

## Fluid Losses from Both Ends! A Primer on Equine Duodenitis/Proximal Jejunitis and Colitis



The Equine Hospital  
Colorado State University  
Knowledge to Heal

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### CONFLICTS OF INTEREST

Partial funding of 2 original research projects  
by Platinum Performance on DTO smectite  
(Biosponge) and Platinum Balance probiotic

No other financial disclosures to report

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### OBJECTIVES

At the conclusion of this activity, participants should be able to:

#### PHARMACISTS

- Describe the most common electrolyte abnormalities identified in horses with duodenitis-proximal jejunitis (DPJ) and colitis.
- List the most prescribed nephrotoxic drugs used in the management of horses with severe colitis with accompanying hypovolemia, endotoxemia and neutropenia.
- List the known pathogens for colitis when the patient may be responsive to specific pharmacotherapeutic agents.

#### TECHNICIANS

- Define duodenitis-proximal jejunitis (DPJ) and colitis in horses.
- Recognize drugs that can affect kidneys when treating horses with severe colitis with accompanying hypovolemia, endotoxemia and neutropenia.
- List pharmacotherapeutic agents used in equine colitis.

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### CASE 1

- ❖ 16-yr-old QH gelding
- ❖ Off feed this am with increasing signs of colic
- ❖ Began pawing 2 hours ago and now trying to roll
- ❖ Diet is a mix of grass and alfalfa hay
- ❖ Lives in a large paddock with 2 other horses




Photo Credit: Diana Hassel

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**CASE 1**

PE Findings:

- HR 56 bpm
- T = 101.4 F
- RR = 20 breaths/min
- MM – pink with hyperemic line at tooth/gum margin
- CRT = 2.5 sec
- GI motility decreased
- Extremities cool, absent digital pulses



*Photo Credit: Diana Hassel*

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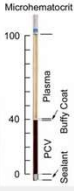
**CASE 1**

**NASOGASTRIC INTUBATION**

8 liters of green, foul-smelling reflux

**POINT-OF-CARE BLOODWORK**

PCV = 48%  
TP = 8.2 g/dL  
Lactate = 2.8 mmol/L


*Photo Credit: Diana Hassel*

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**CASE 1**

**PALPATION PER RECTUM**

Distended loop of fluid-filled small intestine in the mid/dorsal abdomen and moderate gas in the cecum and colon




*Photo Credit: Diana Hassel*

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**CASE 1**

**ABDOMINAL ULTRASOUND**

Fluid-filled, thickened loops of small intestine with increased free peritoneal fluid



*Photo Credit: Diana Hassel*

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### CASE 1

#### ABDOMINOCENTESIS

- Increased volume
- Yellow, clear fluid
- TP 3.1 gm/dl
- Lactate 3.7 mmol/L




*Photo Credits: Diana Hassel*

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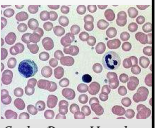
### CASE 1

#### CBC

- Hemoconcentration
- Neutrophilia with sl left shift

#### CHEMISTRY PANEL

- Mild elevation in creatinine (2.0 mg/dL)
- Hyperbilirubinemia (2.9 mg/dL)
- AST 525 IU/L; SDH 37 IU/L
- Na<sup>+</sup> 129 mEQ/L; Cl<sup>-</sup> 92 mEQ/L



*Photo Credit: Diana Hassel*

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### CASE 1

What is your diagnosis?

- Small intestinal strangulating obstruction
- Duodenitis/proximal jejunitis**
- Colitis
- Non-strangulating obstruction of SI

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### WHY DPJ?

- Signalment: (older horse) >>> DDX??
- History >>> insidious vs. acute, severe onset
- Temperature >>> slight fever
- Evidence of SI disease based on rectal, abdominal U/S and NG reflux
- Electrolyte abnormalities
  - Hyponatremia and hypochloremia
- Liver enzyme abnormalities: SDH & AST ↑

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### KEY POINTS

- Insidious onset (vs. acute severe)
- Colic signs mild to moderate and may be somewhat responsive to gastric decompression
- Increased rectal temperature
- Foul-smelling reflux (sour)
- Peritoneal fluid color and clarity
- Peritoneal fluid lactate mildly elevated (compare to systemic lactate)
- Electrolyte abnormalities: hyponatremia and hypochloremia

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### DDX

Always consider strangulating lipoma in the older horse with SI distension

Other rule-outs are causes of SI obstruction without strangulation

- No fever
- No toxic changes or left shift on hemogram
- No thickening of SI walls on U/S exam

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### PROXIMAL ENTERITIS

- Synonyms: Duodenitis/Proximal Jejunitis (DPJ) Anterior Enteritis
- Definition: An acute inflammatory condition of the proximal SI that results in functional ileus, hypersecretion of fluid into the SI lumen, and subsequent SI distention



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### PROXIMAL ENTERITIS

Proposed Causes of DPJ...

- Dysbiosis... changes to the SI microbiome
- *Salmonella spp.*
- *Clostridium spp.*
- *Fusarium spp.* from moldy feed/grain

Risk Factors for DPJ...

- High concentrate diet

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## PROXIMAL ENTERITIS

Gross and Histologic Changes in the SI

- Fluid distension
- Wall edema
- Petechial hemorrhages affecting the most proximal segments of the SI
- Submucosal edema
- Neutrophilic infiltration
- Sloughing of villus tips






Photo credit: Edwards GB, EVE 2000

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## PROXIMAL ENTERITIS

Common Clinical Findings

- Gastric and SI fluid distension
- Dehydration and/or shock
- Decreased GI motility
- Depression
- Colic that may be somewhat responsive to gastric decompression
- May see some degree of SI wall thickening and distention on U/S exam




Photo Credit: Diana Hassel

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## PROXIMAL ENTERITIS

Clinical Pathology and Blood Chemistry

- Neutrophilia +/- left shift
- +/- toxic changes in neutrophils
- Increased PCV
- Increased liver enzymes (GGT, AST, SDH)
- Elevated Anion Gap / Increased Lactate
- Electrolyte abnormalities
  - Hyponatremia, hypochloremia, hypokalemia
- Pre-renal or renal azotemia
  - Caution with nephrotoxic drugs

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## PROXIMAL ENTERITIS

Abdominocentesis

Clear yellow, rarely serosanguinous  
WBC count: 1000-10,000 cells/ul  
Lactate comparable to systemic lactate




Photo Credits: Diana Hassel

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## PROXIMAL ENTERITIS

How Do We Treat Proximal Enteritis?  
Primarily supportive care

- IV fluid therapy
  - Dehydration + Maintenance + Ongoing losses
  - Correction of e-lyte derangements
  - For prolonged refluxing – partial parenteral nutrition



*Photo Credit: Diana Hassel*

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In designing a fluid therapy plan, we consider maintenance requirements, pre-existing dehydration and ongoing losses. In this case (500kg BW), if we assume 5% dehydration and we are losing an average of 3 liters per hour via NGT, what would the fluid requirements be to completely restore fluid volume on day 1?

- A. 25-35 liters
- B. 50-60 liters
- C. 70-80 liters
- D. **120-130 liters**

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## CALCULATING FLUID NEEDS

- Maintenance = 60 mls/kg/day (60 x 500 = 30 liters)
- 5% dehydration = .05 x 500 = 25 liters
- Ongoing losses = 3L/hr x 24 = 72 liters
- Total fluid needs: 127 liters = 5 liters/hr!
- Reduction in maintenance fluid needs in horses off feed



GENERAL ARTICLE  
Effect of feed deprivation on daily water consumption in healthy horses  
David E. Freeman, Alexandra Mooney, Steeve Giguère, Jami Claire, Chloe Everts, Patricia Diskant  
First published: 09 March 2020 | <https://doi.org/10.1111/vej.13259> | Citations: 9

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## PROXIMAL ENTERITIS

How Do We Treat Proximal Enteritis?  
Primarily supportive care


- IV fluid therapy
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  - Correction of e-lyte derangements
  - For prolonged refluxing – partial parenteral nutrition

Gastric decompression

- Indwelling NG tube induces reflux
- Pharyngeal/esophageal trauma/necrosis

Anti-inflammatory therapy

- NSAID: Flunixin meglumine or Firocoxib



*Photo Credit: Diana Hassel*

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## PROXIMAL ENTERITIS

Other Therapies

- Lidocaine CRI
- Prokinetic, analgesic and anti-inflammatory
- Other prokinetics: metoclopramide
- Metronidazole per os (post-refluxing)
- Anti-endotoxin therapy when present
  - Polymyxin B sulfate – side effects
- Limb cryotherapy for laminitis prevention
- Surgical decompression
- Probiotics/glutamine




Photo Credit: Diana Hassel

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## PROXIMAL ENTERITIS

Geographical Differences in Clinical Signs



UGA > Penn > CSU  
Prognosis: 70-91% survival rate

Steward, S. K., Hassel, D. M., Martin, H., Doddman, C., Stewart, A., Elzer, E. J., & Southwood, L. L. (2020). Geographic Disparities in Clinical Characteristics of Duodenitis–Proximal Jejunitis in Horses in the United States. *Journal of Equine Veterinary Science*, 93, 103192.

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## CASE 2

- 6-yr-old Quarter Horse mare
- Mild colic since this am & off feed last night
- Passed some loose feces in the trailer
- PE: T=102.1 F, HR=60 bpm, RR=16, 6-7% dehydrated with cold extremities
- MM hyperemic with CRT of 3 sec
- GI motility decreased with occasional fluid sounds
- Rectal: Mild to moderate gas distention of cecum/colon
- NG tube: No net reflux




Photo Credit: Diana Hassel

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## CASE 2

Based on your clinical findings, what is your preliminary diagnosis?




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## CASE 2

Based on your clinical findings, what is your preliminary diagnosis?  
 To confirm your diagnosis, you submit blood for a CBC and Chemistry profile  
 What are your expected findings if you are correct with your diagnosis of colitis?...

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## COLITIS

What are your expected findings for neutrophil count in this horse?

Increased  
 Decreased  
 Normal

Creatinine?

Electrolytes?

Na<sup>+</sup>, Cl<sup>-</sup>, K<sup>+</sup>  
 HCO<sub>3</sub><sup>-</sup>  
 Anion gap?

Packed cell volume?

Total plasma protein?

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## CASE 1

You receive the following results:	Normal ranges
PCV 51%	(30-45)
TP 8.1 gm/dL	(5.9-7.5)
Fibrinogen 400mg/dL	(100-400)
Total WBC = 2,100 cells/ $\mu$ l	(5500-10,500)
Neutrophils = 600 cells/ $\mu$ l	(3000-7000)
Band neutrophils = 300 cells/ $\mu$ l	(0-100)
Na <sup>+</sup> = 127 mEq/L	(132-142)
Cl <sup>-</sup> = 83mEq/L	(97-104)
K <sup>+</sup> = 2.7 mEq/L	(2.8-4.8)
Bicarbonate 19.2 mEq/L	(26-33)
Creatinine 2.8 mg/dL	(0.7-1.8)
Anion Gap 22 nmol/L	(8-15)

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## COLITIS: ETIOLOGY?

Most cases do not have a specific identifiable cause...Colitis X or undifferentiated colitis

Known pathogens include:

Salmonella spp	Neorickettsia risticii (Potomac Horse Fever)
Clostridium difficile	
Clostridium perfringens	Cyathostomiasis / strongylosis
Coronavirus	

DYSBIOSIS!

Lawsonia intracellularis (EPE)

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## COLITIS

- Dysbiosis occurs >> colon inflammation >> disruption of mucosal barrier >> bacteremia and toxins enter circulation >> systemic inflammation, shock, MODS
- The GI microbiome in colitis patients

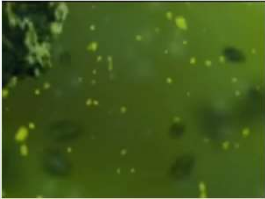


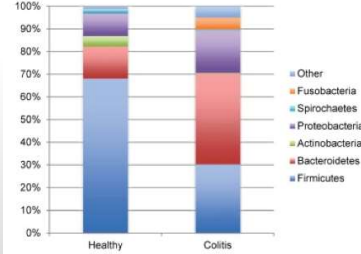
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## Comparison of the Fecal Microbiota of Healthy Horses and Horses with Colitis by High Throughput Sequencing of the V3-V5 Region of the 16S rRNA Gene

OPEN ACCESS Freely available online PLOS one

Marcio C. Costa<sup>1\*</sup>, Luis G. Arroyo<sup>2</sup>, Emma Allen-Vercoe<sup>3</sup>, Henry R. Stämpfli<sup>2</sup>, Peter T. Kim<sup>4</sup>, Amy Sturgeon<sup>1</sup>, J. Scott Weese<sup>1</sup>



- Horses with colitis had *Bacteroidetes* as the predominant phylum and more *Fusobacteria*
- Clostridia* class more abundant in healthy horses

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## Colitis Treatment

Treat underlying cause if cause known and pathogen is amenable to treatment

- Salmonella* spp —
- Clostridium difficile* → METRONIDAZOLE
- Clostridium perfringens* →
- Coronavirus —
- Neorickettsia risticii* (PHF) → OXYTETRACYCLINE
- Lawsonia intracellularis* (EPE) →
- Cyathostomiasis / strongylosis
- Moxidectin; Fenbendazole Power Pak

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## Colitis Treatment

Treat underlying cause if known


For the majority of colitis cases...

- Replacement of fluid & electrolyte losses
- Control GI inflammation & fluid secretion
- Control endotoxemia & sepsis
- Re-establish normal flora

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## Colitis Treatment

Replacement of fluid & electrolyte losses  
Use IV catheters with low thrombogenicity  
e.g., Mila polyurethane



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## Colitis Treatment

Control GI inflammation & fluid secretion  
NSAIDs (e.g., flunixin, firocoxib)  
GI Agents (e.g., organo minerals, kaolin/pectin,  
bismuth subsalicylate)  
Control endotoxemia & sepsis (e.g., fluids,  
electrolytes)  
Reestablish normal flora (e.g., hay, probiotics)


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## Colitis Tx Take-Home Tips

- Treat early and aggressively!
- Be wary of ileus developing – discontinue oral therapies if motility is poor
- Keep an eye on creatinine
  - Many treatments for colitis patients are nephrotoxic!
- Monitor PCV/TP closely
- Watch out for medullary washout with horses on high fluid rates

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## Questions?



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