

to keep it draining well. Parenteral fluids are started at this time.

When the 75 cm. mark is reached the patient is fluoroscoped. If the tube is not at the apex of the duodenal cap, it is advanced to this point, and a brief attempt is made to make it turn into the descending portion of the duodenum. If it does not go, we leave it at this point with sufficient slack in the stomach as previously mentioned and return the patient to his room.

Further fluoroscopic observation is not always necessary as one can usually tell when the tube enters the descending duodenum by:

1. The character of the draining contents which will contain much more bile and small intestinal contents, or

2. By giving the patient a drink of colored solution such as grape juice and if the tube is in the duodenum, the juice will not be drained off immediately, or

3. By the characteristic feel of the rhythmic duodenal contractions on the plunger of a syringe when 5 to 10 cc. of air is introduced into the balloon.

After the tube is beyond the descending portion of the duodenum the balloon is inflated with 30 cc. of air and it will pull the tube down the intestine as it is fed into the stomach.

Using this technique we have been able to get the tube into the intestine within 4 hours in about one-half of our cases, within 12 hours (or overnight) in an additional one-third, while in the remaining one-sixth it has taken over 12 hours.

SUMMARY

The mortality rate from intestinal obstruction has been appreciably decreased in this hospital during the past 1½ years. The greatest factor contributing to this decrease has been the use of the Miller-Abbott tube.

Our experience has taught us that the most gratifying results are obtained in post-operative cases complicated by peritonitis and obstruction.

In pure paralytic ileus, decompression with the intestinal tube is the only uniformly reliable therapeutic measure.

Good results are also obtained in all other types of obstruction. The use of the tube is indicated in any case with small intestinal distention except where there is interference to the blood supply of the intestine, or with external hernias. It is particularly useful in obstructions of subacute or chronic nature, which in our experience comprised about two-thirds of the cases admitted with obstruction.

In cases where the obstruction is caused by a self-limiting disease, such as an inflammatory process, intestinal intubation can sometimes obviate a surgical procedure.

Colonic obstructions usually present the greatest difficulty and yield the poorest results for intestinal intubation.

Interference to the blood supply of the intestine remains a surgical emergency and contra-indicates any delay for intubation. It must be remembered that strangulation may occur during the course of intubation and one must always be on the alert for this complication.

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The Treatment of Massive Gastro-Duodenal Hemorrhage by the Continuous Administration of Colloidal Aluminum Hydroxide

(A Report of 144 Cases)

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THE treatment of massive gastro-duodenal hemorrhage as evidenced by hematemesis or melena has been the subject of much discussion in recent years. The acute emergency of hematemesis presents a troublesome therapeutic problem to the physician, and potentially, a serious danger to the life of the patient. Except when the bleeding is slight, hematemesis usually is caused by the opening of an artery or a vein. Since the immediate aim of treatment is to stop the hemorrhage, the same procedure is usually employed, whatever the primary cause of the bleeding. In most instances, the bleeding ceases spontaneously, regardless of the treatment, even with bed rest alone, but a

certain number of patients have continuous or recurrent hemorrhages, which may result fatally. Various procedures have been advocated, with the hope of reducing the number in whom gastric hemorrhage results disastrously, but the mortality rate in these cases is much higher than is realized generally.

Gross hemorrhage is a complication of peptic ulcer in most cases, but it may result from other causes. Rivers and Wilbur (1) found that about 77 per cent of patients with hematemesis have peptic ulcer, about 13 per cent have carcinoma, and the remaining 10 per cent have other causes to account for the bleeding.

Occasionally one sees patients whose sole complaint is the vomiting of blood and the passing of tarry stools, and who have never experienced any pain, dis-

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comfort or indigestion. These patients were thought to have a so-called silent, concealed or asymptomatic ulcer. It is difficult to believe that an ulcer can exist without any symptoms. Surgeons occasionally have operated upon such patients and have found no ulcer; pathologists also have encountered similar situations, in which the stomach was filled with clots of blood, and yet displayed no evidence of an ulcer.

What are the circumstances which may give rise to such a state? Those of us who have had an opportunity to look into a stomach through a gastroscope have often seen areas of focal hemorrhage in the mucosa, varying in size. Occasionally, a mucosal hemorrhage may be sufficiently close to the surface to bulge like a bleb. The records of one thousand consecutive necropsies at St. Luke's Hospital disclosed that 108 cases, or about 10 per cent, showed mucosal hemorrhages in the stomach or duodenum. These varied in size from one millimeter to two centimeters in diameter. It can readily be seen that if one of these mucosal hemorrhages should tear through the mucosa, it would produce a massive hemorrhage, although no evidence of an ulcer would be found, and the patient probably would not have had any symptoms previously.

In taking histories of patients with peptic ulcer, it often is discovered that they have had massive hemorrhages for which no physician had been consulted, and that, immediately following these, the patients had eaten as before, gone back to work the next day, and had experienced no ill effects, except general weakness for several days. In these cases, a complicating ruptured mucosal hemorrhage, and not an ulcer, may have been the source of the bleeding. This type of bleeding would cease spontaneously, regardless of the treatment.

In the present series of 144 cases of massive hemorrhage, there were twenty-nine cases of hemorrhage without a previous history or symptoms of ulcer. There also were twelve cases in which no roentgenographic evidence of an ulcer could be found.

RATIONALE OF TREATMENT

In the past, the treatment of massive gastro-duodenal hemorrhage has consisted, usually, of an initial period of starvation, and often, transfusions of blood or the parenteral administration of saline or glucose. Surgical intervention to find and stop the bleeding point has been advocated also as an emergency measure. If one examines these measures in the light of physiologic knowledge and clinical experience, their rationale may be open to question.

Emergency Operation. Blackford and Cole (2) recently studied the incidence of fatalities from massive hemorrhage, according to age, as based on the vital statistics of the city of Seattle, and found that only two, or 4 per cent, of the fifty-one deaths from hemorrhage due to peptic ulcer, occurred in patients less than forty-five years of age. In the series of 144 cases in this study, three deaths occurred, and all were in patients more than forty-five years of age.

Fatal hemorrhage from peptic ulcer in younger persons is so rare that emergency operation probably never is justified. A single hemorrhage in a person less than forty-five years of age is, certainly, not an indication for operation, although it is conceivable that, in rare instances, repeated hemorrhages might be. A hemorrhage in a person more than forty-five years of age may be an indication for surgery, es-

pecially when the vessels are sclerotic; on the other hand, there is a fair chance that the patient may never have another episode of bleeding.

It must be emphasized that surgical intervention in the presence of gastric hemorrhage entails great risks. If the bleeding be caused by an acute peptic ulcer, operation is likely to be futile, because there is no external indication of the presence of an ulcer, and the stomach must be opened to deal with the bleeding point. The search for this is so difficult that the ulcer often is not found. In such instances, the shock of the operation, in addition to the prolonged hemorrhage, is almost certain to result in the death of the patient. On the other hand, a chronic ulcer is easily found. However, even in the presence of a known chronic ulcer, operation is inadvisable because the chronic ulcer may not be the source of the hemorrhage. It is impossible to exclude, in such cases, the possibility of a complicating acute ulcer, or a mucosal hemorrhage, which would probably never be found at operation. Furthermore, exsanguinated patients, even when they have received blood transfusions, are poor surgical risks.

Transfusion. A clot is not formed readily in a blood vessel spurting a forceful stream of blood. Consequently, the patient must lose a considerable quantity of blood before formation of a clot can take place. Massive loss of blood reduces the blood pressure and diminishes the blood volume, producing a decrease in the force and volume of flow through the injured blood vessel, which facilitates the formation of a clot and thus stops the hemorrhage. If a transfusion were to be given at this time, the blood pressure would be elevated, and again a forceful stream of blood would be expelled from the broken blood vessel, which might prove fatal to the patient. For this reason, transfusion, as well as intravenous injections of glucose or sodium chloride solution, is contraindicated, as a rule, in the presence of massive hemorrhage. Nevertheless, it often is difficult, in the face of an hysterical family, for the physician to refuse this measure.

Christiansen (3), in treating 289 cases of bleeding ulcer, utilized transfusions in only fourteen instances. He is of the definite opinion that transfusions, rather than being beneficial, have caused the mortality rate to increase almost 100 per cent. A protecting low blood pressure, which is an excellent natural mechanism for promotion of clotting, should not be disturbed. If, however, the systolic blood pressure falls below 90 millimeters of mercury, or the hemoglobin decreases below 30 per cent, a transfusion may be indicated, but not more than 250 cubic centimeters of blood should be administered at one time.

Starvation. It is exceptional for a single hemorrhage from a peptic ulcer to lead to death. The striking fact about the fatal cases is that the hemorrhage continued or recurred in spite of medical treatment. The hemorrhage from a blood vessel in the stomach usually ceases as suddenly as it begins, when the bleeding point is plugged with fibrin. Destruction of this fibrin clot by peptic digestion may be the cause of recurrent bleeding. It seems reasonable to suspect that the acid gastric juice digests the plug of fibrin and thus opens the bleeding vessel anew. Recent evidence indicates that after hemorrhage from an ulcer, much acid still remains in the stomach, and if this is true, it should influence the treatment of acute bleeding.

In this connection it is interesting to note that Andresen (4) and recently Meulengracht (5) of Copenhagen, have treated hematemesis and melena by administering food, and in the series of cases Meulengracht reported, the mortality was much lower than in other recorded series of cases of profuse gastrointestinal bleeding. Apparently the food combines with the acid, thus preventing the digestion of the clot. In a group of 286 cases of severe hematemesis and melena in which this method was used, there were only three deaths, a mortality rate of 1 per cent. Meulengracht contrasted the results in this series with those in a similar group of patients, admitted to the hospital in Copenhagen, whose treatment included complete abstinence from food. In this latter group, the mortality rate was 7.9 per cent.

In the past, then, while trying to avoid dislodging the clot by food or peristalsis, we have left the delicate fibrin at the mercy of strong, unbuffered gastric juice. The fact that Meulengracht has been so successful indicates that the danger of digesting the clot is greater than that of dislodging it mechanically.

If this be true, then the treatment of hematemesis should consist of a method which continuously protects the bleeding area from the digestive action of the hydrochloric acid and pepsin. Since exceedingly satisfactory results have been obtained in a large series of cases of uncomplicated peptic ulcer with the continuous administration of colloidal aluminum hydroxide through an indwelling nasal tube, it was determined to try this method in the treatment of hematemesis.

TECHNIC OF TREATMENT

The material used and the method of its administration in cases of hematemesis are the same as those which have already been described for the continuous control of acidity in peptic ulcer (6, 7, 8). Colloidal aluminum hydroxide is a gelatinous substance, mildly astringent and non-irritating. It is amphoteric, and hence its continuous administration presents no danger of alkalosis. Because of its astringent effect, colloidal aluminum hydroxide hastens the coagulation of blood. Thus the purpose of the continuous administration of colloidal aluminum hydroxide in hematemesis is to promote the formation of a clot, and then to protect the delicate fibrin from the action of strong, unbuffered gastric juice. That colloidal aluminum hydroxide actually does prevent digestion of the fibrin clot can be demonstrated experimentally in a test tube.

As soon as a patient with melena is admitted to the hospital, a soft nasogastric tube is passed through the nose to the cardiac end of the stomach, and the drip treatment is begun. If hematemesis is present, the patient receives colloidal aluminum hydroxide by mouth every hour until vomiting ceases; then the drip treatment is begun.

These patients receive a soft bland diet every two hours, which is the same as that administered to other patients with peptic ulcer. To induce rest, the hypodermic administration of sodium phenobarbital is preferred to that of morphine, because morphine not only interferes with the normal functioning of the gastrointestinal tract, but also has the undesirable effect of causing emesis, in some instances. Small transfusions, usually about 250 cubic centimeters of blood, are given, if indicated.

The technic of administering colloidal aluminum hydroxide by the drip method has been described previously. This method of treatment requires hospitalization of the patient. The colloidal aluminum hydroxide diluted to a 33-1/3 per cent suspension, is continuously instilled into the stomach through a nasogastric tube, at the rate of about fifteen drops each minute, during the night as well as during the day, for ten days. The flow of the drops is regulated and controlled by a special apparatus.

The indwelling nasal catheter was the source of considerable difficulty in some of the early cases. When a small Levin tube was used, the lumen was so small that it would become occluded by particles of food regurgitating back into the tube, or by a thick coating on the walls of the tube of the aluminum hydroxide itself. This, of course, caused cessation of the flow, and necessitated troublesome irrigations of the tube, which corrected the difficulty only temporarily, and therefore had to be repeated frequently. When a large Levin tube was used, many patients complained of soreness in the nose and throat, even when the tube was well lubricated with mineral oil, and frequently they would remove the tube themselves when the discomfort became too great.

These difficulties were overcome by the use of a soft, collapsible, thin rubber tube (9), about 3/16 inch in diameter, which is passed through the nose into the stomach with the aid of a silkworm-gut suture. This tube has entirely eliminated the difficulties of obstruction of the lumen and discomfort to the patient which were experienced with the Levin tube. The nasogastric tube is passed only as far as the lower end of the esophagus. This precaution eliminates the rare possibility of any danger of trauma to the lesion, by the tube.

In the few instances in which patients objected to or could not tolerate the nasogastric tube, the medication was administered by mouth. One ounce of a 33-1/3 per cent suspension of colloidal aluminum hydroxide in water is given every hour during the day until the patient retires and thereafter he is awakened every two hours during the night to receive the same dose. Usually, a sedative is administered in the evening, so that the patient may fall asleep promptly after being aroused for the medication. With the drip method, of course, the patients rest all night without interruption.

Inasmuch as the astringent action of aluminum hydroxide causes some constipation, mineral oil is given daily, or an enema every other day.

RESULTS OF TREATMENT

In a period of a little more than four years, from September, 1935, to December, 1939, 144 patients with hematemesis or melena were treated with colloidal aluminum hydroxide at St. Luke's Hospital. This group includes only those patients who were admitted as emergency cases for the treatment of massive hemorrhage as the leading, often the only symptom. They had been vomiting bright red or dark blood, or had bloody or tarry stools, together with secondary anemia sufficient to produce weakness, pallor, dyspnea or rapid pulse. Patients who had blood-streaked, or occasional "coffee-grounds" vomitus, occult blood in the stools, or rare tarry stools were not included in this group.

One hundred and twelve of the patients were men and thirty-two were women. Only four patients were colored persons. Hemorrhages are not more common in older than in younger persons, and in charting the ages by decades in this series, it is found that the number of cases of massive hemorrhage is approximately the same in each decade, between the ages of twenty-one and sixty years. (Table I)

Ninety-nine patients had duodenal ulcer; twenty-two had gastric ulcer; seven had both types. There were four marginal ulcers, and in twelve cases, no lesion was found.

The colloidal aluminum hydroxide was administered by the drip method in eighty-six cases; in forty-two instances, the patients received the medication orally; in sixteen, colloidal aluminum hydroxide was given by both methods.

In this series of 144 cases of massive hemorrhage, there have been but three deaths. It is interesting to contrast this mortality rate of 2 per cent with that observed at the same hospital in the five-year period preceding the inauguration of this form of medical treatment, when the mortality rate in these cases was 28 per cent. All three deaths occurred within a period of forty-eight days, during November and December,

TABLE I
Age incidence in 144 cases of massive hemorrhage

Age of Patients	Number of Cases
Less than 21	2
21 to 30	32
31 to 40	36
41 to 50	36
51 to 60	30
More than 60	8

1937. Since then, eighty-seven additional cases have been treated, without a death.

All three patients who died were white men, aged forty-five, fifty-one and fifty-six years, respectively.

The first patient, aged forty-five years, had had a duodenal ulcer for seven years, and had been vomiting blood for two weeks before admission to the hospital. The drip treatment was administered for twelve days, during which time he received two transfusions, and death occurred following a severe hemorrhage on the twelfth day. Necropsy revealed a chronic duodenal ulcer, one centimeter in diameter, with a large artery (gastro-duodenal artery) protruding from its base.

The second patient, aged fifty-one years, gave no history of an ulcer, but had been vomiting considerable blood for two days before admission. He received colloidal aluminum hydroxide orally for five days, during which time he received two transfusions. This patient died on the sixth day, and autopsy revealed a superficial ulcer on the posterior wall of the stomach,

about 1.5 centimeters in diameter. Projecting from one end was a large vessel (a large branch of the left gastric artery) of which about four-fifths had undergone necrosis. There was also evidence of generalized arteriosclerosis.

The third patient, aged fifty-six, had complained of epigastric distress for about three months, and had severe hematemesis at the time of admission. He received colloidal aluminum hydroxide orally for three days and had two transfusions, but died on the fourth day. It had been impossible to obtain a roentgenogram of this patient's stomach and permission for an autopsy was refused.

SUMMARY AND CONCLUSIONS

One hundred and forty-four patients with massive hemorrhages resulting from gastric or duodenal ulcer were treated by the continuous administration of colloidal aluminum hydroxide. In this series, there were three deaths, or a mortality rate of 2 per cent, as contrasted to a mortality rate of 28 per cent during a similar period at the same hospital, preceding the inauguration of this form of medical treatment.

The continuous administration of colloidal aluminum hydroxide in massive gastric hemorrhage presents certain advantages over other methods of treatment:

1. It is a harmless, non-absorbable astringent which is capable of hastening the formation of a clot.

2. By virtue of its antacid properties it can prevent the digestion of the clot by continuously neutralizing the excess acid in the stomach, without danger of alkalosis.

3. Because it is a gelatinous substance, it has the additional advantage of mechanically protecting the lesion.

4. As the result of continuous administration of colloidal aluminum hydroxide, both day and night, the delicate granulation tissue formed in the process of healing is not destroyed by the accumulation of acid during the night, and thus the lesion is permitted to heal.

This treatment accomplishes a two-fold purpose: it arrests the bleeding and protects the ulcer, to facilitate its healing.

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