

Roentgenological Changes of the Small Intestine in the Presence of *Schistosoma mansoni*¹

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NUMEROUS REPORTS have been published on the roentgen appearance of the small intestine in certain conditions wherein deficiency states play a role of great importance.² The changes observed have been grouped under the term "deficiency pattern" and are known as hypermotility, hypomotility, hypertonicity, hypotonicity, dilatation of loops, segmentation, coarsening and obliteration of the mucosal folds, and flocculation of barium. Krause and Crilly³ state that the following conditions have been found to produce these alterations in the small intestine: celiac disease, tropical and nontropical sprue, pellagra, peptic ulcer, cancer, tuberculosis of the small intestine, biliary or pancreatic disease, chronic ulcerative colitis, regional ileitis, sclerosing inflammation of the mesenteric lymphatics, hypoproteinemia, diabetes insipidus, parathyroid disease, allergic states. They have also added infestation with *N. americanus* to the list.

Sussman and Wachtel⁴ consider the term "deficiency pattern" a misnomer since it occurs in certain emotional and allergic states with no nutritional deficiency, but they are of the opinion that inflammatory changes in the wall of the small intestine may produce a deficiency pattern. Golden⁵ presents evidence demonstrating that degenerative changes in the intramural nerve plexus of the small intestine may also produce this "deficiency pattern."

The finding of such a pattern in children in a high percentage of

1. Received for publication May 23, 1944.

2. R. Golden, Abnormalities of the small intestine in nutritional disturbances: some observations on their physiologic basis. *Radiology*, 36:262-286, 1941.

T. T. Mackie, Nontropical sprue. *M.Clin.North America*, 17:165-184, 1933.

A. M. Snell and J. D. Camp, Chronic idiopathic steatorrhea. *Arch.Int.Med.*, 53:615-629, 1934.

T. T. Mackie and R. E. Pounds, Changes in the gastrointestinal tract in deficiency states, with special reference to the small intestine; with a roentgenologic and clinical study of 40 cases. *J.A.M.A.*, 104:613-618, 1935.

T. T. Mackie, D. K. Miller, and C. P. Rhoads, Sprue; roentgenologic changes in small intestine. *Am.J.Trop.Med.*, 15:571-589, 1935.

3. G. R. Krause and J. A. Crilly, Roentgenologic changes in the small intestine in the presence of the hookworm. *Am.J.Roentgenol.*, 49:719-730, 1943.

4. M. L. Sussman and E. Wachtel, Factors concerned in the abnormal distribution of barium in the small bowel. *Radiology*, 40:128-138, 1943.

5. R. Golden, *op. cit.*

cases is of great interest.⁶ Golden believes it due to incomplete development of the intramural nervous system, but Sussman and Wachtel opine that the autonomic nervous system in children is complete at birth.

During the past year the writers conducted X-ray studies of the small intestine in forty-seven patients with schistosomiasis mansoni. The group of patients selected for this study could be classified as suffering from asymptomatic schistosomiasis mansoni, since most of them had no symptoms related to the disease or to any other condition.

Forty-three were males and four females. Forty-two were under 25 years of age, fourteen between 15 and 19 years, and twenty-three between 20 and 24. The youngest patient was 9 years old and the oldest, 29. The liver was palpable in only five cases and the spleen in four of these five. Clinically, the majority of cases studied was therefore at the intestinal stage of the disease, and the symptoms and signs, usually associated with deficiency diseases, were never observed. Occasional bouts of diarrhea were reported by fifteen patients.

Hemoglobin values were above 80 percent (Hellige-Wintrobe) in forty-two cases; they were above 85 in forty-one cases, above 90 in thirty-six cases, and above 100 percent in twenty-two. The lowest recorded was 55 percent. The red-blood cell count was above four millions in forty-two patients and above four and one half millions in twenty.

S. mansoni ova were found in the stools of all patients. Ova of *T. trichiura* were reported in forty-one, of hookworm in twenty-six, and of *A. lumbricoides* in ten. Cysts of *E. nana* were found in fourteen and of *E. histolytica* in six. Most of the patients had ova of two or more parasites.

The characteristic X-ray pattern of deficiency disease was observed in fifteen of the patients, but it was doubtful or questionable in six. In twenty-six cases the small intestine was normal. Eleven of the patients, in whom the characteristic X-ray pattern of deficiency disease was observed, had *T. trichiura* ova; seven had *N. americanus*, three *A. lumbricoides*, three *E. histolytica*, three *E. coli*, and one *E. nana*. Only one patient with the X-ray deficiency pattern had ova of *S. mansoni* alone. The stools of all patients with a normal

6. H. Zwerling and W. E. Nelson, Roentgenologic pattern of small intestine in infants and children. *Radiology*, 40:277-282, 1943.

J. S. Bouslog, T. D. Cunningham, J. P. Hanner, J. B. Walton, and H. D. Waltz, Roentgenologic studies of the infant's gastrointestinal tract. *J. Pediat.*, 6:234-248, 1935.

small intestinal X-ray pattern contained the ova of two or more parasites. In forty-three, ova of *T. trichiura* were observed; of *N. americanus*, in eighteen.

The hemoglobin value was over 80 percent in fourteen of the fifteen patients with a positive X-ray intestinal pattern of deficiency disease; the red blood cell count was above four millions in the same number of cases.

DISCUSSION

An analysis of the material presented shows that the cases selected for this study were all in good physical condition and that the high incidence of other intestinal parasites, other than *S. mansoni*, had apparently had very little constitutional effect. As far as could be determined, this group of patients was not suffering from any of the deficiency diseases, therefore the finding of a typical X-ray small intestinal deficiency pattern in fifteen of them (31.9 percent) was surprising. However, due to the presence of other parasites, it is very hard to say what part *S. mansoni* played.

A positive X-ray small intestinal deficiency pattern was observed in eleven (26.8 percent) of the forty-one cases in whom ova of *T. trichiura* were found, and in seven (27 percent) of the twenty-six patients infested with *N. americanus*. It can, therefore, be stated that *S. mansoni* together with *T. trichiura* and/or *N. americanus* produced a typical small intestinal deficiency pattern in about 30 percent of the cases. The percentage of infestation with other intestinal parasites is too low to be of any significance in the production of the X-ray small intestinal pattern.

Krause and Crilly⁷ report that forty of forty-four cases of clinically significant hookworm disease (*N. americanus*) "showed abnormalities of the small intestinal pattern, twenty-six of which were moderately or far advanced. Of fifty-three cases of asymptomatic incidental hookworm infestation, thirty-three had a normal small intestine, sixteen showed minimal variations from the normal, and only four had severe alterations of the normal pattern. Similar changes were observed in two cases of *T. trichiura* and one each of *E. nana* and *A. lumbricoides*. After eradication of the hookworm infestation, a normal X-ray small intestinal pattern was obtained in those cases with minimal alterations." In the severe cases there was a "return towards, but not to the normal pattern." A similar study is now under way by which the authors hope to be able to find out what role *S. mansoni* plays in the X-ray findings reported.

7. G. R. Krause and J. A. Crilly, *op. cit.*

The mechanism for the production of the small intestinal pattern in these patients cannot be stated. *S. mansoni* ova are frequently found in the walls of the small intestine,⁸ although this parasitic infestation affects the large intestine even more intensely. It is possible that through the production of edema in the neighborhood of the muscularis mucosae the motility of the small intestine is so affected as to produce abnormal changes. *T. trichiura* usually affects the coecum and the large intestine, sometimes the lower ileum. Therefore, it is the opinion of the authors that *T. trichiura* cannot play any important role in the alterations observed in the small intestine.

SUMMARY AND CONCLUSIONS

X-ray studies of the small intestine were carried out in forty-seven patients with schistosomiasis mansoni. In fifteen cases (31.9 percent), the characteristic X-ray pattern of deficiency disease was observed. Due to the presence of other parasitic infestations, it was difficult to evaluate the role played by the presence of *S. mansoni*, frequently observed in the walls of the small intestine. These ova may produce edema around the muscularis mucosae, therefore altering the motility of the small intestine.

8. E. Koppisch, Studies on schistosomiasis mansoni in Puerto Rico. VI. Morbid anatomy of the disease as found in Puerto Ricans. Puerto Rico J. Pub. Health & Trop. Med., 16:395-455, 1941.