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An Overview of Regular Dialysis Treatment in Japan (as of 31 December 2004)

Shigeru Nakai, Atsushi Wada, Tateki Kitaoka, Takahiro Shinzato, Yuji Nagura, Kenjiro Kikuchi, Ikuto Masakane, Toshio Shinoda, Chikao Yamazaki, Rumi Sakai, Seiji Marubayashi, Osamu Morita, Kunitoshi Iseki, Takeshi Usami, Naoki Kimata, Kazuyuki Suzuki, Kaoru Tabei, Kiyohide Fushimi, Naoko Miwa, Mitsuru Yauchi, Kenji Wakai, and Takashi Akiba

Patient Registration Committee, Japanese Society for Dialysis Therapy, Tokyo, Japan

Abstract: A statistical survey of 3932 nationwide hemodialysis (hereafter, dialysis) facilities was carried out at the end of 2004, and 3882 facilities (98.73%) responded. The population undergoing dialysis at the end of 2004 was 248 166, an increase of 10 456 patients (4.4%) from that at the end of 2003. The number of dialysis patients per million people was 1943.5. The crude death rate of dialysis patients from the end of 2003 to the end of 2004 was 9.4%. The mean age of patients who underwent dialysis in 2004 was 65.8 years, and that of the total dialysis population was 63.3 years. The percentage distribution of patients who underwent dialysis according to a newly underlying disease showed that 41.3% of patients had diabetic nephropathy and 28.1% had chronic glomerulonephritis. The frequency of calcium carbonate use for dialysis patients was 75.1% and that of sevelamer hydrochloride use was 26.2%. The frequency of sevelamer hydrochloride use does not necessarily have a strong correlation with the dose of calcium carbonate. Patients who received high doses of sevelamer hydrochloride tended to have a low concentration of arterial blood HCO^{3-}. Approximately 15% of dialysis patients used an intravenous vitamin D preparation, generally maxacalcitol. The longer the patients had been on dialysis, the higher the frequency of use of an intravenous vitamin D preparation. When the concentration of serum intact parathyroid hormone (PTH) was more than 200 pg/mL, the frequency of use of an orally administered vitamin D preparation decreased; but that of intravenous vitamin D preparation increased. The percentage of dialysis patients who received percutaneous ethanol injection therapy (PEIT) was 1.4%. The percentage was more than 50% in the patients who had been on dialysis for more than 10 years. The percentage of patients who received PEIT again was 35.0%. The percentage of patients who had been on hemodialysis for more than 10 years and received PEIT again was more than 50%. **Key Words:** Calcium carbonate, Death rate, Intact parathyroid hormone, Sevelamer hydrochloride.

The Japanese Society for Dialysis Therapy has carried out an annual statistical survey of dialysis facilities across the country since 1968. A nationwide statistical survey of 3932 dialysis facilities was carried out at the end of 2004, and 3882 facilities (98.73%) responded. The population undergoing dialysis at the end of 2004, calculated on the basis of the survey results from dialysis facilities, was 248 166, an increase of 10 456 patients (4.4%) from that in 2003. The crude death rate of dialysis patients in 2004 was 9.4%, which is nearly the same as those in previous years.

In the present paper, we report basic data on chronic dialysis patients at the end of 2004 and on newly surveyed items including serum calcium and phosphorus concentrations, frequency of phosphate binder use, parathyroid hormone concentration, and the history of surgical treatment for hyperparathyroidism.

SUBJECTS AND METHODS

This survey of dialysis facilities is carried out by sending questionnaires to individual dialysis facilities

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Address correspondence and reprint requests to Dr Takashi Akiba, Department of Blood Purification and Medicine, Kidney Center, Tokyo Women's University, 8-1 Kawadacho, Shinjyuku-ku, Tokyo 162-8666, Japan. Email: takiba.med2@med.tmd.ac.jp
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at the end of each year. The 3932 dialysis facilities surveyed this year consisted of member facilities of the Japanese Society for Dialysis Therapy at the end of 2004 and additional facilities offering dialysis for patients with chronic kidney diseases that were not members of this society. The number of facilities in the present survey increased by 182 facilities (4.85%) from that in the preceding year's survey.

The questionnaires were mainly sent and collected by mail, although they were also faxed to some of the facilities. Moreover, a floppy disk was sent to facilities which had earlier indicated a preference for an electronic, rather than a paper-based questionnaire.

The present survey comprised two questionnaires. One was a facility survey, in which items relating to the details of dialysis facilities, such as the number of patients, the number of staff members and the number of consoles at individual facilities, were examined (using the questionnaire referred to as 'Sheet I'). The other was a patient survey in which the epidemiological background, treatment conditions and outcome of treatment of individual dialysis patients were investigated (using questionnaires referred to as Sheets II, III and IV).

The response rate for the survey (collection rate of the questionnaire at the end of 2004) was 98.73% (3882 facilities), which slightly decreased from that for the 2003 survey (99.12%). The present survey included 155 new facilities offering peritoneal dialysis, and 83 of the 155 facilities responded, 'No dialysis patients are treated'. The number of facilities from which there was no response to the patient survey questionnaire (Sheets II, III or IV) was 138, showing a slight increase from last year's 87 facilities. Thus, the rate of collection of all the sheets was 95.22%.

I. Tabulation of basic data on chronic dialysis patients at the end of 2004

Data on dialysis population dynamics for the year 2004 were tabulated mainly on the basis of the results of the facility survey. The data included the number of patients introduced to dialysis, the number of patients who died, the total number of dialysis patients at the end of 2004, and the gross death rate for the year 2004. Cumulative survival rate after introduction to dialysis was actuarially calculated on the basis of the results of the patient survey (1).

II. Tabulation of data for new survey items

Items investigated for the first time in the present survey were the types and the amounts of phosphate binders, and those of oral and intravenous vitamin D preparations used. As items related to these survey items, concentrations of the following prior to dialysis were investigated: serum calcium, serum phosphorus, and arterial blood HCO^{3-}. In addition to these, the cumulative number of times of parathyroidectomy (surgical treatment for secondary hyperparathyroidism, hereinafter referred to as 'PTx') and percutaneous ethanol injection therapy (hereinafter referred to as 'PEIT') were carried out and also further investigated.

The frequencies of use and doses of phosphate binders were investigated by providing the following questionnaire items regarding sevelamer hydrochloride, calcium carbonate and aluminum gel. Regarding phosphate binders other than these, the types of phosphate binder used were investigated by asking respondents to choose from the following: sucralfate, colestimide and other phosphate binders. The present survey did not investigate the amounts of these drugs used.

With regard to vitamin D preparations, the type and dose (μg/week) of an oral vitamin D preparation given and the type and dose (μg/week) of an intravenous vitamin D preparation given were investigated. The type of the oral vitamin D preparation was investigated by asking respondents to choose from the following: alphacalcidol, calcitriol, falecalcitriol and other oral vitamin D preparations.

Similarly to oral vitamin D preparations, the type of intravenous vitamin D preparation used was investigated by asking respondents to choose from the following: calcitriol, maxacalcitol and other intravenous vitamin D preparations. The cumulative number of times patients underwent PTx and PEIT by the end of 2004 were also investigated. The number of times considered was up to seven times, and responses of eight times or more were categorized as 'eight times or more' In this section, data for the above-mentioned items were tabulated and the results are shown.

RESULTS AND DISCUSSION

I. Tabulation of basic data on chronic dialysis patients at the end of 2004

1. Number of patients

Table 1 shows a summary of the dynamics of the dialysis patient population in Japan at the end of 2004 obtained from the present survey. Only the totals for the history of dialysis and history of the patients who underwent the longest dialysis treatment shown in this table were obtained from the patient survey, whereas the totals for the other items were obtained

TABLE 1. *Current status of chronic dialysis therapy in Japan*

Number of facilities		3 882	Increase of 165 (4.4%)
Equipment	Number of patient station	97 366	Increase of 4 656 (5.0%)
Capacity	Simultaneous dialysis (people)	96 540	Increase of 4 615 (5.0%)
	Maximum accommodation capacity (people)	328 798	Increase of 16 794 (5.4%)
Chronic dialysis patients†		248 166	Increase of 10 456

†The total number of chronic dialysis patients is the total of the column for the number of patients in Sheet I, and does not necessarily correlate with the total number of patients counted according to the method of treatment.

Daytime dialysis	196 337		(79.1%)	
Nighttime dialysis	42 600		(17.2%)	
Home dialysis	114		(0.0%)	
CAPD	8 774		(3.5%)	
IPD	352		(0.1%)	
Number of patients newly introduced to dialysis	36 084		Increase of 1118 (3.2%)	
Number of deceased patients	22 715		Increase of 1043 (4.3%)	
Years on dialysis†	Male	Female	Unknown	Total
0 ≤ <5	75 431	44 650	78	120 159 (50.8%)
5 ≤ <10	35 089	23 265	3	58 357 (24.7%)
10 ≤ <15	15 936	11 800	2	27 738 (11.7%)
15 ≤ <20	7 977	6 473	3	14 453 (6.1%)
20 ≤ <25	4 999	4 035	0	9 034 (3.8%)
25≤	4 012	2 853	0	6 865 (2.9%)
Patients per million	1 943.5		Increase of 80.8	
Longest dialysis history			37 years and 3 months	

†The number of dialysis patients was calculated from questionnaire Sheets II to IV.

from the facility survey. The total dialysis patient population in Japan at the end of 2004 was 248 166, as determined from the facility survey. The dialysis patient population in Japan at the end of 2003 was 237 710, showing an increase of 4.4% (10 456 patients) from the end of 2003 to the end of 2004. This was nearly the same as the increases observed in previous years.

Similarly, the total dialysis patient population in each prefecture of Japan obtained from the facility survey is shown in Table 2. The dialysis patient population per million people at the end of 2004 was 1943.5. Changes in dialysis patient population per million people are shown in Table 3.

The extent of the increase in dialysis patient population from the end of 2003 to the end of 2004 was the same as those in previous years, although the findings from the survey in 2003 suggested a decrease in the dialysis patient population from the end of 2002 to the end of 2003 (1).

2. Mean age

Dialysis patients in Japan are increasing in age each year. The patient survey showed that the mean age of patients newly introduced to dialysis in 2004 was 65.8 years, and the mean age of the entire dialysis patient population at the end of 2004 was 63.3 years (Table 4). The dialysis population aged by 8.1 years from the end of 1984 to the end of 1994, but only aged by 6.0 years from the end of 1994 to the end of 2004. The rate of aging of the dialysis population has decreased. The mean age of patients newly introduced to dialysis increased by 7.2 years from the end of 1984 to the end of 1994, but increased by only 5.4 years from the end of 1994 to the end of 2004. These findings show that the rate of aging of patients newly introduced to dialysis has also decreased.

Table 5 shows the sex and age distributions of patients newly introduced to dialysis in 2004. Table 6 shows the sex and age distributions of all the dialysis patients at the end of 2004. Tables 7 and 8 show the age distribution according to the primary disease. The data in these tables were obtained from the patient survey.

3. Primary diseases of patients newly introduced to dialysis

A summary of results concerning the primary diseases of patients newly introduced to dialysis in 2004 is shown in Table 7. A summary of results concerning the primary diseases of all the patients at the end of 2004 is shown in Table 8. Tables 9 and 10 show changes in the main primary diseases from 1983 to 2004. Patients with end-stage renal failure caused by diabetes became the largest number of patients newly introduced to dialysis in 1998. The number of patients with diabetic nephropathy has since continuously and markedly increased. These patients

TABLE 2. *Numbers of chronic dialysis patients in prefectures*

Name of administrative divisions	Number of patients	Name of administrative divisions	Number of patients
Hokkaido	12 085	Shiga Prefecture	2 113
Aomori Prefecture	2 641	Kyoto Prefecture	5 004
Iwate Prefecture	2 529	Osaka Prefecture	18 477
Miyagi Prefecture	3 840	Hyogo Prefecture	10 223
Akita Prefecture	1 788	Nara Prefecture	2 560
Yamagata Prefecture	1 935	Wakayama Prefecture	2 421
Fukushima Prefecture	3 827	Tottori Prefecture	1 155
Ibaraki Prefecture	5 488	Shimane Prefecture	1 224
Tochigi Prefecture	4 516	Okayama Prefecture	3 828
Gunma Prefecture	4 289	Hiroshima Prefecture	5 876
Saitama Prefecture	12 079	Yamaguchi Prefecture	2 840
Chiba Prefecture	10 302	Tokushima Prefecture	2 150
Tokyo	24 136	Kagawa Prefecture	2 276
Kanagawa Prefecture	14 490	Ehime Prefecture	2 918
Niigata Prefecture	4 333	Kochi Prefecture	1 845
Toyama Prefecture	2 038	Fukuoka Prefecture	11 178
Ishikawa Prefecture	2 221	Saga Prefecture	1 645
Fukui Prefecture	1 422	Nagasaki Prefecture	3 169
Yamanashi Prefecture	1 805	Kumamoto Prefecture	5 209
Nagano Prefecture	4 000	Oita Prefecture	3 103
Gifu Prefecture	3 562	Miyazaki Prefecture	3 097
Shizuoka Prefecture	8 015	Kagoshima Prefecture	4 400
Aichi Prefecture	13 315	Okinawa Prefecture	3 424
Mie Prefecture	3 375		
		Total[†]	248 166

[†]The total number of chronic dialysis patients is the total of the column for the number of patients in Sheet I, and does not necessarily correlate with the total number of patients counted according to the method of treatment.

accounted for 41.3% of patients newly introduced to dialysis in 2004. In contrast to this, the percentage of patients with chronic glomerulonephritis as the primary disease has tended to decrease year by year. Patients with chronic glomerulonephritis as their primary disease accounted for 28.1% of the patients newly introduced to dialysis in 2004, and were the second largest in number despite the decreasing tendency. Patients with an 'undetermined' primary disease accounted for 9.3% of the patients newly introduced to dialysis, and were the third largest in number. It is desirable that the primary diseases are identified whenever possible to reduce the number of patients categorized into those with 'undetermined' primary diseases. The number of patients with nephrosclerosis as the primary disease also increased steadily to 8.8% of the patients newly introduced to dialysis. There were less patients with

TABLE 3. *Changes in number of patients per million*

Year	Patients per million	Year	Patients per million
1983	443.7	1994	1149.4
1984	497.5	1995	1229.7
1985	547.8	1996	1328.4
1986	604.4	1997	1394.9
1987	658.8	1998	1472.5
1988	721.1	1999	1556.7
1989[†]	790.0	2000	1624.1
1990	835.7	2001	1721.9
1991	937.6	2002	1801.2
1992	995.8	2003	1852.7
1993	1076.4	2004	1943.5

[†]The collection rate is corrected at 86% (ie. rounded off at the 100th order).

TABLE 4. *Changes in annual number of patients newly introduced to dialysis and in mean age of patients at the end of the year*

Year	Mean age of patients newly introduced into dialysis treatment	Mean age of patients at the end of each year
1983	51.9	48.3
1984	53.2	49.2
1985	54.4	50.3
1986	55.1	51.1
1987	55.9	52.1
1988	56.9	52.9
1989	57.4	53.8
1990	58.1	54.5
1991	58.1	55.3
1992	59.5	56.0
1993	59.8	56.6
1994	60.4	57.3
1995	61.0	58.0
1996	61.5	58.6
1997	62.2	59.2
1998	62.7	59.9
1999	63.4	60.6
2000	63.8	61.2
2001	64.2	61.6
2002	64.7	62.2
2003	65.4	62.8
2004	65.8	63.3

TABLE 5. *Patients newly introduced to dialysis in 2004 and their age and sex*

Age of the patients when newly introduced into dialysis	Male	(%)†	Female	(%)†	Total	(%)†
Younger than 5 years old	6	(0.0)	6	(0.0)	12	(0.0)
5 years old ~	6	(0.0)	5	(0.0)	11	(0.0)
10 years old ~	7	(0.0)	9	(0.1)	16	(0.0)
15 years old ~	21	(0.1)	16	(0.1)	37	(0.1)
20 years old ~	83	(0.4)	43	(0.3)	126	(0.4)
25 years old ~	161	(0.7)	81	(0.7)	242	(0.7)
30 years old ~	303	(1.4)	136	(1.1)	439	(1.3)
35 years old ~	422	(2.0)	215	(1.7)	637	(1.9)
40 years old ~	563	(2.6)	275	(2.2)	838	(2.5)
45 years old ~	972	(4.5)	425	(3.5)	1 397	(4.1)
50 years old ~	1 830	(8.5)	829	(6.7)	2 659	(7.8)
55 years old ~	2 433	(11.3)	1 103	(9.0)	3 536	(10.4)
60 years old ~	2 773	(12.9)	1 403	(11.4)	4 176	(12.3)
65 years old ~	3 212	(14.9)	1 680	(13.6)	4 892	(14.4)
70 years old ~	3 388	(15.7)	1 871	(15.2)	5 259	(15.5)
75 years old ~	2 909	(13.5)	1 889	(15.3)	4 798	(14.2)
80 years old ~	1 648	(7.6)	1 447	(11.8)	3 095	(9.1)
85 years old ~	679	(3.1)	679	(5.5)	1 358	(4.0)
90 years old ~	134	(0.6)	184	(1.5)	318	(0.9)
95 years old ~	15	(0.1)	16	(0.1)	31	(0.1)
Total	21 565	(100.0)	12 312	(100.0)	33 877	(100.0)
No information available	61		50		111	
Total	21 626		12 362		33 988	
Mean	64.84		67.37		65.76	
Standard deviation	13.17		13.69		13.42	

†The value in parentheses on the right-hand side of each number is the percentage of patients with respect to the total of the column.

TABLE 6. *Patients and their age and sex at the end of 2004*

Age	Male	(%)†	Female	(%)†	Total	(%)†
Younger than 5 years old	13	(0.0)	18	(0.0)	31	(0.0)
5 years old ~	18	(0.0)	9	(0.0)	27	(0.0)
10 years old ~	28	(0.0)	17	(0.0)	45	(0.0)
15 years old ~	104	(0.1)	67	(0.1)	171	(0.1)
20 years old ~	358	(0.2)	211	(0.2)	569	(0.2)
25 years old ~	964	(0.7)	505	(0.5)	1 469	(0.6)
30 years old ~	2 132	(1.5)	1 133	(1.2)	3 265	(1.4)
35 years old ~	3 510	(2.4)	1 903	(2.0)	5 413	(2.3)
40 years old ~	5 052	(3.5)	2 882	(3.1)	7 934	(3.4)
45 years old ~	7 919	(5.5)	4 595	(4.9)	12 514	(5.3)
50 years old ~	14 253	(9.9)	8 644	(9.3)	22 897	(9.7)
55 years old ~	20 331	(14.2)	12 149	(13.1)	32 480	(13.7)
60 years old ~	21 911	(15.3)	13 054	(14.0)	34 965	(14.8)
65 years old ~	21 525	(15.0)	13 217	(14.2)	34 742	(14.7)
70 years old ~	19 850	(13.8)	12 339	(13.3)	32 189	(13.6)
75 years old ~	14 481	(10.1)	10 775	(11.6)	25 256	(10.7)
80 years old ~	7 321	(5.1)	7 214	(7.8)	14 535	(6.1)
85 years old ~	2 786	(1.9)	3 308	(3.6)	6 094	(2.6)
90 years old ~	761	(0.5)	885	(1.0)	1 646	(0.7)
95 years old ~	72	(0.1)	106	(0.1)	178	(0.1)
Total	143 389	(100.0)	93 031	(100.0)	236 420	(100.0)
No information available	55		45		100	
Total	143 444		93 076		236 520	
Mean	62.64		64.37		63.32	
Standard deviation	12.65		13.12		12.86	

†The value in parentheses on the right hand side of each number is the percentage of patients with respect to the total of the column.

TABLE 7. *Numbers and mean ages of patients newly introduced to dialysis in 2004 listed according to the primary disease*

Primary disease	Number of patients	(%)†	Mean age	Standard deviation
Chronic glomerulonephritis	9 466	(28.1)	65.34	14.76
Chronic pyelonephritis	305	(0.9)	63.72	16.24
Rapidly progressive glomerulonephritis	385	(1.1)	68.42	12.67
Nephropathy of pregnancy/pregnancy toxemia	57	(0.2)	57.33	11.66
Other nephritides that cannot be classified	124	(0.4)	61.51	18.99
Polycystic kidney	909	(2.7)	59.77	12.38
Renal sclerosis	2 978	(8.8)	73.17	11.66
Malignant hypertension	236	(0.7)	60.99	16.97
Diabetic nephropathy	13 920	(41.3)	64.56	11.33
SLE nephritis	268	(0.8)	58.91	14.53
Amyloidal kidney	140	(0.4)	64.62	11.03
Gouty kidney	110	(0.3)	64.63	11.55
Renal failure due to congenital abnormality of metabolism	22	(0.1)	44.00	22.26
Kidney and urinary tract tuberculosis	31	(0.1)	67.13	11.73
Kidney and urinary tract stone	51	(0.2)	67.82	12.37
Kidney and urinary tract tumor	134	(0.4)	69.81	10.84
Obstructive urinary tract disease	104	(0.3)	66.67	18.85
Myeloma	125	(0.4)	69.42	10.54
Hypoplastic kidney	41	(0.1)	44.07	28.03
Reintroduction after transplantation	243	(0.7)	54.62	16.77
Others	957	(2.8)	66.13	15.66
Undetermined	3 123	(9.3)	69.01	13.38
Total	33 729	(100.0)	65.75	13.41
No information available	206		66.90	14.58
Total	33 935		65.76	13.42

SLE, systemic lupus erythematosus (SLE or lupus).
†The value in parentheses on the right-hand side of each number is the percentage of patients with respect to the total of the column.

TABLE 8. *Numbers and mean ages of patients at the end of 2004 according to primary disease*

Primary disease	Number of patients	(%)†	Mean age	Standard deviation
Chronic glomerulonephritis	106 458	(45.1)	61.80	14.76
Chronic pyelonephritis	2 977	(1.3)	61.44	16.24
Rapidly progressive glomerulonephritis	1 437	(0.6)	63.64	12.67
Nephropathy of pregnancy/pregnancy toxemia	1 760	(0.7)	57.77	11.66
Other nephritides that cannot be classified	1 076	(0.5)	55.33	18.99
Polycystic kidney	7 933	(3.4)	61.84	12.38
Renal sclerosis	13 485	(5.7)	72.23	11.66
Malignant hypertension	1 785	(0.8)	61.39	16.97
Diabetic nephropathy	71 394	(30.2)	64.78	11.33
SLE nephritis	2 117	(0.9)	54.69	14.53
Amyloidal kidney	450	(0.2)	63.91	11.03
Gouty kidney	1 258	(0.5)	64.02	11.55
Renal failure due to congenital abnormality of metabolism	236	(0.1)	46.22	22.26
Kidney and urinary tract tuberculosis	458	(0.2)	67.09	11.73
Kidney and urinary tract stone	477	(0.2)	65.80	12.37
Kidney and urinary tract tumor	543	(0.2)	67.72	10.84
Obstructive urinary tract disease	646	(0.3)	58.74	18.85
Myeloma	188	(0.1)	68.45	10.54
Hypoplastic kidney	491	(0.2)	38.04	28.03
Reintroduction after transplantation	1 596	(0.7)	50.29	16.77
Others	4 050	(1.7)	61.00	15.66
Undetermined	15 219	(6.4)	65.63	13.38
Total	236 034	(100.0)	63.32	13.41
No information available	471		65.51	14.58
Total	236 505		63.32	13.42

†The value in parentheses on the right-hand side of each number is the percentage of patients with respect to the total of the column.
SLE, systemic lupus erythematosus (SLE or lupus).

TABLE 9. *Changes in primary diseases in patients introduced to dialysis annually*

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Diabetic nephropathy	15.6	17.4	19.6	21.3	22.1	24.3	26.5	26.2	28.1	28.4	29.9
Chronic glomerulonephritis	60.5	58.7	56.0	54.8	54.2	49.9	47.4	46.1	44.2	42.2	41.4
Renal sclerosis	3.0	3.3	3.5	3.7	3.9	3.9	4.1	5.4	5.5	5.9	6.2
Polycystic kidney	2.8	2.8	3.1	2.9	3.2	3.1	3.1	2.9	3.0	2.7	2.6
Chronic pyelonephritis	2.4	2.2	2.1	2.0	1.8	1.8	1.5	1.5	1.7	1.6	1.1
Rapidly progressive glomerulonephritis	0.9	0.7	0.9	1.0	0.8	0.9	0.8	0.7	0.6	0.7	0.8
SLE nephritis	1.1	1.1	1.1	1.2	0.9	0.9	1.0	1.1	1.3	1.3	1.2
Undetermined	4.4	4.0	4.8	4.2	4.1	3.8	4.0	3.3	3.7	3.7	3.3
Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Diabetic nephropathy	30.7	31.9	33.1	33.9	35.7	36.2	36.6	38.1	39.1	41.0	41.3
Chronic glomerulonephritis	40.5	39.4	38.9	36.6	35.0	33.6	32.5	32.4	31.9	29.1	28.1
Renal sclerosis	6.1	6.3	6.4	6.8	6.7	7.0	7.6	7.6	7.9	8.5	8.8
Polycystic kidney	2.5	2.4	2.5	2.4	2.4	2.2	2.4	2.3	2.4	2.3	2.7
Chronic pyelonephritis	1.4	1.2	1.1	1.2	1.1	1.1	1.0	1.1	0.9	1.0	0.9
Rapidly progressive glomerulonephritis	0.8	0.8	0.8	1.1	0.9	0.9	1.0	1.0	1.1	1.2	1.1
SLE nephritis	1.2	1.1	1.3	1.0	1.1	1.2	0.9	1.0	0.9	0.7	0.8
Undetermined	3.9	4.5	5.0	5.5	5.6	6.1	7.6	9.0	8.4	8.8	9.3

SLE, systemic lupus erythematosus (SLE or lupus).

polycystic kidney disease, pyelonephritis and systemic lupus erythematosus (SLE or lupus) as their primary diseases than those with the primary diseases described above, but the percentages of patients with these diseases were nearly the same as those in preceding years.

When changes in the percentage of patients with renal failure as the primary disease among all the dialysis patients at the end of 2004 were assessed, the number of patients with chronic glomerulonephritis as their primary disease in the entire dialysis population was still the largest, accounting for 45.1% of patients. However, the number of patients with chronic glomerulonephritis as their primary disease has decreased steadily year by year, and the number of patients with diabetic nephropathy as their primary disease began to increase in place of chronic glomerulonephritis patients. The number of patients with diabetic nephropathy as their primary disease accounted for 30.2% of the entire dialysis population at the end of 2004. Supposing that the dynamics of the dialysis patient population in Japan continues to show these trends, the dialysis population with chronic glomerulonephritis as their primary disease and that with diabetic nephropathy are estimated to be equal in a few years. The third largest number of patients in the dialysis population also consists of those with an 'undetermined' primary disease, which began to increase steadily. Reflecting the trend among patients newly introduced to dialysis, the number of patients with nephrosclerosis as their primary disease began to increase steadily in the dialysis population, although their absolute number was still small. Many patients with polycystic kidney disease

TABLE 10. *Changes in primary diseases in patients at the end of each year*

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Diabetic nephropathy	7.4	8.4	9.4	10.5	11.7	12.8	14.0	14.9	16.4	17.1	18.2
Chronic glomerulonephritis	74.5	72.1	72.3	70.6	69.4	67.9	65.9	64.1	61.7	60.4	58.8
Renal sclerosis	1.5	1.7	1.9	2.0	2.1	2.1	2.3	2.6	2.9	3.1	3.4
Polycystic kidney	2.7	2.9	3.0	3.1	3.1	3.2	3.2	3.3	3.3	3.3	3.3
Chronic pyelonephritis	3.1	3.3	2.6	2.4	2.4	2.3	2.2	2.2	2.1	2.0	1.9
Rapidly progressive glomerulonephritis	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SLE nephritis	0.8	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.1
Undetermined	2.2	2.3	2.3	2.5	2.6	2.5	2.6	2.6	2.9	2.9	2.9
Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Diabetic nephropathy	19.2	20.4	21.6	22.7	24.0	25.1	26.0	27.2	28.1	29.2	30.2
Chronic glomerulonephritis	57.7	56.6	55.4	54.1	52.5	51.1	49.7	49.6	48.3	46.6	45.1
Renal sclerosis	3.6	3.8	4.0	4.2	4.4	4.5	4.8	5.0	5.1	5.3	5.7
Polycystic kidney	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.3	3.3	3.3	3.4
Chronic pyelonephritis	1.8	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.3
Rapidly progressive glomerulonephritis	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
SLE nephritis	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9
Undetermined	3.1	3.2	3.9	3.9	4.2	4.4	5.0	5.6	5.9	6.3	6.4

SLE, systemic lupus erythematosus (SLE or lupus).

TABLE 11. *Classification of causes of death of patients introduced to dialysis in 2004*

Cause of death	Male	(%)	Female	(%)	Total	(%)	No information available	Total	(%)
Cardiac failure	385	(21.9)	281	(25.3)	666	(23.2)	2	668	(23.3)
Cerebrovascular disease	108	(6.2)	72	(6.5)	180	(6.3)	2	182	(6.3)
Infectious disease	427	(24.3)	251	(22.6)	678	(23.7)		678	(23.6)
Hemorrhage	32	(1.8)	33	(3.0)	65	(2.3)		65	(2.3)
Malignant tumor	186	(10.6)	75	(6.8)	261	(9.1)		261	(9.1)
Cachexia/Uremia	39	(2.2)	40	(3.6)	79	(2.8)		79	(2.8)
Cardiac infarction	71	(4.0)	39	(3.5)	110	(3.8)		110	(3.8)
Potassium poisoning/Moribund	56	(3.2)	52	(4.7)	108	(3.8)		108	(3.8)
Chronic hepatitis/Cirrhosis	48	(2.7)	13	(1.2)	61	(2.1)		61	(2.1)
Encephalopathy	1	(0.1)	1	(0.1)	2	(0.1)		2	(0.1)
Suicide/Refusal of treatment	24	(1.4)	8	(0.7)	32	(1.1)		32	(1.1)
Intestinal obstruction	8	(0.5)	7	(0.6)	15	(0.5)		15	(0.5)
Lung thrombus/Pulmonary embolus	15	(0.9)	6	(0.5)	21	(0.7)		21	(0.7)
Death due to disaster	8	(0.5)	3	(0.3)	11	(0.4)		11	(0.4)
Others	205	(11.7)	152	(13.7)	357	(12.5)		357	(12.4)
Undetermined	143	(8.1)	77	(6.9)	220	(7.7)		220	(7.7)
Total	1756	(100.0)	1110	(100.0)	2866	(100.0)	4	2870	(100.0)
No information available	17		12		29		1	30	
Total	1773		1122		2895		5	2900	

and collagen disease as the primary diseases were observed following the patients with the above-mentioned primary diseases, but the percentages of these patients among all the dialysis patients at the end of 2004 were nearly the same as those in preceding years.

4. Causes of death

Table 11 shows the classification of the causes of death of patients who were newly introduced to dialysis in 2004 and who died by the end of 2004. Table 12 shows the classification of the causes of death of patients who died in 2004 in the entire dialysis population. Table 13 shows changes in the percentages of the leading causes of death. The classification of the causes of death was changed on the basis of ICD-10 classification starting with the survey at the end of 2003.

The causes of death of patients newly introduced to dialysis in 2004 were infectious diseases (23.6%), cardiac failure (23.3%), malignant tumors (9.1%), cerebrovascular disorder (6.3%), and cardiac infarction (3.8%). Cardiac failure had been the leading cause of death for patients newly introduced to dialysis until 2003. However, infectious diseases were the leading cause of death for the patients newly introduced to dialysis in 2004. The percentage of dialysis patients who died from infectious diseases

TABLE 12. *Classification of causes of death of patients who died in 2004*

Cause of death	Male	(%)	Female	(%)	Total	(%)	No information available	Total	(%)
Cardiac failure	2 991	(23.4)	2185	(27.7)	5 176	(25.0)	2	5 178	(25.1)
Cerebrovascular disease	1 318	(10.3)	871	(11.1)	2 189	(10.6)	2	2 191	(10.6)
Infectious disease	2 423	(18.9)	1459	(18.5)	3 882	(18.8)		3 882	(18.8)
Hemorrhage	253	(2.0)	198	(2.5)	451	(2.2)		451	(2.2)
Malignant tumor	1 311	(10.3)	553	(7.0)	1 864	(9.0)		1 864	(9.0)
Cachexia/Uremia	266	(2.1)	219	(2.8)	485	(2.3)		485	(2.3)
Cardiac infarction	741	(5.8)	379	(4.8)	1 120	(5.4)		1 120	(5.4)
Potassium poisoning/Moribund	689	(5.4)	382	(4.9)	1 071	(5.2)		1 071	(5.2)
Chronic hepatitis/Cirrhosis	245	(1.9)	83	(1.1)	328	(1.6)		328	(1.6)
Encephalopathy	15	(0.1)	7	(0.1)	22	(0.1)		22	(0.1)
Suicide/Refusal of treatment	139	(1.1)	58	(0.7)	197	(1.0)		197	(1.0)
Intestinal obstruction	100	(0.8)	90	(1.1)	190	(0.9)		190	(0.9)
Lung thrombus/Pulmonary embolus	54	(0.4)	30	(0.4)	84	(0.4)		84	(0.4)
Death due to disaster	95	(0.7)	25	(0.3)	120	(0.6)		120	(0.6)
Others	1 252	(9.8)	887	(11.3)	2 139	(10.4)		2 139	(10.3)
Undetermined	898	(7.0)	450	(5.7)	1 348	(6.5)		1 348	(6.5)
Total	12 790	(100.0)	7876	(100.0)	20 666	(100.0)	4	20 670	(100.0)
No information available	158		106		264		2	266	
Total	12 948		7982		20 930		6	20 936	

TABLE 13. *Changes in primary diseases in patients introduced to dialysis annually*

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Cardiac failure	30.3	30.5	31.3	33.2	32.7	36.5	33.4	30.4	30.5	31.1	29.9
Infectious disease	11.0	11.5	11.5	12.0	12.0	12.2	11.7	11.6	12.1	11.3	12.2
Cerebrovascular disease	14.2	15.4	14.2	14.0	14.2	12.9	13.2	13.9	13.7	13.6	13.5
Malignant tumor	7.7	6.9	6.4	6.9	5.8	6.9	7.6	8.2	7.6	7.1	7.4
Cardiac infarction	5.3	4.8	5.3	6.1	6.0	5.4	5.3	5.8	5.8	5.8	5.7
Others	5.1	4.9	5.7	4.7	5.2	4.8	4.4	4.6	4.4	4.5	4.1
Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Cardiac failure	28.2	25.4	24.1	23.9	24.1	24.3	23.2	25.5	25.1	25.0	25.1
Infectious disease	12.6	13.8	14.6	14.9	15.0	16.3	16.6	16.3	15.9	18.5	18.8
Cerebrovascular disease	14.1	13.5	12.9	12.6	12.1	11.3	11.3	11.6	11.2	10.7	10.6
Malignant tumor	7.3	7.2	7.7	8.1	7.7	7.6	8.3	8.5	8.5	8.5	9.0
Cardiac infarction	7.1	7.5	7.4	8.4	7.9	7.4	7.0	7.4	7.4	6.2	5.4
Others	4.5	5.8	6.3	6.7	7.0	7.7	7.9	9.1	9.0	9.7	10.3

increased steadily from 1990. The effects of the aging of patients newly introduced to dialysis and the increase in the number of diabetic patients are considered to be the factors that account for these findings. In contrast, the percentage of patients who died from cardiac failure decreased relatively rapidly from 1994 to 1996, but subsequently remained at a nearly constant level of approximately 23%. The incidence of death from cardiac infarction tended to decline from 2002. This might reflect advances in the treatment of cardiac infarction, including catheter intervention.

The number of patients who died from 'other causes' has increased steadily. It is necessary to clarify whether their cause of death was not adequately identified or whether the number of patients who died from causes other than definite causes has increased.

Regarding the causes of death for the entire dialysis population, cardiac failure was the leading cause of death, accounting for 25.1% of all the patients who died. The incidence of death from cardiac failure among all the patients who died tended to decrease until 2000 but tended to slightly increase from 2001. The second leading cause of death was infectious diseases. The incidence of death from infectious diseases tended to increase from 1990 but began to increase rapidly in 2003, reaching 18.8% in 2004. These tendencies were common to those for the causes of death of patients newly introduced to dialysis. The increases in the number of elderly patients, who have less resistance to diseases, and the number of diabetic patients are considered to have contributed to the increase in the incidence of death from infectious diseases.

In contrast to the above-mentioned causes of death, the percentage of patients who died from cerebrovascular disorder tended to decrease, and the incidence of death from cerebrovascular disorder was 10.6% in 2004. This might reflect an improvement in the control of blood pressure in dialysis patients. The percentage of patients who died from cardiac infarction also clearly tended to decrease during the past 3 years. Although the percentages of elderly and diabetic patients thought to have complications from vascular calcification and coronary artery sclerosis increased markedly, the percentage of patients who died from cardiac infarction decreased; this might indicate the good outcome of the spread of therapies for ischemic cardiac disease, including catheter intervention and coronary artery bypass grafting (CABG), and an improvement in their therapeutic effect.

5. Annual crude death rate

The annual crude death rate was calculated from the facility survey. The annual crude death rate is the rate (%) of the number of patients who died with respect to the mean annual dialysis population. The annual crude death rate in 2004, that is, the rate of patients who died in 2004 with respect to the mean number of dialysis patients at the end of 2003 and that at the end of 2004, was 9.4%.

Changes in crude death rate from 1983 are shown in Table 14. The crude death rates during the past decade ranged from 9.2% to 9.7% and no definite tendency to increase or decrease was observed. The life expectancy of dialysis patients in Japan is considered to have begun to improve substantially despite the increases in the numbers of diabetic patients, who generally have a low life expectancy, and elderly patients.

6. Annual 1-year, 5-year, 10-year, 15-year, and 20-year survival rates of patients newly introduced to dialysis

For patients newly introduced to dialysis from 1983, 1-year, 5-year, 10-year, 15-year, and 20-year survival rates, which were analyzed following the previous year's survey, were compared for each year since their introduction (Table 15). The survival rates were calculated actuarially (2). The survival rates

TABLE 14. *Changes in annual crude death rate*

Year	Crude death rate (%)	Year	Crude death rate (%)
1983	9.0	1994	9.5
1984	8.9	1995	9.7
1985	9.1	1996	9.4
1986	9.0	1997	9.4
1987	8.5	1998	9.2
1988	9.2	1999	9.7
1989	7.9	2000	9.2
1990	9.6	2001	9.3
1991	8.9	2002	9.2
1992	9.7	2003	9.3
1993	9.4	2004	9.4

with respect to the age of patients newly introduced to dialysis showed that the 1-year survival rate of patients newly introduced to dialysis was usually 0.8 or higher. The simple average of 1-year survival rates from 1983 was 0.86. The 1-year survival rates for the past few years were higher than this average. This indicates that the 1-year survival rate improved in the past few years. As mentioned above, the percentage of dialysis patients whose primary disease was difficult to control, such as elderly patients and diabetic patients, increased among the patients newly introduced to dialysis. With this background taken into account, the above-described findings suggest that the 1-year survival rate of dialysis patients improved substantially.

The 5-year survival rate of patients newly introduced to dialysis in 1999 was 0.623. The simple average of the 5-year survival rates of patients newly introduced to dialysis from 1983, as assessed similarly to the simple average of the 1-year survival rates, was 0.602. The average of 5-year survival rates of patients newly introduced to dialysis from 1995 was higher than that from 1983.

The 10-year survival rate of patients newly introduced to dialysis in 1994 was 0.393. The 15-year survival rate of patients newly introduced to dialysis in 1989 was 0.293. Unfortunately, these survival rates in the long-term (e.g. 10 years or more) tended to decrease year by year. This shows the difficulty in realizing the long-term survival of dialysis patients. Alternatively, these findings might reflect the effects of patient aging and complications associated with long-term dialysis.

It has become possible to calculate the 20-year survival rate of patients newly introduced to dialysis since the previous survey in 2003. The 20-year survival rate of patients newly introduced to dialysis in 1984 was 0.256, relatively below the 20-year survival

TABLE 15. *Changes in 1-, 5-, 10-, 15-, and 20-year survival rates of patients introduced to dialysis annually*

Year when patients were year newly introduced to dialysis	Number of patients	1-year survival rate	2-year survival rate	3-year survival rate	4-year survival rate	5-year survival rate	6-year survival rate	7-year survival rate	8-year survival rate	9-year survival rate	10-year survival rate	11-year survival rate	12-year survival rate	13-year survival rate	14-year survival rate	15-year survival rate	16-year survival rate	17-year survival rate	18-year survival rate	19-year survival rate	20-year survival rate	21-year survival rate
1983	11 050	0.837	0.773	0.714	0.669	0.629	0.598	0.567	0.531	0.503	0.473	0.444	0.421	0.398	0.379	0.357	0.338	0.321	0.303	0.288	0.271	0.256
1984	12 036	0.837	0.763	0.705	0.658	0.619	0.583	0.545	0.514	0.485	0.457	0.429	0.404	0.379	0.357	0.338	0.320	0.301	0.286	0.272	0.256	
1985	12 971	0.816	0.748	0.694	0.646	0.604	0.564	0.530	0.490	0.459	0.433	0.408	0.384	0.360	0.337	0.318	0.299	0.280	0.264	0.249		
1986	14 238	0.821	0.754	0.701	0.657	0.608	0.564	0.525	0.492	0.457	0.429	0.402	0.377	0.356	0.334	0.316	0.297	0.279	0.264			
1987	15 424	0.836	0.767	0.707	0.648	0.600	0.553	0.511	0.476	0.444	0.416	0.390	0.366	0.345	0.322	0.302	0.285	0.266				
1988	16 951	0.845	0.769	0.701	0.643	0.592	0.546	0.505	0.469	0.435	0.405	0.379	0.355	0.333	0.309	0.290	0.272					
1989	16 908	0.868	0.789	0.721	0.656	0.604	0.557	0.513	0.475	0.441	0.409	0.384	0.357	0.334	0.312	0.293						
1990	19 339	0.858	0.777	0.709	0.649	0.598	0.548	0.507	0.469	0.435	0.405	0.376	0.350	0.326	0.307							
1991	21 364	0.848	0.765	0.698	0.638	0.583	0.536	0.494	0.458	0.427	0.396	0.369	0.342	0.320								
1992	23 231	0.843	0.759	0.688	0.630	0.577	0.531	0.489	0.453	0.420	0.391	0.364	0.339									
1993	24 540	0.854	0.774	0.704	0.641	0.589	0.541	0.498	0.460	0.426	0.394	0.366										
1994	25 280	0.852	0.774	0.708	0.648	0.593	0.543	0.501	0.462	0.425	0.393											
1995	27 047	0.862	0.784	0.718	0.655	0.602	0.555	0.513	0.473	0.437												
1996	29 510	0.855	0.782	0.714	0.656	0.605	0.559	0.508	0.470													
1997	30 362	0.861	0.785	0.722	0.665	0.609	0.561	0.517														
1998	31 994	0.868	0.798	0.736	0.678	0.619	0.570															
1999	33 578	0.873	0.804	0.741	0.679	0.623																
2000	36 503	0.878	0.806	0.744	0.684																	
2001	37 973	0.876	0.803	0.739																		
2002	38 293	0.877	0.806																			
2003	38 568	0.877																				

TABLE 16. *Frequencies of use of phosphate binders according to the treatment method (for all dialysis patients)*

Treatment method	Sevelamer hydrochloride	Calcium carbonate	Aluminum gel	Others
Hemodialysis	35 503	119 532	1432	3213
%	(26.2)	(75.1)	(1.1)	(2.5)
Hemodiafiltration	3 460	8 442	160	587
%	(37.4)	(76.7)	(1.9)	(6.2)
Hemofiltration	10	29	6	1
%	(20.4)	(61.7)	(13.3)	(2.6)
Hemodiadsorption	118	251	1	35
%	(39.5)	(73.2)	(0.4)	(11.2)
Home hemodialysis	32	69	0	2
%	(35.6)	(75.0)	(0.0)	(2.2)
CAPD	1 060	2 878	79	90
%	(28.5)	(68.5)	(2.2)	(2.5)
IPD	38	118	0	3
%	(40.4)	(79.7)	(0.0)	(3.1)

CAPD, continuous ambulatory peritoneal dialysis.
IPD, intermittent peritoneal dialysis.

rate of patients newly introduced to dialysis in 1983, which was 0.271.

II. Tabulation of data for new survey items

A. Phosphate binder usage

The amount of phosphorus removed by dialysis is limited. Hence, phosphorus intake should be restricted in accordance with the limited amount of phosphorus eliminated. In many cases, however, excessive accumulation of phosphorus cannot be resolved by only dietary restriction. Thus it is necessary to control the absorption of excessively ingested phosphorus by the digestive tract. Aluminum preparations and calcium preparations were previously used as phosphate binders. However, aluminum preparations involve a risk of accumulation in the body, resulting in various complications. Because of this, aluminum preparation usage is currently contraindicated for dialysis patients. As a consequence, calcium preparations are frequently used as phosphate binders. However, calcium preparations might also lead to hypercalcemia. Sevelamer hydrochloride has recently become available as a phosphate binder with a completely new mode of binding mechanism. With the advent of sevelamer hydrochloride, phosphate binder usage in dialysis patients is expected to change significantly in the few years.

Frequency of use of phosphate binders. The percentage of patients who used a particular type of phosphate binder was tabulated for the patients who answered a questionnaire item regarding the 'Use or no use' of a phosphate binder (hence, patients for whom phosphate binder usage was unknown were excluded from the tabulation). The frequencies of binder use for each treatment method are shown in Table 16. The frequency of calcium use was 75.1%, the highest among the listed phosphate binders. However, it was also shown that the frequency of sevelamer hydrochloride use was 26.2%. These findings indicate that sevelamer hydrochloride is already used in approximately one-quarter of the dialysis patients. Aluminum preparations are contraindicated for dialysis patients, but still appear to be used for a very small number of patients.

Dose of sevelamer hydrochloride. The doses of sevelamer hydrochloride for all the dialysis patients are shown in Table 17 (no selection of the subject patients by treatment method was carried out). The percentages shown in the table are for patients who received sevelamer hydrochloride (patients who did not receive sevelamer hydrochloride were excluded from the calculation). The data showed that many patients were given a daily dose of 1.5–6.0 g. The mean dose for all the patients treated with the drug

TABLE 17. *Doses of sevelamer hydrochloride (for all dialysis patients)*

	<0.75	0.75~	1.5~	3.0~	6.0~	9.0~	Total	Dose undetermined	Not used	Undetermined	Total
Number of patients	731	4993	15 218	15 028	3083	1128	40 181	40	108 666	177	149 064
(%)	(1.8)	(12.4)	(37.9)	(37.4)	(7.7)	(2.8)	(100.0)				

was 3.14 g (±4.13 standard deviation, hereinafter the same as this).

The maximum dose of sevelamer hydrochloride is specified as 9.0 g in Japan. Patients given a daily dose of 6.0–9.0 g accounted for 7.7% of all the patients given sevelamer hydrochloride, and those given a daily dose higher than 9.0 g accounted for only 2.8%. The relatively small number of patients who received a daily dose of 6.0 g or higher seemed attributable to constipation, a severe adverse reaction to sevelamer hydrochloride. However, no investigation of adverse reactions to phosphate binders was conducted in this survey, and it is impossible to clarify the reason for the relatively low dose of sevelamer hydrochloride.

Dose of sevelamer hydrochloride and concentrations of serum calcium, phosphorus and intact PTH. The doses of sevelamer hydrochloride and the concentrations of serum calcium, phosphorus and intact PTH for the facility dialysis patients are shown in Table 18. Serum calcium concentrations in mg/dL and mEq/L are tabulated separately. In patients given a high dose of sevelamer hydrochloride, the concentrations of serum phosphorus and intact PTH tended to increase. However, no clear correlation between serum calcium concentration and the dose of sevelamer hydrochloride was observed.

Dose of sevelamer hydrochloride and concentration of arterial blood HCO^{3-} prior to dialysis. The correlation between the dose of sevelamer hydrochloride and the concentration of arterial blood HCO^{3-} prior to dialysis for facility dialysis patients was evaluated. Sevelamer hydrochloride binds to a chloride ion. When sevelamer hydrochloride binds to phosphorus in the intestine, it releases the chloride ion. Because of this, it has been suggested that patients might exhibit hyperchloremic acidosis when they take sevelamer hydrochloride. Patients given a high dose of sevelamer hydrochloride tended to have a low concentration of arterial blood HCO^{3-}, as shown in Table 19. This suggests that sevelamer hydrochloride usage potentially aggravates acidosis in dialysis patients.

Dose of calcium carbonate. The doses of calcium carbonate for all the dialysis patients are shown in Table 20 (no selection of patients according to the treatment method was carried out). The table shows the percentages of patients given a certain calcium carbonate dose with respect to 'all the patients given' calcium carbonate (patients who did not receive calcium carbonate were excluded from analysis). Approximately 75% of

TABLE 18. *Doses of sevelamer hydrochloride and concentrations of serum calcium, phosphorus and intact PTH (for facility hemodialysis patients)*

Means of various serum concentrations	Not used	Doses of sevelamer hydrochloride (g/day)										Unknown	Missing	Total
		<0.75	0.75~	1.50~	2.25~	3.00~	3.75~	4.50~	5.25~	6.00~	6.75~	7.50~	8.25~	9.00~			
Serum calcium concentration (mg/dL)	8.99	9.30	9.24	9.29	9.32	9.35	9.42	9.43	9.47	9.42	9.46	9.35	9.41	9.44	9.29	9.03	9.08
Standard deviation	0.95	0.98	0.96	0.91	0.91	0.93	0.89	0.92	0.88	0.98	0.89	0.97	0.99	0.98	0.83	0.97	0.96
Serum calcium concentration (mEq/L)	5.39	5.36	5.26	5.25	5.48	5.29	5.69	5.44	5.28	5.71	5.95	6.35	8.50	5.39		3.90	5.39
Standard deviation	1.78	2.03	1.67	1.63	1.80	1.65	1.94	1.59	1.50	1.97	2.18	2.21		1.42		0.26	1.76
Serum phosphorus concentration (mg/dL)	5.27	5.83	5.80	5.94	6.07	6.15	6.22	6.21	6.29	6.24	6.08	6.36	6.63	6.35	5.71	5.39	5.48
Standard deviation	1.50	1.55	1.49	1.50	1.51	1.56	1.49	1.45	1.41	1.53	1.51	1.47	1.48	1.59	1.27	1.81	1.54
Serum intact PTH concentration (pg/mL)	167	209	205	221	242	262	274	283	308	309	273	284	242	280	249	151	188
Standard deviation	181	222	243	234	248	262	265	284	270	321	248	272	202	277	320	144	207

TABLE 19. *Doses of sevelamer hydrochloride and arterial HCO_3^- concentration prior to dialysis (for facility hemodialysis patients)*

	Not used	Doses of sevelamer hydrochloride (g/day)										Unknown	Missing	Total
		<0.75	0.75~	1.50~	2.25~	3.00~	3.75~	4.50~	5.25~	6.00~	6.75~	7.50~	8.25~	9.00~			
Pre-dialysis arterial HCO_3^- concentration (mEq/L)	20.7	21.1	20.7	20.1	19.5	19.2	19.0	19.0	18.3	18.2	19.3	18.0	17.7	19.4		20.3	20.4
Standard deviation	3.2	3.3	3.2	3.3	3.0	2.9	2.8	3.1	2.8	2.8	4.1	2.6	1.2	3.4		2.7	3.3

the patients given calcium carbonate received doses from 1.5 to 4.5 g per day.

Relationships of dose of calcium carbonate with concentrations of serum calcium, phosphorus and intact PTH. The doses of calcium carbonate and the concentrations of serum calcium, phosphorus and intact PTH in the facility dialysis patients are shown in Table 21. No definite correlations were observed between the dose of calcium carbonate and the concentrations of serum calcium, phosphorus or intact PTH. The serum intact PTH concentrations in all the patients given calcium carbonate were lower than those in the patients given sevelamer hydrochloride (Table 18). These findings might indicate that calcium carbonate decreased serum intact PTH concentration more effectively than sevelamer hydrochloride. In contrast, patients who had a high serum intact PTH concentration were likely to develop hypercalcemia following the administration of a vitamin D preparation. This might be the reason sevelamer hydrochloride, not calcium carbonate, was more frequently chosen as the phosphate binder. If so, the present findings might reflect the above-described situation. Thus, it is impossible to assess the present results in connection with the PTH inhibitory effects of various phosphate binders.

Dose of calcium carbonate and frequency of its use in combination with sevelamer hydrochloride. The doses of calcium carbonate and the percentages of patients given a combination of calcium carbonate and sevelamer hydrochloride among all the dialysis patients are shown in Table 22. Calcium carbonate was still used as a phosphate binder for the majority of patients, that is, for approximately 70% of all the dialysis patients, as shown in Table 16. However, 20–25% of these patients given calcium carbonate were also given sevelamer hydrochloride, as shown in Table 22.

In the assessment of the correlation between the dose of calcium carbonate and the frequency of combined use of calcium carbonate and sevelamer hydrochloride, the frequency of combined use tended to be slightly higher for patients given calcium carbonate at a elevated daily dose of 6.0 g or higher. However, the difference between the frequencies of combined use at high and low doses of calcium carbonate was approximately 4%, which does not show a very strong correlation between the dose of calcium carbonate and the frequency of combined use of calcium carbonate and sevelamer hydrochloride. Conversely, the frequency of use of sevelamer hydrochloride for patients not given calcium carbonate was 32.4%.

TABLE 20. *Doses of calcium carbonate (for all dialysis patients)*

	<1.5	1.5~	3.0~	4.5~	6.0~	9.0~	12.0~	Total	Dose unknown	Not used	Unknown	Total
Number of patients	8264	47 819	50 223	13 944	7338	1947	1531	131 066	253	43 689	208	175 216
(%)	(6.3)	(36.5)	(38.3)	(10.6)	(5.6)	(1.5)	(1.2)	(100.0)				

TABLE 21. *Doses of calcium carbonate and concentrations of serum calcium, phosphorus and intact PTH (for facility hemodialysis patients)*

Means of various serum concentrations	Not used	Doses of calcium carbonate (g/day)											
		<1.5	1.5~	3.0~	4.5~	6.0~	7.5~	9.0~	10.5~	12.0~	Unknown	Missing	Total
Serum calcium concentration (mg/dL)	8.93	9.10	9.07	9.15	9.16	9.13	9.04	9.07	9.20	9.10	9.23	8.71	9.07
Standard deviation	1.04	0.90	0.90	0.92	0.92	0.94	0.95	1.01	1.07	0.98	1.04	1.03	0.95
Serum calcium concentration (mEq/L)	5.27	5.16	5.31	5.44	5.49	5.61	6.35	4.94	4.47	4.75	4.55	6.00	5.33
Standard deviation	1.72	1.54	1.72	1.75	1.84	1.89	2.07	1.17	1.32	1.24	0.54	2.88	1.73
Serum phosphorus concentration (mg/dL)	5.41	5.16	5.26	5.49	5.74	5.91	6.03	5.81	5.86	5.73	5.35	4.94	5.43
Standard deviation	1.64	1.37	1.42	1.49	1.50	1.57	1.58	1.66	1.53	1.63	1.29	1.80	1.52
Serum intact PTH concentration (pg/mL)	216	179	167	167	172	188	207	214	180	176	198	209	181
Standard deviation	229	189	183	185	183	210	237	272	196	208	258	233	200

Taken together, sevelamer hydrochloride was generally used in 20–30% of the dialysis patients regardless of the dose of calcium carbonate (even when assessment included patients who did not receive calcium carbonate).

B. Vitamin D preparation usage

Method of treatment and the frequency of use of oral vitamin D preparations. Vitamin D preparations are used for the treatment of renal osteopathy accompanying chronic renal failure. Vitamin D preparations such as maxacalcitol and calcitriol that can be administered intravenously have recently become available in Japan. So, at last, it is possible to carry out intravenous vitamin D pulse therapy domestically. With regard to vitamin D preparation usage, the correlations between the treatment methods and usage of oral vitamin D preparation were first assessed (Table 23). The frequency of use of an oral vitamin D preparation tended to be higher for continuous ambulatory peritoneal dialysis (CAPD) patients than that for dialysis patients. The frequencies of use of calcitriol and falecalcitriol were higher

TABLE 22. *Doses of calcium carbonate and frequencies of combined use of calcium carbonate and sevelamer hydrochloride (for all dialysis patients)*

	Doses of calcium carbonate (g/day)							Dose unknown	Not used	Unknown
	<1.5	1.5~	3.0~	4.5~	6.0~	9.0~	12.0~			
Doses of calcium carbonate and frequencies of combined use of calcium carbonate and sevelamer hydrochloride (for all dialysis patients)	1382	7583	7220	2316	1338	326	238	28	13 985	30
Frequencies of combined use of calcium carbonate and sevelamer hydrochloride	(21.6)	(20.8)	(19.1)	(21.9)	(24.6)	(23.1)	(21.2)	(12.0)	(32.4)	(42.9)

TABLE 23. *Treatment methods and frequencies of use of oral vitamin D preparations (for all dialysis patients)*

Treatment method	Alphacalcidol	Calcitriol	Falecalcitriol	Others	Not used	Undetermined
Hemodialysis	48 388	15 687	3904	1032	95 917	947
%	(29.2)	(9.5)	(2.4)	(0.6)	(57.8)	(0.6)
Hemodiafiltration	3 184	1 094	425	78	6 911	39
%	(27.1)	(9.3)	(3.6)	(0.7)	(58.9)	(0.3)
Hemofiltration	12	3	0	2	40	0
%	(21.1)	(5.3)	(0.0)	(3.5)	(70.2)	(0.0)
Hemodiadsorption	87	35	13	0	226	1
%	(24.0)	(9.7)	(3.6)	(0.0)	(62.4)	(0.3)
Home hemodialysis	22	16	13	0	44	0
%	(23.2)	(16.8)	(13.7)	(0.0)	(46.3)	(0.0)
CAPD	1 149	557	296	35	2 463	75
%	(25.1)	(12.2)	(6.5)	(0.8)	(53.8)	(1.6)
IPD	38	33	5	0	72	1
%	(25.5)	(22.1)	(3.4)	(0.0)	(48.3)	(0.7)

CAPD, continuous ambulatory peritoneal dialysis.
IPD, intermittent peritoneal dialysis.

for CAPD patients than for dialysis patients. These findings are thought to reflect the present situation, in which it is difficult to treat CAPD patients with intravenous vitamin D pulse therapy.

Method of treatment and frequency of use of intravenous vitamin D preparations. The relationship between the treatment method and the frequency of use of intravenous vitamin D preparations was then examined. As shown in Table 24, it was found that intravenous vitamin D preparations were used by approximately 15% of dialysis patients. The intravenous vitamin D preparation used by most of these patients was maxacalcitol. Intravenous vitamin D preparations were used by few CAPD patients (only 3%). It 'is quite unlikely' that the low frequency of use of intravenous vitamin D preparations by CAPD patients is caused by them being in a pathologic condition requiring intravenous vitamin D preparations. In the case of CAPD, that is, dialysis at home, patients only visit a hospital once or twice monthly and change dialysate packs at their home or workplace on days other than hospital visit days. Under such circumstances, it is logical that intravenous vitamin D preparations requiring frequent outpatient injections have not been widely used among CAPD patients. It seems necessary to review the methods for the efficient use and the indications of intravenous vitamin D preparations for CAPD patients.

For home hemodialysis patients, as similarly observed for CAPD patients who undergo dialysis at home, the frequency of use of intravenous vitamin D preparations remained much lower than that for facility hemodialysis patients, despite both undergoing the same hemodialysis. It is assumed that the same problem as that encountered for CAPD patients accounted for this situation. The method of using

TABLE 24. *Treatment methods and frequencies of use of intravenous vitamin D preparations (for all dialysis patients)*

Treatment method	Calcitriol	Maxacalcitol	Others	Not used	Undetermined
Hemodialysis	6822	18 359	232	138 605	748
%	(4.1)	(11.1)	(0.1)	(84.1)	(0.5)
Hemodiafiltration	671	2 030	53	8 860	36
%	(5.8)	(17.4)	(0.5)	(76.1)	(0.3)
Hemofiltration	1	7	0	50	0
%	(1.7)	(12.1)	(0.0)	(86.2)	(0.0)
Hemodiadsorption	27	86	1	248	1
%	(7.4)	(23.7)	(0.3)	(68.3)	(0.3)
Home hemodialysis	0	9	0	86	0
%	(0.0)	(9.5)	(0.0)	(90.5)	(0.0)
CAPD	19	123	0	4 309	89
%	(0.4)	(2.7)	(0.0)	(94.9)	(2.0)
IPD	0	6	0	139	1
%	(0.0)	(4.1)	(0.0)	(95.2)	(0.7)

CAPD, continuous ambulatory peritoneal dialysis.
IPD, intermittent peritoneal dialysis.

intravenous vitamin D preparations by home hemodialysis patients might also need to be reviewed.

Duration of dialysis and the frequency of use of oral vitamin D preparations. The durations of dialysis and the frequencies of use of oral vitamin D preparations are shown in Table 25. The frequency of use of oral vitamin D preparations tended to be high in the group of patients who were on dialysis for less than 5 years and in the group of patients who were on dialysis for 20 years or longer.

Duration of dialysis and frequency of use of intravenous vitamin D preparations. Table 26 shows the durations of dialysis and the frequencies of use of intravenous vitamin D preparations. In contrast to the use of oral vitamin D preparations, a strong correlation between the duration of dialysis and the frequency of use of intravenous vitamin D preparations was observed. It was shown that, until the 15th year of dialysis, the frequency of use of intravenous vitamin D preparations increased with dialysis duration. This suggests that the number of patients with a complication from secondary hyperparathyroidism increased with dialysis duration.

For patients who had been on dialysis for more than 15 years, however, the frequency of use of intravenous vitamin D preparations did not increase any more, and decreased slightly as the duration of dialysis increased. This might indicate that in the case of patients who had been on dialysis for more than 15 years, conservative treatment of secondary hyperparathyroidism had become difficult and the number of patients who underwent the required surgical treatment increased; consequently, the number of patients given intravenous vitamin D preparations, that is, conservative treatment, decreased slightly. Data obtained from the present survey concerning the surgical treatment of hyperparathyroidism support this inference, as described below.

Amount of oral vitamin D preparations used. Table 27 shows the amounts of oral vitamin D preparations used for all of the dialysis patients. The amounts used are presented as the weekly doses of each oral vitamin D preparation. Percentages in the table are those of patients receiving certain doses of the drugs. The majority of patients received weekly doses from 0.75 to 3.0 μg of one of the vitamin D preparations, followed by patients given weekly doses from 3.0 to 6.0 μg of the drug, although the different titers of the drugs do not allow simple comparison of the doses. Eighty percent of the patients

TABLE 25. *Durations of dialysis and frequencies of use of oral vitamin D preparations (for all dialysis patients)*

Years on dialysis	<2		2~		5~		10~		15~		20~		25~	
	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)
Alphacalcidol	13 835	(31.7)	15 151	(31.5)	12 492	(27.5)	5 430	(25.0)	2 705	(23.9)	1746	(24.5)	1521	(27.8)
Calcitriol	4 377	(10.0)	4 564	(9.5)	4 041	(8.9)	1 927	(8.9)	1 136	(10.0)	768	(10.8)	612	(11.2)
Falecalcitriol	831	(1.9)	1 159	(2.4)	1 231	(2.7)	705	(3.2)	348	(3.1)	224	(3.1)	158	(2.9)
Others	353	(0.8)	353	(0.7)	264	(0.6)	90	(0.4)	37	(0.3)	27	(0.4)	23	(0.4)
Not used	23 968	(54.9)	26 660	(55.4)	27 136	(59.7)	13 436	(61.9)	7 017	(62.0)	4324	(60.7)	3132	(57.2)
Undetermined	311	(0.7)	235	(0.5)	263	(0.6)	106	(0.5)	82	(0.7)	35	(0.5)	31	(0.6)
Total	43 675	(100.0)	48 122	(100.0)	45 427	(100.0)	21 694	(100.0)	11 325	(100.0)	7124	(100.0)	5477	(100.0)

TABLE 26. *Durations of dialysis and frequencies of use of intravenous vitamin D preparations (for all dialysis patients)*

Years on dialysis	<2		2~		5~		10~		15~		20~		25~	
	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)
Calcitriol	925	(2.1)	1 521	(3.2)	2 025	(4.5)	1 327	(6.1)	860	(7.6)	494	(6.9)	388	(7.1)
Maxacalcitol	2 124	(4.9)	3 417	(7.2)	5 499	(12.2)	4 276	(19.7)	2 625	(23.1)	1613	(22.6)	1066	(19.5)
Others	41	(0.1)	46	(0.1)	89	(0.2)	42	(0.2)	24	(0.2)	26	(0.4)	18	(0.3)
Not used	39 679	(92.1)	42 449	(89.1)	37 402	(82.7)	15 973	(73.7)	7 813	(68.7)	4992	(69.9)	3989	(72.8)
Undetermined	298	(0.7)	226	(0.5)	204	(0.5)	69	(0.3)	43	(0.4)	18	(0.3)	17	(0.3)
Total	43 067	(100.0)	47 659	(100.0)	45 219	(100.0)	21 687	(100.0)	11 365	(100.0)	7143	(100.0)	5478	(100.0)

fell into either of these two groups for any drug (weekly doses from 0.75 to 6.0 μg).

Amount of intravenous vitamin D preparations used. Table 28 shows the amounts of intravenous vitamin D preparations used for all of the dialysis patients. The amounts of intravenous vitamin D preparations used are presented as weekly doses, similarly to those for oral vitamin D preparations used. Percentages in the table are those of patients receiving certain doses of the drugs. In the case of calcitriol, the majority of patients received weekly doses of 1.5 to 3.0 μg, followed by patients who received weekly doses of 3.0 to 4.5 μg. In the case of maxacalcitol, the majority of patients received weekly doses of 15.0 to 30.0 μg, followed by patients who received weekly doses of 7.5 to 15.0 μg.

Serum intact PTH concentration and frequency of use of oral vitamin D preparations. Serum intact PTH concentrations and the frequencies of use of oral vitamin D preparations for the dialysis patients are shown in Table 29. The frequencies of use of alphacalcidol and calcitriol decreased significantly when serum intact PTH concentration was higher than 200 pg/mL. These findings indicate that these oral vitamin D preparations were changed to other preparations when serum intact PTH concentration was more than 200 pg/mL. No such tendency was observed for falecalcitriol, which tended to be frequently used for patients with a serum intact PTH concentration of more than 200 pg/mL. This suggests that falecalcitriol was indicated for patients with serious secondary hyperparathyroidism.

Alphacalcidol and calcitriol tended to be more frequently used for patients with a serum intact PTH concentration of less than 60 pg/mL. Low bone cycling in patients with a low serum PTH concentration has recently been noted as a problem. From this point of view, the findings obtained from the present survey might indicate problems. The indication and the method of administration of vitamin D preparations for patients with a low serum PTH concentration should be reviewed. No such low bone cycling was observed for falecalcitriol, and the frequency of use of falecalcitriol tended to decrease for patients with a low serum PTH concentration.

Serum intact PTH concentration and frequency of use of intravenous vitamin D preparations. Serum intact PTH concentrations and the frequencies of use of intravenous vitamin D preparations for all of the dialysis patients are shown in Table 30. The frequencies of use of calcitriol and maxacalcitol tended to

TABLE 27. *Doses of oral vitamin D preparations used (for all dialysis patients)*

Dosage (μg/week)	<0.75	0.75~	3.0~	6.0~	10.0~	Total	Missing	Total
Alphacalcidol	4823	29 463	16 140	1786	259	52 471	409	52 880
(%)	(9.2)	(56.2)	(30.8)	(3.4)	(0.5)	(100.0)		
Calcitriol	1502	11 357	3 973	370	99	17 301	124	17 425
(%)	(8.7)	(65.6)	(23.0)	(2.1)	(0.6)	(100.0)		
Falecalcitriol	767	3 723	88	11	27	4 616	40	4 656
(%)	(16.6)	(80.7)	(1.9)	(0.2)	(0.6)	(100.0)		

increase with serum intact PTH concentration. This tendency was much clearer when serum intact PTH concentration was higher than 200 pg/mL. For more than 50% of patients with a serum intact PTH concentration higher than 600 pg/mL, either of the above intravenous vitamin D preparations was used.

The relationship between serum intact PTH concentration and the frequency of use of intravenous vitamin D preparations was in contrast to that between serum intact PTH concentration and the frequency of use of oral vitamin D preparations. These findings suggest that when the serum intact PTH concentration was higher than 200 pg/mL, the drug was changed from an oral vitamin D preparation to an intravenous vitamin D preparation for many of these patients.

C. Number of times patients underwent parathyroidectomy (PTx) and percutaneous ethanol injection therapy (PEIT)

Number of times patients underwent PTx and duration of dialysis. When secondary hyperparathyroidism does not respond to conservative treatment, PTx is indicated. However, PEIT has also been used recently as a less invasive surgical treatment than PTx. The trend of surgical treatment for secondary hyperparathyroidism will potentially change further. Table 31 shows the durations of dialysis and the numbers of times facility dialysis patients underwent PTx. The 'percentage of patients who underwent PTx (%)' was obtained by calculating the percentage of patients who underwent PTx 'at least once', using the number of patients who specifically answered the number of times they received PTx (patients who gave a definite answer) as the denominator. The 'percentage of patients who underwent PTx again (%)' was obtained by calculating the percentage of the patients who underwent PTx 'at least twice' using the number of patients who underwent PTx 'at least once' as the denominator.

PTx was carried out on 5.4% of all of the dialysis patients. When the duration of dialysis was more than 10 years, the percentage of patients who underwent PTx increased sharply. These findings corresponded to the results of preceding surveys (3). The 'percentage of patients who underwent PTx again', that is, those who answered that they had undergone PTx 'at least twice' was 8.4%. The patients who underwent PTx again are considered to be those who had a recurrence of either residual parathyroidism or retransplanted parathyroidism after the first PTx, the treatment of which required PTx again. The present survey results indicated that such patients accounted for 8.4% of the patients who had a previous history of PTx. When dialysis duration was of 20 years or longer, 'the percentage of patients who underwent PTx again' tended to discontinuously increase.

This result indicates that when dialysis duration 'exceeds 10 years', the percentage of patients who underwent PTx discontinuously increased. This might indicate that the parathyroid in 'terminal renal failure' was in the state of hyperparathyroidism resistant to systemic medication when the duration of exposure to the medication was more than 10 years. If this is so, the findings that the percentage of patients who underwent PTx again increased discontinuously among patients who had received dialysis for 20 years or longer suggest that the parathyroid

TABLE 28. *Doses of intravenous vitamin D preparations used (for all dialysis patients)*

Dosage (μg/week)	<1.0	1.0~	1.5~	3.0~	4.5~	Total	Missing	Total
Calcitriol	492	1035	2844	2127	1028	7 526	14	7 540
(%)	(6.5)	(13.8)	(37.8)	(28.3)	(13.7)	(100.0)		
Dosage (μg/week)	<7.5	7.5~	15.0~	30.0~	50.0~	Total	Missing	Total
Maxacalcitol	3271	6342	8007	2692	150	20 462	158	20 620
(%)	(16.0)	(31.0)	(39.1)	(13.2)	(0.7)	(100.0)		

TABLE 29. *Serum intact PTH concentrations and frequencies of use of oral vitamin D preparations (for all dialysis patients)*

Serum intact PTH concentration (pg/mL)	<20		20~		40~		60~		80~		100~		120~		140~	
	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)
Alphacalcidol	4 501	(33.2)	4 832	(33.6)	4 010	(32.1)	3 615	(31.1)	3 314	(31.0)	3050	(31.8)	2896	(30.9)	2390	(28.7)
Calcitriol	1 731	(12.8)	1 472	(10.2)	1 215	(9.7)	1 107	(9.5)	1 014	(9.5)	920	(9.6)	866	(9.2)	802	(9.6)
Falecalcitriol	200	(1.5)	218	(1.5)	182	(1.5)	185	(1.6)	213	(2.0)	225	(2.3)	214	(2.3)	217	(2.6)
Others	112	(0.8)	105	(0.7)	86	(0.7)	71	(0.6)	53	(0.5)	63	(0.7)	46	(0.5)	40	(0.5)
Not used	6 976	(51.4)	7 687	(53.5)	6 935	(55.6)	6 578	(56.6)	6 058	(56.6)	5305	(55.2)	5319	(56.7)	4844	(58.1)
Undetermined	42	(0.3)	65	(0.5)	56	(0.4)	60	(0.5)	45	(0.4)	43	(0.4)	46	(0.5)	44	(0.5)
Total	13 562	(100.0)	14 379	(100.0)	12 484	(100.0)	11 616	(100.0)	10 697	(100.0)	9606	(100.0)	9387	(100.0)	8337	(100.0)

Serum intact PTH concentration (pg/mL)	160~		180~		200~		360~		600~		800~		1000~			
	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)		
Alphacalcidol	2 319	(28.9)	2 028	(28.1)	8 698	(25.8)	2 516	(18.7)	462	(13.7)	159	(10.8)	163	(10.7)		
Calcitriol	725	(9.0)	672	(9.3)	3 169	(9.4)	1 026	(7.6)	207	(6.2)	87	(5.9)	89	(5.9)		
Falecalcitriol	238	(3.0)	211	(2.9)	1 374	(4.1)	566	(4.2)	121	(3.6)	63	(4.3)	49	(3.2)		
Others	37	(0.5)	50	(0.7)	167	(0.5)	47	(0.4)	3	(0.1)	3	(0.2)	4	(0.3)		
Not used	4 674	(58.2)	4 231	(58.5)	20 170	(59.8)	9 182	(68.4)	2 548	(75.8)	1152	(78.2)	1209	(79.5)		
Undetermined	35	(0.4)	36	(0.5)	162	(0.5)	83	(0.6)	22	(0.7)	10	(0.7)	7	(0.5)		
Total	8 028	(100.0)	7 228	(100.0)	33 740	(100.0)	13 420	(100.0)	3 363	(100.0)	1474	(100.0)	1521	(100.0)		

TABLE 30. *Serum intact PTH concentrations and frequencies of use of intravenous vitamin D preparations (for all dialysis patients)*

	<20		20~		40~		60~		80~		100~		120~		140~	
Serum intact PTH concentration (pg/mL)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)
Alphacalcidol	86	(0.7)	96	(0.7)	122	(1.0)	156	(1.4)	175	(1.7)	222	(2.3)	266	(2.9)	291	(3.5)
Maxacalcitol	127	(1.0)	232	(1.7)	301	(2.5)	367	(3.2)	464	(4.4)	516	(5.5)	668	(7.2)	770	(9.3)
Others	9	(0.1)	5	(0.0)	9	(0.1)	6	(0.1)	8	(0.1)	6	(0.1)	10	(0.1)	14	(0.2)
Not used	12 934	(98.0)	13 656	(97.3)	11 757	(96.1)	10 849	(95.0)	9 866	(93.5)	8649	(91.6)	8286	(89.3)	7113	(86.3)
Undetermined	41	(0.3)	51	(0.4)	48	(0.4)	46	(0.4)	38	(0.4)	54	(0.6)	49	(0.5)	50	(0.6)
Total	13 197	(100.0)	14 040	(100.0)	12 237	(100.0)	11 424	(100.0)	10 551	(100.0)	9447	(100.0)	9279	(100.0)	8238	(100.0)

	160~		180~		200~		360~		600~		800~		1000~	
Serum intact PTH concentration (pg/mL)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)	Number of patients	(%)
Alphacalcidol	367	(4.6)	381	(5.3)	2 482	(7.3)	1 660	(12.1)	483	(13.9)	206	(13.6)	230	(14.8)
Maxacalcitol	886	(11.1)	922	(12.8)	6 968	(20.6)	4 602	(33.7)	1 360	(39.1)	610	(40.3)	570	(36.8)
Others	13	(0.2)	11	(0.2)	88	(0.3)	67	(0.5)	23	(0.7)	5	(0.3)	1	(0.1)
Not used	6 676	(83.8)	5 843	(81.3)	24 173	(71.4)	7 302	(53.4)	1 597	(46.0)	682	(45.1)	743	(47.9)
Undetermined	22	(0.3)	33	(0.5)	142	(0.4)	41	(0.3)	11	(0.3)	10	(0.7)	7	(0.5)
Total	7 964	(100.0)	7 190	(100.0)	33 853	(100.0)	13 672	(100.0)	3 474	(100.0)	1513	(100.0)	1551	(100.0)

TABLE 31. *Number of times of undergoing parathyroidectomy (PTx) and durations of dialysis (for facility hemodialysis patients)*

Years on dialysis	Number of times of undergoing PTx											Percentage of patients who underwent PTx†	Percentage of patients who underwent PTx again‡
	None	1	2	3	4	5	6	7	8≤	Subtotal	Unknown	Missing	Total		
<2	38 011	624	14	2	2	13	1	0	1	38 668	687	13 776	53 131	1.7	5.0
%	98.3	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0					
2 ≤ <5	40 862	475	22	9	9	31	0	0	1	41 409	919	14 832	57 160	1.3	13.2
%	98.7	1.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	100.0					
5 ≤ <10	37 298	1023	38	15	7	24	1	0	2	38 408	870	13 922	53 200	2.9	7.8
%	97.1	2.7	0.1	0.0	0.0	0.1	0.0	0.0	0.0	100.0					
10 ≤ 15	16 333	1585	81	11	3	14	1	0	5	18 033	364	6 507	24 904	9.4	6.8
%	90.6	8.8	0.4	0.1	0.0	0.1	0.0	0.0	0.0	100.0					
15 ≤ <20	7 316	1570	102	7	6	5	2	0	0	9 008	205	3 276	12 489	18.8	7.2
%	81.2	17.4	1.1	0.1	0.1	0.1	0.0	0.0	0.0	100.0					
20 ≤ <25	3 898	1279	112	13	10	4	0	0	0	5 316	118	1 994	7 428	26.7	9.8
%	73.3	24.1	2.1	0.2	0.2	0.1	0.0	0.0	0.0	100.0					
25≤	2 440	1110	99	20	2	6	0	0	4	3 681	120	1 361	5 162	33.7	10.6
%	66.3	30.2	2.7	0.5	0.1	0.2	0.0	0.0	0.1	100.0					
Total	146 158	7666	468	77	39	97	5	0	13	154 523	3283	55 668	213 474	5.4	8.4
%	94.6	5.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	100.0					

†Percentage of patients who underwent PTx: Obtained by calculating the percentage of patients who underwent PTx 'at least once', with respect to the number of patients who specifically answered the number of times of PTx (patients who gave a definite answer).
‡Percentage of patients who underwent PTx again: Obtained by calculating the percentage of patients who underwent PTx 'at least twice', with respect to the number of patients who underwent PTx 'at least once.

that was retransplanted at the time of the first PTx when patients who had received dialysis for 10–15 years had reached the state of hyperparathyroidism resistant to systemic medication by the time the patients had received dialysis for 20–25 years.

Number of times patients received PEIT and duration of dialysis. Table 32 shows durations of dialysis and the numbers of times facility dialysis patients received PEIT. The 'percentage of patients who received PEIT (%)' was obtained from the number of patients who received PEIT 'at least once' with respect to the total number of patients who specifically indicated the number of times of receiving PEIT. The 'percentage of patients who underwent PEIT again (%)' was obtained from the number of patients who received PEIT 'at least twice' with respect to the total number of patients who received PEIT 'at least once. The percentage of facility dialysis patients who received PEIT was 1.4%, which is lower than that of patients who underwent PTx (5.4%). The relationship between the duration of dialysis and the percentage of receiving PEIT showed that the percentage tended to increase discontinuously when the patients had undergone dialysis for more than 10 years. In the case of PTx, when the patients had undergone dialysis for more than 10 years, the percentage of patients undergoing PTx tended to further increase as the duration of dialysis increased (see Table 31). For PEIT, the increase in the percentage of patients undergoing dialysis for more than 10 years who received PEIT was not necessarily marked, as compared with that for PTx. These findings are discussed later.

In the present survey results, among the patients with a previous history of PEIT 'at least once', the percentage of those 'receiving PEIT again' was 35.0%. This percentage was much higher than that of 'undergoing PTx again' (8.4%). In addition, a strong correlation between the percentage of patients receiving PEIT again and the duration of dialysis was noted. That is, the percentage of patients 'receiving PEIT again' increased discontinuously for patients with the 'duration of dialysis of 5 years or longer.' The percentage of patients 'receiving PEIT again' increased further to more than 50% for the patients both with a previous history of PEIT 'at least once' and the 'duration of dialysis of 10 years or longer.' These findings were considerably different from those for PTx. The present findings suggest that hyperparathyroidism became aggravated very early after receiving PEIT (less than 5 years), and that this condition required PEIT again.

In the case of the patients who had undergone dialysis for more than 15 years, neither the 'percentage of

TABLE 32. *Number of times of undergoing percutaneous ethanol injection therapy (PEIT) and durations of dialysis (for facility hemodialysis patients)*

Years on dialysis	Number of times of undergoing PTx								Subtotal	Unknown	Missing	Total	Percentage of patients who underwent PTx†	Percentage of patients who underwent PTx again‡
	None	1	2	3	4	5	6	7	8≤					
<2	38 148	344	4	3	0	1	1	0	0	38 501	630	14 000	53 131	0.9	2.5
%	99.1	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0					
2 ≤ <5	41 032	241	14	6	0	1	2	0	2	41 298	850	15 012	57 160	0.6	9.4
%	99.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0					
5 ≤ <10	37 937	246	34	20	9	3	7	4	24	38 284	758	14 158	53 200	0.9	29.1
%	99.1	0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.1	100.0					
10 ≤ 15	17 568	207	79	35	21	17	13	4	57	18 001	344	6 559	24 904	2.4	52.2
%	97.6	1.1	0.4	0.2	0.1	0.1	0.1	0.0	0.3	100.0					
15 ≤ <20	8 644	168	62	32	16	7	10	2	48	8 989	201	3 299	12 489	3.8	51.3
%	96.2	1.9	0.7	0.4	0.2	0.1	0.1	0.0	0.5	100.0					
20 ≤ <25	5 127	101	37	20	10	5	5	4	26	5 335	109	1 984	7 428	3.9	51.4
%	96.1	1.9	0.7	0.4	0.2	0.1	0.1	0.1	0.5	100.0					
25≤	3 540	50	28	14	11	4	2	1	25	3 675	127	1 360	5 162	3.7	63.0
%	96.3	1.4	0.8	0.4	0.3	0.1	0.1	0.0	0.7	100.0					
Total	151 996	1357	258	130	67	38	40	15	182	154 083	3019	56 372	213 474	1.4	35.0
%	98.6	0.9	0.2	0.1	0.0	0.0	0.0	0.0	0.1	100.0					

†Percentage of patients who underwent PEIT: Obtained by calculating the percentage of patients who underwent PEIT 'at least once', with respect to the number of patients who specifically answered the number of times of PEIT (patients who gave a definite answer).
‡Percentage of patients who underwent PEIT again: Obtained by calculating the percentage of patients who underwent PEIT 'at least twice', with respect to the number of patients who underwent PEIT 'at least once.

patients who underwent PEIT', nor the 'percentage of patients who underwent PEIT again', increased any further when the duration of dialysis increased. Conversley, as mentioned earlier, the 'percentage of patients who underwent PTx' increased nearly in proportion to the duration of dialysis also for patients who had undergone dialysis for more than 15 years (see Table 31). These findings indicate that in the case of patients who had undergone dialysis for more than 15 years, not PEIT but PTx was carried out to treat hyperparathyroidism resistant to PEIT.

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