# Comparison of Ischemic Colitis in the Young and the Elderly

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## ABSTRACT

**Background:** Ischemic colitis is traditionally known as a disease of the elderly; however, its recognition among the young recently has increased. The aim of this study was to illustrate the features of ischemic colitis in a younger population.

**Methods:** Medical records of patients with ischemic colitis from January 2007 to January 2013 were reviewed. The study was conducted in 2 hospitals, and the patients were divided into 2 groups: < 50 and ≥ 50 years old.

**Results:** A total of 118 patients with ischemic colitis were identified. Fifteen patients (12.7%) were < 50 years of age; 103 patients (87.3%) were ≥ 50 years old. While drugs and vasculitis—as a group—was the most common precipitating factor for ischemic colitis in the younger age group, constipation was the most common precipitating factor in the older age group. All patients in the younger group had rectal bleeding vs 70.9% in the older group ($P = 0.009$). History of coronary artery disease, dyslipidemia, and hypertension were higher in the older group. Length of hospital stay was shorter in the younger group (3.4 days) than the older group (7.2 days).

**Conclusion:** In this study, 12.7% of the patients were under age 50. All patients in this "young" age group experienced rectal bleeding and their hospital stay was shorter.

## INTRODUCTION

Ischemic colitis is a consequence of a sudden reduction of the splanchnic blood flow to the colon, resulting in an ischemic insult. The incidence of ischemic colitis has been estimated to range from 4.5 to 44 per 100,000 population.[1] Ischemic colitis is usually a segmental disease with a sharp demarcation between the normal mucosa and the affected areas.[2,3] Although the splenic flexure and rectosigmoid junction—known as watershed areas—are the most commonly affected areas, the right colon is involved in 20% to 25% of cases.[4-8] These watershed areas, considered to be the weak points of blood supply, exist in the anastomotic areas between the superior mesenteric artery and the inferior mesenteric artery, and the inferior mesenteric artery and the internal iliac artery territory, respectively.[2-10]

The predisposing factors for ischemic colitis are generally divided into 2 categories: vascular factors and bowel factors; both lead to inadequate blood flow to the colonic wall and cause an ischemic injury. The most common cause for the development of ischemic colitis is transient hypoperfusion to the colon, regardless of the cause.[5,11] In systemic hypotension, ischemic injury preferentially occurs in the watershed areas of the colon, which have relatively limited collateral networks. In general, any condition that causes a reduction in the blood supply to the colon potentially can induce ischemic colitis. In this context, vascular surgery, including abdominal aortic aneurysm repair, coronary artery bypass grafting, aorto-iliac reconstruction surgery, endovascular repair of aorto-iliac aneurysm, and any surgical procedure that requires aortic vascular clamping have been associated with a higher incidence of ischemic colitis.[2,3,12,13]

Vasospasm of the colonic vessels is another mechanism for developing ischemic colitis, either due to systemic hypoperfusion, which shunts the blood from the intestine to the brain and other viable organs, or due to exposure to drugs and substances such as phenylephrine and cocaine that have direct or indirect vasoconstrictive effects.[5-8] A third pathophysiology is hyperco-

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agulable states, including gene mutations and coagulation factor deficiencies such as protein C and S.[14-17] Depending on the studies, 28% to 72% of patients with ischemic colitis have one or more coagulation disorders.[16,17] A final pathophysiology for the vascular factors that lead to ischemic colitis is vasculitis, as occurs in cases of systemic lupus erythematous (SLE) and antiphospholipid syndrome.[2,18]

Bowel factors that might precipitate ischemic colitis are constipation, irritable bowel syndrome (IBS), fecal impaction, colonic obstruction, and any other condition that increases the colonic intraluminal pressure, which may compromise the blood flow to the colonic wall, potentially causing ischemic injury.[1,2,14,19]

In spite of the fact that ischemic colitis is known as disease of the elderly, it has been diagnosed increasingly in younger patients but has not been studied extensively in this population. This study aimed to explore similarities and differences of ischemic colitis in a younger population vs an older age group and to identify any risk factors for developing ischemic colitis in the young age group.

## METHODS

The medical records of all patients with the diagnosis of ischemic colitis from January 2007 to January 2013 were reviewed. The study was conducted in 2 hospitals (CGH Medical Center, Sterling, Illinois, and Saint Francis Hospital, Evanston, Illinois) after obtaining Institutional Review Board (IRB) approval from each institution. Demographic details, clinical symptoms and signs, laboratory studies, imaging findings, endoscopic and histological features, location of ischemic colitis, comorbidities, concomitant use of medications, surgical treatment, blood transfusion, hospital stay, requirement for intensive care unit and mechanical ventilation, and all-causes mortality within 30 days were collected. Patients then were divided into 2 groups based on their age at diagnosis of ischemic colitis: younger age group (< 50 years) and older age group ( ≥ 50 years).

Ischemic colitis cases were identified by using International Classification of Diseases, Ninth Revision (ICD-9) codes (557.0: acute vascular insufficiency and 557.9: unspecific vascular insufficiency) because there is no specific code for ischemic colitis. We undertook a comprehensive chart review on each case to determine the diagnosis of ischemic colitis. The diagnosis was made based on clinical symptoms and signs, negative stool studies for infections, with at least 1 diagnostic study consistent with ischemic colitis (computed tomographic [CT] scan, colonoscopy, or histopathology). Exclusion criteria were age < 18 years, pregnancy, positive studies for enteric pathogens, colonic ischemia due to trauma or mechanical causes, acute mesenteric ischemia, chronic bowel (mesenteric) ischemia, acute flare of inflammatory bowel disease, and radiological or colonoscopic evidence of diverticulitis. In addition, we excluded any cases with equivocal or uncertain diagnosis of ischemic colitis or where ischemic colitis was merely considered in the differential diagnosis but never confirmed by objective modalities. The anatomic location of the involved colonic segments was based on the surgery report, CT scan, and colonoscopy findings. If the surgery was performed, then the surgical report was taken for the involved location regardless of the colonoscopy and radiology reports. If the surgery was not deemed necessary, and if there was any discrepancy between CT scan and colonoscopy in terms of location, then the colonoscopy report was utilized. The location of ischemic colitis was divided to the right colon and left colon and then to specific segments of the colon (rectum, recto-sigmoid junction, sigmoid, descending colon, splenic flexure, transverse colon, hepatic flexure, ascending colon, and the cecum). Patients may have 1 or more affected segments.

Our group utilized the same dataset for other studies related to ischemic colitis, however, objectives of the published data and comparison groups were different.[20-22]

### Statistical Analysis

Patients' data were entered into a Microsoft Excel spreadsheet in a coded format and secured with a password. All analyses were completed using SAS software (SAS Institute Inc, Cary, North Carolina). A 2-sided $P$ value of $< 0.05$ was considered statistically significant. For quantitative variables such as the laboratory studies, parametric 2 sample $t$-tests were conducted to compare the means of the 2 age groups, but the assumptions associated with $t$-tests—homogeneity of variances and normality of data—were not satisfied. Hence, the nonparametric Wilcoxon's rank sum test was conducted to compare the means of the groups. The results for quantitative variables were reported as mean and standard deviation. A chi-square analysis, Fisher's exact test, and a Pearson correlation were conducted for categorical variables such as comorbidities.

## RESULTS

### Patients' Clinical Characteristics (Table 1)

A total of 118 patients in both hospitals were diagnosed with ischemic colitis from January 2007 to January 2013. The mean age was 69.4 years, with a female predominance of 83%. These patients then were divided into 2 groups based on age at diagnosis: the "younger group" (< 50 years), and the "older group" (≥ 50 years). Fifteen patients (12.7%) were < 50 years at the time of diagnosis, compared to 103 (87.3%) who were ≥ 50 years. The mean age of the patients in the younger group was 40.8 years vs 73.6 years in the older group. The majority of patients in both groups were white women. There was no difference in smoking habits and body mass index between the groups.

All patients in the younger group (100%) presented with rectal bleeding when compared to 70.87% in the older group, which was statistically significant ($P = 0.009$). Other clinical

**Table 1.** Clinical Characteristics of Age Groups <50 Years and ≥ 50 Years

| | Younger Group (<50 Years) (N=15) | Older Group (≥50 Years) (N=103) | *P*-value |
|---|---|---|---|
| **Mean age (years)** | **40.8** | **73.6** | **NS** |
| **Sex** | | | |
| Female | 12 (80%) | 86 (83.50%) | |
| Male | 3 (20%) | 17 (16.5%) | NS |
| **Race** | | | |
| White | 12 (80%) | 85 (82.52%) | |
| Others | 3 (20%) | 18 (17.48%) | NS |
| Mean body mass index ±SD | 31.3±9.4 | 27.6±6.0 | NS |
| **Smoking Habits** | | | |
| Never smoked | 9 (60%) | 59 (57.84%) | |
| Ex-smoker | 1 (6.67%) | 23 (22.55%) | |
| Current smoker | 5 (33.33%) | 20 (19.61%) | |
| Missing data | 0 | 1 | NS |
| **Clinical Symptoms/Signs** | | | |
| Abdominal pain | 11 (73.33%) | 86 (83.50%) | NS |
| Nausea | 5 (33.33%) | 38 (36.89%) | NS |
| Vomiting | 2 (13.33%) | 32 (31.07%) | NS |
| Diarrhea | 11 (73.33%) | 54 (52.43%) | NS |
| *Rectal bleeding | 15 (100%) | 73 (70.87%) | 0.009 |
| Abdominal distension | 0 (0%) | 8 (7.77%) | NS |
| Fever | 5 (33.33%) | 13 (12.62%) | NS |
| Peritoneal signs | 0 (0%) | 6 (5.83%) | NS |
| Mean SBP±SD | 132.1±26.4 | 135.5±34.2 | NS |
| *Mean DSP±SD | 80.1±13.7 | 69.1±15.5 | 0.0133 |
| Mean HR±SD | 87.5±25.4 | 82.8±21.0 | NS |
| **Comorbidities** | | | |
| *Hypertension | 7 (50%) | 86 (83.50%) | 0.009 |
| *Hyperlipidemia | 3 (21.43%) | 65 (63.11%) | 0.004 |
| *Coronary artery disease | 0 (0%) | 37 (35.92%) | 0.003 |
| Diabetes mellitus | 1 (7.14%) | 24 (23.30%) | NS |
| Congestive heart failure | 1 (7.14%) | 9 (8.74%) | NS |
| Atrial fibrillation | 0 (0%) | 21 (20.39%) | NS |
| Peripheral vascular disease | 1 (7.14%) | 10 (9.71%) | NS |
| Cerebrovascular disease | 2 (14.29%) | 11 (10.68%) | NS |
| Chronic obstructive pulmonary disease | 0 (0%) | 17 (16.51%) | NS |
| Chronic kidney disease | 1 (7.14%) | 14 (13.59%) | NS |
| Deep vein thrombosis | 0 (0%) | 4 (3.88%) | NS |

| | Younger Group (<50 Years) (N=15) | Older Group (≥50 Years) (N=103) | *P*-value |
|---|---|---|---|
| **Comorbidities (continued)** | | | |
| Irritable bowel syndrome | 1 (7.14%) | 2 (1.94%) | NS |
| Abdominal aortic aneurysm | 0 (0%) | 9 (8.91%) | NS |
| Missing data | 1 | 0 | |
| Abdominal surgery (any) | 6 (40%) | 60 (59.41%) | NS |
| Appendectomy | 3 (20%) | 19 (18.81%) | NS |
| Cholecystectomy | 3 (20%) | 26 (25.74%) | NS |
| Hysterectomy | 5 (33.33%) | 31 (30.69%) | NS |
| Missing data | 0 | 2 | NS |
| **Drugs** | | | |
| *Clopidogrel | 0 (0%) | 24 (23.76%) | 0.024 |
| *Aspirin | 2 (13.33%) | 51 (50.50%) | 0.006 |
| *Statins | 1 (6.67%) | 52 (51.49%) | 0.001 |
| *Calcium channel blockers | 0 (0%) | 39 (38.61%) | 0.001 |
| β-blockers | 6 (40%) | 50 (49.51%) | NS |
| ACEIs | 4 (26.67%) | 50 (49.51%) | NS |
| ARBs | 0 (0%) | 13 (12.87%) | NS |
| Diuretics | 2 (13.33%) | 32 (31.68%) | NS |
| NSAIDs | 2 (13.33%) | 9 (8.91%) | NS |
| Digoxin | 0 (0%) | 6 (5.94%) | NS |
| Warfarin | 0 (0%) | 14 (13.86%) | NS |
| Antidepressants/ antipsychotics | 5 (33.33%) | 29 (28.71%) | NS |
| Missing data | 0 | 2 | |
| *Mean hospital stay ± SD (days) | 3.4±1.5 | 7.2±8.0 | 0.0007 |
| Intensive Care Unit stay | 1 (6.67%) | 21 (20.39%) | NS |
| Required mechanical ventilation | 0 (0%) | 14 (13.59%) | NS |
| Occurred while at hospital (inpatient onset) | 0 (0%) | 11 (10.68%) | NS |
| Recurrence | 1 (6.67%) | 9 (8.74%) | NS |
| Required blood transfusion | 1 (6.67%) | 23 (22.33%) | NS |
| Required surgery | 0 (0%) | 14 (13.59%) | NS |
| Death in 30 days | 0 (0%) | 5 (4.85%) | NS |
| Severe ischemic colitis (required surgery or died) | 0 (0%) | 15 (14.56%) | NS |
| **Direct Causes** | | | **0.002** |
| *Constipation | 1 (6.67%) | 15 (14.56%) | |
| *Hypotension | 1 (6.67%) | 6 (5.83%) | |
| *Drug/vasculitis | 4 (26.67%) | 2 (1.94%) | |

Abbreviations: ACEI: angiotensin converting enzyme inhibitors, ARB: angiotensin receptor blockers, NS: not statistically significant, NSAIDs: nonsteroidal anti-inflammatory drugs.
*Signifies statistical significant values.

symptoms and signs (abdominal pain, nausea, vomiting, diarrhea, abdominal distension, fever, and peritoneal signs) were not statistically significant. Although systolic blood pressure and heart rate at presentation were not significantly different between the groups, diastolic blood pressure was lower in the older group vs the younger group (69.1 ± 15.5 mmHg, and 80.1 ± 13.7 mmHg respectively, $P = 0.0133$). Hypertension (HTN) [83.5% vs 50%, $P = 0.009$], hyperlipidemia (HLD) [63.11% vs 21.43%, $P = 0.004$], and coronary artery disease (CAD) [35.92% vs 0.0%, $P = 0.003$] were significantly more frequent in the older group than the younger group. Other comorbidities (diabetes mellitus, congestive heart failure, atrial fibrillation, peripheral vascular disease, cerebrovascular accidents, chronic obstructive pulmonary disease, chronic kidney disease, deep venous thrombosis, IBS, abdominal aortic aneurysm, and autoimmune diseases) and a history of abdominal surgeries (hysterectomy, appendectomy, and cholecystectomy) were not statistically significant.

Use of medications was significantly higher in the older group than the younger group (Table 2). Use of other medi-

cations (beta-blockers, angiotensin converting enzyme inhibitors, angiotensin receptor blockers, diuretics, nonsteroidal anti-inflammatory drugs, digoxin, warfarin, and antidepressants/antipsychotics) was not significant between both groups.

To accurately calculate hospital length of stay (LOS), we used the website www.timeanddate.com. We included both admission and discharge days, but did not calculate LOS in hours. For the younger group, LOS was shorter (3.4 ± 1.5 days) than it was for the older group (7.2 ± 8.0 days) ($P = 0.0007$). The need for intensive care unit stays, mechanical ventilation, and blood transfusions was not different between groups. Severe ischemic colitis, the need for surgery, death within 30 days, recurrence, and inpatient onset of ischemic colitis were lower in the younger group but did not reach a statistical difference. Five patients in the older group died within 30 days of diagnosis from different causes (ischemic colitis [2], sepsis [2], and sudden cardiac death [1]). Four of those patients underwent surgery for ischemic colitis. The mean interval from the admission to death was 19.8 ± 10.3 days (3, 18, 22, 27, 29 days, respectively).

While drugs and vasculitis—together as one direct predisposing factor of ischemic colitis—was significantly higher in the younger group, constipation was noticed frequently in the older group ($P = 0.002$). There were 4 cases of drugs and vasculitis in the younger group (Hydroxycut: age 37, alosetron: age 40, systemic lupus erythematous [SLE]: age 21, fibromuscular dysplasia: age 42), and 2 cases in the older group (meclizine: age 80, SLE: age 73).

**Diagnostic Studies** (Table 3)

Although hemoglobin (Hb) upon admission was not significantly different between age groups, Hb dropped lower during hospitalization in the older group when compared to the younger group (10.2 ± 2.1 g/dL and 11.3 ± 1.5 g/dL, respectively, $P = 0.0367$). Albumin level was also lower in the older group vs the younger group (3.6 ± 0.5 g/dL and 4 ± 0.4 g/dL, respectively, $P = 0.0064$), and renal function as measured with serum creatinine level was worse in the older group than the younger group (1.4 ± 1 mg/dL and 1.0 ± 0.4 mg/dL, respectively, $P = 0.0203$). Blood glucose level at admission, white blood cell count (WBC) at admission, highest WBC during hospitalization, lactic acid levels, and amylase levels were higher in the older group but did not reach statistical significance. The levels of serum sodium (Na), alanine aminotransferase (ALT), lipase, bicarbonate at admission between groups were not statistically significant.

CT scan of the abdomen and pelvis was performed in 86.67% of the patients in the younger group compared to 74.76% of the patients in the older group. CT scan was normal in 7.69% of the younger group vs 11.69% of the older group. None of the radiologic findings of CT scan (wall thickening, induration, pericolonic fat stranding, loss of haustra, free intra-abdominal fluid, pneumatosis coli, portal or mesenteric vein air, pneumoperitoneum, and bowel loop dilation) were statistically significant between groups. Colonoscopy was performed in 93.33% of the younger group compared to 72.82% of the older group, with 1 missing data set in the younger group. None of the endoscopic findings (edema, erythema, erosions or ulcerations, friability or active bleeding, fibropurulent exudate or necrosis, and stricture or stenosis) was statistically significant between age groups. Histopathology (either from endoscopic biopsy or surgery) was available for 93.33% of the patients in the younger group vs 77.67% in the older group. Histology was normal for 7.14% and 3.75%, respectively. None of the histological findings (edema, epithelium loss or ulceration, crypt loss, acute inflammation, chronic inflammation, capillary thrombosis, necrosis or fibropurulent exudate, submucosal hemorrhage, vascular congestion, mucosal or transmural infarction, and chronic ulcer) was statistically significant between the groups. There was 1 case of pancolitis, which was considered to have involved all of the segments and was counted as both right colon and left colon. There was no statistical difference between the age groups in terms of the anatomic location of ischemic colitis.

**Table 2.** Use of Medications Among Patients Diagnosed With Ischemic Colitis, Age ≥ 50 Years vs < 50 Years

| Medication | Older Group ≥50 years | Younger Group <50 Years | *P*-value |
|---|---|---|---|
| Clopidogrel | 23.76% | 0% | 0.024 |
| Aspirin | 50.50% | 13.33% | 0.006 |
| Statins | 51.49% | 6.67% | 0.001 |
| Calcium channel blockers | 38.61% | 0% | 0.001 |

## DISCUSSION

Ischemic colitis occurs infrequently before age 50; however, if it occurs in this age group, an overt precipitating condition such as shock is usually present. During the 6-year study period, ischemic colitis affected young people (< 50 years) in 12.7% of the study population, with a female predominance. This incidence did not differ from results of the other studies, which commonly ranged from 10% to 15%.[23,24] However, ischemic colitis in this younger population has been reported as high as 34%.[25] Although female predominance of ischemic colitis in general and young-onset ischemic colitis has been demonstrated in multiple studies,[4,15,23,25-28] the precise reason for its predominance is still unclear.

Many drugs have been attributed to the development of ischemic colitis including triptans, anticonstipation drugs such as tegaserod and lubiprostone, chemotherapy drugs such as bevacizumab and irinotecan, hepatitis C therapy with pegylated interferon and ribavirin, weight loss medications such as phentermine, and herbal remedies such as ma huang (ephedra) and Hydroxycut.[5-8] Certain medications have been known for their association with

**Table 3.** Laboratory, Radiology, Colonoscopy, Histopathology Findings Between Age Groups <50 years and ≥50years

| | Younger Group (<50 Years) (N=15) | Older Group (≥50 Years) (N=103) | *P*-value |
|---|---|---|---|
| Mean WBC±SD | 10.8±4.0 | 13.3±6.5 | NS |
| Mean highest WBC ±SD during hospital stay | 12.2±6.1 | 14.9±6.9 | NS |
| Mean hemoglobin ±SD | 13.9±1.3 | 12.9±2 | NS |
| *Mean lowest Hb ±SD during hospital stay | 11.3±1.5 | 10.2±2.1 | 0.0367 |
| *Mean albumin ±SD | 4±0.4 | 3.6±0.5 | 0.0064 |
| Mean bicarbonate ±SD | 26.2±3.2 | 25.2±3.8 | NS |
| Mean sodium ±SD | 139.1±3.5 | 138.3±5.3 | NS |
| *Mean creatinine ±SD | 1±0.4 | 1.4±1.0 | 0.0203 |
| Mean ALT ±SD | 31.2±17.7 | 29.7±16.8 | NS |
| Mean amylase ±SD | 60.5±23.5 | 115.8±192.0 | NS |
| Mean lipase ±SD | 148.9±107.5 | 113.4±118.5 | NS |
| Mean glucose ±SD | 114.1±17.3 | 139.2±75.4 | NS |
| Mean lactic acid ±SD | 1.5±0.9 | 5±12.3 | NS |
| **Computed Tomography (CT) Findings** | | | |
| Performed | 13 (86.67%) | 77 (74.76%) | |
| Normal CT | 1 (7.69%) | 9 (11.69%) | NS |
| Wall thickening | 12 (92.31%) | 53 (68.83%) | NS |
| Induration | 5 (38.46%) | 15 (19.48%) | NS |
| Pericolonic fat stranding | 6 (46.15%) | 48 (62.34%) | NS |
| Loss of haustra | 1 (7.69%) | 4 (5.20%) | NS |
| Free intra-abdominal fluid | 2 (15.39%) | 14 (18.8%) | NS |
| Pneumatosis coli | 0 | 7 (9.09%) | NS |
| Portal/mesenteric vein air | 0 | 4 (5.20%) | NS |
| Pneumoperitoneum | 0 | 4 (5.20%) | NS |
| Bowel dilation | 0 | 13 (16.88%) | NS |
| **Colonoscopy Findings** | | | |
| Performed | 14 (93.33%) | 75 (72.82%) | NS |
| Edema | 7 (53.85%) | 45 (60%) | NS |
| Erythema | 7 (53.85%) | 50 (66.67%) | NS |
| Erosions/ulcerations | 10 (76.92%) | 37 (49.33%) | NS |
| Friability/active bleeding | 2 (15.39%) | 22 (29.33%) | NS |
| Exudate/necrosis | 1 (7.69%) | 8 (10.67%) | NS |
| Stricture | 0 | 2 (2.67%) | NS |
| Missing data | 1 | 0 | |
| **Histology Findings** | | | |
| Available | 14 (93.33%) | 80 (77.67%) | |
| Normal histology | 1 (7.14%) | 3 (3.75%) | NS |
| Edema | 3 (21.43%) | 5 (6.25%) | NS |
| Epithelium loss (ulceration) | 5 (35.71%) | 26 (32.5%) | NS |
| Crypt loss | 3 (21.43%) | 7 (8.75%) | NS |
| Acute inflammation | 7 (50%) | 61 (76.25%) | NS |
| Chronic inflammation | 3 (21.43%) | 30 (37.5%) | NS |
| Capillary thrombosis | 1 (7.14%) | 4 (5%) | NS |
| Necrosis/exudate | 4 (28.57%) | 35 (43.75%) | NS |
| Submucosal hemorrhage | 3 (21.43%) | 17 (21.25%) | NS |
| Vascular congestion | 0 | 5 (6.25%) | NS |
| Mucosal/transmural infarction | 2 (14.29%) | 5 (6.25%) | NS |
| Chronic ulcer | 0 | 10 (12.5%) | NS |
| **Location** | | | |
| Left colon | 15 (100%) | 81 (82.65%) | NS |
| Right colon | 0 | 17 (17.35%) | NS |
| Pancolitis | 0 | 1 (1.02%) | NS |
| Rectum | 0 | 4 (4.08%) | NS |
| Rectosigmoid junction | 4 (26.67%) | 11 (11.23%) | NS |
| Sigmoid | 5 (33.33%) | 45 (45.92%) | NS |
| Descending colon | 13 (86.67%) | 61 (62.25%) | NS |
| Splenic flexure | 11 (73.33%) | 48 (48.98%) | NS |
| Transverse colon | 6 (40%) | 28 (28.57%) | NS |
| Hepatic flexure | 0 | 9 (9.18%) | NS |
| Ascending colon | 0 | 14 (14.29%) | NS |
| Cecum | 0 | 13 (13.27%) | NS |
| Missing data | 0 | 6 | |

Abbreviations: ALT: alanine aminotransferase, NS: not statistically significant, WBC: white blood cells.
*signifies statistical significant values.

ischemic colitis, including alosetron and female hormones.[26-29] The role of oral contraceptives and estrogen therapy has been suggested in some studies, however in our study, owing to its retrospective nature, the information on hormonal therapy was not well documented, possibly due to under-reporting of the information.[26,27]

Vasculitis such as SLE and antiphospholipid syndrome also has been associated with ischemic colitis.[2,18] In our study, drugs and vasculitis together were the most direct predisposing factor for ischemic colitis. In the older group, constipation—a known risk factor for ischemic colitis in the younger group—was the most common predisposing factor. The postulated mechanism is that increased colonic intraluminal pressure due to constipation shunts blood flow from the mucosa to the serosa and potentially contributes to a reduction in the colonic blood supply with subsequent ischemic injury. A high frequency of constipation with ischemic colitis, especially in the elderly, has been demonstrated in other studies as well.[25,30] However, constipation was more frequent in young patients with ischemic colitis compared to the elderly in other studies.[31]

Unlike the 2012 study by Kimura et al,[23] our study did not demonstrate a difference in smokers/previous smokers vs never smokers, in either group. This might be related to the smaller numbers of subjects in our study in comparison to the larger Japanese study, which included data from 5 centers, or it might represent an actual difference in the propensity of elderly in United States to continue smoking into old age vs the elderly in Japan.

Hyperuricemia has been shown to be a risk factor for ischemic colitis in young patients;[23] however, uric acid level was not performed in most cases as it is not a routine laboratory test.

Clinical symptoms of ischemic colitis in the young patients

were comparable to the older patients except for rectal bleeding, which was significantly higher in the young group (100% vs 70.87% respectively, $P = 0.009$). It is unclear whether this represents a different pathophysiology between the groups, or it is simply explained by the avoidance of medical attention by young people until serious events such as seeing blood per rectum, occur. Presence of rectal bleeding has been reported to be high in young patients (in almost every study, rectal bleeding was present in 100% of the young patients with ischemic colitis).[23,27,28] Vital signs were not different between the age groups in our study, except diastolic blood pressure, which was lower in the older group. It is expected that the vital signs of the elderly deteriorate quicker than young people with any acute illnesses as their compensation mechanisms are suboptimal in general.

The incidences of HTN, HLD, and CAD were significantly higher in the older group than the younger group. These 3 conditions and the other cardiovascular risk factors have been associated repeatedly with ischemic colitis in the elderly.[4,9,23] It seems that ischemic colitis is a surrogate for cardiovascular diseases, and it may be worthwhile to exclude cardiovascular disease in any patients with ischemic colitis, especially the elderly.

In parallel to the high incidences of these 3 conditions in the older group, use of medications (clopidogrel, aspirin, statins, and calcium channel blockers) also was significantly higher. The association of aspirin and calcium channel blockers with ischemic colitis has been described previously.[32] It is unclear whether this association is a true association or because of the underlying diseases (HTN, HLD, and CAD).

In spite of the fact that rectal bleeding was more frequent in the young group and the admission Hb was not different between the groups, there was a statistically significant fall in Hb during hospitalization in the older group. Higher consumption of antiplatelet agents (aspirin and clopidogrel) in the older group, which predisposes to a higher blood loss with any bleeding, may explain this phenomenon.

Radiologic, endoscopic, histopathological findings were not different between both groups. Although none of the subjects in the younger group had right colon ischemic colitis, it did not reach statistical difference. The hospital length of stay was shorter in the younger group than the older group, which is consistent with other studies.[23]

Study limitations were the small number of patients in the younger group and the retrospective nature of the study, as our data was limited by the database descriptors. However, this is a 6-year experience from a community hospital setting.

## CONCLUSION

Women more commonly developed ischemic colitis in both age groups. Ischemic colitis in the younger group was associated with a higher rate of rectal bleeding and was more commonly precipitated by vasculitis or medication use. Cardiovascular risk factors were seen less frequently in the younger group. Radiological, endoscopic, and histological findings were not different between the young and elderly groups. Further elucidation of our results should be attempted on a larger study.

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## REFERENCES

**1.** Higgins PD, Davis KJ, Laine L. Systematic review: the epidemiology of ischaemic colitis. *Aliment Pharmacol Ther.* 2004;19(7):729-738.

**2.** Balthazar EJ, Yen BC, Gordon RB. Ischemic colitis: CT evaluation of 54 cases. *Radiology.* 1999;211(2):381-388.

**3.** Baixauli J, Kiran RP, Delaney CP. Investigation and management of ischemic colitis. *Cleve Clin J Med.* 2003;70(11):920-921, 925-926, 928-930 passim.

**4.** Brandt LJ, Feuerstadt P, Blaszka MC. Anatomic patterns, patient characteristics, and clinical outcomes in ischemic colitis: a study of 313 cases supported by histology [published online ahead of print June 8, 2010.] *Am J Gastroenterol.* 2010;105(10):2245-2252.

**5.** Sherid M, Ehrenpreis ED. Types of colitis based on histology. *Dis Mon.* 2011;57(9):457-489.

**6.** Sherid M, Sifuentes H, Samo S, Deepak P, Sridhar S. Lubiprostone induced ischemic colitis. *World J Gastroenterol.* 2013;19(2):299-303.

**7.** Sherid M, Samo S, Sulaiman S, Gaziano JH. Ischemic colitis induced by the newly reformulated multicomponent weight-loss supplement Hydroxycut). *World J Gastrointest Endosc.* 2013;5(4):180-185.

**8.** Sherid M, Samo S, Husein H, Sulaiman S, Vainder JA. Pseudoephedrine-induced ischemic colitis: case report and literature review. *J Dig Dis.* 2014;15(5):276-280.

**9.** Medina C, Vilaseca J, Videla S, Fabra R, Armengol-Miro JR, Malagelada JR. Outcome of patients with ischemic colitis: review of fifty-three cases. *Dis Colon Rectum.* 2004;47(2):180-184.

**10.** Paterno F, McGillicuddy EA, Schuster KM, Longo WE. Ischemic colitis: risk factors for eventual surgery. *Am J Surg.* 2010;200(5):646-650. doi:10.1016/j.amjsurg.2010.07.005.

**11.** Pérez-Carral C, Carreira J, Vidal C. Acute ischaemic colitis due to hypotension and amoxicillin allergy. *Postgrad Med J.* 2004;80(943):298-299.

**12.** Lozano-Maya M, Ponferrada-Díaz A, González-Asanza C, et al. Usefulness of colonoscopy in ischemic colitis. *Rev Esp Enferm Dig.* 2010;102(8):478-483.

**13.** Darras S, Paineau J, Patra P, Goueffic Y. Prognostic factors of ischemic colitis after infrarenal aortic surgery. *Ann Vasc Surg.* 2011;25(5):612-619.

**14.** Huerta C, Rivero E, Montoro MA, García-Rodriguez LA. Risk factors for intestinal ischaemia among patients registered in a UK primary care database: a nested case-control study [published online ahead of print March 1, 2011]. *Aliment Pharmacol Ther.* 2011;33(8):969-978.

**15.** Theodoropoulou A, Sfiridaki A, Oustamanolakis P, et al. Genetic risk factors in young patients with ischemic colitis [published online ahead of print June 4, 2008]. *Clin Gastroenterol Hepatol.* 2008;6(8):907-911.

**16.** Midian-Singh R, Polen A, Durishin C, Crock RD, Whittier FC, Fahmy N. Ischemic colitis revisited: a prospective study identifying hypercoagulability as a risk factor. *South Med J.* 2004;97(2):120-123.

**17.** Koutroubakis IE, Sfiridaki A, Theodoropoulou A, Kouroumalis EA. Role of acquired and hereditary thrombotic risk factors in colon ischemia of ambulatory patients. *Gastroenterology.* 2001;121(3):561-565.

**18.** Cervera R, Espinosa G, Cordero A, et al; Catastrophic Antiphospholipid Syndrome (CAPS) Registry Project Group. Intestinal involvement secondary to the antiphospholipid syndrome (APS): clinical and immunologic characteristics of 97 patients: comparison of classic and catastrophic APS [published online ahead of print Jan 3, 2007]. *Semin Arthritis Rheum.* 2007;36(5):287-296.

**19.** Suh DC, Kahler KH, Choi IS, Shin H, Kralstein J, Shetzline M. Patients with irritable bowel syndrome or constipation have an increased risk for ischaemic colitis. *Aliment Pharmacol Ther.* 2007 Mar 15;25(6):681-692.

**20.** Sherid M, Sifuentes H, Samo S, et al. Ischemic colitis: A forgotten entity. Results of a retrospective study in 118 patients. *J Dig Dis.* 2014;15(11):606-613.

**21.** Sherid M, Samo S, Sulaiman S, Husein H, Sethuraman SN, Vainder JA. Is CT Angiogram of the Abdominal Vessels Needed following the Diagnosis of Ischemic Colitis? A Multicenter Community Study. *ISRN Gastroenterol.* 2014;2014:756926.

**22.** Sherid M, Sifuentes H, Samo S, et al. Risk factors of recurrent ischemic colitis: a multicenter retrospective study. *Korean J Gastroenterol.* 2014;63(5):283-291.

**23.** Kimura T, Shinji A, Horiuchi A, et al. Clinical characteristics of young-onset ischemic colitis [published online ahead of print March 1, 2012]. *Dig Dis Sci.* 2012;57(6):1652-1659.

**24.** Tada M, Misaki F, Kawai K. Analysis of the clinical features of ischemic colitis. *Gastroenterol Jpn.* 1983 Jun;18(3):204-209.

**25.** Habu Y, Tahashi Y, Kiyota K, et al. Reevaluation of clinical features of ischemic colitis. Analysis of 68 consecutive cases diagnosed by early colonoscopy. *Scand J Gastroenterol.* 1996;31(9):881-886.

**26.** Preventza OA, Lazarides K, Sawyer MD. Ischemic colitis in young adults: a single-institution experience. *J Gastrointest Surg.* 2001;5(4):388-392.

**27.** Deana DG, Dean PJ. Reversible ischemic colitis in young women. Association with oral contraceptive use. *Am J Surg Pathol.* 1995;19(4):454-462.

**28.** Barcewicz PA, Welch JP. Ischemic colitis in young adult patients. *Dis Colon Rectum.* 1980;23(2):109-114.

**29.** Chang L, Tong K, Ameen V. Ischemic colitis and complications of constipation associated with the use of alosetron under a risk management plan: clinical characteristics, outcomes, and incidences [published online ahead of print March 2, 2010]. *Am J Gastroenterol.* 2010;105(4):866-875.

**30.** Mosele M, Cardin F, Inelmen EM, et al. Ischemic colitis in the elderly: predictors of the disease and prognostic factors to negative outcome. *Scand J Gastroenterol.* 2010;45(4):428-433.

**31.** Matsumoto T, Iida M, Kimura Y, et al. Clinical Features in young adult patients with ischemic colitis. *J Gastroenterol Hepatol.* 1994;9:572-575.

**32.** Cubiella Fernández J, Núñez Calvo L, González Vázquez E, et al. Risk factors associated with the development of ischemic colitis. *World J Gastroenterol.* 2010;16(36):4564-4569.

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