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Incorporating Based-Risk Clinical Parameters to the Assessment on Polyps and Adenomas Detection Rates in Colorectal Cancer Screening

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Abstract

Background and Aim: Colorectal Cancer (CRC) remains a major global health issue, with early detection significantly improving prognosis. Current screening guidelines primarily emphasize age and family history, but other clinical and laboratory parameters could enhance detection rates. Our study investigates the correlation between CRC-related manifestations and screening performance metrics–Polyp Detection Rate (PDR) and Adenoma Detection Rate (ADR).

Methods: This cross-sectional retrospective study analyzed 235,781 colonoscopy procedures from eight multi-center sites affiliated with Assuta Medical Centers in Israel, conducted between 2016 and 2022. The dataset comprised the identification and classification of polyps, adenomas, and Colorectal Cancer (CRC), in conjunction with patient demographics, clinical background, and particular clinical-laboratory manifestations including hematochezia, abdominal pain, family history of CRC, fecal occult blood results and presence of anemia. Quality performance metrics PDR and ADR, as well as potential associations with clinical and laboratory manifestations were computed.

Results: Our study found significant variations in PDR and ADR based on symptom presence. Patients with hematochezia exhibited a PDR of 36.8% and an ADR of 12.1%, compared to 28.7% and 10.8% in those without it. Moreover, patients with fecal occult blood had a PDR of 48.3% and an ADR of 21.5%, compared to 31.6% and 11.0% in those without it. In addition, a family history of CRC also correlated with higher PDR and ADR. Our data also showed that clinical combinations, particularly CRC family history with hematochezia, displayed the highest PDR at 62.3% and ADR at 11.2%, while combinations involving others such as abdominal pain and anemia were less predictive.

Conclusion: Our research indicates that the integration of clinical and laboratory parameters, including the presence of hematochezia and fecal blood occult test, into Colorectal Cancer (CRC) screening protocols could substantially augment the early identification of the disease and enhance screening efficacy. Symptoms, especially when considered in conjunction with a familial predisposition for CRC, seem to serve as significant predictors for pinpointing individuals at elevated risk. These findings support the necessity for a reformed screening paradigm that employs symptom-based criteria to optimize strategies for CRC prevention and detection.

Keywords: Colorectal cancer; Adenoma Detection Rate (ADR); Polyp Detection Rate (PDR); CRC Related Symptoms; Early Detection

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Introduction

Around the world, colorectal cancer is one of the biggest health issues mainly because it comes third among the most commonly diagnosed types of cancer and second as a cause of death from cancer globally [1-3]. The survival rate for CRC depends on which stage it has been detected; this implies that many people could be saved if diagnosed early [4,5]. However, only 67.1% to 71.8% of suitable candidates are tested and diagnosed using a fecal occult blood test (mainly through Fecal Immunochemical Test-FIT) or colonoscopy, which can detect this cancer when still in its pre-cancerous phase [6,7].

Polyps Detection Rate (PDR) and Adenoma Detection Rate (ADR) are two running indicators used to evaluate screening programs for colorectal cancer [8]. These metrics reflect a program's ability to identify conditions that could lead to cancer before it develops [9,10]. This explains why they are often regarded as standards against which screening quality should be measured [9-11]. A high ADR and PDR represent greater success in finding and removing precancerous lesions to prevent CRC development better through such initiatives [11].

Most current guidelines recommend colonoscopies based primarily on age and family history [12-14]; however, it is well known that other manifestations such as hematochezia, abdominal pain, change in bowel habits, anemia and/or a positive FIT might also be linked to the CRC location [15-20]. Research has indicated that there exists a significant correlation between rectal bleeding and an elevated risk of CRC [21], whereas more than 30% of individuals diagnosed with CRC concurrently experience anemia [22]. Nevertheless, there remains a paucity of investigation regarding the relationship between these clinical symptoms and the prevalence of polyps detected through colonoscopy, specifically pertaining to advanced neoplasia (PDR and/or ADR).

Understanding this relationship can improve screening practices by incorporating symptom-laboratory-based risk assessments into existing guidelines. Several studies have shown that including symptoms in screening protocols may result in early detection and improved outcomes [23,24]. Considering the heterogeneous nature of CRC manifestations [25], it is imperative to comprehend their occurrence within an extensive patient cohort to enhance the efficacy of screening and diagnostic methodologies.

The present investigation delves into the relationship between frequently reported clinical and lab manifestations associated with CRC and the detectability of polyps and adenomas. Our objective is to ascertain whether these parameters may serve as reliable precursors for assessing the risk of CRC through a comprehensive analysis of a cohort of patients who have participated in CRC screening.

Materials and Methods

Study design and Data source

This is a retrospective cross-sectional study that looked at 235,781 colonoscopies performed from 2016-2022 in eight multi-center sites connected to Assuta Medical Centers, Israel. We conducted a comprehensive examination of polyps, adenomas, and Colorectal Cancer (CRC) detection, meticulously quantifying these entities according to their number, morphology, and histopathological characteristics. Furthermore, we assessed other colonic abnormalities, the outcomes of biopsies executed during the procedure, patient demographic variables including age and sex, as well as clinical histories encompassing prior diagnoses of cancer or inflammatory bowel disease; specific manifestations associated with CRC, such as hematochezia or fecal occult blood, were also evaluated in conjunction with other indicators such as abdominal pain and anemia.

This comprehensive dataset was utilized to compute the Adenoma Detection Rate (ADR) and the Polyps Detection Rate (PDR) in order to elucidate the relationships among patient symptoms, demographic variables, and the efficacy of Colorectal Cancer (CRC) screening, with the objective of improving early detection and screening methodologies. The Institutional Helsinki Ethics Board approved the study at Assuta Medical Center under protocol number 0043-22-ASMC.

Statistical analysis

IBM SPSS Statistics version 25.0 was used for statistical analysis. To compare categorical variables between groups, a Chi-square test was applied while continuous ones were assessed using unpaired Student's *t*-test after confirming the normal distribution of our data through graphical methods like histograms or Q-Q plots. ADRs among different ages were compared using the chi-squared test as well. A P value <0.05 was considered statistically significant.

Results

The survey consisted of 235,781 colonoscopy records gathered from 2016-2022. The result reveals great variations in the proportion of people with CRC-related symptoms across different patient populations. For instance, hematochezia was observed in 7.5% of patients, while fecal occult blood (FIT) appeared in 9.3%. Abdominal pain was reported by 10.8% of patients, while anemia was diagnosed in 5.7%. Additionally, 14.5% showed family history of CRC (Table 1). Diverse combinations or isolated clinical-lab picture revealed that colorectal carcinoma is characterized by multiple phenotypes rather than a singular clinical representation, both within the examined cohort and in a broader global context.

Subsequently we correlated this data with PDR and ADR, by stratifying patients into cohorts predicated on the presence of symptoms, whether singularly or in combination. Thereafter, we explored PDR and ADR in relation with these cohorts, by juxtaposing the outcomes of individuals exhibiting these manifestations against those devoid of them (Table 2, 3). This model helped us in understanding how the above-mentioned parameters-based risk profiles translate into polyps and adenomas prevalence, thus clarifying their potential influence on screening effectiveness.

The overall ADR and PDR for the whole study population were 26% and 32%, respectively. Upon examination of the dataset in relation to the presence of symptoms, it was observed that patients

Table 1: Prevalence of clinical and lab parameters related to CRC in this study.

Parameters related CRC	Percentage (%)
Abdominal pain	10.80%
Anemia	5.70%
Hematochezia	7.50%
FIT	9.30%
Family history of CRC	14.50%

Table 2: Polyps Detection Rate (PDR) in relation to CRC-related manifestations.

Total Population	Total Population (n)	Patients with polyps (n)	PDR (%)
Abdominal pain	25579	7012	27.40%
Asymptomatic	210202	71079	33.80%
Anemia	13552	3779	27.90%
Normal hemoglobin level	222229	64312	28.90%
Hematochezia	17760	6533	36.80%
No hematochezia	218021	62558	28.70%
Family history of CRC	34351	12936	37.70%
No family history of CRC	201430	67155	33.30%
Positive FIT	21883	10571	48.30%
Negative FIT	213898	67520	31.60%

Table 3: Adenoma Detection Rate (PDR) in Relation to CRC-Related manifestations.

Total Population	Total Population (n)	Patients with Adenoma (n)	ADR (%)
Abdominal pain	25579	2246	8.80%
Asymptomatic	210202	26070	12.40%
Anemia	13552	1084	8.00%
Normal Hemoglobin level	222229	27232	12.30%
Hematochezia	17760	1912	12.10%
No hematochezia	218021	26404	10.80%
Family history of CRC	34351	3753	10.90%
No family history of CRC	201430	24563	12.20%
Positive FIT	21883	4704	21.50%
Negative FIT	213898	23612	11.00%

Table 4: Polyps Detection Rate (PDR; %) by combination of clinical and laboratory manifestations of CRC.

Parameters Combination	PDR (%)
CRC family history and abdominal pain	50.90%
CRC family history with anemia	56.20%
CRC family history with hematochezia	62.30%
CRC family history and FIT positive	48.40%
Positive FIT and abdominal pain	37.60%
Positive FIT and anemia	42.50%
Occult blood and Rectal bleeding	41.10%
Hematochezia and anemia	31.10%
Abdominal pain and anemia	24.00%

Table 5: Adenoma Detection Rate (PDR; %) by combination of clinical and laboratory parameters.

Symptoms Combination	ADR (%)
CRC family history and abdominal pain	9.60%
CRC family history with anemia	7.70%
CRC family history with hematochezia	11.20%
CRC family history and a positive FIT	20.60%
FIT positive and abdominal pain	12.20%
FIT positive and anemia	11.50%
Occult blood and Rectal bleeding	11.60%
Hematochezia and anemia	11.10%
Abdominal pain and anemia	7.40%

presenting with hematochezia exhibited an ADR of 12.1% and a PDR of 36.8%, in contrast to non-bleeding patients whose corresponding rates were 10.8% and 28.7% respectively. Furthermore, in patients with a positive FIT there were an ADR of 21.5% and a PDR of 48.3%, when compared to the alternative cohort, which reported rates of 11% and 31.6%, respectively. In the context of anemic patients, their respective ADR was documented at 8%, while their PDR was noted at 27.9%, contrasting with non-anemic subjects who exhibited rates of 12.3% and 28.9%. In patients complaining about abdominal pain, the ADR was 8%, whereas the PDR was recorded at 27.4%; this is juxtaposed with those individuals who did not report abdominal pain, whose rates were evaluated accordingly. Lastly, patients with a family history of CRC had an ADR of 10% in addition to a PDR of 37.7%. Reported ADR and PDR were 12% and 33.3% for patients without a CRC family history.

The findings suggest that certain manifestations such as hematochezia, positive FIT, and a family history of CRC are associated with higher probability of ADR and PDR, indicating greater chances of finding adenomas and polyps during colonoscopy and highlighting integration of clinical-based risk assessment into prevailing colorectal cancer screening guidelines.

Additionally, the distribution of PDR over various combinations of CRC-related manifestations was analyzed to identify the strongest predictors for CRC (Table 4). Our results showed that a combination of family history and hematochezia resulted in a highest PDR (62.3%), pointing to a strong association with the risk of CRC. This was followed by combinations involving anemia or abdominal pain reported by patients, which had PDRs of 56.2% and 50.9%, respectively. Thus, it can be stated that these specific symptom clusters are characterized by high levels of cancer detection rates among colonoscopy participants with a familial history of colorectal carcinoma, thus further supporting their role as important indicators for suggesting early colonoscopic screening practices. Among occult blood combinations, a positive FIT plus anemia registered the highest PDR value of 42.5%; this was followed by occult blood and rectal bleeding (41.1%). A positive FIT and abdominal pain demonstrated a PDR of 37.6%. Hence this last combination is not a strong predictor for CRC when compared to those a family history of CRC.

On the contrary, some relationships between abdominal pain and anemia (PDR 24.0%) and hematochezia and anemia (PDR 31.1%) had very low PDRs, thus implying their comparatively weak predictive utility for colon cancer. These findings underscore the importance of some parameters in stratifying patients for early and targeted CRC screening.

The identification of potential predictors for Colorectal Cancer (CRC) is critical in evaluating the Adenoma Detection Rate (ADR) associated with the various symptom combinations pertinent to CRC (Table 5). Our findings indicated that the adenoma detection rate reached its peak (20.6%) in instances where a familial history of CRC was present alongside positive occult blood tests, suggesting a probable correlation and an elevated risk for the development of CRC.

Another significant finding was seen when a positive FIT result was associated with abdominal pain, leading to an ADR score of 12.2%. Similarly, in patients with hematochezia, the ADR was 11.6%. Intriguingly, this combination resulted in an enhanced adenoma detection rate (11.2%), thereby reinforcing the significance of utilizing both familial cancer history and the presence of hematochezia as critical indicators for early screening for Colorectal Cancer (CRC). In contrast, other combinations such as a familial history of CRC alongside with anemia (7.7%) and experiencing abdominal pain in conjunction with anemia (7.4%) were correlated with diminished detection rates, thereby indicating a comparatively decreased probability of recognizing adenomatous polyps.

Discussion

The current study aimed to explore the relationship between specific CRC-related manifestations and the effectiveness of CRC screening, as measured by PDR and ADR. Our findings reveal significant correlations between certain parameters, particularly hematochezia, family history of CRC, and a positive FIT with higher PDR and ADR, suggesting that these categories could serve

Summary Table 1 with Significance.

Symptom	Observed Positive	Observed Negative	Expected Positive	Expected Negative	χ^2 Value	p-value	Significant?
Abdominal Pain	7,012	71,079	21,307	56,784	18,363	<0.001	Yes
Anemia	3,779	64,312	17,697	50,394	1,98,329	<0.001	Yes
Hematochezia	6,533	62,558	16,558	52,533	7,977	<0.001	Yes
Family History of CRC	12,936	67,155	19,736	60,355	4,126	<0.001	Yes
Positive FIT	10,571	67,520	23,249	54,842	11,831	<0.001	Yes

Summary Table 2 with Significance.

Symptom	Observed Positive	Observed Negative	Expected Positive	Expected Negative	χ^2 Value	p-value	Significant?
Abdominal Pain	2,246	26,070	6,684	21,632	4,527	<0.001	Yes
Anemia	1,084	27,232	6,415	21,901	30,143	<0.001	Yes
Hematochezia	1,912	26,404	6,558	21,758	23,879	<0.001	Yes
Family History of CRC	3,753	24,563	6,862	21,454	5,709	<0.001	Yes
Positive FIT	10,571	67,520	23,249	54,842	11,831	<0.001	Yes

as valuable indicators for targeted CRC screening. The analysis indicates that patients presenting with rectal bleeding and fecal occult blood tests, both independently, exhibited markedly higher PDR and ADR compared to those without it. This aligns with previous studies that have emphasized the importance of these parameters as potential early indicators of CRC [14-19]. The significantly higher PDR observed in patients with a positive FIT (48.3%) and hematochezia (36.8%) compared to those without it, underscores the potential utility of integrating this model risk assessment into existing screening protocols. Our findings also highlight the importance of family history in CRC risk assessment. Patients with a family history of CRC showed a higher likelihood of polyp and adenoma detection, particularly when combined with hematochezia (PDR 62.3%) or with fecal occult blood (PDR 48.4%). This supports existing guidelines that recommend earlier and more frequent screening for individuals with a family history of CRC. The results of this study suggest that incorporating other parameters into CRC screening guidelines could enhance early detection and improve patient outcomes. The current approach, which largely relies on age and family history, may overlook individuals who present with significant symptoms yet fall outside traditional screening criteria. By adopting a more nuanced, symptom-based approach, healthcare providers could identify high-risk individuals who might otherwise be missed by standard screening protocols.

Furthermore, the diminished prevalence of both PDR and ADR linked to alternative presentations, including abdominal discomfort and anemia, particularly in the absence of additional high-risk factors, implies that these symptoms in isolation may possess reduced prognostic significance for Colorectal Cancer (CRC). Nevertheless, these symptoms should not be disregarded, as they may signify other gastrointestinal disorders that necessitate further examination.

One of the strengths of this study is the large and diverse patient population, which enhances the generalizability of the findings. The comprehensive dataset, spanning multiple centers and years, provides a robust foundation for assessing the relationship several parameters and CRC detection rates. However, incomplete data for many cases, especially missing adenoma results, can indeed contribute to a lower ADR. When key information is absent, it skews the overall findings, making the ADR appear artificially low.

Our study underscores the importance of considering specific symptoms, particularly hematochezia, fecal occult blood, and family history of CRC, in the assessment of CRC risk. These findings advocate for the inclusion of clinical-lab-based criteria in CRC screening guidelines to enhance early detection and improve patient outcomes. Future research should focus on refining this model risk assessment and evaluating it impact on screening efficacy and CRC mortality.

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