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Case and Review

Transmural Colonic Infarction after Routine Colonoscopy in a Young Patient without Risk Factors

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Keywords

Colon ischemia · Ischemic colitis · Colonoscopy · Risk factors · Surgery

Abstract

Colonoscopy is one of the most widely used procedures in medical practice for the diagnosis and treatment of many benign and malignant diseases of the colorectal tract. Colonoscopy has become the reference procedure for screening and surveillance of colorectal cancer. The overall rate of adverse events is estimated to be about 2.8 per 1,000 procedures, while complications requiring hospitalization are about 1.9 per 1,000 colonoscopies. Mortality from all causes and colonoscopy-specific mortality are estimated to be 0.07 and 0.007%, respectively. An exceptional fearsome postcolonoscopy complication is colon ischemia (CI); only few cases have been reported worldwide. We present the case of a 43-year-old woman who presented to the emergency department complaining of abdominal pain; fever and rectal bleeding appeared 12 h after a voluntary 'screening' colonoscopy. She had no risk factors for CI. Her laboratory tests showed alterations in inflammatory markers and a computed tomography scan showed a circumferential thickening in the left colon and free fluid in the abdomen. After 12 h of observation and conservative therapy, the clinical state of the patient worsened with the rising of signs of peritonitis. Laparoscopy showed that colon infarction extended from the distal third of the transverse colon to the proximal rectum. Laparotomy, resection of the pathological colon and terminal colostomy were performed. The specimen examined

confirmed an extended ischemic colitis and transmural infarction on the antimesocolic side, in the absence of a vasculitis. The patient underwent recanalization after 8 months. CI after colonoscopy is a rare and alarming complication that must be known and taken into account in the differential diagnosis of symptomatic cases after colonoscopy, particularly in patients with known risk factors. The diagnosis is mainly based on clinical data, imaging and especially endoscopy. Treatment is almost always conservative but, in some cases in which the pathological process appears irreversible, surgery becomes mandatory.

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Introduction

Nowadays, colonoscopy is one of the most widely used procedures in medical practice for the diagnosis and treatment of many benign and malignant diseases of the colorectal tract as well as the reference procedure for screening and surveillance of colorectal cancer [1–4]. As all endoscopic procedures, it is not without risks, and there are many medical and surgical complications that can follow such a procedure [1–4]. Recent data published by the American Society for Gastrointestinal Endoscopy reveals that 33% of the patients present with transient and minor gastrointestinal symptoms after colonoscopy (swelling, discomfort or abdominal pain, diarrhea, nausea, subcutaneous emphysema, self-limiting bleeding), while major complications are very rare (cardiopulmonary complications, colonic perforation, hemorrhage, postpolypectomy electrocoagulation syndrome, infection, explosion, hematoma or splenic rupture, acute appendicitis, acute diverticulitis, tearing of the mesenteric vessels with intra-abdominal hemorrhage, chemical colitis and other symptoms associated with specific colonoscopic operations), and more than 85% of these are associated with colonoscopy with polypectomy [1]. The overall rate of adverse events is estimated to be about 2.8 per 1,000 procedures, while complications requiring hospitalization are about 1.9 per 1,000 colonoscopies. Mortality from all causes and colonoscopy-specific mortality are estimated to be 0.07 and 0.007%, respectively [1–4].

An exceptional fearsome postcolonoscopy complication is colon ischemia (CI). Since 1990, when this complication was described for the first time, the world literature has reported only 24 cases. In this case report, we describe a rare case of CI in a young patient with no risk factors, who presented a transmural colonic infarction that was treated by extensive colonic resection, in contrast to previous cases reported where the patients were treated with medical therapy alone; furthermore, we present an analysis of the possible pathophysiological mechanism and a review of current literature.

Case Presentation

We present the case of a 43-year-old woman who presented to the emergency department complaining of moderate diffuse abdominal pain; fever and mild rectal bleeding appeared 12 h after a voluntary ‘screening’ colonoscopy. She had a negative personal history for noteworthy medical and surgical diseases, previous surgery, hemostasis disorders, or spontaneous bleeding. No medication was taken daily.

The endoscopic procedure was performed, after a standard preparation with 4 liters of macrogol/polyethylene glycol, under sedation with fentanyl citrate/midazolam. The operator described the procedure as extremely difficult due to the technical impossibility to pro-

ceed along the colon beyond the transition point between the distal third and the middle third of the transverse colon (in absence of obstructive lesions); this finding prompted the operator to ‘force the attempt’ of exploration of the colonic lumen causing a marked insufflation of air (data on air inflow is not available), but after 37 min, it was decided to stop the endoscopic procedure especially in relation to the total absence of mucosal abnormalities in all tracts explored and with the intention to complete the exploration of the proximal colon with a second colonoscopy.

On admission, the patient’s vital signs were stable (blood pressure 110/70 mm Hg, heart rate 80 beats/min), and physical examination showed a distended abdomen, with tenderness on the whole abdomen, in absence of signs of peritonitis. Digital rectal examination showed stains of bright red blood. Her laboratory tests showed alterations in inflammatory markers and other parameters that could be related to a possible septic state: $19.62 \times 1,000$ white blood cells/ μl ($4.10 \times 1,000/\mu\text{l}$), hemoglobin 12 g/dl (12.5–15.5), $84 \times 1,000$ platelets/ μl ($150\text{--}450 \times 1,000/\mu\text{l}$), international normalized ratio 1.62 (0.8–1.2), D-dimer 33,517 ng/ml (10–500), C-reactive protein 13.98 mg/dl (0–0.5), serum procalcitonin 7.67 ng/ml (<0.5). Abdomen X-ray showed colon distension in the absence of free air. Abdomen computed tomography (CT) with contrast medium showed, in addition to the findings already known, a circumferential thickening of the left colon and above the splenic flexure as well as a moderate amount of free fluid in the pelvic cavity and in the perihepatic and perisplenic areas. A diagnosis of covered perforation of the left colon was suspected, and the patient was admitted for monitoring of at least 24 h and was treated with intravenous fluids, intravenous antibiotics and analgesics. However, over the next 12 h, the clinical state of the patient markedly worsened with the rising of signs of peritonitis.

Therefore, we performed an exploratory laparoscopy, which showed a macroscopic picture of colon infarction, involving only the antimesocolic side and extending from the distal third of the transverse colon to the proximal rectum. Intraoperatively we decided to convert to laparotomy for the patient’s safety and performed a resection of the pathological colon and a terminal colostomy, abandoning the possibility of a direct anastomosis because of peritonitis. The specimen examined gave confirmation of the presence of an extended ischemic colitis and transmural infarction on the antimesocolic side (fig. 1), in the absence of a vasculitis. The postoperative clinical course was characterized by rectal discharge of pus from the rectal stump that resolved with daily washing with saline solution. During the stay, we have deepened the analysis of risk factors for CI, focusing on drug history, lifestyle habits and research of rheumatological abnormalities (with laboratory tests and immunohistochemistry), but with negative results. The patient was discharged on day 22.

After an endoscopic follow-up of the rectal stump and the remaining colon that showed no pathological changes, the patient underwent recanalization after 8 months. The clinical course was uneventful and uncomplicated and today continues its outpatient follow-up manifesting wellness.

Discussion

CI or ischemic colitis is a disease resulting by the acute temporary reduction of blood flow to the colon, which results insufficient to support the metabolic demands of the tissues [1, 5]. The initial ischemia-related changes affect the colonic mucosa in first place but can later be extended to all layers of the colonic wall all the way to the serosa [5]. The mucosal damage will develop within about 20 min–1 h, while the transmural infarction within 8–16 h

[5]. Another pathologic mechanism is the reperfusion injury that develops later to restore the normal blood flow: it involves the release of reactive oxygen species that induce a lipid peroxidation in the double layer of cell membranes arriving to necrosis [1, 5].

The degree to which the colonic blood flow may decrease before ischemia is variable and depends on the severity of the trigger event, the presence and, if present, the type of collateral vascularization and on the duration of low blood flow [1, 6].

The etiology underlying colonoscopy-related CI has not been fully elucidated but, in agreement with other authors, the main cause seems to be barotrauma [7–15]. The pressure generated by the insufflated gas on the colonic wall would favor a hyperextension of it, which induces a reduction in total blood flow and a reduction in the arteriovenous oxygen gradient in the colonic wall, as already demonstrated in several experimental studies [13]. To suffer the most is the antimesocolic side, as demonstrated by our case: every vasa recta, before entering the colonic wall, divides into two branches that embrace the colonic lumen heading from the mesocolic to antimesocolic side, up to which developing a terminal type-like vascularization [5]. It was estimated that an intraluminal pressure of 30–40 mm Hg may induce a reversible impairment of the arterial circulation, but if it should exceed 50 mm Hg it may develop irreversible damage [13]. A confirmation of the barotrauma hypothesis is the lack of involvement of the middle-distal rectum as it has a dual blood supply that makes up for any lack of blood supply coming from the inferior mesenteric district. This finding is pointed out in all cases reported in the literature, including ours [10].

However, we cannot exclude other possible suggested etiologies such as temporary twist mesocolon resulting in an extreme traction of the colonic wall which can reduce blood flow as well as repeated trauma to the colonic wall resulting in damage to the arterial micro-circulation [10, 13, 14]. In addition, there are numerous possible predisposing conditions such as decrease of intravascular volume resulting from fasting and preparation as the prolonged duration of the procedure [1, 5, 16, 17].

In the literature, several risk factors for CI are reported. Among them, the most relevant ones are: age >65 years; female sex; cardiovascular disease (atherosclerosis, atrial fibrillation, ischemic heart disease or congestive heart disease, peripheral vascular disease, hypertension and shock); chronic obstructive pulmonary disease; chronic renal failure; gastrointestinal disorders (chronic inflammatory bowel disease and irritable bowel syndrome); diabetes; dyslipidemia; systemic rheumatologic disorders (vasculitis); previous surgery (abdominal surgery/aortic/cardiovascular), and drugs (table 1) [1, 5, 16–18].

We have performed an extensive literature search to identify all rare cases of CI after colonoscopy taking advantage of a variety of databases such as PubMed/MEDLINE, Scopus, Index Copernicus, EMBASE and Google Scholar using the search key words ‘ischemic colitis’ or ‘colon ischemia’ in conjunction with ‘colonoscopy’. We also searched the reference lists of the articles found by our primary search. Between November 1990, when Wheeldon et al. [7] first described this serious complication related to colonoscopy, and May 2016, only 24 case reports were published, excluding our case. The most relevant data of the individual case reports were included in two tables, the first one showing the characteristics of colonoscopy held responsible (table 2), and the second one showing the clinical characteristics of the patient after the endoscopic procedure (table 3). After data analysis, some characteristics of particular interest came out, such as: the sex of the patients is only slightly female dominated (54.55 vs. 45.45%), they are relatively young (mean age 53.76 years) and free of potential risk factors for CI in 63.64% of cases (the most representative risk factors are disorders of the connective tissue in 13.64% and cardiovascular drugs in 18.18%). Moreover,

the main indication for colonoscopy is a screening test (40.9%), performed in a state of complete well-being of the patient.

There are three clinical, diagnostic and therapeutic characteristics shared by CI related to colonoscopy and other forms from other causes: abdominal pain, whether it is widespread or localized (mainly in the left lower quadrant), along with rectal bleeding or bloody diarrhea are the most frequent symptoms (95.45% in both cases); the diagnosis, even though in many cases with the help of an abdomen CT scan (45%), was confirmed by a new colonoscopy/biopsy (first choice in the diagnosis of CI) in most cases (85%). In our case, because of fear of causing more damage and the suspected diagnosis of covered perforation and later on, under the light of the worsening of the clinical condition of the patient, we opted for an exploratory laparoscopy. Finally, almost all cases have been successfully treated with conservative therapy alone (90.9%), in contrast to what was done in the study by Church [8] in which a loop sigmoid colostomy was performed to protect the severe proctitis, and in our case in which a left colectomy was performed because of the irreversibility of the damage identified.

Conclusions

CI after colonoscopy is a rare and alarming complication that must be known and taken into account in the differential diagnosis of symptomatic cases after colonoscopy, particularly in patients with known risk factors. The diagnosis is mainly based on clinical data (abdominal pain and rectal bleeding), imaging (particularly abdomen CT) and especially endoscopy (colonoscopy). The treatment is almost always conservative, but in some cases in which the pathological process appears advanced or even irreversible, surgery becomes mandatory.

Therefore, we suggest to observe a few simple effective 'rules' during colonoscopy: (1) not exceed in the intraluminal gas insufflation; (2) prefer CO₂ to air while insufflating because it is quickly absorbed by microcirculation; (3) do not exceed the duration of the procedure; (4) minimize the trauma on the colonic wall and mesocolon, and (5) do not insist on overcoming obstacles that currently appear hostile.

Statement of Ethics

Written informed consent was obtained from the patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Disclosure Statement

The authors declare that they have no conflicts of interest to disclose.

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Fig. 1. Intraoperative image showing the resected specimen from the distal third of the transverse colon to the proximal rectum in which the infarcted area is visible along the antimesenteric side.

Table 1. Major classes of pharmacologic agents known to be associated with colon ischemia

Antibiotics
Appetite suppressants: phentermine
Chemotherapeutic agents: vinca alkaloids and taxanes
Constipation-inducing medications
Decongestants: pseudoephedrine
Cardiac glycosides
Diuretics
Ergot alkaloids
Hormonal therapies
Hyperlipidemic agents: statins
Illicit drugs
Immunosuppressive agents
Laxatives: osmotic agents
Nonsteroidal anti-inflammatory agents
Psychotropic medications
Serotonin agonists/antagonists
Statins
Vasopressor agents

Table 2. Procedure characteristics from the reports of CI after colonoscopy

First author [ref], year	Age, years	Sex	Risk factors	Indication for colonoscopy	Preparation for colonoscopy	Duration	Abnormality	Procedures
Wheeldon [7], 1990	59	F	Systemic lupus erthematosus	Screening	n.a.	15 min	none	none
Church [8], 1995	45	F	Mixed connective tissue disorder	Rectal bleeding	n.a.	n.a.	none	none
Cremers [9], 1998	44	F	none	Abdominal pain	Polyethylene glycol	n.a.	none	none
Yoshikawa [19], 1999	70	M	none	Rectal bleeding	n.a.	5 min	Diverticulosis	none
Yoshikawa [19], 1999	36	M	none	Rectal bleeding	n.a.	n.a.	none	none
Yoshida [20], 2000	84	M	Pneumonia on pulmonary emphysema	Rectal bleeding	n.a.	n.a.	Polyp	Polyp resection
Nam [21], 2002	50	M	none	Abdominal pain	Sodium phosphate	n.a.	none	none
Lee [22], 2003	49	M	Cardiovascular medication	n.a.	n.a.	n.a.	Polyps	Polyps resections
Versaci [23], 2005	43	F	Systemic lupus erthematosus	Change of bowel habit	n.a.	n.a.	Metaplastic polyp Erythematous areas	none
Nozawa [24], 2007	81	F	Cardiovascular medication	Abdominal pain	Magnesium citrate	n.a.	Polyps	Polyps resections
Yüksel [25], 2008	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Arhan [10], 2009	25	F	none	Constipation	Calcium semnoside Sodium phosphate enema	25 min	none	none
Kao [11], 2009	55	M	none	Screening	n.a.	n.a.	none	none
Dong [12], 2009	54	F	none	Abdominal pain	n.a.	n.a.	none	none
Lee [26], 2010	50	F	none	Abdominal pain	Sodium phosphate	n.a.	none	none
Lee [26], 2010	58	M	Cardiovascular medication	Screening	Sodium phosphate	37 min	Polyps	Polyps resections
Singh-Ranger [27], 2011	49	F	none	Abdominal discomfort	Sodium picosulphate	n.a.	none	Biopsies
Cheng [28], 2012	NA	M	none	Screening	Sodium phosphate	n.a.	Dry, wan mucosa	none
Sapmaz [29], 2014	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Ozturk [30], 2014	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Lee [13], 2014	47	F	none	Screening	Polyethylene glycol	n.a.	Single polyp	Polyp resection
Lee [13], 2014	40	M	none	Screening	Polyethylene glycol	n.a.	none	none
Omar [14], 2015	70	F	none	Screening	Polyethylene glycol	30 min	Diverticulosis	none
Jendrek [15], 2016	77	M	Arteriosclerosis/ cardiovascular medication Ischemic heart disease/diabetes mellitus	Screening	Macrogol/polyethylene glycol	n.a.	Diverticulosis	none
Current report	43	F	none	Screening	Macrogol/polyethylene glycol	37 min	none	none

n.a. = Not available.

Table 3. Patient characteristics from the reports of CI after colonoscopy

First author [ref.], year	Age, years	Sex	Onset	Symptoms	Peritonitis signs	Diagnosis	Treatment	Length of stay, days	Complications
Wheeldon [7], 1990	59	F	24 h	Lower abdominal pain/vomiting watery diarrhea/rectal bleeding	yes	Colonoscopy	Conservative	6	none
Church [8], 1995	45	F	24 h	Fever/shakes/chills/abdominal pain	yes	Colonoscopy	Surgery (Loop sigmoid colostomy)	n.a.	none
Cremers [9], 1998	44	F	48 h	Abdominal pain/rectal bleeding	no	Colonoscopy	Conservative	2	none
Yoshikawa [19], 1999	70	M	n.a.	Abdominal pain/rectal bleeding	no	Colonoscopy	Conservative	8	none
Yoshikawa [19], 1999	36	M	n.a.	Abdominal pain/diarrhea/rectal bleeding	no	Colonoscopy	Conservative	7	none
Yoshida [20], 2000	84	M	n.a.	Rectal bleeding	no	Colonoscopy	Conservative	n.a.	none
Nam [21], 2002	50	M	48 h	Abdominal pain/rectal bleeding	no	Colonoscopy	Conservative	n.a.	none
Lee [22], 2003	49	M	n.a.	Abdominal pain/rectal bleeding	no	n.a.	Conservative	n.a.	n.a.
Versaci [23], 2005	43	F	4 h	Lower abdominal pain mucous diarrhea/rectal bleeding	no	n.a.	Conservative	n.a.	none
Nozawa [24], 2007	81	F	2 h	Left lower abdominal pain/rectal bleeding	no	Colonoscopy	Conservative	8	none
Yüksel [25], 2008	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Arhan [10], 2009	25	F	1 h	Left lower abdominal pain/rectal bleeding	no	US/Colonoscopy	Conservative	5	none
Kao [11], 2009	55	M	n.a.	Lower abdominal pain/rectal bleeding	no	Colonoscopy	Conservative	NA	none
Dong [12], 2009	54	F	n.a.	Lower abdominal pain/rectal bleeding	yes	CT/Colonoscopy	Conservative	NA	none
Lee [26], 2010	50	F	72 h	Abdominal pain/rectal bleeding	no	CT/Colonoscopy	Conservative	6	none
Lee [26], 2010	58	M	n.a.	Abdominal pain/rectal bleeding	no	CT	Conservative	NA	none
Singh-Ranger [27], 2011	49	F	n.a.	Abdominal pain/fever/tachycardia	no	CT	Conservative	NA	none
Cheng [28], 2012	n.a.	M	n.a.	Periumbilical abdominal pain/bloody diarrhea	no	CT/Colonoscopy	Conservative	7	none
Sapmaz [29], 2014	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Ozturk [30], 2014	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Lee [13], 2014	47	F	7 h	Abdominal pain/rectal bleeding	no	CT/Colonoscopy	Conservative	9	none
Lee [13], 2014	40	M	18 h	Abdominal pain/rectal bleeding	no	CT/Colonoscopy	Conservative	9	none
Omar [14], 2015	70	F	24 h	Abdominal pain/rectal bleeding	no	CT/Colonoscopy	Conservative	n.a.	none
Jendrek [15], 2016	77	M	48 h	Left lower abdominal pain/vomiting watery diarrhea/bloody diarrhea	no	US/Colonoscopy	Conservative	n.a.	none
Current report	43	F	12 h	Fever/abdominal pain/rectal bleeding	yes	CT/Laparoscopy	Surgery (Left hemicolectomy, terminal colostomy)	22	Rectal discharge (pus)

n.a. = Not available; US = ultrasonography.