Evaluation and Management of Massive Lower Gastrointestinal Hemorrhage

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Sixty-eight patients with massive lower gastrointestinal (G.I.) hemorrhage underwent emergency arteriography. Patients were transfused an average of six units of packed red blood cells within 24 hours of admission. The bleeding source was localized arteriographically in 27 (40%), with a sensitivity of 65% among patients requiring emergency resection. However, twelve of the 41 patients with a negative arteriogram still required emergency intestinal resection for continued hemorrhage. Radionuclide bleeding scans had a sensitivity of 86%. The right colon was the most common site of bleeding (35%). Diverticulosis and arteriovenous malformation were the most common etiologies. Selective intra-arterial infusion of vasopressin and embolization were successful in 36% of cases in which they were employed and contributed to fatality in two patients. Twenty-three patients underwent segmental resection, whereas seven patients required subtotal colectomy for multiple bleeding sites or negative studies in the face continued hemorrhage. Intraoperative infusion of methylene blue via angiographic catheters allowed successful localization and resection of bleeding small bowel segments in three patients. Overall mortality was 21%. The mortality for patients without a malignancy, with a positive preoperative arteriogram, and emergency segmental resection was 13%.

THE MAJORITY OF PATIENTS with lower gastrointestinal (G.I.) hemorrhage will stop bleeding during resuscitation.[1] Investigation of the source of the bleed can then proceed with endoscopic and radiographic studies, followed by elective resection, if indicated. In those patients with continued hemorrhage, the use of early nuclear bleeding scans and arteriography may lead to localization of the bleeding site.[2-8] Arteriographic localization provides the option for selective vasopressin infusion or embolization, which may control the bleeding.[9-11] Moreover, since the site is localized, those patients that have continued hemorrhage may undergo a segmental bowel resection, as opposed to subtotal colectomy.[6,8]

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The purpose of this study was to examine the clinical course of patients with massive lower G.I. bleeding in an attempt to determine the appropriate evaluation and treatment in this group of patients.

Patients and Methods

Between 1980 and 1987, 68 patients underwent emergency arteriography for massive lower G.I. hemorrhage. The majority of patients were admitted to the Surgical Service from the Emergency Room. Ringers lactate was used for early fluid resuscitation. Blood specimens were obtained for type and crossmatch, complete blood counts, and coagulation studies. All patients had indwelling urethral catheters. A nasogastric tube was placed and irrigated in an attempt to exclude an upper G.I. source. Proctoscopy was performed to search for a bleeding site in the rectosigmoid area. Central venous or pulmonary arterial pressure monitoring lines were established. Patients were transfused an average of 6 units of packed red blood cells within 24 hours after admission. Patients admitted with massive lower G.I. hemorrhage who stopped bleeding underwent a more elective work-up with endoscopic and radiographic studies after stabilization.

Twenty-eight patients underwent scintigraphy in the Nuclear Medicine Department before angiography with technetium-labeled red blood cells.

All patients were then transported for superior and inferior mesenteric angiography. Fourteen of the patients with massive hemorrhage, extravasation on arteriography, and no known cardiac disease received intra-arterial vasopressin at a rate of 0.2–0.4 units/minute or embolization with small particles of absorbable gelatin sponge. Patients with continued or recurrent hemorrhage were taken to the operating room for surgical exploration.

TABLE 1. *Angiographic Results in Patients with Massive Lower Gastrointestinal Hemorrhage*

	Angiogram			
	Positive	Negative	Total	p value
Number	27	41	68	
Transfusion requirement (units of packed red blood cells)	4.9	6.8	6.0	NS
Required emergency surgery	22* (81%)	12 (29%)	34 (50%)	<0.001
Died	7 (27%)	7 (17%)	14 (20%)	NS
Site of hemorrhage†				
Small bowel	5	4	9	
Right colon	11	13	24	
Transverse colon	3	3	6	
Left colon	6	8	14	
Rectum	3	2	5	

* Two patients needed, but refused surgery.
† Three patients had multiple sites of bleeding.

Data collected on each patient included clinical, angiographic, operative, and pathologic findings. The data were entered on a personal computer for analysis. Statistical analysis was performed using students t-test and the method of chi-square where appropriate. A p value of less than 0.05 was considered significant.

Results

Sixty-eight patients (40 men, 28 women) with massive lower G.I. hemorrhage underwent angiographic study.

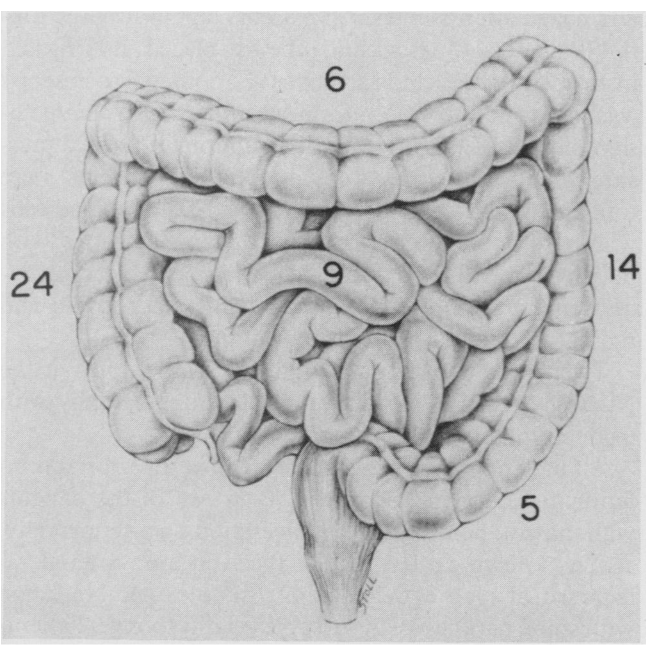

FIG. 1. Distribution of Sites for Massive Lower Gastrointestinal Hemorrhage

The average age was 63 years. The average transfusion requirement during the first 24 hours was 6 units of packed red blood cells. The crude mortality rate for the entire group, including patients with terminal disease or who refused treatment, was 21% (Table 1). Eleven of 68 (16%) of patients had a prior history of a major lower G.I. bleed.

Twenty-seven of 68 patients (40%) had the bleeding site accurately localized by angiography. Twelve of 41 patients (29%) with a negative arteriogram still required emergency operative intervention. The sensitivity of angiography in patients with lower G.I. hemorrhage that required surgery was 65% (Table 1).

The distribution of lower G.I. hemorrhage is depicted in Figure 1. The right colon was the most common site of bleeding (24 patients, 35%). Bleeding from the small bowel was present in nine patients (13%). In 13 patients, the site was never identified.

Radionuclide bleeding scans were performed in 28 patients. These scans were positive in twelve patients (43%). Two patients with negative radionuclide scans required emergency intestinal resection. The sensitivity of bleeding scans in patients ultimately requiring emergency resection was 86%. The site was correctly localized by the bleeding scan in six patients with negative angiograms who required surgery.

Intra-arterial infusion of vasopressin or transcatheter embolization was attempted in 14 patients. Complete or partial cessation of bleeding was observed in five patients (36%). Two patients suffered complications directly attributable to transcatheter therapy. One patient developed a fatal myocardial infarction during intra-arterial infusion of vasopressin. Another patient died of an intestinal infarction after an attempt was made to embolize the bleeding source. All eight patients with unsuccessful angiographic treatment went on to require emergency surgery, and three died (38%). One patient had an unsuccessful attempt at colonoscopic cauterization of a bleeding arteriovenous malformation.

Table 1 compares patient groups with negative and positive arteriograms. There were 27 positive and 41 negative angiograms in the 68 patients studied. There was no significant difference in the transfusion requirements between patients with negative and positive arteriograms. The pathologic findings are listed in Table 2. Diverticulosis and arteriovenous malformations were the most common etiologies. Five patients experienced bleeding from an adenocarcinoma of the colon. The operations performed in the 32 patients that required emergency surgery are listed in Table 3. Twenty-three of 32 of patients (72%) underwent a segmental resection. Patients without malignancy, but with a positive, localizing arteriogram who underwent segmental resection had a mortality rate of 13%. Those with a negative arteriogram who required blind subtotal colectomy had a mortality of 40%.

TABLE 2. *Pathologic Findings in Massive Lower G.I. Hemorrhage*

Pathologic Finding	No. of Patients
Diverticulosis	18
Arteriovenous malformation	16
Adenocarcinoma	5
Inflammatory bowel disease	3
Intestinal ischemia	3
Lymphoma	2
Coagulopathy	2
Carcinoid	1
Leiomyosarcoma	1
Adenomatous polyp	1
Cytomegalovirus colitis	1
Hemorrhoid	1

Table 4 compares the survivors and nonsurvivors with acute lower G.I. hemorrhage. There were no significant differences with regard to age, sex, or number of units of packed red blood cells transfused. Patients with preoperative shock or steroid therapy had a significantly higher mortality rate.

Specific data regarding the nonsurvivors is listed in Table 5. One patient who rebled after a left colectomy for arteriovenous malformation underwent a right colectomy for bleeding diverticulosis and subsequently died. He represented the only patient who rebled after surgery.

Overall, ten of 68 patients (15%) rebled during the index hospitalization. Eight of these ten underwent emergency surgery (the other two refused). Five of the ten rebleeders died, including the two who refused surgery. Four of the five deaths occurred in patients with arteriovenous malformations.

Discussion

The 68 patients in this study represent a select group of critically ill patients with massive lower G.I. hemorrhage, as evidenced by the 6-unit average transfusion requirement, the universal need for angiography, the frequency of surgical intervention, and the relatively high mortality. Other studies of massive lower G.I. bleeding have examined patients with a transfusion requirement of 2–7 units of packed cells and have often included patients who have stopped bleeding and undergone elective resection, as well as patients with relentless hemorrhage requiring emergency surgery.[2-5,8]

Only 40% of patients had the bleeding accurately localized by arteriography. The addition of radionuclide scans increased the diagnostic yield. Nath[6] found that 49% of lower G.I. bleeds were localized by arteriography. Similarly, Colacchio[1] noted positive arteriograms in 41% of patients. Other authors have reported higher rates, ranging from 58% to 86%.[2,4,5,7,8] However, among the 32 patients requiring emergency surgery, 28 (88%) had either a diagnostic arteriogram or radionuclide scan. In animal studies, bleeding scans detect 0.1 ml per minute of bleeding, whereas an arteriogram requires higher rates.[12,13] This may explain why six patients in this study with negative arteriograms had positive bleeding scans.[2] In addition to an enhanced sensitivity, scintigraphy is more likely to detect intermittent bleeding.[12] Bleeding scans may be used as the initial diagnostic procedure in patients with lower G.I. hemorrhage. Patients with positive scans can then undergo arteriography to further characterize the source and to provide a route for selective vasopressin or embolization, if indicated.[13] Others have argued that nuclear scans delay arteriography, diminishing the diagnostic yield of the latter.[2] However, the low morbidity and high sensitivity of scintigraphy argues in favor of its use as the primary diagnostic modality.

Eighty-one per cent of patients with a positive arteriogram required emergency surgery, compared with 29% of those with a negative arteriogram. Thus, a positive arteriogram is a predictor of patients likely to require surgical intervention. However, a negative arteriogram does not exclude the need for operative treatment for continued bleeding. Unlike data from other studies, a larger transfusion requirement did not correlate with the likelihood of a positive arteriogram or a higher mortality.[2,4]

Localizing the bleeding site allows for segmental resection, which has a lower morbidity and mortality than

TABLE 3. *Operations Performed on Patients with Massive Lower G.I. Hemorrhage*

Operation	No. of Patients
Segmental resection	23
Right colectomy	13
Left colectomy	4
Small bowel resection	6
Subtotal colectomy	7
Polypectomy	1
Ligation of bleeding hemorrhoid	1

TABLE 4. *Comparison of Survivors and Nonsurvivors with Massive Lower G.I. Hemorrhage*

	Nonsurvivors	Survivors	p value
Number	14 (20.5%)	54 (79.5%)	
Age (years)	65.5	62.4	NS
Sex			
Males	11	29	NS
Females	3	25	
Admitted in shock	7	4	<0.001
Past medical history			
Hematologic malignancy	4	2	NS
Renal failure	3	3	NS
Diabetes	2	2	NS
Hypertension	4	7	NS
Steroid therapy	3	1	<0.05
Transfusion requirement (units packed red blood cells)	6.4	5.9	NS

TABLE 5. *Clinical Course of Nonsurvivors with Massive Lower G.I. Hemorrhage*

Patient Number	Pathologic Diagnosis	Treatment/Clinical Course
2	Diverticulosis	Subtotal colectomy, sepsis
4	Diverticulosis, lymphoma	Left colectomy, intra-abdominal sepsis
6	Arteriovenous malformation	Vasopressin infusion, myocardial infarction
12	Diverticulosis	Right colectomy, intra-abdominal sepsis, aspiration pneumonia
16	Arteriovenous malformation	Vasopressin/embolization, intestinal infarction, right colectomy, respiratory failure
24	Adenocarcinoma	Refused operation, perforated and bleeding colon cancer, sepsis
29	Arteriovenous malformation	Right colectomy, rebled, vagotomy and pyloroplasty for bleeding peptic ulcer, intra-abdominal abscess
34	Cytomegalovirus colitis, acquired immune deficiency syndrome	Refused operation, exsanguination
36	Diverticulosis	Subtotal colectomy, sepsis
39	Adenocarcinoma	Chronic renal failure, polyarteritis nodosa, vasopressin, right colectomy
57	Arteriovenous malformation, diverticulosis	Left colectomy, rebled, right colectomy, renal failure, cerebrovascular accident
61	Lymphosarcoma, leukemia	No operation, sepsis
63	Coagulopathy	Cardiac arrest during angiography
66	Ischemic colitis	Right colectomy, intra-abdominal abcess

subtotal colectomy,[5-8] although at one institution both procedures had an 11% mortality.[2] In the present study, 23 of 32 operative cases (72%) were segmental resections, similar to 50–91% in the literature.[6-8] One patient (3%) rebled after resection in this study, and the rebleeding rate reported is 0–7%.[2,6,7]

A localizing angiogram also allows for possible nonoperative treatment with selective vasopressin infusion or embolization. Previous reports of intra-arterial vasopressin infusion or embolization in selected groups have generally been favorable.[9,14,15] In this study, bleeding was controlled in only one third of the patients. More disturbing, all patients who had unsuccessful angiographically directed treatment required surgery and had a mortality rate of 38%, probably due to a delay in the appropriate treatment. A previous study has shown that patients in whom vasopressin fails and who require emergency surgery have an increased mortality.[3] Reports of selective intra-arterial vasopressin treatment of diverticular bleeding have shown success in 47–92% of patients.[9] In a collected series, vasopressin was initially successful in 82% of patients, but rebleeding occurred in 41%.[2] Giacchino[16] reported a 75% vasopressin failure rate in patients with diverse etiologies of lower G.I. hemorrhage. The lower success rate in the present study may be due to the fact that a higher percentage of vasopressin-treated patients had nondiverticular hemorrhage (eight of 14). Arteriovenous malformations, which represent venous bleeding, are less likely to be controlled by vasopressin.[3,7] Unfortunately, angiographically directed nonoperative treatment directly led to two fatal complications. Other authors have reported myocardial and bowel infarction after selective vasopressin infusion and embolization.[7,17,18] Rosenkrantz[18] reported postembolic colonic infarction in three of 23 (13%) of cases. At present, most authors reserve transcatheter embolization for vasopressin failures in those patients at prohibitive surgical risk.[18,19] When successful, it may obviate the need for emergency surgery; however, when it is *not*, the subsequent operative mortality is increased.

There was a single failure to control a bleeding arteriovenous malformation with colonoscopic cauterization. However, others have reported good success with electrocoagulation of arteriovenous malformations.[20] Colonoscopy is an excellent diagnostic procedure for patients who stop bleeding, and it is being used with increasing frequency during active bleeding, especially in patients with negative arteriograms.[1,20-22] Moreover, intraoperative entero-colonoscopy has been used for recurrent, nonlocalized bleeding.[20]

Patients with a positive arteriogram and bleeding from the small intestine should have selective intra-operative transcatheter injection of methylene blue in order to localize the site of hemorrhage. This technique was uniformly successful in three patients in this series and has been reported by investigators from this institution[23]and others.[24,25]

The majority of patients with a definable source of massive lower G.I. bleeding have a diverticular bleed or an arteriovenous malformation.[1-3,6,7] However, one recent study showed an increasing trend of lower G.I. bleeding from less common and idiopathic etiologies, with only seven of 30 patients having an arteriovenous malformation or diverticular source.[16] Patients with bleeding from cytomegalovirus ulcers of the colon, for example, have been reported in this study and others, and may be increasing in incidence.[26] Adenocarcinoma of the colon accounted for five of 68 cases of massive lower G.I. hemorrhage (7%).

The most common site of massive bleeding is the right colon.[1-3,9] Type I arteriovenous malformations represent acquired degenerative lesions of aging; these are present in the right colon of up to 27% of all elderly patients.[6,27] They cannot be palpated by the surgeon nor found by conventional pathologic techniques, and are diagnosed by arteriography. There is an increasing experience in colonoscopic diagnosis of these lesions,[28] and they also represent venous bleeding.[29] Radiographic diagnosis depends on the demonstration of a dilated submucosal vein, a vascular tuft, and early filling of a draining vein.[29,30] Extravasation of contrast is rare. These lesions are known for recurrent bleeding. Four of the five patients who experienced rebleeding and who died had arteriovenous malformations. Boley recommends prompt resection of arteriovenous malformations in patients after a single episode of lower G.I. hemorrhage.[31] Unfortunately, arteriovenous malformations may be multiple, and furthermore, may co-exist with diverticula, which are themselves found in 50% of the same population.[5] Patients undergoing a segmental colectomy for massive bleeding presumably from an arteriovenous malformation have rebled from contralateral diverticula and arteriovenous malformations, both in the present study and in those reported by others.[29,30] In the patient with an arteriovenous malformation of the colon with extravasation, segmental resection is indicated. However, in the patient with massive bleeding, diverticulosis of the colon, and an arteriogram showing an arteriovenous malformation but no extravasation, a controversy exists as to whether segmental or subtotal colectomy should be performed. A right colectomy for the usual right-sided arteriovenous malformation will be successful in 80–90% of such patients.[31] Fortuitously, most bleeding diverticuli are also found in the right colon. Several hypotheses exist to explain this finding. Pathologic studies from this institution have shown that right-sided diverticuli have wider lumen, thereby exposing more of the vasa recta to rupture.[32]

The overall mortality in this select series of patients with massive lower G.I. hemorrhage of 21% is higher than that generally reported in the literature for all patients with lower G.I. bleeding (0–11.4%).[2,3,5,6] This may also be due to the high percentage of nonsurvivors in our study with serious complicating medical problems, including renal failure, malignancy, steroid use, hypertension, diabetes, and shock. Many studies exclude terminal patients with malignancy or those patients who decline treatment. Patients without malignancy, with a positive arteriogram, and segmental resection had a mortality of 13%, whereas those with a negative arteriogram, continued bleeding, and "blind" subtotal colectomy had a high mortality rate. Britt[7] reported an overall mortality of 17.5% and an operative mortality of 20.8% among 40 patients with lower G.I. hemorrhage. Collachio[1] reported an operative mortality of 24%. Wright[8] excluded eight patients with terminal illness when reporting a zero mortality; moreover, only 14 of 96 patients even required arteriography. In the literature, the mortality for lower G.I. bleeding varies, depending on which patients are ultimately included for analysis. A common cause of death in the present study was sepsis, a finding confirmed by others.[1,7] The mortality of emergency colon operations in general is reported to be 28%, with sepsis accounting for the majority of deaths.[33] Patients at high risk for death include those with preoperative shock, steroid use, malignancy, rebleeding, as well as those who fail nonoperative therapy or who undergo a blind subtotal colectomy. Steroids have been shown to double the infection rate in surgical patients.[34]

Therefore, a significant percentage of patients with massive lower G.I. hemorrhage will not localize with arteriography. Nearly one third of patients with a negative arteriogram in the setting of massive bleeding will require emergency resection. Bleeding scans effectively supplement arteriography.

Segmental resection should be performed on patients with localized bleeding sites who continue to hemorrhage. Subtotal colectomy may be indicated for multiple colonic bleeding sites or patients with a negative arteriogram with continued hemorrhage; however, mortality is high. Intraoperative transcatheter injection of methylene blue for localization of small bowel bleeding sites is of proven benefit. Nonoperative management should be reserved for patients of prohibitive surgical risk. The management of the patient with an acute lower G.I. hemorrhage requires close communication between surgeon, radiologist, and gastroenterologist.

Conclusion

Sixty-eight patients with massive lower G.I. hemorrhage underwent emergency arteriography. Forty per cent of the patients had a positive arteriogram. Twenty-nine per cent of the patients with a negative arteriogram still required emergency resection for continued bleeding. Transcatheter vasopressin infusion and embolization were successful in only 36% of cases. Patients who failed transcatheter treatment had a mortality of 38%. Diverticulosis, arteriovenous malformations, and colonic cancer were the most common etiologies. Overall mortality was 21%, but was lower for patients with localizing arteriograms and segmental resection.

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