INTRODUCTION

Malaria sometimes known to be the King of Diseases. It is caused by protozoan parasite of the genus Plasmodium. Plasmodium falciparum causes the most serious and sometimes fatal type of disease. The other malarial species i.e., P. vivax, P. ovale, P. malarie and sometimes P. knowlasi can cause acute, severe illness with low mortality rates. People suffering from malarial infection is estimated to be over 500 million annually which leads to about 1-2 million deaths, of whom 90% are sub-Saharan African children. Roughly 60% of Pakistan’s population, live in malaria-endemic regions. In Pakistan 500,000 malarial infectios and 50,000 malaria-attributable deaths occur every year despite of well-established malaria control programme, with approximately 37% of cases to occur in Tribal Areas, followed by Balochistan and Khyber Pakhtunkhwa Provinces.

P. Falciparum is notoriously famous for causing severe and complicated malaria. Same is observed increasingly with P. vivax malaria. The documented severe manifestations include cerebral malaria, hepatic dysfunction, renal dysfunction, severe anemia, ARDS, shock, pulmonary edema, hemoglobinuria, and multiple organ involvement.

Many tests forming the cornerstone of the modern microbiology laboratory are based on very old and tiresome technologies such as microscopy for malaria the gold standard for malaria diagnosis is conventional microscopic examination of peripheral thick and thin blood smears. The accuracy of the test mainly depends on the expertise of the pathologist and smear’s quality. Unfortunately, microscopy quality varies significantly, and is often unreliable. Importantly, it is hard to maintain the quality of microscopy in remote areas where malaria commonly occurs. Today’s world
need is more quick investigations without sacrificing sensitivity, value-added tests and point-of-care tests for both high-and low-resource settings. The rapid diagnostic tests (RDTs) have becoming famous to improve diagnostic accuracy in areas where population are at risk of malaria.

The rationale of the study is to figure the diagnostic accuracy of ICT in diagnosis of malaria in our region because it is rapid and cost effective method as compared to microscopy which needs expert personnel and technique. The burden of malaria in our region is very huge and the expert personnel are not readily available for microscopic detection of malarial parasite and also for proper thick and thin blood slide preparation. As already mentioned above the diagnostic accuracy of ICT is comparable with microscopy so by doing this study we will be able to determine the diagnostic accuracy of ICT malaria in our setup. This will help us to diagnose and manage malaria early and will prevent the complication of malaria and will lessen the morbidity and mortality especially in a low resource setting.

MATERIAL AND METHODS

This study was done on a Cross Sectional Validation Study at Medical Ward, Nowshera Teaching Hospital, Nowshera from April 2015 to October 2015. A total of 161 patients were selected on Non-probability Consecutive Sampling technique by using 37% prevalence of malaria by Sajid’s calculator of sensitivity and specificity sensitivity of 92.12% and margin of error 7%, specificity of 96.5% and margin of error of 3% and a confidence interval of 95%. All male and female patients aged 16 to 60 years (as medical unit deals with adults), fever history in last 24 hours or Temperature of 37.5°C with rigors and chills from axilla were included in the study. Patient already diagnosed smear positive for malaria over the last 1 month because ICT was false positive in these patients, patients who have evidence of other common causes of fever like pharyngitis, tonsillitis, urinary tract infection (UTI) and sinusitis were excluded.

The study was conducted after approval from the hospital ethical and research committee. After informed consent all patients fulfilling the inclusion and exclusion criteria who present to Medical unit Nowshera Teaching Hospital through OPD, emergency or admitted in ward was included in study. Detailed history and physical examination was conducted. After that a base line venous blood sample of 3cc was taken from patient and was sent to Hematology lab HMC/PGMI (the lab personnel would be kept blind regarding the ICT kit result) for thick and thin smear preparation and microscopic confirmation of Plasmodium parasite. A drop of whole blood was added to the pad of ICT kit SD Bioline p.f/p.v (Bio standard diagnostic, Korea) followed by lysis reagent and was interpreted in 10 minutes. The data along with demographic information was recorded on pre designed proforma for statistical analysis.

The data was gathered and interpreted by SPSS version 16. Study variables were age, microscopy and immune chromatography. Mean standard deviation was calculated for continuous data like age of patient. Sensitivity, Specificity, positive predictive value (PPV), negative predictive value (NPV) which was determined by taking microscopy as gold standard.

RESULTS

Age distribution was analyzed and is shown in Table 1. Gender distribution was analyzed as 90 (56%) patients were male and 71 (44%) patients were female. Microscopic findings were analyzed as malaria was positive in 137 (85%) patients and was negative in 24 (15%) patients. ICT findings were analyzed as malaria was positive in 145 (90%) patients and was negative in 16 (10%) patients. Diagnostic accuracy of ICT was analyzed and is shown in Table 2.

Table 1: Age distribution

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Frequency &amp; Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-25</td>
<td>47 (29%)</td>
</tr>
<tr>
<td>26-35</td>
<td>50 (31%)</td>
</tr>
<tr>
<td>36-45</td>
<td>34 (21%)</td>
</tr>
<tr>
<td>46-55</td>
<td>16 (10%)</td>
</tr>
<tr>
<td>55-65</td>
<td>14 (9%)</td>
</tr>
<tr>
<td>Total</td>
<td>161 (100%)</td>
</tr>
</tbody>
</table>

Mean age was 29 years with SD ± 13.18

Table 2: Diagnostic accuracy of ICT

<table>
<thead>
<tr>
<th>ICT findings</th>
<th>Microscopic findings</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>A135 (93%)</td>
<td>145 (90%)</td>
</tr>
<tr>
<td></td>
<td>B10 (7%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>C2 (13%)</td>
<td>16 (10%)</td>
</tr>
<tr>
<td></td>
<td>D14 (87%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>137 (89%)</td>
<td>24 (11%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>161 (100%)</td>
</tr>
</tbody>
</table>

DISCUSSION

In humans, the intraerythrocytic protozoa of genus Plasmodium (i.e. P. falciparum, P. vivax, P. malariae, P. ovale) causes malaria. Malaria caused by Falciparum and Vivax are big health issues in Pakistan. In the last decade, falciparum malaria has increased six folds, which now covers 42% of all the malaria cases documented by National Malaria Control Program, Pakistan. Pakistan is a tropical and agricultural country with urbanized population of 35%. 65% of its population is living in rural areas with widespread irrigation system. Annual floods in the rivers coupled with monsoon season and inadequate waste disposal all over the country, offer a suitable scenario for malaria transmission.

In a study performed by Hetal K Panchal and pratibha B Desai with a sample size of 897 out of which...
respectively. Another study conducted by Endeshaw T
by ICT (parahit RDT), the sensitivity and specificity of
198 were diagnosed as positive and 699 as negative
was 93%. In a study performed by Hetal K Panchal and
predictive value was 88% and the diagnostic accuracy
was 58%, positive predictive value was 93%, negative
and 44% patients were female. Diagnostic accuracy of
ICT was analyzed as the sensitivity was 99%, specificity
was 58%, positive predictive value was 93%, negative
predictive value was 88% and the diagnostic accuracy
was 93%. In a study performed by Hetal K Panchal and
pratibha B Desai with a sample size of 897 out of which
198 were diagnosed as positive and 699 as negative
by ICT (parahit RDT), the sensitivity and specificity of
the test found was also high about 92.12% and 98.41%
respectively. Another study conducted by Endeshaw T
al in China compared to microscopy, the sensitivity of
the Pf/Pan device and Pv/Pf device for detection of P.
falciparum was 87.5% and 91.7%, respectively; and for
detection of P. vivax was 72.0% and 73.8%, respectively. The specificity of the Pf/Pan
device and Pv/Pf device was 94.3% and 96.5%, respectively.

In another study the diagnostic accuracy of ICT
was analyzed as the sensitivity was 97%, specificity
was 60%, positive predictive value was 94%, negative
predictive value was 75% and the diagnostic accuracy
was 92% and Kappa Test value was =0.872. The RDT had
97% sensitivity compared with 85% for the blood smear
microscopy keeping PCR as the gold standard. In
another study conducted at Uganda the sensitivity and
specificity of an RDT was 75% and 90.6% respectively
in the low transmission setting while in the high trans-
mision setting the sensitivity reached to 93.5% and
specificity dropped to 78.1%. In the study conducted
at the China-Myanmar border area, the sensitivity of the
RDT (pf/pan device) was 88.6% for plasmodium falciparum and 69.9% for plasmodium vivax. In
another study conducted in North West Ethiopia, the RDT malaria showed good sensitivity and specificity with an excellent agreement to the reference light microscopy with kappa value of 0.849. There was also a very good agreement between RDT and Light microscopy in de-
tecting different species of plasmodium. Kappa value of 0.853 for plasmodium falciparum or mixed infection and kappa value of 0.849 for non-falciparum species.

Similarly another study held in the urban and rural
areas of Quetta district showed an incidence of plasmo-
dium falciparum 55.55% and 65.82% respectively, and
that of plasmodium vivax at 44.44% and 34.17% respect-
atively. An incidence of plasmodium vivax infections of
24%, 30.7%, and 45% were observed in other studies
conducted in Pakistan, United States and Afghanistan
respectively. In contrast to all these results in a study
in Dr. George Mukhari Hospital, South Africa, out of
59 patients evaluated, 98% had acquired plasmodium
infection in Sub-Saharan Africa. In Sudan plasmodium
falciparum is the prevalent specie, accounting for more
than 95% of all malaria cases, with anopheles arabo-
asis, anopheles gambiae and anopheles funestus as the
main disease vectors. In another recent study in
Romania plasmodium falciparum was documented in
75% of the cases.

In our study it was noticed that malaria was pres-
ent in bulk of patients (68%) belonging to plain areas
as correlated to hilly areas of KP, which is in contrast to
a study in which 24% of patients were from plain areas
of KP. This may be due to the fact that our place of
study was Nowshera and most of the malarial patients
included in this study were either from Nowshera or
other close districts. Another study conducted in Papua
New Guinea showed that the malaria epidemiology in
south Simbu province was more similar to the lowlands
than to other highland areas. Prevalence of anemia
secondary to malaria in endemic areas of the American
continents has been poorly considered. In another
study, uncomplicated malaria was diagnosed by thick
blood smear in 150 Colombian patients. Plasmodium
falciparum and vivax was found in identical proportion
and anemia was found in 50% of the patients.

CONCLUSION

Immune chromatographic technique (ICT) was
more accurate than microscopy in the diagnosis of
malaria in our region. Moreover, it is rapid and cost
effective method as compared to microscopy which
needs expert personal and technique.

REFERENCES

1. Kliegman RM, Stanton B, Geme JS, Schor NF, Beh-
man RE. Nelson textbook of pediatrics: Elsevier
Health Sciences; 2015.
2. Organization WH. WHO Malaria Report. World Health
Organization. 2011.
3. Khattak AA, Venkatesan M, Nadeem MF, Satti HS,
Yaqoob A, Strauss K, et al. Prevalence and distri-
bution of human Plasmodium infection in Pakistan.
malaria/publications/world_malaria_report_2013/
wmr2013_country_profiles.pdf. 2014.
5. Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans
T, et al. Health professionals for a new century: form-
ting education to strengthen health systems in
6. Kakar Q, Khan M, Bile K. Malaria control in Pakistan:
new tools at hand but challenging epidemiological
realities. 2010.
7. Reyburn H. New WHO guidelines for the treatment
of malaria. BMJ. 2010; 340.
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AUTHOR’S CONTRIBUTION
Following authors have made substantial contributions to the manuscript as under:
Hanan A: data collection and typing.
Tahir M: Bibliography Statistics.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.