Gastric Devascularization:

A Useful Salvage Procedure for Massive Hemorrhagic Gastritis

J. DAVID RICHARDSON, M.D., J. BRADLEY AUST, M.D., PH.D.

From the Department of Surgery, University of Texas
Health Science Center at San Antonio,
San Antonio, Texas

Due to poor results with conventional operative therapy for diffuse hemorrhagic gastritis (DHG), a prospective evaluation of gastric devascularization was performed on 21 patients. Sepsis, alcoholism, and steroid abuse were the common etiologic factors. In spite of the fact that these were all critically ill patients, all stopped bleeding with this operation and only two rebled (9%). The average operating time was 84 minutes. There were two operative complications and gastric necrosis did not occur. The mortality was high (38%) due to the primary disease. Gastric devascularization is a useful salvage procedure for the patient with DHG because it can be accomplished rapidly, with few complications, has a low rebleed rate, and causes no permanent sequelae. Since this procedure causes severe gastric mucosal ischemia, it casts doubt only on the importance of this mechanism alone as the cause of "stress ulceration."

DIFFUSE HEMORRHAGIC GASTRITIS (DHG) occurs in a variety of critically ill patients. Sepsis, major operative procedures, severe trauma, and alcohol or steroid abuse are frequently antecedent factors that appear to be etiologically related to the bleeding. The general term "stress ulcer" has, unfortunately, often been used to describe this entity. That designation however is inappropriate because often no underlying "stress" is evident, the term fails to distinguish between gastric and duodenal bleeding, and it does not differentiate between the patient with a single discrete bleeding site and the patient with multiple superficial erosions. Obviously, all of these factors are important in interpreting the results of operative treatment for so-called "stress bleeding." The pathologic entity, diffuse hemorrhagic gastritis, discussed in this paper is a superficial lesion involving the mucosa of the stomach that rarely penetrates more deeply than the muscularis mucosa. Although the fundus and body are characteristically involved, the entire stomach may be involved.

Although a variety of etiologic mechanisms[3,6,9,10] have been evoked in an attempt to explain the pathophysiology of DHG, the underlying mechanism remains obscure. Treatment is aimed at eliminating the underlying disease process, if one is present, and controlling hemorrhage. The bleeding may be sporadic and require no operative treatment or may be massive and life-threatening. Vagotomy and drainage, vagotomy and resection, and subtotal gastrectomy have each been advocated as the operative procedure of choice. Continued unrelenting hemorrhage from the entire stomach may necessitate a total gastrectomy. The rate of rebleeding has been high[1] in the former procedures, while the latter has been associated with potential long-term morbidity should the patient survive.

A review of this institution's dismal results with DHG prompted us to search for a different operative modality when surgical intervention was deemed necessary because of failure of medical therapy. The ideal operation should rapidly stop bleeding, have a low rate of rebleeding, be technically simple to perform, have a low morbidity and mortality from the procedure itself, and cause little or no long-term disability. We have adopted gastric devascularization as the procedure of choice for DHG to prospectively determine if we could improve our results with this serious problem.

Clinical Material

Pre-devascularization Patient Therapy

From 1970 to 1974, 37 patients required operative intervention for DHG (Table 1). Eighteen patients

TABLE 1. *Standard Operative Treatment for DHG (1970–1974)*

	Vagotomy & Pyloroplasty		Gastric Resection	
	No. Pts.	(%)	No. Pts.	(%)
Number of Patients	18		19	
Mean Age	47		35	
Etiologic Factors*				
Sepsis	12		15	
Alcohol	4		4	
Hypoxia	3		5	
Steroids	1		2	
Unknown	1		1	
Re-Bled	11	(61)	7	(37)
Direct Operative Complications	1	(6)	4	(21)
Deaths	10	(55)	12	(63)

* Several patients had multiple factors.

underwent vagotomy and pyloroplasty; the rebleeding rate was extremely high with 11 patients having a significant second bleeding episode. There was one operative complication, an esophageal tear in the course of performing a vagotomy, and 10 of the patients died. In this retrospective review it was clear that many patients died of their primary disease, however a major factor in the ultimate demise of most patients was the failure to control hemorrhage. Nineteen patients underwent gastric resection. Three patients had a total gastrectomy, four had a resection estimated to be between 75 and 95%, and the remainder had a 50 to 75% gastrectomy often combined with a vagotomy. This operation was generally applied to younger patients thought to tolerate a major resection better, or to patients with extensive bleeding surfaces requiring a major resection to extirpate the hemorrhagic area. Although the re-bleeding rate was lower with resection (37% vs. 61% for vagotomy and pyloroplasty), the mortality was still unacceptably high (12 of 19). Additionally, four patients had complications related to the operative procedure itself. Two patients had serious leaks directly contributing to their deaths and two had intra-abdominal abscesses not present pre-operatively. Sepsis was the predominant underlying problem in both groups.

Devascularization Therapy

In the past five years, the number of patients requiring operation for DHG at our primary teaching hospital has decreased dramatically (Fig. 1). The types of patients who present with upper gastrointestinal bleeding secondary to gastritis now fall into three main groups: the alcoholic with deranged clotting

studies, the septic patient with multiple organ failure, and the patient with a history of long-term steroid use (Table 2). The patients are now generally older than those previously requiring operation and have failed to stop bleeding even with vigorous medical management. Table 3 indicates the pre-operative methods used in an attempt to control hemorrhage. All patients had vigorous lavage with iced saline and levarterenol and a majority also received intravenous pitressin. Selective intra-arterial pitressin was used in 11 cases. Although the bleeding ceased in a number of patients, it often later recurred requiring operative intervention. Vagotomy combined with pyloroplasty in four patients and antrectomy in one patient, had been performed with failure to control hemorrhage. The average blood replacement given during the pre-operative, operative, and immediate post-operative recovery periods averaged 4600 ml. The use of this large volume of blood often reflected multiple bleeding episodes, with cessation upon therapy, and massive bleeding in a few patients, rather than a deliberate procrastination in instituting operative treatment.

Whenever feasible, early and aggressive endoscopy was utilized. Seventeen patients underwent endoscopic examination which was diagnostic in 11 cases. Profuse bleeding in the remainder made accurate endoscopic
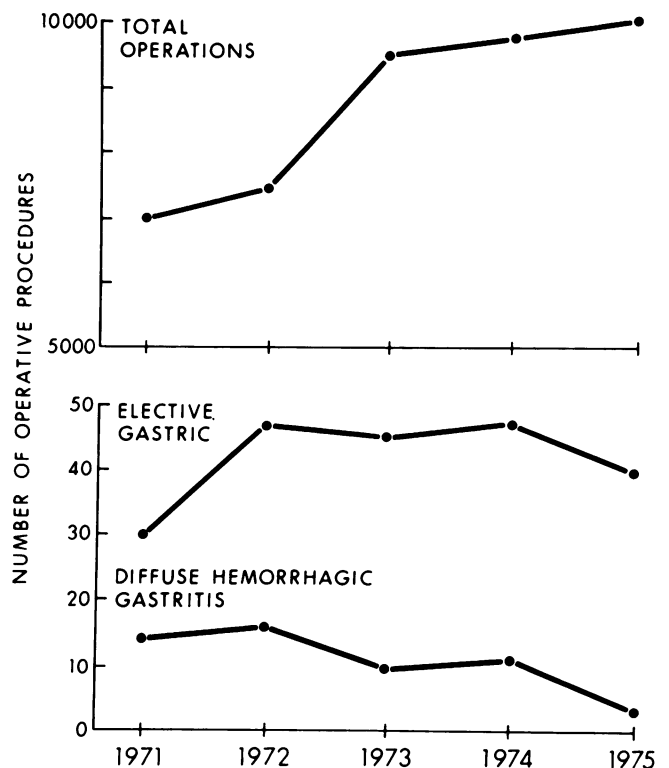

FIG. 1. This graph illustrates the dramatic decrease in the number of operations required for DHG (bottom). The total operative load has markedly increased and the number of elective gastric procedures has remained constant.

TABLE 2. *Operative Treatment for DHG (Devascularization Patients)*

Patients	21
Mean Age	51
Etiologic Factors	
Alcohol	9
Sepsis	8
Steroids	4
Abnormal Coagulation Studies	15

TABLE 3. *Pre-Operative Treatment Prior to Devascularization*

	Of 21 Patients	
	Number	%
Gastric Lavage with Levarterenol	21	100
Intravenous Pitressin	18/21	85
Selective Intra-arterial Pitressin	11/21	52
Previous V & P	4/21	19
Previous V & A	1/21	4
Average Blood Replacement*	4600 ml	

* Includes pre-operative, operative and post-operative transfusions.

diagnosis impossible. Even though complete evaluation of the gastro-esophageal junction, stomach and duodenum was often impossible, any definitive information gained was very useful. If bleeding varices or a duodenal ulcer were definitely excluded, then a limited gastrotomy was done during the operation to visualize those anatomic areas not seen by endoscopy. Eighteen patients underwent gastrotomy even though many had correct diagnoses by endoscopy. In all patients the diagnosis was confirmed by endoscopy or gastrotomy.

Operative Technique

Rittenhouse,[8] of our institution, has previously described the operative procedure we employed. The right and left gastric arteries were ligated near the stomach after being visualized through a lesser sac approach. The left and right gastroepiploic arteries were then ligated near the origin along the greater curvature (Fig. 2). On several occasions all of the gastroepiploic vessels along the greater curvature were divided between clamps and ligated. Care was taken not to injure the short gastric vessels or the spleen, however a previous splenectomy was done in three cases and an incidental splenectomy in another. There was no detectable difference in viability of the stomach in any of the four patients.

If the diagnosis can be clearly established by pre-operative endoscopy, we now feel the stomach should not be opened since creating a gastrotomy lengthens the operating time for these critically ill patients and introduces the possibility of contamination. However, if endoscopy cannot rule out a bleeding duodenal ulcer, we open the stomach, generally in the antral region. The stomach is evacuated of clots and both the duodenum and the fundus can usually be evaluated with a long thin curved retractor. On occasion a sterile endoscope has been passed into the duodenum and esophagus to evaluate these areas when they could not be seen under direct vision.

Results

The results of treatment are shown in Table 4. The stomach usually blanched significantly but there

were no instances of gastric necrosis. The average operating time was 84 minutes. Bleeding promptly ceased in all patients. Only two of the 21 patients rebled (9%). One of these was a four year old boy with burns over 40% of his body surface whose bleeding did not cease following a vagotomy and pyloroplasty. Gastric devascularization was performed and the bleeding promptly stopped; however one week later he again suffered massive bleeding which required a subtotal resection for control. This case was the only failure of the treatment method. The second patient who rebled was a 62 year old female with idiopathic thrombocytopenic purpura who failed to respond to a splenectomy. She was on large doses of steroids and developed a left subphrenic abscess. She subsequently developed massive bleeding from DHG that did not respond to any type of medical treatment. Gastric devascularization stopped this bleeding for several days before she had exsanguinating hemorrhage. At autopsy the stomach was viable with diffuse erosive esophagitis, gastritis and enteritis
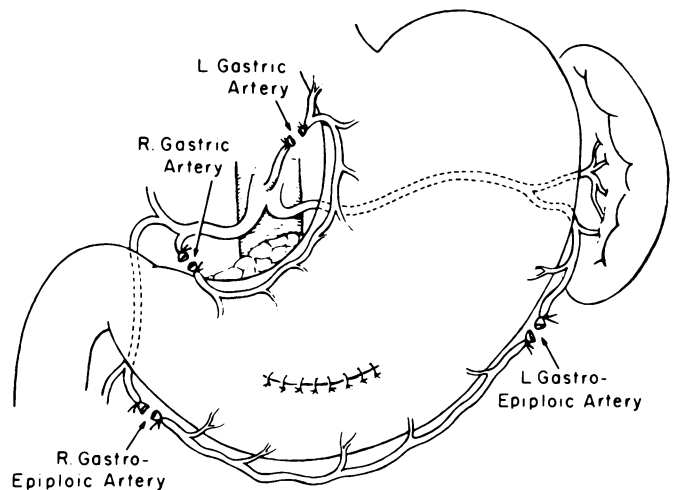

FIG. 2. The operation is accomplished by performing a four-vessel ligation at the sites indicated. The suture line indicates the gastrotomy that was usually performed to absolutely determine the bleeding site.

TABLE 4. *Results of Gastric Devascularization*

	Of 21 Patients	
	Number	%
Immediate Cessation of Bleeding	21	100
Number Re-Bled	2	9
Direct Operative Complications*	2	9
Deaths†	8	38
Gastric Necrosis	0	0

* Incidental splenectomy and dehisced gastrotomy with left subphrenic abscess.

† Hepatic failure (4), sepsis (2), respiratory failure (1), bleeding (1).

present. We did not feel this case truly represented failure of gastric devascularization in light of the multiple bleeding sites throughout the gastrointestinal tract.

The amount of blood required after the immediate postoperative period is shown in Table 5. No further transfusions were required by nearly half the patients. Only the two previously mentioned patients with postoperative bleeding required blood secondary to hemorrhage. The remainder was required due to the underlying disease processes.

In spite of the low rebleeding rate, the mortality was high (37%) in this group of critically ill patients. Hepatic failure (4), sepsis (2), respiratory failure (1), and gastrointestinal hemorrhage (1) were responsible for the 8 deaths. In only one patient was a technical misadventure related to the operation itself contributory to a patient's death. This occurred in an alcoholic who dehisced his gastrotomy and developed a left subphrenic abscess. He subsequently died of the hepatorenal syndrome. One other complication, incidental splenectomy, occurred but the patient recovered without sequelae. Post mortem examinations on five of the 8 deaths showed no gastric necrosis on gross or microscopic examinations of the stomach (Figs. 3 and 4). One other patient required reoperation for drainage of intraperitoneal abscesses. This patient also had no evidence of gastric necrosis. Additionally, the child who rebled and required a subtotal gastrectomy had a viable,

TABLE 5. *Post-Operative Blood Requirements*

Units of Blood	Number of Patients
None	10
<2	5
2–5	4*
>5	2*

* One patient in each group required transfusion for bleeding; the remainder due to anemia with severe prolonged illness.

normal appearing stomach externally and healed his anastomosis uneventfully.

In those patients whose general condition permitted, alimentary function returned in five to 7 days. Postoperative acid determinations were performed on five patients from three weeks to four months after the procedure. There was no free acid in any patient at the time of their examination. Longer follow-up studies of acid secretion have not been obtained yet.

Two brief cases are presented here to illustrate the value of this procedure in selected critically ill patients.

Case 1. A 56 year old diabetic man presented himself to the hospital with a temperature of 40.5°, a pulse of 140 and necrotizing fasciitis of the left lower extremity following an infected insect bite. Appropriate antibiotic treatment was initiated, his ketoacidosis was treated, and the necrotic fascia of the leg was widely debrided. Twenty-four hours later he had an episode of massive upper gastrointestinal bleeding. Endoscopy showed no varices at the gastroesophageal junction but evaluation of the stomach and duodenum could not be made. Intra-arterial pitressin therapy temporarily halted the bleeding but the patient shortly rebled. After 16 units of blood, surgery was undertaken. Gastrotomy revealed hemorrhagic gastritis involving the fundus, body, and antrum. A total gastrectomy would have been necessary to eradicate the bleeding mucosal surfaces. A four-vessel ligation was performed and the bleeding promptly ceased. Five days later, oral intake was started; the fasciitis resolved after debridement and the patient was discharged two weeks later. He was readmitted in 6 weeks for skin grafting. Overnight acid collection showed no free acid.

Comment

This case illustrates the value of gastric devascularization. The patient was in less than optimal condition from his diabetes and was bleeding massively so that an operation was unavoidable. A total gastrectomy would have required a long convalescence and would have made the management of his diabetes much more difficult.

Case 2. A 58 year old male was admitted with massive upper gastrointestinal bleeding. He had a history of ethanol abuse. His arterial pressure was 60 mm Hg on admission and he required six units of blood for hemodynamic stabilization. Although his bleeding subsided with iced saline lavage and levarterenol, he promptly rebled requiring 2000 cc additional replacement.
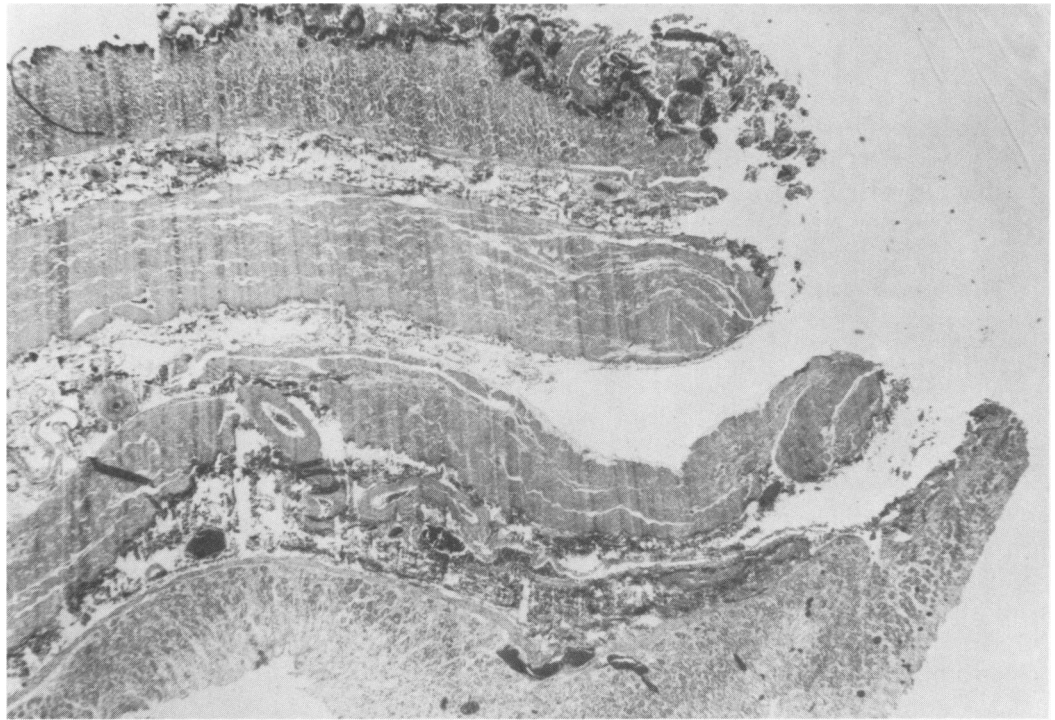
Esophagogastroduodenoscopy showed hemorrhagic gastritis involving the entire fundus and most of the body of the stomach. There was no evidence of varices or duodenal ulcer. At operation the stomach was not opened and a gastric devascularization was performed. The stomach blanched and the bright red blood which had been returning through the tube quickly cleared upon irrigation. The patient did not rebleed and was eating a regular diet five days after the operation. Postoperative secretory studies four months later showed no free acid.

FIG. 3. Postmortem microscopic examination of the stomach in this patient who was seven days postoperative from a gastric devascularization showed autolysis of gastric mucosa but there was no evidence of gastric wall necrosis.

Comment

Several points are important to consider in this case. If an unequivocal diagnosis can be made by endoscopy, then the stomach need not be opened. This lessens the risk of contamination considerably.

Second, the devastating result of DHG, i.e., bleeding, is often a temporally short problem, therefore the operation to appropriately treat the problem should not have the long-term morbidity of a major resection. In this case intestinal function was normal after five days and the patient was discharged in 8 days.

FIG. 4. This photomicrograph is from an autopsy specimen of a patient who died 48 hours following gastric devascularization for gastritis secondary to alcohol abuse. The cause of death was liver failure. Focal areas of ulceration and acute inflammation were present in some portions of the stomach but there was no gastric necrosis.

Discussion

Few subjects in surgical practice have evoked as much controversy as the operative treatment for diffuse hemorrhagic gastritis. As in any other disease in which the underlying cause is unknown, a variety of treatment modalities have been advocated. Drapanas[3] reviewed the surgical literature from 1949 to 1970 and found that the rebleeding rate was high in all operative procedures although vagotomy and resection carried only a 15% rebleed rate and a 20% mortality. Thirty-four of 118 patients (29%) with vagotomy and drainage rebled. Bryant and Griffen[1] reported an unacceptably high rebleed rate after vagotomy and pyloroplasty, which is similar to our experience. Although some authors[5] have reported good results with total gastrectomy, we doubt that this is an operation that can be done with such good results by most surgeons. We also believe it offers many long-term sequelae for a temporally short disease process. Because gastric devascularization can be performed safely, quickly, stops bleeding promptly and has a low rebleed rate, we recommend its more widespread use for this disorder.

Although not within the scope of this paper, mention should be given to our experience using gastric devascularization for other disorders that cause upper gastrointestinal bleeding. It was used once for erosive duodenitis that had bled intermittently over several days. The patient was an extremely poor operative risk and a devascularization was performed. The patient did not rebleed and eventually recovered from the primary problem. Our experience is too limited for us to recommend the procedure for this disorder.

We have also performed the devascularization procedure on 12 patients with bleeding esophageal varices. Seven of these patients had undergone previous porto-systemic shunts that failed and the remaining five were not considered suitable candidates for any type of shunting procedure. Although the initial hemorrhage was controlled in all 12 patients, 8 subsequently rebled. Ten of the 12 patients died and only one survived without rebleeding. He has not rebled in over a year of follow-up. Even though the initial bleeding is controlled, our poor results indicate that this procedure has no place in the management of even end-stage cirrhotics with variceal bleeding.

The documentation that gastric and duodenal erosions occurred frequently and early after major trauma[4] and thermal injury,[2] prompted a great deal of speculation and experimental work on the pathogenesis of "stress ulcer." A number of theories have been proposed to explain the observed phenomena. Back diffusion due to ischemic injury[10] alterations in mucosal flow during ischemia,[9] and changes in gastric mucosal energy metabolism[6] are several that have been proposed. The central factor in all of these theories is ischemia. Ritchie[7] has summarized much of the experimental work noting species differences and has added a note of caution that the precise relationship between ischemia and so-called "stress bleeding" is far from being well understood. The clinical data presented in this series adds further confusion to the role of ischemia in the production of hemorrhagic gastritis. Gastric devascularization is in many ways the ultimate ischemic preparation for the gastric mucosa, however few if any of our patients develop subsequent bleeding. This paradoxical situation only further shows the limited understanding we have of this complex disease entity.

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