What's new in anesthesia & pain management in 2014?

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Presentation outline

• What do we learn about monitoring blood pressure and hemodynamic interactions of ace and dexmedetomidine?
• What's new in using sedative combinations in dogs and cats?
• What's new in using micro-dose of dexmedetomidine?
• What's new in injectable anesthetic combinations?
• What's new in anesthesia monitoring?
• What's new in anesthetic/analgesic products?

Vital blood pressure monitoring

• Maintaining both the blood pressure and cardiac output are paramount to safe anesthesia
• Cerebral perfusion is more dependent on mean arterial blood pressure
• Renal perfusion is dependent on both mean arterial blood pressure and cardiac output
• Cardiac perfusion is more dependent on diastolic blood pressure

Cardiovascular effects of anesthetics

- Vasodilation (−, =, ==) or vasoconstriction (+)
- Premedication:
  - Midazolam (0), acepromazine (−), dexmedetomidine (++), butorphanol (±0), ketamine (+)

Intravenous induction anesthetics:
- Propofol (=), alfaxalone (-)
- Inhalant anesthetics:
  - Profound arteriolar and venous dilation
  - Isoflurane (==), sevoflurane (==)

Exacerbated hypotensive effects

- Acepromazine (−), Propofol (−), Isoflurane (==)
- Midazolam (0), Propofol (−), Isoflurane (==)
- Butorphanol (±0)
- Hypotension, MABP < 40 mmHg

- Dexamethasone (++, propofol (−), isoflurane (==)
- Hemodynamic counterbalance
- Vasoconstriction against vasodilation
- Normotension, MABP > 80 mmHg

Heart rate: blood pressure relationship with any given anesthetic protocol

- **High HR**
  - Inotropes
  - **Low HR**
  - Anticholinergics
  - **Low HR**
  - Observing
  - **High HR**
  - Treat pain

  **Low BP**
  - Ephedrine (0.15 mg/kg, IV)
  - **Low BP**
  - Atropine: 0.02 mg
  - **High BP**
  - Do nothing
  - **High BP**
  - Give opioid or increase inhalant

Rate Pressure Product (RPP) = Heart Rate (HR) × Systolic Blood Pressure (SBP)

- A measure of the stress put on the cardiac muscle based on the number of times it beats per minute (HR) and the arterial blood pressure that it is pumping against (SBP)

- A direct indication of the energy demand of the heart and a good measure of the oxygen consumption of the heart
**Hidden danger of increasing myocardial oxygen consumption**

**Vasodilation**
- SBP 70
- DBP 40
- MBP 50
- HR 145
- Heart O2 consumption  
  - 70 x 145 = 10,150

**Vasoconstriction**
- SBP 140
- DBP 80
- MBP 100
- HR 50
- RPP (SBP×HR)  
  - 140 x 50 = 7,000
  - 140 (↑) x 100 = 14,000

**Take home message**
- Using anesthetic protocols that have hemodynamic balance benefit
- Monitoring blood pressure
- Treat hypotension as it occurs
- Avoid using tight mouth gag in cats and dogs
- Providing 100% oxygen to the sedated patient is always a winner

**Potential uses micro-dose dexmedetomidine**
- Sparing effects on anesthetic induction agents
- Sparing effects on anesthetic maintenance
- Smooth out anesthetic maintenance
- Smooth out rough recovery

**Sparing effect on anesthetic induction**
- Effects of intravenous diazepam or microdose medetomidine on propofol-induced sedation in dogs - Ko et al.  
  - 1 mcg/kg, IV 45 seconds prior to propofol induction
- Reduced propofol by 38%
- Similar to diazepam @ 0.4 mg/kg
Smoothing rough recovery

- From isoflurane-sevoflurane-delirium
- Pain – inadequate analgesia
- Pain or delirium?
- Deferential agent
- Micro-dose of Dexdomitor
- 0.1 ml Dexdomitor
- 0.9 ml saline = 50 mcg/ml
- 0.1 ml = 10 lbs, IV
- 0.2-0.3 ml = 10 lbs, IM

Microdose- CRI

- Prevention of hypotension
- Reduction of anesthetic maintenance
- Can be used with MLK or FLK
- Sparing effect of other anesthetic-analgesic agents
- Prevention of rough recovery
- Can be used without syringe pump
- Intermittent boluses

Dexmedetomidine alone as a sedative in dogs

Degree of sedation
- 62.5, 125, 250 375, 500 µg/m²
Dose dependent sedation-analgesia

- Light – calming effect
- Mild - premedication
- Moderate - immobilization
- Profound- invasive procedures
- 62.5 µg/m²: 2.5 µg/kg, IV or IM
- 125 µg/m²: 5 µg/kg, IV or IM
- 250 µg/m²: 10 µg/kg, IV or IM
- 375 µg/m²: 15 µg/kg, IV or IM
- 500 µg/m²: 20 µg/kg, IM

Dexmedetomidine alone as a sedative in cats

- Label dose: 40 µg/kg, IM
- Cats are less sensitive to dexmedetomidine than that in dogs
- Less bradycardic than that in dogs
- Onset 5 min, peak 15-60 min, recovery 180 min if not reversed

Dexmedetomidine with opioids as a sedative in dogs

Degree of sedation
- 62.5, 125, 250 375, 500 µg/m²

Dexmed + mu opioids in dogs and cats

- Morphine: 0.25-0.5 mg/kg
- Hydromorphone: 0.05-0.1 mg/kg
- Fentanyl: 2-3 mcg/kg
- Rapid onset after IM or IV
- Potential vomiting
- Profound bradycardia
- Respiratory depression
**Dexmed + partial mu or kappa opioid in dogs and cats**

- Buprenorphine: 20-40 µg/kg
- Butorphanol: 0.2-0.4 mg/kg
- Slower onset with buprenorphine
- Less vomiting
- Less bradycardia
- Less respiratory depression
- Reversible for all combinations

**Midazolam**

- By itself – a poor sedative
- Paradoxical excitement
- Minimal cardio-respiratory side effects
- Can be used to enhance sedation of dexmed + opioid combination
- Sparing dexmed in sick patients
- 0.2-0.4 mg/kg, IM or IV

**Dexmedetomidine with opioids as a premedication in dogs**

**Degree of sedation**
- 62.5, 125, 250, 375, 500 µg/m²

**PREMEDICATION**
- Acepromazine
- Dexmed
- Atropine
- Opioids
- NSAIDs

**Dexmed alone**
- Dexmed + opioid
- Dexmed+ketamine

**Dosing rates**
- 62.5, 125, 250, 375, 500 mcg/m², IM
- 2.5 µg/kg, 5, 10, 15, 20 µg/kg
- Light premedication
- 62.5 µg/m² = Geriatrics, cardiac & various systemic dysfunction (liver, kidney, renal) dogs as a premedication
- Propofol- IV induction for ET intubation
- Isoflurane-sevoflurane for maintenance
Pros and cons

A few words about opioids

Butorphanol
Hydromorphone
Morphine
Buprenorphine

Evaluation of dexmedetomidine and ketamine in combination with opioids as injectable anesthesia for castration in dogs

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Objective—To compare the efficacy and cardiorespiratory effects of dexmedetomidine and ketamine in combination with butorphanol, hydromorphone, or buprenorphine with or without remifentanil in dogs undergoing castration.

Design—Prospective, randomized, double-blind, study.

Animals—45 healthy, client-owned, sexually intact male dogs.

Procedure—Dogs were assigned to receive dexmedetomidine (14 μg/kg IV) or saline (5 mL/kg), ketamine (5 mg/kg IV), or buprenorphine (0.1 mg/kg IV) and remifentanil (2 μg/kg IV) or saline (5 mL/kg). After surgery, analgesia and sedation were maintained with remifentanil (0.2 μg/kg/min IV) and ketamine (0.5 mg/kg IV) or buprenorphine (0.1 mg/kg IV) and remifentanil (0.2 μg/kg/min IV). All dogs receiving dexmedetomidine and ketamine received remifentanil and ketamine. All dogs were administered as a single IV injection for induction and maintenance of anesthesia for castration. All dogs received additional doses of dexmedetomidine and ketamine when anesthesia was considered inadequate during surgery.

Results—All drug combinations were well-tolerated. Dogs were intubated within 10 minutes after injection, supplemental oxygen was required during surgery in 1 of 3 of the Dex/Ket, DEX/Ket, and DEX groups, respectively. Dogs that received remifentanil had evidence of postoperative pain in all groups. Postoperative pain was unaffected by the route of administration of remifentanil.

Conclusions and Clinical Relevance—Dexmedetomidine and ketamine were the most effective injectable anesthetic combination used. Recovery was shortened by IV administration of ketamine. There were minimal adverse effects in all groups.

4-W questions for an anesthetic protocol

• What is the health (ASA) status of the patient?
• What is the desirable degree of sedation/anesthesia-analgesia? (mild, moderate, profound sedation)
• What is the duration of sedation/anesthesia?
• What is the route of administration? (IV or IM)
**TTDex**
(Telazol-butorphanol-Dexdomitor)

- Telazol powder (500 mg total)
- Butorphanol **2.5 ml** (10 mg/ml, 25 mg)
- Dexdomitor **2.5 ml** (1250 mcg)
- 5 ml total solution after reconstitution
- Telazol - 100 mg/ml
- Torbugesic - 5 mg/ml
- Dexdomitor - 250 mcg/mL

**Use of TTDex in dogs and cats**

- **0.005 ml/kg**, IM: Geriatric, systemic dysfunctions, light premedication
- **0.01 ml/kg**, IM: mild-moderate sedation
- **0.02 ml/kg**, IM: moderate-profound sedation or minor Sx
- **0.035 ml/kg**, IM: surgical plane of anesthesia up to 30-40 min

**Individualizing anesthetic protocol**

- Providing a basic platform to counteract inhalant induced hypotension
- TTDex or DKB (doggie or kitty magic)
- Top-off additional opioids, sedatives, local anesthetic for regional analgesia

**TTDex- Options**

<table>
<thead>
<tr>
<th>Individual dosage- mg/kg</th>
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<tbody>
<tr>
<td>Telazol</td>
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<tr>
<td>4 mg/kg</td>
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<tr>
<td>3 mg/kg</td>
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<tr>
<td>2 mg/kg</td>
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<tr>
<td>1 mg/kg</td>
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<tr>
<td>0.5 mg/kg</td>
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</tbody>
</table>
**TTDex dosage for dogs and cats**
(based on your desirable effect)

- 0.04 ml/kg, IM only
- 0.035 ml/kg
- 0.03 ml/kg - IV - upper limit
- 0.025 ml/kg
- 0.02 ml/kg
- 0.015 ml/kg
- 0.01 ml/kg

*Draw up drugs separately and mix in the same syringe as a single IM injection*
- Telazol – 0.04 ml/kg
- Torbugesic 0.02 ml/kg
- Dexdomitor 0.02 ml/kg

**Contra-indications of using TTDex**

- Neurologic patients
- Severe cardiac dysfuncion patients
- (specifically with tricuspid valve regurgitation)
- Severe hepatic dysfunctional dogs
- Severe renal dysfunctional cats
- Avoid high dose in seizure history patient
- C-section – best outcome with propofol-isoflurane or propofol-sevoflurane

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**Rabbit anesthesia**

TTDex- 0.04-0.05 ml/kg, IM – healthy, elective Sx  
TTDex-0.02-0.03 ml/kg, IM- Sick rabbits  

better than 0.5 mg/kg-midazolam + butorphanol + 5 mg/kg-ketamine

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**Ferret/ guinea pig anesthesia**

TTDex 0.04 ml/kg, IM
Chinchillas – TTDex-0.02 ml/kg, IM profound sedation, isoflurane 0.5%, reverse with Antisedan

Potbellied pig anesthesia TTDex 0.3 ml per 10-20 lbs, IM

TTDex 0.1-0.2 ml/kg, IM (takes 30 min to work)

TTDex 0.01 mL/100 gram