Journal of Renal and Hepatic Disorders

CODON PUBLICATIONS

ORIGINAL ARTICLES: NEPHROLOGY

Clinicopathological Spectrum and Outcome of Crescentic Glomerulonephritis: A Retrospective Study from North-East India

Manzoor Ahmad Parry[1], Mastakim Ahmad Mazumder[2], Manjuri Sharma[3], Hamad Jeelani[4], Shahzad Alam[5]

[1]DM Nephrology, Department of Nephrology, Sher i Kashmir Institute of Medical Sciences, Soura Srinagar J&K, India; [2]DM Nephrology, Nephrology, Fortis Hospital, Okhla, New Delhi, India; [3]DM Nephrology, Department of Nephrology, Gauhati Medical College and Hospital, Assam, India; [4]DM Nephrology, Nephrology, Narayana Hospital, Guwahati, Assam, India; [5]DM Nephrology, Nephrology, Apollomedics Superspeciality Hospital, Lucknow, UP, India

Abstract

Crescentic glomerulonephritis (CrGN) is characterized by the presence of crescents in more than 50% of glomeruli. This study aims to identify the etiology and clinicopathological features and outcomes of CrGN. In this observational study, 80 biopsy-proven CrGN were included. Patients' demographic profile, clinical parameters, treatments, and outcomes were collected and analyzed. The mean age in our study population was 40.86 ± 16.5 years. Type II CrGN was the most common type of CrGN. Female predominance was observed in type I and type II CrGN. The highest percentage of glomeruli with crescents was seen in type I (87 ± 15.2%, P = 0.04), followed by type III and type II. At the last follow-up, mean estimated glomerular filtration rate was 25.8 ± 11.41 mL/min/1.73 m^2 and was significantly lower in type I CrGN (11.6 ± 4.8 mL/min/1.73 m^2 P = 0.001). The overall 5-year renal survival rate was 55% and was highest in type II (69.4%), followed by type III and type I (27.3%) CrGN (P = 0.0299). In our study, oliguria at the time of presentation, percentage of crescents, glomerular sclerosis, and moderate/severe IFTA were associated with poor renal outcomes. In conclusion, CrGN was seen in 5.7% of kidney biopsies in our study. Type II CrGN was the most common type of CrGN followed by type III CrGN. Renal survival was poor in type I CrGN patients compared to type II and type III CrGN. Also, oliguria, crescents, glomerular sclerosis, and moderate/severe IFTA were associated with poor renal outcomes.

Keywords: crescentic glomerulonephritis; pauci-immune glomerulonephritis; antineutrophil cytoplasmic antibodies–associated vasculitis; lupus nephritis; Ig A nephropathy

Received: 23 August 2021; *Accepted after Revision*: 7 December 2021; *Published*: 25 January 2022

Author for correspondence: Mastakim Ahmad Mazumder, Department of Nephrology, Fortis Hospital, Okhla, New Delhi, India.
Email: mustakimmazumder@gmail.com

How to cite: Parry MA, et al. Clinicopathological Spectrum and Outcome of Crescentic Glomerulonephritis: A Retrospective Study from North-East India. J Ren Hepat Disord. 2022 6(1):24–31.

Doi: https://doi.org/10.15586/jrenhep.v6i1.125

Introduction

Crescentic glomerulonephritis (CrGN) is a histopathological entity characterized by the presence of crescents, usually in more than 50% of the glomeruli sampled (1). CrGN manifests clinically as a rapid decline in kidney function and is classified as rapidly proliferative glomerulonephritis (2). Disruption of glomerular basement membrane (GBM) due to the antibody or immune-complex-mediated injury leads

to the accumulation of circulating leukocytes, inflammatory mediators, and coagulation factors in the Bowman's space. Fibrin exudation and proliferation of parietal epithelial cells, macrophages, and interstitial fibroblasts result in the obliteration of Bowman's space and crescent formation (3). The extent of crescent formation correlates with the severity of glomerular damage (4). Crescents with predominant cellular components represent acute glomerular injury which can resolve with treatment, whereas fibrous crescents, interstitial fibrosis, or tubular atrophy may not have favorable renal outcomes (5).

The etiology and outcomes of the CrGN are heterogeneous (2, 6). CrGN is classified based on the immunofluorescence (IIF) pattern into anti-GBM disease, immune-complex-mediated glomerulonephritis, and pauci-immune glomerulonephritis (2). Pauci-immune glomerulonephritis represents the majority of cases in the adult population, especially amongst whites, males, and people aged more than 65 years (2, 7), whereas CrGN in children is more commonly immune-complex-mediated (8). The clinical course of CrGN depends both on the percentage of glomeruli with crescents and the underlying disease (9, 10). The renal outcome is also determined by the severity of renal insufficiency at the time of presentation (11, 12). Although there is limited data from India (8, 13, 14), there is no published data on CrGN from North-East India. This study aims to identify the etiology and evaluate the clinical characteristics, histopathological features, and outcomes of CrGN.

Material and Methods

Study design and study population

This was a retrospective, observational study conducted at the Department of Nephrology, Gauhati Medical College and Hospital, Assam, India. We included all adult patients (>18 years of age) who underwent native kidney biopsy in our centre and had CrGN in the biopsy. A total of 80 biopsy-proven CrGN diagnosed from January 2013 to January 2018 were included in this study. Patients with less than seven nonsclerotic glomeruli and no consent were excluded. This study was approved by the institutional ethical committee of Gauhati Medical College and Hospital, and informed consent was obtained from all patients.

Data collection

Patients' data regarding demographic profile, clinical features, laboratory parameters, treatments, and morbidity/mortality were collected from the hospital records. Clinical presentations varied from acute kidney injury (AKI), CKD, and asymptomatic urinary abnormalities (AUA). Patients' outcome data with regard to serum creatinine, development of end-stage renal disease, and complications were collected at each follow-up visit until August 2019.

Definitions

Hematuria was defined as the presence of ≥5 red blood cells per high power field in urine microscopy. Proteinuria was measured in 24 h timed collection as 24 h urine protein. Serum creatinine was measured by the enzymatic method and estimated glomerular filtration rate was calculated using CKD Epidemiology Collaboration (CKD-EPI) equation (15). AKI was defined as an increase in creatinine level by 0.3 mg/dL (26.5 mmol/L) within 48 h, or a percentage increase in serum creatinine ≥50% (1.5-fold from baseline) within 7 days, or urine volume # 0.5 mL/kg/h for 6 h. CKD was defined as eGFR, 60 mL/min/1.73 m^2, or markers of kidney damage for more than 3 months (including nephrotic syndrome, AUA, or nephritic syndrome).

Anti-nuclear antibodies (ANA) were measured by indirect IIF assay (catalog number FA 1512-1010-1, Medizinische labordiagnostika, Argentina). Anti-double-stranded DNA antibodies (anti-dsDNA) were measured by enzyme-linked immunosorbent assay (ELISA) (catalog number DNAG37306B BIOGENIX INC. India). Antineutrophil cytoplasmic antibodies (ANCA) were assessed by gauging the anti-myeloperioxidase (anti-MPO) and anti-proteinase 3 (anti-PR3). Anti-MPO (catalog number 704655 Inova Diagnostics, Inc. California, USA) and anti-PR3 (catalog number 704660 Inova Diagnostics, Inc. California, USA) were quantified by the immunoglobulin G (IgG) ELISA kit. Complement factors (C3 and C4) were quantified by nephelometry using antisera (catalog numbers N D08-12 Biocientifica S.A. Argentina and N D09-12 Biocientifica S.A. Argentina respectively).

All kidney biopsy tissue specimens were studied for light microscopy (Magnus opto systems India Pvt Ltd model number CH-20i) and IF microscopy (Zeiss axio zoom v16 model number 3312000226). CrGN was defined by light microscopy as the presence of crescents in more than half of the total glomeruli. IF microscopy was used to categorize the CrGN into types I, II, and III. Type I was characterized by linear deposition of antibodies along GBM and included anti-GBM disease. Type II had granular deposition of immunoglobulins and complement in the glomerulus, and included primary and secondary glomerular diseases. Type III CrGN was defined by the absence of immune deposits in kidney pathology. Interstitial fibrosis and tubular atrophy (IFTA) were graded semiquantitatively into categories none (0), mild (1), moderate (2), and severe (3). Interstitial inflammation was semiquantitatively graded into categories based on the degree of inflammation in tubulointerstitium: 0 (0%), 1 (<20%), 2 (20 to 50%), and 3 (>50%).

Patients were treated as per standard protocols by treating physicians (Table 1). Dialysis was given as indicated.

Table 1: Etiology of crescentic glomerulonephritis in our study population.

Etiology	N (%)
Type I CrGN[a]	11 (13.75)
Type II CrGN	36 (45)
IgAN[b]	11 (13.75)
Lupus	14 (17.5)
Infection-related GN[c]	04 (05)
Membranoproliferative GN	04 (05)
C1q nephropathy	01 (1.25)
Unclassified	02 (2.5)
Type III CrGN	33 (41.25)

a: crescentic glomerulonephritis; b: IgA nephropathy; c: glomerulonephritis
CrGN: crescentic glomerulonephritis; GN: glomerulonephritis.

Plasmapheresis was given for patients having severe renal failure (requiring dialysis or serum creatinine >5.7 mg/dL). Patients were followed up with monthly serum creatinine, urine protein, urine microscopy, and blood counts. Patients' outcomes were collected at the end of follow-up for renal survival, mortality, and eGFR. Multivariate analysis was done to evaluate the risk factors for renal survival.

Statistical analysis

All data were analyzed using the Statistical software, Statistical Package for the Social Sciences (SPSS v 19.0 IBM Corporation, USA). Continuous data were expressed as mean ± standard deviation or median with interquartile range, and categorical data were expressed as frequencies and percentages. Categorical data were compared by using chi-square test or Fisher's exact test and continuous data were compared by student's independent *t*-test or one-way analysis of variance (ANOVA) test. A five percent level of significance was used to carry the statistical analysis, with a P value of <0.05 being statistically significant.

Results

Demography, clinical and laboratory features

A total of 1498 kidney biopsies were done in our centre from January 2013 to December 2018, out of which 85 biopsies were having CrGN (5.7%). Three patients were excluded from the study due to inadequate biopsy and two patients had no follow-up data; 80 patients were included in this study. Follow-up duration varied from 3 to 32 months, and more than 1 year of follow-up data were available in 47 patients (58.8%). The etiology of CrGN in our study population is described in Table 1. Type II CrGN was the most common type, followed by type III and type I CrGN. In type II CrGN, lupus nephritis and IgAN were the most common causes of CrGN. The mean age of patients was 40.86 ± 16.5 years. Patients in type III CrGN were older than patients in type I and type II CrGN. Of 80 patients with CrGN, 43 (53.7%) were female and 37 (46.3%) were male. Female predominance was observed in type I and type II CrGN, whereas there was male predominance in type III. Table 2 describes the clinical and laboratory features of our study population. Duration of symptoms was more in type II CrGN than in type I and type III CrGN (P = 0.011). Oliguria was seen in 53.7% of the study population. Skin rash was significantly (P = 0.015) seen more in type II CrGN (38.9%), compared to type I (9.1%) and type III (12.12%). Hemoptysis was seen significantly (0.0432) more in type I (27.3%) and type III (18.2%), compared to type II (2.7%).

Type II CrGN had the highest mean proteinuria (3.9 ± 2.1, P < 0.0001) and lowest mean serum albumin (2.7± 0.7, P = 0.006). The mean estimated glomerular filtration rate (eGFR) was lowest in type I CrGN (6.7 ± 4.9 mL/min/1.73 m^2), compared to type II CrGN (16.1 ± 8.6 mL/min/1.73 m^2) and type III CrGN (12.4 ± 8.2 mL/min/1.73 m^2), with a P value of 0.003. Serum complements were low in around half of the patients (low C3 in 38.7% and low C4 in 12.5%). Complement C3 (P = 0.0001) and C4 (P = 0.01) were significantly lower in type II CrGN, compared to type I and type III CrGN. ANA was positive in 25 cases (31.3%) out of which the majority (72%) belonged to type II CrGN. Anti-dsDNA was positive only in type II CrGN (16 cases, 50%). ANCA positivity was seen in 37 cases (46.3%), the majority of which had type III CrGN. ANCA positivity was seen in 87.9% cases of type III CrGN out of which 54.5% cases had anti-MPO and 39.4% had anti-PR3 autoantibodies. Anti-GBM antibodies were seen in 6% of patients with type III CrGN. In type I CrGN, anti-GBM antibodies were present in 90.1% and ANCAs were present in 18.2% of patients.

Histopathological features

Characteristic histopathological features noted in kidney biopsies have been summarized in Table 3. Crescents were seen in 75.1 ± 18.3 of glomeruli with the highest percentage seen in type I CrGN (87 ± 15.2, P = 0.04), followed by type III CrGN (76.4 ± 21.4%) and type II CrGN(70.2 ± 18.1%). Fibrocellular crescents were the most common type of crescent seen in all three groups of CrGN. Mesangial proliferation (69.4%, P = 0.0005) and endocapillary proliferation

Table 2: Baseline demographic and clinical manifestations of patients with crescentic glomerulonephritis.

Characteristic	Total (N = 80)	Type I (N = 11)	Type II (N = 36)	Type III (N = 33)	P
Age, mean ± SD	40.86 ± 16.5	38.4 ± 16.4	35.8 ± 14.8	47.2 ± 14.3	0.07
Gender (male:female ratio)	37:43	4:7	12:24	19:14	0.1113
Oliguria, n (%)	43 (53.7)	07 (63.6)	19 (52.8)	17 (51.5)	0.5125
Gross Hematuria, n (%)	04 (5.4)	2 (18.8)	1 (2.8)	1 (30.3)	0.09692
Rash, n (%)	15 (18.75)	1 (9.1)	14 (38.9)	4 (12.12)	0.015564
Arthralgia, n (%)	16 (20)	2 (18.8)	8 (22.2)	6 (18.2)	0.3364
Hypertension, n (%)	50 (62.5)	7 (63.6)	22 (61.1)	21 (63.6)	0.3762
Cough, n (%)	24 (30)	4 (36.4)	9 (25)	11 (33)	0.1949
Hemoptysis, n (%)	11 (13.7)	3 (27.3)	1 (2.7)	6 (18.2)	0.0432
Need of dialysis, n (%)	33 (41.25)	8 (72.7)	12 (33.3)	13 (39.4)	0.035[a]0.625[b]
Duration of symptoms, days; mean ± SD	28.8 ± 16.8	22.8 ± 16.2	34.6 ± 14.8	24.4 ± 15.4	0.011
Hemoglobin, g/d mean±SD	8.8 ± 2.1	7.8 ± 1.9	9.2 ± 2	8.8 ± 2.1	0.140
Total leucocyte (cells*109/L, mean±SD	9.17 ± 3.7	9.2 ± 3.8	9.6 ± 3.6	8.7 ± 3.2	0.562
Serum albumin (g/dL, mean±SD)	2.9 ± 0.7	3.1 ± 0.6	2.7 ± 0.7	3.2 ± 0.6	0.006
24-h proteinuria (g/day, mean ± SD)	3.02 ± 1.6	2.6 ± 1.2	3.9 ± 2.1	2.2 ± 1.4	<0.0001
Serum creatinine (mg/dL, mean ± SD)	5.87 ± 3.9	8.1± 4.6	4.9 ± 3.4	6.2 ± 3.9	0.046
CKD-EPI eGFR (mL/min/1.73 m2, mean ± SD)	13.3 ± 8.3	6.7 ± 4.9	16.1 ± 8.6	12.4 ± 8.2	0.003
Serum complements					
Low C3	31/80	1/11	23/36	07/33	0.0001
Low C4	10/80	0	09/36	01/33	0.0132[b]
Serology (n/N (%))					
ANA Yes	25/80	2/11	18/36	5/33	0.00464
Anti- dsDNA Yes	16/80	0/11	16/36	0/33	<0.00001
ANCA Yes	37/80	2/11	6/36	29/33	<0.0001
Anti-MPO-ANCA Yes	23/80	1/11	4/36	18/33	0.0001
Anti-PR3-ANCA Yes	17/80	1/11	3/36	13/33	0.004
Anti-GBM	12/80	10/11	0/36	2/33	<0.0001[c]

a: class 1 and class 11, b: class II and class III, c: class I and class III
eGFR: estimated glomerular filtration rate.

(97.2%, P ≤ 0.0001) were mostly seen in type II CrGN. The highest percentage of glomeruli with neutrophilic infiltrates was seen in type I (81.2%, P = 0.00861), followed by type II (52.7%) and type III (30.3%) CrGN. Tuft necrosis was significantly seen more in type I CrGN and type III CrGN (45.5% and 24.2%, respectively, P = 0.01937), compared to type II CrGN (8.3%). Chronic lesions in the form of moderate/severe IFTA were seen more in type I CrGN (63.6%), although not statistically significant.

Treatment and outcomes

Treatments of the patients were done as per the standard guidelines (16). Table 4 describes the treatment received by

Table 3: Histopathology characteristics of the study population.

Characteristic	Total (N = 80)	Type I (N = 11)	Type II (N = 36)	Type III (N = 33)	P
Number of glomeruli; median (IQR)	10 (7–13)	11 (6–16)	10 (7–13)	10 (6–14)	
Number of sclerosed glomeruli; median (IQR)	2 (0–4)	1 (0–2)	1.5 (0–3)	1 (0–4)	
Crescents (%), mean±SD	75.1 ± 18.3	87 ± 15.2	70.2 ± 18.1	76.4 ± 21.4	0.04
predominant type (n (%))					
Cellular	27 (33.7)	3 (27.3)	11 (30.5)	13 (39.4)	0.6567
Fibrocellular	44 (55)	6 (54.5)	21 (58.3)	17 (51.5)	0.3245
Fibrous	9 (11.3)	2 (18.2)	04 (11.1)	03 (09.1)	0.6841
Glomerular lesions (n (%))					
Mesangial proliferation	38 (47.5)	04 (36.4)	25 (69.4)	09 (27.3)	0.0005
Intercapillary mesangial sclerosis	7 (8.75)	02 (18.2)	02 (5.6)	03 (9.1)	0.4295
Endocapillary proliferation	35 (43.8)	0	35 (97.2)	0	<0.0001
Neutrophilic infiltration	38 (47.5)	09 (81.2)	19 (52.7)	10 (30.3)	0.00861
Tuft necrosis	16 (20)	05 (45.5)	03 (8.3)	08 (24.2)	0.01937
Glomerular thrombosis	1 (1.3)	0	1 (2.7)	0	<0.0001
IFTA moderate/severe (n (%))	38 (47.5)	07 (63.6)	15 (41.7)	16 (48.5)	0.4377
Vascular (n (%))					
Necrosis	6 (7.5)	01 (09)	1 (2.7)	4 (12.1)	0.3307
Arteriolosclerosis	29 (36.3)	04 (36.4)	11 (30.6)	14 (42.4)	0.5917

IFTA: interstitial fibrosis and tubular atrophy.

Table 4: Treatment characteristics of the study population.

Characteristic	Total (N = 80)	Type I (N = 11)	Type II (N = 36)	Type III (N= 33)	P
IS (n (%))	71 (88.7)	8 (72.7)	33 (91.7)	30 (90.9)	0.1931
Steroids alone	17 (21.2)	1 (9.1)	11 (30.6)	5 (15.2)	0.1678
Steroids plus cyclophosphamide	43 (53.7)	5 (45.5)	13 (36.1)	22 (66.7)	0.0381
Steroids plus other IS	11 (13.7)	2 (18.2)	9 (25)	3 (9.1)	0.2206
PLEX (plasmapheresis) with IS	17 (21.25)	5 (45.5)	2 (5.6)	10 (30.3)	0.0046
PLEX indications (n (%))					
Hemoptysis	1 (1.2)	0 (0)	0	1 (3.0)	–
Renal failure	12 (15)	4 (36.4)	2 (5.6)	6 (18.2)	0.0348
Both	4 (5)	1 (9.1)	0	3 (9.1)	1.0
Hemodialysis (n (%))	46 (57.5)	8 (72.7)	09 (25)	19 (57.6)	0.0034

the patients in this study. Hemodialysis was needed in more than half of the cases at the time of presentation and was significantly more common in type I (72.7%) and type II (57.6%) CrGN (P = 0.0034). Immunosuppression was given in 88.7% of the patients with no difference between the three groups of CrGN. The majority of patients received steroids plus cyclophosphamide, while 21.2% of patients received steroids alone. Fourteen patients (21.25%) received therapeutic plasma exchange, which was significantly (P = 0.0046) more in type I CrGN (45.5%) and type III CrGN (30.3%), compared to type II CrGN (5.6%).

Patients were followed up with a mean follow-up of 23.1 ± 12.4 months. Table 5 describes the outcomes of our study population. Death, renal survival, and eGFR at the end of

Table 5: Outcomes at follow-up for the study population.

Characteristic	Total (N = 80)	Type I (N = 11)	Type II (N = 36)	Type III (N = 33)	P
Follow-up, months	23.1 ± 12.4	10.2 ± 8.8	24.2 ± 12.4	26.2 ± 13.2	0.001
Status at last follow-up					
Scr, mg/dL	3.86 ± 3.2	6.7 ± 5.1	3.5 ± 2.9	3.3 ± 2.8	0.009
eGFR, mL/min/1.73 m^2	25.8 ± 11.41	11.6 ± 4.8	28.4 ± 12.4	27.6 ± 14.8	0.001
5-year renal survival	44 (55)	3 (27.3)	25 (69.4)	16 (48.5)	0.0299
Death	6 (7.5)	1 (9.1)	2 (6.1)	3 (9.1)	0.8366

eGFR: estimated glomerular filtration rate.

follow-up were assessed for the outcome of our study population. At the last follow-up, the mean eGFR was 25.8 ± 11.41 mL/min/1.73 m^2 and was significantly lower in type I CrGN (11.6 ± 4.8 mL/min/1.73 m^2). Renal survival at the end of follow-up was seen in almost half of the patients. Patients with type III CrGN (48.5%) and type II CrGN (69.5%) had significantly better renal survival, compared to type I CrGN (27.3%, P = 0.0299). The overall mortality was 7.5% and there was no significant difference among the three types of CrGN. We analyzed the risk factors of poor renal outcome (Table 6). In our study, oliguria at the time of presentation, a higher percentage of crescents, glomerular sclerosis, and moderate/severe IFTA were associated with poor renal outcomes.

Table 6: Multivariate analysis of predictors of poor renal outcome of CrGN

Variables	Hazard ratio	95% confidence interval	P
Male gender	0.84	0.6–1.4	0.654
Oliguria	2.9	1.6–4.8	<0.0001
Age	1.2	0.8–1.9	0.842
Percentage of crescents	1.3	1.02–1.5	0.002
Glomerular sclerosis	1.8	1.3–2.5	0.01
IFTAa (moderate/severe)	1.7	1.2–2.7	0.025

a: interstitial fibrosis tubular atrophyinterstitial fibrosis tubular atrophy.
IFTA: interstitial fibrosis and tubular atrophy.

Discussion

CrGN is a severe form of glomerulonephritis and is the leading histopathological diagnosis associated with rapidly progressive glomerulonephritis. There is a paucity of data related to CrGN etiology and outcomes from India. We analyzed the clinical, laboratory, treatment, and outcome data of 80 patients with CrGN.

In our study, CrGN was seen in 5.7% of kidney biopsies done from January 2013 to January 2018, which was comparable to the study by Rempelli et al. from South India (17). Although various studies from different parts of the world have reported type III as the most common type of CrGN (2, 18, 19), type II was the most common type of CrGN in our study followed by type III. However few studies from India, China, and Saudi Arabia have reported type II CrGN to be the most common (17, 20–22). The higher incidence of type II CrGN could be explained by the higher incidence of infections and IgA nephropathy in this part of the world. In our study, type I and II CrGN had a female preponderance. Multiple studies have established that type II has a female preponderance, but the gender distribution is variable in type I and type III CrGN (2, 17, 19, 21, 23). In our study, average serum creatinine at the time of presentation was 5.87 ± 3.9 mg/dL; this was more than in studies by Oudah et al. and chen et al. but comparable to Gupta et al. (6, 14, 21) High serum creatinine in our study can be due to late presentation of the patients as was seen in other studies from India. More patients with type I CrGN presented with oliguria, hemoptysis, anemia, and dialysis requirement compared to other types. Other studies have reported that type I CrGN has most severe renal involvement at the time of presentation (21, 23).

Serum ANCA is deemed pathogenic for ANCA-associated vasculitis (AAV). ANCA positivity was seen in 87.9% cases of type III CrGN out of which 54.5% cases had anti-MPO and 39.4% had anti-PR3 autoantibodies. Although most studies have demonstrated similar rates of ANCA positivity (21, 22), other studies from India have shown lower

rates (2, 14). As reported in various reports, 90.9% of cases with type I CrGN had anti-GBM autoantibodies (21, 24). In patients with type I CrGN, ANCA positivity was seen in two (18.0%) cases which was comparable to other studies (21, 23, 25). In critically ill patients, performing a kidney biopsy is not always possible, so ANCA positivity can be taken as a surrogate marker of type III CrGN and possibly treated empirically in such situations of rapidly progressive renal function decline.

On histopathological examination, similar to other studies, the highest percentage of glomeruli with crescents (87%), neutrophilic infiltrates (81.2%), and tuft necrosis (45.5%) was seen in type I CrGN. Also, moderate/severe IFTA was seen more commonly in type I CrGN (21). These histological findings might be an explanation of the severe clinical features seen in type I CrGN patients. Fibrocellular crescents were predominant in each type of CrGN and the proportion of cellular, fibrocellular, and fibrous crescents were similar among the three types. This was consistent with other studies as well (6, 14, 26).

In our study, renal survival was poor in type I CrGN patients, compared to type II and type III CrGN. This was consistent with other studies by Jennette et al., Gupta et al., and Chen S et al. (2, 14, 21) Poor survival in type I CrGN could be due to a higher percentage of crescents in type I CrGN on initial biopsy, compared to type II and type III CrGN. In our study, renal survival was better in type II CrGN, compared to type III CrGN. This was consistent with other studies by Gupta et al. and Chen S et al., while as in studies by Han F et al. and Wu et al., type III CrGN had better outcome, compared to type II CrGN (14, 21, 23, 27). More studies may be needed to evaluate the renal survival in type II CrGN and type III CrGN patients. In our study, no differences in deaths were seen among the three CrGN groups. Multiple predictors have been seen for poor renal outcome in CrGN and include glomerulosclerosis, acute tubular necrosis, fibrinoid necrosis, serum creatinine, age, oliguria, crescents, and interstitial inflammation (2, 5, 7, 16). In our study, oliguria, crescents, glomerular sclerosis, and moderate/severe IFTA were associated with poor renal outcomes. This was consistent with other studies, although age and acute tubular necrosis were not predictive of poor renal outcome (7, 16).

Conclusion

In our study, CrGN was seen in 5.7% of kidney biopsies, which was comparable to other studies from India. Type II CrGN was the most common type of CrGN, followed by type III. In type II CrGN, lupus nephritis followed by IgAN were the most common causes. More patients with type I CrGN presented with oliguria, hemoptysis, anemia, and dialysis requirement, compared to the other types. The highest percentage of glomeruli with crescents, neutrophilic infiltrates, and tuft necrosis was seen in type I CrGN. In our study, renal survival was poor in type I CrGN patients, compared to type II and type III CrGN. In our study, oliguria, crescents, glomerular sclerosis, and moderate/severe IFTA were associated with poor renal outcomes.

Acknowledgments

The authors are grateful to all the supporting staff at the departments of Nephrology and Dermatology, Gauhati medical college and hospital for their help in conducting this study.

Conflicting Interest

All authors declare no conflict of interest.

References

1. Greenhall GH, Salama AD. What is new in the management of rapidly progressive glomerulonephritis? Clin Kidney J. 2015;8(2):143–50. https://doi.org/10.1093/ckj/sfv008
2. Jennette JC. Rapidly progressive crescentic glomerulonephritis. Kidney Int. 2003;63:1164–77. https://doi.org/10.1046/j.1523-1755.2003.00843.x
3. Tipping PG, Kitching AR, Cunningham MA, Holdsworth SR. Immunopathogenesis of crescentic glomerulonephritis. Curr Opin Nephrol Hhypertens. 1999;8(3):281–6. https://doi.org/10.1097/00041552-199905000-00002
4. Couser WG. Rapidly progressive glomerulonephritis: Classification, pathogenetic mechanisms, and therapy. Am J Kidney Dis. 1988;11(6):449–64. https://doi.org/10.1016/S0272-6386(88)80079-9
5. Sasatomi Y, Kiyoshi Y, Takabeyashi S. A clinical and pathological study on the characteristics and factors influencing the prognosis of crescentic glomerulonephritis using a cluster analysis. Pathol Int. 1999;49(9):781–5. https://doi.org/10.1046/j.1440-1827.1999.00943.x
6. Oudah N, Al Duhailib Z, Alsaad K, Qurashi S, Ghamdi G, Flaiw A, et al. Glomerulonephritis with crescents among adult Saudi patients outcome and its predictors. Clin Exp Med. 2012;12(2):121–5. https://doi.org/10.1007/s10238-011-0147-4
7. Falk RJ. ANCA-associated renal disease. Kidney Int. 1990;38(5):998–1010. https://doi.org/10.1038/ki.1990.304
8. Dewan D, Gulati S, Sharma RK, Prasad N, Jain M, Gupta A, et al. Clinical spectrum and outcome of crescentic glomerulonephritis in children in developing countries. Pediatr Nephrol. 2008;23(3):389–94. https://doi.org/10.1007/s00467-007-0647-3
9. Baldwin DS, Neugarten J, Feiner HD, Gluck M, Spinowitz B. The existence of a protracted course in crescentic glomerulonephritis. Kidney Int. 1987;31(3):790–4. https://doi.org/10.1038/ki.1987.67
10. Jennette JC, Thomas DB. Crescentic glomerulonephritis. Nephrol Dial Transplant. 2001;16(suppl_6):80–2. https://doi.org/10.1093/ndt/16.suppl_6.80
11. Levy JB, Turner AN, Rees AJ, Pusey CD. Long-term outcome of anti–glomerular basement membrane antibody

disease treated with plasma exchange and immunosuppression. Ann Int Med. 2001;134(11):1033–42. https://doi.org/10.7326/0003-4819-134-11-200106050-00009
12. Hogan SL, Nachman PH, Wilkman AS, Jennette JC, Falk RJ. Prognostic markers in patients with antineutrophil cytoplasmic autoantibody-associated microscopic polyangiitis and glomerulonephritis. J Am Soc Nephrol. 1996;7(1):23–32. https://doi.org/10.1681/ASN.V7123
13. Choudhury TA, Singh RG, Singh S, Singh TB, Rathore SS. Clinicopathologic spectrum of crescentic glomerulonephritis: A hospital-based study. Saudi J Kidney Dis Transplant. 2014;25(3):689. https://doi.org/10.4103/1319-2442.132241
14. Gupta R, Singh L, Sharma A, Bagga A, Agarwal SK, Dinda AK. Crescentic glomerulonephritis: A clinical and histomorphological analysis of 46 cases. Indian J Pathol Microbiol. 2011;54(3):497. https://doi.org/10.4103/0377-4929.85081
15. Levey AS, Stevens LA, Schmid CH, Zhang Y, Castro III AF, Feldman HI, et al. A new equation to estimate glomerular filtration rate. Ann Intern Med. 2009;150: 604–12. https://doi.org/10.7326/0003-4819-150-9-200905050-00006
16. Kidney Disease: Improving Global Outcomes (KDIGO) Glomerulonephritis Work Group. KDIGO clinical practice guideline for glomerulonephritis. Kidney Int Suppl. 2012;2:139–274.
17. Rampelli SK, Rajesh NG, Srinivas BH, Kumar KH, Swaminathan RP, Priyamvada PS. Clinical spectrum and outcomes of crescentic glomerulonephritis: A single center experience. Indian J Nephrol. 2016;26(4):252. https://doi.org/10.4103/0971-4065.158574
18. Koyama A, Yamagata K, Makino H, Arimura Y, Wada T, Nitta K, et al. A nationwide survey of rapidly progressive glomerulonephritis in Japan: Etiology, prognosis and treatment diversity. Clin Exp Nephrol. 2009;13(6):633–50. https://doi.org/10.1007/s10157-009-0201-7
19. Quiroga B, Vega A, Rivera F, López-Gómez JM, Spanish registry of glomerulonephritis. crescentic glomerulonephritis: Data from the Spanish Glomerulonephritis Registry. Int Med J. 2015;45(5):557–62. https://doi.org/10.1111/imj.12725
20. Alexander S, Yusuf S, Rajan G, John EE, Roy S, Annamalai VC, et al. Crescentic glomerulonephritis: What's different in South Asia? A single center observational cohort study. Wellcome Open Research. 2020;5. https://doi.org/10.12688/wellcomeopenres.16071.1
21. Chen S, Tang Z, Xiang H, Li X, Chen H, Zhang H, et al. Etiology and outcome of crescentic glomerulonephritis from a single center in China: A 10-year review. Am J Kidney Dis. 2016;67(3):376–83. https://doi.org/10.1053/j.ajkd.2015.07.034
22. Al-Hussain T, Asiri S, Amer S, Al Mana H, Akhtar M. Patterns of glomerulonephritis with crescents: Experience at a tertiary medical center in Saudi Arabia. Saudi J Kidney Dis Transplant. 2017;28(3):532. https://doi.org/10.4103/1319-2442.206448
23. Wu T, Peng J, Meng T, Liu Q, Ao X, Lin W, et al. Clinicopathological features and prognostic analysis of 49 cases with crescentic glomerulonephritis. Exp Ther Med. 2019;18(5):3984–90. https://doi.org/10.3892/etm.2019.8023
24. Lin W, Chen M, Cui Z, Zhao MH. The immunopathological spectrum of crescentic glomerulonephritis: A survey of 106 patients in a single Chinese center. Nephron Clin Pract. 2010;116(1):c65–74. https://doi.org/10.3892/etm.2019.8023
25. Levy JB, Hammad T, Coulthart A, Dougan T, Pusey CD. Clinical features and outcome of patients with both ANCA and anti-GBM antibodies. Kidney Int. 2004;66:1535–40. https://doi.org/10.1111/j.1523-1755.2004.00917.x
26. López-Gómez JM, Rivera F. Renal biopsy findings in acute renal failure in the cohort of patients in the Spanish Registry of Glomerulonephritis. Clin J Am Soc Nephrol. 2008;3(3):674–81. https://doi.org/10.2215/CJN.04441007
27. Han F, Chen L, Le J, Choong P, Xu Y, Wang H, et al. The clinicopathologic spectrum of rapidly progressive glomerulonephritis based on glomerular immune deposition and antineutrophil cytoplasmic antibody. Appl ImmunohistochemMol Morphol. 2015;23(10):704–10. https://doi.org/10.1097/PAI.0000000000000134