



Evaluation of Barium Studies and its Current Role in the Era of Cross Sectional Radiography - Single Institute Experience

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ABSTRACT

Aim:

To evaluate the role of barium studies in current era of cross sectional radiography and to revisit basic diagnostic features in interpretation of barium studies.

Subjects and methods:

A retrospective analysis of the indications, number and findings of barium studies done between January 2011 to December 2015 was done.

Results:

The number of barium studies was decreasing over the years. However there were good number of referrals for Barium swallows in spite of endoscopy offering a good alternative. Newer referrals for clearing doubts on cross sectional radiography and for analysis of sphincter complex by Defecography was on the rise. A basic pattern of analysis common to all barium studies is highlighted.

Conclusion:

Though CT and MRI have largely replaced Conventional Barium studies, the latter still has a role to play in identifying the status of the mucosa, diameter of the lumen, level and type of obstruction. Barium also provides dynamic information regarding bowel motility and transit time. These features are not discernible on CT. Evaluation of Barium studies and its current role in the era of cross sectional Radiography - Single Institute experience.

KEYWORDS

Introduction.

It is a general trend in younger radiologists to consider Barium studies as unnecessary and obsolete. Due to the decreasing number of institutions that carry out Barium studies the skill of interpretation is absent in the younger generation of Radiologists. It was decided to study the patterns of referrals for Barium studies, revisit the basic interpretation skills and emphasize the role of Barium in this era of cross sectional radiography.

Subjects and methods.

A retrospective analysis of the indications, number and findings of barium studies done between January 2011 to December 2015 was done. Yearly studies were as follows - 1526 studies in 2011, 981 in 2012, 1352 in 2013, 1557 in 2014 and 716 in 2015. Studies ranged from Barium swallows, meals, enteroclysis, loopograms and enemas. In 2015 the main studies undertaken comprised of 300 Barium Swallows, 82 meals, 79 enemas and 6 Defecography studies.

Results and Discussion :

An evaluation of the Indications for all barium studies showed a varying trend in number of studies done. There was an increase in referrals for newer technique like Defecography which was recently started in the department. Common referrals for Barium swallow was dysphagia, webs, Hiatus Hernias, failure of endoscopy to pass strictures or growth, to evaluate distal extent of cancers and to rule out postoperative perforations. Indications for Barium meal series included gastric outlet obstruction, duodenal and small bowel pathologies beyond the reach of the endoscope. Barium enemas were commonly referred for preoperative evaluation of colon prior to coloplasty and evaluation of caecum. Post operative loopograms to evaluate distal colon was a frequent referral. A fair number of referrals for Barium studies were from our own departmental colleagues to confirm suspected CT findings of

Gastro intestinal tract pathology.

Of late the number of defecograms done is on the rise to evaluate rectal prolapse, rectoceles and enteroceles. Defecograms are usually combined with Ultrasound evaluation of the anal sphincter in our institute.

Interpreting Barium Studies: A retrospective analysis of all Barium studies revealed that the same basic rules are applicable in the interpretation of Barium studies of any part of the bowel. They are briefly described as follows:

1. The Plain film of the Abdomen:

The plain film can still provide a large amount of information specifically related to Gastro Intestinal tract. They include a) Presence of free air under dome or between loops indicating hollow viscus perforation, b) Presence of calcification in tumors, pancreatitis etc. c) Increased number of air fluid levels on an erect film in intestinal obstruction. d) Pattern of air shadows. The narrowed gastric air shadow in linitis plastica and the ahastral pattern of the colon in inflammatory bowel disease have been diagnosed by plain X-Rays.

2. Position of bowel being studied:

Normal position of the bowel in question should be evaluated. The stomach under left dome of diaphragm, the 'C' loop of Duodenum to the right of spine, Duodeno Jejunal flexure to left of spine, jejunal loops in the left upper quadrant, ileocaecal junction in right Iliac fossa, Ascending colon to the right and descending colon to the left are normal positions to be confirmed during evaluation. The displacement of bowel from its normal position indicates either malrotation or displacement by extrinsic pathology.

Normal Jejunal loops are seen in left upper quadrant with a feathery pattern of mucosa. If these loops are located in right

upper quadrant of abdomen rather than left it indicates mal-rotation, or a huge mass lesion in left hypochondrium displacing the bowel loops. [Fig- 1 a & 1b]



Fig 1a - Barium meal series reveals displacement of the stomach superiorly with extraneous impression over the greater curvature[arrow heads] and displaced jejunal loops to the right quadrant due to large lucent shadow [arrows] due to a lipoma in left lumbar region.



Fig 1b-CT confirms the large retroperitoneal lipoma[stars] in abdomen displacing the bowel.

Similarly the colonic position gives information of retroperitoneal structures. However the sigmoid colon and transverse colon can have large mesenteries and can occupy any position in the abdomen.

3. Shape of bowel:

Knowledge of normal shapes and variants is necessary to identify abnormal

Shapes. A J shaped stomach is normal while a stomach with greater curvature above the

lesser curvature indicates a volvulus of the stomach.

Corkscrewing of the duodenum and small bowel indicates mid gut volvulus.

[Fig -2a & 2b]



Fig 2a -Barium meal series reveals corkscrew appearance of the duodenum in a patient with mid gut volvulus.



Fig 2b - Contrast CT depicts Whirlpool sign[arrow] of twisted mesentery due to mid gut volvulus.

4. Size /Caliber of bowel:
The normal gastrointestinal tract varies in caliber. The size of the stomach varies with its content .The small bowel however is normally less than 3 cm¹ when distended while the colonic diameter is usually less than 5 cm.

Dilated small bowel loops if numerous indicate distal obstruction or paralytic ileus. When a dilated bowel loop is noted the following points are to be evaluated. Presence of diffuse dilatation or focal dilatation of the bowel loops. Presence of a transition zone beyond which loops are collapsed. The type of transition zone whether abrupt cut off or irregular narrowing is evaluated .The former indicates benign while the latter indicates neoplastic pathology.

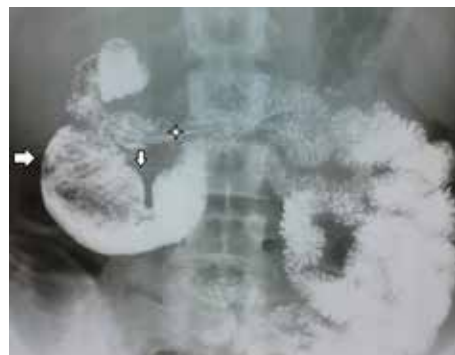


Fig -3 -Hypotonic duodenography in a 23 year female with unexplained anemia. Film taken after tube removal reveals normal gastric rugae [star],and distended 2nd part of duodenum with large polypoidal intraluminal filling defect [arrows].

A dilated bowel with normal mucosal pattern and a large intra luminal filling defect suggests luminal pathology [Fig -3] as compared to dilated bowel with irregularity of the bowel wall which is indicative of pathology primarily arising from the wall [Fig -4 a& b].



Fig 4a - 3 hour barium film in a 10 year old with lymphoma shows centrally pooled contrast as aneurysmal dilatation of the terminal ileum [arrows] and a large extra luminal soft tissue density mass [oval markers].



Fig 4b-CT with oral and IV contrast reveals the aneurysmal dilatation of bowel loop and the gross wall thickening [arrow].

Intraluminal obstruction could be caused by benign masses like trichobezoar, polyps or intussusception .The latter has a concentric ring appearance [Fig - 5] due to the barium between the two loops or a claw sign if obstruction is more severe and barium is unable to pass between the intussuscepting loops.



Fig 5 - Barium enema of ascending colon reveals a dilated caecum with concentric ring appearance due to intraluminal lesion caused by ileo colic intussusception.

A narrowed segment should be analyzed for length of narrowing, bowel wall irregularity, proximal dilatation and adjacent changes. The whole segment of bowel can be narrowed as in Linitis plastica of the stomach. Irregular narrowing and abrupt shelf like proximal borders favors malignant lesion.¹ Crohns disease can present with two or more segments of bowel involvement, adjacent mesenteric abscess or fistulas.

5. Assessment of Bowel wall:

Bowel wall should be assessed throughout and particularly at previously noted pathological site of narrowing or dilatation. The type of wall thickening, circumferential or eccentric gives clues to the underlying pathology. Irregular nodular thickening of bowel in older patients suggests neoplastic involvement. The apple core appearance of colon is historical for neoplastic involvement. [Fig -6]



Fig 6-Barium enema picture reveals typical apple core appearance of the descending colon due to colonic neoplasm.

6. Mucosal /Internal abnormalities:

The mucosal pattern of the whole bowel should be studied with greater attention devoted to the pathological site. Thickened folds, irregularity of mucosa, presence of shouldering or filling defects due to masses should be assessed.

Thickened but normal fold pattern indicates inflammatory or benign pathology [Fig 7].



Fig 7 -Mucosal relief phase of Barium swallow with serpiginous tortuous filling defects of lower thoracic esophagus due to varices in a patient with portal hyper-

tension.

Strictures with smooth mucosal pattern or mild irregularity indicate benign strictures while short irregular narrowing with shouldering indicates malignant strictures.

Absence of normal mucosal pattern can also indicate pathology, as in anastomotic pattern of colon in Ulcerative colitis.

7. Adjacent findings.

The adjacent mesentery should be assessed for fistulas and abscesses. Paucity of

bowel loops adjacent to pathological bowel suggests extrinsic mass [fig 4a & b], retroperitoneal or mesenteric mass [Fig 1a & b] or adenopathy.

8. Distal Flow of Contrast

A very useful sign is the flow of barium beyond the site of pathology. It gives a measure of functional involvement, indicating whether obstruction is total or partial. Assessment of state of bowel distal to pathological site can be done. Presence of skip lesions can be observed.

9. Transit Time

Normally the stomach empties in four hours while the column of Barium reaches

ileocaecal junction in 3-4 hours¹. Imaging at appropriate time will reveal rapid transit of Barium in malabsorption or delayed transit in Obstruction.

10. Extra luminal findings.

All Films should be assessed for adjacent pathology like Hepatomegaly, Splenomegaly and displacement of bowel loops indicating large mass. Secondaries in the spine or ribs will suggest malignant pathology. Calcification within soft tissue mass indicates tumoral calcification.

Therapeutic role of Barium

In paediatric intussusception Barium enema can diagnose as well as reduce the intussusception and relieve the obstruction.

Current status of Barium Studies:

Currently, imaging of the Gastro intestinal system is preferably done by Computed Tomography. Barium is fast losing its primary role in bowel imaging to Computed Tomography and MRI². These modalities give additional information regarding the status of the bowel wall, infiltration to adjacent organs, vascularity of the tumors and a complete idea of the rest of the abdominal organs. Barium however scores over cross sectional modalities in ease of procedure, and in study of the mucosal pattern.

Barium Swallow is a quick safe screening study for symptoms of dysphagia, motility disorder^{2, 3} and post operative evaluation. Patients are also more comfortable with technique of Barium swallow as compared to Endoscopy.

Barium Meals are replaced more often with CT studies. However gastric mucosal morphology such as fold convergence, depressions, superficial elevated lesions⁴ such as adenomas and ulcers are detectable only by double contrast Barium studies.

Conventional Barium enteroclysis used as a problem solving tool, when questions relevant to management are not answered by CT Enteroclysis.¹ Currently evidence based analysis has proved that though CT enteroclysis is superior to conventional study in Crohns disease, the latter is still required to in patients with high clinical suspicion but negative CT.⁵ MR Enteroclysis does not perform as well as Barium enteroclysis but it scores over the former due to the absence of ionizing radiation and evaluation of extra luminal pathology.⁶

Barium enemas are resorted to when colonoscopy is not feasible either due to patient compliance or due to technical rea-

sons. Barium flow can usually reach up to caecum to evaluate pathology in most cases. It also serves as a method to screen the colon in pre operative evaluation prior to colonic interposition in our institute.

For younger patients with inflammatory bowel disease or genetic predisposition to cancer who require repeated screening of bowel, Barium enema or Colonoscopy is a safer option than frequent CT Colonography.

A large number of other Barium studies done in our institute are post operative studies for gastric surgery or loopograms to study the distal bowel in patients subjected to ileostomy or colostomy.

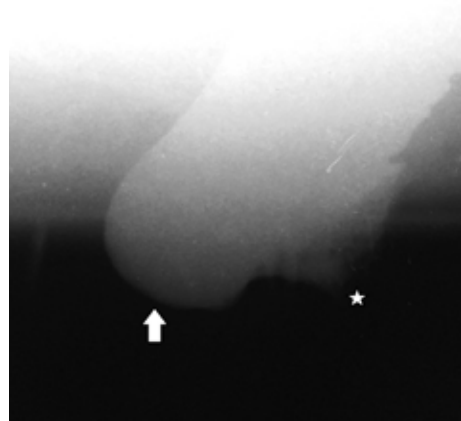


Fig 8 a -Evacuation proctography in resting phase reveals a mild protrusion of the anterior rectal wall [arrows] due to rectocele. Star denotes anal canal.



Fig 8 b -Evacuation proctography in defecation phase reveals increase in size of the outpouching of the anterior rectal wall [arrows] due to rectocele. Star denotes anal canal.

The number of defecograms [evacuation proctography] are slowly increasing in our institute to evaluate anorectal motility disorders, Rectal prolapse, weakness of perineal musculature with enterocele or rectocele¹ [Fig -8 a, b] etc. These lesions are difficult to ascertain during colonoscopy or abdominal CT and need confirmation by Barium studies.

Previous papers² have also commented on the declining number of barium studies.

But like the increase in defecograms in our institute, the pattern of Barium referrals will slowly be more focused to the particular needs of the clinician. Referrals may be directed towards clarification of doubts raised by endoscopy² or cross sectional Radiography. CT depicts the status of the bowel

contrast at a point in time while Barium studies are a continuous process and a means to assess the flow of barium across time. This leads to referrals to clear doubts raised in CT. If barium studies come to a halt these diagnostic dilemmas will be left unanswered and prove a loss to the patient.

Conclusion :

Though CT and MRI have largely replaced Conventional Barium studies, the latter still has a role to play in identifying the status of the mucosa, diameter of the lumen, level and type of obstruction. Barium also provides dynamic information regarding bowel motility and transit time. These features are not discernible on CT. It is also the favored study for follow of patients with Crohns disease or pre malignant lesions who require multiple studies.

Though the volume of barium studies may initially decline, it will stabilize as the pattern of referrals changes to meet the diagnostic dilemmas of both clinicians and cross sectional radiologists. Teaching institutes should motivate younger radiologists to familiarize themselves with Barium studies so that this modality does not become extinct and finally result in a loss to the patient.

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