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RESEARCH ARTICLE
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DIAGNOSTIC ACCURACY AND RELIABILITY OF DIRECT OPHTHALMOSCOPY COMPARED TO NON-MYDRIATIC RETINAL PHOTOGRAPHY FOR DIABETIC RETINOPATHY SCREENING

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ABSTRACT

Objective: To compare the diagnostic accuracy and reliability of Direct Ophthalmoscopy versus Non-Mydriatic Retinal Photography in detecting diabetic retinopathy

Material and Method: This was a comparative cross-sectional research conducted at Department of Optometry, University of Lahore Teaching Hospital, Lahore using purposive sampling and non-probability sampling. The study was conducted from January 2022 To September 2022. Every patient had a standard eye exam, including best corrected refraction and visual functions assessment, and their results were recorded in a database. An optometrist (Optometrist A) performed the initial screening without dilation of the pupil. With a Non Mydriatic fundus camera, two 45 degree retinal pictures were captured: one from the center to the macula and the other from the center to the optic disc. Following evaluation, the patient was informed about the possibility of temporary blurred vision and was advised not to drive after giving their agreeing for pupil dilatation.

Results: Using NMFC without dilating the pupil, direct ophthalmoscope (DO) following pupil dilation, and a slit lamp with Volk's lens, 860 eyes of 430 people with type 2 diabetes were examined for DR. The slit lamp examination results served as a baseline against which to compare the results of NMFC. There were 93 (10.8%) non-readable fundi using biomicroscopy, 176 (20.4%) with NMFC, and 135(15.6%) with DO. Table 1 shows that the number of cases of diabetic retinopathy (DR) identified by slit lamp was 189 (21.9%), NMFC was 150 (17.4%), and direct ophthalmoscopy was 117 (13.6%).

Conclusion: Non-mydriatic retinal photography is more reliable and accurate than direct ophthalmoscopy for the detection of diabetic retinopathy. The selection of these techniques, however, may be contingent upon variables including the accessibility of resources, the configuration of the screening program, and the particular requirements of the target population.

Keywords: Diagnostic accuracy, Non Mydriatic Fundus Camera, Diabetic Retinopathy

Introduction

Every year, about 10,000 individuals with diabetes become blind due to retinopathy, the most prevalent microvascular consequence of the disease[1]. Diabetic retinopathy is one of the main causes of preventable blindness [2]. Diabetic retinopathy causes vision loss through a number of different methods. Macular edema or capillary non perfusion can both impair central vision. Severe and sometimes irreversible vision loss can result from tractional retinal detachment and retinal distortion caused by new blood vessels of PDR and contraction of the surrounding fibrous tissue. Furthermore, there's a chance that the newly formed blood vessels can bleed, which might result in vitreous or preretinal hemorrhage. Lastly, vision loss may result from proliferative diabetic retinopathy associated neovascular glaucoma[3]. Diabetic retinopathy affects 28.78% of people with diabetes, whereas sight-threatening diabetic retinopathy affects 8.6% of people with diabetes[4]. In Pakistan, 26.3% of people had diabetes, of whom 19.2% had known the disease and 7.1% had been identified during screening, according to the country's most recent diabetes census [5]. According to recommendations, DR screening should be done annually on all known diabetics in order to prevent DR from progressing to STDR and causing severe visual impairment [6,7]. In Pakistan, a large number of diabetic patients frequently exhibit variable degrees of retinopathy and visual impairment at the time of initial presentation, which compromises the ultimate visual result. Treatment delays or an inability to identify retinopathy at an acceptable time may be the cause of this situation[8]. The findings have shown significant variances due to the variety of instruments and operators used, which may be related to the health care provider's experience as well as the modality used for screening. The screening processes used in developed countries differ [9]. It is imperative for developing nations to identify screening techniques that fulfill international requirements for > 80% sensitivity and > 95% specificity, in addition to being practicable and economical[10]. Despite having a sophisticated primary, secondary, and tertiary care network of healthcare institutions, Pakistan lacks a functional referral system [11].The lack of skilled and certified ophthalmologists makes the issue worse. There are now about 30,000 licensed and registered ophthalmologists in the nation as opposed to the necessary 100,000 [12]. Therefore, it is unlikely that all patients will require required screening by an ophthalmologist in accordance with suggested recommendations for a very long period. For mass screening, the Non-Mydriatic Fundus Camera has been suggested as a valuable tool [13]. To reduce the workload for ophthalmologists and fulfill the necessary requirements, qualified optometrists can utilize it at the primary or secondary level. In a nation like ours where resources are few, the expense and upkeep make it unusable. If done by a skilled optometrist, direct ophthalmoscopy may be a less expensive procedure. 60% of respondents and 76% of particular respondents were found in a research conducted at a tertiary care diabetic facility[14]. The results of study supported the use of direct ophthalmoscopy by diabetologists, even if the authors recommended investing in health care workers' training until funds allowed a transition to more current equipment, such as a fundus camera. Diabetic retinopathy or other diseases can be diagnosed with arc light instead of an ophthalmoscope, according to a Lahore study that compared the two methods using direct ophthalmoscopy which is considered the gold standard in the hands of an ophthalmologist. The study's sensitivity and specificity analyses supported this conclusion. When using an ophthalmoscope and Arc light to diagnose DR, the study discovered that optometrists were nearly as accurate as ophthalmologists[15]. The sensitivity and specificity of the "direct ophthalmoscope" in the hands of an optometrist have not received much research in Pakistan prior to this study. Two goals were set for the current investigation. Originally, an optometrist used

NMFC in a research to confirm the results. Secondly, to ascertain the optometrist's diagnosis accuracy while using direct ophthalmoscopy. Slit lamp bio microscopy using an objective 90D lens served as the standard reference for this investigation.

Material and Method

This was a comparative cross-sectional research conducted at Department of optometry, University of Lahore Teaching Hospital, Lahore using purposive sampling and non-probability sampling. The research ran from October through December of 2023. Patients with type 1 and gestational diabetes, as well as those with any other eye disease, were excluded from the study. All newly registered type 2 patients with diabetes who were 40 years of age or older, regardless of gender or ethnicity, and who were willing to undergo an eye examination with a dilated pupil, were included. Every patient had a standard eye exam, including a refraction and best-corrected vision assessment, and their results were recorded in a database. An optometrist (Optometrist A) performed the initial screening without dilation of the pupil. With a Non Mydriatic fundus camera, two 45 degree retinal pictures were captured: one from the center to the macula and the other from the center to the optic disc. Following evaluation, the patient was informed about the possibility of temporary blurring of vision and asked to ensure that they were not driving before giving their agreement for pupil dilatation. For pupil dilation, 0.1% tropicamide was used. The fundus was checked by direct ophthalmoscopy by optometrist (Optometrist B) following complete mydriasis. The instructions provided to the optometrists were to use signs of hemorrhages, exudates, alterations in blood vessels, and macular edema to determine if diabetic retinopathy was present or not. The diabetic retinopathy was not graded. The results of the two optometrists were kept a secret from one another in order to avoid observer bias. The vitro retinal ophthalmologist performed the final retinal examination with an objective lens and slit lamp. The HMIS database was updated with the findings. For the sake of this investigation, these results served as the benchmark. For the aim of managing diabetic retinopathy through early treatment, DR was categorized as a regular checkup. The three types of diabetic retinopathy that were identified were non proliferative, proliferative, and clinically significant macular edema (CSME), with or without NPDR/PDR. For the purposes of this investigation, the presence or lack of DR alone was contrasted with the results of direct ophthalmoscopy performed by Optometrist B and NMFC performed by Optometrist A. SPSS version 20.0 was used to do the statistical analysis. The continuous variables were all shown as mean ± standard deviation. The frequency and percentage of each category variable were displayed. Utilizing a 2 x 2 contingency table, the following metrics were determined: PPV, NPV, specificity, and sensitivity. Additionally, kappa statistics were used to display the relationship, or degree of agreement, between two observers.

Table 1: No. of Patients (430) with No. of eyes (860)

Instrumentation	Unable to Diagnose	DR Findings
Non Mydriatic fundus camera	176 (20.4%)	150 (17.4%)
Direct Ophthalmoscopy	135 (15.6%)	117(13.6%)
Slit Lamp	93 (10.8%)	189 (21.9%)

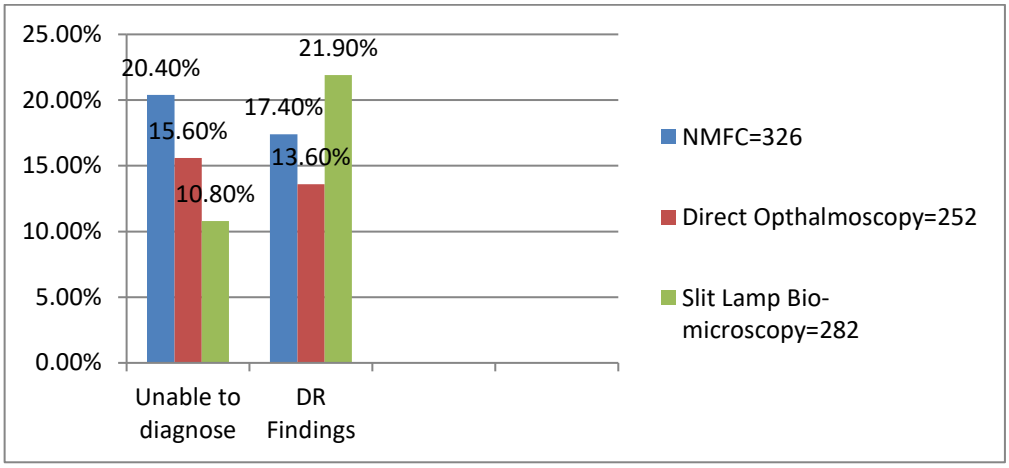
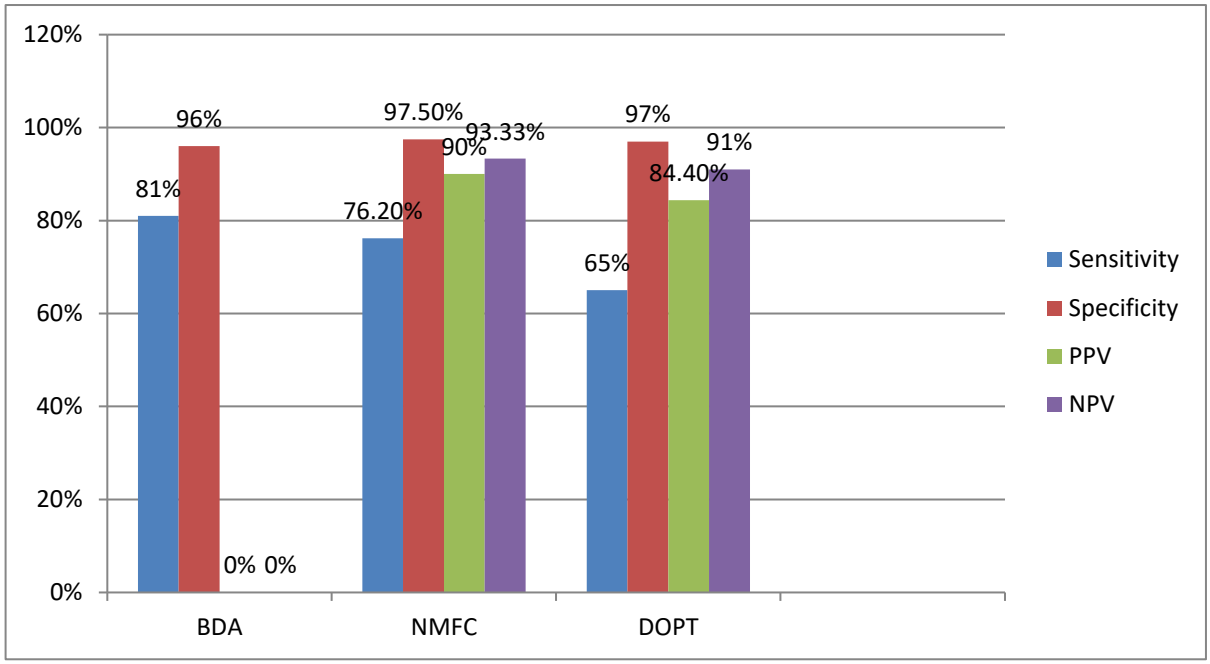


Table 2: Validity Chart of N=860 (430 patients)

Instrumentation	Sensitivity	Specificity	PPV	NPV	Kappa Statics
BDA	81%	96%	-	-	-
Non Mydriatic fundus camera	76.2%	97.5%	90.0%	93.33%	0.73
Direct Ophthalmoscopy	65.0%	97.0%	84.4%	91.0%	0.63



Results

Using NMFC without dilating the pupil, direct ophthalmoscope (DO) following pupil dilation, and a slit lamp with Volk's lens, 860 eyes of 430 people with type 2 diabetes were examined for DR. The slit lamp examination results served as a baseline against which to compare the results of NMFC ophthalmoscopy.

There were 93 (10.8%) non-readable fundus using biomicroscopy, 176 (20.4%) with NMFC, and 135(15.6%) with DO. Table 1 shows that the number of cases of diabetic retinopathy (DR) identified by slit lamp biomicroscopy was 189 (21.9%), NMFC was 150 (17.4%), and DO was 117 (13.6%). Table 2 displays the procedures' validity.

The corresponding kappa value for DR detection by NMFC in comparison to traditional slit lamp diagnosis was determined to be 0.73. This shows that the NMFC observers' agreement with the standard is good. The kappa statistic for DR identification with Direct Ophthalmoscopy (DO) in

comparison to traditional slit lamp diagnosis was determined to be 0.63. This indicates that there is also good agreement between the DO observers and the standard.

Discussion

According to the current study, NMFC has a 76.2% sensitivity, 97.5 % specificity, 90.0% PPV, and 93.33% NPV when used by an optometrist. The results of this investigation not only supported the findings of a prior study by optometrists using NMFC, but they also shown improvements over the previous results, which were 72% sensitivity, 86.3% specificity, 62% positive predictive value, and 90% negative predictive value. Non-Mydriatic fundus photography has been the subject of several evaluations and comparisons with more well-established techniques for the detection of diabetic retinal disease. The most pertinent issue to ask is whether non-mydriatic fundus photography will be more effective than the ordinary clinician utilizing ophthalmoscopy in detecting early curable diabetic retinopathy [16-19]. This study so confirms that NMFC cameras used in digital photography are a helpful tool for mass screening. A common piece of low-cost, traditional equipment used by general practitioners, diabetologists, optometrists, and nurses is the ophthalmoscope. If an optometrist performs a direct ophthalmoscopy and it satisfies the specified requirements, it may be the most economical method, particularly in community screening and primary eye care facilities. According to the current study, Direct ophthalmoscopy performed by an optometrists with a sensitivity of 65.0%, specificity of 97.0%, PPV of 84.4%, and NPV of 91.0%, as well as BDA shows sensitivity of 81% ,and specificity of 96%. Despite the restricted availability and cost-benefits of non-Mydriatic fundus photography, ophthalmoscopy is not regarded as a viable choice in today's technological settings. Conversely, optometrists have access to data that supports them.The suggested test for screening for diabetic retinopathy, according to the findings of a European working committee, is direct ophthalmoscopy through dilated pupils since it is quick, easy, and economical. For DR screening purposes, this group believes that a sensitivity of 60% is sufficient, and that raising the sensitivity to 80% yields very little benefit. According to all points of view, if optometrists are properly trained and informed on appropriate referral processes, direct ophthalmoscopy may be relied upon as a cost-effective screening method[20].

Conclusion

In general, non-mydriatic retinal photography is more reliable and accurate than direct ophthalmoscopy for the detection of diabetic retinopathy. The selection of these techniques, however, may be contingent upon variables including the accessibility of resources, the configuration of the screening program, and the particular requirements of the target population.

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