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RESEARCH ARTICLE

THE CORRELATION OF USG FINDINGS WITH CT (COMPUTED TOMOGRAPHY) SCAN FOR EVALUATION OF BOWEL PATHOLOGY

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Abstract

Introduction: Bowel can be affected by diverse group of pathologies causing varied morphological alteration in and around the bowel. The radiological investigation of choice depends upon the availability, accessibility, affordability and the performance of the method.

Methodology: It was a hospital based prospective comparative observational type of study. Study was conducted from January 01, 2020 to December 31, 2020. After applying exclusion criteria, 50 patients of any age group with bowel related symptoms and palpable abdominal mass, which were attending & referred to RNT Medical College and Associated Group of Hospitals included in the study. Ultrasonography and CT-scans were performed in every patient. The findings were observed and tabulated.

Results: The gender distribution showed male predominance. Out of 50 patients, 15 patients (30%) were female and 35 patients (70%) were male with male to female ratio of 2:1. The peak age incidence was in the 21-30 years of age group with 12 patients (24%) falling in this age group followed by 41-50 years group. There were total of 36 benign bowel wall lesions and 14 malignant cases of bowel wall thickening. Adenocarcinoma was the commonest malignant cause of bowel wall thickening constituting 11 (22%) cases out of total 50 cases, while in benign cases it was abdominal Koch's in 18 (36%) cases out total 50 cases.

Conclusion: USG is often the first imaging study performed in patients with symptoms related to the gastrointestinal tract and it is less invasive, more comfortable for the patient and has a good diagnostic accuracy. For indeterminate cases in USG, CT should be considered for more specific diagnosis. Overall, agreement with final specific diagnosis and diagnostic accuracy of CT for benign and malignant bowel lesions was higher than USG.

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Introduction:-

Bowel can be affected by diverse group of pathologies causing varied morphological alteration in and around the bowel. The different pathological lesions may have similar clinical presentations due to bowel dysfunction or obstruction.

The radiological investigation of choice depends upon the availability, accessibility, affordability and the performance of the method. An investigation which allowing detailed evaluation of the mucosa, lumen, wall and extra intestinal tissue alteration should be preferred.

It is important to differentiate a neoplastic lesion from an infectious/ inflammatory lesion. It is also important to define the location, extent and characterization of the lesion on contrast administration. The imaging modality that we use should encompass high sensitivity and specificity for the lesion and should be able to distinguish between benign and malignant bowel lesions¹.

Barium studies are easily available at less cost provides limited and non-specific information on mucosal and intraluminal abnormalities. Both barium meal follow through and enteroclysis are operator dependent techniques and demonstrate decreased sensitivity due to overlapping of bowel loops and their inability in assessing the intramural and perienteric pathology¹. Bowel Pathologies that were once routinely diagnosed with barium studies e.g. the evaluation of suspected small bowel obstruction and angiography e.g. evaluation of mesenteric ischemia are now preferentially evaluated by CT scans³.

CT has become a versatile tool in assessing the gastrointestinal (GI) tract. It provides accurate information about the gut wall and the surrounding structures and better spatial resolution and possibility of mucosal evaluation with use of negative oral contrast and phasic imaging⁵

The CT findings that need to be analyzed when assessing thickened bowel include pattern of attenuation; focal, segmental or diffuse involvement; and associated perienteric abnormalities⁶

Dedicated small bowel CT is typically requested in patients with known small bowel malignancies or if conventional imaging or endoscopy failed to demonstrate any abnormalities in patients with ongoing clinical symptoms¹³. Good results in tumour detection are achieved with CT enteroclysis^{14, 15}.

The most frequent pathological aspects found by ultrasonography in intestinal diseases are wall thickening, mucosal abnormalities, absence of peristalsis, and extra-intestinal complications like mesenteric thickening, lymph node enlargement and vascularity of the lesion²

Ultrasonography is a safe, noninvasive, inexpensive method for evaluating the bowel without the use of ionizing radiation. It is widely available, and although experience and technical expertise are more important when assessing the bowel compared with other regions of the abdomen, such skills can be obtained through dedicated training and persistent meticulous imaging. Because ultrasonography is performed with real-time imaging, the modality also allows the sonographer to view and assess the motility properties of the bowel.

Ultrasonography is often the first imaging modality used to assess patients with undiagnosed abdominal pain and can demonstrate a wide variety of bowel related diseases.

Computed tomography (CT) is now a days used as a screening technique for patients with symptoms of intestinal disease because of (a) growing confidence in CT in general as a problem solver, especially for many gastrointestinal disorders; (b) a low diagnostic error in the differentiation of intestinal from other abdominal diseases; (c) its potential for providing information for a comprehensive diagnosis and staging of abdominal neoplasms; and (d) its wide availability and ease of performance. Predictably, CT uncovers abnormalities in patients with or without symptoms referable to the intestinal tract.

Aims And Objectives:-

To establish the role of ultrasonography in early detection of mucosal irregularity in bowel pathology. To establish the role of computed tomography in detection of mucosal irregularity in bowel pathology. To evaluate the role of computed

tomography and ultrasonography in the diagnosis of various bowel pathologies especially for early diagnosis. To study the usefulness of computed tomography and ultrasonography in assessing the extent, spread and distribution of various bowel pathologies. To correlate the computed tomography findings with ultrasonography and the clinical, surgical and pathological findings to determine the accuracy of computed tomography and ultrasound findings.

Materials and Methods:-

It was a hospital based prospective comparative observational type of study. Study was conducted from January 01, 2020 to December 31, 2020 in the department of Radio-diagnosis, R.N.T. Medical College and associated group of hospitals, Udaipur.

After applying exclusion criteria, 50 patients of any age group with bowel related symptoms, bowel lesion and palpable abdominal mass detected in clinical examination, ultrasonography and CT-scan presented during the study period were included in the study. Ethical committee clearance was obtained from the institution's ethical clearance committee (Letter No. RNT/STAT./IEC/2019/838). Inclusion criterias were patients presented with: (1) symptoms related to abdomen (2) clinically detected palpable abdominal masses, (3) bowel masses or bowel lesions detected on ultrasonography that were referred for bowel related symptoms.

Exclusion criteriawere:

(1) Patients presented with history of trauma, (2) pregnant women, and (3) Patient who were not giving consent for the study.

Study instruments were:

(1) clinical proforma, and (2) Philips 16 slice and Siemens 128 slice MDCT. (3) various ultrasonography scanner available in our department like Alokapro sound SSD-4000SV, Siemens Acuson X300, Toshiba nemio30, VINNO E10, esaote My lab40, SAMSUNG RS80A etc.

The patients were followed up to correlate the finding with clinical outcome or operative findings and histopathology whenever possible.

For visualization of lumen of bowel were using neutral luminal contrast like water & mannitol. Preparation and administration of Oral contrast: 40% of 200 ml of Mannitol (20% in 100 ml) was mixed with 1300 ml of water to make it 1500 ml of iso-osmotic mannitol (40 gm of mannitol in 1500 ml of water).

The entire volume of oral contrast was offered to the patient and asked to drink under supervision as follows-300ml in each 10-15 min for 45-60minute duration. Table dose of 300 ml was given to distend the stomach just 10 minute before the scanning. Amount of the oral contrast intake was recorded. Any problem due to oral contrast was noted.

Non-contrast CT and contrast-enhanced CT were acquired using a protocol: 120 KVp and 100-300 mAs with 5mm thickness and retro reconstruction of 1.25mm thickness. For contrast study, 80-100 ml of 350mg/ml non ionic iodinated contrast (Iohexol) was injected in adults at the rate of 3-4ml/sec. In children a dose of 2ml/kg of 350mg/ml non ionic iodinated contrast (Iohexol) was injected at a rate of 1.5- 2ml/sec.

Various phases were performed depending upon the clinical and radiological indications. Multiple datasets were acquired with a single bolus of contrast. The following possible imaging times were be used in some cases of imaging the abdomen and pelvis—unenhanced, early arterial phase (20 seconds); late arterial-enteric phase (40 seconds); portal venous phase (70-90 seconds); equilibrium phase (210 seconds); and delayed phase (7-10 minutes). For general survey abdominal imaging, obtaining scans during the portal venous phase was adequate. Images were reconstructed in axial, coronal and segittal planes with a slice thickness and interval of 5 mm.

All the data were entered into a Microsoft Excel spreadsheet. Analysis of the statistical data obtained from the study was carried out by statistical programming software Statistical Package for the Social Sciences - SPSS Statistics Version 16.0.0 (SPSS Inc., Chicago, USA). SPSS is a statistical tool used to analyzed and correlate social data. Sensitivity, specificity and positive predictive and negative predictive value and diagnostic accuracy for each modality USG and CT were calculated. p- Value <0.05 was considered statistically significant. Mc Nemar test was used statistical significance was considered at p-value <0.05.

Results and Discussion:-

The gender distribution showed male predominance. Out of 50 patients, 15 patients (30%) were female and 35 patients (70%) were male with male to female ratio of 2:1.

CT Characteristics of lesions

The CT characteristics of bowel wall lesions manifesting as abnormal bowel wall thickening were studied as follows.

(A) Bowel wall thickness

Bowel wall thickness in 30 (83.33%) out of total 36 benign pathologies were having mild bowel wall thickening and 10 (71.42%) out of 14 malignant cases showed marked bowel wall thickening. Out of the total 34 with mild bowel wall thickening only 4 (11.76%) cases were malignant and 30 (88.23%) were that of benign etiology.

Out of the total 16 with marked bowel wall thickening only 6 (37.5%) cases were benign and 10 (62.5%) were that of malignant etiology.

Extent of lesion

Extent of involvement of bowel wall showed out of total 50 cases, 17(34%), 27(54%) and 6 (12%) cases showed the focal, segmental and diffuse involvement of bowel wall respectively. Smallest size bowel involvement is approximate 2 cm in size in adenocarcinoma of sigmoid region and largest size bowel involvement is approximate 35 cm involving terminal ileum, caecum, ascending colon in a case of Crohn's disease.

Among the 17 cases showing focal involvement of bowel wall, in 9 (52.94%) the etiology was malignant and 8 cases (47.05%) was benign etiology. And out of total 27 cases of segmental involvement, 24 (88.88%) belonged to benign etiology and in 3(12.5%) cases etiology was malignant.

Among the 6 cases showing diffuse involvement of bowel wall, in 4 (66.66%) the etiology was benign and in 2 cases (44.44%) belonged to malignant.

Conversely of total 36 cases of bowel wall thickening of benign etiology, in 8(22.22%) cases there was focal involvement of bowel wall and in 24(66.66%) cases and 4 (11.11%) cases there was segmental and diffuse involvement of bowel wall respectively.

Similarly out of 14 cases of bowel wall thickening due to malignant etiology, 9(64.28%) cases showed focal involvement of bowel wall while remaining 5 cases were showing segmental and diffuse involvement with 3 and 2 cases belonging to these subtype respectively.

Symmetry of lesion:

There were 28 cases (24 cases of benign etiology and 4 of malignant) of symmetrical bowel wall involvement and 22 cases of asymmetrical bowel wall involvement (12 cases of benign etiology and 10 cases of malignant etiology)

Out of 50 cases there were a total of 36 benign and 14 malignant mass cases. Most common malignant masses were adenocarcinoma 11 out of 14 cases (22%) was the single largest group followed by GIST 1 out of 14 (2%) and lymphoma 2 out of 14 (4%)

Most common benign lesion were abdomen TB 18 out of 36 cases (36%) was the single largest group followed by colitis 4 out of 36 (8%) and Crohn's 3 out of 36 (6%) and appendicular lesion 3 out of 36 (6%) and 2 cases (4%) of Jejunitis/ileitis and one case (2%) of volvulus, one case (2%) of epiploic appendagitis, and one case (2%) of abdomen cocoon.

Distribution of bowel lesion:

Only small bowel was the most commonly affected bowel lesion 30 cases followed by only large bowel 11 cases and both small with large bowel lesion seen in 09 cases

USG Characteristics of lesions**Gut signature:**

Among benign group, 26 (72.22%) cases showed maintain gut signature and 10 (27.77%) cases showed lost gut signature. And in malignant group 5 (35.71%) cases showed maintain gut signature and 9 (64.66%) cases showed lost gut signature.

Mucosal irregularity:

was seen in 34 (94.44%) cases in benign group and in all 14 cases (100%) in malignant group.

Peristaltic movements:

Among benign group and malignant group 3-3 cases showed increase peristaltic movements and 4 cases (benign) and 2 cases (malignant) showed decreased peristaltic movements.

Lymph node:

Out of the 50 cases studied, 46 (92%) cases showed lymph node positive status. Among malignant group 8 (66.66%) cases had lymph node size >1cm while 4 (33.33%) measured < 1cm in size.

In benign group 10(29.41%) cases had lymph node size >1cms while 24(70.58%) measured < 1cms in size.

In another view, 24 (85.71%) out of total 28 cases of small size lymph node (<1cms) were showed benign etiology, on other hand 8 (44.44 %) cases out of total 18 cases of lymph node size (>1cms) were showed malignant etiology.

Table 1:-Analysis of malignant lesion (Final diagnosis) (n=50).

	No. of patient	Percentage
Adenocarcinoma	11	22
Lymphoma	2	4
GIST	1	2
Total	14	28

Table 2:- Analysis of benign lesion (Final diagnosis) (n=50).

Diagnosis	No of patient	Percentage
Abdomen Koch's	18	36
Colitis	4	8
Crohn's	3	6
Appendicular pathology	3	6
Intussusception	3	6
Volvulus	1	2
Acute apiploicappendagitis	1	2
Jejunitis/ileitis	2	4
Abdomen cocoon	1	2
Total	36	72

Table 3:- Distribution of various USG findings in Bowel (n=50).

USG Findings		Benign	Malignant
Gut Signature	Maintain	26	5
	Lost	10	9
Mucosal Irregularity		34	14
Peristaltic movement	Normal	29	9
	Increase	3	3
	Decrease	4	2
Lymph node	Significant	13	9
	Insignificant	23	5
Free Fluid		9	5
Mass Lesion		8	8
Mesentery (Inflamed)		4	2

Omentum (Deposit)	1	3
Peritoneum (Thickening)	4	5

Table 4:-For Benign Bowel Cases.

	Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
USG	94.44%	78.57%	91.89%	84.61%	90.00%
CT	97.22%	85.71%	94.59%	92.30%	94.00%

Table 5:- For Malignant Bowel Cases.

	Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
USG	78.57%	94.44%	84.61%	91.89%	90.00%
CT	85.71%	97.22%	92.30%	94.59%	94.00%

Free fluid:

Out of total 50 cases 14 cases were having free fluid in abdomen, among these 14 cases ,9 cases were in the benign category and other 5 were malignant cause of bowel wall thickening.

Mass lesion:

It was seen in 8 (22.22%) out of total 36 cases of benign etiology on other hand 8(57.14%) cases out of total 14 cases of malignant etiology where showing mass lesion in abdomen.

Omental deposit:

It was seen in 1 (2.7%) out of total 36 cases of benign etiology on other hand 3(21.42%) cases out of total 14 cases of malignant etiology where showing deposit in omentum.

Peritoneum thickening:

It was seen in 4 (11.11%) cases in benign group and 5(35.71%) cases in malignant group.

The sensitivity, specificity, PPV and NPV of the USG for the assessment of benign bowel lesion was 94.44%, 78.57%, 91.89%, and 84.61% and Diagnostic accuracy was 90.00% and p value by fisher's exact test = <0.0001

The sensitivity, specificity, PPV and NPV of the USG for the assessment of malignant bowel lesion was 78.57%, 94.44%, 84.61%, and 91.89% and Diagnostic accuracy was 90.00% and p value by fisher's exact test = <0.0001

The sensitivity, specificity, PPV and NPV of the CT for the assessment of benign bowel lesion was 97.22%, 85.71%, 94.59%, and 92.30% and Diagnostic accuracy was 94.00% and p value by fisher's exact test = <0.0001

The sensitivity, specificity, PPV and NPV of the CT for the assessment of malignant bowel lesion was 85.71%, 97.22%, 92.30%, and 94.59% and Diagnostic accuracy was 94.00% and p value by fisher's exact test = <0.0001

Conclusion:-

USG is often the first imaging study performed in patients with symptoms related to the gastrointestinal tract. USG is less invasive, more comfortable for the patient and has a good diagnostic accuracy.USG is able to evaluate intestinal findings, such as the bowel wall thickness, mucosal abnormalities, peristalsis, compressibility, rigidity and extraintestinal structures, such as perienteric fat, mesenteric lymph nodes and adjacent organs.For indeterminate cases in USG, CT should be considered for more specific diagnosis because it may obviate the need for surgery or otherwise change management by identification of benign etiology.The role of CT in staging colon tumors and its ability to detect metastasis and local infiltration into adjacent structures is now well accepted. CT is on stronger ground in the assessment of recurrent tumors.Overall, agreement with final specific diagnosis and diagnostic accuracy of CT for benign and malignant bowel lesions was higher than USG.Computed tomography has rapidly become the imaging modality of choice for small and large bowel wall pathologies.

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