# MANAGEMENT OF BLEEDING FROM ESOPHAGEAL VARICES

RICHARD C. BRITTON, M.D.
Department of General Surgery

THE goal of treatment of portal hypertension and bleeding esophageal varices is the control of hemorrhage and the prevention of its recurrence. Publications have dealt chiefly with the selection of cases, operative mortality, and technical matters of interest to those entrusted with definitive treatment, but have not elaborated upon two important points: (1) the practical measures that may be taken by the general practitioner who sees the patient first, and (2) the effectiveness of the various operative procedures in preventing recurrent bleeding.

This discussion is presented in the belief that it is the *initial* treatment of the cirrhotic patient with bleeding varices that largely determines whether or not he will survive a bleeding episode and recover to the extent that surgical measures may be safely undertaken to prevent recurrent hemorrhage. A program of management is outlined which may be carried out rapidly, is adaptable to the community hospital, and offers the patient a maximum opportunity for survival.

## The Problem in the Bleeding Cirrhotic Patient

The high mortality associated with gastrointestinal bleeding in cirrhotic patients is well known. Approximately one quarter to one half of any group of cirrhotic patients will bleed each year, and the mortality due to hemorrhage is from 25 to 75 per cent. Half of those who survive will bleed again within the year with a mortality of 50 per cent.[1,2] The reserve of the damaged liver is easily compromised by shock, anoxia, severe infection, or the presence of a large amount of blood in the intestinal tract. The essentials of emergency treatment are *rapid control of bleeding*, *protection against infection*, *purgation of the bowel*, *restriction of sodium*, and *intravenous administration of dextrose*.

Emergency major surgical operations are poorly tolerated by cirrhotic patients, as shown by an average emergency mortality of more than 50 per cent.[3,4] Balloon tamponade, on the other hand, will readily control bleeding in from 80 to 90 per cent of patients.[5] Bleeding not readily controlled by tamponade requires the least traumatic surgery necessary to control it, through an approach that will permit appropriate treatment of bleeding lesions other than the varices. Transthoracic suture and mediastinal packing are not suitable therefore, and gastric transection, esophagogastrectomy, or emergency shunt seldom are necessary.

Noncirrhotic patients with extrahepatic portal block and bleeding varices will tolerate emergency major surgery well, but tamponade and further evaluation of the patient are safer when little is known about the patient.

Children with unsuspected postnecrotic cirrhosis and bleeding varices may not survive surgery that is undertaken in the mistaken belief that because they are children they must have extrahepatic portal block. The diagnosis of post-

hepatitic cirrhosis in children is being made with increasing frequency. Reliance upon liver function studies or gross appearance of the liver may be misleading; biopsy of the liver is the only certain way of determining the presence or absence of cirrhosis.

## Emergency Control of Bleeding

Balloon tamponade, using the recently redesigned triple-lumen Sengstaken-Blakemore tube*, offers the safest, most rapid and effective means of controlling

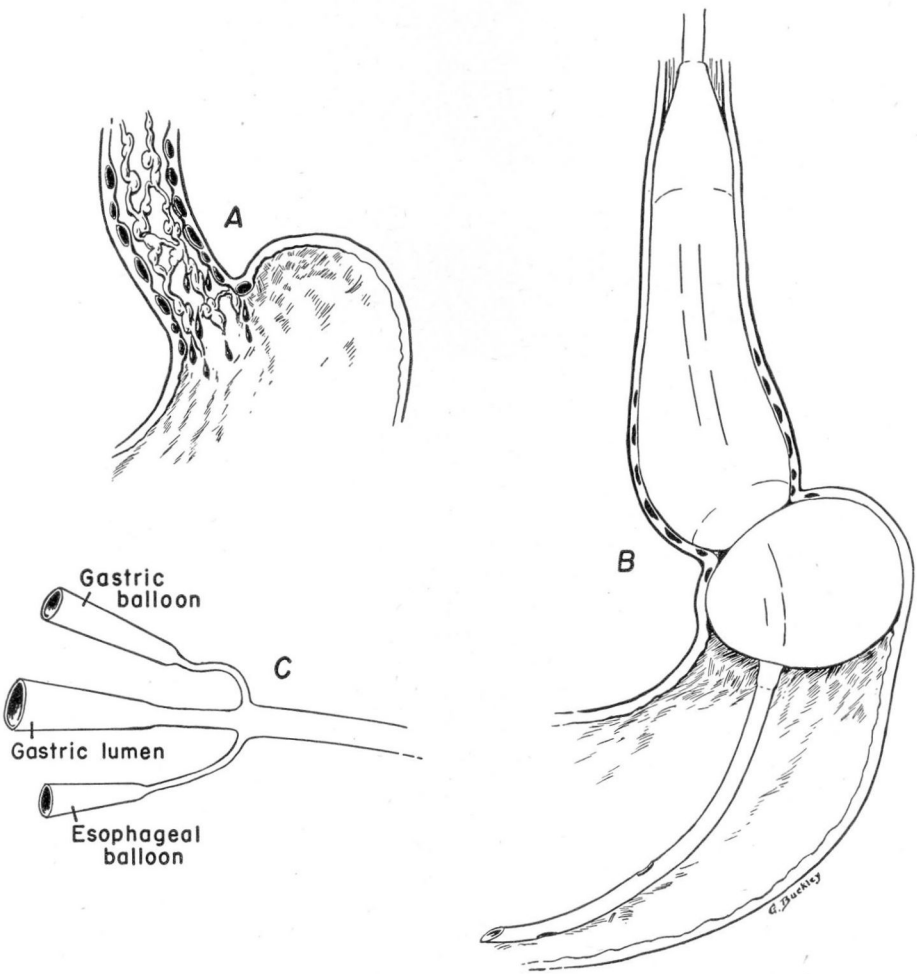


**Fig. 1.** Diagram demonstrates the principle of *lateral* tamponade of esophageal varices with the Sengstaken-Blakemore tube. *A*, bleeding esophageal varices; *B*, esophageal and gastric balloons and gastric tube in place; *C*, proximal aspect of tube.

**Manufactured by the Davol Rubber Company, Providence, Rhode Island.*

esophageal bleeding and of making the patient safely *transportable* (Fig. 1). The principle of its use is *lateral* tamponade of varices by means of a triple-lumen tube with a long esophageal balloon reinforced at top and bottom to prevent herniation into the pharynx or the stomach, and a distal gastric balloon that serves chiefly to prevent regurgitation of the tube, and secondarily to tamponade varices in the gastric fundus when light traction is applied to the tube (Fig. 2).

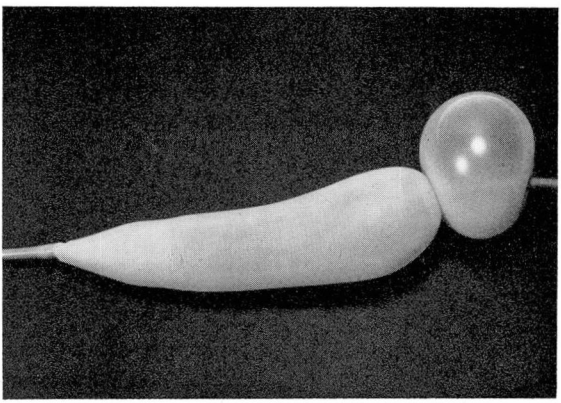

**Fig. 2.** Photograph of the inflated Sengstaken-Blakemore tube. Note the eccentricity of the gastric balloon for positioning it in the gastric fundus.

The eccentric doughnut shape apparent in Figure 1 is for the latter purpose. The central large lumen is for gastric aspiration and feeding. Unlike the single large gastric balloon advocated by some, which depends upon strong traction to occlude all venous collateral vessels at the esophagogastric junction, the Sengstaken-Blakemore tube may be left in place for weeks, if necessary, to prevent further bleeding while the patient is being prepared for a definitive operation. When a significant amount of traction is required to control bleeding, it must be released after 24 hours to prevent mucosal erosion and necrosis. If new bleeding occurs at this point, other measures discussed below are in order.

In practice it is useful to have readily available a tray bearing a balloon, an atomizer containing 5 per cent tetracaine (Pontocaine) hydrochloride or 10 per cent cocaine, a large-stemmed 50-cc. syringe, two rubber-shod clamps, a glass Y tube, and rubber tubing for attachment to any standard sphygmomanometer (Fig. 3). The patient should be kept under sedation with liberal doses of meperidine (Demerol) hydrochloride unless he is comatose. The nares and pharynx are sprayed with the topical anesthetic solution; the balloons are deflated; and the tube, lubricated with a water-soluble lubricant, is passed through the nose into the stomach while the patient sips water—the numbers on the tube being kept toward the patient's right side to insure that the eccentric portion of the gastric balloon will protrude toward the fundus of the stomach. The gastric balloon is then inflated with 150 cc. of air and the tube is withdrawn until the gastric

balloon engages at the esophagogastric junction. Then the tube is taped to the plastic sponge block in order to prevent pressure necrosis of the nasal ala. The esophageal balloon tube is attached to the Y tube, the other limb being attached to the sphygmomanometer. A rubber hand bulb is attached to the remaining end of the Y tube and the esophageal balloon is inflated to an initial pressure of 45 mm. of Hg, and the tubes of both esophageal and gastric balloons are clamped with the rubber-shod clamps to prevent air from leaking from the system (Fig. 3). The stomach tube is then thoroughly irrigated and aspirated with

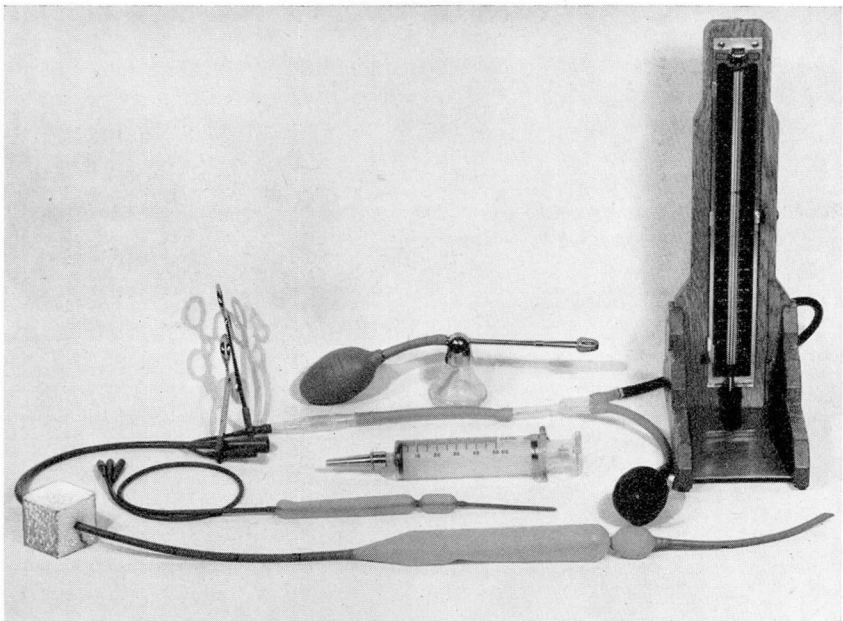

**Fig. 3.** Photograph of the standard equipment used in passing the Sengstaken-Blakemore tube. Note the small pediatric-sized tube.

copious amounts of tap water until the return is clear; then the gastric lumen is put on continuous intestinal suction. If the return is still clear one-half hour later, suction is discontinued and castor oil (60 cc.) and neomycin (1 gm.) are instilled into the tube for the purpose of purging the intestinal tract of blood which may be converted by the intestinal organisms into ammonium compounds which may produce coma. An hour later suction is resumed and continued except during instillation of purgative and neomycin every 6 hours (for a total of three doses), and during irrigation of the tube every hour. If an esophageal-balloon pressure of 45 mm. of Hg is poorly tolerated by the patient, the pressure may be reduced, preferably by 5-mm. stages, to the lowest pressure that will control bleeding.

Intravenous hydration and restoration of blood volume are then effected, with special care to administer as many calories as possible in the form of carbohydrates. Systemic antibiotic agents such as procaine penicillin (300,000 units)

and streptomycin (0.5 gm.) every 12 hours, or one of the tetracycline drugs (500 mg.) every eight hours, should be administered parenterally to supplement the effect of neomycin in the bowel and to control possible respiratory infection to which these patients are subject during intubation. Vitamin $K_1$ (50 mg. intravenously), ascorbic acid (1,000 mg.), vitamin $B_{12}$ (50 $\mu$g.), and multiple vitamins rich in vitamin-B complex should be given after blood has been withdrawn for base line studies of liver function.

Retching and substernal discomfort caused by the tube usually are alleviated by instructing the patient to hyperventilate for a minute, by elevating the head of the bed of the conscious patient, by keeping the stomach empty, and by adequate sedation with meperidine hydrochloride. Because the inflated esophageal balloon completely obstructs the esophagus, salivary secretions cannot be swallowed; therefore, the conscious patient is instructed to expectorate all secretions. Comatose patients require frequent pharyngeal suctioning. It is amazing how well the tube is tolerated after the first few hours. Periodic checking of the amount of tension on the tube is necessary in order to take up slack as the diaphragmatic crura of the esophageal hiatus relax. Esophageal-balloon pressure should be checked every half hour.

On the third day of tamponade the pressure in the esophageal balloon may be reduced to 25 mm. of Hg and, if no bleeding occurs, the balloon may be deflated and the tube may be removed on the fourth day. This time interval is based roughly upon the "lag" period for healing of most soft tissues. If a definitive operation to reduce portal hypertension is to be performed in another hospital, the balloon should be left in place while the patient is being transported. After an episode of bleeding, most cirrhotic patients require a minimal period of three weeks for complete recovery, and consideration of a major surgical procedure.

The appearance of stupor, bizarre behavior, a flapping tremor of the hands when the arms and fingers are extended, along with a marked fetor hepaticus usually herald coma. These changes may be due in part to ammonium intoxication, which is discussed below.

## Failure of Balloon Tamponade

If, within a half hour after passage of the tube, irrigation of the stomach still returns red blood, it is obvious that bleeding has not been controlled. From 10 to 20 per cent of cirrhotic patients bleed from gastric varices, peptic ulcers, or other lesions out of reach of balloons.[6] Such patients require immediate surgical intervention for control of hemorrhage. The most limited operation that will control bleeding is indicated if the patient has serious hepatic impairment. Endotracheal cyclopropane is the anesthetic agent of choice since it induces anesthesia in the patient rapidly, provides adequate relaxation, and permits the use of a high concentration of oxygen. Spinal analgesia may be dangerous if coagulation factors are abnormal, as they so frequently are in these patients. Transabdominal suture of gastric varices beyond the reach of the balloon, through a simple gastrotomy wound in the anterior wall of the stomach, can be

performed rapidly and with the least risk. All time-consuming and nonessential procedures must be avoided; these include measurement of portal pressure and suture of esophageal varices that can be reached by the balloon. Considerable judgment is required in deciding whether or not to proceed with gastric resection for treatment of a bleeding duodenal or gastric ulcer in a patient with obvious impairment of the liver. Gastric resection is usually mandatory for hemorrhagic gastritis, frequently is necessary for bleeding duodenal ulcer, but suture usually suffices for bleeding gastric ulcer.

## Ammonium Intoxication and Stupor

It is now apparent that an abnormally increased concentration of ammonium ions in the blood will produce symptoms progressing from stupor to bizarre behavior, coma, and death. The source of the ammonium in most of these patients appears to be from bacterial decomposition of blood within the intestinal tract. The source in the nonbleeding cirrhotic patient may be his dietary protein. The increase in peripheral blood ammonium is due to inability of the damaged liver to convert ammonium to urea at a normal rate, and to direct passage of portal blood into the peripheral circulation through naturally occurring portasystemic shunts in the esophageal and other collateral systems. The liver of the noncirrhotic patient with gastrointestinal bleeding is able to convert ammonium to urea rapidly, and no significant shunts exist. The noncirrhotic patient who has a large surgically created portasystemic shunt and who takes a high-protein diet may have high concentrations of ammonium in the peripheral blood because the liver is bypassed. Prolonged oral administration of neomycin has proved effective in protecting most patients from coma, thereby permitting ingestion of the all-important high-protein diet. The actual incidence of chronic ammonium poisoning in patients who have surgical shunts is not determined, but clinically is less than 5 per cent.

Two measures have proved effective in rapidly lowering the concentration of ammonium in the blood and, if coma is predominantly due to that condition, in dramatically reversing coma within hours. The first measure aims at reducing the numbers of intestinal organisms that produce the ammonium, and consists of the administration of from 1 to 2 gm. of neomycin by mouth or by nasogastric tube, every six hours, along with the use of purgatives to rid the bowel of blood. The second measure consists of the intravenous administration of 25 gm. of arginine hydrochloride with 50 gm. of dextrose in 500 ml. of water, or of one of the newer commercial preparations of the glutamic acid salt of arginine every six hours. Although no harmful effects of these preparations are known, other than acidosis from arginine hydrochloride and alkalosis and sodium overload from sodium glutamate, they are best reserved for the appearance of neurologic changes or the demonstration of elevated concentrations of ammonium in the blood.

One of the earliest signs of impending coma may be a flapping tremor of the hands when the arms and fingers are extended forcibly by the patient. This sign is an indication for starting arginine treatment and is of greater clinical significance than is fetor hepaticus.

## Prevention of Recurrent Bleeding

During the past fifty years numerous operations have been devised to treat portal hypertension and its complications. Omentopexy and portacaval shunts were designed to increase portal collateral flow. Splenectomy, ligation of the splenic and of the hepatic artery, devascularization of the stomach, and gastric transection were purported to reduce flow into the portal bed or into the varices. Transthoracic and transabdominal suture of varices and esophagogastric resection were aimed at attacking the varices directly.

To evaluate the results of the various operations in preventing recurrent bleeding, the literature was reviewed and all reports giving incidence of recurrent bleeding were compiled. These data are summarized in Tables 1 and 2.

**Table 1.** — *Treatment of intrahepatic block for portal hypertension (Data from a review of the literature)*

| Operation | Total number of patients | Operative mortality | | Cause of Death | | | | Recurrent hemorrhage | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Hemorrhage | | Hepatic failure | | | |
| | | Number of patients | Per cent of total | Number of patients | Per cent of total | Number of patients | Per cent of total | Number of patients | Per cent of total |
| Portacaval shunt | 556 | 76 | 13 | 5 | 1 | 23 | 5 | 20 | 4 |
| Splenectomy | 136 | 52 | 38 | 9 | 10 | 16 | 19 | 33 | 48 |
| Splenorenal shunt | 107 | 18 | 16 | 9 | 10 | 20 | 22 | 33 | 37 |
| Hepatic artery ligation | 40 | 7 | 18 | 0 | — | 8 | 24 | 9 | 23 |
| Suture | 28 | 8 | 28 | 0 | — | 11 | 39 | 9 | 32 |
| Esophagogastric resection | 11 | 4 | 36 | 1 | 14 | 1 | 14 | 1 | 14 |
| Splenic artery ligation | 8 | 0 | — | 1 | 12 | 0 | — | 1 | 12 |
| Devascularization | 7 | 3 | 43 | 0 | — | 0 | — | 1 | 25 |
| Mediastinal packing | 6 | 0 | — | 2 | 33 | 0 | — | 3 | 50 |
| Makeshift | 4 | 0 | — | 1. | 25 | 0 | — | 3 | 75 |
| Vagotomy | 2 | 0 | — | 0 | — | 0 | — | 1 | 50 |

These are gross data with periods of follow-up ranging from a few months to 10 years, the longer periods being follow-ups of shunting operations. The data for several operations are too few to justify comparative analysis, and they indicate the paucity of follow-up reports of these procedures, usually because they have been abandoned.

It is clear that the portacaval shunt offers the best protection against further bleeding. It is interesting and significant that the most effective operation is that which permanently reduces portal pressure. The reasons for this would appear to be that prevention of *surge pressure*, as occurs with coughing, straining, or any

maneuver that increases intraabdominal pressure, is best accomplished by a large portal shunt at the confluence of the portal radicles emptying directly into the low-pressure vena cava[7]. Pressure studies have shown that only transient reduction in pressure results from ligation of the hepatic or the splenic artery, or from splenectomy.[8] The splenorenal shunt is smaller, more subject to occlusion, and less effective than is the portacaval shunt. The superiority of the portacaval shunt probably is due to the fact that the flow through such a shunt is proportional to the fourth power of the radius of the shunt. The average splenorenal shunt is 10 mm. in diameter; whereas, the average portacaval shunt is 20 mm. or more in diameter.

**Table 2.** — *Treatment of extrahepatic block for portal hypertension (Data from a review of the literature)*

| Operation | Total number of patients | Operative mortality | | Recurrent hemorrhage | | Late fatal hemorrhage | |
|---|---|---|---|---|---|---|---|
| | | Number of patients | Per cent of total | Number of patients | Per cent of total | Number of patients | Per cent of total |
| Splenectomy | 233 | 18 | 8 | 154 | 72 | 18 | 8 |
| Splenorenal shunt | 121 | 5 | 4 | 33 | 27 | 5 | 4 |
| Makeshift | 25 | 1 | 4 | 13 | 52 | 3 | 13 |
| Suture | 19 | 0 | — | 9 | 47 | 0 | — |
| Esophagogastric resection | 8 | 0 | — | 5 | 62 | 1 | 13 |
| Devascularization | 6 | 0 | — | 6 | 100 | 0 | — |
| Mediastinal packing | 4 | 0 | — | 3 | 75 | 0 | — |
| Portacaval shunt | 1 | 0 | — | 0 | — | 0 | — |

For patients with extrahepatic portal block, the splenorenal shunt offers the best hope for prevention of bleeding, and for this reason splenectomy should not be performed when esophageal varices are present unless the surgeon is prepared to proceed with a splenorenal shunt. When no shunt is possible because of previous splenectomy, or because the splenic vein is thrombosed or is shown by splenoportography to be unsuitable for anastomosis, suture of varices and splenectomy offer a retrenchment short of esophagogastric resection. An exception to this is the child with a small or anomalous splenic vein; transthoracic suture of varices alone should be performed and the spleen left intact until it is clear that growth has not improved the size or the quality of the splenic vein for the purposes of anastomosis. Premature splenectomy for thrombopenia and varices usually is not justified unless a splenorenal shunt can be effected simultaneously. Esophagogastric resection usually has not been performed except as a last resort, because of the mortality and morbidity attendant upon the operation, the postoperative nutritional problems, and because most of the patients with extrahepatic portal block are children.

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