Objectives

• Brief review of the “normal” neonatal kitten
• Brief review of common disease in neonates
• Care for the sick neonate
  – Thermoregulation
  – Fluid support/catheterization
  – Medication administration
  – Feeding
  – Blood transfusion
• Serial monitoring

Normal neonatal kitten

• Birth – 2 weeks = neonatal period
• 2-4 weeks = transition period
• >4 weeks = socialization/juvenile period
• Birth weight: 100 g +/- 10g
  – Best predictor of survival
  – Underweight if endocrinopathy, poor maternal nutrition, uterine crowding, congenital anomalies
  – Double weight in 10d (10-15g/day) if nursing
Normal neonate - Behaviors

- Sleep 90% of day (deep sleep only for 4 weeks)
- Standing by 10 days
- Able to learn by 3 weeks
- Eyes open at 10-14 days (cloudy cornea clears 24 hrs)
  - Corneal reflex present at birth
  - Menace -- learned after 3 weeks age
  - PLRs difficult to assess until 21d old
  - Reflex irritation from time eyes open
- Reflexes
  - Born with righting, withdrawal, anal/urinary reflex
  - Sucking until 3 weeks age
  - Rooting reflex present at birth
  - Crossed extenders at birth → gone by week 2
  - Voluntary urination/defecation after 18-21 days

Normal neonate - thermoregulation

- 96-98°F week 1
- 99°F week 2
- 100.5°F week 3+
  - Unable to shiver
  - Impaired peripheral vasoconstriction
  - Large body surface non-cornified skin
  - Lack insulating fat
  - Maintain 12°F greater than environment

Normal neonate - fluid balance

- 75% water with large body surface area non-cornified skin
- Nephrogenesis first 3 weeks life
  - Unable to concentrate urine
  - Highly susceptible to dehydration
  - Water turnover 2-3x of an adult
  - High normal BUN × 7d
  - spG 1.006-1.017
  - Mild glucosuria/proteinuria × 6 weeks
Normal neonate - development

- Decreased cytochrome P450 enzymes (liver) first 4 weeks
  - Abnormal bile acids
  - ALP elevation
  - Normal ALT
- GI tract sterile at birth
  - Colonized by bacterium from mother (E. coli, Proteus, Enterococcus, Lactobacillus, Clostridium, Bacterioides)
  - Stool yellowish-tan, soft
- Maternal immunity from colostrum within first 24 hours

Normal neonate - vitals

- Umbilicus fallen off by 3d post-birth
- RR= 30 by 3 hrs post-birth
- Mucous membranes
  - Dark pink/red for one week
  - Later pale pink (along with extremities)
- Heart rate/cardiac output/central venous pressure higher than adults
  - HR>250 bpm until at least 4 weeks age
    - No PNS tone
  - No sinus arrhythmias
  - Heart murmurs innocent until 12 weeks age
- Blood pressure/stroke volume lower than adults

Normal neonate - diagnostics

- Blood sampling
  - Jugular venipuncture (hemolysis)
  - No alcohol (cooling)
  - 100 gm kitten blood volume= 6mL!
  - Hematoma formation
    - Significant loss blood
    - Obstruction airway
  - Less than 10% blood volume/24 hrs
    - 68-75ml/kg= blood volume
Normal neonate - diagnostics

- CBC
  - High red cell mass (MCV) and PCV (42%) at birth
  - PCV decrease to 24% by 8 wks (dilution by increased ECF)
- Serum chemistry
  - BUN high × 7d → then normal
  - Creatinine lower than adults
  - ALP elevated, ALT normal range
  - Phosphorus elevated
  - Normal electrolytes
- Urinalysis
  - Low spG × 3 weeks
  - Proteinuria × 6 weeks
  - Glucosuria × 6 weeks

Normal neonate - diagnostics

- Radiographs hard to interpret
  - Size patient
  - Lack abdominal fat
  - Poor mineralization bones
  - Reduce KVP by 50% and detailed film/screens
- ECG
  - Lead II diagnose arrhythmias

Common illness of neonatal kitten

- Parasitism
  - Fecal-oral parasites (environment)
  - Transplacental transmission
  - Cause
    - Dehydration
    - Anemia
    - Diarrhea
    - Impaction
    - Neurologic disease (aberrant migration)
Common illness

- Septicemia
  - Bacteria enter from GI tract, respiratory tract, urinary tract, skin, umbilical cord
  - Predisposed by:
    - Inadequate colostrum
    - Hypothermia
    - Hypoglycemia
    - Poor nutrition
    - Viral infection
    - Endoparasitism
    - Mastitis/metritis in dam

Common illness

- Clinical signs septicemia
  - Prolonged crying
  - Restlessness
  - Weakness
  - Cyanosis or mucous membrane hyperemia
  - Discoloration/sloughing extremities

Common illness

- Fading kitten syndrome
  - Fail to gain weight, weak, die
  - No apparent reason
  - Look for underlying infection, congenital abnormalities, etc.
Common illness

- Neonatal isoerythrolysis
  - Type B dam with type A tomcat
  - Type A or AB kittens at risk (maternal anti-A antibodies)
  - Hemolysis from maternal antibodies
  - Anemia, icterus, nephropathy (secondary to pigmenturia), DIC
  - First signs hours to days after initial nursing

Common illness

- Hypoglycemia
  - Inadequate nursing
  - Infrequent feeding
- Hypothermia
  - Lack of fat and thermoregulation
  - Temperature <93°F likely to die
- Dehydration
  - Diarrhea
  - Anorexia
  - Inadequate food intake

Treatments for the neonate

1. Thermoregulation
2. Fluid support
3. Glucose supplementation
4. Antibiotics
5. Feeding
6. Blood products
Thermoregulation

- Hypothermia can be deadly
  - Below 94° F: weak suckling, hypomotile intestines, tachycardia
  - Below 85° F: GI stasis, chance bacterial translocation, decrease in heart rate, hypoglycemia
  - Below 70° F: motionless and appears dead, bradycardic, no pulse

Thermoregulation

- Rewarm slowly
  - Over 1-4 hrs (to 98-99°F)
  - Too quickly → increase metabolism and oxygen demand → excess water loss → hypovolemia and shock
- Increase body temperature
  - Heating blankets, hot water bottles, etc
  - Allow for neonate to move away from heat
  - Rotate every 10-20 minutes
  - Increase room temperature/remove drafts
  - Warmed fluids (95-98°F) IV or IO

Fluid support - crystalloids
Isotonic crystalloids (plasmalyte, LRS, or 0.9% saline)

- Give for resuscitation OR for dehydration
- Hypotension/hypovolemia
  - Bolus in 10 mL/kg aliquots → reassess after each bolus
  - Fluids warmed prior to administration
  - Up to a total of 60ml/kg (1 blood volume)
Fluid support - crystalloids

- If dehydrated, replace dehydration AND provide for daily maintenance fluid
  
  - Dehydration
    - Estimate percent dehydration $\times$ body weight (kg) = deficit (L)
  
  - Maintenance fluids
    - $70(\text{wt in kg})^{0.75} + 20\text{ml/kg/day} = \text{daily fluid requirement}$
    - Estimate 60-100mL/lb/day

Isotonic crystalloids

**Example calculation 100g kitten 7% dehydrated:**

100g = 0.1kg (1kg = 1000g)

Dehydration:

$0.07 \times 0.1 = 0.007 \text{ L} = 7 \text{ mL}$

Maintenance:

$70(0.1)^{0.75} = 70 \times 0.18 = 12.4 \text{ mL/day}$

$20 \text{ ml/kg/day} \times 0.1 = 2 \text{ ml/day}$

$14.4 \text{ mL/day} \div 0.6 = 24 \text{ ml/hr}$

Total fluids $= 21.4 \text{ mL/day} = 0.9 \text{ mL/hr}$ for first 24 hours
Fluid support - colloids

- No data for neonates (or cats in general)
- Used for hypovolemia or hypotension
  - Non-responsive to crystalloids
  - “hold” fluid in the vascular space
- Hetastarch
  - 20 ml/kg/day
  - Bolus 5 ml/kg at a time \(\rightarrow\) up to total 20ml/kg
- VetStarch
  - 20 ml/kg/day
  - Labeled for small animals (no data for kittens)

Fluid support - routes

- Oral (less critical)
  - NOT if hypothermic
  - Must tube to give oral fluids
- Subcutaneous fluids (less critical)
  - Warmed fluids
  - 1ml/30g
- IV
  - Place any size catheter (24g or smaller)
  - Any vein is adequate
  - Difficult in tiny animals
  - Don’t forget about using regular catheters as a jugular catheter!!!
Fluid support - routes

• Intraosseous catheter

Advantages of IO catheter

• Can place in ANY sized kitten
• Use hypodermic needles (22 or 25 ga.)
• Administer
  – Fluids
  – Blood products
  – Dextrose (diluted to at least 12.5%)
  – Antibiotics
Dextrose administration

- Give PO, IV or IO (not SQ!!)
- Orally
  - Via syringe
  - Via feeding tube
  - 0.25-0.5mL/100g of 5-10% solution dextrose
- IV or IO
  - Dilute to 12.5% solution (1:4 solution of 50% dextrose)
  - 0.1-0.2 ml/100g of 12.5% solution

Antibiotics

- Often for upper respiratory disease, neonatal septicemia
- Not for diarrhea (disrupt flora \( \rightarrow \) worse diarrhea)
- Prefer parenteral administration if possible
- Penicillins, cephalosporins
- Avoid:
  - Aminoglycosides -- renal damage and ototoxicity
  - Tetracyclines -- enamel hypoplasia
  - Chloramphenicol -- bone marrow suppression
  - Fluoroquinolones -- damage to growing cartilage (moreso pregnant dams)

Antibiotics

- Dosing:
  - Use 30-50% of adult dosage
    - Increased absorption (low serum albumin)
    - Altered drug re-distribution (water, fat percentages)
  - Few to no drugs evaluated for neonates
  - Limited to liquid formulations

www.safefetus.com
www.ppcdrugs.com
Feeding

• Oral only if normothermic, suckling
  – Bottle feeding with commercial milk replacer
  – Use at manufacturer’s suggested proportions

http://www.maddiesfund.org/Maddies_Institute/Videos/Orphaned_Kitten_Care_How_to.html

Feeding

• Tube feeding
  – Risk of over-feeding
  – Oro-gastric
  – Nasogastric

Orogastric tube

• 5 Fr red rubber tube
• Measure from rostral aspect mouth to last rib
• Flex head forward and advance tube along roof of mouth
  – Small amount water to test tube placement
  – Often meow while feeding
  – No coughing while feeding
• Kink tube when remove (aspiration)
• Stomach capacity 4-5mL/100g

Lowchensaustralia.com
Nasogastric tube

- More permanent feeding tube
- Continuous feeding
- No risk aspiration
- 3.5 Fr red rubber tube must fit into kitten’s nose

Nasogastric tube

- Placement
  - Measure tip of nose to last rib – mark tube
  - Lidocaine into nostril
  - Feed tube through nostril to mark on tube
    - Initially tip nose downward
    - Raise head once tube into oropharynx
  - Suture into place
- Radiograph to test placement
How much to feed?

- Caloric requirements vary
  - 1-3 days old: 15 kcal ME/100 g body weight at 1-3 days old
  - > 6d age: 20-25 kcal ME/100 g body weight
- Water: 13-22 ml/100 g wt per day
- In general feed
  - 10-15% of body weight as milk replacer day 0-7
  - 20-25% of body weight as milk replacer day 7-28
  - Less volume/day
    - Monitor body weight
    - Gain 10-15 g/day
  - Divide into feedings every 2-4 hours or feed continuously through NG tube
  - Stomach: 4-5 ml/100g capacity

Anemia

- Neonatal isoerythrolysis
  - Remove kitten from dam ASAP (<24 hrs)
  - Watch for developing anemia
- Parasitism (hookworms, fleas, etc)
- Blood transfusion
  - Weakness, tachycardia, PCV <15%
  - \((\text{Desired PCV} - \text{current PCV}) \times 100 \times \text{Wt (kg)}\)
    - Donor PCV
- Blood type kitten if >3d old (3 drops blood)
- Neonatal isoerythrolysis
  - First 3d life: use blood from dam
  - After 3d: use kitten type blood
- Give transfusion over 1-4 hours
  - Monitor kitten for transfusion reaction
  - Give IV, IO
Failure passive transfer

• Should receive colostrum within 18 hrs birth
• Problem in orphaned kittens
• Kittens at risk for infection until >4 wks old

Failure passive transfer

• Give serum SQ from adult with compatible blood type
  – 15 mL/100g weight serum
  – Give SQ
  – Divide total into three injections (q 8 hrs)

Monitoring

• PCV can be positively affected by treatments (deworming, transfusion)
  – Recheck PCV 2-4 hours after transfusion
  – No more often than q24 hrs
• Dehydration
  – Physical exam limited usefulness
  – SpG <1.017
Monitoring

- Serial body weights critical!
  - Measure every 12 hours
  - 10-15g/day expected weight gain
- Stool color/consistency
  - Normal= pasty yellow/tan
  - Overfeeding= green/yellow/watery
  - White stools= liver disease, enzyme deficiency
  - Bloody stool= coccidia, sepsis
- Exhibit normal behavior

For Animal Care Staff and Volunteers:
After viewing the presentation, take the quiz and receive a Certificate of Attendance!

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