Comparative evaluation of thin smear, thick smear and antigen detection test in the diagnosis of malaria

Chetankumar Maganlal Dharaiya[1], Bhavesh Ramji Faldu[2], Harshid L Patel[3*]

[1]Associate Professor, Dept. of Pathology, GMERS Medical College, Sola-Ahmedabad, Gujrat,
[2]Tutor, Dept. of Pathology, B. J. Medical College, Ahmedabad, Gujrat
[3]Associate Professor, Dept. of Pathology, GMERS Medical College, Gandhinagar, Gujrat,

***Corresponding Author**
E-mail: harshidpatel11111@gmail.com

Abstract

Background: Malaria is a serious and sometimes fatal disease caused by a parasite that commonly infects a certain type of mosquito which feeds on humans. There are many Techniques available for Detection of malarial parasite from the blood.
Objective: The objective of this study is to determine efficacy of different methods for detection of malaria parasite.
Methodology: Total 5344 blood samples that came to pathology laboratory are investigated for malarial parasite by different technique like thin smear and Thick smear that is stained by Gimsa stain and Rapid Diagnostic Test (RDT) for detection of malarial parasite.
Result: Among total 5354 samples were collected 305(5.7%) were found to be positive for malaria of the positive samples 300(98.36%) were positive by Thick smear, 221(72.45%) were positive by Thin smear and 281(92.13%) were positive by Antigen detection method. Among them 211(69.18%) cases of P. Vivax, 77(25.24%) cases of P. falciparum and 17(5.6%) had a mixed infection. Sensitivity of Thick smear is 98.36%, thin smear 72.45% and for antigen detection method it was 92.13%.
Conclusion: Detection of malarial parasite can be best done by combination of Antigen detection method and by Microscopic Examination of Thick smear.

Keywords: Plasmodium vivax, Plasmodium falciparum, Rapid test for antigen detection Sensitivity, Thick smear, Thin smear.

Introduction

Worldwide, Plasmodium vivax accounts for an estimated 80 million cases of malaria each year. Since last many year diagnosis of malaria was done by microscopic examination of thin and thick smear by using different types of stains[1,2] and today this approach is the gold standard for malaria diagnosis that is recommended by the World Health Organization(WHO). However, for microscopy trained technician is required because in case of mild parasitemia there is so much difficulties to find out malarial parasite. In peripheral area where trained technician are not available so that it is very difficult to diagnosed malaria based on examination of smear microscopy. So that mortality is very high due to malaria due to delayed in diagnosis of malaria and patients died due to complication subsequent to malarial fever.[3,4] Areas that cannot afford laboratory diagnostic tests often use only a history of subjective fever as the indication to treat for malaria. Due to the increasing mortality from malaria and the problems of microscopic method, rapid diagnostic tests (RDTs) can be an alternative way for malaria diagnosis in critical situations; however, the result should be approved by microscopic method.[5]

Material and Methods

This prospective study was conducted at B.J. Medical College, Ahmadabadand Gujarat from 2012-2014.Study Population: Patients attending B.J. Medical College and New Civil Hospital, Ahmadabad, Gujarat from 2012-2014.

Blood sample that came to pathology center of our institute were examined for Thick smear and thin smears simultaneously blood was tested by the rapid diagnostic test. Thick smear and thin was stained by Gimsa stain. Smears were examined for malarial parasite under 100X lens of microscope by using wood oil for 100 fields for 5 minutes. We have used malarigen Antigen detection card For the Rapid diagnosis. Samples were subjected to antigen detection as per instruction mentioned in kit literature.

Results

Among total 5354 samples were collected 305(5.7%) were found to be positive for malaria. Among them 211(69.18%) cases of P. Vivax, 77(25.24%) cases of P. falciparum and 17(5.6%) had a mixed infection. Distribution of participants according to age and type of malaria wise mentioned below in Table 1. Comparison of detection of malaria according to type of various method like Thin smear, Thick smear and antigen detection method mentioned below in Table 2.

Table 1: Age wise distribution of participant along with type of malaria

Type of malaria	Age Group		
	0-30 yrs.	30-60 yrs.	>60 yrs.
P.Vivax	92	104	15
P.Falciparum	34	32	11
Mixed infection	10	02	05
Total	136	138	31

Table 2: Comparison of Various methods for diagnosis of malaria

Species	Thick smear	Thin smear	Antigen detection test
P. Vivax	193	143	194
P. Falci	76	54	72
P. Falci and P. Vivax	31	24	15
Total	**300**	**221**	**281**
Sensitivity	98.36%	72.45%	92.13%

Table 3: Comparison of sensitivity of Antigen detection test depending upon the species

Species	Present study	Chayani *et al.;*[17]	Palmer *et al.;*[18]	Farcas *et al.;*[19]	Singh *etal.;* [14]
P. Vivax	91.21%	88.4%	94%	95.5%	94.7%
P. Falci	89.45%	96.8%	88%	87%	84.2%

Sensitivity of Thin smear, Thick smear and antigen detection method was calculated by using Graphed prism software. According to sensitivity of Thick smear is 98.36%, Thin smear 72.45% and for antigen detection method it was 92.13%.

Table 4: Showing sensitivity by different methods for detection of malaria parasite

Species	Thick smear	Thin smear	Antigen detection test
P. Vivax	91.64%	67.77%	91.14%
P. Falci	98.70%	70.12%	93.50%

Discussion

The WHO recommends microscopic examination as the gold standard for P. vivax malaria diagnosis. Physicians at local health centers still use this method, but have asked which of the RDTs is most accurate for diagnosis of this disease.[6]

Due to the high mortality rate of malaria, limitation of the microscopic method in the malaria control program and the need for special equipment, the use of a rapid diagnostic method with microscopic methods seems necessary. Therefore, many efforts have been made to detect malaria outside the range of microscopic techniques. These methods are nucleic acid probes and immunofluorescence, diffusion gel, counter immune electrophoresis, radioimmunoassay, enzyme immunoassay, immune-chromatography test (ICT), hem agglutination test, indirect immunofluorescence, and western blot.[7,8] Polymerase chain reduction (PCR) is used to identify the four Plasmodium species in the cases where the parasite level is low; moreover, it can be used in mixed infection.[9,10]Leishman stained blood smear examination, which is the cornerstone in the laboratory diagnosis of malaria, has undergone little improvement since its inception. This is labor intensive and time taking and therefore delays diagnosis.

Humar *et al.* [11] found HRP2 antigen in 68% cases of treated patients on day 7 and in 27% cases on day 28. In our study 2 cases detected by antigen detection test were negative by thick smear. Singh et al. by studying 344 patients with symptomatic *P. falciparum* and *P. vivax* revealed that sensitivity and specificity were 97.5% and 88% for *P. falciparum* and 72% and 99% *for P. vivax*, respectively. Christian *et al.* reported that if parasitaemia is more than 60 parasites/μL of blood, the dipsticks gave a sensitivity of 96.5-100% and this fell to 11-67% with 10 parasites/μL of blood.[12] Since the present study was performed in tropical areas, the results might be different in sensitivity of considered tests with similar studies conducted on the mentioned subject. Because transmission rates and parasite densities in Gujarat vivax malaria patients are usually high, a high Rapid diagnostic test sensitivity is very important.

Conclusion

From my study we would like to conclude that Detection of malarial parasite can be best done by combination of Antigen detection method and by Microscopic Examination of Thick smear.

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