

History and Current Practice of Blood Purification Therapy in Nippon Medical School Musashi Kosugi Hospital: 31 Years of Practice

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Abstract

Introduction: Renal replacement therapy was established in Japan approximately 40 years ago, and a blood purification unit was established in our hospital 31 years ago. With an eye toward the future, we reviewed and analyzed the practice of blood purification therapy in our hospital to date.

Methods: Patients were selected from 3 decades when therapy was performed: from October 1979 through December 1989, from January 1990 through December 1999, and from January 2000 through December 2010.

Results: The total number of patients was 1,115. The numbers of patients with stage 5D/T chronic kidney disease, with acute kidney injury, and undergoing therapeutic apheresis has increased with each decade. Diabetic nephropathy, chronic glomerulonephritis, and nephrosclerosis are the most frequent primary causes of stage 5D/T chronic kidney disease. The percentage of patients with diabetic nephropathy at our hospital has increased markedly and has recently been more than 50% and has exceeded the national average. The trends observed in our study for mean age at the start of dialysis therapy were similar to national trends. Peritoneal dialysis was started in 1999, and the percent of patients undergoing peritoneal dialysis greatly exceeded the national average. Various pathophysiologies were found to be associated with acute kidney injury and therapeutic apheresis.

Conclusion: The number of patients requiring renal replacement therapy continues to increase with the development of the hospital, especially in the Department of Nephrology. Progress in blood purification therapies is remarkable as well. To successfully address these challenges, we must strive for continued self-assessment.

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Key words: history, blood purification therapy, apheresis, hemodialysis, peritoneal dialysis

Introduction

In Japan, approximately 40 years have passed since hemodialysis was established as a replacement therapy for renal failure, and today, long-term survival is possible in many patients with end-stage renal disease¹. On the basis of requests from hospitals and clinics in the community, the blood purification unit of the Nippon Medical School Musashi Kosugi Hospital was opened in October 1979. The unit was expanded from 4 beds to 10 beds in April 2005. More than 1,000 patients with renal disease have been treated in our unit. There have been remarkable advances in blood purification therapy during this period; various therapies other than hemodialysis began to be provided, and changes were noted in patient characteristics.

In the present study, we divided the data into decades and analyzed the number of patients, patient characteristics, and type of blood purification therapy over the 31 years 3 months that blood purification therapy has been provided in our hospital.

Methods

We reviewed all patients who began blood purification therapy in our hospital from the time that the blood purification therapy unit was established through December 2010. We excluded from the analysis patients who had first undergone therapy at other institutions and were subsequently referred to our hospital.

Patient data were divided into 3 study periods: the 1980s—from October 1979 through December 1989 (10 years 3 months); the 1990s—from January 1990 through December 1999 (10 years); and the 2000s—from January 2000 through December 2010 (11 years). The results were compared with present trends in Japan, compiled from the annual records of the Japanese Society for Dialysis Therapy.

Patients with stage 5D/T chronic kidney disease (CKD) were defined as those who began maintenance hemodialysis or peritoneal dialysis during each period. Patients with acute kidney

Table 1 Numbers of patients

	CKD Stage 5D/T	AKI	Apheresis	Total
1980s	119	75	25	219
1990s	204	88	37	329
2000s	234	258	75	567
Total	557	421	137	1,115

Table 2 Mean age of new patients beginning dialysis

	Our hospital	JSDT (year)
		51.9 (1983)
1980s	57.2	58.1 (1990)
1990s	63.2	63.8 (2000)
2000s	65.1	67.8 (2010)

injury (AKI) were divided into prerenal, intrinsic, and postrenal groups. Patients with AKI included those with CKD requiring transient dialysis therapy, which is called “acute on chronic renal failure.” Therapeutic apheresis included the following treatments: plasma exchange, double filtration plasmapheresis, plasma adsorption, direct hemoperfusion, and cytapheresis. Cell-free and concentrated ascites reinfusion therapy was not included in this study.

Results

The total number of new patients from the establishment of the blood purification unit through December 2010 was 1,115. The number of patients increased with each decade, with a particularly marked increase in the 2000s. The same trend was found for stage 5D/T CKD, AKI, and apheresis (**Table 1**).

The mean age of patients with stage 5D/T CKD at the start of dialysis increased each decade. The mean age in 2000, 65.1 years, was 7.9 years greater than that in the 1980s. As in the annual statistical survey of the Japanese Society for Dialysis Therapy, the mean age tended to increase (**Table 2**)².

The primary causes of stage 5D/T CKD included diabetic nephropathy (DN), chronic glomerulonephritis, and nephrosclerosis (**Table 3**). In

Table 3 New patients beginning dialysis by primary disease in our hospital

	1980s	1990s	2000s
DN	23%	29%	51%
CGN	40%	24%	19%
Nephrosclerosis	11%	17%	13%
PKD	3%	1%	5%
Chronic pyelonephritis	0%	0%	0%
RPGN	0%	1%	2%
Lupus nephritis	0%	1%	0%
Others	23%	27%	10%

DN, diabetic nephropathy; CGN, chronic glomerulonephritis; PKD, polycystic kidney disease; RPGN, rapidly progressive glomerulonephritis

Table 4 New patients beginning dialysis by primary disease nationwide (JSDT)

	1983	1990	2000	2010
DN	15.6%	26.2%	36.6%	43.5%
CGN	60.5%	46.1%	32.5%	21.2%
Nephrosclerosis	3.0%	5.4%	7.6%	11.6%
PKD	2.8%	2.9%	2.4%	2.4%
Chronic pyelonephritis	2.4%	1.5%	1.0%	0.8%
RPGN	0.9%	0.7%	1.0%	1.2%
Lupus nephritis	1.1%	1.1%	0.9%	0.8%
Others	4.4%	3.3%	7.6%	10.7%

JSDT, Japanese Society for Dialysis Therapy; DN, diabetic nephropathy; CGN, chronic glomerulonephritis; PKD, polycystic kidney disease; RPGN, rapidly progressive glomerulonephritis

our hospital, the number of patients with diabetes increased markedly over time, particularly in the 2000s, when 51% of all patients were found to have diabetes (**Table 3**). This percentage is higher than the national average (**Table 4**).

To date, 32 patients have undergone peritoneal dialysis (PD), which was introduced in 1999. Of the patients who began maintenance dialysis after 2000, 13.6% underwent PD therapy, which is a rate higher than the national average.

As with patients with stage 5D/T CKD, the number of patients with AKI increased over time, with a particular increase in the 2000s. Prerenal AKI was most common. These trends were the same for each type of AKI and each generation (**Table 5**).

Similar to the number of patients with stage 5D/T CKD or AKI, the number of patients undergoing

Table 5 Numbers of patients with AKI

	Pre-renal	Intrinsic	Post-renal	Total
1980s	42	26	7	75
1990s	46	34	8	88
2000s	134	108	16	258
Total	222	168	31	421

Table 6 Numbers of patients undergoing therapeutic apheresis by apheresis type

Apheresis type	1980s	1990s	2000s	Total
PE	17	15	19	51
DFPP	0	1	6	7
PA	8	11	15	34
DHP	0	10	30	40
Cytapheresis	0	0	5	5
Total	25	37	75	137

PE, plasma exchange; DFPP, double filtration plasmapheresis; PA, plasma adsorption; DHP, direct hemoperfusion

therapeutic apheresis has increased. The polymyxin-B (PMX) immobilized column was most often used for DHP (**Table 6**).

Discussion

The number of patients we treated with blood purification therapy increased from the 1980s to the 2000s, indicating that dialysis therapy has become widely recognized as an effective treatment for patients with CKD nationwide³. Therefore, the number of patients referred from our hospital's Department of Internal Medicine increased, and an increasing number of patients were also referred from nearby medical clinics, demonstrating that this hospital has become established as a resource for local practices. In addition, our hospital functions as an emergency treatment center, and the number of patients accepted with AKI increased over time. In addition, the number of surgical cases increased, requiring postoperative continuous hemodiafiltration and the extracorporeal ultrafiltration method, and use of the PMX column increased alongside these methods. Finally, blood purification therapy for infectious diseases and multiple organ failure in the

Intensive Care Unit has increased.

Consistent with national trends, both the number of patients with stage 5D/T CKD and the age at which dialysis was started increased during these 30 years⁴. Adaptive expansion of dialysis therapy and an aging society are possible reasons for these trends. In addition, the start of dialysis was delayed in some cases because the predialysis treatment for patients with CKD has improved.

The number of cases of AKI also increased, likely owing to the causes described above, as well as increases in the numbers of critically ill patients referred from the Department of Internal Medicine and patients undergoing surgery. This trend was accelerated in part because the clinical departments of this hospital were expanded after 2000. Increases in cardiovascular disease and the emergency function of the hospital are considered primary causes of the percentage of cases associated with prerenal AKI. Also, the rapid increase in the number of cardiac catheterizations by the expanded Department of Cardiology has increased the number of cases of contrast-agent nephropathy. The number of cases of intrinsic AKI similarly increased, most likely because of the establishment of the Department of Nephrology.

The overall trend in Japan is an increasing number of cases of DN, the primary reason for recommending dialysis². Similarly, the incidence of diabetes mellitus in Western countries is also increasing because of dietary habits and lifestyle⁵. After the 2000s, the collaboration of the Department of Endocrinology and Metabolism was obtained in this hospital, and the consultation of patients with diabetes increased. The high percentage of patients with DN is attributed to the collaboration of Department of Endocrinology and Metabolism in this hospital. Another possible cause is the increase in the number of consultations for patients with diabetes with the increase in the number of catheterizations by the Department of Cardiology.

Regarding therapeutic apheresis, simple plasma exchange was the most common treatment for hepatic failure in the 1980s. In the 1990s, plasma adsorption for neurologic diseases, such as the Guillain-Barré syndrome, increased, and the

frequency of direct hemoperfusion for multiple organ failure and sepsis increased after the PMX column was covered by the Japanese insurance system. This tendency increased further in the 2000s as the number of surgeries for digestive diseases increased. Also, in the 2000s, double filtration plasmapheresis and cytopheresis for autoimmune diseases, such as systemic lupus erythematosus and rheumatoid arthritis, became popular, and various apheresis therapies have come to be performed. The reason for the increase in the diversity of therapeutic apheresis treatments and the number of cases is likely the expansion of the practice of internal medicine in our hospital.

Of the patients who began maintenance dialysis after 2000, 13.6% underwent PD therapy, which is a rate higher than the national average (3.8%)². PD can be performed at the patient's home, and it is thought with positive adaptation to the relatively young patients who can set to work. Also, to judge from the point of view of residual renal function, PD is logically performed in the first phase of maintenance dialysis⁶. Furthermore, with the cooperation of the family, PD can be safely performed for elderly patients and can increase quality of life. Therefore, the Department of Nephrology of our hospital promotes PD. As a result, PD is often selected in our hospital.

In summary, we have reviewed and analyzed the records of patients who have undergone blood purification therapy in our hospital. The total number of patients was 1,115. The number of patients with stage 5D/T CKD, with AKI, and who have undergone therapeutic apheresis increased with each successive decade. These increases are due to the development of the hospital, reflecting an increase in the numbers of patients with various conditions. The incidence of DN increased along with the national average rate of patients undergoing long-term dialysis, and our hospital recently reached more than 50% for, surpassing the national average. As this trend is likely to continue, we will need to prepare for an increase in the number of cases and improve blood purification therapy in the future.

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