Diagnosis and Management of Upper Gastrointestinal Hemorrhage in Children

By WILLIAM M. LIEBMAN, M.D.

Upper gastrointestinal hemorrhage in children is an occurrence that is frightening to the parents as well as to the child. Fortunately, a comprehensive history and physical examination, as well as the age of the patient, will frequently reveal the responsible cause; on occasion, however, intensive diagnostic testing will be required in order to determine the source of the hemorrhage and its cause. In the recent past, the source of hemorrhage could not be identified in 50 per cent or more of the cases.¹⁻³ Newer diagnostic techniques have appreciably reduced the number of undiagnosed cases to less than 10 per cent.

The physician must approach the diagnostic evaluation of a patient with upper gastrointestinal bleeding in a systematic manner to guarantee an accurate localization of the source or sources of the hemorrhage and to start appropriate therapy promptly. In many instances, hematemeses and signs of acute blood loss are present and localize the bleeding source as proximal to the ligament of Treitz.*

continued

* A suspensory muscle of the duodenum — the flat band of smooth muscle originating from the left crus of the diaphragm and continuous with the muscular coat of the duodenum at its junction with the jejunum.

TABLE 1

CAUSES OF UPPER GASTROINTESTINAL HEMORRHAGE

**Newborn**
- Swallowed maternal blood
- Hemorrhagic disease of the newborn
- Stress ulcer
- Gastritis
- Esophagitis (peptic)
- Esophageal varices
- Gastric duplication

**Preschool**
- Esophageal varices
- Peptic ulcer disease
- Gastritis
- Esophagitis (peptic)
- Chalasia with reflux
- Esophageal stenosis
- Pyloric stenosis
- Foreign body or caustic ingestion
- Gastric web, diaphragm
- Abdominal trauma
- Vascular (Rendu-Osler-Weber disease, hemangioma ...)

**School age**
- Esophageal varices
- Peptic ulcer disease
- Stress ulcer
- Gastritis
- Esophagitis
However, hemorrhage distal to pylorus may not present as hematemesis, or by the presence of blood in the stomach upon gastric lavage, but by melena, massive bright-red rectal bleeding, or — rarely — by signs of acute blood loss without other evidence of hemorrhage. The following discussion will present an overview of the basic causes of upper gastrointestinal hemorrhage, conventional and newer diagnostic testing, and the management of patients.

NEONATAL PERIOD
Fortunately, upper gastrointestinal hemorrhage is not particularly common in neonates (Table 1). Within the first 24 hours of life, one major cause is swallowed maternal blood. It may be determined by means of the Apt-Downey test for the presence of fetal hemoglobin in the vomitus. In the largest reported series in newborns, Sherman and Clatworthy described 94 cases of gastrointestinal bleeding and found that most cases had their onset within 48 hours after birth and ceased within one day.4 Swallowed maternal blood was the most common cause of upper gastrointestinal hemorrhage in this age group, and hemorrhagic disease of the newborn was the second most common. Over 50 per cent of the cases had no demonstrable cause, since the lesions could not be demonstrated by conventional radiographic studies. In a brief report, Stanley-Brown and Stevenson described eight cases with massive hemorrhage.5 None required surgery, none died, all required transfusion, and in none was the cause found. In the future, more sources of bleeding should be identifiable with the use of endoscopic examination.

POSTNEONATAL PERIOD TO PUBERTY
The most common causes of upper gastrointestinal hemorrhage in this group are peptic ulcer disease, peptic esophagitis, ulcers and gastritis induced by aspirin, and stress and esophageal varices.

Gastric and duodenal ulcers in infants and children may present with hemorrhage as their initial manifestation.6,7 Abdominal pain may not be associated with bleeding in these patients. This makes management exceedingly difficult, because bleeding may occur without warning. If abdominal pain is part of the patient’s symptoms, it typically does not have a relationship to eating. It is not consistently relieved by food and antacids.

Patients who have ulcers and gas-

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**TABLE 2**

**DIAGNOSTIC STUDIES**

<table>
<thead>
<tr>
<th>Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC</td>
</tr>
<tr>
<td>Absolute platelet count</td>
</tr>
<tr>
<td>Prothrombin time</td>
</tr>
<tr>
<td>Partial thromboplastin time</td>
</tr>
<tr>
<td>Type, cross-match</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper gastrointestinal and small-bowel series</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Endoscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esophagogastroduodenoscopy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorescein string test</td>
</tr>
<tr>
<td>Staged aspiration of intestinal contents with a Miller-Abbott tube</td>
</tr>
<tr>
<td>Cr44-tagged red blood cells and stool counting</td>
</tr>
<tr>
<td>Visceral angiography</td>
</tr>
</tbody>
</table>

**Surgical exploration**
tritis induced by aspirin may surprisingly have taken only small doses, yet their hemorrhage may be massive.

It is difficult to understand why there is such variability in response to aspirin. Stress ulcers complicate cases of sepsis and central nervous system damage secondary to head trauma and following major burns. Physicians should be alert to this complication and should test all stools in these patients for occult blood. Should it become 3+ or more, intensive treatment with antacids or nasogastric suction should be started.

Gastroesophageal reflux due to an incompetent lower esophageal sphincter may result in severe peptic esophagitis with bleeding. It is an uncommon occurrence in infancy and childhood.

Varices result from portal hypertension (extrahepatic or intrahepatic). A careful history of the perinatal period must be obtained to determine whether factors during this period could account for extrahepatic portal hypertension. Virtually all cases of extrahepatic biliary atresia — whether or not surgery is successful in relieving the obstruction — will result in portal hypertension and biliary cirrhosis. One-fourth of patients with neonatal hepatitis will heal with cirrhosis and portal hypertension.

Bleeding from esophageal varices is painless; vomiting occurs secondary to gastric irritation by the blood.

Blunt abdominal trauma secondary to accidents may produce an upper gastrointestinal hemorrhage as a result of an injury to the duodenum, which is fixed in a retroperitoneal position. The upper gastrointestinal series in these patients is often dramatic, demonstrating an eccentric obstructing lesion.

DIAGNOSTIC APPROACH IN ALL CONDITIONS AND INITIAL MANAGEMENT

The guiding principle in all cases should be a vigorous diagnostic approach to achieve accurate diagnosis of the site and cause of the hemorrhage in the shortest possible time (Table 2). Unless the patient is in shock, the first step in the investigation of upper gastrointestinal hemorrhage is a complete history and physical examination. Pertinent facts in the history include an assessment of the general state of the patient’s health, previous and present disease, the presence of cough, epistaxis, jaundice, diarrhea, hematochezia, melena, bleeding tendency, and recent ingestion of medicines (including aspirin, phenylbutazone, reserpine, and theophylline and chronic use of adrenocorticosteroids). In all cases, an estimate of the blood loss must be made as well as its color and character.

The physical examination must continued
start with an assessment of the general appearance of the patient. Vital signs must be taken immediately to determine if the patient is in shock or volume depleted. The patient is then examined for the presence of petechiae, ecchymoses, spider angiomas, jaundice, hemangiomas, and abnormal pigmentation. The abdominal examination is performed with special reference to the presence of palpable masses, evidence of gastrointestinal obstruction, enlargement of the liver or spleen, presence of bruits, prominent abdominal veins, and tenderness over the midepigastric or periumbilical area.

Venipuncture should be performed promptly for the purpose of obtaining blood for a complete hemoglobin, hematocrit, white blood count including an absolute platelet count, prothrombin time, partial thromboplastin time, and blood type and cross matching. An intravenous needle or intracatheter should be placed as rapidly as possible; if the patient is in shock, a cutdown should be placed in the saphenous vein. The largest needle, intracatheter, or cutdown possible should be inserted so that blood and fluids may be administered as rapidly as possible. The smallest needle or intracatheter that should be used in infants is a number 20; in older children a number 16 or 18-gauge needle or intracatheter should be used. Ringer’s lactate, saline, or plasma-nate is administered as rapidly as possible until the blood pressure stabilizes and/or blood is available for transfusion. An emergency cross match should be obtained on blood if the hemorrhage is massive and the patient is in shock. Standard cross matching may take too long, and the patient may lose too much blood by the time the material is ready to be administered.

Once the intravenous line is established and the administration of fluids is begun, a decision should be made whether a central venous catheter should be placed in order to monitor blood and fluid replacement. In most infants and children, this is not necessary. Management can be almost as effective if the vital signs are followed. The blood pressure, not the pulse, is the first vital sign to stabilize. The pulse may take as long as a day to return to normal.

Once an intravenous line is established and volume expansion has started, a rubber or polyvinyl nasogastric tube of sufficient diameter should be inserted into the stomach and aspiration started. In children aged five to 10 years, a pediatric EWald tube should be used to aspirate the stomach. An adult EWald tube should be used in older children. The rate of bleeding can be monitored with the use of these tubes, and the blood aspirated. EWald or nasogastric tubes should not be left in place if the patient has esophageal or gastric varices that are the source of bleeding. If the patient is actively bleeding in the stomach and does not have esophageal varices, irrigation of the stomach should be initiated with iced saline. In most cases, hemorrhaging will slow or cease, at least temporarily, within 30 to 45 minutes of aspiration. The initial goals of nasogastric aspiration are to decrease the rate of hemorrhage and to clear the stomach of blood. The latter is important if panendoscopy is to be used for direct examination of the esophagus, stomach, and duodenum.

Gleason and co-workers reported the use of fiberoptic endoscopy in 25 children, the primary indication in 10 being upper gastrointestinal bleeding. The bleeding site was ascertained in all. Ament and colleagues continued
reported on 143 children undergoing upper endoscopic examination.14 Thirty-eight of the 143 had upper gastrointestinal hemorrhage, and the bleeding site was found in 30. In my experience, the bleeding site was found in 17 of 18 cases undergoing upper endoscopic examination.15 In the first series, gastric ulcer disease was the most common source of hemorrhage; in the second series, gastric ulcer disease was equally common; and in my series, duodenal ulcer disease was the most common source of hemorrhage. No complications were encountered in any of the series.

FIBEROPTIC ENDOCOSPY

The fiberoptic instruments consist of thousands of individual thin glass fibers bound together in a flexible bundle with an identical spatial arrangement at both ends. The length and diameter of the bundle vary with each instrument and with each manufacturer. The examining end of the instrument consists of an objective lens for focusing within a rigid compartment. In addition, hollow channels are present within the instrument for the purpose of suction, air, water, and the passage of foreign-body forceps, snares, or cannulas. Control levers are present at the examiner’s end of the instrument for controlling the tip of the instrument. This allows the tip to be moved up, down, right, and left.

In order to perform endoscopic procedures, premedication is required in children just as in adults. Upper intestinal endoscopy is possible using local anesthesia in school-age and teenage children.13,15 It may be possible to perform the procedure routinely in preschoolers and infants using the same type of sedation, but experience with this has been limited. For adequate sedation, meperidine, 2 mg./kg., is administered. This medication is administered 45 to 60 minutes before the procedure. Diazepam, with or without meperidine, is administered intravenously in a slow manner until the child is at ease; the dosage of diazepam may be as much as 1 mg./kg. or more. In children less than 10 years of age, adequate relaxation and cooperation may not be possible with the above means; therefore, general anesthesia may be necessary for the accurate performance of the endoscopic examination. With the use of sedation, topical anesthesia — such as spraying, swabbing, or gargling with tetracaine — has frequently not been necessary in the emergency situation. Atropine, 0.01-0.02 kg., is frequently given as premedication to decrease salivary and gastric secretion.

Radiographic studies often fail to demonstrate superficial gastric lesions as well as small intestinal lesions, and they fail to demonstrate esophageal varices in up to 50 per cent of cases.16 The discrepancy between radiography and endoscopy in the early diagnosis of the sources of upper gastrointestinal hemorrhage has been established in children as well as adults. In published studies, endoscopy disclosed the site of bleeding in nearly all cases, while radiography, when it could be performed, failed to demonstrate its source in more than 80 per cent of the cases. Furthermore, a lesion demonstrated radiographically cannot be confirmed as the site of bleeding by barium studies. The most common sources of upper gastrointestinal bleeding recognized at endoscopy in all pediatric endoscopic series are gastric and duodenal ulcers that are peptic in origin or are secondary to stress or ulcerogenic drugs, hemorrhagic gas-

Upper intestinal endoscopy is possible using local anesthesia in school- and teenage children continued
Before prescribing, please consult complete product information, a summary of which follows:

**INDICATIONS:** Tigan is indicated for the control of nausea and vomiting.

**CONTRAINDICATIONS:** The injectable form of Tigan in children, the suppositories in premature or newborn infants, and use in patients with known hypersensitivity to trimethobenzamide are contraindicated. Since the suppositories contain benzoic acid they should not be used in patients known to be sensitive to this or similar local anesthetics.

**WARNINGS:** Tigan may produce drowsiness. Patients should not operate motor vehicles or other dangerous machinery until their individual responses have been determined. Reye's Syndrome has been associated with the use of Tigan and other drugs, including antihistamines, although their contribution, if any, to the cause and course of the disease hasn't been established. This syndrome is characterized by an abrupt onset shortly following a nonspecific febrile illness, with persistent severe vomiting, lethargy, irrational behavior, progressive encephalopathy leading to coma, convulsions and death.

**Usage in Pregnancy:** Trimethobenzamide hydrochloride was studied in reproduction experiments in rats and rabbits and no teratogenicity was suggested. The only effects observed were an increased percentage of embryonic resorptions or stillborn pups in rats administered 20 mg/kg and 100 mg/kg and increased resorptions in rabbits receiving 100 mg/kg. In each study these adverse effects were attributed to one or two dams. The relevance of the human is not known. Since there is no adequate experience in pregnant or lactating women who have received this drug, safety in pregnancy or in nursing mothers has not been established.

**PRECAUTIONS:** During the course of acute febrile illness, encephalitis, encephalopathy and electrolyte imbalance, especially in children and the elderly or debilitated, CNS reactions such as opisthotonus, convulsions, coma and extrapyramidal symptoms have been reported with and without use of Tigan or other antihistaminic agents. In such disorders caution should be exercised in administering Tigan particularly to patients who have recently received other CNS-acting agents (phenothiazines, barbiturates, benzodiazepine derivatives). It is recommended that severe emesis should not be treated with an anticholinergic drug alone; where possible the cause of vomiting should be established. Primary emphasis should be directed toward the restoration of body fluids and electrolyte balance, the relief of fever and relief of the causative disease process. Overhydration should be avoided since it may result in cerebral edema.

The anticholinergic effects of Tigan may render diagnosis more difficult in such conditions as appendicitis and obscure signs of toxicity due to overdosage of other drugs.

**ADVERSE REACTIONS:** There have been reports of hypersensitivity reactions and Parkinson-like symptoms. There have been instances of hypotension reported following parenteral administration to surgical patients. There have been reports of blood dyscrasias, blurring of vision, coma, convulsions, depression of mood, diarrhea, disorientation, dizziness, drowsiness, headache, jaundice, muscle cramps and opisthotonus. If these occur, the administration of the drug should be discontinued. Allergic-type skin reactions have been observed; therefore, the drug should be discontinued at the first sign of sensitization. While these symptoms will usually disappear spontaneously, symptomatic treatment may be indicated in some cases.

**HOW SUPPLIED:** Suppositories, Pediatric, 100 mg, boxes of 10. Suppositories, 200 mg, boxes of 10 and 50.

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**TABLE 3**

**DIAGNOSIS OF HEMORRHAGIC LESIONS**

<table>
<thead>
<tr>
<th>Source of Hemorrhage</th>
<th>No. of Cases</th>
<th>Endoscopy</th>
<th>UGI Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esophageal varices</td>
<td>2</td>
<td>2/2</td>
<td>2/2</td>
</tr>
<tr>
<td>Gastric ulcer</td>
<td>3</td>
<td>3/3</td>
<td>1/3</td>
</tr>
<tr>
<td>Duodenal ulcer</td>
<td>4</td>
<td>3/4</td>
<td>2/4</td>
</tr>
<tr>
<td>Esophagitis</td>
<td>1</td>
<td>1/1</td>
<td>0/1</td>
</tr>
<tr>
<td>Erosive gastritis</td>
<td>5</td>
<td>5/5</td>
<td>2/5</td>
</tr>
<tr>
<td>Duodenitis</td>
<td>3</td>
<td>3/3</td>
<td>2/3</td>
</tr>
</tbody>
</table>

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Beecham laboratories
Bristol, Tennessee 37220

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tritis, esophagitis, and esophageal varices (Table 3).

If bleeding is brisk and cannot be controlled enough to allow for comprehensive endoscopic examination, angiography by selective catheterization may be able to localize the site of the bleeding but not the cause. Finding a source of bleeding by the use of angiography is dependent upon a constant rate of bleeding of more than 0.5 cc./minute at the time the examination is done. Conversely, esophageal varices may be visualized on the venous phase of celiac or superior mesenteric angiography, although bleeding from the varices may frequently not be identified.

When the bleeding site has been localized, the catheter can be placed appropriately for the subsequent infusion of vasopressin or other agents for the control of bleeding. Barium studies should not be done if angiography is contemplated, because the barium may impair the localization of the site of bleeding. In addition, barium studies would also delay the performance of any endoscopic examination. Visceral angiography is a rapid and safe procedure in adults; its experience in children has been limited. We have used it in only one case to diagnose a Meckel's diver-
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GASTROENTEROLOGY
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The experimental drug Cimetidine may be the choice for the management of hemorrhagic gastritis.

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PEDIATRIC ULCERS OR ULCERS AND GASTRITIS INDUCED BY DRUGS

In patients with ulcers or gastritis, antacids or nasogastric suction should be started as soon as bleeding ceases. If antacids are used, they should be administered hourly in the acute period following the hemorrhage to maximize their effectiveness. They should be given in this manner during the waking hours for one week. Anticholinergics should be used to inhibit acid secretion during sleep. After one week, the antacids may be given one and three hours after meals. This should be done for three weeks.

If a nasogastric tube is used instead of antacids, it should be put on intermittent suction to aspirate gastric contents. Antacids should not be put down the tube and then aspirated back. After a 24-hour period using a nasogastric tube, it should be discontinued. Antacids should be started, provided bleeding does not recur.

The patient should be fed three meals a day, and caffeine-containing drinks should be withheld from the diet.

New data suggest that the experimental drug Cimetidine® may be the choice for the management of hemorrhagic gastritis. In a limited number of cases, it has demonstrated a profound effect in the reversal of diffuse hemorrhage seen in hemorrhagic gastritis.

If active bleeding continues despite the use of iced-saline lavage or if massive bleeding recurs despite optimal medical management, surgery should be performed. Total replacement of the blood volume in 24 hours is an indication for surgery.

DIAGNOSIS AND TREATMENT OF BLEEDING REFLEX ESOPHAGITIS

Chronic vomiting is the most common symptom of gastroesophageal reflux in children of all

continued
ages. Massive bleeding is uncommon. Patients with bleeding secondary to gastroesophageal reflux should have the head of their bed elevated 30 to 60 degrees. Except during the hours of sleep, they should at all times be given hourly antacids for one month to neutralize gastric acid. Diagnosis of gastroesophageal reflux in infants and children less than 10 years old should be confirmed by performing the Tuttle test or acid reflux test and by measuring lower esophageal sphincter pressure. Children older than 10 years should also have the Bernstein or acid drip test for reflux. A dynamic study, the cine-esophagram, gives a much greater yield of positive results but with a greater radiation exposure. The esophagram gives a low yield of positive studies. If the diagnosis is confirmed, surgical correction of the incompetent lower esophageal sphincter should be done by performing a fundoplication to prevent further reflux, bleeding, and stricture.

**ESOPHAGEAL VARICES**

The two major methods that have been employed in the treatment of variceal hemorrhage are balloon tamponade and the use of vasopressin. The Sengstaken-Blakemore tube, with a single intragastric irrigating channel and an intragastric and an esophageal balloon, and the Linton tube, with a single intragastric balloon and a gastric and esophageal irrigating channel, are the two tubes that gastroenterologists use for tamponade. When either the Sengstaken-Blakemore or the Linton tube is used, the gastric balloon is filled to capacity and is brought into position against the gastroesophageal junction and gastric fundus. Traction is then applied using a traction helmet or another device. If the hemorrhage is not controlled by the intragastric tamponade and the Sengstaken-Blakemore tube is used, its esophageal balloon is inflated. If the hemorrhage is controlled for 24 hours with either tube, the traction is discontinued and the balloons are deflated.

Vasopressin has been used for years in the control of hemorrhage in patients with bleeding esophageal varices. Ten to 20 units of vasopressin are given in 100 cc. of isotonic saline or 5 per cent dextrose water intravenously over a 20-minute interval. This can be repeated at two-to-three-hour intervals as necessary. In addition, intra-arterial infusion of vasopressin through the superior mesenteric artery has been of value in adults for the control of hemorrhage from bleeding esophageal varices as well as other lesions. We have had no experience using this technique in children. The rate of infusion in adults starts at 0.1 unit/cc./minute and is gradually increased to 0.4 unit/cc./minute to control the bleeding if necessary. Surgical ligation of the varices or shunting of the portal circulation is not advised in the first decade of life for bleeding. Virtually all children who have undergone these procedures have had the shunts fail and bleeding recur. The indwelling catheter may be maintained for 72 to 96 hours before its removal. Vasopressin is not without adverse effects, however, since it increases arterial blood pressure, decreases blood flow, and causes coronary artery vasoconstriction.

**MANAGEMENT AFTER THE HEMORRHAGE**

In some patients, the initial evaluation may not have identified the source of hemorrhage. In these cases, the stomach should be cleared completely of blood and repeat en-
Endoscopy performed. This elective endoscopy should be able to identify potential sources of hemorrhage — except an acute gastric or duodenal erosion, which can disappear within two days of hemorrhage. Each patient should be told of the cause if it is recognized; patients in whom it was caused by the ingestion of drugs should be counseled against their use. Iron therapy will frequently be needed to correct the depletion of iron stores. The hemoglobin and hematocrit levels should be periodically assessed, and examination of the feces for occult blood may be indicated in individual cases.

When the patient is asymptomatic, the feces are negative for occult blood, and the hemoglobin and hematocrit levels return to normal, significant hemorrhage from any source can be considered as having ended. However, healing cannot be considered to have occurred. In order to confirm total healing of the source of hemorrhage, repeat barium studies and/or endoscopy should be performed. With reference to peptic ulcer disease, stress ulcers, or gastritis, direct observation of the lesion by endoscopy is preferable for the demonstration of total healing.

Early and accurate diagnosis is critical in formulating the appropriate decisions for management of the patient with upper gastrointestinal hemorrhage.

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