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Esophageal Tamponade in the Management of Acute Variceal Hemorrhage

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Over a seven-year period, 138 patients with portal hypertension presented on 223 occasions with endoscopically proven acute variceal hemorrhage. Hemorrhage ceased spontaneously on 92 occasions (41%). On 126 occasions (57%) passage of the four-lumen modification of the Sengstaken-Blakemore tube was required, and hemorrhage was successfully controlled in 98%. Intubation was refused on five occasions (2%). Hemorrhage recurred during these 223 admissions on 47 occasions (21%); on 11 occasions a second rebleed occurred and on two occasions, a third. Tamponade was required during all of these rebleeds and arrest of hemorrhage was achieved in 87%. Hemorrhage in patients with poorer modified Child's grade was less likely to cease with intubation. The overall rate of control in the 186 episodes of hemorrhage requiring tamponade was 94%. There were 28 complications attributed to the use of tamponade in 186 episodes of hemorrhage (15%). On 12 occasions these complications proved fatal (6.4%). In four further patients failure of tamponade to control hemorrhage was fatal.

KEY WORDS: portal hypertension; acute variceal hemorrhage; tamponade; Sengstaken-Blakemore tube.

In 1950, Sengstaken and Blakemore first described the successful use of a double-ballooned tube for the control of acute hemorrhage from esophageal varices (1). Despite the introduction of a fourth lumen (2) to prevent aspiration of pharyngeal and upper esophageal secretions, the use of tamponade for primary control of hemorrhage in such patients has been controversial. Difficulties in insertion of the tube, the need for constant medical and nursing supervision, and the potential for complications have resulted in a reluctance to use this method to control acute variceal hemorrhage in some centers.

We report our seven-year experience of the use of balloon tamponade in the control of acute variceal hemorrhage, attempt to identify the problems associated with its use, and define its role in the management of bleeding esophageal varices.

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MATERIALS AND METHODS

One hundred thirty-eight patients presented on 223 occasions to the University Department of Surgery, Glasgow Royal Infirmary, from August 1979 until April 1986, with endoscopically proven bleeding esophageal varices. Only patients who had bled within 24 hr of presentation are included in this review. Patients presenting with suspected variceal hemorrhage were initially resuscitated with a combination of crystalloid and colloid solutions and cross-matched blood where appropriate. Any coagulopathy was corrected by the administration of fresh frozen plasma and/or cryoprecipitate. Vitamin K_1 (10 mg daily) and cimetidine (400 mg three times a day) were given parenterally to all patients.

Early endoscopy was performed as part of the initial assessment of each patient. If active variceal hemorrhage was demonstrated at endoscopy and deemed to be so severe that it was unlikely to cease spontaneously, tam-

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ponade was instituted using the Minnesota four-lumen modification of the Sengstaken-Blakemore tube (2). If such proven hemorrhage was minimal and thought likely to cease without intervention, tamponade was not instituted until it was clear that bleeding was continuing, ie, further overt hematemesis or occult hemorrhage reflected in a rising pulse rate and/or falling blood pressure. The tube was inserted by medical staff trained in its use. Our initial practice was to pass the tube orogastrically, but in the last two years the nasogastric route was preferred. The gastric balloon was inflated with 100 ml of water and 20 ml of sodium and meglumine iodamide (Uromiro 340, Merck Ltd.). The esophageal balloon was inflated with air to a pressure of 40 mm Hg as measured by an aneroid barometer.

The position of the tube was confirmed by abdominal radiography immediately after insertion, and the patient was constantly supervised by trained nursing staff in the University Department of Surgery wards. Open drainage of the gastric and pharyngeal channels of the Minnesota tube was supplemented by hourly syringe aspiration. Tube position was maintained simply by taping the tube to the side of the nose or to a spatula at the side of the mouth. Sedatives and analgesics were avoided whenever possible. The Minnesota tube was kept in position with both balloons inflated for 24 hr. The esophageal balloon was then deflated and the tube left in place for an additional 12 hr. If bleeding did not recur, then the tube was removed and destroyed to prevent reusage. If bleeding recurred, the balloons were reinflated for a further 24 hr. When the condition of the patient permitted, injection sclerotherapy using a modified Negus rigid esophagoscope (3), as previously described (4), was undertaken.

Recurrent variceal hemorrhage during admission was defined as the development of shock (pulse > 100/min and/or systolic blood pressure < 100 mm Hg) requiring continued resuscitation or the aspiration of fresh blood through the tube. Any such hemorrhage occurring after initial bleeding had ceased or been controlled with tamponade for 24 hr was deemed to be recurrent. Such recurrent bleeding was treated in a similar manner by tamponade. No patient in this series received vasopressin (pitressin) or other vasoactive agents routinely to arrest variceal hemorrhage.

The severity of the underlying liver disease was assessed in each patient using Pugh's modification of the Child's classification (5). In addition, a prognostic score was calculated on admission for each patient using the derived regression equation described by Garden et al (6). Liver biopsy was performed on all patients during initial or subsequent admissions, unless contraindicated by major coagulopathy.

RESULTS

One hundred thirty-eight patients were admitted on 223 occasions with endoscopically proven variceal hemorrhage. There were 93 males and 45 females with an average age of 53.3 years (range 17–82 years). The etiology of the portal hypertension in these patients is shown in Table 1.

TABLE 1. ETIOLOGY OF PORTAL HYPERTENSION IN 138 PATIENTS ADMITTED WITH ACUTE VARICEAL HEMORRHAGE AND RELATIONSHIP TO MODIFIED CHILD'S GRADE

	Child's grade			
	A	*B*	*C*	*Total*
Alcoholic cirrhosis	4	21	73	98
Chronic active hepatitis	1	5	6	12
Cryptogenic cirrhosis		8	1	9
Primary biliary cirrhosis		2	4	6
Portal vein thrombosis	2	2		4
Primary sclerosing cholangitis	1		1	2
Idiopathic portal hypertension		1	1	2
Unknown		2		2
Metastatic breast carcinoma			1	1
Pancreatic carcinoma		1		1
Wilson's disease		1		1
Total	8	43	87	138

Figure 1 illustrates the outcome of these 223 episodes of variceal hemorrhage.

Spontaneous Cessation of Hemorrhage. In 92 bleeds (41%), hemorrhage ceased without passage of the Minnesota tube. In only two did bleeding recur during admission (both after sclerotherapy) and in both cases tamponade controlled hemorrhage. Eight of the patients in this group died after bleeding had ceased (mean survival 28 days, range 5–54 days): seven of progressive liver failure and one following a cardiac arrest; six of these patients had had sclerotherapy.

Failed Intubation. Five patients would not tolerate passage of the Minnesota tube. In one patient who refused intubation, vasopressin was ineffective but emergency sclerotherapy controlled hemor-

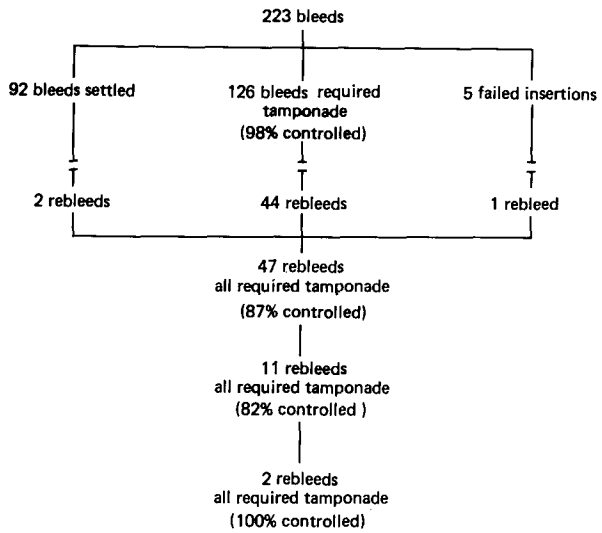

Fig. 1. Outcome of 223 initial episodes of acute variceal hemorrhage in 138 patients.

TABLE 2. CONTROL OF HEMORRHAGE BY TAMPONADE AND RELATIONSHIP TO MODIFIED CHILD'S GRADE

	Child's grade		
	A	*B*	*C*
Initial bleeds	*N* = 4	*N* = 42	*N* = 80
No. of patients in whom initial bleed controlled	4 (100%)	42 (100%)	77 (96%)
Rebleeds	*N* = 2	*N* = 17	*N* = 41
No. of patients in whom rebleed controlled	2 (100%)	16 (94%)	34 (83%)

TABLE 3. COMPLICATIONS OF ESOPHAGEAL TAMPONADE*

	Child's grade		
	A	*B*	*C*
Aspiration → chest infection (no sclerotherapy)			4 (3)
Aspiration → chest infection (postsclerotherapy)		4 (1)	5 (3)
Esophageal tear on intubation			2 (2)
Pulled up tube	1	2	5 (1)
Cardiac arrest		1	3 (1)
Unexplained death			1 (1)
Total	1	7 (1)	20 (11)

*Figures in parentheses denote deaths related to use of Minnesota tube.

rhage. Emergency esophageal transection was required to arrest bleeding in the second patient. In the third patient, bleeding ceased without intervention but hepatic failure ensued and the patient died. Bleeding ceased in the fourth patient but recurred; tamponade was tolerated on this occasion and bleeding was controlled. The last patient underwent emergency sclerotherapy which controlled bleeding.

Hemorrhage Requiring Intubation. Esophageal tamponade was required for the remaining 126 bleeds (57%), and hemorrhage was successfully controlled on 123 occasions (98%). Bleeding recurred on 44 occasions (35%) during these 123 admissions: 25 on deflation of the tube and 19 following sclerotherapy. Esophageal tamponade was required on all of the 47 occasions where bleeding recurred during admission (44 after tamponade, two where bleeding initially ceased, and one where intubation was initially refused).

Hemorrhage was controlled on 41 of these occasions (87%). A second episode of recurrent hemorrhage occurred on 11 occasions (two after sclerotherapy); tamponade was required on all 11 occasions and bleeding arrested on nine. Two patients rebled a third time (one after sclerotherapy), but in both patients hemorrhage was successfully controlled by tamponade. No patient rebled for a fourth time during one admission.

Overall, tamponade was successful in controlling variceal hemorrhage on 175 of the 186 occasions where its use was thought to be necessary (94%). It was more successful in controlling hemorrhage in patients at initial presentation and in patients with less severe liver dysfunction as judged by modified Child's grade (Table 2).

Failed Control of Hemorrhage. The Minnesota tube failed to control variceal hemorrhage on 10 occasions in nine modified Child's grade C patients and once in a modified Child's grade B patient. Five of the modified Child's C patients died before any other life-saving measure could be instituted and in two of these postmortem examination revealed esophageal tears thought to be caused by intubation.

Complications of Tamponade. There were 28 complications attributed to esophageal intubation in 186 episodes where tamponade was necessary (Table 3). Thirteen patients developed chest infections (defined as the development of a pyrexia, in the presence of abnormal physical or radiological signs in the chest and the absence of other obvious causes for the pyrexia, or the production of purulent sputum), but nine of them had undergone injection sclerotherapy under general anaesthesia following tamponade and prior to developing the infection. Seven of these patients died as a consequence of the infection.

Eight patients pulled up the tube with the balloons fully inflated. Most of these patients complained of transient dysphagia but one died from massive uncontrollable hemorrhage from an esophageal tear which was confirmed at postmortem. Four patients sustained a cardiorespiratory arrest on passage of the Minnesota tube: three were successfully resuscitated, but one of these patients died (mentioned in previous paragraph). There were no complications associated with passage of the tube by the nasogastric route. In one patient the tube could not be passed due to nasal septal deviation but orogastric intubation was successful.

Deaths. Table 4 shows details of all deaths in relationship to whether sclerotherapy was undertaken during the final admission and the patients' calculated prognostic index (6). Twelve deaths were attributed to the use of the Minnesota tube and a

TABLE 4. ALL DEATHS IN RELATIONSHIP TO SCLEROTHERAPY AND PROGNOSTIC INDEX

Patient	*Age*	*Sex*	*Child's grade*	*Cause of death*	*Sclerotherapy*	*Prognostic index*
J.McG.	61	M	C	failed control	+	0.00
P.McG.	55	M	C	chest infection	−	0.00
P.B.	67	M	C	esophageal tear	−	0.01
J.K.	39	F	C	failed control, pulled up tube, and arrested	−	0.03
H.D.	52	M	C	chest infection	+	0.06
R.W.	54	M	C	chest infection	+	0.08
A.R.	46	M	C	esophageal tear	−	0.11
T.McL.	47	M	C	failed control	+	0.21
J.D.	56	M	C	failed control	−	0.21
D.J.	66	M	B	chest infection	−	0.23
T.A.	68	M	C	failed control + chest infection	+	0.35
A.B.	36	M	C	failed control	+	0.38
M.G.	61	F	C	pulled up tube	+	0.66*
M.T.	50	F	C	chest infection	−	0.84*
H.S.	69	F	C	chest infection	+	0.87*
M.P.	68	F	C	unexplained death	−	0.91*

*Patients with score ≥ 0.66 would have been expected to survive admission.

further four due to failure of the tube to control hemorrhage.

DISCUSSION

Esophageal tamponade was first described by Westphal in 1930 when an esophageal sound was used to control variceal hemorrhage (7). Rowntree et al (8) fitted an inflatable latex bag to the end of a Miller-Abbott tube to successfully control bleeding. In 1950, Sengstaken and Blakemore developed the double-ballooned tube (1), but regurgitation of gastric contents and aspiration of esophageal and pharyngeal secretions (9, 10) prompted Boyce to add a fourth lumen in 1962 (11). This led to the development of the Minnesota tube, which incorporates all four lumens within one tube (2).

The present study confirms that in many patients (42% in our series), acute variceal hemorrhage will cease without active intervention. This observation might explain the variable results reported for control of variceal hemorrhage using vasopressin (12–15), particularly if those patients in whom hemorrhage might have ceased spontaneously are included in the analysis. We have been unable to categorize this subgroup of patients; the distribution of Child's grades was similar to the group requiring tamponade. Variceal size and pressure were not measured in this study, but these features may identify those whose hemorrhage may cease without intervention.

The 94% control of variceal hemorrhage by tamponade seen in the present series is very similar to the 85–90% control reported by others (4, 11, 16–19). This high control rate was achieved in a predominantly poor-risk group comprising 63% Child's grade C patients. These results compare favorably with those of Panes and colleagues, who recently reported a control rate of 91.5% with tamponade, in a group of patients comprising only 20% Child's grade C (19). Those patients in whom control of hemorrhage was not achieved with tamponade all had poor prognostic scores (6), with advanced liver disease and marked coagulopathy.

Novis and colleagues have shown that hemorrhage will recur in 60% of patients following removal of the tube and that mortality is related to the severity of the bleed (20). Rebleeding, after initial control with tamponade, occurred on 44 occasions in our series (35%). These rebleeds occurred after sclerotherapy on 21 occasions, but it is debatable whether the sclerotherapy was responsible for these subsequent episodes. Barsoum et al have shown that routine tamponade following sclerotherapy does not improve the subsequent rebleed rate (21) and we have not routinely used tamponade in this way after sclerotherapy.

There is much controversy regarding the incidence of serious complications associated with tamponade (9, 10, 16, 19, 22–25). Conn and Simpson proposed that esophageal tamponade should be used only as a last resort because of the high complication rate seen in their center (22). They suggested that prophylactic tracheostomy or endotracheal intubation prior to the use of the tube

should be seriously considered, in an attempt to prevent these complications. The favorable results of our management policy suggest that endotracheal intubation may complicate unnecessarily the medical and nursing care of these patients.

Conn and Simpson found that 14 of 40 patients (35%) admitted with acute variceal hemorrhage treated by esophageal tamponade suffered major complications (22); death was attributed to the use of the tube in nine patients (22%). Pitcher has shown that these complications can be minimized with strict nursing and medical care (16). The mortality per bleed attributed to tamponade in our series of patients was 6.4% (does not include the four deaths due to failed control of hemorrhage) with an overall complication rate per bleed of 15%.

In the study by Garden et al (6), three factors, namely, prothrombin ratio, serum creatinine, and the presence of encephalopathy, were found to have independent significance in the prediction of outcome following acute variceal hemorrhage. A regression equation derived from these factors accurately predicted outcome in 90% of cases, and patients with prognostic scores of 0.66 or greater would have been expected to survive admission (6). It is interesting to note that in only four of the tube-related deaths in our series was the prognostic score of the patient greater than 0.66. We would argue that factors other than tamponade contributed significantly to the deaths of those patients with poor prognostic scores, although the possibility cannot be ignored that the two patients who suffered esophageal tears on intubation might have survived had this event not occurred.

Aspiration of secretions is the most common complication and is reported in 10–20% of cases (18, 21, 22, 25). Our policy has been to avoid sedation of patients when passing the tube and this may reduce the risk of aspiration pneumonia, although intubation in restless patients may be hazardous. The 7% incidence of pneumonia per intubation in our series may reflect unfairly on esophageal tamponade given that most of these patients proceeded to sclerotherapy under general anesthesia. The use of a four-lumened tube undoubtedly minimizes the risk of this complication (16).

Rupture of the esophagus can occur from inflation of the gastric balloon in the esophagus (25), from perforation of the esophagus by the tube itself (22), and following precipitous removal of the tube with the balloons inflated (4). Excessive traction should be avoided, and traction using pulleys and weights has been replaced in most centers by simple taping of the tube to the nose or cheek. The tube was removed by patients on eight occasions with balloons inflated in our series. Limited inflation of the gastric balloon may account for the fact that only one such patient sustained an esophageal rupture.

In a recent prospective, controlled, randomized study comparing a program of endoscopic sclerotherapy with tamponade alone for control of acute variceal hemorrhage, Paquet and Feussner reported an initial control rate of 73% for tamponade versus 95% for sclerotherapy (26). This difference was not statistically significant, although, not surprisingly, definitive control of hemorrhage at 30 days was significantly better in the sclerotherapy group. While it may be desirable to attempt emergency sclerotherapy of bleeding varices, injection is undoubtedly easier when hemorrhage has ceased, might not be practicable in the face of torrential bleeding, and many centers do not have the necessary expertise to provide an emergency sclerotherapy service.

The presence of a Minnesota tube in the stomach is useful in confirming that hemorrhage has been controlled, which may not be possible if a nasogastric tube is not passed when pharmacological agents are used to stop bleeding. Successful pharmacological arrest of hemorrhage might obviate the risk of aspiration associated with tamponade. Further controlled studies are required to determine whether vasoactive agents, such as vasopressin, glypressin, or somatostatin, are more effective and safer than tamponade in controlling variceal hemorrhage. It is unlikely that these agents can improve significantly on our ability to control variceal hemorrhage by tamponade, but they may reduce the incidence of pulmonary complications and so reduce subsequent mortality. We are currently conducting a trial comparing a long-acting somatostatin analog with balloon tamponade in the control of acute variceal hemorrhage.

In conclusion, tamponade has proved to be successful in controlling acute hemorrhage from esophageal varices in our hands. The rate of complications, particularly respiratory, continues to give cause for concern but until effective safe alternatives to tamponade are developed, we will continue to advocate its use for emergency control of acute variceal hemorrhage. This study has shown that the high mortality seen in this patient population may

be a reflection of the severity of underlying liver disease, rather than of a management policy that uses esophageal tamponade for the initial control of acute variceal hemorrhage.

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