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COMPARISON OF ICT MALARIA WITH SLIDE MICROSCOPY IN PEDIATRIC MALARIA PATIENTS

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ABSTRACT

Objective: To evaluate the sensitivity and specificity of rapid malaria test by antigen method in reference to the conventional Light Microscopy.

Material and Methods: The cross-sectional study was conducted at a Private Health Clinic in Tehsil Bara, Khyber Agency, FATA Pakistan, from May 2011 to November 2011. Ninety Eight malaria suspected children less than age 15 years attending the Private Clinic during the study period were included and screened for malaria infection using ICT and slide microscopy.

Results: ICT yielded a very high sensitivity (96.1%) and Specificity (95.7%) for Malaria. The false positive rates and False negative rates were also very low, being 4.3% and 3.9% respectively.

Conclusion: ICT carries a very high diagnostic yield and can be safely substituted for Slide microscopy in settings where slide microscopy may not be readily available.

Key Words: Malaria, Slide Microscopy, Rapid Diagnostic Tests.

INTRODUCTION

Malaria is ranked as the leading communicable disease in Pakistan, accounting for about 10% of the overall Disability. Adjusted Life Years lost, and about 30% of Disability Adjusted Life Years in Tribal Areas of Pakistan. Approximately 68% of the total population of Khyber Agency, a part of Tribal Areas is at risk of malaria[1]. According to Pakistan Federal Ministry of Health (MOH), in 2008/2009, malaria was the leading cause of outpatient visits, health facility admissions and inpatient deaths, accounting for 12% of reported outpatient visits and nearly 10% of admissions. Because a large proportion of the population does not have access to health care services, these figures probably under-estimate the true burden of malaria in the country[1]. In Pakistan, *Plasmodium falciparum* and *Plasmodium vivax* are the major parasites accounting for about 30% and 70% of infections, respectively, during peak transmission periods[2,3].

The malaria transmission pattern in Pakistan is highly seasonal and unstable[4]. Because of this unstable transmission and infrequent exposure to infection, immunity is generally under-developed and all age groups are at risk of malarial disease. Although pregnant women and children under five years of age are the most vulnerable groups. The population at age five and older are also at high risk[4].

In the prevention and control of malaria, prompt and accurate diagnosis is the key to effective disease management[5]. However, in Pakistan, clinical diagnosis and empirical treatment has been the mainstay of malaria management in areas where laboratory facilities are not available. Due to the non-specific nature of signs and symptoms of malaria, clinical diagnosis is unreliable[3,5,6]. In many countries malaria is still being diagnosed clinically, an unreliable method leading to over-diagnosis and over-treatment[7]. Light microscopy (LM) remains preferred and standard for laboratory diagnosis of malaria although it is not accessible and affordable in most peripheral health facilities in the country. Moreover, microscopy is time consuming, requires trained personnel and needs careful preparation and application of reagents to ensure quality results[6,8]. For a better and sustainable control, malaria diagnosis requires a more rapid, easy, sensitive and specific method.

Malaria rapid diagnostic test (ICT) was introduced in the 1990s and has undergone many improvements[9]. The ICT's have been used by health extension workers (HEWs) at health posts in Africa and rest of the world since 2005[10,11,12,13,14]. This study was conducted to evaluate the sensitivity and specificity of rapid malaria test in reference to the conventional LM in Tehsil Bara, Khyber Agency, FATA, Pakistan.

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MATERIALS AND METHODS

The cross-sectional study was conducted at a Private Health Clinic in Tehsil Bara, Khyber Agency, FATA Pakistan, from May 2011 to November 2011, which was a peak transmission season in this region. The district is malarious and covers an area of 1,270 km^2. The altitude of the district ranges between 1,750 and 2,100 feet above sea level. It has a population of more than 100,000 and the majority of its population depends on subsistence farming.

Ninety Eight malaria suspected children less than age 15 years attending the Private Clinic during the study period were included and screened for malaria infection using ICT. Patients who had received anti-malarial drugs during the past four weeks and critically ill patients who were unable to give blood and were comatosed were excluded from the study.

The socio-demographic characteristics and clinical data of the participants were collected using a structured and pre-tested questionnaire. Finger-prick samples were collected and placed in a grease-free, clean, glass slide. The same finger-prick blood sample was used to carry out the ICT in parallel, following manufacturer's instructions using Yd strip. In a single slide, both thick and thin films were prepared. The thin films were fixed in methanol after air-drying, the slides were stained in 10% Giemsa solution for 15 min. Thin and thick films were read at the health centre by an experienced laboratory technician and the result was considered negative if no parasites were seen after examination of 200 fields at 1,000x magnification.

The collected data were computerized using Excel program, exported and analysed by SPSS version 17. Sensitivity, specificity, and positive and negative predictive values were determined for both tests and compared with one another. Kappa value was determined to see the consistency of the results among the diagnostic tools. A *P* value of less than 0.05 was considered significant in all comparisons.

RESULTS

Patient demographic characteristics are shown in Table 1. The clinical findings are shown in Table 2.

DISCUSSION

The present study revealed a high sensitivity and specificity of the ICT. The high sensitivity of the ICT in this study was in line with other studies conducted in Africa[11] and Madagascar[15]. The current study revealed a higher sensitivity and a slightly lower specificity than reports from Myanmar[16]. Overall, the ICT showed good sensitivity when compared to the LM. In set ups where health personnel rely on their clinical judgment, using ICT for the diagnosis of malaria can be helpful for early institution of treatment.

The ICT had high Negetive Predictive Value (NPV), meaning that it was reliable in ruling out

Table 1: Patient's Characteristics

Patient's Characteristics	No. of patients (%ages)
Sex	
Female	32 (32.7)
Male	66 (67.3)
Age (in years)	
Mean±SD	5.4±3.4
Range (Min, Max)	(0.3, 14.5)
Weight (in kg)	
Mean±SD	17.3±11.6
Range (Min, Max)	(6.0, 49.5)
Total	**98**

Table 2: Clinical Findings of Patients

Clinical Findings	No. of Patients (%ages)
High Grade Fever	98 (100.0)
Duration of Fever (in days); Mean±SD	11.2±9.9
Range (Min, Max)	(2, 55)
Chill	2 (2.0)
Vomiting	2 (2.0)
Abdominal pain	1 (1.0)
Low Grade Fever	0 (0.0)
Sleenomegaly	12 (12.2)
Duration (in days); Mean±SD	8.2±5.4
Range (Min, Max)	(2, 15)
Anemia pallor	66 (67.3)
Hb (%)	
Mean±SD	9.7±1.3
Range (Min, Max)	(6.0, 11.8)
MP Slide	
-ve	47 (48.0)
+ve	51 (52.0)
ICT Method	
-ve	47 (48.0)
+ve	51 (52.0)
Total	**98**

malaria. Similarly, the higher Positive Predictive Value (PPV) means that patients will be correctly diagnosed as positive for malaria and avoids unnecessary treatment.

The overall frequency of malaria in the study area was very high, as detected by either the ICT (51%) or the LM (51%). The result was higher than the report from some areas of Baluchistan (23.2%)[17]. While it was in agreement with a report from three regions in Sindh[18]. The high prevalence could be partly explained by the fact that the study was conducted in a peak malaria transmission season in the country. Also, the malaria transmission pattern in Pakistan is highly seasonal and unstable. Because of this unstable transmission and infrequent exposure to infection, immunity is generally under-developed and all age groups are at risk of malarial disease[19]. On the other hand, it might be due to development of anti-malarial or insecticide resistance in the area[5]. The knowledge, attitude and practice of the participants could also be a factor[19]. However, these assumptions should be evaluated with further studies. The high prevalence of malaria, despite the tremendous effort to distribute bed nets and apply outdoor insecticides, heralds the need to evaluate the malaria control system in the area and beyond.

Current subjective or objective fever (axillary temperature of $>37.5^{0}$c) was the most common presenting symptom by the participants (Table 2). Fever detects only 52% malaria. This could be explained by the fact that individuals may carry parasites without symptoms. On the other hand, the significant overlap of malaria symptoms with other tropical diseases might have impaired the specificity of fever and encouraged the indiscriminate use of anti-malarials for managing febrile conditions in endemic areas. Studies of fever cases in Philippines, Sri Lanka, Thailand, Mali, Chad, Tanzania and Kenya have shown high percentages of malaria over-diagnosis when using fever as a clinical diagnostic tool[20,21,22,23,24,25]. Comprehensive investigation to identify the etiologic agents of febrile illnesses could be helpful in the study area and beyond. Defining the malaria-attributable fraction to estimate the frequency of true febrile malaria among all febrile cases, by fitting the risk of fever as a function of parasite density using a logistic regression model, would be of paramount importance[25].

CONCLUSION

Malaria can be safely diagnosed with high sensitivity and specificity through Immunochromatographic tests (ICT) in settings where Slide Microscopy is not readily available.

REFERENCES

1. Malaria Operational Plan Pakistan FY. 2010.
2. Tulu NA: Malaria. In The Ecology of Health and Disease in South Asia 2nd edition. Edited by Kloos H, Zein AZ. Westview Press Inc, Boulder, USA; 1993: 341-52.
3. World Malaria report. WHO; 2011.
4. Ministry of Health (MOH) [Pakistan]: Health and health related indicators. Ministry of Health, Islamabad, Pakistan; 2006.
5. Malaria diagnosis and treatment guidelines for health workers in Pakistan 2nd edition. 2004.
6. World Health Organization: New Perspectives: Malaria Diagnosis, Report of a Joint WHO/ USAID. In Informal Consultation held on 25-27 October 1999. World Health Organization, Geneva, Switzerland; 2000: 4-48.
7. Reyburn H, Redempta M, Chris D, Ilona C, Emmanuel M, Ombeni M, Kapalala S, John S, Andrew K, Raimos O, Brian MG, Christopher JMW: Over diagnosis of malaria in patients with severe febrile illness in Tanzania: a prospective study. BMJ 2004, 329: 1212-14.
8. Haditsch M: Quality and reliability of current malaria diagnostic methods. Trav Med Infect Dis 2004, 2: 149-60.
9. Moody A: Rapid diagnostic tests for malaria parasites. Clin Microbiol Rev 2002, 15: 66-78.
10. Federal Democratic Republic of Ethiopia MoH: National Five Year Strategic Plan for Malaria Prevention and Control in Ethiopia. Addis Ababa, Ethiopia; 2006.
11. 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: 285-88.
12. Sharew B, Legesse M, Animut A, Jima D, Medhin G, Erko B: Evaluation of the performance of CareStart Malaria Pf/Pv Combo and Paracheck Pf tests for the diagnosis of malaria in Wondo Genet, Zambia. Acta Trop 2009, 111: 321-24.
13. Nigussie D, Legesse M, Animut A, H/Mariam A, Mulu A: Evaluation of Paracheck pf and Parascreen pan/pf tests for the diagnosis of malaria in an endemic area of Karnataka, India. Brit Med J 2008, 46: 375-81.
14. Lemma H, Byass P, Desta A, Bosman A, Costanzo G, Toma L, Fottrell E, Marrast AC, Ambachew Y, Getachew A, Mulure N, Morrone A, Bianchi A, Barnabas GA: Deploying artemether-lumefantrine with rapid testing in Ethiopian communities: impact on malaria morbidity, mortality and healthcare resources. Trop Med Int Health 2009, 15: 241-50.
15. Ratsimbasoa A, Randriamanantena A, Raherinjafy R, Rasoarilalao N, Menard D: Which malaria rapid test for Madagascar? Field and laboratory evaluation of three tests and expert microscopy of samples from suspected malaria patients in Madagascar. Am J Trop Med Hyg 2007, 76: 481-85.

16. Ashley EA, Touabi M, Ahrer M, Hutagalung R, Htun K, Luchavez J, Dureza C, Proux S, Leimanis M, Lwin MM, Koscalova A, Comte E, Hamade P, Page AL, Nosten F, Guerin PJ: Evaluation of three parasite lactate dehydrogenase-based rapid diagnostic tests for the diagnosis of falciparum and vivax malaria. Malar J 2009, 8: 241.

17. Ashton RA, Kakar Q, Mukhtar M. :Performance of three multi-species rapid diagnostic tests for diagnosis of Plasmodium falciparum and Plasmodium vivax malaria in high Malaria risk districts of Baluchistan, Pakistan. Malar J 2010, 9: 297.

18. Pakistan Demographic and Health Survey: 2005: Federal Bureau of Statistics, Government of Pakistan, Islamabad, Pakistan; 2006.

19. Shiekh GA, Chandio HS, Naqvi SS, Majeed AS:Evaluation of light microscopy and rapid diagnostic test for the detection of malaria under operational field conditions: a household survey in rural Sindh. Malar J 2008, 7: 118-25.

20. Stephens JK, Phanart K, Rooney W, Barnish G: A comparison of three malaria diagnostic tests, under field conditions in North-west Thailand. Southeast Asian J Trop Med Public Health 1999, 30: 625-30.

21. Dicko A, Mantel C, Kouriba B, Sagara I, Thera MA, Doumbia S, Diallo M, Poudiougou B, Diakite M, Doumbo OK: Season, fever prevalence and pyrogenic threshold for malaria disease definition in an endemic area of Mali. Trop Med Int Health 2005, 10: 550-56.

22. Othnigue N, Wyss K, Tanner M, Genton B: Urban malaria in the Sahel: prevalence and seasonality of presumptive malaria and parasitaemia at primary care level in Chad. Trop Med Int Health 2006, 11: 204-10.

23. Reyburn H, Ruanda J, Mwerinde O, Drakeley C: The contribution of microscopy to targeting antimalarial treatment in a low transmission area of Tanzania. Malaria J 2006, 5: 4-10.

24. Mwangi TW, Mohammed M, Dayo H, Snow RW, Marsh K: Clinical algorithms for malaria diagnosis lack utility among people of different age groups. Trop Med Int Health 2005, 10: 530-36.

25. Smith T, Schellenberg JA, Hayes R: Attributable fraction estimates and case definitions for malaria in endemic areas. Stat Med 1994, 13: 2345-58.