

## Supplemental material

**Supplemental Table 1: Biomarkers of chronic kidney disease (CKD)**

Biomarker	Description	Function	Clinical significance	Reference
<b>Biomarkers of glomerular injury</b>				
Nephrin	180 kD transmembrane protein expressed in glomerular podocytes	Maintains glomerular filtration	Biomarkers of podocytopathies, diabetic nephropathy.  Levels progressively increase with increasing albuminuria.	1.Akankwasa, G.; Jianhua, L.; Guixue, C.; Changjuan, A.; Xiaosong, Q. Urine markers of podocyte dysfunction: A review of podocalyxin and nephrin in selected glomerular diseases. <i>Biomark. Med.</i> 2018, 12, 927–935. 2.Surya, M.; Rajappa, M.; Vadivelan, M. Utility of Urinary Nephrin in Patients with and Without Diabetic Nephropathy and Its Correlation with Albuminuria. <i>Cureus</i> 2021, 13, e20102
Dendrin	Component of slit diaphragm complex	During cell injury, relocates from the membrane to the nucleus and induces apoptosis	It is increased in podocytopathies.  The number of glomeruli with the absence of dendrin correlated inversely with creatinine clearance.	1.Asanuma, K.; Campbell, K.N.; Kim, K.; Faul, C.; Mundel, P. Nuclear relocation of the nephrin and CD2AP-binding protein dendrin promotes apoptosis of podocytes. <i>Proc. Natl. Acad. Sci. USA</i> 2007, 104, 10134–10139. 2.Mizdrak M, Vukojević K, Filipović N, Čapkun V, Benzon B, Durdov MG. Expression of DENDRIN in several glomerular diseases and correlation to pathological parameters and renal failure - preliminary study. <i>Diagn Pathol.</i> 2018 Nov 20;13(1):90. doi: 10.1186/s13000-018-0767-z. PMID: 30458823; PMCID: PMC6247684.
Podocin	43 kDa membrane-associated protein in glomerular slit diaphragm.	Plays an important role in nephrin-mediated cellular signaling and maintaining podocyte structure and function	Levels are increased in rapidly progressive kidney disease characterized by nephrotic syndrome and mesangiosclerosis, glomerulosclerosis, and tubulointerstitial fibrosis. It is predictive of severe glomerular injury.	Mollet, G.; Ratelade, J.; Boyer, O.; Onetti Muda, A.; Morisset, L.; Aguirre Lavin, T.; Kitzis, D.; Dallman, M.J.; Bugeon, L.; Hubner, N.; et al. Podocin inactivation in mature kidneys causes focal segmental glomerulosclerosis and nephrotic syndrome. <i>J. Am. Soc. Nephrol.</i> 2009, 20, 2181–2189
Podocalyxin	It is an	Maintains	Levels are elevated in	Asao, R.; Asanuma, K.; Kodama, F.; Akiba-Takagi, M.; Nagai-Hosoe, Y.;

n	anionic transmembrane sialoglycoprotein, and a component of the slit diaphragm	integrity of kidney filtration barrier	obesity-related kidney disease, lupus nephritis. Levels are associated with the proportion of segmental sclerosis.	Seki, T.; Takeda, Y.; Ohsawa, I.; Mano, S.; Matsuoka, K.; et al. Relationships between levels of urinary podocalyxin, number of urinary podocytes, and histologic injury in adult patients with IgA nephropathy. Clin. J. Am. Soc. Nephrol. 2012, 7, 1385–1393
Immunoglobulin G	150 kDa globular circulating protein	Important component of humoral immunity	Biomarker of mechanical injury to glomerular filtration barrier.	Hou, J.; Cheng, Y.; Hou, Y.; Wu, H. Lower Serum and Higher Urine Immunoglobulin G Are Associated with an Increased Severity of Idiopathic Membranous Nephropathy. Ann. Clin. Lab. Sci. 2019, 49, 777–784.
c-Myb	DNA-binding transcription factor	c-Myb regulates slug protein which plays an important role in epithelial to mesenchyme transition.	Increased in IgA nephropathy and IgA vasculitis. Marker of fibrosis.	Mizdrak, M.; Filipovic, N.; Vukojevic, K.; C' apkun, V.; Mizdrak, I.; Durdov, M.G. Prognostic value of connective tissue growth factor and c-Myb expression in IgA nephropathy and Henoch-Schönlein purpura-A pilot immunohistochemical study. Acta Histochem. 2020, 122, 151479
<b>Biomarkers of tubular injury</b>				
Vanin-1 (Vascular non-inflammatory molecule-1)	It is a glycosylphosphatidylinositol anchored ectoenzyme with pantetheinase activity	Plays an important role in the recycling of pantothenic acid and synthesis of coenzyme A	Levels increased in hypertensive CKD	Bartucci, R.; Salvati, A.; Olinga, P.; Boersma, Y.L. Vanin 1: Its Physiological Function and Role in Diseases. Int. J. Mol. Sci. 2019, 20, 3891.
Galectin-3	32–35 kDa member of the galectin family of -galactoside-binding lectins	Plays an important role in cell growth, and apoptosis, angiogenesis, inflammation, immunity, and fibrosis	Levels increased in Type2 diabetes mellitus with macroalbuminuria and CKD stage 4 and 5.	Hussain, S.; Habib, A.; Hussain, M.S.; Najmi, A.K. Potential biomarkers for early detection of diabetic kidney disease. Diabetes Res. Clin. Pract. 2020, 161, 108082
Uromodulin (Tamm–Horsfall protein)	It is a glycoprotein produced in the thick	Its production is reduced in interstitial fibrosis and	Biomarker for intact renal mass and early stages of CKD.	Steußl D, Block M, Herbst V, Nockher WA, Schlumberger W, Satanovskij R, et al. Plasma Uromodulin Correlates With Kidney

	ascending limb and early distal tubule.	tubular atrophy		Function and Identifies Early Stages in Chronic Kidney Disease Patients. <i>Medicine (Baltimore)</i> . 2016 Mar. 95 (10):e3011.
<b>Other biomarkers of chronic kidney disease</b>				
Asymmetric dimethyl arginine	It is an endogenously produced methylated arginine that reversibly inhibits nitric oxide.	In huge quantities, it inhibits NO and induces fibrosis.	Relevant biomarker for CKD. A significant predictor of cardiovascular morbidity and mortality in CKD and dialysis patients.	Hanai K, Babazono T, Nyumura I, Toya K, Tanaka N, Tanaka M, et al. Asymmetric dimethylarginine is closely associated with the development and progression of nephropathy in patients with type 2 diabetes. <i>Nephrol Dial Transplant</i> . 2009 Jun. 24(6):1884-8.
Beta trace protein	lipocalin-type prostaglandin D2 synthase	Tubular proteinuria	Biomarker for progression of hypertensive CKD in African Americans	Bhavsar NA, Appel LJ, Kusek JW, Contreras G, Bakris G, Coresh J, et al. Comparison of measured GFR, serum creatinine, cystatin C, and beta-trace protein to predict ESRD in African Americans with hypertensive CKD. <i>Am J Kidney Dis</i> . 2011 Dec. 58(6):886-93.

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