

## Increasing Use of Colonoscopy Over a Decade has Detected an Increased Prevalence of Colorectal Tumors on the Elderly

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### Abstract

**Objective:** The advancement of endoscopic technology has brought an increase in colonoscopic examinations. We analyzed the change in the prevalence of colorectal tumors in elderly patients (80 years or older) over a decade.

**Method:** A total of 10,516 patients who were admitted to our hospital for colonoscopic examinations from 2009 to 2011 (recent period) were analyzed and compared with 8,767 historical cases from 1999 to 2001 (prior period). The proportion of patients who were elderly, reason for colonoscopy, completion rate and detection of tumors were analyzed in each period.

**Results:** The rate of elderly patients significantly increased from 2.86% in the prior period to 5.40% in the recent period ( $p<0.001$ ). As to the reasons for colonoscopy, a double-contrast barium enema X-ray study suggestive of colorectal carcinoma significantly decreased from 6.4% to 1.1% ( $p<0.001$ ) and screening studies in the elderly significantly increased from 12.7% to 25.2% ( $p<0.001$ ). The completion rate in the elderly improved (prior period 87.2%, recent period 93.59%,  $p=0.005$ ). The detection of colorectal tumors was significantly higher in elderly (47.5%) than in non-elderly patients (37.3%,  $p<0.001$ ) and the proportion of elderly with colorectal adenoma significantly increased from 2.95% in the prior period to 6.54% in the recent period ( $p<0.001$ ). However, the detection rate of tumors in the elderly significantly decreased over a decade (prior period 54.2%, recent period 47.5%,  $p<0.001$ ).

**Conclusions:** The proportion of the elderly population is increasing with increasing frequency of colonoscopic examinations performed. Extra care might be required when performing endoscopic examination in the elderly.

**Keywords:** Mortality; Colorectal cancer; 80 years or older

### Introduction

The proportion of the elderly population is increasing with increasing longevity in Japan. The prevalence of routine medical examinations and decrease in the number of patients with *Helicobacter pylori* infection in Japanese people might be the reasons for the reduction in gastric cancer-related mortality in recent years. However, colorectal cancer (CRC) is still one of the most common cancers; it is the first and fourth most frequently diagnosed cancer in Europe and the United States, respectively, and mortality of CRC in most of the Asia-Pacific region is still increasing because of progressive westernization of lifestyle [1-3]. In Japan, CRC is the fourth most common cancer among men and the second most common cancer among women, and there were 124,921 new CRC cases, accounting for 14.5% of all malignancies in men and 14.9% of all malignancies in women in 2011 [Center of Cancer Control and Information Services, National Cancer Center, Japan].

The mortality of CRC was the third most common cause of cancer-related deaths among men and the most common cause of cancer-related deaths among women in 2013 [Center of Cancer Control and Information Services, National Cancer Center, Japan]. Approximately 90% of new colorectal cancers are diagnosed in patients over 50 years

and the incidence of colorectal cancer dramatically increases as one ages, regardless of sex and racial background [4]. Various modalities including immunohistochemical fecal occult blood tests, computed tomographic colonography, colon capsule endoscopy, and double-contrast barium enema (DCBE) X-ray are available in Japan. However, if colorectal lesions are detected using these modalities, colonoscopic examinations are needed to evaluate the pathological diagnosis and resect the lesions. For these reasons, colonoscopy remains the gold standard for diagnosis [5], and has even been used as a primary screening method in Japan. Recently, it was reported that colonoscopy significantly reduced mortality from both distal and proximal colorectal cancer in older individuals [6,7]. However, colonoscopic examinations are recognized as an invasive medical procedure for elderly patients due to the preprocedure process and sedation [8]. In this study, we analyzed the change in the prevalence of colorectal tumors in elderly patients between the recent three-year period and a three-year period ten years earlier.

### Methods and Patients

A total of 10,516 consecutive patients who were admitted to Juntendo University Hospital for diagnostic and therapeutic colonoscopy over a 3-year period from January 2009 to December 2011 (recent period) were compared with 8,767 consecutive patients

who underwent diagnostic and therapeutic colonoscopy 10 years earlier from January 1999 to December 2001 (prior period). Elderly patients were defined as patients who were 80 years or older in this study. It's worth mentioning that in our hospital, we perform follow up colonoscopy 1 year after a polypectomy, furthermore, if the patient has multiple synchronous polyps, we repeat the colonoscopy after 6 months for additional treatment. In the recent 3-year period there were 3833 patients who underwent  $\geq 2$  colonoscopic examinations.

Clinical end-points were as follows. The percentage of elderly patients who underwent colonoscopy and the reason for colonoscopic examinations in the elderly were analyzed in each period. After excluding cases in which total examination of the colorectum was not intended, e.g., those admitted for polypectomy, endoscopic mucosal resection (EMR) or endoscopic submucosal dissection (ESD), and those with incomplete bowel preparation, the completion rate of colonoscopy was analyzed in both periods. The detection rate of neoplastic lesions among the elderly and non-elderly patients was analyzed in the recent period. Furthermore, the detection rate of neoplastic lesions was analyzed in both periods among the elderly patients.

These data were obtained from our prospectively compiled database of all patients from 1994, who had undergone colonoscopic examination in our department.

**Statistical analysis**

Statistical analysis was performed using the Chi-square test for categorical variables. A p-value of  $<0.05$  was considered as significant. The statistical analyses were performed using SPSS 19 (IBM® SPSS® Statistics, IBM Corporation, Somers, NY, USA).

**Results**

**Proportion of elderly patients who underwent colonoscopy**

The proportion of elderly patients who underwent colonoscopy in the prior period was 2.9% (251 cases), while it was 5.4% (568 cases) in the recent period. The percentage of elderly patients who underwent colonoscopic examinations significantly increased in the past 10 years ( $p<0.001$ , Chi-square test) (Table 1). The patients were divided into groups according to their age in 10-year increments. The percentage of patients over 70 years of age who underwent colonoscopy also significantly increased from 20.9% (1835 cases) in the prior period to 29.9% (3146 cases) in the recent period ( $p<0.001$ , Chi-square test).

Age group	Prior period (number, %)		Recent period (number, %)		p value
80yr	251	2.90%	568	5.40%	<0.001
70-79yr	1584	18.10%	2578	24.50%	<0.001
60-69yr	2713	30.90%	3081	29.30%	0.013
50-59yr	2380	27.10%	1700	16.20%	<0.001
40-49yr	942	10.70%	1178	11.20%	0.3123
30-39yr	522	6.00%	920	8.70%	<0.001
20-29yr	350	4.00%	433	4.10%	0.6607

19yr	25	0.30%	58	0.60%	0.0049
Total	8767		10516		

**Table 1:** Proportion of patients in each age group who underwent colonoscopy.

**Reason for colonoscopic examinations in the elderly patients**

Common reasons for colonoscopy in the elderly in both study periods were as follows: follow-up of polypectomy, overt bleeding and positive fecal occult blood test; DCBE X-ray study suggestive of colorectal carcinoma; elevated serum tumor markers; abdominal pain; anemia; and screening (Table 2). The frequency of two of the reasons changed considerably between the prior and recent periods. The reason for colonoscopy of DCBE X-ray study suggestive of colorectal carcinoma significantly decreased from 6.4% (16 cases) to 1.1% (6 cases) ( $p<0.001$ , Chi-square test). In turn, the proportion of elderly people who underwent screening studies significantly increased from 12.7% (n=32) to 25.2% (n=143) ( $p<0.001$ , Chi-square test). Screening study was the most frequent reason for colonoscopy in elderly people in the recent period.

	Prior period (number, %)		Recent period (number, %)		p value
polypectomy follow	63	25.10 %	120	21.10%	0.208
overt bleeding	34	13.50 %	92	16.20%	0.332
FOB	33	13.10 %	52	9.20%	0.084
DCBE X-ray suggestive of CRC	16	6.40%	6	1.10%	<0.001
tumor marker	12	4.80%	23	4.00%	0.633
abdominal pain	9	3.60%	16	2.80%	0.555
anemia	7	2.80%	26	4.60%	0.23
none (screening)	32	12.70 %	143	25.20%	<0.001
other	45	17.90 %	90	15.80%	0.459
total	251		568		

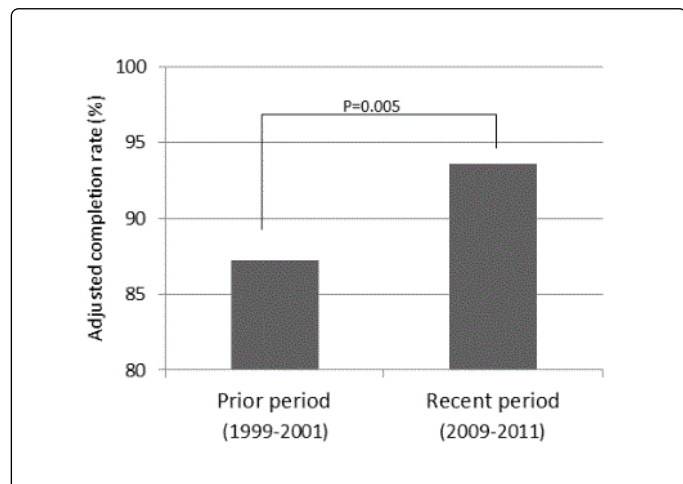
FOB: fecal occult blood test positive

**Table 2:** Reason for colonoscopic examination in the elderly patients.

**Completion rate of colonoscopy**

In the analysis of the completion rate of colonoscopy, 7654 patients in the prior period (elderly 219, not elderly 7435) and 9618 patients in the recent period (elderly 492, not elderly 9126) were included. The crude completion rate (prior period 84.01%, recent period 92.87%,  $p=0.001$  Chi-square test) as well as the adjusted completion rate (prior period 87.2%, recent period 93.59%,  $p=0.005$  Chi-square test) in elderly patients improved in the recent period in relation to the prior period (Figure 1). The adjusted rate was determined excluding

incomplete examinations due to an obstructive disease. It is worth mentioning that no major adverse event including perforation was recorded in the elderly patients in both study periods.



**Figure 1:** Completion rate of colonoscopy in elderly patients. The adjusted completion rate in elderly patients significantly improved in the recent period compared with the prior period (prior period 87.2% vs. recent period 93.59%,  $p=0.005$ , Chi-square test). The adjusted rate was determined excluding incomplete examinations due to an obstructive disease.

### The rate of tumor detection among the patients with age

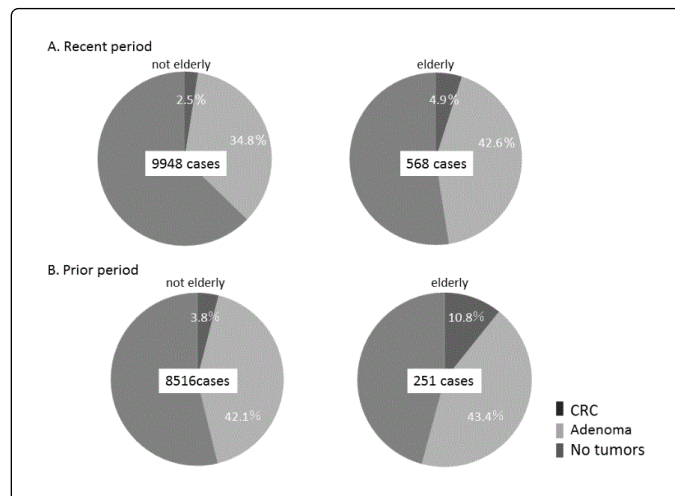
As to the detection of colorectal tumor in the recent period, almost half of the elderly patients (47.5% [270 cases]) were found to have colorectal adenoma or carcinoma, whereas 37.3% (3705 cases) of the non-elderly patients did so. The prevalence of colorectal adenoma (elderly 42.6% vs. non-elderly 34.8%) and colorectal cancer (elderly 4.9% vs. non-elderly 2.5%) were both significantly higher in elderly patients than in non-elderly patients (Figure 2A). The prevalence of colorectal tumor showed a significant age-dependent increase ( $p<0.001$ , Chi-square test).

### Change in the rate of tumor detection in elderly patients in a time span of a decade

Among all subjects, the prevalence of colorectal tumor was 46.2% (4046 cases) in the prior period and 37.8% (3975 cases) in the recent period (data not shown).

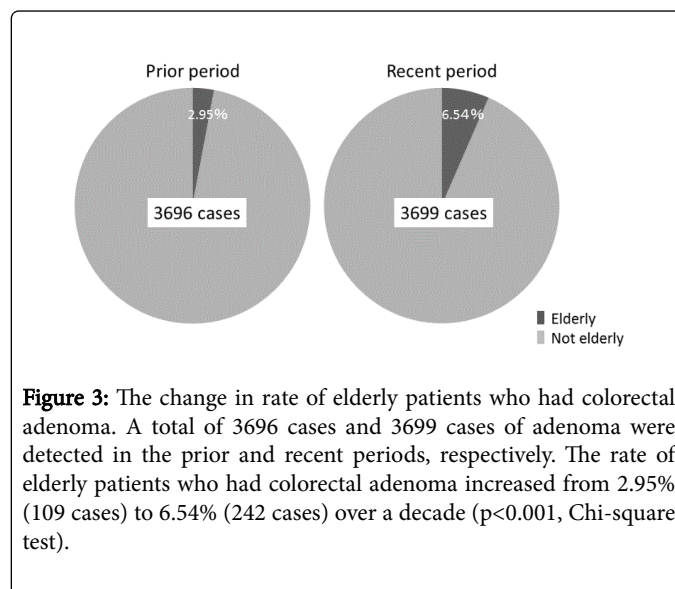
Among the elderly patients, the prevalence of colorectal tumor was 54.2% (136 cases) in the prior period and 47.5% (270 cases) in the recent period (Figures 2A and 2B).

The detection rate of colorectal tumor significantly decreased over a decade among the patients overall and among the elderly patients ( $p<0.001$ , Chi-square test).



**Figure 2:** The prevalence of colorectal tumors in the recent and prior periods. In the recent period, 10,516 consecutive cases (not elderly, 9948; elderly, 568). (A) 8767 consecutive cases (not elderly, 8516; elderly, 251). (B) In the prior period were included. The prevalence of colorectal tumors (both CRC and adenoma) showed a significant age-dependent increase in both periods (A:  $p<0.001$ , B:  $p=0.012$ , Chi-square test). A total of 251 elderly patients underwent colonoscopy in the prior period and 568 in the recent period. The detection rate of colorectal tumors in the elderly significantly decreased over the last 10 years from 47.5% to 54.2% ( $p<0.001$  Chi-square test).

Regarding the findings of colonoscopy, the proportion of elderly patients with colorectal adenoma significantly increased from 2.95% (109 cases) in the prior period to 6.54% (242 cases) in the recent period ( $p<0.001$ , Chi-square test) (Figure 3).



**Figure 3:** The change in rate of elderly patients who had colorectal adenoma. A total of 3696 cases and 3699 cases of adenoma were detected in the prior and recent periods, respectively. The rate of elderly patients who had colorectal adenoma increased from 2.95% (109 cases) to 6.54% (242 cases) over a decade ( $p<0.001$ , Chi-square test).

## Discussion

Increasing age is a risk factor for the development of precancerous adenomas and colorectal cancer, thus raising the issue of screening and surveillance in older patients [4]. Colonoscopy plays an integral role in the diagnosis, management and surveillance of colorectal tumors. However, endoscopists require advanced techniques to perform

colonoscopic examination, an invasive medical procedure, in elderly patients. Japan is an aging society with increasing longevity. Actually, the proportion of individuals  $\geq 80$  yrs. in the Japanese population was 3.83% of the total population of Japan in 2000 and 6.70% in 2011, which is an increase of about two-fold in a decade (Statistics Bureau, Ministry of Internal Affairs and Communications website). In this study, the proportion of elderly patients who underwent colonoscopy significantly increased from 2.9% to 5.4%, which is an approximately two-fold increase in a decade. In addition, the completion rate of colonoscopy in the elderly improved in the recent period compared with the prior period. It was thought that the increased number of colonoscopic examinations performed in the elderly contributed to recent advances in colonoscopy preparation and devices, insertion techniques and the popularization of electric colonoscopy besides the increased number of healthy elderly individuals.

As to the reasons why the elderly individuals underwent colonoscopic examination, there were significant changes in the rates of two reasons. The rate of DCBE X-ray study suggestive of colorectal carcinoma as a reason for colonoscopy significantly decreased and the rate of screening studies in elderly people significantly increased in a decade. Many endoscopists have mastered the colonoscopic insertion technique and many patients could undergo the examination in many hospitals instead of the DCBE X-ray study. The DCBE X-ray study of the large intestine requires injection of air and barium transrectally. Once regarded as a routine screening tool, its role has diminished since the introduction of colonoscopic examination. The sensitivity of the DCBE X-ray study for polyps of  $\geq 10$  mm was only 48%, rendering it suboptimal for screening [9,10]. Colonoscopic examinations would still be needed to diagnose colorectal tumors and other diseases, and to treat them in the future in elderly individuals.

The detectability of colorectal tumors in elderly patients was significantly higher than that in the non-elderly patients in this study. The prevalence of colorectal tumor showed a significant age-dependent increase [4]. In fact, the prevalence of adenoma and advanced adenoma (defined as polyp size  $>10$  mm, villous/tubulovillous histological features, or having high grade dysplasia) in persons 70 to 75 years of age is more than double that among persons 40 to 49 years of age [11-13]. The detection rate of colorectal tumors in the elderly is expected to rise with increasing performance of colonoscopic examinations. We should perform colonoscopic examination in the elderly keeping in mind the high prevalence of colorectal tumors in this population.

Regarding the findings of colonoscopy, the proportion of elderly patients with colorectal adenoma significantly increased over a decade. However, the rate of colorectal tumors significantly decreased in both the overall subjects and elderly patients over a decade. The reasons for colonoscopy in elderly individuals included asymptomatic screening and follow-up studies after tumors were previously resected. As was shown, the percentage of patients who underwent colonoscopy without an apparent manifestation, i.e., screening studies, doubled in 10 years. This indicates that it is safer to perform colonoscopy in elderly individuals than before. Therefore, screening endoscopy might be performed even in elderly patients in the future.

Regarding the treatment procedures of colonoscopy, large colorectal tumors can be resected by endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD) even in elderly patients. However, the incidence of post-ESD (body temperature  $\geq 37^{\circ}\text{C}$ ) fever was significantly higher in patients over 80 years old than in those under 80 years old. It was concluded that age is one of the most

important factors associated with post-ESD fever [14]. It may be necessary to pay special attention to endoscopic treatment in the elderly as well as tumor size.

Limitations of our study were its retrospective nature and that it was performed at a single academic medical center. The study population was restricted to those who underwent colonoscopic examination at our institution. The colonoscopic examinations were performed by many endoscopists, since the study covered two three-year periods a decade apart.

We conducted a retrospective analysis of a large number of patients who underwent colonoscopy, to evaluate the change in very elderly individuals who underwent this procedure in a decade. This increment in the aged population along with a longer healthy life may have contributed to the increase in elderly patients who underwent colonoscopy. With the increasing frequency of colonoscopic examinations performed in patients over 80 years old, the incidence of detected neoplastic lesions significantly increased over a decade. It is predicted that complications from endoscopic treatment of elderly patients will increase in succeeding years. Extra care is required when performing endoscopic procedures and treatments in elderly patients.

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