Oculo-Renal Pathologies- 'Two Sides of the Same Coin'

Dear Editor,

Kidneys and eyes seem very different, but they have certain things in common, including embryological, physiological, and pathological pathways.[1,2] In 1836, Richard Bright[3] first found an association between both organs. Glomerulus and choroid share vasculature which is analogous in structure and function. The renin–angiotensin–aldosterone system (RAAS), which regulates blood pressure, is present in both organs. There is an oculo-specific local regulatory system defined in the retinal vascular endothelium. This system has a considerable function in aqueous humor dynamics, intraocular pressure, and retinal vascular repercussions in chronic systemic diseases such as hypertension and diabetes. Intriguingly, for both eyes and kidneys, the embryogenesis period spans 4–6 weeks of gestation. Consequently, any discrepancies in the course of this time can result in anatomical and physiological malformations in both tissues. Many syndromes affecting both these organs have been documented in the literature.[4]

A detailed eye examination should be conducted in all patients with ESRD.[5]

Systemic lupus erythematosus may show ocular findings such as retinal hemorrhages, cotton wool spots, and disc edema not related to hypertension. Granulomatosis with polyangiitis shows renal involvement ocular involvement in the form of inflammation ranging from mild conjunctivitis or episcleritis to severe necrotizing scleritis. Dense deposit disease is a primary glomerular disease that typically shows electron-dense deposits within the glomerular basement membrane. These patients also develop a peculiar ocular finding in the form of drusen, which are electron-dense retinal deposits sandwiched between the collagenous layer of Bruch's membrane and the retinal pigmented epithelial cells.

Neurofibromatosis 1 patients show peculiar ocular phenotypes in the form of Lisch nodules. Glaucoma, optic nerve glioma, and palpebral neurofibroma are other ocular findings seen in these patients. NF2 patients show ocular findings in the form of cataracts, optic nerve, and retinal hamartomas. Kidneys may show renal artery stenosis, attributable to intimal and medial hyperplasia or due to the compression of the artery. Renal artery aneurysms may also be seen in a certain fraction of these patients. Patients with Alport syndrome show evidence of hematuria due to nephritis which usually progresses to renal failure, eye disorders, and sensorineural hearing loss. It occurs due to mutation in COL4A5, COL4A3, and COL4A4, which are part of the basement membrane in various organs. Ophthalmic manifestations occur in the form of bilateral anterior lenticonus, corneal opacities, cataract, fleck retinopathies, and temporal retinal thinning. Fabry disease is an X-linked lysosomal storage disorder that occurs because of deficiency of α-galactosidase A. The ocular manifestations of this disease include corneal dystrophy, corneal and lens opacities, and conjunctival and retinal vascular abnormalities. There is renal dysfunction due to deposition in endothelial cells, podocytes, and smooth muscle cells. Primary hyperoxaluria is an autosomal recessive disorder that occurs due to inborn error of glyoxylate metabolism and results in extensive deposition of birefringent calcium oxalate crystals in different tissues, including kidneys and eyes. Homocystinuria is also an autosomal recessive disorder that can cause ectopia lentis, glaucoma, optic atrophy, and retinal detachment. Renal

Table 1: Various syndromes showing oculorenal pathologies

Syndrome	Renal manifestation	Ocular manifestation	Other manifestations
WAGR syndrome	Wilms tumor	Aniridia	Genitourinary anomalies and mental retardation.
CHARGE syndrome	Hydronephrosis, reflux, horseshoe kidney, renal agenesis, renal hypoplasia, or multicystic dysplastic kidneys.	coloboma	Choanal atresia, growth and development retardation, genital, cardiac, and ear anomalies.
Von-Hippel-Lindau syndrome	Renal cell carcinoma	Hemangioblastoma	Brain (hemangioblastoma), pancreas (cysts), adrenal (pheochromocytoma).
Tuberous sclerosis	Angiomyolipima (75%-80%) and cysts	Adenoma sebaceum of the lids or less likely retinal or optic nerve hamartomas.	Benign tumors that affect multiple organs, including brain, skin (adenoma sebaceum), and heart.
Bardet-Biedl syndrome	Renal malformations, polycystic kidney disease, 53-82%	Retinitis pigmentosa, strabismus and cataract.	Genital tract (hypogenitalism).
Sturge-Weber syndrome	Angioma	Capillary venous malformations	Capillary venous malformations in the skin, and brain along with angiomas of the face, choroid, and meninges.

complications include thrombotic microangiopathy, neonatal hemolytic uremic syndrome, CKD, tubulointerstitial nephritis, and proximal renal tubular acidosis. Nephronophthisis occurs due to mutations in the genes involved in ciliary, basal body, and centrosome functions, causing renal dysfunction. Other findings include retinal degeneration, cerebellar ataxia, and liver fibrosis. Other syndromes that affect both organs include WAGR syndrome, CHARGE syndrome, Von–Hippel–Lindau syndrome, tuberous sclerosis, Bardet–Biedl syndrome, and Sturge–Weber syndrome [Table 1].

To sum up, there is considerable evidence of how intricately kidneys and eyes are associated with each other at all levels. Thus, this link between the two can be used as screening for the well-being of these crucial organs and alarm nephrologists and ophthalmologists for further tests. Eyes are the windows to kidney diseases. Knowledge in this context can help in diagnosing ocular diseases early in renal disease patients and can also open new domains for treatment as therapies for renal microvascular problems can work in the eyes and vice-versa.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Gargi Kapatia, Gaurav Gupta[1], Utkarsh Kapoor

Department of Pathology, All India Institute of Medical Sciences, Bathinda, Punjab, [1]Department of Ophthalmology, Eye Sure Super-Speciality Eye Hospital, Bathinda, Punjab, India

Address for correspondence:
Dr. Gargi Kapatia,
Department of Pathology, All India Institute of Medical Sciences (AIIMS), Bathinda -151 001, Punjab, India.
E-mail: drgkapatia@gmail.com

References

1. D'Souza YB, Short CD. The eye--a window on the kidney. Nephrol Dial Transplant 2009;24:3582-4.
2. Wong CW, Wong TY, Cheng CY, Sabanayagam C. Kidney and eye diseases: Common risk factors, etiological mechanisms, and pathways. Kidney Int 2014;85:1290-302.
3. Bright R. Tabular view of the morbid appearances in 100 cases connected with albuminous urine. Guy's Hosp Rep 1836;1:380.
4. Pohl M, Bhatnagar V, Mendoza SA, Nigam SK. Toward an etiological classification of developmental disorders of the kidney and upper urinary tract. Kidney Int 2002;61:10-9.
5. Grunwald JE, Alexander J, Ying G-S, Maguire M, Daniel E, Whittock-Martin R, *et al*. Retinopathy and chronic kidney disease in the Chronic renal insufficiency cohort (CRIC) study. Arch Ophthalmol 2012;130:1136-44.

Access this article online

Quick Response Code:

Website: https://journals.lww.com/ijon

DOI: 10.4103/ijn.ijn_182_22

How to cite this article: Kapatia G, Gupta G, Kapoor U. Oculo-renal pathologies- 'Two sides of the same coin'. Indian J Nephrol 2023;33:317-8.

Received: 24-05-2022; **Revised:** 01-08-2022; **Accepted:** 23-08-2022; **Published:** 07-03-2023