ANNALS OF TRANSPLANTATION

ORIGINAL PAPER

e-ISSN 2329-0358
© Ann Transplant, 2021; 26: e931873
DOI: 10.12659/AOT.931873

Received: 2021.02.28
Accepted: 2021.04.09
Available online: 2021.04.16
Published: 2021.05.14

Nationwide Survey of Post-Transplant Glomerular Diseases, Based on the Japan Renal Biopsy Registry (J-RBR)

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEFG 1 Joichi Usui
ABCDE 1 Kunihiro Yamagata
ABCDE 2 Michio Nagata
BDE 3 Akira Shimizu
BDE 4 Asami Takeda
BDE 5 Hitoshi Sugiyama
BDE 6 Hiroshi Sato
BDE 7 Hitoshi Yokoyama
Committee for the Standardization of Renal Pathological Diagnosis and Renal Biopsy and Disease Registry of the Japanese Society of Nephrology

1 Department of Nephrology, Faculty of Medicine, University of Tsukuba, Tsukuba, Ibaraki, Japan
2 Department of Pathology, Faculty of Medicine, University of Tsukuba, Tsukuba, Ibaraki, Japan
3 Department of Analytic Human Pathology, Nippon Medical School, Tokyo, Japan
4 Kidney Disease Center, Japanese Red Cross Nagoya Daini Hospital, Nagoya, Aichi, Japan
5 Department of Human Resource Development of Dialysis Therapy for Kidney Disease, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama, Japan
6 Clinical Pharmacology and Therapeutics, Tohoku University Graduate School of Pharmaceutical Sciences, Sendai, Miyagi, Japan (present address: JR Sendai Hospital, Sendai, Japan)
7 Department of Nephrology, Kanazawa Medical University School of Medicine, Uchinada, Ishikawa, Japan

Part of this work was presented in the 62nd annual meeting of the Japanese Society of Nephrology, Nagoya, in June 2019

Corresponding Author: Joichi Usui, e-mail: j-usui@md.tsukuba.ac.jp

Source of support: This survey was supported in part by a Grant-in-Aid for Intractable (former name, Progressive) Renal Diseases Research, Research on Intractable Disease, from the Ministry of Health, Labour and Welfare of Japan, and the Japan Society for the Promotion of Science (JSPS) KAKENHI Grant Numbers JP19KK0216 (J.U.)

Background: Nationwide data on allograft kidney biopsies have been limited in number, in contrast to the large amount of accumulated data on native kidney biopsies. In this context, we have surveyed transplant biopsy data based on the nationwide database, the Japan Renal Biopsy Registry (J-RBR).

Material/Methods: A total of 2430 transplant biopsy cases were registered in the web-based J-RBR from January 2007 to January 2018. We categorized the entries regarding both the purpose of the biopsy and pathological diagnosis, and confirmed transplant glomerular diseases based on the clinical and pathological diagnosis.

Results: Of the 2430 total transplant biopsy cases, 637 cases, including 9 cases of baseline biopsy, 216 cases of protocol biopsy, and 232 cases of episode biopsy, had a pathological diagnosis, including glomerular diseases, rejection, calcineurin inhibitor nephropathy, and interstitial fibrosis and tubular atrophy. Of these, 127 cases presented with glomerular disease, including 8 cases of baseline biopsy, 23 of protocol biopsy, 59 of episode biopsy, and 37 of unknown purpose). A total of 127 biopsies with glomerular disease revealed a high prevalence of immunoglobulin A nephropathy (n=38, 29.9%), followed by mesangial proliferative glomerulonephritis (n=29, 22.8%) and focal segmental glomerulosclerosis (n=8, 6.3%) when focused on protocol and episode biopsies.

Conclusions: The nationwide transplant biopsy database demonstrated the pathological characteristics of 637 cases, including 127 cases of post-transplant glomerular disease. The protocol and episode biopsies included high prevalence rates of IgAN, followed by FSGS.

Keywords: **Glomerulonephritis, IGA • Kidney Transplantation • Pathology**

Abbreviations: **ANCA** – anti-neutrophil cytoplasmic antibody; **CNI** – calcineurin inhibitor; **DN – diabetic nephropathy; ESKD – end-stage kidney disease; FSGS – focal segmental glomerulosclerosis; IF/TA – interstitial fibrosis and tubular atrophy; IgAN – immunoglobulin A nephropathy; J-RBR – the Japan Renal Biopsy Registry; MesPGN – mesangial proliferative glomerulonephritis; MGN – membranous glomerulonephritis; MPGN – membranoproliferative glomerulonephritis; MPO – Myeloperoxidase; PR3 – Proteinase 3**

Full-text PDF: https://www.annalsoftransplantation.com/abstract/index/idArt/931873

2069 3 1 12

Indexed in: [Science Citation Index Expanded] [Index Medicus/MEDLINE] [Chemical Abstracts] [Scopus]

Background

Post-transplant glomerular disease has a strong impact on kidney allograft failure and long-term graft survival. Glomerular disease accounts for about 30% of end-stage kidney disease (ESKD), and its recurrence after transplantation leads to a decline in kidney allograft function and graft loss [1]. The post-transplant glomerular diseases identified included various characteristics, including not only recurrent glomerular disease but also transmitted glomerular disease and *de novo* glomerular disease. Data on the frequency and prognosis of post-transplant glomerular disease have been accumulated and have been reported for each type of glomerular disease, such as immunoglobulin A nephropathy (IgAN), focal segmental glomerulosclerosis (FSGS), and membranoproliferative glomerulonephritis (MPGN). In Japan, however, the data on post-transplant glomerular disease have been limited to single-center experiences, and nationwide data have never been collected before. In this context, we herein report the incidence and characteristics of post-transplant glomerular disease, based on the Japan Renal Biopsy Registry (J-RBR) [2].

Material and Methods

Entries Based on the J-RBR

We analyzed transplant biopsy data from all over the country based on the J-RBR, which was launched in 2007 by the Committee for the Standardization of Renal Pathological Diagnosis and the Committee for the Kidney Disease Registry of the Japanese Society of Nephrology. It is a nationwide, web-based, and prospective registry system in Japan [2]. The registry includes patient data on the clinical diagnosis, histological diagnosis based on the pathogenesis, and histological diagnosis based on a histopathological examination with additional information. The pathological diagnosis was made by nephrologists, nephropathologists, and pathologists, depending on each institution. The J-RBR appears in the Clinical Trial Registry of UMIN (registration number UMIN 000000618), and the Ethics Review Board of the Japanese Society of Nephrology and each research institution approved the study in accordance with the Declaration of Helsinki (The University of Tsukuba Hospital, No. H20-330). Written informed consent was obtained from all the patients who participated in the J-RBR. In the present sub-study, we surveyed all entries from January 2007 to January 2018 and selected cases with kidney allograft biopsy. The present sub-study was approved by the Ethics Review Board of the University of Tsukuba Hospital (No. H30-253).

The Diagnostic Classification of the J-RBR

In the J-RBR, clinical diagnoses were divided into these categories: acute nephritic syndrome, rapidly progressive nephritic syndrome, recurrent or persistent hematuria, chronic nephritic syndrome, nephrotic syndrome, renal disorder with metabolic disorder, renal disorder with collagen disease or vasculitis, hypertensive nephropathy, inherited renal disease, acute renal failure, drug-induced nephropathy, renal transplantation, congenital renal urinary tract abnormalities, polycystic kidney disease, hemolytic uremic syndrome/thrombotic thrombocytopenic purpura, and others. Next, the histological diagnoses based on the pathogenesis were classified into categories, including primary glomerular disease except IgAN, IgAN, purpura nephritis, lupus nephritis, Myeloperoxidase (MPO)-anti-neutrophil cytoplasmic antibody (ANCA)-positive nephritis, Proteinase 3 (PR3)-ANCA-positive nephritis, anti-glomerular basement membrane antibody nephritis, hypertensive nephrosclerosis, thrombotic microangiopathy, diabetic nephropathy (DN), amyloid nephropathy, Alport syndrome, thin basement membrane disease, infection-related nephropathy, transplanted kidney, and others. Finally, histological diagnoses based on a histopathological examination were divided into these categories: minor glomerular abnormalities, FSGS, membranous glomerulonephritis (MGN), mesangial proliferative glomerulonephritis (MesPGN), endocapillary proliferative glomerulonephritis, MPGN types I and III, dense deposit disease, crescentic and necrotizing glomerulonephritis, sclerosing glomerulonephritis, nephrosclerosis, acute interstitial nephritis, chronic interstitial nephritis, acute tubular necrosis, transplanted kidney, and others.

Clinicopathological Parameters and Statistics

Other than the clinical diagnosis, histological diagnosis based on the pathogenesis, and histological diagnosis based on histopathological examination, each patient's data contained additional information, including the timing and reason for the biopsy and the pathological findings. Information on the timing and reason for the transplant biopsy was divided into baseline, protocol, and episode, on the basis of additional comments in questionnaires from each institution. Baseline biopsies included both time-zero and 1-hour post-reperfusion biopsies. The timing of the protocol biopsies varied depending on the institution. Episode biopsies included cases such as elevation of serum creatinine, proteinuria and hematuria. Cases without any information on the timing of the transplantation were categorized as unknown. As for pathological findings, we focused on 4 categories, namely glomerular diseases, rejection, calcineurin inhibitor (CNI) nephropathy, and interstitial fibrosis and tubular atrophy (IF/TA), as representative. Duplicates were allowed in these pathological findings. Data on age and creatinine are presented as means ± standard deviation.

Indexed in: [Science Citation Index Expanded] [Index Medicus/MEDLINE] [Chemical Abstracts] [Scopus]

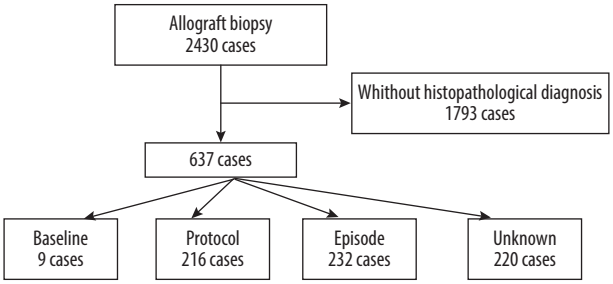

Figure 1. Entry number of the study on renal allograft biopsies of Japan Renal Biopsy Registry.

Table 1. Clinicopathological characteristics of renal allograft biopsies.

		Baseline	Protocol	Episode	Unknown	Total
Number	(n)	9	216	232	220	637
Age	(Average±SD years)	45.8±20.0	43.5±13.6	42.3±14.5	38.4±16.9	41.3±15.4
Sex	(Male: Female)	6:3	102:74	162:70	133:87	403:234
Urinary protein	–	7	73	75	111	266
	±	0	66	45	37	148
	1+	1	30	70	35	136
	2+	1	3	27	22	53
	3+	0	4	14	10	28
	4+	0	0	1	5	6
Hematuria	–	7	125	130	133	395
	±	1	16	27	26	70
	1+	1	14	17	15	47
	2+	0	9	36	18	63
	3+	0	12	22	28	62
Serum creatinine	(Average±SD mg/dL)	7.8±3.7	1.4±0.3	2.5±2.0	2.3±2.0	2.2±1.9
Pathological diagnosis	Glomerular disease	8	23	59	37	127
	Rejection	0	56	114	65	235
	CNI nephropathy	0	14	42	24	80
	IF/TA	0	10	5	29	44

CNI – calcineurin inhibitors, IF/TA – interstitial fibrosis and tubular atrophy.

Results

Diagnosis and Classification in all 2430 Cases

A total of 2430 cases, categorized as "transplanted kidney" cases in the histological diagnosis based on the pathogenesis, were selected for this investigation on kidney allograft biopsy. As for the clinical diagnoses, 2379 cases were categorized as renal transplantations, 4 cases as acute nephritic syndrome, 3 cases as rapidly progressive nephritic syndrome, 36 as chronic nephritic syndrome (of these 36 cases, 23 cases were also labeled as renal transplantation), 5 cases as nephrotic syndrome, 1 case as renal disorder with metabolic disorder, 2 cases as hypertensive nephropathy, 1 case as inherited renal disease, 1 case as acute renal failure, 1 case as drug-induced nephropathy, 11 cases as congenital renal urinary tract abnormalities, and 9 cases as others.

As for the histological diagnoses based on a histopathological examination, 2356 cases were transplanted kidney cases, followed by 8 cases of minor glomerular abnormalities, 1 of FSGS, 2 of MGN, 3 of MesPGN, 1 of endocapillary proliferative glomerulonephritis, 3 of MPGN (types I and III), 1 of dense deposit disease, 1 of crescentic and necrotizing glomerulonephritis, 1 of sclerosing glomerulonephritis, 5 of acute interstitial nephritis, 4 of chronic interstitial nephritis, 9 of acute tubular necrosis, and 35 others.

Indexed in: [Science Citation Index Expanded] [Index Medicus/MEDLINE] [Chemical Abstracts] [Scopus]

Table 2. Pathological diagnosis in biopsy-proven glomerular diseases.

	Baseline				Protocol			
	Transmission	Recurrence	Unknown	Total	Transmission	Recurrence	Unknown	Total
IgAN	4	0	2	6	1	5	8	14
FSGS	0	0	0	0	0	1	1	2
MGN	1	0	0	1	0	0	0	0
MPGN	0	0	0	0	0	0	0	0
MesPGN	0	0	0	0	0	1	5	6
DN	0	0	0	0	0	0	0	0
Others	0	0	1	1	0	1	0	1
Total	5	0	3	8	1	8	14	23
	Episode				Unknown			
	Transmission	Recurrence	Unknown	Total	Transmission	Recurrence	Unknown	Total
IgAN	1	21	2	24	0	20	1	21
FSGS	0	3	3	6	0	2	3	5
MGN	0	0	0	0	0	1	1	2
MPGN	0	0	1	1	0	0	2	2
MesPGN	0	1	22	23	0	0	2	2
DN	0	0	1	1	1	0	1	2
Others	0	0	4	4	0	2	1	3
Total	1	25	33	59	1	25	11	37

IgAN – immunoglobulin A nephropathy; FSGS – focal segmental glomerulosclerosis; MGN – membranous glomerulonephritis; MPGN – membranoproliferative glomerulonephritis; MesPGN – mesangial proliferative glomerulonephritis; DN – diabetic nephropathy.

Transplant Biopsy with Histopathological Findings

Of the 2430 total transplant biopsy cases, 1793 cases were excluded from the present investigation because they were lacking a pathological diagnosis (**Figure 1**). The remaining 637 cases included 9 cases of baseline biopsy, 216 cases of protocol biopsy, 232 cases of episode biopsy, and 220 cases with an unknown cause for the biopsy. Of these 637 cases, post-transplant glomerular disease was diagnosed in 127 cases.

Clinical Characteristics of Renal Allograft Biopsies

Table 1 shows the clinical characteristics of the renal allograft biopsies, including age, sex, urinary protein level, hematuria, serum creatinine, and histopathological diagnosis, represented as glomerulonephritis, rejection, CNI nephropathy, and IF/TA. In 637 cases, the age on average was 41.3±15.4, with 403 males and 234 females; 223 cases presented with proteinuria (more than 1+) and 172 cases with hematuria (more than 1+). The serum creatinine level was 2.2±1.9 mg/dL in total, 7.8±3.7 mg/dL in baseline, 1.4±0.3 mg/dL in protocol, 2.5±2.0 mg/dL in episode, and 2.3±2.0 mg/dL in unknown cause. As for the histopathological diagnoses, glomerular disease was found in 127 cases, rejection in 235 cases, CNI nephropathy in 80 cases, and IF/TA in 44 cases. Of the 127 cases of glomerular disease, 8 were in baseline, 23 in protocol, 59 in episode, and 37 in unknown cause, respectively.

Post-transplant Glomerular Disease

The histopathological diagnoses in cases of biopsy-proven glomerular disease were divided into IgAN, FSGS, MGN, MPGN, MesPGN, DN, and others (**Table 2**). The cases were also classified into transmission, recurrence, and unknown for each type of biopsy. Even though none of the cases were clearly described as *de novo* glomerular disease, "unknown" cases may also include *de novo* glomerular diseases.

A total of 127 biopsies with glomerular disease revealed a high prevalence of IgAN (n=65, 51.2%), followed by MesPGN (n=31, 24.4%) and FSGS (n=13, 10.2%). The number of baseline biopsies was limited, but these biopsies showed a high prevalence of transmission of IgAN from donors compared to other glomerular diseases. In protocol and episode biopsies, the prevalence was the highest for IgAN, with 38 cases (29.9%), 14 in protocol biopsies and 24 in episode, followed by MesPGN, with 29 cases (22.8%), 6 in protocol and 23 in episode, and FSGS, with 8 cases (6.3%), 2 in protocol and 6 in episode.

Indexed in: [Science Citation Index Expanded] [Index Medicus/MEDLINE] [Chemical Abstracts] [Scopus]

Table 3. Characteristics of post-transplant glomerular diseases obtained from nationwide survey.

		Hariharan 1999	Chailimpa-montree 2009	An 2012	Allen 2017	Present study 2019
Country		USA	Canada	Korea	Australia & NZ	Japan
Number of renal transplants	(n)	4913	2026	764	17 549	2 430
Pre-transplant glomerular disease (Biopsy-proven)	(n, %)					
	Total	NA	734	195	6 597	NA
	IgAN	NA	246, 33.5	129, 66.2	2501, 37.9	NA
	FSGS	NA	196, 26.7	16, 8.2	1403, 21.3	NA
	MGN	NA	20, 2.7	4, 2.1	357, 5.4	NA
	MPGN	NA	42, 5.7	8, 4.1	376, 5.7	NA
Post-transplant glomerular disease (Biopsy-proven)	(n, %)					
	Total	167	94	70	NA	127
	IgAN	22, 13.2	45, 47.9	54, 77.1	NA	38, 29.9
	FSGS	57, 34.1	30, 31.9	8, 11.4	NA	8, 6.3
	MGN	16, 9.6	6, 6.4	2, 2.9	NA	0, 0.0
	MPGN	18, 10.8	5, 5.3	3, 4.3	NA	1, 0.8
Recurrence of glomerular disease	(n, %)					
	Total	NA	68	NA	553	33
	IgAN	NA	38, 55.9	NA	225, 40.7	26, 78.8
	FSGS	NA	19, 27.9	NA	144, 26.1	4, 12.1
	MGN	NA	2, 2.9	NA	49, 8.9	0, 0.0
	MPGN	NA	2, 2.9	NA	61, 11.0	0, 0.0

USA – United States of America; NZ – New Zealand; NA – not available; IgAN – immunoglobulin A nephropathy; FSGS – focal segmental glomerulosclerosis; MGN – membranous glomerulonephritis; MPGN – membranoproliferative glomerulonephritis.

The number of cases of IgAN recurrence was 5 in protocol and 21 in episode, accounting for the highest number compared to other glomerular diseases. In addition, MesPGN cases may include IgAN, suggesting that the number of recurrent IgAN cases may have actually been higher. Combining the cases from protocol, episode, and unknown, excluding baseline cases, the number of recurrence cases was 46 for IgAN, 6 for FSGS, 1 for MGN, 0 for MPGN, 2 for MesPGN, and 0 for DN. In addition, as described above, most of the MesPGN cases were presumed to be IgAN.

Discussion

Graft survival has improved year by year, and after 2010, the graft survival rate was 98.7% at 1 year and 94.3% at 5 years for living donor transplants and 96.7% at 1 year and 88.0% at 5 years for deceased donor transplants in Japan (*http://www.asas.or.jp/jst/pdf/factbook/factbook2018.pdf*). These improvements owe much to the improvement in immunosuppressants; in other words, the impact of recurrent glomerular disease on graft survival has been increasing over recent years. El-Zoghby et al reported that glomerular disease accounted for 36.6% of cases of graft loss [3]. Among the different types of glomerular disease, IgAN and FSGS are known to have high recurrence rates of almost 30-60% [4].

Nationwide data on post-transplant glomerular disease are limited, but 4 studies referred to its prevalence, shown in **Table 3** [1,5-7]. The number of allograft kidney biopsy, the prevalence of pre- and post-transplant glomerular disease, and the recurrence rate of glomerular disease were all addressed in these studies. In the present study, there was a total of 127 cases of post-transplant glomerular disease, including 38 cases (29.9%) of IgAN and 8 cases (6.3%) of FSGS when focused on protocol and episode biopsies, excluding the baseline and unknown categories. As for the recurrence of glomerular diseases, there were 33 cases in protocol and episode biopsies, including 26 cases (78.8%) of IgAN and 4 cases (12.1%) of FSGS. In the data from countries other than Japan, either

Indexed in: [Science Citation Index Expanded] [Index Medicus/MEDLINE] [Chemical Abstracts] [Scopus]

post-transplant glomerular disease or the recurrence of glomerular disease or both were given, with IgAN showing the highest number of cases followed by FSGS in most of these studies, except for a survey from the USA. These findings were similar to those of the present study.

Some risk factors have been reported for the development of recurrent glomerular diseases. For example, in recurrent IgAN, young age, male sex, a rapidly progressive course of the original disease before transplantation, the presence of specific HLA genotypes, no HLA mismatch, and high serum IgA levels have been reported to be risk factors [8-10]. For FSGS, recurrent risk factors include young age, rapid progression to ESKD, bilateral nephrectomy, White race, and loss of a previous allograft due to FSGS recurrence [11,12]. Preventive measures, represented as perioperative rituximab and therapeutic plasma exchange, have been studied, but post-transplant recurrence of FSGS remains unresolved.

In the present study, even though the total number was limited when focused on glomerular disease, the high prevalence rates of IgAN and FSGS showed the same trend as in previous studies. In addition, MesPGN in this study might include IgAN, suggesting the possibility that there were more cases of recurrent IgAN. Considering the fact that the prevalence of IgAN is higher in Eastern Asian countries than in North America or European countries, further studies from Japan may help achieve a better allograft prognosis. The present study has 3 limitations. First, the timing of the baseline and protocol biopsies were different depending on the institution. For example, the baseline biopsies included both 0-hour and 1-hour biopsies. Second, the registry form was not fully established for accumulating allograft biopsy data, resulting in there being limited information on the timing of the biopsies and the clinical course. However, the registry was renewed in 2018 and the current system is now suitable not only for native kidney biopsies but also for allograft biopsies. We are aiming to analyze these newly accumulated data with our present data in the near future. Third, the diagnostic ability varied across institutions, which caused difficulties in integrating the information. Our future task is to close diagnostic gaps among institutions and to standardize pathological diagnosis.

Conclusions

The present study is the first to show the whole picture of transplant kidney biopsy in Japan. Nationwide renal transplant data are limited even in other countries, suggesting the importance of accumulating integrated data. This registry is ongoing with more specific data on kidney transplantation, and further studies with more detailed information are needed, with the goals of tackling the recurrence of glomerular disease and attaining better graft survival.

Acknowledgments

We thanks to Dr. Mayumi Takahashi-Kobayashi (University of Tsukuba Hospital), Shuzo Kaneko (University of Tsukuba) for critical reading of the manuscript.

Conflict of interest

None.

Appendix

The following investigators and initial institutions have participated in the development of the J-RBR since 2007: Hirofumi Makino and Hitoshi Sugiyama (Okayama University), *late* Takashi Taguchi (Nagasaki University), Hitoshi Yokoyama (Kanazawa Medical University), Hiroshi Sato (Tohoku University), Takao Saito (Fukuoka University; present institution: Sanko Clinic), Yoshie Sasatomi (Fukuoka University; present institution: Saiseikai Fukuoka General Hospital), Yukimasa Kohda (Kumamoto University; present institution: Hikarinomori Clinic), Shinichi Nishi (Niigata University; present institution: Kobe University), Kazuhiko Tsuruya (Kyushu University; present institution: Nara Medical University), Yutaka Kiyohara (Kyushu University; present institution: Hisayama Research Institute For Lifestyle Diseases), Hideyasu Kiyomoto (Kagawa University; present institution: Tohoku Medical Megabank Organization, Tohoku University), Hiroyuki Iida (Toyama Prefectural Central Hospital; present institution: Toyama Prefectural Rehabilitation Hospital), Tamaki Sasaki (Kawasaki Medical School), Makoto Higuchi (Shinshu University; present institution: National Hospital Organization Matsumoto Medical Center (Matsumoto), Motoshi Hattori (Tokyo Women's Medical University), Kazumasa Oka (Osaka Kaisei Hospital; present institution: Hyogo Prefectural Nishinomiya Hospital), Shoji Kagami (The University of Tokushima Graduate School), Michio Nagata (University of Tsukuba), Tetsuya Kawamura (The Jikei University School of Medicine), Masataka Honda (Tokyo Metropolitan Children's Medical Center), Yuichiro Fukasawa (KKR Sapporo Medical Center; present institution: Sapporo City General Hospital), Atsushi Fukatsu (Kyoto University Graduate School of Medicine; present institution: Fukatsu Medical Clinic), Kunio Morozumi (Japanese Red Cross Nagoya Daini Hospital; present institution: Masuko Memorial Hospital), Norishige Yoshikawa (Wakayama Medical University), Yukio Yuzawa (Fujita Health University), Seiichi Matsuo (Nagoya University Graduate School of Medicine) and Kensuke Joh (Chiba-East National Hospital; present institution: Tohoku University Graduate School of Medicine).

Indexed in: [Science Citation Index Expanded] [Index Medicus/MEDLINE] [Chemical Abstracts] [Scopus]

The following investigators and institutions participated the J-RBR in March 2018.

Hokkaido District: Asahikawa Medical University Hospital (Division of Cardiology, Nephrology, Pulmonology and Neurology, Department of Internal Medicine), Naoyuki Hasebe, Naoki Nakagawa, National Hospital Organization Hokkaido Medical Center (Department of Nephrology), Sekiya Shibazaki, Tomotsune Miyamoto, Masanori Ito, Hokkaido University Graduate School of Medicine (Department of Rheumatology, Endocrinology and Nephrology, Faculty of Medicine and Graduate School of Medicine, Hokkaido University), Saori Nishio, Hokkaido University Graduate School of Medicine (Department of Pediatrics), Takayuki Okamoto, KKR Sapporo Medical Center (Department of Pathology), Akira Suzuki, Sapporo Medical University (Department of Cardiovascular, Renal and Metabolic Medicine), Norihito Moniwa, Marenao Tanaka, Teine Keijinkai Hospital (Department of Nephrology), Hideki Takizawa.

Tohoku District: Iwate Prefectural Central Hospital (Department of Nephrology and Rheumatology), Jun Soma, Izaya Nakaya, Kazuhiro Yoshikawa. Fukushima Medical University School of Medicine (Department of Nephrology, Hypertension, Diabetology, Endocrinology, and Metabolism), Masaaki Nakayama, Koichi Asahi, Hiroaki Satoh. Japan Community Health Care Organization Sendai Hospital (Department of Nephrology), Toshinobu Sato, Asako Fujimori, Satoru Sanada, Mitsuhiro Sato. Tohoku University Hospital and affiliated hospitals (Internal Medicine), Hiroshi Sato, Mariko Miyazaki, Takashi Nakamichi, Tae Yamamoto. Yamagata University School of Medicine (Department of Cardiology, Pulmonology, and Nephrology), Tsuneo Konta, Kazunobu Ichikawa. Yamagata University School of Medicine (Department of Pediatrics), Daisuke Ogino.

Kanto District: National Hospital Organization Chiba-East Hospital (Department of Pathology), Hiroshi Kitamura, (Department of Internal Medicine), Toshiyuki Imazawa, (Department of Pediatrics), Chieko Matsumura, (Department of Surgery), Naotake Akutsu. National Hospital Organization Chiba-East Hospital (Department of Urology), Koichi Kamura, present address, Harunclinic Sakura, Dokkyo Medical University Saitama Medical Center (Department of Nephrology), Tetsuro Takeda, Dokkyo Medical University (Department of Cardiology and Nephrology), Toshihiko Ishimitsu, Gunma University Graduate School of Medicine (Department of Nephrology and Rheumatology), Keiju Hiromura, Yoriaki Kaneko, Hidekazu Ikeuchi, Toru Sakairi, Jichi Medical University (Division of Nephrology), Daisuke Nagata, Shigeaki Muto, Osamu Saito, Tetsu Akimoto, The Jikei University School of Medicine (Division of Nephrology and Hypertension), Takashi Yokoo, Nobuo Tsuboi, Kentaro Koike, The Jikei University School of Medicine, Katsushika Medical Center (Division of Nephrology and Hypertension), Masato Ikeda, Shinya Yokote, The Jikei University School of Medicine, Daisan Hospital (Division of Nephrology and Hypertension), Yoichi Miyazaki, Hiroyuki Ueda, Junichiro Kato, Mai Tanaka, The Jikei University Kashiwa Hospital (Division of Nephrology and Hypertension), Makoto Ogura, Akihiro Shimizu, Juntendo University Faculty of Medicine (Department of Nephrology), Yusuke Suzuki, Miyuki Takagi, Hitoshi Suzuki, Teruo Hidaka, Kawaguchi Municipal Medical Center (Division of Nephrology), Masahiro Ishikawa, Kyorin University School of Medicine (Department of Urology), Kikuo Nutahara, Kyorin University School of Medicine (Division of Nephrology and Rheumatology, First Department of Internal Medicine), Shinya Kaname, Miho Karube, Kazuhito Fukuoka, Mito Saiseikai General Hospital (Division of Nephrology), Itaru Ebihara, Chihiro Satho, Nippon Medical School (Division of Nephrology, Department of Internal Medicine), Shuichi Tsuruoka, Yukinao Sakai, Akio Hirama, Akiko Mii, Nihon University School of Medicine (Division of Nephrology, Hypertension and Endocrinology), Yoshinobu Fuke, Saitama Medical University, Faculty of Medicine (Department of Nephrology), Hirokazu Okada, Tsutomu Inoue, Saitama Medical University, Saitama Medical Center (Department of Nephrology and Hypertension), Takatsugu Iwashita, Yuta Kogure, Kouichi Kanouzawa, Hajime Hasegawa, Showa University School of Medicine (Division of Nephrology, Department of Medicine), Takanori Shibata, Showa University Fujigaoka Hospital (Division of Nephrology, Department of Medicine), Yoshihiko Inoue, St. Marianna University School of Medicine (Division of Nephrology and Hypertension, Department of Internal Medicine), Tomo Suzuki, Daisuke Ichikawa, Sayuri Shirai, Yugo Shibagaki, Tokai University School of Medicine (Division of Nephrology, Endocrinology and Metabolism), Takehiko Wada, Masafumi Fukagawa, Teikyo University School of Medicine (Department of Internal Medicine), Yoshihide Fujigaki, Teikyo University School of Medicine (Department of Urology), Shigeo Horie(*), Satoru Muto(*), *: present address, Juntendo University School of Medicine (Department of Urology), Tokyo Medical University Ibaraki Medical Center (Department of Nephrology), Masaki Kobayashi, Kouichi Hirayama, Homare Shimohata, Tokyo Metropolitan Children's Medical Center (Department of General Pediatrics), Riku Hamada, Hiroshi Hataya, Tokyo Women's Medical University (Department of Pediatric Nephrology), Motoshi Hattori, Kenichiro Miura, Kiyonobu Ishizuka, Tokyo Women's Medical University (the Forth Department of Medicine), Kosaku Nitta, Keiko Uchida, Takahito Moriyama, Toranomon Hospital, Nephrology Center, Yoshifumi Ubara, Tatsuya Suwabe, Junichi Hoshino, Noriko Hayami, The University of Tokyo (Department of Nephrology and Endocrinology), Masaomi Nangaku, Tetsuhiro Tanaka, Yoshifumi Hamasaki, Kenjiro Honda, University of Tokyo (Department of Pediatrics), Yutaka Harita, Kenichiro Miura, University of Tsukuba (Department of Nephrology), Kunihiro Yamagata, Joichi Usui, Tetsuya Kawamura, Yokohama City University Graduate School of Medicine (Department of Medical Science

Indexed in: [Science Citation Index Expanded] [Index Medicus/MEDLINE] [Chemical Abstracts] [Scopus]

and Cardiorenal Medicine), Kouichi Tamura, Junji Yamauchi, Yokohama City University Medical Center, Nobuhito Hirawa, Sanae Saka, Akira Fujiwara.

Koushinetsu District: Niigata University Graduate School of Medical and Dental Sciences (Division of Clinical Nephrology and Rheumatology), Ichiei Narita, Shin Goto, Yumi Itoh, Naofumi Imai, Shinshu University School of Medicine (Department of Nephrology), Yuji Kamijo, Koji Hashimoto, Akinori Yamaguchi, Sonoda Kosuke, University of Yamanashi Hospital (Third Department of Internal Medicine), Fumihiko Furuya, Daiichiro Akiyama, Kazuya Takahashi, Kenichiro Kitamura.

Hokuriku District: National Hospital Organization Kanazawa Medical Center (Department of Nephrology and Rheumatology), Kiyoki Kitagawa, Kanazawa Medical University School of Medicine (Department of Nephrology), Hitoshi Yokoyama, Keiji Fujimoto, Norifumi Hayashi, Kanazawa Medical University (Department of Diabetology & Endocrinology), Daisuke Koya, Yuka Kurosima, Kanazawa University Hospital (Division of Nephrology), Takashi Wada, Kengo Furuichi, Miho Shimizu, Norihiko Sakai, Komatsu Sophia Hospital, Yasuhiro Katou, Yuta Yamamura, Moriyama Koshino Clinic, Yoshitaka Koshino, Public Central Hospital of Matto-Ishikawa, Kazuya Takasawa, Chikako Takaeda, Sugita Genpaku Memorial Obama Municipal Hospital, Haruyoshi Yoshida, Takayasu Horiguchi, Toyama Prefectural Central Hospital (Department of Internal Medicine), Masahiko Kawabata, Toyama City Hospital (Department of Internal Medicine), Satoshi Ota, Yoh-ichi Ishida, University of Fukui, Faculty of Medical Sciences (Division of Nephrology, Department of General Medicine), Masayuki Iwano, Hideki Kimura, Naoki Takahashi, Kenji Kasuno, University of Toyama (Second Department of Internal Medicine), Hidenori Yamazaki.

Tokai District: Aichi Children's Health and Medical Center (Department of Pediatric Nephrology), Naoya Fujita, Satoshi Hibino, Kazuki Tanaka, Aichi Medical University School of Medicine (Division of Nephrology and Rheumatology), Yasuhiko Ito, Takuhito Nagai, Takayuki Katsuno, Hironobu Nobata, Chuno Kosei Hospital, Shogo Kimura, Yuka Soga, Fujinomiya City General Hospital, Masanori Sakakima, Kazuto Kitajima, Taichi Sato, Yutaro Kawakatsu, Fujita Health University School of Medicine (Department of Nephrology), Yukio Yuzawa, Hiroki Hayashi, Kazuo Takahashi, Hamamatsu University School of Medicine, University Hospital (Internal Medicine1, Division of Nephrology), Hideo Yasuda, Naro Ohashi, Taichi Sato, Japanese Red Cross Nagoya Daini Hospital (Kidney Center), Asami Takeda, Yasuhiro Otsuka, Nagoya City East Medical Center, Minamo Ono, Tatsuya Tomonari, Nagoya City University Graduate School of Medical Sciences (Department of Cardiorenal Medicine and Hypertension), Michio Fukuda, Masashi Mizuno, Taisei Suzuki, Satoru Kominato, Nagoya Kyoritsu Hospital (Department of Internal Medicine), Hirotake Kasuga, Nagoya University Graduate School of Medicine (Department of Nephrology), Seiichi Matsuo, Shoichi Maruyama, Yoshinari Yasuda, Shizuoka General Hospital (Department of Nephrology), Noriko Mori, Satoshi Tanaka, Mie University Graduate School of Medicine (Department of Cardiology and Nephrology), Eiji Ishikawa, Mika Fujimoto, Tomohiro Murata, Masaaki Ito, Yokkaichi Social Insurance Hospital (Division of Nephrology and Blood Purification), Yasuhide Mizutani, Hitoshi Kodera, Masato Miyake.

Kinki District: Hyogo Prefectural Nisihinomiya Hospital (Department of Pathology), Kazumasa Oka, Ikeda City Hospital (Department of Nephrology), Nobuyuki Kajiwara, Kitano Hospital, Tazuke Kofukai Medical Research Institute (Department of Nephrology and Dialysis), Tatsuo Tsukamoto, Tomomi Endo, Eri Muso, Kobe University Graduate School of Medicine (Division of Nephrology and Kidney Center), Shinichi Nishi, Shunske Goto, Kobe University Graduate School of Medicine (Department of Pediatrics), Kazumoto Iijima, Hiroshi Kaito, Takeshi Ninchoji, JCHO Kobe Central Hospital, Yoko Adachi, National Hospital Organization Kyoto Medical Center (Division of Nephrology), Koichi Seta, Kensei Yahata, Kyoto Prefectural University of Medicine Graduate School of Medical Science (Department of Nephrology), Keiichi Tamagaki, Tetsuro Kusaba, Yayoi Shiotsu, Kyoto University Graduate School of Medicine (Department of Nephrology), Motoko Yanagita, Hideki Yokoi, Kaoru Sakai, Akira Ishii, Nara Medical University (Department of Nephrology), Kazuhiko Tsuruya, Kenichi Samejima, National Cerebral and Cardiovascular Center (Division of Hypertension and Nephrology), Satoko Nakamura, Osaka City University Graduate School of Medicine (Department of Nephrology), Eiji Ishimura, Katsuhito Mori, Akihiro Tsuda, Shinya Nakatani, Osaka City General Hospital (Division of Nephrology and Hypertension),Yoshio Konishi, Takashi Morikawa, Chizuko Kitabayashi, Osaka City General Hospital (Division of Pediatrics), Rika Fujimaru, Osaka General Medical Center (Department of Kidney Disease and Hypertension), Terumasa Hayashi, Tatsuya Shoji, Osaka Women's and Children's Hospital (Department of Pediatric Nephrology and Metabolism), Katsusuke Yamamoto, Osaka Medical College (Department of Pediatrics), Akira Ashida, Osaka Red Cross Hospital (Department of Nephrology), Akira Sugawara, Masao Koshikawa, Yoshihisa Ogawa, Tomoko Kawanishi, Osaka Rosai Hospital (Department of Nephrology), Atsushi Yamauchi, Katsuyuki Nagatoya, Ryota Haga, Osaka University Graduate School of Medicine (Department of Nephrology), Yoshitaka Isaka, Ryohei Yamamoto, Tomoko Namba, Saiseikai Shiga Hospital (Division of Nephrology), Toshiki Nishio, Shiga University of Medical Science (Department of Medicine), Shinichi Araki, Shirasagi Hospital (Kidney Center), Shigeichi Shoji, Kenjiro Yamakawa, Senji Okuno, Toyonaka Municipal Hospital (Division of Nephrology), Megumu Fukunaga, Wakayama Medical University (Department of Pediatrics), Yuko Shima, Wakayama Medical University (Department of Nephrology), Takashi Shigematsu, Masaki Ohya.

Indexed in: [Science Citation Index Expanded] [Index Medicus/MEDLINE] [Chemical Abstracts] [Scopus]

Chugoku District: Kawasaki Medical School (Department of Nephrology and Hypertension), Naoki Kashihara, Tamaki Sasaki, Hajime Nagasu, Kurashiki Central Hospital (Division of Nephrology), Kenichiro Asano, Motoko Kanzaki, Kosuke Fukuoka, Hiroshima University Hospital (Department of Nephrology), Takao Masaki, Shigehiro Doi, Ayumu Nakashima, Toshiki Doi, Mizushima Kyodo Hospital (Department of Nephrology), Kan Yamazaki, Nobuyoshi Sugiyama, Yuichiro Inaba, Kouji Ozeki**,** Okayama Saiseikai General Hospital (Department of Nephrology), Makoto Hiramatsu, Keisuke Maruyama, Noriya Momoki, Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences (Department of Nephrology, Rheumatology, Endocrinology and Metabolism), Hiroshi Morinaga, Keiko Tanaka, Ayu Akiyama, Saiseikai Yamaguchi General Hospital (Department of Internal Medicine), Tsuyoshi Imai, Shimane University Faculty of Medicine (Division of Nephrology), Takafumi Ito, Tottori University, Faculty of Medicine (Division of Pediatrics and Perinatology), Shinichi Okada, Koichi Kitamoto, Hiroki Yokoyama, Yuko Yamada.

Shikoku District: Kagawa University, Faculty of Medicine (Department of Cardiorenal and Cerebrovascular Medicine & Department of Clinical Pathology), Tetsuo Minamino, Tadashi Sofue, Yoko Nishijima, Yoshio Kushida, Kochi University, Kochi Medical School (Department of Endocrinology, Metabolism and Nephrology), Yoshio Terada, Taro Horino, Yoshinori Taniguchi, Yoshiko Shimamura, Kochi University, Kochi Medical School (Department of Pediatrics), Mikiya Fujieda, Masayuki Ishihara, Tokushima University Graduate School (Department of Pediatrics, Institute of Biomedical Sciences), Shoji Kagami, Maki Urushihara, Yukiko Kinoshita, Tokushima University Graduate School (Department of Nephrology, Institute of Biomedical Sciences), Toshio Doi, Hideharu Abe, Kojiro Nagai.

Kyushu District: Fukuoka University (Division of Nephrology and Rheumatology, Department of Internal Medicine, Faculty of Medicine), Hitoshi Nakashima, Kosuke Masutani**,** Japanese Red Cross Fukuoka Hospital (Department of Pediatrics), Ken Hatae, Manao Nishimura, Hiroyo Maruyama, Japanese Red Cross Fukuoka Hospital (Nephrology and Dialysis Center), Koji Mitsuiki, Kumamoto University Graduate School of Medical Sciences (Department of Nephrology), Masashi Mukoyama, Masataka Adachi, Kurume University School of Medicine (Division of Nephrology, Department of Medicine), Kei Fukami, Junko Yano, Kyushu University Graduate School of Medical Sciences (Department of Medicine and Clinical Science), Toshiaki Nakano, Akihiro Tsuchimoto, Shunsuke Yamada, Yuta Matsukuma, Kyushu University Graduate School of Medical Sciences (Department of Environmental Medicine), Yutaka Kiyohara, Toshiharu Ninomiya, Masaharu Nagata, Miyazaki Prefectural Miyazaki Hospital (Division of Nephrology), Naoko Yokota-Ikeda, Keiko Kodama, Nagasaki University Hospital (Department of Pathology), *late* Takashi Taguchi, Nagasaki University Hospital (Department of Nephrology), Tomoya Nishino, Hideyuki Arai, Yoko Obata, Tadashi Uramatsu, National Fukuoka Higashi Medical Center (Kidney Unit), Ritsuko Katafuchi, National Hospital Organization Kyushu Medical Center, Masaru Nakayama, Oitaken Kouseiren Tsurumi Hospital (Division of Nephrology), Ryokichi Yasumori, Saga University, Faculty of Medicine (Department of Internal Medicine), Yuji Ikeda, Motoaki Miyazono, Shuichi Rikitake, Makoto Fukuda, St. Mary's Hospital, Harumichi Higashi, University of Miyazaki Hospital (Division of Nephrology), Shouichi Fujimoto, Yuji Sato, Masao Kikuchi, Akihiro Minakawa, University of Occupational and Environmental Health (Second Department of Internal Medicine), Masahito Tamura, Tetsu Miyamoto, University of the Ryukyus Graduate School of Medicine (Department of Cardiology, Nephrology and Neurology), Yusuke Ohya, Kentaro Kohagura.

References:

1. Allen PJ, Chadban SJ, Craig JC, et al. Recurrent glomerulonephritis after kidney transplantation: risk factors and allograft outcomes. Kidney Int. 2017;92(2):461-69
2. Sugiyama H, Yokoyama H, Sato H, et al. Japan Renal Biopsy Registry: The first nationwide, web-based, and prospective registry system of renal biopsies in Japan. Clin Exp Nephrol. 2011;15(4):493-503
3. Hickson LJ, El-Zoghby ZM, Lorenz EC, et al. Patient survival after kidney transplantation: Relationship to pretransplant cardiac troponin T levels. Am J Transplant. 2009;9(6):1354-61
4. Morozumi K, Takeda A, Otsuka Y, et al. Recurrent glomerular disease after kidney transplantation: An update of selected areas and the impact of protocol biopsy. Nephrology (Carlton). 2014;19(Suppl. 3): 6-10
5. Hariharan S, Adams MB, Brennan DC, et al. Recurrent and de novo glomerular disease after renal transplantation: A report from renal allograft disease registry. Transplant Proc. 1999;31(1-2):223-24
6. Chailimpamontree W, Dmitrienko S, Li G, et al. Probability, predictors, and prognosis of posttransplantation glomerulonephritis. J Am Soc Nephrol. 2009;20(4):843-51
7. An JN, Lee JP, Oh YJ, et al. Incidence of post-transplant glomerulonephritis and its impact on graft outcome. Kidney Res Clin Pract. 2012;31(4):219-26
8. Avasare RS, Rosenstiel PE, Zaky ZS, et al. Predicting post-transplant recurrence of IgA nephropathy: The importance of crescents. Am J Nephrol. 2017;45(2):99-106
9. Andresdottir MB, Haasnoot GW, Persijn GG, Claas FH. HLA-B8, DR3: A new risk factor for graft failure after renal transplantation in patients with underlying immunoglobulin A nephropathy. Clin Transplant. 2009;23(5):660-65
10. Garnier AS, Duveau A, Demiselle J, et al. Early post-transplant serum IgA level is associated with IgA nephropathy recurrence after kidney transplantation. PLoS One. 2018;13(4):e0196101
11. Ponticelli C. Recurrence of focal segmental glomerular sclerosis (FSGS) after renal transplantation. Nephrol Dial Transplant. 2010;25(1):25-31
12. Kienzl-Wagner K, Waldegger S, Schneeberger S. Disease recurrence-the sword of damocles in kidney transplantation for primary focal segmental glomerulosclerosis. Front Immunol. 2019;10:1669

Indexed in: [Science Citation Index Expanded] [Index Medicus/MEDLINE] [Chemical Abstracts] [Scopus]