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Evaluation of quality measures for Colonoscopy in Colorectal cancer screening among patients in Mahosot hospital, Vientiane capital, Lao PDR: A cross-sectional, prospective study

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ABSTRACT

Background: In Lao PDR, colorectal cancer (CRC) is a significant public health concern, accounting for 8.5% of all cancer cases and ranking as the fourth most common cancer in the country. Colonoscopy emerges as the gold standard for CRC screening. The quality of a colonoscopy is critical to achieving positive patient outcome. Key quality indicators mainly include adenoma detection rate, bowel preparation adequacy, average withdrawal time, cecal intubation rate and complication post colonoscopy procedure.

Objectives: This study aimed to evaluate the prevalence of colorectal polyps and cancer detected, determine adenoma detection rate, and assess the quality of colonoscopy procedure during colorectal cancer screening of our centre and another representative of referral centre in Laos.

Methods: We conducted a cross-sectional descriptive study from July 2023 to February 2024, involving 288 individuals for collecting demographic data, procedure indications, and various colonoscopies.

Results: A total of 288 patients were enrolled in the study. The mean age was 45.57 ± 14.67 years (SD) with approximately equal gender distribution (Female 50.67%). The majority of colorectal cancer screenings were conducted in individuals under 50 years old. Most patients achieved optimal bowel preparation, and underwent complete colonoscopy procedures. Approximately 95.5% underwent a complete colonoscopy with an average withdrawal time of 8.16 ± 4.37 minutes. Pathological analysis revealed non-neoplastic, benign neoplastic, and malignant polyps. The overall adenoma detection rate was 27.63%, with advanced adenoma detection in 5.81% and colon cancer detection in 5.9%. Patients over 50 years exhibited a higher risk of adenoma detection rate while good bowel preparation did not significantly affect detection rates. However, longer withdrawal times during colonoscopy correlated with increased adenoma detection rate.

Conclusion: Our study showed that the quality indicators of colonoscopy were acceptable with results indicating an average risk of colorectal cancer screening with overall adenoma detection rate, achieved adequate bowel cleansing, with high rate of cecal intubation rate, and appropriated withdrawal time examination as per protocol associated with increased adenoma detection.

Keywords: Colonoscopy, Colorectal cancer, Quality measures

1. Introduction

Colorectal cancer is the third most common cancer and is projected to become the second most common cause of mortality with approximately 1 million deaths annually [1]. In Laos, CRC poses a significant public health concern, accounting for 8.5% of all cancer cases and ranking as the fourth most common cancer in the country [2].

Colonoscopy is one of the most effective screening methods for CRC. Since most CRC develop from benign polyps, colonic polyps are very common, especially in patients aged 50 years or older. Detecting and removing colorectal polyps at an early stage can significantly reduce the risk of developing CRC, as shown in large cohort study conducted in the US. This study with a long-term follow-up of 20 years, found that screening colonoscopy was associated with a statistically significant reduction in the risk of CRC (multivariate hazard ratio 0.44; 95% CI, 0.38 to 0.52) and mortality (multivariate hazard ratio, 0.32; 95% CI, 0.24 to 0.45) compared to those who had never undergone screening endoscopy [3].

The quality of colonoscopy can have a significant impact on colon cancer incidence and mortality. Several factor that can impact the quality of a colonoscopy include the skill of the endoscopist, the type of equipment used and the quality of the bowel preparation. Therefore, it is essential to prioritize high-quality screening test to detect colon cancer early and improve patient outcomes. Improving the quality and performance of the procedure is a goal of every endoscopist; however, measuring and applying the quality indicators (QIs) of colonoscopy in daily clinical practice remain as challenges for many practitioners. Optimizing the QIs of colonoscopy, with a focus on the four major indicators: adenoma detection rate (ADR), average withdrawal time (AWT), bowel preparation adequacy, and cecal intubation rate (CIR) [4].

Many countries worldwide follow the ASGE 2015 guideline for quality indicators for colonoscopy for CRC screening in average-risk individuals *(S. Table 1).*

There is limited data regarding screening colonoscopy in Laos. Therefore, this present study aimed to evaluate the prevalence of colorectal polyps and cancer detected during screening colonoscopy, determine ADR, and evaluate of quality of colonoscopy procedure of our centre, as well as another representative of referral centre in Laos.

2. Methods

2.1 Study Area

The study was conducted at the Gastroenterology and Hepatology Department of Mahosot Referral Hospital in Vientiane, where patient demographics, medical facilities, and specialized personnel provided an appropriate setting for colorectal cancer screening. The hospital's accessibility and specialized resources enabled the enrolment and examination of a diverse patient population presenting with gastrointestinal symptoms.

2.2 Study Design

This research employed a cross-sectional, prospective design, targeting adult patients aged 18-74 who presented with symptoms warranting colorectal examination. The study spanned from July 2023 to February 2024, enrolling 288 patients based on predetermined eligibility criteria related to lower gastrointestinal (GI) alarm symptoms, such as lower GI bleeding, iron deficiency anaemia (IDA), significant weight loss, palpable abdominal mass, and positive faecal occult blood tests (FOBT). Screening focused individuals with an average risk of colorectal cancer (CRC), including those aged 50 and above. Exclusion criteria included patients with incomplete colonoscopy, prior history of colon cancer, certain comorbid conditions, and other factors impeding complete medical preparation or the colonoscopy procedure.

2.3 Sample size and sampling

A total of 288 patients were selected for the study using purposive sampling based on the inclusion and exclusion criteria, ensuring a representative cohort of patients with symptomatic indications for colorectal cancer screening. The sample size was determined to provide a reliable assessment of ADR and other quality indicators for colonoscopy.

2.4 Data Collection

The questionnaire was validated following a pre-test to enhance its quality and usability. Data was collected using a structured questionnaire and medical record note from Endoscopy's room, Gastro-enterology and Hepatology Department. A split dose of Sodium Phosphate (SWIFF) 45ml was used as bowel preparation regimen. All colonoscopies were used Fujifilm EC-720R/L, Fujifilm EC-600WL. The ELUXEO Lite EP-6000 Processor and Light source. The procedure was performed by experienced endoscopist, with more than

1000 cases of colonoscopy performed, and one GI fellow with experience in more than 500 cases. Colonoscopy was performed under light sedation using intravenous Midazolam and fentanyl. During the endoscopic withdrawal time, the endoscopist was allowed to perform polypectomy using image enhanced to identify colonic polyp by LCI (Linked Colour Image and BLI (Blue Light Image) mode. The polypectomy specimen was sent for pathology for evaluation. The quality of bowel cleansing was assessed using the Boston Bowel Preparation Scale (BBPS).

2.5 Data Analysis

The data were entered into a computer using Excel or Google form for extraction. Data were analysed by using STATA version 14.0. Continuous data was described using mean, standard deviation (SD), median, minimum and maximum and comparison was made using chi-square test or Fisher's exact test. Findings related to demographic factors, Bowel Cleansing quality, WT and Adenoma detection were analysed using Bivariate and Multiple logistic regressions to determine correlations between variables. A 95%CI was used, and a P-value of <0.05 was considered statistically significant.

2.6 Ethical Clearance

All participants who underwent colonoscopy screening provided written informed consent and answered the questionnaire. The study was approved by Lao Ethical Research Committee, University Health of Sciences on August 03, 2023. (No. 582/REC).

3. Results

A total of 300 patients were enrolled in this study. The recruitment process is illustrated in figure 1. Nine patients were excluded: 4 cases due to a history of colectomy, and 5 cases due to inadequate bowel preparation. Of the remaining 288 patients, 13(4.5%) had incomplete colonoscopy: 6 due to mass obstruction, 6 due to poor bowel cleansing, and 1 due to failed colonoscopy. Therefore, the final sample consisted of 275 patients for CRC screening (Figure 1).

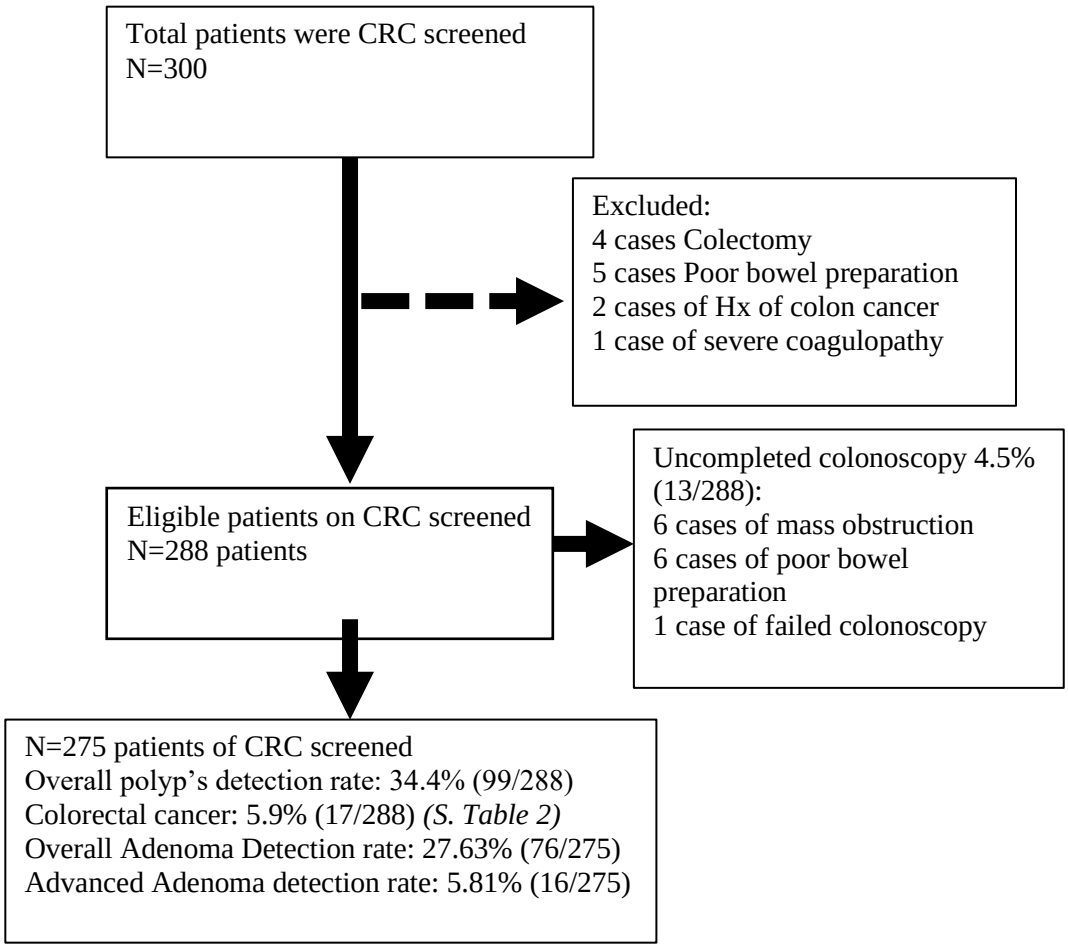

Figure 1: Flow chart of the recruitment process

Among 288 participants, the mean age was 47.59±14.67 years, with a balanced sex distribution, 146/288 (50.69%) being female. More than half of the participants were below 50 years of age, while 42% were age between 50 and 75 years. The average BMI was 22.84 ± 3.51. More than half of patients lived in Vientiane capital and 80% had education beyond high school level. A quarter of participants had health insurance. The most common comorbidities were hypertension (42/288, 15%) and diabetes 16/288, 5.6%. Only 1% of participants were using warfarin and aspirin (Table 1).

Table 1: Patients Characteristics, n=288

Variable	Total (n)	Percentage (%)
Gender		
Male/Female	142	49.31
Female	146	50.69
Age, years, mean (SD)	47.59 ±14.67(20-86)	
Age≤ 50	159	55.2

Variable	Total (n)	Percentage (%)
Age 50-75	120	41.67
Age ≥75	9	3.13
Mean (±SD)	47.59 ±14.67(20-86)	
BMI, mean (SD)	22.84 ± 3.51(15.6-35.2)	
BMI≤18.5	24	8.33
BMI 18.5-24.9	189	65.63
BMI 25-29.9	64	22.22
BMI ≥ 30	11	3.82
Mean (±SD)	22.84 ± 3.51(15.6-35.2)	
Professional		
Government Official	75	26.04
Housewife	79	27.43
Worker	27	9.38
Farmer	20	6.94
Unemployed	11	3.82
Other	76	26.39
Address		
Vientiane capital	160	55.56
Provincial	128	44.44
Education level		
Illiterate	9	3.13
Primary school	50	17.36
High school	140	48.61
Bachelor's degree	75	26.04
> Bachelor's degree	14	4.86
Payment methods		
Out of pocket payment	207	71.88
Health Insurance	81	28.12
Comorbidity	68	23.61
Hypertension	42	14.58
Diabetes	16	5.56
CAD	0	0
Other	8	2.78
Current medication	46	15.97
Anti-hypertensive	43	14.93
Oral hypoglycemic agent	14	4.86
Warfarin	3	1.04
ASA	1	0.35

Abbreviation: BMI; Body Mass Index, CAD; Coronary Artery Disease, ASA; Aspirin

A change in bowel habits is the most common indication of colonoscopy (63.19%), followed by bleeding in the lower gastrointestinal tract (36.81%) and being older than 50 (33.33%). Significant weight loss (9.72%), iron deficiency anaemia (2.08%), surveillance (2.43%), a family history of colorectal cancer (1.39%), and a positive fecal occult blood test (1.04%) are some of the less common signs. This demonstrates how common bowel-related symptoms are among the patients (Table 2).

Table 2: Indication of colonoscopy, n=288

Indications:	Total (n)	Percentage (%)
Age > 50	96	33.33

Indications:	Total (n)	Percentage (%)
FOBT positive	3	1.04
Bowel habit change	182	63.19
Lower GI bleeding	106	36.81
Family history of CRC	4	1.39
IDA	6	2.08
Significant weight loss	28	9.72
Surveillance	7	2.43

Abbreviation: FOBT; Fecal Occult Blood Test, GI; Gastro-Intestinal bleeding, CRC; Colorectal Cancer, IDA; Iron Deficiency Anaemia

Figure 2 illustrated that the overall Adenoma Detection Rate (ADR) was 27.63% (76 cases) with 27.46% in male and 21.23% in females.

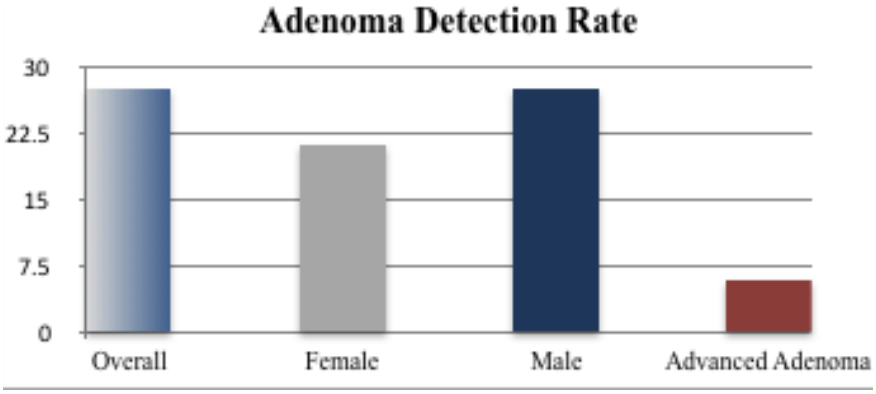

Figure 2: Adenoma Detection Rate among patient underwent colonoscopy

Ninety-nine polyps were detected in 70 cases, resulting in a polyp detection rate of 34.38% (99/288). Two-thirds of polyps were in left-sided colon. Pathologically, they were classified as non-neoplastic polyps, benign neoplastic polyps and malignant polyps accounting for 6.06%, 76.77% and 17.17% respectively. Sixteen cases of advanced adenoma were identified out of 275 cases and colon cancer was detected in 5.9 %. Only one case reported complications, including abdominal pain and post-polypectomy bleeding (Table 3).

Table 3: Description of Polyps detection and pathological finding (n=288)

Variable	Total (n)	Percentage (%)
Polyp detection rate 99/288	**34.375**	
Polyps		
No	218	75.69
Yes	70	24.31
Location:		
Cecum	7	7.07
Ascending colon	12	12.12
Transverse colon	19	19.19
Descending colon	11	11.11
Sigmoid	27	27.27
Rectum	28	28.28

Variable	Total (n)	Percentage (%)
Classification as:		
Right sided colon	36	36.36
Left side colon	63	63.63
Pathological finding: (99)		
Non-neoplastic polyp	6	6.06
Benign neoplastic polyps	76	76.77
Malignant polyp	17	17.17
Complications:		
No	287	99.65
Yes	1	0.35

There was no significant difference in adenoma detection between males and females. Patients over 50 years old had a higher risk of adenoma detection compared to those under 50 years old, with an odds ratio (OR) of 3.27 (95% CI: 2.87-5.71, P<0.001). There was no significant difference in other indications for colonoscopy in CRC screening. Good bowel preparation defined as a Bowel Preparation Scale (BBPS) score of ≥ 6, was not associated with increased adenoma detection. However, colonoscopy examinations with a withdrawal time of more than 9 minutes were associated with increased adenoma detection, with an OR of 4.09 (95% CI: 1.83-9.10, P=0.001) (Table 4).

Table 4: Bivariable and multiple variable analyses of demographic, BBPS and WT of CRC and adenoma detection, n=288

Characteristics	Total sample (n)	Adenoma detection		Crude OR	Adj. OR	95% CI	P-value
		(n)	(%)				
Sex							
Male	142	39	27.46	1	1		
Female	143	31	21.23	0.71	0.2	0.31 – 1.04	0.007
Age							
<50 years	192	32	16.60	1	1		
≥50 years	96	38	39.58	3.27	3.68	1.91 – 6.77	<0.001
Education level							
Illiterate	9	6	55.56	1	1		
Primary school	50	16	32.00	0.37	0.46	0.10 – 2.11	0.300
High school	14	28	20.00	0.20	0.22	0.05 – 0.98	0.040
Bachelor's degree	75	19	25.33	0.27	0.47	0.09 – 2.27	0.300
>Bachelor's degree	14	2	38.33	0.13	0.16	0.01 – 1.40	0.100
WT (minutes)							
WT <6	91	12	3.19	1			
WT ≥6-9	124	28	22.58	1.92			
WT >6	60	23	38.33	4.09	N/A	N/A	N/A
BBPS							
BBPS <6	9	1	11.11	1			
BBPS ≥6	266	62	23.31	0.52	N/A	N/A	N/A

Abbreviation: Crude OR; Crude Odd Ratio, Ad OR; Adjusted Odd Ratio, CI; Confidence Interval WT; Withdrawal Time, BBPS; Boston Bowel Preparation Scale, N/A; Not-Applicable

4. Discussion

Colonoscopy is a widely used procedure for detection and prevention of colorectal cancer, one of the leading causes of cancer-related deaths worldwide. Ensuring the quality of colonoscopy procedure is a crucial for accurate diagnostic, effective treatment, and ultimately, saving lives.

This is a cross-sectional prospective study evaluated the metrics of indicators of colonoscopy procedure for CRC screening in Mahosot hospital, a referral centre in Vientiane, Laos. The characteristics of the patient cohort consistent with previous studies, including a median age of 47.59 years and a balanced gender distribution. Similar findings were noted in studies from Germany by *Adler et. al* and from Thailand by *Pitulak et. al*, respectively [5, 6]. Patients, typically educated beyond high school, sought CRC screening primarily for adenoma detection, influenced by social-economic factor. The high cancer detection rate underscores Mahosot Hospital's role as a referral centre. When compared to neighbouring countries, a study by *Tran et al*. found the cancer detection rate in Vietnam was 3.5%, another study by *Pitulak et al* found 2.3% in Thailand, and another study by *B.R Parry et al* found 5.1 in Singapore [6-8].

An evaluation of colonoscopy quality revealed commendable adherence to pre-procedure protocol, consistent with benchmarks regarding with optimal bowel preparation, which reported 96% cases achieving BBPS ≥ 6[9]. *Lai et al*. was found that in patients with a BBPS ≥ 5, the polyps detection rate was 40% compared to 24% in those with BBPS< 5 (P=0.02). Additionally, a high CI rate of 95.5% was observed in our findings, similar to findings by *Calderwood et al.* and *CD Wells et al* [10, 11]. Only one case (0.35%) experienced a post-colonoscopy complication, which was defined as post-polypectomy bleeding.

The observed polyp detection rate and ADR in our study closely align with established benchmarks (Overall ADR ≥ 25%). Our findings indicate that individuals over the age of 50 years had an increased risk adenoma detection rate, with an odds ratio (OR) of 3.27 [2.87-5.71], P<0. 001. Additionally, a colonoscopy withdrawal time of more than 9 minutes was associated with an OR of 4.09 [1.83-9.10], P=0. 001.These findings are consistent with study by *Zhao et al* [12, 13].

This study provides a very important data for our centre, a major referral centre in Laos. As a pilot study, it is the first study to evaluate the quality of colonoscopy procedures for

CRC screening. However, our study has several limitations. First, it was conducted at only one centre, so this could not represent the general population undergoing colonoscopy for CRC screening. Secondly, the study duration was short and sample size was small. Thirdly, the colonoscopy procedures were performed by endoscopist in Mahosot centre, and data was collected by endoscopist nurse or assisted endoscopist. This could have minimized inter-observer and intra-observer bias. Additionally, the average age of our patient cohort was relatively young 47.5years old, as most individuals who underwent colonoscopy for CRC screening, which could have affected the adenoma detection rate at our centre.

The findings of this pilot study led to the recommendation of an early colorectal cancer screening as part of a nationwide program for the Lao population in cases where the patient was over 50 or had a high risk of developing colon cancer, such as a family member who had a first-relative history of the disease.

It is crucial to empower patients with knowledge about colorectal cancer screening and encourage their active participation in screening programs. Moreover, healthcare providers should prioritize colonoscopy screening for patient with average risk, aged over 50. While this study provides valuable insight, further research is warranted to explore other potential factors influencing ADR during colonoscopy. These may include the impact of sedation protocol, endoscopist experience, and technological advancements in Image Enhanced Endoscopic and AI-assisted colonoscopy systems.

5. Conclusion

Our study demonstrated that the quality indicators of colonoscopy were acceptable, with results indicating an average risk of colorectal cancer screening with overall ADR $\geq$ 25%. The study also achieved adequate bowel cleansing with a high rate of Cecal Intubation Rate (CIR), and appropriated Withdrawal Time (WT) during examinations, in accordance with the protocol. An age over 50 is a strongly associated with an increased adenoma detection, while factors like gender, indication for colonoscopy in CRC screening and bowel preparation did not show significant associations. However, longer withdrawal times during colonoscopy were linked to higher adenoma detection rates.

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S. Table 1: Quality Indicators for colonoscopies CRC screening in Average-Risk Individual ASGE/ACG 2015

Quality metric	Goal
Preprocedural	
Document of appropriate indication for colonoscopy	> 80%
Informed consent is obtained and documented	>98%
Colonoscopy surveillance by recommendation guideline	≥90%
Intra-procedure	
Record bowel preparation quality	> 98%
Adequate bowel cleansing	≥85%
Cecal intubation with photo documentation	≥95%
Measurement of WT	>98%
Average WT in normal screening colonoscopy	≥ 6 minutes
ADR in asymptomatic, average risk individual	≥25% (F≥20%, M≥30%)
Attempt at endoscopic removal of pedunculated polyps and sessile polyps < 2 cm before surgical referral	> 98%
Post procedure	
Incidence of perforation during screening colonoscopy	< 1:1000
Incidence of polypectomy bleeding	<1%

Quality metric	Goal
Post polypectomy bleeding without surgery	≥90%
Appropriate recommendation for timing of the next colonoscopy is documented and provide to the patient after histologic finding are reviewed	≥90%

S. Table 2: Description of 17 individuals with colon cancer detected by screening colonoscopy

No.	Age	Sex	Location	Character of lesion	Pathological finding
1	41	Male	Sigmoid	Mass	Adenocarcinoma
2	54	Female	Ascending	Polypoid mass	Adenocarcinoma with well-differentiated
3	43	Male	Sigmoid	Circumferential mass	Adenocarcinoma
4	36	Male	Rectum	Large circumferential ulcer	Adenocarcinoma
5	40	Female	Rectum	Ulcero-proliferative mass	Adenocarcinoma with moderately poor differentiated
6	63	Male	Rectum	Ulcero -proliferative mass	Adenocarcinoma with well-differentiated
7	38	Male	Rectum	Ulcero-proliferative mass	Adenocarcinoma
8	39	Male	Cecum	Mass	Adenocarcinoma
9	72	Male	Cecum	Proliferative mass	Adenocarcinoma
10	65	Female	Cecum	Mass	Adenocarcinoma with well-differentiated
11	67	Female	Sigmoid	Mass	Adenocarcinoma with well-differentiated
12	50	Female	Rectum	Proliferative mass	Adenocarcinoma with well-differentiated
13	75	Female	Rectum	Polypoid mass	Adenocarcinoma with well-differentiated
14	72	Male	Ascending	Mass	Adenocarcinoma
15	47	Male	Ascending	Large ulcero-proliferative mass	Adenocarcinoma
16	60	Male	Sigmoid	Infiltrative mass	Adenocarcinoma with well-differentiated
17	60	Male	Transverse	Proliferative mass	Adenocarcinoma