Profile of glomerular diseases in a public hospital of Federal District, Brazil

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Abstract

Introduction: Glomerular diseases are a frequent etiology of chronic kidney disease, especially in the developing countries. **Objective:** To determine the profile of such glomerulopathies in a public hospital located in the city of Brasilia, Federal District. **Methods:** 121 renal biopsies in different patients were performed by the Renal Division of Hospital Regional da Asa Norte (HRAN) between August 2005 and May 2009. Eight renal biopsies in renal-transplant patients were excluded and the medical records of 113 remaining patients were analyzed. Analyzed data: sex, age, laboratory exams, glomerular syndrome, clinical diagnosis, degree of interstitial fibrosis, immunosuppressants use, need for dialysis and clinical outcome. **Results:** The age average was 34.9 ± 16.2 years-old, a predominance of male patients (51.3%). Major glomerular syndromes were: nephrotic syndrome (41.6%) and the rapidly-progressive glomerulonephritis (35.4%). Among primary glomerulopathies focal glomerulosclerosis (26.8%) followed by IgA nephropathy (25%) were predominant; and among the most prevalent secondary glomerulopathies we had lupus nephritis (50%) and diffuse exudative proliferative glomerulonephritis (34.2%).The majority of the patients used immunosuppressants (68.1%) and almost one third of them (29.2%) needed dialysis during their hospitalization. Progressed to chronic dialysis therapy 13.3% of the patients and 10.6% died. **Conclusion:** This study may contribute to better epidemiological understanding of glomerular diseases in the Federal District, guiding the adoption of public policies aiming the quick clinical treatment of such diseases.

Keywords: nephropathy, nephritis, glomerulonephritis, nephrotic syndrome, lupus syndrome, focal segmental glomerulosclerosis, IgA nephropathy, chronic kidney disease

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Introduction

Chronic kidney disease is currently understood as a public health problem, because of its increasing prevalence, high morbidity and mortality, and high costs for maintaining patients with chronic kidney disease (CKD) stage 5 in different modalities of renal replacement therapy (RRT) (hemodialysis, peritoneal dialysis, and kidney transplantation).[1-3] Currently, over one million people worldwide are estimated to be on any form of chronic dialysis therapy, and Latin America accounts for almost one quarter of such patients.[4-6] The cost of that treatment is high: Brazilian data have shown that more than 10% of the budget of the Health Ministry is destined to maintain RRT programs, while North-American data point to a cost of 29 billion dollars per year to treat patients that need RRT.[7,8]

In Brazil, as in several other countries, glomerular diseases are a frequent etiology of chronic kidney failure, [9,10] and kidney biopsy plays a fundamental role in the correct histopathological and etiological diagnosis and even in the prognosis of such cases.[11,12]

Glomerular diseases often have an insidious and asymptomatic course, which determines diagnostic delay, contributing to a poorer kidney and patient's clinical survival.[13]

Epidemiological studies of glomerular diseases, even when conducted regionally, are important because they contribute to better understanding the incidence of those pathologies and allow the adoption of differentiated strategies aiming at new forms of prevention and treatment.

This study aimed at identifying the profile of patients with glomerular diseases

undergoing kidney biopsy at a secondary referral hospital for internal medicine of the Brazilian Federal District, the Hospital Regional da Asa Norte (HRAN).

Materials and Methods

The study consisted of a retrospective analysis of the medical records of all patients undergoing kidney biopsy in primitive kidneys from August 2005 to May 2009, who remained hospitalized and cared for at the Service of Nephrology of the HRAN.

During that four-year period, 121 kidney biopsies were performed, eight of which were excluded from the study because they were performed in transplanted kidneys. Thus, 113 biopsies constituted the object of study.

Data analyzed were divided into four major groups:

a) Clinical data on admission: including data referring to age, sex, and kidney biopsy indication.

b) Laboratory data: including serum levels of urea, creatinine, and albumin, as well as hemoglobin and hematocrit values.

c) Histopathological data: referring to the results of the kidney biopsy and the degree of interstitial fibrosis reported by the pathologist.

d) Data of treatment and clinical outcome: referring to the need for using immunosuppressive agents, for performing dialysis during hospitalization, and the clinical outcome of patients until the end of study (conservative follow-up, death, chronic dialysis, or loss to follow-up).

The indications for kidney biopsy were in accordance with the Brazilian Consensus of Glomerulopathies[13] and were as follows: urinary abnormalities; suspicion of rapidly progressive glomerulonephritis (RPGN); nephritic syndrome; nephrotic syndrome; and undetermined kidney failure.

Urinary abnormalities were defined as the presence of micro- or macroscopic hematuria associated or not with some degree of proteinuria. Rapidly progressive glomerulonephritis was defined as the abrupt loss of kidney function over a few days or weeks in association with active urinary sediment, presence of proteinuria, and normal or enlarged size kidneys on ultrasonography. Nephritic syndrome was defined as the sudden start of hematuria associated with oliguria, edema, and arterial hypertension associated or not with a mild deficit in kidney function (the latter defined as creatinine elevation up to 1.5 mg/dL). Nephrotic syndrome was defined as 24-hour proteinuria > 3.5 g in association with hypoalbuminemia and variable edema. Arterial hypertension was defined as systolic blood pressure > 140 mm Hg and/or diastolic blood pressure > 90 mm Hg. Undetermined kidney failure was defined as kidney function loss with no apparent cause in the presence of unaltered urinary sediment and normal or enlarged kidney size on ultrasonography.

The histological diagnoses were divided into three groups: primary glomerulopathies; secondary glomerulopathies; and others. The latter group comprised the following: tubulointerstitial nephrites; acute tubular necrosis; normal kidney; and insufficient samples.

Histological analysis comprised light microscopy (LM) and direct immunofluorescence (IF). The biopsies were performed by the Nephrology staff of HRAN, stored in a solution for transportation and mailed to the Laboratory of Pathology of the Federal University of São Paulo (UNIFESP) for analysis. For LM, the fragments were fixed in Bouin's solution, embedded in paraffin, underwent semi-serial and sequential histological sections, and stained according to the following methods: hematoxylin-eosin (H&E) staining; Jones' silver stain; periodic acid Schiff stain (PAS); and Masson trichrome staining. For IF, the samples underwent cryostat sectioning and were incubated with fluorescein conjugated antisera, anti human immunoglobulins A, G, and M, Kappa and Lambda light chains, C1q and C3d complement fractions, and fibrinogen.

The WHO recommendations modified in 1995 were used for the histological classification of the glomerulopathies.[14]

Assessment of chronicity was considered based on the percentage of sclerosed glomeruli, tubular atrophy, and semiquantitative analysis of the degree of interstitial fibrosis described by the pathologist (mild fibrosis defined as present in up to 20% of the sample; moderate fibrosis, from 20% to 50%; and severe fibrosis, more than 50%).

Statistical analysis

Numerical data were expressed as mean ± standard deviation for variables with normal distribution, and as median (maximum-minimum) for variables without a normal distribution. Categorical data were expressed in percentages and categorical variables were compared by use of the chi-square test or Fisher exact test. Numerical variables were compared by use of the Student *t* test for independent samples. The normality of quantitative variables was assessed by use of Shapiro-Wilk and Kolmogorov-Smirnov tests.

All significance probabilities (p values) presented are of the bilateral type and values below 0.05 were considered statistically significant. The statistical analysis of data was performed by use of the SAS software, version 9.2 (Statistical Analysis System, Cary, NC, USA).

Results

On admission, the mean age of the population studied was 34.9 ± 16.2 years, and male patients prevailed (58/113; 51.3%) (Table 1).

The major indications for kidney biopsy were as follows: nephrotic syndrome (47/113; 41.6%); RPGN (40/113; 35.4%); urinary abnormalities (16/113; 14.2%); nephritic syndrome (6/113; 5.3%); and undetermined kidney failure (4/113; 3.5%) (Table 1).

Laboratory data were as follows: mean hemoglobin, 11.5 ± 2.6 g/dL; hematocrit, 33.6 ± 7.9; urea, 83.0 ± 53.1 g/dL; creatinine, 3.3 ± 3.3 g/dL; serum albumin, 2.9 ± 0.7 g/dL (Table 1).

Regarding the histopathological diagnoses, primary glomerulopathies (52/113; 46%) predominated, followed by secondary glomerulopathies (38/113; 33.6%) and others (20.4%) (Table 1).

Regarding the degree of interstitial fibrosis described by the pathologist, the findings were as follows: absent (45/113; 39.8%); mild (37/113; 32.7%); moderate (21/113; 18.6%); and severe (10/113; 8.8%) (Table 1).

Most patients used immunosuppressive agents throughout hospitalization (77/113; 68.1%), and almost one third of the patients required dialysis (33/113; 29.2%). The major clinical outcomes until the end of the study were as follows: conservative treatment (83/113; 73.8%); chronic dialysis (15/113; 13.3%); death (12/113; 10.6%); and loss to follow-up after hospital discharge (3/113; 2.7%) (Table 1).

Regarding primary glomerulopathies (n = 52), focal segmental glomerulosclerosis (FSGS) predominated (14/52; 26.9%), followed by IgA nephropathy (13/52; 25%), minimal change disease (MCD) (11/52; 21.1%), membranous glomerulopathy (MGN) (7/ 52; 13.5%), and undetermined chronic glomerulonephritis (CGN) (7/52; 13.5%) (Figure 1).

Regarding secondary glomerulopathies (n = 38), lupus nephritis predominated (19/38; 50%), followed by diffuse proliferative glomerulonephritis (DPGN) (13/38; 34.2%), pauci-immune glomerulonephritis (PAUCI GN) (3/38; 8%), and hypertensive nephrosclerosis (3/38; 8%) (Figure 1). In the cases of lupus nephritis, class IV predominated (11/19; 57.9%), followed by class V (4/19; 21%), class III (3/19; 15.8%), and classes I/II (1/19; 5.3%).

In the group denominated "others" (n = 23), the major diagnoses were as follows: normal kidney (8/23; 34.8%); insufficient material (7/23; 30.4%); tubulointerstitial nephritis (6/23; 26.1%); and acute tubular necrosis (2/23; 8.7%).

Table 2 shows the variables sex, age, indication for biopsy, degree of interstitial fibrosis, use of immunosuppressive drugs, need for dialysis, and clinical outcome expressed with individualized values for each specific type of histological finding.

Table 1 Admission, laboratory, histopathological data, use of immunosuppression, dialysis need, and clinical outcome of the patients undergoing kidney biopsy (n=113)..

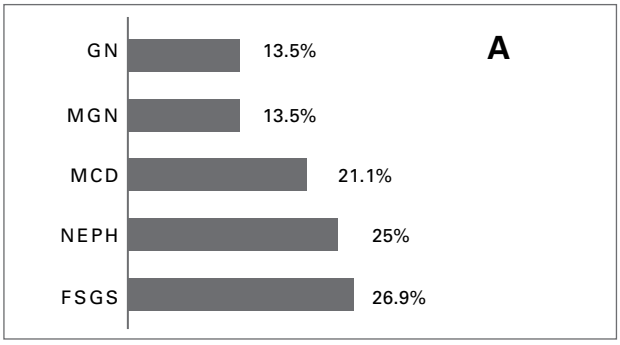
Parameters	Values
Age (years)	34.9 ± 16.3
Sex (M/F) %	51.3 / 48.7
Kidney biopsy indication %	
a) Nephrotic syndrome	41.6
b) RPGN	35.4
c) Urinary abnormalities	14.2
d) Nephritic syndrome	5.3
e) undetermined KF	3.5
Hemoglobin – g/dL	11.5 ± 2.6
Hematocrit	33.6 ± 7.9
Serum urea – mg/dL	83 (17 - 300)[a]
Serum creatinine – mg/dL	3.3 (0.5 - 13.7)[a]
Serum albumin – g/dL	2.9 ± 0.7
Histopathological diagnosis %	
a) primary glomerulopathy	46
b) secondary glomerulopathy	33.6
c) others	20.4
Degree of interstitial fibrosis	
a) absent	39,8
b) mild	32.7
c) moderate	18.6
d) extensive	8.8
Immunosuppression (yes/no) %	68.1 / 31.9
Dialysis need (yes/no) %	29.2 / 70.8
Clinical outcome %	
a) conservative	73.4
b) chronic dialysis	13.3
c) death	10.6
d) lost to follow-up	2.7

[a] Median (minimum – maximum).

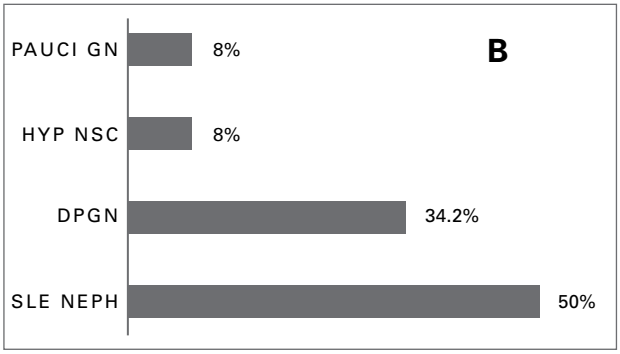
When comparing indication for biopsy and histological finding, the following was observed:

- Patients undergoing biopsy due to nephrotic syndrome (n = 47) had the following results: FSGS (27,6% -13/47); MCD (23,4% - 11/47); lupus nephritis (17% - 8/47); MGN (14,9% -7/47); others (10,6% - 5 /47); hypertensive nephrosclerosis (4,2% - 2/47); and IgA nephropathy (2.1% - 1/47) (Figure 2).
- Patients undergoing biopsy due to RPGN (n = 40) had the following results: lupus nephritis (27.5% - 11/40); PDGN (25% - 10/40); others (12.5% - 5/40); IgA nephropathy (10% - 4/40); PAUCI GN (7.5% -3/40); and FSGS (2.5% - 1/40) (Figure 2).
- Patients undergoing biopsy due to urinary abnormalities (n = 16) had the following results: IgA nephropathy (43.7% - 7/16); others (43.7% - 7/16); DPGN (6.3% - 1/16); and hypertensive nephrosclerosis (6.3% - 1/16) (Figure 2).

Figure 1. A. Distribution of primary glomerulopathies (n = 52). **B.** Distribution of secondary glomerulopathies (n = 38).



CGN = Chronic glomerulonephritis; MGN = Membranous glomerulopathy; MCD = Minimal change disease; IgA NEPH = IgA nephropathy; FSGS = Focal segmental glomerulosclerosis.



PAUCI GN = Pauci-immune glomerulonephritis; HYP NSC = Hypertensive nephrosclerosis; DPGN = Diffuse proliferative glomerulonephritis; SLE NEPH = Lupus nephritis.

- Patients with nephritic syndrome (n = 6) had the following histological results: others (50% - 3/6); DPGN (33.3% - 2/6); and IgA nephropathy (16.7% - 1/6) (Figure 2).
- Patients with undetermined kidney failure (n = 4) had the following results: others (75% - 3/4) and chronic GN (25% - 1/4) (Figure 2).

Regarding the patients whose indication for biopsy was RPGN, except for the subgroup "others" and the isolated case of FSGS, all others (85% -34/40) showed cell crescent formation, and in half such cases (42.5% - 17/40) the crescents occupied more than 50% of the biopsy sample, characterizing crescentic glomerulopathies. It is worth emphasizing that two patients with PAUCI GN (66.7% - 2/3) were diagnosed as having systemic vasculitis (Wegener's granulomatosis).

Comparing patients having primary and secondary glomerulopathies, no statistically significant difference was observed regarding age, sex, use of immunosuppressive medication, frequency of dialysis during hospitalization, and hematocrit and serum albumin levels. However, patients with primary glomerulopathies had higher levels of hemoglobin (11.7 ± 2.5 g/dL *vs.* 10.7 ± 2.8 g/dL; p = 0.0393) and a higher incidence of chronic dialysis as clinical outcome (21.1% *vs.* 5.2 %; p = 0.0342), while patients with secondary glomerulopathies had a higher frequency of death as clinical outcome (21% *vs.* 5%; p = 0.0477) (Table 3).

Discussion

Our study aimed at delineating the profile of patients suspected of having glomerular disease undergoing kidney biopsy at a public hospital of the Brazilian Federal District.

Suspicion of glomerular disease was confirmed in almost 80% of the cases undergoing biopsy. This emphasizes that a high degree of clinical suspicion is required so that a quick diagnosis can be established and treatment initiated.[13]

Our study identified that glomerular diseases predominated and that the major indication for kidney biopsy was the presence of nephrotic syndrome. Primary glomerulopathies, as compared to secondary ones, were also found to predominate, FSGS being the most frequently found among the primary glomerulopathies, while lupus nephritis was the most common among the secondary ones. Those data are in accordance with those of several national[15-18] and Latin American[19,20] studies.

Table 2 Differences in the variables sex, age, biopsy indication, degree of interstitial fibrosis, immunosuppressive treatment, need for dialysis, and clinical outcome separated according to each specific glomerulopathy (n = 90)

	FSGS	IgA	MCD	MGN	Chronic GN	SLE	DPGN	PAUCI GN	HYP NSC
Parameters	(n = 14)	(n = 13)	(n = 11)	(n = 7)	(n = 7)	(n = 19)	(n = 13)	(n = 3)	(n = 3)
Sex									
a) Male	7 (50%)	8 (61.5%)	7 (63.6%)	4 (57.1%)	4 (57.1%)	1 (5.3%)	12	1 (33.3%)	3 (100%)
b) Female	7 (50%)	5 (38.5%)	4 (36.4%)	3 (42.8%)	3 (42.8%)	18 (94.7%)	1 (7.7%)	2 (66.7%)	0
Age (years)	34.5 ± 14.7	33.1± 11.4	34± 21	51.8 ± 15.5	35.3 ± 17.5	25.1± 7.1	34.3± 16	34.3 ± 28.3	52.6± 16.2
Biopsy indication									
a) Urinary abnormalities	0	7 (53.8%)	0	0	0	0	1 (7.7%)	0	1 (33.3%)
b) RPGN	1 (7%)	4 (30.8%)	0	0	6 (85.7%)	11 (57.9%)	10 (76.9%)	3 (100%)	0
c) Undetermined KF	0	0	0	0	1 (14.3%)	0	0	0	0
d) Nephrotic syndrome	13 (93%)	1 (7.7%)	11 (100%)	7 (100%)	0	8 (42.1%)	0	0	2 (66.7%)
e) Nephritic syndrome	0	1 (7.7%)	0	0	0	0	2 (15.4%)	0	0
Interstitial fibrosis									
a) No	4 (28.5%)	6 (46.2%)	5 (45.5%)	2 (28.6%)	0	5 (26.3%)	9 (69.2%)	0	0
b) Mild	4 (28.5%)	4 (30.8%)	6 (54.5%)	4 (57.1%)	0	8 (42.1%)	1 (7.7%)	1 (33.3%)	2 (66.7%)
c) Moderate	5 (36%)	2 (15.4%)	0	1 (14.3%)	3 (42.8%)	4 (21%)	2 (15.4%)	1 (33.3%)	1 (33.3%)
d) Severe	1 (7%)	1 (7.7%)	0	0	4 (57.1%)	2 (10.5%)	1 (7.7%)	1 (33.3%)	0
Immunosuppressive drug use	10 (71.4%)	9 (69.2%)	8 (72.7%)	3 (42.8%)	5 (71.4%)	13 (68.4%)	8 (61.5%)	3 (100%)	2 (66.7%)
Dialysis	3 (21.4%)	3 (23%)	2 (18.2%)	0	7 (100%)	5 (26.3%)	5 (38.5%)	2 (66.7%)	0
Clinical outcome									
a) Conservative	11 (78.5%)	11 (84.6%)	8 (72.7%)	7 (100%)	1 (14.3%)	11 (57.9%)	11 (84.6%)	1 (33.3%)	3 (100%)
b) Chronic dialysis	3 (21.4%)	2 (15.4%)	0	0	6	1 (5.3%)	1 (7.7%)	0	0
c) Death	0	0	3 (27.3%)	0	0	5 (26.3%)	1 (7.7%)	2 (66.7%)	0
d) Lost to follow-up	0	0	0	0	0	2 (10.5%)	0	0	0

Table 2 shows several specific data of each glomerulopathy found in our study, which are in accordance with the literature,[12] as follows:

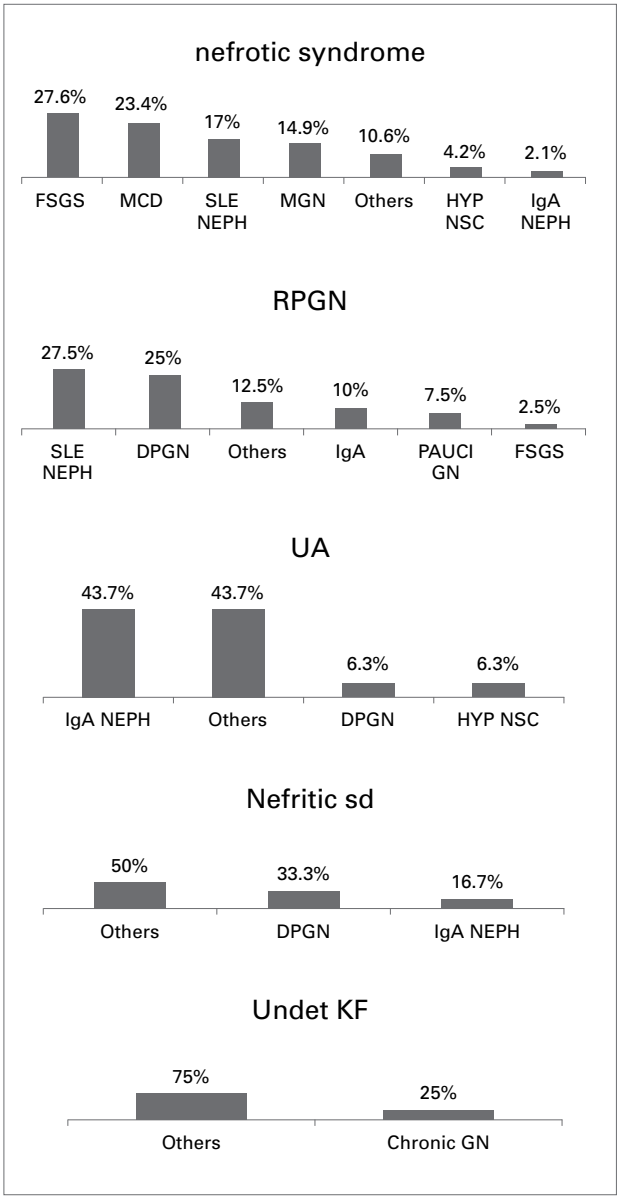
- a large number of cases of FSGS evolving to chronic dialysis need;
- among patients with nephrotic syndrome, FSGS, MCD, and MGN predominated;
- patients with MGN belonged to an older age group;
- lupus nephritis affected mainly younger individuals and women;
- a high percentage of patients with PAUCI GN presenting as RPGN and evolving to death.

Many of the correlations between clinical symptomatology and biopsy result observed in our study are in accordance with classical data in the literature, such as the strong association between nephrotic syndrome and FSGS and between urinary abnormalities and IgA nephropathy. The fact that a large number of patients presenting with RPGN had a histological report of lupus nephritis can be explained by the predominance of class IV, with a traditionally more aggressive presentation.[21,12]

The second most common histological finding among patients with urinary abnormalities was non-glomerular diseases (subgroup "others"). This can be explained both by the fact that tubulointerstitial diseases can mimic glomerular diseases and by the biopsy findings described as normal kidney in this subgroup that could correspond to thin basement membrane disease (TMD), since such pathology requires electron microscopy to be diagnosed (not performed in our study). In some studies, TMD exceeds IgA nephropathy as the major cause of urinary abnormalities.[22]

In our study, the most prevalent primary glomerulopathies in decreasing order were: FSGS; IgA nephropathy; MCD; and MGN. Such glomerulopathies have

Figure 2. Correlation between biopsy indication and histopathological findings.



greatly variable prevalence worldwide, depending on the country of origin.[23-27] Several studies have reported that FSGS has become the major primary glomerulopathy causing nephrotic syndrome worldwide.[28,29]

The presence of DPGN (in our study, highly related to acute post streptococcal glomerulonephritis) as the second major cause of secondary glomerulopathy has also been reported in some national studies,[17] but not at a such high proportion as that found in our study. Although we do not have a consistent explanation for that, it is worth emphasizing the highest incidence of post streptococcal glomerulonephritis in developing countries and the significant percentage (over 5%) of cases evolving to rapidly progressive forms in adult patients.[30-31] Some studies question the benignity of "acute glomerulonephritis" over time, especially when related to epidemic outbreaks caused by some specific bacterial strains.[32,33]

In our study, patients with primary glomerulopathies most frequently had chronic dialysis as clinical outcome as compared with the subgroup of patients with secondary glomerulopathies. That emphasizes the insidious course of those diseases, mainly in their initial phases. Many patients, especially those with FSGS, were referred to our service after a significant loss of kidney function, therefore evolving more rapidly to end-stage kidney failure.

Regarding the immunosuppressive treatment, apparently little difference was observed between both groups with glomerular diseases. However, in the subgroup of secondary glomerulopathies, many deaths occurred, which can be attributed to the fact that that subgroup comprised many patients with lupus nephritis (mainly class IV), in addition to patients with systemic vasculites and DPGN evolving to crescent formation. That profile of patients contributed to the finding

Table 3 Comparison of the demographic and laboratory data, immunosuppressive treatment, and clinical outcome of patients with primary and secondary glomerulopathies undergoing biopsy at HRAN (n = 90).

Parameters	Primary(n = 52)	Secundary (n = 38)	p value
Age (years)	36.5 ± 16.6	31.1 ± 15	0.1193[a]
Male sex %	57.6	44.7	0.2243[b]
Presence of fibrosis %	67.3	63	0.6824[b]
Immunosuppression %	76.9	73.6	0.7244[b]
Dialysis need %	28.8	31.5	0.7799[b]
Outcome: chronic dialysis %	21.1	5.2	0.0342[b]
Outcome: death %	5.7	21	0.0477[a]
Hemoglobin – g/dL	11.7 ± 2.5	10.7 ± 2.8	0.0393[a]
Hematocrit	34.5 ± 8.1	31.6 ± 7.7	0.1012[a]
Albumin – g/dL	2.9 ± 0.6	2.8 ± 0.6	0.6754[a]

a = Student t test; b = chi-square test; c = Fisher exact test.

that the second glomerular syndrome requiring kidney biopsy in our study was the suspicion of RPGN, a fact not observed in other national studies.[15-17] Several studies have shown the high impact of lupus nephritis on morbidity and mortality, especially in the presence of other risk factors, such as non-Caucasian race and low socioeconomic level, frequent in developing countries and among the patients of our study.[34,35] A study comparing patients with lupus nephritis and patients with other primary glomerulopathies undergoing the same immunosuppression has reported death as an outcome more frequent among lupus patients, showing the impact of the underlying autoimmune disease on the immunosuppression degree of those patients.[36] Therefore, the most immunosuppressed profile of patients with secondary glomerulopathies may have contributed to the greater frequency of death as a clinical outcome, regardless of the form or type of immunosuppression used.

Conclusion

Our study provides important epidemiological information about the profile of patients with glomerular diseases at a public hospital of the Federal District in Brazil. However, further studies are required at other services in the Federal District and in other states of the West-Central region to the better understanding of the behavior of glomerulopathies in that Brazilian region.

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References

1. Salgado Filho N, Brito DJA. Doença Renal Crônica: a grande epidemia deste milênio. J Bras Nefrol 2006; 28:1-5.
2. Sesso R, Lopes AA, Thome FS, Bevilacqua JL, Romão Junior JE, Lugon J. Relatório do censo brasileiro de diálise 2008. J Bras Nefrol 2008; 30:233-8.
3. Bastos MG, Carmo WB, Abrita RR *et al*. Doença Renal Crônica: problemas e soluções. J Bras Nefrol 2004, 26:202-15.
4. Hafez MH, Abdellatif DA, Elkhatib MM. Prevention of renal disease progression and renal replacement therapy in emerging countries. Artif Organs 2006; 30:501-9.
5. Cusumano AM, Romao JE, Poblete Badal H *et al*. Latin-American Dialysis and Kidney Transplantation Registry: data on the treatment of end-stage renal disease in Latin America. G Ital Nefrol 2008; 25:547-53.
6. Cusumano A, Garcia-Garcia G, Di Gioia C *et al*. End-stage renal disease and its treatment in Latin America in the twenty-first century. Ren Fail 2006; 28:631-7.
7. Sesso R. Epidemiologia da doença renal crônica no Brasil. *In:* Barros E, Manfro RC, Thomé FS, Gonçalves LF. Nefrologia: Rotinas, Diagnóstico e Tratamento. 3ed. Porto Alegre: Artmed, 2006. p.39-46.
8. Hamer RA, El Nahas AM. The burden of chronic kidney disease: is rising rapidly worldwide. BMJ 2006; 332:563-4.
9. Oliveira MB, Romao Jr JE, Zatz R. End-stage renal disease in Brazil: epidemiology, prevention, and treatment. Kidney Int Suppl 2005; 68:S82-86.
10. Maisonneuve P, Agodoa L, Gellert R *et al*. Distribution of primary renal diseases leading to end-stage renal failure in the United States, Europe, and Australia/ New Zealand: results from an international comparative study. Am J Kidney Dis 2000; 35:157-65.
11. Cohen AH, Nast CC. Clinical utility of kidney biopsies in the diagnosis and management of renal disease. Am J Nephrol 1989; 9:309-15.
12. Barros RT, Alves MAR, Kirsztajn GM, Sens YAS, Dantas M. Glomerulopatias: patogenia, clínica e tratamento. 2. ed. Editora Sarvier, São Paulo, 2006.
13. Sociedade Brasileira de Nefrologia (SBN). Consenso Brasileiro de Glomerulopatias. J Bras Nefrol 2005; 27(2-Supl.1).
14. Churg J, Sobin LH, editors. Renal disease: classification and atlas of glomerular diseases. Tokyo: Igaku-Shoin , 1995.
15. Cardoso AC, Mastroianni-Kirsztajn G. Padrões histopatológicos das doenças glomerulares no Amazonas. J Bras Nefrol 2006; 28:39-4.
16. Carmo PAV, Carmo WB, Bastos MG, Andrade LCF. Estudo das Doenças Glomerulares na Zona da Mata Mineira. J Bras Nefrol 2008; 30:15-2.
17. Malafronte P, Mastroianni-Kirsztajn G, Betôncio GN *et al*. Paulista Registry of glomerulonephritis: 5-year data report. Nephrol Dial Transplan 2006; 21:3098-105.
18. Polito MG, de Moura LA, Kirsztajn GM. An overview on frequency of renal biopsy diagnosis in Brazil: clinical and pathological patterns based on 9,617 native kidney biopsies. Nephrol Dial Transplant 2010;25(2):490-6.
19. Arias LF, Henao J, Giraldo RD, Carvajal N, Rodelo J, Arbeláez M. Glomerular diseases in a Hispanic population: review of a regional renal biopsy database. São Paulo Med J 2009; 127:140-4.
20. Mazzuchi N, Acosta N, Caorsi H *et al*. Frequency of diagnosis and clinic presentation of glomerulopathies in Uruguay. Nefrologia 2005; 25:113-20.
21. Korbet SM, Lewis EJ, Schwartz MM, Reichlin M, Evans J, Rohde RD. Factors predictive of outcome in severe lupus nephritis. Lupus Nephritis Collaborative Study Group. Am J Kidney Dis 2000; 35:904-14.
22. Van Paassen P, Van Breda Vriesman PJ, Van Rie H, Tervaert JW. Signs and symptoms of thin basement membrane nephropathy: a prospective regional study on primary glomerular disease-The Limburg Renal Registry. Kidney Int 2004; 66:909-13.
23. Chang JH, Kim DK, Kim HW *et al*. Changing prevalence of glomerular diseases in Korean adults: a review of 20 years of experience. Nephrol Dial Transplant 2009; 24:2406-10.

24. Covic A, Schiller A, Volovat C *et al*. Epidemiology of renal disease in Romania: a 10 year review of two regional renal biopsy databases. Nephrol Dial Transplant 2006; 21:419-24.
25. Rychlík I, Jancová E, Tesar V *et al*. The Czech registry of renal biopsies. Occurrence of renal diseases in the years 1994-2000. Nephrol Dial Transplant 2004; 19:3040-9.
26. Li LS, Liu ZH. Epidemiologic data of renal diseases from a single unit in China: analysis based on 13,519 renal biopsies. Kidney Int 2004; 66:920-3.
27. Panichi V, Pasquariello A, Innocenti M *et al*. The Pisa experience of renal biopsies, 1977-2005. J Nephrol 2007; 20:329-35.
28. Oliveira MB, Penna DO, Saldanha LB, Mota ELA, Barros RT, Romão Jr JE. Primary glomerular diseases in Brazil (1979-1999): is the frequency of focal and segmental glomerulosclerosis increasing? Clin Nephrol 2004; 61:90-7.
29. Hass M, Spargo B, Coventry S. Increasing incidence of focal segmental glomerulosclerosis among adult nephropathies: a 20-year renal biopsy study. Am J Kidney Dis 1995; 26:740-50.
30. Rodriguez-Iturbe, B. The current state of poststreptococcal glomerulonephritis. J Am Soc Nephrol 2008; 19:1855-64.
31. Barros RT, Vieira Jr JM. Glomerulonefrites secundárias às infecções bacterianas. *In*: Barros RT, Alves MAR, Kirsztajn GM, Sens YAS, Dantas M. Glomerulopatias: patogenia, clínica e tratamento. 2. ed. Editora Sarvier, São Paulo, 2006.
32. Sesso R, Pinto SWL. Epidemic glomerulonephritis due to Streptococcus zooepidemicus in Nova Serrana, Brazil. Kidney Int 2005; 97:132-6.
33. Sesso R, Pinto SWL. Five-year follow-up of patients with epidemic glomerulonephritis due to streptococcus zooepidemicus. Nephrol Dial Transpl 2005; 20:1808-12.
34. Barr RG, Seliger S, Appel GB *et al*. Prognosis in proliferative lupus nephritis: the role of socio-economic status and race / ethnicity. Nephrol Dial Transplant 2003; 18:2039-46.
35. Korbet SM, Lewis EJ, Schwartz MM, Reichlin M, Evans J, Rohde RD. Factors predictive of outcome in severe lupus nephritis. Lupus Nephritis Collaborative Study Group. Am J Kidney Dis 2000; 35:904-14.
36. Balbi AL, Barbosa RA, Lima MCP, de Almeida DB. Estudo comparativo das complicações terapêuticas no lúpus eritematoso sistêmico e nas glomerulopatias idiopáticas. Rev Assoc Med Bras 2001; 47:296-301.