

# C-section: why and how ?

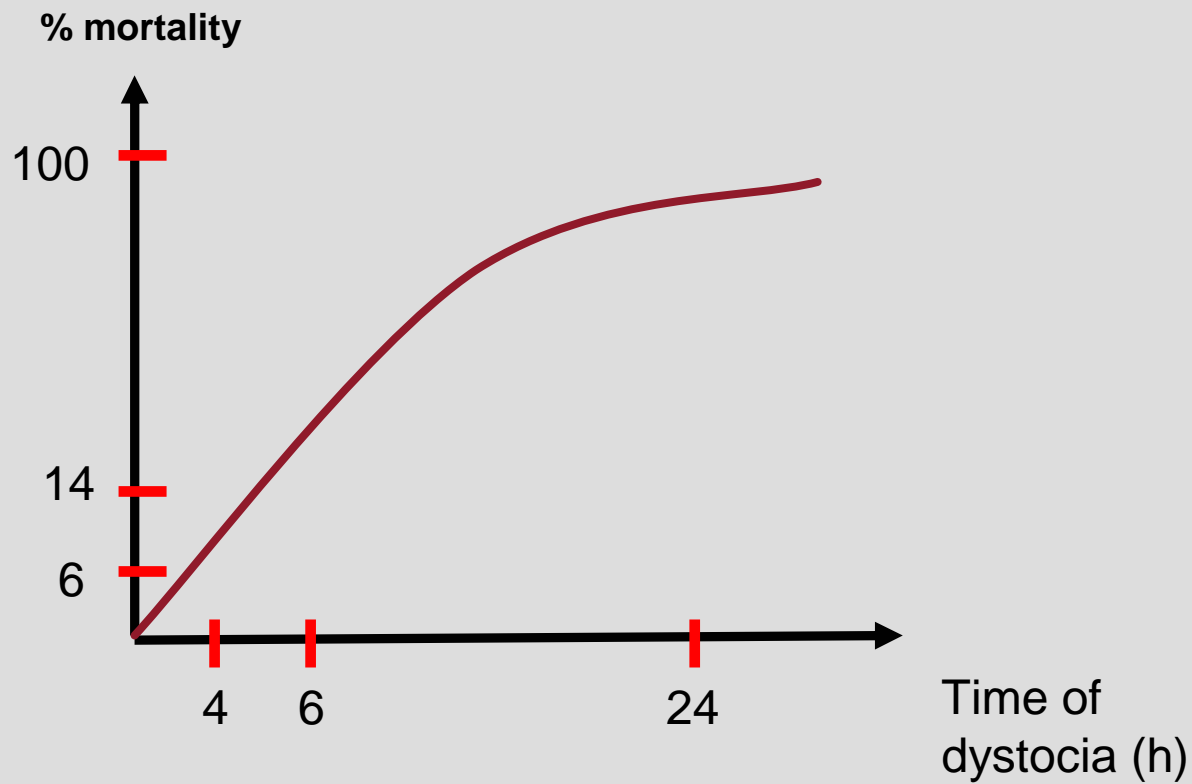
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[www.vetreproduction.com](http://www.vetreproduction.com)





# Dystocia and neo-mortality



*Darvelid AW, J Small  
Anim Pract, 1994*



# Dystocia and C-section

Pregnancy



5 - 16% \*

Dystocia



60 - 70% \*\*

C-section

\* Fontaine et al, 2007; Linde-Forsberg et al. 2005

\*\* Bergström et al. 2006 ; Münnich, ISCFR, Vienna, 2008



# Dystocia: Risk factors

- Boston terrier, bulldog, French bulldog >80%
  - mastiff, Scottish terrier, miniature bull terrier, German wirehaired pointer, Clumber spaniel, Pekingese and Dandie Dinmont terrier ...
- Nulliparous > 6 years old
- Number of puppies
  - < 3 puppies
  - >8-12 puppies
- History of uterine inertia
- Vestibulo vaginal anatomical abnormality



# Dystocia: Risk factors

- Fetal Malposition / malpresentation non reducible
- Fetal distress HR<150 bpm
- Lack of emergency veterinary facilities in proximity
- Metabolic disorder or others in late pregnancy
- Fetal monstrosity
  - Hydrops



# C-sections: Indications

- Medical treatment : no efficacy
- Dystocia
- « Convenience » C-section
  - When risk factors



# C-section: Objectives

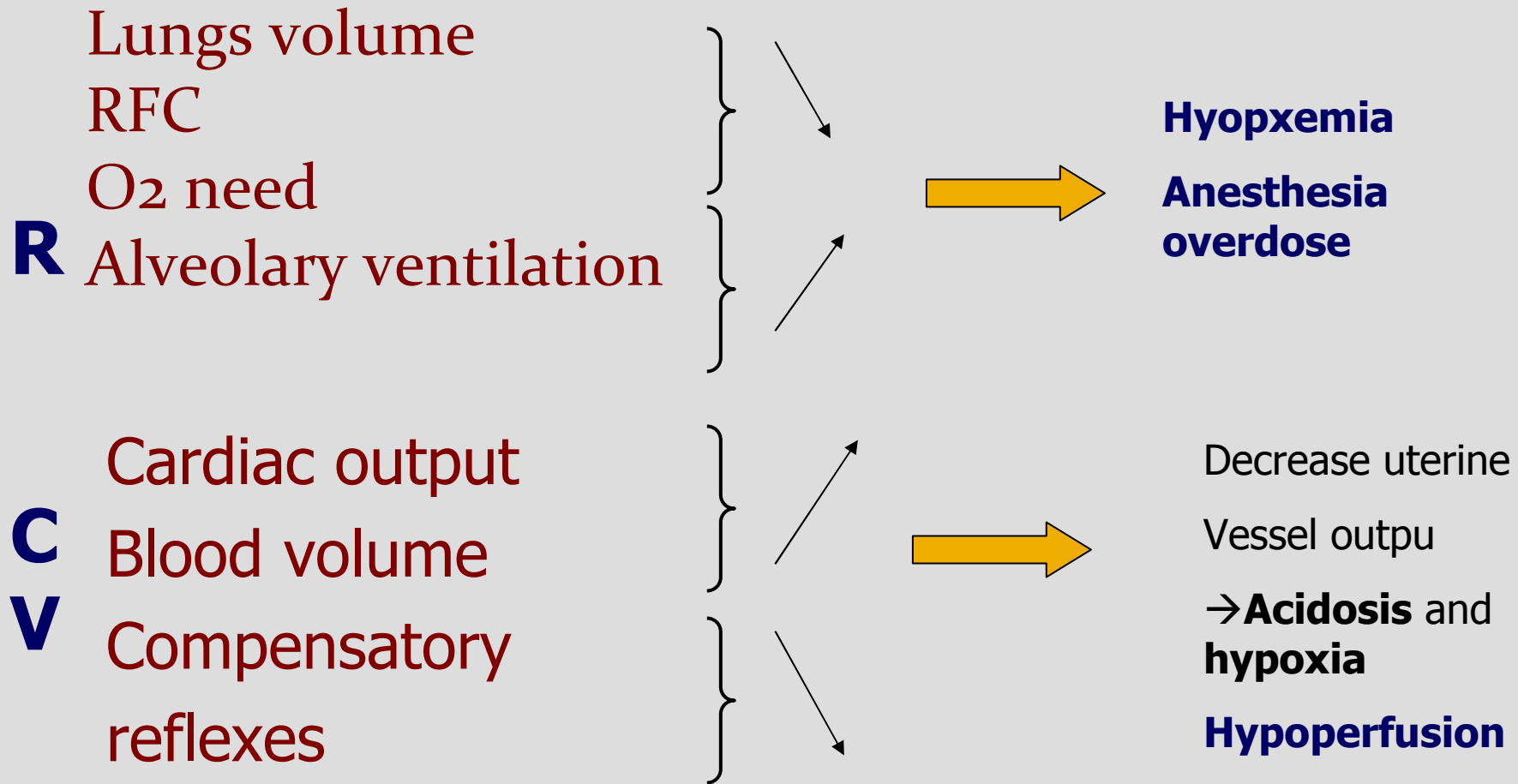
- Neonates able to:
  - Breathe
  - Move
  - Suckle
- Bitch
  - alive
  - Maternal behaviour
  - Milking
- Key factor
  - Anesthesia management
  - Surgical procedure

# Anesthesia and C-section





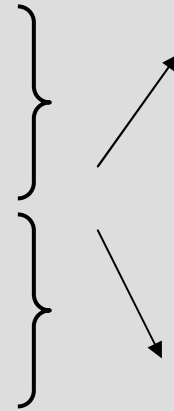
## Some reminds ...





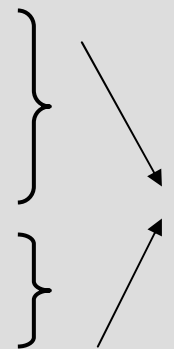
## Some reminds ...

**N** Sedative effects  
P4 and  $\beta$ -endorphines  
Biotransformation  
Barbiturics



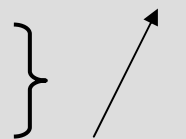
**Sensitivity increases** to anesthetic agents  
Becareful to barbiturics

**D** Gastric vidange  
POS tonus  
Gastrine



**Regurgitation** during  
Induction and  
Extubation

**M** Abdominal volume



**Hypoventilation**  
**Hypotension**



# Bitch preparation

- Stomach → full = **Intubation systematic**
- **Fluidotherapy** : 10-20 ml/kg/h (2/3 Glc 5% + 1/3 NaCl 0.9% + 20 mEq/l K<sup>+</sup>)
- **Anti-vomiting**: metoclopramide 0.2-0.4 mg/kg IM, effective after 10' during 1-2 h,
- (**Preoxygénation** : 250 ml/kg/min by mask during 3 to 5 min.)



# Bitch preparation

- **Premedication to avoid**
  - Acepromazine à 0.03 mg/kg SC
    - Increase hypotension
  - Glycopyrrolate: 0.01 mg/kg IM soit 0.3 ml/10kg
  - Diazepam: 0.2-0.4 mg/kg IV
    - *Antagoniste* : Flumazénil (Merck) 0.01 mg/kg IV
  - Medetomidine (Domitor<sup>®</sup>) : 5-10 µg/kg IV SC
    - *Antagoniste* : Atipamezole



# Induction

## Rapid intubation

- **Thiopental** to avoid: respiratory depression, **sleeping**, suckling reduction, slowly metabolize.
  - *Suckling reduction during 4 days in humans*
- ± **Ketamine** possible but prolonge neonate resuscitation necessary.
  - 4 6mg/kg IV + diaeépam 0.2 04 mg/kg
- ? **Medetomidine** : analgesic, myorelaxation, antagonists, but respiratory depression and major peripheric vasoconstriction
  - 20 4µg/kg IV then 1 drop sub lingual (neonates)
- + **Propofol** : reference, respiratory depression but rapidly metabolize
  - 4 6mg/kg ' IV.
- + **Alfaxan** respiratory depression but rapidly metabolize



# Maintenance

Reactive anesthesia

- **Injectables** : aggravation of depression

+ **Volatils**

best control but also respiratory depression

**Isoflurane** : rapid effect, less metabolize comparing to halothane (< 1%), éliminé rapidement



# Analgesia

- **Morphine** : 0.1 – 0.2 mg/kg IV, after neonate extraction  
*Antagoniste* : Naloxone : 0.004 – 0.04 mg/kg (0.01 – 0.1 ml, solution 0.4 mg/ml)
- ? **Meloxicam**: 1 injection



# Our Gold standard protocol

- (Mask Pre-oxygénation)
- Induction with Propofol
- Isoflurane + O<sub>2</sub>
- Lidocaine white line infiltration
- Neonates in pediatric incubator (supply by O<sub>2</sub> < 1 h)

# C-section Planification or *in Emergency*





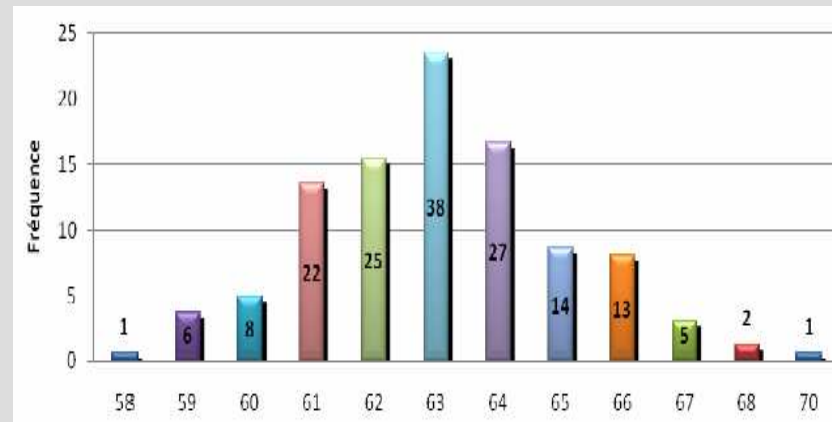
# Why a schedule C-section

- Emergency CS /Planned CS (all puppies alive): 0.31 \* [807 litters, 3907 puppies] Moon et al., 2000
- Commonly by night
- Vet alone with the breeder



# How to plan !

- **Highlighting drop of P<sub>4</sub> (<2 ng / ml):**
  - Starting 61 days post-ovulation
  - Following rectal temperature drop (2-3 times a day, beginning 57 d post-mating)
  - Starting 55-60 d of estimated gestation length assessed by ultrasound
    - operator-dependent and approximate (80% reliable to  $\pm 2$  days. In practice, this technique is unsatisfactory)



- **Before Induction of parturition** using aglepristone



# C-section and planification

- **Recent studies:**
  - Parturition induction with aglepristone before the drop of progesterone
    - Fiéni et al, 2001; Baan et al, 2005; Fontbonne et al, 2008
- **Our study: C-section before drop of P<sub>4</sub>**
  - Alizine (10-15 mg/kg) 60-61 d post-ovulation
  - C-section > 12 h post-injection (20-22 h)



# C-section and planification

- **Alizine:**
  - Imitate drop of P<sub>4</sub>
  - Stimulate Prolactine and Oxytocine secretion
- Before parturition and after surfactant production (61 d post-ovulation)
  - Kutzler, ISCFR, Vienna, 2008



# Results

- 0 % bitch morbidity
- No parturition at the time of C-section
  - 61 d post-ovulation:  $P_4 > 5$  ng/ml
  - 62 d post-ovulation:  $P_4 < 2$  ng/ml (18% of cases, personal data)
- > 90% bitch milking
  - in the 4 hours after birth



# Results

- 0% fetal mortality
- < 5 % neonate mortality
  - vs 20% in emergency, Moon et al. 2000
- Normal neonate weight range

# Neonate anesthesia

## General considerations





# Respiratory system

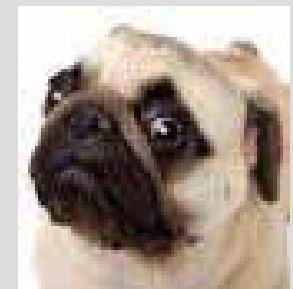
## ■ Respiratory system

- tidal volume is similar to adult
- 2-3x higher tissue oxygen consumption
- ➔ higher respiratory frequency (20-30 bpm)



## ■ Anatomy:

- Tongue relatively large in relation to pharynx
- Narrow larynx
- Higher compliance of thorax
- Low functional residual capacity





# Respiratory system

- Hypoventilation/rebreathing expected to increase
- Hypoxia if no oxygen is supplemented
- attention barotrauma!
- **In practice:** spontaneous ventilation, but adequate respiratory monitoring and O<sub>2</sub> supplementation recommended



# Cardiovascular system

- Low pressure, low volume, low peripheral resistance
- Immature autonomic nervous system in neonates
- CO is primarily dependent on HR:  
$$CO = HR \times SV$$
- Fixed SV
  - Loss of 5ml/kg → severe hypotension
- Vascular content is more or less fixed:
  - Bad tolerance to volume-overload
  - Bad tolerance to hypotension
  - Haematopoiesis immature until 2-3 months



# Hepatic system

- Immature hepatic microsomal enzyme system
  - Decreased metabolism of drugs

- Low plasma albumin concentration
  - Increased free fraction of most AE drugs

- Minimal glycogen stores
  - Highly sensitive to hypoglycaemia
    - Reduce pre-anaesthetic fasting period!
    - Reduce postoperative fasting period!

Until 8 weeks  
of age



# Pharmacological consequences

- Weigh patients carefully
- Avoid medication with pronounced hepatic metabolism
- Dose reduction
- Use dilutions of anaesthetics



# Renal system

- Suboptimal kidney function < 8 weeks:
  - Avoid excessive fluid administration
  - Use infusion pump, burette system, paediatric flow regulator or SC injection





# Thermoregulation

- Less subcutaneous fat
- High BSA/BW ratio
- Decreased possibility to shiver
- Depressant effect of anaesthetics
- Higher critical temperature



Increased risk of hypothermia





# Limit Hypothermia

↘ T° ⇒ ↗ Morbidity

- Bradycardy ; ↘ Cardiac output ; Hypotension
  - Metabolic and respiratory acidosis
  - Cerebral irrigation ↘ 6-7%
  - ↘ Immunity
- **Reduce surgical duration**
    - Clip surgical site before induction
    - Intravenous catheter before induction
  - **Fight against hypothermia**
    - Bair Hugger<sup>®</sup> (Warm air cocoon)
    - Warm saline solution perfusion
    - Peritoneal rinsage 45°C
    - Kettle (7min microwave=12 h of hot)
    - Pediatric incubator after surgery





# Pediatric anesthesia Preparation

- **Fasting**
  - No fasting of non weaned animals
  - > 6 weeks of age: deprivation of food max. 3h
- **Premedications**
  - To prevent anaesthetic induced bradycardia
  - To decrease bronchial secretions



# Pediatric anesthesia Premedication

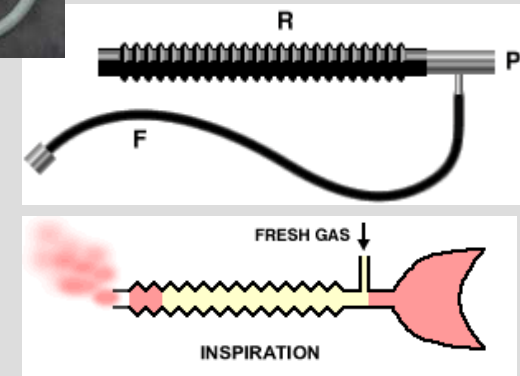
- **Glycopyrrolate**
  - smoother onset
  - longer duration of effect
  - less chance on sinus tachycardia
  - 0.01 – 0.02 mg/kg SC, IM, IV
  - Unpredictable action < 2 weeks of age
- **Opioids: (methadone, morphine, buprenorphine, butorphanol)**
  - Excellent analgesia + sedation
  - Dose reduction
  - Well tolerated by paediatric patients, but:
    - Bradycardia:
      - Combine with anticholinergics
    - Respiratory depression
  - Possibility to antagonize
  - IV, IM, SC, epidural/spinal, transdermal





# Pediatric anesthesia Induction and Maintenance

- **Inhalant induction**
  - 4 L/min 100% O<sub>2</sub>
  - 3 – 5% Iso; 5 – 8% Sevo
- **Injection induction**
  - Not recommended before 4 weeks of age
  - Alfaxan: no study before 12 weeks of age
- **Maintenance**
  - Preferably intubation
  - Always oxygen supplementation!
  - Non-rebreathing systems:
    - T-piece/Bain system: spontaneous breathing
    - High oxygen flow: 200- 300 mL/kg/min
  - Rebreathing system
    - Paediatric circlesystem: ventilation possible
    - Watch out for barotrauma





# Surgery preparation

- **Appropriate-sized clipper blades**
  - Facilitate precise clipping
  - Reduce skin laceration
- **Quick skin preparation**
  - Avoid alcohol
    - Evaporation and cooling effect:  $\searrow T^{\circ}$
  - Warm chlorhexidine solution
    - Prolonged residual activity
    - Gram+ and Gram-
    - No skin irritation
- **Antimicrobial therapy if**
  - Contaminated/Dirty procedure
  - Surgical duration > 90 min.
  - Debilitate animal





# Thank you for your attention !

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Centre de Reproduction des Carnivores du Sud-Ouest (CRECS)

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