Chronic Kidney Disease and Cataract: Seeing the Light

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Chronic kidney disease (CKD) affects more than 10% of the world's adult population, and its prevalence increases with age. Visual impairment is common in CKD, and results from the increased likelihood of cataract, glaucoma, microvascular and diabetic retinopathy, and age-related macular degeneration [1].

Hypertension and diabetes are the most common renal diseases with ocular complications. In addition, many inherited forms of renal diseases have ocular features. This is because the kidney and the eye are structurally similar with glomerular/retinal epithelial cells overlying a basement membrane of collagen IV $\alpha 3\alpha 4\alpha 5$ and capillary network [1, 2], and the kidney and eye sharing developmental processes that are dependent on the same transcription factors [2]. Inherited diseases with ocular manifestations include Alport syndrome, dense deposit disease, tuberous sclerosis, cystinosis, Fabry disease, nephronophthisis, and renal-coloboma syndrome [2]. In addition, some treatments for renal disease have ocular complications, such as steroid-induced cataract and hydroxychloroquine-associated maculopathy. Renal failure itself results in the ocular features of scleral calcification, and cataracts.

The paper by Liu et al. [3] in this issue of American Journal of Nephrology highlights the increased preva-

lence of cataracts in CKD, and, for the first time, suggests that cataracts become more common as renal failure worsens. The relationship between CKD and cataract has long been suspected, but it was only recently that it was only recently confirmed. The study by Liu et al. [3] is a retrospective analysis of data from a public health system; the authors included only individuals who had accessed cataract surgery. Overall, patients with CKD had a 1.84 increased risk (95% CI 1.73–1.95) of cataract after correcting for age, gender, hypertension, socioeconomic status, smoking, and other comorbidities. The risk was even higher for those with end-stage renal failure (2.33, 95% CI 2.10–2.59), suggesting that CKD itself contributed to cataracts. However, this study did not conclude whether CKD was important in cataract initiation or progression.

Cataract is the clouding of the lens that reduces vision and produces glare and, less often, monocular diplopia. Worldwide, cataract is the commonest cause of blindness. In the US, 17.2% of adults over the age of 40 years have at least one cataract, and a further 5.1% have already had corrective surgery [4].

Cataracts impair the quality of life, contribute to depression, with an effect comparable to a major medical condition such as stroke [5], and increase morbidity and mortality, through more frequent falls and hip fractures.

Depending on their location within the lens, cataracts are categorized as cortical, nuclear sclerotic or posterior sub-capsular. Ageing is associated with cortical cataract, and steroids and diabetes with a subcapsular location. CKD has an increased risk of both cortical and subcapsular cataracts that are frequently bilateral, and may be asymmetrical.

Treatment includes the surgical removal of the native lens and replacement with an intraocular prosthesis ("pseudophakia"). A lens implant improves the quality of life, with further benefit from second eye surgery. In the US, cataract surgery between 2000 and 2012 yielded society a 4,567% return on its cost [5].

The pathophysiology of cataract is complex and incompletely understood. Genetic, environmental, nutritional, and systemic factors are involved. Age and ultraviolet light exposure are important [6]. Typically, nuclear cataracts result from continued concentric deposition of cortical fibres and compression of the lens nucleus. Cortical cataracts occur with changes in hydration of the lens cortex.

Increased cataract in CKD may reflect shared risk factors such as age, smoking, hypertension, diabetes, dyslipidemia, and obesity [7], but multivariate analyses suggest that CKD is also an independent risk factor.

Possible pathogenetic mechanisms underlying cataracts in CKD include atherosclerosis, endothelial dysfunction, oxidative stress, inflammation, renin-angiotensin system dysfunction, and Ca-P dysregulation (from vitamin D deficiency, hypocalcemia, or Klotho disturbance) [7]. It is likely that better treatment of CKD will slow the development of cataracts.

According to Liu et al. [3], we will witness increased incidence of cataracts in CKD patients. The treatment is simple, and improves our patients' quality of life and reduces mortality. Collaboration with ophthalmologists continues to be important in managing these patients.

Disclosure Statement

The authors have no conflicts of interest to declare.

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