GOLDEN

PATHOLOGIC EXAMINATION OF THE SMALL INTESTINE

THOMAS

Radiologic Examination of the Small Intestine

2nd Edition

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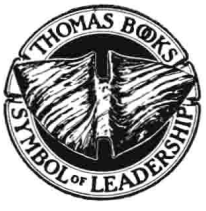

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PREFACE TO THE SECOND EDITION

The purpose of this edition is that stated in the Preface to the first edition, that is to continue the assembling of information which seems to be helpful in understanding the significance of the x-ray examination of the small intestine. In these pages the intention is to apply the lessons of anatomy and physiology to clinical problems as they are disclosed by this method of examination.

Much new work on the small intestine has appeared and additional information concerning the anatomical structure and the physiology of the small intestine has become available. Some of this information has proved to be helpful. Evidence of differences in function of different portions of the small intestine has been demonstrated which may play a part in the specificity of malabsorption of certain food elements in some of the nutritional disorders.

On the other hand, puzzling observations have emerged from routine examinations which at present seem to defy explanation. We have been taught that one of the functions of the parasympathetic nervous system is to increase tonus and peristalsis. Yet it seems that a discrepancy in these two effects of parasympathetic action is not infrequently observed. Rapid propulsion may be associated with low tonus; slow movement of the barium content may occur with high tonus. Changing ideas concerning norepinephrine versus epinephrine as the physiologic antagonist of the parasympathetic are of interest, but specific information concerning possible differences in the effect of these two substances on the intestine does not seem to be available at present.

The loss of response of the intestine to anticholinesterase drugs which inhibit the destruction of acetylcholine seems to be of great significance. It indicates that a deficiency of acetylcholine exists because production or liberation of acetylcholine in the wall of the intestine is insufficient under existing conditions. This in turn suggests a disturbance in the production or availability in the intestinal wall of this important substance, possibly because of electrolyte imbalance or deficiency in the quantity or quality of enzymes, co-enzymes, protein, etc. It is important to recognize this insufficiency of acetylcholine as a functional condition which may be reversible as in hypokalemia.

Another possible factor in diminution of acetylcholine effects is the permeability of the effector cell membrane. The gas distention of the intestine in porphyria disappears during spontaneous remissions of the disease. Does the porphyria affect adversely the permeability of the membrane of the smooth muscle cells or does it combine with and inactivate the acetylcholine in the intestinal wall when the disease is active? Whatever the mechanism, the disorder is reversible.

These examples emphasize the importance to clinical medicine of continued investigation of the physiology of the small intestine which will undoubtedly provide more information concerning certain functions which are now obscure.

In addition to functional disorders, the ability of radiologic methods of examination to disclose abnormalities produced by organic disease of the small intestine has been amply established. Obviously the examination must be carefully done and the interpretation based on an understanding of the physical effect of the disease on the wall of the intestine.

In the following pages, as is customary, the values for blood protein are given in grams-percent and those for electrolytes in milligrams-percent, but the units are not repeated. Where milli-equivalents per liter are used, the unit (mEq/L) is given.

A small intestine study necessitates the exposure of several films and one or two fluoroscopic observations. The possible hazard to health of exposure to x-rays during diagnostic procedures is causing considerable discussion at present. Actually some of the potential dangers from x-ray have been known for more than half a century. The development of atomic fission was followed by a great deal of experimental work on the biological effects of ionizing radiation from any source. Two hazards have been emphasized in the public press, namely the possible shortening of the life of the irradiated individual and the possibility of future genetic effect. Many of the opinions regarding potential damage to patients are based on the effects of whole body irradiation of animals; in some of the published reports, these experimental results, with an admixture of fanciful imagination, are extrapolated to humans who undergo roentgen examinations, but who do not have whole body irradiation. Some writers have even attempted to estimate the number of days a life might be shortened by one examination of the chest. Throughout the past half century longevity has steadily increased. The decrease in infant mortality and the increase in the average length of life has continued during the past three decades during which radiologic methods of examination have undergone great development and extensive application in medicine. The great increase in the accuracy of diagnosis by means of x-ray methods of examination has played no small part in the extension of the human life span. Unfortunately some patients have refused x-ray examinations because of fear engendered by unwarranted or inaccurate statements in the public press. Avoidance of an x-ray examination may be a great hazard as it may readily result in failure to detect disease.

Stone* discussed the various factors involved in the problem of exposure to x-rays in diagnostic procedures and placed them in their proper perspective in relation to other hazards of life. Genetic effects following irradiation of gonads were demonstrated in animals many years ago; geneticists believe that they may

*Stone, R. S.: Common sense in radiation protection applied to clinical practice. *Am. J. Roentgenol., 78*:993-999, 1957.

appear in humans in future generations although as yet none have been observed. Mutations, however, may be produced by causes other than ionizing radiation. Nevertheless this potential hazard cannot be ignored. No x-ray examination should be requested by a physician without clear evidence of the need for it and clear understanding of its purpose. The examination should be done by a properly trained physician aware of the potential dangers of ionizing radiation. All measures which do not hamper the examination should be adopted to minimize the amount of radiation absorbed in the body, to delimit accurately the area over which it is applied and to protect the gonads of young individuals. The amount of radiation required for diagnostic procedures can be reduced by the use of high voltage current, a thick filter, a long target-film distance, high speed films and intensifying screens, and careful delimitation of the size of the field by the use of adjustable rectangular cones. Ardran**, and Billings, Norman and Greenfield*** have shown that these methods greatly reduce the amount of radiation absorbed in the body. When these precautions are taken, these writers calculate that the average gonadal dose of radiation due to x-ray examinations accumulated through age thirty is less than twenty-five per cent of the dose accumulated during that time from natural background radiation. With all due regard for potential dangers from radiation, care must be taken to avoid depriving a patient of the benefit of an x-ray examination which may disclose an immediate hazard to his health or even to his life.

Again I am happy to express my gratitude for material contributed by radiological colleagues in the United States and other countries. Individual acknowledgments are made in appropriate places.

My thanks are due Mrs. Margaret Szenes-Dugo, New York, and Mrs. Joan Guiberson, Los Angeles, for their secretarial help. I am indebted to Dr. Michael J. Lepore, New York, for valuable suggestions particularly in Chapter XVI. Dr. Andrew H. Dowdy, Chairman of the Department of Radiology of the University of California at Los Angeles, kindly made the skillful services of the departmental photographer, Mr. Paul Stout, available to me.

To Mr. Charles C Thomas I am most grateful for his sympathetic understanding of certain unavoidable delays in the completion of the manuscript. The courtesy and help of Mr. Payne Thomas, of Mr. Warren H. Green and of other members of the publishing staff are much appreciated.

R. G.

**Ardran, G. M.: The dose to operator and patient in x-ray diagnostic procedures. *Brit. J. Radiol., 29*:266-269, May 1956.

***Billings, M. S., Norman, A., and Greenfield, M. A.: Gonad dose during routine roentgenography. *Radiology, 69*:37-41, 1957.

PREFACE TO THE FIRST EDITION

The material presented in the following pages has been assembled in an attempt to collect information which, at the present time, seems to be helpful in understanding diseases and disorders of the small intestine. The discussions of various topics will not be all-inclusive from the standpoint of the anatomist, the physiologist, and the pathologist, as they were presented from the point of view of a radiologist. The basic facts concerning the action and control of the small intestine are of importance to the surgeon and the internist who have to deal with the problems of abdominal diagnosis and the treatment of intestinal disorders. Familiarity with these facts is even more important for the radiologist who tries to study this complex structure by roentgen methods. No attempt has been made to discuss the treatment of disease of the intestine.

Of particular interest are the newer ideas concerning the transmission of nerve impulses, sometimes called the "chemical mediator" theory. Continued research in neuromuscular physiology will undoubtedly yield more knowledge concerning the influences which modify the production of acetylcholine and its destruction by choline esterase. Then it certainly will be possible to understand and perhaps to control abnormal physiologic conditions which are now obscure. Examples which may be mentioned are the motor disorders of the small intestine associated with disease of the liver, injuries of the spine, and the mechanism of the action of morphine.

This material has been assembled over a period of many years. Much of it has been presented at instructional courses at the meetings of the American Roentgen Ray Society and the Radiological Society of North America. In fact, preparation for these courses was a potent stimulus and the first manuscript was prepared for distribution as an "outline" of the course given at the Cleveland meeting of the Radiological Society in 1940. Many instructive cases have been sent to me by colleagues from various parts of the country. Acknowledgments are made later in individual cases, but I wish here to express my appreciation for these valuable contributions to the collection. Time has not been available for a complete review of the literature. Apologies are offered to those who deserve credit for priority in certain observations.

It is interesting to note the evolution of interest in the small intestine during the last decade and a half. In times past, the small intestine was largely ignored. Some of the patients whose histories are summarized in connection with illustrations were referred for psychotherapy before evidence of organic disease of the small intestine was demonstrated. At the present time, it is obvious that the more attention paid to it, the more rewarding is its study by roentgen methods.

Tribute is due to two pioneers in the roentgen investigation of the small intestine: Professor Gösta Forssell of Stockholm and Dr. Lewis Gregory Cole of New York. My first study of the small intestine was done in 1928, under the stimulus of a remark by Dr. Cole, in an attempt to rule out organic disease in a case of apparent pseudocyesis.

Success in the use of radiologic methods of examination rises in proportion to the cooperation of clinician and radiologist. In no field is sympathetic discussion of the clinical problem and the roentgen findings more vital than with the small intestine. In the present state of knowledge it is often impossible to make a "diagnosis" in the strict sense of the term, yet the roentgen observations may offer the wise doctor a lead which will be of great assistance in selecting therapeutic or further diagnostic procedures. In many cases, variations from the usual appearance of the barium shadows of the intestine will be recognized, the significance of which cannot be understood, but this should be stimulating rather than discouraging.

This book has been prepared for publication under the stress of war conditions. Although its purpose is simple, it may seem incomplete: this is due in part to the extensive ramifications of the subject but more particularly to the certainty that new and important work is coming which will help solve some of the many problems in intestinal physiology. Even during the period of its preparation for publication, the book has been altered to include some recent observations. The study of the small intestine is in its early stages. Undoubtedly much significant new information concerning its normal physiology and its disorders will become available in the near future.

The opaque medium used for the study of the small intestine is pure barium sulfate. It has become customary to refer to this material simply as "barium." Some editors of medical publications object to this abbreviation and pedantically insist on "barium sulfate meal" instead of "barium meal." However, the term sanctified by custom has prevailed in the following pages and the reader may safely assume that "barium" means "barium sulfate."

Grateful acknowledgment is due the American Journal of Roentgenology and Radium Therapy, Radiology, Review of Gastroenterology, and Thomas Nelson and Sons for permission to use again a number of illustrations which have been published previously.

Many colleagues on the staff of the Presbyterian Hospital and the College of Physicians and Surgeons have patiently answered questions and have made many helpful suggestions. To Dr. Edith Sproul and Dr. Homer D. Kesten, of the Department of Pathology, I am indebted for some photomicrographs of the intestinal wall. I am grateful to Dr. Arthur Purdy Stout, Director of the Department of Surgical Pathology, for many photographs of specimens; to Dr. John Caffey, Radiologist of the Babies Hospital, who supplied some films

as well as helpful suggestions; to Dr. Walter W. Palmer, Director of the Department of Medicine, for his stimulating criticism of the manuscript; to Dr. David Nachmansohn who kindly reviewed the statements concerning neuromuscular physiology; to Mrs. Haig H. Kasabach for the drawings of the rotation of the intestine and of the Miller-Abbott tube, and to Miss Paullynn Stines, R.N., for information concerning the reaction of patients receiving treatment with the Miller-Abbott tube. Many of my Associates and Residents in the Department of Radiology have called my attention to interesting observations. I wish also to express my appreciation of the courtesy and helpfulness of the editorial staff of the J. B. Lippincott Company.

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