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Purpose:
The aim of this study is to retrospectively assess the contribution of the minimal preparation CT to the diagnosis of colorectal cancer in the patients who were referred to department of gastroenterology with colorectal cancer prediagnosis and have consequent colonoscopically visible mass and histopathological proof.

Materials and methods:100 consecutive cases referred from department of gastroenterology between September 2008 and December 2012 with confirmed colonoscopical mass diagnosis were included to our study (Age range: 18–90 Sex: females 41 and 59 males). Radiological findings were statistically compared with pathological findings as a gold standard.

Results:Of these patients with colonoscopically visible mass, minimal preparation CT revealed asymmetric wall thickening (n:89), extracolonic mass (n:3), and symmetric wall thickening (n:2) and normal wall thickness (n:6). 79 cases had enlarged lymph nodes in pericolonic mesenteric fat tissue while remaining have no lymph nodes (21). 54 cases had stranding in pericolonic mesenteric fat tissue and remaining individuals showed normal fat density. The masses were located in rectum (n:54), sigmoid colon (n:17), descending colon (n:10), transverse colon (n:2), ascending colon (n:14), and cecum (n:3).

Conclusion:In colorectal and extracolonic mass investigation we recommend minimal preparation CT, which is highly sensitive and more acceptable by patients.

Key words:Minimal preparation, Computerised Tomography, colonoscopy, pathology.

Introduction

Colorectal cancer forms about 10% of cancers in men and women. Colorectal cancer is a significant health problem in developed countries causing serious morbidity and mortality. It is the third most common cancer in the United States (US) and is placed as second in terms of deaths caused by cancer (1).

The majority of colorectal cancers develop from existing adenomatous polyps. This adenomatous polyp-carcinoma process is 10-15 years, determination and and treatment of these precancerous adenomatous polyps are possible in this period (2). It has been proven in many prospective, case-control and predictive studies conducted for this purpose that the various screening strategies and testing reduced the colorectal cancer mortality (3-7). In this respect, colorectal cancer is preventable and treatable disease. Therefore, the implementation of the screening method for the diagnosis of precancerous adenomatous lesions has great importance to reduce the morbidity and mortality of colorectal cancer.

When colon cancer is detected at an early stage, it can be treated with high level of cure with appropriate surgical intervention with minimal morbidity and mortality. However, some of patients are at an advanced stage when they are diagnosed and the 5-year survival for these patients is only 8%.

Overall survival of colon cancer is prolonged with each passing year. This case is associated with the development of diagnosis methods used, the increase in prevalence of screening programs, the development of new surgical techniques, and the introduction of new methods in radiotherapy and systemic treatment.

The American Cancer Society has divided the tests for early diagnosis of adenomatous polyps and colorectal cancer in 50 years and older asymptomatic adults into two groups in 2008 and presented a proposal as follows (8).

Tests for the detection of colorectal cancer: (a) Each year, high-sensitivity fecal occult blood test (b) Each
year, high-sensitivity fecal immunochemical test (c)
High-sensitivity fecal DNA test (indefinite duration)

Tests for the detection of adenomatous polyps and colorectal cancer: (a) every five years, flexible sigmoidoscopy or (b) Every 10 years, conventional colonoscopy or (c) Every 5 years, double-contrast barium enema or (d) Every 5 years, computed tomography (CT) colonography.

American Cancer Society has divided the test into two groups for the first time as for the detection of colorectal cancer and for the detection of adenomatous polyps and colorectal cancer in this latest proposal revised in 2008. The second group of tests are superior in detecting of precancerous adenomatous polyps and especially colorectal cancer at early stage.

Although conventional colonoscopy is a method that entire colon can be examined and allows biopsy and resection of the lesion, it has been reported that the entire colon could not be evaluated in about 5-10% of patients. In addition, it is can be said that about 20% of all adenomas may be overlooked (9). The complications such as perforation (0.8-1 / 1000), major hemorrhage (3/1000) and death (1/30000) can be seen in diagnostic and therapeutic colonoscopy (9,10).

In the studies conducted with the newly developed multi-slice computed tomography (MSCT) devices, qualified virtual reconstructions can be made that even smaller polyps than 3 mm can even be determined as a result of faster shooting time and spatial resolution results provided.

We aimed to investigate contribution of MSCT, which is more advantageous for the patient and time and comfortable with minimal preparation, to diagnosis in the determination of colon cancer when it is compared with screening methods such as colonoscopy, virtual colonoscopy.

Materials and Methods

Mass was detected in 94 of 100 patients in colonoscopy who were admitted with a preliminary diagnosis of colorectal cancer to endoscopy unit of Gastroenterology Clinic. In six patients, ulcerated submucosal polypoid was present in colonoscopy. The clinical and pathological findings of 100 patients with mass or suspected mass in colonoscopy were compared retrospectively with MDCT data. Fifty-nine and forty-one of 100 patients enrolled in the study were male and female, respectively. The mean age was 54 ± 16 years.

Our study is a retrospective data archive study and the study protocol was approved by the local ethics committee.

Patients enrolled in the study were examined by Olympus Evis lucera CF Q260 AL colonoscopy equipment. One day before this examination, a box of 250 ml Xm diet was given and plenty of water was requested to drink and one hour before the examination, 135 ml of Bt enema was applied via rectum, bowel cleansing was provided by going to toilet within 5-20 minutes. All colonoscopy reports were examined and recorded. Histopathological results of all patients that biopsy was taken in the colonoscopy were recorded.

Asymmetric wall thickening and mass lesions associated with bowel loop in MSCT were considered malign radiologically. Symmetric wall thickening was considered benign. Extracolonic findings, increased density, lymph node, metastasis were evaluated separately. The thoracic sections entering the cross-sectional area were also examined and abnormal findings were recorded. The distribution of mass according to bowel loops were made. Pathology results were accepted as the gold standard.

Continuous variables and discrete variables used in our study were compared with Student’s t-test and chi-square test.

Abdominal pelvic CT scanning of our patients in our study group was performed with the devices of 64-detector multislice Philips Brilliance V2.6.1 (2007) and 16-detector Toshiba Activion V3.00 (2010). Acquired images were evaluated with two expert radiologists experienced in abdominal pelvic CT in the workstation (Philips Brilliance Workspace Extented Philips Medical Systems, Best The Netherlands). Images were analyzed in the axial plane. Then, if necessary, the three-dimensional reformatted images were created and the sagittal and coronal sections were also utilized. Routine imaging of the abdomen and pelvis CT scan was made from xyphoid process to symphysis pubis including the inguinal canal orifices by holding breath. Our patients were informed to drink 1 glass of water per 5 minutes after 6 hours of fasting by adding 10 cc of 76% urographin for 1.5 ml of water. Shooting was performed about 1 hour after that oral intake finished and 1-1.5 cc of iv contrast material per kg was given as 200 / sec during shooting. The images were obtained at the 50th second in the portal phase.

The parameters used in the shooting made with CT devices with 64 and 16 detectors for our patients have been summarized in Table 1.
Results

Fifty-nine of the patients (59%) were male and 41 (41%) of them were female. Female / male ratio was 3/2. Mean age was 54 ± 16 and the age range was 18-90.

Mass was detected in 94 patients with colonoscopy and submucosal ulcerated polypoid appearance was present in 6 patients. In MSCT, the asymmetric wall thickness, normal wall thickness, extracolonic mass and symmetrical diffuse wall thickness were determined in 89 (89%), 6 (6%), 3 (3%) and 2 (2%) of 100 patients in the study, respectively.

In 79 of 100 patients (79%), enlarged lymph nodes were present in pericolonic mesenteric adipose tissue, lymph nodes were not detected in 21 (21%) patients in pericolonic mesenteric adipose tissue. In 54 of 100 patients (54%), increase in density was present in pericolonic mesenteric adipose tissue, density was normal increases in 46 (46%) patients in pericolonic mesenteric adipose tissue.

The additional extracolonic findings in our patients included in the study that we found were; invagination in 2 patients (2%), inguinal hernia in 5 patients (5%), Spigelian hernia in 1 patient (1%), sliding type of hiatal hernia in 4 patients (4%), hemangioma of the liver in 5 patients (5%), cholelithiasis in 8 patients (% 8), ovarian cancer in 2 patients (2%), benign cystic pathology in the ovaries in 3 patients (3%), bronchiectasis in 2 patients (2%), left diaphragmatic elevation in 1 patient (1%), lung cancer in 2 patients (2%), chilaiditi syndrome in 1 patient (1%), omental cake appearance in 1 patient (1%), left iliac vein thrombosis in 1 patient (1%), splenic infarct in 1 patient (1%), cysts in the spleen in 1 patient (1%), pancreatic mass in the head in 1 patient (1%), lymphocele in the left lower abdomen in 1 patient (1%), horseshoe kidney view in 1 patient (1%), diverticulum view in the bladder in 2 patients (2%).

The mass settlements detected with MSCT were rectum in 54 (54%) patients, sigmoid colon in 17 (17%) patients, descending colon in 10 (10%) patients, transverse colon in 2 (2%) patients, ascending colon in 14 (14%) patients, cecum in 3 (3%) patients, respectively.

During the diagnosis, lung metastasis, liver metastases, both lung and liver metastases and adrenal gland metastasis were present in 4 (4%) patients, 19 (19%) patients, 11 (11%) patients and 6 (6%) patients, respectively. Distant metastasis was not detected in 60 (60%) patients.

Histopathologic diagnosis of 92 (92%) patients included in our study was colorectal cancer and inflamatuar-infective proces was detected in 8 (8%) patients. Histopathologic diagnoses of 100 patients were determined in accordance with adenocarcinoma in 79 (79%) patients (Figure 1a, b), mucinous adenocarcinoma in 7% patients (Figure 2a, b), signet ring cell adenocarcinoma in 2 (2%) patients (Figure 3a, b), diffuse large b-cell lymphoma in 1 (1%) patient (Figure 4), tubulo-villous adenoma in 3 (3%) patients, solitary rectal ulcer in 4 (4%) patients (Figure 5), non-caseified granulomatous infectious colitis (tbc) in 1 (1%) patient (Figure 6), infected colitis in 2 (2%) patients, infected ulcerated colitis in 1 (1%) patient (Figure 7).

The statistical results of our study, the sensitivity, specificity value, positive predictive value, negative predictive value the overall strength of the test were found to be 93%, 25%, 93%, 25% and 88%, respectively.

Discussion

Colorectal cancer is a major health problem that causes serious morbidity and mortality today. Colon cancers are defined as the third most common type of cancer in the United States (11) and the second most common type of cancer in Europe, and the second in both sexes in cancer-related deaths (12).

Conventional colonoscopy is the gold standard method for colorectal cancer screening. The sensitivity of

<table>
<thead>
<tr>
<th>Table 1. CT parameters</th>
<th>CT parameter values</th>
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</thead>
<tbody>
<tr>
<td>64 detector Brilliance</td>
<td>512 512</td>
</tr>
<tr>
<td>16 detector Toshiba</td>
<td>512 512</td>
</tr>
<tr>
<td>Kolimasyon</td>
<td>64x0,625 16x0,625</td>
</tr>
<tr>
<td>Pitch</td>
<td>1 1</td>
</tr>
<tr>
<td>Thickness</td>
<td>3mm 3mm</td>
</tr>
<tr>
<td>Rotations time</td>
<td>1 1</td>
</tr>
<tr>
<td>Increment</td>
<td>1,5cm 3mm</td>
</tr>
<tr>
<td>FOV</td>
<td>35cm 39cm</td>
</tr>
<tr>
<td>Kvp</td>
<td>120 120</td>
</tr>
<tr>
<td>Matrix</td>
<td>512 512</td>
</tr>
<tr>
<td>MAS</td>
<td>250 250</td>
</tr>
<tr>
<td>Filter standart (B)</td>
<td>L:60,W:360 L:40,W:400</td>
</tr>
<tr>
<td>windows</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1: 37-year-old male patient’s with axial CT (a) and colonoscopy images (b), mass lesions showing expansion into the lumen at the level of the descending colon, asymmetric wall thickening and heterogeneous contrast enhancement; and accompanying view of pericolonic lymph node (adenocarcinoma).

Figure 2: 70-year-old male patient’s axial CT (a) and colonoscopy images (b) asymmetric wall thickness increase in the rectum, perikolonik lymph nodes, pericolonic spiculated density increase (mucinous adenocarcinoma).

Figure 3: 41-year-old male patient’s axial CT (a) and colonoscopy images (b) asymmetric wall thickness increase at the level of the cecum and one lymph node view in adjacent mesenteric fat tissue (signet ring cell adenocarcinoma).
conventional colonoscopy in the detection of colon cancer is 90-95%, the sensitivity in the detection of polyps larger than 1 cm is 90%, the sensitivity in the detection of polyps smaller than 1 cm is 75% (13-14). The lesion skip ratios for conventional colonoscopy for polyps smaller 5 mm, polyps 6-9 mm in size and polyps larger than 1cm were 16-27%, 12-13% and 0-6%, respectively (15). In some studies, the specificity of colonoscopy increases to 100% (16,17).

Conventional colonoscopy and the other screening tests (stool occult blood test, double-contrast barium enema) have some limitations. Therefore, new methods of screening and diagnosis were needed. Vining et al. (18) have defined CT colonography for the first time in 1994. This method was developed later and was accepted as a screening method in 2008 by the American Cancer Society. Primarily desired condition for both conventional colonoscopy and CT colonography, which were accepted as a method of screening for colorectal cancer, is patient compliance. Unfortunately, this rate is around 40% in conventional colonoscopy (19). In both tests, patient preparation is the most important point. The first step of the patient preparation is the bowel cleansing. It is emphasized in the studies conducted on this subject that the colon should be thoroughly cleaned for the correct interpretation of CT colonography (20-22). CT colonography is inadequate in terms of evaluation of extracolonic structures (23). The most important factor that conventional colonoscopy and CT colonography can be used as a screening
method for colorectal cancer is that the patient can tolerate the examination in other words, the ratio of patient satisfaction. The most important factor in determining this ratio is the amount of pain felt during shooting (24). The issues such as that the patient feels uncomfortable (eg privacy) during conventional colonoscopy examination and bowel cleansing constitute negative effects in the use of this procedure as a screening procedure. Although the risk of colon perforation and hemorrhage was low in conventional colonoscopy, these risks are always present (9,10). In our study, no complications were encountered in our patients. There are also some complications of CT colonography. The most important complication is perforation. The risk of perforation was found in CT colonography as 0.059% in a study conducted with 11000 patients (25). The most important disadvantage is that CT colonography is at best only a screening test, and only detects the presence of the lesion. In other words, the lesion detected with MDCT colonography must be confirmed and treated with conventional colonoscopy. Another disadvantage of this method is that advanced computers and expensive software are required for CT colonography. Long duration of the evaluation is also a disadvantage disadvantage which causes difficulties for the spread of this examination as a screening test in intensive workload.

Before, colonoscopy examination, which was before the “gold standard”, was used for the investigation of delicate, elderly and bedridden colorectal cancer patients are, and barium enema carries many problems in terms of the tolerance of patients and the colon cleaning process with enema. In MDCT with minimal preparation, it does not require air blowing via rectum or administration of contrast material compared with CT colonoscopy. This method (multislice computed tomography minimal preparation) is a method which can be tolerate more by sensitive and elderly people.

MSCT with minimal preparation is a method that is well tolerated and has a high sensitivity and specificity to diagnose the pathology or extracolic malignancies which may contribute to the symptoms of the patients (26).

Multislice computed tomography with minimal preparation is not sensitive enough to diagnose the lesions and polyps smaller than 1-2 cm when compared with CT colonoscopy and conventional colonoscopy. However, although small colonic lesions may have malignant potential and young patients require more long term follow up, invasive carcinoma may take 5 to 8 years for polyps (27) and therefore, they have less clinical significance in delicate, elderly and bedridden patients (28).

Rectosigmoid region and all colon segments were examined in detail for the localization of colorectal cancer. In our study, the lesions were localized in the rectosigmoid region by 71%, the ascending colon and cecum by 17% and the transverse colon and descending colon by 18%. In a similar study conducted by Chhaya Jagat Bhatt et al. (29), the rectosigmoid region, the ascending colon and cecum and the transverse colon and descending colon were involved as 63.6%, 18.2% and 18.2%, respectively. In our study, colorectal cancer were diagnosed pathologically in 97% of patients with focal asymmetric thickening of the bowel wall, in 69% of patients with positive pericolonic lymph nodes, in 50% of patients with increased pericolonic fatty tissue density. In a recent study series conducted by Chhaya Jagat Bhatt et al. (29) on 100 cases, 96.4% of patients with asymmetric bowel wall thickening, 10% of patients with positive pericolonic lymph nodes and 47% of patients with increased pericolonic fatty tissue density were found to be associated with malignancy.

It has been proven that MDCT with minimal preparation was effective because the resolution for detecting bowel wall thickening in the gastrointestinal tract, extraluminal pathologies, changes of pericolonic mesenteric fat tissue (29).

MDCT with minimal preparation may be helpful approximately 98% in discrimination of malignant and benign in intestinal pathologies with the help of some criteria (Table 2) (29). Our results have provided similar information when compared with previously published studies (Table 3).

Sensitivity and specificity ratios are acceptable. However, the reasons of the low specificity and NPV are that cases of colon cancer were included only in the study and the lack of a control group. Because, false positive data was only obtained in 6 of 92 patients in MDCT. The wrong conclusion were obtained in these 6 patients due to solitary rectal ulcer in 3 of them, non-caseified granulomatous colitis in 1 of them, advanced age-related collapsed bowel loops and examination with insufficient contrast enhancement in 2 of them. Findings in terms of sensitivity is 93%. This may be due to the difficulty in the diagnosis of cancer in cohort studies and often elderly people do not demand confirmatory tests. However, if the patients are thought to be delicate to be studied with conventional colonoscopy or CT colonoscopy and it is 1 in 12 or 50% (30). In this case, patients were exposed to resection for colonic malignancy. Enhanced
Table 2. Auxiliary parameters, which are used in the benign and malignant etiology discrimination in MDCT.

<table>
<thead>
<tr>
<th>Major Criteria</th>
<th>Minor Criteria</th>
</tr>
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<tbody>
<tr>
<td>Residential age</td>
<td>age</td>
</tr>
<tr>
<td>Wall thickening degree</td>
<td>neighboring masses</td>
</tr>
<tr>
<td>Thickening symmetry format</td>
<td>pericolic fatty tissue changes</td>
</tr>
<tr>
<td>The enhancement pattern wall</td>
<td>acid</td>
</tr>
<tr>
<td>Relevant segment length</td>
<td>lymph nodes</td>
</tr>
<tr>
<td></td>
<td>liver metastases</td>
</tr>
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<td></td>
<td>liver abscess</td>
</tr>
</tbody>
</table>

Table 3. The studies conducted with MDCT on the detection of colorectal cancer between 1993 and 2008 and its comparison with the results obtained in Dicle University Faculty of Medicine.

<table>
<thead>
<tr>
<th>Studies</th>
<th>Patient</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>PPV   (%)</th>
<th>NPV  (%)</th>
<th>Extra-colonic tumor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day et al.</td>
<td>37</td>
<td>88</td>
<td>86</td>
<td>64</td>
<td>96</td>
<td>3.3</td>
</tr>
<tr>
<td>Domjan et al.</td>
<td>118</td>
<td>75</td>
<td>96</td>
<td>75</td>
<td>96</td>
<td>2.5</td>
</tr>
<tr>
<td>Robinson et al.</td>
<td>195</td>
<td>100</td>
<td>87</td>
<td>46</td>
<td>100</td>
<td>5.6</td>
</tr>
<tr>
<td>Ng et al.</td>
<td>1031</td>
<td>85</td>
<td>91</td>
<td>49</td>
<td>98</td>
<td>2</td>
</tr>
<tr>
<td>Kealey et al.</td>
<td>72</td>
<td>75</td>
<td>87</td>
<td>43</td>
<td>97</td>
<td>1.4</td>
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<tr>
<td>Ganeshan et al.</td>
<td>391</td>
<td>95</td>
<td>88</td>
<td>45</td>
<td>99</td>
<td>3.6</td>
</tr>
<tr>
<td>Western General Hospital</td>
<td>85</td>
<td>100</td>
<td>93</td>
<td>71</td>
<td>100</td>
<td>4.7</td>
</tr>
<tr>
<td>Dicle university medical hospital</td>
<td>100</td>
<td>93</td>
<td>25</td>
<td>93</td>
<td>25</td>
<td>3</td>
</tr>
</tbody>
</table>

recovery program that laparoscopic resection and postoperative care-assistance are developed may also be the reason for this. It was understood with bowel examination program in Scotland in May 2008 that MDCT with minimal preparation is recommended as a valid imaging modality especially for bedridden and delicate patients between 50-74 years of age (30).

There are some limitations of our study that can not be changed due to it was a retrospective study. We have some difficulties in some cases in terms of the interpretation of bowel wall thickening due to poor bowel opacification of oral contrast agent used and collapse of bowel loop.

As a result; 93% of patients that a mass was detected in colonoscopy and were diagnosed pathologically as colorectal carcinoma with biopsy were correlated with MDCT with minimal preparation.

MDCT with minimal preparation is a non-invasive imaging method which is well tolerated and does not require pre-bowel preparation. When it was compared with current data, it was observed to be highly sensitive in the detection of colorectal cancer and extracolonic tumors in delicate, weak or elderly patients. Therefore, we recommend MDCT with minimal preparation which has high sensitivity and is tolerated maximum by patients, as an imaging method for the investigation of spread of colorectal cancer or extracolonic tumors.

References