



Original Research Article

Foveal serous detachment and its association with body mass index and severity in diabetic retinopathy

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ABSTRACT

Purpose: To determine the prevalence of foveal serous retinal detachment in diabetic macular edema among Indians, establish the affiliation between serous retinal detachment (SRD) and severity of diabetic retinopathy, to study its association with the body mass index (BMI) and demographic profile of these patients.

Materials and Methods: Retrospective single-center analysis was done of all patients with diabetic macular edema at the retina clinic between December 2016 to October 2017.

Results: The overall prevalence of serous retinal detachment in diabetic retinopathy was 46.5%. The average central macular thickness (CMT) of patients having sub foveal SRD was 584.6 microns. Statistically, significantly higher mean was found in patients with Proliferative diabetic retinopathy (PDR) having SRD (p-value 0.017) over those with Non-Proliferative diabetic retinopathy (NPDR). A higher prevalence of SRD was noted among men (p-value 0.035) and with patients with higher BMI (p-value 0.0028).

Conclusion: Higher prevalence of serous retinal detachment (SRD) was seen in proliferative diabetic retinopathy with a higher prevalence among the Indian population with male predilection and among patients with higher BMI.

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1. Introduction

Diabetic retinopathy (DR) is the most common complication of diabetes mellitus (DM), has long been recognized as a microvascular disease having a significant impact on the world's health systems. The estimated number of people with DR worldwide will escalate from 126.6 million in 2010 to 191.0 million by 2030, and the figure with vision-threatening diabetic retinopathy (VTDR) is expected to escalate from 37.3 million to 56.3 million.¹

A recent systematic review of 35 population-based studies showed that the prevalence of DR, proliferative diabetic retinopathy (PDR), diabetic macular edema (DME), and VTDR among individuals with diabetes is 34.6%, 7.0%, 6.8%, and 10.2%, respectively.²

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World Health Organization report suggests that India has 31.7 million diabetic subjects, and the number is expected to increase to 79.4 million by 2030.³⁻⁵

Detection of serous macular detachment is found to be higher on OCT compared to fundus fluorescein angiography (FFA) and Ophthalmoscopic examination. Due to the presence of CME, improved resolution, image quality and cross-sectional observational ability of OCT has made it sensitive to pick even minor macular detachments in patients with diabetic CME, states Kang et al.⁶

Using OCT, the study intends to know the frequency of serous macular detachment (Figure 1) in diabetic CME in the Indian scenario, its correlation to the severity of diabetic retinopathy and its association with BMI.

2. Aims and Objectives

Retrospective case analysis was done

1. To study the prevalence of subretinal fluid and its association with the severity of diabetic retinopathy among Indians.
2. To study the demographic profile of patients with diabetic macular edema having SRD on OCT.
3. To assess the central macular thickness in these patients on spectral-domain OCT.
4. To determine the association of BMI and severity of diabetic retinopathy.

3. Materials and Methods

Analysis of records of all patients between December 2016 to October 2017 with diabetic macular edema having subretinal fluid demonstrated on spectral-domain OCT were included in the study. Declaration of Helsinki was adhered to during the study.

3.1. Inclusion criteria

1. Patients with diabetic retinopathy,
2. Clinically significant macular edema in the fundus examination,
3. Based on the description by Kang the presence of CME and serous macular detachment documented by OCT type 3A.

3.2. Exclusion criteria

1. Previous history of vitreoretinal surgery
2. Epiretinal membrane or vitreomacular traction (VMT) documented by OCT
3. Patients with posterior segment pathology other than diabetic retinopathy and previous ocular surgery
4. Central serous retinopathy
5. Patients with a history of previous laser photocoagulation or grid laser treatment
6. Neovascular age-related macular degeneration
7. Patients with media opacity, vitreous hemorrhage
8. Macular edema not related to diabetics

3.3. Methodology

Case records of all patients with diabetic macular edema who visited the retina clinic at Dr. B.R. Ambedkar Medical College between December 2016 to October 2017 were analyzed retrospectively. A complete ophthalmic evaluation of both anterior and posterior segment and assessment of BMI was done using the formula $\text{weight (kg)} / \text{Height (m)}^2$.

Spectral-domain OCT was performed using the Primus^R 200. Patients having subretinal fluid and foveal detachment demonstrated on OCT were included in the study, demographic detail and BMI was calculated and results

were tabulated accordingly.

Based on modified Klein classification the grading of diabetic retinopathy was done as follow

1. Non-proliferative diabetic retinopathy
2. Moderate non-proliferative diabetic retinopathy
3. Severe non-proliferative diabetic retinopathy
4. Proliferative diabetic retinopathy

This modification was proposed as a standardized alternative to the more detailed Early Treatment Diabetic Retinopathy Study (ETDRS).⁷

The subjects were classified into one of the four categories according to the BMI⁸

1. Underweight—BMI <18.5 kg/m²
2. Normal—BMI 18.5–24.9 kg/m²;
3. Overweight—BMI 25–29.9 kg/m²
4. Obese—BMI ≥ 30 kg/m²

3.4. Definition of CME on OCT

The OCT examination showing CME was the presence of hypo reflective intraretinal cavities radiating from the center of the macula in cross-sectional scans included. On elevating the posterior surface of the retina over a non-reflective cavity with minimal shadowing of the underlying tissues serous macular detachment was suspected to be present. All records of the patients including age, sex, height, and weight, etc. were tabulated.

Macular edema on OCT will be defined by the following (Kang et al.)⁶

1. Type 1 is shown by thickening of the fovea with homogeneous optical reflectivity throughout the whole layer of the retina;
2. Type 2 is shown by thickening of the fovea with markedly decreased optical reflectivity in the outer retinal layers.
3. Type 3 is shown by thickening of the fovea with subfoveal fluid accumulation and the distinct outer border of a detached retina and comprises
4. Type 3A, without foveal traction, and
5. Type 3B, with apparent vitreo-foveal traction All data was compiled and tabulated

4. Results

The prevalence of serous foveal detachment was 46.5%, present in 41 of the 88 patients. (Graph 1)

The study was done in a total of 88 patients out of which men accounted for almost 78% of patients and women were 22% that is 68 and 19 respectively. (Graph 2)

Subfoveal serous detachment was seen among 41 of the 88 patients amounting to 46.5% of the study group. Among the 41 (46.5%) of the patients with subfoveal SRD 26

(63.5%) and 15 (36.5%) were men and women respectively. This is found to be statistically significant with a higher prevalence amongst men (p-value 0.035).

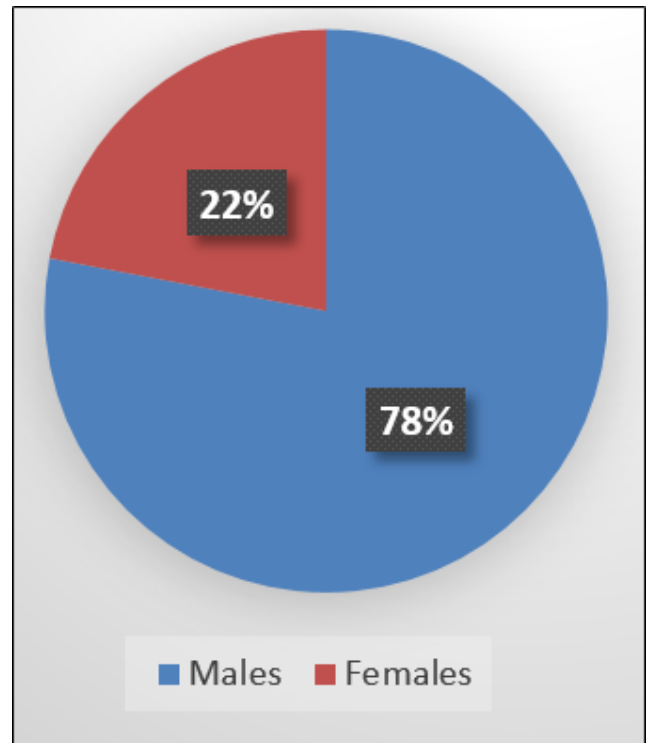
The average age of male patients in this group was 52.15 years' age group varied from 43- 75 years and in females was 54.64 years with a range of 46-70 years.

The central macular thickness of patients having sub foveal SRD was 584.6 microns and those without was 438.74 micron in men. The average macular thickness in females was 426.76 microns and with SRD was 578.3 micron.

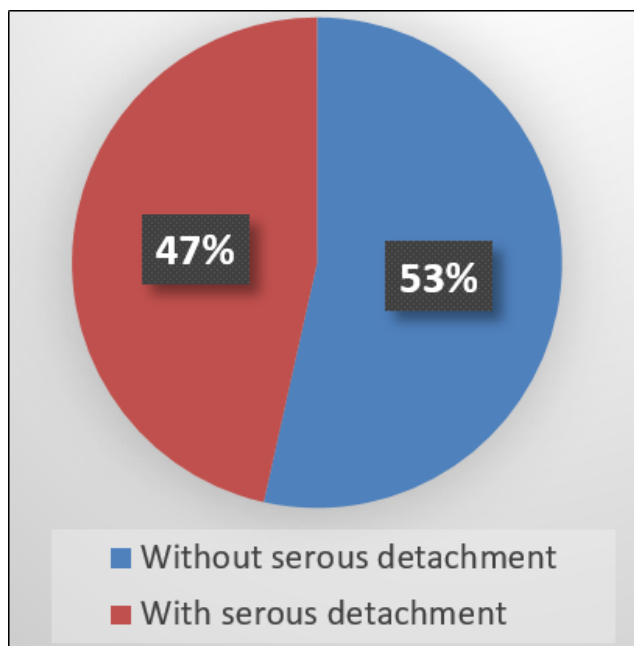
SRD was prevalent in 22% with moderate NPDR (9 of 41 patients), 27% with severe NPDR (11 of 41 patients), and 51.2% with PDR (21 of 41 patients). (Graph 3)

Statistically significant higher mean CMT (566 microns) was found in patients with PDR having SRD (p-value 0.017) than those with NPDR.

Range of BMI among men involved in the study was found to be 21.2 -26.5 kg/ m² and among women the range was 20.2- 24.5 kg/ m² which was statistically significant (p-value 0.0028).



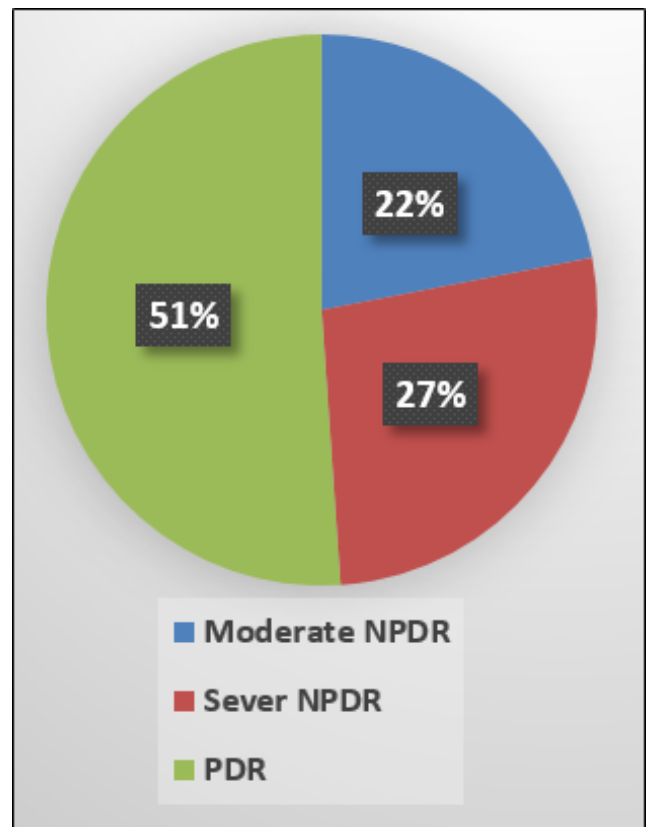
Graph 2: Sex distribution



Graph 1: Distribution of type of foveal detachment

5. Discussion

Blindness is a known complication of Diabetic retinopathy. CSME can occur at any stage of diabetic retinopathy causing visual loss. Macular edema can be precisely detected by using OCT which is the main pathologic feature of diabetic maculopathy. The edema may be symmetrical or involve only a sector of the macular area. The main characteristics of macular edema in OCT, apart from



Graph 3: Distribution of type of diabetic retinopathy having serous retinal detachment (SRD)

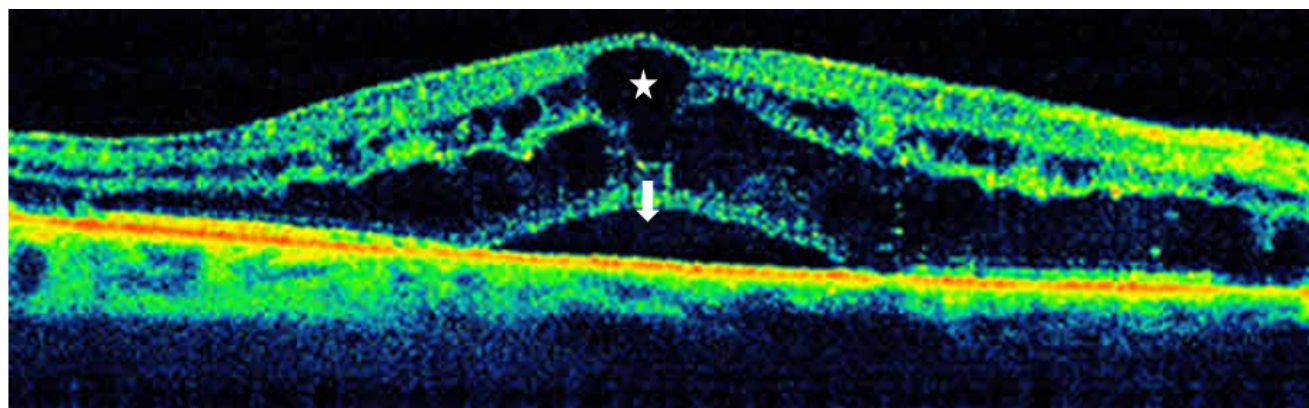


Fig. 1: Optical coherence tomography (OCT) showing retinal elevation with optically clear space between the sensory retina and the retinal pigment epithelium, serous macular detachment (SRD) (↓) and cystoid diabetic macular edema (DME) (*)

increased retinal thickness include

1. Intraretinal spaces of reduced reflectivity
2. Disintegration of the layered retinal structure
3. Flattening of the central foveal depression
4. Fluid under the neurosensory retina

Mohan et al. proposed analysis showed that for every 5-year increase in the duration of diabetes, the risk for DR increased by 1.89-fold. The risk for DR increased by a factor of 1.7 for every 2% elevation of glycated hemoglobin (HbA1c).⁹

7% to 15% of patients with diabetic macular edema (DME) have demonstrated serous macular detachment.^{10,11}

Marmor reported the development of retinal detachment depended on the osmotic or oncotic pressure of intraocular fluids.¹² In eyes with DME, vascular hyperpermeability might increase such pressures, resulting in SRD. High-resolution OCT has enabled observation of the cystoid spaces in the outer plexiform layer that sometimes rupture toward the SRD, suggesting that extravasated blood components pour directly into the SRD.¹³ No association was found between VA and foveal thickness in eyes with foveal SRD,¹¹ whereas these eyes often have a poor prognosis after treatment.¹⁴ OCT often delineates hyperreflective foci in subretinal fluids. According to Early treatment diabetic retinopathy study subfoveal hard exudates develop after the resolution of the macular edema (ME) that correspond to the confluent hyperreflective foci along with impaired visual function.^{14,15}

The detachment of the sensory retina occurs when fluid from the retinal or choroidal circulation leaks into the subretinal space and the compensatory mechanism for fluid removal is exceeded. Weinberg et al. suggested that the pathogenesis of serous retinal detachment is due to leakage from the retinal or choroidal circulation into the subretinal space exceed when it exceeds its drainage capacity. Ravalico & Battaglia opined it is linked to the

limitations of the draining vascular system and in the function of the retinal pigment epithelium. Kang et al. reported that in diabetic eyes the incidence of CME and serous macular detachment increases with the existence of retinal vascular hyperpermeability. The external limiting membrane is permeable to fluid and albumin, with the disruption of the inner blood-retinal barrier, the excess fluid reaches the subretinal space in large amounts, fails to be removed by the retinal pigment epithelium resulting in sub foveal detachment. According to a study by Otani et al., OCT showed three patterns of diabetic macular edema:

1. Retinal swelling
2. Cystoid macular edema
3. Serous retinal detachment

Among the 59 eyes included in the study, only nine eyes (15%) showed serous retinal detachment (six eyes with retinal swelling and three eyes with both retinal swelling and cystoid macular edema. In our study all the 88 patients had cystoid macular edema and 41 had serous detachment.

The presence of Neuro Sensory Detachment adversely affects the prognosis of DME, and can significantly limit effective laser treatment of the macula.¹⁶ Poor visual prognosis after vitrectomy has been reported in the presence of NSD in DME.¹⁷

Our study the overall prevalence of SRD was found to be 46.5% which was comparable to 31% in a study published by Ozdemir et al.¹⁸ We found a higher prevalence of serous retinal detachment in patients with worsening of diabetic retinopathy with a maximum number of patients having PDR and higher body mass index.

The overall central macular thickness was highest among patients with proliferative diabetic retinopathy and among patients with higher body mass index.

Among the various patterns of DME, NSD under the fovea has been reported in 3–31% of patients in various studies but our study shows a relatively higher value. An

Indian study by Gupta et al. have reported the presence of systemic hypertension as a significant and independent risk factor for NSD in DME, but we are emphasizing the association of NSD with the severity of diabetic retinopathy and higher body mass index.¹⁹

In our study higher BMI seems to be associated with increased association of sub foveal detachment similar to the study done by Natallia et al. which showed, in men increased risk of DM complications occurred at higher BMI levels (27.5 < BMI 29.99). Ocular complications occurred at higher BMI levels than any other complications in both genders.²⁰

6. Conclusion

A higher prevalence of sub foveal serous retinal detachment among the Indian population was noted. SRD adversely affects the visual prognosis in patients with diabetic retinopathy. This study gives an insight in to need for a larger prospective population-based study, to know the possibility of neurosensory detachment affecting the final visual prognosis and treatment of vision-threatening diabetic retinopathy depending upon the severity of retinopathy and higher body mass index and its association with the increasing prevalence of diabetic retinopathy.

7. Source of Funding

None.

8. Conflict of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this article.

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