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Role of the Pulsatile Thrust of the Aorta in Genesis of Gastric Ulcer.* (25829)

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A jet stream of gastric juice obtained by overnight aspiration from the stomach of patients with duodenal ulcer, projected intermittently over a period of hours, at an ejection pressure of 30 cm of H₂O will produce ulceration in the duodenum of rabbits quite regularly(1). Even perforation of the duodenum has been observed as early as 1.5 hours following commencement of the jet perfusion. On the contrary, a constant flow at the same pressure produces little injury to the duodenum. During the past year, bleeding was observed from the stomach of a patient in whom that viscus had been elevated into the thorax 15 years previously as replacement of the esophagus, for a high-lying cancer. At the recent operation, the pulsatile thrust of the aorta upon the lesser curvature of the stomach, site of origin of the gastric bleeding, was very obvious. This observation suggests the need of assessing the role of the pulsatile aortic thrust in genesis of gastric ulcer.

Methods and materials. Adult mongrel dogs were operated upon under pentobarbital anesthesia. In Group I, through a left subcostal incision, the postero-lateral aspect of the diaphragm was incised exposing the aorta

which was dissected free for 3 cm cephalad to the celiac artery. The anterior wall of the stomach was placed behind this segment of the aorta and either sutured back onto itself or to the left lateral abdominal wall (Fig. 1A). In another group of dogs (1A), 30 mg of histamine in beeswax was given intramuscularly once daily to determine whether augmentation of gastric secretion would accelerate ulcer production under these circumstances. In Group II, the stomach was placed behind the aorta of dogs in the same location, with this difference: the aorta in the chest was divided and aortic continuity re-established by a Teflon graft (Fig. 1B). In consequence, there was no forward blood flow through the segment of the aorta, behind which the fundus of the stomach was placed. To insure absence of pulsations in the portion of the aorta overriding the stomach, an aortic ligature was placed just proximal to the celiac artery. There were 12 dogs each in Group I and Group II, and 6 dogs in Group IA. Upon recovery from operation, all the dogs were fed *ad libitum*.

Results. In Group I, 9 of 12 dogs (75%) died as a result of development of ulceration at the area subjected to the thrust of aortic pulsations. Of these 9 dogs, 5 succumbed

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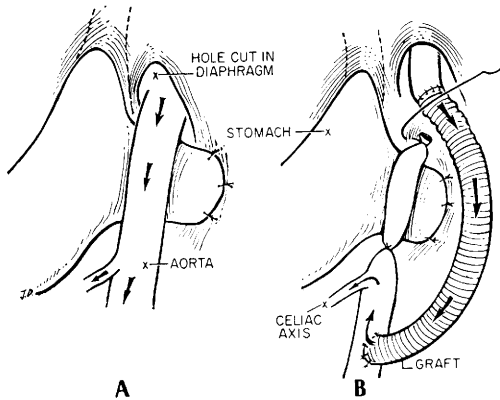


FIG. 1. A. Area of retroaortic placement of stomach. B. Control procedure with segment of aorta overriding stomach without pulsatile flow.

suddenly following a massive upper gastrointestinal hemorrhage secondary to acid-peptic erosion of the gastric and aortic wall with formation of a gastroaortic fistula. Time of appearance of fatal ulceration was between 4 and 17 days with a mean of 10 days. One dog died on the 12th postoperative day without developing an ulcer. The remaining animals are living and well, more than a month following surgery.

In Group IA, 3 dogs succumbed less than 5 days postoperatively, without evidence of gastric ulceration. One of the dogs died 5 days postoperatively, as the result of massive upper gastrointestinal hemorrhage secondary to perforation of a gastric ulcer into the aorta. Another dog died 12 days postoperatively and had a small ulcer in the gastric mucosa overlying the aorta. The remaining animal is alive, 28 days after his operation.

In Group II, there have been 3 deaths, all more than one week postoperatively and no evidence of gastric ulceration has been observed. The longest survivor amongst the 3 fatalities died 22 days following the procedure. The remaining 9 survivors appear to be free from ulcer up to more than 2 months after operation.

Discussion. It is evident from these experiments that the pulsatile thrust of the aorta upon the stomach evokes ulceration of

the mucosa with eventual perforation of the viscus, either into the free peritoneal cavity or directly into the aorta with establishment of a gastro-aortic fistula. Local venous obstruction, which has been shown to potentiate development of ulcers(2), is present to the same extent in all groups of animals and thus is not a determining factor. Histamine hypersecretion has not decreased significantly time of appearance of the gastric ulcers.

It is well known that gastric ulcer in man is accompanied frequently by a gastric juice of relatively low volume and digestive power, as compared with the larger volumes, greater acidity and peptic power of gastric juice in patients with duodenal ulcer. Moreover, gastric mucosa is extraordinarily refractory to injury by the gastric juice compared with the very susceptible esophageal epithelium and with duodenal mucosa. In fact, since the time of John Hunter, investigators have continually been asking themselves: why does the stomach not digest itself?

In any position, the stomach of the dog falls away from the aortic pulsations. In man, whether he sits, stands or lies supine, the thrust of aortic pulsations makes itself felt upon his stomach. Perhaps one of the best treatments for gastric ulcer would be to have the patient assume the prone position for long periods of time whenever possible.

Conclusions and summary. 1. Retroaortic placement of the fundus of the dog's stomach is followed by development of gastric ulcer at site of impingement of the aortic thrust upon the gastric wall. Perforation with formation of a gastroaortic fistula was a frequent sequel. 2. It is not unlikely in man that the mid lesser curvature gastric ulcer owes its origin in part to the thrust of aortic pulsations.

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