MISCONCEPTIONS ABOUT EMERGENCY AND CRITICAL CARE

Justine A. Lee, DVM, DACVECC
CEO, VETgirl
justine@vetgirlontherun.com

Garret Pachtinger, VMD, DACVECC
COO, VETgirl
garret@vetgirlontherun.com

Introduction

Conflict of Interest Disclosure

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Logistics: CE Certificates

- No need to raise your hand!
- Type in questions
- Emailed to you 48 hours after the webinar
- Active participation = no quiz
- Watching video later, must complete quiz
  - ELITE members only
- Email / contact with ANY questions
  - garret@vetgirlontherun.com
  - justine@vetgirlontherun.com

Call in from Smart Phone!

“Live and learn…”

- Improvements in ECC
- New modalities
- Updates based on:
  - Research
  - Clinical experience
- May refute older modalities ➔ misconceptions
- “Learn and live?”
Common misconceptions

- IV fluids: does it matter what bag I grab?
- That we use the “shock dose” of IV fluids
- Septic, shocky cats look just like septic, shocky dogs.
- VPCs should always be treated with lidocaine or procainamide.
- CPR and Fluids – like PB&J?
- Analgesics should be withheld as they cause respiratory depression.
- That you can’t do PPN in your clinic.

What bag should I grab?

- LRS
- Plasmalyte 148
- Normosol-R
- Lower on the list...
- 0.9% NaCl
- 0.45% NaCl + 2.5% dextrose
- Rarely if ever...
- 5% dextrose in water

Crystalloids

<table>
<thead>
<tr>
<th>Solution</th>
<th>Ringers</th>
<th>LRS</th>
<th>Plasmalyte 56</th>
<th>Plasmalyte R</th>
<th>Plasmalyte A</th>
<th>Norm R</th>
<th>NaCl</th>
<th>K</th>
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</table>

Complications of fluid therapy

- 0.9% NaCl
- Volume overload
- Heart murmur?
- Myelosclerosis
Complications of fluid therapy

- Na+
- Speed of correction of dehydration?
- Ability to assess the patient?
- Serial physical examination
- PCV/TS
- CVP
- Body weight

Monitoring Na+

- Not to exceed 0.5 mmol/hour or 12-24 mmol/day
- Acute increase, acute decrease
- Chronic idiogenic osmoles
  - Sorbitol
  - Taurine
  - Inositol
  - Amino acids

Treatment for hypernatremia

- TBW (present) X Posm (present) = TBW (previous) X Posm (previous)
- Treat cautiously with 5% dextrose slowly!
- Rapid lowering of serum [Na+] results in shift of water into brain = cerebral edema
- < 0.5 mEq/L/hr

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That we use the “shock dose” of fluids

- 60 kg Great Dane GDV
- Shock dose = 3600 – 5400 mls
- Does it really take this much?

That we use the “shock dose” of fluids

- Where does this dose come from?
  - Blood volume
- Use small amounts frequently
- It’s easier to give small amounts frequently than to take it away later
- ± 1/3 of a shock dose IV over XX amount
For those of you mathematically impaired under cortisol stimulation…

- Shocky dog?
- No calculator?
- Add a “0” to the pound weight

- 77 lb dog presents tachycardiac, shocky, pale, poor pulse quality after HBC
  - $77 + 0 = 770$ mls!

**Misconception:**

- Septic, shocky cats look just like septic, shocky dogs

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**Shacky dogs**

- Gurney
- Flat
- Pallor
- Tachycardiac $> 180$ bpm
- Poor pulses
- Febrile, hypothermic

**Shacky cats**

- Cold
- Flat
- Bradycardiac
- Poor pulses
- Pallor?

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**Severe sepsis in cats: 29 cases (1986-1998)**

Collins A. Brady, vet; Cindy M. Ono, vet, mat, vacc; Thomas J. VanWinkle, vet, vacc; Lory G. King, vet, DVM, DACVECC, MS

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**Shacky cats**

- If bradycardiac, cold, flat: look for!
  - Pyothorax
  - Septic peritonitis (perf’d cancer)
  - Bacteremia
  - Bite wounds
  - Pyometra
  - FIP
  - Pneumonia
  - Pyelonephritis
Clinical signs of severe sepsis in cats:
- Lethargy
- Pallor
- Poor pulse quality
- Tachypneic
- Hypo or hyper-thermia
- Abdominal pain
- Icteric
- Bradycardia

Clinical application
- Bradycardiac cats should worry you more than tachycardiac cats!
- Look for sepsis in bradycardiac, cold, flat, pale cats!
- Diagnostics:
  - CBC/CHEm
  - Full body rads
  - U/A/UC
  - Abdominal ultrasound + belly tap

Misconception:
- VPCs should always be treated with lidocaine or procainamide.

Continuous ECG Monitoring
- Heart rate:
  - Dogs: < 60 > 160
  - Cats: < 140 > 220
- Arrhythmias:
- Causes:
  - Heart disease
  - Electrolyte imbalance
  - Myocardial hypoxia
  - Pain/stress
  - Splenic disease
  - Underlying disease

Use anti-arrhythmics if signs of poor perfusion!
- Cold peripheral limbs
- A prolonged CRT > 2.5 sec
- Tachycardiac:
  - > 170 bpm (dogs)
  - > 240 bpm (cats)
- Poor pulse quality
- Hypotensive
Anti-arrhythmics

**PROS**
- Slow HR to allow ventricular filling
- Anti-inflammatory
- Free radical scavenger
- Analgesia

**CONS**
- Vomiting
- Diarrhea
- Seizures
- Negative inotrope
- Decrease myocardial function
- Increase fibrillation threshold
- Increase oxygen demand
- Arrhythmogenic

Clinical application

**Treat the underlying disease**

**Assess the patient**
- Still hypotensive?
- Painful?
- Hypoxic?
- Electrolytes?
- Anemic?
- Perfusion?

If treated underlying problems & hypoperfused:
- Lidocaine
  - 1-4 mg/kg IV slow → CRI 25-50 mcg/kg/min
  - Only ventricular arrhythmias
- Procainamide
  - 6-8 mg/kg IV slow → CRI 25-40 mcg/kg/min

Misconceptions: Analgesia should be withheld until stable.
ER/ICU → trauma!
- Bite wounds
- BDLD
- Contusions
- Pneumothorax
- Abrasions
- Road rash
- Rib fractures
- Pneumothorax
- Soft tissue injury

Analgesia is important, but...
- ABCDs
  - Did you assess the patient’s cardiorespiratory first?
  - Did you assess the patient’s neuro status first?

- Picking the “right” analgesic in the ER
  - Reversible?
  - Titratable?
  - Cardiorespiratory sparing?
  - Pros vs. cons

Berg and Orton AJVR 1986
- Evaluated ABG in dogs treated with morphine and oxymorphone after intercostal thoracotomy
- Found hypoventilation based on $\uparrow \text{pCO}_2$
- Was not clinically significant

Analgesic choices
- Oxymorphone 0.1 mg/kg IV q. 4-6
- Torbugesic 0.1-0.3 mg/kg IV q. 1-4
- Morphine 0.5 mg/kg IM q. 4
- Fentanyl 1-5 mcg/kg/hr CRI

In the ER: Some vets pick NSAIDS over opioids. Boo!!
- Fear of hypoventilation
  - Dose dependent
- Fear of making shock worse
  - Treat shock first!
- Fear of respiratory arrest
  - Treat underlying lung disease first!

Before reaching for an opioid:
- Volume resuscitate first
- Treat underlying lung disease!
  - Thoracocentesis
  - Oxygen therapy
- Pick something reversible
  - Naloxone 11-22 mcg/kg, IV/IM
When considering NSAIDS:

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good analgesic</td>
<td>GI toxic</td>
</tr>
<tr>
<td>Readily available</td>
<td>Nephrotoxic</td>
</tr>
<tr>
<td>Inexpensive</td>
<td>As good as opioids?</td>
</tr>
<tr>
<td>Anti-inflammatory</td>
<td></td>
</tr>
</tbody>
</table>

Clinical application: When to reach for NSAIDS

- Wait until > 8-12 hours and stable, warm, normotensive
- When it’s safe for oral, it’s safe for injectable.

Multimodal analgesic therapy

- Multi-modal therapy: opioids + NSAIDs + lidocaine patch!
- Local anesthetics!
  - Lidocaine patches
  - Line blocks

Does dextrose help for nutrition?

- RER (kcal/day) = 30 X (weight in kg) + 70
- 1 L of 5% dextrose in water = 170 kcals
- Cat on 20 ml/hr X 24 hours = 480 mls
- Received < 80 kcals in 24 hours!
For once, fat is good!

- Intravenous lipid emulsion (ILE)
- Intravenous fat emulsion (IFE)

Uses:
- Component for nutritional therapy (1960s)
  - PPN
  - TPN
- Vehicle for drug delivery (i.e., lipid emulsions)
- Antidote for fat-soluble drug toxicity

Intravenous lipid emulsion (ILE)

- Veterinary nutritional guidelines:
  - Lipid: Do not exceed 2 g/kg/day

- Some utilize 20% ILE for sole PPN replacement with 100% of RER as lipid for short-term therapy (1-2 days).
  - Parvovirus
  - Hepatic lipidosis

General RER calculations

- Dog: 15 kcal/lb of dog
- Cat: 20 kcal/lb of cat

Formulations:
- 20% ILE = 2 kcal/mL = 200 mg/mL = 1 g/5 mls

Using a 20% ILE to meet 100% RER:
- Patient RER = X mls of 20% ILE
  \[ \text{Patient RER} = \frac{X \text{ mLs}}{2} \]

Example: 11 lb cat

- RER: 20 kcal X 11 lbs = 220 kcal/day
- Meeting 100% of RER via 20% ILE
  - 220/2 = 110 mL/day = 4.6 mL/hour
General RER calculations

- Some nutritionists recommend not to exceed 2 g/kg/day
  - Cat: 2 g/kg/day X 5 kg = 10 g/day = 50 mL/day

- Nutritional requirement of 100% RER:
  - Cat = 110 mL/day

- Always feed the gut → if not, consider PPN in your clinic
  - Dedicated, clean, sterile peripheral catheter

Corticosteroids

- Immuno modulation
- Anti-inflammatory
- Reduce vascular leakage

Trauma and Shock

- Previously recommended for shock
- No longer recommended.
- Large clinical trials in people → detrimental effect
- Also limits use of NSAIDs – an effective analgesic

Head Trauma

- NO CLEAR BENEFIT shown in human head trauma

  WHY BAD?
  - GI bleeding
  - Immunosuppression
  - Delayed wound healing
  - Perpetuation of a catabolic state
  - Hyperglycemia

DON'T - Just DON'T
Give steroids in head trauma patients!
CRASH: Corticosteroid randomisation after significant head injury* BMC Emergency Medicine 2001:1:1

- CRASH study
  - Overall mortality higher with steroids
  - Steroid use within 8 hours of head injury = significantly higher risk of death within 2 weeks vs. placebo
- Steroids are “not recommended for improving outcome or reducing ICP”

What does this mean if I shouldn’t give steroids?

- Treat for shock, head trauma, etc
- Perfuse, perfuse, perfuse with IV fluids
- 100% avoid concurrent NSAID

What does this mean if I shouldn’t give steroids?

- Tight glycemic control
  - IV fluids
  - Regular insulin IM
  - Monitor BG closely → hard to assess neuro if hypoglycemic!
- Stop the seizures!
  - Diazepam, phenobarbital, pentobarbital
  - Decreases cerebral metabolism

What does this mean if I shouldn’t give steroids?

- Decrease ICP (intracranial pressure):
  - 15-30°
  - Minimize jugular restraint/pressure
  - Mannitol 0.5-2 g/kg IV over 20-30 minutes
- Perfusion, perfusion, perfusion
  - Oxygen therapy
  - IV fluids to:
    - Maintain blood pressure
    - Increase perfusion
    - Dilute hyperglycemia

Steroid doses = Go big or go home… NO!

- Physiologic: 0.05 mg/kg IV q. 12
- Anti-inflammatory: 0.1 mg/kg IV q. 12
- Immunosuppressive: 0.25 mg/kg IV q. 12

Steroids – My $0.02

- Allergic Reaction
  - 0.1mg/kg IV/IM q12 (†)
  - Oral Prednisone 0.5mg/kg PO tapering
# Steroids – My $0.02

**IMHA**
- 0.2-0.25mg/kg IV q12
- Oral Prednisone 1mg/kg PO q12

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**Addisonian Crisis**
- 0.1mg/kg IV q12
- Then convert out of crisis to physiologic
- Sometimes a little higher

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## Misconceptions: CPR and Fluids are like PB&J

- Seems intuitive – IV Fluids during CPR expands blood volume
- More volume → increase blood flow to the brain and heart
- Is it a universal truth?

### CPR and IVF
- Hypovolemic patients – YES.
- Euvolemic patients – NO
- The major determinant of myocardial blood flow is coronary perfusion pressure
- CPP = MAP - CVP

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### CPR and IVF
- Only indicated in hypovolemia to restore blood volume
- Increases central venous pressure (right atrial pressure) in the euvolemic or hypervolemic patient – opposing coronary perfusion
- Myocardial perfusion pressure = Aortic diastolic pressure – right atrial pressure (RAP)
CPR and IVF
- CPR study in dogs
- Rapid administration of 1 L of normal saline (0.9% NaCl) or 10% Dextran
- Take home - disproportionate increases in right atrial and intracranial pressures relative to the increase in aortic and mean arterial pressures

Bottom line
- During CPR
  - Intravenous fluid therapy should be administered at high volume rates only to animals with preexisting hypovolemia.

Misconceptions: Pulmonary Edema requires furosemide
- Furosemide
  - Loop diuretic
  - Decreases blood volume
  - Reduces capillary hydrostatic pressure
  - Decreases intrapulmonary shunt and improves gas exchange
  - Decreases lung water
  - May cause selective pulmonary venodilation

Misconceptions: Pulmonary Edema requires furosemide
- CHF
- Increased hydrostatic pressure
- Production of edema

Misconceptions: Pulmonary Edema requires furosemide
- Endothelial injury
- Secondary to inflammation and/or vascular barotrauma
- Loss of integrity of alveolar/capillary membrane
- Macromolecules to leak into the alveoli
### Misconceptions:
**Pulmonary Edema requires furosemide**
- Seizures
- Head trauma
- Electrocution
- Upper airway obstruction

<table>
<thead>
<tr>
<th>Misconception</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massive catecholamine release</td>
<td></td>
</tr>
<tr>
<td>Surge in pulmonary capillary pressure.</td>
<td></td>
</tr>
<tr>
<td>Increase in hydrostatic pressure → stress failure and microvascular permeability.</td>
<td></td>
</tr>
<tr>
<td>Increased protein level of the fluid can vary</td>
<td></td>
</tr>
</tbody>
</table>

### Misconceptions:
**Pulmonary Edema requires furosemide**
- Diuretic therapy does not seem justified
- Leakiness of the microvascular barrier
- Elevated protein levels
- More studies to come
- Have I given a dose?
- Not a standard, cookie cutter treatment…

<table>
<thead>
<tr>
<th>Misconception</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>If I don’t use diuretics…what do I use?</td>
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<tr>
<td>Oxygen therapy</td>
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<td>Pain management PRN</td>
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<tr>
<td>Careful, judicious IVF</td>
<td></td>
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<tr>
<td>Antibiotics?</td>
<td></td>
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<tr>
<td>And again…a dose if needed?</td>
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### Misconceptions:
**Point of care glucometers are rapid and accurate in all situations**

<table>
<thead>
<tr>
<th>Misconception</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greyhound</td>
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<tr>
<td>HGE / Hemoconcentrated</td>
<td></td>
</tr>
<tr>
<td>Anemia / IMHA</td>
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</tr>
<tr>
<td>Other…</td>
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</tr>
<tr>
<td>Many situations where PCV isn’t “normal” or ideal.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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</tbody>
</table>
Misconception
Glucometers are perfect!

- Inaccurate for anemic and hemoconcentrated samples
- Changes in BG are associated with a number of adverse effects on the body.
- Question remains…how do they work?

Misconception
Glucometers are perfect!

- Many glucose meters are calibrated to use the plasma portion of blood
- Red blood cells are removed before blood glucose testing.
- Hemoconcentrated = more RBC and less plasma
- Anemia = more plasma portion – less RBC

Conclusions and Clinical Relevance—
Dogs with hemodilution or hemoconcentration, POCgluc did not reflect actual patient glucose concentrations.
Corrected POC glucose = POCglucose + ([1.6 X PCV] - 81.3)

Conclusions: Misconceptions
- Know updates in ECC
- Utilize therapeutics appropriately
  - IVF
  - ECG monitors
  - Analgesics
- Recognizing septic cats!
  - “Simple” physical exam findings (heart rate)
Questions?

@VetGirlOnTheRun
VetGirlOnTheRun
Garret@vetgirlontherun.com
Justine@vetgirlontherun.com

Check out our 2015 upcoming VETgirl appearances!

Dr. Justine Lee
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- IVS, Amelia Island, July 2015
- IVECCS, DC, September 2015

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- NCASAM, October 2015
- GVMA, November 2015
- CVC, San Diego, Dec 2015