

# Massive Upper Gastrointestinal Hemorrhage Following Surgical Operations

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MUCOSAL ulceration of the stomach, duodenum, and upper jejunum occurs after major burns,<sup>5, 6, 19</sup> intracranial operations,<sup>7</sup> prolonged steroid therapy,<sup>17, 18</sup> a variety of major surgical procedures,<sup>2, 8, 9</sup> and occasionally after frostbite.<sup>1, 10</sup> These ulcers are often referred to as *stress ulcers*. They may be associated with massive hemorrhage and perforation. The etiology of these ulcers has never been clearly defined, nor has the degree of "stress" necessary for their development been measured. Prevention of this complication has not been successful. The importance of this problem has led us to examine our experience in this regard at the University of Michigan Medical Center and the Veterans Administration Hospital between 1962 and 1966. This study is limited to massive upper gastrointestinal hemorrhage following surgical operation. Patients admitted to the hospital because of gastrointestinal bleeding, or who bled prior to the time of their initial surgical operation, are not included. Instances of hemorrhage following intracranial procedures, burns or in patients on medical management with prolonged steroid therapy, are also excluded.

Twenty-four patients are included in this series all of whom required transfusions of 2,000 ml. or more of whole blood within a 24-hour period.

Predisposing factors common to the clinical course of these patients are examined to determine the etiology and pathogenesis of gastrointestinal hemorrhage following operation. Results of treatment are evaluated.

## Factors Affecting Mortality

Ages of the patients ranged from 10 to 87 years. Seventeen (71%) of the patients died. Two of the five patients under age 40 died, while 15 of the nineteen patients over age 40 died. Clinical conditions associated with the younger patients included appendicitis, embryonal cell carcinoma, and trauma, while those associated with the older group included aortic aneurysm, malignant neoplasm and trauma.

The older patients had more serious illnesses, were more debilitated, and experienced more postoperative complications than younger patients.

**Primary Operation.** The most frequent single operation followed by hemorrhage was resection of aortic aneurysm. Gastrointestinal hemorrhage following aortic resection was 100% fatal in our experience. The largest group of patients underwent operation on the gastrointestinal tract (Table 1).

Factors common to the clinical courses of these patients were arterial hypotension and severe infection prior to the onset of gastrointestinal hemorrhage.

**Hypotension** was documented from the anesthesia record at the time of operation, or from vital signs recorded during the postoperative period. Hypotension was de-

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defined as a period of 15 minutes or longer during which time the systolic blood pressure was below 80 ml. of mercury in normotensive patients or a systolic drop of more than 50 ml. of mercury in hypertensive patients. Episodes of hypotension preceded gastrointestinal hemorrhage in 18 patients. Fourteen of these episodes occurred at the time of operation and four during the postoperative period. Eleven patients bled within 7 days of a hypotensive episode. Four patients bled 7 days or more after the first period of hypotension. All of the latter sustained further episodes of hypotension prior to the onset of bleeding. In addition to these 18 patients, two others were thought to be clinically in "shock" prior to hemorrhage, but because no blood pressures are recorded, they are omitted from the *hypotensive* group.

Major infection was present in 20 patients. All infections were confirmed by positive cultures. Patients with fever or elevations in white blood cell counts, without positive culture, were excluded.

In patients who had multiple sites of infection, the same organisms were frequently cultured from all sources (Table 2). The majority of cultures yielded gram-negative bacteria (Table 3). The combination of hypotension and infection was present in eighteen patients.

**Steroids and Ulcer History.** Eight patients received hydrocortisone analogues during hospitalization. In seven the steroids were used only terminally to sustain blood pressure. One patient had been on long term steroid therapy for dermatomyositis prior to her initial operation (appendectomy) and subsequent hemorrhage.

Six patients had a history compatible with previous peptic ulcer disease. One had undergone multiple operations for intractable pain. Another had an ulcer defect demonstrated on upper gastrointestinal roentgenograms shortly before developing hemorrhage from a separate acute ulcer.

TABLE 1. *Location of Primary Operation*

	Died	Survived	% of Total
Alimentary tract	4	4	33
Aortic aneurysmectomy	6	0	25
Orthopedic	2	2	17
Tracheostomy	3	0	13
Celiotomy and retroperitoneum	0	2	8
Pulmonary	0	1	4

TABLE 2. *Sites of Infection by Culture*

Source of Culture	Number of Patients
Pulmonary	15
Wound	9
Urine	8
Blood	6
Intraperitoneal abscess	5
Bile	1

**Treatment.** Two patients died before any treatment could be instituted. Nine were treated conservatively with an anti-ulcer regimen and blood replacement. Eight of these patients died. Two were treated by surgical ligation of the bleeding points; both died.

Nine patients were treated by ligation in conjunction with vagotomy and a drainage procedure (eight pyloroplasties and one gastroenterostomy). Three of the nine patients died. All who died had recurrent bleeding, but only one died of exsanguination. Of six survivors, bleeding recurred in two. One patient treated initially with vagotomy, pyloroplasty and ligation underwent partial gastric resection to control recurrent hemorrhage. No further bleeding occurred, but the patient died of a cerebrovascular accident.

Two patients underwent subtotal gastrectomy as the initial treatment for hemorrhage. One rebled, and both died. Table 4 summarizes the results of treatment.

**Location of the Ulcers.** Eleven patients had gastric ulcers. The ulcers were single

TABLE 3. *Organisms Isolated by Culture*

Organism	Number of Patients
Aerobacter-Klebsiella	11
Pseudomonas	10
Escherichia coli	9
Staphylococci	7
Proteus	5
Coliforms	5
Strep. faecalis	3
Monilia	3
Mycobacterium tuberculosis	1

in seven patients and multiple in four. Seven patients had duodenal ulcers which were single in six patients and multiple in the seventh. Five patients had ulceration of both the stomach and duodenum. One patient survived hemorrhage without operation. The source of hemorrhage in this patient remained undetermined.

**Cause of Death.** Shock secondary to blood loss was considered the cause of death in six patients. Overwhelming infection was thought to be the cause of death in four. Other causes are listed in Table 5.

### Discussion

In 1867, Billroth reported a case of gastrointestinal hemorrhage following removal of a substernal thyroid.<sup>4</sup> Since that time there have been several reports of gastrointestinal hemorrhage following various operations.<sup>2, 8, 9</sup> Acute ulceration is reported to occur in 1% of unselected consecutive

autopsies.<sup>8</sup> The incidence was higher (3%) in autopsies performed after postoperative deaths.<sup>15</sup> The overall incidence in 50,000 operations reported by Fogelman was 0.06%.<sup>9</sup>

In the series here reported the most common primary operation was the resection of an aortic aneurysm. Gastrointestinal hemorrhage has also been reported to have followed cardiovascular surgery.<sup>3, 13, 16</sup> In cardiovascular surgery periods of hypotension are not uncommon. In our series eighteen of 24 patients had sustained episodes of hypotension prior to hemorrhage. While a causal relationship between hypotension and ulceration has never been established in man, gastric ulceration and hemorrhage has been produced by such means in rabbits.<sup>14</sup> In these animals, the gastric mucosa became ischaemic during shock following blood loss. Multiple, pale, sharply defined areas appeared in the gastric mucosa. Following reinfusion of the rabbits' blood, hemorrhage occurred from the areas which were sites of greatest ischaemia during the period of hypotension. Circulatory changes secondary to shock may be an important factor in the pathogenesis of intestinal ulceration and hemorrhage.

We have noted, as have others,<sup>2, 9</sup> the high incidence of severe infection in patients with postoperative gastrointestinal hemorrhage. Twenty patients had clinically evident, culture confirmed infections prior to hemorrhage. Severe infections—espe-

TABLE 4. *Results of Treatment*

Method of Treatment	Rebled	No Rebleeding	Died	Survived	% Mortality
No treatment	—	—	2	0	100
Transfusion	—	—	8	1	89
Ligation of bleeding point	0	2	2	0	100
Vagotomy and drainage procedure*†	5	4	3	6	33
Subtotal gastric resection	1	1	2	0	100

\* Eight pyloroplasties, and one gastroenterostomy.

† One patient rebled after vagotomy and pyloroplasty, and subsequently underwent 50% gastric resection. No rebleeding occurred, but the patient died of a cerebrovascular accident.

cially with gram-negative organisms—are known to be associated with shocklike states. Whether infection or hypotension cause peptic ulceration and hemorrhage, or are manifestations of whatever factors predispose to the development of hemorrhage, has not been determined.

Medical treatment is ineffective in massive gastrointestinal hemorrhage. Ten of the eleven patients in our study treated without operation died. Others report mortalities from massive gastroduodenal hemorrhage ranging from 80%<sup>2, 3</sup> to 100%<sup>12, 20</sup> with conservative management.

Ligation of bleeding points was ineffective in controlling hemorrhage and reducing mortality. In our series, two patients underwent ligation of bleeding points, both of whom died. Beil *et al.*<sup>2</sup> report four cases of ligations, with three deaths. In a large series on massive gastroduodenal hemorrhage, Foster *et al.*<sup>11</sup> reported four postoperative patients with massive hemorrhage treated with suture of the bleeding point and ligation of the left gastric artery, of whom three died. Patients who develop postoperative gastrointestinal hemorrhage are poor risks. For this reason we used vagotomy and pyloroplasty in conjunction with ligation of the bleeding points in most instances. This procedure reduced the mortality resulting from gastrointestinal hemorrhage following operation. Though there was a high incidence of recurrent bleeding associated with this procedure, death resulted from exsanguination in only one of these patients. Foster *et al.*<sup>11</sup> in their series of patients with bleeding peptic ulcer, report two patients with postoperative ulceration and hemorrhage treated with vagotomy and pyloroplasty, with one death.

Three patients in our series underwent subtotal gastric resection, all of whom died. Beil<sup>2</sup> reported nine of fifteen patients treated in this manner died. Gilchrist<sup>12</sup> reported three patients treated by partial gastrectomy, all of whom survived, and none

TABLE 5. Cause of Death

Immediate Cause of Death	Number of Patients
Hemorrhage	6
Infection	4
Aspiration	2
Cerebrovascular accident	2
Renal failure	1
Status epilepticus	1
Unexplained	1

of whom experienced recurrent bleeding.

Massive gastroduodenal ulceration and hemorrhage occurring in the postoperative period may be causally related to preceding episodes of hypotension. Early surgical management offers the only hope for cure. Vagotomy and pyloroplasty, in conjunction with ligation of the bleeding points, has been effective in reducing mortality from this disease.

### Summary

The results of management of 24 cases of massive upper gastrointestinal hemorrhage occurring in the postoperative period are presented. Hypotension and sepsis are believed to be important predisposing factors in the etiology and pathogenesis of postoperative hemorrhage. Vagotomy and pyloroplasty proved to be effective in reducing the mortality from gastrointestinal hemorrhage following operation.

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