



Foldscope assisted microscopy for the examination of Soil Transmitted Helminths (STH)

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Article History

Received: 29 August 2019

Reviewed: 01/September/2019 to 14/October/2019

Accepted: 17 October 2019

Prepared: 20 October 2019

Published: January - February 2020

Citation

Anil Tambekar, Nishant Burnase, Abhay Gaidhane, Punit Fulzele, Zahiruddin Quazi Syed. Foldscope assisted microscopy for the examination of Soil Transmitted Helminths (STH). *Medical Science*, 2020, 24(101), 102-106

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General Note



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ABSTRACT

Background: Conventional microscopic examination in the diagnosis of helminth infection is a widely accepted method worldwide (Jain et al., 2019). Though it has been a successful technique for investigating presence of helminth in a stool samples, yet it requires a good laboratory set up (Gondivkar, Bhowate, Gadail, Sarode, et al., 2019). It is found that the epidemic of helminth infection is most frequent among the underdeveloped and developing countries which are deficient in basic medical facilities (Pordy et al., n.d.). The current study could be the solution upon this which includes the use of foldscope a kind of portable microscope. **Methodology:** The current study was conducted in a community setting in which the study subjects were pregnant women. The targeted parasites include *Ascaris lumbricoides*, *Trichuris trichiura*, *Nectator americans*, *Entamoeba histolytica* and *Giardia spp.* In this study a foldscope was implemented for the microscopic observation of stool samples. **Results:** The collected stool samples were examined under conventional microscope, to find out the presence of helminth eggs, furthermore positive samples were viewed under foldscope to check its utility in the stool microscopy for the identification of helminth. It was found that the oval shaped structures of helminth eggs can be examined by both conventional microscope as well as by foldscope. **Conclusion:** The findings of this study meet the expected results thus; it could be concluded that foldscope would be an evolutionary asset for the diagnosis of Soil transmitted helminths.

Keywords: Foldscope, microscopy, helminth, diagnosis

1. INTRODUCTION

Parasitic helminth infection is one of the major health issues all around the globe. According to WHO 3.5 billion people affected by soil-transmitted helminths infection and approximately 450 million people caused morbidity globally (Parameshwarappa, Chandrakanth, and Sunil 2012). Soil transmitted helminth are the human parasites which usually reside into the intestine of the host. Helminth infections during pregnancy leads to manifestations like anemia and malnutrition and could also be resulted into poor physical and mental development of fetus (Blackwell 2016). Soil transmitted helminth infections are categorized as neglected tropical diseases by World Health Organization (Hotez et al. 2008). It is a common causes of anemia among the children (Dhar et al. 2019). WHO reported that 244,000 children having severe malnutrition (Balwani et al. 2019). The infections are also found among the pregnant women especially in the tropical and semi-tropical regions as humid climate provides favorable conditions for the growth and transmission of helminths which could lead to improper fetal development (Malavade 2015). The parasitic infestation of soil transmitted helminths are one of the most common infection among the children particularly affecting the health of impoverished people all over the world (Ganguly et al., 2017). Previous studies estimated that about 1.45 billion people were found to be get infected by at least one of the helminth parasite (Ghiwot, Degarege, and Erko 2014). These type of infection mainly found in rural and urban slum areas, lower level of education and hygiene or health care awareness (Gaidhane et al. 2013). Parasitic infection is caused by *Ascaris lumbricoides*, *Nector americans*, *Ancylostoma duodenale*, *Entamoeba histolytica*, *Giardia lamblia*, *Trichuris trichiura* (Glinz et al., 2010). Though, the infection by the helminths *Ancylostoma duodenale*, *Necator americanus*, *Trichuris trichiura* and *Ascaris lumbricoides* are not usually associated with the mortality but it could lead to chronic morbidity (Campbell et al. 2016). Helminthiasis may cause iron deficiency anemia, *Hookworm* directly feed on blood of host (Chaudhary and Dhage 2008) and (Jukema et al., 2019). There is no as such golden standard method is available for the diagnosis of helminth infection but, stool microscopy has been routinely performed for the identification of helminthes (Deng et al., 2019). Drug resistance is not uncommon in medical and veterinary field (Geerts and Gryseels 2000) and (Shaheed et al., 2019). Nowadays, along with microscopy PCR based molecular diagnosis is also performed for the more accurate outcomes as it is more specific however, it is not economically feasible (Gupta and Bhake 2017). Diagnosis of Helminths by RT-PCR is very useful (Gupta and Bhake 2018). There is a need of novel method in the helminth diagnosis as the prevalence of helminth infections is usually abundant in underserved remote areas which are deficient in medical facilities (Gondivkar, Bhowate, Gadail, Gondivkar, et al., 2019). Identification of helminth by foldscope microscopy could be a boon for the economically backward countries as it relay on few resources moreover, it could also be accessible in remote areas (Ephraim et al., 2015; Jain et al., 2019)

2. METHODOLOGY

This is a community-based study which was carried out in a rural area of Wardha district located in the Maharashtra, a state in India. The pregnant women were included as subjects and asked to provide stool samples in a stool container. The collected stool samples then carefully brought to Research laboratory at Datta Meghe Institute of Medical Sciences. Each sample was then proceeded for the wet mount microscopic examination to find out presence of targeted helminth species (Shahid et al., 2014). A loop-full stool sample was placed on a clear glass slide and a thin uniform smear was prepared with iodine which is further covered with glass cover slip and sealed by PVC sealing solution to avoid any leakage as, it could damage the lens of foldscope. The prepared slides were observed under conventional microscope and then under foldscope to check the presence of helminth eggs. In case of conventional microscope, slides were initially focused under 10X magnification and later visualized under 40X magnification for a clear view. The same slide was examine under foldscope and images were captured by the attached Smartphone without any zoom as the lens of foldscope has better magnification of 140X and was also coupled with a LED illuminator, a source of bright light (Ganguly et al., 2017).

3. RESULT & DISCUSSION

The traditional diagnosis methods like stool microscopy using conventional microscope have been implemented to examine helminth larvae and eggs. Microscopic examination of stool to find out presence of helminth species is a widely accepted worldwide but it could not be a useful technique in the underdeveloped rural and remote areas (Parija and Srinivasa 1999). This helps in arriving at a diagnostic conclusion. In the current study we have tried to make an alternative to conventional microscopy by using foldscope which can be carried to remote areas with comparatively very less efforts. All the collected samples were examining firstly under conventional microscope and only the samples were found positive for the presence of helminth eggs were then observed under foldscope to assure that the foldscope imaging can be a better replacement for the conventional microscope. An oval shaped thick-walled structures of helminth eggs were observed in the images captured by a Smartphone attached to foldscope and under the conventional microscope (Figure: 1,2,3 and 4).

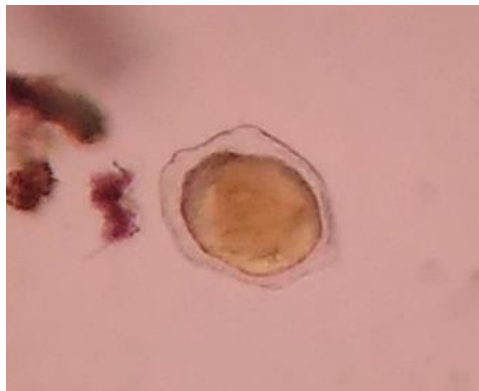


Figure 1 Egg of Hookworm



Figure 2 Cyst of Entamoeba



Figure 3 Egg of *Ascaris lumbricoides*



Figure 4 Egg of *Ascaris lumbricoides*

4. CONCLUSION

After examining the samples under both conventional microscope and foldscope, it was observed that the eggs structures of helminth can be studied by using foldscope as, the images which were taken by foldscope were clear and the morphological discrimination of helminth eggs was possible. The images acquired by foldscope clearly showing the thick walled oval shaped structures which are analogous to the eggs of soil transmitted parasites. From these results we can also conclude that foldscope is not only capable of finding helminth larvae and eggs but also can discriminate among various species of soil transmitted helminth. Public health program must be done for social awareness about helminths infection (Singh et al., 2018). Maternal infection with STH may also increase susceptibility of the unborn child to infection with STH, but it is unclear if this is due to shared environmental factors. Co-infections may necessitate combination chemotherapy depending on drug efficacy for the infecting species (Pal, Oswal, and Vankar 2018).

Conflicts of Interest: The authors declare no conflict of interest.

Financial resources of the study

Department of Biotechnology, Government of India

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