□ ORIGINAL ARTICLE □

Associations of Mental Health and Physical Function with Colonoscopy-related Pain

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Abstract

Objective   To clarify the effects of mental health and physical function in association with colonoscopy-related pain.

Methods   The mental health and physical function were evaluated using the Japanese version of the SF-8 Health Survey questionnaire. Poor physical status was defined as a physical component summary (PCS) <40 and poor mental status as a mental component summary (MCS) <40. Pain was assessed using a visual analogue scale (VAS), with significant pain defined as VAS ≥70 mm and insignificant pain as VAS <70 mm. The background and colonoscopic findings were compared in patients with significant and insignificant pain.

Patients   This study evaluated consecutive Japanese patients who were positive on fecal occult blood tests and underwent total colonoscopy.

Results   Of the 100 patients, 23 had significant and 77 had insignificant colonoscopy-related pain. A multiple logistic regression analysis showed that MCS <40 [odds ratio (OR) 6.03; 95% confidence interval (CI) 1.41-25.9, p=0.0156], PCS <40 (OR 5.96; 95% CI 1.45-24.5, p=0.0133), and ≥300 seconds to reach the cecum (OR 4.13; 95% CI 1.16-14.7, p=0.0281) were independent risk factors for colonoscopy-related pain.

Conclusion   The mental health and physical function are important determinants of colonoscopy-related pain. Evaluating the mental health and physical function of patients prior to colonoscopy may effectively predict the degree of colonoscopy-related pain.

Key words: colonoscopy-related pain, mental health, physical function, colonoscopy, visual analogue scale

Introduction

Colorectal cancer is one of the most commonly encountered neoplasms worldwide (1), and both its prevalence and mortality rates have been increasing (2). Colonoscopy plays an important role in reducing the rate of colorectal cancer deaths, not only by diagnosing colon cancer itself, but by removing premalignant lesions and early cancers (3, 4). In addition, colonoscopy is the most reliable tool for evaluating inflammatory bowel disease and for detecting other structural lesions of the colon. Colonoscopy, however, is considered an uncomfortable procedure and is often accompanied by pain. Risk factors for colonoscopy-related pain may include lower body mass index (BMI), younger age, lengthy intubation time, poor preparation status, previous hysterectomy, and antispasmodic agents use (5). However, it is still difficult to predict colonoscopy-related pain in advance.

Anxiety has been associated with abdominal pain (6) and colonoscopy-related pain (7). Furthermore, a lower mental quality of life (QOL) has been associated with abdominal pain and discomfort, such as irritable bowel syndrome (8). We therefore hypothesized that colonoscopy-related pain may also be associated with lower mental QOL. As few studies to date have assessed the association between colonoscopy-related pain and QOL, this study was designed to evaluate the effects of mental health and physical function on colonoscopy-related pain.

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Materials and Methods

This single center study was approved by the Ethics Committee of Saiseikai Yokohama-shi Nanbu Hospital. The trial was registered with the University Hospital Medical Information Network in Japan (registration number UMIN 000013510).

Participants

This study evaluated consecutive Japanese patients who were positive on fecal occult blood tests and underwent total colonoscopy at Saiseikai Yokohama-shi Nanbu Hospital between March and October 2015. The purpose of colonoscopy was screening, not treatment (e.g., polypectomy or endoscopic mucosal resection). Patients with active intra-abdominal and pelvic malignancy, ulcerative colitis, Crohn's disease, microscopic colitis, and other organic gastrointestinal tract disorders were excluded, as were patients with a history of abdominal surgery (8).

Bowel preparation and unsedated colonoscopy

All eligible participants were instructed to eat a low-fiber diet the day before undergoing colonoscopy, to abstain from food after (9) PM the evening before the procedure, and to ingest 10 mL of 0.75% sodium picosulfate (SP) oral solution (Pola Pharma, Tokyo, Japan) at bedtime. Starting at 05:00-06:00 AM on the day of the procedure, participants ingested a polyethylene glycol (PEG) solution (Niflec®, Ajinomoto Pharmaceuticals, Tokyo, Japan). Participants were encouraged to drink water if they experienced thirst. All colonoscopies were performed at 1:30-4:00 PM, using an Olympus colonoscope (CF-HQ290ZL/I, Tokyo, Japan) with a transparent soft-short-hood. Air was insufflated during insertion and withdrawal.

Data collection

All participants completed a questionnaire prior to undergoing colonoscopy. Information collected from the questionnaires included participant age and sex; BMI, based on self-recording of height and current weight; current cigarette smoking (yes/no) and current alcohol drinking (yes/no), and marital status (married/not married). Other information collected from the questionnaire included history of hypertension (yes/no), diabetes mellitus (yes/no), hyperlipidemia (yes/no), and hyperuricemia (yes/no); medication with antidepressants (yes/no), anxiolytics (yes/no), sleep medications (yes/no), and chronic analgesics (yes/no); and previous colonoscopies (number).

Evaluation of QOL

The mental health status and physical function were evaluated using the Japanese version of the SF-8 (9), a generic questionnaire derived from the longer 36-item Short-Form Health Survey (SF-36), which was developed to estimate the health-related QOL (HRQOL) based on scores form eight domains and two summaries. Results of the SF-8 and SF-36 show high correlation with each other. Physical component summary (PCS) and mental component summary (MCS) scores were calculated as described in the manual for the Japanese version of the SF-8. A score of 50 is the mean for the Japanese general population across the 8 domains and 2 scores; lower scores indicate a poorer HRQOL. A PCS score <40 was defined as a poor physical status, and a MCS score <40 was defined as a poor mental status (10).

Evaluation of items associated with colonoscopy

All colonoscopies were performed by a single expert endoscopist (E.Y.) with 10 years of experience, who was certified by the Japanese Society of Gastrointestinal Endoscopy.

In Japan, screening colonoscopy is usually performed without the administration of sedative drugs. To more accurately evaluate the degree of pain, none of the study participants were administered any analgesics. Oxygen saturation and blood pressure were continuously monitored throughout the procedure. All colonoscopic procedures were performed in the absence of carbon dioxide insufflation, sedatives, music, or any other factor that could have affected pain.

The colonoscopy-associated factors that were evaluated included the use of anticonvulsants (e.g., glucagon, butyl scopolamine bromide) and the degree of colonic cleansing. The latter was evaluated on a 5-point scale, with 4 indicating very good (colon empty and clean); 3 indicating good (presence of clear liquid in the gut); 2 indicating moderate (presence of brown liquid or small amounts of semisolid residual stool, fully removable by suction or displaceable, thus allowing complete visualization of the underlying mucosa); 1 indicating poor (presence of semisolid stool, only partially removable with a risk of incomplete visualization of the underlying mucosa); and 0 indicating very poor (presence of semisolid or solid stool, colonoscopy incomplete or need to stop colonoscopy) colonic cleansing. Participants with scores of 0 or 1 point were considered poorly prepared (11).
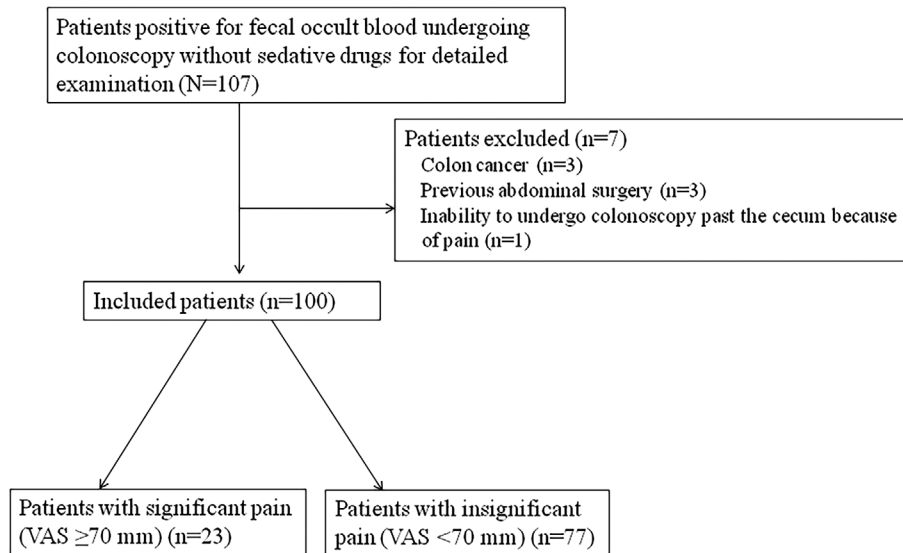
Other colonoscopy-associated factors included the time to reach the cecum and the time needed for the entire procedure, as well as the presence or absence of diverticula. Left-sided diverticula were defined as those in the sigmoid colon, descending colon, and rectum, and right-sided diverticula as those in the cecum, ascending colon, and transverse colon.

Measurement of primary outcome

Colonoscopy-related pain was evaluated directly after colonoscopy using a visual analogue scale (VAS) consisting of a 100-mm line, with 0 indicating no pain and 100 indicating the worst possible pain. A VAS score of 70 or greater was defined as severe pain (12).

Statistical analysis

All of the statistical analyses were performed using the Excel-Toukei 2010 software program for Windows (Social Survey Research Information Co., Ltd., Tokyo, Japan). The differences between the measured and group values were

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│ Patients positive for fecal occult blood │
│ undergoing colonoscopy without sedative  │
│ drugs for detailed examination (N=107)   │
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                    │
                    │        ┌──────────────────────────────────────────────────┐
                    │        │ Patients excluded (n=7)                          │
                    ├───────▶│  Colon cancer (n=3)                              │
                    │        │  Previous abdominal surgery (n=3)                │
                    │        │  Inability to undergo colonoscopy past the cecum │
                    │        │  because of pain (n=1)                           │
                    │        └──────────────────────────────────────────────────┘
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         ┌──────────────────────────┐
         │ Included patients (n=100) │
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│ Patients with          │  │ Patients with          │
│ significant pain       │  │ insignificant pain     │
│ (VAS ≥70 mm) (n=23)    │  │ (VAS <70 mm) (n=77)    │
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Figure. Flowchart of the study.

Table 1. Demographic and Clinical Characteristics of Participants Included in This Study.

	Participants (n=100)
Age (yr), mean ± SD (range)	64.9 ± 12.1 (35–84)
Sex (male: female)	74:26
BMI (kg/m^2), mean ± SD	23.8±3.0
Obesity (BMI ≥25 kg/m^2), n (%)	29 (29%)
Alcohol drinking, n (%)	52 (52%)
Cigarette smoking, n (%)	19 (19%)
Married, n (%)	91 (91%)
Hypertension, n (%)	39 (39%)
Diabetes mellitus, n (%)	12 (12%)
Hyperlipidemia, n (%)	16 (16%)
Hyperuricemia, n (%)	7 (7%)
Antidepressants, n (%)	4 (4%)
Anxiolytic agents, n (%)	2 (2%)
Sleep medications, n (%)	3 (3%)
Chronic analgesics, n (%)	0 (0%)
Previous colonoscopies (≥2)	45 (45%)
PCS, mean ± SD	48.6 ± 6.5
PCS <40, n (%)	12 (12%)
MCS, mean ± SD	49.6 ± 6.6
MCS <40, n (%)	12 (12%)

SD: standard deviation, BMI: body mass index, PCS: physical component summary, MCS: mental component summary

analyzed using the Chi-square test and Student's *t*-test. A multivariable analysis was performed using a conditional logistic regression model, and p values <0.05 were considered to be statistically significant.

Results

Figure shows the flow diagram of this study. Of the 107 participants initially enrolled, 7 were excluded, including 6 who met the exclusion criteria and 1 who could not undergo colonoscopy past the cecum due to pain. Thus, this study ultimately enrolled 100 participants; Table 1 summarizes their baseline demographic and clinical characteristics and Table 2 summarizes the results of colonoscopy. The male-to-female ratio of the participants was 2.85:1, and their mean age was 64.9±12.1 years (range, 35-84 years).

Based on the results of VAS, the patients were divided into a significant pain group (SPG; VAS ≥70 mm) of 23 participants and an insignificant pain group (IPG; VAS <70 mm) of 77 participants. Table 3 shows a comparison of the SPG and IPG groups. The percentages of ≥300 seconds to reach the cecum (p=0.0097), participants with MCS <40 (p=0.0178), and PCS <40 (p=0.0019) were significantly higher in the SPG than in the IPG group. A multiple logistic regression analysis using these three parameters in addition to age and gender showed that MCS <40 [odds ratio (OR) 6.03; 95% confidence interval (CI) 1.41-25.9, p=0.0156], PCS <40 (OR 5.96; 95% CI 1.45-24.5, p=0.0133), and ≥300 seconds to reach the cecum (OR 4.13; 95% CI 1.16-14.7, p=0.0281) were independent risk factors for colonoscopy-related pain (Table 4).

Discussion

Colonoscopy is an uncomfortable procedure often accompanied by pain. Various techniques and methods have been developed to reduce the pain, such as water-aided colonoscopy (13), relaxation music (14), aromatherapy (15), visual stimulation (16), carbon dioxide insufflation (17), and a transparent soft-short-hood (18). Although studies have analyzed the effects of patient characteristics on colonoscopy-related pain (5, 7), few have assessed the association between colonoscopy-related pain and patient QOL.

This study showed that a lower MCS was associated with increased colonoscopy-related pain. Although a previous study showed that colonoscopy-related pain was associated with anxiety (7), mental health differs from anxiety. Mental health is defined as not just the absence of a mental disorder, but as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is

Table 2.   Results of Colonoscopy in All Included Participants.

	Participants (n=100)
Butyl scopolamine bromide use, n (%)	72 (72%)
Glucagon use, n (%)	27 (27%)
Poorly prepared, n (%)	2 (2%)
Time to reach cecum, seconds, median (IQR, range)	204 (96.5, 86–960)
Time needed for total procedure, seconds, median (IQR, range)	652 (213.5, 394–1,560)
Right-sided diverticula, n (%)	31 (31%)
Left-sided diverticula, n (%)	3 (3%)
Both-sided diverticula, n (%)	14 (14%)

Table 3.   Demographic and Clinical Characteristics of Participants in the SPG (n=23) and IPG (n=77) Groups.

	SPG (n=23)	IPG (n=77)	p
Age (years), mean ± SD	63.0 ± 12.8	65.5 ± 11.9	0.4005[S]
Sex (male: female)	14:9	60:17	0.1018[C]
BMI (kg/m^2), mean ± SD	23.9 ± 3.1	23.7 ±3.0	0.8681[S]
Obesity (BMI ≥25kg/m2), n (%)	6 (26.1%)	23 (29.9%)	0.7257[C]
Alcohol drinking, n (%)	10 (43.5%)	42 (54.5%)	0.3512[C]
Cigarette smoking, n (%)	7 (30.4%)	12 (15.6%)	0.1112[C]
Married, n (%)	22 (95.7%)	69 (89.6%)	0.3743[C]
Hypertension, n (%)	8 (34.8%)	31 (40.3%)	0.6365[C]
Diabetes mellitus, n (%)	2 (8.7%)	10 (13.0%)	0.5784[C]
Hyperlipidemia, n (%)	4 (17.4%)	12 (15.6%)	0.8537[C]
Hyperuricemia, n (%)	2 (8.7%)	5 (6.5%)	0.7164[C]
Antidepressants, n (%)	0 (0%)	4 (5.2%)	0.2646[C]
Anxiolytic agents, n (%)	0 (0%)	2 (2.6%)	0.4349[C]
Sleep medications, n (%)	0 (0%)	3 (3.9%)	0.3365[C]
Chronic analgesics, n (%)	0 (0%)	0 (0%)	-
Previous colonoscopies (≥2), n (%)	12 (52.2%)	33 (42.9%)	0.4306[C]
PCS <40, n (%)	7 (30.4%)	5 (6.5%)	0.0019[C]*
MCS <40, n (%)	6 (26.1%)	6 (7.8%)	0.0178[C]*
Butyl scopolamine bromide use, n (%)	15 (65.2%)	57 (74.0%)	0.4090[C]
Glucagon, n (%)	8 (34.8%)	19 (24.7%)	0.3380[C]
Poorly prepared, n (%)	1 (4.3%)	1 (1.3%)	0.3594[C]
≥300 seconds to reach the cecum, n (%)	9 (39.1%)	8 (10.4%)	0.0097[C]*
≥900 seconds for total procedure, n (%)	0 (0%)	8 (10.4%)	0.1070[C]
Right-sided diverticula, n (%)	8 (34.8%)	23 (29.9%)	0.6549[C]
Left-sided diverticula, n (%)	0 (0%)	3 (3.9%)	0.3365[C]
Both-sided diverticula, n (%)	5 (21.7%)	9 (11.7%)	0.2229[C]

SPG: significant pain group, IPG: insignificant pain group, SD: standard deviation, BMI: body mass index, PCS: physical component summary, MCS: mental component summary
[S]Student's t test; [C]Chi-square test; *(p<0.05)

Table 4.   Multiple Logistic Regression Analysis of Factors Associated with Pain during Colonoscopy.

	Odds ratio	95% CI	p
Male sex	0.32	0.10–1.02	0.0534
Age	0.97	0.93–1.02	0.2703
≥300 seconds to reach the cecum, n (%)	4.13	1.16–14.7	0.0281*
PCS <40	5.96	1.45–24.5	0.0133*
MCS <40	6.03	1.41–25.9	0.0156*

CI: confidence interval, BMI: body mass index, PCS: physical component summary, MCS: mental component summary
*(p<0.05)

able to make a contribution to her or his community (19). Therefore, colonoscopy-related pain may be altered by social background, community, and racial identification. The mechanism underlying the association between lower MCS and colonoscopy-related pain is unclear. However, colonic spasm may impede insertion of the endoscope and subsequent observation. These patients may require insufflation of excess air to properly view the colonic mucosa, resulting in discomfort and pain. Previously, we showed that a lower MCS was associated with irritable bowel syndrome (8),

which presented as spastic colon. Patients with a lower MCS may present with spastic colon, leading to colonoscopy-related pain. However, further investigation will be necessary to prove this hypothesis.

This study also showed that a lower physical function was associated with colonoscopy-related pain. Physical function is a broad measurement tool that most likely represents a composite picture of many illnesses and psychosocial factors. However, the mechanism by which the physical function influences colonoscopy-related pain is probably very complex. None of the participants in this study had a motor disorder, such as paralysis, indicating the need for future studies to determine the association between a reduced physical function and increased colonoscopy-related pain.

The factors previously associated with colonoscopy-related pain included the intubation time, bowel preparation status, diverticular disease, number of previous colonoscopies, BMI, and antispasmodic agent use (5, 7). However, only a lengthy intubation time and lower HRQOL were associated with colonoscopy-related pain in this study. These findings may have been due to recent advances in endoscopic equipment and techniques. This study used CF-HQ290ZL/I fibers, which have new insertion tube technologies to reduce colonoscopy-related pain, and a transparent soft-short-hood which effectively reduces pain and simplifies cecal intubation (18). In contrast, the sample size may have been too small to show significant differences in these other factors, indicating the need for larger-scale studies.

This study had several limitations. First, it was a case-control study, which may suggest bias, particularly in the female sample size. Second, all colonoscopies were performed by a single expert endoscopist. Therefore, we have to validate our findings in an inexperienced endoscopist. Third, the baseline gastrointestinal (GI) symptoms and functional GI disorder status were not evaluated in this study. Patients with functional gastrointestinal disorders have been reported to have visceral hypersensitivity and a lower mental QOL (20, 21).

In conclusion, the mental health and physical function are considered to be important determinants of colonoscopy-related pain. Evaluating the participants' mental health and physical function before colonoscopy may thus make it possible to predict the degree of colonoscopy-related pain.

(Trial registration # registration number UMIN000013510)

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