase was not standardized and varied with the duration of surgery since this was a clinical study. After the extubation, the cats were given 200 $\mu\text{g}/\text{kg}$ atipamezole IM, to antagonize the dexmedetomidine and hasten recovery.

During recovery the post-operative discomfort was scored by the researcher. The breathing pattern (abdominal, costal or abdominal-costal), the presence of a respiratory stridor and coughing were evaluated and documented. After full recovery from anesthesia the cats were returned to their owners. The owners received a questionnaire on post-operative discomfort during the first 24 hours after surgery. This discomfort could be caused by upper airway irritation associated with endotracheal intubation or the use of the V-gel. There were four different scores: hoarseness, vomiting, reluctance to eat and coughing during the first twenty-four hours after surgery. (See table 1)

Questions:	Choice answers:
Coughing 24h after surgery?	-no -yes, a little -yes, a lot
Hoarseness, change voice sound 24h after surgery?	-no -yes, a little -yes, a lot
Vomiting 24h after surgery?	-no -yes, occasionally -yes, often
Reluctance to eat 24h after surgery?	-no -yes, trouble eating pellets, only soft food -yes, no eating at all
General impression about discomfort score 1 to 10.	1: no discomfort 10: a lot of discomfort

Table 1 Questionnaire received by the owners

Readout parameters recorded were:

- Total dose of propofol required for endotracheal intubation or V-gel placement.
- Time between induction and getting a first reading on the capnometer.
- Mean of the maximum isoflurane concentration in the environment.

- Post-operative discomfort of the upper respiratory system, subjectively scored by the researcher during the recovery.
- Post-operative discomfort of the upper respiratory system, subjectively scored by the owner 24h after surgery.

SPSS was used for statistical analysis of the data.

The first three parameters were tested by the Students-T-test and the discomfort was tested by the Pearson Chi-Square test. The level of significance was set to $P < 0.05$. Because this was a clinical study the length of the surgeries were not the same. For the comparison of the discomfort between the groups the length of the period of intubation (intubation time) required testing. Therefore the intubation time was also tested with the Students-T-test.

Results

Twenty-one cats were recruited, ten cats allocated in the V-gel group and eleven cats in the ET-group.

The significant difference was calculated by means of the Students-T-test for the following parameters: dose of propofol; inductiontime-first reading on the capnometer and the maximum isoflurane leakage. The level of significance was set to $P < 0.05$.

The mathematical parameters are presented in table two. The outcome of the Students-T-test is summarized in table three.

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Age in weeks	V-gel	10	64,7100	64,29141	20,33073
	Tube	11	59,0818	73,27436	22,09305
Weight in kg	V-gel	10	3,3200	,68928	,21797
	Tube	11	3,2636	,78009	,23521
Dose propofol in mg	V-gel	10	6,6100	2,93085	,92682
	Tube	11	8,2864	2,37003	,71459
Max isoflurane in mg/m3	V-gel	10	9,8867	10,47393	3,31215
	Tube	11	9,6545	15,09320	4,55077
Inductiontime-first capnogram in sec.	V-gel	10	52,5900	30,47441	9,63686
	Tube	11	117,2727	27,47395	8,28371
Intubationtime in min.	V-gel	10	25,9000	14,09846	4,45833
	Tube	11	23,0909	7,18964	2,16776

Tabel 2

Independent Samples Test

	t	df	Sig. (2-tailed)
Age in weeks	0,186	19	0,854
Weight in kg	0,175	19	0,863
Dose propofol in mg	-1,448	19	0,164
Inductiontime-first capnogram in sec.	-5,116	19	0,000
Max isoflurane in mg/m ³	0,041	19	0,968
Intubation time in min.	0,584	19	0,566
General impression of discomfort	1,103	19	0,284

Table 3 Student-T-test.

1. Total dose of propofol required for endotracheal intubation or V-gel placement.

The mean dose of propofol required for intubation exceeded (8.29 ± 2.37 mg) the dose required for placement of the V-gel (6.61 ± 2.93 mg) (see table 2 and figure 1). The difference in required doses between both groups was not significant ($t = -1.448$, $df = 19$, $P = 0.164$) (see table 3).

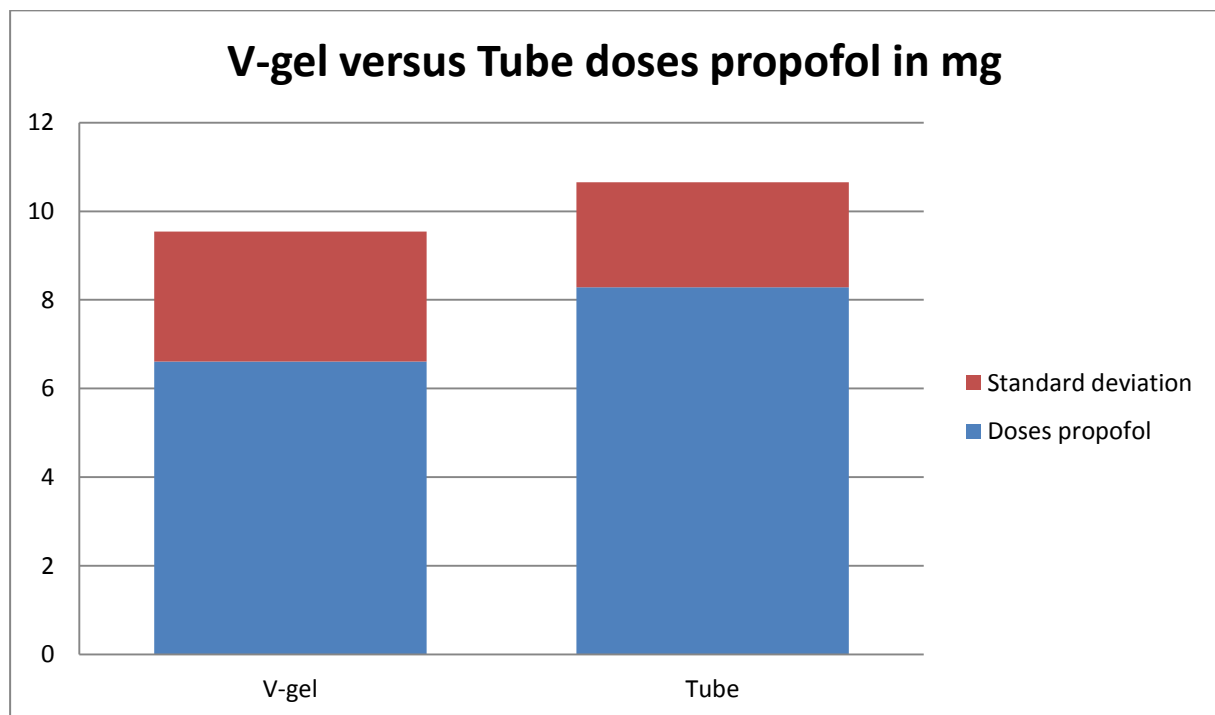


Figure 1: Mean dose of propofol required for intubation or placing of the V-gel.

2. The time between induction and getting a first reading on the capnometer in seconds.

The mean time between the induction and getting a first reading on the capnometer in the ET-group exceeded the time for the V-gel group (see figure 2 and table 2). The induction time for the V-gel was 52.59 ± 30.47 seconds, and for the ET-group 117.27 ± 27.47 seconds. This difference is significant between both groups ($t = -5.116$, $df = 19$, $P = 0.000$) (see table 3).

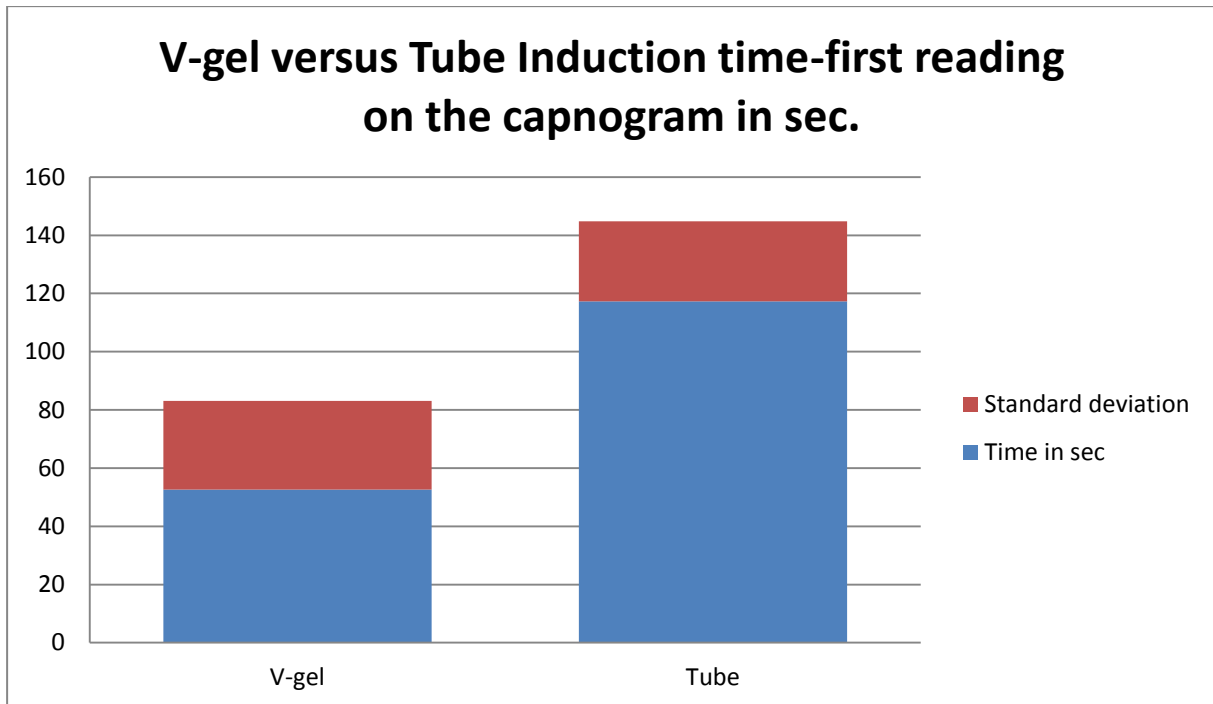


Figure 2: Mean induction time – first reading on the capnometer.

3. The mean of the maximum isoflurane concentration in the environment during the maintenance phase.

The mean of the maximum isoflurane concentration in the environment of the V-gel group ($9.89 \pm 10.47 \text{ mg/m}^3$) exceeded the concentration in the ET-group ($9.65 \pm 15.09 \text{ mg/m}^3$) (see figure 3 and table 2). There was no statistically significant difference between both groups ($t=0.041$, $df=19$, $P=0.968$) (see table 3).

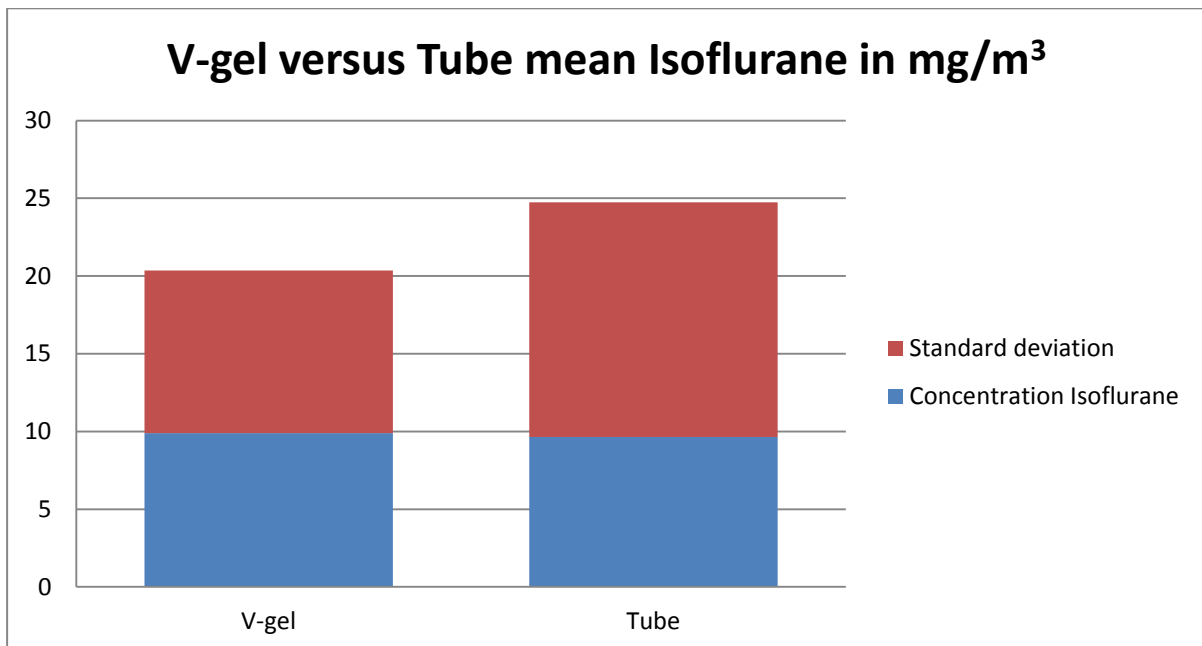


Figure 3: The mean of the maximum isoflurane concentration in mg/m^3 .

4. Post-operative discomfort during the recovery, scored by the researcher.

The duration of the time the animals were intubated was 25.9±14.10 minutes in the V-gel group and 23.09±7.19 minutes in the ET-group (see table 4).

	Group	N	Mean	Std. Deviation	Std. Error Mean
Intubation time in min.	V-gel	10	25,9000	14,09846	4,45833
	Tube	11	23,0909	7,18964	2,16776

Table 4: Intubation time in minutes between the V-gel and ET-group.

There was no significant difference in the length of intubation time between both groups (t=0.584, df=19, P=0,566)(see table 3).

The post-operative discomfort is tested with the Pearson Chi-Square, with a significance level of P<0.05.

During recovery no cat coughed.

During recovery an upper airway stridor was heard in six cats, all in the ET-group. No cat from the V-gel group had a stridor (see table 5). Upper airway stridor in the recovery was significantly more often observed in the ET-group than in the V-gel group (value=7.636, df=1, P=0.006).

	Group	Stridor during recovery		Total
		no	yes	
	V-gel	10	0	10
	Tube	5	6	11
	Total	15	6	21

Table 5: six cats with an upper airway stridor during recovery.

5. Post-operative discomfort related to upper airway irritation subjectively scored by the owner.

All questionnaires were fully filled in by the owners.

There were four different scores: hoarseness, vomiting, reluctance to eat and coughing twenty-four hours after surgery (see table 1).

Hoarseness

The distribution of the scores of hoarseness in the first twenty-four hours after surgery is shown in table 6.

There was no significant difference between both groups comparing the hoarseness (value=1.575, df=2, p=0.455).

Crosstab

Count

		Hoarseness post-surgery			Total
		no	yes, a little	Yes, a lot	
Group	V-gel	8	1	1	10
	Tube	6	3	2	11
Total		14	4	3	21

Table 6: scored hoarseness 24h after surgery.

Coughing

The distribution of the scores of coughing is shown in table 7. There was no significant difference, concerning coughing, between both groups (value=1.575, df=2, p=0.455).

Crosstab

Count

		Coughing during post-surgery		Total
		no	yes, a lot	
Group	V-gel	10	0	10
	Tube	10	1	11
Total		20	1	21

Table 7: Coughing 24h after surgery.

Vomiting

The scores of vomiting are shown in table 8. There was no significant difference, concerning vomiting, between both groups (value=0.955, df=1, p=0.329).

Crosstab

Count

		Vomiting during post-surgery		Total
		no never	yes often	
Group	V-gel	10	0	10
	Tube	10	1	11
Total		20	1	21

Table 8: Vomiting 24h after surgery.

Reluctance to eat

The distribution of the scores of reluctance to eat is shown in table 9. There was no significant difference between both groups (value=0.509, df=1, p=0.476).

Crosstab

Count		Reluctance to eat		Total
		no reluctance to eat	yes, trouble eating pellets, only soft food	
Group	V-gel	8	2	10
	Tube	10	1	11
Total		18	3	21

Table 9: Reluctance to eat 24h after surgery.

Discussion

The V-gel and the endotracheal tube were compared in spontaneous breathing cats under isoflurane anesthesia.

During this study the clinical applicability of the V-gel, the airway security obtained with the V-gel and the possible reduction in post-operative discomfort due to intubation with the V-gel, were investigated. For the comparisons, five readout parameters were measured, namely: dose of propofol required for intubation; time between induction and first reading on the capnometer; maximum isoflurane concentration in the environment, measured at a fixed distance of 2cm from the head by a Miran 205B Type Saphiree 100 isoflurane analyzer; post-operative discomfort during recovery and post-operative discomfort twenty-four hours after surgery.

From the five readout parameters that were measured, only two were statistically significant in advantage of the V-gel. The other three parameters were not significant different for the ET-group or the V-gel group.

The most important difference between the V-gel and the endotracheal tube is less time between induction and the first reading on the capnometer. In the V-gel group the time was 52.59 ± 30.47 seconds compared with the 117.27 ± 27.47 seconds in the ET-group.

For minimizing upper airway discomfort during recovery, the second parameter, the V-gel scored better than the endotracheal tube. During the recovery six cats had an upper airway stridor, all six cats belonged to the ET-group. No cat from the V-gel group had clinical signs referring to any upper airway discomfort during the recovery.

An important benefit is that the V-gel is easier to use than the endotracheal tube. To place the endotracheal tube you need an assistant, who opens the mouth and stretches the neck to facilitate that the second person can place the tube in the trachea. To position the V-gel you need only one person, who can open the mouth with one hand and place the V-gel with the other hand. The V-gel is pushed forward into the mouth until it cannot go further and the cuff can be inflated. (See appendix 1 figure 7) It is not easy to see if the V-gel is properly placed. Therefore you need to connect a capnogram immediately after placing the V-gel. The V-gel is properly placed, when a normal reading is seen at the capnometer and when the patient breathes normally without visible effort.

When the V-gel is placed, it's best to move the animal minimal. During moving it is possible that the V-gel will dislocate in the oropharynx and leakage of isoflurane can occur. Another disadvantage of the V-gel is that it fills up the oral cavity. If surgery of the mouth is necessary, V-gel cannot be used.

The readout parameters with no significant difference between the two groups were: the required dose of propofol, maximum concentration isoflurane leakage and the discomfort scored by the owners.

The maximum concentration of isoflurane measured in the environment was in the V-gel group ($9.89 \pm 10.47 \text{ mg/m}^3$) and in the ET-group ($9.65 \pm 15.09 \text{ mg/m}^3$). In Holland the MAC-value (Maximum Allowable Concentration) for isoflurane is 153 mg/m^3 (20 ppm) during an eight hour workday [4]. This means, during a work day, a maximum of 153 mg/m^3 isoflurane can be inhaled without enduring any adverse health effects. The maximum isoflurane leakage that was measured during this study was 24.74 mg/m^3 . Therefore both the V-gel and the endotracheal tube provide a secure airway for the use of volatile anesthesia in spontaneous breathing cats.

The leakage of isoflurane was very low in both groups, considering the Dutch MAC-value, but this was only measured in spontaneous breathing cats. In human medicine, a comparable LMA (the I-gel) has been tested for coping with higher pressure, produced during ventilation. This study showed that there is more leakage, when used at a higher pressure. [5] More research is necessary for the use of V-gel in ventilated cats. Therefore the V-gel can only be used in healthy (ASA-1 or ASA-2 patients) cats offered for surgery, when ventilation will not be expected.

Twelve (57%) of the twenty-one cats experienced upper airway discomfort in the twenty-four hours after surgery, eight from the ET-group and four from the V-gel group. More research of the upper airway discomfort is necessary, because in this study the discomfort was scored subjectively by the researcher and the owners. In a following study the upper airway discomfort needs to be scored blind by the researchers.

It could be stated that the V-gel is easy in use and a good alternative for the use of endotracheal intubation in spontaneous breathing cats under isoflurane anesthesia.

Acknowledgement

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Figure 4:

http://www.google.nl/imgres?imgurl=http://www.patientedlibrary.com/imagescooked/22307W.jpg&imgrefurl=http://www.patientedlibrary.com/generateexhibit.php%3FID%3D22307%26TC%3D%26A%3D1266&usg=__pBmtlexg0u06r6jrglNFhZlW4kQ=&h=325&w=432&sz=31&hl=nl&start=17&zoom=1&tbnid=TjSh1KDZ92C5WM:&tbnh=150&tbnw=199&ei=M-oRTqufLYjm-gaml7XkDQ&prev=/search%3Fq%3Dintubation%26um%3D1%26hl%3Dnl%26client%3Dfirefox-a%26rls%3Dorg.mozilla:nl:official%26biw%3D1280%26bih%3D652%26tbn%3Disch&um=1&itbs=1&iact=rc&dur=522&page=2&ndsp=18&ved=1t:429,r:15,s:17&tx=118&ty=94&biw=1280&bih=652

Figure 5:

http://www.google.nl/imgres?imgurl=http://www.anecare.com/Products/images/LMA-brief1.jpg&imgrefurl=http://www.anecare.com/Products/QED-LMA-brief.html&usg=__OSi52tSS3poZv8wZ2NdOu2pnPCA=&h=280&w=320&sz=15&hl=nl&start=0&zoom=1&tbnid=b-6ujGpf3OJ23M:&tbnh=130&tbnw=147&ei=iJ4RTsayJ4WSOs-EmaAL&prev=/search%3Fq%3DLMA%26um%3D1%26hl%3Dnl%26client%3Dfirefox-a%26rls%3Dorg.mozilla:nl:official%26biw%3D1280%26bih%3D681%26tbn%3Disch&um=1&itbs=1&iact=hc&vpx=174&vpy=353&dur=105&hovh=210&hovw=240&tx=88&ty=127&page=1&ndsp=28&ved=1t:429,r:14,s:0&biw=1280&bih=681

Figure 6:

http://www.google.nl/imgres?imgurl=http://www.lmaco.com/images/lma-flexible-ru-web.jpg&imgrefurl=http://www.lmaco.com/pwpcontrol.php%3FpwpID%3D4338&usg=__G4sVz96xkdaQeLrvJLCJmTKqPUE=&h=332&w=331&sz=44&hl=nl&start=0&zoom=1&tbnid=EUa4tr9vAxUUiM:&tbnh=122&tbnw=114&ei=iJ4RTsayJ4WSOs-EmaAL&prev=/search%3Fq%3DLMA%26um%3D1%26hl%3Dnl%26client%3Dfirefox-a%26rls%3Dorg.mozilla:nl:official%26biw%3D1280%26bih%3D681%26tbn%3Disch&um=1&itbs=1&iact=hc&vpx=165&vpy=208&dur=1114&hovh=225&hovw=224&tx=102&ty=141&page=1&ndsp=28&ved=1t:429,r:7,s:0&biw=1280&bih=681

Appendix 1

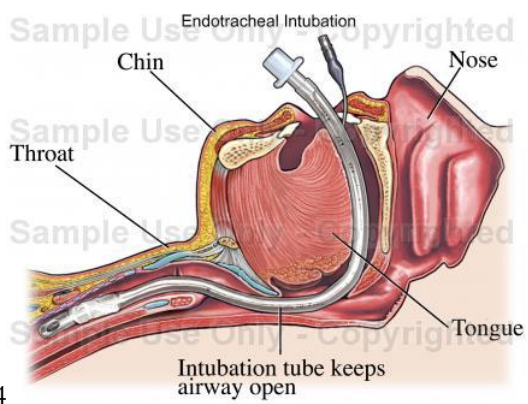


Figure 4

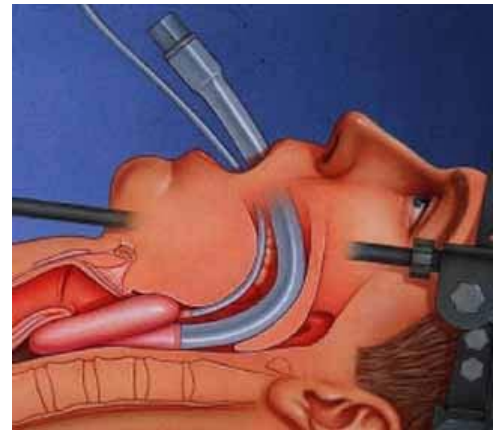


Figure 5



Figure 6
The classic-LMA



Figure 7



Figure 8
Above: new V-gel
Below: prototype V-gel

Appendix 2 Statistics

Table 15: Print out of Students-T-test statistics data

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Doses propofol in mg	Equal variances assumed	,732	,403	-1,448	19	,164	-1,67636	1,15809	-4,10028	,74755
	Equal variances not assumed			-1,432	17,360	,170	-1,67636	1,17031	-4,14161	,78889
Inductiontime-first capnogram in sec.	Equal variances assumed	,232	,635	-5,116	19	,000	-64,68273	12,64219	-91,14314	-38,22232
	Equal variances not assumed			-5,090	18,247	,000	-64,68273	12,70783	-91,35494	-38,01051
Max isoflurane in mg/m3	Equal variances assumed	,074	,789	,041	19	,968	,23212	5,72800	-11,75672	12,22097
	Equal variances not assumed			,041	17,839	,968	,23212	5,62849	-11,60056	12,06480
Overall discomfort after surgery	Equal variances assumed	2,689	,118	1,103	19	,284	1,236	1,120	-1,109	3,582
	Equal variances not assumed			1,095	17,916	,288	1,236	1,129	-1,136	3,609
Age in weeks	Equal variances assumed	,002	,966	,186	19	,854	5,62818	30,22030	-57,62364	68,88000
	Equal variances not assumed			,187	18,983	,853	5,62818	30,02401	-57,21672	68,47308
Weight in grams	Equal variances assumed	,171	,684	,175	19	,863	56,36364	322,66129	-618,97421	731,70148
	Equal variances not assumed			,176	18,990	,862	56,36364	320,67651	-614,84481	727,57208
Intubationtime in min.	Equal variances assumed	4,225	,054	,584	19	,566	2,80909	4,81336	-7,26538	12,88357
	Equal variances not assumed			,567	13,100	,581	2,80909	4,95740	-7,89246	13,51064