

# The clinical value of studies on colonoscopy and positron-emission tomography with computed tomography in the diagnosis of colorectal cancer

**Authors' Contribution:**  
 A – Study Design  
 B – Data Collection  
 C – Statistical Analysis  
 D – Data Interpretation  
 E – Manuscript Preparation  
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## ABSTRACT:

**Introduction:** Colonoscopy and PET / CT are among the major diagnostic tests for colorectal cancer. The sensitivity, specificity, and accuracy of these studies are still being assessed differently.

**Objective:** The aim of the study was to compare the sensitivity, specificity and accuracy of colonoscopy and PET / CT in the diagnosis of colorectal cancer.

**Material and methods:** The medical records of 125 patients with colonoscopy and PET / CT in the years 2014–2015 were analyzed retrospectively. The research was done at the Professor Franciszek Łukaszczuk Oncology Center in Bydgoszcz. Based on the macroscopic description of colonoscopy, the results were divided into two groups: with and without probability of cancer. The average SUV value in PET / CT for colorectal cancer was calculated and without this diagnosis. The average value of SUV 14 and higher was considered probable, while 11 or less had no probability of cancer. Standardized mathematical formulas were used to evaluate the sensitivity, specificity and accuracy.

**Results:** More than half of the patients – 78 (62.4%) were males. The majority of patients – 42 (36.6%) were aged 65–74. The majority (106) (88.8%) were diagnosed as polyps and 24 (15.6%) as tumor-like lesions. Polyps were placed in the rectum – 32 (30.2%), in the sigmoid colon – 26 (24.5%) and 15 (13.2%) in the ascending colon. Tumors were located in the rectum – 11 (45.8%) and 4 (16.7%) in the recto-sigmoid junction. 38 (24.6%) adenocarcinomas and 67 (43.5%) adenomas were diagnosed. The detection rate of RIG was 32% in colonoscopy and PET / CT. The sensitivity of the colonoscopy was 80%, the specificity – 68.4% and the accuracy – 71.4%. The sensitivity, specificity and accuracy of PET / CT were 65%, 75%, 4% and 72.7%, respectively.

**Conclusions:** Colonoscopy has a higher sensitivity in colorectal cancer diagnosis, but specificity and accuracy are higher in PET / CT.

## KEYWORDS:

colorectal cancer, colonoscopy, PET / CT, sensitivity, specificity, accuracy

Colorectal cancer (CRC) is found to be one of the most common cancers in the world and in Poland. Developed countries are seeing a dynamic increase in disease and mortality. It can be concluded that CRC constitutes a significant problem for contemporary oncology. It is estimated that there are 17,000 cases diagnosed in Poland every year. Colorectal cancer ranks second among deaths in men and third among women. Men die due to this cancer on average twice as often as women. According to the data from the first decade of the 21st century, the 5-year survival rate was around 48% [1]. The basic diagnostic examination of colorectal cancer involves colonoscopy, or endoscopic examination allowing to view the mucosa of the large intestine with the possibility of collecting a sample for histopathological examination. Colonoscopy is a diagnostic method characterized by high sensitivity and specificity [2].

Positron-emission tomography paired with computed tomography constitutes a diagnostic tool that can be used to differentiate between benign and malignant tumors, to assess the extent of malignant neoplasms and their metastases, and to differentiate the recurrence of the neoplastic process. Fluorodeoxyglucose 18FDG was used in the PET/CT study to assess the severity of neoplastic disease and in the diagnosis of primary foci. The study is also used to assess the recurrence of colon cancer. The combination of two methods increases the specificity and sensitivity of each. PET/CT also proves to be useful in planning treatment in patients with colorectal cancer. Complementary imaging of the neoplastic

lesion structure allows to determine the size of the tumor and surrounding lymph nodes. The use of PET/CT techniques may allow a change in the treatment technique in 50% of patients [3, 4, 5].

In order to detect CRC in patients with symptoms deriving from the lower digestive tract, colonoscopy and PET/CT tests are performed. Both diagnostic methods are characterized by high sensitivity, specificity and accuracy in the diagnosis of colon cancer. Hence, the attempt to compare the clinical value of colonoscopy and PET/CT in the same patients diagnosed with CRC. The PET/CT scan is a complementary method to colonoscopy, especially in the assessment of the stage of cancer in terms of N and M characteristics in TNM staging. Assessment of the T characteristic and sensitivity, specificity and accuracy as compared to colonoscopy was performed less frequently.

## PURPOSE OF PAPER

This study aims to compare the sensitivity, specificity and accuracy of colonoscopy and PET/CT in the diagnosis of colorectal cancer.

## MATERIAL AND METHODS

Medical documentation of 125 patients with symptoms from the

lower gastrointestinal tract was retrospectively reviewed. In the years of 2014-2015, these patients underwent colonoscopy with the collection of a histopathological section and a positron-emission tomography with computed tomography (PET/CT). Endoscopy was performed by a total of six colonoscopists using the EVIS EXERA II, Olympus camera. The tests were performed in the Department of Oncology Endoscopy and in the Franciszek Lukaszczyc Oncology Centre in Bydgoszcz.

Among the patients there were 47 (37.6%) women and 78 (62.4%) men (mean age 63.5 years). Based on the macroscopic description of the colonoscopy, the results were divided into those with and without the likelihood of cancer. Lesions in the large intestine deviating from the physiological norm were taken into account, such as: polyps, tumors, ulcerations, infiltrations.

The PET/CT study descriptions contained the SUV value (standardized uptake value) for individual organs. The value of glucose metabolism in the large intestine for characteristic T in the TNM classification was taken into account. Due to the lack of specific SUV reference values, the mean SUV value for CRC histopathological diagnoses was calculated also without this diagnosis. The mean value of SUV was 14 in the group of patients diagnosed with CRC. An equal and higher value was considered to indicate the likelihood of CRC in PET/CT. The mean value of SUV was 11 in the group of patients without CRC. An equal or less value was considered a result in which there was no likelihood of CRC.

The test to confirm or rule out the occurrence of cancer was histopathological examination, which was compared with colonoscopy and PET/CT. Based on the collected data, the sensitivity, specificity and accuracy of colonoscopy and PET/CT were calculated. The sensitivity, diagnostic specificity of the test as well as the positive and negative prediction and the accuracy of diagnosis were calculated in accordance with the generally accepted formulas. The Bioethical Commission issued consent for carrying out the research (BC 63/2016).

## RESULTS

### Characteristics of patients

Over half of the respondents – 78 (62.4%) were men. The largest number of patients – 42 (36.6%) were in the age group 65–74. In general, the average age was over 63.5 years, while the standard deviation of 15.9% of the average value indicated a slight age diversity. The average age of women and men was similar, i.e., 61 and 65 ( $p=0.06$ ).

### Colonoscopy and PET/CT

All patients were subjected to colonoscopy with collection of tissue for histopathological examination. In the case of 106 (68.8%) people, polypectomy was performed, and 48 patients (31.2%) underwent colonoscopy with biopsy. As a result of colonoscopy done in 125 people, 154 macroscopic lesions were found, which were examined histologically. The most frequent diagnoses were – 106 (68.8%) polyps and – 24 (15.6%) nodular lesions.

Detailed analysis of colonoscopy was limited to the macroscopic diagnosis of exophytic lesions: tumors and polyps. The largest number

of tumors – 11 (45.8%) were located in the rectum and – 4 (16.7%) in the rectosigmoid junction. The smallest number of one (4.2%) was found in the (4.2%) in the transverse colon and caecum. In women, there were no tumors in the transverse colon, ascending colon or the cecum, and in men in the sigmoid and hepatic flexure. The location of tumors in the large intestine was similar in women and men ( $p = 0.625$ ).

The majority of polyps were located in the rectum – 32 (30.2%), in the sigmoid colon – 26 (24.5%) and 15 (13.2%) in the ascending colon. The smallest number was found in the rectosigmoid junction – 2 (1.9%) and 1 in the hepatic flexure and Bauhin's valve. The largest number of polyps were 12 (38.7%) and 20 (26.7%) found in the rectum in women and men, respectively. Colon polyps were similarly located in women and men ( $p = 0.074$ ).

Cancer was suspected in 57 patients (36.6%) in colonoscopy, and in 54 (35.1%) in the PET/CT study.

### Histopathological examination

The largest numbers of diagnoses involved – 38 (24.6%) adenocarcinomas, 30 (19.5%) adenoma tubular low-grade dysplasia, 15 (9.7%) hyperplastic polyps, 14 (9.1%) tubulovillous adenomas with low-grade dysplasia and 2 squamous cell carcinomas.

### Sensitivity, specificity and accuracy of colonoscopy and PET/CT examination

Colonoscopy sensitivity in the diagnosis of CRC was 80%, specificity 68.4%, accuracy 71.4%, while PET/CT was 65%, 75.4% and 72.7%, respectively.

## DISCUSSION

In our retrospective study we selected a group of symptomatic patients in whom pathological changes lesions found in the large intestine during endoscopic examination. There are many scientific reports regarding the evaluation of CRC diagnosis methods using colonoscopy and PET/CT [6, 7, 8, 9]. Comparison of the sensitivity, specificity and accuracy of colonoscopy and PET/CT in the diagnosis of CRC in the same patient is rarely the subject of research.

Colonoscopy is a test characterized by a high value of colon cancer detection. In one study, colonoscopy was performed on a similar number of patients as in our case. On average, 90% of colon cancers were detected there [10]. In our study, cancer was suspected in every third patient and a slightly greater number of cancers was diagnosed. Such large differences in the diagnosis and detection of CRC can be explained by the characteristics of patients participating in this study, they were older patients with a longer duration of symptoms and, therefore, with a more advanced cancer.

However, according to others in the Far East, colon cancer was detected in colonoscopy in only 3.6% in a three times greater number of symptomatic patients. According to the authors, the low percentage of detected CRC may be related to the population's genetic conditions and environmental factors. Similarly, more men were examined. In general, several hyperplastic polyps and a dozen adenomas were detected. The majority of polyps were located in the

sternum and sigmoid colon (26% each), while 20% were polyps in the rectum [11]. In our case, hyperplastic polyps were found in every 10th patient, adenoma was detected in almost every second patient, while colorectal cancer was found in every third patient. In our studies, polyps were most often located in the rectum, with the sigmoid colon being the second most frequent location.

A less invasive test in the diagnosis of CRC is PET/CT. The sensitivity of PET/CT in the diagnosis of stage T1 colorectal cancer is 79.5%, while in T2-T4, as much as 92.9%. According to these authors, on average approximately 81% of colon cancers can be detected with PET/CT [12]. In our study, however, the sensitivity and specificity of PET/CT was 65% and 75.4%, and a lesser percentage of 24.6% of adenocarcinomas was detected. Lower sensitivity of PET/CT may be associated with a smaller number of respondents and a large number of doctors performing colonoscopy and perhaps a lower staging of cancer in these patients.

The next study examined the sensitivity and specificity of PET/CT in the diagnosis of advanced colorectal cancer. There were more women in the study group, and their average age was 63.3 years. PET/CT was performed before colonoscopy. 258 biopsies were performed in patients. Every third patient was diagnosed with adenomas, 14.3% with adenocarcinomas, 8.5% with inflammations and 21% with hyperplastic polyps. The sensitivity of PET/CT was 54%, specificity 100%, positive predictive value was 100% and 56% was negative [13]. In contrast to our group, there were more women in the group of patients, but the patients were of similar age. In our study, every fourth patient was diagnosed with adenocarcinoma, almost every second adenoma and every 10th with hyperplastic polyp. PET/CT sensitivity was higher by about 10%, while specificity was lower by 25%. The positive predictive value was 54 and the negative predicted value was 100. Different predictive values indicate that our patients had fewer true positive and false positive results, and truer negative and false negative ones.

Another study also analyzed the results of the PET/CT scan compared to colonoscopy. All PET/CT results were evaluated in patients without prior diagnosis of colorectal cancer. To assess the accuracy of PET/CT, the results of the study with colonoscopy were compared. The study group included 157 patients, with the same number of men and women aged 61 on average, according to the authors, the sensitivity of the study is 64.4%, while the spe-

cificity, negative predictive value and diagnostic accuracy of PET/CT is 96%, 90% and 87%, respectively [14]. In our studies, the sensitivity was similar, specificity was lower by about 20%, negative predictive value was higher by 10% and accuracy was 15% lower. So, generally the results were similar.

Huang et al. point to somewhat different data, especially regarding sensitivity. In this case, the sensitivity, specificity and accuracy of FDG PET/CT in the detection of colorectal cancer is respectively: 60%, 99.1%, and 98.8%. However, the study included a small group of 36 people who had colonoscopy and PET/CT performed in the course of two days. The positive predictive value is 23.1%, the negative is 99.8%, while detectability is half as much as in Poland [15]. Our research was conducted on a 4 times larger group of patients. Sensitivity was higher (65%), while specificity and accuracy were lower. The positive predictive value was more than halved, while 100% was negative.

In conclusion, both colonoscopy and PET/CT are good diagnostic tests for the detection of primary CRC in symptomatic patients. PET/CT also gives the opportunity to assess the spread of cancer (TNM). In our study, both methods are characterized by high sensitivity, specificity, and accuracy. Unfortunately, due to economic reasons and easiness of access in CRC diagnostics, a colonoscopy is first performed, which also gives the possibility of final diagnosis based on histopathological examination. Therefore, the role of colonoscopy cannot be overestimated in screening. PET/CT scan is not the gold standard in CRC diagnosis, despite its high values of sensitivity and specificity. The possibility of planning optimal treatment is given by a combined diagnostic procedure using colonoscopy and PET/CT.

We have demonstrated that in many studies there are differences in the assessment of accuracy, sensitivity, and specificity in both colonoscopy and PET/CT. It seems that they depend not only on factors such as the severity of cancer, its biology, genetic and environmental factors, but also on the preparation of the intestine, the quality of the test, and the apparatus itself. Thus, prospective randomized clinical trials are required to determine the true role of colonoscopy and PET/CT in the diagnosis of colorectal cancer.

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