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# Cancer Development and Mortality Differences in Patients with Glomerulonephritis after Renal Biopsy: A Single Center Retrospective Cohort Study

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**Objectives:** This retrospective cohort study was conducted to evaluate the cancer incidence in renal biopsy proven glomerulonephritis (GN) patients during the follow ups and to find out the mortality differences according to cancer occurrence.

**Methods:** This is a retrospective cohort study conducted in a single center. Among 1,600 patients who have underwent renal biopsy between 2003 and 2017, in Seoul National Bundang Hospital, after excluding 611 patients who are inappropriate for the analysis, a total 929 adult patients were analyzed. (Figure) Baseline clinical characteristics, renal biopsy result and types and dose of immunosuppressant usages during the follow-up were collected. Incidence of cancer was censored when the 1st cancer was diagnosed and the mortality was detected during the follow ups.

**Results:** During the mean 52.4 months (range 1.0-166.7 months) of follow-up, total 49 cases were newly diagnosed as cancer. When we compared the clinical characteristics between the patients who developed cancer and the others, cancer patient were older and had higher prevalence of coronary heart disease and diabetes, lower level of hemoglobin and higher immunosuppressant usage. (Table) When the multivariate Logistic regression analysis were conducted to find out the risk factors for the cancer development, membranous nephropathy (MN) pathologic diagnosis showed hazard ratio of 2.6 (95% CI 1.32-5.30) after adjusting age, gender, clinical parameters and usage of immunosuppressant. In MN patients, the patients who developed cancer had higher mortality with hazard ratio of 5.95 (95% CI 1.36-26.09, p=0.018) compared to MN patients without cancer, when the multivariate Cox's proportional hazard model were conducted.

**Conclusions:** Among the GN population without concurrent cancer, patients with MN should be aware of cancer developments during the follow up, since they have significant higher risk of cancer devolvement and which results in higher mortality rate.

Flow sheet of study population selection

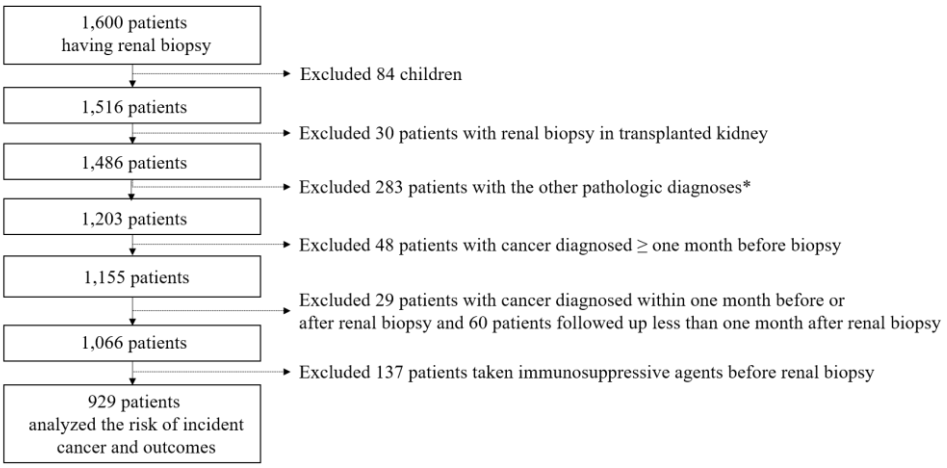


Figure 1. Selection of patients
* Pathologic diagnoses other than non-specific GN, amyloidosis, crescentic GN, diabetic nephropathy, FSGS, IgA nephropathy, lupus nephritis, minimal change lesion, membranous nephropathy, MPGN-immune complex type, TIN, or TMA

Clinical characteristics of patients according to development of cancer after renal biopsy

| | Cancer (-) | Cancer (+) | p-value |
|---|---|---|---|
| Number | 880 | 49 | |
| Age (year) | 48.8 ± 16.4 | 57.5 ± 13.4 | <0.001 |
| Gender (male, %) | 430 (48.9) | 28 (57.1) | 0.359 |
| History of CVD | 69 (7.8) | 4 (8.2) | 0.790 |
| History of CHD | 52 (5.9) | 7 (14.3) | 0.019 |
| DM | 142 (16.4) | 14 (29.8) | 0.018 |
| Hypertension | 549 (62.4) | 29 (59.2) | 0.653 |
| SBP (mmHg) | 128.7 ± 18.9 | 132.8 ± 23.8 | 0.395 |
| DBP (mmHg) | 74.0 ± 12.0 | 72.8 ± 12.7 | 0.521 |
| Protein (g/dl) | 6.1 ± 1.1 | 6.2 ± 1.3 | 0.637 |
| Albumin (g/dl) | 3.4 ± 0.8 | 3.2 ± 0.7 | 0.083 |
| Bilirubin (mg/dl) | 0.51 ± 0.40 | 0.49 ± 0.22 | 0.548 |
| Cholesterol (mg/dl) | 217 ± 89 | 211 ± 73 | 0.760 |
| Glucose (mg/dl) | 119 ± 46 | 112 ± 36 | 0.359 |
| Hemoglobin (g/dl) | 12.7 ± 2.2 | 11.7 ± 2.2 | 0.008 |
| Creatinine (mg/dl) | 1.32 ± 1.42 | 1.95 ± 2.63 | 0.891 |
| GFR (ml/mion/1.73 m2) | 79.0 ± 35.8 | 71.2 ± 36.8 | 0.185 |
| UPCR (g/g cr) | 3.06 ± 3.81 | 3.93 ± 4.30 | 0.102 |
| Albumin by dipstick (≥2+) | 645 (76.7) | 35 (72.9) | 0.548 |
| Pathologic diagnosis | | | 0.077 |
| Non-specific GN | 28 (3.2) | 2 (4.1) | |
| Amyloidosis | 5 (0.6) | 1 (2.0) | |
| Crescentic GN | 27 (2.1) | 2 (4.1) | |
| Diabetic nephropathy | 49 (5.6) | 4 (8.2) | |
| FSGS | 88 (10.0) | 6 (12.2) | |
| IgA nephropathy* | 388 (44.1) | 12 (24.5) | |
| Lupus nephritis | 24 (2.7) | 3 (6.1) | |
| MCD | 81 (9.2) | 1 (2.0) | |
| MN* | 118 (13.4) | 13 (26.5) | |
| IC type of MPGN | 32 (3.6) | 2 (4.1) | |
| TIN | 32 (3.6) | 2 (4.1) | |
| TMA | 8 (0.9) | 0 (0.0) | |
| FU until detection of cancer (months) | 52.2 ± 45.6 | 58.4 ± 43.7 | 0.174 |
| Usage of immunosuppressive medication until detection of cancer | | | |
| Any kind of immunosuppressant (n, %) | 378 (43.0) | 31 (63.3) | 0.005 |
| Azathioprin (n, %) | 39 (4.4) | 4 (8.2) | 0.278 |
| Cyclophosphamide (n, %) | 122 (13.9) | 12 (24.5) | 0.039 |
| Mycophenolate (n, %) | 49 (5.6) | 4 (8.2) | 0.519 |
| Rituximab (n, %) | 11 (1.3) | 0 (0.0) | 1.000 |
| Prednisolone (n, %) | 373 (42.4) | 29 (59.2) | 0.021 |
| Tacrolimus (n, %) | 84 (9.5) | 3 (6.1) | 0.614 |
| Cyclosporin (n, %) | 63 (7.2) | 2 (4.1) | 0.571 |
| Total dose of medication until detection of cancer | | | |
| Azathioprin (g) | 1.53 ± 14.95 | 3.41 ± 15.44 | 0.214 |
| Cyclophosphamide (g) | 1.39 ± 5.28 | 4.91 ± 14.28 | 0.025 |
| Mycophenolate (g) | 56.20 ± 32.07 | 46.73 ± 26.79 | 0.476 |
| Rituximab (g) | 0.03 ± 0.38 | 0.0 ± 0.0 | 0.431 |
| Prednisolone (g) | 4.46 ± 10.22 | 6.48 ± 10.96 | 0.035 |
| Tacrolimus (g) | 0.18 ± 1.04 | 0.05 ± 0.26 | 0.416 |
| Cyclosporin (g) | 7.48 ± 47.10 | 1.01 ± 6.06 | 0.392 |

* The p-value for development of cancer was significant ($p < 0.05$) when the incidence of cancer was compared between patients with a certain pathologic finding and the others