Increased incidence and improved prognosis of glomerulonephritis: a national 30-year study

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ABSTRACT

Background. While there are many cross-sectional studies of glomerulonephritis (GN) incidence, changes in incidence over time, particularly in the 21st century have received less attention. Similarly, little is known about temporal changes in GN prognosis. The presence in Denmark of comprehensive registries for renal biopsy results, end-stage renal disease (ESRD), comorbidity and mortality permit these questions to be addressed.

Methods. Data for all renal biopsies in Denmark between 1985 and 2014 were extracted from the Danish Renal Biopsy Registry and Pathobank registries. The date of first dialysis or transplantation was extracted from the Danish Nephrology Registry for those patients developing ESRD. Dates of death and presence of chronic comorbid conditions at date of biopsy were extracted from the National Patient Registry. The incidence of GN, adjusted to the 2013 European standard population, was calculated. ESRD incidence and mortality were calculated, both in absolute terms and after correction for age, comorbidity and presence of renal tubulointerstitial fibrosis.

Results. The incidence rose from 33.3 patients per million (ppm)/year in 1985–94 to 46.5 ppm in 2005–14. The increase could in part be related to changes in renal biopsy policy. Large increases in Anti-neutrophil cytoplasmic antibody (ANCA) vasculitis (ANCAV) (3.1–7.7 ppm/year) and focal segmental glomerulosclerosis (FSGS) (1.5–5.7 ppm/year) incidence were noted. The biopsy-proven prevalence of GN in 2014 was 748 ppm of which 155 ppm were being treated with dialysis or transplantation. Adjusted ESRD incidence fell by 25% during the study period, mortality by 62% and combined ESRD/mortality by 46%. The fall in ESRD incidence was limited to minimal change GN, FSGS, membranous GN and lupus nephritis, while reductions in mortality, and the combination of ESRD and/or death, were seen for nearly all GN diagnoses.

Conclusions. This study suggests that the incidence of GN has generally increased between 1985 and 2014, but some of the increase may be related to changes in renal biopsy policy. Major increases in FSGS and ANCAV incidence have occurred. The prognosis of GN, both as regards ESRD and mortality, has improved.

Keywords: ANCA, epidemiology, FSGS, glomerulonephritis, IgA nephropathy, lupus nephritis, membranous nephropathy, membranoproliferative glomerulonephritis, minimal change disease, prognosis
INTRODUCTION

While there are many studies concerning the incidence and prevalence of glomerulonephritis (GN), fewer studies have been published concerning changes in incidence over time [1–15]. Most of these studies only cover the period before 2000 [1–4, 6, 9, 10, 13, 14], while others only have a short period of observation [5, 8, 11]. Many of the studies do not have a defined background population, and thus express relative frequencies rather than absolute incidence. Two large reviews of the studies have been published [12, 16]. The studies are characterized by considerable regional heterogeneity, but in general document a falling frequency of mesangio proliferative GN (MesPGN) and membranous GN (MGN), and an increase in focal segmental glomerulosclerosis (FSGS). The frequency of IgA nephropathy seems to have fallen in recent years.

Only three studies have presented long-term studies with recent data [12, 15, 17]. The existence of a national, comprehensive renal biopsy registry in Denmark since 1985 permits an evaluation of changes in absolute GN incidence over a long period of time. Furthermore, by linking these data with national registries of end-stage renal disease (ESRD), comorbidity and death, estimates of GN prognosis can be performed.

MATERIALS AND METHODS

All patients with GN, as confirmed by renal biopsy, and residing in Denmark between the years 1985 and 2014 inclusive, were included. The study was an observational study in epidemiology and followed the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines for reporting observational studies [18].

Renal biopsies

The renal biopsy information was derived from two registries:

1. Danish Renal Biopsy Registry (DANYRBI). This registry recorded all biopsies performed in Denmark between 1985 and 1999 [19]. The reproducibility of the glomerular diagnosis has been investigated and found acceptable with a kappa value of 0.61 [20].

2. Since 2000 renal biopsy results have been registered by the National Pathology Data Bank (Patobank).

The following Systematized Nomenclature of Medicine (SNOMED) diagnoses were included (SNOMED codes in parentheses): minimal changes disease (MCGN), (M00100, combined with proteinuria or nephrosis: S65080, S67020, or S67550), endocapillary GN (EndGN, M46870), FSGS (M53341), MesPGN (M46811, M46862), MGN (M68130), membranoproliferative GN (MPGN) (M46842), proliferative GN (ProlGN, M46810), Focal GN (M46861), extracapillary (crescentic) GN (M46880), anti-glomerular basement membrane GN (AntiGBM) (S67400), ANCA vasculitis (ANCAV) (S76950), lupus nephritis (LN) (S38720). Due to inaccurate diagnosis of IgA nephropathy in early years, this diagnosis was combined with MesPGN, and classified as MesPGN. For most of these biopsies, the correct diagnosis will probably have been IgA GN and not primarily MesPGN. Most cases of EndGN will have been infection-related GN. For each patient, only one biopsy was included, being the first biopsy with a GN diagnosis. Patients <15 years old were excluded. For biopsies with multiple GN diagnoses, the first mentioned diagnosis was chosen, with the following exceptions: AntiGBM, ANCAV and LN were given first priority; MCGN was ignored in the presence of a more specific diagnosis. Microscopic diagnoses were supplemented with the following clinical diagnoses [International Classification of Diseases (ICD)] vide infra if these were compatible with microscopy: lupus (ICD-8 734.19, ICD-10 32.1–32.9), ANCAV (ICD-8 446.29, ICD-10 31.3), antiGBM (ICD-8 446.19, ICD-10 M31.0). The presence in the biopsy of tubulointerstitial fibrosis (M49000-M49005) was noted, but the registries do not contain information concerning degree of fibrosis.

The abbreviations used in this article are shown in Table 1.

Statistics

Charlson comorbidity index (CCI) [21] was calculated from the registered comorbidity. Incidence rates were calculated for the whole population and by 10-year age group. Temporal changes were assessed using three cohorts: 1986–94, 1995–2004 and 2005–14. Age-standardized incidence rates were calculated from the European Standard population 2013 published by Eurostat, the Statistical Office of the European Union [22].

Table 1. Abbreviations

| Abbreviation | Description |
|--------------|-------------|
| ANCA         | Antineutrophil cytoplasmic antibody |
| ANCAV        | ANCA vasculitis |
| AntiGBM      | Anti-glomerular basement membrane glomerulonephritis |
| CCI          | Charlson comorbidity index |
| DANYRBI      | Danish Renal Biopsy Registry |
| DM           | Diabetes mellitus |
| EndGN        | Endocapillary glomerulonephritis |
| ESRD         | End-stage renal disease |
| FSGS         | Focal segmental glomerulosclerosis |
| GN           | Glomerulonephritis |
| ICD          | International Classification of Diseases |
| LN           | Lupus nephritis |
| LPR          | National Patient Registry |
| LTF          | Lost to follow-up |
| MCGN         | Minimal change glomerulonephritis |
| MGN          | Membranous glomerulonephritis |
| MesPGN       | Membranoproliferative glomerulonephritis |
| MemPGN       | Membranoproliferative glomerulonephritis |
| ProlGN       | Proliferative glomerulonephritis |
| SNOMED       | Systematized Nomenclature of Medicine |
| STROBE       | STrengthening the Reporting of Observational studies in Epidemiology |
Normally distributed variables were compared using Student’s t-test. Categorical and non-parametric variables were compared using Chi-square and Mann–Whitney.

Patients were followed until death, emigration or 1 January 2015. Patient survival [censored for lost to follow-up (LTF)], renal survival (time to ESRD, censored for patient death or LTF) and combined survival (time to death or ESRD, censored for LTF) were calculated using Kaplan–Meier analysis and Cox proportional hazards iterative regression analysis. Relative risks for the cohorts 1995–2004 and 2005–14, compared with 1985–94 as referent, were calculated after adjusting for patient age, sex, comorbidities and tubulointerstitial fibrosis. It was assumed that tubulointerstitial fibrosis was a marker of changes in biopsy indications, in that increased biopsy incidence of uraemic patients with reduced kidney size would increase the incidence of tubulointerstitial fibrosis. The Statistica (Tulsa, USA) program was used for the statistical analysis.

### RESULTS

Patient details are shown in Table 2 and Figure 1. The mean age at biopsy rose from 46.3 ± 18 to 50.6 ± 18 years and CCI from 1.5 to 2.3 during the period of observation. The incidence of GN diagnoses is shown in Table 3. For most diagnoses, the absolute number and population-adjusted incidence of GN increased. However, the incidence of MesPGN, extracapillary GN and AntiGBM was unchanged, and EndGN incidence fell. Large increases in ANCAV (3.1–7.7 patients/million/year (ppm/year)) and FSGS (1.5–5.7 ppm/year) incidence were noted. The incidence of GN overall rose from 33.3 to 46.5 ppm/year. The biopsy-proven prevalence of GN in 2014 was 748 ppm of which 155 ppm were being treated with dialysis or transplantation. The relative frequency of the diagnoses for the period 2005–14 is compared with other published series in Table 4. Comparison between the studies is difficult due to differences in histological

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**Table 2. Distribution of patient number, relative per cent, age, sex and Charlson comorbidity index classified by renal diagnosis and cohort**

| Diagnosis                  | Number | Relative per cent | Age (years) | CCI       |
|----------------------------|--------|-------------------|-------------|-----------|
|                           | 85-94  | 95-04  | 05-14 | 85-94 | 95-04 | 05-14 | 85-94 | 95-04 | 05-14 |
| Minimal change             | 85-94  | 95-04  | 05-14 | 85-94 | 95-04 | 05-14 | 85-94 | 95-04 | 05-14 |
| Endocapillary              | 49     | 31     | 24    | 3.5   | 2.0   | 1.2   | 42.6 ± 1 | 52.2 ± 20 | 43.9 ± 18 |
| FSGS                      | 62     | 83     | 255   | 4.5   | 5.3   | 12.3  | 45.3 ± 16 | 46.7 ± 16 | 50.7 ± 17 |
| Mesangioproliferative      | 480    | 490    | 487   | 34.6  | 31.0  | 23.5  | 43.5 ± 17 | 45.8 ± 18 | 44.6 ± 19 |
| Membranous                 | 189    | 216    | 257   | 13.6  | 13.7  | 12.4  | 50.0 ± 17 | 54.0 ± 16 | 56.0 ± 16 |
| Membranoproliferative      | 59     | 70     | 103   | 4.3   | 4.4   | 5.0   | 45.3 ± 19 | 48.9 ± 16 | 56.4 ± 15 |
| Extracapillary             | 76     | 59     | 92    | 5.5   | 3.7   | 4.4   | 59.3 ± 15 | 56.4 ± 20 | 53.9 ± 19 |
| AntiGBM                    | 46     | 35     | 63    | 3.3   | 2.2   | 3.0   | 48.5 ± 21 | 53.8 ± 23 | 58.2 ± 20 |
| ANCAV                      | 116    | 222    | 332   | 8.4   | 14.1  | 16.0  | 57.9 ± 13 | 61.3 ± 14 | 61.7 ± 15 |
| Proliferative              | 19     | 23     | 35    | 1.4   | 1.5   | 1.7   | 55.8 ± 18 | 46.9 ± 21 | 44.1 ± 19 |
| Focal                      | 7      | 24     | 29    | 0.5   | 1.5   | 1.4   | 43.2 ± 21 | 51.3 ± 18 | 54.2 ± 16 |
| Lupus                      | 172    | 191    | 233   | 12.4  | 12.1  | 11.2  | 38.5 ± 17 | 37.0 ± 15 | 41.1 ± 16 |
| Total                      | 1388   | 1579   | 2076  | 100   | 100   | 100   | 46.3 ± 18 | 48.8 ± 18 | 50.6 ± 18 |

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**FIGURE 1**: Adjusted incidence of renal diagnoses by cohort.
classification, non-inclusion of secondary GN and subdivision of the results into cohorts and age groups. The published figures have therefore been adjusted to facilitate comparison.

The relationship of incidence to patient age is shown in Table 5 and Figure 2. The increase in incidence was particularly marked in age groups >50 years, but was also present in younger age groups.

In total, 692 (13.7%) biopsies contained tubulointerstitial fibrosis. This was evenly divided between diagnoses with some outliers: MCGN 16%, EndGN 5%, FSGS 28%. The proportion of biopsies with tubulointerstitial fibrosis rose during the period of observation (1985–94 5%; 1995–2004 14%; 2005–14 20%). The prevalence of chronically reduced renal function at biopsy increased (1985–94 47%; 1995–2004 57%; 2005–14 65%). The standardized incidence rate for biopsies without tubulointerstitial fibrosis also increased (1985–94 31.9 ppm/year; 1995–2004 32.0; 2005–14 37.3).

This increase was common for most diagnoses, except for MesPGN, where incidence fell from 10.7 ppm/year to 8.0.

The changes in 1-, 5- and 10-year absolute incidence of ESRD, death and ESRD/death combined are shown in Table 6. An unadjusted bivariate Kaplan–Meier analysis, including the two cohorts 1995–2004 and 2005–14 was performed. With one (stated) exception, the significance values shown refer to the overall significance of the analyses. The number of patients with EndGN, ProlGN and Focal GN was too small for statistical analysis. The incidence of ESRD showed a heterogeneous pattern. For some diagnoses incidence rose in the period 1995–2004, and then fell. Only MCGN, ANCAV and LN showed a consistent fall in ESRD incidence. There was no overall change in absolute ESRD incidence.

For all diagnoses except MGN, mortality fell, and this was significant for MCGN, extracapillary GN, ANCAV and LN. MGN showed a heterogeneous pattern, with an initial rise followed by a significant fall. The overall 5-year mortality fell from 24% to 14%. Except for MesPGN, falls in combined ESRD and death were also seen and were significant for MCGN, extracapillary GN, ANCAV and LN. The combined 5-year ESRD/mortality fell from 36% to 26%.

Multivariate Cox proportional hazards analysis including age, sex and comorbidity was performed to investigate whether changes were independent of changes in patient age and comorbidity. The results are shown in Table 7. The number of patients with EndGN, AntiGBM, ProlGN and Focal GN was generally too small for statistical analysis. The adjusted ESRD incidence fell by 25% during the period. This reduction was considerable for the period 2005–14, where incidence fell 20% compared with 1995–2004. The fall was particularly notable for MCGN, extracapillary GN, ANCAV and LN. The combined 5-year ESRD/mortality fell from 36% to 26%.

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DISCUSSION

Cross-sectional results from the DANYRBI have previously been published [28]. Detailed reviews of previously published
incidence studies are available [12, 16]. Comparison between the studies is difficult due to differences in histological classification, non-inclusion of secondary GN, and subdivision of the results into cohorts and/or age groups. A comparison of our latest results with selected publications is shown in Table 3. The published figures have been adjusted to facilitate comparison. The distribution in the present study is generally not atypical. IgA nephropathy is the most common diagnosis. MCGN, FSGS, MGN and LN are common diagnoses. EndGN, MPGN and crescentic GN are rare, while AntiGBM GN is excessively rare. The main difference is the high rate of ANCAV in recent years compared with most other countries (vide infra).

The primary aim of this study was to assess changes in the incidence and prognosis over time. This study has several advantages. The possibility of linking renal biopsy diagnoses to patient comorbidity, consequent death and/or ESRD, and general population statistics is unique. All registries involved are comprehensive. However, there are considerable methodological problems associated with assessing changes over so long a period.

The incidence of GN generally increased during the study period, except for EndGN, which fell. However, it would appear that the indications for renal biopsy were also increased. The average age of patients increased, and the increase in incidence was particularly marked among elderly patients. This is not the whole explanation, in that the incidence also increased among younger age groups (Table 5, Figure 2). Another possibility is that the indication for biopsy was increased to include patients with some degree of reduced renal size. Assuming that shrunken kidneys will have an increased degree of

Table 4. Absolute and adjusted incidence of GN classified by renal diagnosis and cohort

| Cohort               | Incidence (ppm) | Adjusted incidence (ppm) |
|----------------------|-----------------|--------------------------|
|                      | 85-94           | 95-04                    | 05-14 | 85-94 | 95-04 | 05-14 |
| Minimal change       | 2.7             | 3.1                      | 3.7b  | 2.6   | 3.1   | 3.7   |
| Endocapillary        | 1.2             | 0.7a                     | 0.5b  | 1.1   | 0.8   | 0.5b  |
| FSGS                 | 1.5             | 1.9                      | 5.7c  | 1.5   | 1.9   | 5.7c  |
| Mesangioproliferative| 11.3            | 11.3                     | 10.8  | 11.2  | 11.3  | 10.7  |
| Membranous           | 4.4             | 5.0                      | 5.7b  | 4.7   | 5.3   | 5.8b  |
| Membranoproliferative| 1.4             | 1.6                      | 2.3b  | 1.4   | 1.6   | 2.3b  |
| Extracapillary       | 1.8             | 1.4                      | 2.0   | 2.0   | 1.5   | 2.1   |
| AntiGBM              | 1.1             | 0.8                      | 1.4   | 1.1   | 0.9   | 1.5   |
| ANCAV                | 2.7             | 5.1c                     | 7.4c  | 3.1   | 5.8c  | 7.7c  |
| Proliferative        | 0.4             | 0.5                      | 0.8a  | 0.5   | 0.6   | 0.8a  |
| Focal                | 0.2             | 0.6b                     | 0.6b  | 0.2   | 0.6b  | 0.7c  |
| Lupus                | 4.1             | 4.4                      | 5.2b  | 3.8   | 4.1   | 5.1b  |
| Total                | 32.7            | 36.3                     | 46.2  | 33.3  | 37.3  | 46.5  |

\(^aP<0.05.\)  
\(^bP<0.01.\)  
\(^cP<0.001\) (versus 1985–94).

#ppm: patients per million inhabitants/year. Adjusted for European standard population 2013.

Table 5. Absolute incidence of GN classified by patient age and cohort

| Age (years) | Incidence (ppm) |
|-------------|-----------------|
|             | 85-94           | 95-04 | 05-14 |
| 15–19       | 26.1            | 35.0  | 36.3a |
| 20–29       | 30.9            | 31.4  | 37.4  |
| 30–39       | 29.0            | 27.3  | 39.1c |
| 40–49       | 28.4            | 28.2  | 39.6e |
| 50–59       | 42.0            | 45.1  | 46.9  |
| 60–69       | 48.7            | 55.9  | 66.0f |
| 70–79       | 37.5            | 51.4a | 70.0a |
| >79         | 7.0             | 17.4b | 30.4a |

\(^aP<0.05.\)  
\(^bP<0.01.\)  
\(^cP<0.001\) (versus 1985–94).
tubulointerstitial fibrosis, and vice versa, this will result in an increased incidence of tubulointerstitial fibrosis in the biopsies, which is what we found. However, the standardized incidence of fibrosis-free GN also increased, so this is not the entire explanation.

These considerations are not relevant for FSGS and ANCAV, where the increases were dramatic. The rising incidence of FSGS is well described in the literature [1–3, 5, 6], with some exceptions [8, 11, 15], and is often ascribed to increases in FSGS due to environmental and lifestyle changes, in particular the general increase in obesity [4, 5]. The increasing ANCAV incidence has also been previously described [29–31]. The cause is unknown. The increase in MCGN has previously been described [3, 15, 17], although one study has shown a stable incidence [5].

Similarly, a rising MGN has generally been seen after 2000 [11, 12, 15, 17]. We were unable to confirm previous studies, which have observed a falling incidence of MPGN [9, 13, 14, 17] and LN [11, 17]. Studies of IgA nephropathy incidence are heterogeneous, some finding an increase over time [5, 6, 10, 17], others an unchanged or falling incidence [9, 12, 15]. We found an unchanged incidence; interpretational difficulties are discussed below.

The overall absolute incidence of ESRD did not change during the study period. The incidence of ESRD generally rose from 1985–94 to 1995–2004, and then fell. The indication for dialysis and/or transplantation therapy has been widened to include elderly patients and those with Type 2 DM. Thus, the national incidence of ESRD rose from 62 to 139 ppm/year between 1990 and 2000 [32] after which it stabilized. This may explain the observed pattern. After adjusting incidence for age and Table 6. The 1-, 5- and 10-year incidence of end-stage renal disease (ESRD), death and the combination, classified by renal diagnosis and cohort

| ESRD | 1 år | 5 år | 10 år | Significance |
|------|------|------|-------|--------------|
|      | 85-94 | 95-04 | 05-14 | 85-94 | 95-04 | 05-14 | 85-94 | 95-04 | 05-14 |
| Minimal change | 0 | 2 | 0 | 3 | 2 | 2 | 12 | 3 | 0 | P = 0.05 |
| Endocapillary | 0 | 16 | 18 | 2 | 16 | 18 | 2 | 16 | 18 |
| FSGS | 5 | 7 | 2 | 24 | 21 | 16 | 40 | 38 | 33 |
| Mesangioproliferative | 6 | 8 | 8 | 18 | 17 | 20 | 26 | 26 | 34 |
| Membranous | 2 | 6 | 2 | 10 | 16 | 3 | 19 | 21 | 19 | P < 0.01 |
| Membranoproliferative | 16 | 14 | 18 | 34 | 22 | 26 | 50 | 42 | 42 |
| Extracapillary | 28 | 43 | 20 | 44 | 55 | 37 | 48 | 57 | 45 |
| AntiGBM | 43 | 49 | 51 | 63 | 69 | 61 | 72 | 73 | 64 |
| ANCAV | 12 | 20 | 7 | 18 | 30 | 18 | 38 | 37 | 24 | P < 0.01 |
| Proliferative | 22 | 27 | 15 | 29 | 43 | 19 | 43 | 54 | 46 |
| Focal | 33 | 13 | 22 | 50 | 18 | 22 | 50 | 21 | 22 |
| Lupus | 12 | 18 | 13 | 14 | 12 | 6 | 20 | 18 | 9 | P < 0.05* |
| Total | 7 | 12 | 9 | 18 | 20 | 16 | 27 | 27 | 25 | P < 0.05 |

Death

| Minimal change | 6 | 4 | 1 | 15 | 8 | 3 | 23 | 14 | 15 | P < 0.05 |
| Endocapillary | 28 | 36 | 8 | 21 | 22 | 8 | 12 | 10 | 8 |
| FSGS | 7 | 0 | 4 | 18 | 10 | 14 | 34 | 26 | 25 |
| Mesangioproliferative | 7 | 6 | 4 | 18 | 16 | 10 | 28 | 28 | 23 |
| Membranous | 6 | 12 | 5 | 18 | 24 | 12 | 29 | 33 | 29 | P < 0.05 |
| Membranoproliferative | 10 | 7 | 12 | 23 | 18 | 26 | 35 | 32 | 35 |
| Extracapillary | 42 | 27 | 9 | 63 | 39 | 20 | 75 | 54 | 20 | P < 0.001 |
| AntiGBM | 35 | 18 | 14 | 48 | 35 | 33 | 54 | 47 | 46 |
| ANCAV | 20 | 18 | 11 | 41 | 34 | 23 | 57 | 47 | 43 | P < 0.01 |
| Proliferative | 21 | 13 | 6 | 37 | 22 | 14 | 52 | 39 | 14 |
| Focal | 14 | 4 | 8 | 57 | 8 | 20 | 57 | 42 | 48 |
| Lupus | 7 | 3 | 4 | 20 | 13 | 11 | 27 | 19 | 12 | P < 0.05 |
| Total | 11 | 9 | 6 | 24 | 20 | 14 | 34 | 30 | 25 | P < 0.001 |

Combined

| Minimal change | 6 | 6 | 1 | 17 | 9 | 5 | 38 | 14 | 16 | P < 0.01 |
| Endocapillary | 12 | 26 | 20 | 21 | 36 | 26 | 28 | 45 | 26 |
| FSGS | 10 | 8 | 6 | 37 | 30 | 24 | 57 | 51 | 41 |
| Mesangioproliferative | 12 | 12 | 11 | 30 | 26 | 26 | 42 | 40 | 44 |
| Membranous | 8 | 15 | 6 | 26 | 32 | 13 | 39 | 42 | 35 | P < 0.001 |
| Membranoproliferative | 24 | 19 | 28 | 47 | 36 | 44 | 67 | 59 | 61 |
| Extracapillary | 61 | 56 | 37 | 79 | 69 | 48 | 86 | 73 | 52 | P < 0.01 |
| AntiGBM | 63 | 76 | 61 | 81 | 80 | 71 | 85 | 82 | 74 |
| ANCAV | 26 | 32 | 20 | 49 | 46 | 34 | 67 | 58 | 49 | P < 0.01 |
| Proliferative | 37 | 35 | 21 | 47 | 52 | 29 | 63 | 65 | 52 |
| Focal | 42 | 17 | 25 | 71 | 25 | 39 | 71 | 49 | 50 |
| Lupus | 10 | 10 | 6 | 30 | 20 | 16 | 40 | 31 | 20 | P < 0.01 |
| Total | 17 | 18 | 14 | 36 | 32 | 26 | 48 | 44 | 40 | P < 0.001 |

*1995–2004 versus 2005–14 only.

Figures in per cent.
Table 7. Risk of ESRD, death and the combination, relative to the cohort 1985–94

| Diagnosis       | 95-04 | 05-14 | 95-04 | 05-14 | 95-04 | 05-14 |
|-----------------|-------|-------|-------|-------|-------|-------|
| Minimal change  | 0.44  | 0.21  | 0.53  | 0.29  | 0.54  | 0.31  |
| Endocapillary   | 2.52  | 2.56  | 0.51  | 0.37  | 1.15  | 0.99  |
| FSFGS           | 0.87  | 0.59  | 0.49  | 0.35  | 0.75  | 0.48  |
| Membranoproliferative | 0.83  | 1.00  | 0.69  | 0.44  | 0.77  | 0.76  |
| Membranoproliferative | 1.01  | 0.32  | 0.79  | 0.31  | 0.88  | 0.32  |
| Extracapillary  | 1.20  | 0.58  | 0.52  | 0.20  | 0.79  | 0.36  |
| AntiGBM         | 1.64  | 1.39  | 0.33  | 0.26  | 1.09  | 0.86  |
| ANCAV           | 1.11  | 0.69  | 0.57  | 0.37  | 0.72  | 0.45  |
| Proliferative   | 1.57  | 1.01  | 0.42  | 0.98  | 1.21  | 0.87  |
| Focal           | 1.65  | 1.06  | 0.20  | 0.38  | 0.74  | 0.67  |
| Lupus           | 1.04  | 0.50  | 0.59  | 0.36  | 0.76  | 0.43  |
| Total           | 0.94  | 0.75  | 0.62  | 0.38  | 0.76  | 0.54  |

*P < 0.05.
*P < 0.01.
*P < 0.001.

Adjusted for age, sex and comorbidity.

Increased incidence and improved prognosis of glomerulonephritis

In this study, the incidence of ESRD fell by 25%. This fall was significant for MGN, and LN, and borderline significant for MCGN and FSFGS.

No change in ESRD incidence was seen for ProLGN, Focal GN, EndGN, AntiGBM and MesPGN. While the first four diagnoses were too rare to permit reliable statistical analysis, the observation is probably true for MesPGN. The estimates of incidence and prognosis of MesPGN are problematic. No reliable estimates of the proportion of IgA nephritis in this study could be made. Younger patients with monosymptomatic haematuria and a normal renal function will rarely be biopsied, since the presumptive diagnosis is IgA nephropathy, and treatment nonspecific. Renal biopsy is reserved for patients with progressive renal failure or a high degree of proteinuria. This probably explains the poor prognosis of MesPGN in this study compared with other series [33, 34]. The incidence of non-fibrotic MesPGN fell from 10.7 to 8.0 ppm/year; the findings are not incompatible with other series [33, 34]. The incidence of non-fibrotic MesPGN in Denmark for a number of renal diagnoses were too rare to permit reliable statistical analysis, the observation is probably true for MesPGN.

With these caveats, this study suggests that the incidence of MesPGN in this study compared with other series [33, 34]. The incidence of non-fibrotic MesPGN fell from 10.7 to 8.0 ppm/year; the findings are not incompatible with other series [33, 34]. The incidence of non-fibrotic MesPGN in Korea.

CONFLICT OF INTEREST STATEMENT

None declared. The results presented in this article have not been published previously in whole or part, except in abstract format.

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