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ORIGINAL ARTICLE

Comparison of Computed Tomography with Histopathology as Gold Standard for Identification and Prediction of Bowel Thickening and Malignancy

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ABSTARCT

Background: Thickness of the bowel wall is a typical finding in patients having abdominal computed tomography scans. It could be a natural variation or the result of neoplastic, inflammatory, viral, or ischemic diseases. While certain radiologic patterns might lead to an accurate diagnosis, yet misidentification can occur.

Objective: To assess the accuracy of computed tomography in identifying bowel wall thickening as a predictor of malignancy, with histopathology serving as the gold standard.

Study Design: Retrospective comparative study.

Place and Duration of Study: Department of Radiology, Shaikh Zayed Hospital, Lahore from 1st January 2023 to 30th September 2023.

Methodology: One hundred and ten patients who underwent both abdominal computed tomography scans and subsequent histopathological/colonoscopic assessments of bowel wall samples were included. A proficient radiologist assessed computed tomography abdomen scans for the extent of thickening, and peri-intestinal irregularities like solid organ abnormalities, mesenteric stranding, abscess and sinus tracts, and engorged lymph nodes. Categorical variables were reported as frequencies and percentages. Sensitivity and specificity were also calculated.

Results: There were 70 (63.64%) males and 40 (36.36%) females with mean age of 56.6±16.8 years. The most common clinical indication was abdominal pain, reported by 55 (50%) patients. By CT 58 (52.73%) patients found to have malignancy while by histopathological examination 55 (50%) had malignant lesions. The most prevalent diagnosis was adenocarcinoma of the ascending, transverse, cecum, descending colon, sigmoid, and rectum. The sensitivity, specificity, PPV, NPV and accuracy of CT was 94.55%, 89.09%, 89.66%, 94.23% and 91.82% respectively.

Conclusion: The computed tomography is very useful tool for detecting bowel thickness/malignancy and can be used as an emergency examination modality.

Keywords: Bowel wall thickening, colon, abdominal pain, computed tomography.

INTRODUCTION

The diagnosis of intra-abdominal diseases is frequently made using abdominal computed tomography (aCT).[1] One frequent aCT observation is colonic wall thickening (CWT).[1,2] There are no firm recommendation criteria for CWT, despite the fact that practitioners typically perform colonoscopic examinations to identify the underlying pathology.[2] On CT scans, bowel wall thickening (BWT) is a relatively prevalent finding, particularly in patients who report severe abdominal discomfort. Decompressed bowel loops and varying degrees of distension can make it difficult to identify BWT because both large and small BWT are erratic and dependent on intestinal wall distension.[3] The ideal thickness of the small bowel wall is up to 3 mm in decompressed bowels and between 0 and 2 mm in inflated bowels.[4] In relation to the colon, the ideal range for wall thickness is between 0 and 2 mm for distension and 6 and 8 mm for decompression. BWT on CT scans may represent a normal range or be related to an inflammatory response related to gastrointestinal (GI) neoplasms or infectious diseases.[5-7] Due to the fact that CT scan has yet an unknown BWT predictive value leading to non-recommendation of the test by the American Society of Gastrointestinal Endoscopy.[8-10]

The reported lesion rate of CWT ranges from premalignant to malignant is 15%-65%.[2] Based on a CT scan, a few investigations have demonstrated that malignant lesions result in notable and localized thickening; nevertheless, no clear indicators that accurately predict neoplasia have been found.[10] Ultrasound (US) is the preferred initial imaging technique, particularly in emergency situations which can evaluate initial phases of Crohn's disease with an ease in diagnosing intra-abdominal problems, such as fistulas, strictures, and abscesses.[11-14] Histological analysis is a key component in inflammatory bowel disease (IBD) diagnosis. IBD is chronic illnesses that are becoming more prevalent globally. The two main types of IBD are ulcerative colitis (UC) and Crohn's disease (CD) wherein the intestinal wall thickens, is observed[15,16] and high morbidity with a decreased quality of life is observed and elaborates that comparing endoscopy results the conventional abdominal ultrasonography makes a very minor contribution to the diagnosis of primary colon malignancies.[17-19]

The present study was designed for assessing the role of aCT scan in identifying the bowl thickness. As in Pakistan, there is a lack of data regarding the significance of histological findings and CT scan in the bowel wall thickening. The results of this study provided a valuable insight in opting aCT scan as the most accurate tests and procedures for analyzing the wall thickness as a predictor of malignancy, with histopathology serving as the gold standard.

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MATERIALS AND METHODS

This retrospective comparative study was conducted at Department of Radiology, Shaikh Zayed Hospital, Lahore from 1st January 2023 to 30th September 2023. A total of 110 patients between 18-65 years, who underwent both abdominal CT scans and subsequent histopathological/colonoscopic assessment of bowel wall samples were included, whereas incomplete colonoscopy, inadequate bowel preparation, and a history of gastrointestinal disorder, a bowel tumour, and/or preceding colorectal surgery, missing laboratory parameters, and insufficient filling of the intestinal lumen with the CT contrast material were excluded from the study. The sample size was calculated using the WHO available sample size calculation software wherein the incidence of IBD in South Asia as within 0.51-1.95[18] keeping a 80% power of test, 95% CI and 5% margin of error a total of 110

sample size was generated. A well-structured questionnaire was designed for entering the relevant information from the medical records available into the proforma in form of codes which can further be entered and interpreted/analysed through statistical software.

Every patient provided written, informed consent prior to the initiation of the enrollment as study participants. The data was collected from the medical records of the selected patients. The medical reports of each patient provided information on their age, gender, medical history, and pathology report. Applying single blindness strategy, the Radiologists who were blind to the results of the histopathology independently evaluated the CT scans. A proficient radiologist assessed CT abdomen scans for the extent of thickening, and peri-intestinal irregularities like solid organ abnormalities, mesenteric stranding, abscess and sinus tracts, and engorged lymph nodes. Following oral preparation with four liters of polyethylene glycol, each patient had an ileoscopy and a colonoscopy. During the endoscopy, the morphological findings of the intestine were detected and noted with extreme care. These findings included deep ulcers, strictures, normal, skip lesions, mass, polyp, and the site of involvement. All of the patients had endoscopic pinch samples obtained from the ileum and cecum, which were then mounted on filter paper and sent for histological analysis. Following HE staining, tissue specimens embedded in paraffin were used to assess the histological results. An expert pathologist evaluated each specimen for crypts, lymphoid aggregates, surface epithelium ulceration, granuloma, and inflammatory infiltration location. The ultimate diagnosis incorporated histological, clinical, imaging, and endoscopic findings. The data was analyzed using SPSS-23.0. Independent t test was used for comparing the aCT results with histological findings wherein the p value <0.05 was considered significant. The sensitivity and specificity was compared using 95% CI.

RESULTS

There were 70 (63.6%) males and 40 (36.4%) were females with mean age of 56.6±16.8 years. Majority of the patients who underwent the subject procedure belonged to the age group of 49-65 years (54.54%) followed by 29-48 years age group (36.36%) (Table 1)

Clinical indications varied among the participants, with the most common being abdominal pain, 54(49%) patients. Other clinical indications were intestinal pathology 14 (12.73%), malignancy 12 (10.91%), metabolic issues 6 (5.45%), weight loss 12 (10.91%), constipation 4 (3.64%), diarrhea 4 (3.64%), and inflammatory bowel disease 4 (3.64%) [Fig. 1].

By CT scan imaging there were 58 (52.73%) patients found to have malignancy while by histopathological examination 55 (50%) had malignant lesions. The incidence of thickening at various sites of the gastrointestinal tract by CT revealed that the small intestine displayed thickening in 20(34.48%) patients. Conversely, the large intestine showed thickening in 38 (65.41%) cases. Regarding malignancy sites identified through histological evaluation, the small intestine demonstrated malignancy mainly in the duodenum and ileum, accounting for approximately 9 (16.36%) of the cases each. Additionally, the jejunum presented malignancy in 3 (5.45%) patients. In the large intestine, malignancy was predominantly observed in the colon, with 5 (9.09%) cases. Moreover, the sigmoid colon displayed malignancy in 10 (18.18%) cases, while the rectum exhibited malignancy in 6 (10.90%) with P value 0.978 (Table 2).

Table 1: Demographic details patients undergoing abdominal CT scans and subsequent histopathological/colonoscopic for the assessment of bowel wall samples (n=110)

Variable	No.	%
Age (years)		
18-28	10	9.09
29-48	40	36.36
49-65	60	54.54
Gender		
Male	70	63.6
Female	40	36.4

Table 2: The distribution of bowel thickening on CT and histological findings

Site	Histological diagnosed malignancy	aCT diagnosed BWT	P value
Small intestine			
Duodenum	9 (16.36%)	8 (13.79%)	0.878
Jejunum	3 (5.45%)	3 (5.17%)	--
Ileum	9 (16.36%)	9 (15.51%)	--
Large Intestine			
Caecum	13 (23.63%)	16 (14.45%)	0.456
Colon	5 (9.09%)	6 (10.34%)	0.978
Sigmoid	10 (18.18%)	9 (15.51%)	0.865
Rectum	6 (10.90%)	7 (12.06)	0.911

Table 3: Comparison of 95% CI of CT features with histological diagnosis accuracy

	Histological diagnosed malignancy		aCT diagnosed BWT	
Statistic	Value	95% CI	Value	95% CI
Sensitivity	98.1%	86.78% to 99.86%	94.55%	84.88% to 98.86%
Specificity	91.23%	87.75% to 96.90%	89.09%	77.75% to 95.89%
Positive Likelihood Ratio	9.12	4.15 to 19.59	8.67	4.06 to 18.49
Negative Likelihood Ratio	0.03	0.01 to 0.06	0.06	0.02 to 0.18
Disease prevalence (*)	50.00%	40.32% to 59.68%	50.00%	40.32% to 59.68%
Positive Predictive Value (*)	93.24%	80.25% to 96.32%	89.66%	80.24% to 94.87%
Negative Predictive Value (*)	82.3%	80.21% to 99.04%	94.23%	84.41% to 98.01%
Accuracy (*)	98.9%	81.23% to 99.11%	91.82%	85.04% to 96.19%

Fig. 1: Clinical indications of enrolled patients underwent aCT and histological assessment of the bowel wall thickening

By CT 58 (52.73%) patients found to have malignancy while by histopathological examination 55 (50%) had malignant lesions. The sensitivity, specificity, PPV, NPV and accuracy of CT was 94.55%, 89.09%, 89.66%, 94.23% and 91.82% respectively (Table 3).

The sensitivity and specificity of the various CT features including heterogenous assessment of enhancement as well as the ball wall thickening and grey attenuation was analyzed (Table 4).

It was observed that CT showed highest sensitivity with the focal segmental bowl wall involvement with a sensitivity value of 97.10% while the highest specificity of the CT was presented by marked bowl wall thickening >2cm as 93%. The test was least specific for grey attenuation and least sensitive the focal segmental bowl wall involvement (Fig. 2).

Table 3: Comparison of histological findings according CT scan findings

CT Finding	Histopathology		Total
	Positive	Negative	
Positive	52	6	58
Negative	3	49	52
Total	55	55	110

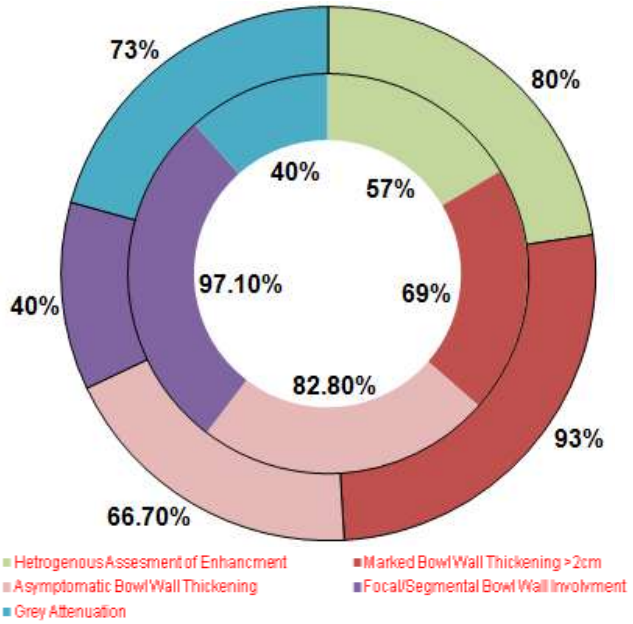

Fig. 2: Comparison of sensitivity and specificity of various CT characteristics (Inner circle: Sensitivity, Outer circle: Specificity)

DISCUSSION

Abdominal discomfort, both acute and chronic, is a major reason for ER visits. CT has become a more commonly used technique for diagnosing abdominal discomfort.[20] The extensive use of CT has led to the common detection of CWT.[21] The specificity and sensitivity of conventional CT scans for CWT are low.[22] This observation could be a variation of normal or the result of benign or malignant illnesses. Because of this, extensive endoscopic assessments, like colonoscopies, are required to identify the potential aetiology of CWT.[20] Thus, using histological findings as the gold standard, this study showed the accuracy of a CT scan in identifying cancer of the bowel wall.

Research using larger sample size of patients and yielded an overall sensitivity of 74.5%-100% for routine CT detection of colorectal cancer.[24-25] These findings were comparable to the present study and reported that out of 110 patients, malignancy was proved in 55 patients after taking histological assessment, yielding a sensitivity of 94.55%.Similarly, another retrospective study investigated 132 patients who had colonoscopies due to thickening of the intestinal wall seen on CT scans revealed CT scans having very high sensitivity and specificity (95.6% and 90.4%, respectively).[26] These results were in line with research by Colvin et al[24] that found that CT had a 100% sensitivity and a 95.7% specificity in identifying colon cancer.

An observational prospective cohort study assessed the probability of intra-abdominal cancer in the subsequent year by examining a common indicative problem, particularly abdominal discomfort. Overall, men aged ≥70 (3.39%) had the highest probability of experiencing abdominal pain per se, while women aged 40–59 had the lowest risk (0.49%). The increased risk in men is probably due to variations in the incidence of colorectal, oesophagogastric, pancreatic, bladder, and kidney cancers between both genders.[27] The present study, which was partially similar to the above-cited study, found that the most often reported symptom of intestinal wall thickening was abdominal pain. The mean age of the patients was 56.75±16.8 years, with 70 (63.64%) males and 40 (36.36%) females. There was no discernible gender difference in the risk factors linked to thickening of the intestinal wall.

The current study had some limitations originating from a single-center setting that has a disproportionate numbers of patients in comparison to other centres, which may limit their applicability to different clinical settings. A further restriction was the tomography showing the wall's thickness, but not recording the thickness in millimetres.

CONCLUSION

The most common clinical indication was abdominal pain. CT scans demonstrated 94.55% sensitivity and 89.09% specificity in detecting bowel wall thickening, using histopathology as the gold standard. The results indicated that CT imaging is a reliable diagnostic technique for identifying malignant lesions, which can assist with the early detection and treatments of carcinomas

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