ANESTHESIA FOR PEDIATRIC PATIENTS
“THE WEE ONES”

Sheilah Robertson - Senior Medical Director - Lap of Love Veterinary Hospice

1

Talking Points

2
Robust yet a vulnerable population

Physical
Psychological
Pain
Stress

Socialization
Isolation
Bad experience
Disease
Anesthesia mortality
Brodbelt et al 2007, 2008

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>0.17</td>
<td>0.24</td>
</tr>
<tr>
<td>Healthy ASA I-II</td>
<td>0.054</td>
<td>0.112</td>
</tr>
<tr>
<td>Sick ASA III-V</td>
<td>1.3</td>
<td>1.4</td>
</tr>
</tbody>
</table>

ASA status:
American Society of Anesthesiologists

Time of death

% of all deaths

- Premed
- Induction
- During
- Post-op

3 hours
Risk Factors - age or weight?

< 5 kg  < 2 kg

Perioperative mortality in cats and dogs undergoing spay or castration at a high-volume clinic

J.K. Levy\textsuperscript{a,\*}, K.M. Bard\textsuperscript{b}, S.J. Tucker\textsuperscript{a}, P.D. Diskant\textsuperscript{a}, P.A. Dingman\textsuperscript{a}

0.03%
Perioperative mortality in cats and dogs undergoing spay or castration at a high-volume clinic

J.K. Levy\(^a\), K.M. Bard\(^b\), S.J. Tucker\(^b\), P.D. Diskant\(^b\), P.A. Dingman\(^a\)

<table>
<thead>
<tr>
<th>NUMBERS &amp; SEX</th>
<th>MORTALITY %</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 of 42,349</td>
<td>0.009</td>
</tr>
<tr>
<td>34 of 71,557</td>
<td>0.048</td>
</tr>
</tbody>
</table>

44% < 6 months

27% < 6 months
Neonatal pain experiences

Pain in neonates is different

Johnston et al

PAIN 2011

International Association for the Study of Pain
Working together for pain relief
Neonatal Hind Paw Injury Alters Processing of Visceral and Somatic Nociceptive Stimuli in the Adult Rat
Wang et al 2004 J Pain

Effect of neonatal circumcision on pain response during subsequent routine vaccination
Taddio et al 1997 The Lancet
Central Plasticity [sensitization]

Activation of NMDA* receptors

Glutamate

*N-methyl-D-aspartate

Effect of age on post-operative pain following routine OHE Polson et al 2013 JFMS

< 4 months

Adults ± pregnant
# Effect of age on post-operative pain

<table>
<thead>
<tr>
<th>Mechanical Threshold</th>
<th>Simple Descriptive Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>Behavior</td>
</tr>
<tr>
<td>0</td>
<td>No pain – posture, can palpate wound</td>
</tr>
<tr>
<td>1</td>
<td>Mild pain – responds to wound pressure</td>
</tr>
<tr>
<td>2</td>
<td>Moderate pain – hunched, responds to wound pressure</td>
</tr>
<tr>
<td>3</td>
<td>Severe pain – miserable, hunched, growls, can’t palpate wound</td>
</tr>
</tbody>
</table>

Kittens had lower pain scores
No difference in wound sensitivity
Do psychological and physiological Stressors alter the acute pain Response to castration and tail docking in lambs

Don’t separate litter mates
Adverse event surveillance in small animal anesthesia
McMillan and Darcy 2016

<table>
<thead>
<tr>
<th>ADVERSE EVENT</th>
<th>RELATIVE FREQUENCY %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arousal / breakthrough pain</td>
<td>10.7</td>
</tr>
<tr>
<td>Hypoventilation</td>
<td>9.7</td>
</tr>
<tr>
<td><strong>Airway complications</strong></td>
<td><strong>9.4</strong></td>
</tr>
<tr>
<td>Hypothermia</td>
<td>7.0</td>
</tr>
<tr>
<td>Arrhythmias</td>
<td>4.7</td>
</tr>
<tr>
<td>Recovery excitement / delirium</td>
<td>3.0</td>
</tr>
<tr>
<td>Desaturation</td>
<td>3.0</td>
</tr>
<tr>
<td>Potential aspiration</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Intubation
Increased risks for minor, routine and short procedures

Small size
Laryngospasm
Swelling
Trauma
Lidocaine?
Masks

Supraglottic airway devices

http://docsinnovent.com/

Weight of cat

Order code

5kg

C6 = D10012

4 - 6kg

C5 = D10011

3 - 5kg

C4 = D10010

3 - 5kg

C3 = D10009

1.5 - 3kg

C2 = D10008

1 - 2kg

C1 = D10007
### Dose of propofol (mg/kg)

<table>
<thead>
<tr>
<th></th>
<th>ETT</th>
<th>V gel</th>
</tr>
</thead>
<tbody>
<tr>
<td>dose</td>
<td>5.6</td>
<td>4.1</td>
</tr>
</tbody>
</table>
Faster return to feeding
Fasting

NPO

??

?
Hypoglycemia?

**Research Study**
Cornell et al 2018 JFMS

Effect of transmucosal corn syrup application on post-operative blood glucose concentrations in kittens
Total Injectable protocols

DKB = Add 1 ml of dexmedetomidine, 1 ml of ketamine and 1 ml of butorphanol in a sterile vial creating 3 mls of the mixture.

DVM 360 February 2011

Dr Bushby - Mississippi State University

Review article Warne et al 2014 JAVMA

Evaluation of the perioperative analgesic efficacy of buprenorphine, compared with butorphanol, in cats
Fast track anesthesia and surgery

Research Study  Hasiuk et al 2015

Application of fast-track surgery principles to evaluate effects of atipamezole on recovery and analgesia in cats anesthetized with dexmedetomidine-ketamine-hydromorphone
Dexmedetomidine

Sedation
Dose related from 2 and 40 µg/kg IM

Analgesia
Only at 40 µg/kg IM

Slingsby and Taylor 2008 J Vet Pharmacol Ther

Alfaxalone

Approved for IV induction
IM, SC - off label
# IM combinations for sedation / anesthesia

<table>
<thead>
<tr>
<th>ALFAXALONE mg/kg (10mg/ml)</th>
<th>WITH [DRUG] mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Methadone 0.4</td>
</tr>
<tr>
<td>2</td>
<td>Butorphanol 0.2</td>
</tr>
<tr>
<td>2</td>
<td>Buprenorphine 0.02</td>
</tr>
<tr>
<td>2</td>
<td>Midazolam 0.25</td>
</tr>
</tbody>
</table>

Peak effect at 10 minutes  
Duration 20-35 minutes

Ketamine or Alfaxalone  
Dexmedetomidine  
Hydromorphone  
Meloxicam + IT block

Ketamine or Alfaxalone  
Dexmedetomidine  
Butorphanol  
Meloxicam + Scrotal block
Alfaxalone cats ate sooner

Bupivacaine (0.25%) 2 mg/kg

Benito et al 2016

Analgesic efficacy of intraperitoneal administration of bupivacaine in cats

Bupivacaine (0.25%) 2 mg/kg
Intratesticular block

1-2 mg/kg LIDOCAINE

2 mg/kg LIDOCAINE

Value of IT blocks

Blunted nociceptive response to surgery – HR, MAP, HRV

Reduced isoflurane requirements
Blunted HR and BP response to surgery
Post-operative Complaints

1. Feeling cold
2. Nausea
3. Pain

Warmth is analgesic in healthy newborns
Gray et al 2012 Pain
Predictors of temperature at the end of anesthesia

1. Duration of anesthesia
2. Reason for anesthesia
3. ASA Status
4. Baseline temperature

JVECCS

In vitro evaluation of the effect of hypothermia on coagulation in dogs via thromboelastography

Temperature changes clot kinetics and speed of fibrin build-up

Clots form more slowly but strength is unaffected
Delayed Recovery

- Increased solubility of inhalant agents
- Decreased MAC* 5% per 1°C fall

*Minimum Alveolar Concentration

Drug Metabolism

- Liver Enzymes
- Cardiac Output
- Hepatic Perfusion
Delayed return of spontaneous respiration
Depressed respiratory drive

Wound Infection – Risk Factors

Duration of surgery
Hypothermia

Beal et al/ Vet Surg 2000
“Prep” Solutions?

Does it matter?

Clinical study: Isaza et al 2017

N=43
8-18 weeks
Females

PREMED INDUCTION CLIP PREP SX

C = chlorhexidine
A = Alcohol
W = Water

P=0.84

97.8°F 36.5°C

35.1°C

35.0°C

FLEECE AND CIRCULATING WATER BLANKET
Clinical study: Isaza et al 2017

36.5°C

Premed | Induction | Clip | Prep | SX | Recovery

Focus

Fleece and circulating water blanket

Original Article

Warm air body blanket

The effect of short time periods of pre-operative hypothermia

The effect of short time periods of pre-operative warming in the prevention of per-operative

Horn et al 2012 Anesthesiology

Works well in people
Veterinary studies

Dog studies showed no benefit
Cats – not yet studies

Monitoring
ALWAYS ASSESS PAIN