Just Breathe: Managing Anesthesia in the Brachycephalic Patient

EMILY WHEELER, DVM, DACVAA

Outline

- Brachycephalic animals
- Brachycephalic airway
- Other concerns for brachycephalic animals
- Anesthetic challenges in brachycephalic animals
- Anesthetic risk and risk assessment
- Anesthetic management techniques

Brachycephalic Animals

https://www.acvs.org/small-animal/brachycephalic-syndrome

Breeds of Concern

- Chihuahua
- Shih-tzu
- Cavalier King Charles Spaniel
- Pug
- French Bulldog
- Lhasa Apso
- Boxer
- (British/English) Bulldog
- American Bulldog
- King Charles Spaniel
- Dogue de Bordeaux
- Bull Mastiff
- Boston Terrier
- Olde English Bulldogge
- Pekingese

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American Bulldog

King Charles Spaniel

Dogue de Bordeaux

Bull Mastiff

Boston Terrier

Olde English Bulldogge

Pekingese

Growing in Popularity and Prevalence

"An exponential rise in ownership of brachycephalic breeds has occurred in recent years, particularly of French Bulldogs, where kennel club registrations have increased by 3000 percent over the last 10 years in the UK. The increase in popularity of these breeds has led to increased awareness of conformation-related health issues seen in some brachycephalic dogs"

- Ladlow et al. 2018, Veterinary Record

AKC Most Popular Dog Breeds

- Only the Bulldog (English) made it into the AKC top 10 breeds of the 2000s up to 2013
- AKC 2000 Roster: Pugs were the only of these in the top 15 dog breeds
- None of these were in the AKC top 10 breeds of the 1990s

Breed	1980	1990	2000	2009	2015	2016	2017	2018	2019	2020
Bulldogs (English)	34	32	21	7	5	4	5	5	5	5
French Bulldog	104	81	71	24	6	6	4	4	4	2
Pug	40	28	15	17	33	32	31	28	31	29

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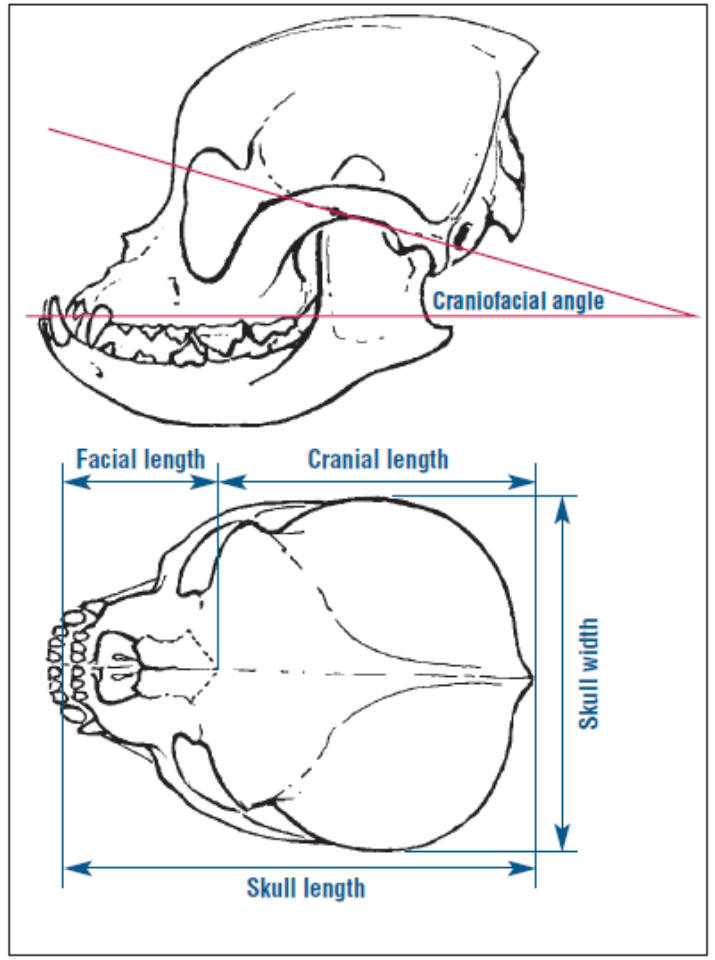
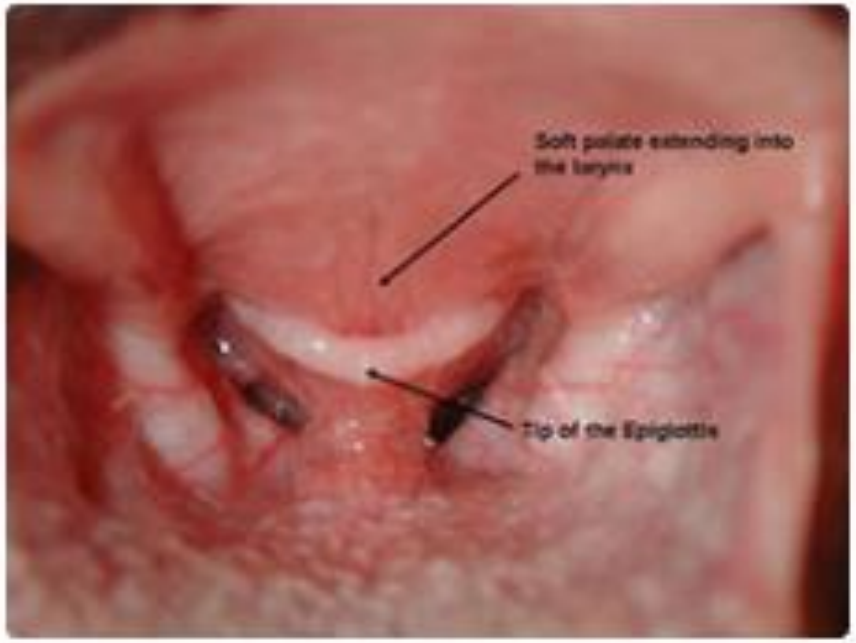
Abnormalities in Brachycephalic Dogs



(Koch et al. 2003)

Brachycephalic Airway Syndrome

- Brachyephalia: local chondrodysplasia as a result of domestication
  - Ankylosis in the cartilage of the base of the skull leads to a shorted longitudinal axis of the skull
- Combination of elongated soft palate, stenotic nares, and everted laryngeal saccules
- May also have a hypoplastic trachea, laryngeal collapse, or laryngeal paralysis
- Narrow the lumen of the upper respiratory tract and restrict breathing from increased resistance
- Can lead to asphyxiation or collapse during excitement or heat from weather or activity
- Must produce higher negative pressure by increased labored breathing distal to the resistance to obtain sufficient oxygen
- Negative pressure draws soft tissues into the airway lumen and causes hyperplasia and possibly collapse
- Clinical signs: stertorous breathing, loud snoring, coughing, gagging, syncope, collapse, difficulty eating



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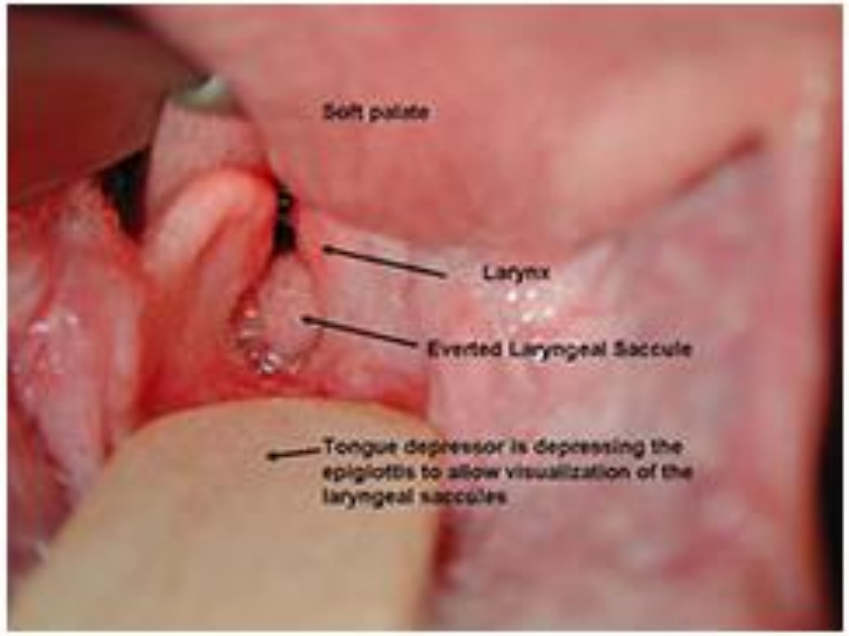
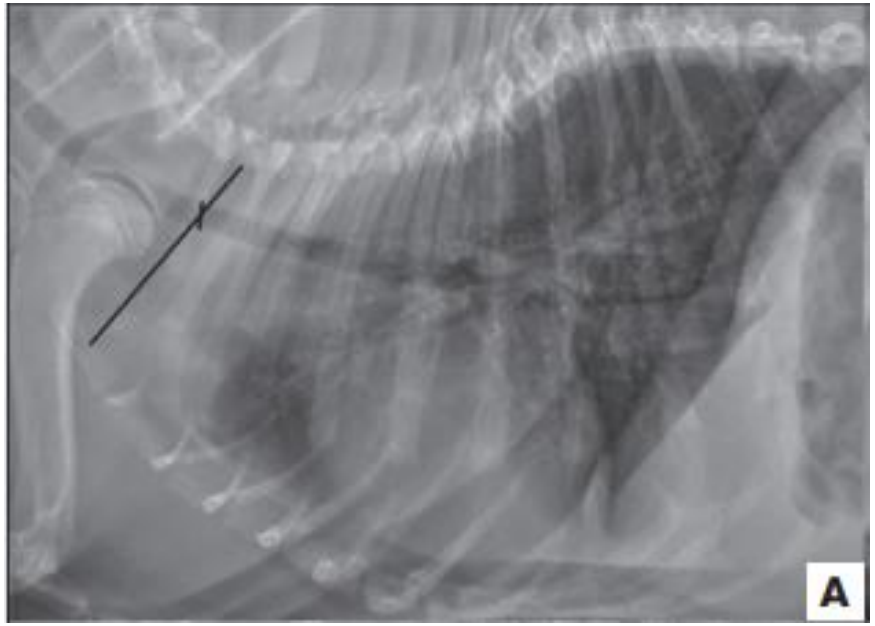
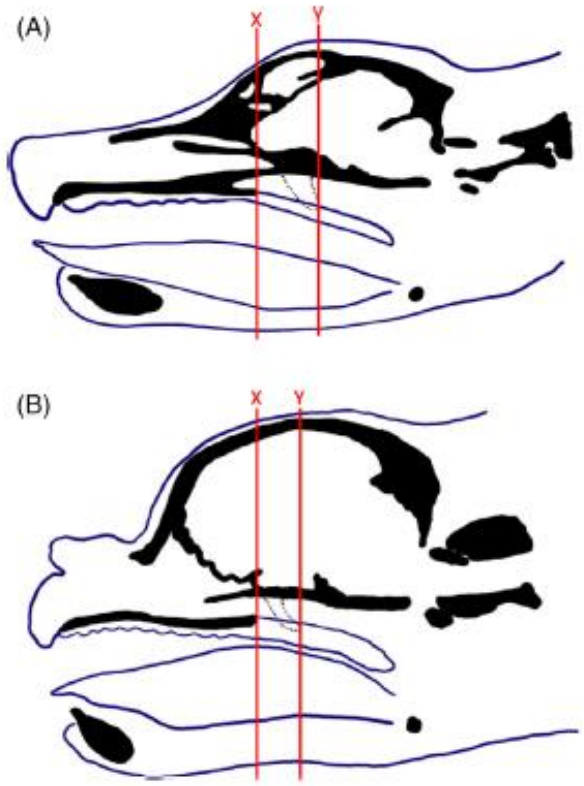




https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7424946/pdf/cvj_09_971.pdf

Additional Features

- Jones et al. 2019
  - CT scan performed of 28 client-owned either brachycephalic or mesaticephalic dogs to evaluate tongue volume and density
  - Total tongue volume indexed to body weight and length of skull was increased in brachycephalic dogs
  - Total air to total soft tissue ratio was decreased in brachycephalic dogs
  - Supported relative macroglossia in brachycephalic dogs



(Jones et al. 2019)

Brachycephalic airway obstructive syndrome in dogs: 90 cases (1991–2008)

Frank J. Fasanella, DVM; Jacob M. Shivley, DVM;
Jennifer L. Wardlaw, DVM, MS, DACVS; Sumalee Givaruangsawat, PhD

- Medical records search to identify brachycephalic dogs admitted to the hospital with one or more conditions associated with BAOS (stenotic nares, elongated soft palate, everted laryngeal saccules, everted tonsils, and hypoplastic trachea) that underwent a laryngoscopic exam and that may or may not have been surgically treated
- Recorded information pertaining to reason for evaluation, history, physical exam, information obtained on laryngoscopic exam, presence of a hypoplastic trachea if assessed, and peri-operative complications if surgery occurred
- 90 dogs including Bulldogs, Pugs, Boston Terriers, French Bulldogs, Boxers, and a Shih Tzu
- 69% had stertor or stridor, 61% were dyspneic, 53% had signs of respiratory distress, 48% had exercise or stress intolerance, 31% had gagging or coughing episodes, 14% vomited, 13% were cyanotic, 6% had collapsed, and 4% were hyperthermic

- 94% had an elongated soft palate, 77% had stenotic nares, 66% had everted saccules, and 56% had everted tonsils, 39% (of those evaluated) had a hypoplastic trachea
- 92% underwent some form of corrective BAOS surgery
- Four dogs (5%) developed intraoperative complications (hypotension, tachycardia, or atrioventricular block)
- Ten (12%) dogs had postoperative complications
  - Four major complications (severe dyspnea or death)
  - Six minor complications (excessive respiratory noise, dehiscence, or regurgitation)

Surgical Intervention

- Soft palate resection (staphylectomy) to shorten soft palate
- Rhinoplasty to enlarge stenotic nares
- Laryngeal saccule resection
- Other
  - Tonsillectomy for everted tonsils
  - Laser-assisted turbinectomy for aberrant nasal turbinates
  - Arytenoidectomy for advanced laryngeal collapse
  - Salvage procedures: partial laryngectomy, permanent tracheostomy, and largyngeal tie back
- Success of surgical intervention is variable
  - May see improved clinical signs but persistent physical activity limitations

Gastrointestinal Dysfunction

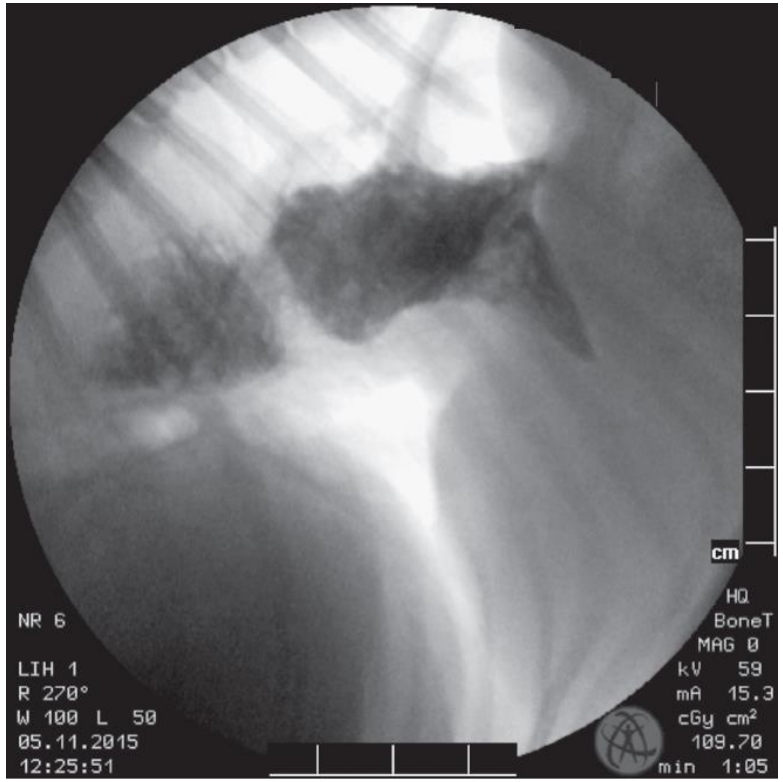
- Poncet et al. 2005
  - Dysphagia described when dogs are excited or in respiratory distress
  - 73 dogs presenting for evaluation of upper respiratory tract disease had an anesthetized airway exam followed by oesophageal and gastroduodenal fibroscopic examinations
  - All dogs had abnormalities of the upper respiratory tract
  - 71 of the 73 dogs showed oesophageal, gastric, or duodenal anomalies
  - There was a correlation between the severity of digestive and respiratory clinical signs

Table 5. Distribution of the endoscopic anomalies in 73 dogs

	Oesophagus (n=73)	Stomach (n=73)	Duodenum (n=66)
Non-inflammatory anomalies	Oesophageal deviation 12 (16·4%) Hiatal hernia 3 (4·1%) Cardial atony 28 (38·4%) Gastro-oesophageal reflux 23 (31·5%)	Gastric stasis 23 (31·5%) Pyloric mucosal hyperplasia 63 (86·3%) Pyloric stenosis 22 (30·1%) Pyloric atony 4 (5·4%) Duodenogastric reflux 6 (8·2%)	None
Inflammatory anomalies	Distal oesophagitis 27 (37%)	Diffuse inflammation 65 (89%) Punctiform inflammation 28 (38·4%)	Diffuse inflammation 35 (53%)

Gastrointestinal Dysfunction

- Reeve et al. 2017
  - Theory that an anormal increase in abdominal pressure compounded with low intrathoracic pressure from inspiratory effort may induce a hiatal hernia which can predispose to gastro-esophageal reflux
  - Reviewed records of fluoroscopy barium swallow studies performed in brachycephalic dogs referred for treatment of brachycephalic obstructive airway syndrome
  - Concurrent clinical signs included chronic regurgitation of food, water, or both
  - Of the 36 dogs, 16 had hiatal hernias (all in French Bulldogs), 31 had delayed esophageal transit time, 27 had gastro-esophageal reflux, and 4 had redundant esophagus



Gastrointestinal Dysfunction

- Kaye et al. 2018
  - Retrospective analysis of English bulldogs, French bulldogs, and Pugs that presented for surgical management of BAS pre- and post-operatively
  - Significant GI sigs were reported in 56% of dogs and 93% of French Bulldogs
  - There was a 74% reduction in significant regurgitation and 48% reduction in vomiting after BAS surgery most notably in the French bulldog

TABLE 2. Breed-specific gastrointestinal scores at "pre" and "6-weeks post" surgery

Grade		Presurgery (T=0)			Postsurgery (T≥6 weeks)		
		1	2	3	1	2	3
Pug (n=43)	Pty. (n=)	43	0	0	43	0	0
	Reg. (n=)	38	4	1	41	2	0
	Vom. (n=)	40	2	1	41	1	1
French bulldog (n=43)	Pty. (n=)	38	5	0	39	4	0
	Reg. (n=)	6	19	18	36	2	5
	Vom. (n=)	27	9	7	35	7	1
English bulldog (n=12)	Pty. (n=)	11	0	1	10	1	1
	Reg. (n=)	7	1	4	10	1	1
	Vom. (n=)	10	2	0	11	1	0

Definitions for each grade are below (Poncet *et al*. 2005): Grade 1 Never vomiting; occasional regurgitation or ptyalism, Grade 2 Occasional to regular vomiting; regular regurgitation; regular to daily ptyalism, Grade 3 Daily to constant vomiting and regurgitation; often to constant ptyalism, Pty. ptyalism, Reg. regurgitation, Vom. vomiting

Thermoregulation

- Davis, Cummings, and Payton 2017
  - Brachycephalic and non-brachycephalic dogs exposed to a cool treatment then a hot treatment and respiratory pattern was measured
  - Body condition score was positively associated with body temperature and negatively associated with tidal volume
  - Brachycephalic dogs had a greater increase in RR in response to heat stress
- Hall, Carter, and O'Neill 2020
  - Report on incidence, fatality, and canine risk factors of heat-related illness (HRI) in UK dogs under primary veterinary care in 2016
  - Significant risk factors for incidence of HRI included breed, higher bodyweight relative to breed/sex, age over 2 years, brachycephalic skull shape, and weight > 50kg
  - Odds ratio for brachycephalic dogs was 2.10 compared to a mesocephalic base
  - Nine breeds had a significantly higher odds ratio of HRI (Chow Chow, Bulldog, and French Bulldog were the top three for risk)

Ocular Abnormalities

- Shallow orbits with protruding globes leads to increased risk of corneal ulceration and globe prolapse (Ladlow et al. 2018)
- Costa, Steinmetz, and Delgado 2021
  - Facial structure does not allow adequate ocular coverage and lubrications, and there is decreased corneal sensitivity
  - Analyzed ocular disorders in 93 brachycephalic dogs diagnosed with brachycephalic ocular syndrome (BOS) to further characterize the disorder
  - Corneal ulcers, corneal pigmentation, corneal fibrosis, and entropion were the most common abnormalities
  - Most common surgical techniques were medial canthoplasty, conjunctival flap, and electroepilation

Lower Airway Disease

- Consequences of concurrent upper airway and gastrointestinal dysfunction
- Darcy, Humm, and Haar 2018
  - Reviewed medical records of patients with a diagnosis of aspiration pneumonia
  - Individually assessed records of Pugs, French Bulldogs, and Bulldogs for variables of interest
  - The incidence of aspiration pneumonia of all dogs of these breeds seen in the hospital over the evaluated time period was 1.91% compared to 0.46% in all other breeds making their relative risk 3.77 times higher
  - Bulldogs and French Bulldogs were at a significantly higher risk than Pugs
  - Gastrointestinal signs of vomiting or regurgitation were the most common risk factor (66%)
  - Other commonly associated risk factors were neurologic disease (10%) and a recent history of general anesthesia (10%)

Cardiovascular Abnormalities

- Hoareau et al. 2012
  - Evaluated brachycephalic and meso- or dolicocephalic dogs that presented for healthy exams
  - Arterial sampling and oscillometric blood pressure measurement performed
  - 27% of the brachycephalic dogs had previous syncopal episodes, 18% breathed with open mouths most of the time, and all dogs had a high frequency of snoring
  - Bicarbonate, $PaCO_2$, hemoglobin, and PCV were significantly higher and the PaO_2 was significantly lower in the brachycephalic dogs
  - SAP, MAP, and DAP were significantly higher in the brachycephalic dogs
  - Dogs with higher $PaCO_2$ were older and had a higher body condition score
  - Increased upper airway resistance may influence lower airway physiology and the cardiovascular system

Other

- Other conformation related issues: skin fold pyoderma; hemivertebrae, which may be accompanied by spinal cord compression; Chiari-like malformation; dystocia; and dental malocclusion

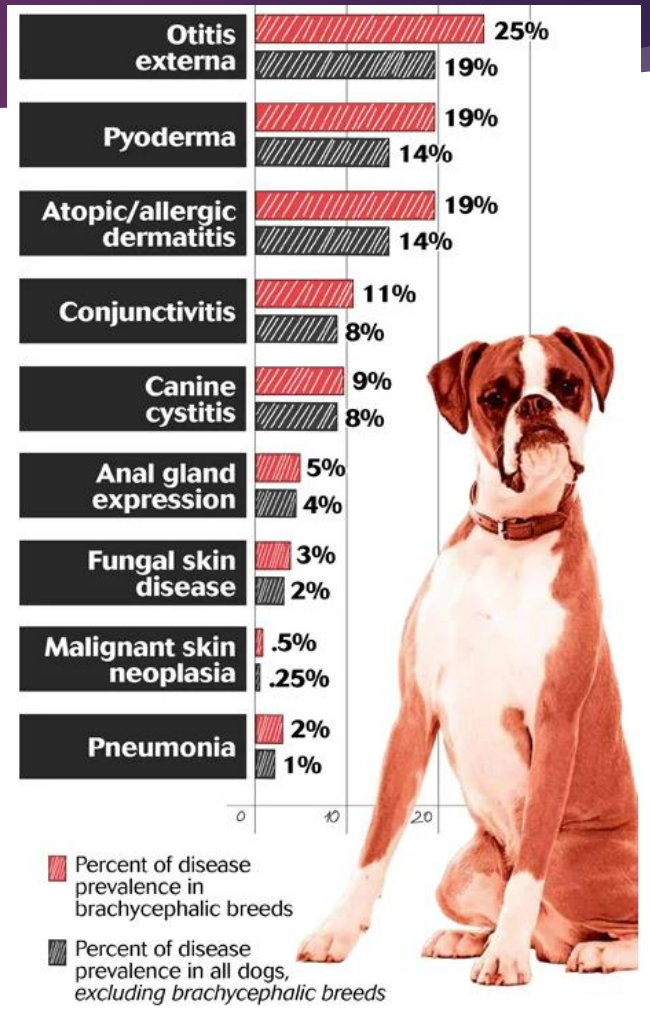
Unravelling the health status of brachycephalic dogs in the UK using multivariable analysis

D. G. O'Neill[1]✉, C. Pegram[1], P. Crocker[1], D. C. Brodbelt[1], D. B. Church[2] & R. M. A. Packer[2]

- Growing evidence that brachycephalic breeds are predisposed to range of disorders related to their conformation and shorter lifespans
- VetCompass Programme that collects data from primary-care veterinary practices was used to evaluate overall health of a large group of dogs and compare brachycephalic to non-brachycephalic breeds
- Included 22,333 dogs from 784 veterinary clinics from an overall population in 2016, 4169 (18.74%) of which were brachycephalic
- Of the 30 most common precise disorders, 8 disorders had higher odds (corneal ulceration, heart murmur, umbilical hernia, pododermatitis, skin cyst patellar luxation, otitis externa, and anal sac impaction) and 2 disorders had reduced odds in brachycephalic types: undesirable behavior and claw injury
- Of the 16 grouped disorders, 6 had higher odds (cardiac, ophthalmologic, upper respiratory tract, aural, dermatologic, and anal sac), and 1 had reduced odds (behavioural) in brachycephalic types
- Brachycephalic dogs had reduced health overall

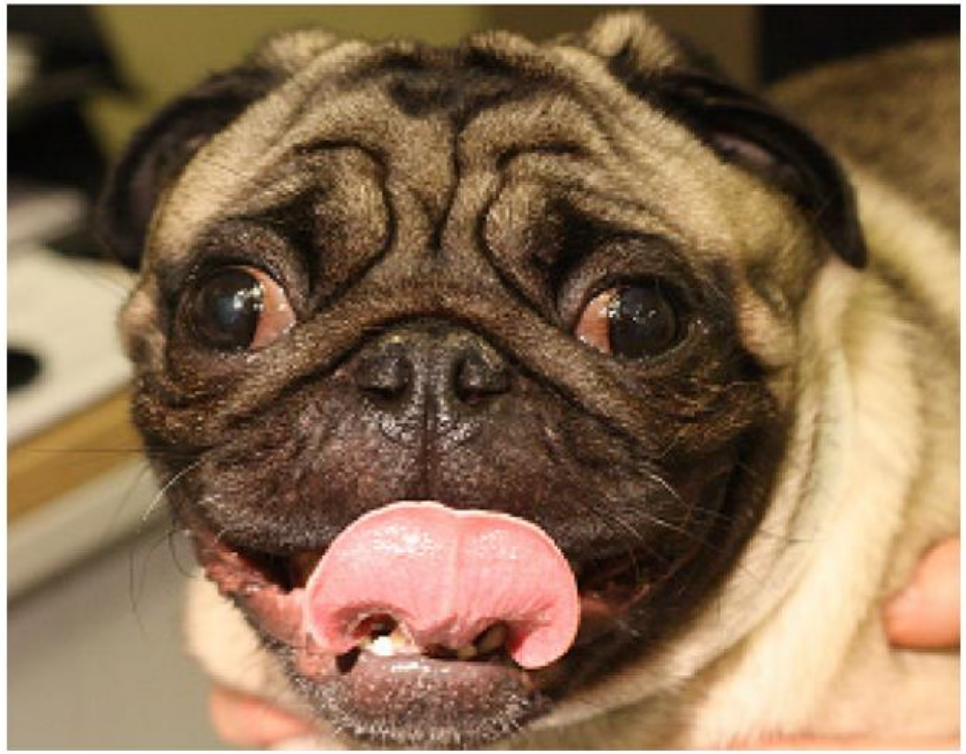
Conditions unrelated to brachycephaly

- Nationwide Pet Insurance analysis 2007 to 2015 of claims for brachycephalic and non-brachycephalic dogs taking out conditions known to be related to brachycephaly



https://www.dvm360.com/view/data-brachycephalic-breeds-suffer-higher-incidences-non-respiratory-diseases

Anesthetic Challenges in the Brachycephalic Patient



(Packer and Tivers 2015)

Anesthesia and the Respiratory System

- Relaxation of nasal alar and pharyngeal musculature can predispose to upper airway obstruction
- With deeper sedation and anesthesia, the cough reflex is abolished
- Laryngospsam is more likely to occur when the larynx has been traumatized during intubation (i.e. difficulty experienced with intubation)
- Administration of high oxygen concentrations may affect ventilatory stimulus
- Anesthetics and perianesthetic drugs alter the central and peripheral chemoreceptor response to CO2 and oxygen in a dose-dependent manner and may affect tidal volume, respiratory frequency, and minute ventilation and response to hypoxemia and/or hypercapnia
- General anesthetics interfere with airway cilia activity, mucous clearance, and pulmonary resistance to infection

Anesthesia and the Gastrointestinal Tract

- Anesthetic agents may cause changes in saliva production, nausea, vomiting, ileus, regurgitation, GER, constipation, reduced secretion of digestive fluids, and aerophagia (from panting)
- Associated perioperative complications include pulmonary aspiration and/or esophagitis following vomiting, regurgitation, or GER and post-operative ileus
  - Aspiration can cause pneumonia, pneumonitis, and hypoxemia
  - Esophagitis can cause esophageal stricture with chronic GI complications
  - Post-operative ileus can cause discomfort, nausea, vomiting, delayed oral intake, increased risk of respiratory complications, and prolonged hospital stays
- Anesthetic drugs and adjuncts decrease lower esophageal pressure and predispose to GER
- GER can occur in the absence of regurgitation

- Shaver et al. 2017
  - Evaluated brachycephalic dogs (cases) presenting for corrective surgery of brachycphalic syndrome and non-brachycephalic dogs (controls)
  - Anesthetic GER documented by continuous monitoring of esophageal pH with a pH monitor
  - Brachycephalic dogs had a reduced esophageal pH compared to control dogs
  - GER was present in 60% of cases, and 40% of controls but underpowered data
- Fenner et al. 2020
  - Reviewed medical records of 258 dogs that underwent surgery for BOAS to identify incidence and associated risk factors for regurgitation 24 hours post-operatively
  - 34.5% of dogs regurgitated during the first 24 hours post-operatively of which all but one dog regurgitated multiple times compared to previous reports of 1.3% in a heterogenous population of dogs
  - Post-operative regurgitation was positively associated with a history of regurgitation but negatively associated with age

Other anesthetic effects

- Altered thermoregulation, hypothermia, iatrogenic hyperthermia
- Decreased tear production
- High inspired oxygen fraction, which can predispose to atelectasis
- Vasodilation and myocardial depression, which can lead to hypotension

Anesthetic Risk and Risk Assessment

(Packer and Tivers 2015)

Risk of anesthesia-related complications in brachycephalic dogs

Michaela Gruenheid DVM[1], Turi K. Aarnes DVM, MS[2], Mary A. McLoughlin DVM, MS[3], Elaine M. Simpson DVM[4], Dimitria A. Mathys MsPH, VMD[5], Dixie F. Mollenkopf MS[6], and Thomas E. Wittum PhD[7]

- Due to anatomic abnormalities and clinical signs, brachycephalic dog breeds are believed to have higher anesthetic risk
- Retrospective analysis of anesthetic records for dogs that had undergone anesthesia for routine surgery or advanced imaging in 2012
- All eligible brachycephalic dogs identified and matched with an eligible non-brachycephalic dog based on procedure and demographic characteristics if possible and information regarding any peri- or postanesthetic complications was recorded
- Brachycephalic dogs were approximately twice as likely to have a perianesthetic complication and approximately four times as likely to have a postanesthetic complication
- Dysphoria and VPCs were the only complications more common in nonbrachycephalic dogs
- For each 30-minute increase in the duration of anesthesia, the odds of a perianesthetic complication increased by 18%

Anesthetic risk during subsequent anesthetic events in brachycephalic dogs that have undergone corrective airway surgery: 45 cases (2007–2019)

Crystal R. Doyle DVM[1], Turi K. Aarnes DVM, MS[1], Gregory A. Ballash DVM, MPH[2], Erin L. Wendt-Hornickle DVM[3], Caroline F. Baldo DVM, PhD[3], Rebecca A. Johnson DVM, PhD[4], Thomas E. Wittum PhD[2], and Mary A. McLoughlin DVM, MS[1]

- Doyle et al. 2020
  - Reviewed records of dogs that underwent surgery to treat clinical signs of brachycephalic airway disease and subsequently underwent general anesthesia
  - Noted any peri-anesthetic complications
  - 51% of dogs experienced postanesthetic complications at the time of corrective upper airway surgery but in only 26% of subsequent anesthetic events
  - Dogs were more likely to have postanesthetic complications if during anesthesia they had a bradycardic event or had a longer duration of anesthesia
  - Controlling for the effects of bradycardia and anesthetic duration, dogs had a 79% decreased odds of a postanesthetic complication during subsequent anesthetic events after airway surgery

Risk Assessment

- Tarricone et al. 2019
  - Evaluated medical records for dogs undergoing surgical intervention for BOAS to evaluate the association of preoperative predictor variables with outcome to derive a predictive score (BRisk score)
  - The predictive score was subsequently validated on a cohort of dogs presenting for BOAS surgery
  - A negative outcome was reported in 12.9% and death occurred in 3% of the score derivation group
  - Six variables were independent predictors of outcomes: breed, history of airway surgery, additional planned procedures, BCS, clinical severity of airway compromise, and temperature
  - The score was a predictor of negative outcome in both the construction and validation groups
  - Negative outcome occurred in 3.2% with a score </= 3 and 39.6% with a score > 3

BRisk Score

Score category				
Breed	Brachycephalic breed, NOT English or French Bulldog **0 points**	English or French Bulldog **0.5 point**		
Surgical history	No history of prior airway surgery **0 points**	History of prior airway surgery **1.5 points**		
Procedures planned	No additional procedures planned **0 points**	Additional procedures (other than airway surgery) planned **1.5 points**		
Body condition score	BCS<=2.5 **1 point**	2.5<BCS<=3.5 **0 points**	BCS>3.5 **1 point**	
Level of compromise at admission	No stertor or stertor only at exercise **0 points**	Stertor at rest **1.5 points**	Oxygen and sedation needed at admission **2 points**	Intubation needed; unable to extubate without surgery **4 points**
Admission rectal temperature	Admission rectal temperature<=100° F **1.5 points**	100°F (37.8°C)<rectal temp<=101°F (38.3°C) **1 point**	101°F (38.3°C)<rectal temp<=103°F (39.4°C) **0.5 points**	Admission rectal temp >103°F (39.4°C) **0 points**

BCS=body condition score (0-5), F=Fahrenheit, C=Centigrade

BRisk score>3= medium to high risk
BRisk score>4=high risk

Conformation factors linked to BOAS

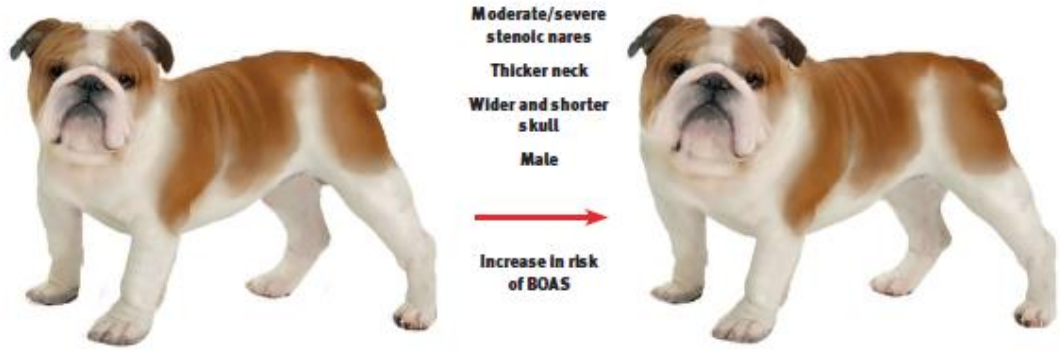


FIG 2: Conformational risk factors for the bulldog

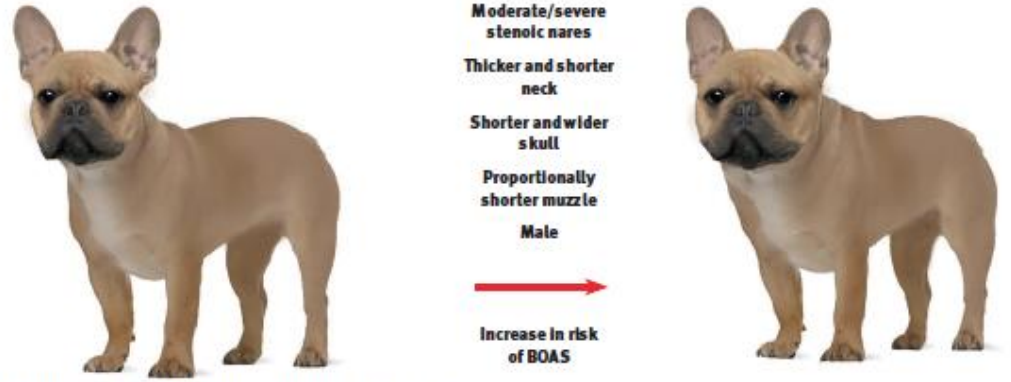


FIG 3: Conformational risk factors for the French bulldog

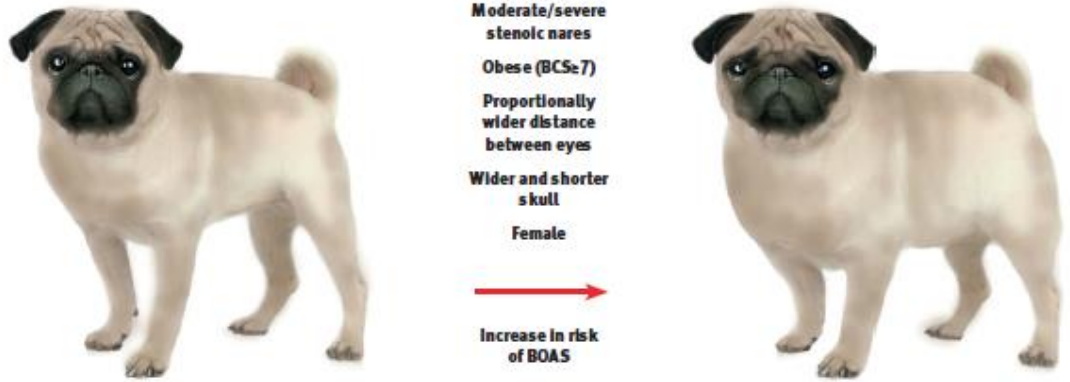


FIG 4: Conformational risk factors for the pug, BCS Body condition score

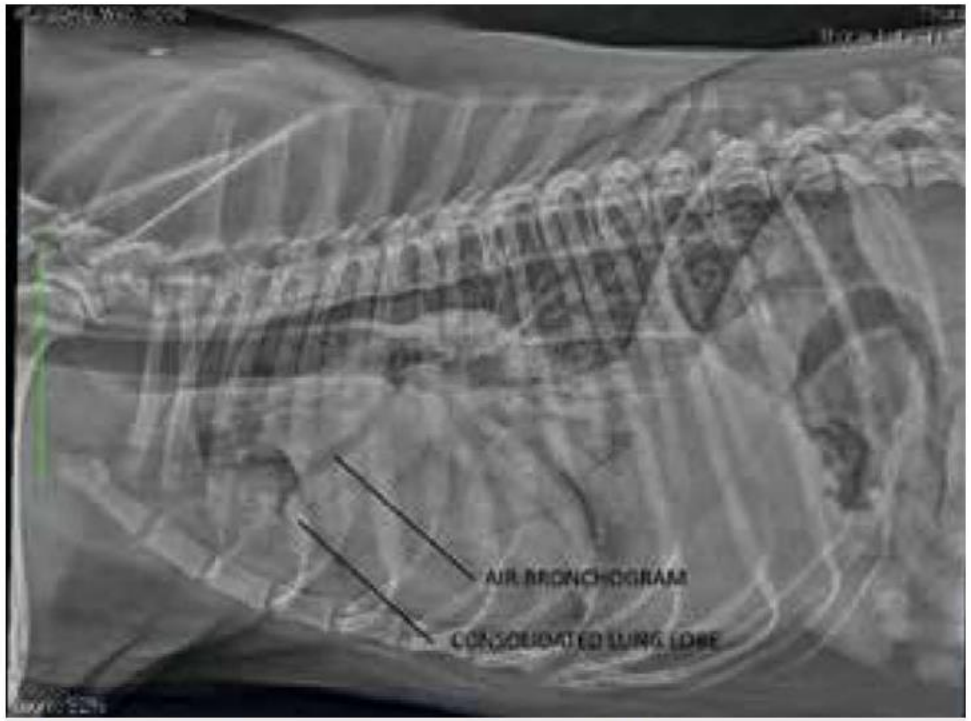
(Ladlow et al. 2018

Anesthetic Management Approach

(Miller and Gannon et al. 2015)

Patient Preparation

- Risk assessment
- Owner preparation
- Consider sedation if indicated
- Gastrointestinal protective medications
- Fasting recommendations
- Consider thoracic imaging



The forgotten complication: aspiration pneumonia in the canine patient

https://www.theveterinarynurse.com/review/article/the-forgotten-complication-aspiration-pneumonia-in-the-canine-patient

Inform Owners of Risk

"…Pertinent information regarding the anesthetic procedure and pet-specific risk factors should be discussed with the pet owner. Because of safety concerns, pet owners are sometimes hesitant to authorize discretionary procedure requiring general anesthesia…This concern is best alleviated with appropriate communication between the veterinary team and the pet owner, along with education of the pet owner regarding the entire anesthetic process."

- 2020 AAHA Anesthesia and Monitoring Guidelines for Dogs and Cats*

Inform owners of risk

- Have a brachycephalic dog specific consent form
- Owners do not understand the risk associated with brachycephalic breeds
  - Opportunity for education
  - Opportunity to promote improved welfare in these patients

Do dog owners perceive the clinical signs related to conformational inherited disorders as 'normal' for the breed? A potential constraint to improving canine welfare

RMA Packer, A Hendricks and CC Burn*

- Lack of recognition of clinical signs discourages the pursuit of veterinary care and may have a negative impact on animal welfare
- Administered to dog owners included information pertinent to BOAS in the form of questions about respiratory difficulty and respiratory noise and assessed all study dogs for stenotic nares and skull conformation
- Received a 'formal' BOAS affected status if they underwent internal airway assessment or based on other parameters
- Over 60% of affected cases had breathing difficulties during exercise/activity at least daily (90% of unaffected dogs had never experienced this)
- 68% of affected dogs had snoring/snorting/wheezing (<2% of unaffected dogs) and snoring in 100% of affected dogs (21% in unaffected)
- 58% of BOAS-affected dog owners reported their dog did NOT currently have a or have a history of breathing problems

Consider Sedation

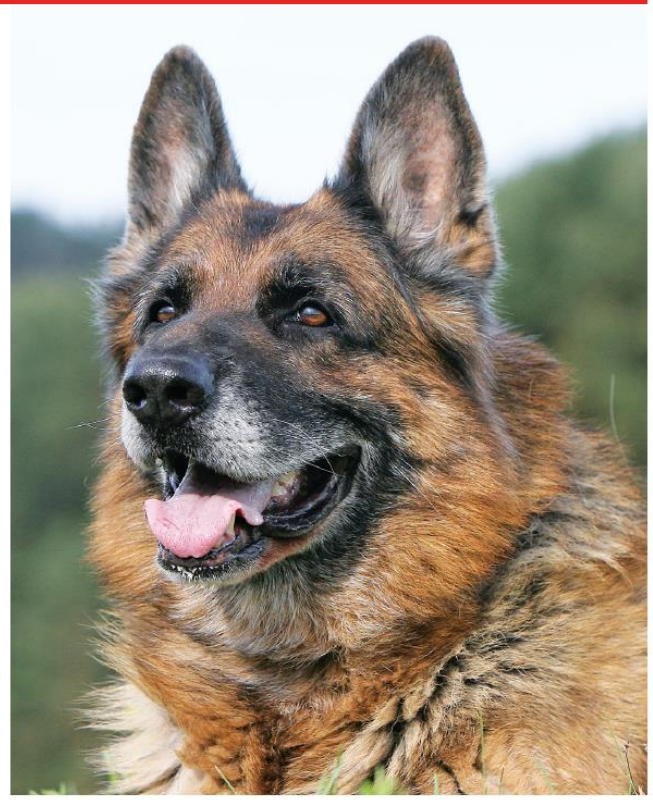
"Anxiolytic drugs should definitely be administered for all fractious/aggressive/fearful patients and should be strongly considered for patients that develop any level of fear, anxiety, or stress during a visit to the veterinary hospital."

- 2020 AAHA Anesthesia and Monitoring Guidelines for Dogs and Cats*

The "Chill" Protocol

Chill Protocol to Manage Aggressive & Fearful Dogs

Renata S. Costa, DVM, MPhil, MANZCVS, GradDipEd
Alicia Z. Karas, DVM, MS, DACVAA
Stephanie Borns-Weil, DVM, DACVB
Cummings School of Veterinary Medicine at Tufts University



Gastrointestinal Medications

- Antiemetics do not necessarily prevent regurgitation
- Consider pro-kinetic agents
- Consider antacid medications
- Prepare in advance if possible

Postoperative regurgitation and respiratory complications in brachycephalic dogs undergoing airway surgery before and after implementation of a standardized perianesthetic protocol

- Developed perianesthetic protocol for brachycephalic dogs undergoing general anesthesia
- Gastrointestinal medication regimen based on history
  - No regurgitation history: metoclopramide (0.5 mg/kg, SC) + famotidine (1.0 mg/kg, IV or SC) at the time of pre-medication
  - Regurgitation history: treatment with metoclopramide and a proton pump inhibitor started 1 week prior to surgery
- Dexamethasone SP (0.15 mg/kg, IV) immediately prior to surgical incision for airway surgery at surgeon discretion
- Opioid administration avoidance if only airway surgery is being performed and administration based on pain assessment
- Recovery in the ICU with delayed extubation until patient was fully alert
- Informed consent form given to owners of brachycephalic dogs

- Records were evaluated for dogs that underwent airway surgery with or without concurrent procedures before and after implementation of the protocol
- Post-operative opioid administration was significantly lower post implementation
- Incidence of post-operative regurgitation was significantly lower after implementation (9 % post vs 35% pre)
- No significant difference in incidence of postoperative pneumonia (2% post and 5% pre) or respiratory distress (18 % post and 28% pre) were found after implementation, though these were uncommon occurrences overall
- History of regurgitation was the only patient characteristic that was significantly associated with post-operative regurgitation
- Concluded that this perianesthetic protocol for brachycephalic dogs was beneficial for patients undergoing airway surgery even in dogs that did not have prior clinical gastrointestinal signs

Fasting Recommendations

Patient Status	Withhold Water for ____ Hr		Withhold Food for ____ Hr				Feed Pâté-Consistency Wet Food	Treatments and Medications				Other
	0*	6–12	1–2	2–4	4–6	6–12		Monitor BG	Chronic Oral Meds†	Anti-emetic‡, Antacid, and Promotility Medications	Insulin	
Healthy	✓				✓				✓			
<8 wks of age or <2 kg	✓		No longer than 1–2 hr				✓ In pre-op period	Before, during, and after induction	✓			Perform as first case of the day
Diabetic	✓			✓			½ meal 2–4 hr prior	Before, during, and after	✓		½ dose given 2–4 hr prior	Perform as the first case of the day
History of, or at risk for, regurgitation		✓				✓	Consider feeding 10%–25% of normal amount 4–6 hr prior to induction		✓	✓		
Emergent		ASAP								✓		Stabilize patient prior to induction

Fasting Recommendations

Patient Status	Withhold Water for ____ Hr		Withhold Food for ____ Hr				Feed Pâté-Consistency Wet Food	Treatments and Medications				Other
	0*	6–12	1–2	2–4	4–6	6–12		Monitor BG	Chronic Oral Meds†	Anti-emetic§, Antacid, and Promotility Medications	Insulin	
History of, or at risk for, regurgitation		✓				✓	Consider feeding 10%–25% of normal amount 4–6 hr prior to induction		✓	✓		

Fasting Recommendations

- Shorter fasting times overall for healthy, adult patients
- Higher incidence of reflux and lower gastric pH associated with long durations of fasting

General Anesthetic Management Recommendations

- Careful administration of sedatives
- Prepare a range of ET tubes
- Preoxygenate if possible
- Rapid induction technique
- Facilitate rapid recovery
- Maintain airway as long as is practical
- Carefully observe respiration after extubation
- Position to facilitate optimal breathing
- Be prepared to intervene

Preanesthetic Management

- APPROPRIATE sedation
- Consider choice of opioid
- Consider an anticholinergic
- Very close monitoring
- Prepare to intervene

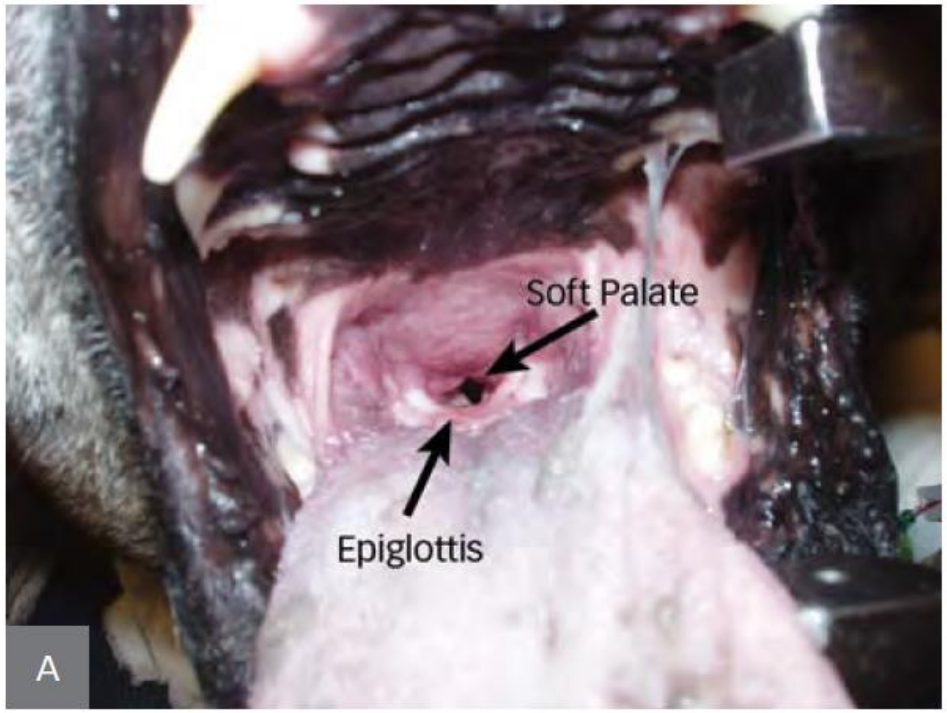
Comparison between dexmedetomidine and acepromazine in combination with methadone for premedication in brachycephalic dogs undergoing surgery for brachycephalic obstructive airway syndrome

Ilaria Petruccione [a], Pamela J. Murison [a], Derek Flaherty [b], Adam Auckburally [b]

- Brachycephalic dogs scheduled for airway surgery
- Pre-medication with methadone (0.3 mg/kg) and acepromazine (0.02 mg/kg) or dexmedetomidine (2 mcg/kg) IM
- Induced with propofol and maintained on sevoflurane and administered dexamethasone and omeprazole after induction
- After premedication, dogs which received acepromazine were less sedate, 2 dogs in the acepromazine and 3 dogs in the dexmedetomidine groups regurgitated, and no dogs had airway obstruction or required supplemental oxygen
- There was no difference in induction score, but dogs in the acepromazine group required more propofol
- Time to extubation was longer in the acepromazine group but there was no difference in recovery scores
- Incidence of complications (regurgitation, airway obstruction, sedation requirement) did not differ between groups

Induction

- Preoxygenate ONLY IF POSSIBLE
- Attain a secure airway quickly
- Prepare for a difficult intubation
  - Laryngoscope
  - Range of ET tube sizes
  - Other intubation aides
- Rapid IV induction technique
- Evaluate the airway



(Miller and Gannon 2018)

Intraoperative management

- Multimodal analgesia
- Consider steroids
- Be cognizant of heat support
- Monitor for signs of trouble
- Prevent and address regurgitation if occurs
- Minimize anesthesia time

Opioid-free anaesthesia for the surgical correction of abnormalities associated with brachycephalic obstructive airway syndrome in five dogs

María Isabel Gómez Martínez, M. A. Fernández • Published 2 March 2021 • Medicine, Biology • Companion Animal

- Case series of 5 cases of dogs undergoing surgical correction of abnormalities associated with brachycephalic obstructive airway syndrome successfully performed with opioid-free anesthesia
  - Premedications: medetomidine or dexmedetomidine
  - Induction: Propofol or alfaxalone
  - Maintenance: Isoflurane in 100% oxygen
  - Bilateral extraoral maxillary nerve block with bupivacaine
  - Other medications administered: metoclopramide, omeprazole, maropitant, dexamethasone, paracetamol, meloxicam
- Intraoperative nociception considered based on increase in HR, RR, and NIBP greater than 20%
  - Only an event in 1 case and treated with medetomidine

- Post-operative pain assessment with Glasgow Composite Measure Pain Scale
  - 3/5 required buprenorphine 6-7 hours after performance of nerve block
- No post-operative complications
  - 1 dog required sedation with medetomidine due to stress
- Concluded opioid-free anesthesia including a bilateral maxillary nerve block is a suitable technique for dogs undergoing surgical correction of abnormalities associated with brachycephalic obstructive airway syndrome

Recovery

- "Sit up" for success
- Wait for extubation
- Evaluate respiratory pattern and effort
- Wait to administer NSAIDs
- Prepare to sedate
- Prepare to treat oversedation
- Prepare to reintubate

(Grubb 2016)

Post-Operative Monitoring

- Monitor for changes in respiratory pattern
- Monitor for delayed or persistent regurgitation
- Monitoring at home after discharge

Save time and decrease stress! Complete the following form to create customized, printable discharge instructions for your anesthesia patients.

Enter Your Information | View the Instructions | Print the Instructions

Today's Date: 01/03/2022

Veterinarian's Name: Dr.

Hospital

Patient

Anesthesia

Food and Water

Activity

Medication

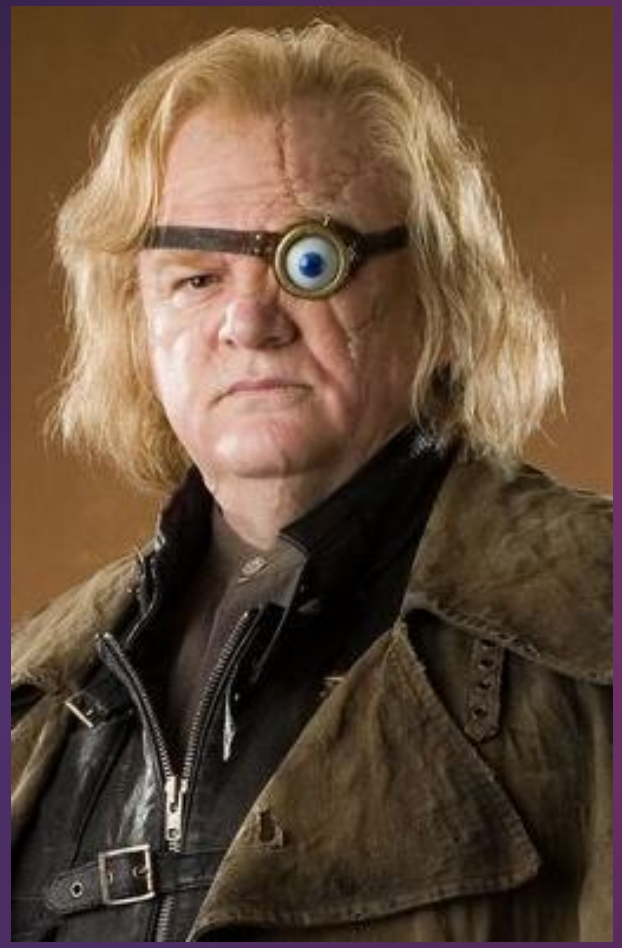
Home Care

Seek Immediate Veterinary Care if...

- [x] The incision has signs of redness, swelling, or discharge, or if any sutures are missing.
- [x] Seems agitated or uncomfortable for more than 2 hours.
- [x] Has difficulty breathing.
- [x] Begins squinting [HIS/HER] eyes for more than 1 hour at a time.
- [x] Develops any wounds on [HIS/HER] body.
- [x] Refuses to eat or drink for more than 12 hours.
- [x] Does not defecate for more than 48 hours.
- [x] Has diarrhea for more than 12 hours.
- [x] Vomits more than three times in 12 hours.

Outline

- Brachycephalic animals
- Brachycephalic airway
- Other concerns for brachycephalic animals
- Anesthetic challenges in brachycephalic animals
- Anesthetic risk and risk assessment
- Anesthetic management techniques



https://hero.fandom.com/wiki/Alastor_Moody

CONSTANT VIGILANCE

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Images

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Questions?