SMALL BOWEL DISEASES- EVALUATION WITH CT ENTEROCLYSIS

Mohammed Reshad[1], Aarathy Appukuttan[2], Devdas Acharya[3], Ravichandra G[4], Vinayaka US[5]

[1]Assistant Professor, Department of Radiodiagnosis, Yenepoya Medical College, Mangalore.
[2]Postgraduate Resident, Department of Radiodiagnosis, Yenepoya Medical College, Mangalore.
[3]Professor & HOD, Department of Radiodiagnosis, Yenepoya Medical College, Mangalore.
[4]Professor, Department of Radiodiagnosis, Yenepoya Medical College, Mangalore.
[5]Associate Professor, Department of Radiodiagnosis, Yenepoya Medical College, Mangalore.

ABSTRACT

BACKGROUND

For many years, 'conventional' double contrast enteroclysis has been suggested as the technique of choice for the evaluation of the small intestine. Computed tomography (CT) performed with oral and intravenous contrast material has a proven track record of depicting bowel wall and mesenteric abnormalities. CT enteroclysis was developed to overcome the individual deficiencies of CT and conventional enteroclysis and to combine the advantages of both barium enteroclysis and conventional abdominal CT examinations into one technique. The present study is a longitudinal study to evaluate the role of multi–detector row helical Computed Tomographic (CT) enteroclysis for the depiction of small bowel diseases in patients.

Aim of Study- To prospectively evaluate the role of multi–detector row helical Computed Tomographic (MDCT) enteroclysis for the depiction of small-bowel diseases.

MATERIALS AND METHODS

Study Group- CT enteroclysis was done for 35 clinically suspected cases of small-bowel diseases referred to Department of Radiodiagnosis, Yenepoya Medical College, Mangalore from October 2014 to September 2016.

RESULTS

Of the 33 patients who underwent successful CT enteroclysis, positive findings were obtained in 16 patients (48.5%), and negative findings were obtained in 17 patients 51.56%). Among the 16 patients, CT enteroclysis allowed the detection of small-bowel masses in 4 patients including 2 Adenocarcinoma, 1 gastrointestinal stromal tumour and 1 lymphoma. CT enteroclysis demonstrated metastatic lymph nodes in 2 cases; small-bowel abnormalities in 12 patients including 4 patients with Crohn's disease and 2 patients with small-bowel tuberculosis. Images demonstrated site and cause of small bowel obstruction in 2 cases and areas of stenosis in 12 cases with the mural and extramural inflammatory changes.

CONCLUSION

CT enteroclysis is a fast, well-tolerated, and reliable imaging modality for the depiction of small-bowel diseases. This technique provides adequate small-bowel distension in a majority of patients. In addition, CT enteroclysis allows the detection of extraluminal disease and provides information relative to the entire abdomen that is not obtained with small-bowel follow-through or endoscopy.

KEYWORDS

CT Enteroclysis, Small Bowel Diseases.

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BACKGROUND

Imaging investigations have dominated the evaluation of small-bowel disease for more than 100 years, until the advent of capsule endoscopy, and have presented formidable diagnostic challenges to radiologists due to the length and convoluted course of the small bowel. For the evaluation of small-bowel disease, small-bowel follow-through has been the most commonly performed examination because of its simplicity, availability, and low cost.

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Corresponding Author:
Dr. Aarathy Appukuttan,
Postgraduate Resident,
Department of Radiodiagnosis,
Yenepoya Medical College, Deralakatte,
Mangalore-575018,
Karnataka.
E-mail: aarathyappukuttan@gmail.com
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For many years, 'conventional' double contrast enteroclysis has been suggested as the technique of choice for the evaluation of the small intestine.[1] Barium enteroclysis has been shown to have overall higher accuracy and reliability at the expense of increased invasiveness and decreased patient tolerance without the use of conscious sedation.[2]

Adequate distension of the small bowel allows imaging of mucosal abnormalities and provides functional information by defining free peristaltic contraction or fixation of the small bowel loops, but major disadvantage is the limited information about the state of the bowel wall and extramural pathology. Thus, it has largely been replaced by computed tomography (CT).

Computed tomography (CT) performed with oral and intravenous contrast material has a proven track record of depicting bowel wall and mesenteric abnormalities.[3, 4] A comparison of barium enteroclysis and abdominal CT performed in the same patients with small-bowel Crohn's disease has demonstrated a much higher yield of CT in revealing mural and extraluminal manifestations of disease,

including abscesses, while enteroclysis was superior for luminal abnormalities including low-grade bowel obstruction from stenosis, ulcerations, and demonstration of fistulae mainly as a result of the enteral volume challenge generated by the controlled infusion of the contrast agent.[5,6]

It was only a matter of time until CT enteroclysis was developed to overcome the individual deficiencies of CT (no distension of the small bowel) and conventional enteroclysis (No extraluminal information) and to combine the advantages of both barium enteroclysis and conventional abdominal CT examinations into one technique. As reported by Kloppel et al in 1992, CT enteroclysis was shown to be useful in depicting mucosal abnormalities, as well as bowel thickening, fistulae, and other extra-intestinal complications of Crohn's disease. In patients suspected of having small-bowel obstruction, Bender et al[7] showed that CT enteroclysis was superior to conventional CT for the diagnosis of lower grades of bowel obstruction and was also able to reveal the nature of the obstructive lesion, including adhesions.[8,9,10]

The present study is a longitudinal study to evaluate the role of multi–detector row helical Computed Tomographic (CT) enteroclysis for the depiction of small-bowel diseases in patients extending from October 2014 to September 2016 at Yenepoya Medical College, Mangalore.

MATERIALS AND METHODS

Study Group

The study protocol was approved by the ethics committee of research centre of our institution. From October 2014 to September 2016, CT enteroclysis was done for suspected and proven case of small-bowel diseases referred to Department of Radiodiagnosis.

Exclusion Criteria

- Contraindicated cases for contrast study.
- Patients who are contraindicated for enteroclysis like Colonic obstruction, suspected perforation, and Paralytic ileus.
- Patients who refuse of placement of nasogastric tube and in whom enteroclysis tube cannot be positioned in adequate position.

From October 2014 to September 2016, CT enteroclysis was performed in 35 consecutive patients who were clinically suspected of having small-bowel disease. The study group comprised 35 patients [25 male and 10 female; age range, 11-85 years; mean, 41.03 years (SD – 19.64)]. Of the 35 patients, CT enteroclysis was performed successfully in only 33 patients.

CT Enteroclysis Protocol

Patients with normal renal function tests were taken up for CT enteroclysis scan after 4 hours of fasting. Risks of contrast administration were explained to the patient and written consent was obtained prior to the contrast study.

CT enteroclysis was performed in all patients with the same protocol. A 13 or 11-F Bilbao Dotter catheter (Indovasive; Biorad Medisys, India) was positioned into the duodenojejunal junction by using fluoroscopic guidance (Allengers- 525, 40 KW/50 kVA, 500 mA). Following this the patient was shifted to the CT table.

The patients were given neutral contrast media [100 mL Mannitol (20% w/v) in 1000 mL tap water]. The quantity of water infused was less than 2000 mL in all patients (depending on the tolerance).

Patients were imaged while in supine position. A single source 16 detector row CT unit (G E Bright Speed 16 slice; G E Medical Systems USA) was used with following parameters.

Range	Dome of Diaphragm To Symphysis Pubis
Detector Row Configuration	16 X 0.625
Beam Collimation	10.0 mm
Helical Thickness	5.0 mm
Pitch	1.375:1
Table Speed (mm/rot)	13.75
Tube Potential (kVp)	120 kVp
Effective Tube Current (mA)	220 mA

Table 1. Fundamental Technical Protocols

The patients received 60-70 mL of intravenous non-ionic iodinated contrast material Iopromide (Ultravist 370; BAYER, Schering Pharma, Berlin, Germany) via an automated power injector (Nemoto Kyorindo, Japan) at a rate of 3.5 mL/sec. The delay between the start of contrast material injection and the start of image acquisition was 18 seconds. CT scan was performed in both arterial and venous phase from the dome of diaphragm to the symphysis pubis in a cephalocaudal direction during a breath hold. Original data were reconstructed at 0.625 mm intervals with the standard algorithm and 0.625 mm image reconstruction. Original transverse and multiplanar reformatted images were stored in DICOM format.

Original transverse and multiplanar reformatted images in transverse, coronal and sagittal plane were reviewed with a standard window level (40 HU) and width setting (400 HU) that is used in our department for viewing the abdomen and the pelvis with adjustments made when needed.

RESULTS

Of the 33 patients who underwent successful CT enteroclysis, positive findings were obtained in 16 patients (48.5%), and negative findings were obtained in 17 patients 51.56%).

Among the 16 patients, CT enteroclysis allowed the detection of small-bowel masses in 4 patients; including adenocarcinoma (n = 2), gastrointestinal stromal tumour (n = 1) and lymphoma (n = 1). CT enteroclysis also depicted unsuspected extra-digestive disease in two patients. Extra-digestive disease consisted of metastatic lymph nodes. CT enteroclysis demonstrated small-bowel abnormalities in 12 patients including 4 patients with Crohn's disease and two patients with small-bowel tuberculosis. CT enteroclysis images demonstrated areas of stenosis that were located in the jejunum (n = 2) and distal ileum (n = 10). In all the cases, CT enteroclysis accurately demonstrated the mural and extramural inflammatory changes that are caused by the disease. Multiplanar reformatted CT enteroclysis images determined the length of the affected portion of the small bowel, areas of skip lesions and ileal fistulous tract in case of Crohn's diseases.

CT enteroclysis allowed the determination of the site, level, and cause of the sub-acute obstruction in 2 patients

who were clinically suspected of having low-grade small-bowel obstruction (Defined as spontaneously resolving episodes of small-bowel obstruction) in patients who had previously undergone ileocolic resection (n = 3).

Negative findings from CT enteroclysis were obtained in 17 patients. Only some of the patients in this group underwent a clinical follow-up and few patients underwent other investigation.

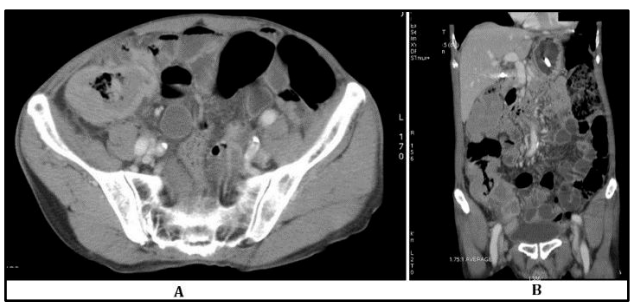

Figure 1 (A & B) - Heterogeneously enhancing circumferential bowel wall thickening of the ileocecal region predominantly involving the caecum with peri-lesional fat stranding – Suggestive of lymphoma

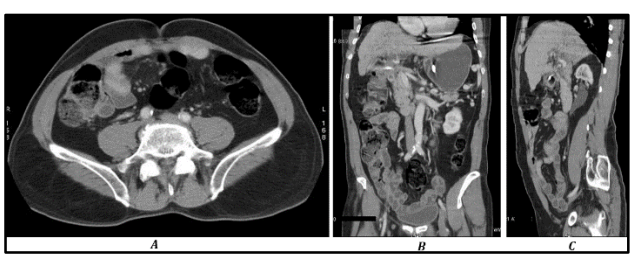

Figure 2 (A, B & C) - Short segment enhancing circumferential wall thickening in the mid-ileal loop causing focal narrowing of the lumen with proximal dilatation of the small bowel loops

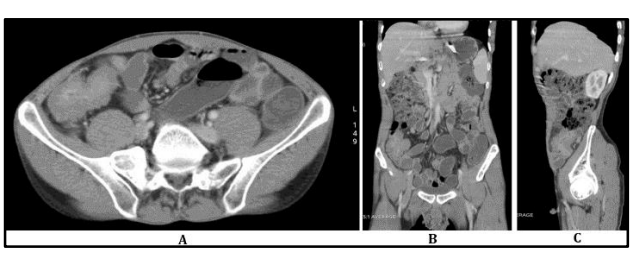

Figure 3A, B, C. Long segment diffuse wall thickening involving the terminal ileum, ileocaecal junction, caecum and part of the ascending colon

There is evidence of fat stranding adjacent to the ascending colon with multiple enlarged pericolic and mesenteric lymph node.

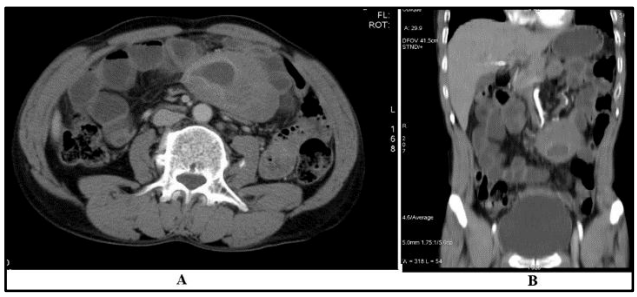

Figure 4A & B. Heterogeneously enhancing well-defined lobulated mass lesion with central cystic areas arising from the small bowel in the left lumbar region causing displacement of the adjacent bowel loops – Suggestive of GIST

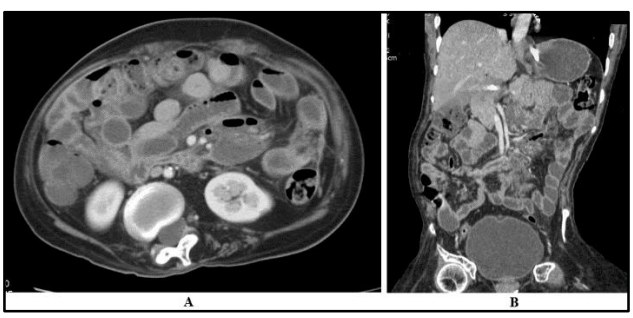

Figure 5A & B. Long segment, concentric bowel wall thickening involving the distal ileal loops and minimally involving the ileocaecal junction and caecum, which on post contrast study shows enhancement of the mucosa with stratification of the bowel wall. Adjacent fat stranding with multiple enlarged mesenteric lymph nodes seen.

Multiple loculated collections with enhancing wall and air pockets seen in the mesentery largest measuring 34 X 18 mm in the left lumbar region.

Suggestive of Crohn's disease with fistulous communication.

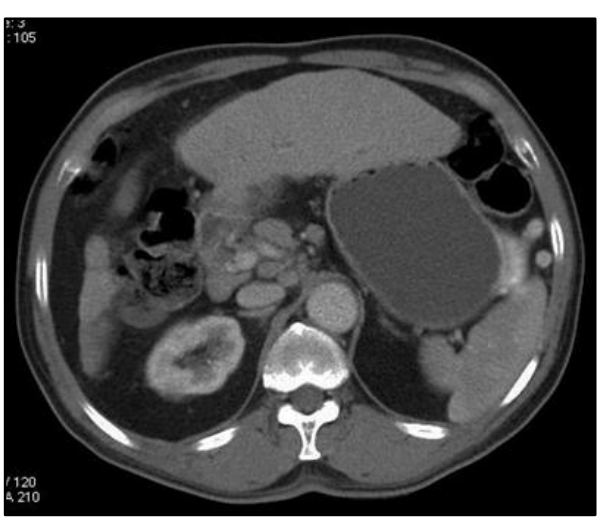

Figure 6. Small amount of positive oral contrast was seen in the peritoneal cavity along the greater curvature of stomach – suggestive of perforation

DISCUSSION

CT enteroclysis is an imaging modality that combines the advantages of enteroclysis and multi–detector row helical CT. CT enteroclysis allows the detection of various small-bowel diseases, wherever they are located (i.e., intraluminal, intramural, or extramural). Although direct comparison between the different modalities was not performed in our study, our results would suggest a trend of superiority of CT enteroclysis over barium follow-through examination and endoscopy for facilitating the diagnosis of small-bowel diseases.

We routinely used transverse CT enteroclysis images in association with multiplanar reformatted images. We found that the multiplanar reformatted images did provide additional information with respect to the final diagnosis in the majority of patients especially for the patients with Crohn's disease. In this particular subgroup of patients, multiplanar reformatted images were helpful in determining the site and the length of the affected small-bowel loops.

Age (Yrs.)	Number	Total Number	Percentage
11-35	14	35	40
36-60	12	35	34
61 - 85	9	35	26

Table 2. Description of age

Mean age of patients in our study was 41.03 years (11 - 85 years). 71.4% of the study population were male and remaining (28.6 %) were female.

In our study, CT enteroclysis was easy to perform and tolerated in all but two patients. CT enteroclysis depicted a broad spectrum of pathologic processes that affected the small bowel in all the 16 patients in whom they were present. Of all the 16 patients with positive findings, 4 cases of these were small bowel neoplasm and the remaining 12 patients depicted inflammatory/infective small-bowel diseases.

Study	Number	Total Number	Percentage
Positive	16	33	48.5
Negative	17	33	51.5

Table 3. Distribution of positive and negative studies

Study	Number	Total Number	Percentage
Inflammatory	12	16	75
Neoplastic	4	16	25

Table 4. Distribution of Inflammatory and Neoplastic lesions

Small Bowel Masses

In cases of small-bowel tumours, CT enteroclysis allowed the detection of 4 tumours. All these tumours were confirmed with surgical findings. CT enteroclysis depicted the adenocarcinoma and lymphoma tumours as diffuse circumferential wall thickening involving the terminal ileum, the ileocecal junction and the proximal caecum and the GIST as focal nodular lesions that was located in the small-bowel wall. In addition, CT enteroclysis allowed the detection of metastatic lymph nodes in the same session in two patients. These results suggest that CT enteroclysis facilitates better evaluation of patients with small- bowel tumours than barium follow-through and endoscopic examinations alone, which only demonstrates the intraluminal abnormality. Our results also suggest that CT enteroclysis could replace the combination of abdominopelvic CT study and barium follow-through examination that is commonly performed for the evaluation of patients with small-bowel tumours, thus decreasing the patient's exposure to ionising radiation.

Inflammatory/Infective Small Bowel Diseases

In our study, the findings of CT enteroclysis helped in demonstration and diagnosis of suspected cases of complicated IBD more accurately than with MDCT (Routinely done but not compared in our study) due to the increased bowel distension achieved in CT enteroclysis. CT enteroclysis demonstrated with a high degree of accuracy the inflammatory changes, including stenosis and multiple skip lesions that affected the small bowel. It also facilitated in diagnosing of an enteric fistulous tract in one patient.

In our study, 3 patients had previous history of inflammatory bowel diseases and had undergone resection with ileocolic anastomosis. In 2 of these patients, CT enteroclysis allowed the determination of the site, level, and cause of the subacute obstruction and revealed no significant abnormality in the other patient at the anastomotic site.

The present study also shows the effective role of MDCT enteroclysis in detection of small bowel diseases, both neoplastic and inflammatory. It allows better evaluation of small bowel disease, detection of extraluminal component of the disease and provides information relative to the entire abdomen.

Our Study has Limitation that Relates to the Fact That-

1. Only few of the patients in whom CT enteroclysis showed normal findings have clinical follow-up. For ethical consideration; however, it may be difficult to perform aggressive examination in patients for whom CT enteroclysis did not show any abnormality and for those in whom symptoms resolved spontaneously.
2. Lack of histopathologic proof for over half of studies, and the fact that we could not estimate the sensitivity of CT enteroclysis because it is virtually impossible to prove that all negative studies are actually true-negative.
3. Therefore, more studies are needed to determine the actual sensitivity of CT enteroclysis in facilitating the evaluation of small-bowel diseases.

CONCLUSION

CT enteroclysis is a fast, well-tolerated, and reliable imaging modality for the depiction of small-bowel diseases. This technique provides adequate small-bowel distension in a majority of patients. In addition, CT enteroclysis allows the detection of extraluminal disease and provides information relative to the entire abdomen that is not obtained with small-bowel follow-through or endoscopy. The results of our study are in the line with published literature and support the use of CT enteroclysis in routine for patients who are suspected of having small-bowel disease. A large prospective study should be planned in large number of patients to substantiate the findings of our study.

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