Original Article

Identification of Cases by Non-Microscopic Rapid Diagnostic Test in Suspected Malaria Infection in Community Setting

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Abstract

Background: Malaria presents a diagnostic challenge in most tropical countries. Malaria is diagnosed predominantly by using clinical criteria, with microscopy as gold standard for detecting parasitemia. Recently, rapid diagnostic tests (RDTs) have been developed for situations in which reliable microscopy may not be available.

Objective: To identify the cases of malaria by non-microscopic Care Start malaria Pf/Pv combo RDT in suspected malaria infection in community setting.

Subjects and Methods: This descriptive observational study was conducted from October to December 2010 in Ehsas Field Hospital, Kot Addu, District Muzaffargarh. Data was collected from Medical and Paediatric outpatient departments of field hospital. Patients of age 5 – 75 years were included in the study. Malaria was clinically suspected in patients with recent fever, chills and/or anemia and was confirmed by Care Start malaria Pf/Pv combo RDT as per the manufacturer's instruction. Data was analyzed by SPSS 17. This study was not sponsored by manufacturer.

Results: Among patients of age 5 – 75 years, 2196 patients were clinically suspected and 1767 cases were confirmed for malaria infection by RDT common age group suspected was 16 – 25 yaers 556 (25%). Case identification rate of RDT was 80%.

Conclusion: Non-microscopic Care Start malaria Pf/Pv combo RDT has reliable diagnostic accuracy to identify confirmed cases of malaria infection and may be preferred during malaria epidemics in community setting.

Key words: Community setting, Diagnostic accuracy, Histidine rich protein, Lactate dehydrogenase, Malaria

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infection, Rapid diagnostic test.

Introduction

Malaria is a serious disease characterized by fever, chills and anemia and is caused by parasite that is transmitted from one human to other by the bite of Anopheles mosquitoes. There are four kinds of *Plasmodium* species that can infect human; *Plasmodium vivax, falciparum, ovale* and *malariae*. Almost 250 million annual malaria cases and one million deaths have been reported globally.[1] Pakistan faces about 4.5 million annual suspected and 1.6 million confirmed cases of malaria.[2]

Early diagnosis and prompt treatment of malaria is necessary for prevention of its complications. The majority of malaria cases are found in countries where cost-effectiveness is an important factor and training of personnel to perform diagnostic test is also a major consideration. Malaria is diagnosed predominantly by using clinical criteria, with microscopy as gold standard for detecting parasitemia.[3] Recently, rapid diagnostic tests (RDTs) have been developed for situations in which reliable microscopy may not be available. RDTs are based on the detection of antigens released from parasitized red cells. Malaria antigens currently targeted by RDT are histidine – rich proteins 2 (HRP – 2), *Plasmodium* lactate dehydrogenase (PLDH) and *Plasmodium* aldolase.[4] In recent years, local[5,6,7] and international[8,9,10] studies have found that RDTs have excellent sensitivity and specificity when compared with conventional microscopy to diagnose malaria infection.

Natural disasters like floods are catastrophic events that can lead to disease outbreaks in affected regions. Pakistan faced flood in 2010 that began following heavy monsoon rains leading to outbreak of infectious diseases in the affected regions.[11] Malaria was one of the common disease outbreaks in these regions. WHO provided Care Start malaria Pf/Pv combo RDT kits to diagnose malaria infection in affected population. The objective of this study was to identify cases of malaria by non-microscopic CareStart malaria Pf/Pv combo RDT in suspected malaria infection in community setting.

Subjects and Methods

This descriptive study was conducted from October to December, 2010 in a field hospital of a flood affected area, Kot Addu, District Muzaffargarh, Punjab, Pakistan. "Ehsas Field Hospital" was established in September, 2010 in partnership with Government of the Punjab, and King Edward Medical University / Mayo Hospital, Lahore, in Kot Addu. Data was collected from Medical and Paediatric outpatient departments (OPD). Patients of age 5 – 75 years were included in the study. Malaria was clinically suspected in patients with recent fever, chills and / or anemia and was confirmed by performing CareStart malaria Pf/Pv combo RDT. This combo RDT (pLDH/HRP-2 antigen test) was designed for the differential diagnosis between *P. falciparum* and the other *Plasmodium* species. It contained a membrane strip precoated with two monoclonal antibodies as two separate lines across the strip. One monoclonal antibody was pan specific to *Plasmodium* lactate dehydrogenase (pLDH) of the *Plasmodium* species and other line consisted of a monoclonal antibody specific to histidine – rich proteins 2 (HRP – 2) of the *P. falciparum* species. Single drop of blood was required for the test and half hour time was awaited to interpret the results. Data was entered in SPSS 17 and was presented as frequency tables and bar diagrams. Patients were according to the individual merit. This study was not sponsored by manufacturer.

Results

Total of 2196 patients of age 5-75 years, examined in Medical and Paediatric OPDs, were included in the study. Common age group was 16 – 25 years 556 (25%), followed by 5 – 15 years 469 (21%), 36 – 45 years 437 (20%), 26 – 35 years 327 (15%), 46 – 55 years 196 (9%), 56 – 65 years 174 (8%), and 66 – 75 years 43 (2%) (Figure 1). These 2196 patients of suspected of malaria were subjected to Care Start malaria Pf/Pv combo RDT and 1767 cases were found positive for malaria infection (*P. vivax or P. falciparum*) Hence case identification rate of non-microscopic Care Start malaria Pf/Pv combo RDT was 80% (Table 1).

Table 1: Case identification rate of Care Start malaria Pf/Pv combo RDT (n = 2196).

Suspected Malaria cases	2196
Cases identified by RDT	1767 (80%)

Discussion

Present study had 2196 patients of age range of 5 – 75

years. Common age group was 16 – 25 years (25%).

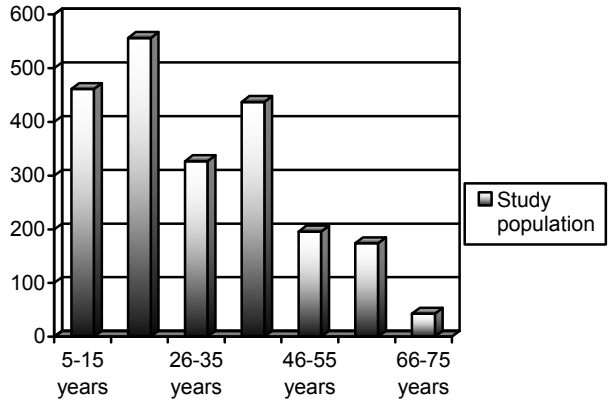

Figure 1: Age Distribution of suspected malaria cases (n = 2196).

Ashton et al[9] in ethopia reported comparable sample size of suspected malaria cases in their study. However, local[5,6] and international[10,12] studies have reported less sample size. The difference may be due to the fact that these studies were hospital based while we reported data of community setting in disastrous area.

The recommended and current gold standard method for the routine laboratory diagnosis of malaria is the microscopic examination of stained thick and thin blood films. RDTs offer the possibility of more rapid non-microscopic methods for rapid diagnosis. Present study evaluated performance of Care Start malaria Pf/Pv combo RDT. We found that out of 2196 suspected cases, 1767 cases were found positive for malaria infection (*P. vivax or P. falciparum*). Case identification rate of RDT was 80%. Our results are comparable to the studies which looked at the performance of Care Start malaria Pf/Pv combo RDT. Mekonnen et al[10] reported that diagnostic performance of CareStart malaria Pf/Pv combo test for the diagnosis of *Plasmodium* was comparable with microscopy with a sensitivity, specificity, PPV, and NPV of 95.8%, 100%, 100% and 96% respectively. Sharew et al[12] reported good diagnostic validity of Care Start malaria Pf/Pv combo test with sensitivity 99.4%, specificity 98%, PPV 94.4% and NPV 99.8%. Authors of the study also found diagnostic performance of Care Start Malaria Pf/Pv Combo test comparable to that of Paracheck Pf test. Ashton et al[9] in ethopia evaluated diagnostic performance of Care Start, Para Screen and ICT Combo RDTs and found Care Start RDT better.

Studies done at national[5,6,7] and international levels[13,14] using immunochromatographic RDTs have also comparable results in term of sensitivity (92 – 100%) and specificity (84-99%). False positive cases of different RDTs have also been studied by Maltha et al[15] at frequencies ranging from 8.2% to 29.1%. However, authors reported no significant relation between false positive results and parasite density on microscopy.

Results of present study are in concordance with the results reported in national and international literature. They add to the evidence that non-microscopic RDT may be relied upon for the detection of *Plasmodial* antigen when microscopy is not available. Present study has certain limitation. We could not compare our results with gold standard microscopy, therefore, diagnostic accuracy could not be determined.

Conclusion

CareStart malaria Pf/Pv combo RDT can be relied upon for identification of cases of malaria infection and may be preferred during malaria epidemics in community setting. The Care Start combo RDT has the added advantage of being simple to interpret, cost-efficient, and may be preferred for malaria diagnosis when microscopy is not accessible, particularly during times of malaria epidemics in community setting.

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References

1. World Health Organization. Malaria. http://www.who.int/topics/malaria/en/
2. Ministry of Health, Government of Pakistan. National malaria control program.www.moh.gov.pk
3. Murray CK, Gasser RA, Magill AJ, Miller RS. Update on rapid diagnostic testing for malaria. Clin Microbial Rev 2008; 21: 97-110.
4. UNICEF. Malaria diagnosis: A guide for selecting rapid diagnostic test kits. 2007. www.unicef.org/supply/files/Guidance_for_malaria_rapid_tests.pdf

5. Harani MS, Beg A, Khaleeq L, Adil SN, Kakepoto GN, Khurshid M. Role of ICT malaria immunochromatographic test for rapid diagnosis of malaria. J Pak Med Assoc 2006; 56: 167-71.
6. Ahmad SQ, Abbasi SA, Tariq MA, Mirza SA, Salamat A. Evaluation of *Plasmodium* lactate dehydrogenase based immunochromatographic kit for the diagnosis of malaria. J Coll Physicians Surg Pak 2003; 13: 176-7.
7. Rahim F, Haque AU, Jamal S. Comparison of Amrad ICT test with microscopic examination for rapid diagnosis of malaria. J Coll Physicians Surg Pak 2002; 12: 530-3.
8. Jelinek T, Grobusch MP, Nothdurft HD.Use of dipstick test for rapid diagnosis in non-immune travelers. J Travel Med 2000; 7: 175-9.
9. Ashton RA, Kefyalew T, Tesfaye G, Counihan H, Yadeta D, Cundill B, et al. Performance of three multi – species rapid diagnostic tests for diagnosis of *Plasmodium falciparum* and *Plasmodium vivax* malaria in Oromia Regional State, Ethiopia. Malar J 2010; 9: 297.
10. Mekonnen Z, Ali S, Belay G, Suleman S, Chatterjee S. Evaluation of the performance of CareStart malaria Pf/Pv combo rapid diagnostic test for the diagnosis of malaria in Jimma, southwestern Ethiopia. Acta Trop 2010; 113: 285-8.
11. Malik MR, Hussain A, Iqbal MZ, Irfan M, Sehar B. Flood devastated the barriers of epidemics at district Rahim Yar Khan. J Sheikh Zayed Med Coll 2010; 1: 129-33.
12. Sharew B, Legesse M, Animut A, Jima D, Medhin G, Erko B. Evaluation of the performance of Care Start Malaria Pf/Pv Combo and Paracheck Pf tests for the diagnosis of malaria in Wondo Genet, southern Ethiopia. Acta Trop 2009; 111: 321-4.
13. Singh N, Saxena A, Valecha N. Field evaluation of the ICT Malaria P.f / P.v immunochromatograph test for diagnosis of *Plasmodium falciparum* and *P.vivax* infection in forest villages of Chhandiwara, Central India. Trop Med Int Health 2000; 5: 765-70.
14. Gasser RA, Arevalo I, Miller RS, Magill AJ, Forney JR, Sirichaisinthrop J, et al. Preliminary evaluation of the NOW ICT malaria P.f / P.v rapid diagnostic device for the detection of *Plasmodium falciparum* and *Plasmodium vivax*. (Abstract) Am J Trop Med Hyg 2001; 65 (suppl): 320.
15. Maltha J, Gillet P, Cnops L, van den Ende J, van Esbroeck M, Jacobs J. Malaria rapid diagnostic tests: *Plasmodium falciparum* infections with high parasite densities may generate false positive *Plasmodium vivax* pLDH lines. Malar J 2010; 9: 198.