

## URGENT COLONOSCOPY FOR THE DIAGNOSIS AND TREATMENT OF SEVERE DIVERTICULAR HEMORRHAGE

DENNIS M. JENSEN, M.D., GUSTAVO A. MACHICADO, M.D., ROME JUTABHA, M.D., AND THOMAS O.G. KOVACS, M.D.

### ABSTRACT

**Background** Although endoscopy is often used to diagnose and treat acute upper gastrointestinal bleeding, its role in the management of diverticulosis and lower gastrointestinal bleeding is uncertain.

**Methods** We studied the role of urgent colonoscopy in the diagnosis and treatment of 121 patients with severe hematochezia and diverticulosis. All patients were hospitalized, received blood transfusions as needed, and received a purge to rid the colon of clots, stool, and blood. Colonoscopy was performed within 6 to 12 hours after hospitalization or the diagnosis of hematochezia. Among the first 73 patients, those with continued diverticular bleeding underwent hemicolectomy. For the subsequent 48 patients, those requiring treatment received therapy, such as epinephrine injections or bipolar coagulation, through the colonoscope.

**Results** Of the first 73 patients, 17 (23 percent) had definite signs of diverticular hemorrhage (active bleeding in 6, nonbleeding visible vessels in 4, and adherent clots in 7). Nine of the 17 had additional bleeding after colonoscopy, and 6 of these required hemicolectomy. Of the subsequent 48 patients, 10 (21 percent) had definite signs of diverticular hemorrhage (active bleeding in 5, nonbleeding visible vessels in 2, and adherent clots in 3). An additional 14 patients in this group (29 percent) were presumed to have diverticular bleeding because although they had no stigmata of diverticular hemorrhage, no other source of bleeding was identified. The other 24 patients (50 percent) had other identified sources of bleeding. All 10 patients with definite diverticular hemorrhage were treated endoscopically; none had recurrent bleeding or required surgery.

**Conclusions** Among patients with severe hematochezia and diverticulosis, at least one fifth have definite diverticular hemorrhage. Colonoscopic treatment of such patients with epinephrine injections, bipolar coagulation, or both may prevent recurrent bleeding and decrease the need for surgery. (N Engl J Med 2000;342:78-82.)

©2000, Massachusetts Medical Society.

**D**IVERTICULAR bleeding is a common cause of severe lower gastrointestinal bleeding in adults.<sup>1</sup> Identification of the origin of the bleeding, including diverticula, by endoscopy is facilitated by cleansing the colon with a purge.<sup>1,2</sup> For more than a decade, the stigmata of hemorrhage on endoscopy, such as active bleeding or adherent clots, have been used to identify the site of bleeding and determine the risk of renewed bleed-

ing from an upper gastrointestinal ulcer.<sup>3</sup> However, most endoscopists do not perform urgent colonoscopy to identify stigmata of bleeding from lower gastrointestinal lesions, such as diverticula. Rather, they perform elective colonoscopy (when the patient may not be bleeding).

There have been case reports of treatment with colonoscopy for diverticular hemorrhage.<sup>4-9</sup> Johnston and Sones described four patients who were treated with an endoscopic heater probe.<sup>4</sup> Three of the patients had active bleeding, and one had a sentinel clot in a diverticulum. Kim and Marcon reported the successful treatment of active diverticular hemorrhage with injection of epinephrine in one patient.<sup>6</sup> Savides and Jensen described three patients with severe, recurrent lower gastrointestinal bleeding in whom nonbleeding visible vessels were successfully treated with bipolar coagulation.<sup>9</sup> Hokama et al. described three patients with diverticular bleeding that was controlled by an endoscopic hemoclip.<sup>10</sup> Neither complications nor recurrent bleeding in the short or long term was reported in these series. We evaluated the use of colonoscopy performed on an urgent basis for the diagnosis and treatment of patients with severe diverticular hemorrhage.

### METHODS

#### Patients and Design of the Study

In two sequential studies of urgent colonoscopy, we prospectively studied 121 patients with severe hematochezia and diverticulosis. The studies were approved by the institutional review boards at participating centers (University of California at Los Angeles Medical Center and Veterans Affairs Greater Los Angeles Healthcare System), and all patients gave written informed consent. Medical management consisted of hospitalization, monitoring, and resuscitation in intensive care or telemetry units. Anticoagulants and nonsteroidal antiinflammatory drugs, including aspirin, were discontinued before colonoscopy. Patients also received transfusions of red cells for severe anemia and blood products to correct any coagulopathy before they underwent urgent colonoscopy. Only patients who had evidence of diverticulosis on colonoscopy were enrolled in the study; all other patients with hematochezia were excluded.

A team of intensivists, internists, and general surgeons managed the treatment of all patients in consultation with gastroenterologists. All patients received a sulfate purge (Golytely, Baintree Laboratories, Baintree, Mass., or Colyte, Schwarz Pharmaceuti-

---

From the Center for Ulcer Research and Education (CURE) Hemostasis Research Unit, Digestive Disease Research Center, Division of Digestive Diseases, University of California at Los Angeles Center for the Health Sciences, and the Veterans Affairs Greater Los Angeles Healthcare System, Los Angeles. Address reprint requests to Dr. Jensen at CURE, Digestive Disease Research Center, VA GLAHS, 11301 Wilshire Blvd., Bldg. 115, Rm. 318, Los Angeles, CA 90073-1003, or at djensen@med1.medsch.ucla.edu.

cals, Milwaukee), either orally (in the case of 67 percent of patients) or by nasogastric tube (in the case of 33 percent) to rid the colon of clots, stool, and blood.<sup>1,2</sup> The procedure usually required 5 to 6 liters of purge and three to four hours before the colon was clean.<sup>1,2</sup> Urgent colonoscopy was defined as colonoscopy performed at the bedside 6 to 12 hours after hospitalization or the diagnosis of hematochezia and within 1 hour after clearance of stool, blood, and clots, as documented by a physician.

**Definition of Diverticular Hemorrhage**

A definite diagnosis of diverticulosis as the source of bleeding required the finding of one of the following after vigorous irrigation of diverticula: active bleeding, a nonbleeding visible vessel, or an adherent clot. Two other types of diverticulosis were defined: incidental diverticulosis, in which diverticulosis was present but the bleeding originated from another lesion or lesions, and presumptive diverticular hemorrhage, in which diverticula had no evidence of bleeding but no other major colonic lesions or bleeding sites were identified on enteroscopy.

**Patients Treated Medically and Surgically**

The first study was conducted from June 1986 to June 1992 and included 73 consecutive patients with severe hematochezia (for four or more hours after hospitalization, as documented by a physician or nurse) and diverticulosis. Seventeen patients had definite diverticular hemorrhage on the basis of colonoscopic findings of signs of hemorrhage and were treated medically. Once the hematochezia cleared, the diets of all patients were changed from liquids to solids as tolerated. The patients were observed in the hospital in case bleeding recurred. If bleeding continued or recurred, the patient received transfusions. In the event of severe bleeding, as evidenced by further hematochezia after colonoscopy, and if the patient had already received at least 3 units of packed red cells in addition to an initial transfusion for resuscitation, emergency hemicolectomy was performed.

**Patients Treated Medically and Colonoscopically**

The second prospective study was conducted from June 1994 to December 1998 and included 48 consecutive patients with hematochezia and diverticulosis. Ten patients had definite diverticular hemorrhage on the basis of signs of hemorrhage and were treated by colonoscopy. Medical treatment was also continued. Colonoscopic treatments were standardized among investigators on the basis of our previous laboratory studies of coagulation of the right side of the colon<sup>11,12</sup> and a pilot study in patients with diverticular hemorrhage.<sup>10</sup> During the procedure the patients underwent conscious sedation.

In patients with active bleeding, 1- or 2-ml aliquots of epinephrine (dilution, 1:20,000) were injected in four quadrants to control the bleeding (in the case of shallow, broad-based diverticula) or to close the mouth of the diverticulum by tamponade (in the case of narrow-necked or deep diverticula). Nonbleeding visible vessels were treated by bipolar coagulation (Gold probe, Microvasive, Boston Scientific, Natick, Mass.) with 10 to 15 W of power, moderate appositional pressure directly on the vessel, and one-second pulses until good coagulation and flattening of the vessel were achieved.<sup>10</sup> Nonbleeding adherent clots were injected with epinephrine (dilution, 1:20,000) in four quadrants around the pedicle of the clot, and the clot was shaved down to 3 to 4 mm above the attachment with a polypectomy snare by cutting it off without coagulation and without pulling the clot off its attachment. Then the underlying stigmata (usually a nonbleeding visible vessel) was coagulated with a bipolar probe.<sup>13</sup> For future identification in the event of repeated colonoscopy or surgical procedure, the mucosa adjacent to the diverticulum was labeled with India ink.<sup>14</sup>

After recovery from sedation, patients were given full liquid diets for 24 hours and then switched to regular diets as tolerated. The patients were encouraged to move around after colonoscopy, unless bleeding recurred or they were being monitored by telemetry.

**TABLE 1. PREVALENCE OF DIVERTICULAR HEMORRHAGE AND BLEEDING FROM OTHER SITES IN PATIENTS WITH SEVERE HEMATOCHYZIA AND DIVERTICULOSIS.**

DIAGNOSIS*	MEDICAL AND SURGICAL TREATMENT (N=73)	MEDICAL AND COLONOSCOPIC TREATMENT (N=48)
	number (percent)	
Definite diverticular hemorrhage	17 (23)	10 (21)
Presumptive diverticular hemorrhage	0	14 (29)
Incidental diverticulosis†	56 (77)	24 (50)
Colonic angioma	17 (23)	2 (4)
Polyps or cancer	10 (14)	3 (6)
Ischemic colitis	9 (12)	4 (8)
Upper gastrointestinal ulcers or varices	6 (8)	3 (6)
Rectal lesions or internal hemorrhoids	4 (5)	5 (10)
Other ulcers (anastomosis or polypectomy)	4 (5)	4 (8)
Small-bowel sites	4 (5)	1 (2)
Inflammatory bowel disease	2 (3)	2 (4)

\*The diagnoses were based on stigmata of hemorrhage, ulcerations, the size or number of lesions, or combinations of these findings on urgent colonoscopy or enteroscopy, defined as that performed 6 to 12 hours after hospitalization or the diagnosis of hematochezia. Definite diverticular hemorrhage was diagnosed as a diverticulum with active bleeding, a nonbleeding visible vessel, or an adherent clot. Presumptive diverticular hemorrhage was diagnosed when there was diverticulosis without evidence of bleeding and with no other lesions identified as bleeding sites. Incidental diverticulosis was diagnosed in patients with another source of gastrointestinal hemorrhage in whom diverticulosis was also present on colonoscopy. Because of rounding, percentages may not total 100.

†The specific cause of the severe hematochezia identified on urgent colonoscopy (or enteroscopy) is listed.

**Long-Term Medical Management**

After being discharged from the hospital, all patients with definite or presumptive diverticular hemorrhage followed high-fiber diets with supplemental psyllium (Metamucil, Procter & Gamble, Cincinnati, or Citrucel, SKB, Pittsburgh), took analgesics other than nonsteroidal antiinflammatory drugs as necessary, and were cautioned not to take any over-the-counter or prescription medications that might cause or aggravate gastrointestinal hemorrhage, such as nonsteroidal antiinflammatory drugs (including aspirin) and anticoagulants. They were also instructed to avoid eating pop-corn, nuts with shells, and foods that contained small, hard seeds (such as sesame and caraway) and to use stool softeners and other over-the-counter medications for constipation. Residual iron-deficiency anemia was treated with iron supplements and foods high in iron content. These long-term management recommendations were reinforced at each visit to the gastroenterology clinic.

**Statistical Analysis**

Chi-square tests were used to compare data.<sup>15</sup> A P value of less than 0.05 was considered to indicate statistical significance. All reported P values are two-tailed.

**RESULTS**

In the first study, in which patients received medical and surgical treatment, 17 of the 73 patients with diverticulosis and severe hematochezia (23 percent) had signs of diverticular hemorrhage. The other 56 (77 percent) had incidental diverticulosis, because a site of bleeding other than a diverticulum was identified and treated (Table 1). In the second study, in

which patients received medical and colonoscopic treatment, 10 of 48 patients with diverticulosis and severe hematochezia (21 percent) had definite diverticular hemorrhage, 14 (29 percent) had presumptive diverticular hemorrhage, and 24 (50 percent) had incidental diverticulosis. Among the 24 patients in the second study with definite or presumptive diverticular hemorrhage, 21 percent had active bleeding, 8 percent had nonbleeding visible vessels, 12 percent had adherent clots, and 58 percent had no signs.

A total of 27 patients had definite diverticular hemorrhage: 17 in the first study and 10 in the second study (Table 2). The mean ( $\pm$ SE) ages in the two groups were similar:  $66\pm 3$  years in the first group and  $67\pm 4$  years in the second. All these patients had one or more coexisting conditions. Recent use of nonsteroidal antiinflammatory drugs was more common among patients in the second study than in the first study (30 percent vs. 18 percent), but the difference was not significant. The number of units of packed red cells transfused for resuscitation before colonoscopy was similar in the groups.

We diagnosed active bleeding in six of the patients who were treated medically and surgically and five of those who received medical and colonoscopic treatment. We found nonbleeding visible vessels in four of the patients treated medically and surgically and two of those who received medical and colonoscopic treatment; such vessels were usually seen at the neck (lip) of the diverticulum. We found adherent clots in seven of the patients who were treated medically and surgically and three of those who received medical and colonoscopic treatment.

After urgent colonoscopy, 9 of the 17 patients treated medically and surgically had recurrent or persistent bleeding severe enough to require additional transfusions (Table 3). Bleeding stopped in three of these nine patients after medical treatment, including transfusions of 2 or fewer units of packed red cells. However, severe bleeding continued in six, and emergency hemicolectomy was performed. Two of the six patients had complications after surgery. Table 4 shows the relation between the stigmata of diverticular hemorrhage and the incidence of recurrent bleeding in patients who received medical and surgical treatment.

All 10 patients with definite diverticular hemorrhage in the second study were treated endoscopically. None had recurrent bleeding or complications or required further red-cell transfusions or surgery (Table 3). In this group of patients, the median time from colonoscopy to discharge was two days, as compared with five days for the 17 patients with definite diverticular hemorrhage in the group treated medically and surgically.

During follow-up, no patient with definite diverticular hemorrhage had late recurrent bleeding (more than 30 days after discharge) (Table 3). The median duration of follow-up was 36 months in the group treated medically and surgically (range, 24 to 54) and

**TABLE 2.** CLINICAL AND ENDOSCOPIC FINDINGS IN 27 PATIENTS WITH DEFINITE DIVERTICULAR HEMORRHAGE.\*

VARIABLE	MEDICAL AND SURGICAL TREATMENT (N=17)	MEDICAL AND COLONOSCOPIC TREATMENT (N=10)
Age — yr	$66\pm 3$	$67\pm 4$
Coexisting conditions — %†	100	100
Recent NSAID use — no. of patients (%)	3 (18)	3 (30)
Initial red-cell transfusion before colonoscopy — units	$6.0\pm 1.2$	$4.8\pm 1.4$
Endoscopic finding — no. of patients (%)		
Active bleeding	6 (35)	5 (50)
Nonbleeding vessel	4 (24)	2 (20)
Adherent clot	7 (41)	3 (30)

\*Plus-minus values are means  $\pm$ SE. NSAID denotes nonsteroidal antiinflammatory drug. In 67 percent of patients, stigmata of diverticular hemorrhage were found near the left side of the colon.

†Coexisting conditions included any clinically active serious medical or surgical conditions involving a major organ system other than the colon.

**TABLE 3.** OUTCOME OF TREATMENT FOR DIVERTICULAR HEMORRHAGE.

VARIABLE	MEDICAL AND SURGICAL TREATMENT (N=17)	MEDICAL AND COLONOSCOPIC TREATMENT (N=10)	P VALUE
Endoscopic hemostasis — no. (%)	0	10 (100)	0.001
Additional bleeding — no. (%)*	9 (53)	0	0.005
Severe bleeding — no. (%)†	6 (35)	0	0.03
Emergency hemicolectomy — no. (%)	6 (35)	0	0.03
Median time to discharge after colonoscopy — days	5	2	<0.001
Complications — no. (%)	2 (12)‡	0	0.26
Late bleeding — no. (%)	0	0	1.0
Follow-up — mo			
Median	36	30	
Range	24–54	18–49	

\*Additional bleeding was defined as self-limited or recurrent hematochezia that occurred after purging of the colon and colonoscopy and that required no more than an additional 2 units of packed red cells.

†Severe bleeding was defined as continued or recurrent hematochezia that required at least 3 units of packed red cells.

‡One patient had pneumonia, and one had a wound infection.

30 months in the group treated medically and colonoscopically (range, 18 to 49). Bleeding recurred in one patient (who was taking warfarin) among those with presumptive diverticular hemorrhage in the second study. The median follow-up in this subgroup was 23 months (range, 5 to 64).

## DISCUSSION

Before the introduction of colonoscopy, diverticulosis was thought to be the most frequent cause of

severe lower gastrointestinal tract bleeding in older people, particularly in the United States.<sup>1,2,12</sup> The diagnosis of diverticular hemorrhage was most often based on the results of barium enema, findings at surgery, or a finding of extensive nonbleeding diverticulosis. In several studies, urgent colonoscopy after thorough removal of blood and stool from the colon indicated that diverticular hemorrhage was the second most common diagnosis, after colonic angioma, among elderly patients who were hospitalized because of very severe ongoing hematochezia.<sup>1,2,12</sup> Improvements in endoscopic technology have made it possible for gastroenterologists not only to diagnose sources of bleeding accurately but also to achieve hemostasis at diverticula with active bleeding, visible vessels, and adherent clots and other bleeding sites.<sup>1,2,4-10</sup>

In our paired prospective studies, we used major stigmata of hemorrhage during urgent colonoscopy to identify the bleeding site, provide a prognostic guide, and focus colonoscopic therapy. Among patients with diverticulosis and severe hematochezia, 23 percent of those in the first study and 21 percent of those in the second study had definite stigmata of diverticular hemorrhage (Table 1). However, when we excluded the 50 percent of patients with incidental diverticulosis in the second study (i.e., those who had another known site of gastrointestinal hemorrhage), we found the following prevalence of stigmata among patients with endoscopically documented definite or presumptive diverticular hemorrhage: active bleeding, 21 percent; nonbleeding visible vessels, 8 percent; adherent clots, 12 percent; and no stigmata, 58 percent.

Unlike the case with hemorrhage from ulcer,<sup>3,16-19</sup> there are few data on the frequency of early recurrent bleeding after the medical treatment of diverticular hemorrhage. In our first study, 53 percent of the patients who were treated medically but not endoscopically had additional bleeding, requiring transfusions of packed red cells, and 35 percent had recurrent or continued bleeding severe enough to require emergency colectomy. The percentage of patients who required additional transfusions and the percentage who required surgery were higher among those with active bleeding (67 percent and 50 percent, respectively) than among those with nonbleeding visible vessels (50 percent and 25 percent, respectively) or adherent clots (43 percent and 29 percent, respectively) (Table 4). These rates of recurrent bleeding are similar to those reported for patients with peptic ulcers and similar stigmata of recent hemorrhage who were treated medically.<sup>19</sup>

The colonoscopic treatments used for hemostasis differed depending on the stigmata of hemorrhage and were based on our experience with endoscopic treatment of peptic ulcers with the same signs of hemorrhage,<sup>13,16</sup> prior laboratory work,<sup>11</sup> and a recent pilot study of the treatment of nonbleeding visible vessels

in diverticula.<sup>9</sup> Active bleeding or adherent clots were first treated with an epinephrine injection, whereas nonbleeding visible vessels were coagulated, without an epinephrine injection.<sup>9</sup> Bipolar probes were chosen because of their excellent efficacy and good safety.<sup>16</sup> None of the patients with definite diverticular hemorrhage who underwent colonoscopic treatment required surgery, and none had complications after colonoscopic diagnosis or treatment. However, we studied only a small number of patients, and the treatments were not randomized. Thus, larger studies are warranted to confirm our results.

The rate of recurrence of diverticular hemorrhage in retrospective surgical series has varied, but it was as high as 50 percent in studies in 1957<sup>17</sup> and 1972<sup>18</sup> and 38.4 percent in a more recent retrospective review.<sup>19</sup> High rates of recurrent diverticular hemorrhage are often used as the rationale for early surgery to prevent a recurrence when the patient is older and presumably at higher risk.<sup>17-19</sup> On the basis of our results, a different approach should be considered, consisting of colonoscopy performed on an urgent basis by a skilled and experienced endoscopist to identify the type of diverticular hemorrhage — definite, presumptive, or incidental — with endoscopic hemostasis and India-ink tattooing of the diverticulum at the site of the lesion in case severe hematochezia recurs; avoidance of the use of nonsteroidal antiinflammatory drugs (including aspirin) and anticoagulants; and careful long-term medical and dietary management. The last recommendation is unproved, and further studies of the secondary prevention of diverticular hemorrhage are warranted. In our opinion, surgery should be reserved for patients in whom definite or presumptive diverticular hemorrhage has been diagnosed by urgent colonoscopy after vigorous purging of the colon and for whom medical and colonoscopic treatment has failed or resulted in complications.

**TABLE 4.** RELATION BETWEEN STIGMATA OF DIVERTICULAR HEMORRHAGE AND RECURRENT BLEEDING IN PATIENTS WHO RECEIVED MEDICAL AND SURGICAL TREATMENT.

SIGN OF HEMORRHAGE	NO. OF PATIENTS	RECURRENT BLEEDING	
		RED-CELL TRANSFUSION OF ≤2 UNITS	RED-CELL TRANSFUSION OF ≥3 UNITS AND EMERGENCY HEMICOLECTOMY
no. of patients (%)			
Active bleeding	6	4 (67)	3 (50)
Nonbleeding visible vessel	4	2 (50)	1 (25)
Adherent clot	7	3 (43)	2 (29)
Total	17	9 (53)	6 (35)

Supported in part by grants from the National Institutes of Health (ROI 33273) and the Human Studies Core of the National Institutes of Health (41301).

## REFERENCES

1. Jensen DM, Machicado GA. Diagnosis and treatment of severe hematochezia: the role of urgent colonoscopy after purge. *Gastroenterology* 1988;95:1569-74.
2. *Idem*. Management of severe lower gastrointestinal bleeding. In: Barkin JS, O'Phelan CA, eds. *Advanced therapeutic endoscopy*. 2nd ed. New York: Raven Press, 1994:201-8.
3. Swain CP, Storey DW, Bown SG, et al. Nature of the bleeding vessel in recurrently bleeding gastric ulcers. *Gastroenterology* 1986;90:595-608.
4. Johnston J, Sones J. Endoscopic heater probe coagulation of the bleeding colonic diverticulum. *Gastrointest Endosc* 1986;32:160. abstract.
5. Ramirez FC, Johnson DA, Zierer ST, Walker GJ, Sanowski RA. Successful endoscopic hemostasis of bleeding colonic diverticula with epinephrine injection. *Gastrointest Endosc* 1996;43:167-70.
6. Kim YI, Marcon NE. Injection therapy for colonic diverticular bleeding: a case study. *J Clin Gastroenterol* 1993;17:46-8.
7. Andress HJ, Mewes A, Lange V. Endoscopic hemostasis of a bleeding diverticulum of the sigma with fibrin sealant. *Endoscopy* 1993;25:193.
8. Bertoni G, Conigliaro R, Ricci E, Mortilla MG, Bedogni G, Fornaciari G. Endoscopic injection hemostasis of colonic diverticular bleeding: a case report. *Endoscopy* 1990;22:154-5. [Erratum, *Endoscopy* 1990;22:202.]
9. Savides T, Jensen DM. Colonoscopic hemostasis of recurrent diverticular hemorrhage associated with a visible vessel: a report of three cases. *Gastrointest Endosc* 1994;40:70-3.
10. Hokama A, Uehara T, Nakayoshi T, et al. Utility of endoscopic hemoclipping for colonic diverticular bleeding. *Am J Gastroenterol* 1997;92:543-6.
11. Jensen DM. GI endoscopic hemostasis and tumor treatment — experimental results and techniques. In: Jensen DM, Brunetaud J-M, eds. *Medical laser endoscopy*. Dordrecht, the Netherlands: Kluwer Academic, 1990:45-70.
12. Jensen DM, Machicado GA. Control of bleeding. In: Raskin JB, Nord HJ, eds. *Colonoscopy: principles and techniques*. New York: Igaku-Shoin, 1995:317-32.
13. Jensen DM, Kovacs TOG, Jutabha R, Machicado GA, Savides T, Smith J. A safe and effective technique for endoscopic removal of adherent clots from GI lesions: cold guillotining after epinephrine injection. *Gastrointest Endosc* 1996;43:297. abstract.
14. Hyman N, Waye JD. Endoscopic four quadrant tattoo for the identification of colonic lesions at surgery. *Gastrointest Endosc* 1991;37:56-8.
15. Bailar JC III, Mosteller F. *Medical uses of statistics*. 2nd ed. Waltham, Mass.: NEJM Books, 1992:183-4.
16. Jensen DM. Endoscopic control of nonvariceal upper gastrointestinal hemorrhage. In: Yamada T, ed. *Textbook of gastroenterology*. 3rd ed. Vol. 2. Philadelphia: Lippincott Williams & Wilkins, 1999:2857-79.
17. Knight CD. Massive hemorrhage from diverticular disease of the colon. *Surgery* 1957;42:853-61.
18. McGuire HH Jr, Haynes BW Jr. Massive hemorrhage for diverticulosis of the colon: guidelines for therapy based on bleeding patterns observed in fifty cases. *Ann Surg* 1972;175:847-55.
19. McGuire HH Jr. Bleeding colonic diverticula: a reappraisal of natural history and management. *Ann Surg* 1994;220:653-6.

---

## ELECTRONIC ACCESS TO THE JOURNAL'S CUMULATIVE INDEX

---

At the *Journal's* site on the World Wide Web (<http://www.nejm.org>) you can search an index of all articles published since January 1990. You can search by author, subject, title, type of article, or date. The results will include the citations for the articles plus links to the abstracts of articles published since 1993. Single articles and past issues of the *Journal* can also be ordered for a fee through the Internet (<http://www.nejm.org/customer/>).

---