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Original Article

Persistent Colonic Schistosomiasis among Symptomatic Rural Inhabitants in the Egyptian Nile Delta

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Abstract. ***Background and Aims:*** **Human schistosomiasis is one of the most important and unfortunately neglected tropical diseases. The aim of the current study was to investigate the prevalence and characteristics of colonic schistosomiasis among symptomatic rural inhabitants of the Middle Northern region of the Egyptian Nile delta.**
Patients and Methods: **This study recruited 193 inhabitants of the rural community in the Egyptian Nile Delta referred for colonoscopy because of variable symptoms. After giving written informed consent, they were exposed to thorough history, clinical examination, stool analysis, abdominal ultrasonography, and pan-colonoscopy with biopsies.**
Results: **Twenty-four cases out of the 193 patients had confirmed active schistosomiasis with a prevalence rate of 12.4%. Bleeding with stool was the predominant manifestation of active Schistosoma infection among the cases either alone or in combination with abdominal pain. On clinical examination, most patients (n=17; 70.8%) did not have organomegaly, and 25% had clinically palpable splenomegaly as far as 75% of them had sonographically detected hepatic peri-portal fibrosis. Also, 66.6% of patients have significant endoscopic lesions (polyps, ulcers, mass-like lesions), and 16.6% of them had colonic affection beyond the recto-sigmoid region.**
Conclusion: **Colonic schistosomiasis is still prevalent among the Egyptian Nile Delta's symptomatic rural inhabitants at a rate of 12.4%. Of them, 66.6% had significant endoscopic colorectal lesions. This persistent transmission of schistosomiasis in the Egyptian Nile Delta's rural community sounds the alarm for continuing governmental efforts and plans to screen the high-risk groups. The prevalence rate reported in the current study is lower than the actual prevalence rate of schistosomiasis due to focusing only on a subgroup of individuals.**

Keywords: Schistosomiasis; Colonic; Rural inhabitants; Egyptian Nile Delta; Prevalence.

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Introduction. Human schistosomiasis (Bilharziasis) is one of the most important neglected tropical diseases currently not receiving enough public attention. It is endemic in 77 countries in the tropical and subtropical communities, with about 250 million individuals worldwide infected.[1] The Middle East and North Africa (MENA region) represented an endemic hot spot for schistosomiasis late in the 20thcentury.[2,3]

In Egypt, *Schistosoma mansoni (S. mansoni)* has almost totally replaced *Schistosoma haematobium* in the Nile Delta and spread to other regions of the country since the middle of the 20th-century following the construction of the High Dam.[4]

Ongoing control measures have markedly decreased the incidence of the disease. The disease's characteristics have changed as a result of the government-sponsored mass treatment campaigns, implemented over the past decades, that succeeded in reducing the prevalence of infection all over Egypt from 3% in 2003 to 0.3% in 2012.[5]

However, the transmission may remain ongoing due to the widespread distribution of the intermediate snail host, poor sanitation, lack of health education, and decreased treatment availability, especially among the high-risk groups.[6] Furthermore, the data about the newly acquired infections in Egypt is scarce.

Among the high-risk groups who may maintain schistosomiasis' ongoing transmission are the farmers and fishermen.[4,7-9]

The farmers and fishermen in the Egyptian Nile Delta's geographic area mainly reside in the rural countryside. They cultivate and fish in brackish water, harboring the schistosoma snail intermediate host, and they sometimes practice promiscuous defecation in the water. Consequently, they act as both victims susceptible to be infected and offenders disseminating the infection.[8-10]

The aim of the current study was to investigate the prevalence and characteristics of colonic schistosomiasis among symptomatic adult rural inhabitants of the Middle Northern region of the Egyptian Nile delta.

Patients and Methods.

Study area. Subjects of the current study were symptomatic inhabitants of the rural community attending the endoscopy units of both the Department of Hepatology, Gastroenterology and Infectious Diseases, Kafrelshiekh University, Egypt, and the Tropical Medicine Department, Tanta University, Egypt. Attendants to both units reside in Kafr-El-Sheikh and Gharbia governorates. Both governorates are located in the Middle and North of the Nile Delta. The Western and Eastern borders of this geographic area are the Rosetta and Damietta branches of the River Nile. The Northern border is the Mediterranean Sea. (**Figure 1**). The area of the Nile delta is considered an endemic area for *S. mansoni* infection.[10]

Kafr-El-Sheikh and Gharbia governorates are agricultural districts. In this rural community of the Nile Delta, inhabitants are primarily farmers and, to a lesser extent, fishermen. They practice agriculture and fishing in potentially infected water supplies.

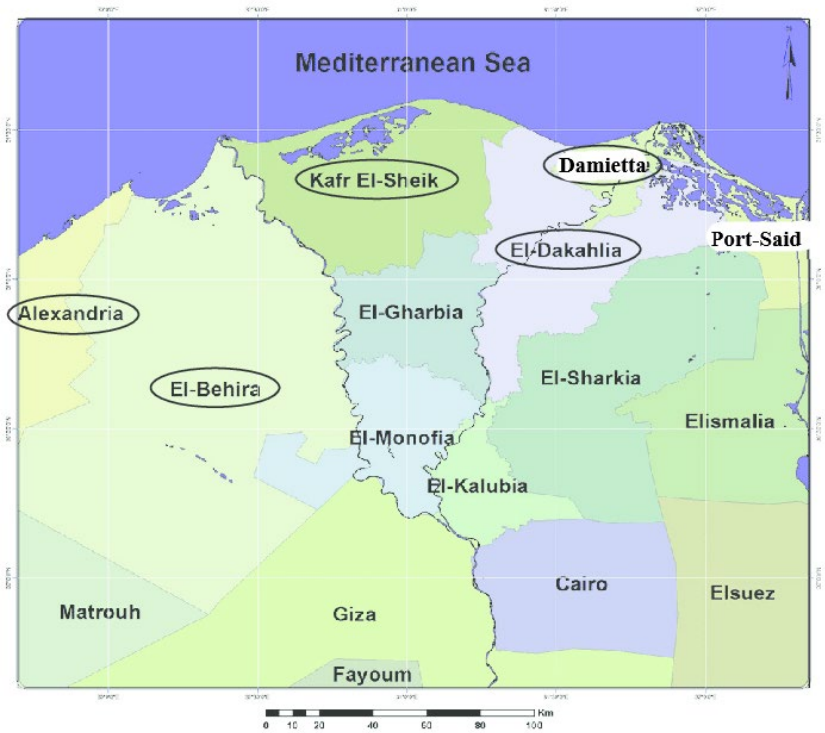

Figure 1. The geographic study area. Note that this geographic area occupies the Middle and Northern zone of the Nile Delta. The whole western border of this geographic area is the Rosetta branch of the River Nile, while a reasonable distance of its Eastern borders is the Damietta branch of the River Nile.

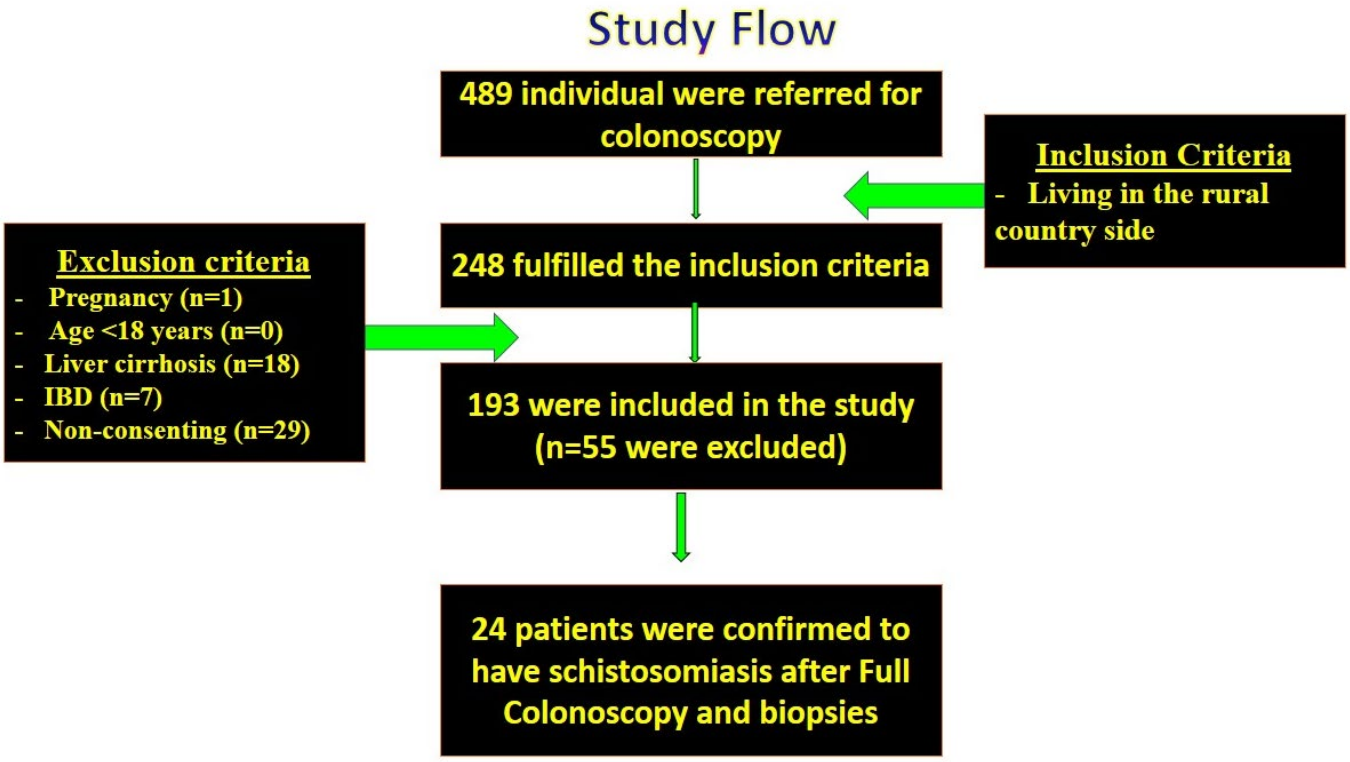

Figure 2. Study flow chart. IBD; inflammatory bowel diseases.

Ethical consideration. Permission and official approval to carry out the study was obtained. All patients signed a written informed consent prior to inclusion into this study, and the institutional ethical committee in Tanta University Faculty of Medicine approved the study. The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki.

Study design. A cross-sectional study:

a) Our study's primary end-point was determining the percentage of symptomatic adult inhabitants in the rural community with active colonic *schistosomiasis*.
b) Our study's secondary end-points were to characterize clinical, sonographic features of colonic schistosomiasis besides the extent of the *schistosoma* induced pathology in the colon.
c) Inclusion criteria (**Figure 2**): Patients with the following criteria were recruited
   - Any gender
   - Living in the rural countryside
   - Patients referred for colonoscopy due to complaints related to colon affection
d) Exclusion criteria: These patients were excluded from the study
   - Pregnant ladies
   - Non-Adults (<18 years)
   - Patients with established liver cirrhosis
   - Patients with inflammatory bowel diseases (IBD)
   - Patients with known other organic bowel damage, e.g., bowel cancer
   - Patients not willing to participate or failed to give consent

Study subjects. They are histologically confirmed *S. mansoni* infected patients (n= 24). This study was carried out over 18 months, between August 2018 and January 2020. Four hundred eight-nine colonoscopies were performed during the study period. Two hundred forty-eight fulfilled our inclusion criteria, while 241 were excluded being non-inhabitants of the rural community. Finally, 193 of them gave written informed consent to participate in the study after explaining the concept, steps, benefits, and possible adverse events of the investigation. Fifty-five were excluded from the study due to: Failure to give consent (n=29), Patients with IBD (n=7), pregnancy (n=1), and the presence of established liver cirrhosis (n=18) (**Figure 2**). Thorough history taking, clinical examination, stool analysis, abdominal ultrasonography, and pan-colonoscopy evaluated all the patients.

Confirmation of active Schistosoma infection. Detection of *S. mansoni* eggs in stool samples was viewed as the gold standard for the infection diagnosis. However, it has some limitations in cases of closed (due to excess fibrosis) or light infections,[11] and that is why active schistosomiasis in this study was defined by detecting the *S. mansoni eggs* in the histopathology specimens obtained during colonoscopy **(Figure 3)**. Endoscopic specimens after proper processing were stained with hematoxylin and eosin (H&E) and examined under a high power field. At least five serial sections were examined before the specimen was considered negative**.**

Stool analysis. Stool samples were processed in the

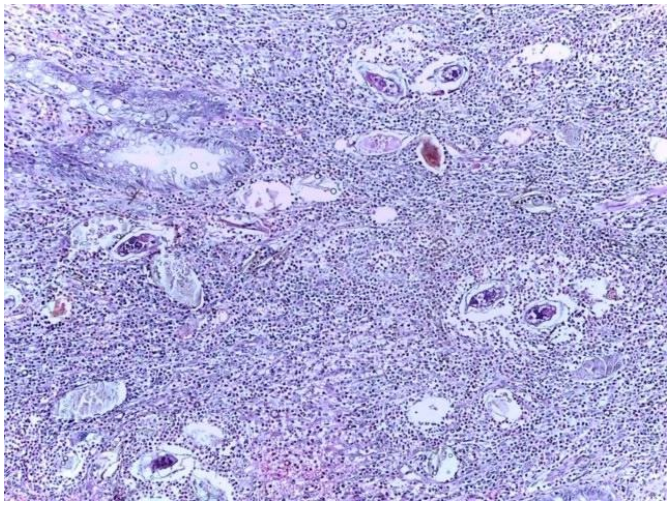

Figure 3. Schistosomal granulomatous reaction composed of multiple schistosomal ova surrounded by an admixture of lymphocytes, eosinophils, macrophages, plasma cells and peripherally located fibroblasts (H & E x200).

laboratory following the Kato–Katz procedure.[12]

Abdominal Ultrasonography. Done on the day of colonoscopy or 7 days later at the same day of receiving the histopathology reports. Patients were fasting and examination with the greyscale ultrasound machine was done before being examined by colonoscopy to avoid the masking effect of air insufflation or one week later while patients were fasting. Grading of schistosomal hepatic periportal fibrosis was carried out following the thickness of three peripherally located portal tracts into three grades; I (mean thickness from 3 to 5 mm), II (mean thickness from >5 to7 mm), and III (mean thickness from >7 mm).[13]

Colonoscopy examination. Pan-ileocolonoscopy was planned for all rural residents. The examination was done following a one-day bowel preparation using the polyethylene glycol electrolyte solution as 4 sachets (MOVIPREP, Norgine Limited, UK, or the comparable local products when unavailable). Patients were prepared with one liter of Moviprep (2 sachets) in the evening before and one liter of Moviprep (2 sachets) in the early morning of the colonoscopy. The examination was done under conscious sedation most of the time. Examining the whole colon was possible with a 100% caecal intubation rate; however, terminal ileum intubation was possible only in 76.4% (n=19) of patients. The meticulous colonic examination was done during scope withdrawal, and mucosal biopsies were taken from the entire colon segments as well as the morphologically detected lesions.

Rectal snip examination. Four rectal snips were obtained at the time of colonoscopy. Two were sent with the histopathology specimens, and 2 were examined under the microscope to confirm the presence or absence of schistosoma eggs (Crush biopsy or squash technique).[14,15]

Patient management. All patients with confirmed *S. mansoni* infection in this study were treated with praziquantel 600 mg tabs in a single oral dose given after a heavy (fatty) meal (40 mg/kg body weight).[16] A second dose was given 4 weeks later to achieve the presumed 95-100% efficacy in parasite eradication.[17] Among our patients, 8 patients were scheduled for follow-up colonoscopy after 3 months from the index colonoscopy.

Data analysis. The data were analyzed using SPSS, version 23 (SPSS Inc., Chicago, Illinois, USA). Data were expressed in number (No), percentage (%) mean ($\bar{x}$) and standard deviation (SD).

Results.

Study populations and clinical characteristics. In this study, 24 out of the 193 symptomatic rural inhabitants examined were infected with active *S. mansoni* as confirmed by colonoscopy and biopsies with a prevalence rate of 12.4% (with 95% CI 12.1%, -25.6 %). Patients were diagnosed both in the Department of Hepatology, Gastroenterology and Infectious Diseases, Kafrelshiekh University (n=13) and in the endoscopy unit of the Tropical Medicine Department, Tanta University (n=11). The clinical characteristics of the cases are shown in **Table 1**.

In this cohort of patients, either the elderly and young adults were infected; the age range was 22 to 68 years, while the mean age was 45.54 ± 13.96 years, with a high male predominance (83.3%). In this study, only 11 out of 24 patients (45.8%) were positive for *S. mansoni* eggs in their stool samples.

All patients with confirmed active schistosoma infection in this study were referred to our endoscopy units due to colon affection manifestations. Overt bleeding with stool was the predominant manifestation

Table 1. Demographic and clinical characteristics of the patients'.

Variable	Number (%)
Age (years) (mean ±SD, range)	45.54 ± 13.96 (22.0-68.0)
Gender	
Male	20 (83.3%)
Female	4 (16.7%)
History of previous schistosoma infection	
No significant history	10 (41.7%)
History of previous treatment	19 (79.2%)
History of *Schistosoma mansoni* infection	14 (58.3%)
Complaint	
Blood in stool	10 (41.7%)
Abdominal pain	2 (8.3%)
Combined	12 (50%)
Examination	
No Abnormality Detected	17 (70.8%)
Hepatomegaly	1 (4.2%)
Splenomegaly	6 (25.0%)

of active *S. mansoni* infection among the cases either alone or in combination with abdominal pain (**Table 1**). Of note,58.3% gave a history of prior *S. mansoni* infection confirmed by stool examination at a time point over the last 10 years. However, 41.7% of the patients, and at the best of their knowledge, did not report any history of previous schistosomal infection. However, most of them (n=19, 79.2%) received oral praziquantel treatment; for their prior *S. mansoni* infection (n=14, 58.3%) or during the mass treatment campaigns implemented by the primary health care. On clinical examination, most patients (n=17, 70.8%) did not have organomegaly, and 25% had clinically palpable splenomegaly.

The infected patients' laboratory data showed that 10 cases (41.7%) had the profile of microcytic hypo-chromic anemia with hemoglobin levels variable from 8.8 to 10.7 gm/dl with a mean of 9.53±0.71. However, among the 6 patients (25%) with clinically palpable splenomegaly, the pattern of anemia was normocytic normochromic with a mean hemoglobin concentration of 10.18±0.34.

Ultrasonic Features. When these cases were examined by abdominal ultrasonography, the frequency of organomegaly (splenomegaly and hepatomegaly) increased to 50.0% versus 29.2% on clinical assessment, respectively **(Table 2).**

The most dangerous sequela of intestinal *schistosomia*sis is the development of schistosomal hepatic peri-portal fibrosis. Unfortunately, 75.0% of the infected rural inhabitants had schistosomal hepatic fibrosis, although it was of grade I (mild form) in half of the cases (50%).

Endoscopic Features. The adult *S. mansoni* worms migrate against blood flow to the pelvic venous plexus to lay eggs, and that is consistent with this study's findings where on colonoscopy, the recto-sigmoid region was always involved. Furthermore, 16.6% of lesions showed extension beyond the recto-sigmoid region to involve the entire left colon **(Table 2)**.

The most commonly encountered morphologic feature during colonoscopy was mucosal erythema and congestion (**Supplementary video I**) either alone (n=7, 29.2%) or associated with mucosal ulcerations (n=5, 20.8%). Colonic schistosomal polyps either as the sole manifestation of colonic schistosomiasis (n=3, 12.5%) or in combination with erythema and ulcerations (n=3, 12.5%) where it is limited to the rectum and sigmoid regions **(Figure 4)**. An interesting finding of the current study is that 2 patients (8.3%) were diagnosed with mass-like lesions confused with cancer **(Table 2)**.

All cases with Schistosomal polyps (n=6) were snared successfully during endoscopy without significant adverse events, while the two patients with mass-like lesions were referred to surgical resection, and benign schistosomal nature was histologically confirmed. Colonoscopy follow-up for 8 patients (polyps n=6, mass-like lesions n=2) showed complete resolution of the morphologic features associated with schistosomiasis. Furthermore, surgical margins were free from any apparent lesions. From the eight patients, multiple rectal and sigmoid biopsies were negative for schistosomiasis.

Table 2. Ultrasonic, Endoscopic and histopathologic features of the Patients'.

Character	Number (%)
Ultrasonography	
No organomegaly	12 (50.0%)
Splenomegaly without hepatomegaly	8 (33.3%)
Hepatomegaly without splenomegaly	2 (8.3%)
Hepatosplenomegaly	2 (8.3%)
Schistosomal Hepatic Fibrosis	
No Fibrosis	6 (25.0%)
Grade I	12 (50.0%)
Grade II	5 (20.8%)
Grade III	1 (4.2%)
Affected Colon	
Rectum	3 (12.5%)
Sigmoid	6 (25.0%)
Rectum & sigmoid	11 (45.8%)
Sigmoid and left colon	2 (8.3%)
Rectum, sigmoid and left colon	2 (8.3%)
Colon lesion	
Polyp	3 (12.5%)
Ulcer	3 (12.5%)
Erythema with inflammation	7 (29.2%)
Granular mucosa	1 (4.2%)
Mass like	2 (8.3%)
Ulcers & erythema	5 (20.8%)
Polyp & erythema	2 (8.3%)
Polyp, ulcer & erythema	1 (4.2%)
Microscopy	
Living ova	16 (66.7%)
Dead ova	5 (20.8%)
Both	3 (12.5%)

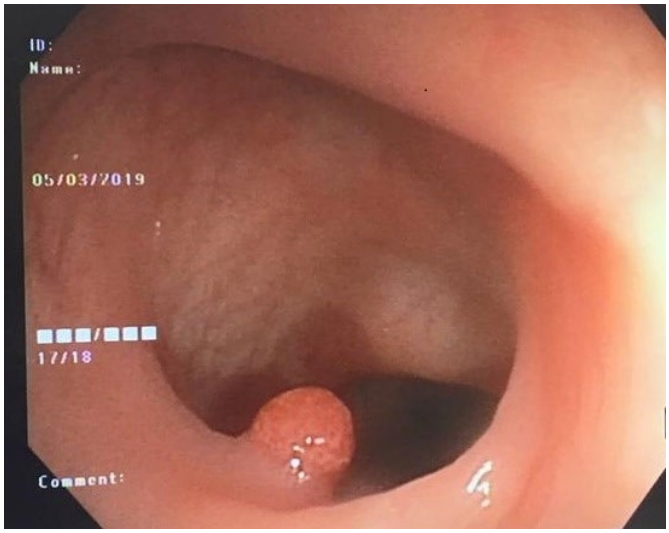

Figure 4. Small schistosomal colonic polyp.

Histologic Features. From the histopathologic point of view (**Figure 3**), all patients showed active *S. mansoni* infection features with the living ova surrounded by the characteristic eosinophilic granuloma containing macrophages, plasma cells, and lymphocytes and variable degrees of fibrosis (100%). A group of cases (15.5%) harbored both living and dead *S. mansoni* ova. The differentiation between living and dead schistosomal ova was feasible by noticing the transparency of the eggs, its internal structures, the shell, the presence of calcification, and granuloma.

Rectal snips directly examined by the crush technique demonstrated the *S. mansoni* ova in 21 patients (87.5%). The three patients negative for Schistosoma ova by rectal snips were the 2 patients with mass-like lesions and one patient with colonic polyp as the sole finding of colonic schistosomiasis.

Discussion. Schistosomiasis has plagued the Egyptian population since the ancient Egyptians. The disease's prevalence has tremendously decreased but, unfortunately, the awareness and index of suspicion. As at present, there is only one drug available for individual treatment, and preventive mass chemotherapy, and no vaccine, the infection's resurgence is to be feared.[18]

The spread of schistosomiasis among the rural community inhabitants has long been investigated in Egyptian[8,9,19] and international research.[20,21]

The prevalence of *S. mansoni* among the symptomatic inhabitants of the rural community in the Middle and Northern Nile Delta, according to the current study, is 12.4%, a number lower than the reported rates not only from Egypt but also from other endemic hot spots in rural communities as in Nigeria (17.8%)[21] and in Brazil (> 20.5%).[22] Indeed, this rate is lower than the actual prevalence rates due to focusing on a subset of populations. In Egypt, among the Nile Delta inhabitants, the same region investigated in the current study, the prevalence was reported to be 37.7% in the year 2000.[4] Furthermore, the prevalence rate is lower than the rates among other high risk groups. Among fishermen in Brazil, it is 13.9%, while among those of Manzala Lake in Egypt, the prevalence was 24.6%. The lower prevalence rates reported in the current study can be explained by health education and mass treatment campaigns practiced in the country over the last years. In our study, previous Egyptian[8,9] and international studies,[20,21] males predominate; because they were more exposed. In our community, males are responsible for the family earnings most of the time; they have greater employment in agricultural work and higher contact with water.[23]

Intestinal manifestations such as diarrhea and colicky pain and dysenteric features may pass unnoticed, and asymptomatic forms of the infection are more common.[24] With the infection progression, the chronic sequelae set up with hepato-splenic affections development, established portal hypertension occurs, and anemia becomes normochromic.[25] All patients with confirmed schistosomal infection studied had a history of bleeding per rectum and/or abdominal pain and consequent hypochromic sideropenic anemia, and that was why they were referred for pan-colonoscopy. In addition, 29.2% of them had clinically palpable hepatomegaly and/or splenomegaly, which points to two crucial issues. First, patients are symptomatic probably due to a severe infection, and patients had a neglected ongoing long-term infection, which is why they had hepato-splenic affection.[25]

Other studies reported different rates of hepatomegaly and splenomegaly among inhabitants of *S. mansoni* high-risk regions both in Egypt[4] and in Tanzania,[26] with percentages of 22.3%, 20.8%, and 59.70%, 13.73%, respectively. These figures are different from our figures of 4.2% and 25% due to the advanced stage of the disease in our cohort with established periportal fibrosis

We reported, 75% of them had schistosomal periportal fibrosis, although half (50%) were of the mild form. This rate is much higher than that of 13.79% found by Mazigo et al. in 2015[26] in Tanzania. The difference is attributable to both the number and the nature of participants. We enrolled only 193 high-risk sub-group with clinical manifestations in our study compared to 1671 individuals described as permanent inhabitants in their study.[26] Furthermore, high prevalence rates of schistosomal periportal fibrosis were reported from different subgroups and geographic locations in Egypt. In Gharbia Governorate, a prevalence rate of >50% was reported,[19] while remote governorates, e.g., Ismailia, reported a rate of 43%,[27] and the pooled data from 5 governorates in lower Egypt reported a rate of 50.3%.[4] However, our higher prevalence rates were due to targeting a high-risk symptomatic group of small sample size compared to the general populations in the studies mentioned above.

In fact, in Egypt, hepatic periportal fibrosis is commonly seen with complicated *S. mansoni* infection. However, confusion may occur with the presence of liver cirrhosis.[28] Consequently, following our exclusion of patients with established liver cirrhosis who may be confused for periportal fibrosis, we can assume that our patients had schistosomal hepatic periportal fibrosis.

Zaher et al. in 2011[29] encountered eggs of *S. mansoni* in stool samples of 99 persons (0.33%) out of the 30,000 outpatients in Egypt, while Gad et al. in 2011[30] found stool examination positive for ova in 25 (9.83%) patients only out of 205 biopsy-positive schistosomiasis cases in Egypt. Hence, we alarm practitioners in endemic areas not to rely solely upon stool analysis for diagnosing colonic schistosomiasis. They can ask for rectal sip examination or colonoscopy and biopsy due to high

positivity rates of 87.5% and 100%, respectively, compared to 45.8% positivity of stool analysis as reported in the current study.

Severe chronic intestinal schistosomiasis may result in colonic or rectal polyposis, stenosis, or present as an inflammatory mass that may be even confused with cancer.[31-33] One of the crucial findings of the current study is its ability to assess the colon both morphologically (by endoscopy) and pathologically (by histology) to investigate the extent of *S. mansoni* induced colon affection. On complete colonoscopy examination, 66.6% of patients have significant lesions (polyps, ulcers, mass-like lesions) while 33.4% had mild mucosal erythema and granularity.

Acute and chronic inflammatory changes could be observed in the same colon segment of chronic active schistosomal colitis patients.[23] This is consistent with the findings of the current study, the majority of patients (66.7%) had mucosal erythema and congestion consistent with acute active infection, and at the same time, endoscopic features of chronicity as polyps and masses were also observed.

An interesting Egyptian study by Gad et al. in 2011[30] reported the prevalence of colorectal schistosomiasis among patients with different gut symptoms to be 20.83% by colonoscopy and biopsy. In this study, the authors biopsied any suspected schistosomal lesion (n=66) with additional 2 biopsies from the apparently normal rectal mucosa (n=139). The latter two were examined by crush biopsy, while the other biopsies (average 3-6 per patient) were examined by histopathology. *S. mansoni* was detected in 205 patients out of 984 patients by colonoscopy.

Endoscopic findings of the 205 confirmed cases reported by Gad et al.[30] with schistosomiasis included patchy mucosal congestion (n=39,19%), patchy mucosal petechiae (n=11, 5.4%), patchy mucosal erosions +ulcers (n=5, 2.4%), patchy telangiectasia (n=5, 2.4%), sessile mucosal polyps at the sigmoid colon (n=6, 2.42%), and apparently normal mucosa (n=139). When these figures were compared with our reported figures, we reported that 66.6% of patients have significant lesions (polyps, ulcers, mass-like lesions), which means that our cohort suffered more. Furthermore, we reported a finding lacking from their cohort; the mass-like lesions related to schistosomiasis.

In the study of Gad et al.,[30] the squash technique established the diagnosis of schistosomiasis in all endoscopically apparently normal cases by demonstrating the schistosomiasis ova with its characteristic lateral spine. In our study, the squash technique demonstrated the schistosoma ova in 19 cases. In the two cases with mass-like lesions, the rectal snips were negative.

In the study of Gad et al.[30] schistosomiasis affected the rectum (n=25, 12.2%), sigmoid colon (n=26, 12.7%) or rectum and colon (n=154, 75.1%), while in our study the figures were 12.5%, 25%, and 62.5% respectively. In addition, we reported lesions beyond the recto-sigmoid in 18.2% of cases. The obvious differences between our study and that of Gad et al. are probably related to the nature of patients recruited. Patients of the current study were high-risk group inhabiting a highly endemic area.

The presence of colonic schistosomal polyposis does not appear to predispose patients to significant bowel malignancy development.[33,34] There is agreement among authors that *S. mansoni* is not related to cancer colon. The reported cases of schistosomiasis in patients with bowel malignancy are no more than epidemiological association,[33-36] and this is consistent with findings of the current study.

The high frequency of schistosomal polyps reported in the current study (25%) is consistent with literature reports of high frequency of schistosomal colonic polyps in Egypt compared with other endemic regions like Brazil.[25] These findings of prevalent schistosomal colon polyps should alarm the endoscopists working in endemic areas to consider schistosomiasis in the differential diagnosis of left-sided colonic polyps.[33]

One of the most important retrospective studies[36] that focused on colonic schistosomiasis was carried out in Saudi Arabia and recruited 216 patients with schistosomal colonic disease out of 2458 who had sigmoidoscopy or colonoscopy over 10 years, diagnosed by endoscopic biopsies (prevalence rate of 8.8%). The colonoscopic appearance was suggestive of schistosomiasis in 98 of these patients (45.37%), *S. mansoni* ova in stool was detected in only 24 of these 216 patients (11.11%). The most common histopathological finding in these patients' colonic biopsies was *S. mansoni* ova in the colonic mucosa with no or mild inflammatory cell infiltrates. The most common symptoms were abdominal pain or distention reported in 84 patients (38.88%). Sixty-five patients (30.09%) had hepatosplenic schistosomiasis. Eight patients (3.7%) had schistosomal polyps, and two patients had colonic malignancy in which no association between their malignancy and *S. mansoni* infection was established. The authors concluded that colonoscopic examination is valuable in colonic schistosomiasis as it can show characteristic colonic lesions, and colonic biopsies are diagnostic and correlate with histological findings.

Although we have some agreements with this study[36] regarding the importance of colonoscopy in diagnosing colonic schistosomiasis, the low yield of stool ova detection, and schistosomal's benign nature colonic affection, we have disagreements on other points. We have a higher frequency rate of colonic schistosomiasis (12.4% vs. 8.8%); contrary to abdominal pain and distention, our patients mainly presented with rectal bleeding, they reported lower prevalence rates of hepato-splenic affection, and also we had a higher frequency of

schistosomal polyps (25% vs 3.7%). We believe these differences are related to the endemicity of schistosomiasis in Egypt compared to Saudi Arabia.

The safety of endoscopic polypectomy for schistosomal colonic polyps among Egyptian patients has long been documented as early as 1983,[38]. This was emphasized in the current study and in many previous publications[29,30,36] with minimal risk of adverse events, similar to the reports for the current study.

The current study showed the histologic features of active schistosomiasis with the schistosomal granulomatous reaction composed of multiple schistosomal ova surrounded by an admixture of lymphocytes, eosinophils, macrophages, plasma cells, and peripherally located fibroblasts **(Figure 1)** and variable degrees of fibrosis. Many studies reported different activity patterns and fibrosis,[30,36] which seems correlated with the stage of infection, either acute or chronic.

This study had its limitations, first, targeting only symptomatic individuals. The aim was to determine the prevalence among complaining patients to highlight a daily clinical practice and alarm clinicians in the area for the persistence of this disease despite the great governmental efforts to control it. The second limitation was targeting only a specific patient group, and hence the prevalence rates reported in the current study cannot be applied to the whole community. Third, the small sample size of the affected patients; this probably related to targeting only a specific category of patients. Fourth, it may underestimate the prevalence among symptomatic rurals due to the exclusion of patients with IBD and liver cirrhosis patients. However, this was valuable to achieve the secondary end-points of the study. IBD and liver cirrhosis are associated with morphological changes in the colon, which may obscure the *S. mansoni* induced colon pathology. Furthermore, liver cirrhosis may confuse the diagnosis of Schistosomal periportal fibrosis. Furthermore, patients with structural colon damage as IBD and liver cirrhosis may be excluded from the regular agricultural and fishing activity in the area.

Conclusions. Out of the 193 symptomatic rural inhabitants recruited to the current study, we reported active schistosomiasis in 12.4%, with 66.6% of patients had significant endoscopic colorectal lesions. All these data points to the persistent transmission of schistosomiasis in the Egyptian Nile Delta's rural community. However, the great success in controlling this infection achieved by governmental efforts over the past 4 decades with the collaboration of the health care system and stakeholders should not discontinue screening programs, particularly for high-risk groups, e.g., farmers, fishermen, etc. If not detected and effectively treated, these individuals will represent a great challenge for the diseases' resurgence because they are suitable for breeding schistosomiasis through water channels and the snail intermediate host.[3,7]

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