Opening Pandora's Box: The Role Of Contrast Enemas In Abdominal Imaging

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Abstract

The widespread use of contrast radiography has made it easier to diagnose and treat many abdominal conditions in both children and adults. Apart from barium, other contrast media such as Gastrografin, clear fluids such as saline and Hartman's solution and even tap water and air have all been employed as contrast, with good results. Contrast enemas play an important role in the diagnosis of abdominal emergencies such as appendicitis, intestinal obstruction in neonates and children, inflammatory bowel disease and ischemic colitis and are also useful in screening for colorectal polyps and cancer. Gastrografin and other fluids are preferred to barium, in the presence of acute inflammatory pathology or when perforation is a possibility.

INTRODUCTION

With refinements in radiographic techniques, the utility of contrast enemas in the diagnosis and treatment of abdominal pathology has increased tremendously over the last 50 years. In 1808, Sir Humphrey Davy discovered barium, a soft silvery metal that rapidly tarnishes in air and reacts with water. Its radio-opaque character established its utility in outlining the bowel; the low cost, safety, and accuracy in diagnosis and its value in management. In 1969, Noblett introduced Gastrografin, allowing non-operative management of many neonates with uncomplicated meconium ileus. Later, other agents including air, water, and Hartmann's solution were also found to be of value. This paper is an attempt to illustrate the scope of contrast enemas, with an emphasis on commonly encountered problems in primary care practice. (Table 1)

Figure 1

Table 1: Role of contrast enemas in abdominal imaging

Agent	Indication
Barium Sulfate	-Colorectal cancer screening every 5-10 years in patients over 50 -Diagnosis of lower abdominal pain, weight loss, constipation, rectal bleed -Diagnosis of polyps and cancers of the colon -Suspected appendicitis, volvulus, Hirschsprung's disease, Intussusception (also therapeutic) -Suspected pseudoobstruction -Colovesical, colovaginal or coloenteric fistulas
Gastrografin	-Diagnostic in incomplete/ complete large bowel obstruction -Hematochezia -Suspected acute diverticulitis -Contrast medium of choice in CT scans of abdomen and pelvis -Diagnostic and therapeutic in volvulus, intussusception, Meconium ileus. -Management of penetrating wounds of back and flank (in diagnosis of injuries to retroperitoneal organs) -Assessment of integrity of low colonic anastomosis -Assess integrity of ileal pouch -Suspected colovesical, colovaginal or coloenteric fistulas
Tap water	Diagnostic and therapeutic in intussusception (ultrasound-guided reduction of intussusception)

Figure 2

Tap water mixed with Iodine contrast	Contrast for CT study (better delineation of mucosal abnormality)
Hartmann's solution	Diagnosis and treatment of childhood intussusception (ultrasound-guided).
Air	Diagnosis and treatment of childhood intussusception (ultrasound-guided). Peroral pneumocolon

Prior to the availability of relatively recent advances in imaging technology, many laporotomies were performed for presumptive diagnoses or for emergencies emanating from

the abdomen resulting in unexpected pathology being encountered. Because one did not know for certain as to what was going on inside, the abdomen has long been described as a "Pandora's box," referring of course to the ancient Greek myth of the misery-filled vessel that was presented as a gift by Zeus to Pandora's husband, Prometheus. The myth of Pandora's box is one of many stories that reflect our innate fear of unlocking long-concealed secrets of nature.

Contrast radiography has revealed many secrets from outside the box (abdomen), so that opening the box has become less hazardous. It has also revolutionized the way the gastrointestinal tract could be visualized, enabling many "hidden" areas of the body to be adequately assessed and pathology treated more appropriately. Most patients undergo a double-contrast barium enema (DCBE) with high-density barium suspension introduced into the colon, followed by insufflation of air. A single-contrast barium enema (BE) can be performed on patients with suspected obstruction and in patients who are too old or debilitated to tolerate a double-contrast study.

ACUTE APPENDICITIS

Before the development of sonography and computed tomography (CT) scanning, BE was extensively used to diagnose appendicitis.[1] There is still a place for BE in the management of suspected appendicitis, in peripheral hospitals with limited access to these technical advances. The normal appendix fills more often when contrast enema is administered and incomplete or non-filling of the appendix accompanied by extrinsic mass effect on the cecum is considered to be a positive sign for appendicitis. Identification of the cecal apical changes of appendicitis needs good cecal distention, which is reliably achieved with a contrast enema. Both oral and IV contrast material are avoided without loss in diagnostic accuracy.[2]

BE has a high sensitivity and specificity (83 and 96%) and an overall accuracy of 91.5% in appendicitis.[3,4] It, however, has several disadvantages. These include the relative high incidence of non-diagnostic studies, risk of contrast extravasation in the presence of perforation, and inability to provide information about disease outside of the colon.[5,6] It also uses radiation and is uncomfortable for the patient.[7] The appendix does not fill in many healthy patients and if it does fill, its length being highly variable does not exclude the possibility of distal appendicitis.

Contrast helical CT examination of pediatric patients with symptoms suggestive of appendicitis has a sensitivity of 95% and a specificity of 94%.[8] Despite its obvious value, CT has limitations in children and young adult females as it relies heavily on intraperitoneal fat for its accuracy. Children have very little fat and should be spared radiation. Young adult females, who possess relatively more subcutaneous than interperitoneal fat, have the additional conundrum of potential gynecologic disease, the features of which mimic appendicitis.[9] In these situations, sonography with or without endovaginal imaging should be chosen over CT.9

INTUSSUSCEPTION

Intussusception, an invagination of the proximal portion of the bowel into an adjacent distal bowel segment, is second only to an incarcerated inguinal hernia as a cause of intestinal obstruction in infants.[10,11] The classic triad of intermittent colicky abdominal pain, vomiting and bloody stools full of mucus ("currant jelly" stools) is seen infrequently (`20%). Often infants present with only 2 symptoms.[12] Though plain films show a pattern of small bowel obstruction, they do not confirm the diagnosis of intussusception, which should be made as early as possible, so that treatment can be instituted before ischemic changes supervene, necessitating surgical treatment and possible resection of the ileocecal pole.[13]

Barium, water-soluble contrast media, water, electrolyte solutions, or air may be used with radiographic or ultrasound guidance to diagnose and reduce intussusception. The relative merits of the various non-operative approaches in diagnosing intussusception, is summarized in Table 2.

Figure 3

Table 2: Relative merits of various modalities in the non-operative management of intussusception15

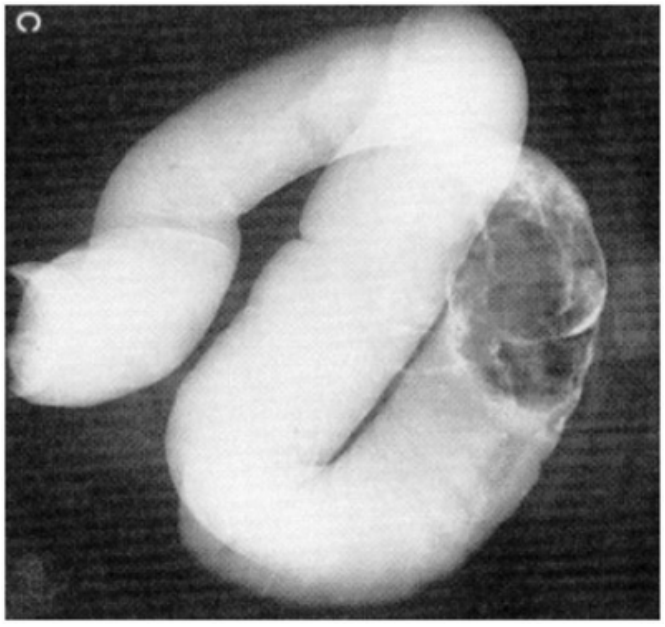
Modality	Advantages	Disadvantages
Barium Enema + Fluoroscopy	Success rate of 55-90% Requires more experience Low perforation rates (0.39-0.7%)	X-ray exposure Barium peritonitis Visualizes only intraluminal content
Air Enema + Fluoroscopy	Success rates of 70-95.6% Less x-ray exposure than barium Requires less experience	X-ray exposure Higher perforation rate (0.14-2.8%) Visualizes only intraluminal content
Water soluble contrast (saline) enema + ultrasound	No x-ray exposure Longer procedure time Success rate of 76-95.5% Visualizes all components of intussusception Low perforation rate (0.26%)	Needs experienced sonographer

Barium enema is the gold standard and rectal instillation under fluoroscopy is a time-tested method for both diagnosing and reducing childhood intussusception, with a success rate ranging from 55-90% and a risk of perforation

of <1%.[14,15] If symptoms exist for less than 24 hours, the success with a barium enema is as high as 80-90%.[16,17] Contraindications include bowel perforation, complete obstruction and unstable presentation. Intussusception has two classic signs.[18] The “meniscus sign” (Figure 1) produced by the rounded apex of the intussusceptum protruding into the column of contrast material and the “coiled spring” appearance (Figure 2) caused by the edematous mucosal folds of the returning limb of the intussusceptum outlined by the contrast.

Figure 4

Figure 1: The meniscus sign in intussusception

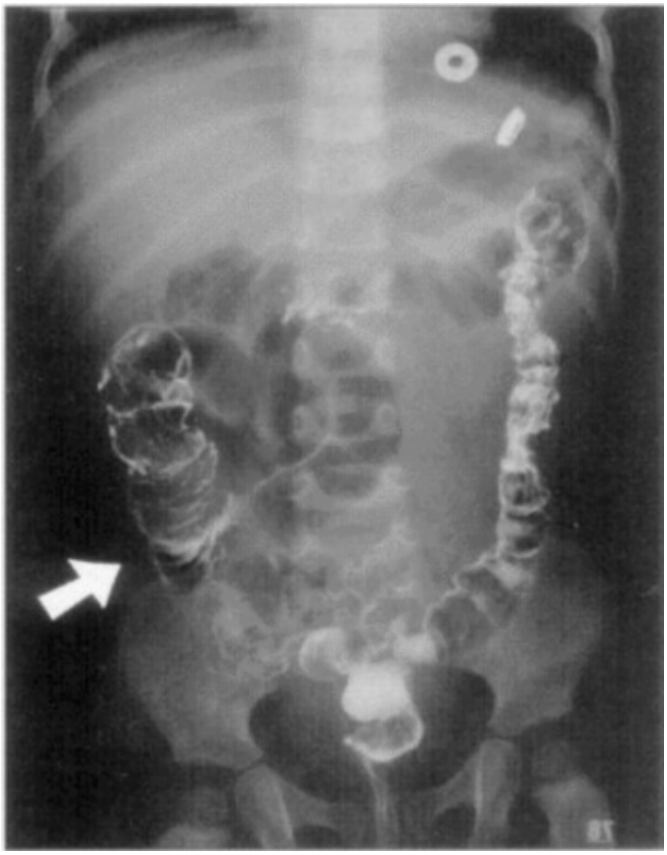


Infusion of air to a maximum pressure of between 125 and 150 mm Hg into the colon without contrast (eg, air enema) is replacing barium.[19] Pneumoreduction has a similar success rate in diagnosing and treating childhood intussusceptions.[20,21] Air insufflation has an increased the risk of perforation due to oscillations in intraluminal pressure, but as there are no problems associated with barium extravasation, the overall risk of complications is the same or less than that with barium.[22,23] Less radiation exposure due to shorter reduction times is another advantage (4-7 rads.)[24,25] A prospective analysis of 181 cases of pneumoreduction had an overall success rate of 84%, with 4 perforations (1.6%). Four minutes fluoroscopy time was a good critical point in differentiating successful and failed cases.[26]

Kim et al first described hydrostatic reduction under ultrasound guidance in 1982.[27]. Pressures within the colon, are more constant with hydrostatic reduction than with pneumoreduction lowering the risk of perforation. A combination of Ringer lactate/saline and water-soluble contrast medium under ultrasound guidance can simultaneously diagnose and confirm sonographic reduction; fluoroscopic confirmation adds minimal radiation.[28] The method is highly successful (76-95.5%), with the ability to view all components of the intussusception and a low complication rate (<1% perforation)18.

Figure 5

Figure 2: Coiled spring appearance in intussusception



HIRSCHSPRUNG'S DISEASE

BE is a good initial screening test for Hirschsprung's disease in severely constipated children, since it correlates well with manometry and biopsy. In newborns with suspected megacolon, BE has a sensitivity of 83% and a specificity of 98%. It is particularly useful in centers without easy access to pediatric gastroenterology services. A normal enema in this setting allows continuation of medical therapy, with further evaluation only if there is poor response. On the other hand, an abnormal enema, requires referral to a facility equipped to perform confirmatory manometry or biopsy.[29]

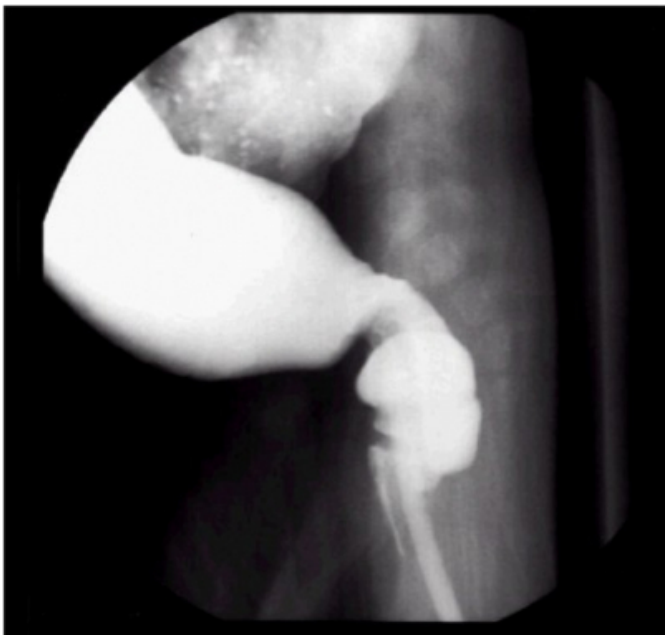
Both barium and water-soluble contrast enemas have

equivalent sensitivity. Using 8 different radiologic criteria found on contrast enemas, a scoring system was devised to assist in diagnosing Hirschsprung's disease.29 When 6-8 criteria were present, the probability of Hirschsprung's disease was 100%, with 4-5 criteria 66% and with 1-3 criteria 40%.. Of the criteria, cobblestone appearance, mucosal irregularity and presence of mucosal serrations attained specificities of between 90%-100%. The sensitivities, of the criteria however, were much lower. Appearance of the transition zone, rectosigmoid index and delayed evacuation had the greatest sensitivities (65-80%).[30]

In older children a characteristic transition zone between narrow-caliber distal aganglionic bowel and dilated upstream, normally ganglionated bowel is seen.(Figure 3) This is often difficult to observe in newborns with Hirschsprung's disease. Failure to evacuate the administered contrast within 24 hours may be one of the diagnostic features of Hirschsprung's disease.30

Figure 6

Figure 3: Barium enema showing dilated colon, transition zone narrowed distal segment.



INFLAMMATORY BOWEL DISEASE

DCBE is the primary radiologic tool in confirming the diagnosis of ulcerative colitis and in assessing the extent and severity of the disease. BE made this distinction possible in only 75% of patients.[31, 32] Contrast enema findings in Ulcerative colitis and Crohn's disease are outlined in Table 3.[33] DCBE demonstrates detail such as granular mucosa in ulcerative colitis and aphthoid ulcers and discontinuous disease in Crohn's disease, helping to differentiate the two, especially during the early stages.[34] There is a high congruence (95%) between the radiological and endoscopic diagnosis.[35]. Although generally safe and well tolerated, DCBE is relatively contraindicated in patients with severe colitis as it may precipitate toxic megacolon or perforation.

Figure 7

Table 3: Barium Enema Findings In Inflammatory Bowel Disease

Ulcerative Colitis	Crohn's disease
Granularity of the mucosa	Aphthous ulcers, Deep or confluent ulcerations
Collar button ulcers	Cobblestone appearance
Stippling of the mucosa	Segmental distribution
Thickening or loss of haustrations	pseudopolyps
Pseudopolyps	Loss of haustrations
Confluent, contiguous, circumferential disease	Fissures, fistulas
Narrowing of the lumen	Sacculations
Loss of rectal valves	Strictures
Widened pre-sacral space	
Backwash ileitis (inflammation of the terminal ileum)	

ISCHEMIC COLITIS

Typically, ischemic colitis presents with the sudden onset of mild crampy left lower quadrant abdominal pain accompanied, or followed within 24 hours, by bloody diarrhea or bright red blood per rectum. The splenic flexure, descending colon, and sigmoid are the commonest sites of ischemic injury. The spectrum of ischemic colitis encompasses submucosal or intramural hemorrhage, transient ischemic colitis, chronic ulcerative ischemic colitis, colonic stricture, gangrene or fulminant total ischemic colitis. 35 Despite a growing understanding of the pathophysiology of colonic ischemia and its disparate clinical presentations, many cases of transient or reversible ischemia still are missed. The reasons include delay in diagnostic studies, its often self-limited nature, and confusion with inflammatory bowel disease.[36]

Thumbprints, the major radiologic finding in the acute stage, represent submucosal and mucosal hemorrhage and edema. (Figure 4) Contrast enema repeated one week after an initial study should reflect evolution of the injury. Areas of hemorrhage either resolve and the study returns to normal or the thumbprints are replaced by a segmental pattern of colitis, as the mucosa ulcerates.[37] In late cases, fibrosis and strictures develop, demonstrated radiographically as areas of narrowing of the colon.

Care must be taken during barium enema to avoid over-

distending the colon, because increasing intraluminal pressure beyond 30 mm Hg diminishes intestinal blood flow to the mucosa and shunts blood away from the mucosa to the serosa, increasing the risk of ischemic damage. Using carbon a potent vasodilator which is absorbed rapidly from the colon, leads to a shorter period of distention and less compromise of colonic blood flow.[38]

Figure 8

Figure 4: Thumbprinting in ischemic colitis

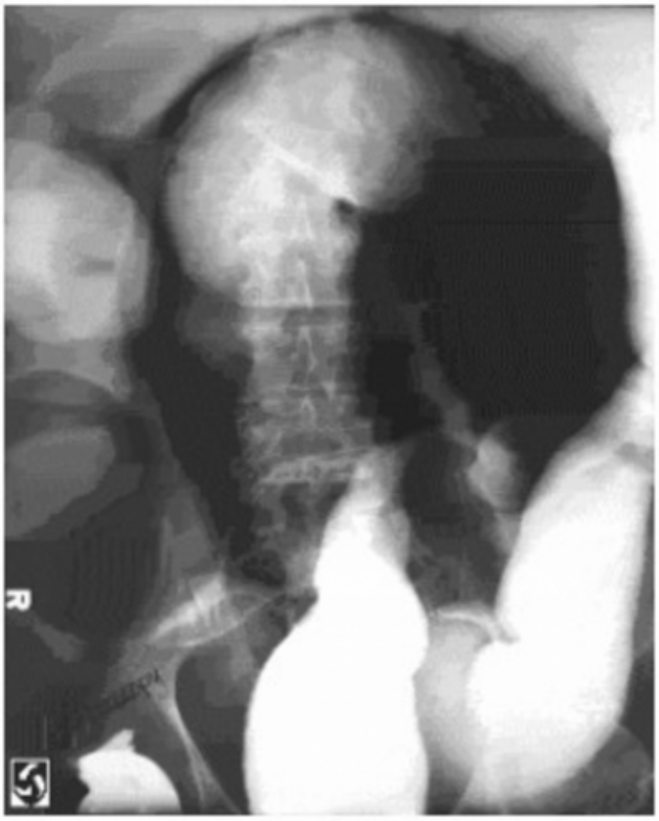
VOLVULUS

Volvulus most commonly occurs in the sigmoid followed by the transverse colon and cecum. They all share the same predisposition: a long freely redundant mobile colon and mesocolon, lack of fixation and short mesenteric attachment of the proximal and distal mesocolic limbs. Volvulus is associated with old age, presence of chronic constipation, and mental retardation.[39,40] Central abdominal pain of sudden onset followed by abdominal distension, tenderness, bloody mucus discharge or inability to pass flatus is characteristic.

A barium enema may assist with the diagnosis of sigmoid or cecal volvulus when the noncontrasted study is equivocal. The appearance of a bird's beak or “ace-of-spades” sign is due to narrowing of the recto-sigmoid at the neck of the volvulus causing complete or partial obstruction.[41] (Figure 5) This has also been described in cecal volvulus.[42] A distended and downwardly displaced transverse colon may mimic it, by forming a pseudovolvulus. A distended transverse colon, however, has a convex inferior margin, with the double central wall extending cephalad, the opposite of sigmoid volvulus.

Figure 9

Figure 5: Ace of spades appearance in sigmoid volvulus



INTESTINAL PSEUDOOBSTRUCTION

Acute colonic pseudo-obstruction (Ogilvie's syndrome), is characterized by recurrent abdominal pain, nausea, vomiting and massive distention of the colon.[43] The syndrome is often accompanied by systemic disease or recent surgery. Associated conditions include: postoperative state, trauma, pregnancy, electrolyte imbalances, hypoxemia, significant co-morbid illness and neuromuscular diseases such as parkinsonism and cerebrovascular accidents.[44] Acute colonic pseudo-obstruction is also associated with medications that cause a decrease in colonic motility such as narcotic analgesics, anticholinergics, tricyclic antidepressants and anti-parkinsonian drugs.[45] If mechanical obstruction cannot be definitively excluded with the clinical history and plain film radiography, a water-soluble contrast enema (diatrizoate meglumine or Gastrografin) is useful in ruling out other

causes of obstruction such as neoplasms, ischemic colitis and strictures due to diverticular disease or inflammatory bowel disease. Care must be taken with enemas, since increases in intracolonic pressure may cause perforation. Given the nature of pseudo-obstruction, air should not be instilled into the colon when the barium enema is performed and contrast enemas are contraindicated when perforation is known to exist.[46]

PERORAL PNEUMOCOLON AND SMALL BOWEL ENEMA

When targeting the terminal ileum, a peroral pneumocolon (POPC) may be the preferred initial study. A peroral pneumocolon obtains double-contrast images of the distal ileum and right colon. After oral administration of barium, once the barium meal has reached the cecum, air is introduced into the colon via a rectal catheter. Reflux of air into the distal ileum results in air-contrast views of the ileum.[47] In a study of 34 patients of whom 29 had undergone prior barium meal small bowel follow through studies, POPC was found to be superior in 86.2%. In 5 patients who could not retain barium enema, POPC investigation was successful,[48] suggesting that this method is a viable alternative in patients with hypotonic or atonic anal sphincters.

SCREENING FOR COLORECTAL CANCER (CRC)

Prior to the advances and availability of endoscopy, DCBE was considered the best technique for demonstrating subtle lesions such as small polyps or cancers.[49] The sensitivity of DCBE is 50-80% for polyps less than 1 cm, 70-90% for polyps larger than 1 cm and 50-80% for stage I and II adenocarcinomas.[50,51] An independent panel, after accounting for bias in their literature review, estimated the sensitivity of DCBE for cancer and large polyps to be 65-75%.[52] At 5-year intervals, it has been recommended by numerous organizations as an option for colorectal cancer screening.[53,54] Single-contrast barium enemas are not effective in colorectal cancer screening. Rex et al., reported on their sensitivity and noted that pre-malignant lesions were found in only 2% of 738 patients, with no cancers being detected.[55] The frequency of polyps seen with the single-contrast barium enema ranges from 1-7.8%, but increases to 10-13% with DCBE.49 False-positive findings are mainly due to adherent stool and non-neoplastic mucosal irregularities, with rates ranging from less than 1 % for cancers, to 5-10% for large polyps and up to 50 % for small polyps.50

Based on a computer simulation model, DCBE every 5 years was found to reduce mortality due to CRC by more than two-thirds and when combined with flexible sigmoidoscopy every 5 years, by 77.1%.54 Cost analysis based on the same model suggested that DCBE every 10 years was the most cost-effective approach in screening for CRC, costing $7052 per death due to CRC prevented compared to DCBE every 5 years $ 12143, colonoscopy every 10 years $17751, DCBE and flexible sigmoidoscopy every 5 years $18991.54

Radiologists have argued that the advantages of using barium enema for colorectal cancer screening are that it examines the whole colon (unlike sigmoidoscopy), is cheaper than colonoscopy, safer than colonoscopy, and as accurate as colonoscopy for detection of cancer and large polyps.[56] However, some have suggested, that the diagnostic contribution of double-contrast barium enema in colorectal cancer screening should be confined to use as an adjunct to incomplete colonoscopy.[57] Immediate DCBE after incomplete colonoscopy allows complete colonic evaluation in most cases, often adds vital diagnostic information, and eliminates repeated bowel preparation and unnecessary delay in diagnosis. In a prospective study of 103 patients, in 14 significant additional information was provided.[58]

ADVERSE REACTIONS TO BARIUM ENEMAS

Barium has the potential to cause significant complications. It may form an impaction, which occludes the lumen of bowel causing constipation or complete obstruction. Inactive, dehydrated, elderly patients, and neonates are at greater risk of impaction. Copious fluid intake, prompt evacuation of the barium and stool softener or laxative following the procedure, minimizes this risk.[59]

Perforation due to catheter tip insertion and over-inflation is potentially the most serious, occurring in approximately 0.02-0.04%. The barium spills into the peritoneum, retroperitoneal space, or intramurally even dissecting the transverse mesocolon.[60] Perforation is more likely in a colon weakened by iatrogenic trauma due to biopsy or polypectomy or disease such as tumor, diverticulitis, inflammatory bowel disease or ischemia. It can also occur if the retention balloon is inflated within a stricture, tumor, inflamed rectum or colostomy stoma.[61] Free barium is inert, but the dyes, bacteria and partially digested food matter dumped into the peritoneum, cause peritonitis and third-spacing of fluid leads to hypovolemia. Bacteremia has been found in as many as 23% of patients following barium enema and, rarely may cause septicemia.61 The patient can

rapidly develop sepsis and/or shock, with a 50% mortality.[62] Barium can also induce an inflammatory reaction, the barium crystals becoming coated with a fibrin membrane, followed by fibrosis and granuloma formation. Venous intravasation in the setting of altered mucosal integrity found in inflammatory bowel disease or diverticulitis, is another potentially life-threatening, though extremely rare complication. [63,64]

Allergic reactions to barium are rare. Possible causes include preservatives in the barium, latex in the examining gloves or glucagon. The rubber tubing used during administration of the enema can also cause severe urticarial reaction.[65]

GASTROGRAFIN

Gastrografin contains a mixture of sodium and meglumine amidotrizoate. The contrast-giving substances in gastrografin are salts of amidotrizoic acid in which the X-ray absorbing iodine is present in stable chemical bond. Gastrografin is water-soluble and has a high osmolarity. Therefore, it tends to cause a fluid shift into the colon and, subsequently, may increase colonic motility. In the presence of uncomplicated meconium ileus advantage is taken of the high osmotic pressure of gastrografin. The surrounding tissue is forced to release considerable amounts of fluid, which then flows into the gut and dissolves the hardened meconium. Likewise in suspected high impaction or volvulus, a gastrografin enema may be both diagnostic and therapeutic because it stimulates emptying of stool. Gastrografin is of particular value in the evaluation of suspected partial or complete stenosis, acute hemorrhage, and megacolon, and is the contrast of choice in computerized tomography of the abdomen. It is also used to differentiate between mechanical and pseudo-obstruction, in which it may also be both diagnostic and therapeutic. The relative merits of barium and gastrografin as contrast media are compared in Table 3.

Gastrografin, unlike barium, does not elicit an inflammatory response, and so can be used without prejudice in suspected acute diverticulitis, making it a cost-effective method of elucidating the cause of left lower quadrant peritonitis.[66] Wexner and Daley found that it was possible to safely, promptly and accurately differentiate acute diverticulitis from other causes of left lower quadrant peritonitis during the early stages, therby avoiding the complications associated with misdiagnosis and shortening hospital stay.66 Compared to computed tomography, contrast enema had a sensitivity of 0.82 (95%CI 0.71;0.90) and a specificity of 0.81 (95%CI 0.67;0.91) for diagnosing diverticulitis of the sigmoid colon.[67]

Chapman et al[68] reviewed 140 cases of large bowel obstruction to determine the accuracy of water-soluble contrast enema in comparison with plain abdominal x-rays. Findings at laparotomy and follow-up (for the non-operated cases) were used as reference. Using plain radiographs, the diagnosis of mechanical obstruction was made with a sensitivity and specificity of 84% and 72%, respectively, whereas contrast enema (barium or gastrografin) had a sensitivity and specificity of 96% and 98%, respectively.

Contrast enhanced computed tomographic enema (CECTE), a technique that uses gastrografin to delineate the retroperitoneal viscera by simultaneously opacifying the small bowel, duodenum, colon, GU tract, and major vessels is useful in the management of stable patients with penetrating trauma to the back and flank. By identifying the nature and location of the resulting retroperitoneal injuries, up to 92% of patients presenting with penetrating injuries can be managed non-operatively.[69]

Gastrografin enema used 10-12 days after surgery has been used to assess radiological leakage after low anterior resection.[70] It has been used to assess anastomosis and ileal pouch integrity (pouchogram) before closure of the ileostomy after ileo-anal-pouch anastamosis (IPAA). Abnormal findings in a pouchogram including anastomotic and pouch leaks, and anstomotic strictures prior to ileostomy closure, indicated those patients at high risk of long-term complications following IPAA.[71]

Contra-indications to gastrografin include manifest hyperthyroidism, iodine hypersensitivity, pregnancy and lactation. (Table 4) Fluid and electrolyte imbalance must be corrected before the examination. In adults the contrast medium should be diluted with 3-4 times its volume of water. For children over 5 years of age, the contrast medium should be diluted with 4-5 times its volume of water; for children up to 5 years of age a dilution with 5 times its volume of water is recommended.

Figure 10

Table 4: Advantages and disadvantages of Barium and Gastrografin enemas

	Barium	Gastrografin
Advantages	Ubiquitous and cheap	Safer if used pre and post-operatively, partial or complete obstruction, suspected perforation. -Hygroscopic action therapeutic in volvulus, intussusception, Meconium ileus.
Disadvantages	-Inspissation -Obstruction -Barium peritonitis -Granuloma formation -Contraindicated if partial or complete obstruction, hemorrhage, if surgery contemplated, threatening perforation (eg.acute diverticulitis)	-Hypersensitivity. -Diarrhea, exacerbation of colitis. -Contraindicated in hyperthyroidism, pregnancy

A simpler, inexpensive alternative to barium or Gastrografin is achieved by combining tap water with intravenous iodine contrast medium (gastrografin). This has been used for computed tomographic (CT) study, has good acceptance and tolerance and can accurately detect mural wall abnormalities.[72] Disadvantages include the risk of water intoxication, hyponatremia and peritoneal contamination in the event of a transmural breach of the colon.[73,74]

COLONIC FISTULAS

Colonic fistulas though uncommon can occur to the parietes and internally to a variety of organs. External fistulas invariably are a complication or the result of a surgical procedure, such as a leaking anastomosis or incision and drainage of an abscess resulting most commonnly from colonic diverticular disease and less commonly from Crohn's disease or a malignancy of the colon.[75]

Both barium and Gastrografin have been used extensively but with poor success (5-80%) in demonstrating the presence of colovesical, colovaginal or coloenteric fistulas.[76] and, therefore are not reliable in demonstrating a fistula tract. When a tract is demonstrated, it helps to define the location of the fistula and the underlying pathology.76 Similarly, with colovaginal fistulas, reported success in delineating the fistula with fistulograms, vaginograms, and enema studies ranges from 34% to 100%. Whenever a fistula is suspected, using gastrografin avoids the undesirable consequences of peritoneal extravasation of barium. Magnetic resonance imaging (MRI) has been found to be of value in demonstrating the sinus tracts and fistulae associated with Crohn's diease. In a study to investigate its potential, MRI identified the sinuses, fistulae and extramucosal inflammatory disease in 14 out of 17 patients (83%)[77] A CT scan of the abdomen and pelvis is the most sensitive (~95%) and specific (100%) test for detecting complications of diverticular disease, including fecal fistula.[78,79] Its value can be enhanced by avoiding oral contrast ingestion and having the patient evacuate rectally administered barium.[80]

CONCLUSION

This role of contrast enemas in the management of abdominal pathology has come a long way since the introduction of barium and gastrografin. Refinements in ultrasound technology and the realization that other liquids and air can be used in diagnosis and hydrostatic reduction of pediatric abdominal emergencies, have expanded the role of contrast enemas considerably. The use of liquids mixed with iodinated compounds and air as contrast agents are gaining in popularity, as they are both cheap and effective alternatives to barium or gastrografin, in outlining large bowel pathology. Barium is still widely used in the investigation of suspected large bowel pathology and remains a cost-effective alternative in colorectal cancer screening. Gastrografin is the preferred contrast in children and when perforation is a possibility. The evolution of contrast radiography has enabled many secrets from Pandora's box to be unlocked, improving the management of many abdominal problems.

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