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Evaluation of the Performance of Medical Laboratories in Malaria Microscopical Examination in El Obeid City-North Kordofan State

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Abstract: External quality assessment (EQA) and Internal Quality control (IQC) are an alternative tool to cross-checking of blood slides in the quality control of malaria microscopy. This study was aimed to check EQA and IQA of malaria microscopy in El Obeid City North Kordofan. A total of 76 laboratories (55%private and 45%public) were participated in the study.

A well-designed questionnaire plus five blood films (two negative and three positive films with different parasitaemia; (low, moderate and high) were distributed for each laboratory under study. Two slides (stained and unstained) blood films and one ml of Geimsa stain were collected from each laboratory.

The study revealed that, most of laboratories were using Geimsa, but the EQA and IQC for both staff and stain were demonstrated poor performance. Although, only 20% had a record for malaria results, 50% of laboratories reporting only whether the parasite identified or not. 75% were using only thick blood film. The results of the five blood films were; 61% were correct clear negative, 49% were negative with artifacts, while the three positive slides were correctly as follows; low (49%), moderate (76%) and (59%) of high parasite density.

The major errors include; not reporting the density of malaria low (50%), moderate (31%) and high parasite (13%), but those reporting wrong were low (24%,) moderate (39%) and high parasite (24%).

The study concludes that, the EQA and IQC of microscopical examinations for malaria parasite in laboratories in ElObeid were acceptable, further training courses and effective quality assurance scheme were needed.

Keywords— ElObeid, EQA, IQC, Malaria, Microscope**.**

1. Introduction

Malaria is a mosquito borne infectious disease affecting humans and other animals caused by parasitic protozoan's belonging to the genus Plasmodium [1]. Malaria causes symptoms that typically include fever, vomiting and headache [2]. The disease is most commonly transmitted by an infected female Anopheles mosquito [3], the mosquito bite introduces the parasites from the mosquito's saliva into person's blood [4]. The parasites travel to the liver where they mature and reproduce. Four species of Plasmodium's can infect and be spread by humans (P.falciparum, P.vivax, P.ovale and P.malariae) [3]. The species P. knowlesi is rarely causes disease in humans [5]. Most deaths are caused by P. falciparum but the others species were caused milder form of malaria [6]. Malaria is typically diagnosed by the microscopic examination of blood using blood films, or with antigen based rapid diagnostic tests [7].

Methods that use the Polymerase Chain Reaction (PCR) to detect the parasites DNA have been developed but not widely used in areas where malaria is common due to their cost and complexity [8,9]. The risk of disease can be reduced by preventing mosquito bites through the use of mosquito nets and insect repellents or with mosquito control measures such as spraying insecticides and draining standing water [10,11. 12].

Several medications are available to prevent malaria in travelers to areas where the disease is common [13,14].

2- Materials and Methods

This is a cross sectional descriptive study was conducted during the period of March to August 2017 in El Obeid city, North Kordofan which is located about 588 km west of Khartoum, longitude 13.11 North and latitude 30.12 East. The population enrolled in this study was included medical laboratories providing microscopically examination for malaria in El Obeid. About 76 laboratories (32 public and 44 private).

Each laboratory that offer blood film examination for malaria in El Obeid were included in this study while those not carried out malaria microscopical examination were excluded from the study.

2.1 Ethical considerations

The health authorities at the state and locality levels were informed about the study which was only started after having their permission and all individuals enrolled in this study were being asked to participate in the study, and an informed consent was obtained.

2.2 Data collection tools

A well designed questionnaire were used to collect general

Variable	frequency	Percentage (%)
IQC for stain (Yes)	16	21
(No)	60	79
IQC for staff (Yes)	14	18
(No)	62	82
EQC for lab (Yes)	34	45
(No)	42	55
blood film record (Yes)	15	20
(No)	61	80

and technical data, and the result of slides that were distributed as a part of evaluation process as well as 1 ml Giemsa stain were collected from each laboratory enrolled in the study.

2.3 Study procedure

After having consent, the questionnaire were completed by the interviewer. Then a total of (5) slides were submitted for reading by the person who routinely perform blood film examination. These slides included; one slide with no malaria parasite, another slide with no malaria parasite, but containing stain deposits, and three slides with malaria parasites; low, moderate and high parasitaemia. From each participant laboratory; one stained and one unstained blood film were selected randomly as well as getting 1ml Geimsa stain.

2.4 Data analysis

All data was recorded in standard master sheets from the questionnaire that was filled by the investigator, and then were analyzed by the statistical package for social sciences (SPSS) program version 20.

3. Results

The samples and Geimsa stain were examined microscopically to compare the results of each laboratory. The smears and Geimsa were examined in reference laboratory of malaria in El Obeid by the well experience and qualification

investigators to confirmation the result. The results of study revealed that, out of 56 laboratory included in the study 44 (58%) were private laboratory and 32 (42%) public laboratory (Table 1).

Table 1: Frequency of laboratory enrolled in study

Laboratory	frequency	Percent (%)
Private	44	58 %
public	32	42%
Total	76	100

Our finding reveals that the majority of the medical laboratories under study were didn't have internal quality control for stain 60 (79%) but only 16 (21%) had IQC for stain, only 14 (18%) laboratory has IQC for staff, while didn't have were 62 (82%), 34 (45%) of the laboratory has EQC system and 42 (55.5%) has not EQC, majority number 61(80%) of laboratories don't have records for blood film , but only 16(20%) have records for blood film results. (Table 2) .

Table 2: Internal Quality control and external quality control:

The investigation revealed that, the result of the negative clear who were reported true 49 (64%) and false is 27 (36%), negative with artifacts true 39 (51%) and false were 37 (49%) as shown in table 3.

The result for blood film with low parasitemia participant were reported true 39 (51%) and wrong were 37 (49%), moderate parasitemia true result were 61 (80%) and wrong were 15 (20%), and high parasitemia truer were 47 (88%) and false were 19 (12%) as shown in table 3.

The major errors include; not reporting the density of malaria (low 52%, moderate 33% and high parasite 20%), but who reporting wrong were (low 49%, moderate 20% and high parasite 12%).

Table 3: Frequency of given slides to laboratory

Variable	Frequency	Percentage (%)
Negative clear Correct	49	64
wrong	27	36
Negative with artifact Correct	37	49

wrong **Low parasitemia** Correct	39 39	51 51
wrong **Moderate parasitemia** Correct	37 61	49 80
wrong **High parasitemia** Correct	15 47	20 62
wrong	29	38

4. Discussion

This study is an attempt to evaluate the reliability of malaria microscope looking through both variation of result and associated quality assurance basics (general condition of microscopes, qualification and experience of technologist). The study assumption is that any defect in one or more of these basics will consequently affect the reliability and accuracy of the laboratory results. From the result most of the checked laboratories were private constitute almost about more than half (personal contact). Considerable number of them were established 6- 15 years ago, about half are well experienced personnel. Qualification is high and have an academic certificate; BSc, MSc and even PhD holders). This may be in part due to the medical laboratory college had 15 years since it was established. About two-third experienced a basic malaria course, while the majority attended refresh. Most of laboratories used Geimsa (91%) with the correct concentration (10 % for 10 minutes and 3% for 30 minutes) .

The result showed that severe shortage in IQC for laboratory staff and stain only 14 (18%) for both, on the other side the majority of them were haven't EQC (55%) since the duration of EQC are monthly (33%) quarterly (8%) and (59%) are not. This could be referred to neglecting, will nestles and weak supervision.

From the result most of the laboratories use good oil immersion with good condition of microscopes which gives correct true negative result and false negative result. These can be on line with the study that done by Merghani et al. (2016) in Dongola [15] when using good efficient microscopes they gives low false positive result.

Writing a full report is of great value, but only 50% laboratories making blood film report with insufficient data this agree with the study done by Mukadi et al. (2008)

conducted in the Democratic Republic of Congo [16] .

Most of laboratories (46%) make only thick blood (79%) with low quality (14%) and the blood doesn't give chance for detection of parasite species and this can affect treatment. The study has focused on the way in which blood is collected, spread, and dried and if it has any influence on sensitivity on parasite detection.

The results obtained from blood films distributed to laboratory revealed that; result of the negative clear true is about 49 (64%) and false is 27 (36%, blood film with low parasites count true were 39 (51%) and wrong were 37 (49%) , moderate parasites true result were 61 (80%) and wrong were 15 (20%) and result of blood film with high parasites count true answer were 47 (88%) and false were 19 (12%), study by Hamdy and Aljafari (2017) in Khartoum [17] reported (44.3 %) those who report density of parasite true.

5. Conclusion

From the result of the current study, it is concluded that the most frequent laboratories technicians in the area of the study were acceptable works but need more IQC as soon as strong EQA

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