Anatomy - small intestine

- 10-30 m
- duodenum: 1m; duodenocolic fold
- jejunum: 17-28 m, long (40 to 60 cm), mesojejunum
- ileum: 0.7 m; ileocecal fold to the dorsal band of the cecum; the terminal part forms a papilla → the ileal orifice is located in the center of the papilla

Physiology - small intestine

- Intraluminal digestion of carbohydrates, fats and proteins with pancreatic enzymes
- Amylase, lipase, tripsin, chymotripsin, carboxypeptidase, elastase
- Pancreatic secretion: 10-12 l/100 bwkg/day
- Liver: cholic acid, chenodeoxycholic acid + glycine and taurine → to form conjugated bile salts → lipolysis
- Absorption: ions, water, carbohydrate, protein, fat, iron, calcium, magnesium etc.

Surgery of the small intestine in eq

- 34% of all colic surgeries
- 70% strangulating obstruction

Small intestine – nonstrangulating obstructions

- Ileal impaction
- Muscular hypertrophy of ileum
- Ascarid impactions
- Duodenitis, prox. jejunitis
- Neoplasia
- Gastroduodenal obstruction
- Miscellaneous simple obstr

Small intestine – non strangulating obstruction

- Ileum impaction
  - Seasonality: winter - early spring
  - Anaplocephala perfoliata
  - Up to 90 cm
  - Conservative fluid: 5l/hour, flunixin: 0.5 mg/kg 3-4x/day, mineral oil
  - Surgery: massage, no enterotomy!
  - Prognosis: in early cases: favorable
  - Delayed diagnosis: ileus, gastrectomy, laminitis, mucosal necrosis, perforation etc.
  - Anthelmintics: pyrantel pamoate + praziquantel
Small intestine – non strangulating obstruction

- Ileum muscle hypertrophy
  - Similar symptoms, recurrent colic
  - Anorexia, weight loss
  - Treatment: jejunocostomy

Small intestine – non strangulating obstruction

- Ascarid impaction
  - Parascaris equorum
  - 5 months of age (4-24 months)
  - Obstruction, intussusception, abscessation, rupture
  - > 50% following anthelmintic treatment
  - Surgery: enterotomy/typhlotomy
  - Complication possibilities: focal necrotizing enteritis, peritonitis, abscess formations, adhesions, ascarid-induced damage of the intestinal wall, release toxins, low grade liver disease, low grade pneumonia, failure to remove all worms at surgery →
  - Mortality: 90% in serious cases!!

Duodenitis- proximal jejunitis (DPJ)

- Cause: not known (Clostr., parasites, toxins etc.)
- Symptoms: fever, leukocytosis, reflux (48 hour 24 hours)
- Reflux: often reddish discoloration
- Therapy:
  - Medical
  - Surgical

Duodenitis - proximal enteritis

- Differential diagnosis:
  - Ob. caus.
  - Gik: symptoms similar
  - Fever, leukocytosis, large amount of reflux (48 hour 24 hours)
  - Following decompression more improvement
  - Less changes in peritoneal fluid
  - Rect exam prox. distension
  - Reflux: can be reddish
- Therapy:
  - Medical
    - Decompression, electrolyte correction (K, Ca!)
    - AB, Antiendozon and laminitis preventive treatment
  - Surgical

DPJ

Proxim.mov

Small intestine – non strangulating obstruction

- Enteritis and fibrosis
  - Eosinophyl cell gastroenteritis
  - Local
  - Generalised
Small intestine – strangulating obstructions

- Volvulus
- Epiploic foramen
- Pedunculated lipoma
- Mesenterial tears
- Intussusception
- Ingual hernia
- Tear in gastrolienal lig.
- Umbilical hernia
  - Richter’s hernia
  - Littre’s hernia
- Diaphragnostic hernia

Small intestine – strangulating obstruction

- Foramen epiploicum Winslowi
  - 4 cm wide entry into the vestible of the omental bursa
  - Dorsal-craniodorsal: caudate process of the liver
  - Cranioventral border: portal vein
  - Ventral border: gastropancreatic fold
  - 8-18 cm bowel can be incarcerated

Small intestine – strangulating obstruction

- Foramen epiploicum Winslowi
  - 90% left to right
  - 70% ileum is involved
  - 65-70% cribbiters and wind suckers!!
  - 60-80% survival rate
  - 35-70% on long term
  - Often reoperation
  - Clinical signs:
    - can be confusing
    - 38% mild!
    - 50% no reflux
    - US

Small intestine – strangulating obstruction

- Volvulus
  - Mesentumen 180°-torsion 2-4 months of age
- Volvulus nodosus 2-7 months – „making a knot”

Small intestine – strangulating obstruction

- Pedunculated lipoma
  - benign, smooth-walled fat tumor
  - suspended in thin mesenteric pedicle
  - 90% small intestine, 9% small colon
  - in older horses
  - The reported youngest was 8 yrs old
  - 4 studies: significantly higher in geldings
  - Surgery:
    - Resection of the lipoma (blindly in some cases – risk of mesenteric rent/bleeding!!)
    - Resection of the affected intestines depending on the viability
    - Incidental pedicled lipomas should be removed by ligation and transection
    - Incidental small, broad based tumors should not be removed
    - Survival rate: 50-80%
Small intestine – strangulating obstruction

Intussusception
- Jejunojejunal, jejunoileal, ileoileal, ileocecal
- Segmental motility diff: enteritis, acarid/tapeworm infections, mesenteric arteritis etc.
- Jejunojejunal (all age, long intussusception, acute/chronic)
- Ileocecal (<3y, usually small intussusception, most common, 27% chronic, intermittent colic)

Diagnostic of small intestine intussusception
- Long segments cause signs of severe small intestine obstruction
- Short segments cause mild, intermittent colic and usually postprandial; reduced appetite and feces, elevated temperature, weight loss
- Rectal exam.: distended loops of small intestines, intussusception can be palpated as a firm, painful tubular structure
- In chronic cases: can be palpated a hypertrophised segment proximal to the obstruction
- US: concentric rings appearance

Surgical management of intussusceptions

Ileocaecal and ileoileal: ileocecostomy, jejunocecostomy; removal of the affected bowel through typhlotomy

Jejunojejunal: if not reducible: resection

Small intestine – strangulating obstruction

Mesenteric rents
- Congenital/secondary to mesodiverticular band, primary lesion of unknown cause, trauma or mesenteric stretching
- Mares in postpartum period
- Predispose to later strangulation
- Surgery: resection(?) and/or suture the tear
- Prognosis: depending on the strangulating lesions

Inguinal hernia
- Indirect: most common, small intestine passes through vaginal ring to vaginal tunic
- Direct: jejunum (and testicle) escapes through a rent of the peritoneum and transverse fascia in the subcutaneous space of the scrotum and prepuce
- Mild to severe colic
- The intestines compresses the vessels→ testicle becomes swollen, firm and cold
- Rectal exam: small intestine in the vaginal ring and can be distended loops
- US

Mesenteric rents

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Surgical management of acquired inguinal hernias

- Early stages: general anesthesia in dorsal recumbency → gentle massage of the bowel per rectum and/or massage of the scrotum
- Nonreducible: inguinal incision + ventral midline celiotomy → resection → end to end/jejunocecostomy
- Survival rate: 76%

Small intestine – strangulating obstruction

- Through a rupture in the gastrolienal or nephrosplenic lig.
- Mesodiverticulum, mesenterium duplex
- Meckel’s diverticulum, Littre’s hernia
- Herna umbilicalis, Richter’s hernia
- Herna diaphragmatica
- Intramural haematoma

Surgical techniques – small intestines

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Assessment of intestinal viability

- Clinical assessment (54%)
  - Colour (serosa, mucosa)
  - Peristalsis, change in peristalsis following reposition
  - Mesenterial art pulsation
- Fluorescein dye: reliable in ischemic strangulating obstr
- Surface oximetry (P\text{O}_2) (in mm Hg) (specificity: 100%)
- Doppler ultrasound: hemorrhagic strangulation
- Histopathology (94%)

Surgical techniques – small intestines

Hand-sewn End-to-End Jejunojejunostomy

- Penrose drain to prevent leakage
- Transection: 50-60\textdegree from the mesenteric attachment & large stoma
- Appose the mesenteric surface first
- Two-layer continuous pattern: mucosa/submucosa: simple continuous, seromuscular layer: Lembert or Cushing
- Close the mesenteric defect

Decompression and Resection
Surgical techniques – small intestines

Jejunocecostomy

End-to-Side or Side-to-Side
The ileal stump should be short as possible
As close to the base of the cecum as possible
Stoma: Midway between the dorsal and medial band of the cecum
Small intestine aligned, directed toward the base of the cecum
Suture in two layers
Remove the dehydrated contents from the large colon—emptying the small intestine to the cecum is easier

End-to-Side or Side-to-Side

Aftercare for small intestinal surgery
• NGT (secondary gastric rupture!)
• Early feeding as possible (>24 hours)
• Broad-spectrum antibiotics
• Flunixin meglumine (3 days)
• Fluids
• Prokinetic drugs
• Adhesions, Peritonitis, Laminitis prevention

Complications and pitfalls
• Anastomotic obstructions
• Postoperative ileus
• Adhesions
• Short bowel syndrome
• Anastomatic dehiscence
• Peritonitis
• Hemorrhage
• Mesenteric rents
• Pyrexia
• Thrombophlebitis
• Long-bone fracture
• Cecal impaction
• Recurrent colic
• Incisional infections
• Colitis/diarrhea
• Pneumonia

Thank you for your attention!