Anesthesia & Pain Management for TNR Clinics

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KORET SHELTER MEDICINE PROGRAM

Community Goals

Clinic Goals

Indiviudal
Patient
Goals

Community Goals

Humane population management of community cats

- Reduced public health concerns
- Reduced public complaints

Clinic Goals

High volume/high quality surgery

- Maximize human safety
- Efficienct flow
- Minimize cost

Indiviudal Patient Goals

Sterilization

Healthier patient

Minimize patient stress

Why it’s challenging…

Challenges re: Anesthesia

- Cannot do pre-anesthetic exams
- Variable hydration & health status
- May not adequately be fasted
- Sheer volume of patients to monitor
- Extensive follow-up not possible
- TNR cats are stressed
- Prolonged recovery depending on amount of injectable anesthesia used
- Cannot rapidly manipulate anesthetic plane

Patient Selection

- Before induction:
  - Flag overt abnormalities
  - Any high risk patients?
- After induction:
  - Flag abnormalities
  - Confirm gender
- Vet makes final call

- CV/Resp disease
- Infectious disease
- Wounded

- Possibly the only chance to sterilize this patient

TNR Anesthesia

The ideal TNR anesthesia protocol…

Rapid induction of immobilization & unconsciousness	Excellent muscle relaxation	Perioperative analgesia
Administered in small volume	Reversible	Wide safety margin
Rapid & smooth recovery	Cost-effective	Predictable & effective in variety of cats

- Dissociatives
- Sedatives/ Tranquilizers
- Opioids
- Local Anesthetics
- NSAIDs
- +/- Anti-cholinergics

TKX = telazol – ketamine – xylazine

Positives	Cautions
Predictable w/ rapid onset	Prolonged recovery time (telazol)
Inexpensive	Hypotension
Small drug volume	Hypothermia
Rarely causes vomiting	Hypoxemia
Less sensitive to sound	Only partially reversible

- Op CatNip's protocol
- Reconstitute 1 vial of telazol w/ ket & xylazine & sterile water
- Dose: 0.25ml/adult cat or 0.15ml/kitten IM
- $5/cat
- Can give additional half dose or supplement with Iso
- Reversed w/ yohimbine IV (volume = TKX)

MKB = dexmedetomidine – ketamine – buprenorphine

Positives	Cautions
Better cardiovascular support	Larger drug volume (1mL/adult cat)
More reversible	More costly
Faster recovery than TKX	Post-induction apnea?
Rapid onset of action	Shorter action of duration than TKX

TTDex = telazol – butorphanol – dexmedetomidine

Positives	Cautions
Predictable w/ rapid onset	More costly
Better cardiovascular support	Post-induction apnea?
Small drug volume for adults	Sensitive to sound/stimulation
Rarely causes vomits	Very small drug volume for kittens
Very reversible	

Other cocktails…

- Telazol-butorphanol w/ or w/o dexdom
- Ketamine – midazolam – dexdox – buprenorphine

TNR Pain Management

Challenges re: Pain Management

- Cannot use behavior observation to assess pain
- Cannot modify analgesia once administered
- Can only administer analgesia once
- Cannot tailor analgesia protocol

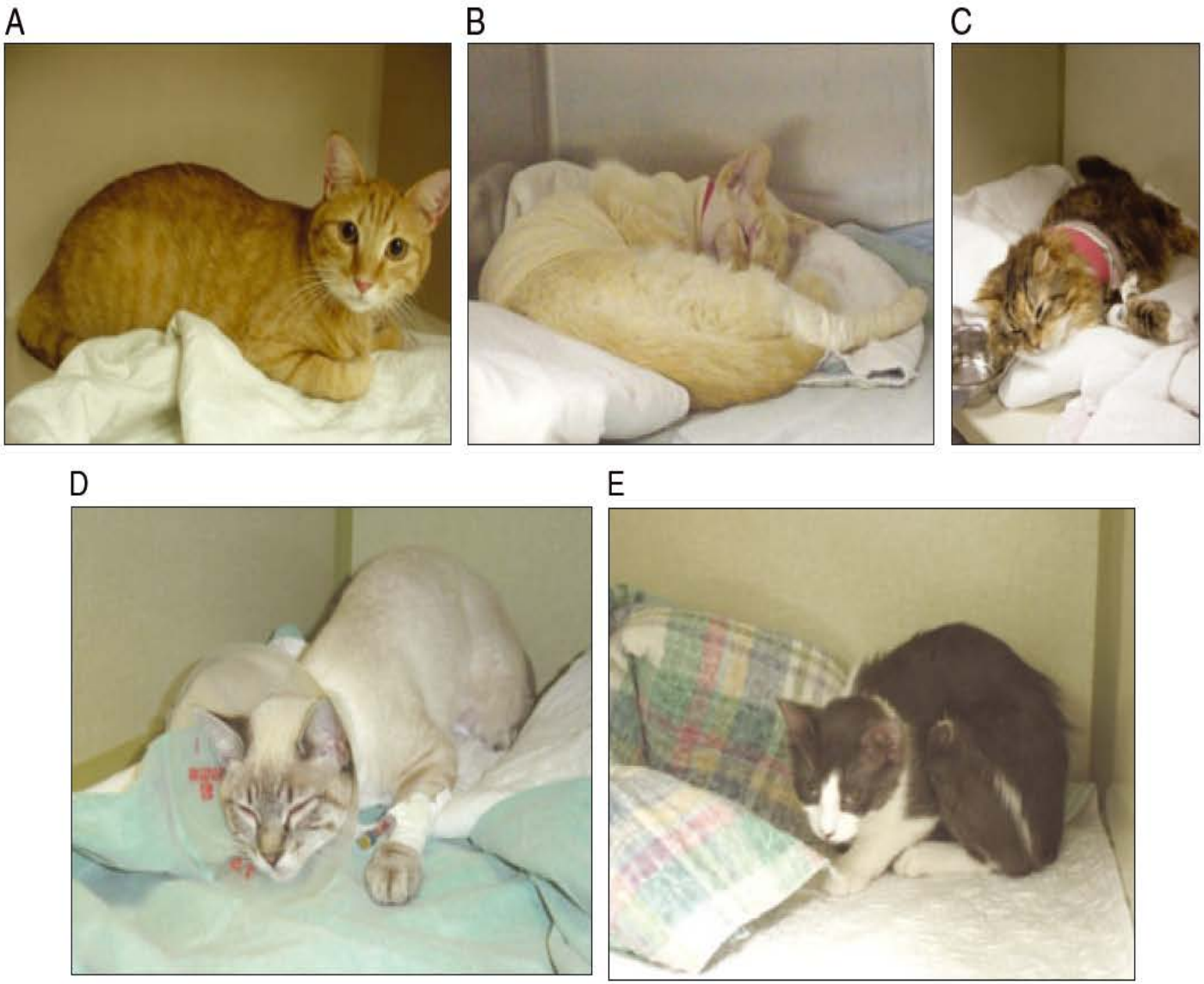


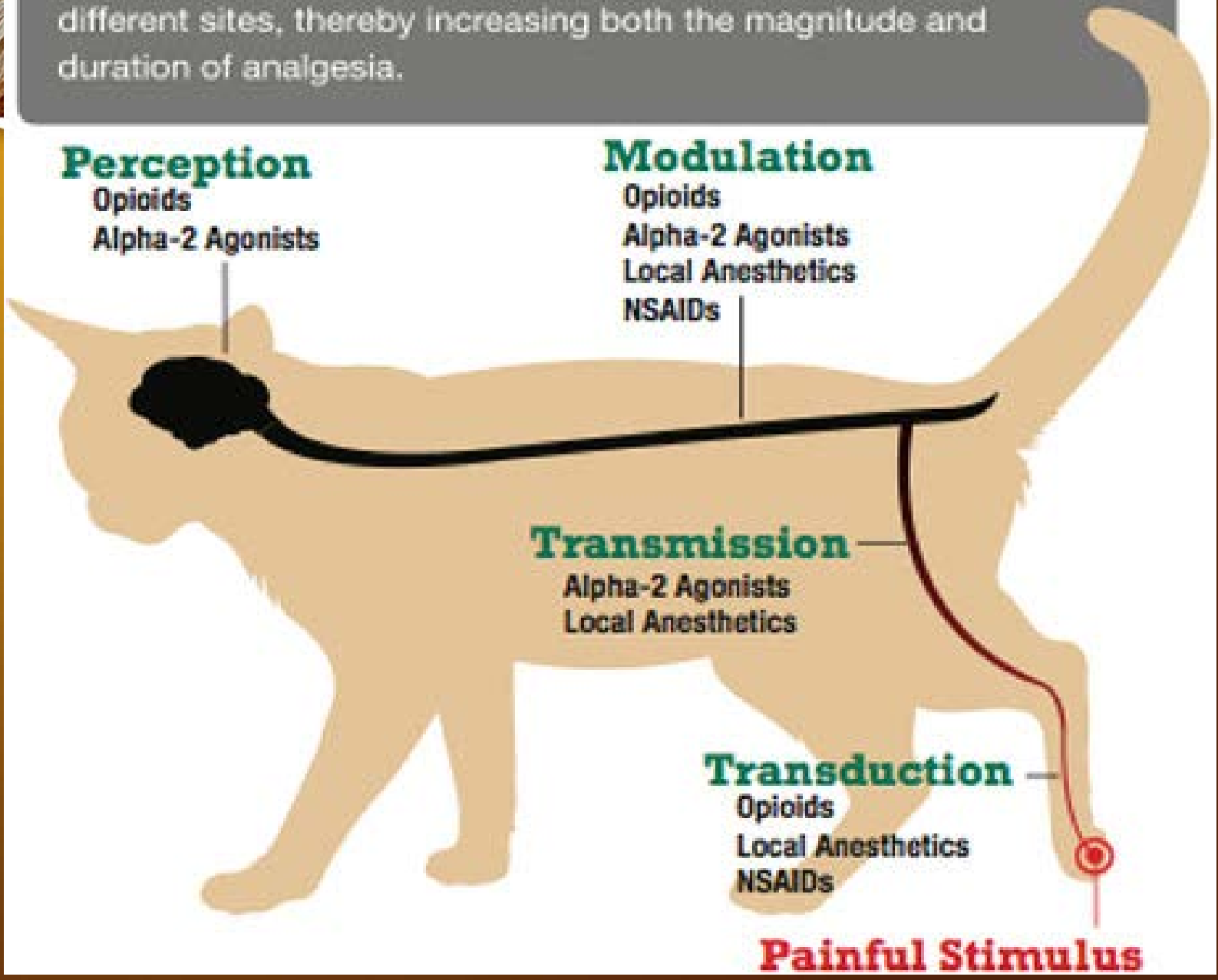
FIG 1. Illustrations of normal postures and facial expressions and those that may be indicative of pain. (A) A cat with a normal posture – the cat's head is up, the cat is alert and the eyes are open. (B) A cat resting after surgery in a normal relaxed and curled up position. (C) This cat is 'flat out' and tense after surgery – also note the facial expression. (D) and (E) These cats have had abdominal surgery; the hunched posture and low hung head are suggestive of pain. Note also that the eyes are either held shut or half closed and appear "slanted" or "squinted" compared to the cat in Figure 1A.

The ideal TNR analgesia protocol…

Gentle tissue handling	Minimal surgical time	Minimal incision length	Avoid painful areas when handling/moving
Multi-modal	Wide safety margin	Preventative	Soft bedding in traps
Prevent hypothermia	Cost-effective	Predictable & effective in variety of cats	Reduce stress

Additional analgesia if inflammation present

Figure 3. Multimodal analgesia is defined as the use of multiple drugs or drug classes that interact with the pain pathway at different sites, thereby increasing both the magnitude and duration of analgesia.



Opioids

- Some are inhalant-sparing
  - Less so than in dogs
- Relatively safe
  - Low risk of respiratory depression
  - Ileus uncommon
  - Reversible
- Synergistic with alpha 2 adrenergic agonists
- Efficacy based on route of administration
  - IV > IM > OTM > SC

Buprenorphine & Butorphanol

- Combination did not provide increased antinociception than either drug administered alone (Johnson et al., 2007)

- Bup vs Torb IM
  - Peri-op OVH analgesic efficacy studied (Warne et al, 2014)
  - Torb alone (pre & post-op)→ rescue analgesia for all cats needed
  - Bup alone at pre-op → rescue analgesia for most cats needed
  - Bup during pre- AND post-op → sufficient analgesia

Buprenorphine SC Route

- Typical clinical dosage (0.02mg/kg) → erratic absorption
- Resulted in more treatment failures compared to IV & IM routes

- Subcutaneous SR (SCSR)
  - ZooPharm (non-FDA approved)
    - One SC dose lasts 72 hour period
    - No PK studies published
    - BID-dosed OTM & SCSR administration provided similar clinical efficacy
    - Meloxicam had been administered to all (Catbagan et el., 2011)
  - Simbadol
    - FDA-approved for cats
    - One SC dose lasts 24 hours; can use up to 3 days
    - Much higher dosage

Buprenorphine OTM Route

- Bioavailability?
  - Shown to have high bioavailability (116%) & provided antinociception effects similar to IV route (Robertson et al, 2003)
  - Sampling from carotid artery relayed significantly lower bioavailability (20-52%) (Hedges et al., 2013)

- Significant clinical difference in pain scores & treatment failures compared to IV & IM routes (Giordano et al., 2010)

Tramadol

- Weak μ agonist
- Dose titration, toxicity, & safety data lacking
- Controlled Sched IV
- Oral formulation
  - Bioavailability = 60%
  - Peak concentration within 45 min
  - Potentially useful for post-op pain but bitter

NSAIDs & Cats

- Historically not used long term for fear of adverse effects
- New studies have looked at safety of long term administration
- Same adverse side effects as in other species
- Deficiency of glucuronidation pathway → slower metabolism of some NSAIDs
- In dogs, pre-op admin is more efficacious than post-op admin
  - Likely similar in cats
  - However, if normotension can't be guaranteed

  → limit NSAID use to **post-op** only

NSAID Options

- Carprofen
  - SC or IV is effective for 24 hrs
  - Undergoes glucuronidation → repeat administration not recommended
- Ketoprofen
  - As effective as carprofen and meloxicam for at least 18 hrs post-neuter
  - More likely to alter platelet function → only give post-op
- Meloxicam – labeled for cats
  - COX-2 selective
  - Oral suspension approved for long-term DJD treatment in other countries

New NSAID - Robenacoxib (Onsior; Novartis)

- COX-2 selective
- Approved for cats for post-op pain
- Max of 3 days via oral route; labeled for longer use outside U.S.
- Short half-life but long resident time in inflamed tissue
- Recent studies:
  - Better post-op analgesia than SC meloxicam (Kamata et al, 2012)
  - Better post-op analgesia than SC bup (Staffieri et al, 2013)

Local Anesthetics

- IVAPM and Task Force of Pain Mgmt Guidelines that “because of their safety and significant benefit, local anesthetics should be utilized, insofar as possible, with every surgical procedure.

PROS

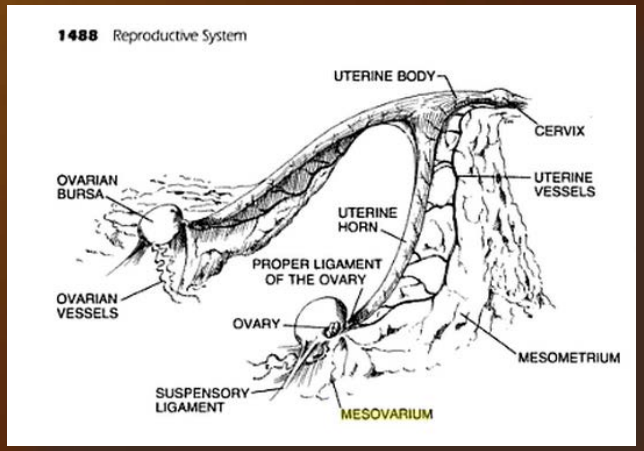
- Block transmission of noxious stimuli
- Anesthetic-sparing
- Antimicrobial
- Immunomodulating
- Do not appear to delay tissue healing
- Relatively inexpensive
- Safe

CONS

- Short action duration
- Increased ax time
- May increase bleeding

Locals – Infiltrative Anesthesia

- Perform before surgery/before transection
- 25- or 22- gauge needle
- Aspirate first
- For incisional block
  - May need to infiltrate linea alba or muscle, not just SC tissue
  - Should block length of entire incision
- For ovarian ligament block
  - Infiltrate mesovarium
  - eg. 4kg cat = 0.5mL of 2% lidocaine
- For intratesticular block
  - Inject into caudal pole of testis until palpably firm/swollen (<0.5mL/testicle)
- Splash block of body wall
  - Before closure of abdomen



Local Anesthetics

	Lidocaine 1-2%	Bupivacaine 0.25-0.75%
Onset of action (min)	5-10 (faster)	10-20
Duration (min)	90-200	180-600 (longer)
Max dosage in cats (mg/kg)	6 (2mg/kg is typical)	2 (1mg/kg is typical)
Painful/irritating	Yes	No

Recommendations for Pain Mgmt in TNR…

- Administer analgesia preventatively based on severity of surgery rather than based on behavior
- Use multimodal analgesia
- Use gentle tissue handling to minimize trauma
- Avoid painful areas when handling even anesthetized patients to avoid starting a new pain cascade
- Outfit traps with soft bedding/copious newspaper to avoid additional pain
- Use additional analgesia if inflammation present (ie. pyo)

Detailed Recommendations

- Do not use butorphanol alone for analgesia
- Use locals whenever possible
- Administer NSAID postoperatively (provide fluids when warranted)
- Multimodal analgesia is optimal since we can’t tailor analgesia for TNR patients
- Changes in behavior constitute best assessment of feline pain
- Buprenorphine
  - 0.02mg/kg IV or IM or OTM
  - If OTM, give full agonist opioid, as well, or even Bup IV/IM as premed
  - Do not use SC route unless trying SR formulation

All things anesthesia-related…

Pediatrics

- At greater risk for hypothermia + hypoglycemia

→ Minimize ax + sx time

→ Support body temperature early on

→ Feed as soon as awake

→ Injectable preferred over inhalant (less nausea on recovery)

Endotracheal Intubation?

- CEPSAF 2007 study:
  - Increased odds of death for MINOR procedures (2.3)
  - Decreased odds of death for MAJOR procedures (0.6)

- Recommendations
  - No, don't intubate if
    - procedure is short (<30 min)
    - cat is healthy
  - Yes, intubate if
    - procedure is long
    - sick
    - obese

Oxygen & ventilation should always be available!

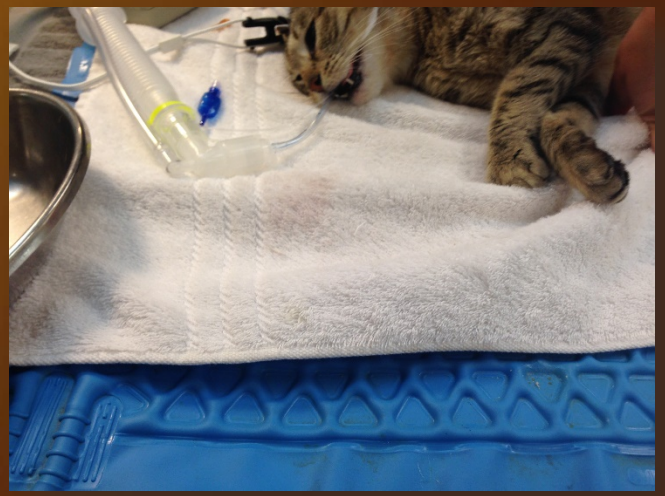
Hypothermia

- Impaired tissue perfusion
- Exacerbates pain
- Increased surgical site infections
- Impaired coagulation
- Prolonged recovery
- Unsteady state of anesthesia

→ increased morbidity

Preventing Hypothermia

Avoid using cold fluids	Reduce heat loss from extremities	Use forced hot air
Reduce contact w/ cold surfaces	Provide insulation	Avoid cold scrubs + soaking body surface w/ alcohol
Avoid excessive fur removal	Limit body cavity exposure	Use short-acting ax



Fluid Therapy

- Increased odds of death found in CEPSAF 2007 study with IV fluids (4x)

- Recommendations:
  - Give intra-op or immediately post-op
  - Use mildly warmed fluids
  - Give to
    - Pregnant
    - Lactating
    - Geriatric
    - Sick

Reversal?

- Yes:
  - To expedite recovery
  - Cats do not experience adverse effects of tiletamine
  - Multimodal analgesia should be used

Monitoring

- Begins with induction
  - Monitor every 3-4 min until recumbent
- CEPSAF 2007 study:
  - Reduce odds of death with intra-op pulse oximetry (0.2)
- Critical periods for cats:
  - Intra and post-operative

Monitoring & Recovery

- Area should be clean, quiet, warm, dry with good visibility

- Op Catnip
  - Overall mortality rate = 0.35% (related to ax = 0.23%)
  - Most deaths during first 3 hrs post-op

→Must have highly trained staff/volunteers in recovery

Tips from the field

- Corn oil instead of eye lube
- Ensure that all vaccines are NOT drawn up too early
- Fluid warmers
- Express bladders since cats still in traps overnight

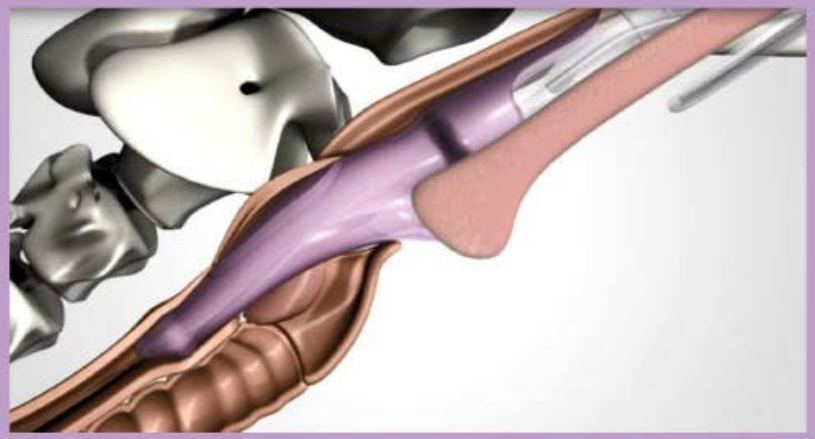
CPR

- Training – differentiate depression vs arrest
- Readily available:
  - ETT
  - Oxygen
  - Means of ventilation
  - Reversal/CPR drugs
  - Emergency drug charts
- Assign a CPR leader = designates tasks + records

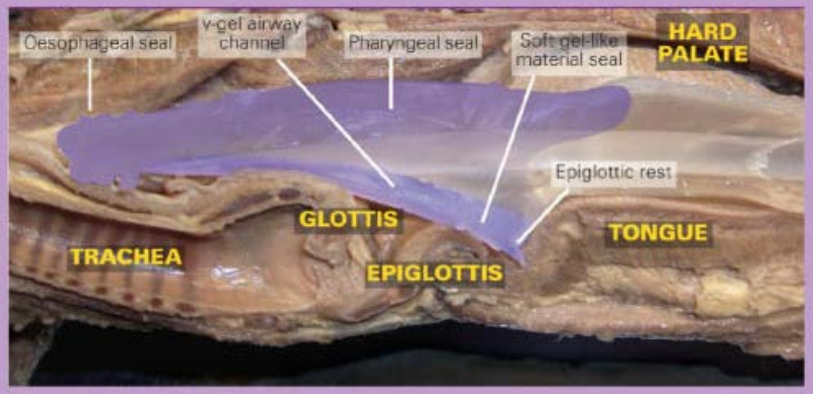
CPR

- Turn off inhalant anesthesia
- CAB
  - C = Circulation = 100 compressions/min x 2min
  - A = Airway = secure a patent airway
  - B = Breathing = 10 breaths/min
- At same time: reverse anything that can be reversed

V-Gel



Cat v-gel® relative to the upper airway anatomy



CPR: Emergency Drugs

- Epinephrine 1:1000
  - 0.01 mg/kg (lower dose) IV or IO
  - Intratracheal: must be 10x IV dose
  - Every 3-5 minutes

- Atropine
  - 0.04 mg/kg – IV or intratracheal diluted w/ saline
  - Can give if patient is resuscitated but bradycardic


EPINEPHRINE

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