

# Pioneer Gastroenterological Radiology Studies

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## Abstract

In the middle third of the 20th century, Mount Sinai radiologists were able to describe and establish specific radiologic criteria for the diagnosis of many gastrointestinal diseases. They then delineated specific radiologic patterns to diagnose such diverse conditions as inflammatory bowel disease of the small bowel and colon, protein-losing disorders, vascular disease of the small bowel, benign and malignant tumors, metastases and lymphoma of the gastrointestinal tract. Richard H. Marshak, Bernard S. Wolf, and Mansho T. Khilnani were the leaders in these radiologic investigations which established criteria that enabled generations of subsequent radiologists to arrive at definitive diagnoses.

**Key Words:** Small bowel radiology, regional enteritis, Crohn's colitis, inflammatory bowel disease, diverticulitis, esophagus.

## Introduction

STIMULATED BY THE ABUNDANCE of clinical material provided by the gastroenterologists on the staff of The Mount Sinai Hospital from the 1930s through the 1960s, Mount Sinai radiologists were able to collect, catalog, correlate and establish specific radiologic criteria for the diagnoses of a number of gastroenterological diseases and conditions, so as to enable generations of subsequent radiologists and gastroenterologists to arrive at definitive diagnoses.

## Regional Enteritis

Once "regional enteritis" (Crohn's disease) had been described by Crohn, Ginsburg and Oppenheimer (1) and was generally accepted as a disease, many patients came to Mount Sinai's GI Clinic for treatment. And many came specifically to see Dr. Crohn himself, at his private office. In 1944, Dr. Richard H. Marshak joined Dr. Crohn's practice as his radiologist, at 1075 Park Avenue,

New York, and had the opportunity to perform appropriate barium examinations on many patients with ileitis and other gastroenterological diseases. Within a few years, in collaboration with Dr. Bernard Wolf, Director of Radiology at The Mount Sinai Hospital, and Dr. Mansho Khilnani, Dr. Marshak was able to use this abundant material to identify the radiologic features of regional enteritis and present these findings in a logical and sequential fashion. Using this radiographic material, Dr. Crohn wrote a seminal monograph in 1949 (2), illustrated by Dr. Marshak's small bowel barium studies (Figs. 1–3), describing the pattern of radiologic changes in regional enteritis.

In 1953, Marshak and Wolf (3, 4) studied 71 cases of chronic ulcerative granulomatous jejunitis and explained the sequence from the non-stenotic to the stenotic phase. Furthermore, they demonstrated the diffuse nature of jejunoileitis which sometimes could involve the entire small bowel. They presented criteria to distinguish the marked thickening and nodularity of the folds associated with Crohn's disease from similar findings in other entities, such as lymphoma.

Subsequently, Drs. Marshak, Wolf and Khilnani transformed radiology of the small bowel from the nonspecific diagnosis of "disordered motor pattern," so commonly offered in the 1940s and early 1950s, into a coherent understanding of the radiologic manifestations of a variety of small bowel diseases, including not

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**Footnote:** Figures 1–6 are illustrations of the original radiographs from the files and film library of the late Dr. Richard H. Marshak.



**Fig. 1.** Non-stenotic type of ileojeunitis. The loops are rigid and markedly separated. The mucosal pattern is cast-like (short arrow). Several pseudopolyps are also identified (long arrow).



**Fig. 2.** Stenotic phase of ileojeunitis. The distal jejunum and proximal two-thirds of ileum are involved with alternating areas of narrowing and dilatation (short arrows) with superficial ulceration (long arrows) and separation of the loops.

only inflammatory bowel disease but also such entities as sprue (5) (Figs. 4 and 5), malabsorption (6), protein-losing disorders of the gastrointestinal tract (7), parasitic infestation of the small bowel (8), immunoglobulin deficiency disease (9), vas-



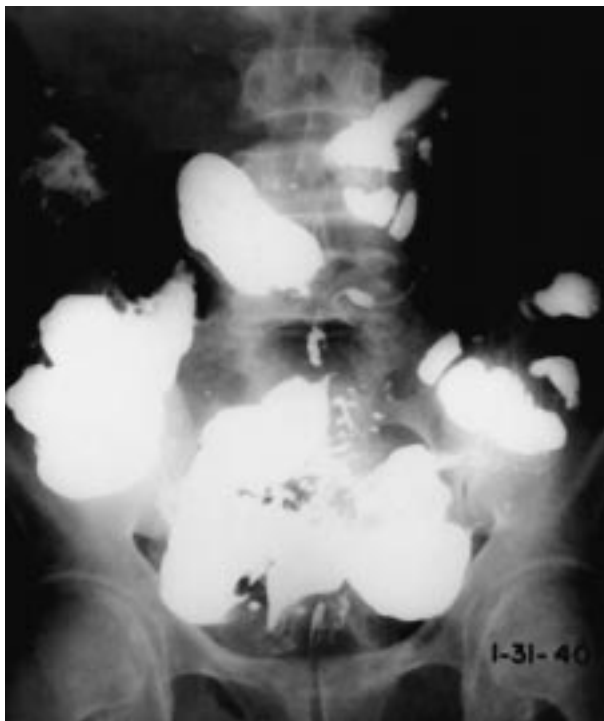
**Fig. 3.** Recurrent ileitis with marked stenosis and proximal dilatation (short arrows). The patient is status post ileo-transverse colostomy (anastomosis — long arrow).

cular disease of the small bowel, including vasculitis (10, 11), benign and malignant tumors of the small bowel (12), small bowel metastases (13) and lymphoma (14). Marshak and Lindner (15) assembled and published, in 1970, the material previously reported. *Radiology of the Small Intestine* became the first standard text of small bowel radiology.

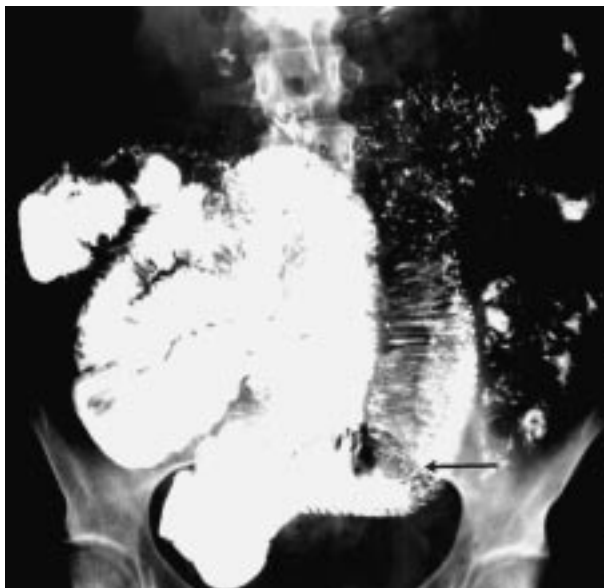
### Inflammatory Bowel Disease of the Colon

The Mount Sinai radiologists and gastroenterologists also investigated and described the radiologic changes in inflammatory bowel disease of the colon. Marshak, Wolf and Eliasoph had published "Non-specific Ileocolitis" (16) in 1956 and "Segmental Colitis" (17) in 1959, before the landmark publication of Lockhart-Mummery and Morson's, "Crohn's Disease (Regional Enteritis) of the Large Intestine and Its Distinction from Ulcerative Colitis" in 1960 (18). In these papers, the authors referred to granulomatous disease of the colon and were able to identify the radiologic features which distinguish it from ulcerative colitis.

Early descriptions of other radiologic manifestations of inflammatory bowel disease included a 1950 description of megacolon by Marshak and Lester, reporting a transition from a normal-sized



**Fig. 4.** Sprue. Marked segmentation in association with the moulage sign. Additionally, there is moderate dilatation and hypersecretion.



**Fig. 5.** Sprue. Marked dilatation, flaccidity, flocculation and non-obstructive intussusception (arrow).

bowel in a patient with ulcerative colitis, to subsequent development of toxic megacolon (Fig. 6) (19, 20). The radiologic features of strictures of the colon associated with ulcerative and granulomatous colitis were also presented by Mount Sinai radiologists in 1962. Further studies of inflammatory bowel disease of the colon by Wolf and Marshak in 1962 (21, 22) and by Marshak,



**Fig. 6.** Megacolon, a complication of ulcerative colitis. There is marked dilatation of the transverse colon with effacement of the haustral pattern and nodularity of the contour.

Linder and Wolf in 1966 (23) clearly distinguished Crohn's colitis from ulcerative colitis on the basis of their specific radiologic findings.

### Other Colonic Disorders

Other disorders of the colon were described by Mount Sinai radiologists, including radiologic findings in diverticulitis with abscess formation and vaginal fistula (1948) (24), diverticulitis and diverticulosis (1957) (25), diverticulitis of the cecum and right colon (1958) (26), lipoma of the colon (1954) (27), scirrhus carcinoma of the colon (1963) (28) and familial polyposis with special emphasis on the differential diagnosis and radiologic features of metastases to the colon, by Khilnani, Marshak, Eliasoph and Janowitz (29) in 1966.

### Esophagus

Additionally, Dr. Bernard Wolf was particularly interested in the x-ray demonstration of esophageal disease, beginning with an early description of peptic esophagitis (30), followed by a series of papers, many with Marshak and Khilnani, on the roentgen diagnosis of hiatal hernia (31), contraction ring associated with gross hiatal herniation (32), peptic ulcer of the esophagus and esophagitis with gastric-lined esophagus (33), as well as a description of the gastroesophageal vestibule and its differentiation from the phrenic ampulla and minimal hiatal herniation (34). Wolf's initial description of "use of a one-half inch barium tablet to detect minimal esophageal stric-

tures” (35) presented an objective method for measurement of esophageal strictures (36).

### Conclusion

The papers and text described above were important, classical contributions to the understanding of the x-ray findings in diseases of the gastrointestinal tract. In many cases, these primary descriptions acted as a guide to subsequent authors and clinicians during the next three to four decades.

On a personal note, I was privileged to know and work with several of these radiologists who were pioneers in gastrointestinal radiology, including Bernard Wolf, Mansho Khilnani and, most significantly, Richard H. Marshak. Initially, they were my mentors and, later, my colleagues. Although they had different personalities, they all shared a passion for excellence, a remarkable dedication to their work, and intellectual and mental energy to allow them to pursue their goals relentlessly until achieved. Richard Marshak, in particular, was instrumental in advancing small bowel radiology by deciphering the complexities of the follow-through small bowel barium study. In the decades that Dr. Jerold Kurzban and I spent working with Dr. Marshak in his office, we were exposed to an extraordinary spectrum of gastrointestinal radiology, an experience which helped us to maintain the high standards set by our predecessors.

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