

CT AND MR ENTEROCLYSIS IN THE EVALUATION OF SMALL BOWEL DISEASE

M. Siva Sridhar¹, D. Sai Raghavendra², D. Sowjanya³, Manjula Sridhar⁴

¹Associate Professor, Department of Radiodiagnosis, Andhra Medical College, Visakhapatnam.

²Consultant Radiologist, Department of Radiodiagnosis, G.M.R. Hospital, Srikakulam.

³Consultant Radiologist, Department of Radiodiagnosis, OMNIRK Hospital, Visakhapatnam.

⁴Consultant Radiologist, Department of Radiodiagnosis, Pragati Medical Centre, Visakhapatnam.

ABSTRACT: OBJECTIVE: The objective of our study is to find out the validity of Multi-detector row helical CT (MDCT) enteroclysis and Magnetic resonance (MR) enteroclysis findings with enteroscopy, histopathology, and clinical diagnosis taken as reference standard.

SUBJECTS AND METHODS: The study group for this blinded prospective study was composed of 64 patients with suspected small bowel disease. CT and MR enteroclysis examinations were performed on same patient and studies were interpreted by two radiologists. The reference standard for the presence of small bowel disease is based on the final clinical diagnosis after reviewing all of the available information.

RESULTS: All 64 patients underwent CT and MR enteroclysis. The sensitivity and specificity of CT enteroclysis are 95% and 100% respectively. The sensitivity and specificity of MR enteroclysis are 90% and 100% respectively. Good interobserver agreement noted between CT and MR enteroclysis in evaluation of various parameters of small bowel diseases like bowel wall thickening, bowel wall enhancement and lymphadenopathy.

CONCLUSION: CT and MR Enteroclysis examinations are reliable investigations in the evaluation of small bowel disease. Enteroclysis should supplement and precede enteroscopy to rule out luminal narrowing. Enteroclysis could differentiate crohns from intestinal tuberculosis in majority of cases.

KEYWORDS: Enteroclysis, Crohns and Tuberculosis.

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INTRODUCTION: The small bowel remains the most challenging segment of the alimentary tube to examine, due to its length, caliber, and overlap of loop. Independent of the imaging technique used, it is essential to have a fluid-distended loop because mural wall thickening is the hallmark of intestinal disease. Collapsed loops may result in an apparently thickened wall, which can hide lesions or mimic disease.¹ Several years ago, the only methods to assess the small bowel were conventional enteroclysis or small-bowel follow-through but it has many limitations like unsatisfactory bowel distention, no differentiation between bowel wall and high attenuating content, visualisation of only intraluminal lesions and so on.²

Furthermore with the advent of computed tomography and Magnetic resonance, imaging of abdomen gaining popularity for evaluating small bowel lesions, but they showed some limitations like inadequate distension of bowel, non visualization of mucosal pathology and improper delineation of ileo-caecal junction. The disadvantage of fluoroscopic barium follow through to provide extra luminal information and CT and MRI to provide luminal abnormalities in inadequately distended

bowel can be overcome by controlled bowel distension in CT and MR enteroclysis.

Computed tomographic (CT) enteroclysis is a hybrid technique that combines the methods of fluoroscopic/endoscopic intubation-infusion small-bowel examinations with that of abdominal CT. The functional information, soft-tissue contrast, direct multiplanar capabilities, and lack of ionizing radiation suggest that MR enteroclysis has a greater potential than other techniques to become the ideal diagnostic method for imaging of the small bowel.

Although, numerous contrast agents are used for luminal opacification and optimal visualization of the small bowel, we propose water with as an oral contrast agent in our study because it provides optimal luminal distension, contrast homogeneity, satisfactory visualization of ileocaecal junction, various patterns of mucosal enhancements and features of various small bowel diseases.

AIMS AND OBJECTIVES: To find out the validity of Multi detector row helical CT enteroclysis and Magnetic resonance (MR) enteroclysis findings with enteroscopy, histopathology and clinical findings taken as reference standards

METHODOLOGY:

Study Setting: King George Hospital, Visakhapatnam.

Study Design: Cross sectional study.

Study Duration: 2 years (2013 to 2014).

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Corresponding Author:

Dr. Maddila Siva Sridhar, Professor,

Department of Radio Diagnosis, Andhra Medical College, Visakhapatnam.

E-mail: drsridharkgh@gmail.com

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Inclusion Criteria: The study group included patients with normal renal function (serum creatinine < 1.4 mg/dl) who were suspected of having.

- Active inflammatory small-bowel disease.
- Unexplained gastrointestinal bleeding.
- Refractory celiac sprue.
- Sub acute Small-bowel obstruction.
- Small-bowel tumor.
- Chronic diarrhea.

Exclusion Criteria:

- Pregnancy.
- Acute or chronic renal failure.
- History of allergy.
- Suspected bowel perforation.
- High-grade obstruction.

Sample Size: 64 Subjects: The sample size was calculated based on sensitivity of enteroclysis in the detection of small bowel disease based on previous studies.

Sampling Method: Non probability sampling. Consecutive 64 patients with clinically suspicious small bowel disease.

MATERIALS:

- 11-13F nasojejunal tube.
- CT: GE 16 Slice CT machine.
- Non ionic iodinated IV contrast material 80ml.
- MRI: GE 1.5 T MRI machine.
- Gadolinium IV Contrast material.

PROCEDURE:

- Bowel preparation-a low-residue diet, ample fluids, laxative on the day prior to the examination, and nothing by mouth on the day of the examination.
- 12-F enteroclysis nasojejunal (NJ) catheter tip was placed in the DJ junction to left of the spine under fluoroscopy/endoscopic guidance.
- 1 litre (ltr) of room temperature water + 40ml of 20% mannitol was infused by hand injection over half an hour via NJ tube at a rate of 30-35ml/mt.

CT Phase:

- 1 ltr of water was infused over half an hour via NJ tube.
- 80 ml of nonionic iodinated contrast material was injected intravenously through a 18-20-gauge cannula at a rate of 3 ml/sec by using an automated power injector.
- CT Images were obtained from the superior surface of the liver to the lower margin of the symphysis pubis during a single breath hold.
- 5mm thick slice CT sections were taken in arterial, venous and delayed phases with 0.6mm reconstruction done. Next multiplanar reconstruction of the source images was done.

MR Phase:

- Patients were taken to MR immediately after CT enteroclysis.

- MR enteroclysis was performed using a 1.5-T magnet (Signa, GE Healthcare). Patients were scanned in the supine position with a 16-channel torso array coil using the following protocol: Axial, Coronal and sagittal FIESTA (Fast Imaging Employing Steady State Sequence) (TR/TE 3.4/1.4, matrix 224x224, flip angle 45, slice thickness 7mm). After administration of 0.2mmol/kg of gadodiamide (Omniscan, GE Health care) at 3 ml/s and a 45 sec delay 3D Coronal and Axial LAVA (Liver acquisition volume acceleration) sequences were performed. All sequences were performed during breath holding.

RESULTS: NJ tube insertion was tried in 68 patients among which 4(6%) patients could not tolerate NJ tube insertion. There was difficult intubation in ~40 % of patients. The patients experienced no side effects from the intravenous administration of contrast media. Most of the patients tolerated injection of 2lts of water.

Small Bowel Diseases:

- The final standard diagnosis is made in collaboration with clinical/ intra Op follow up, histopathology and enteroscopy.
- Findings of CT enteroclysis were positive in 38 subjects and normal in 26 subjects suspecting of small bowel diseases.
- Findings of MR enteroclysis were positive in 36 subjects and normal in 28 subjects suspecting of small bowel diseases.

Utility of CT and MR enteroclysis was studied in 23 cases of suspected crohns disease patient. Among them only 12 cases turned out to be positive for crohns disease.

Gastrointestinal Tuberculosis: In our study we have come across 8 cases of intestinal tuberculosis predominantly involving the terminal ileum and IC valve. Asymmetrical wall thickening was seen in 7 out of 8 patients. 6 out of 8 patients showed luminal narrowing with bowel wall thickening and 1 patient presented with small bowel feces sign.

Sub Acute Small Bowel Obstruction: In our study we have come across 12 cases suspecting small bowel obstruction. CTE and MRE have identified transitional point in 11 patients.

Among the 12 small bowel obstruction cases, we came across 3 cases of small bowel parietal adhesions(3), small bowel tumor(1), intestinal tuberculosis(2), fibrostenotic crohns disease(2), pseudo obstruction(1), inguinal hernia(1), benign stricture(1).

Adhesions: In our study we found that 7 patients presented with parietal adhesions. We didn't come across any case of the inter loop adhesions. We found that all patients with adhesions had a history of abdominal surgery. This concurs with our study in which most of patients presented with diffuse abdominal pain.

Small Bowel Tumors: In our study 1 case of small bowel tumor was seen. It was proved to be Adenocarcinoma.

DISCUSSION: CT and MR Enteroclysis in Small Bowel Diseases: In our study CT Enteroclysis and MR Enteroclysis have showed high sensitivity and specificity in diagnosing small bowel diseases. CT and MR Enteroclysis had demonstrated the abnormal small bowel findings like bowel wall thickening, mural enhancement and lymphadenopathy which are in some conditions nonspecific to diagnose specific disease pathology.

High sensitivity and specificity of Enteroclysis in diagnosing small bowel disease is also seen in a study done by Mourad Boudiaf,³ on 107 patients.

CT and MR Enteroclysis in Crohns disease. The main imaging findings on enteroclysis in crohns disease are: mural thickening, mural hyper enhancement, creeping fat, engorged vasarecta (the comb sign), lymphadenomegaly, fistulas or abscesses.

Similar imaging findings of crohns disease are seen in a study done by Maglinter DD.⁴

In our study there is also no specific age distribution but has more male predilection.

Mural enhancement and wall thickening are sensitive imaging findings in crohns disease.

Similar high sensitivity is seen in a study done by Zappa M et al.⁵

In our study segmental, multi segmental (skip lesions) and diffuse wall thickening is seen in equal proportions. There is no specific predilection of length and segmental involvement.

There is typical sparing of the IC valve in crohns disease. Conspicuous sparing of the ileo-caecal valve is seen in crohns disease.

In our study only 1/3rd of patients showed creeping fat around the inflamed bowel. Hence Creeping fat sign is less sensitive and more specific for crohns disease.

Prominent vasarecta is seen in 62 % of cases. Similar findings are seen in a study done by Liu YB et al.⁶

CT and MR Enteroclysis in Gastrointestinal tuberculosis. The most common CTE finding of intestinal tuberculosis are asymmetrical mural thickening, which is typically concentric but if eccentric tends to involve the medial caecal wall.⁷ Localized lymphadenopathy is usually seen. Enteroclysis helps in delineating narrowed segment with proximal dilatation.

Histopathology showed langerhans and epithelioid cells.

In our study most of the intestinal tuberculosis cases predominantly involved the terminal ileum and IC valve. Caecal wall thickening is seen in 62 % cases.

CT and MR Enteroclysis in Small bowel obstruction. In our study Enteroclysis had demonstrated transitional point in 100 % patients. CT enteroclysis is superior to abdominal CT for detection of transition points because of its improved distention.⁸ CTE had demonstrated small bowel feces sign in 16-17% small bowel obstruction patients.

Small bowel feces sign is defined by the presence of particulate (colon like) feculent matter mingled with gas

bubbles in the lumen of dilated loops of the small intestine. The reported prevalence of the sign in SBO is low (7%-8%)⁹

In our study CT and MR Enteroclysis, has favoured the fact that Post operative adhesions are most common cause for small bowel obstruction.¹⁰

CT and MR Enteroclysis in Adhesions. It is generally thought that parietal adhesions cause abdominal pain and inter loop adhesions are associated with bowel obstruction.¹¹

This concurs with our study in which most of patients presented with diffuse abdominal pain.

In our study all patient showed absence of fat planes between the bowel and post OP scar region. Three patients showed herniations of the into the post OP defect.

CTE and MRE have differentiated obstructive and non obstructive adhesions. Deformity and fixation of small bowel without demonstration of a transition point indicates non obstructive adhesions. The use of an optimal infusion flow of contrast is critical in differentiating obstructive from non- obstructive adhesions involving the small bowel.¹²

Small bowel tumors. In our study 1 only case of small bowel tumor is seen. This low incidence is coinciding with study done by J A Buckley.¹³

A 75 yrs old patient presented with lesion showing circumferential wall thickening at DJ flexure measuring 3.6x4.8cms noted. Later on histopathology the lesion turned out to be Adenocarcinoma.

In conclusion enteroclysis has diagnosed all small bowel lesions.

Miscellaneous regional and diffuse Small Bowel Diseases

These particular category of small bowel diseases show nonspecific enteroclysis findings, close correlation with a particular patient's detailed history and medications (i.e, a history of radiation therapy, a known connective tissue disorder,) or, with relevant previous imaging examinations if available, and with the patient's laboratory evaluation, is critical.

The Images provided Representing the following data. Figure(1): CT Enteroclysis Coronal & Axial Images–Circumferential symmetrical homogenously enhancing multisegmental wall thickening of small bowel–CROHN'S DISEASE. Figure(2): MR Enteroclysis plain & coronal contrast enhanced axial images–segmental, circumferential, symmetrical wall thickening with homogenous enhancement–CROHN'S DISEASE. Figure(3): CT Enteroclysis contrast sagittal & axial images –short segment, symmetrical brightly enhancing wall thickening of ileal lopp with partial stricture & intestinal obstruction–TB ILEITIS.

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CTE	Final Diagnosis		P value
	Present	Absent	
POSITIVE	38	0	<0.05
CTE NEGATIVE	2	24	

Table 1: Validity of CTE in comparison to final diagnosis

Sensitivity	95%
Specificity	100%
Positive predictive value	100%
Negative predictive value	92%
P value	<.05

Table 2

Sensitivity, specificity, PPV, NPV of CTE when CTE diagnosis is compared with final diagnosis.

MRE	Final Diagnosis		P value
	Present	Absent	
Positive	36	0	<0.05
MRE negative	4	24	

Table 3: Validity of MRE in Comparison to final diagnosis

Sensitivity	90%
Specificity	100%
Positive Predictive Value	100%
Negative Predictive Value	85%
P Value	< .05

Table 4: Crohns Disease

There was also no specific age distribution and was more common in males.

	No. of patients with bowel adhesions
Hysterectomy	4
Appendicetomy	2
Penetrating bowel trauma	1

Table 5: Various surgeries undergone by the patients presenting with Adhesions

