Diabetic retinopathy (DR), a window for prediction of potential stage of diabetic kidney disease (DKD) and its progression: An analysis of real-world data

Mansi Gupta, MS[1]; Ankit Chavhan, BE[1]; Dr Ganesh Babu TC, MD[1]; Dr. Sulatha Bhandary, MD[2]; Dr. Shankar P. Nagaraju, MD[2]; Dr. Jayanti Gupta, PhD[3]

[1]Carl Zeiss India Pvt. Ltd., Bangalore, India; [2]Kasturba Medical College, Manipal University, Manipal, India; [3]Nishkash Consulting, Mumbai, India;

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PURPOSE

- To substantiate clinical correlation between stages of DR and DKD and establish risk factors impacting the association in real world patient data.
- This study has supported the development of an AI based model which predicts the potential stage of DKD in patients diagnosed with certain severity of DR.
- An analysis such as this can assist in early detection of renal dysfunction due to DKD leading to early intervention by the nephrologist to manage the disease efficiently.

METHODS

- Data were collected from a total of 366 patients.
- Data were collected in the form of fundus images and demographic data.
- Inclusion criteria for population under evaluation:
  - History of diabetes, DR and DKD.
  - Availability of fundus image data and nephrology parameters such as urine protein, serum creatinine and estimated glomerular filtration rate (eGFR).
- Fundus data were collected from FF450 (ZEISS, Jena, Germany) along with DR stage annotations, done by the ophthalmologist, from VISUHEALTH platform (ZEISS, Jena, Germany).
- The association between stages of DR and DKD at the baseline visit of patients was analyzed using the chi-square test.
- A multivariate logistic regression model was used to identify significant risk factors as predictors of DKD stage.
- Follow up data from one visit for each patient were used for progression analysis.

Diabetic Retinopathy , a strong predictor for potential stage of diabetic kidney disease

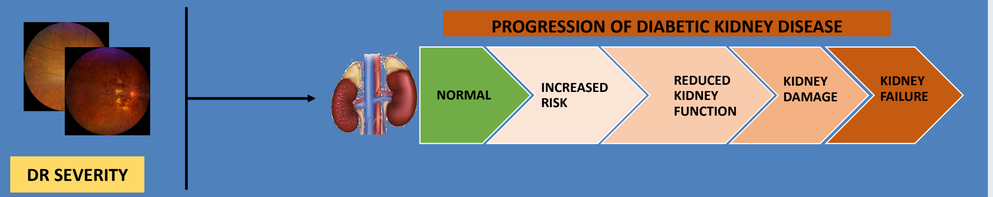

Table 1: Association of baselines DR and (clubbed) DKD Stages

	DR Stage at Baseline					
DKD Stage at baseline	0	1	2	3	4	Row Total
(1, 2, 3A, 3B)	18	12	55	113	59	257
(4, 5)	10	0	16	47	36	109
Column Total	28	12	71	160	95	366
Chi-square test of association = 10.3, df = 4, **p-value = 0.035**						

Table 1: Chi Square Analysis to evaluate association between DR stages and stages of DKD

Table 2: Association of DR progression and DKD progression

	DR Progression		
DKD Progression	No	Yes	Row Total
No	46	8	54
Yes	31	16	47
Column Total	77	24	101
Chi-square test of association = 5.1, df = 1, **p-value = 0.023**			

Table 2: Chi Square Analysis to evaluate association of DR progression and DKD Progression

Email: mansi.gupta@zeiss.com

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RESULTS

- p-value = 0.035 indicates association between clubbed stages of DKD [Early DKD Stage (Stage 1, 2, 3A and 3B) and Advanced DKD Stage (4 and 5)] and severities of DR.
- The p-value of 0.023 is indicative that the severity of DR and DKD progress in a similar fashion (Table 2).
- Odds Ratio (OR) of the following:
  - Age = OR 1.03, p-value 0.003
  - History of hypertension = OR 7.28, p-value <0.001
  - Duration of hypertension = OR 1.10, p-value < 0.001
  - HbA1C = OR 0.79, p-value <0.001
  - Presence of urine protein = OR 19.67, p-value <0.001

are indicative that these parameters are significant risk factors towards DKD stage prediction.

CONCLUSIONS

- A significant association between DR stages and clubbed DKD stages, as well as significant association between DR and DKD progression.
- Such an association in real world data can assist the ophthalmologists in timely referral of long-standing diabetic patients to the nephrologists before the patients progress to end-stage renal disease (ESRD) and eventually renal replacement therapy.
- Association between DR and DKD progression can facilitate an early detection of DKD stage through non-invasive procedures like fundus imaging and urine dipstick test, leading to better management of renal diseases by clinicians.