Original Article

Comparison of the Effect of Preoperative Colonoscopy and Barium Enema on the Prognosis of Colon Cancer Patients

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Key Words
Colonoscopy;
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Purpose. Complete colonoscopy is usually performed preoperatively in colon cancer patients to exclude synchronous colonic tumors. Some surgeons avoid preoperative endoscopy in cases of a colon tumor with a narrow bowel lumen to avoid dissemination of the tumor cells during the colonoscopy procedure with squeeze pressure. The purpose of this study was to determine whether double-contrast barium enema is an alternative to preoperative whole-colon screening in colon cancer patients with respect to oncologic outcomes.

Methods. We retrospectively reviewed the medical records of patients diagnosed with colon adenocarcinoma and underwent surgery at the Tri-Service General Hospital, Taipei, Taiwan, between January 2008 and December 2013. The patients were randomly divided into two groups. One group underwent complete colonoscopy and the other a double-contrast barium enema for preoperative whole-colon screening. The outcome variables analyzed were postoperative recurrence, disease-free survival, and overall survival.

Results. Three-hundred and two patients were enrolled in this study. They were divided into two groups: 152 (50.3%) who underwent complete colonoscopy and 150 (49.7%) who underwent double-contrast barium enema for newly diagnosed colon cancer. There were no statistically significant differences in pathologic staging between the two groups. Furthermore, recurrence rate, disease-free survival, and overall survival also showed no differences.

Conclusions. In colon cancer patients undergoing preoperative whole-colon screening, double-contrast barium enema is an alternative option when preoperative colonoscopy is not under consideration due to narrowing of the bowel lumen. However, these two screening tools had no effect on the oncologic outcomes of colon cancer patients.

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Colorectal cancer (CRC) is the third leading cause of cancer-related death in Taiwan.[1] Multiple techniques have been used for colorectal cancer screening, including the fecal occult blood test (FOBT), fecal immunochemical testing, colonoscopy, double-contrast barium enema (DCBE), and computed tomography (CT) colonography.[2-4]

Colonoscopy is a well-established procedure for

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the evaluation of lower gastrointestinal tract diseases, including colorectal polyps and cancer, and has become one of the most popular choices for CRC screening because of the possibility of simultaneous diagnosis and treatment.[5] Complete colonoscopy is usually attempted preoperatively to rule out synchronous malignant colorectal cancers, which occur in 5%-10% of patients.[6]

However, some surgeons fear that preoperative whole-colon screening via colonoscopy with squeeze pressure might cause dissemination of tumor cells in cases of colon tumors with a narrow bowel lumen. Others fear the possibility of distant tumor cell implantation after colonoscopy with tumor biopsy.

The purpose of this study was to determine whether double-contrast enema is an alternative to preoperative whole-colon screening of colon cancer patients with a narrow bowel lumen with regard to oncologic outcomes.

Materials and Methods

We retrospectively reviewed the medical records of patients who were diagnosed with colon adenocarcinomas and underwent surgery at the Tri-Service General Hospital, Taipei, Taiwan, between January 2008 and December 2013. Patients with obstructed right-side colon cancer, distant metastasis, synchronous colorectal cancer or other malignancies were excluded from the study. The diagnosis of colon cancer with bowel lumen narrowing was confirmed by colonoscopy and pathological analysis, according to the American Joint Committee on Cancer (AJCC) 8th edition. The patients were randomly divided into two groups. One group underwent complete colonoscopy and the other group, double-contrast barium enema for preoperative whole-colon screening. Incomplete colonoscopy was defined as any colonoscopy that did not reach the cecum. T and N staging was performed based on the pathology of the surgical specimen, and all surgical specimens were dissected by a fixed team of gastrointestinal pathologists within the hospital. CT was used to evaluate distant metastasis in all patients. Follow-up was conducted at three-month intervals over a period of two years and at six-month intervals for the succeeding three years. Follow-up indicators included FOBT, abdominal ultrasonography, chest radiography, serum tumor marker [carcinoembryonic antigen (CEA), carbohydrate antigen 19-9 (CA19-9)] level assessment, colonoscopy, and CT scanning of the abdomen and pelvis. Patients underwent colonoscopy three months after surgery and annually thereafter. Biopsies were performed for all cases of suspicious recurrence. Metachronous cancer was defined as a secondary colon cancer occurring more than 6 months after the index cancer.

Clinical data, including age, sex, clinical stage, pathological stage, and overall recurrence, were analyzed. All statistical analyses were completed using SPSS software for Windows (IBM, New York, USA), and a significance level of 5% was used for all analyses.

Results

The characteristics of all patients are shown in Table 1. A total of 589 patients diagnosed with colon adenocarcinoma and admitted to Tri-Service General Hospital, Taipei, Taiwan between January 2008 and December 2013 were recruited for this study. We excluded 71 patients who were diagnosed with obstructed right-side colon cancer, initial distant metastasis or synchronous colorectal cancer; 160 patients were lost to follow-up after their operation or had incomplete medical records; 26 patients refused surgical treatment because of advanced age or existing comorbidities; and 30 patients had other malignancies. The remaining 302 patients with newly diagnosed colon cancer with bowel lumen narrowing were enrolled in this study and analyzed (Fig. 1). The 302 patients were divided into two groups: 152 (50.3%) underwent complete colonoscopy and 150 (49.7%) underwent double-contrast barium enema to rule out synchronous colon tumors. The average age of the patients was 68.9 years in the complete colonoscopy group and 67.9 years in the double-contrast barium enema group. There were no statistically significant differences in the pathologic stage or overall recurrence for

Table 1. Patient characteristics and comparison of patients who underwent complete colonoscopy and barium enema

	Complete colonoscopy (n = 152)	Barium enema (n = 150)	*p*-value
Age (Mean ± SD)	68.3 ± 13.0	67.9 ± 12.9	0.82
Sex			0.27
Male	74	82	
Female	78	68	
Tumor location			0.88
Transverse	30	27	
Descending	45	40	
Sigmoid	77	83	
Pre-op clinical stage			0.25
I	23	19	
II	57	61	
III	72	70	
Pathological stage			0.12
I	33	16	
II	67	72	
III	52	62	
T staging			0.23
T1	17	10	
T2	20	14	
T3	105	119	
T4	10	7	
N staging			0.15
N0	100	88	
N1	29	38	
Recurrence	15 (8.7%)	16 (10.7%)	0.58
Survival	57 (33.1%)	61 (40.7%)	0.17

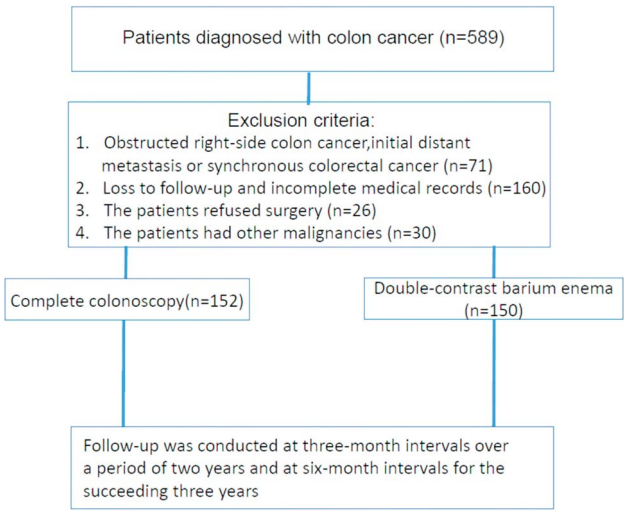

Fig. 1. Flowchart showing the management of patients diagnosed with colon cancer.

patients in the complete colonoscopy group and double-contrast barium enema group. In addition, disease-free survival (Fig. 2) and overall survival (Fig. 3) were not significantly different between the groups.

Discussion

Synchronous colorectal cancers have been reported in 5%-10% of patients, and synchronous adenomatous polyps in colon cancer have been reported in 15%-50% of cases.[7,8] Therefore, complete colonoscopy is usually attempted preoperatively in all colorectal cancer patients to rule out the presence of synchronous malignant colorectal lesions, as the presence

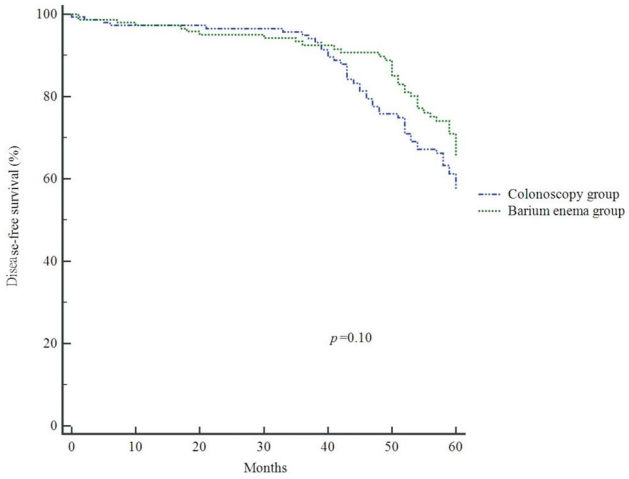

Fig. 2. Disease-free survival.

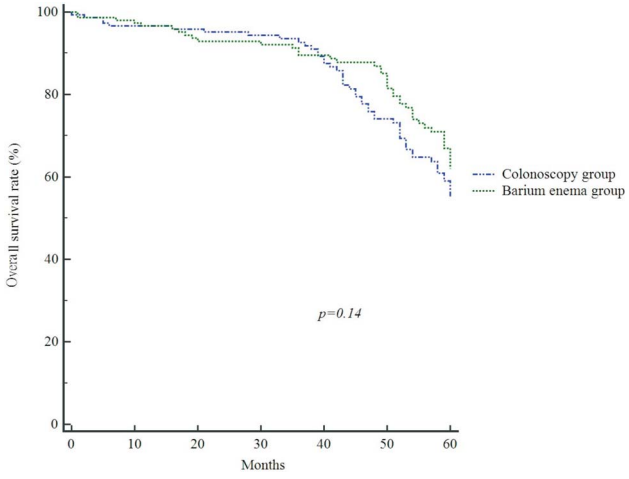

Fig. 3. Overall survival.

of synchronous lesions often alters the surgical plan. In the presence of colon cancer, many colonoscopists prefer not to perform complete colonoscopy to avoid the risk of tumor cell implantation into the damaged site of colonic mucosa.[9] Besides, tumor cell dissemination may occur during colonoscopic procedures because of mechanical alteration of the colon through insufflation of air, advancement of the colonoscope, and application of transabdominal pressure.[10]

In one study, blood samples were examined using a cytokeratin (CK) 20 reverse-transcriptase polymerase chain reaction (RT-PCR)-based protocol to determine the rate of tumor cell dissemination into peripheral circulation before and after colonoscopic stent insertion for colorectal cancer. Increasing levels of CEA and CK 20 mRNA expression were noted in the peripheral circulation of patients with colorectal cancer.[11] These results indicate the possibility of hematogenous tumor cell dissemination during colonoscopy. However, the presence of circulating tumor cells in the peripheral circulation does not necessarily result in the metachronous recurrence of colon cancer, as the implantation of circulating tumor cells appears to be highly inefficient, and most of the tumor cells are rapidly destroyed.[12] Maeda et al. performed in vivo studies that suggested exfoliated cells maintain their viability and ability to implant only when they travel a short distance through the colon,[13] and the majority of exfoliated colorectal cancer cells were found within 5 cm above or below the tumor. In addition, the intrinsic characteristics of the colonic mucosa also restrict tumor cell implantation, and the distribution of exfoliated cancer cells may also explain the low incidence of mucosal implantation after colonoscopic procedures.[14]

Sometimes, it is difficult to complete a colonoscopy because of tumor obstruction due to a narrow bowel lumen, patient discomfort, inadequate bowel preparation, and fixation or adhesions from prior surgery. It has been reported that preoperative colonoscopy is not possible in as many as 50% of patients.[15] The consequence of an unsuccessful preoperative procedure is the requirement for a repeat examination immediately after the operation. Barlow et al.[16] suggested performing a colonoscopy after surgery when the colonoscopy is more likely to be successful. Intraoperative colonoscopy is another option when preoperative complete colonoscopy is not possible. However, not all researchers agree on the effectiveness of intraoperative colonoscopies due to the increased surgical time and possible risk of infection.[17]

There are little data on the recommendations made for preoperative whole-colon screening of colon cancer patients with incomplete colonoscopy. In our study, we performed double-contrast barium enemas in some of the patients with incomplete preoperative colonoscopy, and the 5-year overall survival, 5-year disease-free survival, and postoperative recurrence rates were not statistically different from the preoperative colonoscopy group. A review article suggested that patients with incomplete colonoscopy should undergo a second colonoscopy rather than DCBE given the inadequate sensitivity and accuracy of DCBE and the suboptimal and noninterpretable nature of DCBE in some patients.[18] However, our study yielded data supporting the use of DCBE as a preoperative whole-colon screening tool, without an effect on oncologic outcomes, in colon cancer patients.

Conclusions

Patients who are newly diagnosed with colon cancer should undergo preoperative whole-colon screening, as the presence of synchronous lesions often alters the treatment plan. Double-contrast barium enema is an alternative option when preoperative colonoscopy is not applicable in cases of colon tumors because of narrowing of the bowel lumen. Both colonoscopy and double-contrast barium enema have no effect on the oncologic outcomes of colon cancer patients.

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原　著

大腸鏡檢查與鋇劑攝影對大腸癌患者預後影響的比較

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目的　大腸癌病人手術前常接受大腸鏡檢查以排除其他部位同時之大腸癌病灶。一些外科醫師避免因腫瘤造成腸腔狹窄的情況去完成全大腸鏡檢查，以避免因擠壓導致腫瘤細胞的播種。這個研究的目的是探討鋇劑攝影是否能夠成為大腸鏡檢以外另一種可選擇的術前篩檢工具。

方法　經由回朔性病歷分析 2008 年 1 月至 2013 年 12 月被診斷為大腸癌並接受手術的患者的病歷。一組患者進行了完整的大腸鏡檢查，另一組患者則進行了鋇劑攝影。分析兩組病人在術後復發率，無病生存率和總體存活率是否存在差異。

結果　共有 302 名患者被收入了這項研究。他們被分為兩組：152 名患者 (50.3%) 接受了完全結腸鏡檢查，150 名患者 (49.7%) 接受了鋇劑攝影。兩組比較下，病理分期及復發率無統計學差異。此外，無病存活率和總體存活率也沒有顯著差異。

結論　因腸腔狹窄而未完成術前大腸鏡檢查時，鋇劑攝影是另一種選擇。然而，這兩種篩檢工具對結腸癌患者的預後沒有影響。

關鍵詞　大腸鏡、鋇劑攝影、大腸癌。