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Massive upper gastrointestinal hemorrhage : differential diagnosis and management

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MASSIVE UPPER GASTROINTESTINAL HEMORRHAGE
DIFFERENTIAL DIAGNOSIS
AND
MANAGEMENT

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Introduction and Definition

Although the clinical picture of massive upper gastrointestinal hemorrhage is usually unmistakable to the clinician, the student, upon reviewing the literature is confronted with the problem that there is no concensus as to what criteria constitute massive upper gastrointestinal hemorrhage. Much is written on the treatment of this disorder, but only confusion results from any attempt to compare mortality figures for each type of therapeutic regime available. The reason for this underlying confusion lies in the variable criteria for the inclusion or exclusion of specific cases of so-called massive upper gastrointestinal hemorrhage; the lack of standardization of age groups; and the failure to consider and group the patients according to associated or concurrent significant disease disorders. Other sources of confusion are the failure of combined medical surgical management programs to specify the criteria utilized to indicate the need for change from medical management to surgical intervention.

As indicated the definition of massive upper gastrointestinal hemorrhage will vary in each series reported; however, the following criteria seem to be the

most generally acceptable: The patient with diffusely bloody vomitus and who manifests clinical signs of hemorrhagic shock; and further corroborated by a reduction in RBc's to three million or less, a hemoglobin of 7.5 gms.% or less, a hematocrit of 30% or less, or a blood volume of 60% of normal.

History in Brief

With the development of refinements in diagnostic procedures, pre- and post- operative care, hematologic facilities, laboratory procedures, and anesthesia, the pendulum of therapeutic concepts has swumg widely under the influence of the mortality rates resulting from any one approach to management.

Originally, nothing more than the following was offered to the hemorrhaging patient and mortality rates were consequently high. Early physicians in their hopeless effort to manage upper gastrointestinal hemorrhage thought that to maintain a state of hypotension was the only method of arresting the hemorrhage, presuming that this would allow clot formation to take place, and if undisturbed would eventually seal off the bleeding vessel. With the advent of blood transfusions, both medical and sur-

gical proponents assumed greater interest in the management of the bleeding patient. Although their experience soon revealed that many patients could be saved with adequate conservative management and blood transfusions, a significant proportion of patients did not respond to this form of therapy, and surgical intervention was found to further reduce the overall mortality rate. Thus evolved the current concept of medical surgical management which has done much to reduce previous high mortality rates to the lower currently acceptable levels.

Etiologic Spectrum and Classification of Massive Upper Gastrointestinal Hemorrhage.

Infants and Children: Although this discussion is primarily confined to the adult patient bleeding massively from the upper gastrointestinal tract, for the sake of completeness some mention of the causes of gastrointestinal hemorrhage in infants and children is in order. As will be noted, however, gastrointestinal hemorrhage in infants is more peculiar to the lower gastrointestinal tract, in contrast to the adult patients where one notes the gastrointestinal hemorrhage is more peculiar to the upper gastrointestinal tract.

Brayton, and Norris, (1), reporting on 428 infants and children from Los Angeles Childrens' Hospital with gastrointestinal hemorrhage found the following:

Classification	Etiology	Patient Number
Upper Gastrointestinal tract bleeding.	Esophageal varices	17
	Peptic ulcer	11
	Hiatus hernia	2
	Acute gastritis	1
		31 Total
Lower Gastrointestinal tract bleeding.	Intussusception	142
	Colon polyps	40
	Meckel's diverticulum	27
	Local anorectal conditions	12
	Hemangiomas of the intestine	2
	Congenital stenosis of hepatic flexure	1
		225 Total
		256 Grand Total
General Gastrointestinal causes.	Enterocolitis	14
	Ulcerative colitis	12
	Swallowed blood from nose and mouth	10
	Constipation with impaction	9
	Persistant vomiting	2
	Swallowed foreign body	1
		65 Total

con't		
Gastrointestinal bleeding associated with blood dyscrasias.	Leukemia	29
	Purpura	23
	Hemorrhagic disease of Newborn	16
	Erythroblastosis fetalis	4
	Acquired hemolytic disease	2
	Hemophilia	2
	Aplastic anemia	2
	Megaloblastic anemia	1
	Unclassified dyscrasias	5
		84 Total

In this series melena was the most common manifestation rather than hematemesis. The only fatal gastrointestinal hemorrhages they reported in the series was due to esophageal varices.

Hodgson and Kennedy from Mayo Clinic, (2), reviewed 246 cases of gastrointestinal hemorrhage in infants and children, and found that the most common causes of hemorrhage were: (1) Ulcerative colitis, and (2) Colon polyps. These accounted for 60% of the causes. They commented that ulcerative colitis was higher in their series than in others but assumed it was due to the selective referral system at their clinic. The following table may sumarize their results:

Etiology	Total Cases	Age Groups 0-2	2-6	7-15
Chronic ulcerative colitis	94	1	12	81
Colon Polyps	40	0	31	9
Cause undetermined	19	4	10	5
Meckel's diverticulum	17	6	8	3
Intussusception	17	14	3	0
Esophageal varices	10	0	4	6
Duodenal ulcer	8	0	4	4
Blood dyscrasias	11	3	4	4
Mesenteric lymphadenitis	5	0	4	1
Volvulus	6	5	1	0
Regional enteritis	5	0	1	4
Jejunal polyps	1	0	0	1
Gastric ulcer	1	1	0	0
Gastroenteritis	2	1	1	0
Lymphosarcoma of ileum	1	0	0	1
Foreign body in esophagus	1	1	0	0
Meningitis	2	2	0	0
Hemorrhagic disease of newborn	2	2	0	0
Carcinoma of rectosigmoid	1	0	0	1
Acute enteritis	2	0	2	0
Ileal bands	1	1	0	0

All bleeding disorders of the nose, mouth, and rectum were omitted from their series. The authors found that in the age group 2 and below the most common lesion responsible for gastrointestinal hemorrhage was intussusception, then Meckel's diverticulum, and third was volvulus. The latter was always associated with some degree of malrotation. In the age group 2-6 the most common cause was colon polyps with chronic ulcerative colitis next and undetermined etiology group third. In the age group 7-15 the most common cause was chronic ulcerative colitis, second was colon polyps, and third the eso-

phageal varices.

Thus, one may note that gastrointestinal hemorrhage in the infant or child is more common in the lower gastrointestinal tract, and more over usually manifested as melena without hematemesis clinically.

Adults: The spectrum of causes of gastrointestinal hemorrhage in the adult patient differs to that found in the infant and child by the fact that the more common site of hemorrhage is in the upper gastrointestinal tract, and also, manifested by hematemesis as well as melena. The following tables are a composite review of the larger series presented in the literature. From these series one can then draw several conclusions: The leading proportion of each series is made up of the peptic ulcer patient, which roughly comprises 60-70% of the entire group; next is the patient with gastrointestinal hemorrhage of undetermined etiology comprising roughly 10-15% of the entire spectrum; and, third is the patient with esophageal varices and comprising 8-15% of the entire group. Of the peptic ulcer group, roughly 60% are duodenal ulcer bleeders, 10% are gastric ulcer bleeders, and the least common being stomal ulcer bleeders, 2.5%; the latter two being of the entire group of bleeders.

Author	Yr.	Cases	Peptic ulcer	Esoph. varices	Gastritis	Gastric CA	Hiatus hernia	Misc.	Undet. etio.
Brown	1950	324	76%	10%	0%	2%	0%	4%	8%
Gott	1952	215	63%	6%	5%	1%	0%	3%	22%
Palmer	1952	121	35%	7%	22%	0%	0%	13%	22%
Schiff	1952	640	53%	12%	1%	2%	2%	0%	21%
Warthin	1953	246	75%	9%	5%	0%	0%	1%	10%
Atik	1954	296	48%	23%	2%	0%	0%	8%	21%
Dunphy	1954	184	80%	8%	9%	3%	0%	0%	0%
Welch	1955	445	49%	32%	5%	3%	3%	0%	7%
Jones	1956	1910	56%	3%	30%	2%	2%	3%	4%
Berkowitz	1956	500	75%	8%	1%	1%	1%	2%	12%
Zimmerman	1956	200	72%	14%	0%	2%	0%	5%	7%
Smythe	1957	111	48%	11%	9%	5%	0%	13%	4%
Composite Averages:			60.8%	12%	7.4%	1.8%	.5%	4.3%	11.5%

(3).

Further study of the peptic ulcer groups reveals that duodenal ulcer bleeders are ubiquitously more prominent than either gastric or stomal ulcer bleeders.

Author	Duod. ulcer	Gast. ulcer	Stomal ulcer	Total ulcer gp.
Smythe	45(40.5%)	20(18%)	0%	65
Knight	39	11	0	50
Allen	94	42	8	144
Costello	171	33	4	208
Warthin	48(55.5%)	7(8.1%)	1(1%)	56
Welch	210(59%)	41(11%)	8(2%)	259
P.B.Brigham	127	15	6	148
Gunz	101	62	6	169
Gott,Smith	114(58.6%)	19(9.7%)	3(1.5%)	136
Stewart	60(48.3%)	46(37%)	4(3.2%)	110
Berkowitz	500(60%)	50(10%)	12(2.5%)	350
Clev. City Hosp.	103(35%)	35(11.6%)	3(1%)	141

(4a,b,c,d,e,f,g,h,i,j,k).

The (%) figures as seen above are in terms of the entire spectrum of causes in each series.

In summary, once again, the spectrum of etiological causes can be divided into three main categories: I. Peptic ulcer bleeders which roughly comprise 60-70% of the entire group; II. Esophageal varices group comprising 8-15% of the entire group; and III. The undetermined etiology group comprising roughly 10-15% of the entire spectrum. Of the peptic ulcer group, duodenal ulcer bleeders predominate constituting roughly 60% of the entire peptic ulcer group; gastric ulcers comprising around 10%, and stomal ulcers least common and making up 2.5% of the entire group of massive upper gastrointestinal bleeders.

Multiple lesions as etiological cause of hemorrhage: That this occurrence may exist is revealed by noting its mention through much of the literature and illustrated well by the following results of a series of 53 patients that Zamcheck, (5), reported on as having multiple lesions as demonstrated by X-ray, surgery, or gross and microscopic pathological exams:

Diagnosis	Number of Cases
Gastric ulcer, duodenal ulcer	2
with gastritis	1
with gastritis and hiatus hernia	1
with duod. diverticulum	1
with hiatus hernia	2
Gastric ulcer, gastritis	6
Gastric ulcer, hiatus hernia	1
Duodenal ulcer, gastritis	14
Duodenal ulcer, gastritis,hiatus hernia	3
Duodenal ulcer, hiatus hernia	2
Duod. ulcer, duod, diverticulum	3
Duod. ulcer, duod. and gastric diverticulum	1
Duodenal ulcer, gastric diverticulum	1
Duod. ulcer, metastasis chorioCA jejunum	1
Marginal ulcer, duod. deformity, duod. divertic.	1
Marginal ulcer, hiatus hernia	1
Esoph. varices, duod. ulcer, hiatus hernia, and duod. diverticulum	1
Esophageal varices, gastritis	1
Esophageal varices, hiatus hernia	1
Gastritis, hiatus hernia	4
Gastritis, duodenal diverticulum	1
Gastritis, hiatus hernia, duod. diverticulum	1
Gastritis, duodenitis	1
Gastritis, hiatus hernia, duodenitis	1
Hiatus hernia, duodenal diverticulum	1
Total	53

Diagnostic Methods

Clinical: The initial approach to diagnosis of massive upper gastrointestinal hemorrhage is through an adequate history and physical examination. Hematemesis and melena, as manifestations of massive upper gastrointestinal hemorrhage, may be due to a number of disorders. The problem of diagnosis may be simplified, however, if it is kept in mind that

90% of all cases are due to primary intragastric or duodenal diseases, such as peptic ulcer, gastritis, benign and malignant tumors of the stomach; and the remainder, most of which are due to bleeding from esophageal varices, (6). Such historical findings as heavy alcohol intake, occurrence of jaundice, ascites, enlarged liver or spleen, and liver palms are valuable clinical findings in the differentiation of esophageal varices from other possibilities. This differentiation is notably important in that esophageal varices are associated with extremely high mortality rates when bleeding, in addition to directing the clinician along an entirely different avenue of management, (these points to be discussed in a section to follow). In obtaining the history one should never forget that cirrhotic patients have a greater incidence of peptic ulcer than is found in the general population, being roughly 15-25%, (Panke, (7a), and Cole, (7b)), and that a cirrhotic patient could be bleeding massively from a peptic ulcer rather than from esophageal varices.

On the other hand, upon directing attention to the peptic ulcer group of patients, the most important clinical finding is a history of previous

ulcer which has been diagnosed medically. It is interesting to note, however, that in the various series reported 10-18% of peptic ulcer bleeders offer no previous history of upper gastrointestinal symptoms prior to the event of massive upper gastrointestinal hemorrhage, (Chin and Wekesson, (7b)).

Similarly, all intragastric and duodenal diseases may be diagnosed if the history of previously diagnosed involvement exists or the history of typical previous symptomatology exists. However, because of variability to symptoms, e.g. location of pain, severity of pain, radiation of pain, dysphagia, belching, nausea, etc., with each of the possible diagnoses, one finds these clinically non-reliable at the time the patient is admitted with acute massive upper gastrointestinal bleeding.

Estimation of the degree of blood loss clinically: The tilt test is a valuable clinical test for crudely evaluating the amount of blood loss in terms of its massiveness. Other clinical means for determining the degree of blood loss includes: Blood pressure changes, pulse, shock, amount of hematemesis.

Laboratory: Laboratory procedures of value are the RBC count, hemoglobin, and hematocrit determinations. The limitation of these tests in acute blood loss is the lag in time required for hemodilution and thereby failing to reflect accurately the amount of blood loss that has occurred. Yet these are crude indices of hemorrhage. The blood volume determination studies are a more accurate evaluation of massive blood volume losses which are acute in onset, according to Gunz et al, (4h). Kruger, Baker, and Mosemanin, (8) reviewed 61 cases of massively bleeding peptic ulcers employing blood volume determinations to evaluate the blood loss and concluded that it is a simple and safe technique which objectively determines the severity of continued hemorrhage when employed in serial determinations to evaluate the quantitative aspects of post hemorrhage hemodilution, and allows an objective determination of the patients response to blood transfusion therapy.

Similarly, Ellison, Zollinger, Cedars, and Britt, (9), concluded that blood volume studies were extremely valuable when repeatedly performed to determine the patients response to transfusion.

Compensatory volume changes may also be noted; and the blood volume studies aid also in avoiding overloading errors particularly in patients with associated cardiac disease. Welchsler, et al, (10), concluded that total blood volume determinations have their value in revealing the amount and type of blood loss, (RBC or plasma), as well as indicating continued blood loss and helpful in preventing overloading in the older patient.

Roentgenology and Endoscopy: The value of roentgenologic visualization of the source of bleeding is of great value to the clinician and of equal value to the surgeon contemplating surgical intervention.

Hamptom (11) in 1937 was the first to systematically approach this problem. He strongly advocated emergency upper gastrointestinal studies in view of his low morbidity-mortality rates in performing the procedures and the accuracy in discovering the responsible lesion.

Elmer, Rousuckm, and Ryan, (13) reported on 58 patients having active bleeding prior to or during examination. Emergency X-rays were done within the

first 24-to48 hour period and repeated X-rays whenever it was possible 2-to-3 weeks later. They discovered the responsible etiology in 44 of their 58 patients by emergency X-ray series of the upper gastrointestinal tract. It also was noted that some of the previously observed smaller ulcers had completely healed during the interval between the first and second series of X-rays. These authors recommend early upper gastrointestinal X-rays and fluoroscopy in order to obtain the highest yield of diagnosis. They reported no morbidity or mortality from the procedure even though the study included patients actively bleeding during the examination.

Atik and Simeone, (4e) reporting on 296 such cases reported that 199 of these were subjected to emergency X-ray studies and a diagnosis was obtained in 150 of these.

Zamcheck et al, (5), reported on 123 patients with massive upper gastrointestinal hemorrhage. The diagnosis in 20 of these patients was obvious through history and physical examination and thus, these patients were not subjected to emergency X-ray studies. The remainder underwent emergency X-ray studies in

which the results were as follows: In 72 patients the etiology was demonstrated and later confirmed by either gastroscopy, esophagoscopy, or by gross and microscopic examination of the resected specimen: In an additional six patients the correct diagnosis was made initially but subsequent studies revealed additional lesions missed at the time of the emergency studies: In 14 patients an incorrect diagnosis was made and subsequent upper gastrointestinal films identified the lesion in 5 of the 14 patients; and in the remaining 11 patients no satisfactory roentgen diagnosis was made on the initial emergency upper gastrointestinal X-ray studies. Of this entire group, 81 patients had no gastrointestinal bleeding secondary to the procedure, although 10 had non-serious or dubious bleeding episodes following the procedure. The remaining 12 had severe bleeding, but 8 of these were actively bleeding prior to or during the emergency upper gastrointestinal X-ray studies. In this study 61% of the emergency studies were done within the first 48 hours, 77% were done within the first 72 hours, and the remainder within 7 days of their admission.

Smythe, Osborne, Richards, Zamcheck, and Mad-

ison, (4i), found that by doing emergency upper gastrointestinal X-rays and fluoroscopy in 96 such patients that a diagnosis was made in 83%. Their positive roentgenological diagnoses were confirmed by ancillary studies.

It is generally agreed that as soon as shock is under control, subjecting the patient to emergency upper gastrointestinal X-ray studies and fluoroscopy will yield a high percentage of accurate diagnoses with a very small or negligible degree of associated morbidity and mortality.

Jones, (12), in 1942 commented that esophagoscopy should never be performed to make the diagnosis of varices since a barium swallow is much easier and equally able to demonstrating the same.

There is some disparity of opinion as to the value of either esophagoscopy or gastroscopy in locating the lesion responsible for massive bleeding. Some feel that they are contraindicated in that if varices are responsible, additional trauma is added. Also, it is difficult to visualize the lesion when there are clots of blood in the esophagus and stomach, even in the experienced hands, (Jones, (12)). Others, Atik and Simeone, (4e), re-

ported good results in making the diagnosis in 11 of 17 patients that were scoped. Smythe, Osborne, Zamcheck, Richards, and Madison, (4i), used endoscopy actively and if varices were suspected this was done as an emergency procedure in bed. Jones, (12), and Zamcheck, (5), feel that gastritis is extremely difficult to diagnose by X-ray and that gastroscopy is best employed in its determination. In general, in the hands of an expert endoscopist, these procedures should yield valuable information in the establishment of a diagnosis for the massive upper gastrointestinal bleeding patient, (5).

Miscellaneous and Technical Diagnostic Procedures Include: 1). The Sengstaken-Blakemore Tube, which is used by the physician who suspects the etiology of the upper gastrointestinal bleeding to be from esophageal varices. The method of its use, as well as its principle, will be discussed in a following section discussing management of bleeding esophageal varices. The physician, in his frantic efforts to control hemorrhage and hematemesis, occasionally loses sight that there is a definite morbidity and mortality connected to the use of this

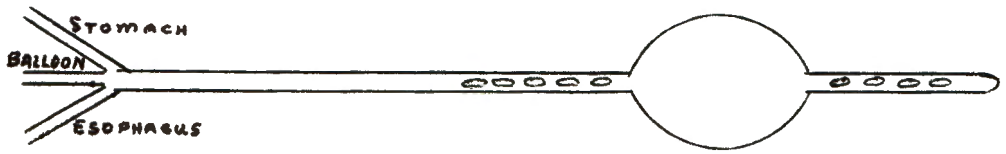
tube if its complications are not constantly kept in mind. Many feel that this tube does little at the most in controlling bleeding esophageal varices and offers no added diagnostic value over the other available procedures, (14).

Conn, (14), reported on 50 patients treated with the Sengstaken tube in which the tube was employed 81 times and the average period of treatment was 78 hours. Of these, 19 patients developed complications directly attributable to the use of the tube. Nine of these died as a direct consequence of the tube and six had factors complicating esophageal tamponade which directly contributed to the eventual demise of the patient; (41 of his 50 patients died). The complications encountered were: Ulcerations of nasopharynx, esophagus, and stomach, secondary to pressure necrosis from traction to the tube; tears of the esophagus, (a rare complication); aspiration pneumonia secondary to inadequate drainage of secretions from the mouth and esophagus; obstruction of the trachea by the inflated balloon, (most common complication); and recurrent hemorrhage secondary to poorly attended management in care following deflation of the balloon

due to leakage. Conn concluded that esophageal tamponade is difficult, dangerous, and is inconsistant in yielding any diagnostic information. Keeping these complications in mind the use of the tube may be of some help in controlling hemorrhage in an occasional patient when nothing else is available.

L.M. Rouselot, (46), found good results with the use of the Sengstaken tube, especially in those patients having a history of previously diagnosed esophageal varices. Taking special care to avoid complications of the use of the Sengstaken tube, special benefit was found to arresting the bleeding and in this manner aiding to bring the patient out of shock. Similarly, patients in shock, and unable to be taken to X-ray for fluoroscopy, for diagnosis of site of hemorrhage were aided by use of the tube.

2). Nachlas Triple Lumen Single Balloon Tube: This is a triple lumen tube as diagrammed below---



Its value is that once it assumes its posture in the gastroesophageal area and the balloon is inflated for tamponage effect, the remaining two lumen are attached to separate suction bottles draining respectively the esophagus and stomach such that the presence of bloody drainage in one of the bottles identifies the general area of hemorrhage. Nachlas, (16,15), of Boston City Hospital has reported repeatedly on this with enthusiastic results in ruling out esophageal varices or lesions bleeding below the esophagus.

3). The string test: Haynes and Pittman, (17), and Traphagen and Karlan, (18), report on the use of a radiopaque tape with cross markings at one inch intervals and weighted down by a mercury bag which the patient swallows. After an adequate period of time is allowed for the mercury bag to carry the tube into the duodenum and upper part of the jejunum, a 5% fluorescein solution which fluoresces under an ultraviolet light is injected into one of the antecubital veins. A flat plate of the abdomen is taken to make certain that the tape is in the duodenal area. The tape is then withdrawn and examined for evidence of blood and for fluorescence.

Three possibilities can occur: One, no blood staining of the tape and no fluorescence implying no past or current bleeding in the area traversed by the tape; two, blood staining of the tape, but no fluorescence implying evidence of past bleeding which has subsided; and third, blood staining and fluorescence indicating active and current bleeding. By comparing the area of the tape affected to that same position of the tape on the flat plate of the abdomen, the approximate area of hemorrhage is determined.

4). The Geiger Counter Nasogastric Tube: Healey, (19), and others recently advocate the use of a specially designed nasogastric tube containing three small Geiger-Mueller counters spaced at intervals of 8 inches apart. After this tube has been inserted, autologous RBC's labeled with 28 to 68 microcuries of P32 are injected into a vein. As these become mixed with the general circulation some of them leak out into the gastrointestinal tract from the bleeding lesion and their radiation is picked up by the geiger counter nearest the lesion. Since the radiation penetration of P32

through tissues is small, the other two geiger counters will fail to record any significant radioactive pickup. By comparing the active counter with its position on a flat plate of the abdomen, the approximate site of the lesion is determined. These authors found this valuable in the detection of multiple bleeding sites as well.

Factors Influencing Mortality Rates

Shock: Shock, as applied to this category, is of the hemorrhagic type. When an animal is suddenly bled to the extent of 30-40% of its calculated blood volume, recovery without assistance does occur. The physiological compensatory mechanisms of vasoconstriction and the uptake of fluid from the tissues are sufficient to restore the blood volume to normal. If repeated bleeding occurs, however, and the blood pressure is kept at a low level, a state of shock supervenes from which, after a time,recovery becomes impossible. The recovery is irreversible even though the animal is transfused with all the blood which has been removed. Shock is then said to be "irreversible", (28). Zweifach, (20), studied the capillary cir-

culation in the mesentery and omentum of the dog and in the meso-appendix of the rat. He found the reactivity of the vessels is increased in the earlier stage of hemorrhagic shock. The caliber of the vessels appeared narrow and hypersensitive to the action of adrenaline. At this stage, presumably, fluid is being absorbed into the vascular system and hemodilution is taking place. With the lapse of time, and as the animal passes into the irreversible stage of shock, the vessels become dilated and hyperreactivity gives place to reduced responsiveness to stimulation. It has been demonstrated that a vasoexcitor material, (VEM), is liberated during the stage of vascular hyperactivity; whereas, a vasodepressor material, (VDM), appears in the blood in the irreversible stage of the hemorrhagic shock. The first mentioned substance, (VEM), is believed to be renin; whereas, VDM is a product of the liver, (28).

Mazur and Shorr, (21), have studied this material, obtained from the concentrates of saline extracts of beef, dog, horse, and human livers; and found that the depressor activity of the concentrates was in direct proportion to its ferritin content.

The basis for liberation of VDM is severe hepatic anoxia; under conditions of hypoxia, the liver is also unable to inactivate VDM.

Laveen, (22), showed experimentally that hepatic anoxia can easily occur. Employing dogs he was able to show that massive bleeding from the gastroduodenal artery resulted in a greater decline of hepatic artery pressure and arterial flow, than did massive bleeding of equal quantities of blood whose source was from the femoral artery. This work was stimulated by the frequently repeated comment in the literature that for some reason, shock resulting from massive upper gastrointestinal hemorrhage was more profound than shock resulting from massive blood loss of a more distal artery. He noted that, although 75% of the blood supply to the liver is derived from the portal vein, that 50% of its oxygen supply is obtained from the hepatic artery. His work also revealed that under normal conditions the portal venous oxygen tension is 15 volumes % (or 75% saturated), as compared to 19 volumes %, (95% saturation), for the arterial blood of the hepatic artery. Thus, the drop in pulse pressure in the gastroduodenal artery, secondary to sudden

and massive blood loss, results in a severe drop in the hepatic artery flow. The resulting liver anoxia sets the stage for the production of VDM which, on gaining access to the peripheral vascular system exerts its deleterious effects upon the compensatory mechanisms of vasoconstriction.

J. Fine, and others, (23), in discussing this mechanism, state that cross circulation of the liver with another dog, so that liver ischemia is prevented in the dog undergoing massive blood loss and shock, prevents "irreversibility" and reduces the profoundness of shock. They assumed that under these conditions the liver is prevented from forming or incapable of inactivating VDM. In their work on dogs they found low oxygen saturation in the hepatic artery, even during the early stages of hemorrhagic shock.

In man, a sudden loss of 30% of his blood volume, results in a condition which, the patient's homeostatic mechanisms cannot be repaired by assistance of blood replacement. Laufman, (24), states, man's ability to tolerate massive blood loss depends on; 1). the rate of loss; 2). the extent of the bleeding; and 3). the age of the patient. In

the discussion of shock it is of prime importance to regard it from the standpoint of its effect on the vital organs of the body; the heart, kidney, and brain; in order to understand why the mortality rates increase with age and with specific concurrent diseases.

Freedman and Field, (25), reported on 95 patients which bled massively from the upper gastrointestinal tract and found that 56% of these revealed electrocardiographic evidence of myocardial ischemia or actual infarction. Pre-existing coronary sclerosis predisposes to myocardial ischemia under these conditions, (25). However, it is interesting to note the reports of Kinney and Mallony, (26), and Aschenbrenner, (27), who report myocardial infarctions in young patients in their very late teens secondary to massive upper gastrointestinal, or lower gastrointestinal hemorrhage. Their patients were free of coronary arteriosclerotic vessel disease. Best and Taylor, (28), state that the patient undergoing massive blood loss and subsequent shock, frequently manifests an increased clotting tendency. Whether myocardial infarction in the young patient is due to ischemia or thrombosis

of vital vessels was not determined. Yet, this emphasizes the possible lethal effects of shock on patients of all age groups.

Fazekas, (29), revealed in his experimental work on dogs some of the effects of hemorrhagic shock in reduction of total cerebral blood flow. By bleeding dogs massively to reduce the blood pressure from a resting systolic of 102 to a 48, (a drop of 53 points mm. Hg.), he noted a 26% reduction in the effective cerebral blood flow circulation. Applying this to the human patient he noted that under normal conditions the total cerebral blood flow is about 800 cc/min.. When there was a reduction of the effective circulating blood volume, either due to blood loss or other forms of drug induced shock, severe enough to reduce the cerebral blood flow rate to 475 cc/min, abnormal electroencephalographic changes became manifest.

Renal disturbances are commonly seen in the patient with massive upper gastrointestinal hemorrhage, or any other forms of massive hemorrhage. These are usually transient. It is generally agreed that 25% of the resting cardiac volume output passes to the kidneys in the normal person, (Best and Taylor, (28)). With a reduction in total circulating blood volume,

azotemia develops. Within 24 hours of gastrointestinal bleeding the bacterial nitrogenous breakdown products of blood are absorbed and reach the kidneys. The kidneys, in turn, are already hampered by a diminished blood volume flow, and a corresponding reduction in filtration pressures secondary to the existing shock. The total BUN is elevated and the volume of urine during the first 24-48 hours is diminished. If the effects of anoxia have not been prolonged and severe, the kidneys will recover their excretory functions and eventuate a forced diuresis. However, if the effects of shock have been severe, irreversible renal shut down may occur.

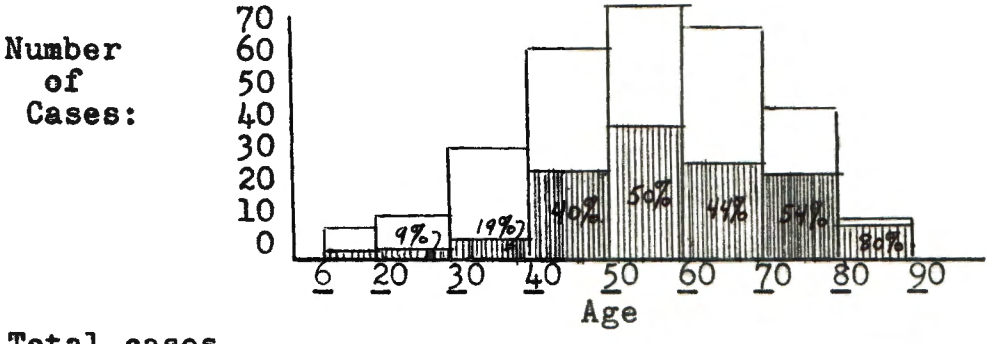
The ability of the patient to tolerate massive blood loss is by the effectiveness of his compensatory mechanisms to maintain an adequate circulating blood volume for the avoidance of anoxic anemia.

Shenkin, et al, (30), by massively bleeding 40 normal volunteers noted that the supine patient could tolerate, (without showing increased heart rate, pulse rate, decreased blood pressure, or the development of subjective symptoms of vertigo or syncope), the loss of an additional 1000 CC's of blood that the orthostatic patient could not tolerate. The author con-

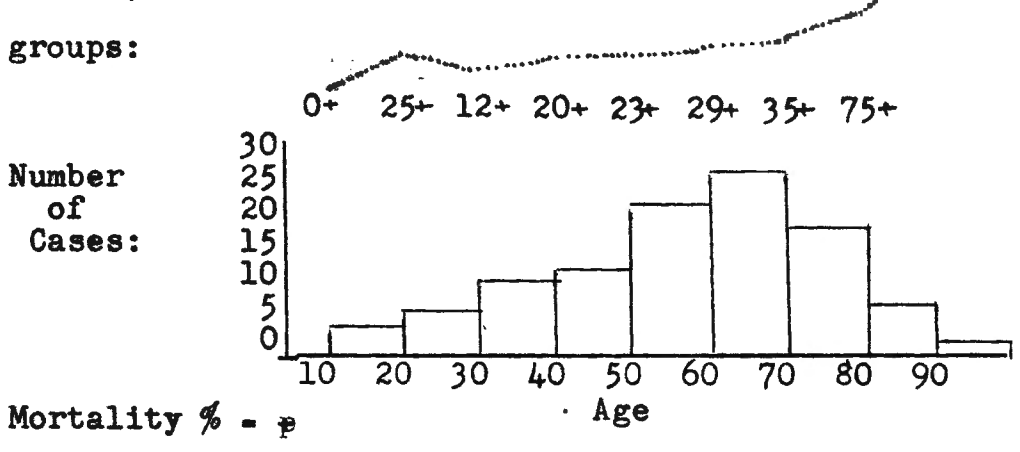
cluded that the standing patient had pooling of venous blood, adding increasing burdens to the already taxed compensatory vasoconstricting mechanisms of the peripheral circulatory system. Thus, arose the concept of the tilt test as a means of evaluating a patient who has bled massively. The patient is seen in bed, and appears to be comfortable as well as having stable vital signs. Yet, this is the picture of pre-eminent shock. When such a patient is elevated to the sitting position his compensatory mechanisms give away and there is a drop in blood pressure, rise in the pulse and heart rate, and the patient subjectively complains of vertigo and may develop syncope. R.L. Welchsler, and others, (10), clinically employed this test in determining impending shock, and to determine if the alleged blood loss which had occurred was massive or not. In their 35 cases reported, they were impressed by the fact that no false positive tests occurred. Where massive blood loss had occurred it was usually positive, although they found 4 of the 35 patients with massive blood loss failed to show positive findings. They advocate its use to crudely evaluate blood loss and the patients progress to blood replacement therapy.

Age: Age plays an important role on mortality rates as is observed in larger series of massive upper gastrointestinal hemorrhage reported.

Atik, and Simeon, (4e), reported on 296 cases from the Cleveland City Hospital. They found the following mortality rates in their overall hospital results, (showing rise in mortality in the 40 and above age groups):



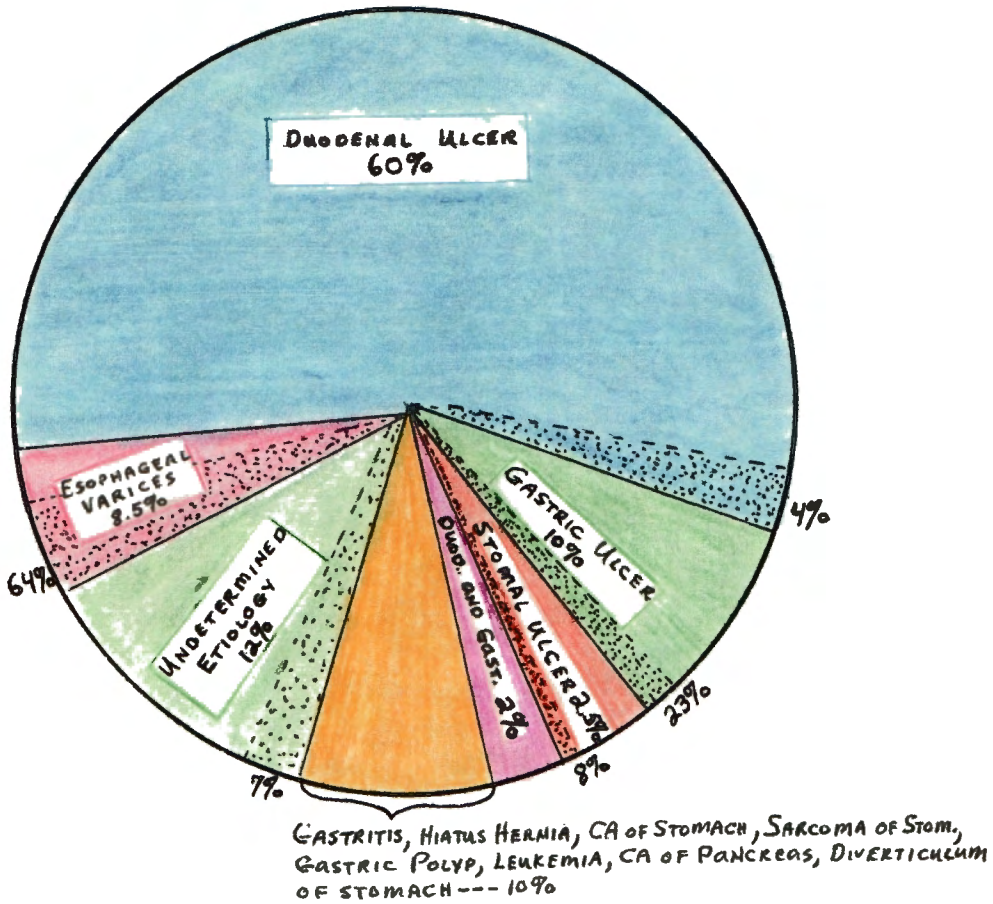
Osborne and Dunphy, (31), also noted the peak decades in terms of mortality were in the 60 to 70 age groups, and the low being in the 40 and below age groups:



Similarly, the following authors found the highest mortality rates to fall in the age groups 50 to 90:

Author	Cases	Age Groups (% Mortality) 10-40	40-50	50-60	60-90
Blackford,(32)	116	4%	8%	8%	16%
Gunz, et al (4h)	274	0%	2.7%	3.8%	12%
Stewart, (4f)	110	0%	4%	10%	20%
Berkowitz, (4g)	500	8%	4%	5.6%	32%
Cosgriff, (33)	128	3%		18%	
Zimmerman, (34)	200	10%	18%	18%	24%
Smythe, (4i)	109	10%	8%	20%	30%

Site of Hemorrhage: This seems to be an important factor in determining mortality. For example, patients bleeding from esophageal varices are reported by Berkowitz, (4g), to carry a combined medical-surgical mortality of 64%, and a 71% mortality as reported by Costello, (4c). In considering the group hemorrhaging from peptic ulcers it becomes obvious that gastric ulcers carry a higher mortality rate than either duodenal or marginal ulcer bleeders. Zimmerman, (34), reported in his series that gastric ulcer bleeders carried twice as high a mortality as duodenal ulcers. Berkowitz, (4g), in 500 cases of massive upper gastrointestinal hemorrhage found that 10% were made up of gastric ulcer bleeders with a mortality rate of 23% in contrast to 4% for duodenal ulcers and 8% for stomal ulcers:



Note: Shaded coloring indicates mortality %.

Saltzstein, Mahlin, Scheinberg, (35), reported on 402 such cases, and found that deaths from hemorrhaging gastric ulcers were three times greater than deaths from duodenal hemorrhaging ulcers. Costello, (4c), reported a 48% mortality for bleeding gastric ulcers, and a 10% mortality for duodenal bleeding ulcers.

Thus, the site of hemorrhage does influence the overall mortality figures. When gastric ulcers pen-

etrate a vessel, it is a larger vessel of the gastric artery, or the gastroduodenal artery, which is in contrast to the smaller vessels penetrated by duodenal ulcers. This is the reason most authors feel gastric ulcers carry a higher mortality then the rest of the peptic ulcer group, and result in a larger loss of blood over a same period of time, (4g).

Duration of Hemorrhage: It has long been observed that, patients not responding to conservative management, surgical intervention is optimally contemplated during the first 48 hours. Surgery beyond this time period is associated with a rapid rise in mortality rate. Elliott, et al, (35), pointed out in 206 patients, excluding patients with esophageal varices and blood dyscrasias, that those who did respond to blood replacement therapy did so in the following manner: 71% responded in the first 24 hours; and 91% of those responding did so within the first 48 hours. It then becomes obvious that little if anything is gained by continuing only medical management, beyond this period of time, in such a patient.

Recurrent Hemorrhage: Massive hemorrhage in older patients carries a 30% mortality according to Blackford and Williams, (32). They also state that the first and second bouts of massive hemorrhage are the most dangerous in that 75% of the deaths occurring in their series were due to the first bout of hemorrhage. What then is the outlook of the patient surviving his first bout of massive upper gastrointestinal hemorrhage? The following graph shows mortality figures to recurrent bouts of hemorrhage as noted by the various authors. In each case the figures represent those obtained from patients over the age of 45.

Authors	% Mortality with Recurrent Bouts of Upper Gastrointestinal Hemorrhage
Babey and Hurst, (36)	27%
Holman, (37)	46%
Baker, (36)	31%
Nevin, (38)	53%
Wilkinson, (39)	74%

Allen, (4a), reported a 60% mortality with the first bout of hemorrhage, and found that 60% of the survivors had a recurrent bout of hemorrhage. The literature reflects the highest mortality rates with the first and second bouts of hemorrhage particularly

in the patient over the age of 45. Thus, the fact that subsequent hemorrhage carries a significantly high mortality, cann not be challenged.

Hematemesis vs. Melena Alone: Meulengracht, (40), was the first to call attention to the greater mortality rates associated with hematemesis in contrast to that with melena alone. Saltzstein, (41), reporting on 402 cases of massive upper gastrointestinal hemorrhage found that 343 were from ulcers; and of this group, 50% had hematemesis, and 50% had melena. Of those patients with hematemesis, 78% died from hemorrhage, in contrast to 22% of those having only melena. Berkowitz, (4g), found that those patients with hematemesis had a mortality of 8.7%, in contrast to a mortality of 4.7% in those patients with only melena. Welch, (42), reported a mortality of 20% in patients with hematemesis, in contrast to 4% for melena alone. Schiff, and Shapiro, (43), could not verify this in their series; however, the general consensus in the literature is that there is a higher mortality rate with hematemesis than with melena alone.

Concomitant Diseases: Concurrent cerebral, cardiac, pulmonary, renal, and hepatic disorders, along with any other systemic diseases, all tend to raise the overall mortality in proportion to the amount of compromise effected on the total body reserves. The presence of any of these would favor earlier consideration of surgical intervention.

General Concepts of Management of Upper Gastrointestinal Hemorrhage

Management of Upper Gastrointestinal Hemorrhage of Peptic Ulcer Etiology

The frequently debated question of whether conservative medical management or surgical management offers the best method of care for the massive upper gastrointestinal hemorrhaging patient is perplexing. Series of surgical and medical management regimens are not statistically comparable; however, when one is discussing the merits of one over the other, several important considerations must be taken into account: a). Which method is most likely to arrest the massive upper gastrointestinal hemorrhage, and; b). which method will prevent recurrences of massive upper gastrointestinal hemorrhage.

Although there are no clear cut answers, certain

factors play an important role in influencing the selection of the method which will yield the greatest benefit for a specific patient. Yet, there are proponents of each method claiming distinct advantages of one over the other. It is impairative to evaluate the merits of each and to incorporate these into a common therapeutic approach which will yield the most gratifying results in terms of arresting the massive upper gastrointestinal hemorrhage, preventing recurrence, and maintaining the lowest possible mortality rate.

The groundwork for supporting the medical approach arises from the fact that conservative management alone is adequate for the majority of patients with massive upper gastrointestinal hemorrhage, excluding esophageal varices and blood dyscrasias. The question thus arises; why subject each patient to surgery? However, one must also consider prevention of recurrence, as well as whether or not the recurrence is significant enough to be taken into serious account on selecting the management program.

As was noted above in the section on factors affecting mortality rates; recurrence of hemorrhage is common, also, the mortality rate associated with re-

currence is significant. That the recurrence from gastric ulcer carries a higher mortality rate than does the recurrent hemorrhage of duodenal ulcer etiology is illustrated further by Ivy, et al, (44), claiming that in 1080 patients with bleeding gastric ulcers the mortality rate for recurrent hemorrhage was 16.7%. In 2150 bleeding duodenal ulcer patients, the recurrent hemorrhage mortality rate was 8.8%.

The surgical advocates admit that conservative management alone is adequate in the majority of patients, however, they raise question to the overall mortality through medical management because of the increased mortality rate the patient is subjected to with recurrent hemorrhage, especially in the older age groups. Why subject the patient to a period of trial and error, watchful,waiting procedures of medical management to see if he will respond? It is known that if he should not be the responding candidate, this prelude of fruitless conservative management places this patient in a higher mortality bracket by delaying the arrest of the massive hemorrhage. The internist will argue in return that, such a great percentage of patients will respond to

medical management, why subject all patients to the associated mortality of the surgical procedure? The associated surgical management mortality rate in itself is inheritantly greater than the mortality rate obtained should this be the type of patient who will respond to medical management alone. Having presented some of the debatable concepts, a review of some of the clinical experience in terms of eventual mortality rates of each method of management is in order. One must bear in mind that each series is not statistically comparable in that some degree of selectivity for selecting the surgical candidate is made and varies with each series.

Stewart and Rudman, (7a), discussed the definitive treatment of hemorrhaging peptic ulcers at the meeting of the American Surgical Association in 1950. Their choice of management was one of immediate transfusion followed by surgery as soon as the vital signs were stabilized. At the same meeting, (April 20, 1950), Bowers and Rossett, (7a), reported favorable and excellent results from conservative management. They favored this over the surgical approach. Stewart, Cosgriff, and Gray in 1956, (33), found in their series that immediate blood replacement followed by

early gastric resection would yield the best results and lowest mortality rates. Stewart is probably the only one who has attempted to compare the two methods of management. His earlier work took 52 patients bleeding massively and in shock. He divided them into two groups; the first treated conservatively, and the other subjected to surgery after adequate blood transfusion. Although the series was small he found that the surgical mortality was in the neighborhood of 19%; whereas, the medical mortality was around 25%.

Karlson, Enquist, Dennis, and Fierst in 1958, (45), approached the problem by separating their series into: 1). non-operative regimen, (58 patients, 8 deaths); 2). immediately operated group, (37 patients, 5 deaths); and 3). selectively operated, (35 patients, 5 deaths). They found the resulting mortality rate was exactly the same for each group, being 14%.

Gunz, Burry, and Hough, (4h), excluded esophageal varices, and blood dyscrasias from their series of 274 cases. During the first 48 hour period the patient was treated conservatively as advocated by Zollinger, et al, (9). The patient who failed to

respond to medical management was then subjected to surgery. The mortality rate for the surgical group was 19.4%, (29 patients having failed on medical management and receiving surgery). His combined mortality was 7.7%.

Blackford and Williams in 1940, (32), presented their conclusions that blood replacement with prompt surgical intervention was the procedure of choice in the patient over 45 years of age with a critical bleeding ulcer. This agrees with reports by Allen and Benedict; Stewart; Hinton; Finister; Gordon and Taylor; and Pfeiffer. The mortality rate in the 45 and over age groups from massive upper gastrointestinal hemorrhage of peptic ulcer etiology at the time these authors reported was in the range of 30%. Rivers, B.H., (32), from Mayo Clinic in discussing Blackford and Williamson's views agreed that a massive hemorrhage in the 45 and over age group was more likely to be fatal, but expressed the belief that absolute surgical intervention was not indicated because, the concept at that time was that 70% survival rates existed in the patients treated only medically.

Saltzstein, Mahlin, and Scheinberg, (41), in

reporting on 402 massive upper gastrointestinal hemorrhaging patients,treated 80%, (343 patients), of the bleeding peptic ulcer group conservatively, and found a mortality rate of 5.1%. The remaining 20% were treated surgically and they had a mortality of 5.9%.

Atik, (4e), reported on 138 cases of hemorrhaging peptic ulcers in 1954. He found a 16,8% mortality rate with conservative medical treatment in 108 patients. This was in contrast to 30 surgically treated patients having a mortality rate of 26.6%. In an attempt to show mortality as a peculiarity of age in this same group of patients he divided his series into the following age groups, and excluded patients with esophageal varices, and blood dyscrasias:

Age	Method of Rx.		Mortality %	
	Med.	Surg.	Med.	Surg.
Beyond age 50	109	30	42%	17%
Below age 50	78	11	14%	36%

Stewart, Cosgriff, and Gray, (33), operated on 193 patients for massive upper gastrointestinal hemorrhage during the years 1947-55. They found that the average age for their patients was 57.2, and 18%

were over 70 years of age. In this group, 128 patients were over 50 years of age and the corresponding mortality rate in this age group was 18%. This was in contrast to the 3% mortality rate for the rest of the group below the age of 50.

Hoffman, and Cohen, (45), in reporting of 52 cases, (31 due to duodenal ulcer, and 21 due to gastric ulcer), found the following:

Treated Medically:

Over age 50	Total	Deaths	Mortality %
Duod ulcer	18	2	11.1%
Gastric ulcer	6	3	50.0%
Total	24	5	20.0%

Treated Surgically:

Over age 50	Total	Deaths	Mortality %
Duod ulcer	13	3	23.0%
Gastric ulcer	15	2	13.3%
Total	28	5	17.9%

Elliot, Hartle, Marshall, and Zollinger, (35), in a series of 529 cases with gastrointestinal bleeding, found 278 cases with massive upper gastrointestinal hemorrhage from causes other than esophageal varices or blood dyscrasias. They subjected 80 of these patients to surgery. These same patients had failed to respond to transfusion management in a 48

hour period, or showed evidence of recurrence of bleeding after being stabilized following a 24 hour period of conservative management. The results were as follows:

Emergency surgery vs. Elective surgery	Cases	Deaths	Mortality %
Emergency surgery for uncontrolled hemorrhage	60	9	15.0%
Emergency surgery for recurring hemorrhage	20	4	20.0%
Total emergency surgery	80	13	16.3%
Elective surgery after bleeding was controlled	31	1	3.0%

The mortality in those patients treated by conservative medical management was 7.5%. Their combined medical surgical mortality was 10.7%.

Gunz, Burry, and Hough, (4h), had the following results in 279 cases of massive upper gastrointestinal hemorrhage, excluding esophageal varices and blood dyscrasias:

	Survivals	Deaths	Mortality %	Total Cases
Med Rx	245	16	6.1%	261
Surg Rx	29	7	19.4%	36
Total	274	23	8.4%	297

What can be said then, once having reviewed the experiences of those reporting on the two management programs. It is obvious that there is an inherant mortality rate for each medical and surgical approach. Also, that careful selection of the best approach must take into consideration all factors previously mentioned influencing the overall mortality rates. Age, the intensity and rate of blood loss, and the site of hemorrhage are some of the most critical factors to be considered. One must remember that, once the patients with esophageal varices and blood dyscrasias are excluded, a large proportion of patients will respond to adequate blood replacement and conservative management. Also, those patients responding to conservative management and adequate blood replacement will do so approximately in the following manner, (Zollinger et al, (35)): 71% will respond in 24 hours and 91% will respond in 48 hours. Thus, the optimum period for the trial of conservative management, particularly in the age group over 45, is 48 hours. The physician must then recognize the patient who is not going to respond, and subject him to surgery. This, of course, is not a hard

and fast rule, but especially of value if the bleeding lesion is a gastric ulcer, and the patient has associated concurrent diseases. These would force the surgeons hand in recommending surgical intervention over continued conservative management.

As is shown above, the surgical percentage mortality figures are higher than medical mortality rates. One must remember, however, that some selectivity was exercised in selecting the surgical patient, and that by and large the patient appeared not to be responding to adequate conservative management. If surgery had not been invited the mortality rate in this group can be assumed to have been higher than the eventual medical mortality rates given by each author.

Although the first and second bouts of hemorrhage, particularly in the older patient (45 and over), is the most dangerous mortality wise, subsequent bouts of recurrent hemorrhage also carry a significant mortality rate. One can then say, the best management procedure is that which is tailored to meet the specific needs of each patient. This is best accomplished by a combined medical surgical

management regimen taking all the mortality factors into consideration, and selecting the most efficacious therapeutic approach for the individual patient.

By such a method, the lowest mortality rates will be accomplished. Dunphy, (4k), reports a combined medical surgical mortality rate of 5.6%. Berkowitz, (4g), had a combined medical surgical mortality rate of 6.6%. Karlson, et al, (45), reported a combined medical surgical mortality rate of 14%. Gunz, et al, (4h), had a combined mortality rate of 7.7%. Other authors report the following mortality rates for combined medical surgical treatment:

Years	Authors	Cases	Deaths	Mortality %	No. of Surg. Cases
1948	Dunphy and Hoerr	45	1	2.2%	4
1949	Warthin	56	2	3.5%	9
1950	Bowers	150	2	1.3%	2
1950	Peter, Bent & Brigham	127	2	1.5%	15
1951	Saltzstein	343	18	5.0%	68
1953	Mayo Clinic	99	5	5.0%	23
1954	Alsobrook	87	4	4.0%	12
Average % Mortality----------				3.21%	

The currently acceptable combined medical surgical management mortality rate is 5%, (4h).

Some mention must be made of two very current types of advocated methods of management. The first,

Wangensteens' hypothermia perfusion method, (56), in gastric lesions which primarily reduces the secretory activity of the gastric mucosa. This may be used in tiding the patient over the crisis until he can be prepared for an elective procedure. The second, is in duodenal ulcer hemorrhage by employing Weinbergs' concepts of pyloroplasty and vagotomy after suture ligation of the bleeding vessel at the base of the duodenal ulcer crater, (56). The reduction in acid secretion produced by vagotomy is inadequate to produce healing of gastric ulcers, and indeed, gastric ulcers may occur after treatment of duodenal ulcer, and simple vagotomy. Thus, the vagotomy is combined with pyloroplasty or gastroenterostomy. Where these newer concepts will fit into the overall picture of management of massive upper gastrointestinal hemorrhage must await further trial of each in sizeable series of patients. Until this is done, full appreciation of the benefits and limitations of each will not be realized.

Above, there has been noted the individual problems of medical, surgical, and combined medical surgical treatment of massive upper gastrointestinal

hemorrhage; and, an attempt has been made through comparison of corresponding mortality rates to point out the efficacy of each. One may summarize from the literature the following criteria for selecting the patient for surgery:

1). Patients over the age of 50.
2). Etiology is primarily of bleeding peptic ulcer group.
3). Failure to respond to transfusions and medical management after 48 hours, or that patient who stabilized within the first 24 hours but has had recurrent hemorrhage.
4). Recurrent bout of hemorrhage.
5). Associated diseases such as diabetes, cardiac, renal, or liver disease.

Current Concepts Regarding the Diagnosis and Management of Upper Gastrointestinal Hemorrhage from Esophageal Varices.

The incidence of bleeding esophageal varices as a part of this total group of massive upper gastrointestinal bleeders varies somewhat with the type of hospital reporting their experiences. Generally, it is higher in a city, county, or university hospital. This does not imply that it is more peculiar to the indigent patient, but merely that the private patient is more likely to be discovered by his family physician to have a liver disorder and placed under medical management for the prevention of the develop-

ment of this complication

Incidence of Esophageal Varices

Author	Cases of Esoph. Varices	% of Entire Group	Total Cases of Massive Upper GI Hemorrhage
Stewart	3	2.4%	123
Gott and Smith	1	0.5%	195
Welch	62	17.0%	364
Costello	24	8.0%	300
Warthin and Warren	8	9.3%	86
Cleveland City Hospital	68	23.0%	296
Berkowitz	42	8.4%	500
Gunz, Burry, and Hough	2	0.7%	286
Smythe, Osborne and Zamcheck	12	10.8%	111
Atik and Simeone	68	22.9%	298
Zimmerman	29	14.5%	200
Totals	319	10.0%	2059

Generally, it can be said, with due consideration to the type of institution reporting, that the overall incidence is about 10.0%, (Table above).

It is estimated that roughly 50%, (Welch, (4b)), of those bleeding massively from esophageal varices the first time will not survive.

Atik and Simeone, (4e), approached mortality from the standpoint of age:

	Med Rx	Surg Rx	% Mortality Med	Surg
Beyond age 50	46	6	91%	33%
Below age 50	13	3	54%	33%

In their total group of 69 patients treated both medically and surgically, 52 died for an overall total mortality of 77%.

Smythe, et al, (4i), reported a 53% mortality; whereas, Berkowitz, (4g), found a 64% mortality rate to esophageal variceal bleeders.

Rousselot, et al, (47), found in their series that 50-to-80% of patients surviving the first episode of hemorrhage from varices will not live over 1-2 years, and that one-half of these mortalities will occur during subsequent hemorrhages.

Screening Tests: In regards to screen testing, the history and clinical findings are indeed helpful, but occassionally a patient with bleeding varices fails to manifest clinical evidence of cirrhosis. It is helpful to rely upon certain screening tests.

The BSP retention can be employed as a screening test. It is known that the BSP retention is elevated in all cases of massive blood loss regardless of etiology, however, the degree of retention is much greater in cirrhotic patients than in other forms of massive bleeders. Knight, et al, (4j),

demonstrated the value of this procedure as a screening method:

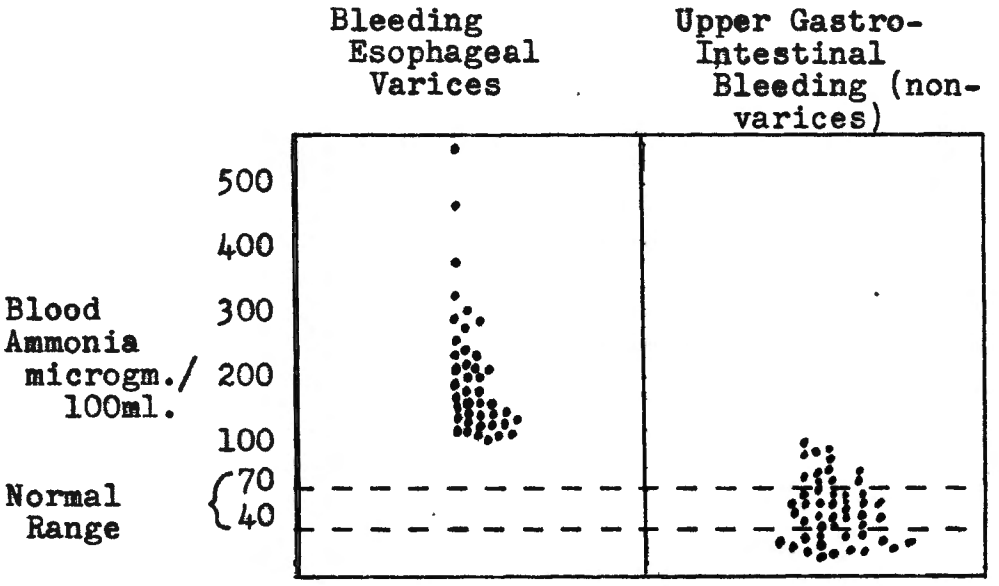
Diagnosis	% BSP Retention in 30 Minutes					Total
	0-10%	10-20%	20-30%	30-40%	40-50%	
Duodenal ulcer	20	4	1	0	0	25
Esophageal varices	0	1	5	11	9	26
Gastric ulcer	4	2	2	0	0	8
Gastritis	0	0	1	0	0	1
Cirrhosis & marginal ulcer	0	0	1	0	0	1
Cirrhosis & duodenal ulcer	0	0	1	0	0	1

He was thus able to note the highest values in patients with esophageal varices and cirrhosis.

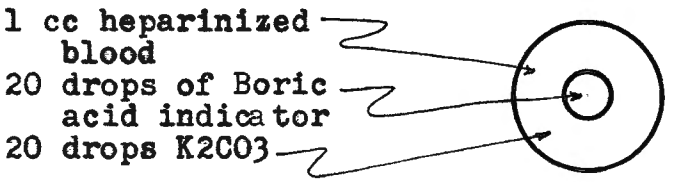
Zamcheck, et al, (48), studied 61 patients with gross upper gastrointestinal hemorrhage at time of admission with BSP retention. They found a slight increase, less than 20%, in all bleeding patients, excluding cirrhotic patients with varices. In 9 proven cirrhotic patients with upper gastrointestinal hemorrhage the BSP retention elevation was in the range of 17-to-60%. Of 37 patients without cirrhosis and bleeding massively from the upper gastrointestinal tract, they found a dye retention in the range of 0-17%. They concluded, the eleva-

tion is significantly higher in cirrhotic patients to warrant its use as a screening method.

Blood ammonia may also be useful as a screening test. McDermott in 1957, (49), enthusiastically reported on the use of blood ammonia determinations as a screening test for ruling out esophageal varices in cirrhotic patients. He found consistantly elevated blood ammonia values in those patients bleeding from varices and stated that this elevation is due in main to the existence of extensive portal systemic collateral circulation; not an index of variations in liver function as much as a reflection of the presence of esophageal varices. He compared this to the BSP test and found it consistantly more accurate as a screening procedure. This is illustrated with the following graphic illustration of McDermott's results: He also discusses a relatively easy method for determining blood ammonia quickly on the ward on a qualitively and crudely quantitative basis. A Conway diffusion dish is used for this easy method, and is shown beneath the following graph.



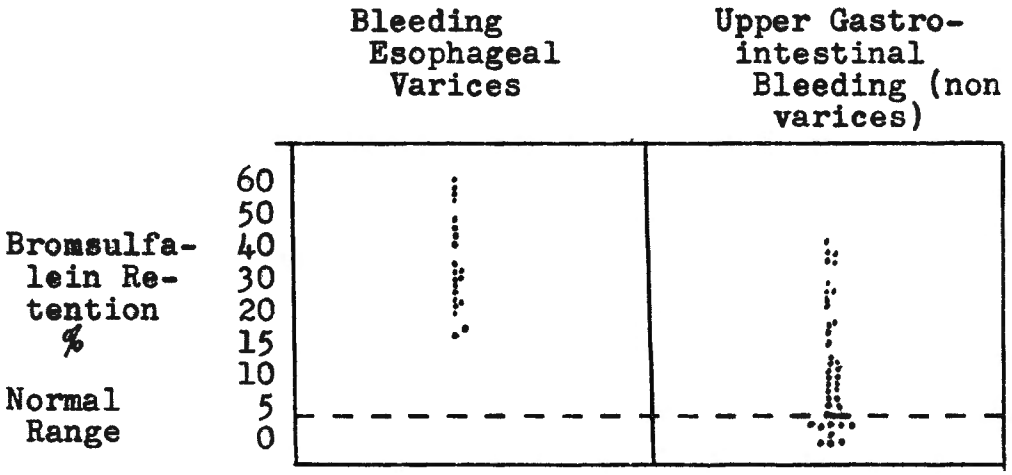
Conway Diffusion Dish



Twenty drops of a Boric acid indicator mixture is placed in the center reservoir and 20 drops of K_2CO_3 supersaturated solution is placed in the outer reservoir. This is covered by a glass slide with mineral oil to seal it off from the air. Then 1cc. of heparinized blood, (blood drawn up into a syringe containing heparin) is added to the outer reservoir of the dish and quickly sealed over by the glass slide. With gentle rotary motion mixing of the

blood and K_2CO_3 occurs. Then NH_3 is released which diffuses into the center reservoir and causes the indicator to change to pinkish or grayish blue color within 3 minutes time. If this occurs one can assume that the blood ammonia level is in the range of 120-125 micrograms/100ml.. The normal blood ammonia being 40-60 micrograms/100ml..

McDermott compared the above blood ammonia graph to the following findings using BSP retention determinations:

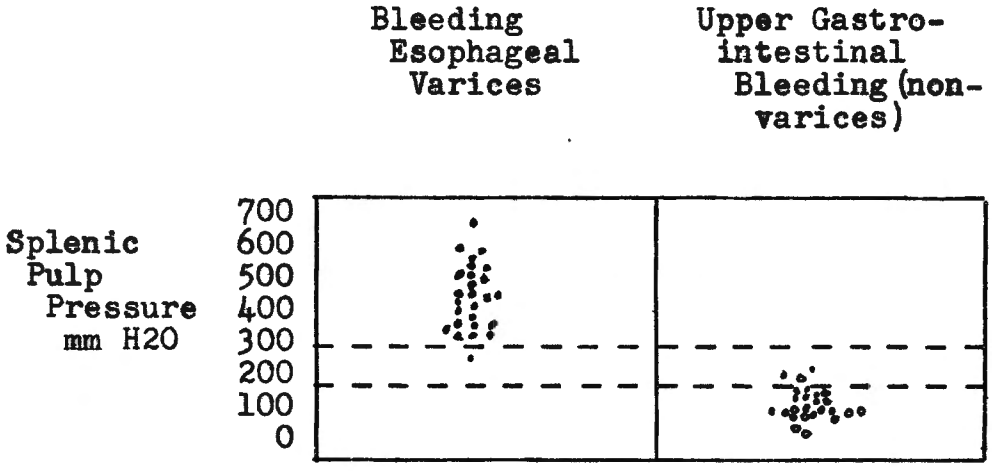


The graph shows that many of the cases of upper gastrointestinal bleeding not from esophageal varices also had an elevated BSP retention. Thus, he was able to show that the blood ammonia determination was consistantly more accurate as a screening proce-

dure.

Splenoportography and splenic pulp manometric studies can yield valuable diagnostic information. The procedure was first done in this country by Rousselot, (50), in 1952: Although its clinical use was reported in the European literature prior to 1952. Rousselot, (7a), found that splenic pulp manometric studies obtained at time of splenoportography are more accurate than the BSP retention or blood ammonia screening methods. In 112 patients splenic pulp pressure readings were obtained: 33 of these during the actual bout of hemorrhage, and 80 after the cessation of hemorrhage. Of those who were bleeding from varices, 94% had a pressure reading over 290 mm H20, and 53% had a reading in the range of 400-650 mm H20. While the average for those bleeding from other sites,as was later established by other diagnostic procedures, had a reading in the range of 100 to 250 mm H20. The average manometric reading for those bleeding from varices was 413 mm H20. The diagnosis was further established by portography, which revealed the portal collateral circulation secondary to portal hypertension. Splenic

pulp manometry readings in this series resulted in accurately determining varices as the etiology of bleeding in 90% of the cases:

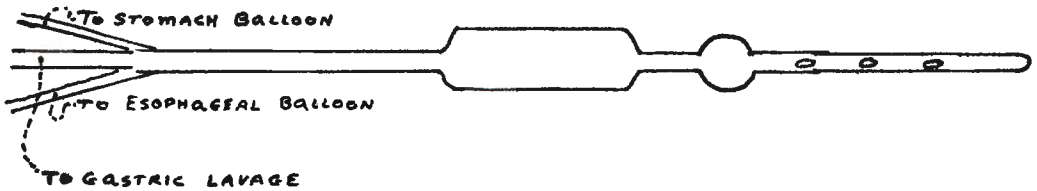


Patients with cirrhosis of liver --•
Patients with normal liver --o

Panke, Rousselot, et al, (50), in describing the technique and pre-operative preparations, sited the following as contraindications for the splenic portograph procedure: 1). Marked alteration of the blood clotting mechanism: 2). History of allergy to the radiopaque medium: 3). Inability of the patient to cooperate if in coma or pre-coma, (tearing of spleen from violent respiratory excursions): 4). Known tumors of the spleen.

Additional laboratory procedures are those included in liver profile studies and barium swallow X-ray studies which will not be elaborated upon here.

Emergency Surgical Approach: Since roughly 50% of those patients bleeding massively from esophageal varices will succumb to the bleeding, various surgical therapeutic attempts have been made to modify this undesireable poor prognosis. The multiplicity of procedures reported upon indicate the futility that the surgeons efforts meet in attempting to salvage patients in the high mortality group. Devascularization of esophagus and stomach has been done, but the long term results are poor. Frequently hemorrhage recurrs in spite of this. Splenectomy, in an attempt to reduce the portal vein venous pressure has likewise produced discouragingly poor results. The Sengstaken-Blakemore tube has already been discussed. The prin-



ciple of this tube is to cause a tamponage effect by blowing up the balloon when in position within the esophagus, and thereby stopping the hemorrhaging by

pressure against the bleeding points. Many feel little value is done by this tube and frequently much harm can be done. Many resume bleeding after the balloon is deflated, and 10% continue to bleed inspite of the tube. Transthoracic ligation of the esophageal varices as practiced by Linton does have some value in tiding the patient over the crisis until he can be prepared for an elective shunt procedure. Linton claims that doing this procedure early he obtained an 80% survival rate, (51). Welch, (4b), reported a 60% recovery rate with ligation of the varices through a transthoracic approach. The volume of blood entering the portal system can be reduced by hepatic artery ligation; however, as was noted by Zimmerman and Levine, (34), the results are unpredictable and measurements have not shown that the portal venous pressure is reduced by this procedure. Esophagogastrectomy,on the other hand, is found to carry a high mortality rate in patients under these conditions. Treatment of portal hypertension by decompression of the portal bed through creation of new collaterals such as with portocaval shunt surgery has been reported by many authors. There does

seem to be some merit to shunt procedures when a poor prognosis without some surgical attempt at arresting the hemorrhage is present. Sullivan and Payne, (52), in 1956 reported on 9 such patients operated upon for bleeding varices after the bleeding was controlled by the Sengstaken tube. Three patients died postoperatively for a 33% mortality rate, and 6 survived to be discharged from the hospital. Three of these died later with recurrent bleeding and three were still alive at the time of their report. Mikkelson, and Pattison in 1958, (53), reported on 11 patients undergoing emergency portocaval shunt surgery. Four of their patients died early in the postoperative period for a 36.6% mortality; whereas, 7 patients survived the surgery. Two of the 7 died after discharge from the hospital. Rousselot, et al, (47), reported on their series of 58 patients which underwent portocaval shunt surgery for bleeding varices. Eleven of these underwent the procedure as an emergency: 7 of these survived for a 36% mortality rate. Before such a procedure can be universally accepted, and its true value determined, certainly more patients will have to be subjected to this surgery and the natural his-

tory of secondary portal hypertension determined.

Criteria for Selecting the Esophageal Varicele Bleeder for Elective Shunt Surgery: McDermott, et al, (54), from Massechusetts General Hospital in Boston reviewed the criteria for selecting the surgical candidate for elective shunt procedures. They found that if the following criteria were followed; mortality rate of 17% would occur regardless of the type of shunt procedure employed.

Clinical Criteria
1. Reasonable good nutritional status.
2. Without ascites.
3. Without jaundice.

Laboratory Criteria
1. Serum albumin higher than 3 gms..
2. Bilirubin less than 2 mg/100cc..
3. BSP of less than 25%.
4. Prothrombin greater than 50% of normal.

Thus these anastomoses effectively reduce portal vein pressure, but they are indicated only in the absence of ascites or jaundice and if adequate hepatic reserve exists.

Comparison of Shunt Procedures: On reporting 237 elective portocaval shunt procedures during the periods of 1945-1958,

authors compared their results against 166 cases of splenorenal shunts performed during the same interval of time. In both groups, shunt surgery was dictated by a history of at least one major bout of massive upper gastrointestinal hemorrhage. Portocaval shunt procedures seemed to drop the portal pressures more than did splenorenal shunts. Survival rates in all shunt procedures, regardless of type, were 75% at 5 years, and 43% at 10 years. Aside from the pancytopenia, and ammonia intoxication reported in the portocaval shunt procedures, the latter is considered superior to splenorenal shunts in reducing the portal hypertension. The portocaval shunt is used if the portal vein is wide, after splenectomy or if the spleen is not very large. Splenorenal shunt is used on the other hand if the spleen is large or if the portal vein is narrow or thrombosed.

In children, King and Shumaker, (55), state that in their experiences, splenorenal shunts are poor especially in the groups under 11 years of age. This is because of the small size of the vessels and resultant inadequate anastomosis. Also, thrombosis frequently occurs due to the small orifice of

the anastomosis. Their experience with splenectomy and esophagogastrectomy is extremely poor. Since the etiology of varices is different in children, they advise a trans-esophageal ligation of the varices, and the shunt procedures be reserved for the patient when he becomes an adult, should recurrences of hemorrhage occur at that time.

Management of Other Causes of Massive Upper Gastrointestinal Hemorrhage

Because the less frequent causes of hematemesis and melena are volumineus, this paper will not dwell on specific treatment and therapeutic regimen of each. They will only be mentioned as a matter of completion, and the importance of keeping them in mind in the differential diagnosis noted. The commonest causes clinically, as previously mentioned above, are peptic ulcer, and esophageal varices associated with hepatic cirrhosis. Among the less frequent causes are hiatus hernia, gastric cancer, gastritis, blood dyscrasias, esophagitis, mesenteric thrombosis, G.I. neoplasms other than gastric cancer, and diverticuli of the alimentary tract. Other causes include benign tumors of the stomach, cancer of esophagus, mesenteric throm-

bosis, erosion of aorta due to periaortitis, and other rare miscellaneous conditions.

Etiology of hematemesis and melena in 640 cases admitted to Cincinnati General hospital over a 10 year period was as follows; peptic ulcer, (52.9%); undetermined etiology, (20.6%); hepatic cirrhosis with ruptured esophageal varices, (12.5%); gastric CA, (2.3%); hiatal hernia, (2.1%); gastritis and gastric erosions, (1.1%); ruptured aortic aneurysm, (0.8%); and miscellaneous causes, (7.5%); (65).

Current Concepts Regarding Management of Massive Upper gastrointestinal Hemorrhage of Undetermined Etiology

The literature reveals some disparity of opinion in the management of this category. This group of patients present a very perplexing problem in management. They represent anywhere from 10-14% of the entire group of massive upper gastrointestinal bleeders.

Wilkinson and Tracy, (39), reported this group comprising 11.6% of their entire group of massive upper gastrointestinal bleeders. Saltzstein, (41), reported that of 402 cases of such patients, 15% were of undetermined etiology. Stewart, et al,

(33), found that even at operation in 193 patients where the diagnostic procedures were carried even to laparotomy, no lesion could be found in 10.8%. Berkowitz, (4g), reported the incidence of this group as 11.6% with a mortality rate of 7%. The question then arises, what does one do for this patient after a complete diagnostic workup has failed to reveal the responsible lesion.

There appear to be three different schools of thought on management of this type of patient. The first, as exemplified by Cole, (7b), on the assumption that although a blind gastrectomy is done, a lesion above or below the area left behind will continue to bleed. In addition one subjects the patient to the inherit mortality of the surgical procedure. The second school originated with Wangensteen's findings in 1945, (57); eighteen patients underwent extensive workup without finding the etiology. These patients were then subjected to a laparotomy, and still no lesions were found. A subtotal gastrectomy was carried out and later on gross and microscopic examination of the specimens, revealed very small and inconspicuous superficial gastric mucosal erosions. Further accumulation of sim-

ilar cases with similar findings stimulated him to strongly advocate an emperic subtotal gastrectomy in all such patients of this category. Porter, et al, (57) in 1950, reported that superficial gastric mucosal erosions or shallow gastric ulcers which the surgeon could not identify grossly were the responsible lesions. They then advocated a 75% subtotal gastric resection. Others having similar experiences and advocating emperic subtotal gastrectomies are Crohn, (58); Ives, (59); Cooper, (60); and Theieme, (61). The question which must then arise: What percentage of this group who do receive a blind gastrectomy will obtain a permanent cure, and what percentage will have recurrences? Kirtley, et al, (62), were stimulated by this question and took 36 patients with hemorrhage of obscure origin and separated them as follows:

Group A: (received exploratory laparotomy)
(no lesion was found---12 patients)
(no blind gastrectomy was done)

Group B: (received laparotomy and blind gastrectomy done-- 21 patients)
(this group contained 7 patients from group A which had recurrent bouts of hemorrhage by not having had an emperic gastrectomy)

Gray, et al, (63), did a similar study on 48

cases with the following findings:

Group A: (received laparotomy)
(no gastrectomy on an emperic basis)
no lesion found-- 28 patients

Group B: (received laparotomy)
(gastrectomy done on emperic basis)
(no lesion found-- 20 patients)

Of the group A patients, 63% experienced further recurrent hemorrhages within 5 years of the laparotomy. In the B group only 11% experienced recurrent lapse of hemorrhage after the blind gastrectomy.

The third school of thought does not alienate themselves completely from the blind gastrectomy group, but attempts to minimize the number of emperic subtotal gastrectomies by conducting a thorough exploration of both upper and lower GI tracts. Then through a gastroduodenotomy explore the esophagogastric junction, stomach, and duodenum. If no lesion is found they then form a puncture wound just distal to the ligament of Treitz and with irrigation for removal of clot formation, and transillumination, examine this part of the duodenum below the pylorus. If still no lesion is found they close the gastroduodenotomy, and puncture wound of the jejunum, and proceed with the blind gastrectomy.

This approach is advocated by Osborne and Dunphy, (31), and Patton, (64).

Conclusion and Summary

Thus, a great step forward has been made from the chaotic era of high mortality rates and inadequate selectivity of both patient and therapeutic regimen. The present concept of management has done much to reduce previous high mortality rates to the lower currently acceptable levels; however, it behooves each physician and facility participating in the management of this patient to constantly review their results in an effort to maintain their mortality rates within currently acceptable levels as well as improving them whenever possible.

Such that the primary points may be further emphasized, they will be listed in summary numerically:

1). The term, massive upper gastrointestinal hemorrhage, should be employed only to apply to that patient bleeding from the upper gastrointestinal tract, and in which the blood loss is rapid and acute enough to produce hemorrhagic shock.

2). Prolonged severe hypotension from acute hemorrhage may cause irrepairable damage to vital organs, especially in the older patient.

3). Mortality risk of hemorrhage from ulcer etiology increases with age of patient and is greater in gastric ulcer than duodenal ulcer.

4). Other factors influencing mortality are degree of shock, site of bleeding, presence of hematemesis, and concurrent diseases.

5). Most patients respond to medical treatment, however, a sizable group will require surgery. The emphasis must be in recognizing this patient early in the conservative management regimen.

6). Surgical intervention when indicated carries the lowest risk during the first 48 hours of active bleeding.

7). Peptic ulcers make up the greatest proportion of the entire spectrum of upper gastrointestinal hemorrhage; in the order of frequency---duodenal, gastric and stomal ulcers respectively.

8). Bleeding esophageal varices constitutes another significant portion of the spectrum. Early diagnosis is manditory due to its peculiar mortality rate and different management regime.

9). The third group of importance, aside from the rare miscellaneous causes of massive upper gastrointestinal hemorrhage, is that of undetermined etiology. Its significance is in the approach to management which is indicated to arrest and prevent hemorrhage recurrence.

10). The objective of any management procedure is to arrest the hemorrhage and prevent recurrences.

11). The best approach is one, tailor-made to meet the specific needs of each patient. Currently this is best accomplished by a combined medical-surgical management approach.

THE END

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