



Anesthesia Update

What has changed & what has remained the same?

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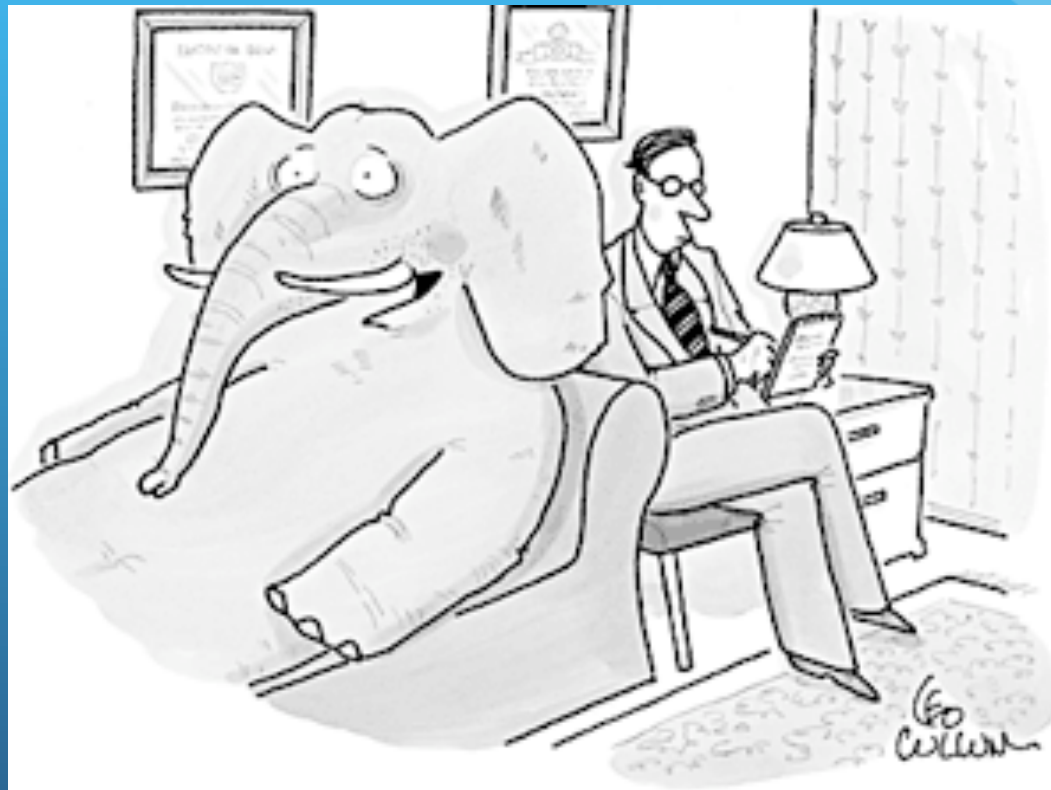
“Impactful” Anesthetic Changes

- Patient demographics
 - Geriatrics
 - Complex diseases
- Drugs
 - Isoflurane
 - Propofol
 - Alpha-2 agonists (dexmedetomidine)
 - Alfaxalone
- Monitoring
 - Pulse oximetry
 - Blood pressure
 - Capnography
 - Temperature homeostasis
- Pain Management
 - NSAIDs – Meloxicam
 - Multimodal analgesia
 - Locoregional anesthesia

Use What You Know

- Preferable to use familiar drugs & techniques
- No “BEST” anesthetic protocol
 - Standard protocols OK but.... Every case still requires individualized care/consideration
 - Even good “recipes” not necessarily safer
- No “SAFEST” anesthetics just safe anesthesiologists!
- So how do we learn to use new products?

Propofol vs Alfaxalone



"I'm right there in the room, and no one even acknowledges me."

Propofol vs Alfaxalone

- Very similar in terms of quality of induction, anesthesia & recovery
- Very similar cardiopulmonary effects based on independent clinical studies & clinical experience
- So why consider using it?

• References

- Bigby SE et al. Postinduction apnoea in dogs premedicated with acepromazine or dexmedetomidine and anaesthetized with alfaxalone or propofol. *Vet Anaesth Analg*. 2017 Mar 2.
- Maney JK et al. A comparison of cardiopulmonary and anesthetic effects of an induction dose of alfaxalone or propofol in dogs. *Vet Anaesth Analg*. 2013 May;40(3):237-44.
- Amengual M et al. An evaluation of anaesthetic induction in healthy dogs using rapid intravenous injection of propofol or alfaxalone. *Vet Anaesth Analg*. 2013 Mar;40(2):115-23.
- Mathis A et al. Comparison of quality of recovery from anaesthesia in cats induced with propofol or alfaxalone. *Vet Anaesth Analg*. 2012 May;39(3):282-90.
- Suarez MA et al. Comparison of alfaxalone and propofol administered as total intravenous anaesthesia for ovariohysterectomy in dogs. *Vet Anaesth Analg*. 2012 May;39(3):236-44.
- Taboada FM et al. Induction of anaesthesia with alfaxalone or propofol before isoflurane maintenance in cats. *Vet Rec*. 2010 Jul 17;167(3):85-9.

Less apnea

- Results a bit equivocal

- Keates H et al. Effect of intravenous dose escalation with alfaxalone and propofol on occurrence of apnoea in the dog. Res Vet Sci. 2012 Oct;93(2):904-6.
- Campagna I et al. Comparison of the effects of propofol or alfaxalone for anaesthesia induction and maintenance on respiration in cats. Vet Anaesth Analg. 2015 Sep;42(5):484-92.

- Consider clinical relevance

- Induction
- IV sedation

Unmatched Versatility



Intravenous Induction

- Can be used safely for virtually any case requiring anesthesia
 - Hepatic, renal, CNS, cardiopulmonary disease
 - Many references....
 - Effective for continuous intravenous infusions
 - Propofol heinz-body anemia cats
 - C-section
 - Metcalfe S et al. Multicentre, randomised clinical trial evaluating the efficacy and safety of alfaxalone administered to bitches for induction of anaesthesia prior to caesarean section. Aust Vet J. 2014 Sep;92(9):333-8.
 - Doebeli A et al. Apgar score after induction of anesthesia for canine cesarean section with alfaxalone versus propofol. Theriogenology. 2013 Nov;80(8):850-4.

Across Many Species

- Reptiles
- Fishes
- Ferrets
- Rabbits
- Chinchillas
- Rodents (mice, rats)
- Marmosets
- Monkeys
- Some birds
- Horses
- Swine
- Camelids
- Goats
- Sheep
- Cattle
- Deer
- Etc, etc....

Intramuscular Use

- Dose dependent sedation to anesthesia
- When used alone IM
 - Sedation < 5 mg/kg < Anesthesia
 - When combined with dexmedetomidine & opioid doses as low as 2 mg/kg may produce anesthesia
- Appropriate precautions required
 - Equipment for maintenance of airway readily available (ETT, oxygen etc.)

Sedation

- Used alone or in combination with opioids, dexmedetomidine and/or benzodiazepines
- IM, SQ or IV

Combinations Sedation

- Midazolam
 - (0.1-0.2 mg/kg)
- Butorphanol
 - (0.1-0.4 mg/kg)
- Hydromorphone
 - (0.05 mg/kg)
- Buprenorphine
 - (10-20 mcg/kg)
- Alfaxalone
 - (0.5-3.0 mg/kg)
- Midazolam + alfaxalone
 - Equivocal IM
 - Better IV
- Butorphanol + alfaxalone
 - Nice addition IM/IV
- Hydromorphone + alfaxalone
 - Nice addition IM/IV
- Midazolam + opioid + alfaxalone
 - May be beneficial in some cases

And....

- Reasonable shelf-life
 - Extra-label (7 days in fridge)– AU label
- Smaller volume required
 - ~ twice as “potent” as propofol

LWD

- 7 year old, FS, Bichon Frise
- Presented for dental
 - Probable extractions
- PE
 - Bit nippy & “unpleasant”
 - Marked dental disease
 - Otherwise essentially normal
- Laboratory Data
 - CBC, biochem, UA - unremarkable



Laboratory Data

- **Will not replace thorough history & physical**
- No evidence routine lab work in otherwise healthy asymptomatic patient (veterinary or human) will “**significantly**” alter anesthetic protocol or reduce anesthetic risk
- But “concern for clinician” in 8-16% of geriatric patients during routine screening
- Questionable in terms of anesthetic practice... but may be valuable & timely to perform such screening with anesthetic event

LWD

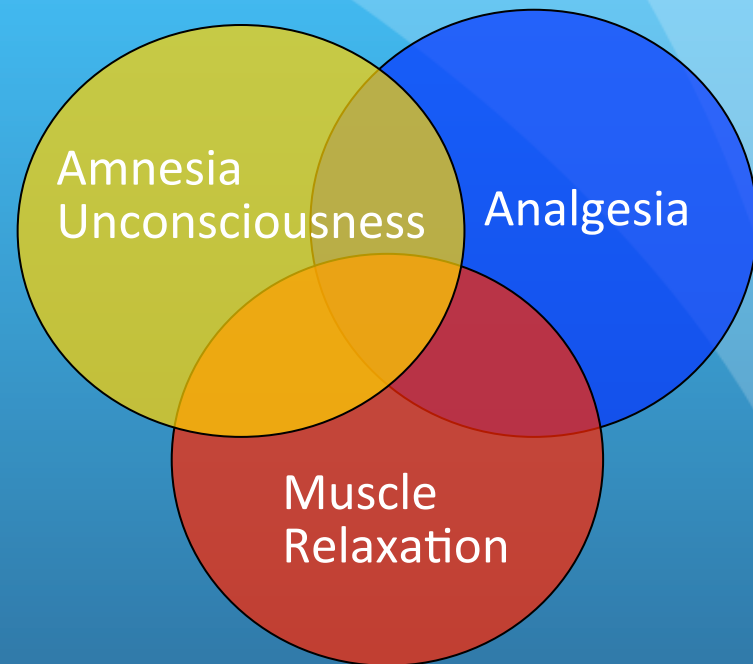
- Premedication
 - Dexmedetomidine 5 mcg/kg IV
 - Hydromorphone 0.05 mg/kg IV
- Induction
 - Alfaxalone (2 mg/kg) IV, to effect
- Maintenance
 - Isoflurane
 - Locoregional blocks as indicated



Dexmedetomidine

- Sedative
- Analgesic
- Muscle relaxant
- Reversible
- But significant cardiovascular effects

Anesthesia



Dose Selection

- Cardiovascular effects do not change within clinically useful dose range
 - Predictability & reliability improved with higher dose
- Primary reasons for altering label dose, reduce cost & shorten duration of effects

Veterinary Surgery
27:612-622, 1998

Hemodynamic Effects of Medetomidine in the Dog: A Dose Titration Study

BRUNO H. PYPENDOP, DMV and JOHN P. VERSTEGEN, DMV, MSc, PhD

Dexmedetomidine Dose Selection

Clinical (CM)

- Dogs
 - 5 mcg/kg IV
 - 10 mcg/kg IM
- Cats
 - 10 mcg/kg IV
 - 20 mcg/kg IM

Label

- Dogs (sedation/analgesia)
 - 10-30 mcg/kg IV
 - 10-40 mcg/kg IM
- Cats
 - 40 mcg/kg IM

Metabolic Scaling

Predictability & Efficacy

- Higher doses
- Combined with opioid
- IV better than IM
- Calm better than excited patient
- Semimembranosus better than lumbar

Alfaxalone Intravenous Induction

- Alfaxalone 2 mg/kg IV
 - Induction characteristics & cardiopulmonary changes similar to propofol
- **Marked intravenous & inhalant dose reduction (30-60%)**
 - **Greater magnitude of effect & longer time to effect**

Intravenous Anesthetic PK & CO

Dexdomitor

- 20 units of drug
- Injected over 1 minute
- CO 4L/min
- **20 units/4L**
- **5 units/L**

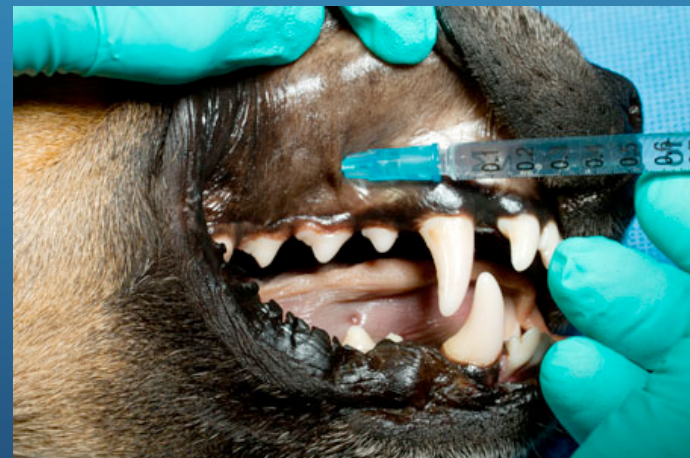
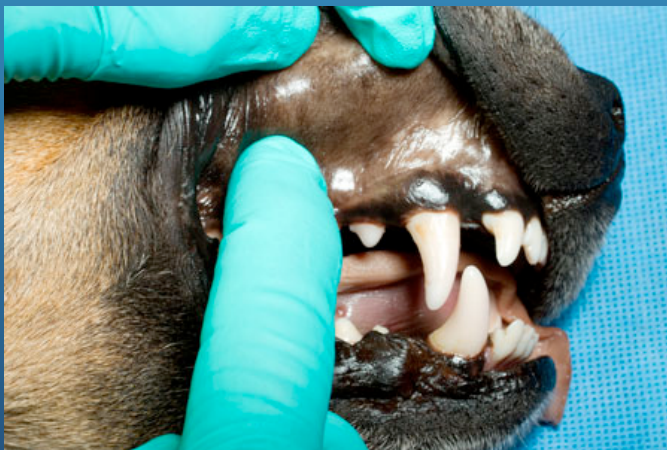
No Premed

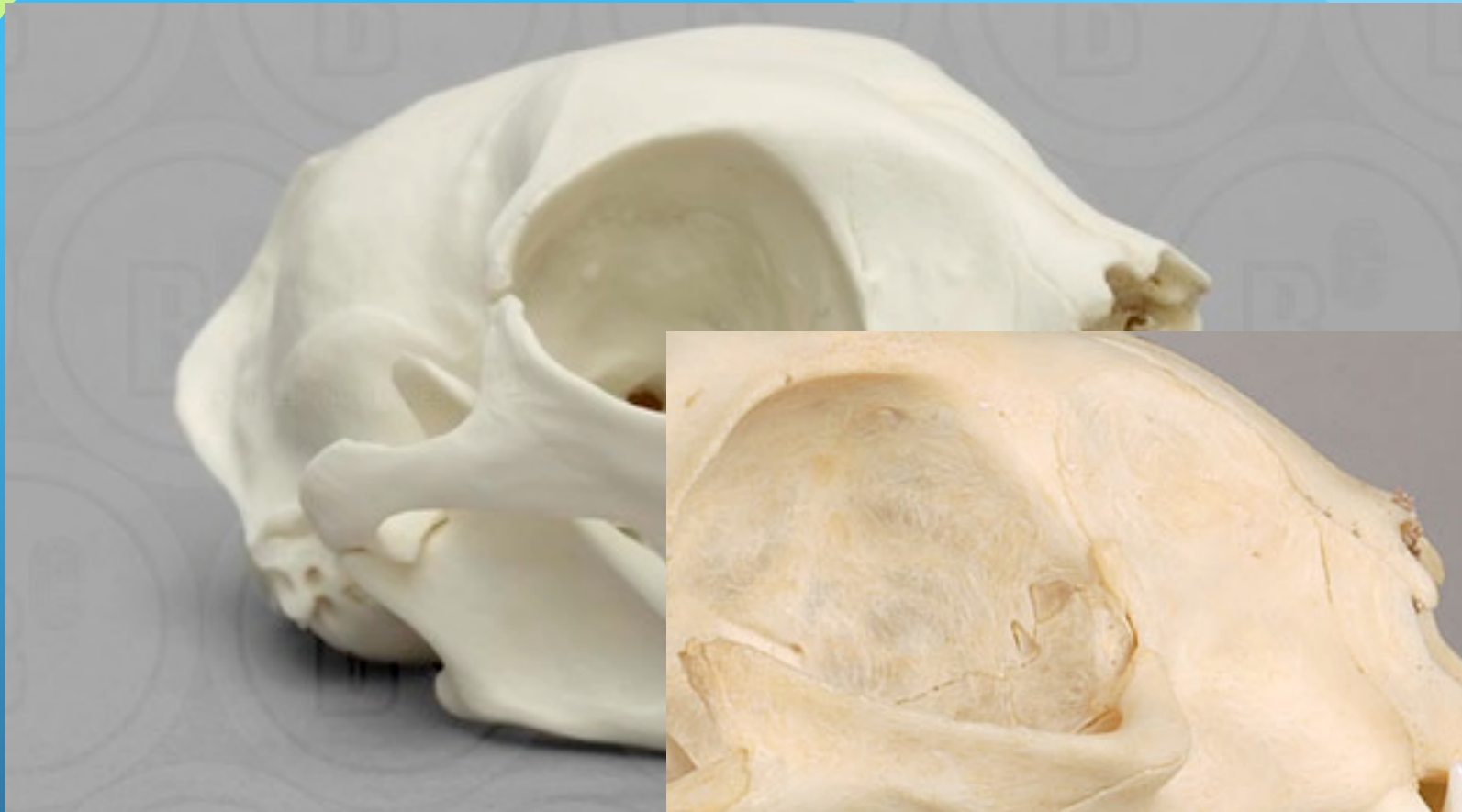
- 20 units of drug
- Injected over 1 minute
- CO 8L/min
- **20 units/8L**
- **2.5 unit/L**

Also may take twice as long to see effects of drug!!

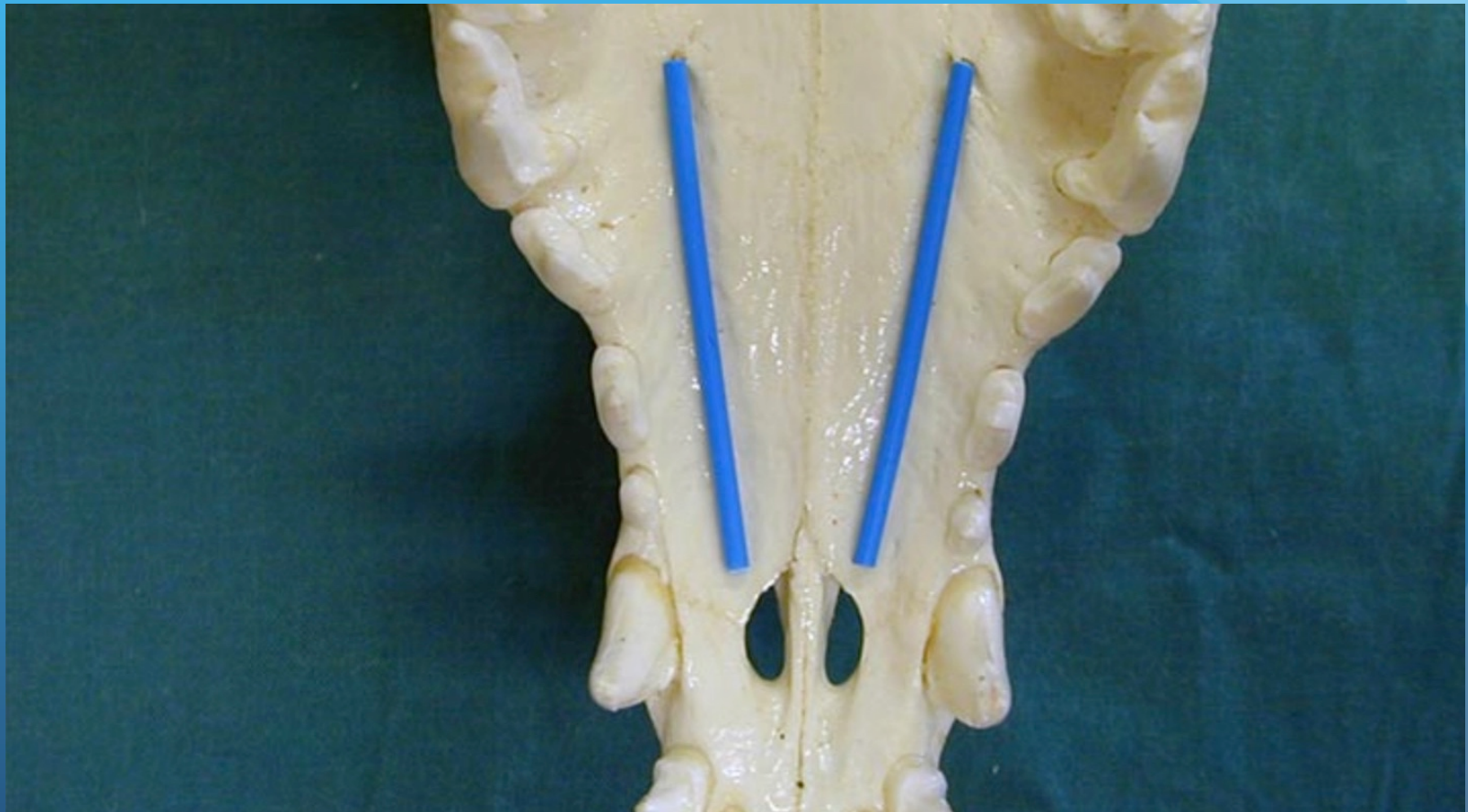
Locoregional Anesthesia

- Local anesthetic
 - Inhalant sparing effect
 - Multimodal analgesia
 - Easy, inexpensive, effective

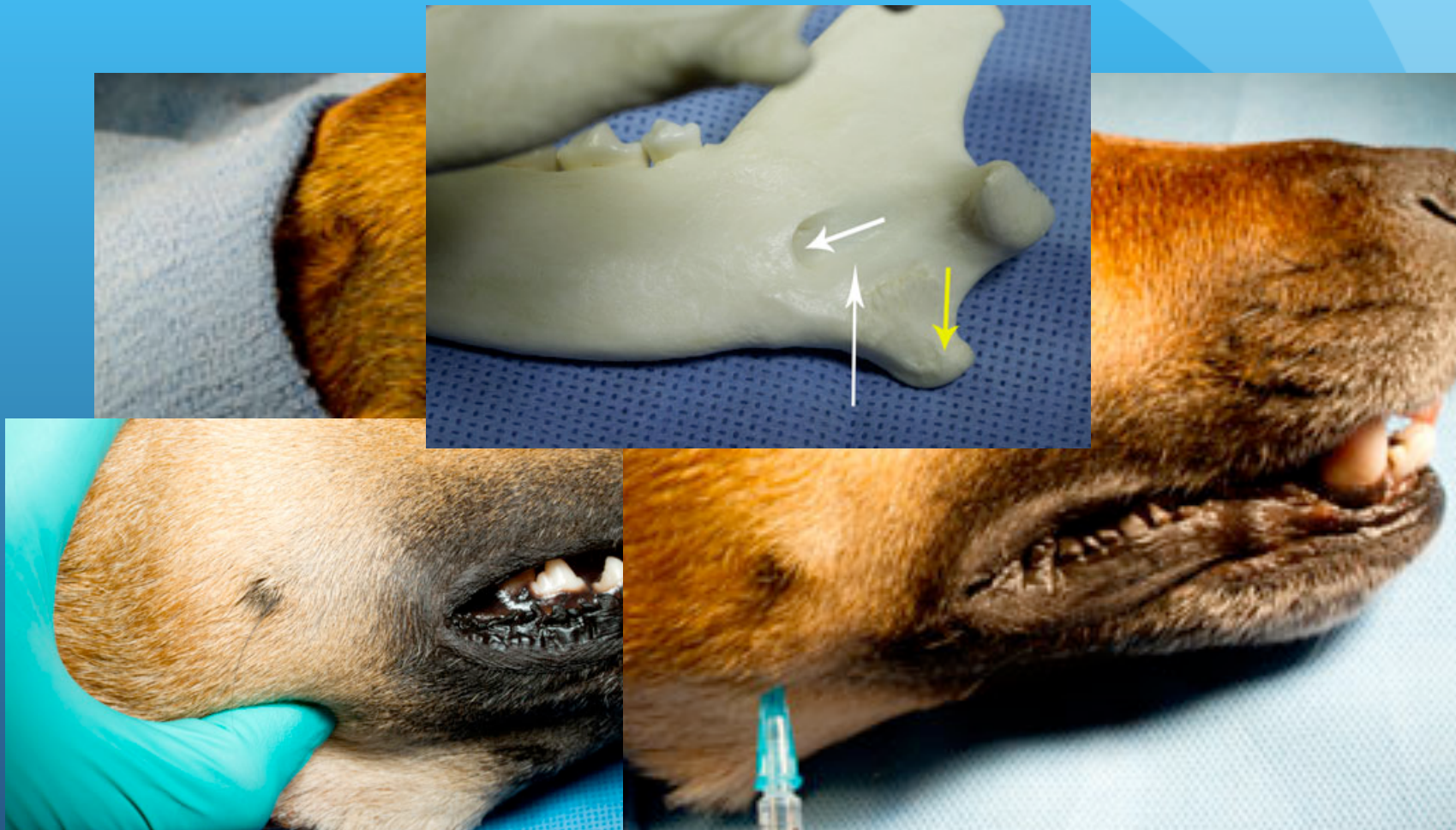




Palantine Nerve Block



Caudal Mandibular Nerve Block



Cheddar

- 10 yr, MC, DSH
- Heart murmur, confirmed HCM
- Right hind limb fracture
 - Caught leg in door, fell of chair/couch?



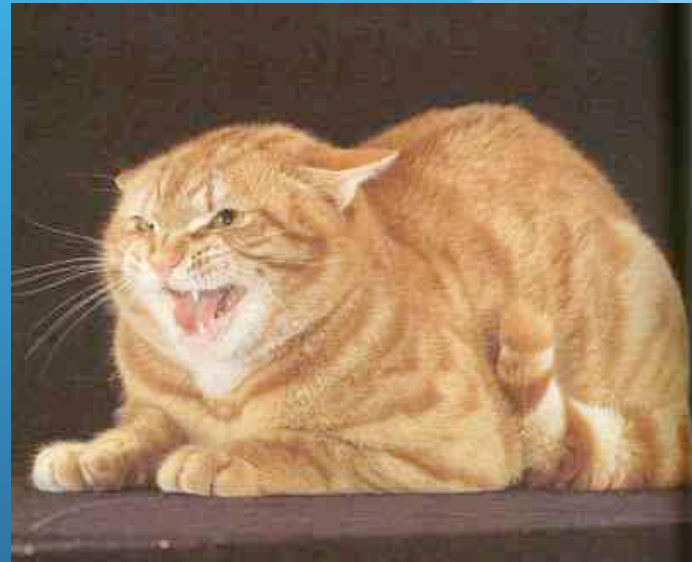
Cheddar – the horrible!

- Hx

- Generally healthy, HCM diagnosed 1 yr earlier
- No meds at this time

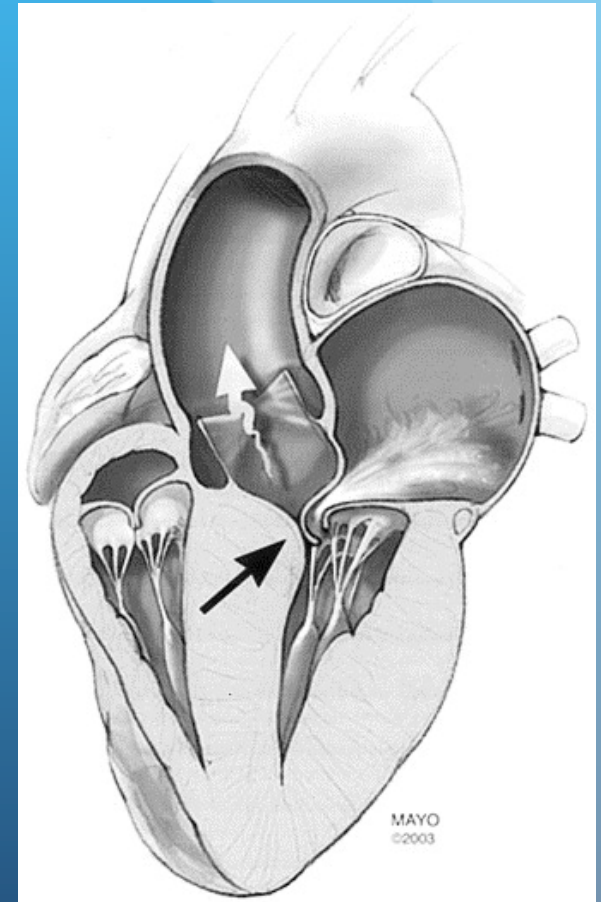
- PE

- Nearly impossible, very fractious cat!
- “Seems OK”, closed fracture?



Hypertrophic Cardiomyopathy

- Diastolic dysfunction
 - Reduced SV & CO
- Elevated contractility contributes to dynamic LVOT obstruction during systole
 - Increased pressure gradient across outflow tract
- Hypertrophy may predispose to ischemia



Hemodynamic Goals

- Optimize diastolic ventricular volume
 - Adequate preload
 - Minimize tachycardia
 - More time for ventricular filling
- Avoid exacerbating LVOT obstruction
 - Avoid drugs increasing contractility
 - Avoid excessive vasodilation

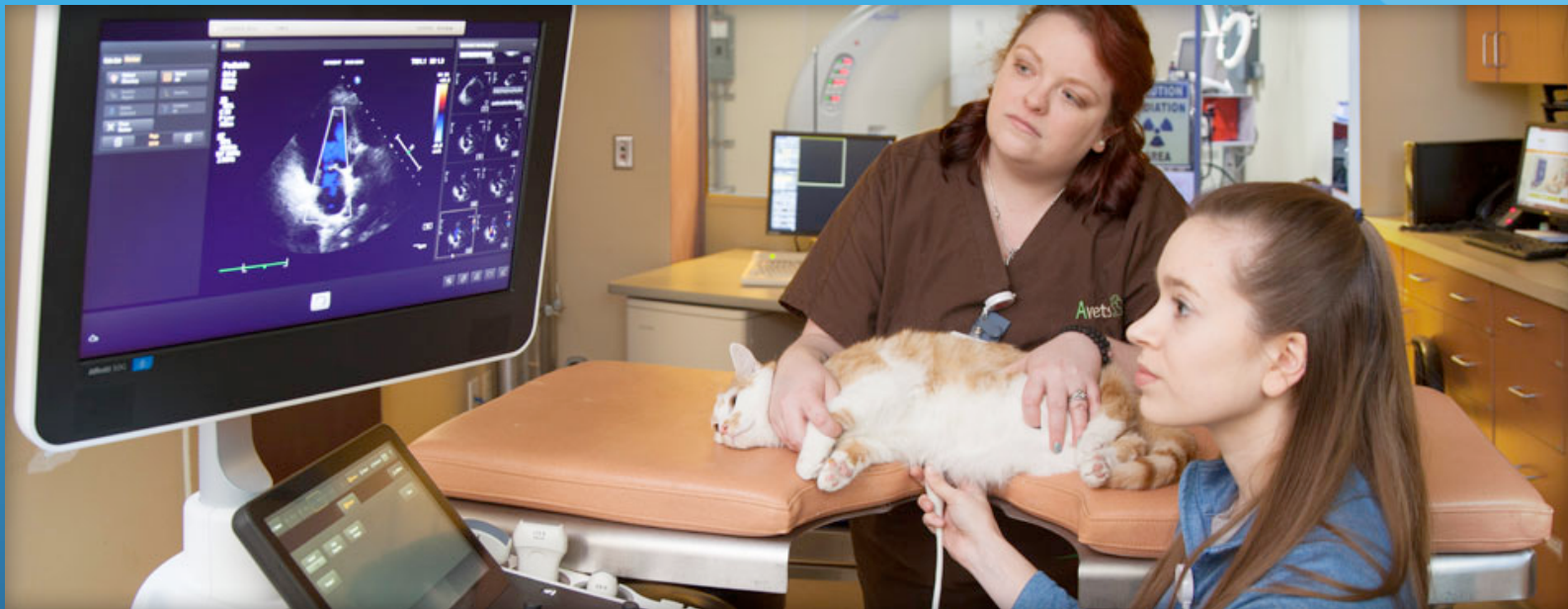
What is your initial approach for managing “Cheddar”?

- Tank him down
- Opioid alone
- Acepromazine + opioid
- Ketamine + midazolam/acepromazine + opioid
- Dexmedetomidine + opioid
- Alfaxalone IM
- Refer him to one of your “friends”

Options

- Ace IM ±
 - Likely insufficient, reduces afterload, may increase LVOT obstruction
- Ketamine IM ±
 - Effective, increases heart rate & contractility, may increase LVOT obstruction
- Dexmedetomidine IM ±
 - Effective, increases afterload, may decrease LVOT obstruction, longer diastolic time for myocardial perfusion
 - Not ideal for cardiac examinations
- Alfaxalone IM ±
 - Effective, dose dependent sedation – anesthesia
 - Volume required acceptable?
 - Improved conditions for cardiac examinations

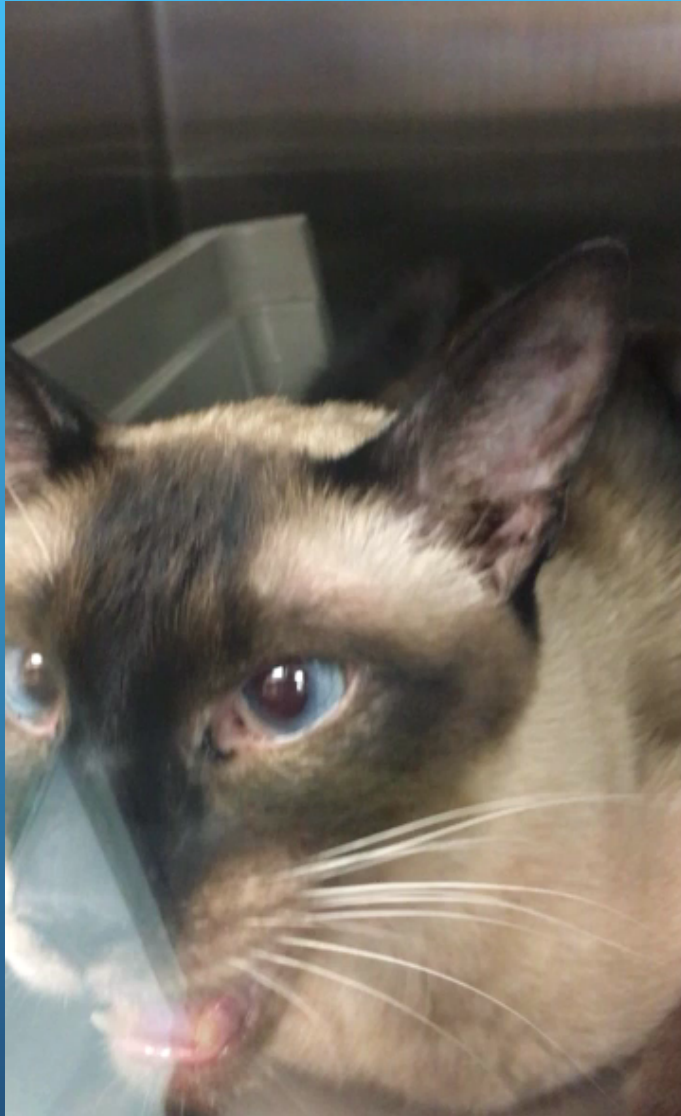
Cardiac Examinations Cats



Respiratory Distress

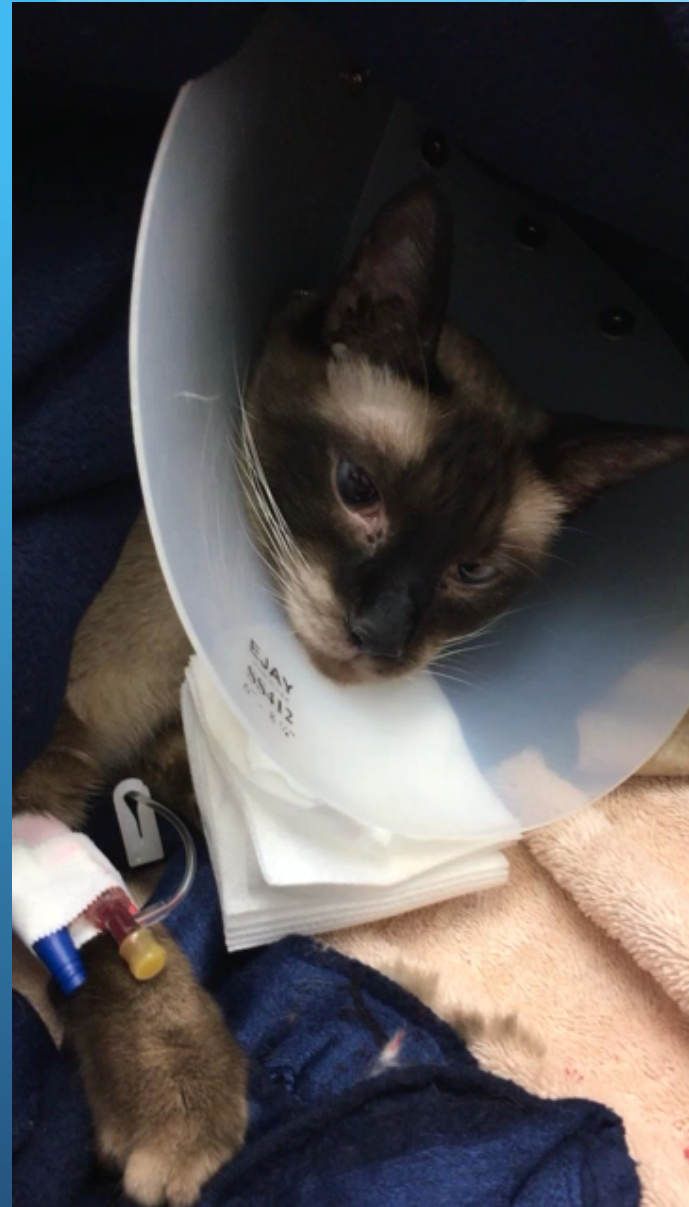
- 11 yr old, Siamese, FS
- Acute respiratory distress
- No significant history





- Acepromazine
- Opioid
- Benzodiazepine
- Dexmedetomidine ???
- Ketamine ???

- Alfaxalone 2 mg/kg
- Butorphanol 0.2 mg/kg
- Combining with butorphanol seems to improve overall efficacy & quality of sedation



Bailey

- 9 yr old, MN, Min Pinscher
- Very painful & swollen stifle
- Admitted for joint taps, mass? aspiration
- No other significant history or concurrent meds

Bailey



- Dexmedetomidine 5 mcg/kg IV
- Hydromorphone 0.1 mg/kg IV
- Insufficient sedation for proposed procedure

Bailey



- Added 0.25 mg/kg alfaxalone IV
- Alfaxalone vs propofol
 - Clinical impressions
 - Breath more regularly, less apnea

Support

- Sedation vs Anesthesia
- Co-morbidities
- Invasiveness & nature of procedure
- Duration of procedure?
- Ability to assess/monitor patient
- Supplemental oxygen
- Intravenous catheter
- Intravenous fluids
- Pulse oximetry
- Blood pressure
- ECG

Argo - Straining to urinate

- 20+ yr, FS, DMH
 - Suspect feline asthma
 - Suspect chronic renal disease
 - Significant osteoarthritis
 - Previous “reaction” during anesthesia
 - Massive pulmonary edema & bronchoconstriction during intubation
 - Dexmedetomidine, hydromorphone, propofol
- PE - unremarkable

Argo



Argo

- Opioid and/or ace – won't work
- Dexmedetomidine – previous reaction, feline asthma
- Ketamine – undesirable characteristics, suspect chronic renal disease
- Alfaxalone IM – very thin body condition

2mg/kg Alfaxalone IV
4 min post injection



Intravenous Sedation

- Frequently require short-term profound sedation in patients
- Ideal option when dexmedetomidine is not!
- Ensure appropriate support!

6 min post injection



Billy

- 14yr, MC, JRT
- Ventral neck abscess?
- Uncomfortable & nippy
- Heart murmur (III/VI), long standing
 - Not worked up, suspect mitral regurgitation
- Plan U/S & biopsy neck mass



Billy does not like lying on his back!

Drug	Considerations
Dexmedetomidine	Heart murmur, MVD?
Opioid	Maybe but unlikely
Midazolam	Maybe but unlikely
Acepromazine	Maybe but long recovery
Alfaxalone	Yes but...

Combinations Sedation

- Midazolam
 - (0.1-0.2 mg/kg)
- Butorphanol
 - (0.1-0.4 mg/kg)
- Hydromorphone
 - (0.05 mg/kg)
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 - Equivocal IM
 - Better IV
- Butorphanol + alfaxalone
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 - Nice addition IM/IV
- Buprenorphine + alfaxalone
 - Limited experience?
- Midazolam + opioid + alfaxalone
 - May be beneficial in some cases

Intravenous or Intramuscular

Billy

- Butorphanol 0.1 mg/kg IM
- Intravenous catheter
- Alfaxalone IV to effect



Alfaxalone IM Anesthesia

- Minor surgical procedures
 - Dexmedetomidine 10-15 mcg/kg
 - Alfaxalone 2-3 mg/kg
 - Butorphanol 0.2-0.4 mg/kg
 - Or
 - Hydromorphone 0.02-0.05 mg/kg
 - Or
 - Buprenorphine 10-30 mcg/kg
- New “Kitty Magic”



Thank you



jurox

Anesthetic Checklists



- <https://ava.eu.com/resources/checklists/>

BODY WT: 20 kg
SX IVF: 200 ml/hr
Fluid bolus (10 ml/kg/15 min) 200 ml
Maintenance Fluids 52.02 mL/hr

DRUG	(mg/mL)	Dose (mg/kg)	mg or mcg	ml
Dexmedetomidine*	0.5	5	100	0.2
Acepromazine	10	0.02	0.40	0.04
Butorphanol	10	0.2	4.0	0.40
Hydromorphone	10	0.05	1.0	0.10
Hydromorphone	2	0.05	1.0	0.50
Fentanyl*	0.05	2	40	0.80
Alfaxalone	10	2	40	4.0
Propofol	10	4	80	8.0
Ketamine	100	7.5	150	1.5
Diazepam	5	0.375	7.5	1.5
Midazolam	5	0.375	7.5	1.5
Cefazolin	100	22	440	4.4
Dexmedetomidine*	0.5	1	20	0.04
Maropitant	10	1	20.0	2.00
Famotidine	10	0.5	10	1.0
Other				

* mcg doses

Dopamine	1.6	7	8400 mcg/hr	5.25 ml/hr
Fentanyl	0.05	5	100 mcg/hr	2 ml/hr
Lidocaine	20	2	40.0	2.00
Atropine	0.5	0.05	1.00	2.00
Glycopyrrolate	0.2	0.005	0.10	0.50
Epinephrine	1	0.01 - 0.1	0.2 - 2	0.2 - 2

Pre-surgical Checklist

Prior to induction

- ☐ Patient identity confirmed
- ☐ Does owner have questions or concerns prior to surgery? Y / N
- ☐ Owner consent signed and deposit obtained
- ☐ Physical exam completed
- ☐ Additional diagnostic tests required: _____
- ☐ Blood work & other diagnostic data reviewed
- ☐ Anesthetic equipment safety checked and monitors operating normally
- ☐ Anticipated critical anesthetic events reviewed (i.e. complications, drug interactions, concurrent disease)
- ☐ Surgical site marked/confirmed
- ☐ Perioperative medications required: _____

Prior to incision

- ☐ Has sterility been confirmed
- ☐ Has antibiotic prophylaxis been given within the 30 min?

Prior to closing

- ☐ Have all specimens been collected and proposed procedures completed?
- ☐ Instrument, sponge and needle count correct

Prior to leaving OR

- ☐ Specimens and samples labeled
- ☐ All proposed procedures completed

After Surgery is Completed

- ☐ Additional postoperative procedures required:
- ☐ All charges recored

History _____

Physical exam _____

Lab data _____

Meds _____

Other _____