Ileus

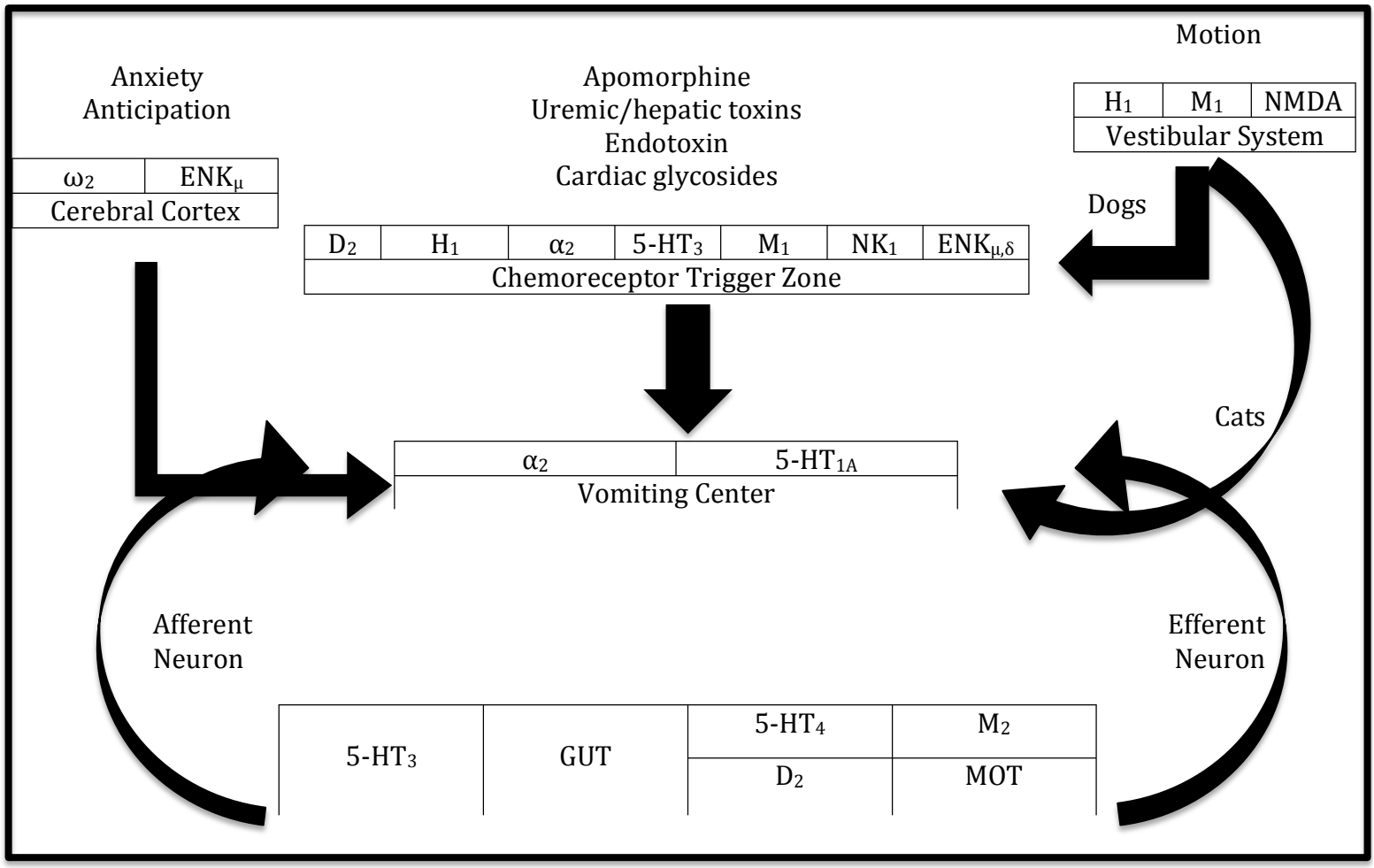
- Gastric emptying disorders
  - Mechanical obstruction
  - Defective propulsion
    - Caused by abnormalities in myenteric neuronal or gastric smooth muscle function or antropyloroduodenal coordination
    - Associated with:
      - Infectious/inflammatory diseases
      - Ulcer
      - Post-surgical gastroparesis
      - Electrolyte imbalance
      - Drugs (cholinergic antagonists, opioid agonists)
  - Adynamic ileus
    - Major surgery
    - Pain
    - Electrolyte imbalances: ↓K^+, ↓Ca^{++}
    - Inflammation
      - Parvoviral enteritis
      - Pancreatitis
      - Peritonitis
      - Gastroenteritis
    - Mechanical obstruction
    - Nematode impaction
    - Uremia
    - Pseudo-obstruction syndrome
      - Clinical evidence of obstruction w/out evidence of physical obstruction
      - Associated with idiopathic sclerosing enteropathy in the dog
    - Dysautonomia (often multiorgan)
  - Idiopathic megacolon
    - r/o pelvic canal stenosis, dysautonomia, neuropathy and Manx sacral spinal cord deformities
    - Caused by generalized dysfunction of colonic smooth mm
  - Myenteric ganglionitis
  - DDx of Ileus
    - Gas ileus
      - Generalized
        - Aerophagia
        - Smooth mm paralyzing drugs
        - Hypokalemia
        - Generalized peritonitis
        - Enteritis
      - Localized
        - Localized peritonitis
        - Early-stage bowel obstruction
        - Mesenteric artery ischemia
    - Fluid ileus
      - Generalized
        - Enteritis
        - Hypokalemia
        - Diffuse intestinal neoplasia
      - Localized
        - Foreign body
        - Obstructive tumor
        - Intussussception
- Diagnostics
  - Radiography
    - Survey radiographs only likely to detect gross abnormalities (ie adynamic ileus)
  - Positive contrast radiography
    - Obtain radiographs at predetermined intervals following oral administration of positive contrast agent
      - Immediately following, at 15, 30, and 60 minutes, then 2, 3, and 6 hours
    - Emptying of stomach should occur within 15 minutes, anxiety may delay up to 45 minutes
    - Stomach should be completely empty within 4 hours, most dogs complete in 1-2 hours
    - Fluoroscopy allows direct assessment of frequency of gastric contractions, coordination of antropyloric movement, and coordination of peristaltic movement
    - Movement through the intestine is dependent on amount of viscosity of contrast so intestinal transit time of barium is poor measure of intestinal motility

        - Enteroclysis
            - Inflate the small intestine w/ dilute barium via an enterostomy tube
            - Further information about morphologic features, limited information on motility
    - Radiopaque markers
        - Barium impregnanted polyspheres (BIPS) can be used to provide assessment of gastric emptying and intestinal transit rate of solid foods
        - # of markers leaving region of interest at certain intervals used to calculate % of emptying
    - Endoscopy
        - To rule out gastritis or obstructive disease
    - Scintigraphy
        - Allows assessment directly of gastric emptying of food labeled with a radioisotope
    - Breath hydrogen testing
        - When carbohydrates are fermented in large intestine, hydrogen is produced
        - Gas is then carried in the blood stream and excreted in the breath
        - Use a capped syringe containing breath and measure hydrogen content
        - Reliability influenced by collection technique, type of carbohydrate used, SIBO, flatulence, antibiotic use, and criteria utilized to assess a significant increase in breath hydrogen…

Vomiting

- When upper GI rids itself of contents due to irritation, overdistention or overexcitability
- A reflex mediated by activation of bilateral nucleus tractus solitarii (or emetic center)
    - Located in parvicellular reticular formation in the lateral region of the medulla oblongata
- Triggering the reflex
    - Neural pathway
        - Emetic center receives input several different afferents
            - Gastrointestinal tract afferent neurons
                - Vagal and sympathetic neurons
                    - Stimulation by inflammation or overdistention
            - Higher centers of the brain
                - Cerebral cortex and limbic system
                - Cause vomiting due to primary diseases (inflammation, hydrocephalus, etc), psychogenic stimulation (fear, pain, stress) or from ↑ intracranial pressure
            - Vestibular apparatus
            - CRTZ
                - Bilateral set of centers on brainstem
                - On the floor of the fourth ventricle
                - Free nerve endings directly contact CSF by ependymal pores
                - Activated by the vestibular system or through humoral pathway
        - Vomiting center sends signal through efferent motor neurons
            - Via sensory aspect of CN V, VII, IX, X and XII
            - Via spinal nerves to the diaphragm and abdominal musculature
- Antiperistalsis
    - At the onset of vomiting, strong intrinsic contractions occur in duodenum and stomach
    - Waves travel backward up intestine at rate of 2-3 cm/sec
- Vomiting act
    - Sequence of events:
        - Deep breath
        - Raising of the hyoid bone and larynx
        - Closing of the glottis
        - Lifting of the soft palate
        - Strong downward contraction of the diaphragm
        - Relaxation of the lower esophageal sphincter

- Three phases of vomiting:
  - Nausea
    - Conscious recognition of subconscious excitation at the emetic center
    - Seen as ptyalism, tachycardia, nervousness, hiding, yawning, attention seeking, shivering
    - There is a decrease in aboral gastric and esophageal motility and relaxation of the lower esophageal and pyloric sphincters
  - Retching
    - First: a single phase, retrograde giant contraction resulting in peristaltic motion emptying the proximal duodenum into the stomach
    - Second: deep inspiratory movements, forceful contractions of the abdominal musculature, and closure of the glottis
    - Results in negative intrathoracic pressure and positive intraabdominal pressure
    - An inhibition of the respiratory center and closing of the nasopharynx and glottis occurs at the end of retching
  - Expulsion of stomach contents through the mouth



D=dopaminergic, H=histaminergic, M=acetylcholine (muscarinic), NK=neurokinin, 5-HT=serotonin, α=α-adrenergic, ω=benzodiazepine, ENK=enkephalinergic opioid, MOT=motilin, NMDA=glutamate

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Diagnostic Utility of Abdominal Ultrasonography in Dogs with Chronic Vomiting

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Key Points

- 68.5% of dogs could have been diagnosed without ultrasound
- 22.5% of dogs needed the ultrasound
- Increased diagnostic utility assoc with increasing age and diagnosis of GI LSA or gastric adenocarcinoma

Questions

1. The chemoreceptor trigger zone is located in:
    a. The dorsal vestibular nuclei
    b. The floor of the fourth ventricle
    c. The substantia nigra
    d. The nucleus tractus solitarii
2. Emetic center afferents include:
    a. GI tract nervous system
    b. Vestibular system
    c. CRTZ
    d. Cerebrum and limbic system
3. On positive contrast radiograph, gastic emptying should be complete in
    a. 45 minutes
    b. 2 hours
    c. 4 hours
    d. 6 hours
4. Emetic center efferents include:
    a. CN V, VII, IX, X, and XII
    b. Spinal nerves to diaphragm and abdominal muscles
5. A pseudo-obstruction syndrome is when
    a. Thickening of the intestinal wall impedes flow
    b. There is clinical evidence of obstruction with no physical obstruction
    c. Neurologic peristaltic dysfunction leads to obstruction of the lumen with normal ingesta
    d. Presence of a foreign body with no changes on diagnostic imaging