Intussusception

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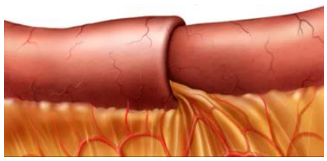
- It is an **acquired** invagination of the intussussceptum (proximal bowel) into the intussescipiens (distal bowel) by peristaltic activity.
- It is the **<u>most common cause of bowel obstruction</u>** in children 3 months - 3 years old.

Why is it important to diagnose and treat intussusception?



Intussusception → mesentery of intussusceptum is compressed → venous congestion → edema and obstruction → arterial insufficiency → ischemia → necrosis

Types of intussusceptions:

a. **Primary (idiopathic);** most common

No lead point, possible cause is hypertrophied Peyer's patches after an upper respiratory tract infection or gastroenteritis, which are usually viral (adenoviruses and rotaviruses in 50% of cases).

<u>Incidence</u>: can occur at any age, highest incidence is in infants 4-9 months; 2/3 are boys. Most are well-nourished and healthy.

> Lead point: an abnormality in the intestines that is trapped by peristalsis and provokes intussusception.

b. **Secondary** (1.5-12%)

Increases in proportion with age, and usually there is a lead point (Meckel's diverticulum is the most common).

Clinical presentation: triad seen in <25%

1. Intermittent, crampy abdominal pain

Sudden onset and termination of pain, may be associated with hyperextension, breath holding, and vomiting. The baby is comfortable between attacks but eventually will become lethargic.

2. Currant jelly stools (due to ischemia and mucosal sloughing)
3. Palpable mass on PEx.

Early physical exam:

a. Normal vital signs
b. Cramps every 15-3o min.
c. Dance sign (empty RLQ with RUQ fullness)
d. Sausage shaped/ curved mass
e. Audibles peristalsis

As the obstruction progresses: Bowel movements will stop, bilious emesis, Increasing abdominal distention

Late physical exam:

Redcurrant jelly stools, Leukocytosis and electrolyte abnormalities, hypotension, fever, tachycardia, dehydration, intussusceptum prolapse through the anus. (grave sign).

Diagnosis:

1. **AXR** (50% diagnostic): Abdominal mass, abnormal distribution of gas and fecal contents, sparse large bowel gas, air-fluid levels.
2. **Ultrasound**: 'target' or 'donut' lesion, in a transverse plane, 'pseudokidney' sign on a longitudinal section. Advantages: lack of radiation exposure, less cost, detects lead points, guides therapeutic reduction.
3. **CT and MRI**: 'target' or 'donut' sign
   not routinely used, may detect pathologic causes e.g. lymphoma

Non-operative management: **Hydrostatic and pneumatic reduction**

Preparation	Nasogastric tube to decompress the stomach, Bowel rest (NPO), IV fluids, CBC and serum electrolytes.
Procedure	Air or water-soluble isotonic contrast is used, fluoroscopically monitored
Success rate	85%
Advantages	decreased morbidity, cost, and length of hospital stay
Contraindications	intestinal perforation (free intra-abdominal air), peritonitis, persistent hypotension.
Results	a. Unsuccessful: try again after 30 min to 24 hours b. Successful: admit for observation, bowel rest, IV fluids

Pneumatic decompression is quicker, safer, less messy with less exposure to radiation.

Maximum safe air pressure is: 80 mmHg for younger infants, 110-120 mmHg for older infants.

Drawbacks: a. Possibility for tension pneumoperitoneum (0.4-2.5%):

Immediate cessation of the procedure, release air through large gauge needle, and operative exploration.

b. Poor visualization of lead points.

c. Poor visualization of reduction process.

Operative management:

	Open approach	**Laparoscopic approach** high success rate, low conversion rate 5.4%
Indications	- Unsuccessful/ incomplete nonoperative reduction - Peritonitis - Presence of lead point - Pneumoperitoneum	
Preparation	- Broad-spectrum abx - IV fluids - Insert urinary catheter, to monitor urine output - NGT	
Procedure	1. Right lower abdominal incision 2. Gently manipulate the leading edge of the intussusceptum back to normal position 3. Avoid excessive pulling 4. Incidental appendectomy is often performed 5. Questionable ischemic bowel is warmed with saline-saoked pads and re-evaluated 6. +/- resection and anastomosis of bowel when: - Inability to manually reduce the intussusception - Ischemic bowel - Identification of a lead point	- We use three abdominal ports - Apply gentle pressure distal to the intussusceptum using atraumatic graspers - Traction proximal to the intussuscipiens - If resection is needed, exteriorize the bowel through the umbilical incision
Contraindications		- Peritonitis - Hemodynamic instability - Severe bowel distention

Recurrent intussusception: seen earlier by parents

- Non-operative: 10-15% (1/3 within 24 hours, majority within 6 months)
- Open operative: less likely
- Laparoscopic reduction: 10%

Postoperative intussusception: Rare, occur 10 days postop, 3-10% of cases of postoperative bowel obstruction.

Diagnosis: high index of suspicion + ultrasound

Treatment: operative reduction (usually without resection).

Appendix 1

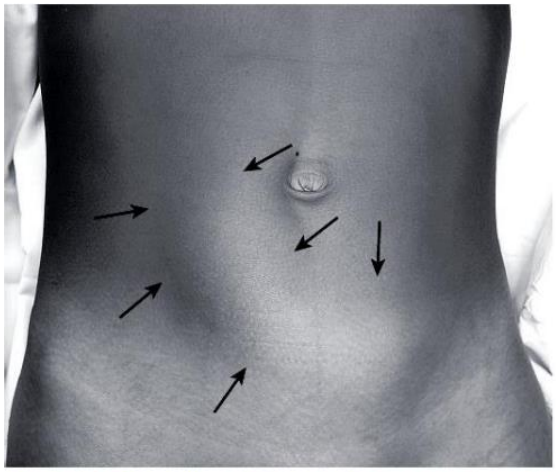


FIGURE 38-2 ■ This 10-year-old boy has a palpable sausage-shaped mass (arrows) due to an intussusception.

FIGURE 38-3 ■ This abdominal radiograph in a patient with intussusception shows dilated loops of small bowel in the right lower quadrant and a right upper quadrant soft tissue mass density in the vicinity of the transverse colon near the hepatic flexure (arrow).

FIGURE 38-4 ■ This transverse sonographic image shows the alternating rings of low and high echogenicity due to an intussusception. This finding has been called a 'target' sign.

FIGURE 38-5 ■ Sonogram showing the 'pseudokidney' sign seen with intussusception on longitudinal section.

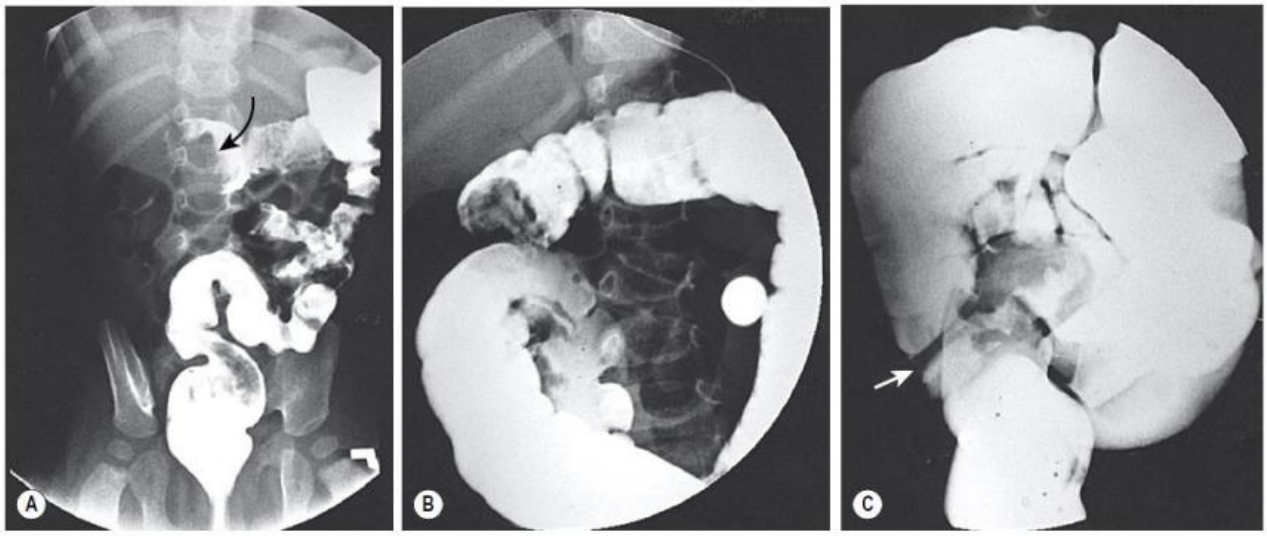


FIGURE 38-7 ■ Fluoroscopic examination using isotonic contrast for hydrostatic reduction of intussusception. **(A)** Intussusception (arrow) seen in midtransverse colon. **(B)** Reduction has occurred to the hepatic flexure. **(C)** Complete reduction with reflux of contrast medium into the terminal ileum. Note the edematous ileocecal valve (arrow).

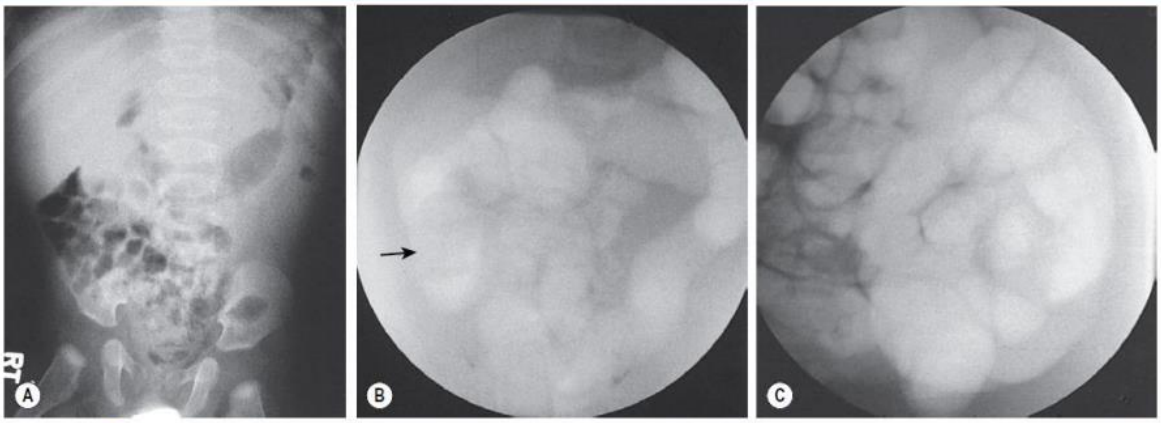


FIGURE 38-8 ■ Plain radiography and fluoroscopic examination using air for pneumatic reduction of an intussusception. **(A)** Plain radiograph showing a mass effect in the right upper quadrant. **(B)** Pneumatic reduction to the vicinity of the cecum with the intussusception still present (arrow). **(C)** Complete reduction with reflux of air into multiple loops of small intestine. (Courtesy of Charles Maxfield, MD.)

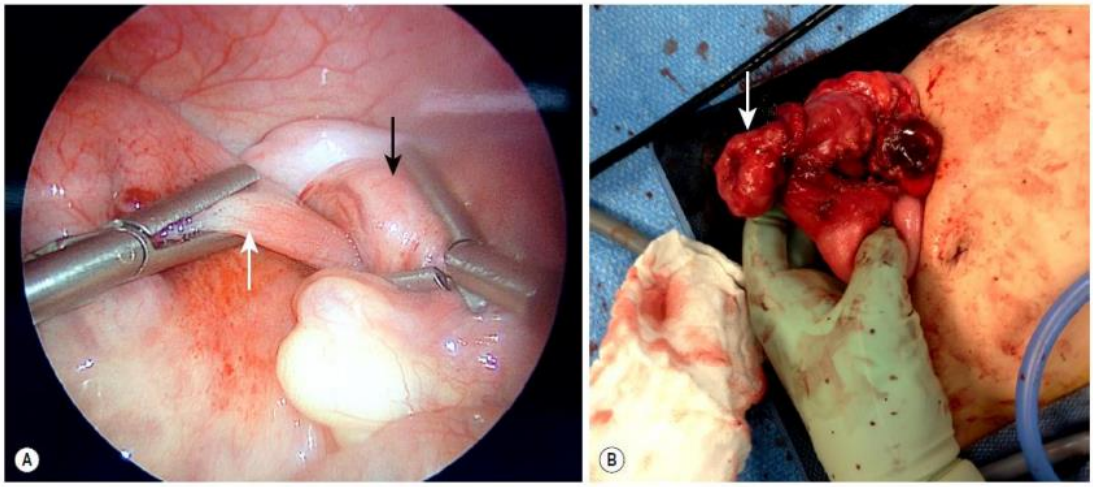


FIGURE 38-10 ■ **(A)** This laparoscopic photograph shows an incompletely reduced intussusception with the intussusceptum (white arrow) telescoping into the intussuscipiens (black arrow). **(B)** A pathologic lead point due to a Burkitt lymphoma was found requiring conversion to open.

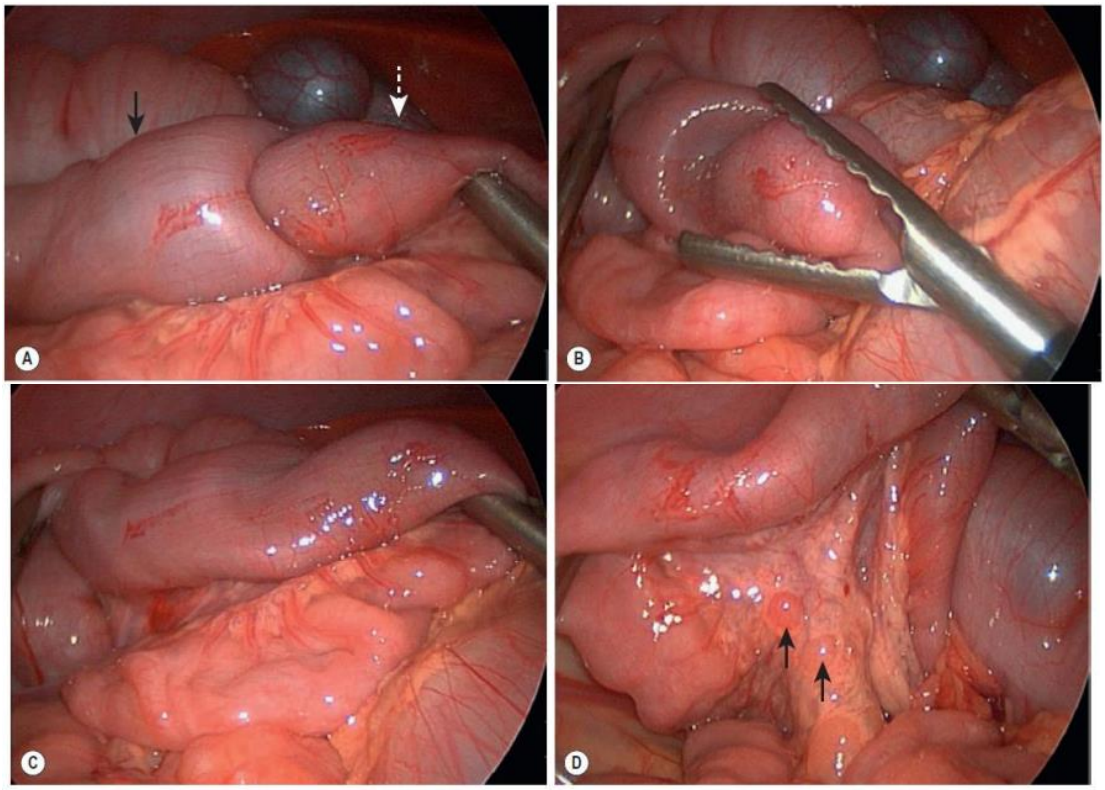


FIGURE 38-11 ■ Laparoscopic reduction of intussusception with hypertrophied lymph nodes is depicted in these four operative photographs. **(A)** Intussusceptum (white arrow) is seen telescoping into the intussuscipiens (black arrow). **(B)** The intussusception has almost been completely reduced. **(C)** This intussusception has been completely reduced and the bowel appears viable. **(D)** Hypertrophied mesenteric lymphadenopathy (arrows) is seen. This lymphadenopathy may reflect a recent viral illness.

Hypertrophic pyloric stenosis

- One of the most common surgical conditions in newborns.
- Risk factors: family history, male gender, younger maternal age, first-born infant, maternal feeding patterns.
- Premature infants are diagnosed later than term or post-term infants.

Etiology: unknown (multifactorial)

1. **Genetic factors:** Race discrepancies, male gender (M:F = 4:1), birth order.
2. **Environmental factors:** Method of feeding, seasonal variability, exposure to erythromycin, transpyloric feeding in premature infants.
3. **Other factors:** Excessive substance P, decreased neurotrophins, deficient NOS, Gastrin hypersecretion.

Clinical presentation:

History	Physical exam	Investigations
Full-term neonate (2-8 weeks) with infrequent, nonbilious, projectile vomiting that later progresses to occur with every feeding. (Signs of gastritis are common e.g. coffee-ground emesis)	- Baby looks well initially, but symptoms progress to dehydration & somnolence. - Visible peristaltic waves in the mid to left upper abdomen. - Palpable pylorus (olive sign) in 70-90%	**Labs:** hypochloremic, hypokalemic, metabolic alkalosis with paradoxical aciduria. **Ultrasound:** is the standard diagnostic test - muscle thickness ≥4 mm (≥3mm if <30 days age) - pyloric channel length ≥16mm **Upper GI series:** if US findings are equivocal - 'string' sign, 'double track' sign

Treatment: HPS is not a surgical emergency

- IV fluid resuscitation is a priority, if inadequate can cause persistent alkalosis, decreased respiratory drive, and postoperative apnea.
- Withhold feeding (+/- gastric decompression)
- Surgical correction by pyloromyotomy

Differential diagnosis of nonbilious vomiting:

- **Medical causes:** GERD, gastroenteritis, increased ICP, metabolic disorders
- **Anatomic causes:** antral webs, foregut duplication cyst, gastric tumors, extrinsic gastric compression by a tumor.

	Open approach	Laparoscopic approach
Procedure	Incision options: 1. RUQ transverse incision (most common) 2. Omega-shaped incision superior to the umbilicus, followed by incising linea alba cephalad. Then the pylorus is exteriorized through the incision, and a longitudinal serosal incision is made in the pylorus, using blunt dissect the firm pyloric fibers until the submucosa is seen, and mucosa bulges out. **If perforation of the mucosa occurs, myotomy should be closed, and a new one is made 90-180^o from the original one. Feedings are withheld for 24 hours postop.*	- Introduce 3 ports, enter the abdomen through the umbilical port and insufflate. - Longitudinal pyloromyotomy is made - Check mucosal integrity - Evacuate pneumoperitoneum after removal of instruments.
Postoperative care:	- Ad libitum feeding in the early postop period - We don't give prophylactic perioperative abx	- Control pain with acetaminophen - Most are discharged on the first postop day
Complications	- Mucosal perforation 1-2% - Incisional hernia 1% - Prolonged postop emesis, due to reflux or incomplete myotomy. (Less common 2-26%). - Duodenal injury	- Wound infection 1-2% - Postop emesis (common)
Outcomes	Nowadays, mortality is almost zero due to improvement in neonatal resuscitation, anesthesia and surgical techniques. Morbidity rate is 1-2%.	

Appendix 2

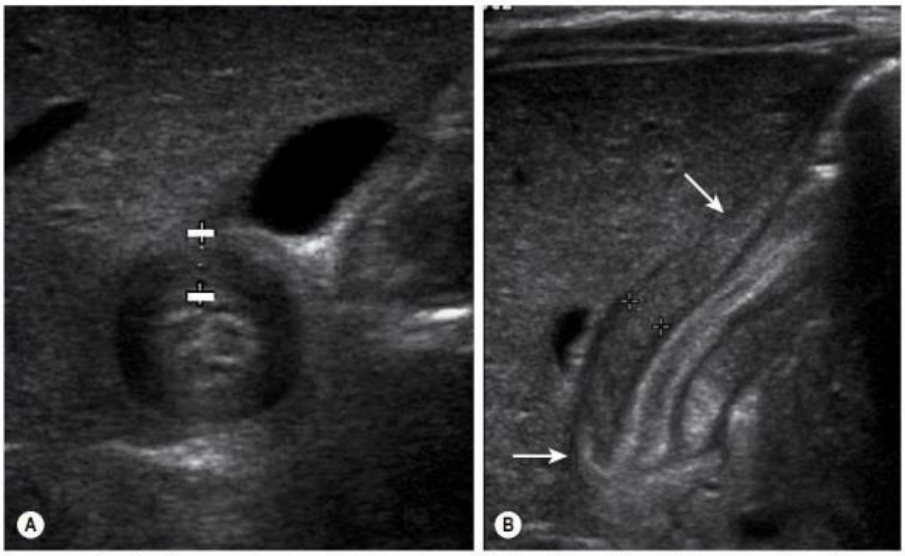


FIGURE 29-1 ■ Ultrasonography has become the standard imaging study for diagnosing pyloric stenosis and has supplanted physical examination at most institutions. The (**A**) transverse and (**B**) longitudinal views of hypertrophic pyloric stenosis are seen here. Muscle thickness greater than or equal to 4 mm on the transverse view or a length greater than or equal to 16 mm on the longitudinal view is diagnostic of pyloric stenosis. On this study, the pyloric wall thickness was 5 mm and the length (arrows) was 20 mm.

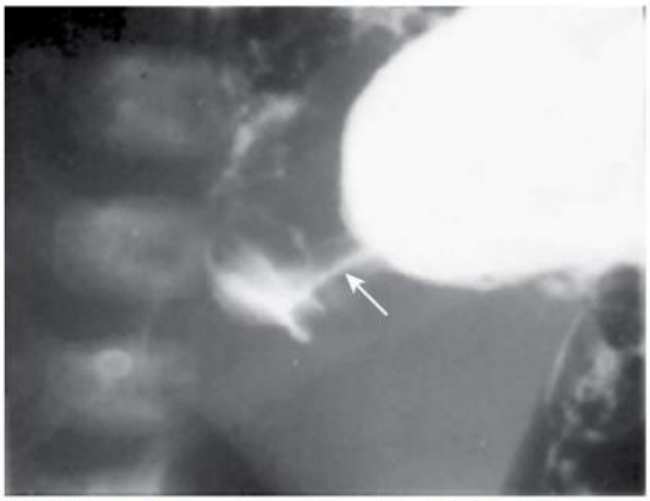


FIGURE 29-2 ■ At some hospitals outside of urban centers, ultrasound technicians and radiologists proficient in performing an ultrasound study for pyloric stenosis are not available. Also, in some instances, an ultrasound study can be equivocal. An upper gastrointestinal series can be helpful in making the diagnosis of pyloric stenosis or confirming an equivocal ultrasound study. In this upper gastrointestinal study, note the 'string sign' indicating a markedly diminished pyloric channel (arrow) and subsequent gastric outlet obstruction. It is important to evacuate the contrast material after this study to reduce the risk of aspiration and pulmonary complications.

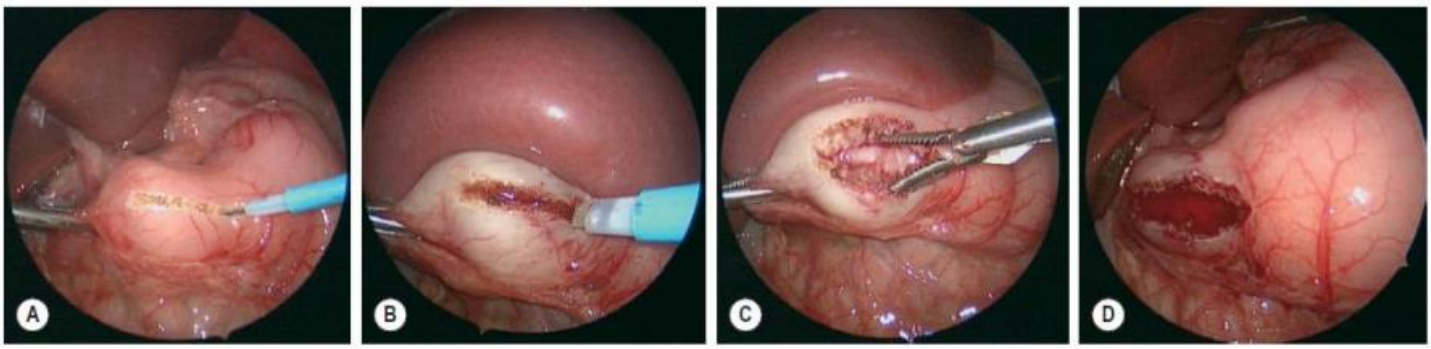


FIGURE 29-5 ■ These intraoperative photographs depict a laparoscopic pyloromyotomy. (**A**) The spatula tipped cautery is being used to incise the serosa and outer muscular layer of the hypertrophied pylorus. (**B**) The tip of the cautery is introduced into the hypertrophied muscle and twisted to break up the muscle fibers and create a space for insertion of the pyloric spreader. (**C**) The pyloric spreader is introduced into the muscle and gently opened to split the hypertrophied muscle fibers. The submucosa is visualized through the myotomy. (**D**) Air is introduced into the stomach to assess the integrity of the mucosa.