Triple-infections with intestinal parasites in an Immigrant: Calls healthcare providers to continue with a comprehensive differential diagnosis

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1 Introduction:

Intestinal parasites are causing a significant global health concern, with over 3.5 billion people affected worldwide [1,2,3]. The infestation rates vary depending on the country of residence and individual demographics related to populations' exposure. Common intestinal parasites include soil-transmitted helminths such as*Ascaris lumbricoides* , *Trichuris trichiura* , hookworm, and protozoa like *Giardia intestinalis* and *Entamoeba spp* [4, 5]. Least developed countries in particular, face higher prevalence and burden rates of these infections due to factors related to poverty and underdevelopment including limited access to clean water, poor hygiene and sanitation practices, malnutrition, and hot and humid climates [6,7]. This combination of conditions and practices create an ideal environment for the transmission, spread, and local establishment of intestinal parasites [8,9,10]. Sudan and South Sudan are predominantly endemic with soil-transmitted helminthes and other parasitic diseases [10 - 23].

Additionally, infection with intestinal parasites poses a serious health, socio-cultural, and economic burdens in endemic countries, while in industrialized nations, mainly immigrants, seasonal workers, and nomadic populations are the primary groups at risk [24, 25]. Transmission of parasites can occur through direct person-to-person contact or contact with contaminated sources like food, water, or soil [26]. In high burden areas, coinfections with multiple parasites are increasingly occurring due to the poor living conditions, malnutrition, and weakened immuno-system [27,28, 29]. It lead to high morbidity, mortality, disability, and enhance the susceptibility to other infections [27 - 29]. Children, teens and adult, are at higher risk of adverse health outcomes with multiple parasitic infections compared to single infestations [30]. Here, we report case to highlight how poor socio-economic conditions and disadvantaged living situations of immigrants can profoundly affect health outcomes even in developed countries.

2 Case history:

A male freelancer, aged 31, from South Sudan, was admitted to Alban Jadeed Teaching Hospital in Khartoum, Capital city of Sudan in February 2023 after a job trip to Sudan, due to hematemesis and melena. Upon reviewing his medical history, it was found that he had no prior history of jaundice, hepatitis, or alcohol abuse. However, the patient had previously experienced diarrheal syndrome years ago, but underlining causative left uninvestigated.

3 Methods:

Clinical examination showed that the patient had ascites and hepatosplenomegaly. Baseline investigations revealed a low white blood cell count of 2,200 cells/µl, platelets of 50,000 /µl, and hematocrit of 25%. Viral screening for hepatitis B, C, and HIV all yielded negative results. Stool examination indicated the presence of *S. mansoni* eggs with the characteristic broad lateral spine, as well as Rhabditiform first-stage larvae of *S.*

stercoralis and Hookworm egg (Figure 1). Abdominal ultrasound showed hepatosplenomegaly, with the left lobe of the liver was the most affected site and central sonolucencies distinct from the true cirrhotic pattern, a portal vein diameter of 18mm, and a moderate amount of peritoneal fluid. Esophagogastroduodenoscopy and colonoscopy were subsequently performed in response to the previous findings.

4 Conclusion and result:

Esophagogastroduodenoscopy revealed 2nd and 3rd grades esophageal varices with active hemorrhage, resulting in the patient's referral to Ibn Sinna Hospital for the placement of a Sengstaken Blakemore tube for 12 hours. The patient subsequently underwent endoscopic sclerotherapy with 5% ethanolamine oleate twice, which helped improve his condition. A colonoscopy revealed a pale and atrophic colonic mucosa with no ulcers or polyps present. In addition to endoscopic sclerotherapy for the esophageal varices, the patient was treated with praziquantel (20mg/kg) orally, three times a day for one day, for *S. mansoni* infection, and albendazole (400mg) twice a day for three days for *S. stercoralis* infection. The patient's condition improved and he was discharged from the hospital. During the follow up visits, repeated stool examinations for ova and rhabditiform larvae showed negative results, and over the following months, no relapse of hemorrhage occurred. This indicating full recovery of the patient.

5 Discussion:

This case report highlights the importance of a thorough investigation of patients presenting with gastrointestinal symptoms, such as hematemesis and melena. Particularly for those live or had recent visit to areas hyper-endemic with intestinal parasites. This underscores the need for raising awareness among the local communities and visitors about the locally endemic diseases through improving reporting and timely sharing of health data publicly. This will further guide healthcare providers in improving their differential diagnosis and advice for those who plan to travel to endemic area about precautions and prophylaxis they should take.

In this case report, the young male was admitted to the hospital with signs of liver and spleen enlargement, coupled with low blood cell counts. While the liver function tests showed no abnormality, the stool exam confirmed triple infections with *S. mansoni* , and hook worm eggs and Rhabditiform first-stage larvae of *S. stercoralis* . Interestingly, the Hepatosplenic schistosomiasis observed in this case, represents the severe complicated type of *S. mansoni* infection, with the development of hemorrhaging from esophageal varices [31]. This is the most commonly encountered and critical complication.

Based on the initial differential diagnosis of this patient's symptoms, could have concluded various syndromes, which include hepatitis, liver cirrhosis, or even malignancy [32,33]. However, the ultrasound showed a distinct central sonolucencies and the absence of a true cirrhotic pattern. The patient's viral screening and liver function tests were unremarkable. The etiology of the patient's symptoms and unique shift in the clinical manifestations could be attributed to the interplay between the triple infections and the body immuno-response.

Although the patient is an immigrant from South Sudan, however, prior to the separation in 2010, South Sudan and Sudan were a single country, and both countries are heavily endemic with intestinal parasites, therefore, it could not be exclusively confirmed that his acquired these infections at his home country [34]. Specially that, schistosomiasis and strongyloidiasis both can persist in patients for a long while undetected.

The final diagnosis of chronic hepatosplenic schistosomiasis was established based on the following criteria: 1) Identification of*S. mansoni* egg in the stool sample; 2) presence of portal hypertension and esophageal varices with normal liver function test and no evidence of hepatic cirrhosis; 3) Travel and residency history of the patient in hyper endemic countries.

The early detection of these triple infections was challenged by the fact that infection with *S. stercoralis* can happen without symptoms, especially in areas of high endemicity [35]. This is exactly the case with our patient indicated by that; the larva was detected incidentally in his stool sample. The presence of this additional parasitic infection was indicated confirmed through stool examination and there is no dermatologic evidence of Strongloides (such as Larva currens), as well as the lack of pulmonary or gastrointestinal

manifestations like steatorrhea, malabsorption or protein losing enteropathy. This indicates that the triple infections has altogether altered the clinical presentation of symptoms to look non-like any of these infections separately.

In Sudan, both of these infections are endemic, and schistosomiasis affects around 50% of the population in certain regions [36]. In order to improve public health measures relating to parasitic infections like *S. mansoni* , hook worm and *S. stercoralis* , several key steps are essential. The first and most important measure is to raise awareness among communities at risk and healthcare providers regarding the local risk, prevalence, and mode of transmission, personal protection and prevention measures from these parasitic infections [37]. Public health education campaigns should implemented complemented with massive and social media sessions to engage the community and emphasize the importance of proper sanitation, hygiene, and safe practices for food, water, and defecation [37]. These interventions should be particularly intensified among populations living in crowded settings and suboptimal conditions such as camps for refugees and internally displaced persons (IDPs) to reduce the risk of infection. Additionally, this should be supported with systematic screening and treatment programs or massive drugs administration (MDA) program for treatment and prevention among people at high-risk either due to previous or current exposure to sources of potential contamination [38]. Specially that, the currently ongoing war in the country has distributed the originally fragile health system including diagnostic services, surveillance system, and healthcare and medication services throughout the country [39,40,41]. While on the hand, it has created a suitable environment for the emergence of invasive pathogens and vectors, intensified the transmission and dynamic of infections, and increased the vulnerability of the forcibly displaced persons that represents over 85% of the country population [39,40,41]. In the current situation it would be more strategic to invest in a multisectoral collaborative framework that develop and implement a One Health strategy. The One Health strategy implements cost-effective strategic planning and intervention for improving human, animal, and the environment health through capitalizing on prevent and control interventions and reduce the exposure of vulnerable population to risk factors rather than curative medicine [42]. This multisectoral framework should bring health, agricultural, animal resources, metrological and climate, education, humanitarian, and development sectors altogether to maximize the impacts through prioritization, integration, for a better use of resources.

In conclusion, this case documents the complications of having multiple infections on the same time and how this alter the clinical presentation of diseases. It also highlights the importance of considering co-infection and/or multiple infections especially for parasitic infections that have similar manifestation. Therefore, it might be a good strategy for healthcare providers to keep going with the differential diagnosis after making the first detection particularly among patients presenting with gastrointestinal symptoms in endemic areas. Although this might seems to cost more resources, however, considering that the golden standard tool for the diagnosis of intestinal parasites, implementing comprehensive screening for additional infection will not cost anything more than a few extra-minutes. Considering the zoonotic nature of parasitic infections, implementing One Health strategy will substantially reduce the resources needed for the surveillance, prevention, and control of these infections among human, animal, and the environment. This will improve the health and socioeconomic of poor communities and animals.

Consent for Publication

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

Authors' contributions

EES, and AA contributed in the Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Supervision; Validation; Visualization; Writing – original draft and Writing – review & editing of final version.

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Figure legends:

Figure 1: Showing **A** : the *S. mansoni* eggs with the characteristic broad lateral spine, **B** : Hookworm egg and**C** : Rhabditiform first-stage larvae of *S. stercoralis* (Iodine preparation)