Fluid Therapy in Foals

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Fluid Therapy in Neonatal Foals

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“Not your mother’s fluid space” - Dr. JE Palmer

I. Physiologic differences between neonatal foals and adult horses

- **Higher total body water** – largely due to higher interstitial fluid volume

<table>
<thead>
<tr>
<th>Fluid compartment</th>
<th>Adults</th>
<th>Foals</th>
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<tbody>
<tr>
<td>TBW</td>
<td>60%</td>
<td>80%</td>
</tr>
<tr>
<td>ECF</td>
<td>20%</td>
<td>40%</td>
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<tr>
<td>ICF</td>
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- Increased capillary filtration and large interstitial fluid volume reserve
  - Fetal lambs
    - Capillary filtration coefficient 5x adult values
    - Permeability for plasma proteins – 15x adults
  - Helps foal adapt to fluid challenges
    - After fluid loss – neonates can restore plasma volume in 1/10 the time of an adult
    - Once distress is detected – can be severe
  - Potential problems
    - Makes it more difficult to treat hypovolemia as fluid readily goes to the interstitium
    - Makes foals more susceptible to fluid overload
      - Rapid fluid redistribution thus little stimulus for vasopressin and renin release
      - Fluid tends to be retained outside the vascular space

- **Easily sodium overloaded**
  - Compounded by perinatal disease
  - Many commercially available replacement fluids are high in sodium
  - Goal – limit daily sodium intake to < 3 mEq/kg/day
    - This would be 1 liter of Na based crystalloids to a 50 kg neonate
  - However – renal tubular damage can result in Na wasting so foals with renal dysfunction may require additional sodium

- **Require energy** – exogenous glucose support common

- **Often require IgG, colloid support?**
II. Normal fluid balance

- Normal maintenance fluid requirement = 100 ml/kg/day (5L for a 50 kg foal)
- Dietary intake
  - Normally 20-25% of body weight or 10-12.5 L/day
  - Therefore once they begin nursing well urine is hypostenuric
- Urine output – can help monitor nutritional intake and hydration status
  - First urination
    - Typically 6-12 hours of age
    - Initial urine s gr often >1.020, decreases to < 1.010 over time
  - Over 24 hrs of age – urine production ~ 150/ml/kg/day
    - 5-10 fold greater than an adult horse

III. Fluid therapy for hypovolemia

- 20 ml/kg over 10-20 minutes
- Re-evaluate patient – successful therapy indicated by:
  - Improve pulse quality
  - Warm extremities
  - Return of borborygmi
  - Urine production
  - Improved mental status
- Repeat bolus if necessary – goal is return of adequate perfusion (often not normal)
- Generally balanced ionic solutions are best
  - Supplemental dextrose may be beneficial
  - Hypertonic saline – concerns for sodium overload
  - Colloids – may be indicated in some cases but “generally not the answer” for hypovolemia in foals
    - Leak into interstitium
    - Increase fluid retention in interstitial space

IV. Fluid therapy for maintenance of hydration

- General maintenance – 100 ml/kg/day – but influenced by many factors
- Do not be locked into a rate based on “tradition”
- Fluid overload is common when 100 ml/kg/day is given – esp. in sick foals
  - Fluid overload is more of a problem than mild fluid restriction
  - Therefore, the fluid rate is often decreased
- Maintenance fluids generally preferred – lower in sodium
  - Plasmalyte-56
  - Normosol-M

V. Fluid therapy for glucose support

- Most compromised foals not eating benefit from exogenous glucose support
Independent of glucose status i.e. even hyperglycemic foals that are mobilizing glucose faster than it is being used typically do not have adequate glucose stores

- **Start at 4 mg/kg/min**
  - If this is tolerated, increase to 6mg/kg/min and then 8 mg/kg/min
  - Ex: 50 kg foal
    - 4 mg/kg/min x 50 kg = 200 mg/min
    - 200 mg/min x 60 min = 12,000 mg/hr
    - 10% dextrose = 100 mg/ml
    - Infusion rate = 120 ml/hr of 10% dextrose
  - May require insulin therapy