Colon Blood Flow

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I
formation concerning blood flow in the large intestine of man, par-
ticularly in the small vessels, is limited; perhaps in part because many
of the technics of measurement applicable to experimental animals cannot
be used in humans. The purpose of this report is to delineate some of the
circumstances under which changes in the blood flow in the human colon
do occur and, thereby, to illustrate a few of the mechanisms mentioned by
Dr. Haddy in his contribution to the symposium.

All determinations were made on the mucosal or luminal side of the
colon in human subjects, some normal and some with colostomies. The
technics of measurement were not quantitative, so the data indicate only
an increase or a decrease in blood flow. Moreover, they reflect blood flow
only in the mucosa and submucosa rather than that of the total colon. For
these reasons, a few preliminary remarks are in order concerning the vascu-
lar anatomy of the colon and the technics used in these experiments.

The anatomy of the main branches of the mesenteric vessels is well
known, but that of the intrinsic vessels of the colon is less familiar. The re-
cent studies of Brockis and Moffat and of Griffiths have helped to clarify
the distribution of these intramural vessels and their plexuses. The arteriae
rectae pierce the muscle coat of the colon and then give off a number of
branches in the submucosa before continuing on towards the antimesen-
teric border. Some of these submucosal branches anastomose with branches
of the neighboring arteriae rectae to form the primary submucous plexus.
Other branches of the arteriae rectae continue toward the mucosa to
anastomose with similar branches and with branches rising from the pri-
mary submucous plexus to form the secondary submucous plexus. The sec-
ondary submucous plexus lies on the external side of the muscularis mu-

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cosae and gives rise to small arteries which pierce the muscularis mucosae to form the mucosal plexus on its internal side. Very fine arteries arise from the mucosal plexus and pass vertically to supply the mucosa. In general, the venous system follows a similar pathway to the arteries and forms similar plexuses. It has been postulated, but not definitely shown, that intramural arteriovenous anastomoses exist, a vital question in any evaluation of the blood flow.

METHODS

Five principal methods to determine changes in blood flow have been used in the studies under discussion. They are not as elegant as the methods used in experimental animals, but have provided useful information in humans. The results obtained by these technics probably represent the sum of the blood flow in the submucosal plexuses, mucosal plexus, and the mucosal vessels.

**Needle Thermocouple**

Continuous temperature recordings are obtained using a fine needle thermocouple inserted directly into the mucosa of the colon. This method can be used only in patients with colostomies and it produces some interruption of the local integrity of the vessels. Furthermore, there may be temperature variations up to 1.5°C. between different parts of the exposed bowel when the area of the colostomy is large.

**Heated Thermocouple Rectal Recorder**

This instrument, which may be used in patients with intact colons, consists of a small copper sphere which is heated by a constant electric current to a temperature of 1–2°C. above the resting rectal temperature. An inverse relationship exists between the temperature of the sphere and the rate of blood flow through the surrounding tissues. The temperature difference between the heated sphere and a “cold junction,” also rectally inserted, yields a rough qualitative measurement of blood flow.

**Stoll-Hardy Radiometer**

This instrument introduces the fewest artifacts, but measures only radiant heat and can be used only in patients with colostomies. The major source of inaccuracy is the moisture on the surface of the mucosa of the colostomy.

**Graded Color Changes**

Changes in the color of the exposed colostomy mucosa are compared to a graded hemoglobin scale under standardized lighting conditions.