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MACULAR THICKNESS IN ALL QUADRANTS IN DIABETIC RETINOPATHY DETECTION

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ABSTRACT

Introduction: *Diabetic retinopathy (DR) is a condition in which the retina deteriorates and eyesight gradually worsens due to high blood sugar levels.*

Aim of the study: *the main aim of the study is to Macular Thickness In All Quadrants In Diabetic Retinopathy Detection*

Material and method: *the goal of this study was to evaluate whether or not there were any significant differences in the macular thickness between persons who were classified as normal and those who had type II diabetes.*

Conclusion: *In the preclinical model of DR, there was an irregularity in the thickness of the retina in some areas and layers of the retina.*

Keywords: *Diabetic retinopathy; Diabetics; Retina*

INTRODUCTION

OVERVIEW

Ocular disease is often regarded as a major health concern since the eye is a primary sensory organ. Unfortunately, many diseases have no symptoms in their early stages, thus the only way to catch them is via regular eye exams. While it may be difficult to diagnose at first, DR is described in detail in this article. Diabetic retinopathy (DR) is a condition in which the retina deteriorates and eyesight gradually worsens due to high blood sugar levels. Recognizing DR early is crucial since it can help prevent retinal degeneration and, ultimately, blindness. In addition, the United States spends nearly half a billion dollars annually on diabetes-related blindness-related healthcare costs. There are about 899,000 people in the United States who have vision impairments. As a result, it is very important to recognise DR in its earlier stages. Once the patient shows signs of having the condition, they frequently develop a progressive disease that can result in a variety of structural complications, some of which can cause the patient to go blind. Proliferative diabetic retinopathy, tractional retinal detachment, and neovascular glaucoma are all examples of structural problems. These options complement systemic care, the initial line of defence against diabetic retinopathy. The first two constitute the bedrock of care because they can be administered reliably and repeatedly within the confines of an outpatient clinic.

DIABETIC RETINOPATHY (DR)

Optical coherence tomography (OCT) scans, however, are unable to show the microvascular architecture of the eye, save for the shadows created by blood vessels. Due to the fact that OCTA is capable of capturing an image of blood vessels, several research have extracted blood vessel-related characteristics from pictures obtained using OCTA. According to the most current research in the field, the capabilities of these traits demonstrated varying levels of power for the early identification of DR.

LITERATURE REVIEW

Parthasharathi, G. & Kumar (2022) If treatment is not received, diabetic retinopathy, a condition that is caused by diabetes that has been present for a significant amount of time, may lead to complete blindness. As a consequence of this, diabetic retinopathy should be diagnosed as early as possible so that appropriate medical therapy may be administered to protect the patient from the complications of the condition. Detection by a manual ophthalmologist takes much more time and causes a significant amount of pain throughout the examination. Recently, one of the most widespread tendencies has been the use of machine learning as a means of improving performance in many different areas, including medical picture analysis and categorization. Thus, early diagnosis of diabetic retinopathy can benefit from an automated procedure. Exudates, haemorrhages, and micro-aneurysms are extracted and classified in this study using machine learning. Multiple neural networks are used to get this result.

Schottenhamml, Julia & Hohberger (2022) Both optical coherence tomography angiography (OCTA) and artificial intelligence (AI) are relatively new areas of study, and they are complementary to one another. Other imaging methods have not been able to achieve the micrometer-level resolution that is available with OCTA's non-invasive, in-vivo, three-dimensional observation of retinal blood flow. This was previously thought to be impossible. Because it does not need any injections containing dye, it is a safer technique for patients to undergo. Because it enables the automated processing of enormous volumes of data at a performance level that significantly exceeds that of prior algorithms, artificial intelligence (AI) has sparked a lot of interest in many different aspects of day-to-day life. In recent years, it has been used in a number of ground-breaking investigations, one of which being the discovery that a computer programme named AlphaGo can defeat human players at the strategic board game known as Go. This essay will begin with a quick introduction to each of these topics before diving into the numerous recent presentations of AI applications in OCTA imaging.

Bidwai, Pooja & Gite, Shilpa & Pahuja (2022) It's brought on by long-term uncontrolled diabetes, which causes wildly varying blood sugar levels. By catching it early, you can obtain the treatment you need to keep your eyesight from deteriorating. Most clinical research make use of fundus photographs, which are images of the retina taken using a special camera called a "fundus camera." This article provides an overview of diabetes, touching on its definition, prevalence, consequences, and AI methods for detecting and classifying diabetic retinopathy at an early stage. After discussing the potential issues and challenges in ophthalmology, a summary of the current datasets, screening techniques, performance metrics, and biomarkers in diabetic retinopathy is provided, as well as a prediction of the field's potential future growth.

Elsharkawy, Mohamed & Sharafeldeen (2022) Early diagnosis of diabetic retinopathy (DR) is crucial in the battle against irreversible retinal damage and vision loss caused by diabetes. For this purpose, it makes use of data on the shapes' evolution in the past. Segmented layers of the OCT B-scans volume are then mined for distinctive texture features that can be used to diagnose DR. Second-order reflectivity is calculated by using the Markov-Gibbs random field (MGRF) model to each layer. To represent the obtained picture attributes, we employ descriptors based on the cumulative distribution function (CDF). Finally, a global subject diagnosis is reached by combining the twelve layers' categorization results using a majority voting scheme.

Morya, Arvind & Janti, Siddharam & Sisodiya (2022) Artificial intelligence (AI) is a discipline that draws from many others in an effort to automate jobs that now need human intelligence by building platforms capable of giving robots the ability to behave, perceive, and reason intelligently. Building such systems is the goal of the field of study known as artificial intelligence (AI). Artificial intelligence (AI) is predicted to aid ophthalmologists in the detection and treatment of ocular disorders at every stage, from the cornea to the retina. Computerized analytics are becoming widely accepted as a more efficient and objective way for interpreting image series in the area of ophthalmology. The power of intraocular lenses may also be determined with this method (IOLs). This review article aims to investigate several points about the use of AI to the field of ophthalmology.

METHODOLOGY

RESEARCH METHODOLOGY

Using optical coherence tomography with and without retinopathy, the goal of this study was to evaluate whether or not there were any significant differences in the macular thickness between persons who were classified as normal and those who had type II diabetes.

STATISTICAL ANALYSIS

- Pie charts, scatter plots, and histograms were used for visual examination of the quantitative data collected and analysed using SPSS 23.0.
- The post Hoc test was used to demonstrate that the distributions were nearly normal after the Shapiro wilk test (Table 3.2), indicating that parametric statistics may be used when all p-values are greater than 0.05.

RESULTS

DEMOGRAPHIC PROFILE OF THE STUDY

We examined 420 eyes from 210 individuals ranging in age from 40 to 80 years old (mean age was 54.54 ± 9.67 years).

Gender

Table 4.1 Patient Profile of Normal control group

GENDER	NO OF EYES	PERCENTAGE
MALE	20	33.3%
FEMALE	40	66.7%
TOTAL	60	100%

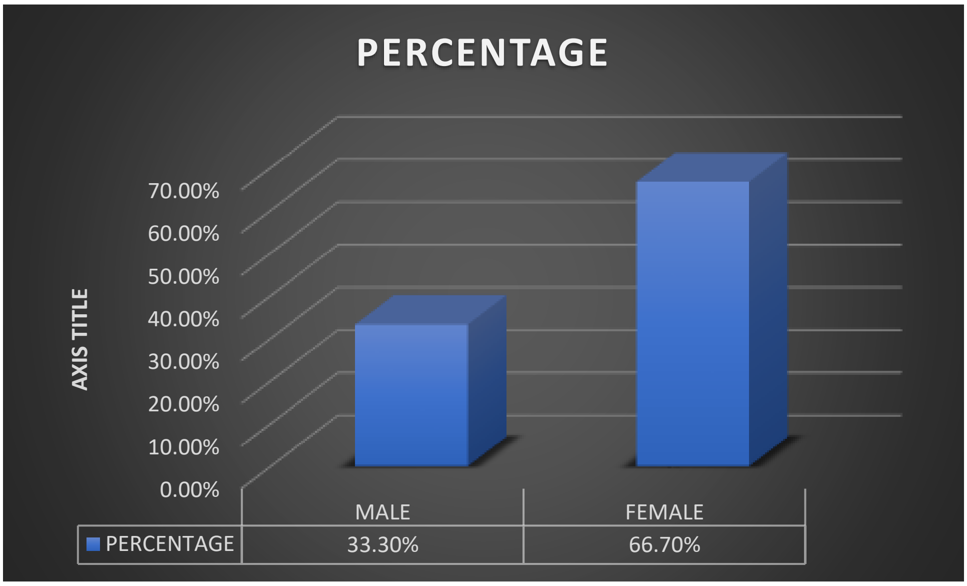

Figure 4.1 Patient profile of Normal control group

The Normal control group profile, which is displayed in the Table, indicates that in the population under study, there were 40 (66.7%) eyes of female patients and 20 (33.3%) eyes of Male patients showing an unequal distribution. This was the case because of the unbalanced distribution of male patients.

Type II diabetic patient

Table 4.2 Patient Profile of Type II diabetic Patients

GENDER	NO OF EYES	PERCENTAGE
MALE	188	52.2%

FEMALE	172	47.8%
TOTAL	360	100%

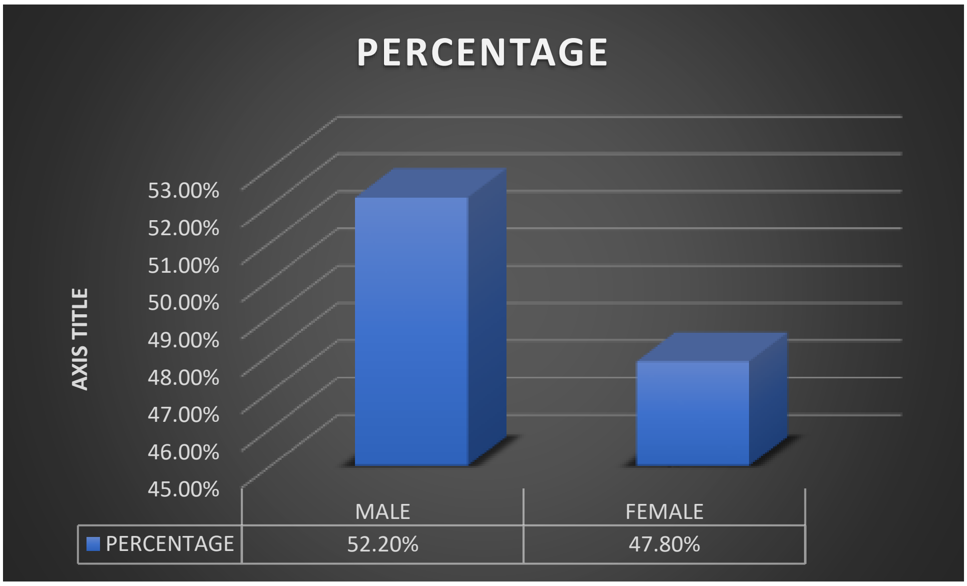

Figure 4.2 Patient Profile of Type II diabetic patient

According to the Type II diabetes patient profile, which is shown in Table, the study population included 172 eyes belonging to female patients (47.8%), and 188 eyes belonging to male patients (52.2%), indicating an almost equal distribution of the two sexes' eyes.

Side of Eye involved in Normal control group

Table 4.3 Side of Eye involved in Normal control group

SIDE OF EYE INVOLVED	NO OF EYES	PERCENTAGE
RIGHT	30	50.0%
LEFT	30	50.0%
TOTAL	60	100%

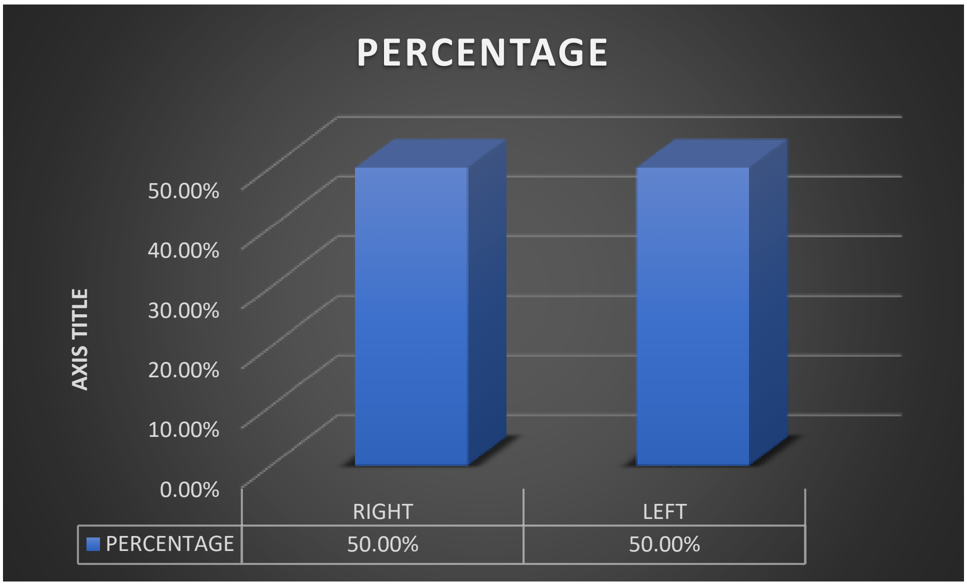

Figure 4.3 Side of Eye involved in Normal control group

The Normal control group profile, which is displayed in Table, indicates that in the study population, there were 30 (50.0%) right eyes and 30 (50.0%) left eyes of patients showing equal distribution in the Normal control group. This is denoted by the fact that in the Normal control group there was no significant difference between the eyes.

MACULAR THICKNESS IN ALL QUADRANTS IN DIABETIC INDIVIDUALS

Table 4.4 Gender-specific distribution of macular thickness across all four quadrants in diabetic patients and those without diabetes

		GENDER	NO OF EYES	MEAN	STD. DEVIATION	P-VALUE
CENTER	CMT	MALE	188	305.48	99.939	0.126
		FEMALE	172	289.62	96.080	
INNER	TM	MALE	188	337.93	63.414	0.500
		FEMALE	172	333.19	69.796	
	SM	MALE	188	339.50	69.835	0.481
		FEMALE	172	334.27	70.692	
	NM	MALE	188	341.75	66.160	0.411
		FEMALE	172	336.22	61.040	
	IM	MALE	188	343.18	78.891	0.053
		FEMALE	172	328.59	61.893	
OU	TM	MALE	188	295.40	64.447	0.334
		FEMALE	172	288.85	63.766	
	SM	MALE	188	304.57	57.979	0.949
		FEMALE	172	304.18	58.069	

	NM	MALE	188	321.18	63.181	0.485
		FEMALE	172	316.72	57.352	
	IM	MALE	188	298.11	61.480	0.131
		FEMALE	172	288.54	58.012	
	CUBE VOLUME	MALE	188	10.576	1.5902	0.298
		FEMALE	172	10.406	1.4888	
	AVERAGE CUBE THICKNESS	MALE	188	295.70	44.364	0.307
		FEMALE	172	291.05	41.441	

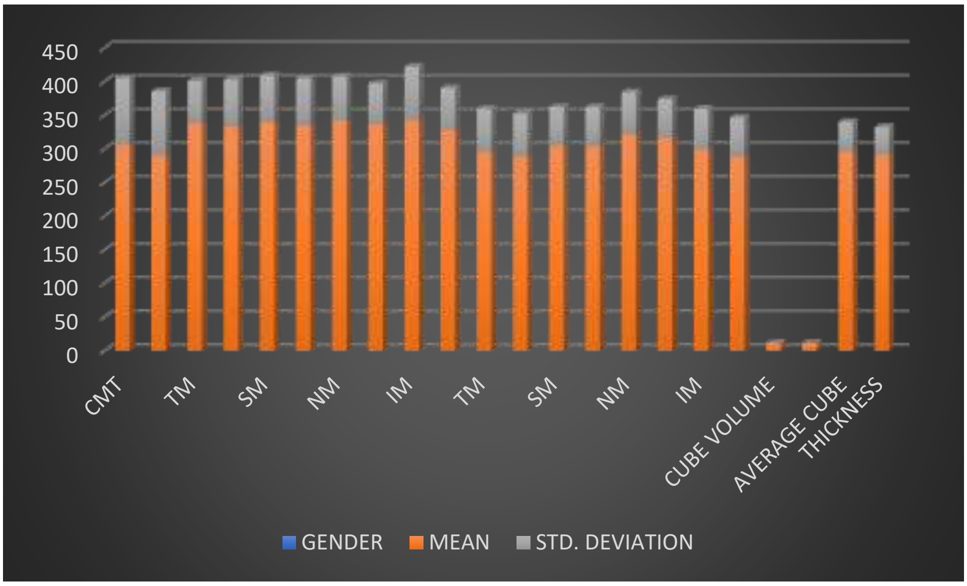

Figure 4.4 Gender-specific distribution of macular thickness across all four quadrants in diabetic patients and those without diabetes

According to the Independent T test, our research demonstrates that the mean macular thickness in all four quadrants for diabetes patients is equivalent in males, and women of 360 eyes of Type II diabetic persons. This was determined using a 95% confidence interval. There was no discernible difference between the sexes at all.

Age versus severity of Diabetic Retinopathy

Table 4.5 Age versus severity of Diabetic Retinopathy

GROUPS	NO OF EYES	MEAN	STD. DEVIATION	P-VALUE
Mild NPDR.	60	53.67	7.745	0.03
Moderate NPDR	60	55.43	7.788	
Severe NPDR	60	57.05	9.559	

PDR.	60	57.83	11.594	
CSME	60	58.62	9.424	
Total	300	56.52	9.436	

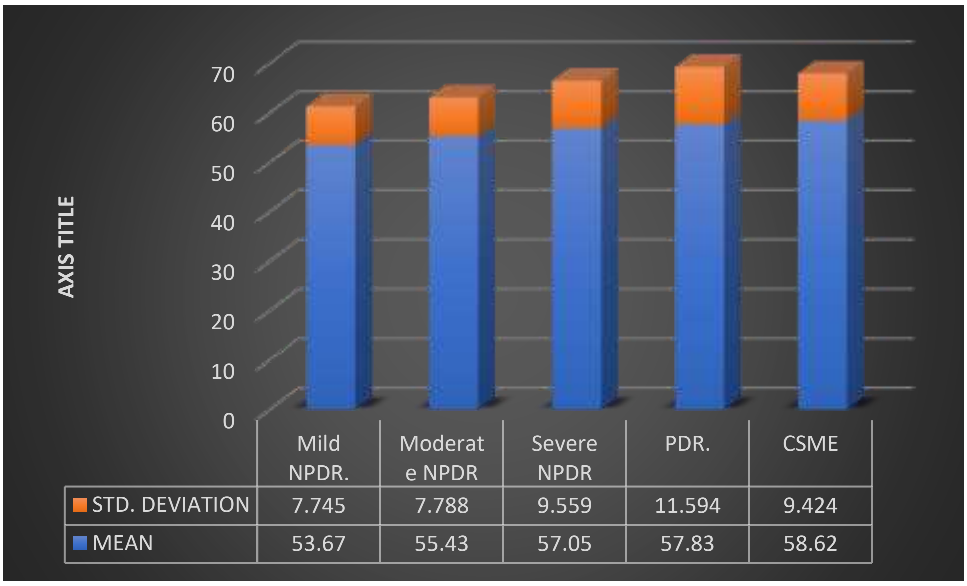

Figure 4.5: Error bar showing Age versus Severity of DR

There is also an increase in the severity of diabetic retinopathy in our study when compared with Age using the One-way ANOVA Test using post-Hoc test at 95 percent confidence interval. This was determined by comparing the severity of diabetic retinopathy with age at the time of diagnosis of diabetic retinopathy.

CONCLUSION

In the preclinical model of DR, there was an irregularity in the thickness of the retina in some areas and layers of the retina. In this analysis, four locations of retinal thickness abnormalities were detected in the training set. Even though these four locations were not validated by the validation set, it was clear that retinal thickness anomalies were not uniform throughout the retina or within the individual retinal layers. This was the case both overall and within the retina. This study emphasised the use of high-resolution studies for specific retinal areas as well as individual retinal layers. These analyses were conducted while taking into consideration the intrinsic variability of the retina.

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