

What should we expect when colon wall thickening is detected on abdominal CT scan in the era of artificial intelligence?



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Clinical and pathological differences of breast cancer in younger and elderly patients.

AIM: Except for emergencies, endoscopic findings were investigated in patients with increased thickness of the colon wall on abdominal CT.

MATERIAL AND METHODS: Patients who underwent colonoscopy due to the detection of thickening of the colon wall in the abdominal CT performed for non-emergency reasons in the General Surgery Clinic of Health Sciences University Haseki Training and Research Hospital between January 2018 and December 2020 were evaluated retrospectively. Data were obtained by scanning the hospital database.

RESULTS: Fifty-four patients who underwent colonoscopy after incidentally detected increased colonic wall thickening determined from the hospital database. Endoscopic examinations revealed tumors in 30 patients (55.6%), inflammatory bowel disease (IBD) in 9 patients (16.6%), nonspecific colitis in 1 patient (1.9%), polyps in 3 patients (5.6%), and diverticula in 2 patients (3.7%). No pathology was detected in 9 patients (16.6%). Patients were aged between 21 and 87 (mean 59,04 years, SD \pm 18,54).

DISCUSSION: Tumor is the primary endoscopy finding in cases where an increase in colon wall thickness is detected incidentally on abdominal CT, except in emergencies. We performed this preliminary study in the near future to determine the diagnostic algorithm with the use of artificial intelligence in radiology and thus avoid unnecessary investigations.

CONCLUSION: In our study, the main reason for the incidentally detected increase in colon wall thickness is the tumor. A diagnostic algorithm can be created with machine learning, a subcomponent of artificial intelligence.

KEY WORDS: Artificial intelligence, Bowel wall thickening, Colonoscopy, Computed tomography

Introduction

Abdominal computed tomography (CT) is a frequently used method in the diagnosis of patients presenting with abdominal pain, cancer screening, monitoring of chronic diseases, and digestive system complaints (bloating, diarrhea, constipation, etc). Intestinal wall thickening is a common finding on abdominal CT scans. This finding can be seen in conditions such as tumors, inflammatory bowel diseases, infection, or even in the absence of any disease^{1,2}. The bowel wall thickening can be seen

without any pathology, as it is often seen in conditions such as tumors, inflammatory bowel diseases, infectious diseases. When an increase in the thickness of the intestinal wall is detected, endoscopy should be performed to investigate whether there is a pathological condition³. The length of the involved segment, whether it is symmetrical or asymmetrical, its enhancement status, and whether the bowel is distended or not give an idea in diagnosis. Whether the involvement is focal (< 5 cm), segmental (6-40 cm) or diffuse (>40 cm) is also helpful in the differential diagnosis. While more focal involvement is seen in tumors, segmental or diffuse involvement is more common in inflammatory diseases^{4,5}. Increasing digitization of imaging systems makes these features easier and more perfect to identify and creates a database. Machine learning, a subcomponent of artificial intelligence, creates algorithms based on observations, experience and data usage. As the data increases, the prediction gets better and better⁶.

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Material and Method

In this retrospective study, the results of colonoscopy performed between January 2018 and December 2020, due to the detection of wall thickness in the colon on abdominal CT performed for various complaints and findings were evaluated.

The patients aged 18 years and older who applied directly to the University of Health Sciences Haseki Research and Training Hospital General Surgery Clinic for reasons such as abdominal pain, bloating, changes in bowel habits or who were referred from other clinics for consultation and who underwent colonoscopy upon detection of intestinal wall thickness in abdominal CT taken between January 2018 and December 2020. Fifty-four patients who underwent colonoscopy after incidentally detected increased colonic wall thickening determined from the hospital database. Of the patients 38 (70,4%) were male and 16 (29,6%) were female and their ages ranged from 21 to 87 (mean 59,04 years, SD \pm 18,54).

Emergency cases were not included in the study. Approval was obtained from the University of Health Sciences Haseki Research and Training Hospital Ethics Committee (Date: 14.07.2021; protocol number: 68-2021).

SPSS 15.0 was used for statistical analysis. For descriptive statistics, categorical parameters were presented as numbers and percentages, and numerical parameters were presented as mean, median, standard deviation, minimum and maximum. Chi-square test was also studied to compare of groups.

Results

Abdominal CT showed increased wall thickness in the ileocaecal region in 5 patients, ascending colon in 10 patients, transvers colon in 3 patients, descending and sigmoid colon in 14 patients, rectum in 16 patients. In the remaining 6 patients more than one segment of the colon were involved.

Endoscopic examinations revealed tumors in 30 patients (55,6%), inflammatory bowel disease (IBD) in 9 patients (16,7%), nonspecific colitis in 1 patient (1,9%), polyps in 3 patients (5,6%), and diverticula in 2 patients (3,7%); no pathology was detected in 9 patients (16,7%). The increase in wall thickness in 30 patients with tumors was in the right colon and transverse colon in 10 patients (33,3%), in the left colon in 12 patients (40%), in the rectum in 8 patients (26,7%). The mean age of 8 female and 22 male patients with tumor was 65,96 (SD \pm 12,99) years.

In the logistic regression analysis performed to investigate the age and gender factors in terms of malignancy, it was seen that age was significant in terms of malignancy, but there was no difference in terms of gender. The distribution of endoscopic findings by age and gender is given in (Table I).

In the ROC analysis performed in terms of age, the cut-off age was found to be 52,5%, the sensitivity was 83%, and the specificity was 54,2% (Table II).

When the malignant and non-malignant patient groups were evaluated after endoscopy, the difference between the two groups was significant in terms of focal or diffuse, symmetrical or asymmetrical wall thickening ($p < 0.001$). While wall thickening was asymmetrical in

TABLE I - Distribution of endoscopic findings by age and gender

Endoscopic finding	Total number	%	Female	%	Male	%	Mean age
Tumor	30	55,5	8	26,7	22	73,3	66
IBD	9	16,7	3	27,3	6	72,7	42
Miscellaneous	6	11,1	2	28,6	4	71,4	67
Normal	9	16,7	3	42,8	6	57,2	57

TABLE II - The age and gender factors in terms of malignancy.

		B	S.E.	Variables in the Equation Wald	df	Sig.	Exp(B)
Step 1a	Age	,055	,019	8,288	1	,004	1,056
	Gender (1)	,709	,682	1,083	1	,298	2,033
	Constant	-3,511	1,313	7,149	1	,008	,030

a. Variable(s) entered on step 1: age , gender.

TABLE III - ROC analysis in terms of the age

Risk Factor	AUC (%95)	Cut off	p value	Sensitivity (%)	Specificity (%)
Age	0,731(0,592-0,869)	52,5	0,004	83,3	54,2

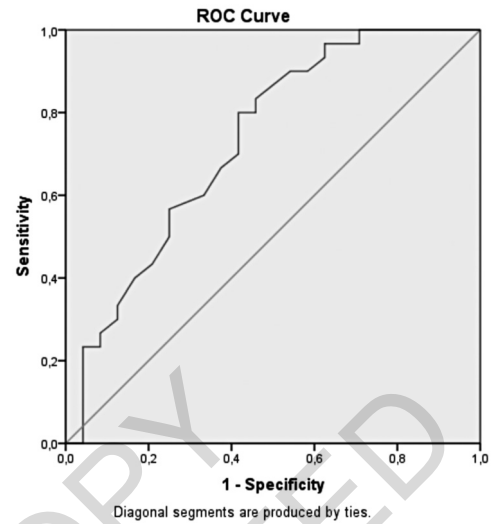


TABLE IV - Statistical differences between benign and malignant colonic wall thickening.

	Benign	Malign	p value
Symmetric/Asymmetric	6/18	0/30	<0,001
Focal/Difuse	9/15	1/29	<0,001

all cases in the malignant group, this rate was 25% in the benign group. In the malignant group, wall thickening was 96.66% diffuse type, whereas, in the benign group, 62.5% were diffuse and 37.5% were focal type. There was significant difference between diffuse and focal localizations ($p < 0.001$) (Table III).

Discussion

Detection of increased wall thickness in the colon on abdominal CT can often occur in conditions such as tumor, inflammatory bowel diseases, ischemia, infection, or it may be without any pathology⁷. The causes of the colonic wall thickening (CWT) on CT detected in patients applying to the emergency department with complaints such as abdominal pain, gas and inability to pass stool may differ from the causes of incidentally detected CWT. In this retrospective study, we found that tumors were the most common cause of incidentally detected CWT. Since CWT detected in emergency and non-emergency situations is examined together in the literature, there are different rates.

Wolff et al. retrospectively evaluated 107 patients in their study². Patients whose wall thickness was detected when CT was performed urgently or electively and who underwent endoscopy within 30 days were included. It was reported that 28% of the patients had no pathology, 8% had malignancy and 10% had IBD. The most common diagnosis was ischemic colitis (36.4%), and infectious

colitis was found in 16 (14.9%) patients. We think that the inclusion of emergency cases in studies increases the rate. For this reason, the increase in wall thickness, especially in the case of infection, should be re-evaluated after the infection regresses.

In the retrospective study of Uzzaman et al 165 patients with CWT were examined³. Elective and emergency situations were not separated. CWT was mostly detected in the rectum (30.3%), followed by the cecum (26.67%). Likewise, in our study, the most common sites of wall thickness increase were the rectosigmoid region and rectum (%38,7). Cancer was found in 21.82% of patients, and neoplasia (adenomatous polyp or cancer) in 35.76% of patients. The rate of endoscopic lesion detection was 57.58% despite the presence of CWT on CT. However, in our study, the rate of not detecting pathology in endoscopy despite CWT was 19.64%. Also in this study, including emergency cases caused the rates to appear different from our study.

In the study of Akbaş et al, five-year colon wall thickness data were scanned retrospectively, and endoscopy findings were compared with biochemical data⁴. 116 patients were evaluated for age and biochemical data (hemoglobin (Hb), albumin, neutrophil lymphocyte ratio (NLR), thrombocyte lymphocyte ratio (PLR), and mean platelet values (MPV)). In this study, the malignancy rate was found to be 44.8%.

Rockey et al., who prospectively examined the correlation between CWT and colonoscopy, evaluated 50 patients in an 18-month period and found the rate of pathology detection in colonoscopy to be 67%⁵.

In the review published by Macari M and Balthazar E J, it was reported that the CWT on CT was all-around symmetrical or asymmetrical, the degree of thickness, focal or diffuse, accompanying intestinal changes were important in the diagnosis and differential diagnosis⁷. In our study, no discrepancy was found in terms of location in patients with pathology in endoscopy. But there

was significant difference in terms of symmetrical or asymmetrical thickening of the colonic wall between malign and benign group. In addition, colon wall thickening was mostly focal in the malignant group and diffuse in the benign group. With the increase in prospective studies on this subject, it is clear that CT will play a more important role in diagnosis and will guide the indication of colonoscopy, which is an invasive procedure.

Al-Khowaiter et al. stated that when CWT detected in emergency cases is due to infection, it may return to normal after treatment ⁸.

In their retrospective study, Daniel et al. evaluated the increase in wall thickness in the entire GIS and found the detected malignancy rate to be 51.6% ¹³. The malignancy rate is close to the rate we found in our study. However, in this study, upper and lower GIS wall thickening were evaluated together.

In a prospective study conducted in India, where tuberculous peritonitis is common, it was reported that the increase in wall thickness was caused by 62.12% tuberculosis and 15.16% tumor ⁹. Again in India, Kumar et al. reported the causes of ileal and/or cecal wall thickening detected in abdominal CT as 48% tuberculosis and 20% Crohn's disease in their prospective study, and detected adenocarcinoma in only 1 patient ¹⁵. Therefore, endemic reasons should be taken into account in people from different geographical areas in the era of globalization and mass migrations.

Nicholson et al. reported that computed tomography predicted colon pathology at a high rate compared to the final result after colonoscopy and biopsy, and colonic wall thickening was demonstrated on CT in patients who did not require colonoscopy before¹⁰.

Thickening of the colon wall is also a common finding in inflammatory bowel diseases, and more common, symmetrical thickening is observed in abdominal CT ¹¹⁻¹⁴. Recently, abdominal symptoms such as abdominal pain, nausea and vomiting have been observed due to COVID 19 disease. Although the most common form is respiratory tract disease, different symptoms and findings can be seen due to the virus targeting host cells that express angiotensin converting enzyme (ACE)-2 receptors. These cells are also found in the gastrointestinal tract, liver and kidneys ¹⁹. Bhayana et al. found thickening of the intestinal wall in 29% of the patients with covid 19 who underwent abdominal CT for reasons such as abdominal pain, nausea, vomiting²⁰. Tirumani et al. reported that 18.1% of patients with covid 19 had abdominal findings, which were independent of respiratory tract disease. The most common finding in their study was the fluid-filled colon, and they found less intestinal wall thickening (1.4%) and in 61.5% of the patients, intestinal findings were found incidentally without any abdominal symptoms ²¹. For these reasons, now the possibility of covid 19 should also be considered in patients with incidentally detected thickening of the intestinal wall.

Conclusion

CWT detected on abdominal CT is a finding that should be examined with endoscopy. The rate of detection of malignancy in elective conditions is high. However, in case of an increase in wall thickness detected in emergency conditions, it should be re-evaluated after the emergency conditions subside and should be evaluated together with clinical findings. Especially in cases of incidentally detected focal, asymmetrical colon wall thickening, tumor should be considered and endoscopy should be done quickly.

In the near future, with the increase in the use of machine learning and artificial intelligence in radiology, the diagnostic algorithm will precisely be determined, thus avoiding unnecessary research and time loss.

In addition, the possibility of covid 19 should also be considered. We think that prospective studies on this subject will be instructive.

Riassunto

Con questo studio sono stati valutati i risultati del controllo colonscopico di zone di aumentato spessore di scoperta casuale sulla TC dell'addome eseguita per altre motivi, escluse le emergenze.

Si è trattato dello studio retrospettivo sull'archivio dell'ospedale a proposito di 58 pazienti che erano stati sottoposti a colonscopia perchè era stato rilevato un ispessimento della parete del colon nella TC addominale eseguita per altri motivi - non di emergenza - nella Clinica di Chirurgia Generale dell'Università di Scienze della Salute Haseki Training and Research Hospital tra il gennaio 2018 e dicembre 2020. L'età dei pazienti era compresa tra 21 e 87 anni (media 59,04 anni, SD ± 18,54). Su questi pazienti gli esami endoscopici hanno fatto diagnosticare l'esistenza di tumore in 30 pazienti (55,6%), di una malattia infiammatoria intestinale (IBD) in 9 pazienti (16,6%), di colite non specifica in 1 paziente (1,9%), di polipi in 3 pazienti (5,6%), e diverticoli in 2 pazienti (3,7%). Nove pazienti (16,6%) sono risultati esenti da patologia.

Dunque una neoplasia è stato il reperto endoscopico principale nei casi in cui un aumento dello spessore della parete del colon era stato rilevato accidentalmente alla TC addominale (eseguita al di fuori di indicazioni di emergenza). Si è trattato di uno studio preliminare, con l'intenzione nel prossimo futuro di determinare un algoritmo diagnostico con l'uso dell'intelligenza artificiale in radiologia ed evitare così indagini non necessarie.

In conclusione, nel nostro studio, il motivo principale dell'aumento accidentale rilevato nello spessore della parete del colon è risultato essere una neoplasia. Un algoritmo diagnostico potrebbe essere creato con l'apprendimento automatico, una sottocomponente dell'intelligenza artificiale.

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