Abstract:
The symptom of emesis in the neonate is common and caused by a myriad of clinical states, some pathologic and some benign. There are many clinical data points that steer the astute clinician toward certain diagnoses and away from others. The focus of this article is to provide a framework for evaluating a neonate that presents to an emergency department with emesis. After reading this article, the emergency department clinician will have a better understanding of the clinical presentation and evaluation of surgical and nonsurgical etiologies of emesis in the neonate.

Keywords:
neonate; emesis; emergency department; newborn; pyloric stenosis; gastrointestinal; gastroesophageal reflux; gastroesophageal reflux disease; malrotation; volvulus; intestinal atresia; Hirschsprung disease; incarcerated hernia; necrotizing enterocolotis

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Emesis in the Neonate: Recommendations for Initial Management

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Emesis in the neonate is a common presenting complaint in the emergency department (ED). Studies have noted a chief complaint of emesis in 11 to 36% of neonatal ED visits.[1,2] The severity of vomiting is broad and ranges from simple, uncomplicated gastroesophageal reflux (GER) to life-threatening etiologies. It can be challenging to determine the severity of overall illness and emesis in an infant amid what is often a high level of parental concern. The focus of this article is to provide a framework for evaluating a neonate that presents to the ED with emesis. By the end of this article, the clinician will know the common causes of neonatal emesis and have a solid grounding in what tests to order, when to admit patients, and when to consult pediatric surgery.

HISTORY AND PHYSICAL EXAMINATION

When evaluating the presenting complaint of neonatal emesis, strong skills in history taking and physical examination are paramount. There are several striking features in the history and the physical examination that can narrow the focus for the clinician, help eliminate tests, and minimize delay in diagnosis of potentially life-threatening etiologies of neonatal emesis.

Key features in the history include a birth history focusing on gestational age, delivery complications, need for admission to the neonatal intensive care unit, and birth weight. Elements notable in the prenatal history include maternal laboratory values, prenatal ultrasound scans, and the levels of amniotic fluid, as polyhydramnios may be one of the first indications of intestinal obstruction. Finally, a

focused family history includes details such as milk--protein allergy in siblings and if an infant is a first-born male (at higher risk for pyloric stenosis). The presence of fever and a history of accidental or nonaccidental trauma are also critical elements of the history.

A feeding history including what an infant consumes, total volume of feeds, frequency, feeding behavior, and an elimination history for both urine and stool should be obtained. Calculating the percentage an infant is below birth weight is important. Healthy neonates regain their birth weight by 2 weeks of age at the latest and should not be greater than 10% below birth weight at any given time following birth. In addition, infants should gain 20 to 30 g/d after the initial period of weight loss following birth.

When asking the caregiver about the color of emesis, prompting parents with the word *bilious* will often illicit an answer of yes when emesis is yellow in color.[3] Determining the frequency, estimated volume, and whether emesis is projectile or worsening is also important.

Physical examination of the neonate will give the provider a great deal of information when evaluating an infant with emesis. Vital signs including heart rate, respiratory rate, blood pressure, temperature, and oxygen saturations should be obtained in all neonates presenting to the ED with emesis. A weight should likewise be obtained without clothing or a diaper.

An overall impression of appearance is essential. A lethargic, obtunded, toxic-appearing infant should steer a clinician to establish an urgent plan of care, whereas a well-appearing, well-hydrated, active infant should provide initial reassurance. Signs of dehydration include dry mucous membranes, cracked lips, a sunken anterior fontanelle, increased skin turgor, delayed capillary refill, and an infant that does not produce tears when crying. A neurologic examination including feeling for a full or bulging fontanelle may indicate a central nervous system (CNS) lesion, trauma (accidental or not), or CNS infection. Physical findings of bruising or trauma may indicate nonaccidental trauma. Examination of the abdomen should be notable for the presence or absence of abdominal distention, tenderness, organomegaly, masses, ascites, and the presence and characterization of bowel sounds. Examination of the inguinal and genital areas is necessary to exclude an incarcerated inguinal hernia or ambiguous genitalia presenting with an adrenal crisis. Examination the anorectal region may reveal physical examination findings such as blood in the case of necrotizing enterocolitis or intussusception. In addition, establishing the presence of a patent anus is a critical element of the examination.

Hallmark features of concern in the history and physical examination include bilious emesis, weight loss, lethargy, an obtunded infant, shock, dehydration, and an acute abdomen.

TABLE 1. Common surgical and nonsurgical causes of emesis in the neonate.

Surgical Etiologies	Nonsurgical Etiologies
Hypertrophic pyloric stenosis	Gastroesophageal reflux
Malrotation with midgut volvulus	Gastroesophageal reflux disease
Intestinal atresia or stenosis	Sepsis and infection
Meconium syndromes	Inborn errors of metabolism
Hirschsprung disease	Increased intracranial pressure
Incarcerated inguinal hernia	Feeding intolerance
Necrotizing enterocolitis	Necrotizing enterocolitis

DIAGNOSTIC EVALUATION

The evaluation of a neonate presenting with emesis offers the clinician a wide array of tests to rule in or out specific etiologies (Table 1). However, many tests are nonspecific and do not provide clarity of diagnosis. In addition, for many well-appearing, hydrated neonates with nonbilious emesis, a complete history and physical examination should suffice as long as there is close follow-up from the primary care physician. A metered blood glucose should be done for any lethargic, obtunded, or dehydrated infant. Electrolytes may yield information about a neonate's hydration status with hypernatremia or a low bicarbonate level indicate of dehydration in an infant. The presence of hypokalemic, hypochloremic metabolic alkalosis is

TABLE 2. Imaging mode of choice for common etiologies of emesis.

Etiology	Imaging Mode of Choice
Hypertrophic pyloric stenosis	Pyloric ultrasound scan
Intestinal malrotation ± midgut volvulus	Upper gastrointestinal (GI) series
Intestinal atresia or stenosis	Abdominal plain film ± upper or lower GI series
Meconium syndrome	Abdominal plain film ± lower GI series
Hirschsprung disease	Abdominal plain film followed by lower GI series
Necrotizing enterocolitis	2-View abdominal plain film
Increased intracranial pressure	MRI if available and time allows. CT if MRI not available or need is emergent.

Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging.