VETERINARY MEDICINE

A Pain in the Gut:

Bovine Colic

Megan Righi, DVM

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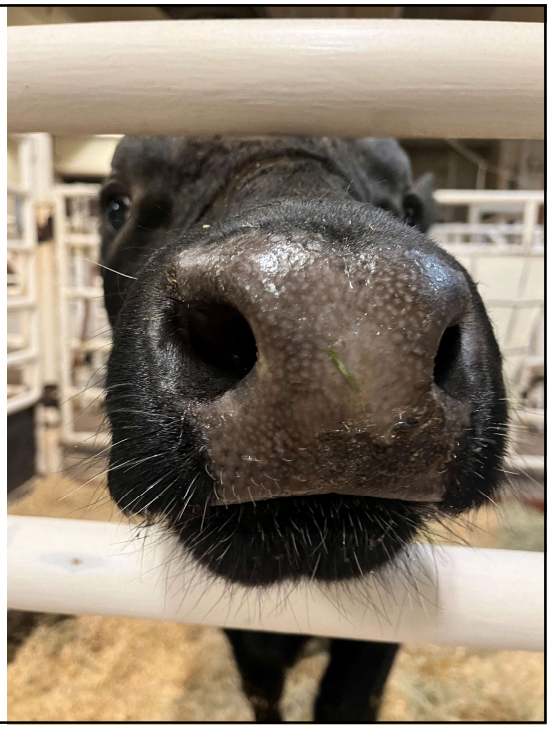
What's Ahead

- General overview colic in cattle
- Different diagnostics tools
  - Bloodwork
  - Urinalysis
  - Abdominocentesis
  - Ultrasound
- Clinical case examples from OSU



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Bovine Colic

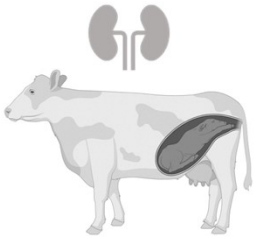
Common causes

- General term for abdominal discomfort/pain
- Derangements with any of the organ systems in the abdomen

Gastrointestinal

Peritoneal

Urogenital



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Causes of Colic

Gastrointestinal

- Indigestion
- Bloat
- Enteritis (Salmonella, Clostridium, coccidiosis, BVD, etc.)
- Obstructions (displaced abomasum, FBs, volvulus, HBS, pyloric lymphoma)
- Atresia coli/ani

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Causes of Colic

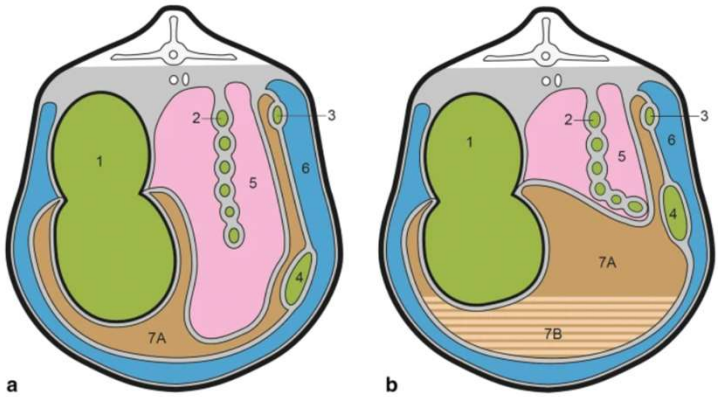
Peritoneal/Omental

- Diffuse/ localized peritonitis
- Omental bursitis
  - Necrotizing rumenitis
  - Migrating TRP
  - Grade 5 abomasal ulcers

Type-5 abomasal ulcer and omental bursitis in 14 cows

Ueli Braun, Christina Reif, Monika Hilbe & Christian Gerspach

Fig. 1



Cross section of the bovine abdomen. Illustration of a cross section of the bovine abdomen, modified after Hemmingsen [13]. **a** Normal findings, **b** Omental bursitis with empyema in the omental bursa. 1: Rumen; 2: Spiral colon; 3: Duodenum; 4: Abomasum; 5: Intestinal recess; 6: Peritoneal cavity; 7 A: Omental bursa; 7 B: Empyema in a cow with omental bursitis (hatched)

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Causes of Colic

Urogenital

- Urolithiasis
- Pyelonephritis
- Type IV vagal indigestion
- Hydrops
- Uterine torsion
- Scrotal hernia

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Workup

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Workup

History

- Vaccines/ Deworming
- Feed
- Housing
- Travel/ new additions
- Reproductive status
- Manure consistency/ output

Physical Exam

- Vitals
- Abdominal Contour
- Pain assessment

Diagnostics

- Bloodwork
- Rumen fluid evaluation
- Urinalysis
- Abdominocentesis
- Ultrasound

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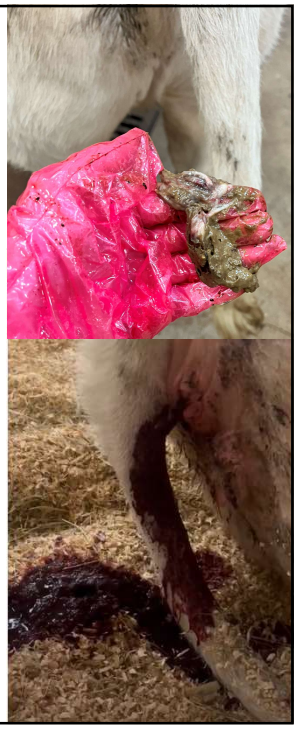
Physical Exam findings

Variable/Non- Specific Signs

- QAR to obtunded
- Tachycardia/tachypnea
- +/-Pyrexia
- +/- Abdominal distension
- Acute drop in milk production/ feed intake
- Rumen atony/hypomotility
- Straining to defecate/urinate
- Bruxism
- Flank watching
- Increased frequency of standing/laying down
- Kicking at abdomen/ abdomen guarding
- Distended bowel on rectal exam
- Manure content/ lack there of



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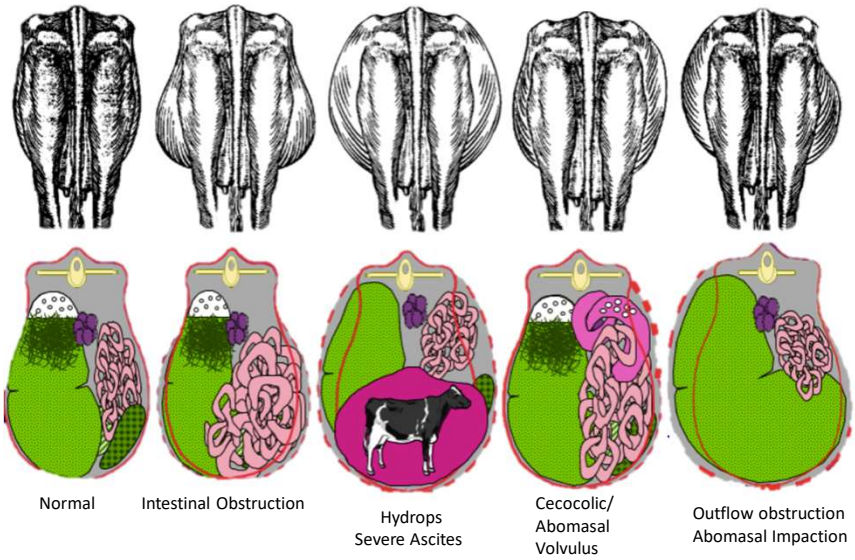
Abdominal Contour



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Pain Assessment

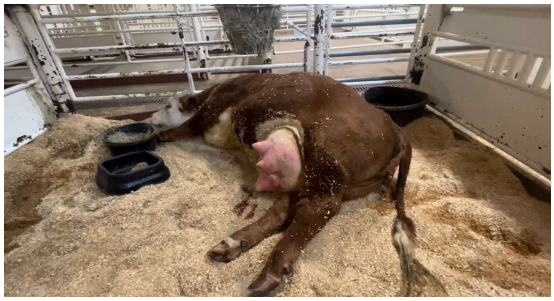
Most Recent Data

Pain Assessment in Cattle by Use of Numerical Rating and Visual Analogue Scales—A Systematic Review and Meta-Analysis

Theresa Tschoner,[1,*] Kristina R. Mueller,[2] Yury Zablotski,[1] and Melanie Feist[1]

Meta analysis Jan 2024

- Subjective (experience, gender)
- Small sample sizes
- **More research needed**



Pain scales:

- Numerous ranges
- Adults: dairy lameness and mastitis
- Calves: dehorning, disbudding, castration

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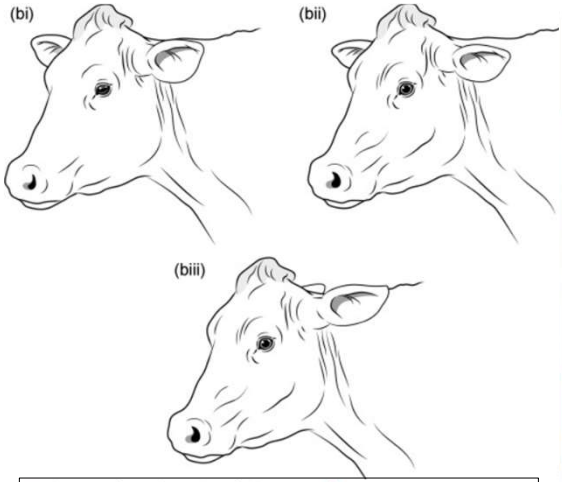
Pain Assessment

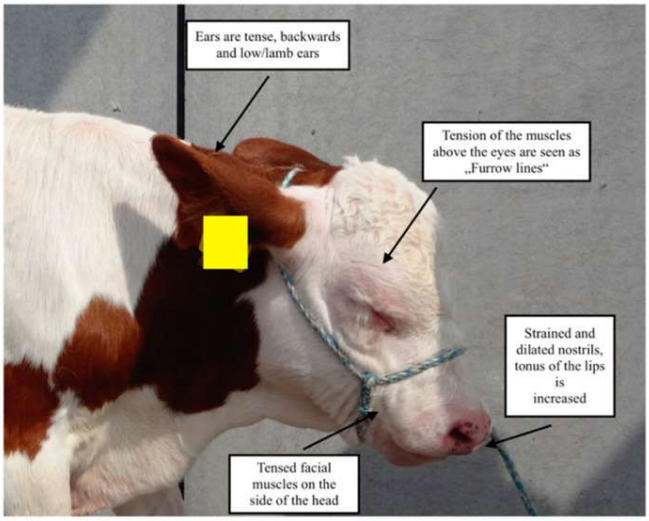
Methods for Pain Assessment in Calves and Their Use for the Evaluation of Pain during Different Procedures—A Review

Theresa Tschoner



Pain evaluation in dairy cattle

Karina Bech Gleerup,[a] Pia Haubro Andersen,[b] Lene Munksgaard,[c] Björn Forkman[a]



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Diagnostics

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Bloodwork

Further rule in/out

- ↓K, ↓Cl, ↑pH = likely proximal obstruction
- Other metabolic derangements
- ↑ TP = chronic inflammation
- ↑ BUN, normal creatinine = GI bleed
- Lactate (<2mmol/L)

i-STAT Values

Blood Gas	Normal Values
pH	7.35-7.5
PCO2	35-45 mmHg
PO2	90+ mmHg
BEecf	-2 to +2 mmol/L
HCO3	20-30 mmol/L
TCO2	21-31 mmol/L
sO2	90%+

Chem 8+	Normal Values
Na	134-152 mmol/L
K	3.7-5.3 mmol/L
Cl	94-109 mmol/L
iCa	1.2-1.5 mmol/L
TCO2	23-32 mmol/L
Glu	56-74 mg/dL (adults)
BUN	<20 mg/dL
Creatinine	<1.8 mg/dL

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Rumen Fluid Analysis

Methods of collection

Orogastric tube

- salivary contamination

Rumenocentesis- ventral rumen sac

- Complications
  - Hematomas
  - Abscessation
  - Localized peritonitis

Rumen Fluid	Normal
Color	Olive green to green-brown
Protozoa (evaluate ASAP)	Small, medium and large
Odor	Sweet/fermentive
pH	5.5-7
Sedimentation	5-10 min
Methylene blue	2-6 min
Chloride	<30 mmol/L

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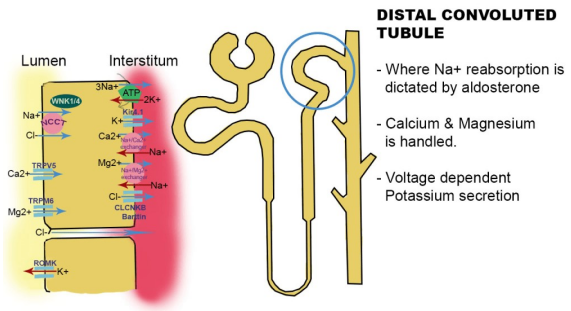
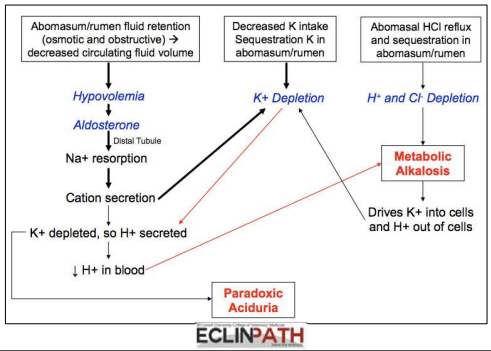
Urine Derangements

Paradoxic Aciduria- Hypokalemia

- Water, HCl, K_+ and Cl sequester in the abomasum → metabolic alkalosis + hypovolemia
- ↓ GFR→ Aldosterone → Distal CT to hold onto Na_+
  - K_+ is also depleted, so Na_+ is exchanged for H_+ instead of K_+
- ↑ H+ in urine = ↓pH of urine
  - Normal urine pH: 6-7
- Associated with poor prognosis





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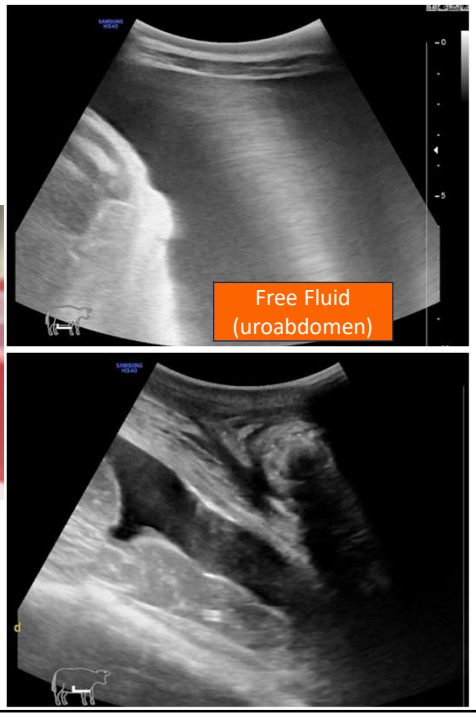
Abdominocentesis

- 18-20g 1.5-2in needle
- Best = US guide
- Suspect urine?
  - Creatinine
  - Heat up on slide



	Normal values
Color	Clear- amber colored
TNCC	5000-10,000 cells/uL
Protein	<2.5 g/dL
Lactate	<1.3 mmol/L

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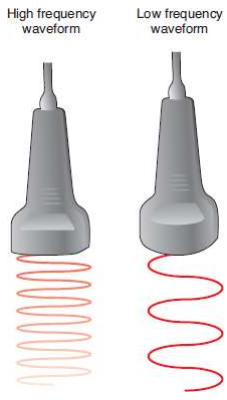
Ultrasound

Transabdominal + Rectal

- Best = low frequency probe (3.5-5mHz)
  - View of deeper structures
  - Most rectal probes will get the basic job done
  - Curvilinear usually lower mHz than linears
- May need to clip- **ASK OWNER FIRST** ☺



https://radiologykey.com/physics-of-ultrasound-2/

Case Report | Open access | Published: 01 July 2007

Transrectal ultrasonographic diagnosis of jejunoileal intussusception in a cow

Tolga Karapinar & Mustafa Kom

https://www.eimedical.com/blog/flat-linear-vs.-curved-rectal-probe-how-do-i-choose

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Ultrasound

Left side:

- Rumen
  - Lateral longitudinal groove about halfway down
- Spleen
- Reticulum

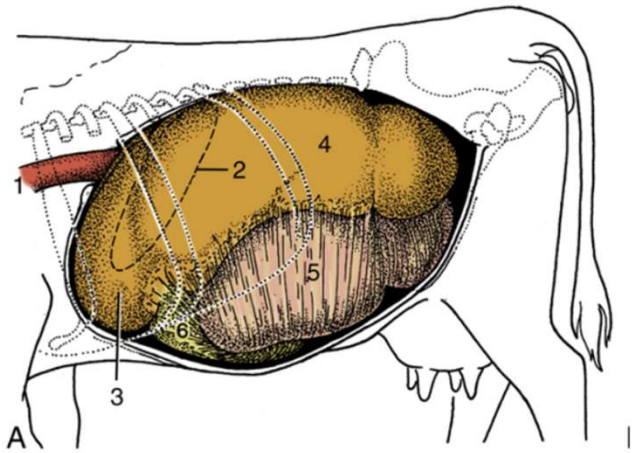

FIG. 28.4 Topography of the bovine abdominal viscera. (A) **Relationship of abdominal viscera to the left abdominal wall.** 1, **Esophagus**; 2, outline of **spleen**; 3, **reticulum**; 4, **dorsal sac of rumen**; 5, **ventral sac of rumen**, covered by **superficial layer of greater omentum**; 6, fundus of **abomasum**, covered by superficial wall of greater omentum. TVA

Clark, UMN CVM Large Animal Anatomy: Abdomen 2

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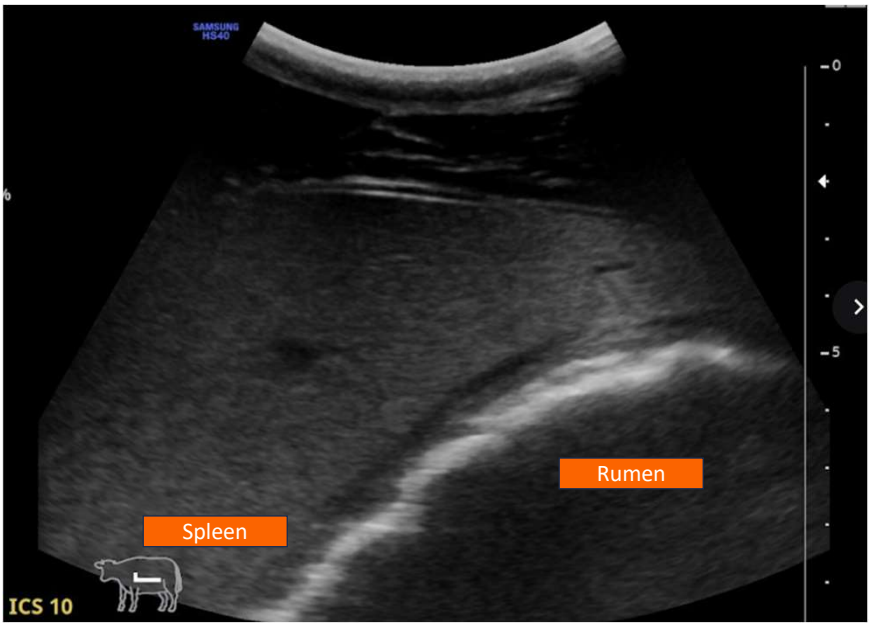
Ultrasound

Left side: Spleen
(ICS 7-12)



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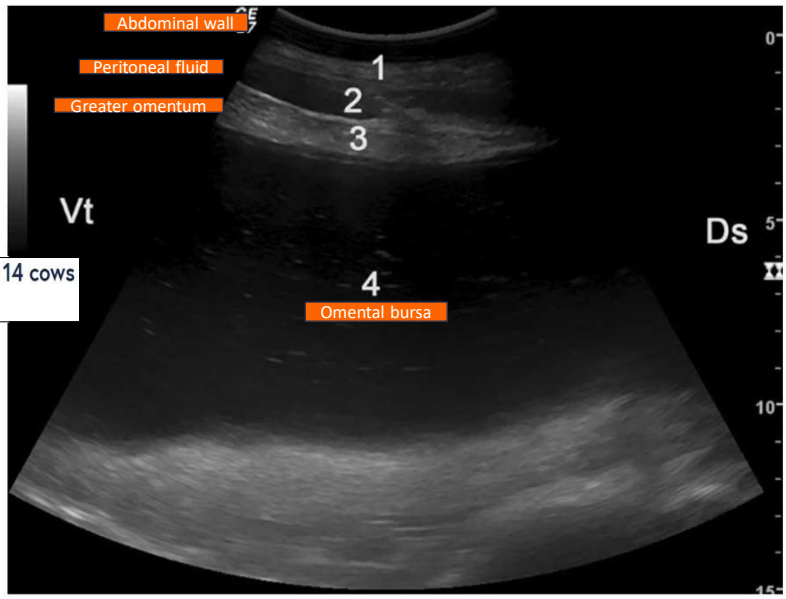
Ultrasound

Omental bursitis
(Lower half of abdomen)

Type-5 abomasal ulcer and omental bursitis in 14 cows
Ueli Braun, Christina Reif, Monika Hilbe & Christian Gerspach

Fig. 4



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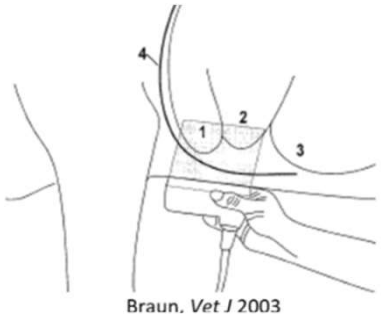
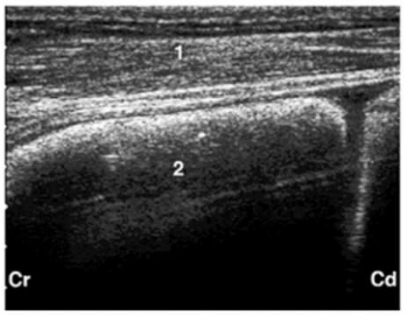
Ultrasound

Reticulum (ventral midline)

- Caudal to xyphoid
- Sagittal view
- Bi-phasic contraction
  - Second contraction should pull all away off body wall
- Some gas content → can't see into the bowel
- Should lay smooth on body wall



Braun. *Vet J* 2003



Braun, *VCNA* 2009

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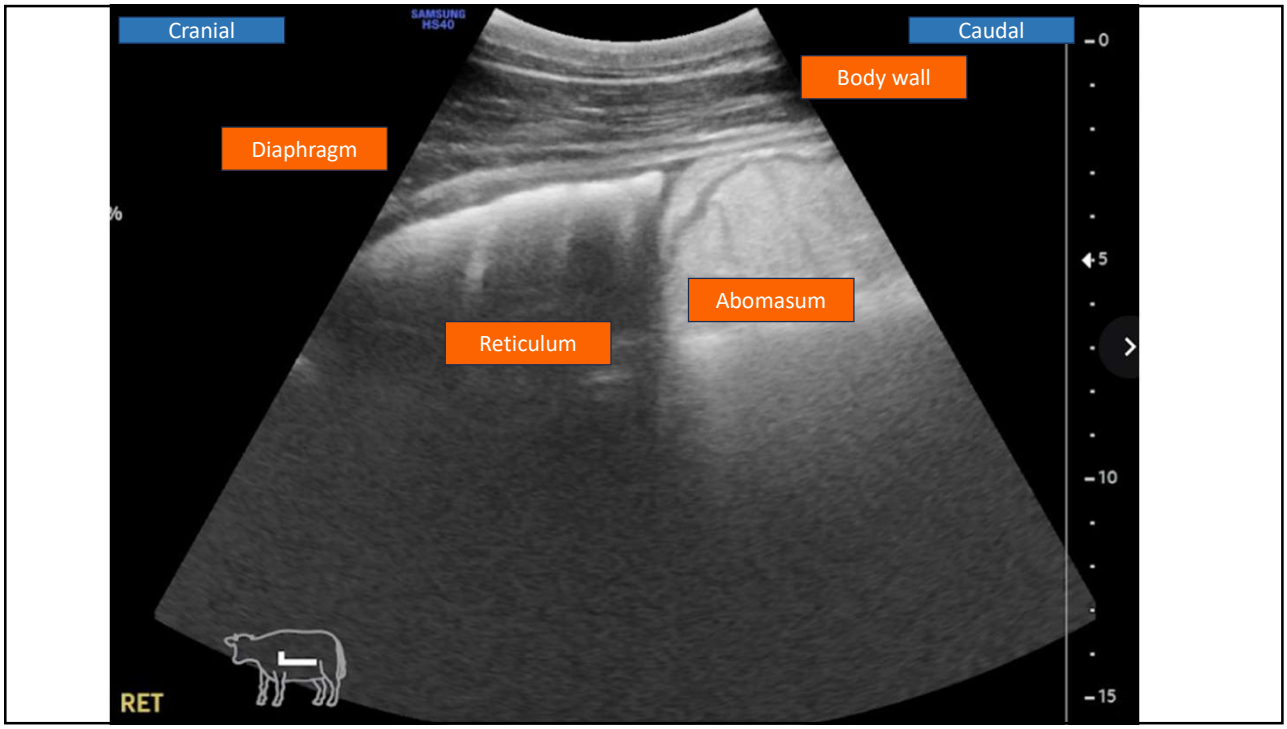

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Ultrasound

Right Side:

- Liver
- GB
- Omasum
- Abomasum
- Duodenum
- Small intestine

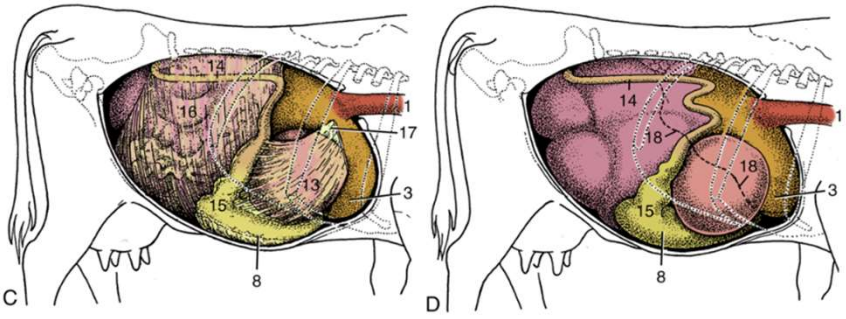

FIG. 28.4 Topography of the bovine abdominal viscera. (C) **Relationship of abdominal viscera to the right abdominal wall; the liver has been removed.** (D) **Position of the parts of the stomach seen from the right.** 1, **Esophagus**; 3, **reticulum**; 8, **body of abomasum**; 13, **omasum**, covered by **lesser omentum**; 14, **descending duodenum**; 15, **pyloric part of abomasum**; 16, **greater omentum** covering the intestinal mass; 17, **lesser omentum** cut away from the liver; 18, position of caudoventral border of **liver**. TVA

Clark, UMN CVM Large Animal Anatomy: Abdomen 2

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Ultrasound

Right Side: Liver

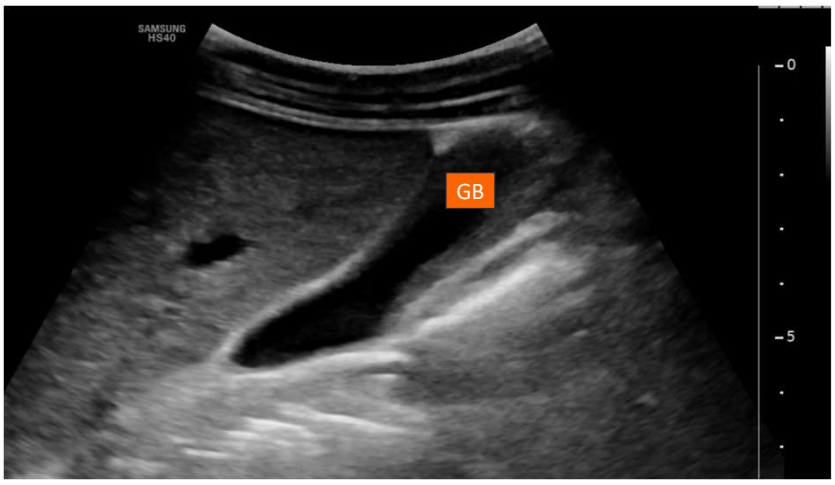
(ICS 6-12)

Streeter et al 2007

25

Ultrasound

Right Side: Gallbladder (ICS 9-12)



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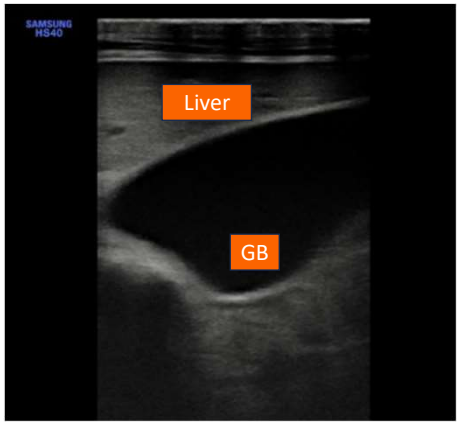
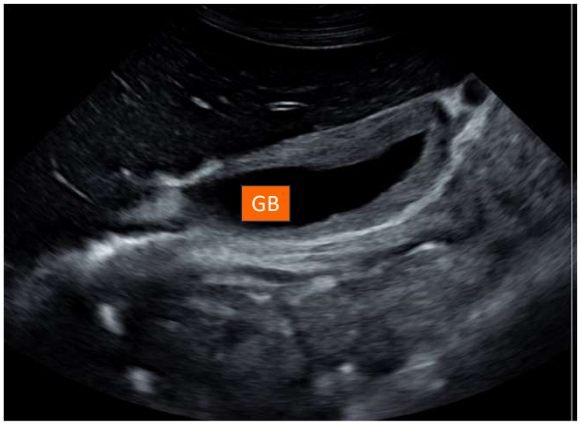
Ultrasound

Right Side: Gallbladder

Enlarged: Off feed



Thick edematous wall: Consider Salmonella dublin



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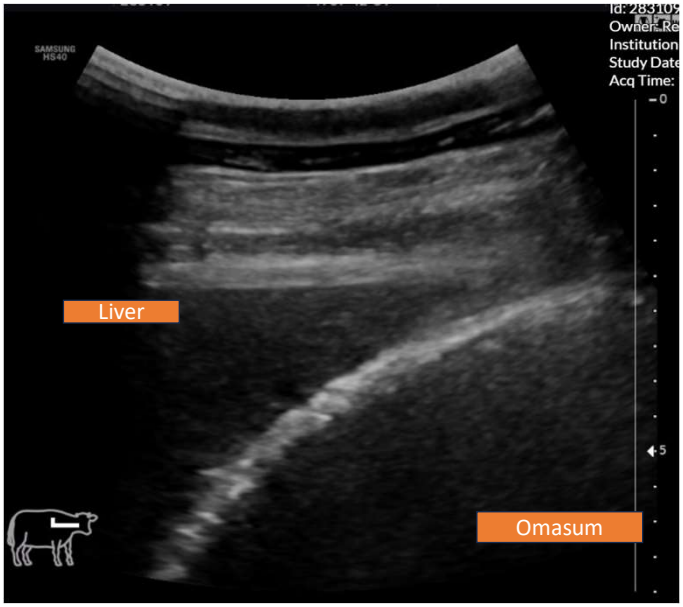
Ultrasound

Right Side: Omasum

(Mid-low ICS 7-10)

Imran et al 2011



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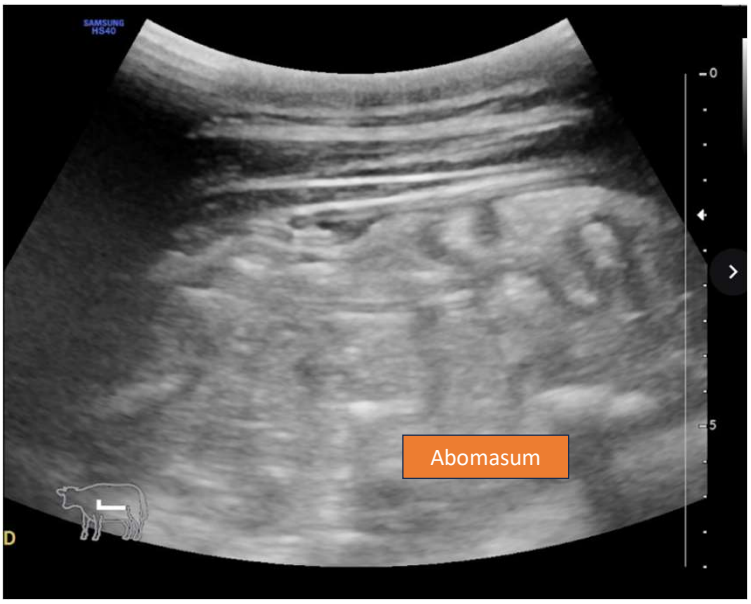
Ultrasound

Right Side: Abomasum

(ventral abdomen)



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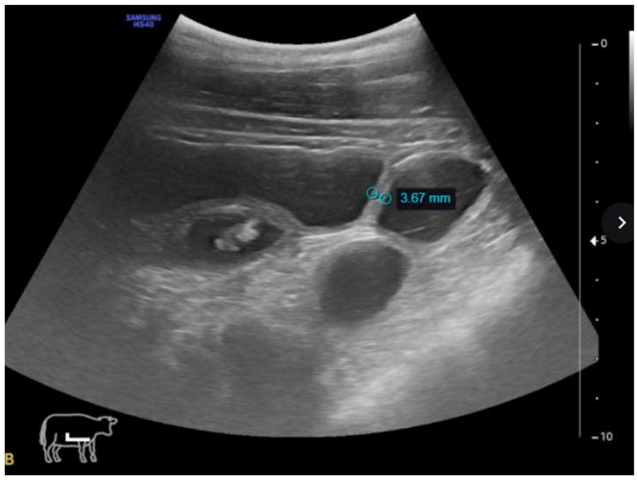
Ultrasound

Right Side: Small Intestines

Area of 8th ICS to the tuber coxae

Adult:

- Wall thickness: <3mm
- Diameter: 2-4cm



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General Colic Treatment Overview

Medical Management- Hospital

Supportive care
- IVFT + electrolyte additives

Analgesics
- Lidocaine CRI (prokinetic)
- Opioids (in hospital only**)
- NSAIDs- careful

Others
- Pantoprazole
- Isolation stalls (infectious enteritis) + PPE

Prognosis:
- Depends on etiology

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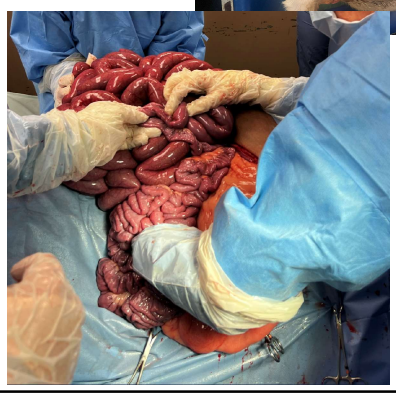
General Colic Treatment Overview

Surgery

- Uncontrollable pain
- Bloodwork suggestive of a proximal obstruction
- Two distinct populations of small bowel on US
- May need to try to stabilize prior
  - Time sensitive= HBS, torsion/ volvulus
- Standing vs. general anesthesia



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Case Examples

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Case 1:

6yo Black Angus Bull

- Lethargic + melena for 5 days
- Treated with Albon and LA300
- Hyporexia

- Moderately dehydrated
- Slight generalized abdominal distension
- Mildly painful abdominal palpation
- Mass palpable just cranial to the pelvic brim

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Case 1:

Workup

Hypomotile bowel

Two populations of SI:

- Distended
- Collapsed

Chem8+
Na: 129 mmol/L
K: 2.2 mmol/L
Cl: 79 mmol/L
iCa: 0.98 mmol/L
TCo2: 37 mmol/L
Glu: 116 mg/dL
BUN: 13 mg/dL
Creat.: 1.6 mg/dL
Hct: 37 %
Hb: 12.6 g/dL
AnGap: 17 mmol/L

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Case 1:

Surgery

- R flank exploratory laparotomy
  - General anesthesia
- 18in long jejunoileal intussusception with perforation
  - Difficult to exteriorize completely
- Humane euthanasia

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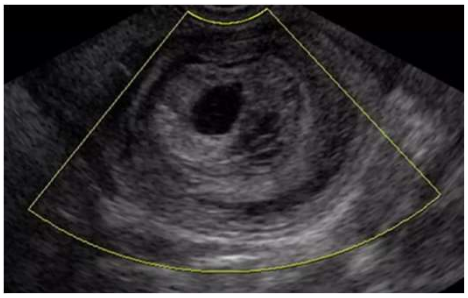
Intussusception

Overview

- Most common SI obstruction in cattle
  - ileus/reflux→ mesenteric entrapment + vascular compromise → necrosis (sepsis, adhesions, peritonitis)
- Cause : abnormal peristaltic motion, parasites, neoplasia
- Lack of manure initially → "blackberry jam"
- Ultrasound
  - distended small intestines (2 populations) or "target sign"



Imran et al, 2011

	Calves	Adults
Site	Ileocecal/ileocolic, cecocolic, colocolic	**Jejunoileium**

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Intussusception

Treatment

Long-Term Survival in 241 Cases of Intussusception in Cattle and Factors Associated with Mortality

Laurens Chantillon, Conceptualization, Methodology, Software, Validation, Formal analysis,

Exploratory laparotomy (R-flank laparotomy)

- Short mesentery = hard exteriorization
- More difficult to ligate due to increased fat in mesentery

Prognosis: Poor

- 44.8% survived to discharge; 13% died after discharge
- Males and calves <226d = higher mortality risk
- Spontaneous healing = rare

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Intussusception

Differentials

Mesenteric Volvulus
- Quicker, some stool, no blood, not as dehydreated

Hemorrhagic Bowel Syndrome
- Quicker, more blood in stool, more stool

Acute sever enteritis w/ ileus
- Quicker, diarrhea by 24h, febrile, toxic

Intestinal incarceration
- No blood, less mucus, +/- stool, +/- febrile

Fat necrosis (fescue)
- Slower, hard mass, no blood, some stool, not febrile

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Case 2:

6mo Milking Shorthorn heifer

- Local show 1wk ago
- 5 days prior: vaccinated with clostridial/resp
- 36 hours prior: off feed and water + suspected mild bloat; O treated with Therabloat
- 12 hours prior: Therabloat, flunixin, Pepto-Bismol and mineral oil
  - No gas released when tube passed or rumen trocar
  - Flank watching
- Presentation: recumbent

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Case 2:

Physical Exam

- Recumbent, depressed
- BCS: 2.5/5
- Temp: 86F (hypothermic)
- HR: 54bpm, weak pulse
- RR: 16 brpm
- Ruminations: 0/2 min
- Abdomen appeared distended bilaterally
- Injected, pale-white MM
- CRT >3 seconds
- Pings diffusely over right side, evident splash on left
- No manure staining

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Case 2:

Physical Exam

Orogastric tube:

- No gas released
- pH: 8 (normal 6-7)- salivary contamination
- Only a few medium sized protozoa active; 80% of the remainder dead
- No foul odor
- Color: green-brown

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Case 2:

Bloodwork

PCV: 34% TP: 6.8g/dL

Systemic lactate: 1

Chem 8+

Mild hypokalemia

Mild hypochloremia

Hypoglycemia

Elevated BUN; Normal Creatinine

Outcome:
i-STAT RESULTS

Chem8+
Na: 132 mmol/L
K: 3.5 mmol/L
Cl: 89 mmol/L
iCa: 1.04 mmol/L
TCo2: 36 mmol/L
Glu: 28 mg/dL
BUN: 93 mg/dL
Creat.: 0.8 mg/dL
Hct: 30 %
Hb: 10.2 g/dL
AnGap: 11 mmol/L

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Case 2:

Diagnostics

CG8+ (blood gas)

- pH: NORMAL
- pCO2:↑ ↑ - would expect lower pH if primary resp acidosis
- HCO3: ↑
- Base Excess: 11

Hypochloremic metabolic alkalosis with a full respiratory compensation

Outcome:
i-STAT RESULTS

CG8+
pH: 7.366
PCO2: 63.3 mmHg
PO2: 96 mmHg
BEecf: 11 mmol/L
HCO3: 36.2 mmol/L
TCo2: 38 mmol/L
sO2: 97 %
Na: 132 mmol/L
K: 3.5 mmol/L
iCa: 1.10 mmol/L
Glu: 29 mg/dL
Hct: 31 %
Hb: 10.5 g/dL
Show Less

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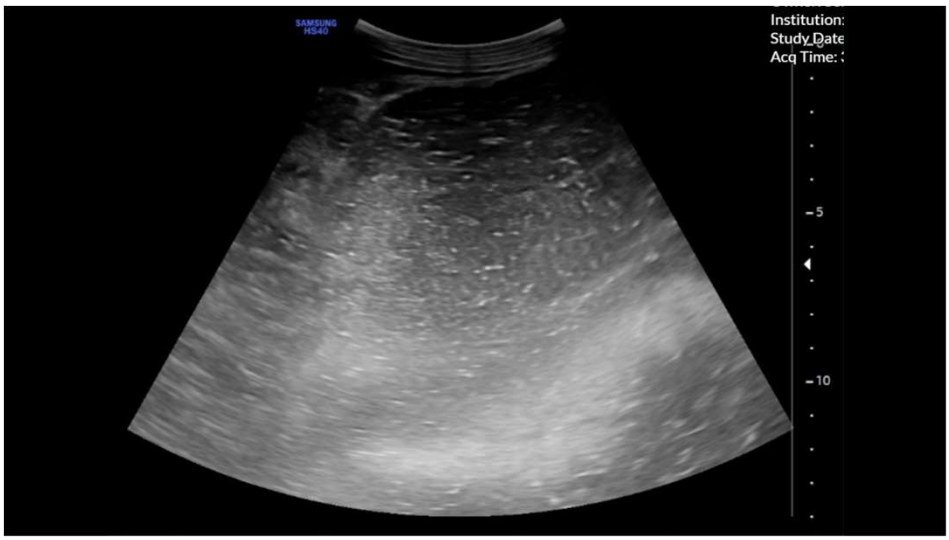
Case 2:



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Case 2

- O elected humane euthanasia
- Passed liquid melena with foul odor
- Agreed to gross necropsy with histology, did not want to go forward with additional testing

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Case 2

Necropsy

Top differential: Clostridium spp; septicum ("Braxy")

Duodenum: severe, acute, regionally extensive, necro-ulcerative duodenitis with an **obstructive hematoma**

Abomasum: **severe dilation, acute hemorrhagic abomasitis**

Omasum: **severe dilation**

Gram stain: **predominant G+ rods**

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Braxy vs. HBS

Both

Cifici et al, 2012

- Sudden onset
- Obstructive clot formation from acute, hemorrhagic, necrotic enteritis
- High fatality

Jonge et al, 2023

"Braxy" or "Bradshot"

- **Clostridium septicum**
- **Abomasitis**
- North America: young beef/dairy cattle (sheep in Europe/Australia)
- Some association with frozen pasture

Hemorrhagic Bowel Syndrome

- Unknown (suspect **Clostridium perfringens type A** or Aspergillus fumigatus)
- **Jejunitis**
- 2+ years old dairy cattle in early lactation on high concentrates

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Treatment options

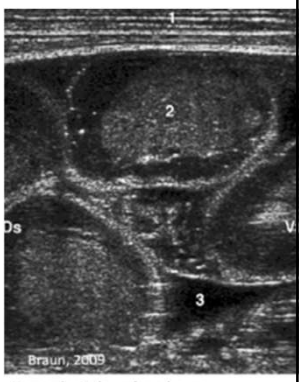
Braxy:

- Supportive care
- Sx typically unrewarding
- C&D antitoxin?
- Every thought & prayer you can give

HBS:

- R-side Laparotomy
  - Manual massage of clot vs. Enterotomy vs. RNA
- Supportive care + blood transfusion
- C&D antitoxin?
- Some suggest activated charcoal
- Thoughts & prayers

UMN Large Animal Surgery- Supplemental Notes



Hemorrhagic bowel syndrome

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Braxy & HBS

Differentials

Intussusception
- Febrile, slower progression

Acute Salmonellosis
- Febrile, more diarrhea, foul odor

Type II BVD
- Febrile, more diarrhea, ulcers, multiple cases

Mesenteric Volvulus
- Massive intestinal distension

Bleeding Abomasal Ulcers
- No distended SI

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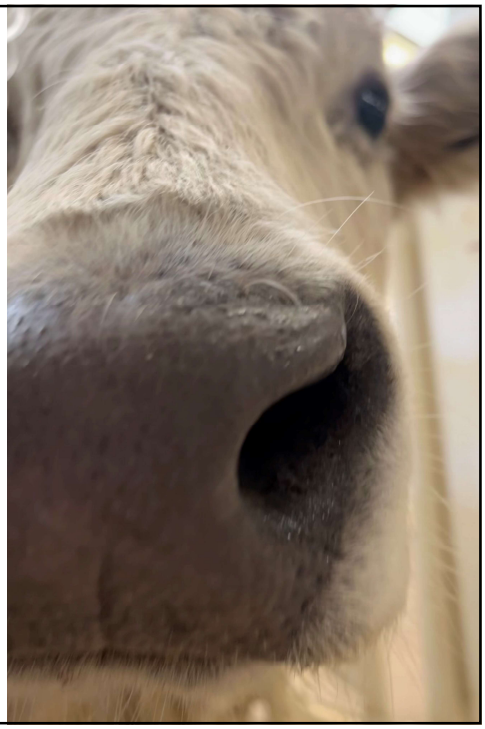
Case 3

14m old composite heifer

- Playful
- Diet: costal hay + some alfalfa
- Day previously did not go w/ O to do chores
- Ocular discharge for last few days
- Last manure pile passed 18 hours ago
- Anorexic for 10+ hours



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Case 3

Physical Exam

- Temp: 101.2F
- HR: 72bpm
- RR: 32bpm with ↑ generalized sounds
- RC: 2/2 min
- MM: pale pink, slightly tacky
- Dried bilateral ocular discharge
- Mild mucopurulent nasal discharge

- No evidence of abdominal distension
- Negative withers pinch
- Small amount of mucus covered manure in rectum

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Case 3

Diagnostics: bloodwork

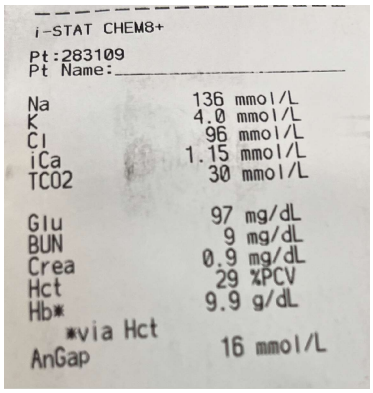
- PCV: 43% TP: 6.7g/dL
- Lactate: 1.0mmol/L
- Chem 8+ iSTAT: Mild ↓K, low-normal Cl

Venous blood gas:

- WNL

CBC & Full Chemistry

- Mild elevation in LDH: 919 (310-750)
- All other values WNL



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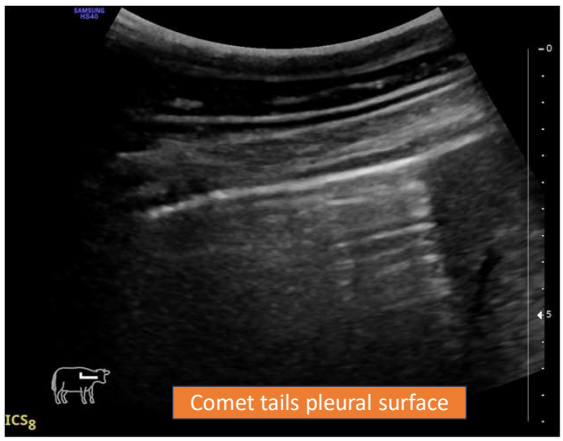
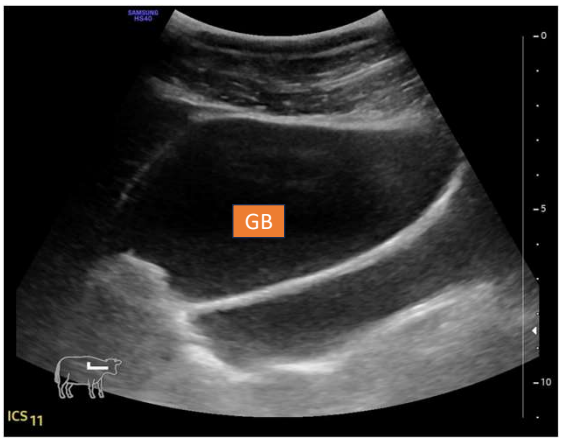
Case 3

Diagnostics- ultrasound





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Case 3

Diagnostics- ultrasound

Distended SI

- Diameter: 3.2-4cm
- Wall thickness: 1.8mm
- Swirling of GI contents

Plan

- NPO
- IVFT
- Monitor behavior closely
- Measure abdomen
- Surgery if remained painful and/or bloodwork abnormalities appeared

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Case 3

Progression

- More uncomfortable
- Abdominal distension

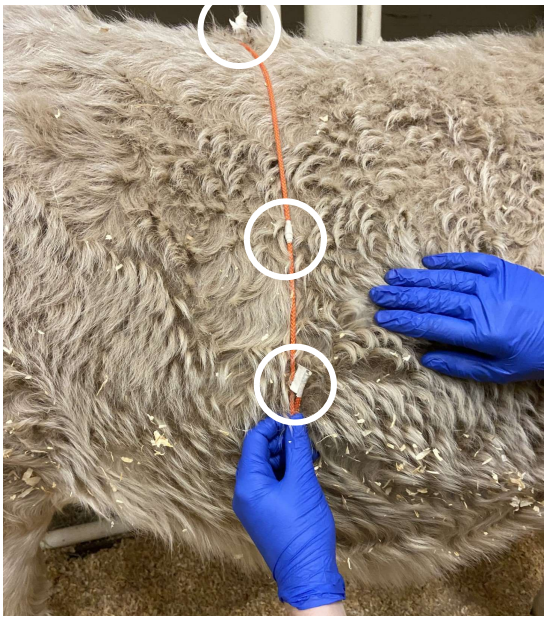
Bloodwork

Venous blood gas:

- pH 7.49
- Mild hypokalemia (3.5mmol/L)

Chem 8+ iSTAT:

- Chloride: 89 mmol/L



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Case 3

Surgery

- General anesthesia
- Mesenteric volvulus w/ flange volvulus
- Bowel appeared healthy
- Corrected volvulus
- Lavaged abdomen + heparin
- Recovered great

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Case 3

Post-Op

- Lidocaine CRI + IVFT
- Analgesia + Abx
- Belly band
- Immediately began eating hay
- Manure: 2 small liquid piles in first 24 hours, normal formed stool until discharge
- Discharged home 10 days later

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Case 3

Second presentation

Four months later

- Lethargy for a few days
- Febrile (103.7F) and kicking at abdomen day of presentation

Exam

- Mild tachycardia
- Pyrexia
- Melena and painful on abdominal palpation
- Firm mass palpable on rectal exam (right ventral)
- Mild hypokalemia and hypoalbuminemia

Surgery round 2:

- Full of adhesions ☹
- O elected humane euthanasia

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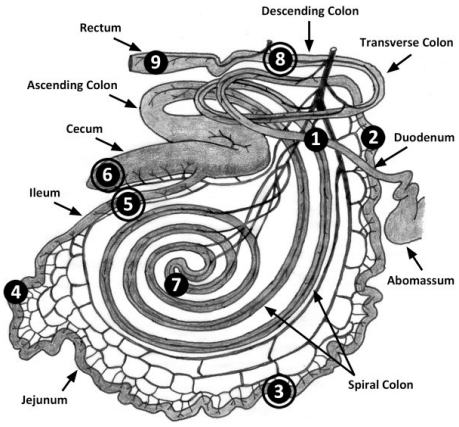
Mesenteric Volvulus

Sporadic + uncommon
Unknown cause: suspect frolic or jump or after a fall
Location: mesentery root or jejunal flange



Most painful GI obstruction + rapid deterioration
- Recumbent w/in 12-24h
- Massive SI distension

Typical presentation: JAVMA Braun et al 2023
"Continues to be the most severe form of ileus and most difficult to treat"
Colic signs in ~65.6%
14/61 cattle survived; 77% were euthanized

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Take away points

- Numerous causes of abdominal discomfort in cattle
- Uniform pain scale needed
- Utilize ultrasonography to help assess in the field
- Prognosis varies greatly on the etiology
- If suspicious of an obstruction, discuss options with the O
  - Referral ASAP if elected
- Cattle are fibrin machines

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Dr. Righi – Equine/ Food Animal

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