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Original Article

Clinicopathological characteristics and renal outcomes in IgA nephropathy patients with nephrotic range proteinuria

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Abstract: Studies on the association between clinicopathological characteristics and renal prognosis in IgA nephropathy (IgAN) with nephrotic range proteinuria are limited. A cohort study enrolled 89 patients admitted to The Six Affiliated Hospital of Sun Yat-sen University from 2013.01 to 2015.07, diagnosed with IgAN by renal biopsy and followed up. Of the included patients, 17 patients presented with nephrotic range proteinuria (proteinuria ≥3.0 g/24 hr), with the rate of 19.1%. Compared to the subnephrotic proteinuria group, patients in nephrotic range proteinuria group had higher serum creatinine (SCr), higher pathological score, more severe tubular/interstitial injury and significantly extensive podocyte foot process effacement. Adjusting Logistic regression analysis indicated that extensive podocyte foot process effacement present was the independent risk factor of nephrotic range proteinuria in IgAN patients. Furthermore, 83 patients were enrolled in the follow-up cohort, 13.3% of whom developed renal progression after median 18 months, with rate of 28.6% in patients with nephrotic range proteinuria. Multivariate Cox regression analysis showed that SCr at baseline and extensive podocyte foot process effacement present were independent predictors of poor renal prognosis in IgAN patients. In our center, 19.1% patients of IgAN present with nephrotic range proteinuria, of whom, 28.6% have developed renal progression. Extensive podocyte foot process effacement present is the only independent risk factor of nephrotic range proteinuria and one important predictor of poor renal prognosis in IgAN patients. Further researches will be handled to explore the mechanisms of podocyte injury in IgAN.

Keywords: IgA nephropathy, nephrotic range proteinuria, podocyte, foot process effacement, renal progression

Introduction

IgA nephropathy (IgAN), first described in 1968, is the most common primary glomerulonephritis in the world at present [1]. In Europe, IgAN has constituted about 20-30% of the primary glomerulonephritis, while 30-50% in Asia and about 45% in China [2]. About 15-40% of the IgAN patients achieve the end stage renal disease (ESRD) 10-20 years after diagnosis of the disease [1]. Proteinuria more than 1 g/24 hr, renal insufficiency and high pathological score have been confirmed to be the predictors of ESRD [3-5].

Clinical features of IgAN vary widely, but the most common one is that of hematuria with subnephrotic proteinuria. Nephrotic range proteinuria is uncommon at presentation with approximately 6% of cases [5]. Hallmark of pathological characteristics of IgAN on light microscopy is an increase in mesangial matrix and hypercellularity with predominance of IgA deposits in mesangial and paramesangial areas on immunofluorescence microscopy. Electron microscopy usually shows electron-dense material corresponding to immune deposits on immunofluorescence microscopy, but occasionally in subepithelial and subendothelial portions of glomerular basement membrane (GBM) [6]. Recently, more and more study findings have confirmed the concept that proteinuria is the podocytopathy which involved unstable actin cytoskeleton of podocyte, such as minimal-change disease (MCD), idiopathic

membranous nephropathy (IMN) and focal segmental glomerulosclerosis (FSGS) [7, 8].

Up to now, studies on the association between clinicopathological characteristics, especially podocyte dysfunction, and renal prognosis in IgAN with nephrotic range proteinuria are limited. So we conducted a single-center, cohort study to explore clinicopathological features and renal outcomes in IgAN patients with nephrotic range proteinuria.

Materials and methods

Patient's selection

Patients were admitted from the Six Affiliated Hospital of Sun Yat-sen University from January 2013.01 to July 2015 and diagnosed with IgAN by renal biopsy. Glomerular diseases listed below were excluded, lupus nephritis, chronic liver disease related glomerulonephritis, liver cirrhosis related IgAN, Henoch-Schonlein purpura, renal allograft and Alport syndrome. There were 89 eligible patients enrolled in the study. All of them have written informed consent.

Clinical definitions

Nephrotic range proteinuria was defined as proteinuria ≥3.0 g/24 hr by quantification. Macrohematuria was defined as that gross hematuria recurred more than two times and urinalysis sustained abnormal in the interval. Estimated glomerular filtration rate (eGFR)=175 × Scr $(mg/dl)^{-1.234}$ × age $(year)^{-0.179}$ [if female, ×0.79], MDRD equation [9]; Hypertension was defined as resting systolic blood pressure (SBP) ≥140 mmHg, diastolic blood pressure (DBP) ≥90 mmHg, or need for antihypertensive therapy. Body mass index (BMI) was calculated as the weight (in kilograms) divided by height squared (in square meters). Serum creatinine (SCr), uric acid, albumin, cholesterol, etc were measured after an overnight fast at the time of biopsy.

Pathological evaluation

Renal biopsy was performed in every patient and the biopsy specimens were reviewed by one pathologist who was unaware of clinical details of the patients. All the samples were divided into three parts for light, immunofluorescence and electron microscope examinations. The pathological characteristics included Lee's grade, Oxford classification, total number of glomeruli, global/segmental glomerulosclerosis, crescent proportion, capsular adhesions, mesangial proliferation, interstitial inflammatory infiltration, vascular thickening, IgA deposition intensity, IgA deposition locations and presence of podocyte foot process effacement.

Lee's grade was divided into grade I, II, III, IV, V according to Lee's glomerular grading system [4]. Oxford classification was scored as follows: mesangial score ≤0.5 (M0) or >0.5 (M1), endocapillary hypercellularity absent (E0) or present (E1), segmental glomerulosclerosis absent (S0) or present (S1), tubular atrophy/interstitial fibrosis ≤25% (T0), 26-50% (T1) or >50% (T2) [10]. Extent of mesangial proliferation was calculated by mild (4-5 cells), moderate (6-7 cells), severe (≥8 cells). Interstitial infiltration was defined as none, mild (<25%), moderate (25-50%), severe (50%-75%) and widespread (>75%). Presence of extensive podocyte foot process effacement was measured by visual inspection with >90% of glomeruli presenting with podocyte foot process effacement under electron microscope.

Follow-up assessment

Patients diagnosed as CKD stage 5 and dialysis (CKD5D) at baseline were excluded within the follow-up cohort. Adverse renal outcomes evidenced by a 50% rise from baseline SCr levels, or onset of dialysis treatment or kidney transplantation.

Statistical analysis

The statistical analysis was performed on SPSS16.0 software for Windows. For quantitative variables, if symmetric distribution, mean ± standard deviation (SD) for statistical description, and student's t test for statistical inference; and if asymmetric distribution, median (Q25-Q75) for description and Mann-Whitney test for inference. For qualitative variables, frequency for description and Chi-square test or Fisher's exact test for inference of the nominal variables, and Mann-Whitney test for the ordinal ones.

Logistic regression model was used for multivariate analysis to identify the risk factors for

Table 1. Clinical features of patients with or without nephrotic range proteinuria

Variable	Nephrotic range proteinuria group (n=17)	Subnephrotic proteinuria group (n=72)	*P*-value
Age (years)	30.53±12.92	35.93±11.45	0.091
Male/Female (n)	12/5	40/32	0.258
BMI (Kg/m^2)	22.74±3.63	21.81±6.89	0.592
Systolic blood pressure (mmHg)	134.53±18.17	135.93±20.94	0.800
Diastolic blood pressure (mmHg)	82.41±13.25	85.47±15.49	0.454
Hypertension (n [%])	7 (41.2)	35 (48.6)	0.581
Macrohematuria (n [%])	2 (11.8)	6 (8.3)	0.645
Microhematuria (+)	2 (2, 3)	2 (1, 2)	0.065
Proteinuria dipstick (+)	3 (3, 3)	1 (1, 2)	<0.001
Proteinuria quantification (g/24 hr)	4.54 (3.75-6.03)	0.70 (0.39-1.63)	<0.001
Hemoglobin (g/L)	112.12±27.27	123.46±26.45	0.089
Serum calcium (mmol/L)	2.18±0.20	2.30±0.15	0.018
Serum phosphorus (mmol/L)	1.53±0.48	1.22±0.26	0.008
Blood urea nitrogen (mmol/L)	14.23±11.69	7.76±4.95	0.002
Serum creatinine (μmol/L)	187.0 (98.5-523.5)	102.5 (84.5-177.5)	0.014
eGFR (ml/min/1.73 m^2)	34.60 (10.90-71.45)	63.00 (35.67-89.20)	0.059
Serum uric acid (μmol/L)	538.76±122.36	445.73±123.69	0.007
Serum albumin (g/L)	32.66±7.54	39.95±6.80	<0.001
Serum cholesterol (mmol/L)	4.95±3.75	4.35±2.60	0.143
Serum LDL (mmol/L)	3.74±1.19	2.87±0.84	0.001
Serum IgA concentration (g/L)	3.37±1.19	3.43±0.96	0.855

Abbreviations: BMI, Body mass index; eGFR, Estimated glomerular filtration rate; LDL, Low-density lipoprotein.

nephrotic range proteinuria in IgAN. The incidences of adverse renal events were analyzed by Kaplan-Meier method and compared with the log rank test. Cox proportional hazards regression model was used for multivariate analysis to identify the independent predictors of prognosis. *P* values were two-sided and P<0.05 was considered to be statistically significant.

Results

Baseline clinicopathological characteristics

Of the 89 eligible patients enrolled in our study, 17 patients presented with nephrotic range proteinuria (proteinuria ≥3.0 g/24 hr), with the rate of 19.1%. The median proteinuria quantification in the 17 patients was 4.54 g/24 hr (Q25-Q75:3.75-6.03) g/24 hr, while the median one of the rest 72 patients was 0.70 g/24 hr (0.39-1.63) g/24 hr.

As shown in **Table 1**, there were no significant differences in age, gender, body mass index, blood pressure, episode of macrohematuria, extent of microhematuria, hemoglobin and serum IgA concentration between the nephrotic range proteinuria group (NP group) and the subnephrotic proteinuria group (SNP group). The comparison indicated that in NP group, serum albumin was lower (32.66±7.54 g/L vs. 39.95±6.80 g/L in SNP group, P<0.001); serum low-density lipoprotein was higher (3.74±1.19 mmol/L vs. 2.87±0.84 mmol/L in SNP group, P=0.001); serum uric acid was higher (538.76±122.36 mmol/L vs. 445.73±123.69 mmol/L in SNP group, P=0.007); blood urea nitrogen was higher (14.23±11.69 mmol/L vs. 7.76±4.95 mmol/L in SNP group, P=0.002) and serum creatinine was higher (187 μmol/L (98.5-523.5) μmol/L vs. 102.5 μmol/L (84.5-177.5) μmol/L in SNP group, P=0.014). Proportions of patients for CKD stage 1, 2, 3, 4, 5 in NP group were 17.6%, 17.6%, 17.6%, 5.9% and 41.2%, respectively; while the patient proportions in SNP group were 26.4%, 27.8%, 30.6%, 5.6% and 9.7%, respectively, P=0.052.

Histologic results showed that in NP group extent of mesangial proliferation seemed more

Table 2. Pathological characteristics of patients with or without nephrotic range proteinuria

Variable	Nephrotic range proteinuria group (n=17)	Subnephrotic proteinuria group (n=72)	*P*-value
Global glomerulosclerosis (%)	26.67 (3.33, 55.36)	19.52 (6.08, 36.01)	0.517
Segmental glomerulosclerosis (%)	0 (0, 3.39)	0 (0, 5.51)	0.744
Crescent (%)	25.93 (8.06, 41.67)	9.23 (4.28, 18.05)	0.008
Capsular adhesions (n [%])	3 (17.6)	18 (25)	0.745
Mesangial proliferation (n [%])			0.184
Mild	5 (29.4)	18 (25)	
Moderate	9 (52.9)	51 (70.8)	
Severe	2 (11.8)	3 (4.2)	
Interstitial infiltration (n [%])			0.008
None	1 (5.9)	5 (6.9)	
Mild	2 (11.8)	34 (47.2)	
Moderate	5 (29.4)	20 (27.8)	
Severe	9 (52.9)	11 (15.3)	
Widespread	0	2 (2.8)	
Vascular thickening (n [%])	14 (82.4)	64 (88.9)	0.433
IgA deposition intensity (+)	3 (3, 3)	3 (2, 3)	0.293
IgA depositing in GBM (n [%])	1 (5.9)	16 (1.4)	0.347
Extensive podocyte effacement (n [%])	7 (41.2)	10 (13.9)	0.026
Lee's grade (n [%])			0.018
Grade II	2 (11.8)	4 (5.6)	
Grade III	2 (11.8)	35 (48.6)	
Grade IV	6 (35.3)	19 (26.4)	
Grade V	7 (41.2)	14 (19.4)	
Oxford M1 (n [%])	16 (94.1)	72 (100)	0.191
Oxford E1 (n [%])	6 (35.3)	20 (27.8)	0.540
Oxford S1 (n [%])	7 (41.2)	23 (31.9)	0.469
Oxford T (n [%])			0.003
T1	3 (17.6)	17 (23.6)	
T2	9 (52.9)	11 (15.3)	

Abbreviations: GBM, Glomerular basement membrane; Extensive podocyte effacement, Extensive podocyte foot process effacement present; Oxford M1, Mesangial score >0.5; Oxford E1, Endocapillary hypercellularity present; Oxford S1, Segmental glomeruloscleosis present; Oxford T, Tubular atrophy/interstitial fibrosis; T1, Tubular atrophy/interstitial fibrosis 26-50%; T2, Tubular atrophy/interstitial fibrosis >50%.

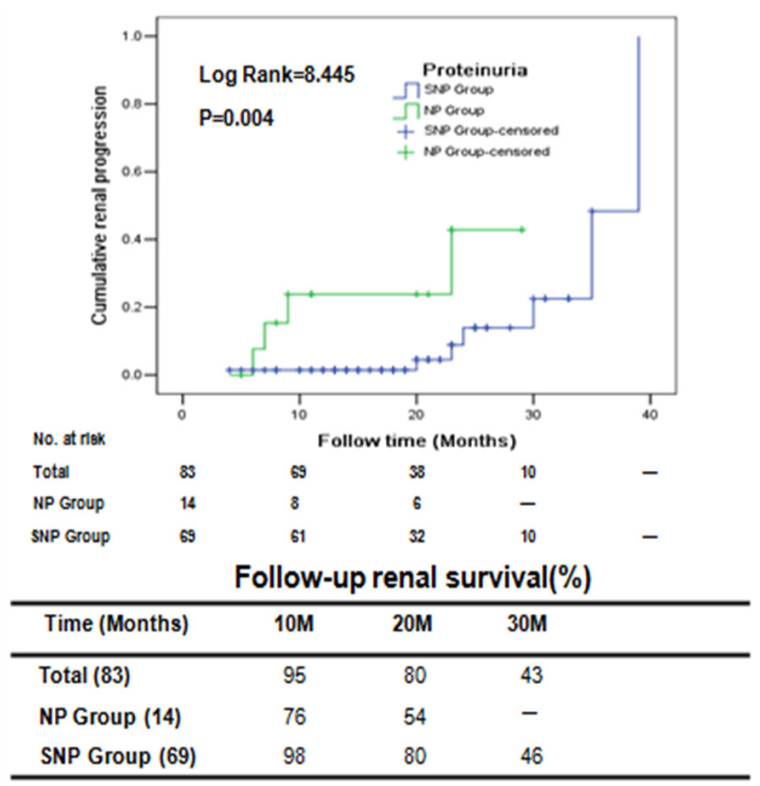
obvious (severe mesangial proliferation 11.8% vs. 4.2% in SNP group, P=0.184), extent of crescent was more serious (crescent proportion 25.93% (8.06-41.67)% vs. 9.23% (4.28-18.05)% in SNP group, P=0.008); severe interstitial infiltration was more common (52.9% vs. 18.1% in SNP group, P=0.008); tubular atrophy/interstitial fibrosis was more serious (Oxford classification T2 52.9% vs. 15.3% in SNP group, P=0.003) and patients in NP group had higher pathological score, with 76.5% of cases achieving Lee's grade IV and V, while 45.8% in SNP group, P=0.018. Extensive podocyte foot process effacement present was more notable in NP group than that of SNP group (41.2% vs. 13.9%, P=0.026). Including extent of global/segmental glomerulosclerosis, capsular adhesions, endocapillary hypercellularity, vascular thickening, IgA deposition intensity and locations, there were no obvious differences between the two groups (**Table 2**).

As listed in **Table 3**, adjusting Logistic regression analysis indicated that among all the clinicopathological variables, extensive podocyte foot process effacement present (odds ratio [OR]=8.781, 95% confidence interval [CI], 1.875-41.132, P=0.006) was the only indepen-

Table 3. Risk factors for nephrotic range proteinuria in patients with IgA Nephropathy

Variable	Univariate analysis		Multivariate analysis[1]		Multivariate analysis[2]	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Serum UA (per 1 μmol/L)	1.006 (1.001-1.010)	0.011	1.004 (0.997-1.010)	0.254	1.005 (0.998-1.012)	0.148
BUN (per 1 mmol/L)	1.124 (1.031-1.224)	0.008	1.016 (0.903-1.143)	0.793	1.005 (0.880-1.147)	0.947
Extensive podocyte effacement[a]	4.340 (1.341-14.044)	0.014	8.224 (1.793-37.716)	0.007	8.781 (1.875-41.132)	0.006
Crescent proportion (per 1%)	1.053 (1.017-1.089)	0.003	1.040 (1.000-1.082)	0.050	1.028 (0.986-1.072)	0.191
Oxfold T2[b]	7.200 (2.010-25.830)	0.002	1.498 (0.193-11.610)	0.699	2.518 (0.259-24.519)	0.426

Abbreviations: UA, Uric acid; BUN, Blood urea nitrogen; Extensive podocyte effacement, Extensive podocyte foot process effacement present; T2, Tubular atrophy/interstitial fibrosis >50%; T0, Tubular atrophy/interstitial fibrosis ≤25%. Note: [1]All variables confirmed *P* value <0.05 in univariate analysis were included in the multivariate analysis model. [2]All variables confirmed *P* value <0.05 in univariate analysis, age at presentation and gender were included in the multivariate analysis model. [a]Yes reference to No. [b]T2 reference to T0.



Follow-up renal survival(%)

Time (Months)	10M	20M	30M
Total (83)	95	80	43
NP Group (14)	76	54	—
SNP Group (69)	98	80	46

Figure 1. Cumulative renal progression for patients with or without nephrotic range proteinuria seen in follow-up; SNP Group, subnephrotic proteinuria group, NP Group, nephrotic range proteinuria group.

dent risk factor of nephrotic range proteinuria in patients with IgAN.

Follow-up outcomes

There were 83 patients enrolled in our follow-up cohort with the median follow-up time 18 months (range 4-39) months. During follow-up period, 11 patients (13.3%) had developed adverse renal events, among whom 5 patients (6.0%) reached a 50% rise from baseline SCr levels and 6 patients (7.2%) met onset of dialysis treatment.

For NP group, 14 patients were followed up and 4 patients (28.6%) developed progressive renal dysfunction after median follow-up time 11 months (7.8-23.0) months, while in the SNP group, seven (10.1%) of 69 patients had met adverse renal events, P=0.155. In **Figure 1**, Kaplan-Meier curve showed that renal survival for all the enrolled patients was 95%, 80% and 43% after 10, 20 and 30 months; there was significant difference between the patients with or without nephrotic range proteinuria, with 98%, 80% and 46% after 10, 20 and 30 months in SNP group while only 76% and 54% after 10 and 20 months in NP group, P=0.004. Adjusting age, gender, proteinuria and SCr at biopsy, Cox proportional hazards regression model indicated that SCr at baseline (per 1 μmol/L, relative ratio [RR]=1.006; 95% CI, 1.002-1.009; P=0.001) and presence of extensive podocyte foot process effacement (RR=7.478, 95% CI, 1.467-38.117, P=0.015) were independent predictors for renal progression in IgAN patients (**Table 4**).

Discussion

Our retrospective study included 89 patients, 17 patients presented with nephrotic range proteinuria, with the rate of 19.1%. Compared to the subnephrotic proteinuria group, patients with nephrotic range proteinuria presented with higher level of serum creatinine, more

Table 4. Risk factors for renal progression in patients with IgA Nephropathy

Variable	Univariate analysis		Multivariate analysis[1]		Multivariate analysis[2]	
	RR (95% CI)	*P* value	RR (95% CI)	*P* value	RR (95% CI)	*P* value
SCr baseline (per 1 μmol/L)	1.005 (1.003-1.008)	<0.001	1.006 (1.002-1.009)	0.001	1.006 (1.002-1.009)	0.001
NP baseline[a]	6.205 (1.514-25.434)	0.011	2.904 (0.512-16.479)	0.229	2.914 (0.498-17.043)	0.235
Extensive podocyte effacement[a]	8.206 (2.136-31.527)	0.002	6.508 (1.360-31.138)	0.019	7.478 (1.467-38.117)	0.015
Crescent proportion (per 1%)	1.044 (1.013-1.077)	0.006	1.012 (0.971-1.055)	0.567	1.015 (0.969-1.063)	0.526
Oxflod S1[b]	6.411 (1.328-30.955)	0.021	4.673 (0.762-28.643)	0.096	5.892 (0.788-44.074)	0.084

Abbreviations: SCr, Serum creatinine; NP, Nephrotic range proteinuria; Extensive podocyte effacement, Extensive podocyte foot process effacement present; S1, Segmental glomerulosclerosis present; S0, Segmental glomerulosclerosis absent. Note: [1]All variables confirmed *P* value <0.05 in univariate analysis were included in the multivariate analysis model. [2]All variables confirmed *P* value <0.05 in univariate analysis, age at presentation and gender were included in the multivariate analysis model. [a]Yes reference to No. [b]S1 reference to S0.

severe crescent formation, tubular/interstitial injury and significantly extensive podocyte foot process effacement. Adjusting Logistic regression analysis indicated that extensive podocyte foot process effacement was the only independent risk factor of nephrotic range proteinuria. Furthermore, 83 patients enrolled in our follow-up cohort, 13.3% of the patients have developed a 50% rise from baseline SCr levels or onset of dialysis after median 18 months, with 28.6% after median 11 months follow-up in patients with nephrotic range proteinuria. Multivariate Cox regression analysis showed that SCr at baseline and presence of extensive podocyte foot process effacement were independent predictors of poor renal prognosis in IgAN patients.

According to the previous investigations, cases with nephrotic range proteinuria in IgAN seem more frequent in our center with about 19% compared to 6% [5]. For renal prognosis, Ruan Y et al. have reported that 7.8% of patients with 1.0-3.5 g/24 hr proteinuria in IgAN occurred doubling of SCr or ESRD and Qin J et al. have found that 5-year renal survival rate of nephrotic IgAN patients was 84.7% [11, 12]. Interestingly, more researches have been focused on nephrotic IgAN like MCD changes, which calls for immunosuppressive treatment, especially glucocorticoid, and have met more optimistic prognosis with 0-1.6% cases reaching renal progression after long-term follow-up [12-14]. In our study, 28.6% of patients with nephrotic range proteinuria developed adverse renal outcome after median 11 months and the 20-month renal survival rate was 54%, due to patients presented with worse renal function at biopsy in our center. So we need to adjust renal function at baseline for further analysis.

A prominent finding in our research is that presence of extensive podocyte foot process effacement is not only the independent risk factor of nephrotic range proteinuria, but also an independent predictor of poor renal prognosis in patients with IgAN.

Podocyte is a key type of cell in GBM that is believed to prevent proteinuria in healthy persons. The study by Faul et al. [8] addressed that cyclosporine has direct effects on the actin cytoskeleton (and therefore the shape) of podocytes to prevent proteinuria, which strongly suggested that proteinuria is a podocytopathy. Mutations of protein involved in podocyte actin cytoskeleton, including synaptopodin and calcineurin, will lead to the rearrangement of the actin cytoskeleton and subsequent proteinuria. Recently, Lai KN and his co-workers have confirmed that glomerulo-podocytic communication plays an important role in the podocytic injury in IgAN. They designed a series of elegant in vitro experiments to treat mesangial cells with pIgA1 isolated from IgAN sera then this mesangial cell-conditioned medium was used to treat podocytes, and they found that TGF-β and Ang-II in the medium could lead to podocyte dedifferentiation with cytoskeletal disorganization and loss of adhesiveness [15-17]. These data show that podocyte apoptosis occurs in IgAN, likely through mesangio-podocyte communication. Further researches had reported that podocytes also mediated the glomerulotubular cross-talk. In vitro study, humoral factors released from mesangial cells, as mentioned above, might result in the events of proteinuria and tubule/interstitial injury in IgAN [18]. Podocyte injury, like loss of the podocyte cytoskeleton would mainly manifest as extensive effacement of foot processes on electron microscopy. Our results also confirmed that in the nephrotic range proteinuria group, extent of mesangial proliferation, tubular/interstitial injury and presence of extensive podocyte foot pro-

cess effacement was more common. Based on adjusting all the related variables, presence of extensive podocyte foot process effacement independently influenced development of heavy proteinuria and renal survival in IgA nephropathy.

We also have drawn attention to Oxford classification of IgAN. As same as the validation reports, segmental glomerulosclerosis and tubular/interstitial injury (tubular atrophy, interstitial fibrosis or infiltration) present might be more obvious in patients with massive proteinuria especially cases of renal dysfunction. On the other hand, we demonstrated that patients with nephrotic range proteinuria presented with more serious of crescent proportion. In our records, there are 91.8% of patients with crescent formation presenting with crescent proportion <50% (especially 86.6% of the patients with crescent proportion <25%). Crescent formation in IgAN has become more attractive. About 20-60% of IgAN patients present with crescents, but whether crescents can independently indicate the poor prognosis in IgAN is also controversial [19, 20]. Actually, immunosuppressant, mainly glucocorticoid has been widely used in IgAN patients with proteinuria more than 1.0 g/24 hr, in most cases that may complicate with crescent formation [21]. Glucocorticoid therapy is thought to have effect on remission of proteinuria and protection of renal survival. Some researchers even found out glucocorticoid receptors on podocyte, suggesting glucocorticoid can directly act on podocyte, independent of immune T cells [22]. We have concerned that for the 14 patients in NP group during follow-up period, steroids application was more common in the group of non-renal progression (90%), compared to 25% in the group of renal progression, P=0.041. In the univariate analysis for prognosis, glucocorticoid seemed to be a protective factor for renal function deterioration (RR=0.272, 95% CI, 0.056-1.312, P=0.105).

In our study, we have found that extensive podocyte foot process effacement plays an important role in onset of massive proteinuria and renal progression, however, the podocyte evaluation was only visual and qualitative without any quantitative or morphometric analysis. Meanwhile, as this current study has limited follow-up information, we should call for long-term follow-up and develop further prospective study to get more evidence of this condition.

Our preliminary research has got a conclusion that, 19.1% patients of IgAN present with nephrotic range proteinuria. Presence of extensive podocyte foot process effacement is the only independent risk factor of nephrotic range proteinuria in patients with IgAN. In our follow-up cohort, 13.3% of the patients have developed adverse renal outcome after median 18 months, while the ratio is 28.6% after median 11 months follow-up in patients with nephrotic range proteinuria. Serum creatinine at baseline and presence of extensive podocyte foot process effacement are independent predictors of poor renal prognosis in IgAN patients. We will conduct more researches to explore the mechanism of podocyte injury in IgAN, which may provide more information about the targeted therapy for IgA nephropathy.

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Disclosure of conflict of Interest

None.

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