Toe Removal

- 3 yo FS German Shepherd
- Chief Complaint:
  - 5th digit amputation LH
    - Foot caught on the door
- Pertinent history
  - Aggressive dog – owner able to muzzle
  - Healthy otherwise
Physical Exam

- Limited physical exam due to behavior

- Cardiovascular:
  - Heart: 150 bpm, normal rhythm and no murmur
  - Pulse: strong and synchronous
  - MM: unable to check

- Respiratory
  - 36 BPM
  - Lungs: lungs auscult clear
Bloodwork

- PCV: 55% TP 8.0 g/dL
- CBC
  - WNL
- CHEM
  - WNL
Problem List

- Aggression
  - Dog
  - Personnel

- Pain

- No health issues otherwise
Sedation Protocol

- Patient should go first thing in the morning
  - Sedated shortly after coming in and going home early

- Sedation options and advantages
  - Acepromazine (0.02-0.05 mg/kg IM or SQ)
  - Dexmedetomidine (3-10 mcg/kg IM or SQ)
  - Opioid (type depends on procedure to be performed)
  - Ketamine (2-3 mg/kg IM)
  - Benzodiazepine – not a good option
Sedation Protocol

- Dexmedetomidine (4 mcg/kg) IM
- Hydromorphone (0.1 mg/kg) IM
- Ketamine (3 mg/kg) IM

- Reliable (yet not excessive) sedation
- Low doses of different drugs
- Able to safely place catheter
Induction and Maintenance

- Propofol (4-5 mg/kg) IV
  - Given to effect – lower dose depending on level of sedation
  - Advantage: good quality for recovery – go home

- Ketamine (3-5 mg/kg) IV
  - Possibly prolonged recovery – minor problem
  - Healthy patient – no contraindication

- Inhalant anesthetic for maintenance
  - Intubation always a must
Pain Management

- Opioid – full mu agonist
  - Great analgesia
  - Duration of action 2-4 hrs
  - Repeat every 2 hrs intra-op – half of original dose

- Dexmedetomidine
  - Good analgesia (best if combined with opioid)
  - Duration of action – 30 - 45 min
Pain Management

- **Locoregional anesthesia**
  - Ring block
  - Bier Block

- **Lidocaine**
  - < 4 mg/kg

- **Bupivacaine**
  - < 2 mg/kg
Monitoring

- **Blood pressure**
  - Doppler always preferred
    - Systolic > 90 mmHg

- **Capnography**
  - ETCO2 – 35-45 mmHg

- **Pulse oximeter**
  - Oxygen hemoglobin saturation
    - SpO2 > 98%

- **ECG**
Recovery

- Post-operative medication is administered ahead of time
- Be prepared to extubate
- Have sedation available – administer IF needed
  - Dexmedetomidine (0.5-1mcg/kg IV)
    - Reversible
    - Short duration of action
  - Acepromazine (0.05-0.1mg/kg IV)
    - Longer duration of action
    - Not reversible
- Pull catheter as soon as patient is stable and send them home
Dental Anesthesia

- 10 yo MN DSH

- Chief complaint:
  - Dental with possible extractions

- Pertinent history
  - Dental disease
  - Chronic renal disease
  - Previous dental performed 2 years ago with history of hypotension
Physical exam

- **Cardiovascular:**
  - Heart: 180 bpm, normal rhythm, and no murmur
  - Pulse: strong and synchronous
  - MM: moist and pink

- **Respiratory**
  - Lungs: 30 bpm, lungs auscult clear
Bloodwork and UA

- HCT: 36% TP: 6.7 mg/dL
- ALB: 2.7g/dL
- Creatinine: 2.2 mg/dL
- BUN 40 mg/dL
- All other values WNL

- USG: 1.025
- Protein: 2+
Problem List

- Pain
  - Teeth extractions
    - Systemic analgesia
    - Local analgesia

- Chronic renal disease
  - Avoid AKI

- Proper depth of anesthesia
  - Multimodal anesthesia and analgesia
Premedication Protocol

- Personal preference

- Catheter placed without sedation

- Benzodiazepine (select one)
  - Midazolam - 0.2 mg/kg IV
  - Diazepam - 0.2 mg/kg IV

- Opioid
  - Morphine - 0.3-0.5 mg/kg IV
  - Buprenorphine - 0.015 – 0.02 mg/kg IV
Premedication Protocol

- Other options
  - Acepromazine – 0.02-0.04 mg/kg SQ
    - Hypotension
    - Possible increase in blood flow
  - Dexmedetomidine – 3-5 mcg/kg SQ

- Opioid
  - Morphine – 0.3-0.5 mg/kg SQ
  - Buprenorphine – 0.02 mg/kg SQ
Premedication Protocol

- **Alfaxalone**

  - Can be given IM or SQ
  - Good selection for fractious cats
  - Has to be combined with another sedative
    - Opioid
    - Dexmedetomidine

  - Minimal cardiovascular side effects

  - Good option for patients
    - Heart disease
    - Renal disease
    - Avoid stress
Induction and Maintenance

- Propofol – 5 mg/kg IV slowly to effect
- Ketamine – 5-7 mg/kg IV

- Personal choice:
  - Ketamine -1 mg/kg IV bolus + Propofol – 4 mg/kg IV slowly to effect

- Maintenance
  - Inhalant anesthetic
    - Intubation – a must
Monitoring Anesthesia

- **Blood pressure**
  - Doppler always preferred
    - Systolic > 90 mmHg
      - HAVE TO MAINTAIN GOOD BLOOD PRESSURE
      - RBF RBF RBF

- **Capnography**
  - ETCO\textsubscript{2} – 35-45 mmHg

- **Pulse oximeter**
  - Oxygen hemoglobin saturation
    - \text{SpO2} > 98%

- **ECG**
Pain Management

- **Dental blocks**
  - Maxillary
  - Infraorbital
  - Mandibular
  - Mental

- **Drugs**
  - Lidocaine (< 2 mg/kg)
  - Bupivacaine (< 1.5 mg/kg)

- **Nerve blocks for oral surgery in cats**
  - Clinician’s brief (Feb 2014)
  - Dr. Brett Beckman
Pain Management

- Opioid
  - Premedication

- Morphine
  - Repeat every 2 hours (half of original dose)

- Buprenorphine
  - Duration of action 6-8 hours
    - Repeat if needed or towards end of procedure
Anesthesia Maintenance

- Common problem
  - Too deep – hypotensive
  - Too light – good blood pressure

- Balanced anesthesia – inhalant + injectables

- Repeat opioid intraoperative

- Dexmedetomidine (1-2 mcg/kg IM or SQ)
  - Duration of action - 45 min – may repeat if needed

- Ketamine (0.3-0.5 mg/kg IV)
  - Duration of action - 10 min – may repeat if needed
Fluid Therapy

- CKD patient

- Pre-operative
  - 45-60 ml/kg/day (2-3 ml/kg/hr)
  - Dehydration ≠ Hypovolemia

- Intra-operative
  - 3-5 ml/kg/hr
  - No fluid bolus

- Post-operative
  - 45 ml/kg/day (2ml/kg/hr)
Intraoperative Management

- Full monitoring equipment
- Blood pressure! Blood pressure! Blood pressure!
- HAVE TO maintain blood flowing to the kidneys

- Doppler for pressure measurement
  - Systolic > 90 mmHg
  - Mean > 60 mmHg

- Be prepared to treat hypotension
  - Ephedrine (bolus)
  - Dopamine (CRI)
  - Dobutamine (CRI)
Anesthesia and CKD

- Risk of AKI is high
  - Optimize RBF at all times

- Comorbidities that may affect anesthesia
  - Hypoalbuminemia
  - Hyperkalemia
  - Dehydration
  - Anemia
  - Hypertension
Post-operative Recovery

- Monitor during recovery
  - Check blood pressure q 5-10 min
  - Check SpO₂
    - Provide oxygen if needed

- Provide analgesia
  - Opioid immediately post-op
  - NO NSAID
  - Consider sending home on buprenorphine
    - 0.02-0.03 mg/kg OBM q 6-8 hrs

- Consider rechecking bloodwork in 2-5 days
Amputation

- 5 yo MC Labrador Retriever

- Chief complaint
  - Non-weight bearing LH

- Pertinent history
  - HBC 4 hours ago
Physical Exam

- **Cardiovascular**
  - HR 160 bpm
  - No murmur
  - Strong pulse with deficits (asynchronous)
  - Mucous membrane – pink and moist

- **Respiratory**
  - Tachypnea
  - No crackles or wheezes

- **Abdomen:** WNL with intact bladder

- **Musculoskeletal:** LH swollen and non-weight bearing
Bloodwork

- HCT: 55% TP: 7.5 g/dL
- CREAT: 2.0 mg/dL
- BUN 40 mg/dL
- ALT: 700 mg/dL
- ALB: 4.0 g/dL
- Everything else WNL

- UA
  - USG 1.055
  - No protein
  - No blood
Radiographs

- Hindlimb + pelvic radiographs
  - Comminuted femoral fracture
  - Pelvis intact

- Chest radiographs
  - Mild bilateral pulmonary contusion

- Abdominal radiographs
  - WNL
Cardiovascular Work Up

- Presence of pulse deficits + tachycardia

- ECG
  - Tachycardia
    - HR 160 bpm
  - Intermittent VPC’s
    - 5 VPC’s/ min
    - Uniform shaped

- Blood pressure
  - 150 mmHg

- Mucous membranes pink with CRT of 2.5 s
Problem List

- Elevated ALT
  - Muscle damage

- Mild azotemia
  - Dehydration

- Cardiac Contusion
  - VPC’s
    - Cardiac output

- Tachycardia
  - Pain

- Pulmonary Contusion
  - Hypoxemia

- Pain
  - Intra-operative
  - Post-operative
    - Acute
    - Chronic

- +/- Blood loss
  - Pre-op
  - Intra-op
Pre-Operative Stabilization

- **IV catheter and fluids**
  - Crystalloid bolus of 20 ml/kg + reassess
    - Tachycardia
    - Blood pressure

- **Analgesia**
  - Full Mu opioid
    - Tachycardia
    - Blood pressure

- **Supplemental oxygen if needed**
  - $\text{SPO}_2 < 94\%$
Premedication Protocol

- **Full Mu opioid – very painful procedure**
  - Hydromorphone (0.1 mg/kg) IM, SQ, IV
  - Morphine (0.3-0.4 mg/kg) IM, SQ, IV (slowly)

- **Benzodiazepine**
  - Midazolam (0.2 mg/kg) IV
  - Diazepam (0.2 mg/kg) IV

- **Dexmedetomidine and acepromazine**
  - Avoid

- **ECG before induction**

- **Pre-oxygenation – 5 minutes with a mask**
Induction and Maintenance

- Propofol – 4-5 mg/kg IV to effect

- Ketamine – 3-5 mg/kg IV
  - May increase HR
  - May exacerbate arrhythmias
    - Increase in myocardial oxygen consumption

- Inhalant anesthetic
  - Balanced anesthesia
Analgesia

Perception

Cortex
Thalamus

Projection

Modulation

Transmission

Transduction

Noxious stimulus:
Mechanical
Chemical
Thermal
Analgesia

- **Epidural**
  - PF morphine and PF local anesthetic
    - Morphine 0.1 mg/kg (PF morphine usually 1 mg/ml)
    - Bupivacaine 0.3-0.5 mg/kg
    - Lidocaine 0.2 mg/kg
  - Very effective
    - Acute and chronic pain
      - Wind up pain
Analgesia

- **Opioid**
  - Any pure mu agonist
  - **Hydromorphone or Morphine**
    - Duration of action 2-4 hours
    - Repeat every 2 hours intra-operative
    - Repeat every 4 hours post-operative

- **Fentanyl CRI**
  - Bolus 5 mcg/kg IV (5-10 min)
  - CRI – 8-12 mcg/kg/hr - intra-operative
  - CRI – 4-5 mcg/kg/hr - post-operative
**Analgesia**

- **Ketamine CRI**
  - Very effective when combined with an opioid
    - Helps prevent wind-up pain
  - Widely available in most practices

- IV bolus 0.5-1.0 mg/kg
- 10-20 mcg/kg/min

- Post-operative period
  - 3-4 mcg/kg/min
CRI Equipment

- Calculator
- Syringe
- Syringe Pump
- Fluid bag
- Fluid Pump
- Extension set

- Add diluted drug to syringe/bag and choose appropriate flow rate to achieve desired CRI
Other Options

- Fluid bag
- Buretrol
- Dial-a-flow
- Extension set
Calculating CRIs

- Ketamine CRI
- 20 kg dog at 10 mcg/kg/min
  - 20 kg x 10 mcg/kg/min = 200 mcg/min = 0.2 mg/min
  - 0.2 mg/min x 60 min = 12 mg/hr
  - 12 mg/hr / 100 mg/ml = 0.12 ml/hr

- Flow rate of fluids at 10 ml/hr (dial-a-flow)
- Add 50 ml of fluids to buretrol
  - 50 ml at 10 ml/hr = 5 hours
  - 0.12 ml/hr x 5 hr = 0.6 ml of ketamine into the buretrol
Safety First

- 0.6 ml of ketamine to 50 ml of fluids
- 60 mg of ketamine to 50 ml of fluid
- If malfunction happens….

- Buretrol empties into the dog
  - 50 mls of fluid = 2.5 ml/kg bolus of crystalloid
  - 60 mg of ketamine = 3 mg/kg ketamine

- Dial-a-flow not accurate enough…
  - CRI is a range 10-50 mcg/kg min used to effect
Post-Operative Recovery

- Proper analgesia
  - Opioid + ketamine overnight

- Monitor
  - SpO2 > 94%
  - Pulmonary contusions
  - Atelectasis from anesthesia
  - Some degree of hypoventilation from sedatives
  - Blood pressure
  - ECG – arrhythmias will still be present

- Overnight care
  - If hospital is not equipped for overnight care consider transferring
Questions?

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