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Appropriateness of colonoscopies in a Tunisian endoscopy center: factors and EPAGE-I/II criteria comparison

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Abstract

Background There is a growing demand for colonoscopy, worldwide, resulting in increased rate of inappropriate referrals. This “overuse” of colonoscopies has become a major burden for health care.

Objectives to assess the appropriateness of colonoscopies performed at the endoscopy unit of the university hospital of Sousse and to compare these results of appropriateness according to the European Panel of Appropriateness of Gastrointestinal Endoscopy (EPAGE) I and EPAGE II criteria.

Patients and methods this cross-sectional study included all consecutive patients referred for a diagnostic colonoscopy, between January 2017 and December 2018. Patients referred for exclusively therapeutic indications, those with incomplete colonoscopies were not included. Patients with poor bowel preparation or missing data were also excluded. Indications were assessed using the EPAGE I and EPAGE II criteria.

Results From 1972 consecutive patients, 1307 were included. Overall, 986 (75.4%) of all referrals were for out-patients. The majority of patients were referred by gastroenterologists ($n = 1026$ patients; 78.5%), followed by general surgeons ($n = 85$; 6.5%). The commonest indications were lower abdominal symptoms (275; 21%) followed by uncomplicated diarrhea (152; 11.6%). Relevant findings were present in 363 patients (27.7%). Neoplastic lesions were the dominant finding in 221 patients (16.9%). EPAGE I and EPAGE II criteria were applicable for 1237 (88.8%) and 1276 (97.7%) patients respectively. Hematochezia and abdominal pain recorded the highest inappropriate rates with both sets of criteria. Appropriate colonoscopies increased to 76.4% when EPAGE II criteria were applied; whereas uncertain and inappropriate procedures decreased to 10.3% and 10.9% respectively. Appropriateness of indication was significantly higher in hospitalized patients. For the EPAGE II criteria, the specialty of the referring physician was also significantly associated to the appropriate use. The agreement between EPAGE I and EPAGE II criteria was slight using the weighted version of k ($k = 0.153$).

Conclusions The updated and improved EPAGE II guidelines are a simple and valid tool for assessing the appropriateness of colonoscopies. They decreased the inappropriate rate and the possibility of missing potentially severe diagnoses.

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Keywords Appropriateness review, Colonoscopy, Diagnostic techniques and procedures

Introduction

In recent years, several factors led to a gradually increased demand for diagnostic colonoscopies especially its availability, the marked and continuous quality improvement, the achievements in patient's safety and tolerability as well as the implementation of colorectal screening programs [1, 2]. These reasons for growing demands may lead to an "over use" of this procedure with increasing inappropriate indications that does not respond to clinical practice guidelines. This has raised significant concerns over exposing patients to unnecessary risks, increasing the overall costs as well as the waiting time for colonoscopy [3–5]. Appropriate use of colonoscopy as a fundamental procedure in the diagnosis of digestive diseases, is a major criteria of quality of care [6]. Therefore, selecting and prioritizing the demands is very important to avoid overburdening endoscopy units, optimize efficiency and cost-benefit of this procedure, and reduce potential risks resulting from inadequate colonoscopy referrals.

Over the past decades, a range of criteria has been developed for assessing the appropriateness of referrals for colonoscopy based on the RAND appropriateness method particularly the criteria developed by the European panel on the appropriateness of gastrointestinal endoscopy (EPAGE) [7–11]. These internet based criteria, were created with the help of an expert panel, and published on 1998 (EPAGE-I). Although they have been developed with sound methodologies and have been validated, they are still considered imperfect due to their suboptimal sensitivity and poor specificity, which raised the need for more accurate selection strategies. Thus, they were revised and updated in 2008 (EPAGE-II criteria). The latter criteria were being the most accepted for their improved sensitivity for relevant findings and higher appropriateness rates of the indications [11, 12].

Adherence to these criteria in clinical practice may contribute to reducing the rates of inappropriateness and more interestingly, to decreasing the risk of ignoring significant lesions.

However, the weak agreement among the two versions of guidelines represents a real problem as the magnitude of inappropriate use depends on the criteria chosen.

To our knowledge there have been no reported studies comparing these two sets of criteria in Tunisia. Also, we could not found enough publications aiming at the evaluation of the appropriateness of colonoscopy which left a gap on essential understanding of the reasons underlying the upward trend of colonoscopies. Due to limited resources, we critically reviewed our clinical practice in order to help propose efficient strategies to control the growing demand in our endoscopy unit.

Thus, the aims of the present study were [1] to assess the appropriateness of colonoscopies performed at the endoscopy unit of the university hospital of Sousse and [2] to compare these results of appropriateness according to EPAGE I and EPAGE II criteria, in order to identify the most appropriate version for our population characteristics.

Patients and methods

We performed a cross-sectional study in the gastrointestinal endoscopy unit at the university hospital of Sahloul in Tunisia. All consecutive patients (hospitalized or outpatients) referred for a diagnostic colonoscopy between January 2017 and December 2018, were included. Non inclusion criteria were referrals for exclusively therapeutic indications and patients with incomplete colonoscopies, except for those who had a benign or malignant stricture preventing a complete examination. Patients with poor bowel preparation or missing data were also excluded.

Data collection

Demographic data were collected retrospectively. The following variables were recorded: sex, age, medical history, type of patient (outpatient or hospitalized), indication for colonoscopy (when several indications were identified, the one leading the highest EPAGE score was selected), specialty of the prescriber, further colonic explorations before colonoscopy. The results of endoscopic and histological findings were also collected.

The EPAGE score, or "Evaluation of Predictive Accuracy of GI Endoscopy," serves as a tool for evaluating the appropriateness of gastrointestinal endoscopic procedures, such as colonoscopies, by assessing various clinical criteria. These criteria encompass clinical indications, patient characteristics (like age and symptoms), and the balance between potential benefits and risks associated with the procedure. EPAGE employs a scoring system where each criterion is assigned a specific weight or score, determined by expert consensus and clinical guidelines, to guide decision-making regarding whether a procedure is warranted.

The appropriateness of colonoscopy referrals was determined with both sets of criteria EPAGE I and EPAGE II (Table 1), available at www.EPAGE.ch. Each indication was assigned an appropriateness score from 1 to 9. Colonoscopy was appropriate if the score was 7 to 9 and inappropriate between 1 and 3. The appropriateness of the colonoscopy was uncertain for a score between 4 and 6. The score was inapplicable when the indication

Table 1 Appropriateness classification by clinically relevant diagnoses using EPAGE I and EPAGE II criteria

Relevant findings	AN n (%)		A n (%)		U n (%)		I n (%)		NA n (%)		total
	EPAGE I	EPAGE II	EPAGE I	EPAGE II	EPAGE I	EPAGE II	EPAGE I	EPAGE II	EPAGE I	EPAGE II	
Colorectal cancer	7 (10.3)	55 (80.9)	14 (20.6)	9 (13.2)	26 (38.2)	3 (4.4)	8 (11.2)	1 (1.5)	13 (19.1)	0	68
Advanced adenoma	8 [13]	48 (84.2)	18 (31.5)	8 (14)	11 (19.2)	1 (1.7)	12 (21)	0	8 (14)	0	90
Non advanced adenoma	22 (24.4)	37 (41.1)	21 (23.3)	18 (14)	29 (32.2)	7 (7.7)	12 (13.3)	26 (28.8)	6 (6.6)	2 (2.2)	57
Serrated adenoma	1 (16.6)	4 (66.6)	1 (16.6)	2 (33.3)	2 (33.3)	0	2 (33.3)	0	0	0	6
Crohn's disease newly diagnosed	1 (4.3)	20 (87)	7 (30.4)	1 (4.3)	13 (56.5)	2 (8.7)	2 (33.3)	0	0	0	13
Ulcerative colitis newly diagnosed	0	10 (76.9)	7 (53.8)	0	4 (30.8)	1 (7.7)	2 (8.7)	2 (15.4)	0	0	23
CD later identified as UC	0	0	1 (33.3)	1 (33.3)	2 (66.7)	0	0	2 (66.6)	0	0	3
Microscopic colitis	0	8 (100)	5 (62.5)	0	3 (37.5)	0	0	0	0	0	8
Ischemic colitis	0	1 (100)	0	0	1 (100)	0	0	0	0	0	1
Eosinophilic colitis	0	1 (100)	1 (100)	0	0	0	0	0	0	0	1
Infectious colitis	1 (14.3)	4 (57.1)	1 (14.3)	2 (28.6)	2 (28.6)	1 (14.3)	1 (14.3)	0	2 (28.6)	0	7
Severe active known IBD	0	0	7 (30.7)	15 (65.2)	8 (34.8)	2 (8.7)	8 (34.8)	6 (26)	0	0	23
Non neoplastic stricture	0	0	0	26 (81.2)	30 (93)	4 (12.5)	2 (6.0)	2 (6.2)	0	0	32
Angiodysplasia	1 (3.2)	26 (83.9)	8 (25.8)	0	10 (32.3)	4 (12.9)	3 (9.7)	1 (3.2)	9 (29.0)	0	31

(AN: appropriate and necessary; A: appropriate; U: Uncertain, I: inappropriate; NL: not listed;

n (%))

was not included in any of the 309 scenarios provided by the site of EPAGE.

The following endoscopic findings were categorized as relevant: neoplastic lesions including colorectal cancer (CRC) and adenomatous polyps (conventional adenoma, serrated adenoma), inflammatory bowel disease (IBD), non-malignant stenosis, angiodysplasia, ischemic colitis, microscopic colitis, infectious colitis and eosinophilic colitis [17].

Statistical analysis

All statistical analyses were carried out using the SPSS statistical package (version 24.0, SPSS Inc, Chicago, IL, USA),

Continuous variables were described as means \pm standard deviations, when normally distributed. Categorical variables were presented with absolute and relative frequencies.

In univariate analysis, categorical variables were compared using chi-square and Fisher's exact tests. Continuous variables were compared using Students t-tests. We considered a two-tailed p-value of 0.05 or less statistically significant.

We analyzed the agreement between the EPAGE I and the EPAGE II criteria by using the weighted version of kappa.

Sensitivity, specificity, positive predictive value and negative predictive value for significant lesions and CRC were calculated and used as objective criteria to validate both sets of criteria.

Results

During the study period, 1972 consecutive patients were eligible for the study. Among them, 665 were excluded due to: incomplete examination of the colon (361), therapeutic purposes (78), or missing data (147) (Fig. 1).

Of the remaining 1307 patients, there were 593 women (45.4%) and 714 men (54.6%) (Sex ratio=1.2) with a mean age of 54 \pm 15.6 years. Of them, 849 (65%) were over 50 years.

Overall, 986 (75.4%) of all referrals were for out-patients. The majority of patients were referred by gastroenterologists ($n=1026$ patients; 78.5%), followed by general surgeons ($n=85$; 6.5%), general practitioners and other specialties ($n=196$; 15%). The commonest indications were lower abdominal symptoms (275; 21.0%) followed by uncomplicated diarrhea (152; 11.6%).

Screening colonoscopies in asymptomatic patients or with known IBD represented 4.5% of the overall indications. EPAGE I and EPAGE II criteria were applicable for 1237 (88.8%) and 1276 (97.7%) patients respectively.

According to EPAGE I criteria, the indications of colonoscopy were labeled appropriate in 564 (43.2%) patients, uncertain in 424 (32.4%) and inappropriate in 172 (32.4%) patients. Appropriate colonoscopies increased to 76.4% when EPAGE II criteria were applied, whereas uncertain and inappropriate procedures decreased to 10.3% and 10.9% respectively. As detailed in Table 2, hematochezia and abdominal pain recorded the highest inappropriate rates with both sets of criteria (Table 2).

On univariate analysis, appropriate indication was associated with age (>50 years) but not with gender, with both sets of criteria. Appropriateness of indication was significantly higher in hospitalized patients ($p<0.05$). For the EPAGE II criteria, the specialty of the referring physician was also significantly associated to the appropriate use. The agreement between EPAGE I and EPAGE II criteria was slight using the weighted version of k ($k=0.153$) (Table 3).

The classification of appropriateness was coincident in only in 428 patients (32.7%). The two version were particularly divergent in the assessment of uncomplicated

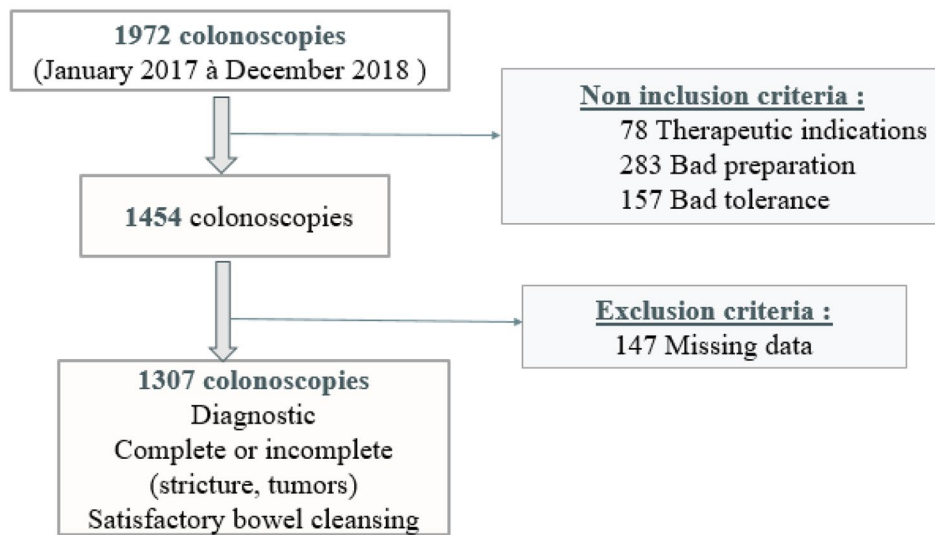


Fig. 1 Synopsis study

Table 2 Distribution of inappropriate colonoscopies according to EPAGE and EPAGE-II criteria by indications

Inappropriate indications	EPAGE I n (%)	95% CI	EPAGE II n (%)	95% CI
Iron deficiency anemia	4 (2.3)	0.07–4.57	1 (0.7)	0.0001–2.08
Hematochezia	35 (20.3)	14.33–26.36	2 (1.4)	0.0001–3.34
Lower abdominal pain	28 (16.2)	10.76–21.79	60 (42.2)	34.12–50.37
Change in bowel habits	1 (0.5)	0.0001–1.71	2 (1.4)	0.0001–3.34
Uncomplicated Diarrhea	23 (13.3)	8.28–18.45	2 (1.4)	0.0001–3.34
Evaluation of known Ulcerative colitis	22 (12.7)	7.79–17.78	20 (14.0)	8.36–19.80
Evaluation of known Crohn's disease	14 (8.1)	4.05–12.22	12 (8.4)	3.87–13.02
Surveillance post polypectomy	34 (19.7)	13.81–25.71	39 (27.4)	20.12–34.80
Surveillance after curative intent resection of CRC	2 (1.1)	0.0001–2.76	1 (0.7)	0.0001–2.08
CRC screening	1 (0.5)	0.0001–1.71	1 (0.7)	0.0001–2.08
Other	8 (4.5)	1.50–7.79	2 (1.4)	0.0001–3.34
Total	172 (100)		142 (100)	

Table 3 Agreement between EPAGE I and EPAGE II criteria

		EPAGEII					Total
		AN	A	U	I	NL	
EPAGEI	AN	133	96	3	40	0	236
	A	214	101	4	3	6	328
	U	167	129	84	42	2	424
	I	23	6	44	93	6	172
	NL	129	1	0	0	17	147
Total		666	333	135	142	31	1307

(AN: appropriate and necessary; A: appropriate; U: Uncertain, I: inappropriate; NL: not listed)

diarrhea (from 13.3 to 1.4% inappropriate colonoscopies), hematochezia (from 23.3 to 1.4% inappropriate explorations) and post polypectomy surveillance where the 19.7% of explorations deemed inappropriate by EPAGEI, raised to 27.4% with EPAGE II.

Of the 1307 colonoscopies, 55% were macroscopically and histologically normal. Relevant findings were present in 363 patients (27.7%). Neoplastic lesions were the

dominant finding in 221 patients (16.9%), and included non advanced adenomas (24.7%), advanced adenomas (4.3%) and CRC (5%). Angiodysplastic lesions were diagnosed in 31 patients (8.5%), IBD in 36 (9.8%) and benign stenosis in 31 (8.5%).

The overall diagnostic yield (DY) for the 1307 colonoscopies was 27.1%. Surveillance after polypectomy had the highest DY (55.7%), whereas, the exploration of

abdominal pain had the lowest DY (8.7%). The DY for men was significantly higher than that for women (47.8% vs. 28.6%; $p=0.001$). When comparing those aged 50 years or more with younger patients, increasing age did not influence the DY (35.9% vs. 39.8%; $p=0.92$).

Sensitivity, specificity, positive predictive value and negative predictive value for both EPAGE I and EPAGE II are listed in Table 4. Sensitivity was higher and specificity was lower for the EPAGE II (Table 4).

Discussion

To our knowledge, this is the first Tunisian study evaluating the appropriateness of colonoscopies with comparison of EPAGE I and EPAGE II criteria.

The main results of our study showed that only 43.2% of our colonoscopies were appropriate when applying EPAGE I criteria. This percentage of appropriateness increased markedly to 76.5% by using the EPAGE II criteria.

Interestingly, appropriateness rates are variable among studies depending on the type of criteria used [13, 18–21]. The 43.2% appropriate use found in our study by using the EPAGE I criteria was similar to the rate of 40% reported by Assi et al. [18] and lower than the 59% reported by Terraz et al. [22]. Previous researches have shown that appropriateness rates of colonoscopies were variable between 62.3% and 81%, according to the EPAGE II criteria [14, 15, 20, 21].

Higher appropriate use in our study was associated to older age (more than 50 years old) and hospitalized patients. However, gender was not associated with appropriateness [15, 19, 23]. These results were consistent with those reported in the previous literature [13, 21, 24, 25].

The main disagreement between the two sets of criteria was related to their assessment of Hematochezia (23.3% were deemed inappropriate by EPAGE I, whereas 1.4% were inappropriate according to EPAGE II) and uncomplicated diarrhea (13.3% inappropriate with EPAGE I, 1.4% inappropriate with EPAGE II).

According to EPAGE II, referral for hematochezia in patients over 50 years, results in a high appropriateness even if a presumed anorectal source of bleeding has been identified which seems to be safer in terms of detecting synchronous lesions [26]. When EPAGE I criteria were

used in this group of patients, the indication was deemed uncertain or even inappropriate [16].

The assessment of diarrhea according to EPAGE I criteria required prior prescription of anti-diarrheal drugs before referring the patient for colonoscopy. However, this requirement was not included in the new version of the guidelines EPAGE II [27]. Regarding the surveillance post polypectomy, the EPAGE II criteria updated the standardized time intervals for the endoscopic surveillance based on the best available scientific evidence [28]. In the current study, the rate of normal colonoscopies (55%) was similar to previous findings of Denis et al. [24] (54%) and Agar et al. [29] (57.8%), but lower than those of Chan et al [30] (65.5%).

The diagnostic yield of colonoscopy is considered an important parameter for judging both the usefulness and the appropriateness of this procedure [31]. The 27.1% found in our study was an intermediate figure between the 23.5% and 40.8% reported in other studies [15, 19, 24, 32, 33]. These figures seem very dependent on the definition used for relevant findings, thus, a direct comparison is difficult [34, 35].

Regarding the probability of detecting a clinically relevant finding, the indication of the colonoscopy is a main factor affecting the DY [36, 37]. Patient's gender (male vs. female) is also a significant determinant of the DY [14, 18, 20, 31]. The DY was significantly higher in men.

In our study although increasing patient age was significantly associated to the appropriateness of the indication, it had no influence on the DY, this has been also observed in other studies [14, 32]. In fact, there was no significant difference in DY in patients >50 years compared with those <50 years. The patterns of relevant findings diagnosed for these two groups of patients were different: adenomas and CRC were the main findings in patients aged >50 years whereas IBD and Colitis were found more frequently in young patients [38, 39].

When using the EPAGE II guidelines, we found that appropriate indications significantly increased the DY compared to uncertain and inappropriate indications. This finding is in agreement with those of many other European studies [14, 20]. However, in the case of the EPAGE I criteria the situation was different [40].

For the uncertain indications according to the EPAGE I, we were able to diagnose 141 relevant findings

Table 4 Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for the EPAGE I and EPAGE II guidelines

	EPAGE I			EPAGE II		
	Relevant findings	CRC	CI 95%	Relevant findings	CRC	CI 95%
Sensitivity (%)	41	38.1	38.3-43.7%	82.0	94.1	79.9-84.1%
Specificity (%)	48.4	50.8	45.7-51.1%	23.0	22.6	20.7-25.3%
PPV (%)	67.8	3.7	65.3-70.3%	76.5	95.5	74.2-78.8%
NPV (%)	23.6	94.3	21.3-25.9%	29.6	6.4	27.1-32.1%

(CRC: colorectal cancer ; CI: Confidence Interval)

(DY=33.2%). Thus, it may have been reasonable to consider uncertain indications as a part of the appropriate indications when applying this set of criteria. In the case of the EPAGE II criteria, the DY of the uncertain group was lower (18.5%) and no CRC was diagnosed among these patients. These important findings showed that an uncertain indication does not always justify colonoscopy as a first approach. Therefore, an alternative management of this group may be considered [14].

Our study showed that the EPAGE I criteria were not as sensitive as the EPAGE II, with an important number of serious diagnoses among the uncertain and inappropriate groups. According to the literature, applying EPAGE I criteria and performing colonoscopies with appropriate indications only, could lead to missing up to 15% of relevant diagnoses [40]. This finding was in agreement with those of Bersani et al., who showed a low sensitivity of appropriateness guidelines [41].

On the other hand, appropriateness according to the EPAGE II criteria significantly increased the probability of relevant findings at colonoscopy, and therefore, reduced the possibility of oversight of potentially severe lesions. Our study is consistent with those reported in the previous literature [14, 20, 42, 43]. Eskeland et al [14] showed that the EPAGE II guidelines have a high sensitivity and negative predictive values for detecting relevant diagnoses (93.1%; 75.5%) and CRC (98%; 97%).

However, in this current study, we demonstrated that this positive association between appropriateness and the DY of relevant findings and CRC is imperfect. Therefore, these guidelines should be used to assist the clinician in making the decision about the need to request a colonoscopy but they should not be used as the only tool for the decision. These results are consistent with other EPAGE II studies [14, 20, 42].

Regarding the internet based approach; we demonstrated that the EPAGE web pages are easy to use. However, some of the alternatives are not fully developed. In our study, we solved this issue by consulting the EPAGE methodology articles [11, 28, 44]. Nevertheless, this is constraining and time wasting. Terraz et al. [22] reported that consulting the website took a mean time of 1.8 min. The other disadvantages of these guidelines are the lack of accessibility to internet and the disturbance of the patient-physician relationship.

We recommend the updated and improved EPAGE II guidelines as a straightforward and valid tool for assessing the appropriateness of colonoscopies and identifying inappropriate referrals in clinical practice. However, it is important to note that the EPAGE II criteria, published in 2009, may be outdated and not fully applicable due to recent recommendations on surveillance after polypectomy [1, 2].

In conclusion, the EPAGE II guidelines are a valid tool for assessing the appropriateness of colonoscopies and for detecting inappropriate referrals in clinical practice and they extended the appropriateness of colonoscopy and decreased the inappropriate rate and the possibility of missing potentially severe diagnoses. These guidelines are more sensitive than the first set of criteria in detecting relevant diagnoses and CRC. They can help in prioritizing patients, organizing waiting lists, reducing the burden of unnecessary workload, reducing costs and improving the quality of care of the public healthcare system.

Nevertheless, the sensitivity and specificity of the EPAGE II criteria indicate that these guidelines should be viewed merely as an aid in medical decision-making and not replace the physician's judgement. They should be integrated into a global clinical evaluation.

Finally, these findings should be used to establish local guidelines for colonoscopy indications more adapted to local epidemiological and symptom profile.

Abbreviations

CRC	Colorectal Cancer
IBD	Inflammatory Bowel Disease
EPAGE	European Panel on the Appropriateness of Gastrointestinal Endoscopy

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Author contributions

All authors reviewed the manuscript. All authors: (Aya Hammami, Amira Hassine, Jihene Sahli, Hela Ghali, Omar Khalil Ben Saad, Nour Elleuch, Wafa Dahmani, Ahlem Braham, Salem Ajmi, Aida Ben Slama, Hanen Jaziri and Mehdi Ksiaa) contributed equally to this work.

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Data availability

data is available upon reasonable request from the corresponding author.

Declarations

Ethics approval and consent to participate

The study ensured patient anonymity by rigorously safeguarding their personal information and identities throughout the research process, aimed at protecting participant privacy and confidentiality. Moreover, oral consent was obtained from patients prior to their inclusion in the study. Oral consent entails verbally informing participants about the study's nature, purpose, and their rights as participants. It is important to note that these patients were already scheduled to undergo colonoscopy, thus their participation in the study did not subject them to any additional risks. Our only requirement was their consent for the information gathered during colonoscopies to be published. The members of the Ethics Committee of the Sahloul University Hospital, Sousse, Tunisia, meeting on 21 February 2024, certified that the research project entitled "The appropriateness of colonoscopies in a Tunisian endoscopy centre: associated factors, and comparison of EPAGE-I and EPAGE-II criteria", proposed by Dr Aya Hammami et al, is registered under the number HS 15-2024.

Consent for publication

Not Applicable.

Ethics committee full name

The Ethics Committee of the Sahloul University Hospital, Sousse, Tunisia.

Competing interests

The authors declare no competing interests.

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