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Evaluation of a Satisfactory Operation for Ulcer.

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For half a century surgeons have been performing operations upon the stomach for the relief of ulcer without knowing actually what are the criteria of a successful operation. A few years ago, an effort was made in this clinic to attempt to define some of the attributes of a satisfactory operation for ulcer. Within a few years,² it became apparent what some of the characteristics of a satisfactory operation are for ulcer in man. In the meanwhile, employing Code's scheme of liberating histamine slowly from beeswax,³ a satisfactory scheme for producing ulcer in experimental animals has been developed.⁴ By implanting daily a suitable dose of histamine-in-beeswax, ulcer can be produced quite regularly in the majority of commonly available small animals.⁵ This method of producing ulcer affords an excellent scheme of assessing the protection afforded by a given operation. It is the purpose of this communication to report the observations and experiences of such a study.

Procedure. Adult mongrel dogs only were used in this study. Each procedure (Fig. 1) was performed in 4 dogs. All anastomoses were done by employing the closed aseptic technique. Following operation, the dogs were allowed to recover for 3 months. They were then injected daily with 30 mg of the

histamine-beeswax mixture; the injections being made intramuscularly along the spinal muscles and multiple sites were used to permit a better distribution and liberation of the histamine. The injections were done at about 5:00 p.m. following which the dogs' feed pans were removed and no more food given until the following morning. All the surviving animals were sacrificed at the end of 40 days. Obviously moribund animals were sacrificed earlier in order to obtain fresh specimens. Control dogs were injected with each series of animals.

Results. Group I. Gastrojejunostomy—Two of the dogs died after 3 and 13 injections respectively, of large 1.5 to 2 cm perforated jejunal ulcers. The other 2 dogs survived the injection period and at autopsy both showed large jejunal ulcers. All ulcers were on the jejunal side of the anastomosis and there were no duodenal or gastric ulcers.

Group II. Small Gastric Resection or Antral Excision—All dogs developed large jejunal ulcers from 1 to 3 cm in diameter. Three of the 4 dogs survived the 40-day injection period. The other dog was sacrificed after 35 injections; moribund from hemorrhage from a large jejunal ulcer.

It is thus apparent that neither of these two procedures furnished any protection against the development of ulcer.

Group III. Extensive Gastric Resection, 75%, and Group IVA, Extensive Gastric Resection with Excision of Antral Mucosa will be considered together as they are fundamentally the same operation except for a technical variation in inversion of the duodenum.

In the IVA operation, the antral mucosa is also excised, and the antral musculature is utilized to effect a satisfactory closure of the duodenal stump. None of the 8 dogs in these two groups developed any evidences of jejunal ulcer and all dogs survived the 40-day

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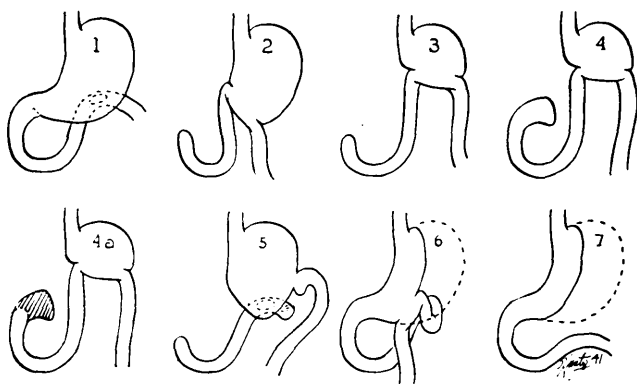


FIG. 1.

Types of operative procedure employed in assessing its protective influence against the development of ulcer provoked by histamine-in-beeswax:

1. Gastrojejunostomy.
2. Antral excision.
3. Three-quarter gastric resection.
4. Finsterer exclusion operation.
- 4A. Finsterer exclusion operation with removal of antral mucosa (size of gastric resection the same in 3, 4, and 4A).
5. Schmilinsky operation of antral excision with total intra-gastric regurgitation.
6. Fundusectomy with gastrojejunostomy.
7. Fundusectomy.

injection period. In 4 of the animals a few scattered superficial erosions were noted in the gastric pouch but the jejunum in each instance was entirely normal. This operation would thus appear to furnish satisfactory protection against the development of ulcer.

Group IV. Finsterer Antral Exclusion—Three of the 4 dogs in this series survived the 40-day injection period. There were no evidences of jejunal ulceration or erosion; however, numerous submucosal hemorrhages and superficial erosions were noted throughout the gastric pouches.

The other dog expired after 32 injections and showed a rather marked jejunitis and gastritis of the residual pouch but no definite ulcer.

This operation as well as the small gastric resection (Group III) offer the opportunity of testing the validity of the Edkins' "gastric" hypothesis. The antrum is alleged to be the source of a hormone "gastrin" which stimulates the secretion of acid from the corpus and fundus of the stomach.

The results noted in the dogs upon which the small gastric resection was done would

tend to invalidate this thesis, for despite complete excision of the antrum, all animals developed jejunal ulcer. There are more changes noted in the gastric pouch in the antral exclusion operation but the findings in the jejunum are not unlike those in which the antrum has been removed. It would thus appear that this operation would not support the Edkins' thesis either, although the changes in the gastric pouch might be interpreted as evidences of increased stimulation.

Group V. Schmilinsky Operation. This procedure includes antral excision with implantation of the proximal loop on the fundus of the stomach to insure complete intra-gastric regurgitation. Three of the 4 dogs died after 2, 8, and 11 injections, respectively, of large perforated jejunal ulcers varying in size from 1 to 3 cm. The other dog survived the injection period but showed a typical jejunal ulcer at autopsy. It is thus apparent that this operation increases the development of jejunal ulcer rather than offering any protection.

Group VI. Fundusectomy with Gastrojejunostomy. All dogs survived the injection

period. One dog developed a superficial duodenal erosion and 2 dogs developed a rather marked antral gastritis. No definite pathologic change was noted in the other dog.

Group VII. Fundusectomy. This procedure includes excision of the acid-secreting area, as described by Connell. All dogs survived the injection period. One dog developed a 1 cm duodenal ulcer just distal to the pylorus and two dogs developed duodenal erosions with marked antral gastritis. The other dog showed a mild antral gastritis.

It would appear that these latter 2 procedures offer relatively satisfactory protection against the development of ulcer but not as

complete as the extensive gastric resection.

Conclusions. The extensive gastric resection (operations III and IVA) offer the best protection against the development of jejunal ulcer. No jejunal ulcer developed and all dogs survived the injection period.

Gastrojejunostomy, the small gastric resection and the Schmilinsky operation offer no protection. All animals developed jejunal ulcer with employment of the histamine-bees-wax technique.

The small gastric resection and the antral exclusion operations would suggest that the Edkins' "gastrin" hypothesis is invalid.

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Morphogenetic Effects of Ultraviolet Radiation.

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Holtfreter has recently described¹ the physical properties of the superficial membrane (the "surface coat") of the early Amphibian embryo, and has indicated² ways in which it may play an important role in morphogenesis. Ultraviolet radiation would seem an excellent means for further study of the surface coat, since this type of energy penetrates poorly, and methods have been worked out which permit its localization in any given region of the embryo.³

In surveying the literature on the effects of ultraviolet radiation on embryonic cells, a number of discrepant observations become apparent. On the whole, ultraviolet exerts an inhibitory effect, but various stimulatory effects have been described, for which it is difficult to account. Thus Hinrichs⁴ found

various degrees of inhibition in *Fundulus* embryos, but a few were stimulated, presumably because they were affected by only a small dose of energy. In a general discussion Hinrichs⁵ later asserts that although vertebrate embryos may be stimulated with ultraviolet, this is to be done only with difficulty. Higgins and Sheard⁶ obtained a transitory speeding up of gastrulation in *Rana pipiens* eggs, but otherwise describe no stimulatory effects. Brandes⁷ found that while most of his amphibian embryos showed inhibitory effects on the radiated side, others were stimulated, showing more rapid gastrulation movements and increase in mass on the radiated side. As a preliminary to the further use of ultraviolet energy, the present study was carried out with the aim of ascertaining conditions under which consistent and reproducible effects may be obtained.

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⁵ Hinrichs, Marie A., *Proc. Soc. Exp. Biol. and Med.*, 1928, **26**, 175.

⁶ Higgins, G. M., and Sheard, C., *J. Exp. Zool.*, 1926, **46**, 333.

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