Egyptian Journal of Clinical Ophthalmology "*EJCO*"
An International peer-reviewed journal published bi-annually

Volume 8, Issue 1, Dec. 2025: pp: 59-66 www. ejco.sohag-univ.edu.eg

Original Article

OCULAR LESIONS IN RENAL TRANSPLANT PATIENTS

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Received: 3/3/2025
Accepted: 28/5/2025 **Doi:** 10.21608/ejco.2025.443640

Abstract

Purpose: *Assessment of ocular lesions in end stage renal patients following a successful kidney transplantation.* ***Patients and methods:*** *This is a retrospective cross sectional observational study that included 60 eyes of 30 patients with chronic kidney disease which treated in its end stage by kidney transplant since 1 to 5 years before beginning of this study. Comprehensive ophthalmological examination was done at ophthalmology department of Luxor university, in a period between March 2024 and March 2025. We evaluated the ocular complaints of the patients, ophthalmological examination findings, posttransplant duration, and the medications used. Ocular pathologies were classified as corneal, conjunctival, lens, vitreoretinal, and optic disc pathologies for the analysis.* ***Results:*** *The most common findings were dry eye, followed by cataract and vitreoretinal pathologies. The most common vitreoretinal pathology was diabetic retinopathy, followed by hypertensive retinopathy.* ***Conclusion:*** *Ocular findings were seen in most of the kidney transplant recipients. Therefore, it is required that these patients undergo routine ocular screenings in order to provide early diagnosis and administrate treatment when needed.*

Keywords: *Eye findings, Ocular lesions, Renal transplantation, Diabetic retinopathy, Dry eye.*

1. Introduction

Kidney transplantation remains the most effective therapeutic option for individuals with end-stage renal diseases. Recent improvement in surgical procedures, immunosuppressive protocols, and high-quality postoperative care have significantly enhanced graft survival rate and reduced the rejection [1]. Despite of these advancements, various ocular lesions may occur after kidney transplantation, either as a result of the pre-existing disease of kidney dysfunction due to metabolic factors including uremia, anemia, and oxidative stress or due to the immunosuppressive therapies [2.3]. Addressing ocular issues in renal transplant patients is essential as these complications may negatively affect visual function and quality of their life. This study aims to explore the prevalence of ocular abnormalities in renal transplant patients and investigate their association with underlying cause of renal insufficiency, transplant duration and immunosuppressive treatment regimens.

2. Materials and Methods

The study was designed as a cross-sectional retrospective observational investigation. Renal transplant patients being followed-up at the Nephrology outpatient clinic of Luxor university, Luxor, Egypt. 30 patients with successful transplant were referred for a comprehensive ophthalmologic examination at ophthalmology department, Luxor university in period between March 2024 to March 2025 with history of transplantation varies from 2019 to 2023. After obtaining informed consent, all patients underwent a complete ocular examination including autorefraction (Topcon RM800), ocular motility and external examination, slit-lamp bio microscopy, Goldmann applanation tonometry and fundoscopy using a non-contact 78 D lens following pupil dilation. Retinopathy patients were referred for a documented Fluorescein angiography and OCT macula (Topcon SS DRI Triton). Ocular findings were classified as corneal, conjunctival, lens related, vitreoretinal, optic disc related disease, to make the analysis easier retinopathies were grouped as Hypertensive retinopathies, diabetes related complications including clinically significant macular edema, non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR); and other retinopathies as AMD. Previous nephrological history including underlying disease leading to End stage renal disease (ESRD), post-transplant duration, creatinine level at time of examination and immunosuppressive regimen were recorded. The immunosuppressive protocol was administered as a combination of either Tacrolimus, steroids and mycophenolate mofetil (Tacrolimus based) or Cyclosporin, steroids and mycophenolate mofetil (Cyclosporin based) to all patients. All statistical analyses were conducted using IBM SPSS Statistics Version 29.0 [4]. The methodology encompassed descriptive statistics for continuous and categorical variables, inferential statistics for correlation and comparative analyses, and advanced statistical modeling. Specifically, descriptive analyses involved measures of central tendency, dispersion, and normality testing, while inferential analyses utilized various correlation coefficients and t-tests/ANOVAs for group comparisons. Categorical data were analyzed using Chi-square tests and related effect size measures. $P < .05$ was considered significant

3. Results

The study population consists of 60 eyes of 30 successfully post-transplant patients (21 males, 9 females, M: F 2.3:1) with an average age of 50.5 years (range: 31-67 years), indicating a middle-aged cohort. The average transplant duration is 3.3 years (range: 1-6 years), representing patients in the early to intermediate post-transplant period. The relatively wide age range (36 years) and moderate standard deviation (12.8 years) suggest good age diversity in the sample. 23 patients were with co morbidities of DM and HTN or both in 23 patients. In accordance to immunosuppressive regimen, 42 patients (70%) were on Tacrolimus based regimen and 18 patients were on Cyclosporin based regimen. There was at least one abnormal ocular finding in 53 subjects (88.3%); in the remaining 7 eyes (11.6%) the eye examination was unremarkable. Dry eyes and cataracts were the most significant eye lesions in those patients (33.3%, 61.7%). Cataracts were predominantly posterior subcapsular (26 eyes), 12 eyes were pseudophakic either before or after transplantation. Diabetes related ocular complications were seen in 41.7% of diabetic subjects. Retinopathies were varying between diabetic retinopathies “sever NPDR or PDR” and Hypertensive retinopathy. Ocular findings of less clinical importance or less frequency included AMD “Drusen, CNV”, Arcus senilis, Pannus, Mature senile cataract and Diabetic Papillopathy, as shown in figs. (1, 2 & 3). Corneal signs recorded ranged between arcus snelins, fibrosous

pannus or corneal opacities of previous trauma which irrelevant to our issue. None of the recipients had intraocular pressure (IOP) higher than 21 mmHg. The correlation matrix reveals multiple significant risk factors for eye conditions in post-transplant patients. Age shows the strongest correlation with eye conditions ($r = 0.687$, $p < 0.001$), explaining approx. 47% of the variance in ocular complications. This represents a large effect size, indicating age as the primary risk factor. Transplant duration demonstrates a moderate-to-large correlation ($r = 0.456$, $p < 0.001$), suggesting that longer post-transplant periods increase complication risk. Diabetes mellitus ($r = 0.534$, $p < 0.001$) and hypertension ($r = 0.467$, $p < 0.001$) both show substantial correlations, highlighting the importance of metabolic comorbidities. The interrelationships between age, DM, and HTN suggest a complex web of cardiovascular and metabolic risk factors that compound ocular complications, fig. (4). There is a highly significant association between age and eye condition prevalence ($p < 0.001$). The relationship shows a clear age-related pattern: younger patients (<40 years) have low complication rates (16.7%), middle-aged patients (40-60 years) show moderate rates (58.3%), while older patients (>60 years) demonstrate very high rates (93.3%). This represents a nearly six-fold increase in risk from the youngest to oldest age groups. The linear-by-linear association test confirms a strong dose-response relationship, suggesting that eye complications increase progressively with age in post-transplant patients, fig. (5). There was a highly significant progressive increase in eye condition prevalence with transplant duration ($F = 12.45$, $p < 0.001$). Patients at 1-2 years post-transplant have the lowest complication rates, those at 3-4 years show intermediate rates (26.7% higher than early period), and patients at 5-6 years demonstrate the highest rates (63.4% higher than early period). This suggests a cumulative effect of immunosuppression exposure over time. The 36.7% difference between intermediate and late periods indicates continued risk accumulation even beyond the initial post-transplant years. Clinically, this supports intensified ophthalmologic surveillance protocols for patients beyond 3 years post-transplant, fig. (6). The post-transplant ocular lesions in relation to immunosuppressive regimen was more significant with Tacrolimus based patients (38 eyes, 71.6%) than Cyclosporin based patients (15 eyes, 28.3%) and this can be explained by higher number of patients were on Tacrolimus based immunosuppressives (42 eye of total enrolled eyes, 70%). There was no significant correlation between any of the two groups in dry eye and cataract occurrence with their administration, fig. (7). This suggests that the choice between these immunosuppressive agents should be based on other clinical factors rather than ophthalmologic considerations, as both regimens carry similar ocular complication risks. The logistic regression model demonstrates excellent predictive capability, explaining 66.3% of variance in eye condition occurrence (Nagelkerke $R^2 = 0.663$). The model shows good fit (Hosmer-Lemeshow $p = 0.565 > 0.05$). Age emerges as the strongest independent predictor, with each additional year increasing odds by 9.3% (OR = 1.093, $p < 0.001$). For a 10-year age difference, this translates to a 2.4-fold increase in risk. Transplant duration significantly increases risk, with each additional year raising odds by 51% (OR = 1.510, $p = 0.012$). Diabetes mellitus is a powerful risk factor, increasing odds by 243% (OR = 3.434, $p = 0.030$). While hypertension shows a substantial effect size (OR = 2.401), it doesn't reach statistical significance ($p = 0.100$), possibly due to sample size limitations. The study protocol was approved by the scientific ethical committee of the faculty of medicine, Luxor university, Luxor, Egypt. It was conformed to the ethical guidelines of the 1975 Helsinki Declaration. An informed written consent was taken from each patient of their acceptance to participate in this study.

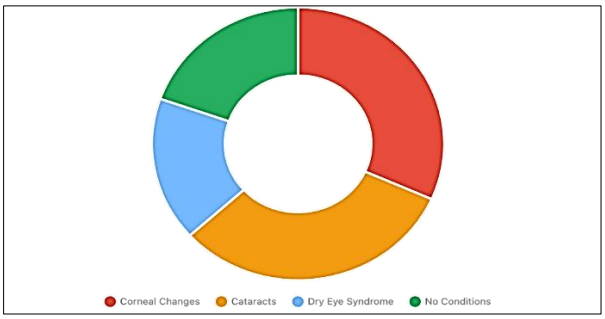
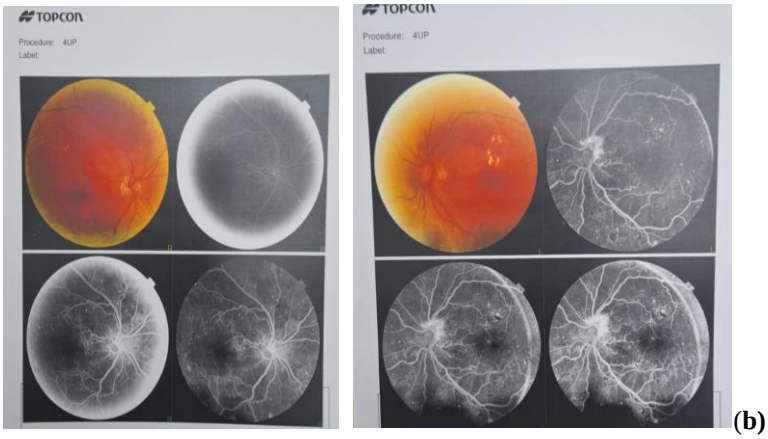


Figure 1: Eye conditions prevalence



(a) **(b)**

Figure 2: Diabetic retinopathy in postrenal transplantation patient fluorescein angiography; **a.** right NPDR with CMO, **b.** left PDR (NVDs) with CMO

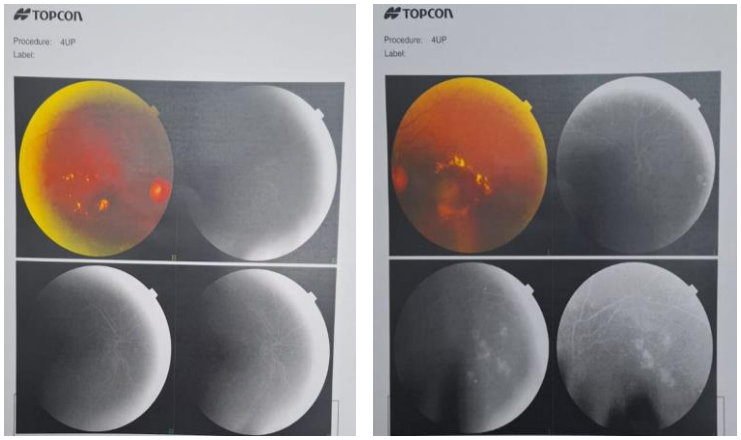


Figure 3: diabetic retinopathy in postrenal transplantation patient fluorescein angiography. Bilateral NPDR in the same patient with cataract.

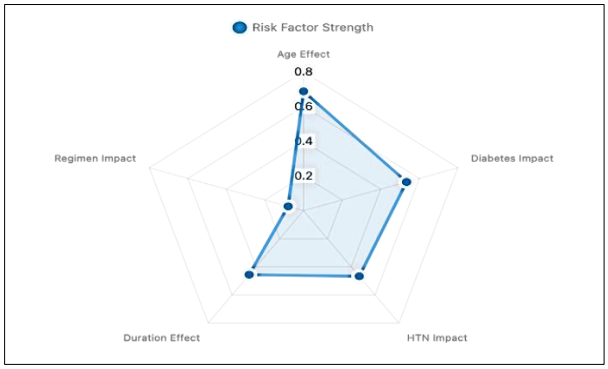


Figure 4: Risk stratification model

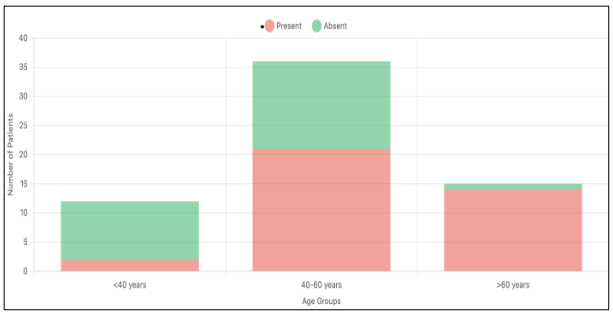


Figure 5: Correlation between eye lesions and age of patients

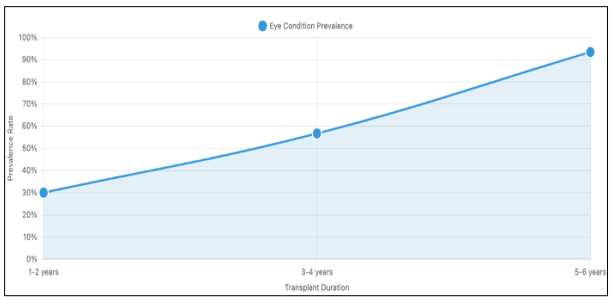


Figure 6: Transplant duration effect on eye lesions prevalence

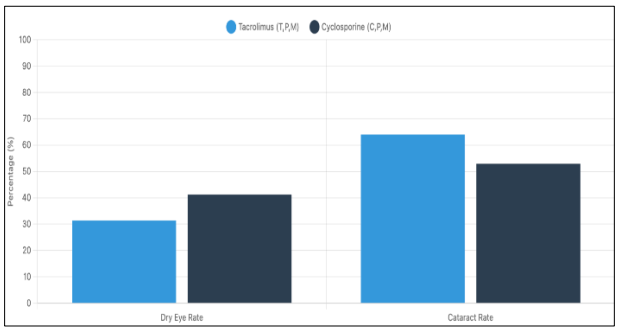


Figure 7: Immunosuppression regimen impact on common ocular lesions

4. Discussion

In recent years, a significant progress has been occurred in the field of organ transplantation, particularly kidney transplantation which offer better outcomes for patients with end stage organ failure. Consequently, ocular complications with renal transplantation have more frequently reported. These may stem from underlying systemic illness, progression of pre-existing condition or development of new ocular ailments associated with posttransplant immunosuppressive medications [5]. In this study, we reported that 88.3% of the patients had at least one ocular finding. Previous studies in the literature have also listed high rates of ocular findings in transplant patients that ranged from 52% to 89% [3,6,7]. In this study, Cataracts and Dry eyes were the most significant eye lesions in those patients (61.7%, 33.3%). The same results were in Almila Sezenoz et al.'s study found that the most common ocular finding was dry eye syndrome (35.6%), followed by lens (34.0%) and retina pathologies [7]. Strempel et.al. observed dry eye in 50% of renal transplant patients [8]. Also, in Trung et al. dry eyes were observed 59.4% [9]. Dry eye is complex and may present with symptoms of ocular discomfort, visual fluctuation, tear film instability. It is often influenced by systemic factors related to kidney dysfunction, such as chronic inflammation, drug use, and comorbidities, even in cases

where the transplant is considered successful [9,10]. In the present study, the second most common ocular findings were lens-related pathologies 61.7%. Cataracts are a well-documented complication among organ transplant recipients, often attributed to long-term use of immunosuppressive agents such as corticosteroids, cyclosporine, and tacrolimus. Additionally, post-transplant diabetes is known to further elevate the risk of developing cataracts [5,7]. This goes in accordance with incidence was recorded in some studies between 32.26% and 78% [11,12]. Compared with the literature, the prevalence of cataract was relatively high in our study group. Almila Sezenoz et al. reported cataract in 34% of cases, this difference might be because 11.6% of their patients were pseudophakic, that they had already undergone cataract surgery [7]. Some prior studies have identified a dose-dependent association between corticosteroid use and the severity of cataract formation [13]. However, in our study, no significant correlation was found between the use of postoperative oral medications and the development of cataracts. This discrepancy might be attributed to the evaluation of patients receiving a combination of immunosuppressive agents, rather than prednisolone alone. A study by Kian-Ersi et al. reported a reduction in ocular complications when the number of immunosuppressive drugs was increased from monotherapy to triple therapy [6]. Contrary to previous literatures, we did not observe any opportunistic ocular infections [14]. This finding aligns with more recent evidence suggesting that the implementation of updated post-transplant immunosuppressive regimens has substantially lowered the risk of such infections [3,7]. In this study, a strong correlation observed with the time elapsed since transplantation and the development of ocular complications. In contrast, studies by Almila Sezenoz et al. and Lanewala et al. suggested no clear relationship between post-transplant duration and ocular involvement, noting that most patients exhibited ocular symptoms within the first five years following surgery [7,15]. In our study group, diabetes mellitus emerged as the leading cause of chronic kidney disease. However, it remains uncertain whether this was a primary condition or a consequence of renal pathology. Previous research has more commonly identified hypertension as the primary contributing factor to both retinopathy and chronic kidney disease [6]. In this study, diabetic retinopathy was observed in 41.7% of participants with diabetes. In comparison, a study by Yaprak A Ç et al. reported retinopathy rates of 47.9% and 42.6% among patients receiving preemptive transplantation and those on dialysis, respectively [16]. Other published data indicate that hypertensive retinopathy occurs in approx. 8.4% to 40% of cases, whereas diabetic retinopathy has been reported in 12% to 15.1% of affected individuals [6,17,18]. Additionally, prior research suggests that undergoing dialysis may accelerate the progression of diabetic retinopathy [19]. While increased intraocular pressure (IOP) is a well-known complication of topical steroid use, systemic corticosteroids are infrequently associated with the development of glaucoma [20]. In this study, no significant elevation in IOP was observed. However, previous studies have documented cases of glaucoma and optic disc changes suggestive of glaucomatous damage, which were attributed to postoperative use of prednisolone [7, 21].

5. Recommendations

1) We suggest prospective studies through regular randomized protocols of ophthalmic examination for all transplant patients before kidney transplantation and reporting follow-up results in the postoperative period that may provide valuable insights.

2) Establish longitudinal follow up studies to assess progression pattern in such cases for longer duration with larger

sample size for immunosuppressive impact on ocular lesions in such patients.

6. Conclusions

This comprehensive study reveals that ocular complications are highly prevalent in post-transplant patients, affecting nearly two-thirds of the population. The findings establish a clear hierarchy of risk factors: age is the dominant predictor, followed by diabetes mellitus, transplant duration, and hypertension. Importantly, the choice between tacrolimus and cyclosporine-based immunosuppression does not significantly impact ocular complication rates, allowing clinical decision-making to focus on other factors. The progressive nature of complications over time, suggests that older patients and those with longer transplant duration require more intensive ophthalmologic surveillance.

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