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Prevalence of Vitreous & Retinal Disorders among Sudanese Diabetic Patients: A B-Scan Ultrasonography study

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Abstract: Background: Retina and Vitreous abnormalities represent the most common eye disorders in the diabetic patients, they may associated with severe complications. **Objective:** The present study was planned to study the vitreous and retina pathologies in diabetic patients using B-Scan ultrasound (U/S). **Methods:** A total of 203 Sudanese diabetic patients with long diabetic disease duration (mean 16.28 ± 4.830) years were enrolled in a descriptive, analytical study. 55% (n = 112) were male and 45% (n = 91) were females. The mean age of the participants was 62.28 ± 8.041(range between 30-79 years -old). The study was conducted in a Sudanese ophthalmologic hospital in Khartoum, during the period from 2016 –2019. A Nidek (Echoscan US – 4000) - B-Scan ultrasonic unit with 10 MHZ transducer was used. A high frequency direct contact technique was applied. The inclusion criteria included adult diabetic patients. **Results:** The vitreous and retina disorders were more prevalent in diabetic hypertensive participants 55 % (n = 112). The high frequency of the disorders was observed in age groups (60–69) and (50–59) years-old. The most common disorder was retinal detachment which was detected in 30.5% (n = 62) followed by vitreous changes in16.3% (n = 33). Posterior vitreous was observed in 15.8% (n = 32), vitreous hemorrhage seen in 15.3% (n = 31), both retinal detachment with vitreous hemorrhage were detected in 11.3%) (n = 23), retinal detachment with cataract were reported in 3.4% (n = 7), retinal detachment with Vitreous changes were seen in 3% (n = 6), and other changes were noted in 4.4% (n = 9) of the participants. There is no significant a statistical association between gender /diabetic duration nor age with the disorders (P = 0.2, 0.43, and 0.5) respectively. **Conclusion:** The Vitreous & Retinal disorders were more prevalent in diabetic hypertensive patients. The high frequency of the disorders was observed in the age group (50–70). The U/S is useful method in diagnosing Vitreous & Retinal disorders among the diabetics.

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I. Introduction

Retina and Vitreous abnormalities represent the most common eye disorders in diabetic patients, they may associated with severe complications. Diabetic eye disease and its complications, is a leading causes of blindness and visual dysfunction in adults.[1] Eye is fluid filled structurelocated in the anterior part of the orbit and embedded in the fat, and the tenon's capsule separates it from the orbital wall. The anterior segment forms 1/6th of eyeball and posterior segment forms 5/6th of eyeball. Normal axial length of the eye is 22 mm.[2] The vitreous body is bounded posterolaterally by the internal limiting membrane of the retina, anterolaterally by the nonpigmented epithelium of the ciliary body, and anteriorly by the lens zonular fibers and posterior lens capsule. The retrolental space of Erggelet and the canal of Petit are potential spaces.[3]

Diabetes mellitus (DM) is a condition that impairs the body's ability to process blood glucose. There are three major types of diabetes; Type 1 diabetes Also known as juvenile diabetes, this type occur when the body fails to produce insulin, people with type one diabetes are insulin dependent. Type 2 diabetes the way the body uses insulin. while the body still makes insulin unlike in type one, the cells in the body do not respond to it as effectively as they once did, this is the most common type of diabetes, according to the national institute of diabetes and

digestive and kidney diseases and it has strong links with obesity. The third isgestational diabetes, this type occurs in women during pregnancy when the body can become less sensitive to insulin, gestational diabetes does not occur in all women and usually resolves after giving birth.[4]

Ocular symptoms are commonly evaluated in the emergency department (ED) and compose approximately 2%to 3%of all ED visits.[5]These presentations can be benign or can result in permanent vision loss if not quickly identified, diagnosed, and treated. Three common diagnoses encountered in the ED; retinal detachment (RD), vitreous hemorrhage (VH), and vitreous detachment (VD). RD is considered a true ophthalmologic emergency that requires immediate diagnosis and treatment.[6] Patients with RD may have sudden, painless, monocular vision loss as well as flashes and floaters in the visual field. Similar to RD, symptoms of VH and VD may include vision loss, blurry vision, and visual floaters. Distinguishing of these three conditions is clinically important because patients with VH and VD can often be discharged with close outpatient follow-up, whereas patients with RD may need emergency evaluation by an ophthalmologist.

Currently, patients with ophthalmologic symptoms undergo initial testing which includes visual acuity, direct ophthalmoscopy, slitlamp examination, and tonometry.[7] However, the criterion standard for the ocular diseases diagnosis establishment, such as RD is an ophthalmologic evaluation. The diagnosis of ocular disease by an ophthalmologist may involve procedures such as a dilated ophthalmoscopic examination, optical coherence tomography, or ophthalmic ultrasonography.[8,9] These procedures are used to evaluate the posterior chamber of the eye and clearly visualize the distinct layers of the retina.

Ultrasonography has been used by ophthalmologists for decades to evaluate ocular symptoms but has gained favor by emergency medicine practitioners.[10] Previous studies have shown that emergency medicine physicians are able to use ocular point-of-care ultrasonography (POCUS) to identify RD in the ED.[11-14] Ocular U/S is a diagnostic modality that may aid practitioners in identifying ocular disease processes.[15]ultrasonography is ideal for the ED setting because of its portability, lack of radiation exposure, and time efficiency. Using U/S to evaluate ocular pathology is promising because the eye is superficial and fluid filled. The available literature has shown that emergency medicine practitioners can detect ocular anomalies using ocular POCUS.[16]

Ocular disease processes may progress to permanent vision loss if not diagnosed and treated quickly. Use of ocular B-Scan ultrasonography may be effective for early and accurate detection of ocular disease. The purpose of this study is to assess the prevalence and types of the vitreous and retina pathologies detected by ultrasound examination in diabetic patients. Also to compare the U/S findings with study gender and/or age groups.

2. Material and Methods

A descriptive, analytical study, study took place in a Sudanese ophthalmologic hospital - in Khartoum, during the period from 2016 –2019.203 Sudanese diabetic patients were included. The including criteria included; all diabetic patients with long duration of the disease (more than 10 years). The children and adults with short duration the disease were excluded. A Nidek (Echoscan US – 4000) B- Scan ultrasonic unit with high frequency 10 MHZ transducer was used. A direct contact technique was applied. Initial examinations were done under high gain (80 dB to 100 dB) and low gain (60 dB to 70 dB).

Ultrasound evaluations of the eye and orbit were performed in the supine or sitting position. The probe was placed directly over the conjunctiva or cornea or placed over closed lids. The former has the advantage of reducing the sound attenuation caused by the lids; however it requires sterilization of the probe between procedures. A coupling gel was used to provide standoff and avoid attenuation caused by air.

The data collected during the study were stored in a compact disk in a personal computer. The statistical software SPSS Inc. Version 16.0. Chicago, USA, was utilized to interpret the data. Data were presented as percentage and frequency. Chi-square test was used to evaluate the association between age and gender with sonographic findings of the posterior segment of the eye. The statistical association considered significant when $P < 0.05$. Approval from the Research Ethics Committee was not required according to national guidelines because this study was classified as a service evaluation.

3. Results:

The study included 203 patients with diabetic mellitus (DM). 55% of the participants (n = 112) were male and 45% (n = 91) were females. The mean age of the participants was 62.28 ± 8.041(range between 30-79 years -old). Table1: summarizes the common U/S findings; the most common disorders was retinal detachment which was detected in 30.5% (n = 62) followed by vitreous changes in16.3% (n = 33). Posterior vitreous was observed in 15.8% (n = 32), vitreous hemorrhage was seen in 15.3% (n = 31), retinal detachment with vitreous hemorrhage were detected in 11.3%) (n = 23), retinal detachment with cataract were reported in 3.4% (n = 7), retinal

detachment with Vitreous changes were seen in 3% (n = 6), and other changes were noted in 4.4% (n = 9) of the participants. The detail of other changes includes (other pathology including hyper mature cataract + vitreous change (5 patients), posterior vitreous detachment + vitreous change (one patient), retinal cyst (one patient), Vitreous change + axial length defect (one patient) and high myopia + vitreous change (one patient).

Table2 presents a cross-tabulation of associated clinical history of the participants with the U/S findings, the vitreous and retina disorders were more prevalent in diabetic hypertensive participants 55 % (out of 203). Table3: shows a cross-tabulation of the U/S findings with the gender of participants, the high frequencies of vitreous and retina disorders were noted in male gender. No significant statistical association was observed between the gender and the disorders (P = 0.2). Table 4: summarizes a cross tabulation between age groups and ultrasound findings, the high frequency of the disorders was observed in age groups (60–69), and 18.7 % of the Retinal detachments noted in this age group. A statistical analysis revealed, no significant statistical association between the participants' age and the disorders (P = 0.5) Tables 5 & 6 demonstrate a cross-tabulation between Duration of DM and the U/S findings, Pearson Chi-Square Test showed that no significant statistical association between Duration of DM and the U/S findings (P = 0.4).

Figure1 presents the associated clinical history of the participants besides the diabetes, 55% of the participants were diabetic hypertensive. Figures 2 through 5 show a sample images of the B-scan U/S findings, a Retinal detachment seen in Figure2, a posterior vitreous detachment observed in Figure3, a retinal detachment associated with vitreous hemorrhage noted in Figure4, and vitreous changes presented in Figure5.

Table 1: Frequency of ultrasound findings of the study.

U/S findings	(n)	(%)
Retinal Detachment	62	30.5
Vitreous Changes	33	16.3
Vitreous Hemorrhage	31	15.3
Retinal detachment + Vitreous changes	6	3.0
Posterior Vitreous Detachment	32	15.8
Retinal Detachment + Vitreous Hemorrhage	23	11.3
Retinal Detachment + Cataract	7	3.4
Others	9	4.4
Total	203	100.0

Table 2: Associated clinical history of the participants * ultrasound findings cross-tabulation

Clinical disorders	Ultrasound findings								
	Retinal Detachment	Vitreous Changes	Vitreous Hemorrhage	Retinal detachment + Vitreous changes	Posterior Vitreous Detachment	Retinal Detachment + Vitreous Hemorrhage	Retinal Detachment + Cataract	Others	Total
No	8	3	1	3	3	1	0	1	20
Hypertension (HTN)	46	19	5	1	21	8	7	5	112
Trauma	3	8	20	1	4	6	0	1	43
HTN+Trauma	0	2	3	1	0	8	0	1	15
Thyroid disease	2	0	0	0	1	0	0	0	3
Heart Disease	2	0	0	0	1	0	0	0	3
Renal Disease	0	1	0	0	2	0	0	1	4
Others	1	0	2	0	0	0	0	0	3
Total	62	33	31	6	32	23	7	9	203

Table 3: Study gender * ultrasound findings cross-tabulation

Gender	Ultrasound Findings								
	Retinal Detachment	Vitreous Changes	Vitreous Hemorrhage	Retinal detachment + Vitreous changes	Posterior Vitreous Detachment	Retinal Detachment + Vitreous Hemorrhage	Retinal Detachment + Cataract	Others	Total
Male	32	18	14	1	20	17	4	6	112
Female	30	15	17	5	12	6	3	3	91
Total	62	33	31	6	32	23	7	9	203

Table 4: Age groups * ultrasound findings cross-tabulation

Age Groups (years –old)	Ultrasound Findings								Total
	Retinal Detachment	Vitreous Changes	Vitreous Hemorrhage	Retinal detachment + Vitreous changes	Posterior Vitreous Detachment	Retinal Detachment + Vitreous Hemorrhage	Retinal Detachment + Cataract	Others	
(30-39)	0	2	1	1	0	0	0	0	4
(40-49)	5	2	2	0	3	0	0	0	12
(50-59)	10	5	8	0	5	3	1	4	36
(60-69)	38	19	17	5	20	16	5	3	123
(70-79)	9	5	3	0	4	4	1	2	28
Total	62	33	31	6	32	23	7	9	203

Table 5: Duration of DM * Ultrasound Findings Cross - tabulation

Duration of the DM (years)	Ultrasound Findings								Total
	Retinal Detachment	Vitreous Changes	Vitreous Hemorrhage	Retinal detachment + Vitreous changes	Posterior Vitreous Detachment	Retinal Detachment + Vitreous Hemorrhage	Retinal Detachment + Cataract	Others	
(30-39)	27	11	12	6	17	7	3	4	87
(40-49)	12	10	10	0	6	6	0	1	45
(50-59)	20	12	7	0	7	7	4	4	61
(60-69)	1	0	2	0	2	2	0	0	7
(70-79)	2	0	0	0	0	1	0	0	3
Total	62	33	31	6	32	23	7	9	203

Table 6: Chi-Square Test for the association of the diabetic duration with the Ultrasound Findings.

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.762a	34	.431
Likelihood Ratio	44.397	34	.109
N of Valid Cases	203		

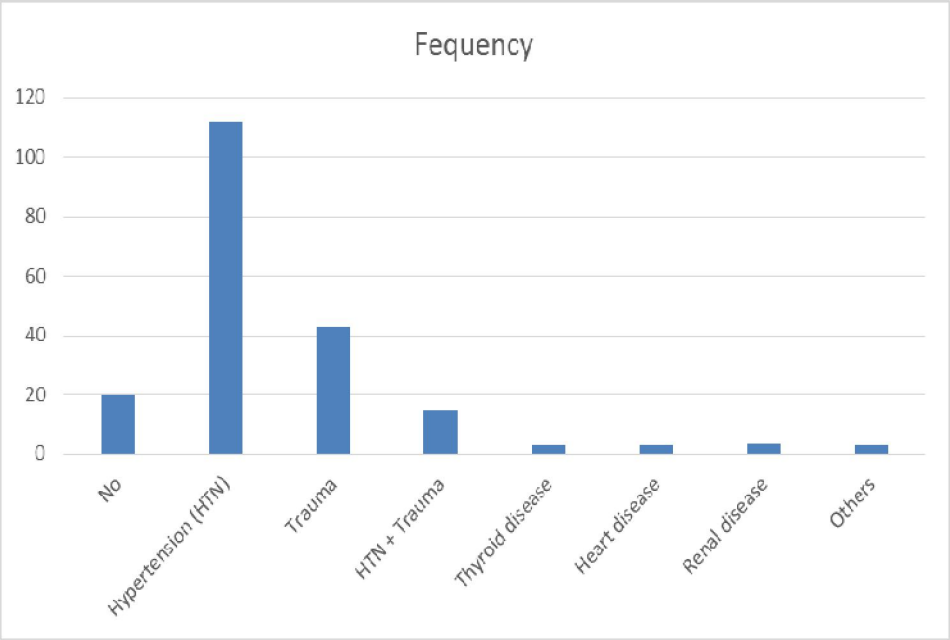

Figure 1: Clinical history of the participants

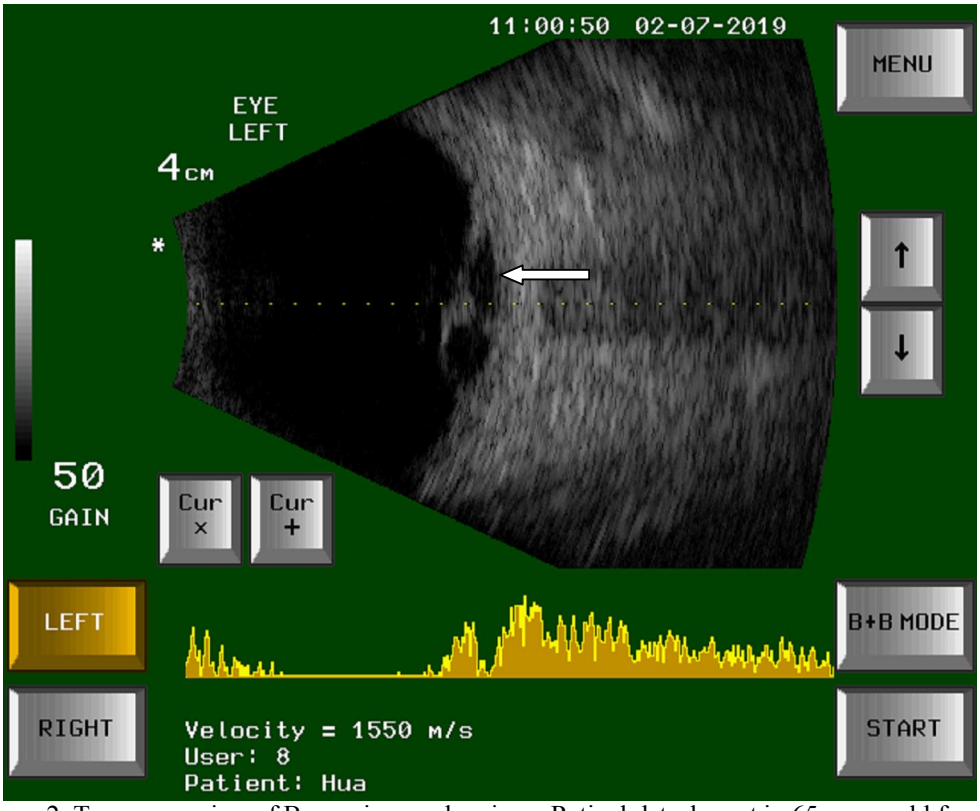

Figure 2: Transverse view of B scan image showing a Retinal detachment in 65 years- old female

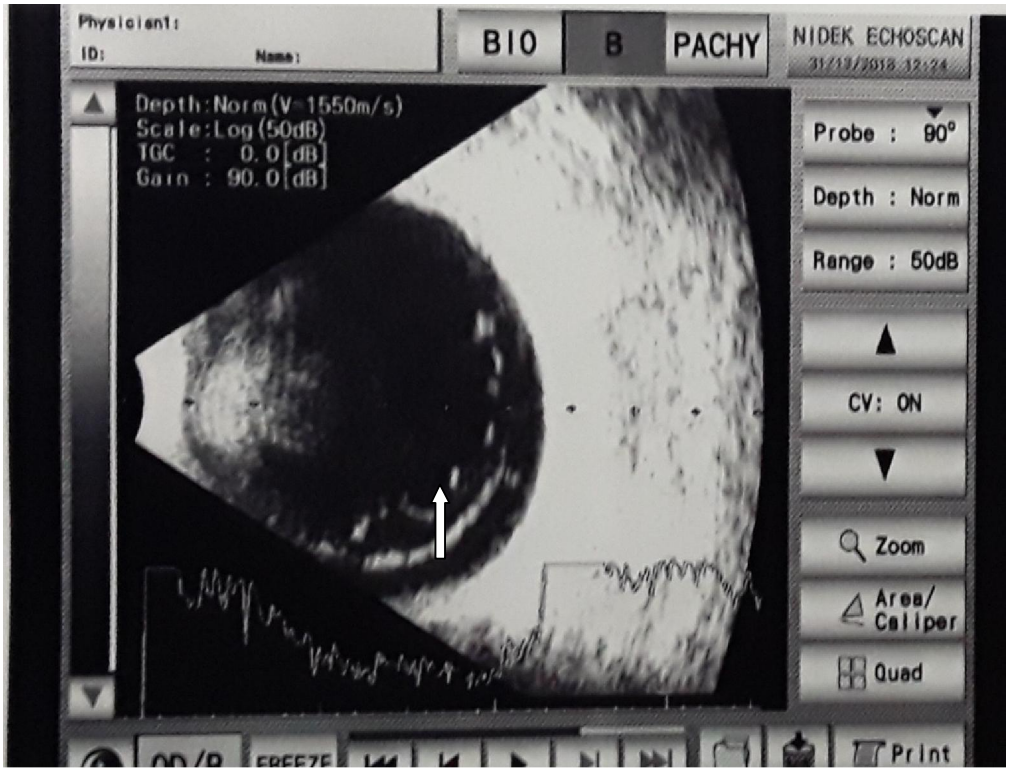

Figure 3: A 61 years- old female transverse B scan image presenting a posterior vitreous detachment

Figure 4: A 59 years- old female transverse B scan image presenting a retinal detachment (white arrows) + vitreous hemorrhage (black arrows).

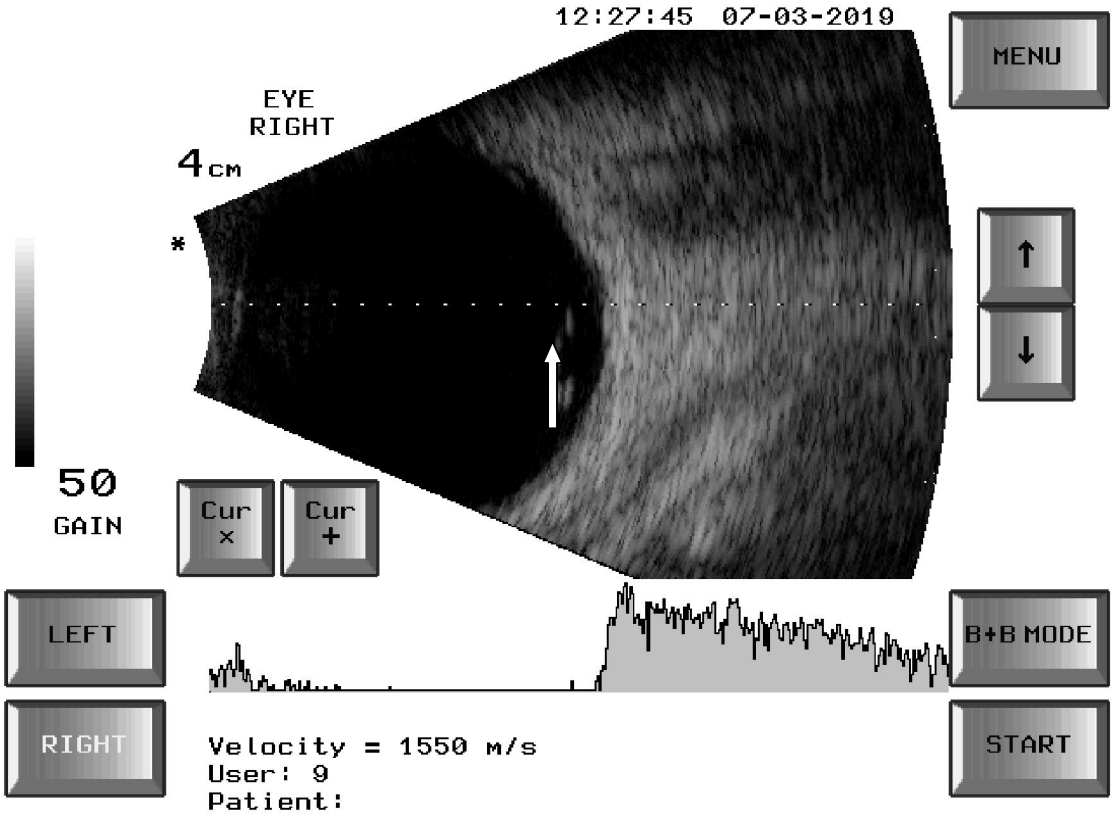

Figure 5: A 59 years- old female transverse B scan image showing floaters (vitreous changes).

4. Discussion

Ophthalmic ultrasound (U/S) has become an indispensable diagnostic tool that has increased the ability to detect and differentiate many ocular and orbital diseases. The main objective of current study was to evaluate the prevalence of vitreous and retina disorders among diabetic patients using B-Scan ultrasonography. Regarding the age the study revealed that the most affected age groups were (60–69) years (n =123) and (50–59) years-old (n = 36) {table 4 } the result agree with study done by Nanda et al [17], In a study by Qureshiand Laghari maximumnumber of patients was also present in the age group of 60-69 years [18].

The study showed that the most common disorders of Vitreous and Retina were retinal detachment which was detected in 30.5% (n = 62) followed by vitreous changes in16.3% (n = 33). Posterior vitreous detachment was observed in 15.8% (n = 32), vitreous hemorrhage was seen in 15.3% (n = 31). [See table1] these findings agree with several study results; Dawood Z et al[19], have proposed that ultrasonography has greatly advanced and this has enabled us to study posterior segment of the eye even in the presence of opaque media. Rabinowitz et al[20] indicated that proliferative diabetic retinopathy (35%) and ocular trauma (33%) were the most common causes of vitreous hemorrhage. Retinal detachment (including patients of RD combined with vitreous disorders) was seen in 30 (15%) cases. Sharma21concluded that the common finding was retinal detachment 21.31 % (out of 122). Javed et al[22] reported that out of 463 patients, the patients of retinal detachment were 68 (14.70%).

According to the patient history the study highlighted that the patient with history of hypertension were more affected 55.2 % (n=112) - [See table2] these results agree with Jitendrakumar et al [23] who have reported that hypertension is a major risk factor for other retinal disorders (eg, retinal artery or vein occlusion, diabetic retinopathy) also, hypertension combined with diabetes greatly increases the risk of vision loss. Patients with hypertensive retinopathy are at high risk of hypertensive damage to other end organs. The current study found that the male were more affected than the female, the

frequency in male was 112, and in female were 91. [See table 3] the findings agree with studies done by Nanda et al 17 and Jitendrakumar et al [23].

Qureshi and Laghari showed that the high frequency of vitreous & retinal disorders was found in the age group (60-69) years-old 18. These results support the present study, which showed that 74.4% of the detected vitreous & retinal disorders was observed in the age group ≥ 60 years- old. [See table4], this agree with the finding of the study done by Jitendrakumar et al [23]

Limitations: The study was conducted in single center, another comparative study is needed. The study was performed by more than on sonographer. The study sample size is not large enough to generalize the results.

5. Conclusion

B scan ultrasonography can be extensively used in evaluating the prevalence of vitreo-retinal disorders even in patients with opaque ocular media, where a preoperative fundoscopic evaluation is virtually impossible for assessment of posterior segment. It is useful for preoperative planning. B-scan is reliable, safe, cheap, rapid investigation and a feasible option. Vitreous and retina disorders were more prevalent in diabetic hypertensive participants 55. The high frequencies of the disorders were observed in age groups (60–69) and (50–59) years-old. Further studies were recommended.

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