비엔동물전문의료센터
BIEN ANIMAL MEDICAL CENTER

비엔 마취 세미나
: Intubation, BOAS, Noisy breathing

Anesthesiologist DVM. Nam
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Previous seminar

- What is monitoring? - 5 steps
- Monitoring ≒ predicting
  - Patient-related
  - Non-patient-related
- Criteria: absolute vs. relative
- Treatments: cause vs. symptomatic
  - Pulse rate (ECG, SpO_2)
  - Blood pressure
  - End tidal carbon dioxide level
  - Temperature
- Quiz

Today seminar

1. Intubation

- ☐ Endotracheal tube
  - ☐ Types
  - ☐ Size determination
- ☐ Materials
- ☐ Intubation preparation
- ☐ Intubation
  - ☐ Positioning
  - ☐ Insertion
  - ☐ Laryngoscopy
  - ☐ After intubation

2. BOAS

- ☐ Morphological changes
- ☐ BOAS

3. Noisy breathing

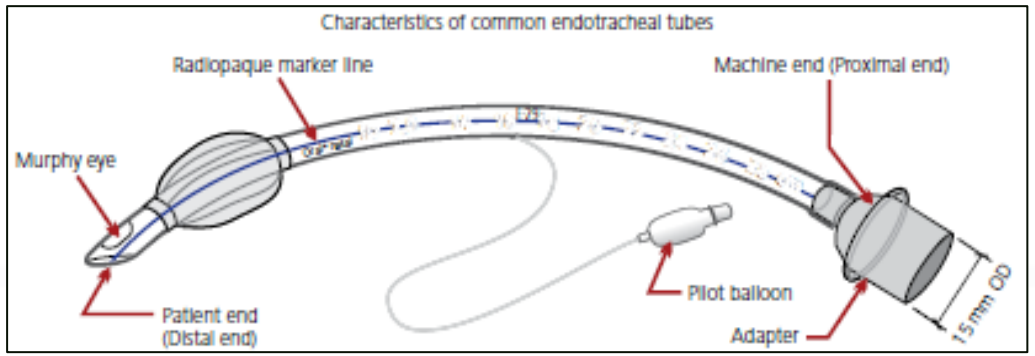
- ☐ Wheeze
- ☐ Rhonchi
- ☐ Stridor
- ☐ Stertor

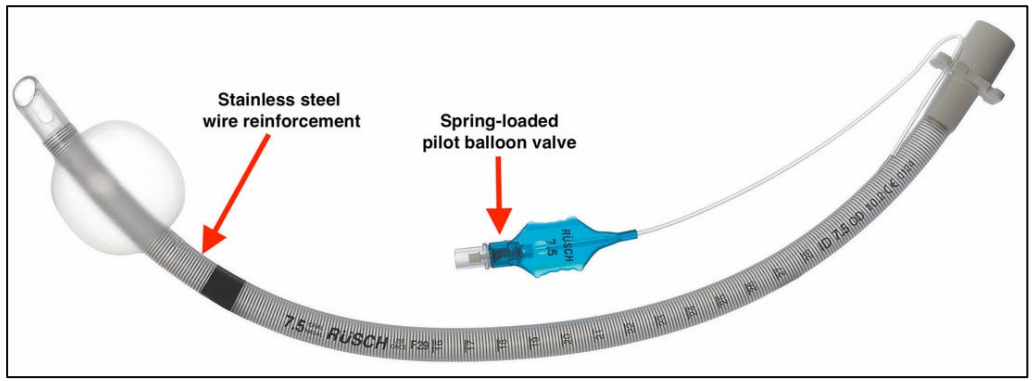
Endotracheal Tube Type

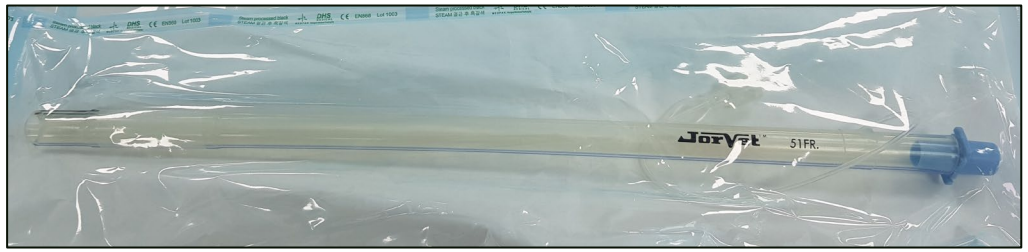
1) Polyvinyl chloride ET tube

2) Armored type ET tube

3) Silicon type ET tube



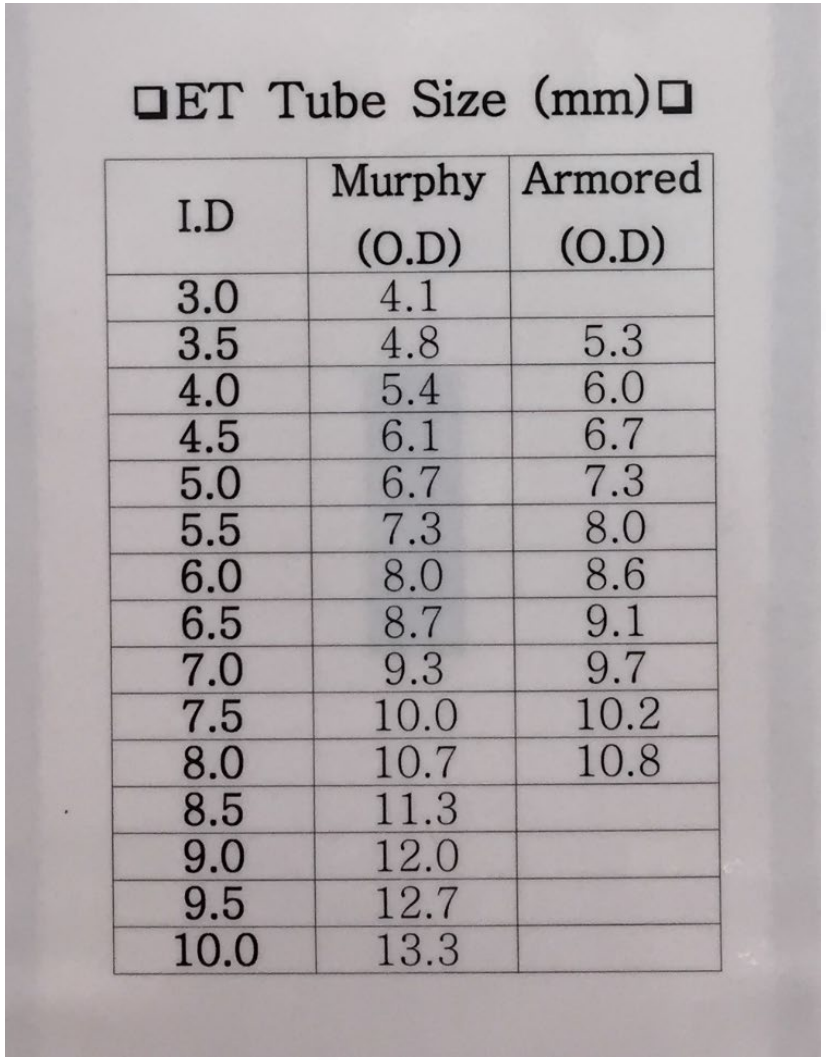




Veterinary anesthesia and analgesia, 5th , William lumb, Wynn jones, 2015

https://mriquestions.com/et-tubes--airways.html

Size determination



❑ET Tube Size (mm)❑

I.D	Murphy (O.D)	Armored (O.D)
3.0	4.1	
3.5	4.8	5.3
4.0	5.4	6.0
4.5	6.1	6.7
5.0	6.7	7.3
5.5	7.3	8.0
6.0	8.0	8.6
6.5	8.7	9.1
7.0	9.3	9.7
7.5	10.0	10.2
8.0	10.7	10.8
8.5	11.3	
9.0	12.0	
9.5	12.7	
10.0	13.3	

Body weight (kg)	Tube ID (mm)
1 ~ 2.5	2.0 ~ 3.0
2.5 ~ 5	3.5 ~ 4.5
4 ~ 9	5 ~ 6
7 ~ 15	7 ~ 8
15 ~ 25	9 ~ 10
25 ~ 45	11 ~ 12
> 40	14 ~ 16

Veterinary Anesthesiology, College of Veterinary Medicine, Seoul National University

Size determination

Ex)

Body weight: 5.4 kg

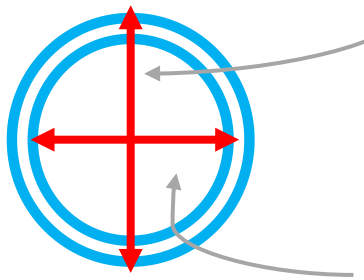
Body weight (kg)	Tube ID (mm)
1 ~ 2.5	2.0 ~ 3.0
2.5 ~ 5	3.5 ~ 4.5
4 ~ 9	5 ~ 6
7 ~ 15	7 ~ 8
15 ~ 25	9 ~ 10
25 ~ 45	11 ~ 12
> 40	14 ~ 16

Size determination

- Thoracic radiograph

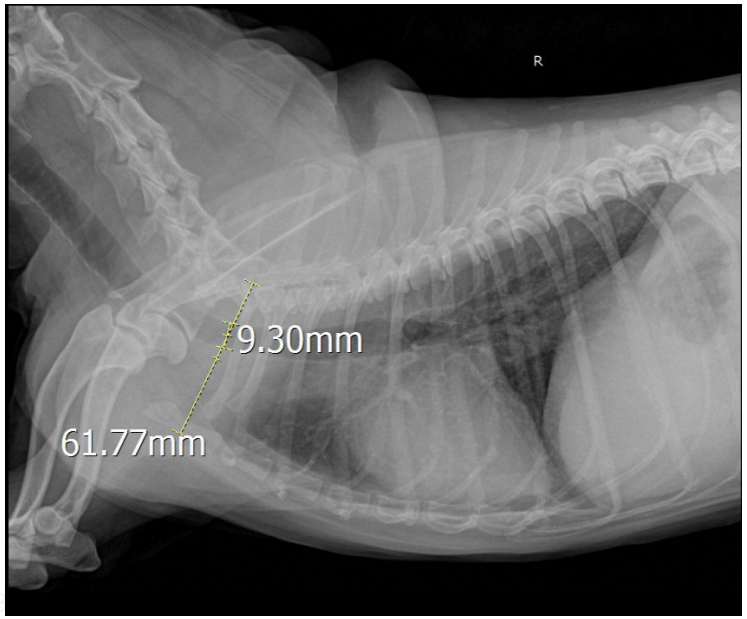
- OD(outer diameter)

= tracheal diameter (on thoracic-radiograph) X { 0.9 / 0.8 / 0.7



OD (outer diameter)

ID (inner diameter)



Size determination

Ex)

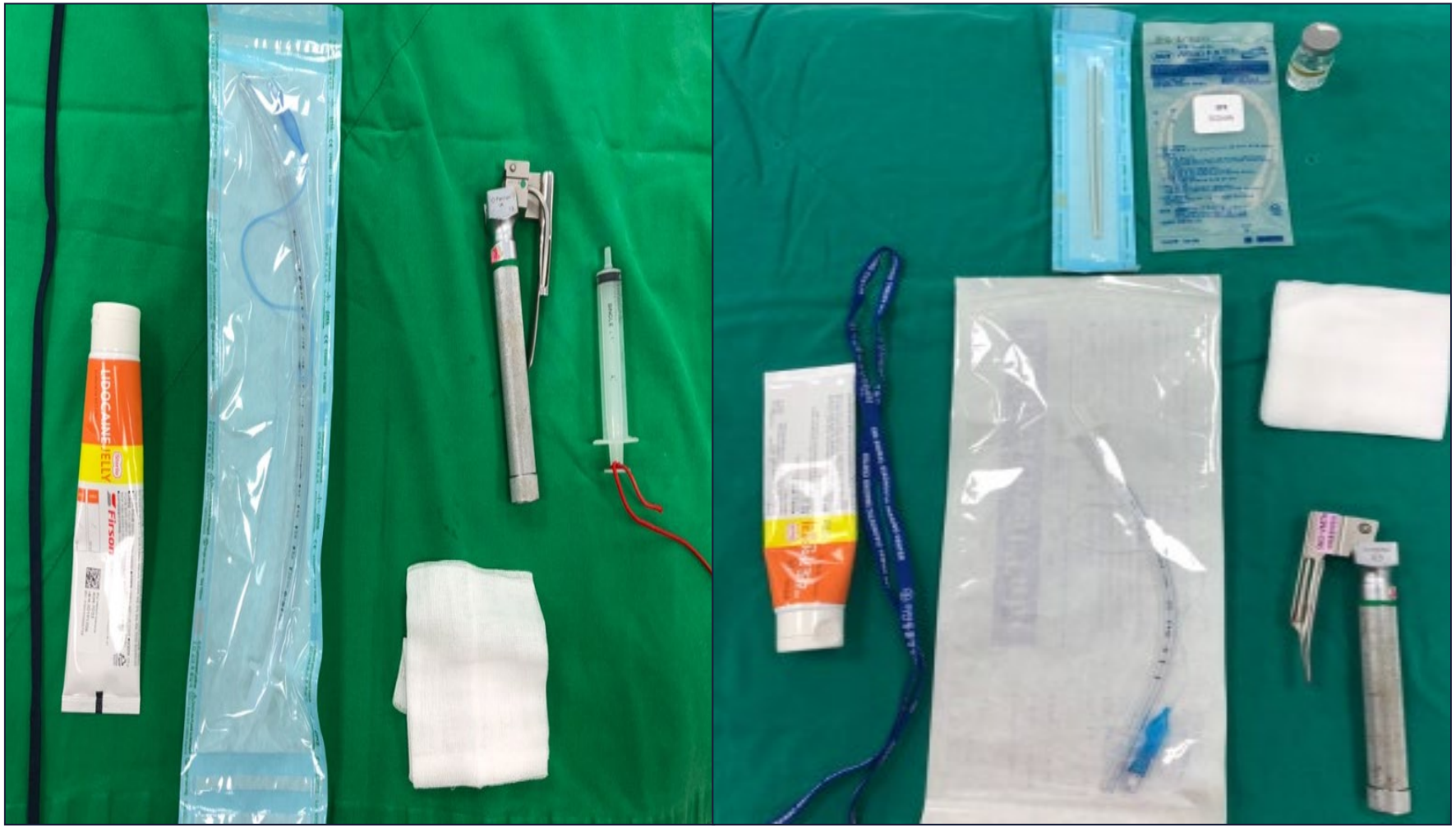
Tracheal diameter: 7.6 mm

OD(outer diameter): 7.6x0.8 = 6.08 mm

I.D	Murphy (O.D)	Armored (O.D)
3.0	4.1	
3.5	4.8	5.3
4.0	5.4	6.0
4.5	6.1	6.7
5.0	6.7	7.3
5.5	7.3	8.0
6.0	8.0	8.6
6.5	8.7	9.1
7.0	9.3	9.7
7.5	10.0	10.2
8.0	10.7	10.8

Materials

- ET tube
- Laryngoscope
- Gauze
- Syringe
- Tie
- Lubricant
- Feeding tube
- Cotton swab

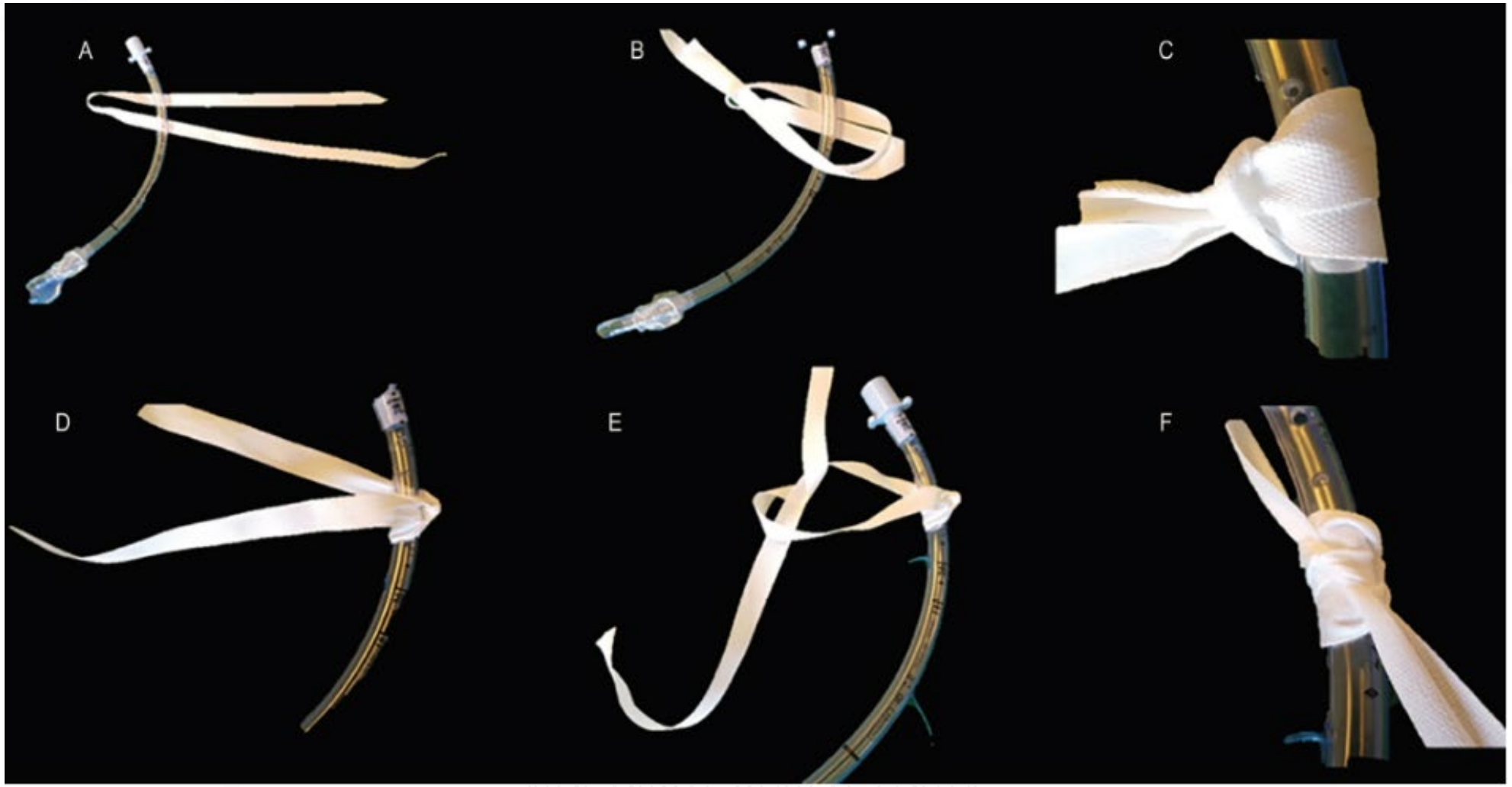


Insertion length

Pre-measure length of ET tube: up to thoracic inlet

Intubation preparation

Modified cow hitch knot



Huw RF Walters MB BChir et el., A modified tie techniques for securing endotracheal tubes, Respiratory care, 2018.

Positioning

1) Sternal or lateral recumbency

2) Open the mouth

➔ Hold top jaw

➔ Thumb and forefinger should be on either side of jaw; behind the canine teeth

➔ Grasp the tongue with a gauze

➔ Extent the tongue between the canine teeth

3) Straighten the head and neck

Veterinary Anesthesiology, College of Veterinary Medicine, Seoul National University

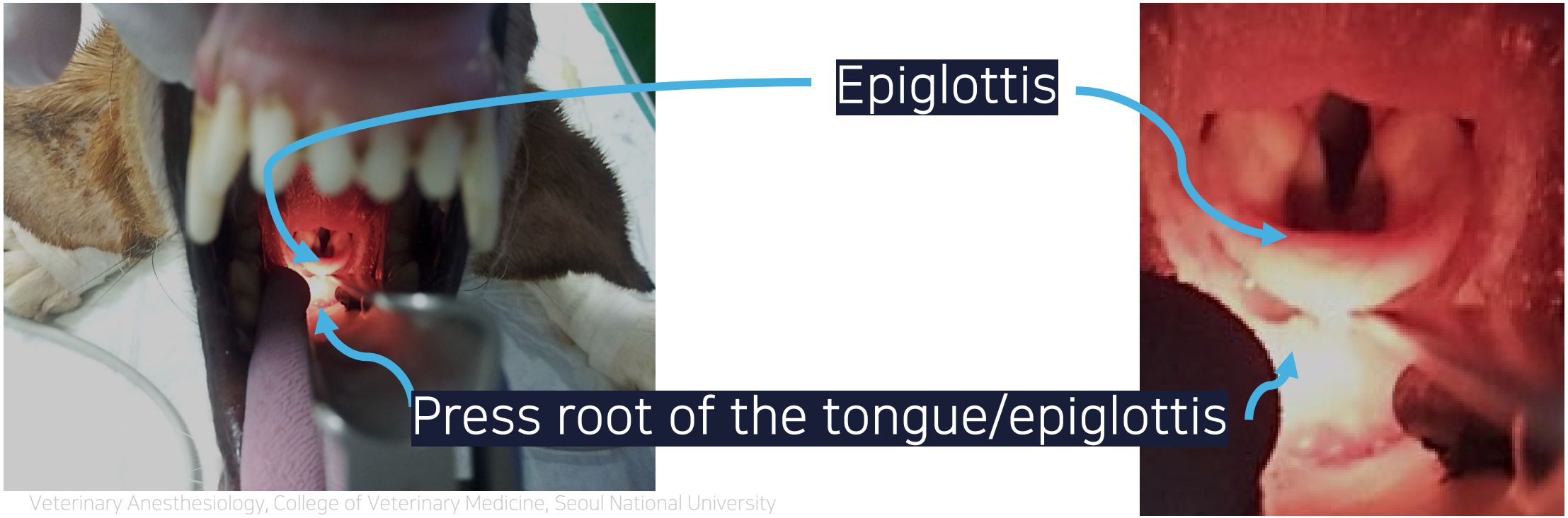
Insertion

Open epiglottis

→ Press base of tongue/epiglottis

Soft-palate displacement

→ Push the soft palate with ET tube



Laryngoscope

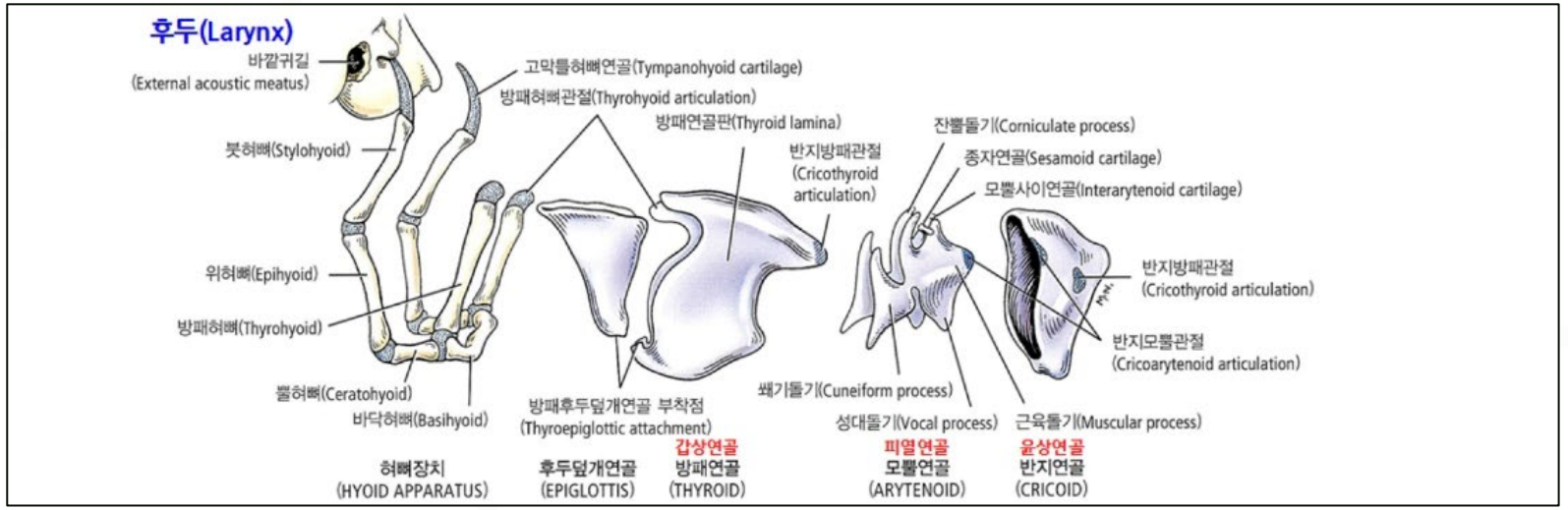
Macintosh type

→ Press **base of tongue**

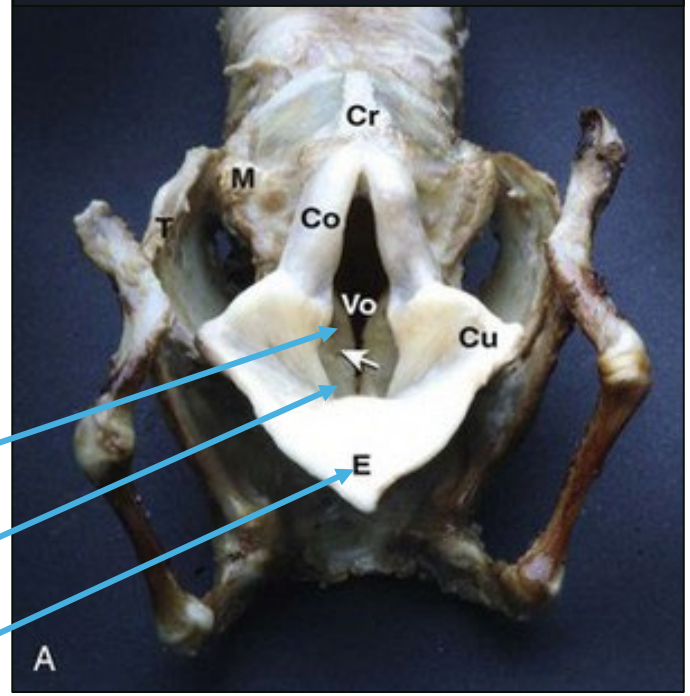
Miller type

→ Press **Epiglottis**

Larynx



A, Articulation of the thyroid and cricoid
Co, corniculate process
Cr, cricoid cartilage
Cu, cuneiform process
E, epiglottis; M, muscular process
T, thyroid cartilage
Vo, vocal fold
Arrow, location of ventricle (saccule)



Larynx of dog

- Guarding the entrance to the trachea

✓ Air passageway

✓ Vocalization

✓ Prevent inspiration of foreign materials

Vocal fold

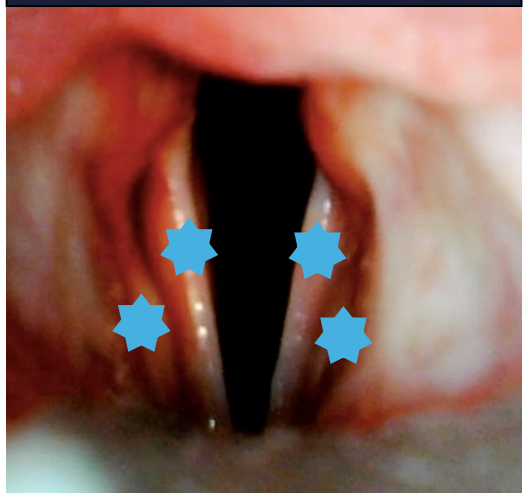
Vestibular fold

Epiglottis

https://veteriankey.com/larynx/

Morphological changes

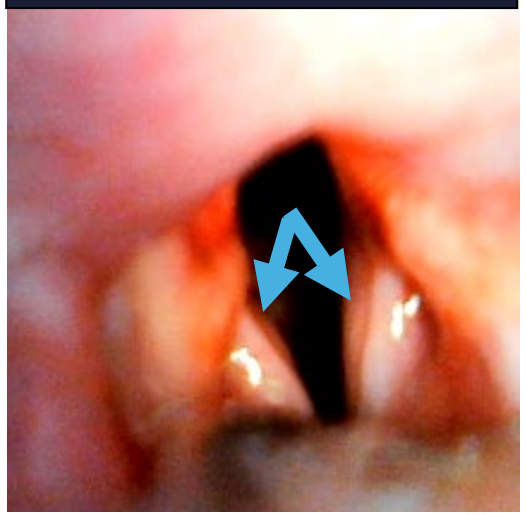
Normal larynx



Swelling of vocal fold

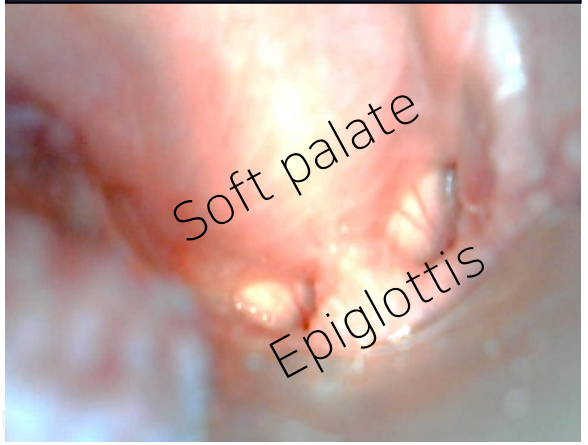
Swelling of vestibular fold

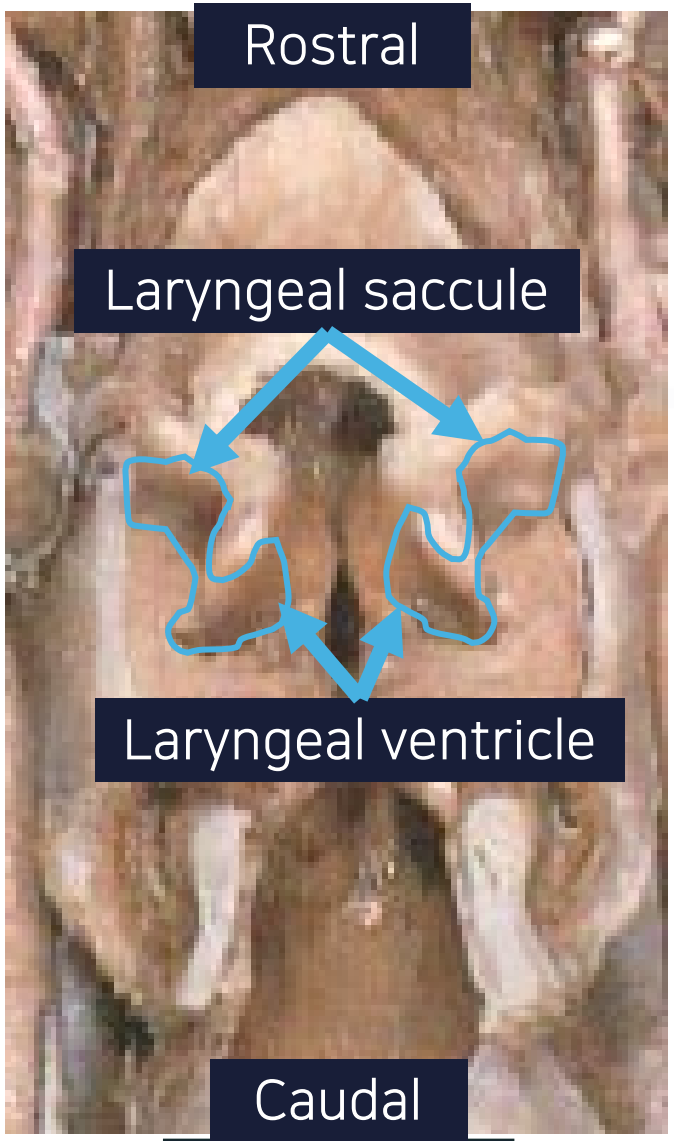
Subglottic edema



Everted saccule

Soft palate elongation





Brachycephalic obstructive airway syndrome

BOAS component

- Stenotic nares
- Elongated soft palate
- Everted laryngeal saccule
- Laryngeal collapse
- Tracheal hypoplasia
- Macroglossia

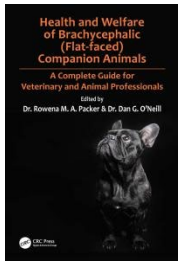
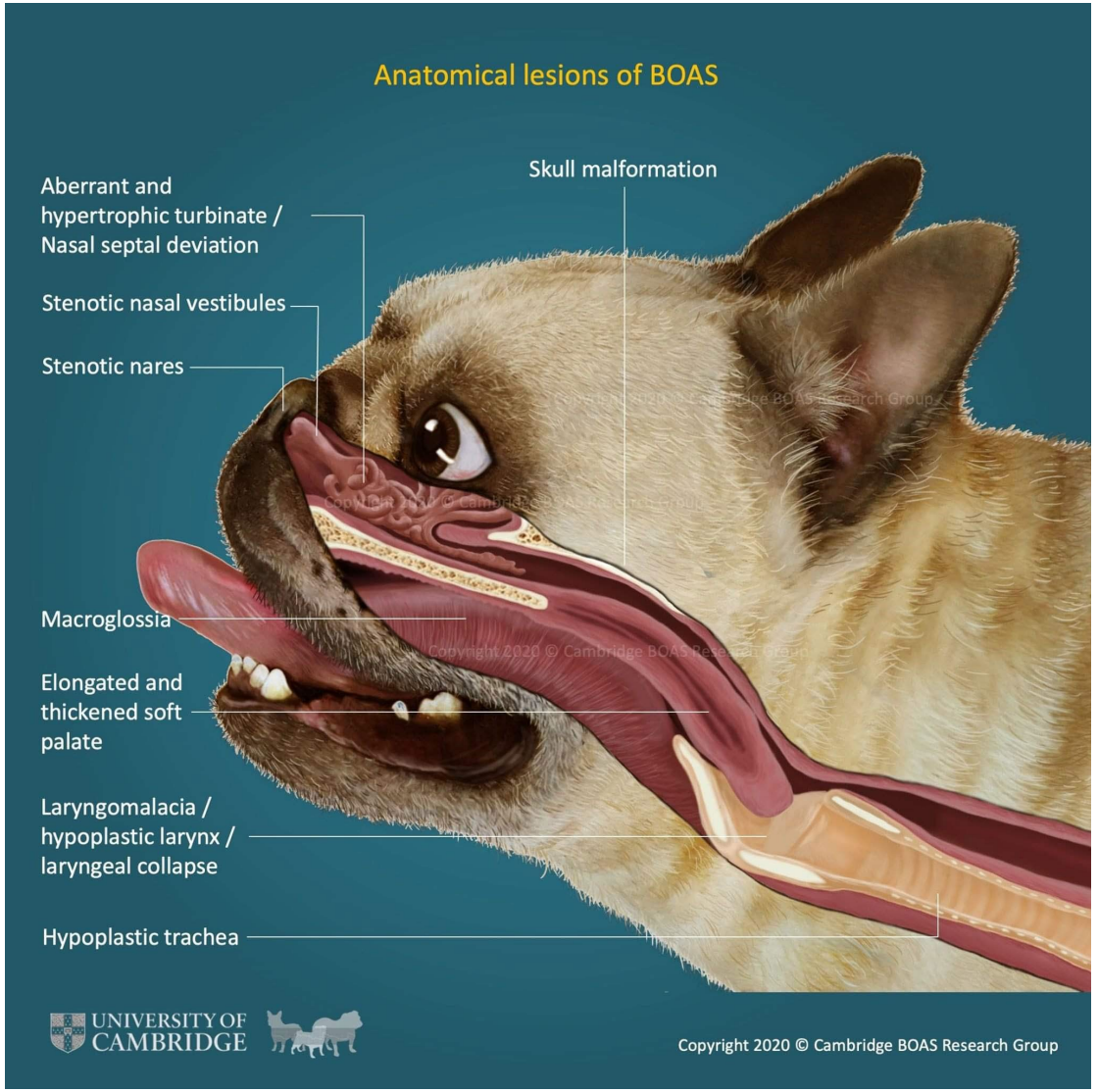


TABLE 10.2
Lesion Sites for Brachycephalic Obstructive Airway Syndrome

Primary	Secondary
• Stenotic nostrils	• Thickened soft palate
• Elongated and thickened soft palate	• Nasopharyngeal collapse
• Nasal turbinate hypertrophy and malposition	• Tonsillar eversion and hypertrophy
• Nasopharyngeal restriction	• Laryngeal collapse
• Macroglossia	• Bronchial collapse
• Tracheal hypoplasia	• Gastrointestinal reflux with oesophagitis
• Laryngeal hypoplasia	• Hiatal hernia



Brachycephalic obstructive airway syndrome

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Compendium

Canine Brachycephalic Airway Syndrome: Pathophysiology, Diagnosis, and Nonsurgical Management

Michelle Trappler, VMD
Kenneth W. Moore, DVM, DACVS

Table 1. Incidence of Brachycephalic Airway Syndrome Components

Study	Stenotic Nares	Elongated Soft Palate	Everted Saccules[a]	Laryngeal Collapse[b]
Poncet et al[18]	84.9% (62/73)	95.9% (70/73)	54.8% (40/73)	69.9% (51/73)
Poncet et al[8]	85.2% (52/61)	100% (61/61)	54.1% (33/61)	63.9% (39/61)
Torrez and Hunt[10]	42.5% (31/73)	86.3% (63/73)	58.9% (43/73)	53.1% (34/64)
Riecks et al[17]	58.1% (36/62)	87.1% (54/62)	58.1% (36/62)	8.1% (5/62)

[a]Stage I laryngeal collapse
[b]Stages II and III laryngeal collapse

Vicious cycle in brachycephalic breeds

Narrowed airway in Brachycephalic breed → Increased negative pressure → Soft tissue inflamed, Larynx and tracheal collapse

Vicious cycle

Brachycephalic obstructive airway syndrome

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5-Year Impact Factor 2.427
Journal Indexing & Metrics »

Perianesthetic Mortality in Domestic Animals: A Retrospective Study of Postmortem Lesions and Review of Autopsy Procedures

J. DeLay

First Published July 1, 2016 | Research Article | Find in PubMed | Check for updates
https://doi.org/10.1177/0300985816655853

Table 1. Autopsy Lesions in Perianesthetic Mortality Cases at a Veterinary Diagnostic Laboratory.[a]

Species	Total Autopsies (%)[b]	No Significant Lesions	Surgical Complication	Lesions of Preexisting Disease						
				Total	Cardiac	Respiratory	Systemic	Neoplasia	CNS	GI
Dog	105 (3.6)[c]	45 (43)	5 (5)	55 (52)	26 (25)	15 (14)	11	5	2	1
Cat	90 (7.9)	31 (34)	4 (4)	55 (61)	29 (32)	17 (19)	9	0	0	0
Horse	9 (0.4)	0	0	9	4	2	3	0	0	0
Rabbit	9 (2.8)	4	0	5	0	3	2	0	0	0
Ferret	4 (6.5)	0	1	3	1	0	1	1	0	0
Guinea pig	1 (3.5)	0	0	1	0	0	0	1	0	0
Chinchilla	1 (4.2)	0	0	1	0	0	1	0	0	0
Rat	1 (3.4)	0	0	1	1	0	0	0	0	0
Tortoise	1 (50)	1	0	0	0	0	0	0	0	0
Total	221 (1.3)	81	10	130	61[c]	37	27[c]	7[c]	2	1

CNS, central nervous system; GI, gastrointestinal.
[a]Data are presented as *n* or *n* (%).
[b]Total number of autopsies of perianesthetic mortality cases (and percentage relative to total number of autopsies in the same time period, 2007–2015).
[c]Three dogs had significant lesions in multiple disease categories.

Table 4. Respiratory Lesions Identified During Autopsy in Perianesthetic Mortality Cases.

Species	No. of Cases	Diagnosis	No. of Cases
Dog	15	Aspiration pneumonia	5
		Brachycephalic syndrome	3
		Tracheal collapse syndrome	3
		Pneumothorax	2
		Laryngospasm	1
		Severe acute pulmonary hemorrhage	1
Cat	17	Pneumothorax	5
		Interstitial pneumonia	3
		Upper respiratory tract obstruction (laryngeal mucous plug)	1
		Pulmonary vascular smooth muscle hyperplasia and vascular/interstitial smooth muscle hyperplasia	2 (1 each)
		Bronchointerstitial pneumonia	1
		Parasitic pneumonia, *Aelurostrongylus abstrusus*	1
		Aspiration pneumonia	1
		Embolic pneumonia	1
		Acute pulmonary edema	1
		Severe laryngeal edema	1
Horse	2	Upper respiratory tract obstruction (from pharyngeal lymphoid hyperplasia)	1
		Aspiration pneumonia	1
Rabbit	3	Laryngotracheitis	1
		Upper respiratory tract obstruction	2

Confirming placement of ET tube

1) Cough reflex (not always present)

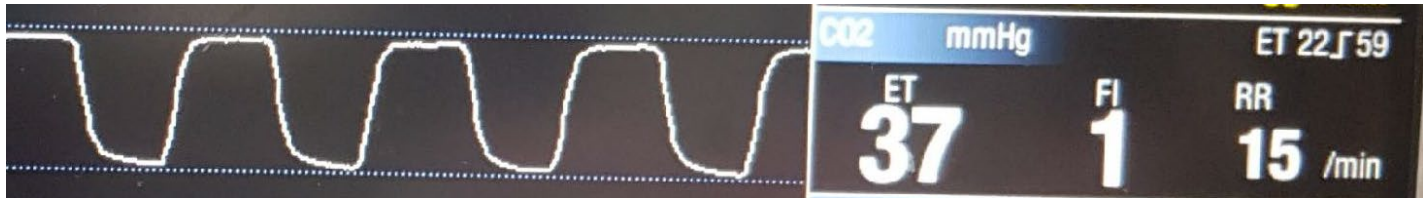
2) Air movement seen in ET tube during exhalation

3) $EtCO_2$ present on capnograph

4) Lung sounds present on auscultation

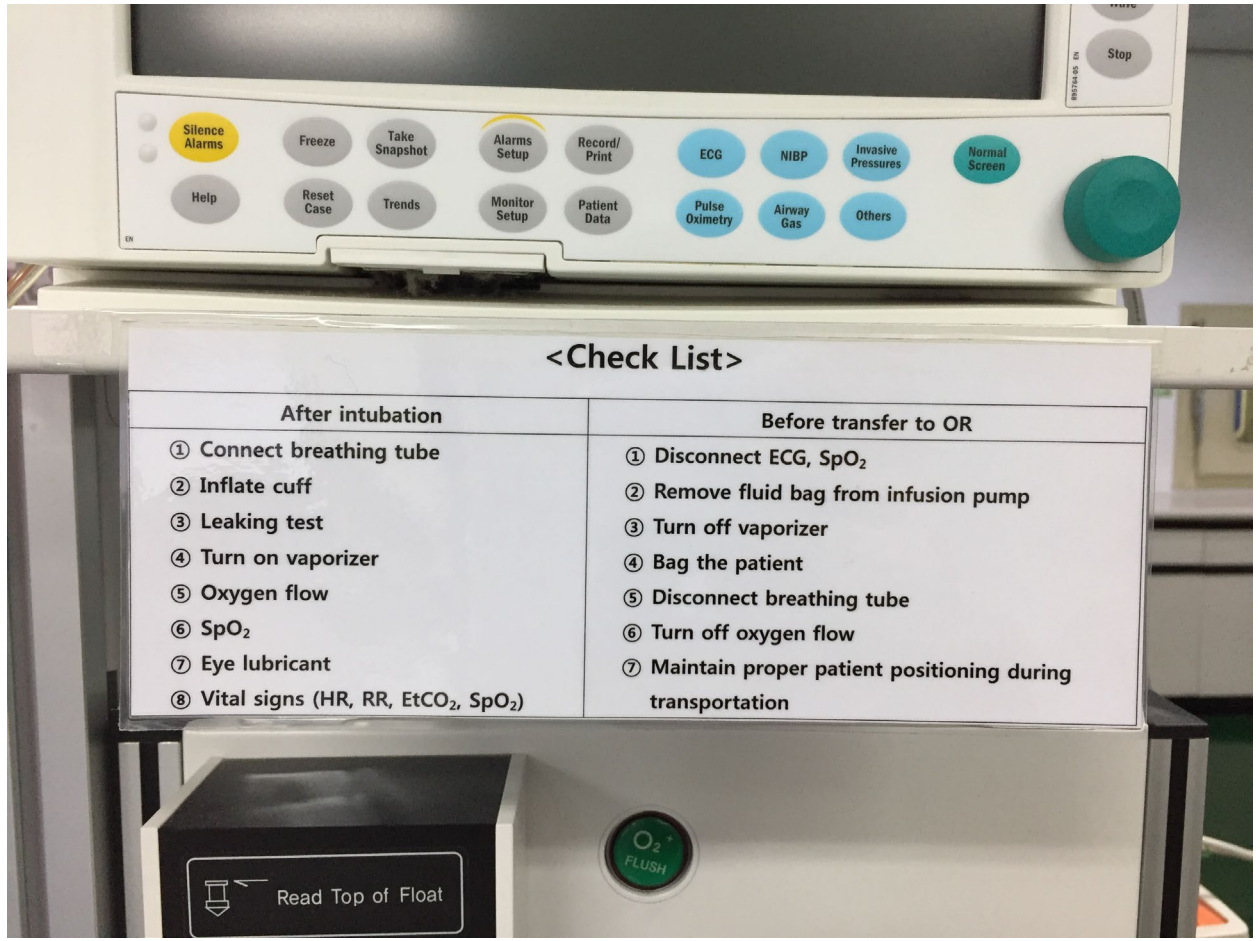
5) Palpate neck

→ Only one firm structure



After intubation

1) Connect breathing tube
2) Fix the ET tube to the patient by tie
3) Adjust oxygen flowmeter
4) Inflate cuff
5) Monitor capnography
6) Leaking test
7) Turn on vaporizer
8) Monitor vital signs



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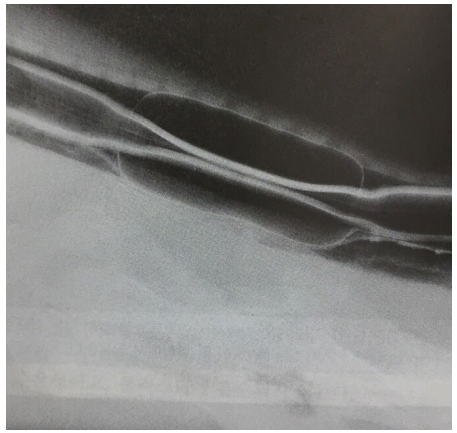

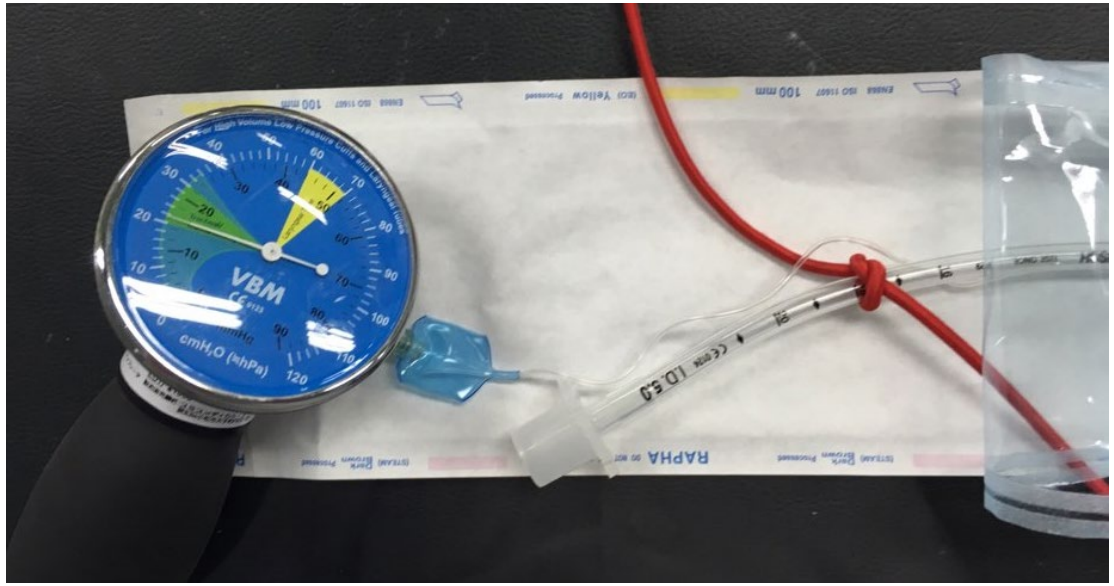

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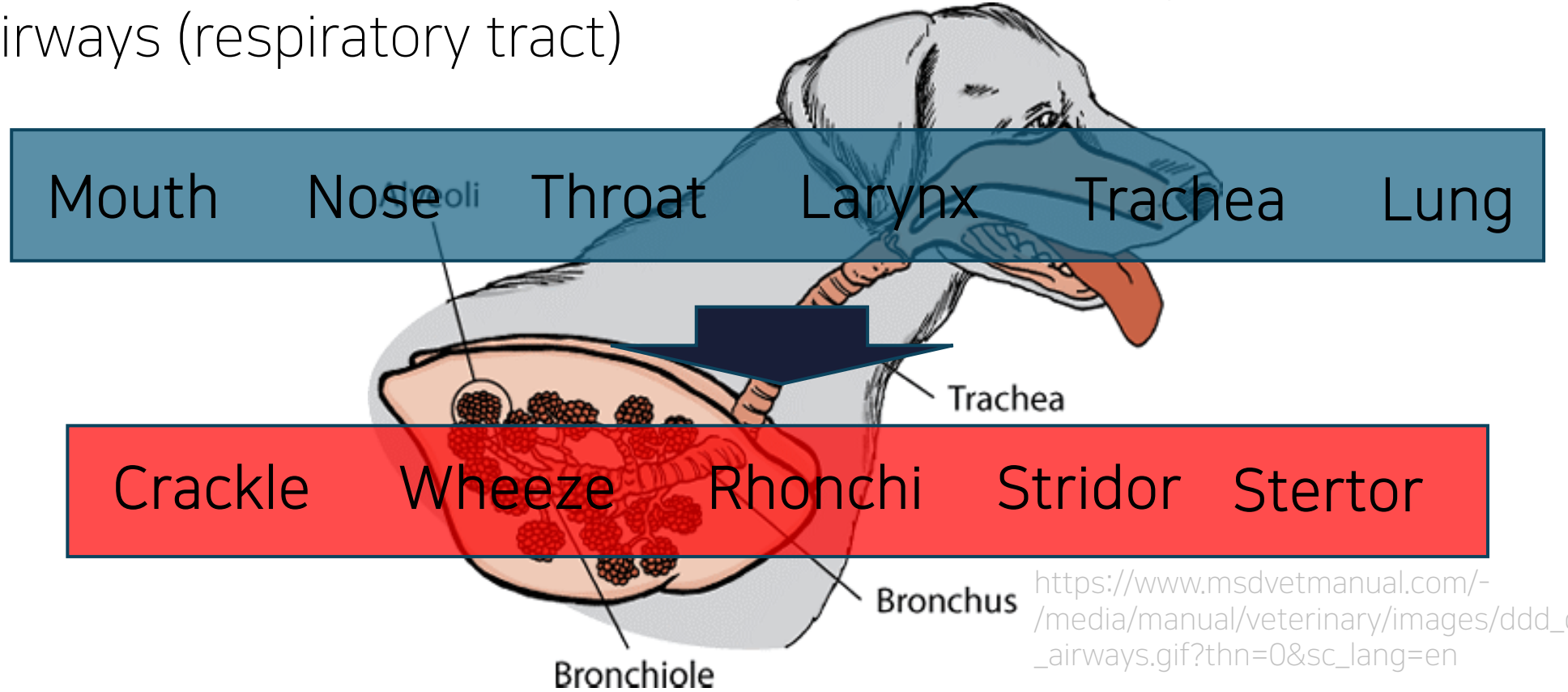
Veterinary anesthesia and analgesia, 5th , William lumb, Wynn jones, 2015

Noisy Breathing

: Typically caused by a partial blockage or narrowing at some point in the airways (respiratory tract)



https://www.msdvetmanual.com/-/media/manual/veterinary/images/ddd_dog_lungs_and_airways.gif?thn=0&sc_lang=en

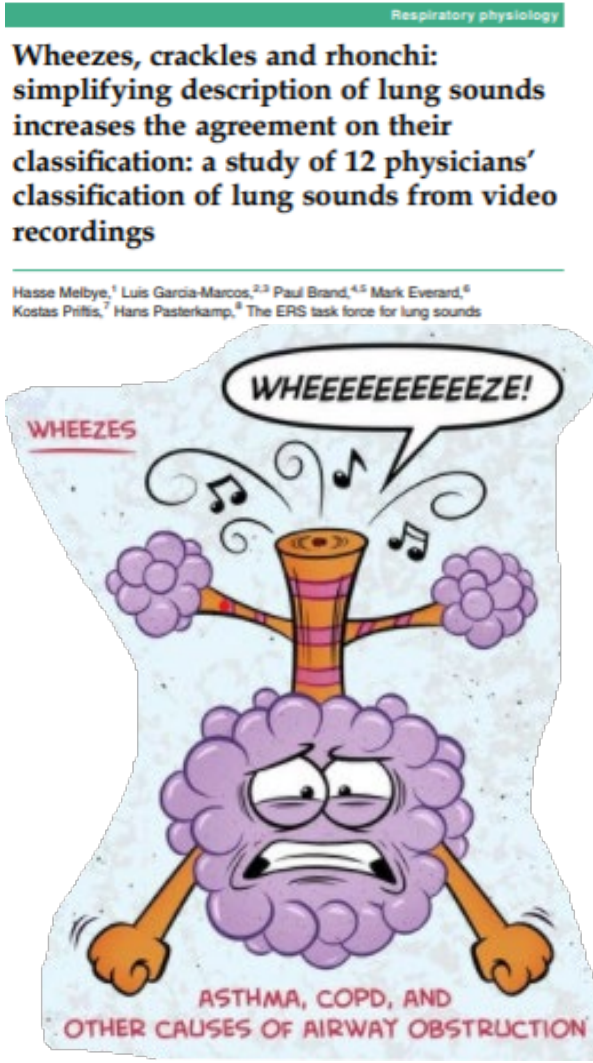
Wheeze

Wheeze

: Continuous, coarse, whistling sound produced in **narrowed** the respiratory airways during breathing.

→ **Usually on exhalation** but may occur during inhalation or both.
→ Long duration (>80 msec), high pitch (>1,000 Hz), sinusoidal (**musical**) sound.

Asthma, bronchoconstriction



https://www.medcomic.com/medcomic/adventitious-breath-sounds/

Rhonchi

Rhonchi

: Low pitched, rattling lung sounds that often resemble snoring when obstruction or secretions in larger airways.

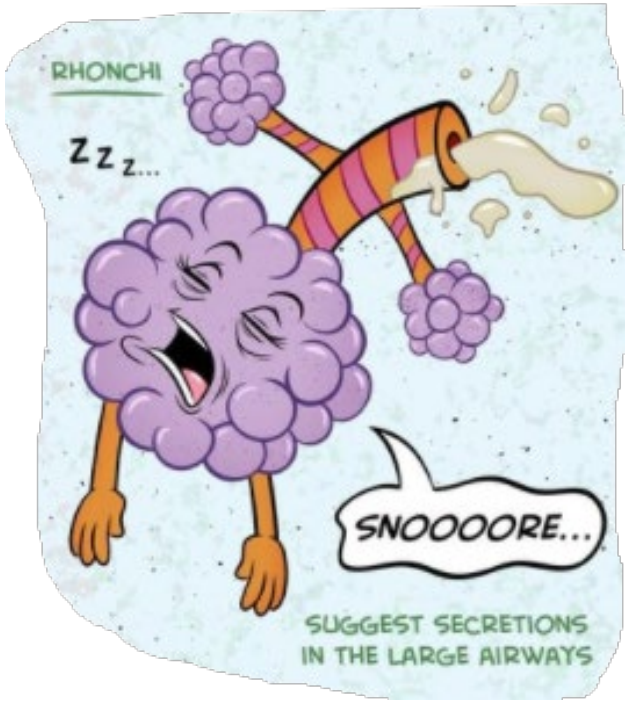
→ Inspiration, expiration both
→ Longer duration (>100 msec), low pitch (<2-300 Hz), loud

Bronchitis

Respiratory physiology

Wheezes, crackles and rhonchi: simplifying description of lung sounds increases the agreement on their classification: a study of 12 physicians' classification of lung sounds from video recordings

Hasse Melbye,[1] Luis Garcia-Marcos,[2,3] Paul Brand,[4,5] Mark Everard,[6] Kostas Priftis,[7] Hans Pasterkamp,[8] The ERS task force for lung sounds



https://www.medcomic.com/medcomic/adventitious-breath-sounds/

Stridor

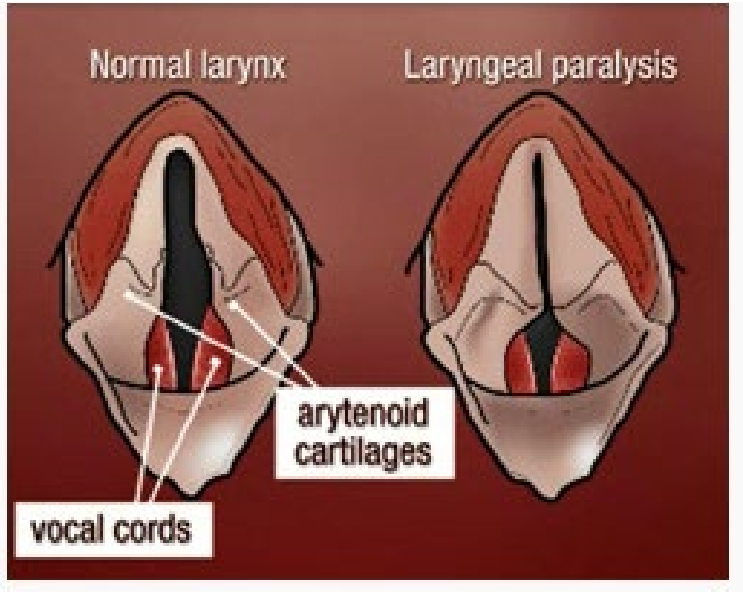
Stridor

: An abnormal, high-pitched, musical breathing sound. It is caused by a **blockage in the throat or voice box (larynx).** It is most often heard when taking in a breath.

→ Usually on inspiration
(Expiratory stridor: intrathoracic tracheal collapse)
→ High pitch

Upper respiratory tract obstrtuction, foreign body

Review
Assessment and causes of stridor
Andreas Pfleger, Ernst Eber*
Division of Paediatric Pulmonology and Allergology, Department of Paediatrics and Adolescent Medicine, Medical University of Graz, Austria



http://www.mountpleasant.com.sg/images/maineducation/54/Screen-Shot-2014-06-17-at-10.48.35-AM.jpg

Stertor

Stertor

: The noise that results from vibration of the **pharyngeal tissues (nasopharynx, oropharynx, soft palate)** due to significant upper respiratory obstruction **(nasal/nasopharynx obstruction)**.

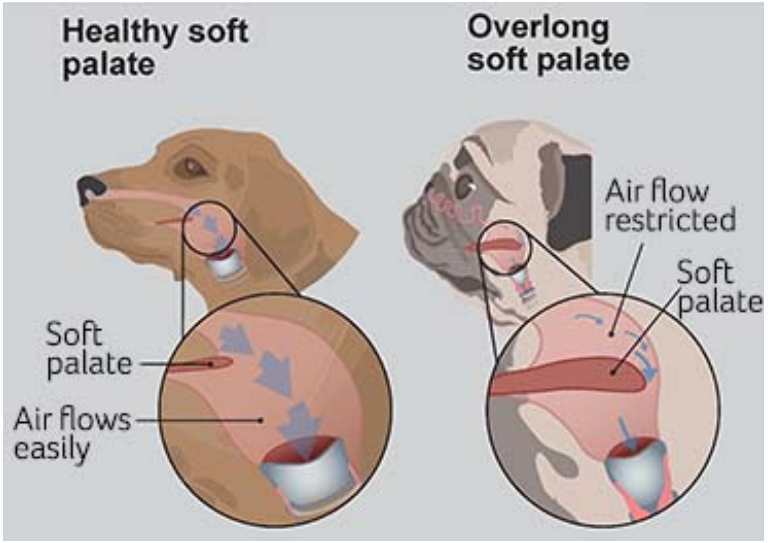
→ Inspiration
→ Low pitch, Loud

Elongated soft palate, nasal tumor, nasal foreign body

CLINICAL SIGNIFICANCE OF PULMONARY FUNCTION TESTS

Upper Airway Obstruction*

John C. Acres, M.D., and Meir H. Kryger, M.D.†



https://www.pdsa.org.uk/media/8486/soft-palate-small.jpg

Localization

Emergency Respiratory Assessment

WORLD SMALL ANIMAL VETERINARY ASSOCIATION WORLD CONGRESS PROCEEDINGS, 2001

Dez Hughes
United States

Respiratory pattern

HELP

Localization of affected airway tract

Heart and Lung Sounds: Good Auscultation

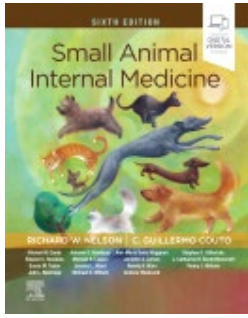
BRITISH SMALL ANIMAL VETERINARY CONGRESS 2008

Mike K. Holgate, BVetMed, CertVC, MRCVS
Mike Holgate Cardiology Referrals Ltd
Alsager, Stoke-on-Trent

Figure 2. Lung sound classification after the American Thoracic Society.

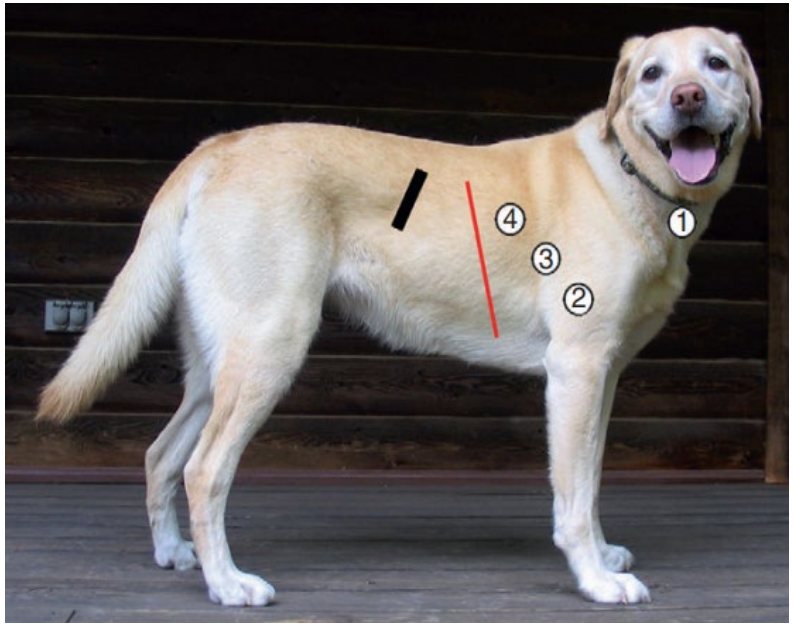
	Produced in	Cause	Example	Characteristics (pitch/amplitude)
Continuous sounds (inspiratory/expiratory)				
Wheeze	Narrowed airways	Airway secretions, airway flutter	Asthma, bronchoconstriction	High/variable
Rhonchi	Large airway with rapid air movement	Large airway secretions	Bronchitis	Low/variable
Stridor	Upper airway Inspiratory	Turbulence/ obstruction	Upper respiratory tract (URT) paralysis, foreign body	High/variable
Stertor	Nasal/nasopharynx	Airway narrowing/ obstruction	Nasal foreign body, nasal tumour	Variable/variable
Discontinuous sounds (inspiratory only)--were 'rales'				
Crackles (fine)	Re-opening small airways	Fibrosis, lower airway disease	Asthma Westie lung	High/low
Crackles (coarse)	Re-opening larger airways	Obstruction, airway secretions	Bronchitis	Low/high

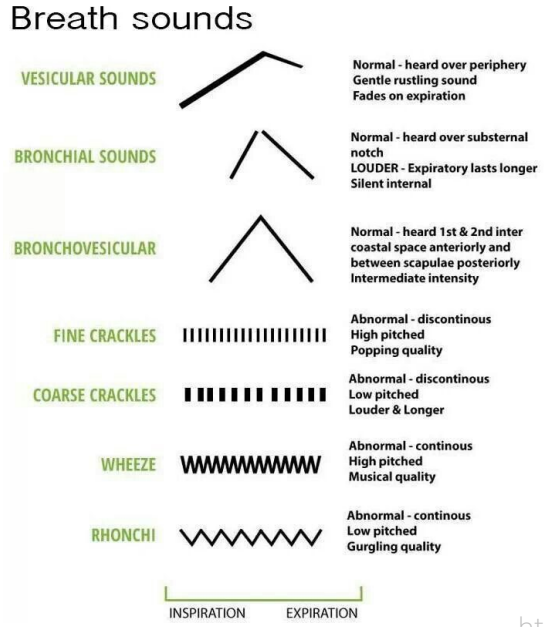
Auscultation



Auscultation

1. Respiratory pattern, respiratory rate
2. Upper airway auscultation (Nasopharynx – Principal bronchi)
3. Lung fields auscultation (Lt. & Rt., cranial, caudal)





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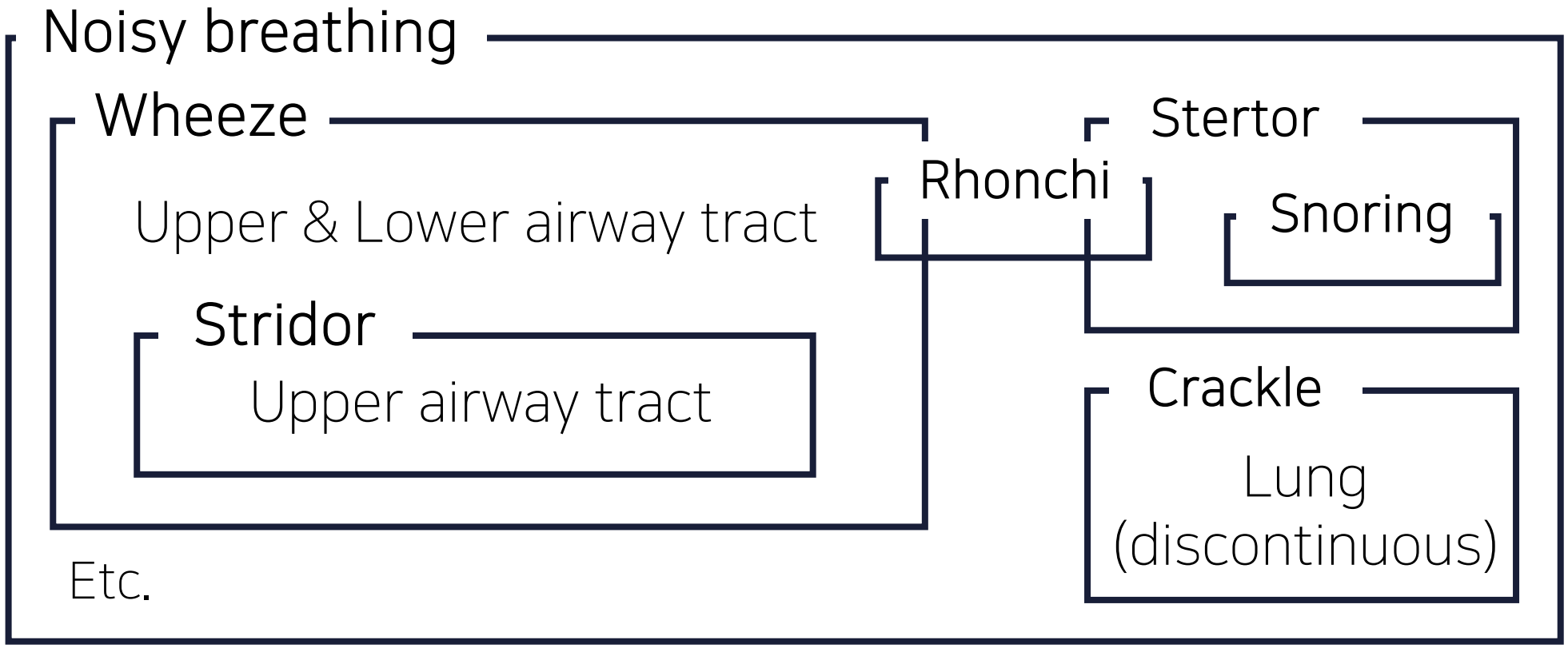
Noisy breathing
Wheeze
Upper & Lower airway tract
Stridor
Upper airway tract
Rhonchi
Stertor
Snoring
Crackle
Lung
(discontinuous)
Etc.


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