

# WHAT MOVES YOU?

## Anesthesia & Pain Management in Small Ruminants

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*20 Jan 2016*





## Conflict of Interest Disclosure:

I have no relevant financial interest, arrangement or affiliation with any company or organization.

# Sheep & Goats

- Local & Regional Anesthesia
- Sedation
- General Anesthesia
- Analgesics
  - NSAIDs
  - Opioids
  - Other

# Local & Regional Anesthesia

- Advantages of local or regional
  - avoids recumbency
  - relatively few post op complication
  - easy to learn & perform
  - minimal assistance required
  - inexpensive
  - can achieve surgical analgesia



# Local & Regional Anesthesia

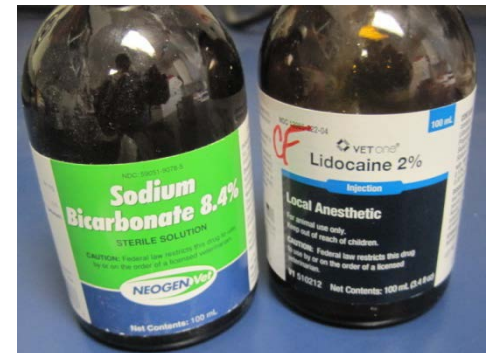
- Epidural
  - Lumbosacral
  - Caudal
- Cornual Nerve
- Inverted L block
- Distal Paravertebral \*
- Regional Bier Blocks \*

# Lidocaine

- More Sensitive!
  - Toxic dose = 10-12 mg/kg
- Maximum TOTAL (blocks + epidural) safe dose (~1 ml / 4.5 kg (10#) bw)

**5-6 mg/kg**

- Buffer with Sodium Bicarb
  - 1:10 dilution



# Lidocaine Overdose

- Signs include:
  - depression
  - behavior changes
  - ataxia
  - muscle tremors
  - opisthotonus
  - blindness
  - apnea
  - hypotensive shock
  - seizures
- Treatment:
  - Diazepam
  - 0.1–0.5 mg/kg IV



# Other local agents

- Bupivacaine – 0.25% to 0.5% solutions
  - Dose = 1 - 2 mg/kg
  - Slower onset (5-10 minutes)
  - Up to 3 x duration vs. lidocaine (2-4 hours)
  - No meat or milk withdrawals established.
- 2% mepivacaine
- 2% procaine



# Epidurals



# CAUDAL EPIDURAL



# Caudal Epidural

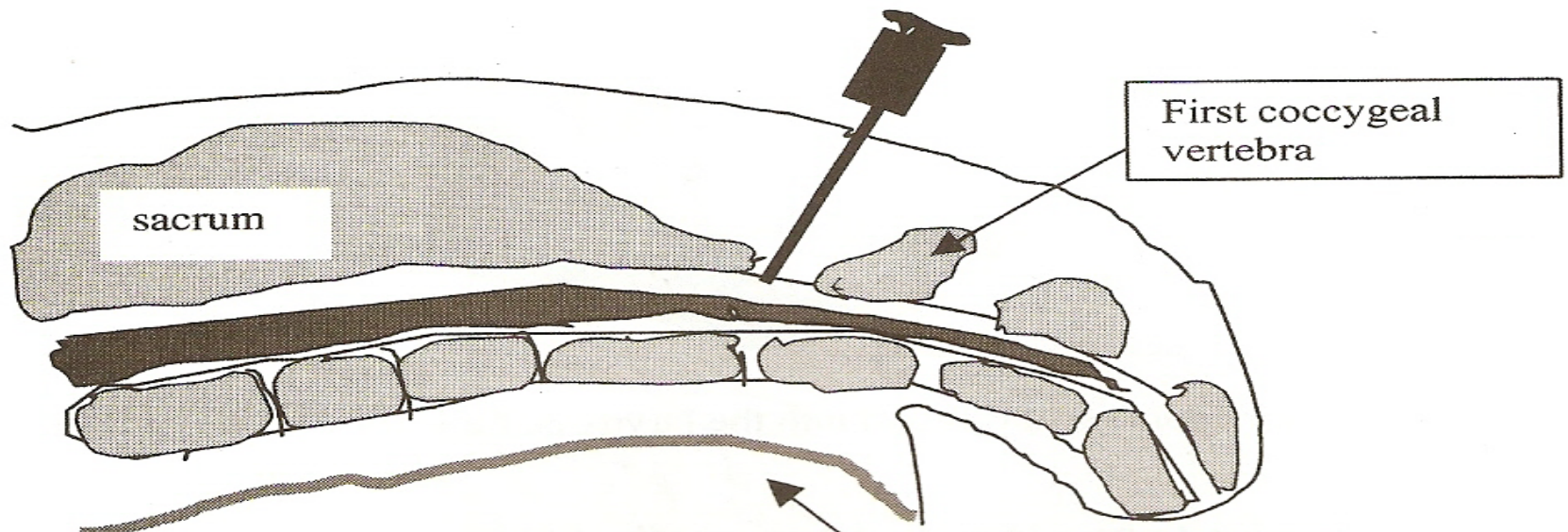
- Workhorse for all obstetrical interventions
- Desensitizes: perineum, vulva, vagina, rectum
  - Castrations, prolapses, dystocia , C sections, vasectomies
- Analgesia without ataxia (usually)
- Can be difficult if very short tail dock (sheep)

# Caudal Epidural

Workhorse of small ruminant ob work!

Location: 5<sup>th</sup> sacral - 1<sup>st</sup> coccygeal or 1<sup>st</sup>–2<sup>nd</sup> coccygeal interspace

Grasp high & pump tail







Shave a small area ( 2 “ square) and surgically prep the site





# Caudal epidural

- Needle angle = 90° angle to slope of tail head
- Slowly advance
  - Feel/see “POP”
  - Animal reaction
- Lack of resistance to injection
  - correct placement
- Hanging drop often doesn't work
- CSF: reduce dose by 1/2





# Caudal Epidural – Lidocaine/Xylazine

- Combined xylazine + lidocaine epidural:
  - Xylazine @ 0.07 mg/kg
  - Lidocaine @ 0.5 mg/kg
- Standard ewe (80 kg or 175 #):
  - 2 ml 2% lidocaine + 0.25 ml 20 mg/ml xylazine in 3 ml syringe
- Onset 5-10 minutes, duration 24-36 hours
- Do NOT combine with other systemic alpha 2s (xylazine, detomidine)



# Xylazine + Lidocaine

- Some hind limb ataxia in 41% sheep
  - 24 hours
  - May lay down
- Eliminated forceful abdominal straining
  - 24 hours (92%)
- Minimal to no sedation or other systemic effects of xylazine observed
  - NO excessive salivation or rumen distention, cardiac effects



# Lidocaine only

- No bicarbonate, no epinephrine
- 0.5 mg/kg
  - 45 kg: **1.0 ml of 2%**
- Onset 1-5 min, duration 1 hour





# High Volume Lidocaine Epidural

- Anesthesia to thoracolumbar junction
- Caudal epidural space
- 1 ml/10 kg BW 2% Lidocaine
  - 200# ewe= 8 ml 2 % lidocaine
  - substantial portion of total safe dose of lidocaine

# LUMBOSACRAL EPIDURAL



# Lumbosacral Epidural

- Useful in ultra-short tailed sheep
- Analgesia from paralumbar space back
  - Onset- 5 min
  - Lasts 3-4 hours
  - Pelvic limb ataxia
- Lidocaine
  - 0.4 mg/kg
  - not xylazine combo



# Lumbosacral Site



# Lumbosacral Epidural

- 0.3 to 0.5 ml of 2% lidocaine per 10 kg BW Lidocaine
- Insert needle (18-20 g x 1.5 or 2 in) at  $\sim 90^\circ$ 
  - Advance slowly: See or feel “pop”
- Injection should be without resistance if properly positioned





# Cornual Nerve Block

- Two sites per horn required in goats
  1. Cornual nerve branch of zygomaticotemporal nerve
    - Midway between lateral canthus of eye and lateral horn base
  2. Cornual branch of infratrochlear nerve
    - Midway between medial canthus of eye and medial horn base



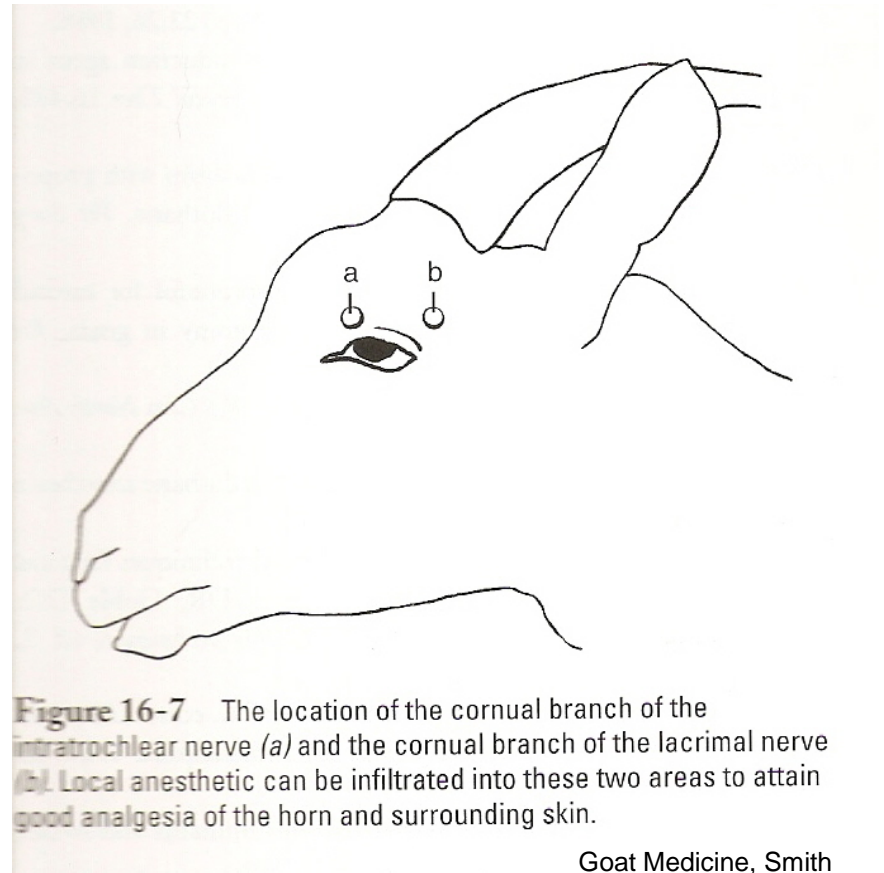


# Disbudding Kids

- Recommend done before 10 days of age.
  - Horn buds have not attached themselves to frontal bones.
  - Local block +/- sedation (detomidine/ketamine)
    - easy to remember
    - reversible w/ atipamezol at same volume
    - Kids: 4.5 kg = 0.01 cc Dormosedan® + 0.1 cc ketamine IV
      - Dilute alpha-2's for safety
  - Other sedation: torbugesic/dexmedetomidine, diluted xylazine



- Adult goat:
  - 1-2 mls 2% lidocaine at 2 sites:
    - halfway between lateral canthus of eye & lateral base of horn
    - halfway between medial canthus of eye & medial base of horn
- Use diluted lidocaine for young kids.
  - ¼ cc 2% each site
    - Dilute to 1% to get adequate volume
    - Buffer with Sodium Bicarb





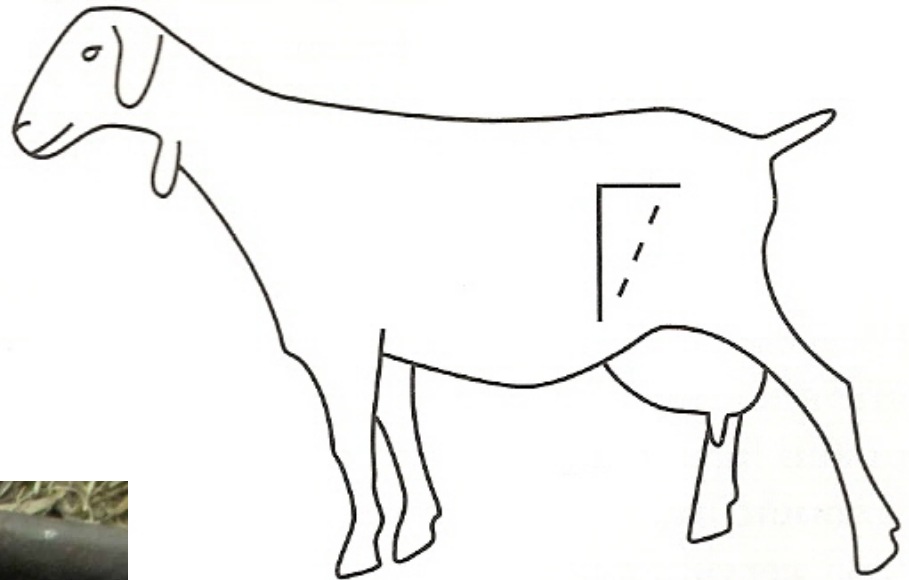
# Disbudding Kids

- Recommend done before 10 days of age
  - Horn buds have not attached themselves to frontal bones.
- Local block
  - ¼ cc 2% each site
  - Dilute to 1% & buffer with Sodium Bicarb
- +/- Sedation
  - Dilute alpha-2's insulin & reverse w/ atipamezol at same volume
  - Detomidine/ketamine – IV, same syringe
    - easy to remember
    - Kids: 4.5 kg = 0.01 cc Dormosedan® + 0.1 cc ketamine IV
  - Torbugesic/dexmedetomidine
    - Dexmedetomidine @ 0.004-0.005 mg/kg + Torbugesic @ 0.33-0.4 mg/kg
    - 4 kg kid: 0.03 ml dexmedetomidine + 0.12 ml torbugesic



# Inverted L block

- Duration: ~ 1.5 hours
- No visceral anesthesia
- May not provide full anesthesia of deep layers & peritoneum



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# Management procedures

tail dock, castration, disbud

## 3 points to consider

1. What age?
  2. What method?
  3. Use of preemptive analgesia? Sedation?
- Preoperatively local anesthetic for castration and tail docking can improve post operative comfort and behavior
    - +/- long acting NSAID
  - Needs to be but practical & efficient!

# SEDATION



# Sedation

- Butorpanol
  - 0.05-0.5 mg/kg, IM or IV
- Diazepam
  - 0.5 mg/kg IV
- Ket-Stun Technique (D. Anderson)
  - Butorphanol 0.02 mg/kg
  - Xylazine 0.04 mg/kg
  - Ketamine 0.1 mg/kg
    - IV, IM or SQ
    - 45-60 min duration of sedation and mild disassociation.

# GENERAL ANESTHESIA

# Gas Anesthesia

- Induction
  - Propofol 4-8 mg/kg IV
  - Ketamine/Valium
  - Ketamine/alpha-2
  - Telazol
  - Mask (3-4% isoflurane or sevoflurane)
- Intubation
- Maintenance – 1-2% iso or sevo
  - 0.5 to 2 L/min O2 flow rate





# Intubation



Need: Speculum, long blade laryngoscope, stylet

- Point nose to ceiling
- Preload tube on stylet
- Pass stylet through oral cavity and arytenoid cartilages
- Feed tube past the arytenoids
  - Withdraw stylet
  - Secure tube-tie
  - Inflate cuff
- Stylet
  - Polypropylene dog catheters
  - Thin aluminum rod



# **INJECTABLE GENERAL ANESTHESIA**



# Alpha 2 Agonists

- Xylazine, detomidine, dexmedetomidine
  - All alpha-s's can produce sedation, bradycardia and respiratory depression
  - Diuretic
- Xylazine much greater risk
  - Two concentrations available
  - Sever cardiac depression→Hypoxemia, Death
    - Av block, HR, CO, BP decrease
  - Pulmonary Edema-individual/breed related, highly variable
  - Reduced rumen motility

# Xylazine

Dose rate is small, dilute preparations and measure accurately

## Xylazine dilution 1 mg/ml

0.5 ml (20 mg/ml) xylazine + 9.5 ml sterile water/saline  
= 1 mg/ml

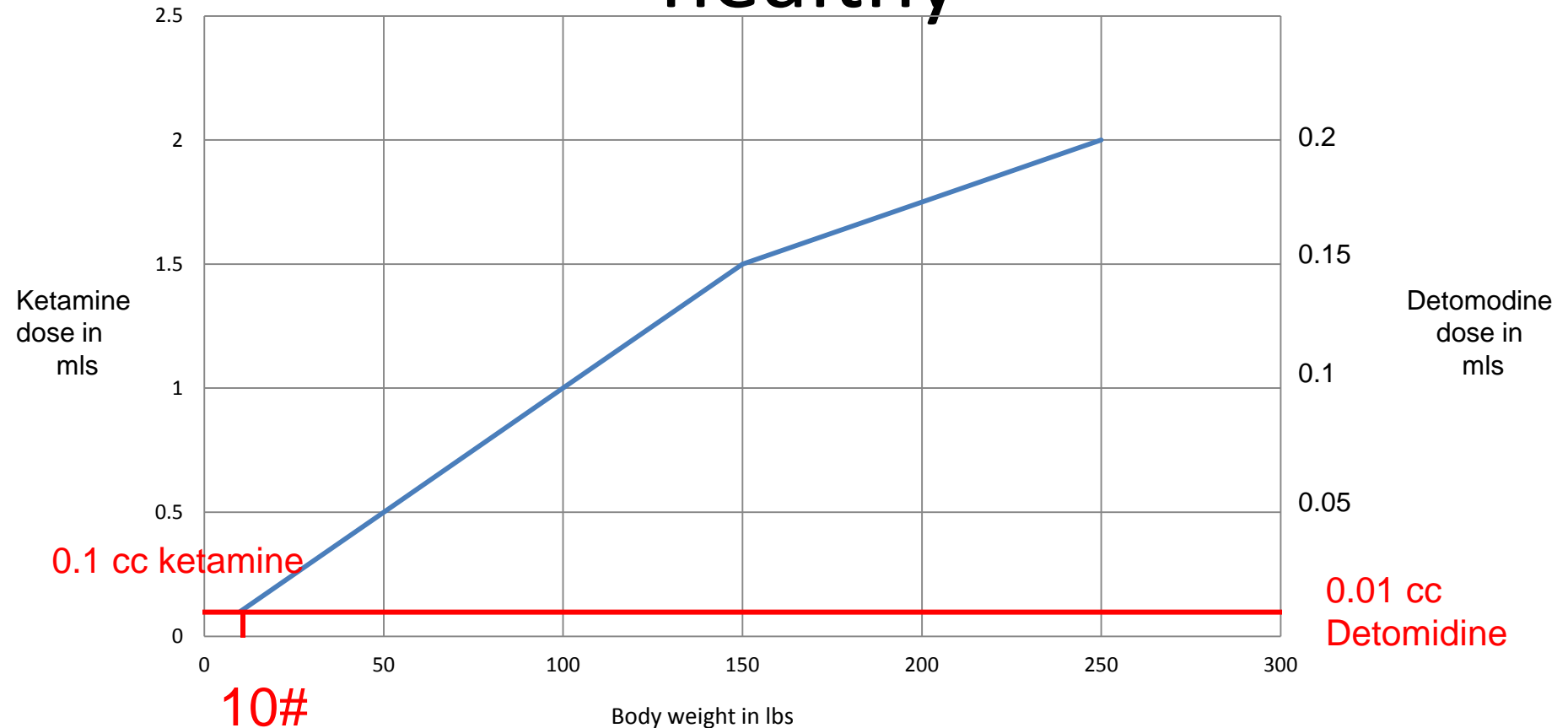
Kids - 0.1 mg ( Nigerian Dwarf) – 0.25 mg / Kid IM

(Mary Smith, AASRP Listserve)

# Ketamine / Detomidine Dosing

- Ketamine (100 mg/ml) & Detomidine (Dormosedan<sup>®</sup>, Zoetis) (10 mg/ml)
- **WATCH UNITS**
- Healthy, young, uncompromised patient
  - Up to ~150 #:
    - ketamine 1 cc/ 100# (45 kg) BW + 0.1 cc Dormosedan<sup>®</sup>/100# (45 kg) BW
    - Additional amounts for animals > 150 are added at half that up to 2.0 / 0.2 cc max.
- Geriatric, compromised- reduce by 15-20%

# Ketamine / Detomidine Dosing- healthy



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# Measuring micro-doses

- Use a low dead space, U100 insulin syringe for alpha-2 dosing to increase accuracy.
  - 1 unit = 0.01 ml



Low Dead Space= 0.002ml

U100 insulin syringes

100 units = 1 cc

1cc, 0.5, 0.3 cc sizes



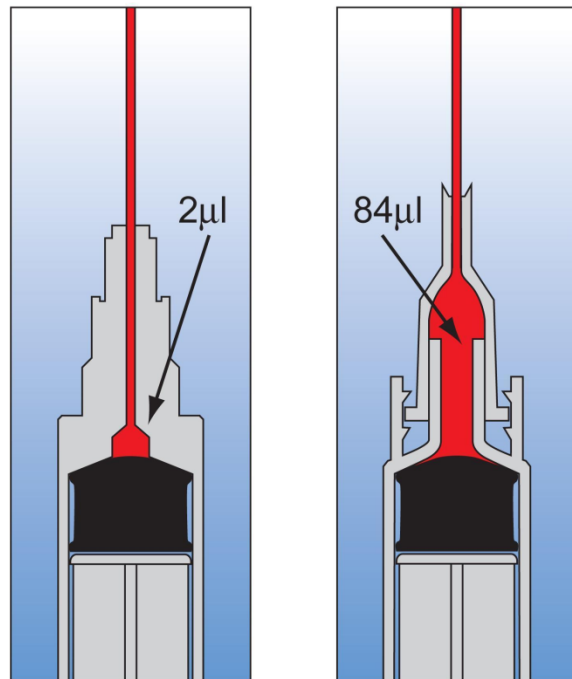
10 u = 0.1 cc = 100# dose

1 u = 0.01 cc = 10 # dose



# Dead Space Comparison

**Figure 1: Mean Volume of Fluid Retained with Plunger Depressed**



Low dead-space syringe

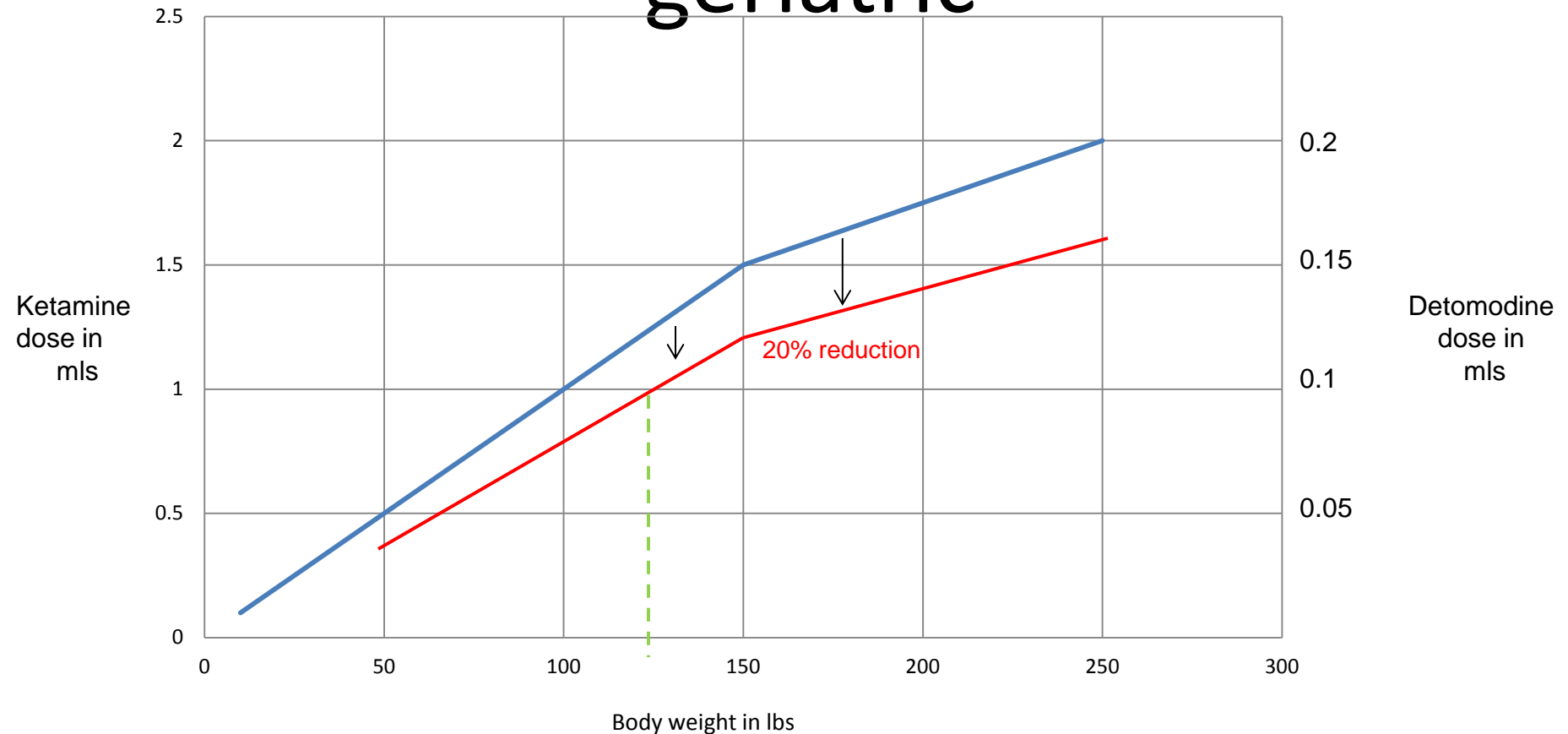
High dead-space syringe

0.084 ml of dead space

= 84 #'s worth of detomidine

Zule, W., "Modeling the effect of high dead-space syringes on the human immunodeficiency virus (HIV) epidemic among injecting drug users", 2010.

# Ketamine / Detomidine Dosing-geriatric



Geriatric 125# = 1.0 cc ketamine + 0.1 cc detomidine

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# Ketamine / Detomidine continued

- 15-25 minutes solid anesthesia
- Additional sedation/duration:
  - add diazepam (0.05-0.1 mg/kg)
  - $\frac{1}{4}$  -  $\frac{1}{2}$  of initial dose ketamine
- Reversible with Atipazemol (Antisedan<sup>®</sup>, Zoetis)
  - same volume as Dormosedan<sup>®</sup>.



# Torbugesic/Dexmedetomidine

- Torbugesic (10mg/ml) & dexmedetomidine (Dexdomitor<sup>®</sup>, Zoetis) (0.5 mg/ml)
- kids (AASRP Listserve)
  - Dexmedetomidine @ 0.004-0.005 mg/kg
  - Torbugesic @ 0.33-0.4 mg/kg
  - IV, same syringe
  - Reverse with atipamezol (diluted)
  - 15-20 minutes anesthesia
  - 4 kg kid: 0.03 ml dexmedetomidine + 0.12 ml torbugesic
    - Up and walking in 10-15 min



# Telazol<sup>®</sup> (Zoetis)

- Tiletamine/zolazepam 1:1 = 100 mg/ml
  - Need immobile longer than 15-25 minutes
    - 45-90 minutes
  - No one to give additional IV doses
- 3-5 mg/kg IV
  - Additional 0.5-1.0 mg/kg –prolong duration



# Other options...

- Ketamine/diazepam
- Ketamine/xylazine
- Single agents – any of previously mentioned drugs

# Analgesia

- Changing standard of care and animal welfare considerations
- Benefit vs. risk analysis
- Pain→stress→delayed healing & complications
- Prevent complications with appropriate drug and dose choice in suitable patient

# NSAID

- Anti-inflammatory, Analgesic, Antipyretic
- Block inflammatory pathways
- Non-sedating
- Longer duration
- Variety of administration routes- IV, IM, SQ, PO
  - Readily absorbed through GI tract
- Ensure adequate hydration status



# NSAIDS- Flunixin meglumine

- Flunixin meglumine (50 mg/ml)
  - Non selective PG inhibitor
  - Acute inflammation/tissue damage- esp. viscera (i.e. surgery)
  - Labeled IV @1.1 - 2.2 mg/kg q 12-24 hours
    - 45 kg: =1.0 ml
    - IM & SQ= tissue damage and prolonged withdrawals
    - SQ @ 2.2 mg/kg sheep withdrawal from FARAD= 60 days
    - FDA warns that use other than IV is in violation of AMDUCA
    - Oral @ 2.2 mg/kg



# NSAIDS - Meloxicam

- Anti-inflammatory, analgesic and antipyretic
- Injectable - 5 mg/ml, 20 mg/ml (CA)
- Oral
  - 7.5 mg & 15 mg tablets
  - 0.5 & 1.5 mg/ml liquid (K9), 15 mg/ml (LA- CA)
- Longer duration of action= SID to EOD dosing
- 2 mg/kg PO loading dose, then 0.5 -1 mg/kg PO q 24-48 hrs
- 0.5 mg/kg IM or SC once( CA cattle dose)



# NSAIDs- Meloxicam



- Advantages
  - Semi-Selective COX 2 inhibitor
  - Inexpensive tablets
    - US\$0.11 / dose @ 45 kg BW
  - Well tolerated longterm with minimal side effects
  - Easily administered
    - Eat in handful grain or peanuts
  - Clinically: arthritis, long term, post surgical, illness

# Opiods

- Potent visceral analgesia
- Controlled substances
- Some sedation, limited excitation in ruminants
- Shorter duration of action than NSAIDS
- In combo with low dose alpha 2=synergistic effects



# Butorphanol

- Sedative, analgesia
  - 3-5 times more potent than morphine
- 10 mg/ml
- Dose: 0.05-0.5 (up to 1.0) mg/kg IM or IV up to q 4 hrs
  - Usually 0.1-0.2 mg/kg = 45 kg = 0.5-1 ml
- Excellent in combinations
- Fewer GI & respiratory side effects than other opioids



# Opioids - others

- Buprenorphine (Buprenex®)
  - 0.004mg/kg IM every 12 hours (goats)
- Fentanyl Patch
  - 0.2 mg/kg, q 2-3 days
- Morphine
  - Epidural – 0.1 mg/kg (15mg/ml morphine) plus 2 cc Lidocaine
- Naloxone reverses morphine/ butorphanol /buprenorphine
  - 0.01-0.02mg/kg IV or IM, redose q 2 -1 hour if necessary.

# Ketamine

- Potent analgesia at sub-anesthetic doses
  - 0.25-0.5 mg/kg IM q 6-8 hours
- Better somatic pain
- No respiratory depression
- Stimulated cardiovascular system

Gabapenten- with NSAID – 900 mg/day sid

# My preference

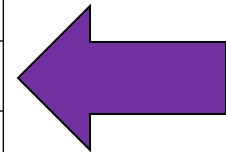
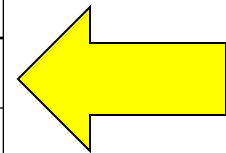
- Ketamine/Dormosedan
  - Pre-med with butorphanol
  - “bump” with valium first, then ½ dose ketamine.
- Telazol<sup>®</sup> - If no one to give additional IV drugs and need longer than 10-15 minutes
- I Never use xylazine except in epidurals





# Cost comparison

Drug Combo	Cost per 45 kg	Cost per 4.5 kg
Ketamine/ Dormosedan	\$ 1.16	\$ 0.12
Telazol	\$ 23.13	
Torbugesic/ Dexdomitor	\$ 12.26	\$ 1.23
Ketamine / Diazepam	\$ 6.44	
Ketamine /Xylazine	\$ 1.45	
Ket Stun	\$ 3.48	
Lidocaine/ Xylazine Epidural	\$ 0.31	
Lidocaine block (max)	\$ 0.23	
Butorphanol	\$ 5.73	



# Questions?



# Contact Info

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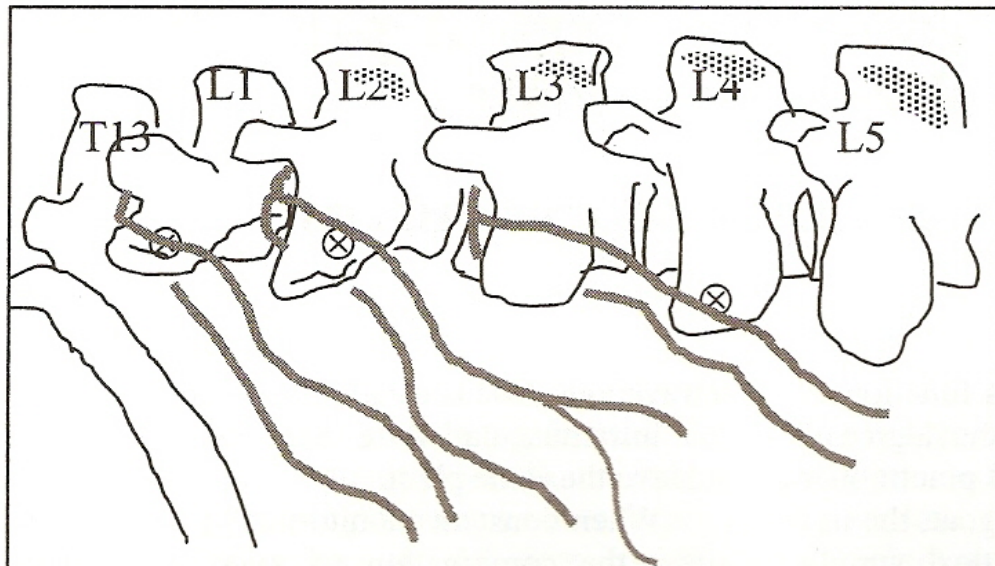


**American Association of Small Ruminant Practitioners**

Removed slides

# Paravertebral

- Insert needle parallel to transverse process of L1, L2 and L4.



⊗ needle insertion site



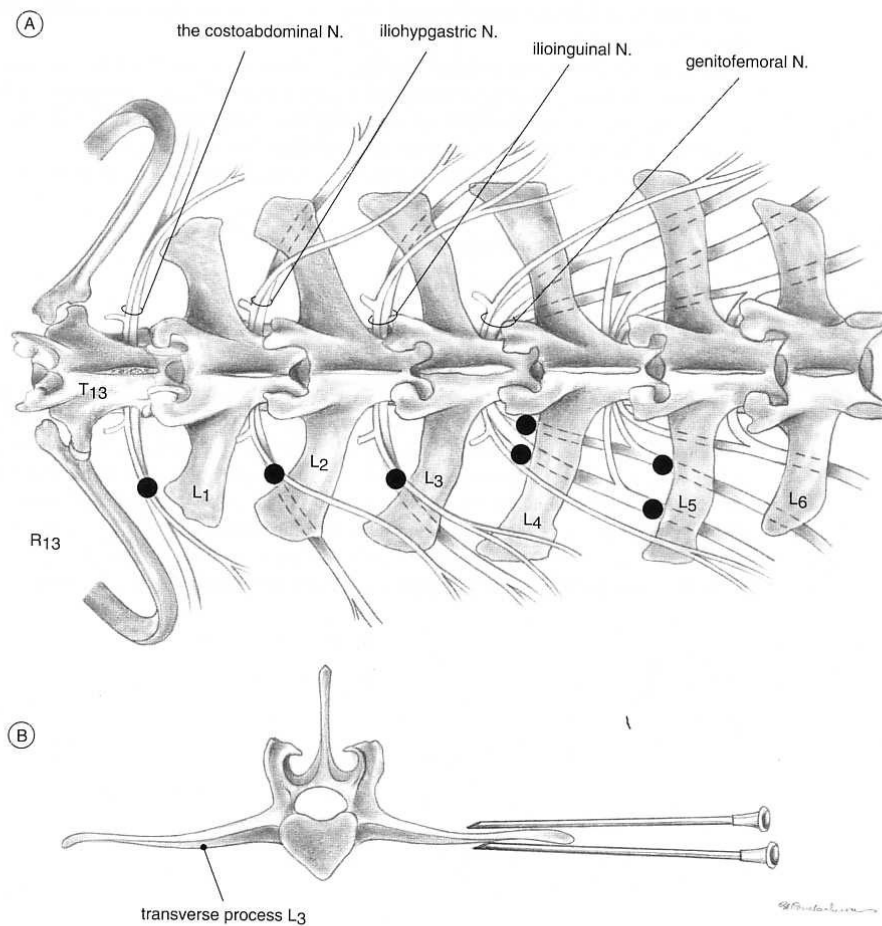


Fig. 2.5. The paravertebral anesthesia in the goat: A. Proximal paravertebral anesthesia (dorsal view); B. Distal paravertebral anesthesia, cranial view (dots = sites).

- Insert needle parallel to transverse process of L1, L2 and L4
- Inject ~ 5 cc 2% lidocaine
  - fanning pattern above and below processes
  - 15 ccs total
- Onset = 5 minutes
- Duration = 2 hrs

# Bier Blocks

- Regional / limb analgesia for up to 90 minutes.
- Dose = 1 mg/ kg lidocaine
  - diluted to a total volume of 1 mL/4.5 kg with sterile saline
- Injected through a butterfly catheter below a tourniquet placed on limb.