Brief Report

Clinical Profile and Renal Survival of Anti-Glomerular Basement Membrane Disease Patients: A Retrospective Case Series from Northern India

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Abstract

Introduction: Anti-glomerular basement membrane (anti-GBM) disease is a rare organ-specific autoimmune disease. The overall and renal outcomes of patients have mostly been reported in small-sized cohorts. We aimed to study the clinical profile, overall survival, and renal survival of anti-glomerular basement membrane disease patients at our center. **Methods:** We conducted a retrospective analysis of the data regarding the clinical profile and renal survival of patients diagnosed with anti-GBM disease from October 2019 to March 2022, having a minimum follow-up of 12 months. **Results:** There were 15 patients in the study, with the mean age of presentation being 51.6 ± 13.7 years. The median duration of symptoms onset to the nephrologist opinion was 15 (10–23) days. The extrarenal manifestations were seen in the respiratory, otorhinolaryngological, and neurological systems. The mean serum anti-GBM titers were 154.5 (14.9–263.5) U/mL. Serum anti-GBM titers were present in 13/15 (86.6%) patients, and 12/13 (92.3%) patients had above the reference range. Anti-neutrophil cytoplasm antibody (ANCA) levels were assessed in 12/15 (80%) patients, and 9/12 (75%) had higher levels. Renal biopsy was available in 14 patients with more than 50% crescents. Along with crescents, necrotizing lesions, rupture of the Bowman's capsule, and granulomatous lesions were also seen. Among the initial therapies, the steroid pulse was given to 13 (86.6%) patients, whereas membrane plasmapheresis was given to 8 (53.3%) patients. Inj. cyclophosphamide and inj. rituximab were given to 8 (53.3%) and 4 (26.6%) patients, respectively. No difference was seen in clinical characteristics, renal biopsy features, treatment received, and outcomes with ANCA positivity except for age, where patients who

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were ANCA positive were older compared to patients who were ANCA negative. One-year renal and patient survival was seen in 4 (26.6%) and 6 (40%) patients, respectively. *Conclusion:* Most patients of anti-GBM disease have active sediments, raised creatinine, and non-specific symptomatology. There is poor renal and patient outcome as most patients present with advanced renal failure.

Introduction

Anti-glomerular basement membrane (anti-GBM) disease is a rare condition with an estimated incidence of 1 per million populations per year [1]. According to the updated 2012 Chapel Hill consensus conference nomenclature, it is defined as small-vessel vasculitis affecting glomerular capillaries, pulmonary capillaries, or both, with anti-GBM autoantibody deposition along the GBM [2]. The principal target of the autoimmune response has been identified as the noncollagenous (NC1) domain of the a3 chain of type-IV collagen (a3[IV]NC1; the "Goodpasture autoantigen") [3]. It is responsible for 10–20% of rapidly progressive renal failure with a bimodal age of presentation [4, 5]. Patients commonly experience non-specific prodromal symptoms for a few weeks, leading to rapidly progressive glomerulonephritis and pulmonary hemorrhage [2]. A significant proportion of patients with anti-GBM disease have anti-neutrophil cytoplasm antibodies (ANCAs) at presentation [6, 7]. Standard treatment for anti-GBM disease includes plasmapheresis along with cyclophosphamide and corticosteroids [1]. Immunoadsorption is an alternative form of extracorporeal therapy for the removal of pathogenic autoantibody [8]. Survival is favorable in patients who recover from their initial illness with preserved renal functions [9]. Despite the availability of potent immunosuppressive agents, less than one-third of patients with anti-GBM disease have preserved kidney function after 6 months [10]. The present study was done to evaluate the renal and patient survival of anti-GBM disease patients and the reason behind poor renal survival among these patients.

Methodology

This is a retrospective analysis of patients diagnosed with anti-GBM disease at a single tertiary care hospital. All patients diagnosed between October 2019 and March 2022 with a minimum follow-up of 12 months were included in the analysis. All clinical details, investigations at the time of biopsy including hematology, biochemistry, urine examination, serum complement levels, se-rology for autoantibodies, treatment, and outcomes were recorded on pre-structured proforma. The double-positive patients who met the diagnosis of anti-GBM disease and, in addition, had positive ANCA serology were also taken for the study. Anti-GBM antibody assay was performed by fluorescence enzyme immunoassay method using the Thermo-Fisher kit. Whereas ANCA was detected by indirect immunofluorescence using the ethanol-fixed human neutrophils using Innova NOVA Lite kit subclassified by ANCA specificity to either c-ANCA or p-ANCA. Diffuse alveolar hemorrhage was diagnosed by either high-resolution 64-slice computed tomography scan of the chest or clinical criteria, such as a drop in hemoglobin of ≥1 g/dL over 24 h with a cough, respiratory distress, or hemoptysis.

For histopathological analysis, renal biopsy specimens were examined under light microscope and by direct immunofluorescence and looked for the presence of crescents and their types, necrotizing lesions, granulomatous lesion, and pattern of immunostaining. Chronicity Index is based upon the crescent type, glomerular sclerosis, tubular atrophy, and interstitial fibrosis, and a score of ≥6 is labeled as severe [11].

The protocol for the treatment of anti-GBM disease followed in our institution is given below:
1. Patient with suspected RPRF is started on pulsed steroid therapy at the time of presentation pending the results of investigations.
2. On having the definite diagnosis of anti-GBM disease, cyclophosphamide with plasmapheresis is the preferred treatment of choice unless contraindicated.
3. Maintenance therapy with azathioprine is to be given to double-positive patients.

As this was a retrospective study and all treatment decisions were made prior to our assessment, the decision to give rituximab or cyclophosphamide in our study was based on treating physician's discretion.

Definitions

Anti-GBM disease was defined by either (i) the presence of circulating anti-GBM antibodies in association with clinical manifestations of alveolar hemorrhage and/or rapidly progressive glomerulonephritis or (ii) biopsy-proven crescentric glomerulonephritis with linear deposition of IgG along the GBM in the absence of another attributable cause (such as diabetes mellitus or paraproteinemia) [12]. Renal replacement therapy (RRT) at presentation was defined by the need for acute dialysis during the first hospital admission [13]. ESRD was defined by a sustained requirement for RRT that did not recover during follow-up or before death. Synchronous and asynchronous crescents were defined by the presence of uniformly aged glomerular or a mix of cellular, fibrocellular, or fibrous crescents in the biopsy, respectively [12]. Rapidly Progressive Renal Failure (RPRF) is defined as progressive renal impairment over a period of a few weeks [14].

Statistical Analysis

The statistical analysis was done using SPSS Version 23.0 (IBM Corp., Armonk, NY, USA)/Stata Version 13, TX, USA). Categorical variables were described as numbers and percentages. Continuous variables were described as mean ± SD or median (IQR) for normally distributed and skewed variables, respectively. χ^2 test was used to compare the categorical variables, while t test or Wilcoxon rank sum tests were used to compare continuous variables as appropriate.

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Table 1. Baseline characteristics

Characteristics	n = 15
Age, years, mean ±SD	51.6±13.74
Male, n (%)	3 (20)
Duration of symptoms onset to nephrologist opinion, days, median (IQR)	15 (10–23)
Prebiopsy hemodialysis, n (%)	8 (53)
Diabetes, n (%)	4 (26.6)
Hypertension, n (%)	7 (46.6)
Lung hemorrhage, n (%)	3 (20)
History of COVID/COVID vaccination, n (%)	2 (13.3)
Hemoglobin, g/dL, mean± SD	9.0±2.3
Serum creatinine, mg/dL, mean (IQR)	8.6 (3.2–6.7)
Anti-GBM level, U/mL, mean (IQR) (n = 13)	154.5 (14.9–263.5)
ANCA (double) positivity, n (%)	9/12 (80)
P ANCA/C ANCA (n = 12)	58.5%/8%

COVID, coronavirus disease; IQR, interquartile range; SD, standard deviation.

Univariate analysis was performed to determine the factors affecting 1-year patient and renal survival. p value of <0.05 was taken as statistically significant.

Results

There were 15 patients in the study; 12/15 (80%) were females (Table 1). The mean age of presentation was 51.6 ± 13.7 years, with bimodal age of presentation. Nine (60%) patients were in the 6th decade of their life, and rest in 2nd and 3rd decades. The median duration of symptoms onset to nephrologist opinion was 15 (10–23) days. The extrarenal manifestations were seen in the respiratory system [3 (20%)], otorhinolaryngological system (2 [3.3%]), and neurological system [1 (6%)]. Active urine sediments were seen in 13 (87%) patients. Prebiopsy dialysis was required in 66.7% of the patients. In 2 (13.3%) patients, there was history of COVID illness and COVID vaccination prior to the onset of symptoms.

The mean serum anti-GBM titers were 154.5 (14.9–263.5) U/mL (Table 2). Serum anti-GBM titers were present in 13/15 (86.6%) patients, and 12/13 (92.3%) patients had above-reference range. In rest of the three patients diagnosis was made by raised serum creatinine level and biopsy-proven crescentric glomerulonephritis with linear deposition of IgG along the GBM. ANCA levels were assessed in 12/15 (80%) patients, and 9/12 (75%) had higher levels. 7/12 (58.5%) patients had

p-ANCA positivity; one had c-ANCA, whereas one had both p-ANCA and c-ANCA positivity. Renal biopsy was available in 14 patients with all having more than 50% crescents, as shown in Figure 1. Synchronous and asynchronous crescents were seen in 50% of the patients equally. Along with crescents, necrotizing lesions, rupture of the Bowman's capsule, and granulomatous lesion were also seen in 78.5%, 14.2%, and 6.6% of the patients, respectively. In 2 (14.2%) patients, there was associated mesangial IgA positivity along with linear IgG as shown in Figure 2. Among the initial therapy, steroid pulse was given to 13 (86.6%) patients, whereas membrane plasmapheresis was given to 8 (53.3%) patients. Inj. cyclophosphamide and inj. rituximab was given to 8 (53.3%) and 4 (26.6%) patients, respectively. No difference was seen in clinical characteristics, renal biopsy features, treatment received, and outcomes in relation to ANCA positivity except for age where patients who were ANCA positive were older compared to patients who were ANCA negative (mean [SD] age –55.4 [10.2] years versus 30.7 [6.0] years, p value –0.003]) (Table 3). On follow-up at 3 months, 6 (40%) patients were dialysis dependent while 4 (26.6%) patients were expired. One-year renal and patient survival was seen in 4 (26.6%) and 6 (40%) patients, respectively. Among the 9 expired patients, 5 expired in the initial 3 months, 2 in the next 3 months, and 2 in another next 3 months. Causes of death were pulmonary hemorrhage (3 patients), infection (1 patient), and irregular dialysis (2 patients). In 3 patients, the cause of death could not be ascertained as they expired at home.

On univariate analysis, no difference in 1-year patient survival was seen in relation to age, ANCA positivity, chronicity on biopsy, or treatment modality used. Similar results were observed for 1-year renal survival except that chronicity on biopsy was associated with dialysis dependency at 1 year (0 vs. 100%, p value –0.014) (online suppl. Table 1; for all online suppl. material, see https://doi.org/10.1159/000534498).

Discussion

The present retrospective study was undertaken to evaluate the clinical profile and renal/patient survival in patients with anti-GBM disease. As per Greco A et al. [15], initial symptoms may include fatigue, weakness, or lethargy; nausea and/or vomiting; loss of appetite; unhealthy, pale appearance. In our study, the most common presenting complaints were nonspecific prodromal symptoms in 80% of the patients, while renal-specific symptoms such as anuria were seen in 2 patients and hematuria in one. This may be

Table 2. Biopsy findings, treatment, and outcomes

Characteristics	n = 15
Kidney biopsy, n (%)	14 (93.3)
Synchronous crescents, n (%)	7 (50)
Necrotizing lesion, n (%)	11 (78.5)
Rupture of bowman's capsule, n (%)	2 (14.2)
Granulomatous lesion, n (%)	1 (7.1)
IgA positivity, n (%)	2 (14.2)
Survival	
One-year renal survival, n (%)	4 (26.6)
One-year patient survival, n (%)	6 (40)

ANCA, anti-neutrophilic cytoplasmic antibodies; anti-GBM, anti-glomerular basement membrane; IgA, immunoglobulin A; IQR, interquartile range; SD, standard deviation.
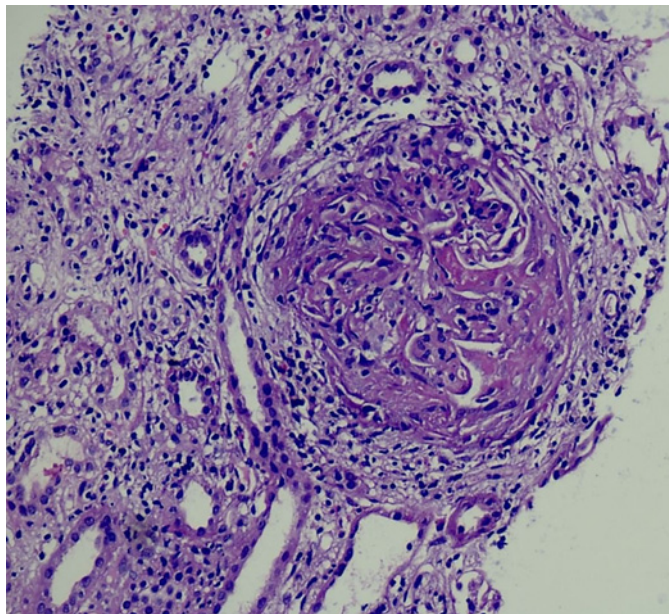
Fig. 1. Renal biopsy in anti-GBM disease: glomerulus from patients showing a fibrocellular crescent with an intact bowman capsule (H&E stain/×40).

the reason for the delayed nephrologist opinion from the onset of symptom. Poor awareness among patients and primary health care providers was considered main reason for late referral in a study by Prabhakar et al. [4], but they did not take into consideration the duration from symptom onset to nephrologist opinion. In a study by McAdoo et al. [12] in three developed countries in 2017, the duration of symptoms to receiving a diagnosis was 2 weeks. The mean age of presentation in our study was 51.6 ± 13.7 years, in studies by Prabhakar et al. and Zahir et al. from India, re-spectively, 39.1 ± 16.5 and 46.7 ± 17 years, while in a study from Europe by McAdoo et al., the mean age of presentation was 58.3 (13–91) years [4, 12, 13]. In the present study, the age of presentation was in between European and Indian studies; maybe we are missing the older population.

In our study, 26% of the patients had diabetes, whereas in study by Zahir et al. [13] the diabetics were 6.2%. There are limited case reports of this association and we should have high suspicion of anti GBM disease in this subgroup of the patients also [16]. This study also describes the real world practice of nephrologists of anti-GBM disease during COVID 19 pandemic. In 2 patients (13.3%), there was association of COVID infection or COVID-19 vaccination (recombinant vaccine containing ChAdOx1-S) in the preceding week as described in many case reports over the last 2 years [17].

In our study, we had 9/12 (75%) patients who were double positive both for anti-GBM and ANCA. Among 9 double-positive patients, 8/9 (88.8%) were p-ANCA positive. In a study by McAdoo et al., patients who are double-positive accounted for 47% of all anti-GBM disease cases, whereas only 23–29% of patients have double positivity in Indian studies [4, 5, 12]. Our study also highlights this common concurrence. We did not observe any difference in clinical characteristics, histo-logical features as well as outcomes (renal survival and 1-year survival) in ANCA-positive or double-positive pa-tients compared to those who were ANCA negative ex-cept for age, where ANCA-positive patients were found to be older compared to ANCA-negative patients. The previous studies have shown mixed picture with small studies reporting poor prognosis [7], while a large study reported better prognosis and outcomes of double-positive patients [12]. In 2 (14.2%) of our renal biopsied patients have concomitant mesangial IgA positivity along with linear IgG; this mesangial IgA positivity along with linear IgG positivity was also seen in 4% patients of the Zahir et al. cohort and multiple other studies also [13, 18, 19].

The use of rituximab in anti-GBM disease has been described in few case reports and case series, wherein it has been mainly used as second-line therapy for re-fractory and relapsed disease [20, 21]. A few studies have used rituximab as induction therapy in anti-GBM disease, where it has been shown to have better outcomes [22]. In our study, we also used rituximab as induction therapy in 4 patients. Dialysis dependency at presentation with poor response to cyclophosphamide in this subgroup and increased risk of infection because of old age were the reasons for rituximab use [22]. However, as compared to cyclophosphamide, there was no statistically significant difference in outcomes.

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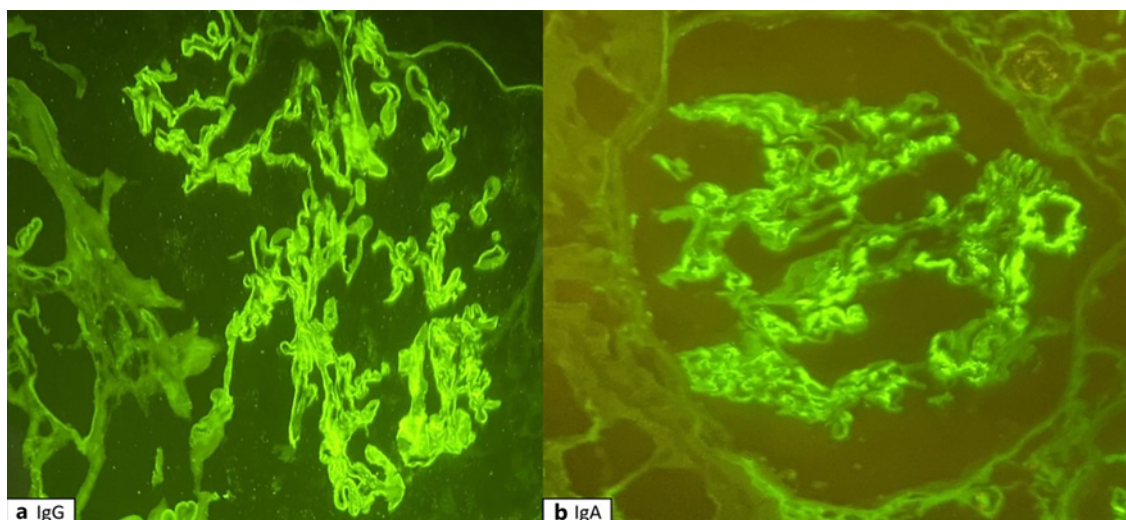
Fig. 2. Kidney biopsy immunofluorescence for IgG revealing linear deposits (3+) along the glomerular basement membrane (paint brush stroke pattern) (**a**) and IgA shows mesangial deposits in 2 out of 14 patients (2–3+) (**b**).

Table 3. Comparison of patients with anti-GBM disease with and without ANCA positivity

Variable	ANCA positive (n = 9)	ANCA negative (n = 3)	p value
Age, years, mean (SD)	55.4 (10.2)	30.7 (6.0)	0.003
Gender (female), n (%)	6 (66.7)	3 (100)	0.248
Duration of symptoms prior to hospitalization, days, median (IQR)	15 (10, 21)	14 (7, 28)	0.708
Dialysis required prior to diagnosis, n (%)	4 (44.4)	3 (100)	0.091
Hemoglobin, g/dL at admission, mean (SD)	9.1 (2.2)	9.6 (3.4)	0.783
Serum creatinine at admission, mg/dL, median (IQR)	4.6 (3.4, 8.2)	12.6 (4.9, 27.3)	0.165
Systemic symptoms, n (%)			
Otorhinological symptoms	2 (22.2)	0	0.371
Neurological symptoms	1 (11.1)	0	0.546
Renal biopsy findings			
Synchronous crescents, n (%)	5 (55.6)	2 (66.7)	0.735'
Asynchronous crescents, n (%)	4 (44.4)	1 (33.3)	
Crescents >75%, n (%)	5 (55.6)	2 (66.7)	0.735
Chronicity on biopsy, n (%)	1 (11.1)	2 (66.7)	0.054
Treatment received			
Cyclophosphamide, n (%)	6 (66.7)	2 (66.7)	1.000
Rituximab, n (%)	3 (33.3)	1 (33.3)	
One-year renal survival, n (%)	1/4 (25)	1/2 (50)	0.540
One-year patient survival, n (%)	4 (44.4)	2 (66.7)	0.505

ANCA, anti-neutrophil cytoplasmic antibody; SD, standard deviation; IQR, interquartile range.

No difference was noted in patient survival in terms of age, delays in presentation, ANCA positivity, chronicity of biopsy, severity of renal function, and treatment modality used. Only chronicity on biopsy was associated with dialysis dependency at 1 year. This was in contrast with other studies where older age, higher creatinine at presentation, and higher anti-GBM titers were associated with poor patient survival [13], while ANCA positivity had mixed results with better [12] or poor outcomes [7]. The difference could be because of small sample size of our study.

The prognosis of anti-GBM disease patients is poor; in our study, one-year patient survival was 40%, whereas overall survival in other Indian studies was 40–88% [4, 13]. In study by Prabhakar et al., increased survival was reported compared to our study (88% vs. 40%). The possible reasons could be because of better healthcare facilities in terms of manpower and access in their center compared to our setting, which is a remote, hilly terrain with low resources. The one-year renal survival in Indian studies was 23% and 9%, whereas in our study it was 26% [4, 12]. Studies done in Europe had shown one-year renal survival and overall patient survival of 32–44% and ~87% respectively, much higher as compared to all Indian studies [12, 23]. The various factors for differences in poor outcomes in our set up compared to Western countries could be the low resource settings with higher patient load, increased incidence of infections, malnutrition, lack of timely access to healthcare and dialysis services, residing in remote areas, and poor financial status of patients. There are several limitations to our study. It was a single-centered, retrospective study with a small sample size (cannot be generalized to larger population). DNAJB9 staining and electron microscopy were not performed in negative circulating anti-GBM patients. Being the retrospective study, some data were missing with respect to serology and histopathology. Also, we did not have complete data regarding the socioeconomic status except the monthly income (86% belong to less than 250 USD/month).

In conclusion, the population of patients seen in a tertiary care hospital of Northern India during the COVID pandemic, most patients with anti-GBM disease have active sediments, raised creatinine, and non-specific symptomatology. There is poor renal and patient outcome as the most patients present with an advanced renal failure. There is a need to reconsider the approach toward the non-specific clinical features for early diagnosis.

Author Contributions

Asheesh Kumar enrolled participants, participated in data analysis, and preparation of the manuscript. Samriti Gupta participated in data analysis and preparation of the manuscript. Dr Kush Dev Singh Jarial, Dr Sukhwinder Sangha, Ashish Chauhan, Vikas Sharma Rajeev Sandal, and Dheeraj Sharma edited the manuscript and approved the final version.

Data Availability Statement

All data generated or analyzed during writing of this manuscript are included in this article. Further inquiries can be directed to the corresponding author.

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