



## MDCT AND ULTRASOUND CORRELATION IN BOWEL LESIONS(A STUDY OF 100 PATIENTS)

**Dr. Shital Turakhia**

Associate Professor, Department Of Radiology, B.j. Medical College, Gujarat University, Gujarat, India

**Dr. Dipali Shah\***

Associate Professor, Department of Radiology, B.J. Medical College, Gujarat University, Gujarat, India\*Corresponding Author

### ABSTRACT

Modern Ultrasound devices with high frequency probes and harmonic imaging significantly improve examination of bowel by offering better overall image quality, better visualization of bowel pathology and associated changes in real time. ("live anatomy"). The development of multi-detector CT(MDCT) scanner with rapid acquisition of thin slices and multiplaner reconstruction allows detailed investigation of intestinal loops. IV and oral contrast(negative or positive) are very useful in detection of inflammatory and neoplastic intestinal pathologies as well as in the evaluation of extra-intestinal involvement (mesenteric LNs) and complications. A prospective study of 100 patients was done at B.J, Medical college, Civil hospital, Ahmedabad over the period of 2 years. Our study aims to illustrate the sonographic findings of multiple bowel pathologies-nature, extent and complications, their differential diagnosis and its correlation with MDCT findings as well as comparison of USG and MDCT findings in diagnosis of different bowel pathology.

**KEYWORDS :** Mdct, Usg, Neoplastic Lesions, Appendicitis, Intestinal Tuberculosis, Ibd, Colitis

### I. INTRODUCTION

USG is the initial modality of choice in evaluating bowel pathologies. Wide availability, relatively low cost of modern devices, noninvasiveness, reproducibility and absence of radiation make this diagnostic method 'doctor and patient friendly', enables frequently repeated examinations especially in chronic inflammatory small bowel diseases and is also safe in young patients and pregnant women. Advances in MDCT with multiplaner (MPR) and 3-Dimensional (3D) reformate capabilities allows the demonstration of pathological processes involving the bowel wall, bowel lumen, mesentery, mesenteric vessels and peritoneal cavity, CT has become an important tool in the pre-operative assessment of bowel pathologies, providing an anatomical road-map for surgery, especially for high grade partial and complete small bowel obstruction.

### II. MATERIAL AND METHODS

A perspective single centered study of 100 cases of clinically suspected bowel pathologies referred to the Radiology Department of BJMC, civil hospital, Ahmedabad, Gujarat from September 2013 to December 2015 evaluated by ultrasound using high frequency linear array transducers and MDCT.

**Study design:** Prospective observational study

**Study Location:** Radiology department, B.J. Medical college, civil hospital, Ahmedabad. It is a tertiary care teaching institute.

**Study duration:** Month September 2013 to December 2015

**Sample size:** 100 patients

**Sample size calculation:** The sample size was estimated on the basis of a single proportion design. Patients were selected as per month's USG reference for bowel pathologies.

**Subjects and selection method:** The study population was drawn from daily referral patients from different departments like medicine, surgery, obstetrics and gynecology department.

**Inclusion criteria:** all aged patients with suspected bowel pathologies referred to radiology department for ultrasonography and MDCT

Exclusion criteria: None, except patients in whom CT is contraindicated.

### PROCEDURE METHODOLOGY:

After written informed consent was obtained, detailed history of each patient was taken and then patients were taken for ultrasonography. Ultrasonography was done always in presence of an attendant, female attendant in case of female patients. Low frequency convex and high frequency linear array transducer was used for evaluation of bowel. In cases where evaluation of deeper structures is required, lower frequency probe was used. Scanning approach varies with location of the lesions. A detailed history of the patients including sign and symptoms, detailed physical examination, biochemical investigations and radiological investigations which included chest x-ray were recorded and analyzed. After proper instructions to the patients, CT scan was performed and following characteristics of the lesions were noted: 1, the size of lesion either in small intestine or large intestine or both, the symmetry (symmetrical/asymmetrical), length of bowel involved (focal/segmental/diffuse) and degree of wall thickening (mild/ marked), pattern of echogenicity, pattern of attenuation /density (homogenous/heterogenous) and vascularity on doppler study. Complication (stricture, fistula, abscess). Other findings including lymphadenopathy and fluid, involvement of adjacent structures, obstruction, distant metastasis and mesenteric vessel involvement.

### III. DISCUSSION AND RESULTS

Distribution of the 100 cases of intestinal lesions on USG and CT was as follows- 78 cases were of non neoplastic lesions and 22 cases were of neoplastic lesions. The maximum numbers of cases along the intestinal tract were in 3rd and 4th decade, followed by 5th, 2nd and 6th decade. The intestinal lesions were most common in male patients. Most of the patients of intestinal lesions were presented with abdominal pain, fever, and altered bowel habits. Non neoplastic lesions were most common in small intestine while large intestine harbors most of the neoplastic lesions; appendix had only non neoplastic lesions.

### INTESTINAL LESIONS

Of all, 100 cases were of intestinal lesions, which were studied and discussed as follows:

#### NEOPLASTIC LESIONS I

22 cases of neoplasm were identified. 14 cases were male and

8 were female. Neoplastic lesions were most common in the age group of 41-50 years (27.3%) and 51-60 years (22.7%).

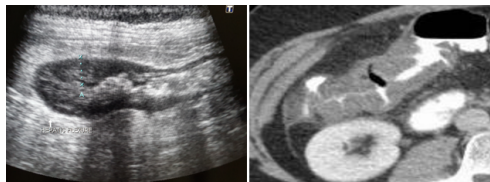
Most of the neoplastic lesions were presented with change in bowel habits (90%), abdominal pain (81.8%), weight loss (59%) and blood in stool in 50% of cases.

Colonic carcinoma at USG most commonly appears as focal and asymmetrical wall thickening in 81.8% of cases. In 81.8% of cases mild and in 9% of cases marked wall thickening (<2cm) were present and all cases appear hypoechoic on usg and on colour Doppler study increased vascularity were seen in 86.8% of cases and no change in vascularity were seen in 9% of cases. And on CT most of the colonic malignancies were show focal, irregular and asymmetrical thickening of the bowel wall in 95.4 % cases. Regular, symmetric and homogeneous wall thickening is more frequently due to benign conditions were seen in 4.5% of cases. In CT heterogeneous contrast enhancement were seen on 95.4% of cases and homogenous enhancement were seen in 1 patient (4.5%). Bowel wall thickening in USG were detected in lesser no of patients (90%) as compared to in CT (99.9%).

Lymphadenopathy were detected in 81.8% of cases in USG and 95.4% of cases in CT. CT was better able to pick up the level & cause of obstruction (9%), distant metastases (18.1%) and other features like adjacent organ involvement, abscesses, strictures (18.8%) as compared to USG which able to detect in 4.5%, 4.5% and 9% of cases respectively.

Therefore complications, local extensions and distant metastasis can be readily visualised on CT as compared to USG. Negative findings on USG do not rule out the diagnosis of colonic carcinoma small masses and overlying bowel gas can lead to false negative results.

Therefore CT had more superior results as compared USG in detection of colonic carcinomas.

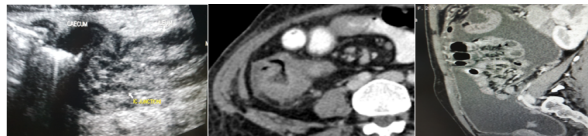


**Figure: USG and CT images showing wall thickening of ascending colon with mildly increased vascularity on doppler.**

### INTESTINAL TUBERCULOSIS

12 cases of intestinal tuberculosis were identified. 8 cases were males and 4 cases were females. Maximum numbers of patients were aged between 11-40 yrs accounting for 66.6% of cases. Abdominal pain was the most common complaint, followed by fever and weight loss. Intestinal tuberculosis shows asymmetrical, focal wall thickening which appears hypoechoic in USG and shows increased vascularity in most of the cases with luminal narrowing. On CT focal circumferential wall thickening with heterogeneous contrast enhancement was seen with gaping and thickened ileo-caecal valve, pulled up cecum, regional lymphadenopathy and pericecal fat stranding was seen. In the 12 patients of abdominal tuberculosis, lymphadenopathy was the most common finding on CT and USG, seen in 10 patients (83.3%) and 7 patients (58.3%) respectively. Intestinal involvement in CT was in 10 patients (83.3%) and in USG was seen in 8 patients (66.6%). IC junction & small bowel involvement were seen in 6 patients (50%) & in 4 patients (33.3%) in CT and in 5 patients (41.6%) & 3 patients (25%) in USG respectively. Tubercular peritonitis was seen in 2 patients (16.6%) in CT and 1 patient in USG. Hepatosplenomegaly was seen in 4 patients in USG and CT. On USG bowel wall thickening was detected in lesser number of patients than on CT scan. USG was less sensitive in detecting wall thickening in small bowel and ileo-caecal region as compared to CT. Also CT was better

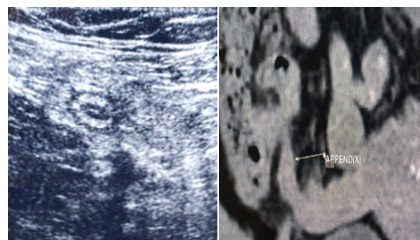
able to pick up the findings in vicinity to the bowel like matting of bowel, pericecal fat stranding. Omental, mesenteric and peritoneal changes were better seen in CT as compared to USG as CT showing greater no of lesions involving these structures. Solid organ involvement was detected almost equally in both USG and CT scan. Therefore CT appeared to be the modality of choice to demonstrate the wide spectrum of findings seen in the abdominal tuberculosis. CT was able to demonstrate more number of findings as compared to sonography in patients with abdominal tuberculosis.



**Figure: USG and CT images showing Pulled up cecum and ileo-caecal junction. Wall of cecum, ileo-caecal junction, terminal ileum and part of ascending colon thickened and showing increased vascularity on Doppler and enhancement in post contrast CT images.**

### APPENDICITIS

26 cases of appendicitis were identified. 16 cases were males and 10 cases were females. Appendicitis was more common in male patients as compared to females. Maximum numbers of patients were aged between 11-30 yrs accounting for 61.5% of cases followed by 19% cases in 4th decade. Abdominal pain in (76% of cases) was the most common complaint, followed by nausea & vomiting (76%) and fever in (69% of cases). Out of 26 patients of appendicitis reactive appendicitis was most common seen in 53.8% of cases, acute appendicitis were seen in 26.9% of cases, tuberculous and perforated appendicitis seen in 11.5% and 7.6 % of cases. In the 26 patients of appendicitis, maximum diameter of appendix ranges from 6-10 mm was found in 61.5% of cases and > 10 mm in 38.4% of cases on both CT and USG. CT detected lymphadenopathy in 18 cases (69.23%) and USG in 15 cases (57.6%). USG was less sensitive in detecting periappendiceal fat stranding and appendiceal wall thickening as compared to CT as less number of patients were detected in USG. CT was better able detect the adjacent bowel inflammation (73%) and complications like perforation, abscess, or phlebolith (11.5%) as compared to USG (57%) and (3.8%) respectively. On ultrasonography findings of acute appendicitis are noncompressible, blind ended aperistaltic tubular structure in right lower quadrant with target lesion or bull's eye appearance, diameter will be more than 6 mm, may be associated with appendicolith, pericecal fluid and prominent adjacent mesenteric fat. Therefore CT was more accurate in diagnosing appendicitis as compared to USG.



**Figure: USG and CT images showing appendiceal wall thickening with few mesenteric lymph nodes.**

### NON SPECIFIC COLITIS

Non specific colitis was identified in 30 patients. Non specific colitis was more common in male patients as compared to females. Maximum numbers of patients were present in 3rd and 4th decade. Most of the patients of non specific colitis were presented with fever (62.8%), abdominal pain (69.2%), and nausea & vomiting in 39.7% of cases and altered bowel habits in 30% of cases. Large intestinal lesions were most common

seen in 80% of cases while small intestinal lesions were seen in 43.3 % of cases. USG was less specific for detection of small intestinal lesions as compared to CT as in USG only 26.6 % of small bowel lesions were detected as compared to CT (43.3%). In the 30 patients of non specific colitis, lymphadenopathy was the most common finding on CT and USG, seen in 20 patients (66.6%) and 16 patients (53.3%) respectively. Fat stranding in CT and USG was seen 12 patients (40%) and 8 patients (26.6%) respectively. Mesenteric thickening in CT and USG was seen in 6 patients (20%) and 5 patients (16%) respectively. Ascites was seen in 3 patients. CT can demonstrate circumferential wall thickening, mostly symmetrical with fold enlargement. CT was better able to pick up the complications like perforations, strictures and abscess as compared to USG as more number of patients was detected.

**INTESTINAL OBSTRUCTION**

12 patients of intestinal obstruction were identified.

Most common site of bowel obstruction was small intestine (83.3%). 16.6% cases involving both small and large intestine. MDCT plays an important role in evaluation of patients with acute small bowel obstruction. As it does not require contrast agent and can depict the exact site and cause of obstruction. The level of obstruction was correctly predicted in all patients in CT and 75% of cases in USG. Out of 12 patients 5 patients (41.6%) had stricture & adhesions, 2(16.6%) patients had colonic malignancy, 1 patient of mesenteric artery syndrome and 1 patient of intussusception. The cause was not known in 2 patients. Therefore CT was more superior as compared to USG in detecting the cause of obstruction as numbers of patients detected were more in CT (83.3%) as compared USG (33.3%).

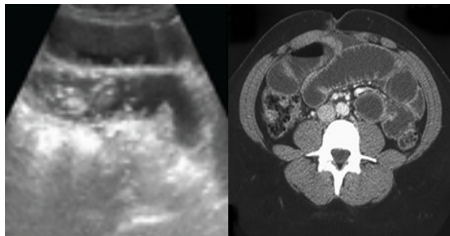


Figure: Small bowel distension, with some degree of wall thickening and fluid distended loops. On CT there is a "whirling" of the mesentery and vascular engorgement.

**BOWEL ISCHEMIA**

8 patients of bowel ischemia were identified. Most common etiology was mesenteric artery thrombosis (62.5%), followed by mesenteric vein thrombosis in 25 % of cases and least common was non thrombotic cause (12.5%). Maximum no. of cases were of mesenteric vessels thrombosis was detected in CT (77.5%) and 2 cases were detected of superior mesenteric artery syndrome. Numbers of cases of bowel wall thickening in mesenteric ischemia were also more detected in CT as compared USG. On USG and CT, the bowel wall appears thickened due to mural oedema, hemorrhage or superinfection. On colour doppler study decreased vascularity was noted in 75% of cases and no enhancement in 2 patients.



Figure: mesenteric vein thrombosis causing mesenteric ischemia producing dilated bowel wall thickening, fat stranding with mesenteric haziness.

**INFLAMMATORY BOWEL DISEASE**

It includes ulcerative colitis and crohn's disease. 2 patients of ulcerative colitis and in patient of crohn's disease was detected. IBD was most common in SI and higher rate of detection of bowel wall thickening was seen in CT (66.6%) as compared to USG (33.3%). Mild symmetrical bowel wall thickening with homogenous enhancement on CT was demonstrated. Increased vascularity was seen in almost all patients in Colour Doppler study. CT was more accurately diagnose the lymphadenopathy, fat stranding and complications like strictures, fistulas or abscess as compared USG as more numbers of patients were detected.

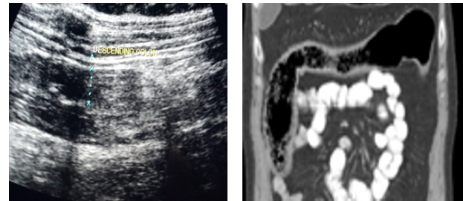


Figure: USG and CT images shows diffuse wall thickening of colon and shows homogenous enhancement in CT images.

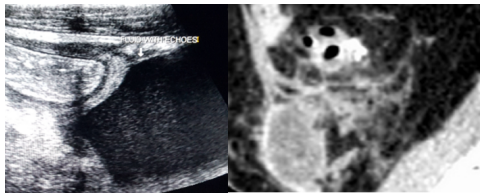


Figure: USG and CT images showing bowel wall thickening, fat stranding, presence of abscess and the presence of extra luminal free air in the collection.

**IV. CONCLUSIONS**

To conclude, USG is the initial modality of choice in evaluating bowel pathologies. It provides correlation between clinical symptomology and sonographic appearance of examined bowel segment (maximal tenderness, resistance, compressibility, presence or absence of peristalsis), while it is highly operator dependent and correct interpretation of sonographic findings needs adequate experience of abdominal and bowel sonography. MDCT is superb in confirming the presence of, determining the site, level and cause of bowel pathologies, and in demonstrating complications, for example infarction and perforation.

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