PART 16

The Digestive System

Chapter 351
Normal Digestive Tract Phenomena

1. Maturation of GI Function

- **Swallowing & Sucking:**
  - **Swallowing of amniotic fluid:** Begins around **12 weeks gestation**.
  - **Nutritive sucking:** Develops at about **34 weeks gestation**.
  - **Swallowing solids:** Requires coordinated oral and pharyngeal movements, which mature **within the first few months** after birth.
  - **Tongue thrust in early infancy:** Upward and outward—suitable for milk expression, but not for solids.
- **Taste Preference:**
  - By **1 month**, infants show preference for **sweet and salty** tastes.
- **Solid Food Interest:**
  - **Around 4 months**, interest increases.
  - **Introduction at 6 months** is based on **nutrition and culture**, not purely swallowing maturity.

2. Feeding Behaviors & Norms

- **Air swallowing** during feeding is normal; **burping** helps reduce stomach distention.
- **Erratic eating in toddlers** is common—might overeat or refuse food.
  - They also **prefer limited foods**.
  - Parents should assess **nutritional intake over several days**, not by meal.
- **Periods of rapid growth** (infancy, adolescence) = increased appetite.
- **Lower appetite in toddlers/preschoolers** often concerns parents but is normal if growth is appropriate.

3. Mouth and Oral Cavity Findings

- **Short lingual frenulum (tongue-tie):** Rarely impacts function, generally does **not need treatment**.
- **Surface furrowing (geographic/scrotal tongue):** Typically **benign**.
- **Bifid uvula:** May occur alone or indicate **submucous cleft palate**.

4. Regurgitation and Gastroesophageal Reflux

- **Common in infants**; can be effortless or forceful.

    - **Volume:** ~15–30 mL per episode; sometimes more.
    - Usually **resolves in 80% by 6 months**, 90% by 12 months.
- Considered **pathologic** if it causes:
    - Failure to thrive
    - Pulmonary symptoms (e.g., apnea, aspiration)
    - Esophagitis

5. Stool Patterns

- **Meconium:** Dark, viscous; passed within **first 48 hours**.
- **Transition stools:** Green-brown, curdy—appear with early feeding.
- **Milk stools:** Yellow-brown by day 4–5.
- **Breastfed infants:** May pass stool rarely after 2–3 weeks—**still normal** if soft and painless.
- **Stool color** is usually insignificant unless:
    - **White/gray** (lack of bile pigments) → may suggest liver issue.
    - **Blood** present → requires attention.
- **Undigested vegetables (e.g., corn):** Normal, due to chewing, not malabsorption.

6. Toddler's Diarrhea

- Occurs between **1–3 years**.
- Characterized by **loose, daytime stools**, normal growth.
- Linked to **excessive juice/sugar intake**; improved by:
    - Reducing unabsorbable carbs
    - Increasing dietary fat

7. Abdominal Exam Norms

- **Protuberant abdomen** is common post-feeding.
- **Liver palpable** 1–2 cm below right costal margin = normal.
- **Riedel lobe:** Benign liver variation.
- **Palpable spleen tip:** May be normal.
- **Aortic pulsations** and **stool masses** are commonly felt.

8. GI Blood Loss & Mimics

- **Swallowed maternal blood or nasal/oral bleeding** can resemble GI bleeding.
- **Red dyes** can mimic blood in stool but **don't test positive for occult blood**.

9. Neonatal Jaundice

- **Common**, especially in **premature infants**.
- Usually due to **indirect (unconjugated) hyperbilirubinemia** from immature liver.
- **Breast milk jaundice:** Benign cause of prolonged indirect hyperbilirubinemia.

- **Direct hyperbilirubinemia** is always **abnormal**:
  - May suggest **liver disease or infection**.
  - **>15–20%** of total bilirubin should not be direct.
- **Color differences:**
  - **Indirect bilirubin:** Golden yellow
  - **Direct bilirubin:** Greenish-yellow
- **Jaundice intensity ≠ bilirubin level.** Always check and fractionate.

Chapter 352
Major Symptoms and Signs of Digestive Tract Disorders

Normal GI Development and Function in Infants and Children

- **Physiologic variation with age:**
  - GI functions differ with maturity.
  - A normal behavior in infancy may be abnormal later.
- **Swallowing development:**
  - Fetuses swallow amniotic fluid by 12 weeks' gestation.
  - Coordinated nutritive sucking begins at ~34 weeks' gestation.
  - Early swallowing relies on a tongue thrusting motion rather than the backward motion needed for solids.
- **Taste preference & feeding:**
  - **By 1 month**: Preference for sweet/salty tastes.
  - **By ~4 months:** Interest in solids increases.
  - Solids are usually introduced at 6 months based on nutrition and culture, not swallowing maturity.
- **Burping:** Necessary to prevent air-related stomach distention from swallowing air during feeding.

Common Normal Oral Variants

- **Tongue-tie (short frenulum):** Rarely needs treatment.
- **Geographic/scrotal tongue:** Normal variant.
- **Bifid uvula:** May indicate submucous cleft palate.

Regurgitation and Gastroesophageal Reflux (GER)

- **Common in first year:** May appear as dribbling or forceful but usually not concerning.
- **Typical volume:** 15–30 mL per episode.

- **Resolution:** In 80% by 6 months, 90% by 12 months.
- **Pathologic reflux (GERD):** If complications like failure to thrive, aspiration, or esophagitis arise, further evaluation is warranted.

Eating Patterns in Young Children

- **Erratic behavior is normal:** Toddlers may eat a lot or very little at times.
- **Parental reassurance:** Focus on overall intake and growth, not individual meals.

Stool Patterns in Infancy

- **Highly variable:** Frequency and consistency can differ among infants.
- **Progression:**
  - Meconium → transitional stools → yellow-brown milk stools.
- **Breastfed infants:** May have frequent stools early and later have infrequent but normal ones.
- **Toddler's diarrhea:** Common, often linked to excessive juice; managed by reducing sugary drinks and increasing dietary fat.

Abdominal Examination Findings

- **Protuberant abdomen:** Normal in infants due to weak muscles and organ size.
- **Palpable liver:** Normal up to 1–2 cm below right costal margin.
- **Other normal findings:** Riedel lobe, spleen tip, vertebral column, and palpable stool.

GI Blood Loss and Jaundice

- **Blood in stool is never normal**, but swallowed maternal blood or nasal/oral bleeding can mimic it.
- **Jaundice:**
  - **Indirect (unconjugated):** Common and usually benign in newborns.
  - **Direct (conjugated):** Abnormal, suggests liver or extrahepatic pathology.
  - **Color difference:** Indirect → golden yellow; direct → greenish yellow.

Table 352.1 Nondigestive Tract Causes of GI Symptoms in Children

GI Symptom	Possible Nondigestive Causes
Anorexia	- Systemic disease (inflammatory, neoplastic) - Cardiorespiratory compromise - Iatrogenic (e.g., drugs, unpalatable diets) - Depression - Anorexia nervosa
Vomiting	- Inborn errors of metabolism - Medications (e.g., erythromycin, chemotherapy, NSAIDs, marijuana) - Increased intracranial pressure, brain tumor - UTI, labyrinthitis - Adrenal insufficiency - Pregnancy - Psychogenic causes

GI Symptom	Possible Nondigestive Causes
	- Abdominal migraine - Poisoning or toxins - Renal disease
Diarrhea	- Infections (e.g., otitis media, UTI) - Uremia - Medications (e.g., antibiotics, cisapride) - Tumors (e.g., neuroblastoma) - Pericarditis - Adrenal insufficiency
Constipation	- Hypothyroidism - Spina bifida - Developmental delay - Dehydration (e.g., diabetes insipidus, renal tubular disorders) - Medications (e.g., narcotics) - Lead poisoning - Infant botulism
Abdominal Pain	- Pyelonephritis, hydronephrosis, renal colic - Pneumonia (lower lobe) - Pelvic inflammatory disease - Porphyria - Fabry disease - Angioedema - Endocarditis - Abdominal migraine - Familial Mediterranean fever - Sexual/physical abuse - Systemic lupus erythematosus - School phobia - Sickle cell crisis - Vertebral disk inflammation - Psoas abscess - Pelvic osteomyelitis or myositis - Medications - ACNES (Anterior Cutaneous Nerve Entrapment Syndrome)
Abdominal Distention or Mass	- Ascites (e.g., nephrotic syndrome, neoplasm, heart failure) - Discrete masses (e.g., Wilms tumor, hydronephrosis, neuroblastoma, mesenteric cyst, hepatoblastoma, lymphoma) - Pregnancy
Jaundice	- Hemolytic disease - Urinary tract infection - Sepsis - Hypothyroidism - Panhypopituitarism

Dysphagia (Difficulty Swallowing)

- **Types:**

    - **Oropharyngeal (transfer dysphagia):** Problem moving food from mouth to esophagus; involves mouth/pharynx muscles.
    - **Esophageal dysphagia:** Problem moving food through the esophagus to the stomach.
- **Odynophagia:** Painful swallowing.
- **Globus sensation:** Feeling of something stuck in the throat, often without a clear cause.

Oropharyngeal Dysphagia

- **Causes:** Neurologic/muscular disorders (e.g., botulism, muscular dystrophy), Chiari malformation, Russell-Silver syndrome, infections, nasal obstruction.
- **Risks:** Aspiration is the most serious complication.
- **Table 352.2** from Nelson Textbook of Pediatrics (2020), listing the causes of **oropharyngeal dysphagia** in children:

Causes of Oropharyngeal Dysphagia

Category	Examples
Neuromuscular Disorders	- Cerebral palsy - Brain tumors - Cerebrovascular disease/stroke - Chiari malformation - Polio and postpolio syndromes - Multiple sclerosis - Myositis, dermatomyositis - Myasthenia gravis - Muscular dystrophies - Acquired or inherited dystonia syndromes - Dysautonomia
Metabolic and Autoimmune Disorders	- Hyperthyroidism - Systemic lupus erythematosus - Sarcoidosis - Amyloidosis
Infectious Disease	- Meningitis - Botulism - Diphtheria - Lyme disease - Neurosyphilis - Viral infections: polio, coxsackievirus, herpes, cytomegalovirus
Structural Lesions	- Inflammatory lesions: abscess, pharyngitis - Congenital web - Cricopharyngeal bar - Dental problems - Bullous skin lesions - Plummer-Vinson syndrome - Zenker diverticulum

Category	Examples
	- Extrinsic compression: osteophytes, enlarged lymph nodes, thyroid swelling, aberrant right subclavian artery (dysphagia lusoria)
Other	- Corrosive injury - Medication side effects - Post-surgical changes - After radiation therapy

Esophageal Dysphagia

- **Causes:**
  - **Motility disorders:** Rare (e.g., achalasia, post-surgical dysmotility).
  - **Mechanical obstruction:** More common, either intrinsic (strictures, webs, tumors) or extrinsic (vascular rings, masses).
- **Associated conditions:** Eosinophilic esophagitis, GERD, congenital abnormalities, caustic ingestion.
- **Symptoms:** Difficulty more with solids than liquids suggests obstruction; patients may point to chest pain or suprasternal notch.

Table 352.3 Causes of Esophageal Dysphagia

Category	Examples
Neuromuscular Disorders	- Eosinophilic esophagitis - Achalasia cardia - Diffuse esophageal spasm - Scleroderma - Gastroesophageal reflux disease (GERD)
Intrinsic Lesions	- Foreign bodies (e.g., food, coins, pills) - Esophagitis: GERD-related, eosinophilic, infectious - Strictures: corrosive injury, pill-induced, peptic - Esophageal webs and rings (e.g., Schatzki ring) - Esophageal diverticula - Neoplasm - Chagas disease
Extrinsic Lesions	- Vascular compression (e.g., vascular ring) - Mediastinal mass/lesion - Cervical osteochondritis - Vertebral abnormalities

REGURGITATION

- **Definition:** Effortless backflow of gastric contents into the esophagus/mouth.
- **Cause:** In infants, usually due to an immature/incompetent lower esophageal sphincter.
- **Distinguishing features:**

- Not distressing.
- Often followed by hunger.
- Resolves with age.

- **Important to distinguish from:** Vomiting (which is an active reflex).

NAUSEA

- **Definition:** Unpleasant sensation of impending vomiting, often epigastric.
- **Triggers:**
  - Environmental (odors, toxins).
  - Visual stimuli.
  - Visceral pain.
  - Stress (psychologic/physical).
- **Pathophysiology:**
  - CNS (chemoreceptor trigger zone, brain-gut axis).
  - GI (gastric hyperacidity, motility issues).
  - Vestibular (motion sickness).
  - ICP (increased intracranial pressure).
- **Chronic Nausea:** Common in adolescents, especially White females with anxiety; may involve:
  - Functional dyspepsia.
  - Gastroparesis.
  - Constipation.
  - Autonomic dysfunction.
- **Management:**
  - Hydration.
  - Antiemetics (antihistaminic, serotonergic, dopaminergic).
  - Complementary therapy (ginger, peppermint, biofeedback).
  - Behavioral therapy.

VOMITING

- **Definition:** Coordinated reflex involving:
  - Salivation, retching, diaphragm descent, abdominal contraction.
- **Controlled by:** Vomiting center in the medulla (influenced by CTZ and CNS centers).
- **Types:**
  - **Obstructive:** Vomiting due to GI obstruction (see Table 352.6).
    - **Bilious vomiting**: If obstruction is below second part of the duodenum.
  - **Non-obstructive:** From upper bowel, pancreas, liver, CNS/metabolic issues, or cyclic vomiting syndrome.

- **Associated condition:** Cannabis hyperemesis syndrome (teenagers).
- **Complications:** Dehydration, electrolyte imbalance, Mallory-Weiss tear, etc. (see Table 352.7).
- **Management strategies:** Covered in Tables 352.8 and 352.9.

Table 352.4 – Differential Diagnosis of Emesis During Childhood

INFANT	CHILD	ADOLESCENT
Common	**Common**	**Common**
Gastroenteritis	Gastroenteritis	Gastroenteritis
Gastroesophageal reflux	Systemic infection	GERD
Overfeeding	Gastritis	Systemic infection
Anatomic obstruction*	Toxic ingestion/poisoning	Toxic ingestion (e.g., marijuana)
Systemic infection†	Pertussis syndrome	Gastritis
Pertussis syndrome	Medication side effects	Sinusitis
Otitis media	GERD	Inflammatory bowel disease
	Sinusitis	Appendicitis
	Otitis media	Migraine
	Anatomic obstruction*	Pregnancy
	Eosinophilic esophagitis	Medications
		Ipecac abuse, bulimia
		Concussion
Rare	**Rare**	**Rare**
Adrenogenital syndrome	Pseudoobstruction	Reye syndrome
Inborn errors of metabolism	Reye syndrome	Hepatitis
Brain tumor (↑ ICP)	Hepatitis	Peptic ulcer
Subdural hemorrhage	Peptic ulcer	Pancreatitis
Food poisoning	Pancreatitis	Cholecystitis
Rumination	Brain tumor	Brain tumor
Renal tubular acidosis	↑ ICP	↑ ICP
Ureteropelvic junction obstruction	Middle ear disease/labyrinthitis	Concussion
	Chemotherapy	Middle ear disease/labyrinthitis

	Achalasia	Chemotherapy
	Cyclic vomiting (migraine)	Cyclic vomiting (migraine)
	Esophageal stricture	Biliary colic
	Duodenal hematoma	Renal colic
	Inborn errors of metabolism	Porphyria
	Gastroparesis	Diabetic ketoacidosis
		Adrenal insufficiency
		Pseudoobstruction
		Intestinal tumor
		Gastroparesis
		Achalasia
		Superior mesenteric artery syndrome
		Distal intestinal obstruction syndrome

Table 352.5: Examples of Causes and Management of Nausea

CAUSE	TREATMENT APPROACH
FUNCTIONAL GASTROINTESTINAL DISORDERS	
Gastroesophageal reflux	Diet and lifestyle changes; acid reduction; refluxate management
Esophagitis (reflux-related, eosinophilic, etc.)	Acid suppression; eliminate environmental/dietary triggers
Dyspepsia	Diet/lifestyle modifications; acid suppression; cyproheptadine
Gastroparesis	Small, frequent meals; dietary changes; prokinetic agents (e.g., metoclopramide, domperidone*, low-dose erythromycin or azithromycin)
Constipation	Hydration; diet/lifestyle changes; stool softeners; stimulant laxatives; other adjuncts as needed
Visceral hyperalgesia	Tricyclic antidepressants (e.g., amitriptyline); cognitive behavioral therapy; hypnotherapy; biofeedback; physical therapy; stress management