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Original Article

Adult Native Renal Biopsy Experience of Ege University for 12 Consecutive Years

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Abstract

Introduction. Establishing epidemiological data on frequency and prevalence of biopsy proven nephropathies may open new directions on prevention, detection and treatment of nephropathies in all age groups.
Methods. We evaluated adult native renal biopsies of Ege University from January 1996 to May 2009. According to the histological findings, renal biopsies were classified in four major categories: primary glomerulonephritis (GN), secondary GN, tubulointerstitial nephropathies and chronic GN.
Results. Among 1702 renal biopsies examined (patients characteristics: male gender 52 %, mean age 40±15 years, range of ages 16-82 years old), the most frequent renal diseases were primary (52.4 %) and secondary (31 %) glomerulonephritis (GN). Chronic GN was diagnosed in 5.23 % and tubulointerstitial nephropathies in 4.4 % of cases. The major causes of primary GN were focal segmental glomerulosclerosis in 10.3 %, membranous GN in 9.2 % and IgA nephropathy in 8.5 % of cases. Amyloidosis in 12.2 %, systemic lupus erythematosus in 11 % and vasculitis in 3.2 % of cases were the most frequent causes of secondary GN. Primary GN was predominant in all age groups. Above the age of 65 years, membranous (14.8 %) and crescentic (9.9 %) GN was the most frequently observed glomerular diseases whereas below the age of 65 years, IgA nephropathy (9 %) was predominant. Amyloidosis (19 %) and lupus nephritis (11.7 %) were the main causes of secondary GN in the same age groups. The diagnoses of secondary GN, chronic GN and TIN tended to increase with time. According to our registry, primary GN was lower and the prevalence of secondary GN was higher as compared to registries of other Balkan countries. The higher prevalence of amyloidosis in our region may explain this discrepancy.
Conclusion. Data obtained, which represent a single centre experience, may allow epidemiologic studies to give answer to several open questions regarding prevention and treatment of nephropathies.

Keywords: glomerulonephritis, renal biopsy, registry

Introduction

Renal biopsy was introduced to regular clinical practice by Iverson and Brun in 1951. Since then, renal biopsy has been a valuable tool for diagnosis, estimation of prognosis and decision of therapeutic regimen in many renal diseases [1].
Epidemiological data on the prevalence of renal diseases in Europe based on large national renal biopsy registries such as those of Italy [2] and Denmark [3] are available. Furthermore, information derived from local or limited national registries has also been reported from other regions. Many other reports based on specific population groups (elderly, Indians, etc.), specific diagnoses (nephrotic syndrome, rapidly progressive glomerulonephritis, etc.) and one centre experience have also been published [4-7].
The aim of this study was to identify the most frequent clinical syndromes, the annual prevalence of major groups of renal diseases and the percentage of different types of renal diseases in the region of the eastern part of Europe covered by the Aegean region of Turkey.

Patients and methods

A total of 1702 adult native renal biopsies performed at the Ege University from January 1996 to May 2009 were retrospectively evaluated. We determined the annual incidence of renal biopsy pathologies and compared them with other registries. Renal biopsy cores were processed according to standard techniques. Fresh biopsy cores were evaluated on the dissecting microscope. Small renal cortical tissue (2-4 mm in length) was separated for immunofluorescence study. The remaining biopsy specimen was fixed in formaline and B5 to be evaluated under light microscopy. Paraffin sections were prepared and stained with hematoxylin and eosin, periodic acid Schiff, Masson trichrome, Kongo red and Jones silver methenamine stains.

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Immunofluorescence studies on cryostat sections using polyclonal antisera against human fibrinogen, IgG, IgM, IgA, C3, C1q, kappa and lambda light chains have been used in clinical practice since 1977. Renal biopsy specimens were analyzed on light and immunofluorescence microscopy. Electron microscopy was not systematically used. For this reason minimal change disease couldn't be included.

The indications for renal biopsy were: (i) nephrotic range proteinuria 3.5 g/24 h; (ii) asymptomatic urinary abnormalities (AUA): persistent low grade proteinuria (< 3.5 g /24 h) with or without microhaematuria; (iii) isolated haematuria: presence of micro or macrohaematuria, without any proteinuria; (iv) nephritic syndrome: combination of haematuria, arterial hypertension and reduced renal function; (v) acute renal failure (ARF): sudden increase (within several days to weeks) of serum creatinine by ≥0.3 mg/dl (≥26.4 μmol/l) and/or reduction in urine output <0.5 ml/kg/hr for more than 6 hours; (vi) Chronic renal failure (CRF): when elevated serum creatinine persisted for >6 months and/or bilateral small kidneys or unilateral small single kidney were diagnosed.

Renal diseases were classified according to the findings in the renal biopsies in four major categories: primary glomerulonephritis (GN), secondary GN, tubulointerstitial nephropathies and chronic GN.

In primary GN the following glomerular diseases were classified: Focal segmental and proliferative glomerulonephritis with or without glomerulosclerosis (FSPGN), Membranoproliferative glomerulonephritis (MPGN), Diffuse proliferative glomerulonephritis (DPGN), Mesangioproliferative glomerulonephritis (MesPGN), Membranous nephropathy (MGN) and Focal segmental glomerulosclerosis (FSGS). In chronic GN, cases with non specific sclerotic glomeruler lesions were included.

Statistical analysis

Data were entered into a database Excel file. The annual incidence was defined as the number of new cases per year related to the mean total population, expressed as per million populations (p.m.p.) per year. Qualitative variables were compared by Chi-square or by Fisher's test as appropriate. P-values < 0.05 were considered statistically significant. All analyses were performed using the SPSS statistical software package (Version 15; SPSS, Inc., Chicago, IL, USA).

Results

During the examined period (from 1996 to 2009), 7450 renal biopsies (pediatric, adult native and transplant biopsies) were performed at the Ege University, Departments of Nephrology, Renal Transplantation and Pediatric Nephrology. Transplant kidney biopsies (n=4250), pediatric renal biopsies (n=1413) and adult renal biopsies with inadequate data or insufficient sample material were excluded from study analysis. Finally, 1702 adult native renal biopsies were included in the study.

The annual incidence of renal biopsy performance was 30 biopsies per million populations (p.m.p.)/year. About 52% of patients who had done a renal biopsy were males. The mean age of patients at the time of renal biopsy was 40±15.3 years (range 16 - 82). The age at the time of renal biopsy increased from 37.3 to 44 years during the period of the study (from 1996 to 2009).

The most common indication for renal biopsy was nephrotic syndrome (NS) in 40.3% of cases. NS followed by asymptomatic urinary abnormalities (AUA) in 32.4%, haematuria in 10.4 %, acute renal failure in 8 %, chronic renal failure in 5.2 % and acute nephritic syndrome in 3.7 % of cases. The most common causes of NS in elderly patients (≥65 years old) and in patients <65 years old were amyloidosis (40 % vs. 29.2 %), MGN (22.5 % vs. 15.56%) and FSGS 17.5 % vs. 15.21 %), respectively.

In this report we present the frequency and pathological basis of glomerulonephritis (GN) in the western part of Turkey during the period of 1996–2009. As can be seen from Table 1, the renal biopsy rate is much higher than in Romania, Serbia, and France (based on one or two centers experience) and lower than in almost all other published national European registries.

Table 1. Summary of the annual renal biopsy rate in European studies

Country (reference)	Type of registry	Follow-up (years)	Number of biopsies	Biopsy rate (p.m.p[a]/year)
Spain (8)	National	6	7016	48
Finland (9)	Six centers	24	3310	176
Denmark (10)	National	13	2380	40
France (11)	Single centre	27	1742	16.3–20.1
Czech Republic (12)	National	7	4004	44.1–69.3
Romania (13)	Two centers	10	606	10.9–11.3
Serbia (14)	Single centre	20	1626	10.8
Turkey	Single centre	12	1702	30

[a]p.m.p.: per million populations

The most frequent renal diseases were primary (52.4 %) and secondary (31 %) glomerulonephritis (GN). Chronic GN was diagnosed in 5.23 % and tubulointerstitial nephropathies in 4.4 % of cases (Table 2).

The most common causes of primary glomerulonephritis were: FSGS in 10.3 %, MGN in 9.2 %, IgA nephropathy in 8.5 %, MPGN in 4.29 %, Crescentic GN in 4.35 %, FSGP in 2.88 %, DPGN in 3.76 % and Mes PGN in 0.53 % of cases (Figure 1). Membranous nephropathy and crescentic GN were the most common causes (14.8 % and 9.9 %, respectively) in patients

Table 2. Distribution of major histological groups of renal disease

	Romania, Moldova and Banat regions, Covic *et al*. 2005 N=606 (%)	IRRB, Gesualdo *et al*. N=14607 (%)	CRRB, Rychlik *et al*. N=4004 (%)	Serbia, Naumovic *et al*., N=1488 (%)	Turkey, Ege, N=1702 (%)
Primary GN	66.2	70.8	59.8	64.2	52.4 [a,b,c,d]
Secondary GN	26.4	23.7	25.4	25.1	31 [a,b,c,d]
TIN	1.5	2.3	4.4	3	4.4 [a,b,d]
Vascular nephropathies	2.3	3.2	3.4	4.2	4
Miscellaneous/unclassifiable	3.6	N/A	2.4	3.5	8.2 [a,c,d]

IRRB, Italian Registry of Renal Biopsy; CRRB, Czech Registry of Renal Biopsy; GN, glomerulonephritis; TIN, tubulointerstitial nephropathy.
[a.] Ege vs Romania, [b.] Ege vs IRRB, [c.] Ege vs CRRB, [d.] Ege vs Serbia ($p<0.05$)

over 65 years old (p=0.03 and p=0.004, respectively) whereas IgA nephropathy (9 %, p=0.008) was more commonly diagnosed in patients under 65 years old. The percentage of biopsies with normal histology on light microscopy were 6.7% in the elderly and 8.8% in patients under 65 years old (p>0.05) (Table 3).

The most common causes of secondary glomerulonephritis were: amyloidosis in 12.2 %; systemic lupus erythematosus in 11 %, vasculitis in 3.2 %, diabetic nephropathy in 1.7 %, hypertensive nephrosclerosis in 1.41 %, thrombotic microangiopathy-hemolytic uremic syndrome (TMA-HUS) in 0.71 %, multiple myeloma in 0.47 % and good pasture-anti glomerular basement membrane disease (GP-AGM) in 0.29 % of cases (Figure 2).

The most common cause of secondary glomerulonephritis in patients older than 65 years was amyloidosis (19 %, p=0.002) and in patients under 65 years old lupus nephritis (11.7 %, p=0.001).

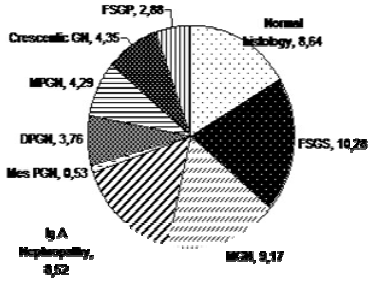

Fig. 1. Primary Glomerulonephritis
GN, Glomerulonephritis; CGN, crescentic glomerulonephritis; DPGN, Diffuse proliferative glomerulonephritis; FSGS, Focal segmental glomerulosclerosis; FSGP, Focal segmental proliferative glomerulosclerosis; MGN, Membranous glomerulonephritis; MPGN, Membranoproliferative glomerulonephritis; Mes P GN, Mesangioproliferative glomerulonephritis

Table 3. Incidence of diagnosis of primary glomerulonephritis in the two age groups

Pathological subtypes	Total %	<65 years %	≥65 years %	p value
Primary pathologies	52.41	52.50	51.24	0.87
Normal histology (light microscopy)	8.64	8.79	6.61	0.51
FSGS	10.28	10.31	9.92	0.98
MGN	9.17	8.73	14.88	0.03
IgA N	8.52	9.04	1.65	0.008
Mes P GN	0.53	0.57	0.00	0.86
DPGN - Post infectious GN	3.76	3.73	4.13	0.98
MPGN	4.29	4.43	2.48	0.43
Crescentic GN	4.35	3.92	9.92	0.004
FSGP	2.88	2.91	2.48	0.99

GN, Glomerulonephritis; CGN, crescentic glomerulonephritis; DPGN, Diffuse proliferative glomerulonephritis; FSGS, Focal segmental glomerulosclerosis; FSGP, Focal segmental proliferative glomerulosclerosis; MGN, Membranous glomerulonephritis; MPGN, Membranoproliferative glomerulonephritis; Mes P GN, Mesangioproliferative glomerulonephritis

The incidence of vasculitis increased from 2.17% to 6.58%, that of chronic GN from 3.18% to 7.89% and of TIN from 1.92% to 5.26% of cases during the period of the study (Figure 3).

Among all primary pathologies, the incidence of MGN decreased from 9.6% to 9.21% during the study (Figure 3). Table 4 indicates annual frequency of different types of primary GN and Table 5 shows annual frequency of

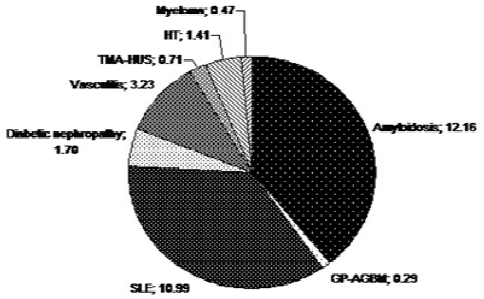

Fig. 2. Secondary Glomerulonephritis
HT: Hypertension, TMA-HUS: Thrombotic microangiopathy-Hemolytic uremic syndrome, SLE: systemic lupus erythematosis, GP-AGM: Good pasture-Anti glomerular basement membrane disease

different types of secondary GN according to the data of 1702 renal biopsies examined during the period of the study (from 1996 to 2009). The percentage of insufficient material decreased steadily during the period of the study (Figure 5). A comparison of annual incidence of primary glomerulonephritis observed in this study with the annual incidence in European regions is shown in Table 6.

The annual incidence of primary glomerulonephritis per million populations observed in this study was lower (MN 2.8, FSGS 3.1, IgA N 2.6, MPGN 1.3, Cres GN 1.3) than in the European regions.

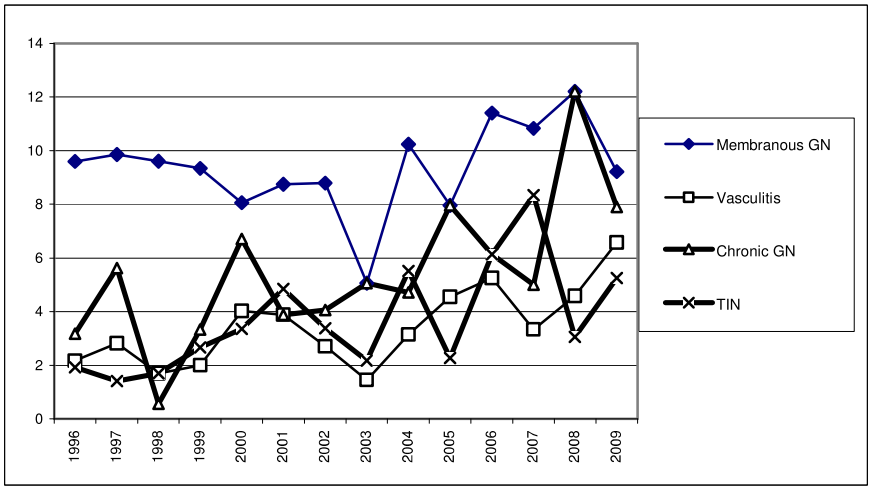

Fig. 3. Annual percentage of more frequent renal diseases with significant changes in percentage during the 12-year follow-up period

Table 4. Annual frequency of different types of primary GN

%	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Primary pathologies	60.2	60.6	58.8	61.3	49.7	46.6	52.7	58.0	51.2	48.9	54.4	48.3	43.5	43.4	52.4
Normal histology (light microscopy)	10.4	5.6	6.2	19.3	10.1	6.8	9.5	13.8	8.7	9.1	10.5	10.0	0.0	1.3	8.6
FSGS	10.9	12.7	11.3	8.7	10.1	10.7	7.4	14.5	7.1	4.5	13.2	7.5	14.5	13.2	10.3
Membranous GN	9.6	9.9	9.6	9.3	8.1	8.7	8.8	5.1	10.2	8.0	11.4	10.8	12.2	9.2	9.2
IgA N	6.1	5.6	7.3	5.3	9.4	7.8	13.5	9.4	8.7	10.2	7.0	9.2	5.3	10.5	8.5
Mes P GN	0.9	1.4	0.0	1.3	0.7	0.0	0.7	1.4	0.8	0.0	0.0	0.0	0.0	0.0	0.5
DPGN- Post enfectious GN	6.43	7.7	6.2	5.3	2.7	2.9	3.4	2.9	0.8	2.3	2.6	5.0	1.5	3.9	3.8
MPGN	5	5.6	4.0	5.3	6.0	4.9	4.1	4.3	5.5	4.5	2.6	1.7	6.1	0.0	4.3
CGN	6.4	4.9	9.0	5.3	1.3	2.9	2.7	5.8	7.1	6.8	4.4	2.5	0.8	2.6	4.3
FSGP	4.5	7.0	5.1	1.3	1.3	1.9	2.7	0.7	2.4	3.4	2.6	1.7	3.1	2.6	2.9

GN, Glomerulonephritis; CGN, crescentic glomerulonephritis; DPGN, Diffuse proliferative glomerulonephritis; FSGS, Focal segmental glomerulosclerosis; FSGP, Focal segmental proliferative glomerulosclerosis; MGN, Membranous glomerulonephritis; MPGN, Membranoproliferative glomerulonephritis; Mes P GN, Mesangioproliferative glomerulonephritis

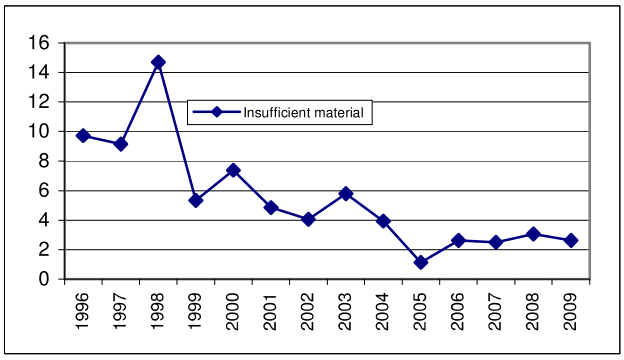

Figure 5. Annual percentage of biopsies with insufficient material

Table 5. Annual frequency of different types of secondary glomerulonephritis (The total 12-year frequency is indicated in the last column)

%	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Systemic diseases	23.5	22.5	22.0	26.0	30.2	35.9	32.4	27.5	33.1	37.5	29.8	35.8	33.6	34.2	31
Amyloidosis	11.6	9.2	12.4	13.3	7.4	9.7	10.1	5.8	12.6	11.4	13.2	14.2	14.5	6.6	12.2
GP-ABGM	0.0	0.0	0.0	0.0	0.7	1.0	0.0	0.7	0.0	1.1	0.9	0.0	0.0	0.0	0.3
SLE	6.1	7.7	4.5	6.0	14.8	18.4	14.9	13.8	10.2	18.2	6.1	15.8	10.7	9.2	11
Diabetic nephropathy	1.7	0.7	1.1	3.3	0.0	0.0	2.0	0.7	2.4	0.0	2.6	1.7	0.8	10.5	1.7
Vasculitis	2.2	2.8	1.7	2.0	4.0	3.9	2.7	1.4	3.1	4.5	5.3	3.3	4.6	6.6	3.2
TMA-HUS	0.2	0.0	0.6	0.0	0.7	1.0	1.4	1.4	3.1	1.1	0.0	0.0	0.0	0.0	0.7
HT	1.7	2.1	1.7	1.3	2.7	1.9	0.7	1.4	0.8	1.1	0.0	0.8	2.3	1.3	1.4
Myeloma	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.2	0.8	0.0	1.8	0.0	0.8	0.0	0.5

GP-ABGM, Good pasture-Anti glomerular basement membrane disease; HT, Hypertension; SLE, systemic lupus erythematosis; TMA-HUS, Thrombotic microangiopathy-Hemolytic uremic syndrome

Discussion

This report provides information about the incidence of renal diseases, diagnosed by renal biopsy, during a period of 12 years in the western part of Turkey. Ege University is one of the biggest universities in Turkey with a very active nephrology unit. We performed 1702 native renal biopsies during a period of 12 years, in a popu lation of approximately 4.7 million inhabitants of the western part of Turkey (30 biopsies p.m.p./per year).

Table 6. Annual incidence of primary glomerulonephritis in different European regions

Incidence (p.m.p.)	MN	FSGS	non-IgAN	IgA N	MesGN	MPGN	CresGN	MCD
Serbia[a]	12.4	11.1	10.8	8.5	19.3	6.1	3.8	1.9
Romania[b]	5.3	3.3	N/A	N/A	10	9.3	3.3	7.3
CRRB[c]	9.3	10.8	11.3	34.5	45.8	4.6	3.2	12.5
Western France[d]	6–17[e]	N/A	N/A	25–27[f]	N/A	2	4–27[g]	N/A
Turkey[h]	2.8	3.1	0.1	2.6	2.7	1.3	1.3	N/A

p.m.p.: per million population; MN, membranous nephropathy; FSGS, focal segmental glomerulosclerosis; non-IgAN, mesangioproliferative non-IgA nephropathy; IgAN, IgA nephropathy; MesGN, both non-IgAN and IgAN; MPGN, membranopriliferative glomerulonephritis; CresGN, crescentic glomerulonephritis; MCD, minimal change disease

[a]Serbia (single centre), period 2000–2006 [14].

[b]Romania (two regions, two centers), period 1995–2004 [13].

[c]CRRB—The Czech Registry of Renal Biopsies (28 centers), period 1994–2000 [12].

[d]Western France (single centre), period 1996–2002 [15].

[e]6 for the 20–59 years range and 17 for the 60–79 years range.

[f]25 for the 20–59 years range and 27 for the 60–79 years range.

[g]4 for the 20–59 years range and 27 for the 60–79 years range.

[h]Western Turkey (Ege) (single centre), period 1996-2009 for 16-82 years range

Although this is a single centre experience, it represents approximately 8% of all native renal biopsies performed in the whole country, which is similar or even higher to the relative population included in several renal biopsies registries [16-18]. Furthermore, all biopsy samples were analyzed at the same department of pathology by the same pathologists.

Renal biopsy registries can provide very important information about the epidemiology of renal diseases. However, geographical and racial characteristics, differrent indications for renal biopsy in various studies, analyzed clinical syndromes and variations in the pathological classification are sources of bias that make comparison and accurate conclusions difficult. For example, the Ita-

lian national registry [19] considered only three clinical syndromes (urinary abnormalities, NS and acute nephritic syndrome), while the Spanish renal biopsy registry included hypertension among the seven clinical syndromes analyzed [20]. Renal biopsy indications were grouped according to six clinical syndromes as described above. Histopathological diagnoses were grouped using a combination of the methods used in Italian and Spanish studies.

Table 1 clearly shows that the renal biopsy rate p.m.p./per year in our study is significantly lower than that in almost all European registries. Although this rate is steadily increasing, it is still significantly lower than that of most European countries excluding Romania and France (Table 1). This low biopsy rate (30 p.m.p./year) is due to a conservative approach before 1990s when the performance of percutaneous renal biopsies became a standard practice at our department. This conservative approach was a consequence of the opinion of most physiciians to perform kidney biopsy only when they felt that histology could alter the therapy or when patients had signs of progressive renal disease.

The mean age of patients at the time of biopsy was 40± 15.3 years old (range 16 - 82) and the majority of patients were males (51.7%). This may partly be explained by the tendency not to perform biopsies in elderly patients. The mean age at the time of renal biopsy increased during the period of 1996 to 2009 (Figure 4). This can be explained by the fact that elderly patients are more frequently having biopsies after ultrasonography-guided biopsy techniques have been introduced in routine clinical practice. This can also explain the increased incidence of systemic diseases and the decreased incidence of primary glomerular diseases in this population. There is no strict definition of the word 'elderly' but most gerontologists consider the age of 65 as the chronological cut-off point between adulthood and elderly. Although many characteristics of glomerular diseases are similar in the different ages, some types of GN may have different incidence, clinical presentation and prognosis in older patients in comparison with younger adults. In this study, the annual incidence of different types of GNs according to the age was also evaluated. Since treatment opportunities increase, the indications for renal biopsy may also increase. A slight male predominance was noted in the normal population, similarly to that observed in the Serbian registry [14].

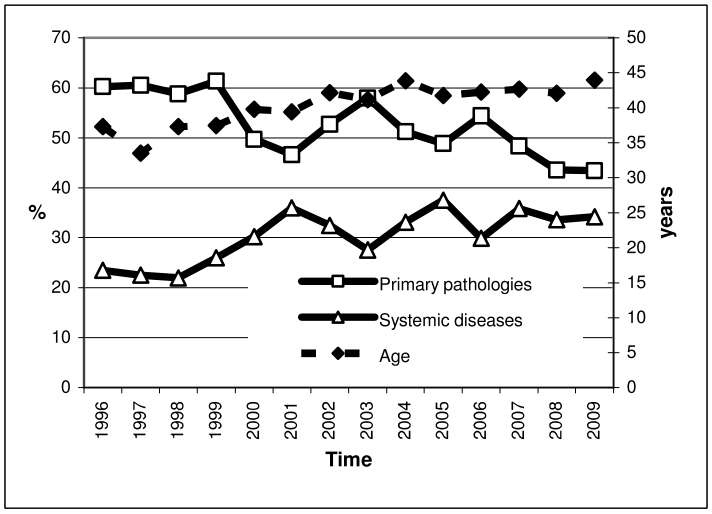

Fig. 4. Annual percentage of primary and secondary pathologies

It is not possible to draw conclusive epidemiological data on the frequency of the various types of GN, since the renal biopsy policy varies from centre to centre. However, some general conclusions can be reached in spite of this limitation. The renal biopsy is routinely examined by immunofluorescence and light microscopy, while electron microscopy is not routinely used. Probably, new techniques, such as PCR and in situ hybridization, applied to fresh renal specimens used for immunofluorescence will improve the diagnostic accuracy providing information on the mediators involved in the renal damage [21].

Our records have shown that renal biopsies are more frequently performed in the male population (51.7 %). This was also observed in the UK Medical Research Council's Glomerulonephritis Registry (61% of RB were performed in male patients) and in the US Renal Data System Annual Report of patients with end-stage renal disease (54.3 %) [22].

In this study the most frequent clinical syndrome of patients having renal biopsy at any age was the nephrotic syndrome followed by AUA in adults. Conversely, in the Italian registry, AUA is more common than nephrotic syndrome, perhaps expressing a tendency of the physicians to perform biopsy for asymptomatic haematuria or proteinuria [7]. In our study, the causes of NS in elderly and adult groups of patients were: amyloidosis (40 % vs. 29.2 %), MGN (22.5 % vs. 15.56 %) and FSGS (17.5 % vs. 15.21 %).

If we compare our results with other reports from different Balkan countries, primary GNs were less frequent than that observed in Romania, Moldova and Banat regions [2005, (66.2 %)], Italian Registry of Renal Biopsy [(IRRB), Gesualdo *et al.* (70.8 %)], Czech Registry of Renal Biopsy [(CRRB), Rychlik *et al.* (59.8 %)] and Serbia [Naumovic *et al.* (64.2 %)]. The prevalence of our secondary GNs were higher than in Romania, Moldova and Banat regions [2005, 26.4 %], IRRB [23.7 %], CRRB [25.4 %] and Serbia [25.1 %]. This may be due to the high prevalence of amyloidosis in our region (Table.1).
FSGS represents the most frequent histological diagnosis (10.3 %). In several studies, its incidence has been reported between 0.1 and 0.9 per 100 000, with a tendency to increase [7,15,23,24], probably due to genetic, socio-economic or environmental causes, or obesity [25 -27]. These data are not similar to those found in Japan [6] Italy [7], and Victoria in Australia [28] where IgAN constitutes the most frequent diagnosis. However, its prevalence is significantly lower in the registries of Kentucky [29] and Brazil [30]. While true variation may exist between populations, differences in biopsy policies, particularly in AUA, and classification criteria for histological diagnosis of renal biopsies may explain, at least in part, the observed geographical variations. We have less IgAN and MPGN than the west Europe due to conservative approach to asymptomatic hematuria and changes in microbiological milieu (Table 6). MPGN and post-streptococcal GN have previously been frequent renal biopsy findings; however, the frequencies of MPGN, post-streptococcal GN and rheumatic fever have decreeased during the past two decades. This has been attributed to improved life standards and public health together with early treatment of pharyngeal infections [31].
Additionally, GN with acute renal failure has been reported as a complication of other infections (e.g., by Brucella mellitensis or methicillin-resistant Staphylococcus aureus [32,33], and more prompt diagnosis and treatment of infectious diseases is probably responsible for the decreased incidence of these glomerulonephritides.
In our environment Familial Mediterranean Fever (FMF) is more common. FMF appears to be the leading cause of AA amyloidosis in our country, followed by tuberculosis and bronchiectasis, with or without chronic obstructive lung disease [31]. Amyloidosis was reported very frequently in our study (39%) among secondary GN. Also our institution was strongly interested in amyloidosis and it was shown that 90% of cases had AA amyloidosis [34].

Conclusion

In conclusion, this one center registry gives information on the incidence and prevalence of various primary and secondary glomerular diseases. Further epidemiologic studies are required in order to answer several open questions regarding prevention and treatment of glomerular diseases.

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Conflict of interest statement. None declared.

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