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# Association Between Obesity Indices and Diabetic Retinopathy


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## ABSTRACT

***Aim:*** *To report the association of generalised and abdominal obesity with Diabetic Retinopathy(DR) in South Indian patients with Type 2 Diabetes .*

***Materials and Methods:*** *Cross sectional study conducted between June 2016 - November 2016 at ACS medical college . Patient details were entered along with duration of diabetes, presence or absence of nephropathy and neuropathy . Height , Weight, Waist circumference and Hip circumference were obtained using standard procedures. BMI and Waist Hip ratio(WHR) were calculated using standard formulae. Detailed ophthalmic evaluation of every patient was done . Dilated fundus examination done by a single investigator and retinopathy graded using ICDR Severity Scale clinical classification. Statistical analysis was done using SPSS Software.*

***Results:*** *Statistically significant association was noted between Severe DR and Nephropathy (p value < 0.006).*

***Conclusion:*** *Both high BMI and high WHR are associated with presence and severity of DR.*


**KEYWORDS : Obesity, Diabetic Retinopathy, Association**

**INTRODUCTION :**

Diabetic Retinopathy is a chronic, progressive, potentially sight threatening disease of retinal microvasculature[1] .Almost all patients with Type 1 Diabetes and >60%of type 2 diabetics will develop some degree of retinopathy after a 20 year history of diabetes[2].

In order to identify and prevent progression of this ophthalmic complication of diabetes, a clear understanding of the association of diabetes with systemic risk factors becomes necessary. In our study, we have reported the association between generalised and abdominal obesity with diabetic retinopathy and we have also analysed few other risk factors such as duration of diabetes, presence or absence of nephropathy and neuropathy and their significance.

**MATERIALS AND METHODS:-**

A prospective cross sectional study conducted between June 2016 to November 2016 at ACS medical college. Subjects were recruited from patients attending ophthalmic Outpatient Department. All type 2 diabetics with diabetic retinopathy were included in the study. Exclusion criteria were type 1 diabetics, severe cataract, corneal opacity or other ocular morbidity preventing proper retinal evaluation and grading. Patient details were entered along with duration of diabetes, presence or absence of nephropathy and neuropathy were noted. Weight was measured using traditional spring balance. Height was measured with an inch tape with subjects standing upright without footwear, heels together and touching the wall. Waist and hip circumference were measured using a tape with subject standing erect. Waist circumference (WC) was measured at the midpoint between the lowest rib and the iliac crest. Hip circumference (HC) was measured around the widest portion of the buttocks.

BMI was calculated using the formula : $Wt(kg) / Ht(m^2)$

WHR was calculated using the formula : WC(cm)/HC(cm)

Using the WHO guidelines,

Generalised obesity was defined as BMI > 25 ; and

Abdominal obesity was defined as WHR > 0.90 in men

and > 0.85 in women

All patients underwent detailed ophthalmic evaluation including anterior segment evaluation, refraction and applanation tonometry. Dilated fundus examination was done by a single investigator and retinopathy was graded using International Clinical Diabetic Retinopathy (ICDR) severity scale according to which Mild NPDR was presence of Microaneurysms only ,Severe NPDR was defined as Microaneurysms and Haemorrhages in 4 quadrants -Venous beading in 2 quadrants and IRMA in 1 quadrant and Moderate was inbetween ,PDR was presence of Neovascularisation. In our study Mild NPDR was noted as grade 1, Moderate NPDR as grade 2, Severe NPDR as grade 3 ,PDR as grade 4.

Grade 1 and grade 2 were classified together as Non – sight threatening retinopathy.

Grade 3 and grade 4 were classified together as Sight threatening (Severe) retinopathy.

All the details were entered in Microsoft excel sheet. Statistical analysis was done using SPSS software. A p value ≤ 0.05 was considered statistically significant.

**RESULTS :**

Total of 60 patients were included in the study.

Sociodemographic profile of study subjects is shown in Table 1.

**Table 1: Socio – demographic profile of the study subjects**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| Age | | |
| ≤60 years | 38 | 63.3 |
| > 60 years | 22 | 36.7 |
| Gender | | |
| Male | 31 | 51.7 |
| Female | 29 | 48.3 |

63.3% of subjects were aged ≤ 60 years. There was slight male preponderance of 51.7% in our study.

The risk profile of the study subjects are shown in Table 2.

**Table 2: Risk profile of the study subjects**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| Duration of diabetes | | |
| ≤5 years | 39 | 65 |
| > 5 years | 21 | 35 |
| Nephropathy | | |
| Yes | 48 | 80 |
| No | 12 | 20 |
| Neuropathy | | |
| Yes | 30 | 50 |
| No | 30 | 50 |
| Waist circumference | | |
| Normal | 15 | 25 |
| Increased | 45 | 75 |
| Waist – hip ratio | | |
| Normal | 4 | 6.7 |
| Increased | 96 | 93.3 |
| B.M.I | | |
| Normal ( ≤ 25) | 17 | 28.3 |
| Obesity (> 25) | 43 | 71.7 |

65% of the study subjects had ≤ 5 years of diabetes. Nephropathy was significantly present in 80% of the subjects. No difference was noted with regard to presence or absence of neuropathy. Waist circumference was increased in 75% of the study subjects. Waist hip ratio was significantly increased in 93.3% of subjects. This is similar to other studies [3,4,5]BMI was abnormal in 71.7% of subjects. This is also similar to other studies[6,7,8,9]

**Table 3 shows the frequency of grades of retinopathy in our subjects.**

**Table 3: Grades of retinopathy of the subjects**

| Grades | Frequency | Percentage |
|---|---|---|
| Grade 1 | 21 | 35 |
| Grade 2 | 23 | 38.3 |
| Grade 3 | 14 | 23.3 |
| Grade 4 | 2 | 3.4 |

Grade 1 and 2 were more common with 35% and 38.3% and the severe (sight threatening retinopathy/STR) grades 3 and 4 were 23.3% and 3.4% respectively.

**Table 4: Association between severe Diabetic Retinopathy and certain suspected risk factors**

| Variable | Classification of variable (number of people in the group out of 60) | Number of subjects with Gr 3 and Gr 4 diabetic retinopathy (out of 16) | Odds ratio (95%C.I Of odds ratio) | Chi – square value | P – value |
|---|---|---|---|---|---|
| Age | ≤ 60 years (38) | 11 | 1.39 (0.41 – 4.69) | 0.27 | 0.60 |
| | > 60 years (22) | 5 | 1.00 | | |
| Duration of DM | > 5 years (21) | 8 | 2.38 ( 0.74 – 7.72 ) | 2.12 | 0.15 |
| | ≤ 5 years (39) | 8 | 1.00 | | |
| B.M.I | > 25 ( 43) | 12 | 1.26 ( 0.34 – 4..63) | 0.0005 | 0.98 |
| | ≤ 25 (17) | 4 | 1.00 | | |
| Waist Circumference | Abnormal ( 45) | 13 | 1.63 ( 0.39 – 6.72) | 0.11 | 0.74 |
| | Normal (15) | 3 | 1.00 | | |
| Waist Hip Ratio | Normal (4) | 2 | 3.00 ( 0.39 – 23.33) | 1.17 | 0.28 |
| | Abnormal (56) | 14 | 1.00 | | |
| Nephropathy | Yes ( 12) | 7 | 6.06 ( 1.56 – 23.57) | 7.56 | 0.006 * |
| | No (48) | 9 | 1.00 | | |
| Neuropathy | Yes (30) | 8 | 1.00 ( 0.31 – 3.14) | 0.00 | 1.00 |
| | No (30) | 8 | 1.00 | | |

( * - statistically significant)

**Table 4 shows the association between severe Diabetic Retinopathy and certain suspected risk factors.**
Statistically significant association was found between nephropathy and STR with a p value <0.006%.

**Fig 1 - shows the status of Pan Retinal Photocoagulation of study subjects.**

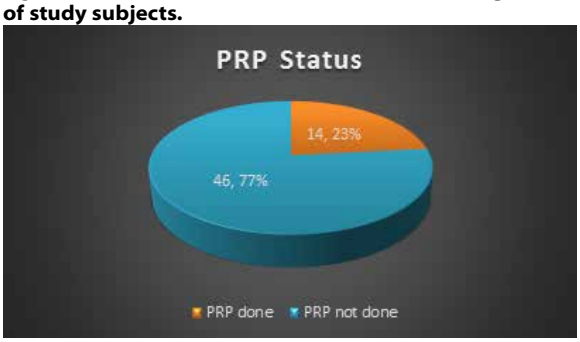


**Table 5 shows the association between pan retinal photocoagulation and certain risk factors.**

**Table 5: Association between PRP Status and certain risk factors**

| Variable | Classification of variable (number of people in the group out of 60) | Number of diabetic retinopathy with PRP (out of 14) | Odds ratio (95%C.I Of odds ratio) | Chi – square value | P – value |
|---|---|---|---|---|---|
| Age | ≤ 60 years (38) | 9 | 1.06 (0.3 – 3.67) | 0.05 | 0.82 |
| | > 60 years (22) | 5 | 1.00 | | |
| Duration of DM | > 5 years (21) | 6 | 1.55 ( 0.46 – 5.28) | 0.49 | 0.49 |
| | ≤ 5 years (39) | 8 | 1.00 | | |

No significant association between age or duration of diabetes and PRP status were obtained .

**DISCUSSION :-**

Obesity has been universally accepted as a major risk factor for coronary heart disease, diabetes mellitus and hypertension [10,11]. However the association between obesity and diabetic retinopathy has not been consistent. Some studies suggest that higher BMI increases risk for diabetic retinopathy, while other studies reported no association or even an inverse association[12,13,14,15].

CURES,[16] a population based study in age group > 20 years found that obesity defined by increased BMI and increased waist circumference was more prevalent in women than in men ( BMI 47.4 vs 43.2% , WC 56.2 vs 35.1 %) and isolated abdominal obesity was more common in women and isolated generalised obesity was more common in men.

In a study by Man et al[17], the authors have concluded that higher BMI conferred a protective effect on diabetic retinopathy, while higher WHR was associated with presence and severity of diabetic retinopathy in women.

In Hughes et al [18] ,a population based cross sectional study in Singapore it was reported that Malay and Indian women were more obese than Chinese women in the age group of 18 -69.

In our study, higher BMI (>25) showed 71.7% association with DR compared to lower ≤BMI which was 28.3%.This is similar to many other studies[6,7,8,9]. CURES study [16] has also shown that WC is a better marker of obesity related metabolic risk in Asian Indian population. In our study, increased WC (≥90 men ; ≥80 women ) showed 75% association with DR and increased WHR (≥0.90 men; ≥0.85 women) showed significant association with DR of 93.3% . This is similar to other studies.[3,4,5]

In a similar study by Katusic et al[19], it was reported that prevalence of DR increases significantly with higher body weight. In another study by Raman et al [20] in urban south Indian population Isolated abdominal obesity and high WHR in women were associated with DR.

In our study, duration of Diabetes > 5 years did not show any significant association with DR (35%) whereas presence of neuropathy showed a 50% association with DR and presence of Nephropathy showed a statistically significant association with Sight threatening DR (odds ratio 6.06 (1.56 – 23.57) and p value of < 0.006). This is similar to multiple studies [21,22,23,24]which have demonstrated the association between DR and chronic kidney disease.

The strengths of our study are that subjects are representative of urban population and retinopathy grading was done by single investigator using standard grading system. The limitations of our study are a small sample size and study conducted over a short duration of time and other risk factors such as Hypertension, Hyper lipidemia and diabetes control were not taken into account.

## CONCLUSION:

In South Indian patients with Type 2 Diabetes both higher Body Mass Index and higher Waist Hip Ratio are associated with presence and severity of Diabetic Retinopathy, though it was not proven statistically significant. However ,there was a statistically significant association between severe DR and declining renal function(p value< 0.006) .Further clinical trials are required to determine whether WHR is a more clinically relevant marker than BMI in Diabetics. Despite inconclusive findings , it is still important for clinicians to encourage the patients to optimise their body weight and disease control to prevent development and progression of Diabetic Retinopathy.

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**Conflict of Interest** : Nil

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