BMJ Best Practice

Hirschsprung disease

Straight to the point of care

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Summary

Hirschsprung disease is most commonly diagnosed in the first year of life.

Presents with vomiting, delayed passage of meconium, abdominal distension, and/or enterocolitis.

May be associated with other congenital anomalies (e.g., Down syndrome, multiple endocrine neoplasia type IIA).

Definitive diagnosis is with a rectal biopsy.

Initial treatment is bowel irrigation, followed by a definitive surgical treatment, either transanally alone or with laparoscopic assistance. Rarely, colostomy or ileostomy is required, with definitive pull-through delayed.

Irrigations often do not work for patients with total colonic Hirschsprung disease. Total colectomy with ileo-procto anastomosis and a protective ileostomy is recommended at the time of diagnosis, with definitive surgery when stoma output is of a thicker consistency (typically when the child is around one year old and has fully transitioned to solid foods).

Definition

A congenital condition characterized by partial or complete colonic functional obstruction associated with the absence of ganglion cells.[1][2] Because of the aganglionosis, the lumen is tonically contracted, causing a functional obstruction. The aganglionic portion of the colon is always located distally, but the length of the segment varies. This determines the varied manifestations of the disease. The vast majority of patients present in the newborn period up to 1 year of age. Diagnosis later in life occurs rarely.

Hirschsprung-associated enterocolitis (HAEC) may present with abdominal distention, tenderness, fever, lethargy, and diarrhea.[3] Severe HAEC can result in life-threatening sepsis and should be treated expeditiously as it is the leading cause of death in Hirschsprung disease.

THEORY

Epidemiology

The disease occurs in approximately 1 in 5000 births, making it a relatively common congenital condition.[16] [17] In one retrospective comparative cohort study from California, the risk was highest among African-American children (with an incidence of 4.1/10,000 births compared with 2.2/10,000 overall).[17] Short-segment Hirschsprung disease affects boys much more frequently than girls, with a male-to-female ratio ranging from 2.8:1 to 4.0:1.[1] Syndromic and long-segment Hirschsprung disease affects boys and girls equally.[1]

Inheritance patterns are complex; the risk for a sister of a male patient is 0.6%, whereas the risk for a brother of a female patient with long-segment disease is 18%.[18] The majority of cases occur sporadically, typically as short-segment Hirschsprung disease with a multifactorial inheritance pattern. However, some cases are familial and are more often long-segment Hirschsprung disease or total colonic aganglionosis (TCA) with an autosomal dominant inheritance pattern.[19] [20]

Approximately 5% to 32% of all individuals affected with the disease have an associated congenital anomaly.[21] Down syndrome is the most common association, with an overall incidence of 7.3% in children with Hirschsprung disease.[22] Other associated syndromes include Shah-Waardenburg syndrome and Mowat-Wilson syndrome.[1] [17] [23][24] Anorectal malformations are rarely associated with the disease; approximately 2% of children with anorectal malformation also had Hirschsprung disease in one systematic review.[25]

Etiology

Hirschsprung disease is a genetic disorder with a complex pattern of inheritance.[19] [24] Genetic studies have identified variants in more than 24 genes associated with the disease.[1] [26]

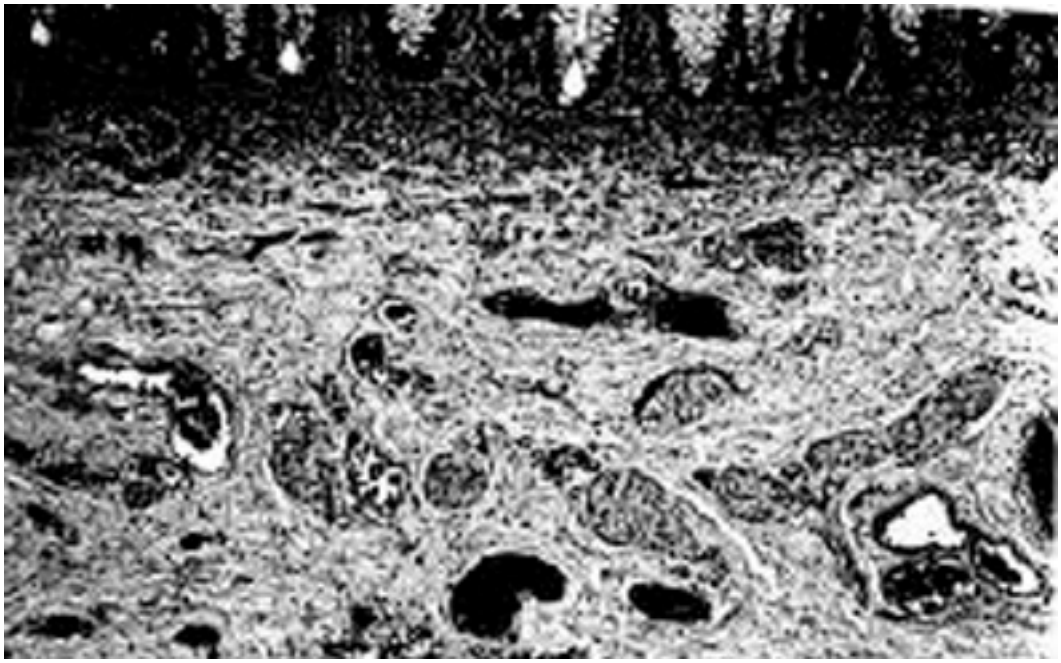
Rearranged during transfection (RET) is the most common gene implicated in Hirschsprung disease, with mutations found in 50% of familial cases and 15% to 35% of sporadic cases.[19] [27][28] Mutations in RET are also implicated in multiple endocrine neoplasia type 2 (MEN2), which is also associated with Hirschsprung disease.[29] See Multiple endocrine neoplasia syndromes .

Endothelin receptor type B (EDNRB) is the second most commonly mutated gene in sporadic Hirschsprung disease, with a frequency of approximately 5%.[24] Mutations in EDNRB lead to Shah-Waardenburg syndrome which is characterized by congenital deafness, pigmentation abnormalities, and Hirschsprung disease.[30]

Other genes implicated in Hirschsprung disease include SOX10 and PHOX2B, which is associated with Haddad syndrome; a combination of Hirschsprung disease and congenital central hypoventilation syndrome.[31]

Pathophysiology

The absence of ganglion cells and the presence of hypertrophic nerves, as well as an increase in the enzyme acetylcholinesterase, are the keys to pathologic diagnosis of the dysfunctional bowel segment.[32] [33] [34] [35]



Histologic section including mucosa with submucosa of the rectum showing clusters of ganglion cells in the submucosal plexus. This excludes Hirschsprung disease at this level

Corman ML. Colon and rectal surgery. 5th ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2005:555; used with permission

Histologic section including mucosa and submucosa of the rectum showing tortuous and hypertrophic nerve trunks of the submucosal plexus. There is no evidence of any ganglion cell present. This establishes the diagnosis of Hirschsprung disease

Corman ML. Colon and rectal surgery. 5th ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2005:555; used with permission

Pathology staining demonstrates a significant increase in the number of oversized nerve fibers located in the muscularis mucosa, the lamina propria, and the submucosa, and an increase in acetylcholinesterase activity. Hypertrophic nerves are those greater than 40 microns in diameter.[35]

Hirschsprung disease is believed to be caused by abnormal development of the enteric nervous system. During embryogenesis, there appears to be an arrest in the craniocaudal migration of the neuro enteric ganglion cells from the neural crest into the upper gastrointestinal tract, down through the vagal fibers, and along the distal intestine.[36] This is thought to result from mutations in genes such as RET, GDNF, EDNRB, SOX10, and PHOX2B, which are integral to the signaling pathways that regulate the migration of these cells during embryonic development.[1] [37] As a consequence, ganglion cells are missing from the Auerbach myenteric plexus, the Henle plexus, and at the Meissner plexus.[18] The number and severity of mutations, in addition to epigenetic and environmental factors, are believed to influence the length of the aganglionic segment.[1]

Under normal circumstances, the ganglia appear to act as a final common path for both sympathetic and parasympathetic influences. Their absence may perhaps produce the uncoordinated contractions of the affected bowel. Spasm, lack of propulsive peristalsis, and mass contraction of the aganglionic segment have all been well documented, in addition to the lack of relaxation of the bowel and the spasm of the internal sphincter.[38] [39] The clinical results of these pathophysiologic events is partial or total colonic functional obstruction.

The role of nitric oxide as a neurotransmitter responsible for the inhibitory action of the intrinsic enteric nerves is being elucidated.[40] [41]

Classification

Length of aganglionic segment

Hirschsprung disease can be categorized by the length of the aganglionic segment. This determines the severity of the disease and subsequent management.[4]

Short-segment (rectosigmoid)

- The aganglionic segment includes the rectum and much of the sigmoid colon. This comprises 80% to 85% of cases.[5]

Long-segment

- The aganglionic segment extends beyond the sigmoid-descending colon (although this definition varies between studies).[4] [6] People with long-segment disease often have more complicated courses and require particularly careful consideration with regard to treatment.[4] [7] Many children with long-segment disease will require intestinal diversion as part of their initial management.[1] This comprises up to 20% of cases.[5]

Total colonic aganglionosis (TCA)

- A very serious condition in which the entire colon is aganglionic, frequently including a variable length of terminal ileum. This comprises about 8% of cases and will usually require intestinal diversion followed by proctocolectomy and reconstruction later in life.[6] [8]

Total intestinal

- Total intestinal aganglionosis is rare (<1% of cases) and occurs when the total amount of ganglionated small bowel is less than 40 cm.[9] Treatment includes intestinal rehabilitation, parental nutrition, and sometimes intestinal transplantation.[10]

Ultrashort-segment

- There is some debate about the existence of this subtype and a 2021 systematic review by the American Pediatric Surgical Association Outcomes and Evidence-Based Practice Committee recommended that this term should not be used.[4]

THEORY

Case history

Case history #1

A 2-day old full-term infant is admitted to the neonatal intensive care unit with bilious vomiting and abdominal distension. He has not yet passed meconium. Upon rectal exam, there is explosive output of stool and gas.

Case history #2

A 3-year-old boy is brought to the pediatrician by his parents with a chief complaint of chronic constipation. They state that he has struggled with constipation for as long as they can remember. They have tried various laxatives without success. On exam, his abdomen is distended and he is underweight.

Other presentations

Children may also present with signs and symptoms of Hirschsprung-associated enterocolitis (HAEC) which include abdominal distention, tenderness, fever, lethargy, and diarrhea.[3] Severe HAEC can result in life-threatening sepsis and should be treated expeditiously as it is the leading cause of death in Hirschsprung disease.[11] [12] [13] A small percentage of patients present with neonatal bowel perforation due to distal obstruction. Cecal or appendiceal perforation in an otherwise healthy neonate should prompt workup for Hirschsprung disease.[14] [15]

Approach

Definitive diagnosis of Hirschsprung disease is established histologically by a rectal biopsy demonstrating the absence of ganglion cells, but this is typically not the first diagnostic test. A careful history and physical exam can help determine which patients warrant further workup. Contrast enemas and anorectal manometry are also useful adjuncts in establishing the diagnosis.

History and physical exam

The classical presentation of Hirschsprung disease is the full-term neonate who does not pass meconium within the first 48 hours of life. Most patients are diagnosed in the neonatal period.[1] A patient who presents later in life may have chronic symptoms of constipation, encopresis, feeding difficulties, and/or faltering growth.[47] A family history of Hirschsprung disease is reported in about 8% of patients.[44]

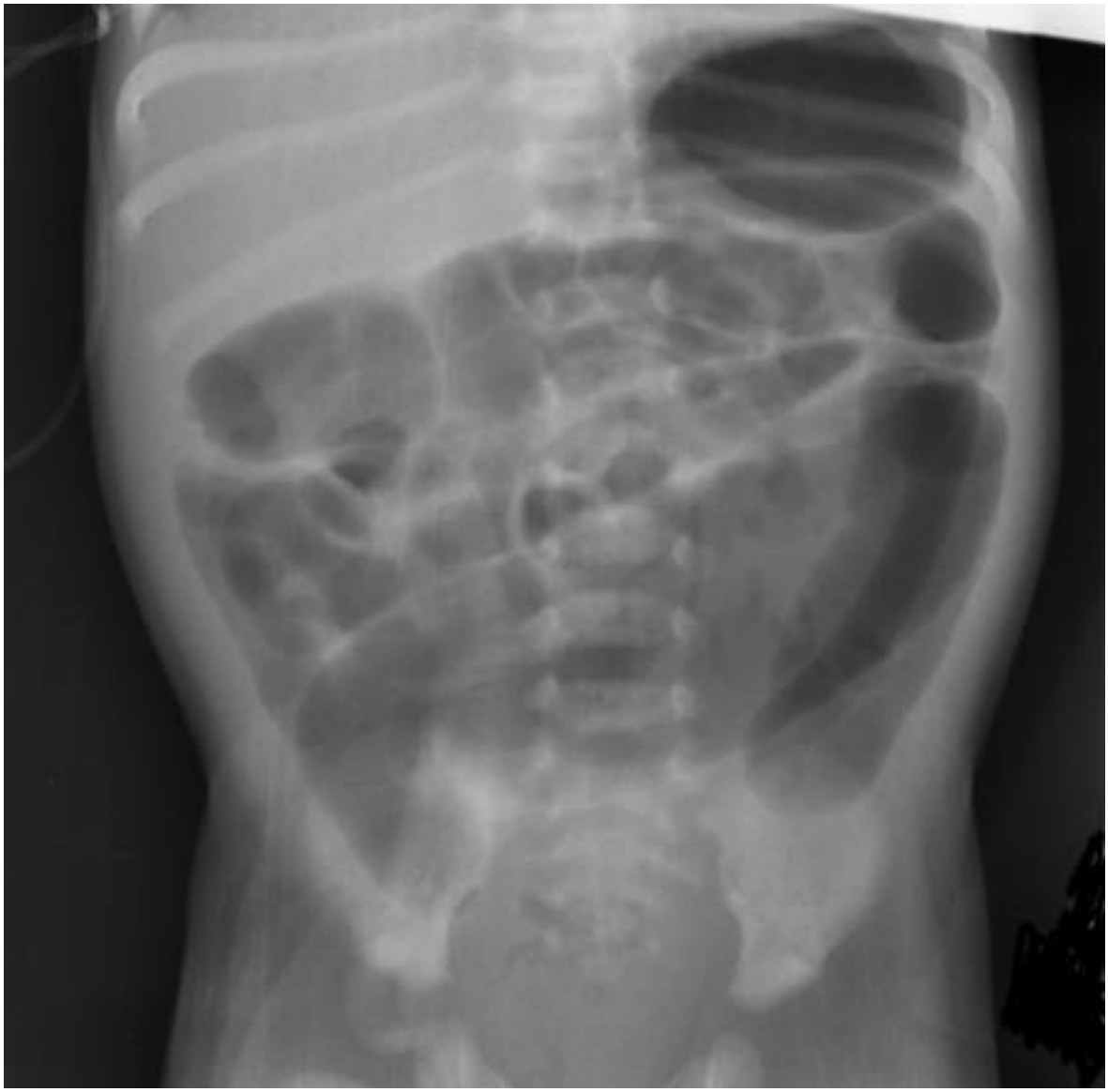
The most common signs of Hirschsprung disease are:

- Abdominal distension
- Vomiting
- Delayed passage of meconium (past the first 24-48 hours of life)
- Explosive passage of stool/gas
- Constipation/obstipation
- Faltering growth

Some patients may also present with signs and symptoms of Hirschsprung-associated enterocolitis (HAEC) which additionally include abdominal tenderness, fever, lethargy, diarrhea, bloody stool, and septic shock.[3] [11] Severe HAEC can result in life-threatening sepsis and should be treated expeditiously as it is the leading cause of death in Hirschsprung disease.[11] [12] [13] Children with delayed diagnosis of Hirschsprung disease (older than 12 months of age) are less likely to present with HAEC.[47]

Imaging

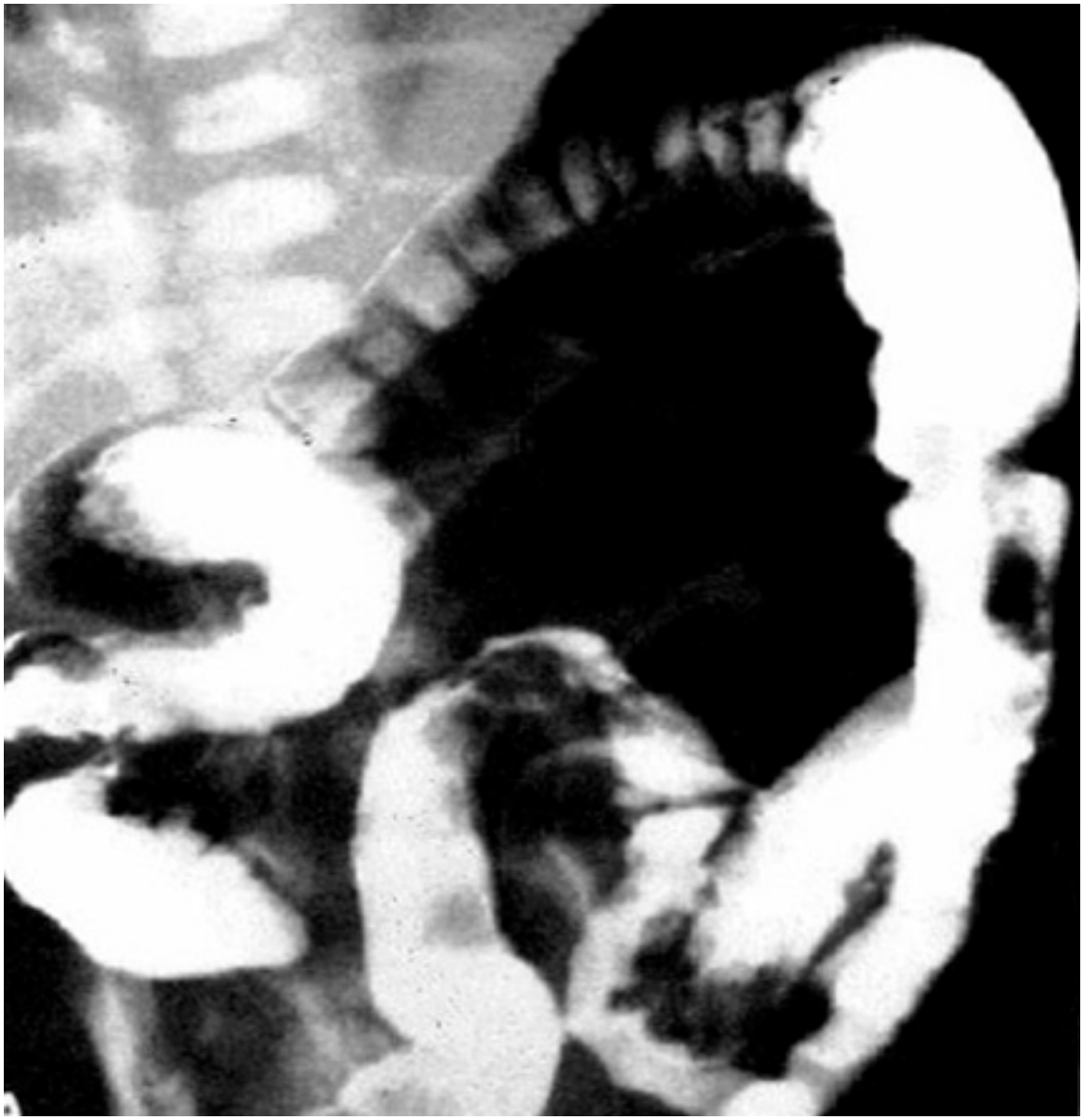
A plain abdominal x-ray may show nonspecific signs of distal obstruction such as dilated intestines and air-fluid levels. There may be an absence of air in the lower pelvis. However, a normal film does not exclude the possibility of Hirschsprung disease.



Abdominal x-ray image showing gaseous distension of the large bowel with air absent from the rectum (typical of Hirschsprung disease)

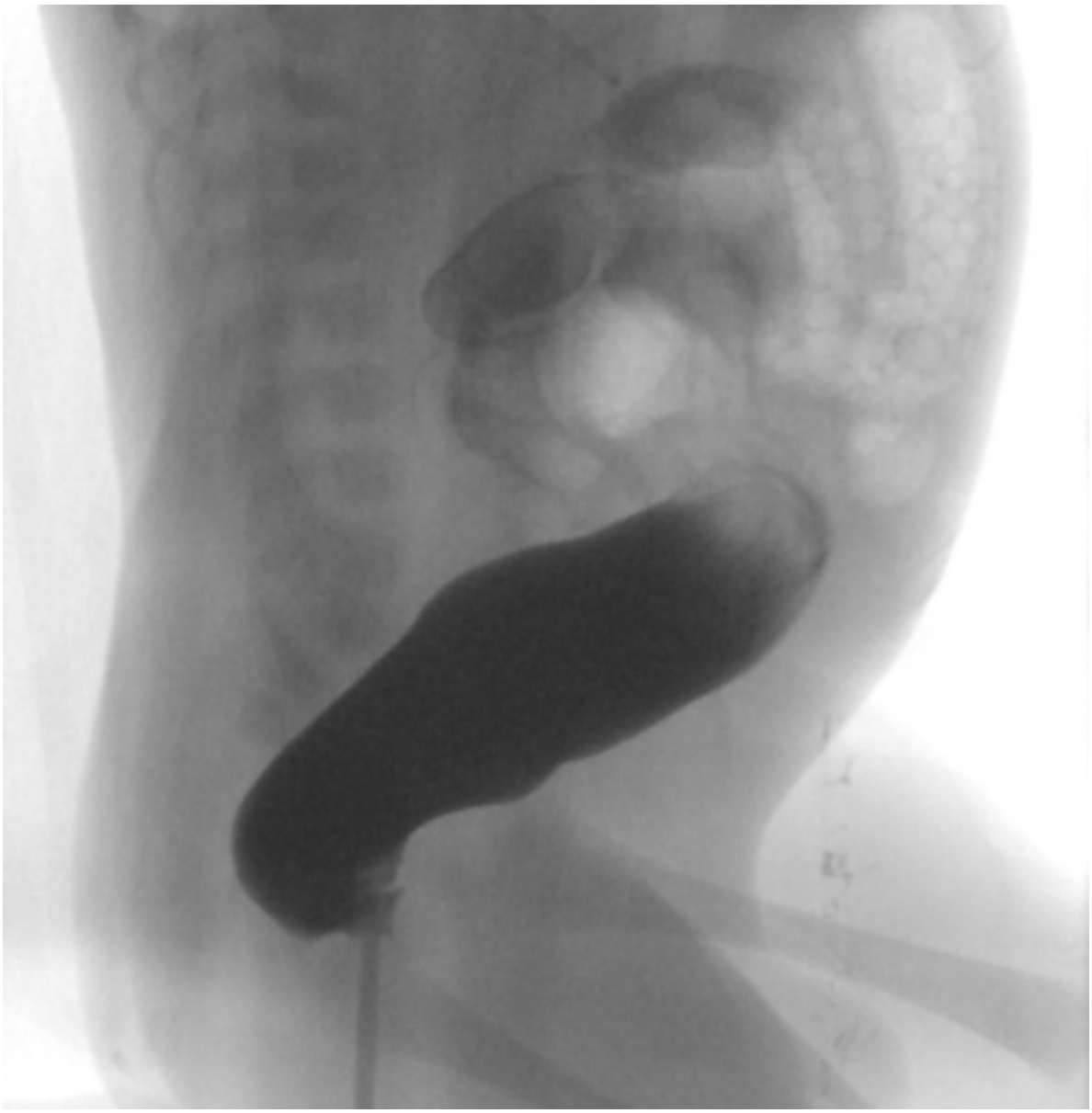
BMJ Case Reports 2012; doi:10.1136/bmj.e5521

A contrast enema performed with water-soluble contrast material is the most valuable imaging test for Hirschsprung disease. A contrast enema is recommended if the clinical evaluation is suspicious for Hirschsprung disease or if there are signs of distal obstruction on x-ray. A rectosigmoid ratio (maximum diameter of the rectum divided by maximum diameter of the sigmoid colon during contrast enema) of <1 is highly suggestive of Hirschsprung disease. Other suggestive findings include retained contrast at >24 hours, mucosal irregularity, or microcolon.[48] A transition zone may be seen on contrast enema but this may be less obvious in neonates.[49] A transition zone on contrast enema can help with surgical planning, but it should be noted that the radiographic transition zone may not correlate with the histologic transition zone.[50] Contrast enema may demonstrate mucosal irregularity in the aganglionic distal colon and may show a transition zone between smaller caliber aganglionic distal colon and dilated proximal ganglionic colon.



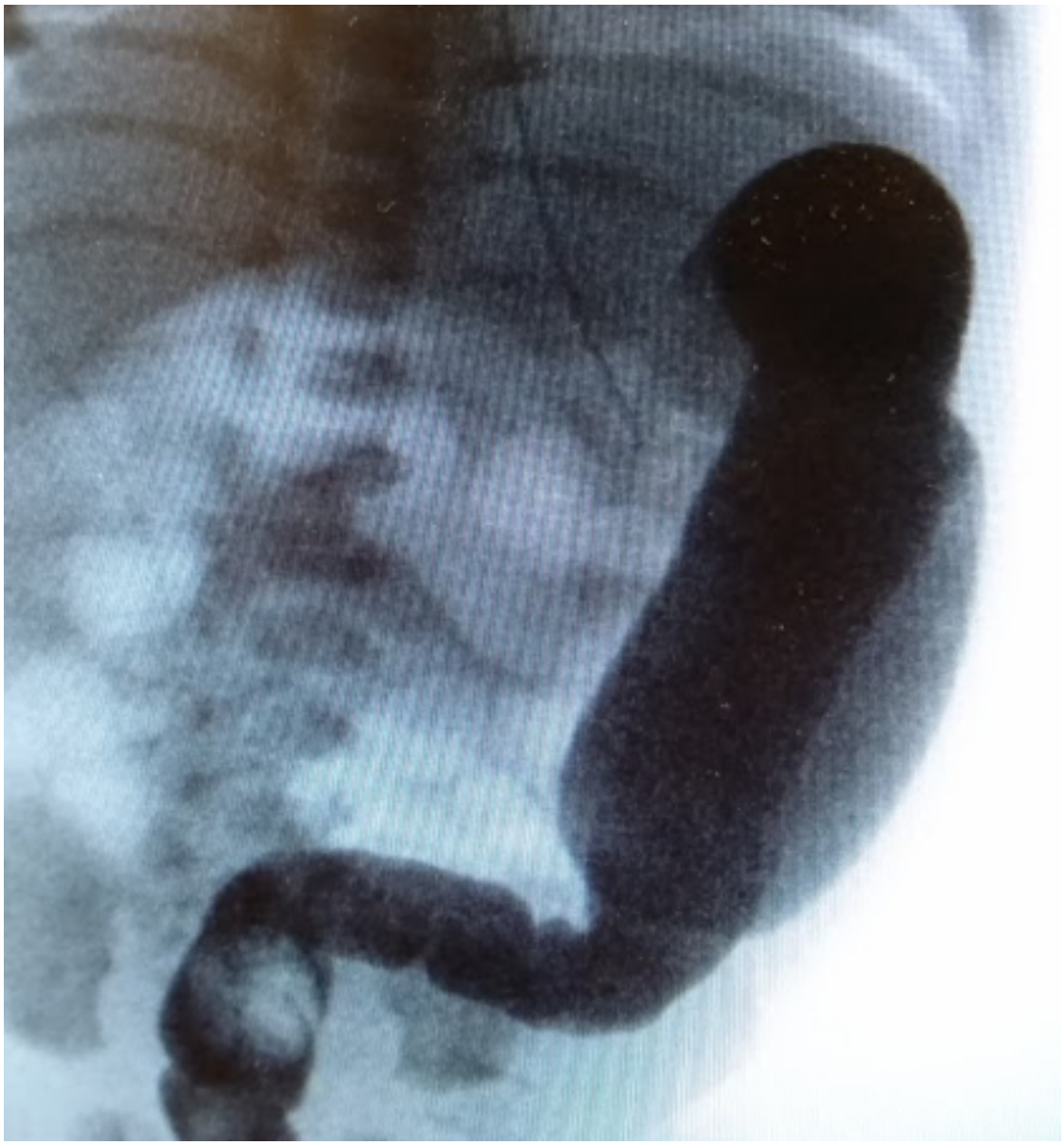
Barium enema performed in a newborn with Hirschsprung disease. Often, classical changes are not obvious in the neonatal period

Corman ML. Colon and rectal surgery. 5th ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2005:555-603; used with permission



Contrast enema showing an abnormal rectosigmoid ratio (sigmoid diameter larger than rectal diameter)

From the personal collection of Lily Cheng, MD; used with permission



Contrast enema may demonstrate mucosal irregularity in the aganglionic distal colon and may show a transition zone between smaller caliber aganglionic distal colon and dilated proximal ganglionic colon

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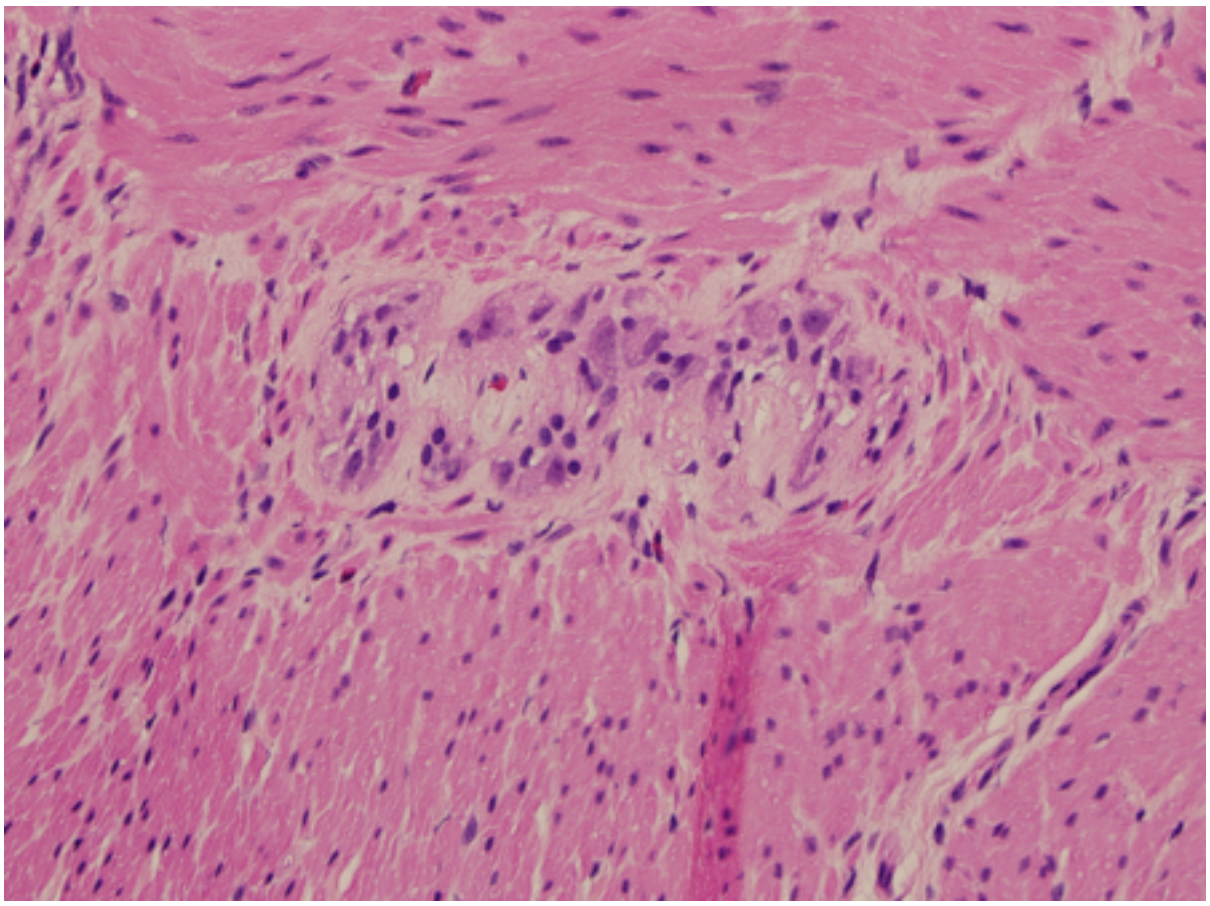
Rectal biopsy

A rectal biopsy is always necessary for definitive diagnosis of Hirschsprung disease. Biopsies should be obtained at least 2 cm proximal to the dentate line and should be at least 3 mm in diameter, ensuring that at least one third of the sample includes submucosal tissue.[27] Rectal biopsies can be performed using either suction or open surgical techniques, with a preference for the least invasive feasible method.[27] A traditional full-thickness rectal biopsy includes both the myenteric and submucosal plexuses and is performed under general anesthesia in the operating room. A suction rectal biopsy can be done at the bedside without sedation, but includes the submucosal plexus only. This may yield inadequate specimen in the older infant or child.[51] Bleeding and perforation are rare complications.[52]

Rectal biopsy pathology will show an absence of ganglion cells in Hirschsprung disease. It may also show the presence of hypertrophic nerves (greater than 40 micrometers in an infant less than 6 months), but

this may be absent in patients with long-segment disease or total colonic aganglionosis (TCA).[53] Other immunohistochemical stains including calretinin, choline transporter, and acetylcholinesterase may be useful ancillary markers.[53] [54]



Hematoxylin and eosin showing ganglion cells in the myenteric plexus

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Anorectal manometry

Anorectal manometry may be helpful in older children as a screening test to identify patients who warrant rectal biopsy. A normal recto-anal inhibitor reflex (RAIR) on anorectal manometry has a negative predictive value of up to 100%.[55] An absent RAIR on manometry should be followed by a biopsy to confirm the diagnosis of Hirschsprung disease.

History and exam

Key diagnostic factors

vomiting (common)

- Vomiting is a nonspecific symptom, but when bilious it must prompt an evaluation for a surgical cause, which could be Hirschsprung disease.

explosive passage of stool/gas (common)

- Also known as a “blast sign”, explosive passage of stool and/or gas upon digital rectal exam is pathognomonic for Hirschsprung disease.

abdominal distension (common)

- Distension due to retained stool and gas is a common presenting symptom in any age group.

delayed passage of meconium (common)

- Most infants with Hirschsprung disease fail to pass meconium in the first 24-48 hours of life.

faltering growth (common)

- Distension and constipation may lead to feeding difficulties and poor weight gain in children with a late diagnosis of Hirschsprung disease.[47]

chronic constipation (uncommon)

- Delayed diagnosis of Hirschsprung disease may present as a history of refractory constipation in children older than 12 months.[47]

Other diagnostic factors

fever (common)

- A sign of Hirschsprung-associated enterocolitis (HAEC).[11] [13]

diarrhea (common)

- May be a sign of HAEC, or may result from overflow incontinence due to severe chronic constipation.[11]

bloody stool (common)

- May be seen in HAEC.[56]

abdominal tenderness (common)

- May be seen in HAEC.[11]

septic shock (common)

- Patients with severe HAEC may present with signs of septic shock including tachycardia, hypotension, lethargy, and altered mental status.[1] [11]

cecal or appendiceal perforation (uncommon)

- Up to 7% of patients present with neonatal bowel perforation due to distal obstruction.[15] [57] Cecal or appendiceal perforation in an otherwise healthy neonate should prompt workup for Hirschsprung disease.[14]

meconium plug syndrome (uncommon)

- Hirschsprung disease is found in up to 15% of neonates presenting with meconium plug syndrome.[58]

Risk factors

Strong

Down syndrome

- A common association, found in up to 16% of babies with Hirschsprung disease.[17] [22][24][42] [43] Between 1% to 6% of babies with Down syndrome have Hirschsprung disease.[42]

male sex

- Short-segment Hirschsprung disease has a male preponderance of up to 4:1.[1] Syndromic and long-segment Hirschsprung disease affects boys and girls equally.[1]

family history

- A family history of Hirschsprung disease is reported in about 8% of patients.[44] The risk for a sister of a male patient is 0.6%, whereas the risk for a brother of a female patient with long-segment disease is 18%.[18]

Weak

Shan-Waardenburg syndrome

- Mutations in the EDNRB-ET3 signaling pathway disrupt neural crest cell development in Shah-Waardenburg syndrome and predisposes to Hirschsprung disease.[30]

Mowat-Wilson syndrome

- Hirschsprung disease is diagnosed in approximately 45% of patients with Mowat-Wilson syndrome, an autosomal dominant disorder characterized by a mutation in the ZEB2 gene.[45]

Haddad syndrome

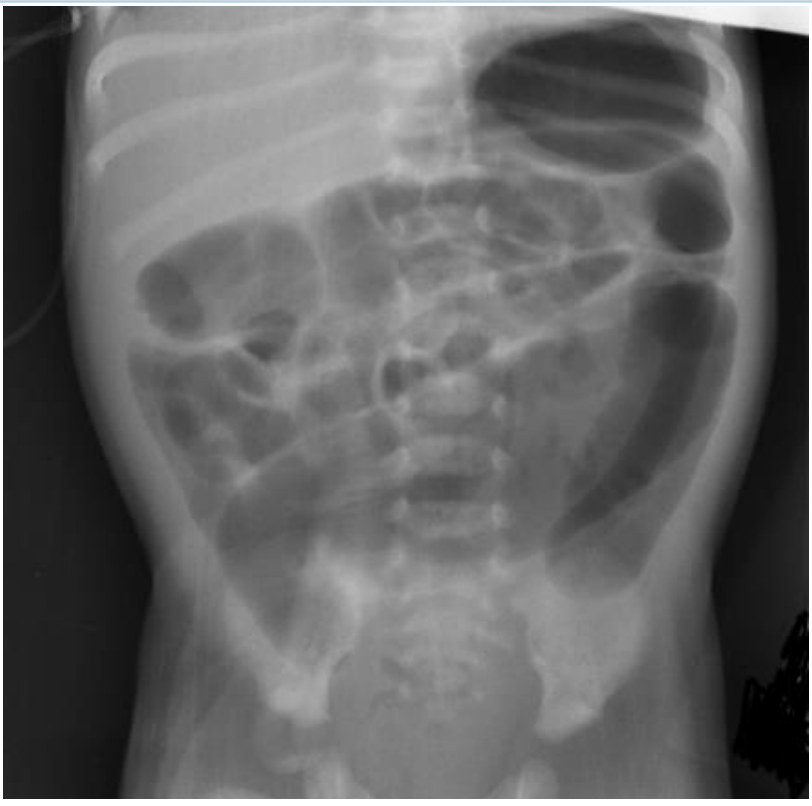
- This syndrome is a combination of Hirschsprung disease and congenital central hypoventilation syndrome due a mutation in the PHOX2B gene.[31] Patients are also at risk for developing neuroblastoma.

multiple endocrine neoplasia type 2 (MEN2)

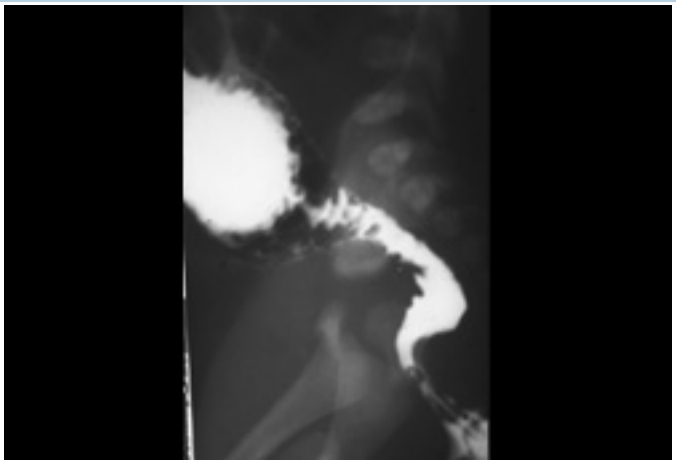
- Mutations in the RET proto-oncogene are associated with MEN2 as well as with Hirschsprung disease.[46] See Multiple endocrine neoplasia syndromes .

Tests

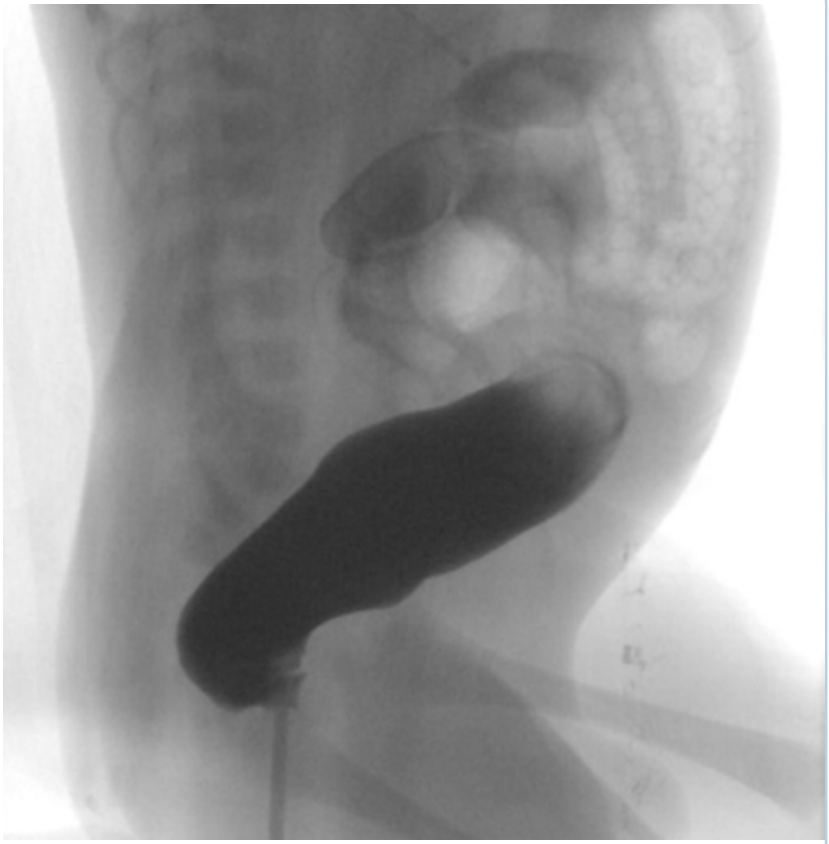
1st test to order

Test	Result
plain abdominal x-ray • In a newborn it is very difficult to differentiate between a dilated colon and small bowel; this is a nonspecific investigation. However, a dilated intestine with a paucity of rectal gas is suggestive of distal obstruction.  *Abdominal x-ray image showing gaseous distension of the large bowel with air absent from the rectum (typical of Hirschsprung disease)* *BMJ Case Reports 2012; doi:10.1136/bmj.e5521* • A normal film does not exclude the possibility of Hirschsprung disease.	**air-fluid levels present; dilated intestine**
contrast enema • Performed with water-soluble contrast material. • A contrast enema is the most valuable initial screening diagnostic test for Hirschsprung disease. • No bowel preparation required. • The infant is placed in a lateral position, and a rectal tube is introduced to barely above the anal canal. • The characteristic image of a dilated descending colon, followed distally by a nondistended rectosigmoid, may not be fully visible in a newborn. Weeks or months later the radiologic changes become more obvious.	**contracted distal bowel and dilated proximal bowel with transition zone in between; rectosigmoid ratio of <1, mucosal irregularity, microcolon**

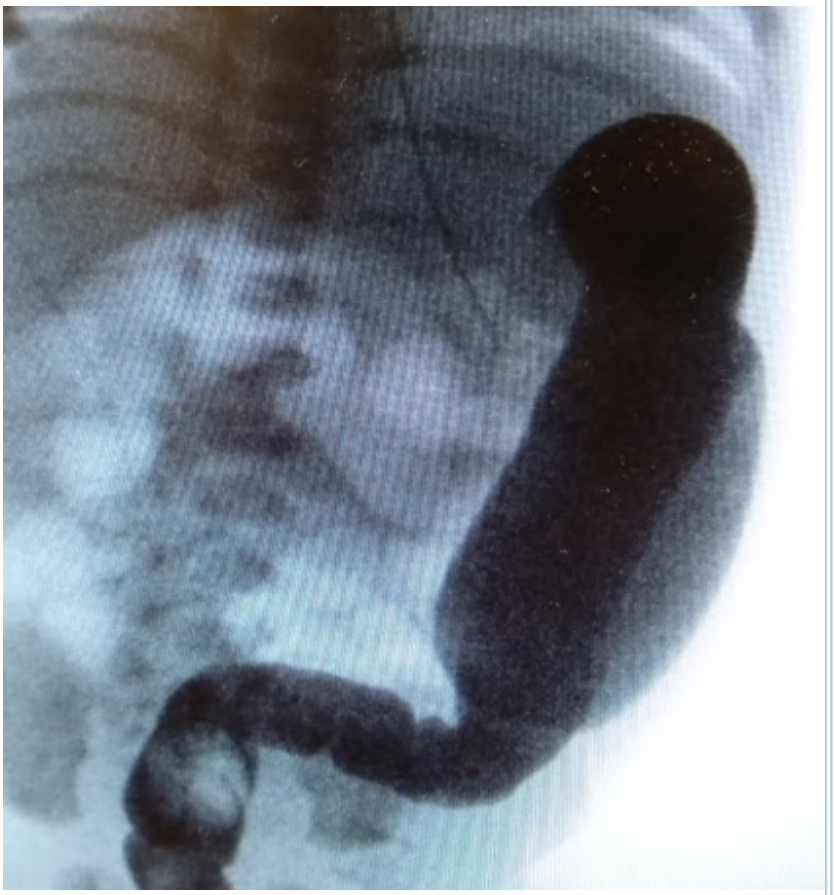
Test	Result



Contrast enema demonstrates the typical proximal dilation, transition zone, and nondistended, aganglionic portion
Corman ML. Colon and rectal surgery. 5th ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2005:555-603; used with permission



Contrast enema showing an abnormal rectosigmoid ratio (sigmoid diameter larger than rectal diameter)
From the personal collection of Lily Cheng, MD; used with permission

Test	Result
 *Contrast enema may demonstrate mucosal irregularity in the aganglionic distal colon and may show a transition zone between smaller caliber aganglionic distal colon and dilated proximal ganglionic colon* *From the personal collection of Lily Cheng, MD; used with permission*	

Other tests to consider

Test	Result
rectal biopsy • Rectal biopsy is necessary for definitive diagnosis of Hirschsprung disease.[54] Biopsies can be performed using either suction or open surgical techniques, with a preference for the least invasive feasible method.[27] • Biopsies should be obtained at least 2 cm proximal to the dentate line and should be at least 3 mm in diameter, ensuring that at least one third of the sample includes submucosal tissue.[27]	**absence of ganglion cells and presence of hypertrophic nerves (>40 micrometers in an infant <6 months); absent calretinin immunoreactivity, presence of acetylcholine esterase immunoreactivity, presence of choline transporter immunoreactivity**

Histologic section including mucosa and submucosa of the rectum showing tortuous and hypertrophic nerve trunks of the submucosal plexus. There is no evidence of any ganglion cell present. This establishes the diagnosis of Hirschsprung disease
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Test	Result
anorectal manometry • Normally when the rectum is distended, the internal sphincter relaxes. This recto-anal inhibitory reflex (RAIR) is absent in patients with Hirschsprung disease and anal achalasia.[55] • An absent RAIR on manometry should be followed by a rectal biopsy to confirm the diagnosis of Hirschsprung disease.	**absent recto-anal inhibitor reflex (RAIR)**

Differentials

Condition	Differentiating signs / symptoms	Differentiating tests
Meconium-plug syndrome	• The expulsion of a plug of meconium with resolution of symptoms and the absence of other signs characteristic of Hirschsprung disease help establish the diagnosis.	• Contrast enema can be both diagnostic and therapeutic. • Air mixed with meconium shows up as a soap bubble or calcification-like appearance on radiographs.
Cystic fibrosis (meconium ileus)	• Manifested by a clinical picture consistent with intestinal obstruction, with the child frequently exhibiting respiratory symptoms. • A family history of cystic fibrosis may be noted.	• The absence of air-fluid levels in an upright abdominal film and the ground-glass appearance of the lower abdomen are characteristic radiographic signs. The contrast enema shows a microcolon or a nondilated one.
Small left colon syndrome	• Symptoms usually improve following contrast enema and resolve after several weeks. • Frequently occurs in infants of mothers with diabetes mellitus.	• Contrast enema demonstrates a narrow left colon to the level of the splenic flexure.
Hypothyroidism	• Colonic ileus and abdominal distension. • The abdominal distension will accompany bradycardia, feeding difficulties, and other signs associated with hypothyroidism.	• TSH is elevated in primary hypothyroidism.
Cerebral injury	• Colonic ileus and abdominal distension. • A history of birth-related head injuries should raise suspicion of this cause of ileus.	• Diagnosis is clinical.
Chronic constipation	• The colon is dilated and full of fecal material all the way down to the anal canal. • Children usually become symptomatic after the sixth month of life; they neither vomit nor become seriously sick. • Eventually, children develop overflow incontinence or encopresis: a constant, chronic soiling without	• Rectal examination in these children reveals a severe fecal impaction just above the anal canal. • Contrast enema shows a reverse pattern of dilation. In idiopathic constipation, the rectosigmoid is enormous and the proximal colon may have a normal caliber.

Condition	Differentiating signs / symptoms	Differentiating tests
	evidence of neuromuscular disturbance. • The rectum is impacted with stool.	
Distal small bowel atresia or stenosis	• Abdominal distension and bilious vomiting.	• Plain x-ray often shows evidence of an intestinal atresia. • Contrast enema will show a microcolon.

Criteria

Diagnosis and grading of Hirschsprung-associated enterocolitis (HAEC)

The following criteria have been proposed as a standardized, clinically relevant approach to the diagnosis of HAEC to help guide appropriate treatment.[11]

Possible HAEC (Grade I)

- Clinical history: anorexia, diarrhea
- Physical exam: mild abdominal distension
- Radiographic findings: normal or mild ileus gas pattern

Definite HAEC (Grade II)

- Clinical history: previous HAEC, explosive diarrhea, fevers, lethargy
- Physical exam: fever, tachycardia, abdominal distension, abdominal tenderness, explosive gas/stool on rectal exam
- Radiographic findings: ileus gas pattern, air/fluid levels, dilated loops of bowel, rectosigmoid cutoff

Severe HAEC (Grade III)

- Clinical history: obstipation, obtunded
- Physical exam: decreased peripheral perfusion, hypotension, altered mentation, marked abdominal distension, peritonitis
- Radiographic findings: pneumatosis, pneumoperitoneum

Approach

Infants typically become symptomatic during the first few days of life.[27] Occasionally, a child may have minimal or absent clinical manifestations during the neonatal period and exhibit moderate, intermittent bouts of symptoms later in life. Children older than 12 months typically present with constipation that is refractory to medical treatment.

Treatment differs depending on type of disease:

- The initial treatment of both short-segment and long-segment disease is similar, as the extent of disease is not known until confirmation of pathology. Infants with short-segment (rectosigmoid) disease can either undergo a definitive surgical procedure at the time of diagnosis, or be managed with irrigations with definitive surgery taking place within 2-3 months.[27]
- Infants with long-segment or total colonic disease (aganglionosis of the entire colon) typically do not respond well to irrigations and will need to undergo colonic mapping biopsies and either ileostomy or colostomy.[1] [27] [59] Definitive surgery (total or subtotal colectomy with ileoanal or coloanal anastomosis) is performed when stoma output is of a thicker consistency, which typically occurs at around one year old when the child has fully transitioned to solid foods.[1]
- In children with Hirschsprung-associated enterocolitis (HAEC), irrigations are done aggressively, along with intravenous fluids and antibiotics (e.g., metronidazole) to improve clinical condition. In rare cases, irrigations do not improve abdominal distension and a diverting stoma is required.[27]
- The management of ultrashort-segment disease is a source of controversy, as there is some debate about the existence of this subtype. See Diagnostic Criteria .

Definitive surgical treatment has changed from a 3-stage surgical approach over 6 to 8 months, to a single-stage operation done in the neonatal period. A single-stage operation should be carried out by a surgeon experienced with this treatment modality. This change has resulted from the development of the transanal and laparoscopic approach, as well as advances in neonatal care. Surgery should be performed in an optimal environment that includes a neonatal anesthesiologist and a neonatal intensive care unit.

Short-segment (rectosigmoid) or long-segment disease

In short-segment disease, the aganglionic segment includes the rectum and much of the sigmoid colon and comprises 80% to 85% of cases.[5] In long-segment disease, the aganglionic segment extends beyond the sigmoid-descending colon (although this definition varies between studies) and comprises up to 20% of cases.[4] [6] The initial treatment of both short-segment and long-segment disease is similar, as the extent of disease is not known until confirmation of pathology.

Bowel irrigation

- All patients receive irrigations in the newborn period to manage abdominal distension prior to proceeding with surgery.[11] Guidance suggests 1 to 3 irrigations per day.[27] Irrigation may not be effective in patients with long-segment or total colonic disease.[27]
- It is extremely important to clarify the difference between an irrigation and an enema. To confuse these two terms may be dangerous for babies with Hirschsprung disease. An enema is a procedure in which a determined amount of fluid containing different irritant ingredients is instilled into the rectum and colon in order to elicit a bowel movement. It is expected that this volume will be spontaneously expelled. Rectal irrigation, on the other hand, is a procedure in which a large tube (20-24 F) is introduced through the rectum, and small amounts of saline solution (10-20 mL) are instilled through the lumen of the tube in order to clear the lumen of the tube. The liquid rectal

and colonic content is expected to drain through the lumen of the tube. The tube is then rotated in different directions and moved back and forth. The operator continues to instill small amounts of saline solution, allowing the evacuation of gas and liquid stool through the tube.

- Children with Hirschsprung disease have a very serious intestinal dysmotility disorder. This means that an enema may aggravate the condition rather than help since there is no capacity to expel the infused volume of fluid. With an irrigation, the patient benefits from the evacuation of the rectosigmoid contents through the lumen of the large tube as the distal obstruction is overcome by the tube.
- HAEC may occur with prolonged abdominal distension and fecal stasis. The stasis leads to bacterial overgrowth, which leads to bacterial translocation and secretory diarrhea. HAEC can result in hypovolemia, endotoxin-related shock, and sepsis, making prompt treatment crucial as it is the leading cause of death in Hirschsprung disease.[11] [12] [13] HAEC must be suspected clinically. See Diagnostic Criteria . Bowel irrigation with saline solution is an extremely valuable procedure for the emergency management of HAEC.[11] By decompressing the bowel, the procedure may dramatically improve a very sick infant. These patients should also receive intravenous fluids and antibiotics (e.g., metronidazole). Initially, children are kept nothing by mouth (NPO) until they begin to improve. In older children, oral antibiotics can be given when they begin to improve and when they are no longer NPO.

Bowel diversion

- Colostomy or ileostomy is necessary if a child is sick with intractable HAEC, bowel perforation, or abdominal distension unresponsive to irrigations.[27]
- An ileostomy or right transverse colostomy is a safe and effective method for decompressing the colon. This is a particularly useful option in emergency situations, for instance if there are no pediatric pathologists available to define the exact level of the transition zone (where circumferential ganglion cells are identified). By using this location for the stoma, the risk of the error of opening the colostomy in an aganglionic area is much reduced. A particular advantage is that the left side of the colon remains untouched, allowing for a future resection of the aganglionic segment and pull-through of the normal ganglionic colon. The disadvantage is that it commits the surgeon to a 3-stage procedure.
- Alternatively, a leveling colostomy can be performed. This is a colostomy placed at the start of the ganglionic portion of the colon, and where there are also no hypertrophic nerves. This obligates the surgeon to pull the colostomy down at the time of the definitive repair, depriving the patient of the protection of a proximal diversion. The advantage of this approach is that the child will require only a 2-stage procedure.
- A diverting stoma should also be considered in very sick, low birth-weight newborns or those suffering from associated defects or concomitant serious medical conditions. Such individuals may benefit from an initial fecal diversion.

Definitive surgery

- Patients typically are recommended to undergo a definitive primary transanal only or a laparoscopic surgical procedure without a preceding colostomy.[60] [61] [62] [63] The advantage of these procedures is to limit the number of operations (i.e., colostomy creation and closure) and to avoid related potential morbidity. Several published reports have demonstrated that there is no difference in rate of complications associated with neonatal surgery when a protective colostomy is not employed.[64] [65] [66] The procedure can also be delayed up to 2-3 months while the patient is primarily managed with irrigations.[1] [67] [68]

- There are several types of operations that are employed, all of which follow the basic surgical principle of removing the aganglionic segment and pulling through normal ganglionic bowel.[2] There are three main technical options for the pull-through procedure:[69] [70]
    - The Swenson operation is a full-thickness excision of the rectum and remaining aganglionic bowel.[63] [71] [72] [73] The original description involved entering the abdomen through a Pfannenstiel, hockey-stick incision, followed by a full-thickness dissection of the aganglionic sigmoid and rectum.[74] This whole procedure can now be done through a transanal approach.[63] [73] [75] [76] The abdominal incision can be avoided in many cases or replaced with laparoscopy. The occurrence of fecal and urinary incontinence, as well as erectile dysfunction, which was felt to be due to nerve injury provoked during aggressive rectal dissection, prompted the development of the Yancey-Soave and Duhamel procedures in an attempt to avoid those complications.
    - The Yancey-Soave procedure includes the resection of the mucosal layer of the distal bowel (endorectal resection) leaving intact a seromuscular cuff and pulling through the normal ganglionic colon inside the cuff.[77] [78] Theoretically, this minimizes the risk of potential injury to important neighboring pelvic structures during rectal dissection.[69] [79]
    - The Duhamel procedure involves normal (i.e., ganglionic) intestine (usually above the most dilated portion) being pulled through a presacral space that has been created by blunt dissection and connecting this lumen to the original rectum left in its anterior position.[80] It avoids the extensive pelvic dissection required in the Swenson operation by preserving the distal aganglionic rectum, dividing the bowel at the peritoneal reflection as distally as possible. The rectal stump is then closed and the normal ganglionic colon is pulled through a presacral path and anastomosed to the posterior wall of the rectum, above the pectinate line.[70] A wide window is created with a stapler between the posterior rectal wall and the anterior wall of the normal ganglionic bowel. The fact that the anal canal is not disturbed likely contributes to the very low incidence of fecal incontinence; however, the Duhamel "pouch" (aganglionic rectum) often becomes dilated which leads to severe constipation.
- To determine the portion of colon to be pulled through, full-thickness biopsies are taken and sent for pathologic examination, looking for ganglion cells and the absence of hypertrophic nerves (at least 40 micrometers thick). The biopsy must be a full-thickness specimen, including submucosa (it is possible to have ganglion cells in the muscularis layer and hypertrophic nerves in the submucosa).[35] If there are no ganglion cells past the splenic flexure, biopsies should be sent of the entire colon and an ileostomy performed, as these patients are considered to have long-segment disease. If proceeding with a pull-through, the anastomosis should be 5 cm proximal to the biopsy with ganglion cells.[81] The normal ganglionic bowel is transanally anastomosed to the anal canal 1 cm to 2 cm above the pectinate line. In the majority of patients, the transition zone is located in the sigmoid colon, which makes it possible to repair the entire defect using only the transanal approach without a laparotomy or laparoscopy. However, when the transition zone is located higher or the surgeon does not feel safe in conducting this dissection higher from below, then an open or laparoscopic-assisted procedure is required in order to mobilize the colon.
- If bowel diversion had been required, then once the child is well, a reconstruction can be planned. If the colostomy was a leveling colostomy, namely that it was placed proximal to the transition zone, then that colostomy can be pulled through and the distal aganglionic bowel resected. If the colostomy was placed more proximally, or if there was an ileostomy created, a pull-through can be performed using normal ganglionic colon proximal to the transition zone, and then the stoma can be closed at a third stage.

- Guidelines do not recommend any single pull-through technique over others for short-segment or long-segment disease; all three major surgical approaches have potential advantages and complications.[1][4] [27]
- Guidelines recommend one dose of preoperative intravenous broad-spectrum antibiotics; consult local protocols.[27]

Total colonic aganglionosis (TCA)

TCA remains a serious surgical challenge. Irrigations often do not work for patients with TCA because it is difficult to reach the dilated small bowel. The patient will require colonic mapping biopsies and an ileostomy.[1] [4] [11] [59] Definitive surgery (total or subtotal colectomy with ileoanal or coloanal anastomosis) is performed when stoma ostomy output is of a thicker consistency, which typically occurs at around one year old when the child has fully transitioned to solid foods.[1] [59]

A 2024 expert consensus on the surgical management of TCA did not favor any single pull-through technique over others, and instead recommends that the technique should be chosen based on the experience of the operating surgeon.[59] All three major surgical approaches have potential advantages and complications.[1] The most commonly performed surgical procedures used to treat TCA include J pouch with ileoanal anastomosis (JIAA), straight ileoanal anastomosis (SIAA) and the Duhamel technique.[82]

Guidelines recommend one dose of preoperative intravenous broad-spectrum antibiotics; consult local protocols.[27]

Treatment algorithm overview

Please note that formulations/routes and doses may differ between drug names and brands, drug formularies, or locations. Treatment recommendations are specific to patient groups: see disclaimer

Acute (summary)		
short-segment/long-segment disease: without enterocolitis		
	1st	**bowel irrigation**
	plus	**definitive surgery**
short-segment/long-segment disease: with enterocolitis		
	1st	**bowel irrigation + intravenous fluids + antibiotics**
	adjunct	**decompression by colostomy or ileostomy**
	plus	**definitive surgery**
total colonic aganglionosis		
	1st	**ileostomy**
	plus	**definitive surgery**

Treatment algorithm

Please note that formulations/routes and doses may differ between drug names and brands, drug formularies, or locations. Treatment recommendations are specific to patient groups: see disclaimer

Acute

short-segment/long-segment disease: without enterocolitis

1st **bowel irrigation**

» The initial treatment of both short-segment (rectosigmoid) disease and long-segment disease is similar, as the extent of disease is not known until confirmation of pathology.

» All patients receive irrigations in the newborn period to manage abdominal distension prior to proceeding with surgery.[11] Guidance suggests 1 to 3 irrigations per day.[27] Irrigation may not be effective in patients with long-segment disease.[27]

» A large tube (20-24 Fr) is introduced through the rectum, and small amounts of saline solution (10-20 mL) are instilled through the lumen of the tube in order to clear the lumen of the tube. The liquid rectal and colonic content is expected to drain through the lumen of the tube. The tube is then rotated in different directions and moved back and forth. The operator continues to instill small amounts of saline solution, allowing the evacuation of gas and liquid stool through the tube.

» Irrigations must be differentiated from enemas. Enemas involve instilling a large volume of fluid containing different irritant ingredients into the rectum and colon in order to elicit a bowel movement. Enemas are not recommended in patients with Hirschsprung disease.

plus **definitive surgery**

Treatment recommended for ALL patients in selected patient group

» Definitive surgery is usually performed within the first week of life. The procedure can also be delayed up to 2-3 months while the patient is primarily managed with irrigations.[1] [67] [68]

» Three surgical techniques exist for definitive surgical management. All have in common the removal of the distal aganglionic segment with pull-through of the proximal normal ganglionic bowel.

Acute

» Guidelines do not recommend any single pull-through technique over others for short-segment or long-segment disease; all three major surgical approaches have potential advantages and complications.[1][4] [27]

» The Swenson operation is a full-thickness excision of the rectum and remaining aganglionic bowel.[63] [71] [72] [73] The original description involved entering the abdomen through a Pfannenstiel, hockey-stick incision, followed by a full-thickness dissection of the aganglionic sigmoid and rectum.[83] This whole procedure can now be done through a transanal approach.[63] [73] [75] [76] The abdominal incision can be avoided in many cases or replaced with laparoscopy. The occurrence of fecal and urinary incontinence, as well as erectile dysfunction, which was felt to be due to nerve injury provoked during aggressive rectal dissection, prompted the development of the Yancey-Soave and Duhamel procedures in an attempt to avoid those complications.

» The Yancey-Soave procedure includes the resection of the mucosal layer of the distal bowel (endorectal resection) leaving intact a seromuscular cuff and pulling through the normal ganglionic colon inside the cuff.[77] [78] Theoretically, this minimizes the risk of potential injury to important neighboring pelvic structures during rectal dissection.[69] [79]

» The Duhamel procedure involves normal (i.e., ganglionic) intestine (usually above the most dilated portion) being pulled through a presacral space that has been created by blunt dissection and connecting this lumen to the original rectum left in its anterior position.[80] It avoids the extensive pelvic dissection required in the Swenson operation by preserving the distal aganglionic rectum, dividing the bowel at the peritoneal reflection as distally as possible. The rectal stump is then closed and the normal ganglionic colon is pulled through a presacral path and anastomosed to the posterior wall of the rectum, above the pectinate line.[70] A wide window is created with a stapler between the posterior rectal wall and the anterior wall of the normal ganglionic bowel. The fact that the anal canal is not disturbed likely contributes to the very low incidence of fecal incontinence; however, the Duhamel “pouch” (aganglionic rectum) often becomes dilated which leads to severe constipation.

Acute

» Guidelines recommend one dose of preoperative intravenous broad-spectrum antibiotics; consult local protocols.[27]

short-segment/long-segment disease: with enterocolitis

1st **bowel irrigation + intravenous fluids + antibiotics**

Primary options

» metronidazole: children: 30 mg/kg/day orally/intravenously given in divided doses every 6 hours, maximum 4000 mg/day; neonates require lower doses, consult specialist for further guidance on dose

» The initial treatment of both short-segment (rectosigmoid) disease and long-segment disease is similar, as the extent of disease is not known until confirmation of pathology.

» Hirschsprung-associated enterocolitis (HAEC) may occur with prolonged abdominal distension and fecal stasis. The stasis leads to bacterial overgrowth, which leads to bacterial translocation and secretory diarrhea. HAEC can result in hypovolemia, endotoxin-related shock, and sepsis, making prompt treatment crucial as it is the leading cause of death in Hirschsprung disease.[11] [12] [13] HAEC must be suspected clinically. Bowel irrigation with saline solution is an extremely valuable procedure for the emergency management of HAEC.[11] By decompressing the bowel, the procedure may dramatically improve a very sick infant.

» All patients receive irrigations in the newborn period to manage abdominal distension prior to proceeding with surgery.[11] Guidance suggests 1 to 3 irrigations per day.[27] Irrigation may not be effective in patients with long-segment disease.[27]

» A large tube (20-24 Fr) is introduced through the rectum, and small amounts of saline solution (10 to 20 mL) are instilled through the lumen of the tube in order to clear the lumen of the tube. The liquid rectal and colonic content is expected to drain through the lumen of the tube. The tube is then rotated in different directions and moved back and forth. The operator continues to instill small amounts of saline solution, allowing the evacuation of gas and liquid stool through the tube.

» Irrigations must be differentiated from enemas. Enemas involve instilling a large volume of

Acute

fluid containing different irritant ingredients into the rectum and colon in order to elicit a bowel movement. Enemas are not recommended in patients with Hirschsprung disease.

» Initially patients should be kept nothing by mouth (NPO) until they begin to improve. Patients should receive intravenous fluids and antibiotics. Metronidazole is usually given. In older children, oral antibiotics can be given when they begin to improve and when they are no longer NPO.

adjunct **decompression by colostomy or ileostomy**

Treatment recommended for SOME patients in selected patient group

» Colostomy or ileostomy is necessary if a child is sick with intractable HAEC, bowel perforation, or abdominal distension unresponsive to irrigations.[27]

» An ileostomy or right transverse colostomy is a safe and effective method for decompressing the colon. This is a particularly useful option in emergency situations, for instance if there are no pediatric pathologists available to define the exact level of the transition zone (where circumferential ganglion cells are identified). By using this location for the stoma, the risk of the error of opening the colostomy in an aganglionic area is much reduced. A particular advantage is that the left side of the colon remains untouched, allowing for a future resection of the aganglionic segment and pull-through of the normal ganglionic colon. The disadvantage is that it commits the surgeon to a 3-stage procedure.

» Alternatively, a leveling colostomy can be performed. This is a colostomy placed at the start of the ganglionic portion of the colon, and where there are also no hypertrophic nerves. This obligates the surgeon to pull the colostomy down at the time of the definitive repair, depriving the patient of the protection of a proximal diversion. The advantage of this approach is that the child will require only a 2-stage procedure.

plus **definitive surgery**

Treatment recommended for ALL patients in selected patient group

» Treatment of enterocolitis with irrigations, hydration, and antibiotics usually takes days or weeks - about a week in hospital and several weeks having the family perform irrigations at home before proceeding to definitive surgery.

Acute

» Three surgical techniques exist for definitive surgical management. All have in common the removal of the distal aganglionic segment with pull-through of the proximal normal ganglionic bowel.

» Guidelines do not recommend any single pull-through technique over others for short-segment or long-segment disease; all three major surgical approaches have potential advantages and complications.[1] [4] [27]

» The Swenson operation is a full-thickness excision of the rectum and remaining aganglionic bowel.[63] [71] [72] [73] The original description involved entering the abdomen through a Pfannenstiel, hockey-stick incision, followed by full-thickness dissection of the aganglionic sigmoid and rectum.[83] This whole procedure can now be done through a transanal approach.[63] [73] [75] [76] The abdominal incision can be avoided in many cases or replaced with laparoscopy. The occurrence of fecal and urinary incontinence, as well as erectile dysfunction, which was felt to be due to nerve injury provoked by aggressive rectal dissection, prompted the development of the Yancey-Soave and Duhamel procedures in an attempt to avoid those complications.

» The Yancey-Soave procedure includes the resection of the mucosal layer of the distal bowel (endorectal resection) leaving intact a seromuscular cuff and pulling through the normal ganglionic colon inside the cuff.[77] [78] Theoretically, this minimizes the risk of potential injury to important neighboring pelvic structures during rectal dissection.[69] [79]

» The Duhamel procedure involves normal (i.e., ganglionic) intestine (usually above the most dilated portion) being pulled through a presacral space that has been created by blunt dissection and connecting this lumen to the original rectum left in its anterior position.[80] It avoids the extensive pelvic dissection required in the Swenson operation by preserving the distal aganglionic rectum, dividing the bowel at the peritoneal reflection as distally as possible. The rectal stump is then closed and the normal ganglionic colon is pulled through a presacral path and anastomosed to the posterior wall of the rectum, above the pectinate line.[70] A wide window is created with a stapler between the posterior rectal wall and the anterior wall of the normal ganglionic bowel. The fact that the anal canal is not disturbed likely contributes to the very low incidence of fecal incontinence;

Acute

however, the Duhamel "pouch" (aganglionic rectum) often becomes dilated which leads to severe constipation.

» If bowel diversion had been required, then once the child is well, a reconstruction can be planned. If the colostomy was a leveling colostomy, namely that it was placed proximal to the transition zone, then that colostomy can be pulled through and the distal aganglionic bowel resected. If the colostomy was placed more proximally, or if there was an ileostomy created, a pull-through can be performed using normal ganglionic colon proximal to the transition zone, and then the stoma can be closed at a third stage.

» Guidelines recommend one dose of preoperative intravenous broad-spectrum antibiotics; consult local protocols.[27]

total colonic aganglionosis

1st **ileostomy**

» Irrigations often do not work for patients with total colonic aganglionosis because it is difficult to reach the dilated small bowel. Patients will require colonic mapping biopsies and an ileostomy.[1] [4][11] [59]

plus **definitive surgery**

Treatment recommended for ALL patients in selected patient group

» Definitive surgery (total or subtotal colectomy with ileoanal or coloanal anastomosis) is performed when stoma output is of a thicker consistency, which typically occurs at around one year old when the child has fully transitioned to solid foods.[1]

» A 2024 expert consensus on the surgical management of TCA did not favor any single pull-through technique over others, and instead recommends that the technique should be chosen based on the experience of the operating surgeon.[59] All three major surgical approaches have potential advantages and complications.[1] The most commonly performed surgical procedures used to treat TCA include J pouch with ileoanal anastomosis (JIAA), straight ileoanal anastomosis (SIAA) and the Duhamel technique.[82]

» Guidelines recommend one dose of preoperative intravenous broad-spectrum antibiotics; consult local protocols.[27]

Emerging

Stem cell transplantation

Considerable effort has been made in researching the possibility of transplanting enteric neuronal stem/progenitor cells to repopulate the aganglionic intestine; however, this therapy remains limited to animal studies.[84] [85]

Genome editing

The development of CRISPR/Cas9 technology has led to advances in this potential therapy for Hirschsprung disease; however, this is limited to animal models and laboratory research using human induced pluripotent stem cell lines.[86] [87]

Patient discussions

The parent (or caregiver) should notify a physician immediately for any symptoms that could be consistent with an episode of enterocolitis. Long-term follow-up with physicians familiar with bowel management in Hirschsprung disease is recommended to maximize the quality of life. Normal bowel function may be achieved with dietary modifications, laxatives, and/or enemas.

There are useful resources and support groups available for patients and caregivers.

[REACH: what is hirschsprung's disease] (https://www.reachhd.org)

[PTN: encouraging and empowering those impacted by anorectal malformations and hirschsprung disease for over 30 years] (https://pullthrunetwork.org)

FOLLOW UP

Monitoring

Monitoring

The European Reference Network guideline recommends that children with Hirschsprung disease receive regular interdisciplinary follow-up to adulthood.[27] Follow-up should be frequent in the first year of life and every 1-2 years afterward, and should include assessment of growth, nutrition, development, and social functioning.[27] Guidelines have been proposed for the evaluation of postoperative complications in children with Hirschsprung disease.[88] [89] [90][102] [103]

Importantly, parents and caregivers should seek urgent medical care for any signs and symptoms of Hirschsprung-associated enterocolitis (HAEC).[11] Recurrent episodes of enterocolitis should prompt evaluation of an anatomic cause.[11] The pathogenesis of HAEC is thought to be due in part to dysbiosis, but there is no good evidence for or against probiotics to prevent HAEC.[12] [104]

Complications

Complications	Timeframe	Likelihood
anastomotic leak/dehiscence (postoperative)	**short term**	**low**
Incidence of postoperative anastomotic leak is reported to be up to 3.4%.[99] Treatment may require antibiotics, drainage, and/or intestinal diversion.		
anastomotic stricture (postoperative)	**short term**	**low**
Incidence of postoperative anastomotic stricture is reported to occur in up to 14.6% of patients.[99] Treatment may require dilation, corticosteroid-injections, and/or re-do surgery.		
inflammatory bowel disease (IBD)	**long term**	**low**
A small number of patients with Hirschsprung disease also develop IBD. Long-segment disease and Down syndrome are risk factors for Hirschsprung-associated IBD.[101]		
Hirschsprung-associated enterocolitis (HAEC)	**variable**	**high**
HAEC is reported in 20% to 60% of patients and can occur both pre- and postoperatively.[12] Early diagnosis and treatment are key.[11] Irrigations and treatment with hydration and metronidazole are the mainstays of therapy.[11] Intrasphincteric botulinum toxin injections have been shown to reduce the incidence of recurrent enterocolitis.[11] [27] On occasion, retention of aganglionic bowel or a dilated segment of colon due to an inadequate pull-through is the cause, and further surgical intervention is required.[11] [35]		
stoma-related complications (postoperative)	**variable**	**medium**
Stoma-related complications include prolapse, stricture, and retraction and are reported in about 21% of patients with Hirschsprung disease and an enterostomy. Patients with long-segment Hirschsprung disease are more likely to experience stoma-related complications, likely due to the longer duration of the stoma.[100]		
soiling (postoperative)	**variable**	**medium**
Soiling or true fecal incontinence after pull-through surgery may be due to injury to the anal canal or sphincters.[90] Postoperative soiling is reported in up to 74% of patients.[88] [99]		
obstructive symptoms (postoperative)	**variable**	**medium**
Obstructive symptoms (e.g., constipation or obstipation) after pull-through surgery is common, reported in up to 40% of patients.[88] [89] [99] Obstructive symptoms may be due to a myriad of factors including but not limited to: internal sphincter achalasia, anastomotic stricture, twisted pull-through, obstructive Yancey-Soave cuff, Duhamel spur, and transition zone pull-through.[89]		

Prognosis

Long-term outcomes for Hirschsprung disease are generally good. Postoperative soiling and obstructive symptoms are relatively common but can usually be managed with proper care.[88] [89] [90]

FOLLOW UP

Long-term outcome varies greatly depending on the severity of disease and the type of pull-through operation performed.[91] Children with delayed diagnosis of Hirschsprung disease have more postoperative complications and may have worse long-term outcomes than patients diagnosed in infancy.[92] [93] Patients with long-segment disease, particularly total colonic aganglionosis, are known to experience worse long-term outcomes than patients with short-segment disease.[4]

Studies suggest children with Hirschsprung disease have a significantly impaired long-term quality of life.[94] [95] [96] The pooled prevalence of fecal incontinence was 20% in one meta-analysis, and unplanned reoperations were common (44%) in one prospective cohort study.[94][95] Soiling and obstructive symptoms improve with age, but adult patients with Hirschsprung disease still report worse bowel function and quality of life than age-matched controls.[97] Transition of care programs and adult providers familiar with the care of Hirschsprung disease are important to preserve quality of life in older patients.[98]

Diagnostic guidelines

International

Guidelines for the diagnosis and management of Hirschsprung-associated enterocolitis (https://link.springer.com/article/10.1007/s00383-017-4065-8) [11]

Published by: American Pediatric Surgical Association **Last published:** 2017

Treatment guidelines

International

Management and outcomes for long-segment Hirschsprung disease: a systematic review from the APSA outcomes and evidence based practice committee (https://www.jpedsurg.org/article/S0022-3468(21)00280-3/abstract) [4]

Published by: American Pediatric Surgical Association **Last published:** 2021

Guidelines for the diagnosis and management of Hirschsprung-associated enterocolitis (https://link.springer.com/article/10.1007/s00383-017-4065-8) [11]

Published by: American Pediatric Surgical Association **Last published:** 2017

Online resources

1. REACH: what is hirschsprung's disease (https://www.reachhd.org) *(external link)*

2. PTN: encouraging and empowering those impacted by anorectal malformations and hirschsprung disease for over 30 years (https://pullthrunetwork.org) *(external link)*

Key articles

- Montalva L, Cheng LS, Kapur R, et al. Hirschsprung disease. Nat Rev Dis Primers. 2023 Oct 12;9(1):54. Abstract (http://www.ncbi.nlm.nih.gov/pubmed/37828049?tool=bestpractice.bmj.com)
- Kawaguchi AL, Guner YS, Sømme S, et al. Management and outcomes for long-segment Hirschsprung disease: a systematic review from the APSA outcomes and evidence based practice committee. J Pediatr Surg. 2021 Sep;56(9):1513-23. Full text (https://pmc.ncbi.nlm.nih.gov/articles/PMC8552809) Abstract (http://www.ncbi.nlm.nih.gov/pubmed/33993978?tool=bestpractice.bmj.com)
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- Kyrklund K, Sloots CEJ, de Blaauw I, et al. ERNICA guidelines for the management of rectosigmoid Hirschsprung's disease. Orphanet J Rare Dis. 2020 Jun 25;15(1):164. Full text (https://pmc.ncbi.nlm.nih.gov/articles/PMC7318734) Abstract (http://www.ncbi.nlm.nih.gov/pubmed/32586397?tool=bestpractice.bmj.com)
- Granström AL, Irvine W, Hoel AT, et al. Ernica clinical consensus statements on total colonic and intestinal aganglionosis. J Pediatr Surg. 2024 Oct;59(10):161565. Full text (https://www.jpedsurg.org/article/S0022-3468(24)00295-1/fulltext) Abstract (http://www.ncbi.nlm.nih.gov/pubmed/38763854?tool=bestpractice.bmj.com)

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5. Butler Tjaden NE, Trainor PA. The developmental etiology and pathogenesis of Hirschsprung disease. Transl Res. 2013 Jul;162(1):1-15. Full text (https://pmc.ncbi.nlm.nih.gov/articles/PMC3691347) Abstract (http://www.ncbi.nlm.nih.gov/pubmed/23528997?tool=bestpractice.bmj.com)

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Images

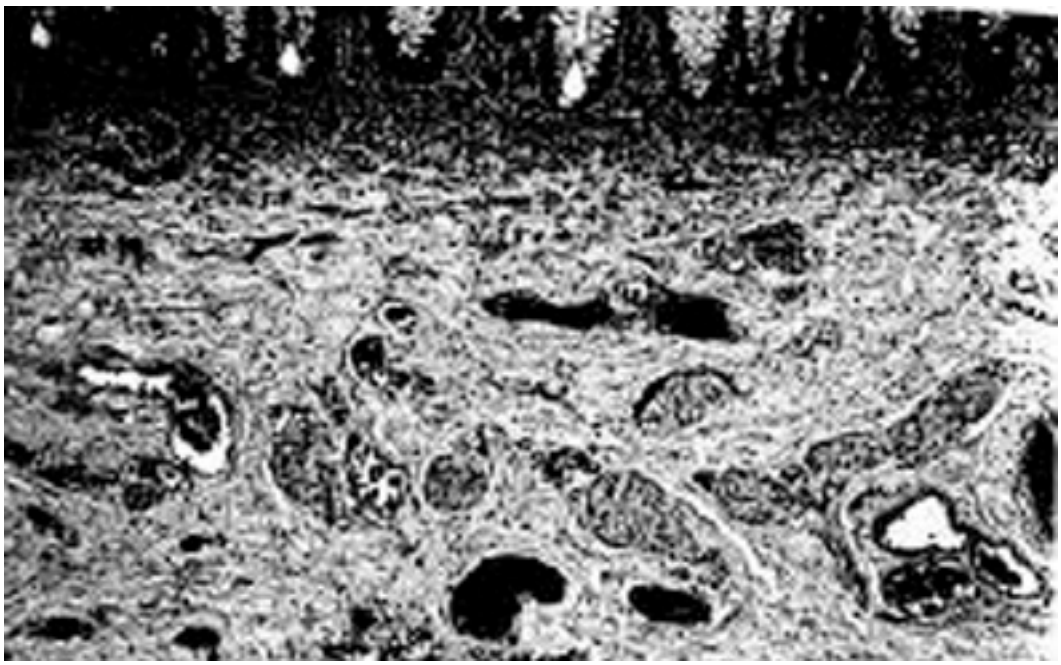

Figure 1: Histologic section including mucosa with submucosa of the rectum showing clusters of ganglion cells in the submucosal plexus. This excludes Hirschsprung disease at this level

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Figure 2: Histologic section including mucosa and submucosa of the rectum showing tortuous and hypertrophic nerve trunks of the submucosal plexus. There is no evidence of any ganglion cell present. This establishes the diagnosis of Hirschsprung disease

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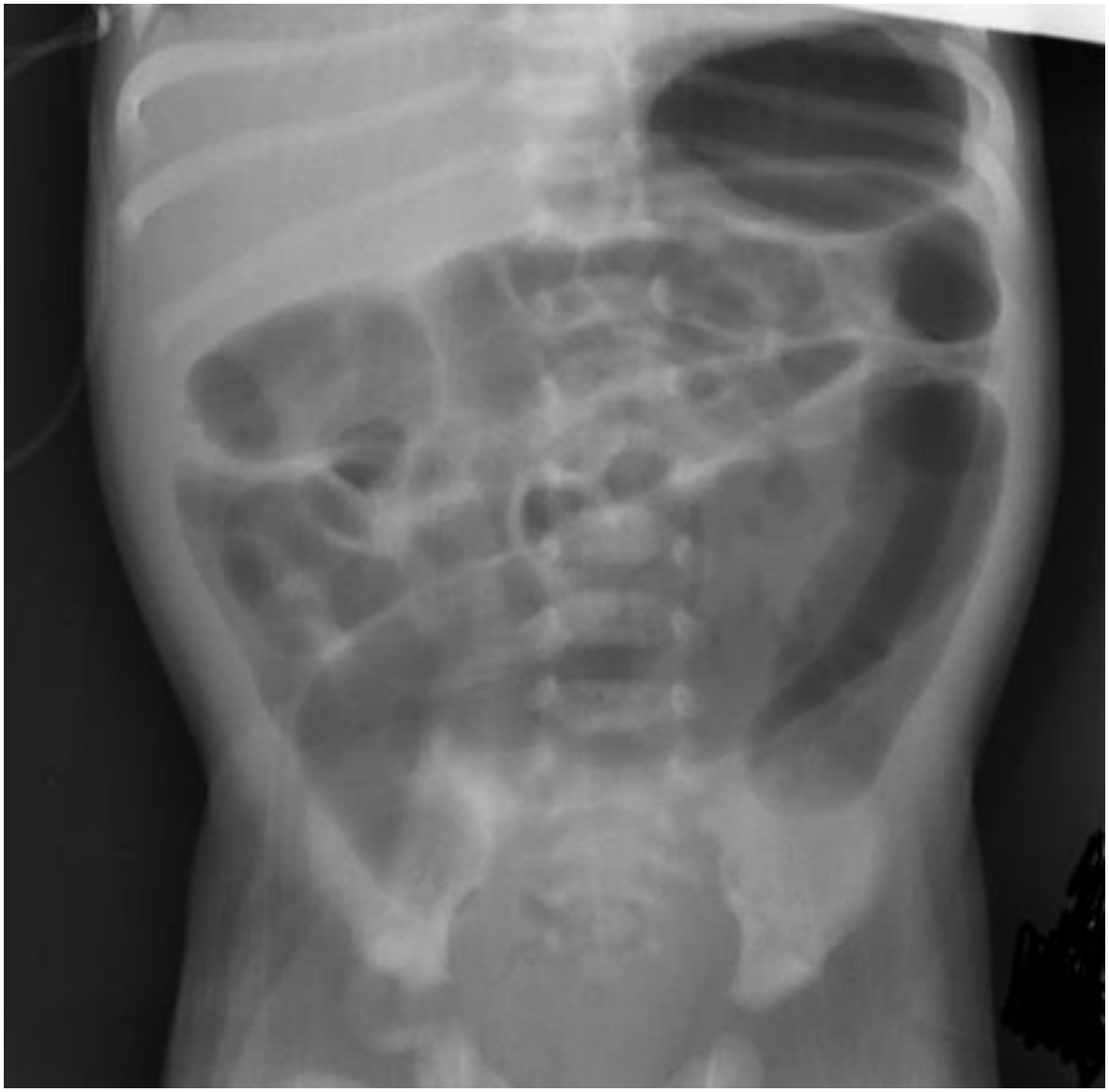

Figure 3: Abdominal x-ray image showing gaseous distension of the large bowel with air absent from the rectum (typical of Hirschsprung disease)

BMJ Case Reports 2012; doi:10.1136/bmj.e5521

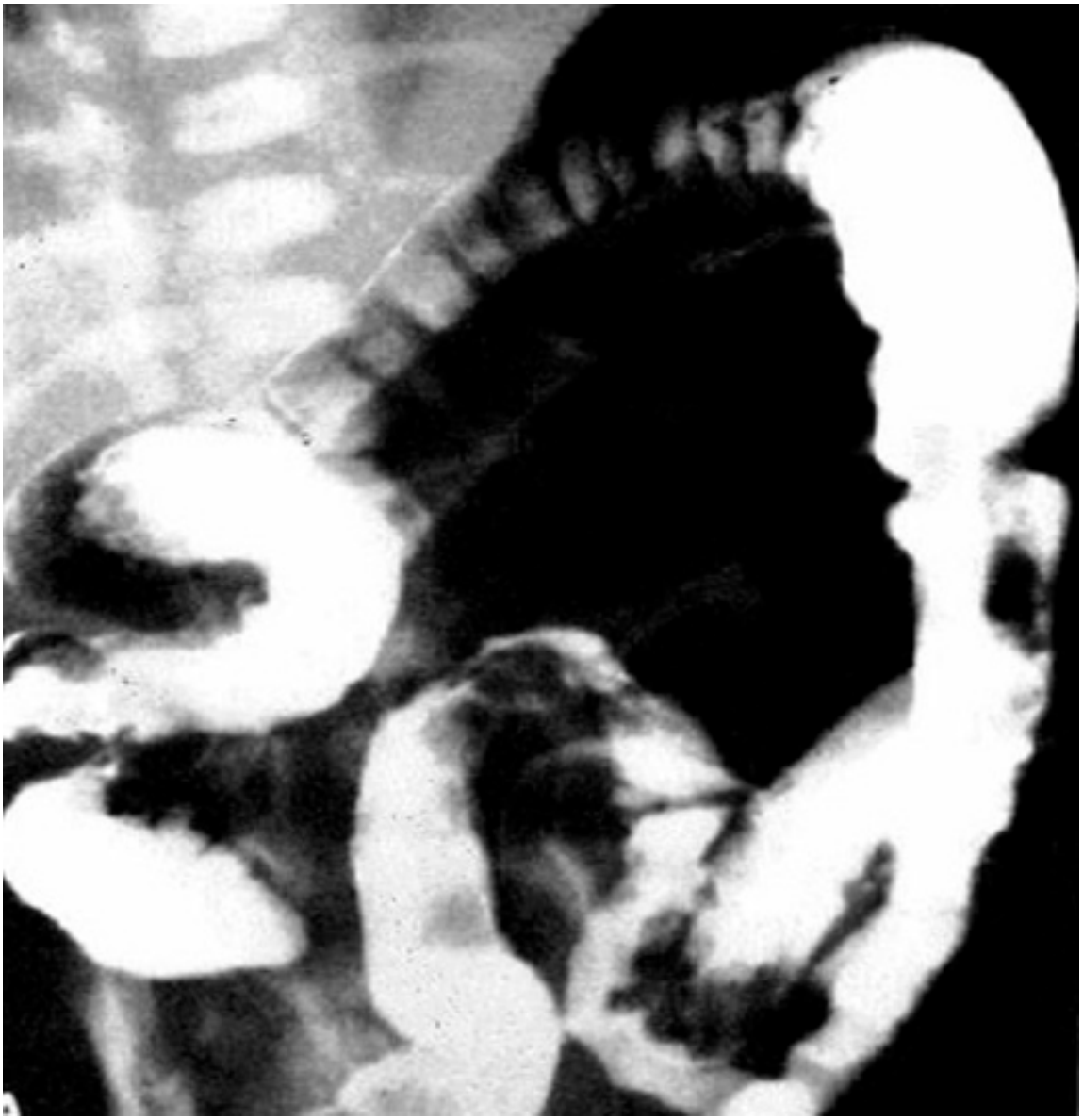

Figure 4: Barium enema performed in a newborn with Hirschsprung disease. Often, classical changes are not obvious in the neonatal period

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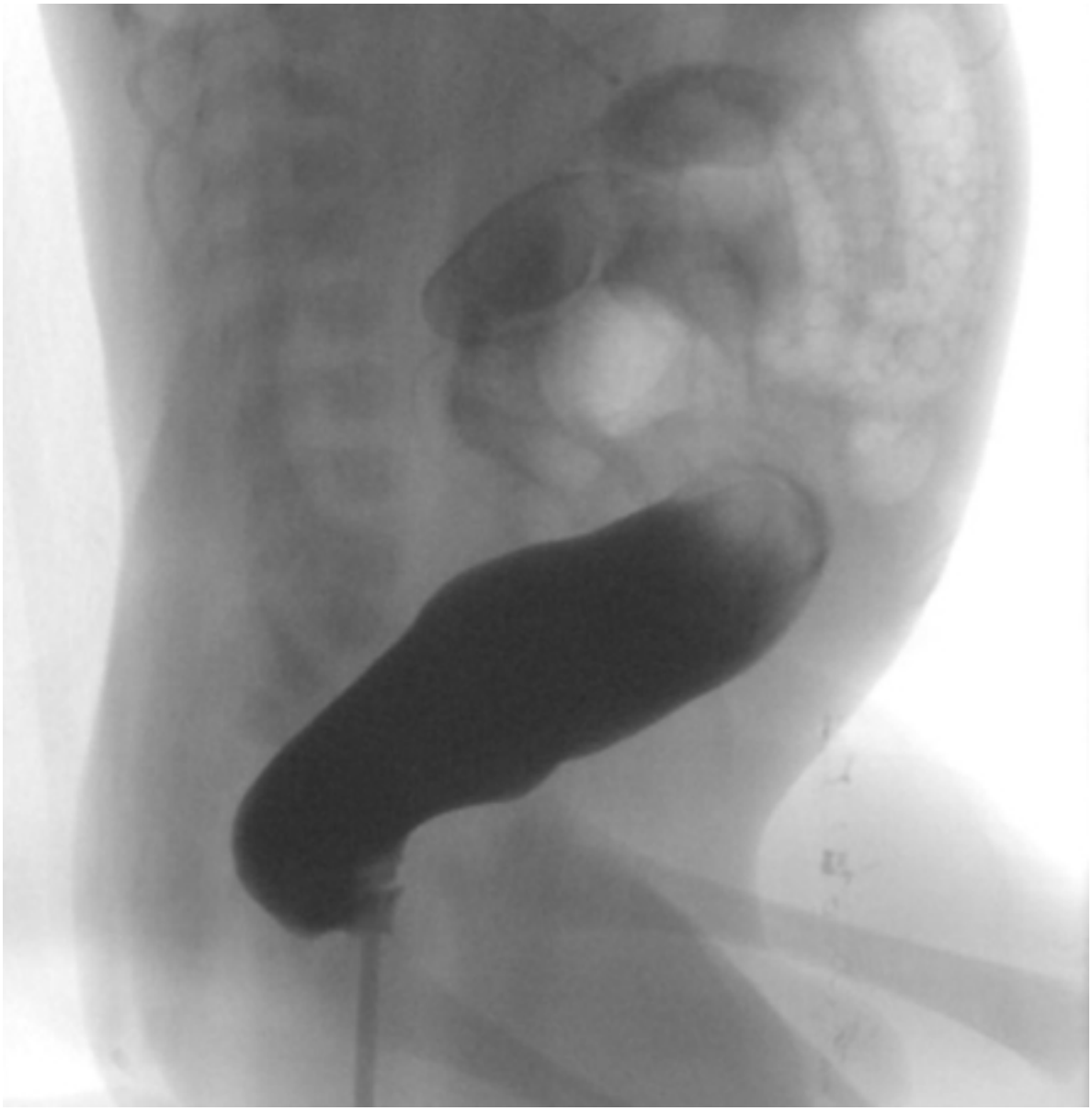

Figure 5: Contrast enema showing an abnormal rectosigmoid ratio (sigmoid diameter larger than rectal diameter)

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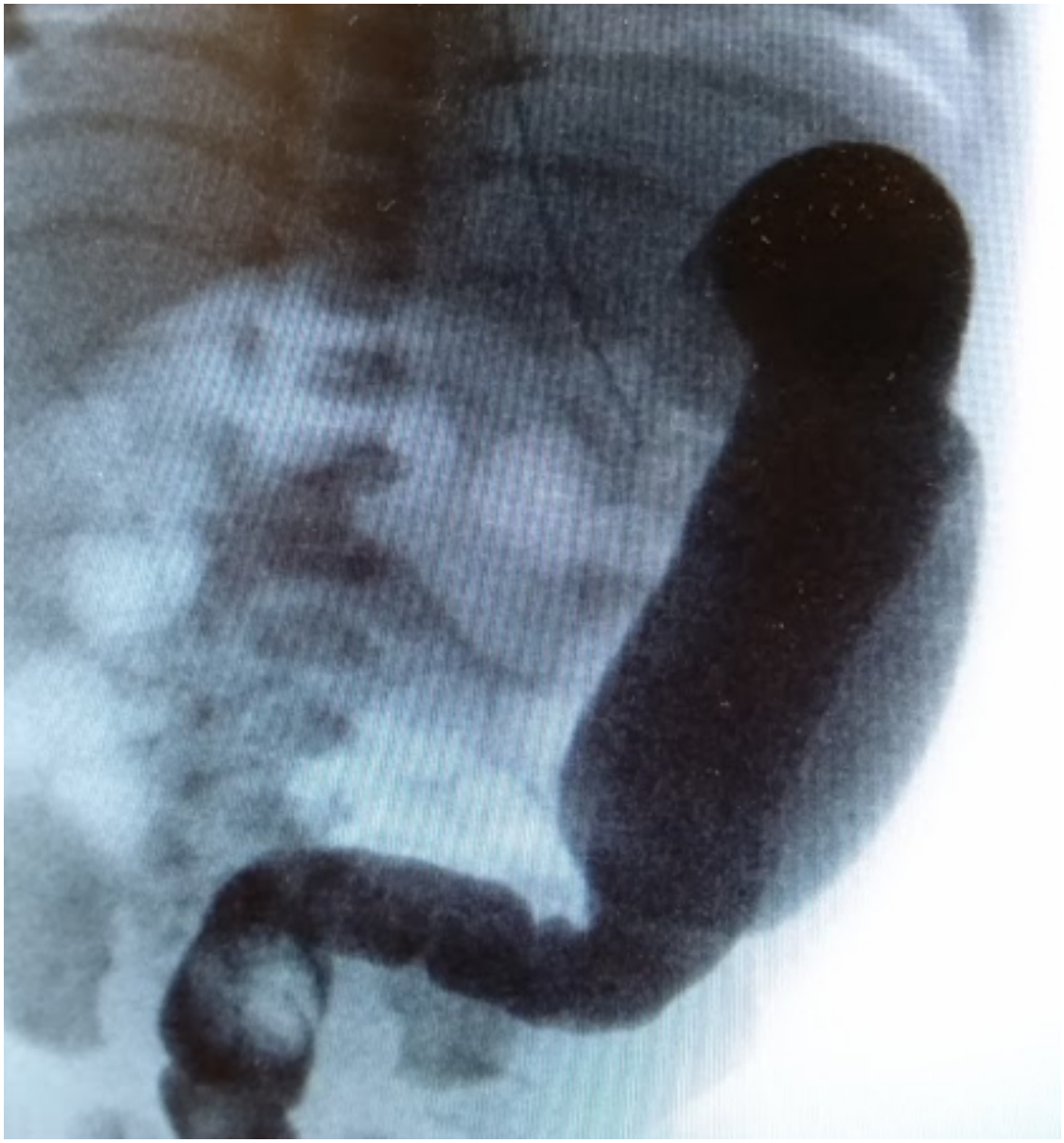

Figure 6: Contrast enema may demonstrate mucosal irregularity in the aganglionic distal colon and may show a transition zone between smaller caliber aganglionic distal colon and dilated proximal ganglionic colon

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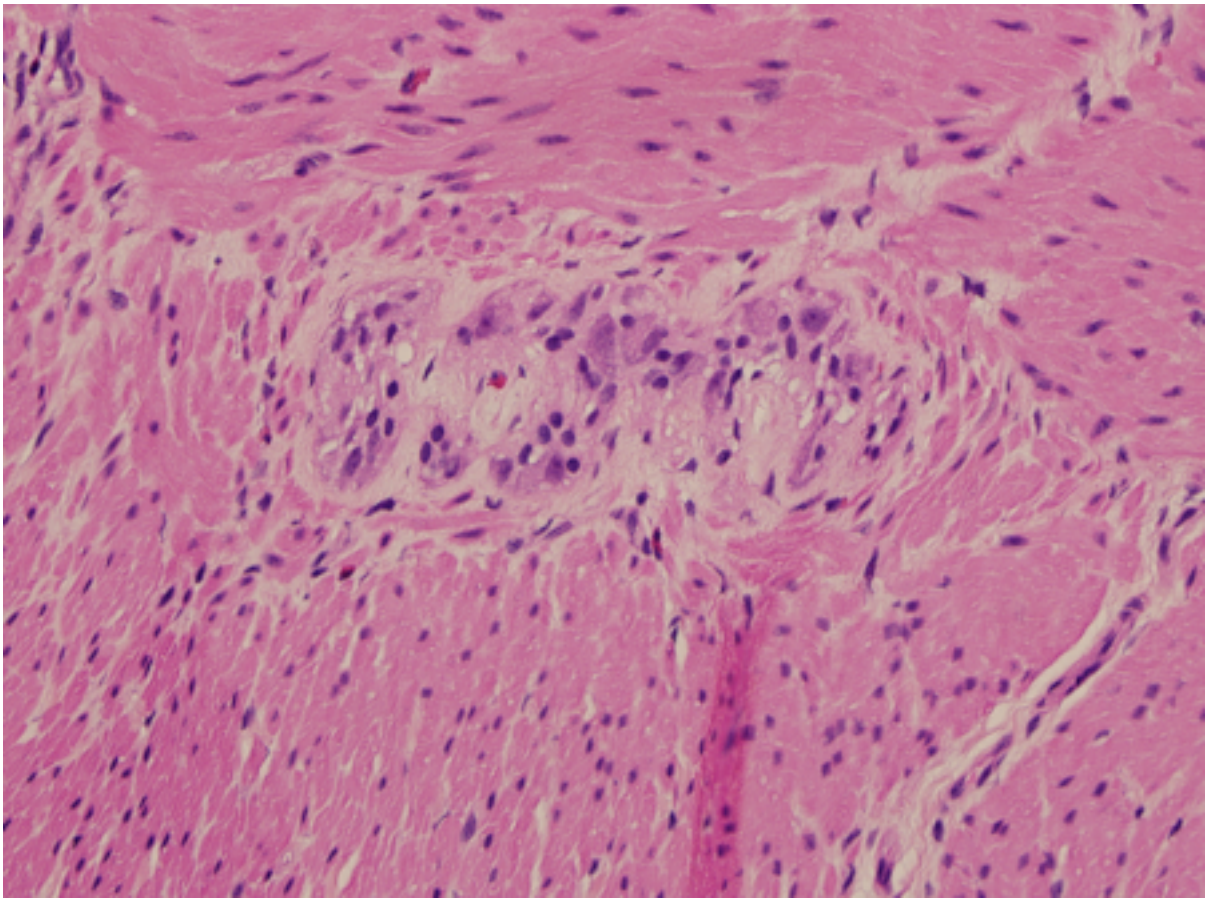

Figure 7: Hematoxylin and eosin showing ganglion cells in the myenteric plexus

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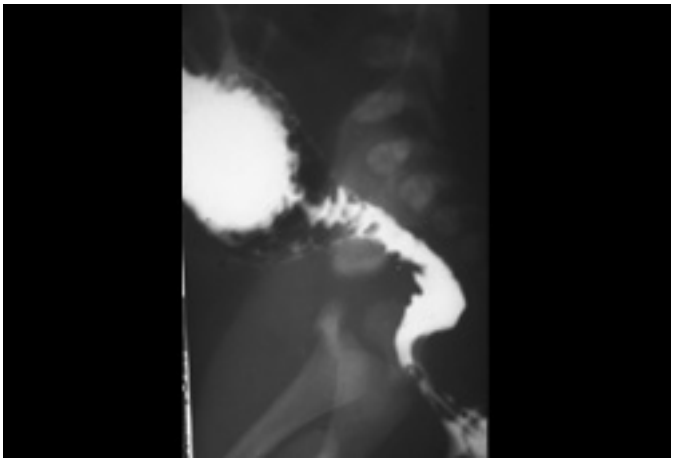

Figure 8: Contrast enema demonstrates the typical proximal dilation, transition zone, and nondistended, aganglionic portion

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This approach is in line with the guidance of the International Bureau of Weights and Measures Service.

Figure 1 – BMJ Best Practice Numeral Style

5-digit numerals: 10,000

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Contact us

+ 44 (0) 207 111 1105
support@bmj.com

BMJ
BMA House
Tavistock Square
London
WC1H 9JR
UK

Contributors:

// Authors:

Lily S. Cheng, MD

Assistant Professor
University of Virginia, Charlottesville, VA
DISCLOSURES: LSC is the co-author of a reference cited in this topic.

Kristy Lynn Rialon, MD

Associate Professor of Surgery
Division of Pediatric Surgery, Texas Children's Hospital, Baylor College of Medicine, Houston, TX
DISCLOSURES: KLR declares that she has no competing interests.

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// Peer Reviewers:

Ivo de Blaauw, MD, PHD

Pediatric Surgeon
Radboud University Nijmegen, Academic Medical Center, Nijmegen, Netherlands
DISCLOSURES: IdB declares that he has no competing interests.

Jose Manuel Tovilla, MD

Colorectal Pediatric Surgeon
Chief of the Colorectal Clinic, Hospital Infantil de Mexico Federico Gomez, Mexico
DISCLOSURES: JMT declares that he has no competing interests.

Daniel P. Doody, MD

Pediatric Surgeon
Department of Pediatric Surgery, Massachusetts General Hospital, Boston, MA
DISCLOSURES: DPD declares that he has no competing interests.