

Supplementary Table S1. Breakdown list of the whole slide images (WSIs).

This breakdown list presents the numbers of WSIs that were collected from the three hospitals for each primary disease category. The rows present the name of the primary disease, and the columns depict the hospital name. Each number represents the number of obtained WSIs or images. ANCA: antineutrophil cytoplasmic antibodies; UTH: The University of Tokyo Hospital; KH: Tazuke Kofukai Medical Research Institute, Kitano Hospital; UTSH: University of Tsukuba Hospital.

	Number of WSIs from UTH	Number of WSIs from KH	Number of WSIs from UTSH	Number of <u>WSIs</u> from all hospitals	Number of <u>images</u> from all hospitals
Focal segmental glomerular sclerosis	6	0	19	25	1 278
IgA nephropathy	28	58	10	96	2 973
ANCA-associated vasculitis	0	5	23	28	1 071
Lupus nephritis	5	7	16	28	1 021

GLOMERULAR CLASSIFICATION BY NEURAL NETWORKS

Diabetic nephropathy	4	0	12	16	446
Minimal change nephrotic syndrome	6	0	0	6	343
Membranous nephropathy	6	0	5	11	487
Membranoproliferative glomerulonephritis	3	3	2	8	225
C3 glomerulonephritis	0	1	3	4	63
Endocapillary proliferative glomerulonephritis	1	2	1	4	199

GLOMERULAR CLASSIFICATION BY NEURAL NETWORKS

Other glomerulonephritis	14	9	2	25	788
Arteriosclerosis-related disease	0	1	9	10	126
Thrombotic microangiopathy	1	1	0	2	50
Cryoglobulin thrombotic glomerulonephritis	1	0	1	2	67
Amyloidosis	1	0	0	1	33
Congenital nephropathy	1	0	0	1	48
Tubulointerstitial nephritis	7	1	0	8	181

GLOMERULAR CLASSIFICATION BY NEURAL NETWORKS

Transplant kidney	14	0	3	17	773
Miscellaneous	1	0	0	1	30
Total	99	88	106	293	10 202

Supplementary Table S2. Annotation criteria for the 12 features that are important for diagnostics.

The annotation criteria consist of the following three aspects: feature, score, and regulation. Feature: the name of the feature. Score: the values of the feature. Regulation: the definition of scoring.

Feature		Score		Regulation	
Capillary Collapse	None	Segmental	Global	Impossible to score	The capillary of a glomerulus is obsolete because it collapses. It does not matter if the Bowman's capsule is thick or fibrotic. When the entire capillary lumen is obsolete, score this feature as "global," and when a portion of the capillary lumen is obsolete, score this as "segmental."
Sclerosis	None	Segmental	Global	Impossible to score	The capillary of a glomerulus is obsolete by the extracellular matrix. It does not matter whether there is a foam cell or hyalinosis. When the entire capillary lumen is obsolete, score this feature as "global," and when a portion of the capillary lumen is obsolete, score this feature as "segmental."

Mesangial Hypercellularity	Normal	Mild	Moderate	Severe	Impossible to score	Count the number of mesangial cells in the most cellular proliferative area except when it is near the vascular pole. If the count is < 4, score this feature as “normal”; if the count is 4–5, score this as “mild”; if the count is 6–7, score this as “moderate”; and if the count is ≥ 8, score this as “severe.” The sclerotic mesangial area must not be evaluated.
Increased Mesangial Matrix	(-)	(+)			Impossible to score	If the width of the matrix in the mesangial area exceeds two mesangial cells, score this as “(+)” The mesangial area that is replaced with anything other than the normal substances is not evaluated.
Mesangiolytic	(-)	(+)			Impossible to score	When the mesangial cells are degenerated, and a portion of the mesangial matrix is melted, score this feature as “(+)” The score of this feature must be evaluated only when the mesangial matrix remains.

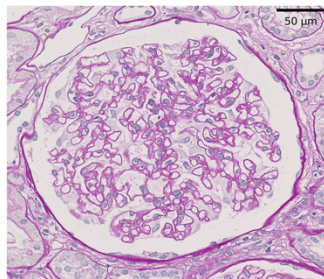
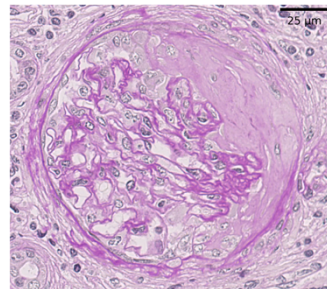
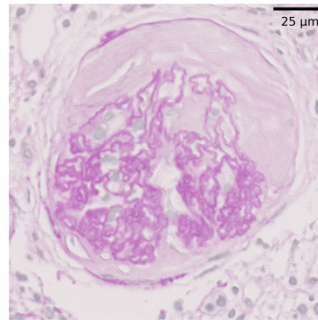
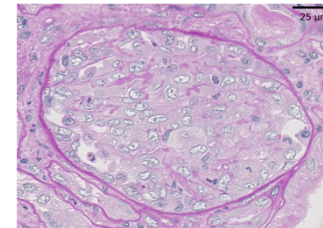
Endocapillary Proliferation	(-)	Segmental	Global	Impossible to score	The number of cells in the vascular cavity has increased and the vascular lumen is narrowed. If proliferation is found in the entire glomerulus, score this feature as “global,” and if found partially, score this as “segmental.” When no vascular lumen is left in an image, score this feature as “impossible to score.”
Fibrous Crescent	(-)	(+)			Define an extracapillary lesion that occupies >10% of the circumference of the Bowman’s capsule. When two or more layers of cells are overlapped, and the proportion of cells occupies $\geq 50\%$, define it as “cellular crescent.” When the proportion of the matrix occupies $\geq 90\%$, define it as “fibrous crescent,” and the others are “fibrocellular crescent.” When some sort of crescent exists in an image, score them separately. Do not distinguish the collagenization of the Bowman's capsule from the ordinal crescent and treat them equally.
Fibrocellular Crescent	(-)	(+)			
Cellular Crescent	(-)	(+)			

Adhesion	(-)	(+)	Impossible to score	When the glomerular capillary and the Bowman’s capsule are in contact in which something is present other than an extracapillary lesion or a sclerotic area, score this feature as “(+).”
Increased Vasculature around the Vascular Pole	(-)	(+)	Impossible to score	This feature means neovascularization at the glomerular vascular pole. When there are two or more blood vessels other than the afferent or efferent arteriole at the vascular pole, score this feature as “(+).” It does not matter whether the blood vessel wall is hyalinized. When the vascular pole cannot be found in an image, score this feature as “impossible to score.”
Afferent/Efferent Arteriolar Hyalinosis	(-)	(+)	Impossible to score	If hyaline-like substances are found in either the afferent or efferent arteriole, score this feature as “(+).” The degree of hyalinosis does not matter. When neither the afferent nor the efferent arteriole can be found in an image, score this as “impossible to score.”

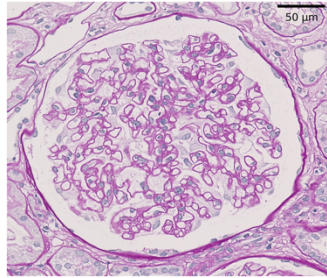
Supplementary Figure S1. Annotation example images for the 12 features.

For the 12 features in the annotation criteria, we present some sample images of each feature. Each image is selected from concordance data, and shows high concordance (not necessarily perfect concordance) between five clinicians in each feature. CC: capillary collapse; Scl: sclerosis; MesHyper: mesangial hypercellularity; IMM: increased mesangial matrix; Mlysis: mesangiolytic; EP: endocapillary proliferation; F-Cre: fibrous crescent; Fc-Cre: fibrocellular crescent; C-Cre: cellular crescent; Adh: adhesion; IVVP: increased vasculature around the vascular pole; AAH: afferent/efferent arteriolar hyalinosis.

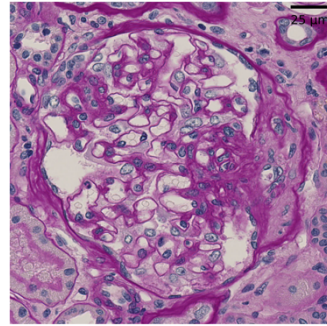
Examples of CC

**None****Segmental****Global****Impossible to score**

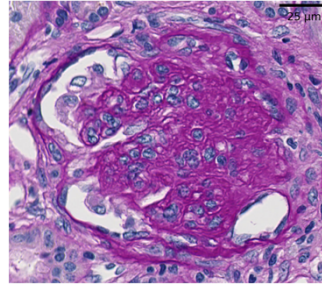
Examples of Scl



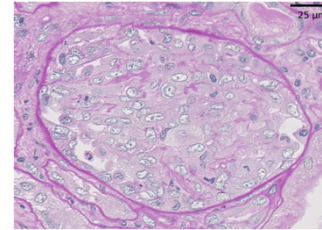
None



Segmental

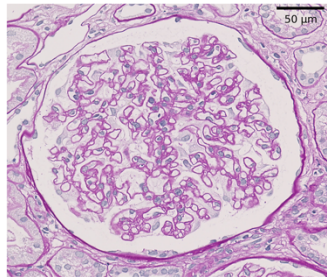


Global

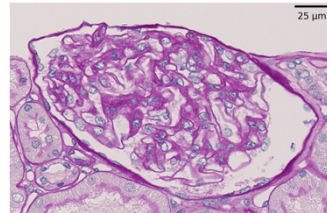


Impossible to score

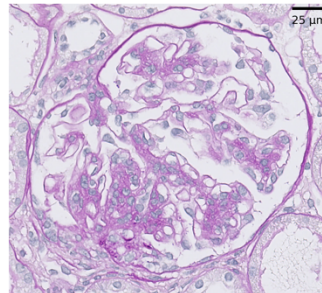
Examples of MesHyper



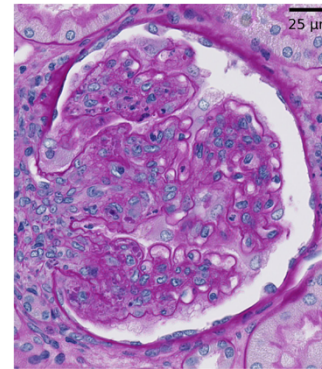
Normal



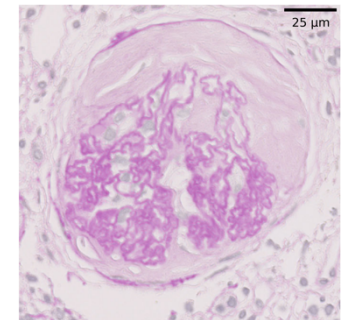
Mild



Moderate

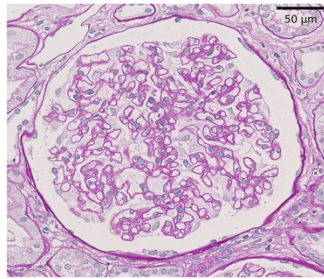


Severe

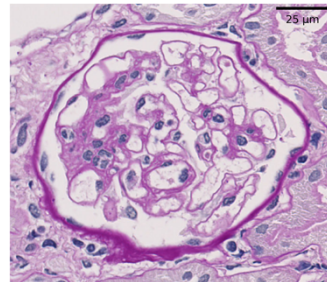


Impossible to score

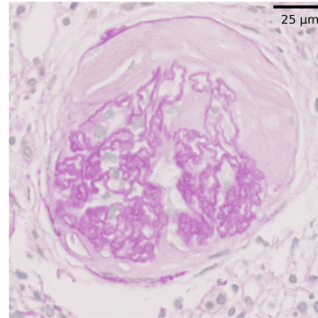
Examples of IMM



(-)

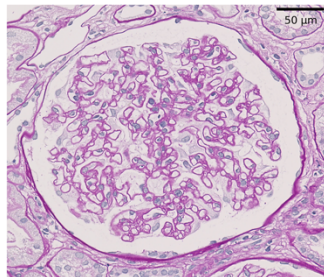


(+)

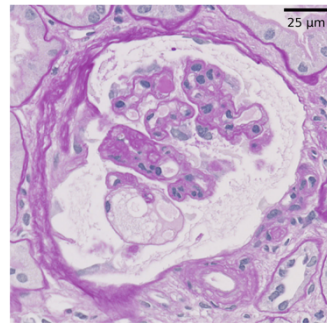


Impossible to score

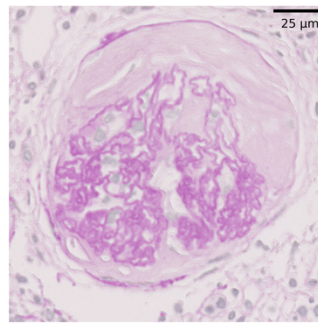
Examples of MLysis



(-)

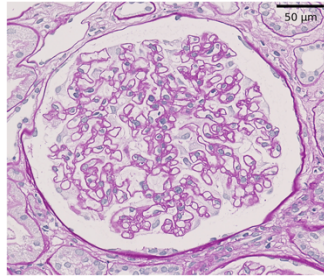


(+)

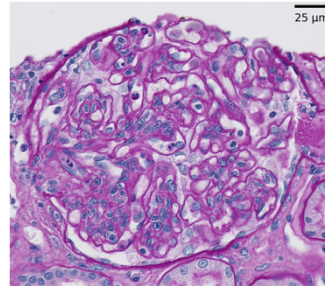


Impossible to score

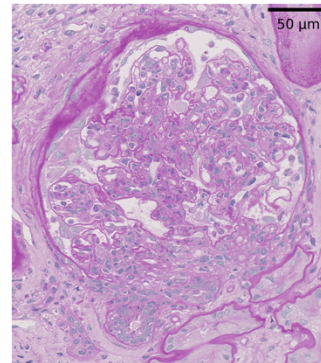
Examples of EP



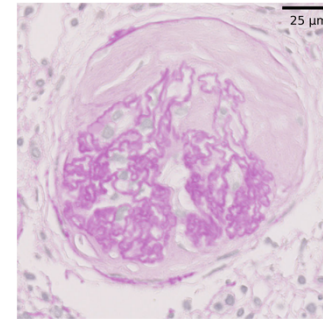
None



Segmental

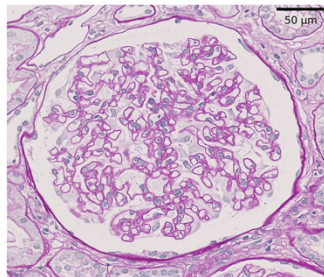


Global

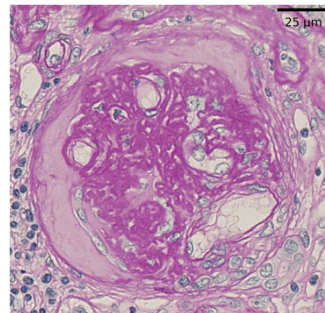


Impossible to score

Examples of F-Cre

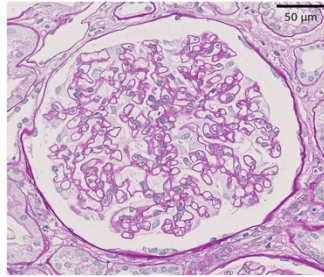


(-)

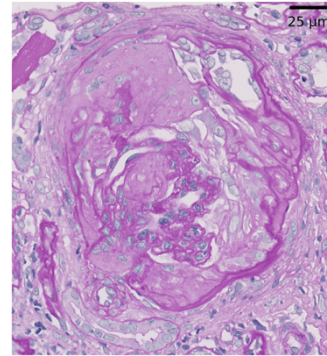


(+)

Examples of Fc-Cre

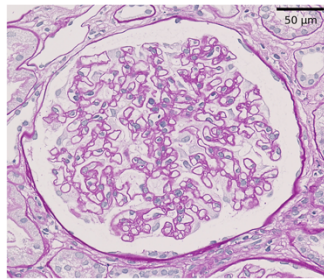


(-)

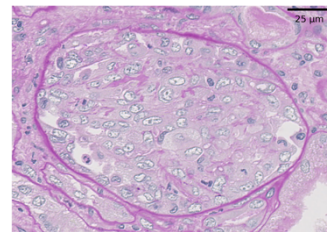


(+)

Examples of C-Cre

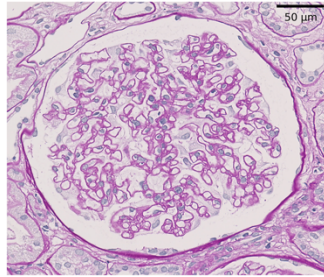


(-)

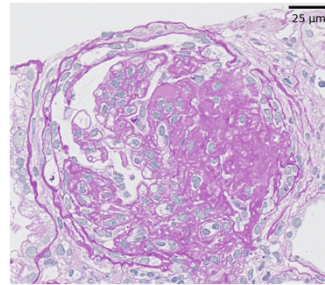


(+)

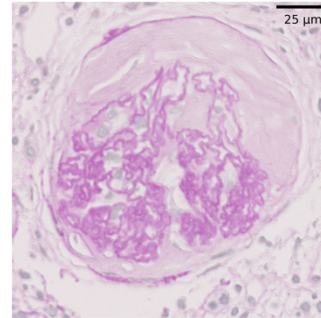
Examples of Adh



(-)

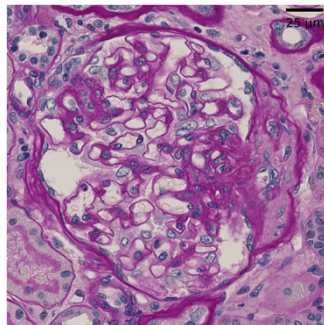


(+)

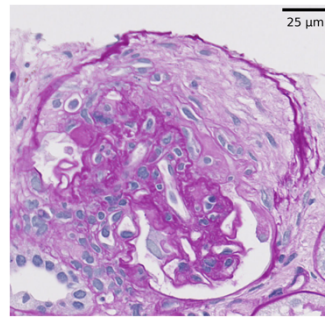


Impossible to score

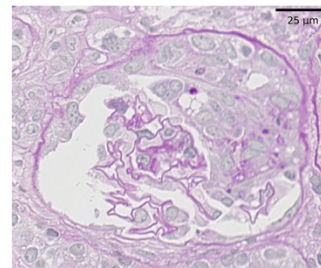
Examples of IVVP



(-)

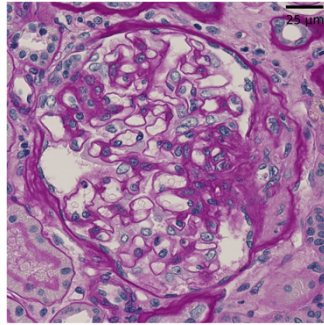


(+)

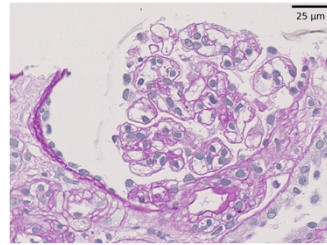


Impossible to score

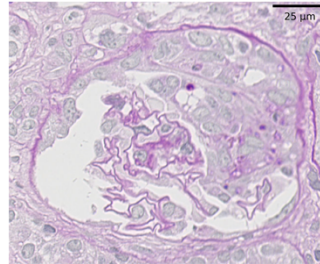
Examples of AAH



(-)



(+)



Impossible to score

Supplementary Figure S2. Images used for concordance evaluation.

We present the images used for concordance evaluation.

