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An Overview of Regular Dialysis Treatment in Japan (as of 31 December 2001)[1]

Patient Registration Committee, Japanese Society for Dialysis Therapy, Tokyo, Japan[2]

Abstract: Questionnaire forms for an annual survey conducted at the end of 2001 were sent out to 3520 institutions, and 3485 replies were received (response rate, 99.00%). According to the survey, the dialysis population of Japan at year end was 219 183 patients, up 6.3% (13 049) over the year before. This equals 1721.9 dialysis patients per million population. The gross mortality rate was 9.3% for the year extending from the end of 2000 to the end of 2001. The mean age of patients beginning dialysis was 64.2 years (±13.7 SD). The mean age of the overall dialysis population in the study year was 61.6 years (±13.1 SD), which was also a higher age than the year before. Among dialysis patients, the primary disease was diabetic nephropathy in 38.1% of patients, slightly down from 39.1% the previous year. Chronic glomerulonephritis was the primary disease in 32.4% of cases, a decrease from 34.7% the previous year. This survey included for the first time the items of the lowest blood pressure during hemodialysis session, vasopressor therapy before dialysis and vasopressor therapy during dialysis session. An analysis of the relationship between the type of vascular access used at the initiation of dialysis and the survival prognosis revealed a significantly higher risk of death in patients undergoing dialysis with synthetic arterio-venous (AV) fistula, AV shunt, or catheter implantation into a central vein than in those receiving dialysis treatments with a native fistula. There was a significantly lower risk of death in the patient group in whom the vascular access was created at 3–6 months before initiation of dialysis than in those in whom such access was created at the time of initiation or within 3 months before the initiation of dialysis. An analysis of the risk factors affecting survival prognosis in maintenance hemodialysis patients showed that risk factors for death are post-dialysis systolic blood pressure over 180 mm Hg and lower than 120 mm Hg, blood pressure elevating progressively from the start to the end of dialysis, serum high density lipoprotein cholesterol concentration of less than 30 mg/dL, and a higher ultrafiltration rate. In comparisons of the death risk between the patient group with a history of intervention for ischemic heart disease and the patient group with a history of myocardial infarction or heart failure but without such intervention, among diabetes patients, those who underwent percutaneous transluminal coronary angioplasty had a significantly lower risk of death than those in whom no intervention was made. **Key Words:** Dialysis, Hazards mode, Mortality, Statistics Survey.

The Japanese Society for Dialysis Therapy has conducted statistical surveys of dialysis facilities and dialysis patients throughout Japan annually since 1968. Questionnaires for the 2001 year-end survey were sent to 3520 dialysis facilities throughout Japan, and 3485 facilities responded (99.00%). Based on the results of the facilities survey, the total dialysis patient population was 219 183 at the end of 2001, up 13 049 (6.3%) from the previous year (1). This figure means there are 1721.9 dialysis patients per one million head of population, an increase of 97.8 from the year before. The increase of the dialysis population in Japan has been approximately linear from year to year since the survey began. The annual crude mortality rate for 2001 was 9.3%, slightly lower than that for 2000 (9.4%).

This report covers (i) basic statistics on chronic dialysis patients through the end of the year 2001; (ii) compiled results of new survey items; (iii) analysis of the relationship between blood access at initiation and patient prognosis; (iv) analysis of factors determining hemodialysis patient prognosis; and (v) analysis of the relationship between ischemic heart disease intervention and prognosis of patient with myocardial infarction/cardiac failure.

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[2]Shigeru Nakai, Takahiro Shinzato, Yuji Nagura, Ikuto Masakane, Tateki Kitaoka, Toshio Shinoda, Chikao Yamazaki, Rumi Sakai, Hiroyuki Ohmori, Osamu Morita, Kunitoshi Iseki, Kenjiro Kikuchi, Kazuo Kubo, Kazuyuki Suzuki, Kaoru Tabei, Kiyohide Fushimi, Naoko Miwa, Atsushi Wada, Mitsuru Yanai, Takashi Akiba.

Address correspondence and reprint requests to Dr Takashi Akiba, Division of Blood Purification and Medicine, Kidney Center, Tokyo Women's Medical University, 8-1 Kawadacho, Shinjyuku-ku, Tokyo 162–8666, Japan. Email: takiba.med2@med.tmd.ac.jp

SUBJECTS AND METHODS

This survey is conducted each year by sending out questionnaires to individual dialysis facilities. A total of 3520 facilities participated in the current survey, including current institutional members of the Japanese Society for Dialysis Therapy, as well as non-member facilities performing chronic dialysis as of the end of December 2001. The total number of facilities participating in the current survey increased by 160 (4.7%) over 2000.

The postal service was generally used to send and receive the questionnaires, but for some facilities the questionnaires were delivered and returned by facsimile. Facilities that submitted a prior request were provided the questionnaires on floppy disk rather than paper.

This survey consists of two categories: facility-specific questions relating to staff and equipment, such as number of patients treated, staffing, and number of dialysis machines and other equipment (Form I), and patient-specific information, such as epidemiological background and dialysis prescriptions for each patient, as well as outcome information (Forms II, III, and IV). The response rate for the facilities survey by the end of the year 2001 was 99.00%. However, the patient survey data were unable to be collected from 123 facilities, resulting in a completed survey return rate of 96.5%.

Changes in the statistical processing system

Until now, statistical processing was performed using a special program written in COBOL language running on an IBM-type mainframe computer. Although this method was very common in the 1980s, it required programming to output new documents, and could not output documents to electronic media.

In the course of downsizing in recent years, statistical processing of the current survey data was switched to a client/server system using Microsoft Windows 2000 as the operating system on a personal computer. Data processing was handled using Oracle8i software. Each type of document was prepared using a data extraction/listing system (programmed in Visual Basic language) on a client computer.

Basic statistics on chronic dialysis patients as of the end of 2001

The number of patients starting dialysis treatment, number of mortalities, and the annual crude mortality rate were complied on the basis of facility survey results for the year 2001. In addition, the cumulative survival rate after starting dialysis therapy was compiled on the basis of the results of the patient survey.

Compilation of new survey items

The following items were surveyed for the first time in the current survey: lowest blood pressure during treatment, vasopressor therapy before dialysis, vasopressor therapy during dialysis, and hemopurification method used to prevent hypotension during treatment. Although oral antihypertensive usage status was also surveyed last year, the choices were revised in the current survey. The following were compiled in the survey.

Lowest blood pressure during dialysis treatment

The lowest blood pressure during dialysis treatment was used as the lowest blood pressure in the survey.

Ratio of lowest blood pressure during treatment and predialysis blood pressure

The relationships of the ratios of the lowest blood pressure during dialysis and the predialysis blood pressure (i.e. lowest blood pressure divided by predialysis blood pressure) to various indices were calculated. Patients for whom this ratio is small can be viewed as patients who experience a large drop in blood pressure during dialysis.

Blood pressure fluctuation patterns

The ratio of the lowest blood pressure during dialysis and the post-dialysis blood pressure (i.e. lowest blood pressure divided by the post-dialysis blood pressure) was calculated. When the ratio of the lowest blood pressure during dialysis and the post-dialysis blood pressure was quite small, the following two conditions were assumed:

1. A large drop in blood pressure during treatment recovered by the end of treatment.
2. Blood pressure rose after treatment.

In addition, when the ratio approached 1.0, the following conditions were assumed:

1. A large drop in blood pressure during treatment did not recover by the end of dialysis.
2. Blood pressure did not drop during dialysis and was stable upon its completion. (Note: When the post-dialysis blood pressure is the lowest blood pressure during treatment, the lowest blood pressure becomes the post-dialysis blood pressure, and the ratio becomes 1.0. In other words, the ratio of the lowest blood pressure during treatment and the post-dialysis blood pressure does not exceed 1.0)

When the ratio of the lowest blood pressure during treatment and the post-dialysis blood pressure are quite small, a common framework is possible in which the blood pressure rises during treatment through the latter half of dialysis. However, when the ratio of the lowest blood pressure during treatment to the post-dialysis blood pressure approaches 1.0, it may be interpreted as functional insufficiency of blood pressure regulation if there is a lack of recovery of the lowest blood pressure during treatment by the end of dialysis, and may be interpreted as adequate function of blood pressure regulation if blood pressure does not drop during treatment and remains stable through the end of dialysis. In other words, as there are two different simultaneous interpretations when the ratio of the lowest blood pressure during treatment and the post-dialysis blood pressure is near 1.0, it is actually impossible to interpret the data appropriately.

To resolve this problem, the current survey analysis attempts to classify the blood pressure fluctuation patterns during dialysis on the basis of the two indices of the ratio of the lowest blood pressure during treatment and post-dialysis blood pressure, and the ratio of post-dialysis to predialysis blood pressure. In blood pressures used to calculate these ratios, the systolic blood pressure was used, as it drops more markedly than diastolic blood pressure does.

The mean value of the respective ratios was used as the cut-off threshold value discriminating between the categories of the ratio of the lowest blood pressure during treatment and post-dialysis blood pressure, and the ratio of post-dialysis to predialysis blood pressure. Because among all hemodialysis patients, the mean ratio of the lowest blood pressure during treatment and post-dialysis blood pressure was 0.88 ± 0.12, the cut-off threshold value of the ratio of the lowest blood pressure during treatment and post-dialysis blood pressure was set at 0.9. Similarly, because the mean ratio of the post-dialysis to predialysis blood pressures was 0.91 ± 0.15, the cut-off threshold value was set at 0.9. Using these indices, patients were classified into the four categories listed below (refer to Fig. 1).

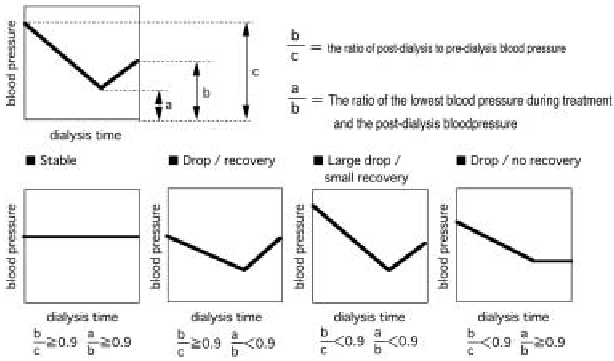

FIG. 1. Conceptual diagram of each category of blood pressure fluctuation pattern. Each category includes patients who do not necessarily conform to the illustrated image.

Large blood pressure drop/small recovery group

Definition: The ratio of the lowest blood pressure during treatment and post-dialysis blood pressure is less than 0.9; the ratio of post-dialysis to predialysis blood pressure is less than 0.9.

Interpretation: This group can be interpreted two ways, as described in (a) and (b) below.

(a) Equivalent to a large drop from a high predialysis blood pressure, and a certain degree of recovery by the end of dialysis.
(b) Very large drop from normal blood pressure, and insufficient recovery by the end of dialysis.

Between the ratio of the lowest blood pressure during treatment and the predialysis blood pressure and blood pressure at the start of dialysis, there was a recognized tendency of a large drop in blood pressure among patients who had high blood pressure at the start of dialysis. Therefore, in this group, most patients were interpreted by criterion (a), and patients thus classified were named the 'large drop/small recovery' group.

Blood pressure drop/recovery group

Definition: The ratio of the lowest blood pressure during treatment and the post-dialysis blood pressure is less than 0.9; the ratio of post-dialysis to predialysis blood pressure is 0.9 or higher.

Interpretation: Large drop in blood pressure during dialysis, and recovery by the end of treatment.

Part of this group includes patients who experienced a blood pressure rise after dialysis without a blood pressure drop during treatment. A relatively small number of patients are thought to have experienced a blood pressure rise from the start to the end of dialysis. This group was designated the 'drop/recovery' group.

Blood pressure drop/no recovery group

Definition: The ratio of the lowest blood pressure during treatment and the post-dialysis blood pressure is 0.9 or higher; the ratio of post-dialysis to predialysis blood pressure is less than 0.9.

Interpretation: Blood pressure that fell during treatment did not recover by the end of dialysis. This group was designated the 'drop/no recovery' group.

Stable group

Definition: The ratio of the lowest blood pressure during treatment and the post-dialysis blood pressure is 0.9 or higher; the ratio of post-dialysis to pre-dialysis blood pressure is 0.9 or higher.

Interpretation: No blood pressure drop during treatment, and pressure remained stable at the end of dialysis. This group was named the 'stable' group.

The concepts of the blood pressure fluctuation patterns of patients classified in each category are shown in Fig. 1. However, these classifications include patients whose blood pressure fluctuation patterns do not necessarily conform to the concepts in the figure.

Vasopressor therapy used prior to the start of dialysis

Vasopressor therapies used prior to the start of dialysis were surveyed using the choices shown in Table 1. All combinations of up to three kinds of vasopressors administered are compiled.

Vasopressor therapy during dialysis

Vasopressor therapy performed during dialysis was surveyed using the choices shown in Table 1.

Oral antihypertensive usage status

Although the usage status of antihypertensives was surveyed last time with the choices of taken orally and not taken orally, choices were set as follows in the present survey:

- Not used.
- Used and the dosage was not reduced. Patient uses antihypertensives (a part or all of the dose of drugs taken orally in conjunction with the dialysis schedule has not been reduced or discontinued).
- Used but the dosage was reduced. Patient uses antihypertensives (a part or all of the dose of drugs taken orally in conjunction with the dialysis schedule has been reduced or discontinued).
- Used but the dosage reduction was unknown. Patient uses antihypertensives but unknown whether or not patient controlled the dosage of antihypertensives in conjunction with the dialysis schedule;
- Usage status unknown. Unknown whether or not patient used the antihypertensives.

Hemopurification modalities to prevent hypotension during treatment

The following choices were surveyed as hemopurification modalities to prevent hypotension during treatment: conventional hemodialysis, high-Na dialysis (dialysate Na concentration 145 mEq/L or higher), other hemodialysis, off-line hemodiafiltration (HDF), on-line HDF, original push-pull HDF, pressure-controlled push-pull HDF, biofiltration (AFBF), and other hemodiafiltration.

Because, among these choices, the former three are hemodialysis treatments and the latter six are

TABLE 1. *Vasopressor therapy choices*

A	Untreated
B	Oral vasopressor
C	Saline
D	High-concentration NaCl solution
E	Concentrated glycerin solution
F	Intravenous vasopressor
G	"oral vasopressor" + "saline"
H	"oral vasopressor" + "high-concentration NaCl solution"
I	"oral vasopressor" + "concentrated glycerin solution"
J	"oral vasopressor" + "intravenous vasopressor"
K	"saline" + "high-concentration NaCl solution"
L	"saline" + "concentrated glycerin solution"
M	"saline" + "intravenous vasopressor"
N	"high-concentration NaCl solution" + "concentrated glycerin solution"
O	"high-concentration NaCl solution" + "intravenous vasopressor"
P	"concentrated glycerin solution" + "intravenous vasopressor"
Q	"oral vasopressor" + "saline" + "high-concentration NaCl solution"
R	"oral vasopressor" + "saline" + "concentrated glycerin solution"
S	"oral vasopressor" + "saline" + "intravenous vasopressor"
T	"oral vasopressor" + "high-concentration NaCl solution" + "concentrated glycerin solution"
U	"oral vasopressor" + "high-concentration NaCl solution" + "intravenous vasopressor"
V	"oral vasopressor" + "concentrated glycerin solution" + "intravenous vasopressor"
W	"saline" + "high-concentration NaCl solution" + "concentrated glycerin solution"
X	"saline" + "high-concentration NaCl solution" + "intravenous vasopressor"
Y	"saline" + "concentrated glycerin solution" + "intravenous vasopressor"
Z	"high-concentration NaCl solution" + "concentrated glycerin solution" + "intravenous vasopressor"
4	Four or more vasopressor therapies
5	Others

TABLE 2. *Characteristics of patients analyzed for blood access at initial dialysis and life prognosis*

	Number of patients	%
Total	5404	(100.0)
Sex		
Male	3337	(61.8)
Female	2067	(38.2)
Diagnosis		
Diabetes	2128	(39.4)
Non-diabetes	3276	(60.6)
Starting dialysis age		
< 15	3	(0.1)
15 ≦ < 30	72	(1.3)
30 ≦ < 45	308	(5.7)
45 ≦ < 60	1307	(24.2)
60 ≦ < 75	2394	(44.3)
75 ≦ < 90	1283	(23.7)
90 ≦	37	(0.7)
Mean ± s.d.	64.8	±13.1

hemodiafiltration treatments, the former three choices were applied to hemodialysis patients, and the latter six choices were performed for hemodiafiltration patients.

Analysis of the relationship between blood access type when beginning dialysis treatment and patient prognosis

The relationship between the blood access type when a patient began dialysis therapy during the year 2001 and the 1-year prognosis was analyzed, as was the relationship between the time at blood access had been created and the 1-year prognosis after starting dialysis. Among patients who started dialysis during the year 2001, those responded to the survey on the blood access type when treatment was initiated and the time when the blood access had been created, were selected for the analysis. Among these patients, moreover, only patients receiving hemodialysis treatment were finally selected in order to eliminate the possible influence of treatment modalities. Ultimately, a total of 5404 patients were used in the analysis. The characteristics of these patients is shown in Table 2, and their blood access type at initiation, and the period from blood access creation to initial dialysis treatment are shown in Table 3.

The prognosis end-point was decided to be death due to diseases. Patients who died due to accident, trauma, and suicide and those who changed treatment modality and those who could not be located were handled as censored cases. The prognosis-tracking period was from hemodialysis initiation through the end of 2001. Outcomes of hemodialysis therapy among patients used in the analysis are shown in Table 4.

The proportional hazard model was used for this analysis (2). Effects of basic background factors, such as gender, age, duration of dialysis, or diabetic status, were mathematically adjusted using the proportional hazard model.

Analysis of factors determining life prognosis of hemodialysis patients

Initiation year of hemodialysis and mortality risk

The numbers of diabetic and elderly patients are increasing annually. It is therefore difficult to accurately compare the outcome of dialysis treatment simply by comparing the annual survival rates of patients initiating dialysis treatment each year. In order to achieve greater accuracy in evaluating the treatment outcome among patients initiating treatment each year, differences in patient distribution relating to gender, age, and diabetic status existing among cohorts initiating treatment each year were mathematically corrected, and the mortality risks of such patients were compared for each initiation year.

The life prognosis was tracked at 1 year, 5 years, and 10 years after initiation of dialysis treatment. Because the treatment modality at the time of initiation of dialysis was not surveyed, only patients whose treatment modality was hemodialysis at the end of the initiation year were used in the analysis.

TABLE 3. *Period from blood access creation to initiation of patients analyzed for blood access at initial dialysis and life prognosis*

Period from blood access creation to initiation	Blood access type: Brescia-Cimino fistula	A-V fistula using a prosthetic graft	Superficially repositioned artery	External shunt	Hemacyte	Catheter	Peritoneal dialysis	Total
< 1 month	1443	38	28	52	13	1742	12	3328
1 ≦ < 2 months	716	16	7	5	1	91	2	838
2 ≦< 3 months	268	3	3	0	1	19	0	294
3 ≦< 6 months	396	5	5	0	1	18	0	425
6 months ≦	470	8	4	1	1	35	0	519
Total	3293	70	47	58	17	1905	14	5404

TABLE 4. *Outcome of hemodialysis in patients analyzed for blood access at initial dialysis and life prognosis*

Outcome	Number of patients
Alive	4593
Dead	
Other cause of death	645
Rejection	2
Accident	2
Suicide	2
Censored	
Secession	1
Treatment change	159
Total	5404

A total of 362 960 patients who began dialysis between 1983 and 2000 were included in the analysis of life prognosis for 1 year; 245 329 patients initiating treatment from 1983 to 1996 were included in analysis of life prognosis for 5 years; and 128 458 patient starting treatment from 1983 to 1991 were analyzed the life prognosis for 10 years after initiation of hemodialysis. The proportional hazard model (2) was used for the analysis. The impact on life prognosis by skewed distribution of patient characteristics such as gender, age, and diabetic status existing among cohorts initiating treatment each year was mathematically corrected in the proportional hazard model.

Factors affecting 1-year life prognosis of hemodialysis patients

Risk factors for 1-year survival through the end of 2001 were analyzed by the proportional hazard model (2) using patients receiving hemodialysis three times per week at the end of 2000 as subjects. The prognosis-tracking end-point was death due to diseases during the year from 1 January 2001 to 31 December 2001. Censored cases were patients switching the treatment for end-stage renal failure from a hemodialysis of three times a week to another regimen, such as kidney transplants and other modalities, discontinuing hemodialysis therapy, lost to follow-up, and died due to unrelated causes, such as accident, trauma, and suicide.

Factors analyzed for life prognosis were post-dialysis blood pressure, ratio of pre- and post-dialysis blood pressure, and serum HDL cholesterol level all of which were surveyed for the first time in 2001. In addition to these factors, the water removal rate (described later) was also analyzed. The effect of basic factors such as gender, age, dialysis length, and diabetic status affecting prognosis were mathematically corrected using the proportional hazard model.

Post-dialysis blood pressure The post-dialysis systolic and diastolic blood pressures and the mean blood pressures were analyzed. The mean blood pressure was calculated as follows.

$$\textit{Mean blood pressure} = [\textit{diastolic pressure} + (\textit{systolic pressure} - \textit{diastolic pressure}) \div 3]$$

A total of 65 112 patients were evaluated and 3936 of these patients died by the end of 2001.

Ratio of pre- and post-dialysis blood pressure

The relationship between the ratio of pre- and post-dialysis blood pressure and life prognosis was analyzed. The ratio of pre- and post-dialysis blood pressure was determined by dividing the post-dialysis blood pressure by the predialysis blood pressure. The ratio of pre- and post-dialysis blood pressure was calculated from the pre- and post-systolic blood pressures, diastolic blood pressures and the mean blood pressure, respectively. A total of 64 778 patients participated, among whom 3901 died by the end of 2001.

Serum high-density lipoprotein cholesterol level

The serum HDL cholesterol level is known to be closely related to the development of atherosclerotic complications. Diabetic status is considered to greatly affect the progress of atherosclerosis. Therefore, there is a possibility that the effects of serum HDL cholesterol level on life prognosis may differ depending on diabetic status. Therefore, in the present study, patients were divided into diabetic and non-diabetic groups, and each group was analyzed separately. The diabetic group included 12 798 patients, and the non-diabetic group had 33 625 patients, with 1059 and 1588 deaths, respectively, by the end of 2001.

Water removal rate

The relationship between the weight loss rate during hemodialysis and life prognosis has been elucidated in a previous report (3). It is possible life prognosis may differ depending on whether water is removed rapidly over a short period or removed slowly over a long period during hemodialysis, even when identical amounts are removed. Here, the water removal rate during hemodialysis was assumed to equate with the weight loss per unit time during hemodialysis.

$$\text{Water removal rate (\%/ h)} = \text{weight loss rate (\%)} \div \text{dialysis time (hour)}$$

Thus, the relationship between this water removal rate and life prognosis was analyzed.

Among patients who had a large weight loss during hemodialysis, the water removal rate was also neces-

TABLE 5. *Characteristics of patients analyzed for death by myocardial infarction/cardiac insufficiency and intervention in ischemic heart disease patients (diabetic patients)*

	Number of patients	%
Total	912	(100.0)
Sex		
Male	646	(70.8)
Female	266	(29.2)
Duration of dialysis (years)		
0 ≦ < 2	277	(30.4)
2 ≦ < 5	352	(38.6)
5 ≦ < 10	232	(25.4)
10 ≦ < 15	46	(5.0)
15 ≦ < 20	5	(0.5)
20 ≦ < 25	0	(0.0)
25 ≦	0	(0.0)
Mean ± s.d.	3.5	±3.2
Primary disease		
Diabetes	912	(100.0)
Non-diabetes	0	(0.0)
Age		
< 15	0	(0.0)
15 ≦ < 30	0	(0.0)
30 ≦ < 45	13	(1.4)
45 ≦ < 60	190	(20.8)
60 ≦ < 75	528	(57.9)
75 ≦ < 90	180	(19.7)
90 ≦	1	(0.1)
Mean ± s.d.	66.4	±9.4

sarily large. The effects on weight loss during hemodialysis were mathematically adjusted when analyzing the relationship between water removal rate and life prognosis. Total participation included 125 700 patients, of whom 8265 died by the end of the year 2001.

Comparison of death risk of patients with and without either previous myocardial infarction or cardiac intervention who received interventions

In the questionnaire at the end of 2000, whether or not a patient received any various type of intervention for ischemic heart disease (CABG, PTCA, stenting) was surveyed, for the purpose of comparison of death risk between those with and without previous intervention. However, a simple comparison of prognoses between those with or without intervention does not provide a fair comparison result, because the majority of patients without intervention did not previously have ischemic heart disease.

Therefore, subjects were limited only to those patients who responded affirmatively to having previously had ischemic heart disease at the end of the year 2000, and the prognosis was compared between the patients with and without intervention. Some patients may have had multiple overlapping interventions. Thus, subjects were divided into four groups: patients with no intervention, those with only CABG, those with only PTCA, and those with PTCA + stenting. The end-point for tracking prognosis was only death by myocardial infarction/cardiac insufficiency.

Progress of ischemic heart disease is considered to be greatly affected by the existence of diabetes. It is possible, therefore, that impact of factors related to the progress of ischemic heart disease may differ between diabetic and non-diabetic patients. For this reason, the diabetic and non-diabetic groups were analyzed separately.

Among patients receiving hemodialysis three times per week at the end of 2000 who responded affirmatively to previously having had myocardial infarction, a total of 2131 responded 'yes' to one of the four intervention categories for ischemic heart disease: none, CABG only, PTCA only, or PTCA + stenting. These patients were divided into diabetic group (912 patients) and non-diabetic group (1219) for analysis. The characteristics of these patients are shown in Tables 5 and 6.

The end-points of prognosis tracking during the year from 1 January 2001 to 31 December 2001 were death due to one of the following four diseases: pericarditis (code 01), pulmonary edema/congestive insufficiency (code 02), myocarditis/myocardial infarction (code 03), and other cardiac insufficiency (code 05). Censored cases were patients discontinuing a hemodialysis regimen of three times a week for kidney transplants and other modalities, or dropouts, or lost to follow-up, or deaths due to causes other

TABLE 6. *Characteristics of patients analyzed for death by myocardial infarction/cardiac insufficiency and intervention in ischemic heart disease patients (non-diabetic patients)*

	Number of patients	%
Total	1219	(100.0)
Sex		
Male	865	(71.0)
Female	354	(29.0)
Duration of dialysis (years)		
0 ≦ < 2	218	(17.9)
2 ≦ < 5	294	(24.1)
5 ≦ < 10	320	(26.3)
10 ≦ < 15	187	(15.3)
15 ≦ < 20	102	(8.4)
20 ≦ < 25	71	(5.8)
25 ≦	27	(2.2)
Mean ± s.d.	7.7	±6.8
Primary disease		
Diabetes	0	(0.0)
Non-diabetes	1219	(100.0)
Age		
< 15	0	(0.0)
15 ≦ < 30	3	(0.2)
30 ≦ < 45	26	(2.1)
45 ≦ < 60	293	(24.0)
60 ≦ < 75	618	(50.7)
75 ≦ < 90	277	(22.7)
90 ≦	2	(0.2)
Mean ± s.d.	66.3	±10.9

TABLE 7. *Outcome of hemodialysis in patients analyzed for death by myocardial infarction/cardiac insufficiency and intervention in ischemic heart disease patients (diabetic patients)*

		Dead					Censored	
Treatment	Alive	Myocardial infarction/cardiac insufficiency	Refusal	Accident	Suicide	Other causes of death	Treatment change	Total
Untreated	375	52	0	0	1	37	21	486
CABG	124	9	0	0	0	6	4	143
PTCA	136	8	1	0	0	14	7	166
PTCA + stenting	96	9	0	0	1	8	3	117
Total	731	78	1	0	2	65	35	912

than myocardial infarction/cardiac insufficiency. Outcome of hemodialysis among these patients are listed in Tables 7 and 8.

The proportional hazard model (2) was used for analysis. Effects of basic background factors, such as gender, age, dialysis length, or diabetic status, were mathematically corrected using the proportional hazard model.

RESULTS AND DISCUSSION

Basic statistics for chronic dialysis patients at the end of 2001

Number of patients

Table 9 is an overview of Japan's dialysis patient population at the end of 2001 obtained in the present survey. In the table, only the patient dialysis length and the longest hemodialysis length are based on the results of the individual patient survey, all other values are based on the facilities survey.

According to the facilities survey, the dialysis population in Japan at the end of the year 2001 was 219 183. The dialysis population was 206 134 at the end of year 2000, the population increased 6.3% from the end of 2000 to the end of 2001.

Similarly, Table 10 indicates Japan's dialysis population by geographic region (prefecture) based on the facilities survey. The proportion of dialysis patients at the end of 2001 was 1721.9 per million general population. As shown in Table 11, the dialysis population per million population has been increasing in a generally linear manner since 1983.

Mean age

The dialysis patient population in Japan has been growing older on an annual basis. According to the patient survey results, the mean age of patients initiating dialysis treatment during 2001 was 64.2 years, and the mean age of the total dialysis population at the end of 2001 was 61.6 years. The mean age of the dialysis population over the last 10 years has been increasing at a rate of 0.6–0.7 annually (Table 12). Table 13 shows the patients coming on dialysis treatment during 2001 by gender and age, Table 14 represents the total dialysis population as of the end of 2001 by gender and age. These tables are based on results of the individual patient survey.

Primary disease causing renal failure

The primary diagnosis of patients initiating dialysis treatment during 2001 is summarized in Table 15 and the primary diseases for the entire dialysis population at the end of 2001 a summarized in Table 16. In these tables, the change in the statistical processing system provided the opportunity to change the denominator used in the calculation of the percentage of each primary disease from the previously used

TABLE 8. *Outcome of hemodialysis in patients analyzed for death by myocardial infarction/cardiac insufficiency and intervention in ischemic heart disease patients (non-diabetic patients)*

		Dead					Censored	
Treatment	Alive	Myocardial infarction/cardiac insufficiency	Refusal	Accident	Suicide	Other causes of death	Treatment change	Total
Untreated	641	49	0	0	0	46	25	761
CABG	96	7	0	1	0	5	2	111
PTCA	203	13	1	1	0	11	8	237
PTCA + stenting	100	2	0	0	0	6	2	110
Total	1040	71	1	2	0	68	37	1219

TABLE 9. *Current state of chronic dialysis treatment in Japan*

Numbers of facilities		3 485 facilities	(+127 facilities, +3.8%)		
Equipment	Patient stations	83 914 units	(+4205 units +5.3%)		
Capacity	Simultaneous dialysis	83 357 pts	(+4883 +6.4%)		
	Maximum capacity	270 149 pts	(+15 671 pts +6.2%)		
Chronic dialysis patients		219 183 pts	(+13 049)		
	Day time	169 386 pts	(77.3%)		
	Night time	40 854 pts	(18.6%)		
	Home hemodialysis	103 pts	(0.0%)		
	CAPD	8 636 pts	(3.9%)		
	IPD	204 pts	(0.1%)		
	Number of patients starting	33 243 pts	(+1225 +3.7%)		
	Number of deaths	19 850 pts	(+912 +4.6%)		
	Patients on dialysis less than 5 years	male 66 680	female 41 065	Gender not specified 58	total 107 803 (51.6%)
	Patients on dialysis 5~9 years	male 30 398	female 20 570	Gender not specified 10	total 50 888 (24.3%)
	Patients on dialysis 10~14 years	male 13 486	female 10 555	Gender not specified 9	total 24 050 (11.5%)
	Patients on dialysis 15~19 years	male 13 486	female 10 555	Gender not specified 9	total 24 050 (11.5%)
	Patients on dialysis 20~24 years	male 13 486	female 10 555	Gender not specified 9	total 24 050 (11.5%)
	Patients on dialysis 25 years and longer	male 2492	female 1 588	Gender not specified 0	total 24 050 (11.5%)
	Rate per million population	1721.9 pts	(+97.8 pts)		
Longest dialysis duration		35 years 10 month			

TABLE 10. *Chronic dialysis patients, by geographic region (prefecture)*

Prefecture	Hokkaido	Aomori	Iwate	Miyagi	Akita	Yamgata	Fukushima	Ibaragi	Tochigi	Gunma	Saitama	Chiba	Tokyo	Kanagawa	Niigata	Toyama
Day time	8 745	1982	1698	2661	1376	1356	2 747	3767	3197	2935	8 090	6847	16 330	9 435	2709	1 466
Night time	1 437	155	349	626	154	270	417	804	767	643	2 063	1857	4 767	2 850	979	334
Home hemodialysis	2	1	0	0	1	0	1	1	0	0	1	3	5	1	0	0
CAPD	359	153	133	106	140	132	228	166	89	103	310	187	757	463	87	117
IPD	18	1	6	0	2	0	23	2	3	15	0	11	17	10	3	5
Total	10 561	2292	2186	3393	1673	1758	3 416	4740	4056	3696	10 464	8905	21 876	12 759	3778	1 922
Prefecture	Ishikawa	Fukui	Yamanashi	Nagano	Gifu	Shizuoka	Aichi	Mie	Shiga	Kyoto	Osaka	Hyogo	Nara	Wakayama	Tottori	Shimane
Day time	1 597	1016	1328	2756	2527	5060	7 812	2061	1429	3148	12 667	7254	1 942	1 897	767	862
Night time	301	194	159	566	503	1343	3 114	615	442	1155	3 056	1665	215	231	162	172
Home hemodialysis	0	0	2	0	3	33	0	0	0	36	1	0	0	0	0	0
CAPD	108	112	54	148	166	361	439	77	56	127	525	330	69	29	127	149
IPD	2	1	1	0	3	24	6	0	6	1	2	12	0	0	7	6
Total	2 008	1323	1544	3470	3202	6821	11 371	2753	1933	4467	16 251	9261	2 226	2 157	1063	1 189
Prefecture	Okayama	Hiroshima	Yamaguchi	Tokushima	Kagawa	Ehime	Kochi	Fukuoka	Saga	Nagasaki	Kumamoto	Oita	Miyazai	Kagoshima	Okinawa	Nationwide
Day time	2 633	4119	2056	1430	1694	2026	1 224	7512	1157	2404	3 574	2290	2 215	3 263	2325	169 386
Night time	582	553	358	280	233	403	329	2071	249	453	905	363	497	519	694	40 854
Home hemodialysis	0	0	0	0	1	0	0	10	0	0	0	0	0	1	0	103
CAPD	301	390	140	190	139	132	59	312	25	97	118	113	56	80	77	8 636
IPD	8	4	0	0	0	0	2	0	0	1	2	0	0	0	0	204
Total	3 524	5066	2554	1900	2067	2561	1 614	9905	1431	2955	4 599	2766	2 768	3 863	3096	219 183

TABLE 11. *Trend in patient per/million population*

Year	Patient/million population
1983	444
1984	498
1985	548
1986	604
1987	659
1988	721
1989	680
1990	836
1991	944
1992	996
1993	1076
1994	1149
1995	1230
1996	1328
1997	1395
1998	1465
1999	1557
2000	1624
2001	1722

TABLE 12. *Trend in patient mean ages, by year of initial dialysis and year end*

	New patients starting dialysis		Patients at year end	
Year	Mean	±SD	Mean	±SD
1983	51.92	15.54	48.25	13.84
1984	53.18	15.31	49.22	13.78
1985	54.41	15.37	50.27	13.67
1986	55.09	15.23	51.11	13.62
1987	55.93	14.93	52.08	13.65
1988	56.89	14.86	52.95	13.55
1989	57.40	14.70	53.75	13.54
1990	58.09	14.61	54.53	13.53
1991	58.15	14.58	55.29	13.54
1992	59.50	14.46	56.00	13.47
1993	59.80	14.36	56.65	13.46
1994	60.43	14.27	57.31	13.46
1995	61.01	14.20	57.96	13.42
1996	61.51	14.16	58.63	13.37
1997	62.22	13.98	59.23	13.35
1998	62.68	13.94	59.93	13.31
1999	63.38	13.85	60.55	13.27
2000	63.78	13.85	61.19	13.21
2001	64.24	13.73	61.60	13.07

total number of patients to the current total, which excludes patients for whom data were not entered. As a consequence, the percentage of each primary disease subtly differs from previous values. The majority of tables in this report conform to percentages determined using as a denominator a patient total excluding patients for whom data were not recorded.

Tables 17 and 18 chart the changes in primary diseases from 1983 to 2001. In these tables, the percentage of each primary disease for each year from 1983 to 2001 has been recalculated using as a denominator a patient total that does not include patients for whom data were not entered. The number of patients with diabetic nephropathy among those initiating dialysis treatment in 2001 increased, and the number

TABLE 13. *Patients starting dialysis treatment in 2001, by age and gender*

							Not specified	
	Male	%	Female	%	Sub-total	%	Grand total	%
Age (year)								
4 and younger	5	(0.0)	7	(0.1)	12	(0.0)	12	(0.0)
5~9	4	(0.0)	1	(0.0)	5	(0.0)	5	(0.0)
10~14	23	(0.1)	9	(0.1)	32	(0.1)	32	(0.1)
15~19	46	(0.2)	32	(0.3)	78	(0.2)	78	(0.2)
20~24	122	(0.6)	51	(0.4)	173	(0.5)	173	(0.5)
25~29	190	(0.9)	110	(0.9)	300	(0.9)	300	(0.9)
30~34	305	(1.5)	159	(1.3)	464	(1.5)	464	(1.5)
35~39	431	(2.1)	217	(1.8)	648	(2.0)	648	(2.0)
40~44	606	(3.0)	330	(2.8)	936	(2.9)	936	(2.9)
45~49	1 002	(5.0)	604	(5.1)	1 606	(5.0)	1 606	(5.0)
50~54	2 045	(10.2)	1 103	(9.2)	3 148	(9.8)	3 148	(9.8)
55~59	2 136	(10.6)	1 005	(8.4)	3 141	(9.8)	3 141	(9.8)
60~64	2 702	(13.5)	1 314	(11.0)	4 016	(12.6)	4 016	(12.6)
65~69	3 241	(16.2)	1 637	(13.7)	4 878	(15.2)	4 878	(15.2)
70~74	3 081	(15.4)	1 780	(14.9)	4 861	(15.2)	4 861	(15.2)
75~79	2 255	(11.2)	1 657	(13.9)	3 912	(12.2)	3 912	(12.2)
80~84	1 207	(6.0)	1 205	(10.1)	2 412	(7.5)	2 412	(7.5)
85~89	542	(2.7)	598	(5.0)	1 140	(3.6)	1 140	(3.6)
90~94	102	(0.5)	94	(0.8)	196	(0.6)	196	(0.6)
95 and older	14	(0.1)	15	(0.1)	29	(0.1)	29	(0.1)
Subtotal	20 059	(100.0)	11 928	(100.0)	31 987	(100.0)	31 987	(100.0)
Not specified	18		12		30		30	
Grand total	20 077		11 940		32 017		32 017	
Average	63.43		66		64		64	
SD	13.42		14		14		14	

TABLE 14. *Number of patients at the end of 2001, by age and gender*

	Male	Female	Sub total	Not spedified	Grand total
Age (years)					
4 and younger	13 (0.0)	12 (0.0)	25 (0.0)		25 (0.0)
5~9	16 (0.0)	11 (0.0)	27 (0.0)		27 (0.0)
10~14	38 (0.0)	32 (0.0)	70 (0.0)		70 (0.0)
15~19	161 (0.1)	105 (0.1)	266 (0.1)		266 (0.1)
20~24	457 (0.4)	238 (0.3)	695 (0.3)		695 (0.3)
25~29	1 223 (1.0)	654 (0.8)	1 877 (0.9)		1 877 (0.9)
30~34	2 280 (1.8)	1 288 (1.5)	3 568 (1.7)		3 568 (1.7)
35~39	3 375 (2.7)	1 964 (2.4)	5 339 (2.6)	3 (4.4)	5 342 (2.6)
40~44	5 040 (4.0)	3 040 (3.6)	8 080 (3.9)	2 (2.9)	8 082 (3.9)
45~49	8 923 (7.1)	5 592 (6.7)	14 515 (7.0)	4 (5.9)	14 519 (7.0)
50~54	16 827 (13.4)	10 374 (12.4)	27 201 (13.0)	7 (10.3)	27 208 (13.0)
55~59	16 054 (12.8)	9 991 (12.0)	26 045 (12.5)	8 (11.8)	26 053 (12.5)
60~64	18 452 (14.7)	11 428 (13.7)	29 880 (14.3)	10 (14.7)	29 890 (14.3)
65~69	18 873 (15.1)	11 589 (13.9)	30 462 (14.6)	11 (16.2)	30 473 (14.6)
70~74	15 712 (12.6)	10 491 (12.6)	26 203 (12.6)	9 (13.2)	26 212 (12.6)
75~79	9 969 (8.0)	8 492 (10.2)	18 461 (8.8)	5 (7.4)	18 466 (8.8)
80~84	5 110 (4.1)	5 324 (6.4)	10 434 (5.0)	4 (5.9)	10 438 (5.0)
85~89	2 181 (1.7)	2 410 (2.9)	4 591 (2.2)	5 (7.4)	4 596 (2.2)
90~94	438 (0.3)	458 (0.5)	896 (0.4)		896 (0.4)
95 and older	46 (0.0)	42 (0.1)	88 (0.0)		88 (0.0)
Sub-total	125 188 (100.0)	83 535 (100.0)	208 723 (100.0)	68 (100.0)	208 791 (100.0)
Not specified	158	76	234	11	245
Grand total	125 346	83 611	208 957	79	209 036
Average	61	63	62	63.94	62
SD	13	13	13	12.58	13

of patients with chronic glomerulonephritis as a primary disease decreased. There was also an increase in patients diagnosed with diabetic nephropathy at the end of the year, and patients with chronic glomerulonephritis as the primary disease also decreased. For the past several years there has been an increase in the number of patients with undiagnosed primary disease at the year end.

TABLE 15. *Patients starting dialysis in 2001: number and mean age, by primary diagnosis*

	Number of patients	Age not specified	Total	Age: Average	Age: Standard deviation
Chronic glomerulonephritis	10 354 (32.4)	10 (33.3)	10 364 (32.4)	63.23	15.00
Chronic pyelonephritis	348 (1.1)		348 (1.1)	62.58	15.52
Rapidly progressive glomerulonephritis	328 (1.0)		328 (1.0)	66.41	14.40
Toxemia of pregnancy	81 (0.3)		81 (0.3)	50.31	12.96
Unclassified nephritis	113 (0.4)		113 (0.4)	57.22	21.07
Polycystic kidney	729 (2.3)		729 (2.3)	59.72	11.79
Renal sclerosis	2 426 (7.6)		2 426 (7.6)	72.15	11.76
Malignant hypertention	191 (0.6)		191 (38.1)	60.21	15.11
Diabetic nephropathy	12 176 (38.1)	10 (33.3)	12 186 (1.0)	63.97	11.18
SLE	316 (1.0)	1 (3.3)	317 (0.5)	55.38	16.55
Amyloid kidney	157 (0.5)		157 (0.4)	66.05	9.41
Gouty nephropathy	117 (0.4)		117 (0.1)	63.85	13.01
Dysbolic renal failure	33 (0.1)		33 (0.2)	43.94	22.68
Tuberculosis	28 (0.1)		28 (0.4)	67.29	10.94
Nephrolithiasis	66 (0.2)		66 (0.4)	66.38	12.99
Malignant tumor of renal and urinary	139 (0.4)		139 (0.4)	68.94	9.67
Obstructive uropathy	112 (0.4)		112 (0.2)	62.30	17.49
Myelome	129 (0.4)		129 (0.4)	66.95	10.42
Renal hypoplasia	67 (0.2)		67 (0.2)	39.43	25.76
Etiology unknown	2 871 (9.0)	8 (26.7)	2 879 (9.0)	67.00	14.17
Rejection of kidney graft	167 (0.5)		167 (0.5)	48.92	14.91
Others	1 021 (3.2)	1 (3.3)	1 022 (3.2)	63.29	16.15
Subtotal	31 969 (100.0)	30 (100.0)	31 999 (100.0)	64.25	13.73
Not specified	18		18	58.39	14.13
Grand total	31 987	30	32 017	64.24	13.73

TABLE 16. *Patients at the end of 2001: number and mean age, by primary disease*

	Number of patients	Age not specified	Total	Age: Average	Age: Standard deviation
Chronic glomerulonephritis	102 233 (49.6)	80 (44.0)	102 313 (49.6)	59.96	13.10
Chronic pyelonephritis	2 933 (1.4)		2 933 (1.4)	59.73	14.59
Rapidly progressive glomerulonephritis	1 150 (0.6)	2 (1.1)	1 152 (0.6)	61.13	15.32
Toxemia of pregnancy	1 727 (0.8)	2 (1.1)	1 729 (0.8)	55.43	9.66
Unclassified nephritis	985 (0.5)		985 (0.5)	53.16	16.95
Polycystic kidney	6 763 (3.3)	3 (1.6)	6 766 (3.3)	60.88	10.86
Renal sclerosis	10 200 (4.9)	14 (7.7)	10 214 (5.0)	71.61	12.10
Malignant hypertention	1 563 (0.8)		1 563 (0.8)	59.91	13.40
Diabetic nephropathy	55 989 (27.2)	62 (34.1)	56 051 (27.2)	63.80	10.81
SLE	2 037 (1.0)	2 (1.1)	2 039 (1.0)	52.34	13.56
Amyloid kidney	457 (0.2)		457 (0.2)	62.60	11.35
Gouty nephropathy	1 186 (0.6)	2 (1.1)	1 188 (0.6)	62.81	11.86
Dysbolic renal failure	230 (0.1)		230 (0.1)	44.33	15.94
Tuberculosis	500 (0.2)		500 (0.2)	65.70	10.56
Nephrolithiasis	468 (0.2)		468 (0.2)	63.79	11.75
Malignant tumor of	447 (0.2)		447 (0.2)	66.32	12.50
Obstructive	612 (0.3)		612 (0.3)	56.47	19.19
Myelome	166 (0.1)		166 (0.1)	66.87	11.80
Renal hypoplasia	439 (0.2)	1 (0.5)	440 (0.2)	35.38	18.53
Etiology unknown	11 588 (5.6)	10 (5.5)	11 598 (5.6)	64.19	13.84
Rejection of kidney graft	1 299 (0.6)	2 (1.1)	1 301 (0.6)	46.79	10.73
Others	3 103 (1.5)	2 (1.1)	3 105 (1.5)	58.90	16.85
Subtotal	206 075 (100.0)	182 (100.0)	206 257 (100.0)	61.59	13.07
Not specified	2 716	63	2 779	62.41	12.97
Grand total	208 791	245	209 036	61.60	13.07

Cause of death

Categories of the cause of death for patients beginning dialysis treatment during 2001 based on patient survey results are shown in Table 19, and categories of the causes of death for all patients through the end of 2001 are shown in Table 20. The change in the percentage ranking of the primary causes of death since 1983 is presented in Table 21.

The percentages of causes of death were previously calculated using the total number of patients as the denominator. In the present survey, however, the total number of patients excluding those for whom data were not entered was used as the denominator. Accordingly, the percentages of the cause of death before 2000 have been recalculated in the following tables. There was no change in the rankings of cause of death among patients in 2001. Although changes in the cause of death, including the category of 'miscellaneous' cause, have been handled separately up to now, it is clear the 'miscellaneous' cause of death category has shown an increasing trend since 1994.

Annual crude mortality rate

The annual crude mortality rate was calculated on the basis of the results of the facilities survey. The annual crude mortality rate, representing the ratio of the annual patient mortalities in 2001 to the mean number of patients at the end of 2000 and 2001 was 9.3%. The change in the crude mortality rate over the past 10 years is shown in Table 22. The trend in the annual crude mortality rate over this 10-year period has ranged 9.4–9.7%, with small increases or decreases.

1-year, 5-year and 10-year survival rates of patients beginning dialysis treatment

Survival rates at 1, 5, and 10 years in patients beginning dialysis treatment in 1983 and later were compared for each year (Table 23). The current survey shows a 1-year survival rate of 0.873 for patients initiating treatment in year 2000, again bettering the past best 1-year survival rate in 1999.

The 5-year survival rate of patients starting treatment in or before 1992 had been declining annually, but the trend was reversed with patients beginning dialysis in 1993 and has since been improving. The 5-year survival rate of the 1996 first-year patients, identified for the first time in the current survey, was 0.602, again exceeding the 5-year survival rate of the 1995 first-year cohort.

The 10-year survival rate had been declining gradually from 1983 through 1988, but the rate was constant in 1988, 1989 and 1990. However, the 10-year

TABLE 17. *Trends in primary disease by year of initial dialysis*

Year	Total	Diabetic nephropathy		Chronic glomerulo-nephritis		Unknown		Renal sclerosis		Polycystic kidney		Chronic pyelonephritis		Rapidly progressive glomerulo-nephritis		SLE	
		No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%
1983	9 858	1 538	15.6	5 750	60.5	432	4.4	297	3.0	274	2.8	239	2.4	90	0.9	112	1.1
1984	10 832	1 885	17.4	6 099	58.7	438	4.0	355	3.3	307	2.8	233	2.2	73	0.7	124	1.1
1985	11 776	2 306	19.6	6 357	56.0	570	4.8	418	3.5	361	3.1	246	2.1	111	0.9	125	1.1
1986	12 565	2 677	21.3	6 881	54.8	533	4.2	466	3.7	366	2.9	257	2.0	122	1.0	151	1.2
1987	14 784	3 266	22.2	8 017	54.6	609	4.1	580	3.9	466	3.2	267	1.8	115	0.8	128	0.9
1988	15 512	3 770	25.3	7 734	51.9	582	3.9	602	4.0	479	3.2	272	1.8	140	0.9	134	0.9
1989	14 374	3 808	27.8	6 812	49.6	576	4.2	591	4.3	445	3.2	216	1.6	114	0.8	141	1.0
1990	16 543	4 326	28.1	7 261	49.5	548	3.6	900	5.8	483	3.1	243	1.6	111	0.7	188	1.2
1991	23 005	6 406	30.0	10 148	47.2	826	4.0	1285	5.9	687	3.2	406	1.8	137	0.7	302	1.4
1992	21 563	6 132	31.1	9 092	46.1	792	4.0	1262	6.4	581	2.9	337	1.7	158	0.8	283	1.4
1993	23 440	7 010	32.7	9 711	45.3	781	3.6	1453	6.8	615	2.9	266	1.2	184	0.9	277	1.3
1994	24 059	7 376	33.4	9 745	44.2	938	4.3	1474	6.7	601	2.7	327	1.5	184	0.8	284	1.3
1995	25 858	8 236	34.5	10 195	42.7	1152	4.8	1630	6.8	613	2.6	312	1.3	211	0.9	296	1.2
1996	28 234	9 351	35.4	10 995	41.6	1423	5.4	1810	6.9	708	2.7	310	1.2	228	0.9	353	1.3
1997	29 283	9 939	36.6	10 703	39.4	1619	6.0	2004	7.4	693	2.5	353	1.3	308	1.1	291	1.1
1998	30 051	10 729	38.7	10 506	37.9	1687	6.1	2002	7.2	721	2.6	345	1.2	258	0.9	334	1.2
1999	30 438	11 009	39.2	10 215	36.3	1860	6.6	2117	7.5	679	2.4	346	1.2	285	1.0	357	1.3
2000	31 925	11 685	39.0	10 381	34.7	2414	8.1	2428	8.1	761	2.5	312	1.0	329	1.1	288	1.0
2001	32 017	12 186	38.1	10 364	32.4	2879	9.0	2426	7.6	729	2.3	348	1.1	328	1.0	317	1.0

TABLE 18. *Trends in primary disease for patients at end of given year*

Year	Total	Chronic glomerulonephritis		Diabetic nephropathy		Unknown		Renal sclerosis		Polycystic kidney		Chronic pyelonephritis		SLE	
		No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%
1983	48 489	35 125	74.7	3 592	7.4	1 091	2.3	721	1.5	1308	2.7	1493	3.1	383	0.8
1984	54 576	38 166	72.7	4 559	8.4	1 231	2.3	923	1.7	1574	2.9	1828	3.4	430	0.8
1985	61 616	43 218	72.3	5 812	9.4	1 409	2.3	1 159	1.9	1820	3.0	1605	2.6	544	0.9
1986	66 751	47 149	70.7	7 024	10.5	1 700	2.5	1 324	2.0	2055	3.1	1601	2.4	607	0.9
1987	80 075	55 563	69.5	9 335	11.7	2 056	2.6	1 660	2.1	2510	3.1	1929	2.4	718	0.9
1988	83 762	56 880	68.5	10 692	12.9	2 128	2.6	1 782	2.1	2714	3.3	1891	2.3	765	0.9
1989	84 720	55 826	67.0	11 823	14.2	2 219	2.7	1 971	2.4	2739	3.3	1904	2.3	763	0.9
1990	95 834	61 430	65.7	14 273	15.3	2 524	2.7	2 508	2.7	3183	3.4	2069	2.2	924	1.0
1991	114 253	70 301	63.6	18 737	16.9	3 163	3.0	3 372	3.0	3816	3.4	2410	2.2	1198	1.1
1992	121 655	73 526	62.8	20 820	17.8	3 568	3.0	3 756	3.2	4000	3.4	2451	2.1	1315	1.1
1993	131 492	77 326	61.5	23 983	19.1	3 823	3.0	4 430	3.5	4304	3.4	2450	1.9	1431	1.1
1994	142 626	82 242	60.3	27 438	20.1	4 352	3.2	5 117	3.8	4594	3.4	2595	1.9	1601	1.2
1995	152 373	86 222	59.1	31 080	21.3	4 928	3.4	5 740	3.9	4862	3.3	2658	1.8	1659	1.1
1996	163 960	90 874	57.7	35 468	22.5	5 855	3.7	6 549	4.2	5250	3.3	2696	1.7	1797	1.1
1997	173 162	93 622	56.2	39 350	23.6	6 803	4.1	7 266	4.4	5521	3.3	2711	1.6	1867	1.1
1998	181 484	95 201	54.6	43 590	25.0	7 622	4.4	7 937	4.6	5793	3.3	2766	1.6	1929	1.1
1999	185 688	94 965	53.2	46 670	26.1	8 214	4.6	8 361	4.7	5899	3.3	2722	1.5	1994	1.1
2000	201 914	100 370	51.6	52 575	27.0	10 139	5.2	9 724	5.0	6404	3.3	2814	1.4	2050	1.1
2001	209 036	102 313	49.6	56 051	27.2	11 598	5.6	10 214	5.0	6766	3.3	2933	1.4	2039	1.0

survival rate of the 1991 first-year patients, first identified in the current survey, is 0.396, a relatively large decline from 0.403 of the 10-year survival rate of the 1990 first-year dialysis patients.

The cumulative survival rate after starting dialysis treatment has not declined in spite of the continuous increase in the number of elderly and diabetic patients in the dialysis patient population, and there have even been improvements in the 1- and 5-year survival rates. These results seem to suggest the beneficial effects of technical improvements made in dialysis therapy.

Statistics on new survey items

Lowest blood pressure during treatment

The mean lowest systolic blood pressure during treatment was 122.16 ± 23.09 mm Hg (±SD), and the mean lowest diastolic blood pressure during treatment was 68.39 ± 13.52 mm Hg. With regard to the relationship between the systolic blood pressure at the start of treatment and the lowest systolic pressure, the survey identified a strong tendency for the lowest systolic blood pressure during treatment to decline when the systolic blood pressure was 160 mm Hg or higher at the start of treatment, as shown in Fig. 2. A similar trend was confirmed for the diastolic blood pressure. There was a large difference between the diastolic blood pressure at the start of treatment and the lowest diastolic blood pressure during treatment when the diastolic blood pressure at the start of treatment was 100 mm Hg or higher.

The relationship between the post-dialysis blood pressure and the lowest blood pressure during treatment was also examined (Fig. 3). It was found that there was a greater difference between post-dialysis systolic blood pressure and the lowest systolic blood pressure during treatment when the post-dialysis systolic blood pressure was 160 mm Hg or higher, similar to the relationship between the predialysis blood pressure and the lowest blood pressure. However, the difference between the post-dialysis systolic pressure and the lowest systolic pressure was smaller than that between the predialysis systolic pressure and the lowest systolic pressure. The diastolic blood pressure also followed this pattern. The difference between the post-dialysis diastolic blood pressure and the lowest diastolic blood pressure became larger when the post-dialysis diastolic blood pressure was 100 mm Hg or higher. However, the difference between the post-dialysis diastolic pressure and the lowest diastolic pressure was smaller than that between the predialysis diastolic pressure and the lowest diastolic pressure.

TABLE 19. *Causes of death in patients starting dialysis in 2001*

	Male	Female	Sub-total	Not specified	Grand total
Heart failure	416 (23.6)	331 (29.8)	747 (26.0)		747 (26.0)
Cerebrovascular disorder	150 (8.5)	86 (7.7)	236 (8.2)		236 (8.2)
Infectious disease	353 (20.0)	205 (18.5)	558 (19.4)		558 (19.4)
Bleeding	44 (2.5)	38 (3.4)	82 (2.9)		82 (2.9)
Malignant tumor	186 (10.6)	80 (7.2)	266 (9.3)		266 (9.3)
Cachexia/Uremia	64 (3.6)	45 (4.1)	109 (3.8)		109 (3.8)
Myocardial infarction	93 (5.3)	56 (5.0)	149 (5.2)		149 (5.2)
Potassium intoxication	59 (3.4)	23 (2.1)	82 (2.9)		82 (29)
Chronic hepatitis/Cirrhosis	59 (3.4)	16 (1.4)	75 (2.6)		75 (2.6)
Encephalopathy					
Suicide/rejection	26 (1.5)	9 (0.8)	35 (1.2)		35 (1.2)
Ileus	5 (0.3)	1 (0.1)	6 (0.2)		6 (0.2)
Pulmonary thomboembolism	12 (0.7)	8 (0.7)	20 (0.7)		20 (0.7)
Accidental death	7 (0.4)	4 (0.4)	11 (0.4)		11 (0.4)
Other	163 (9.3)	122 (11.0)	285 (9.9)		285 (9.9)
Cause unknown	124 (7.0)	86 (7.7)	210 (7.3)		210 (7.3)
Subtotal	1761 (100.0)	1110 (100.0)	2871 (100.0)		2871 (100.0)
Not specified	5	3	8		8
Grand total	1766	1113	2879		2879

Ratio of the lowest systolic blood pressure during treatment and the predialysis systolic blood pressure

Table 24 shows the relationship between each dialysis treatment mode and the ratio of the lowest systolic blood pressure during treatment and the predialysis systolic blood pressure. Although no large differences were found in the ratio of the lowest systolic blood pressure during treatment and the predialysis systolic blood pressure among the various treatment modes, the ratio was fairly high for home hemodialysis, and fairly low for hemofiltration and sorbent dialysis.

The ratio of the lowest systolic blood pressure during treatment and the predialysis systolic blood pressure was relatively high for males (0.81 ± 0.13) compared with females (0.79 ± 0.14). The survey tracked the correlation between age and the ratio of the lowest systolic blood pressure during treatment and the predialysis systolic blood pressure. Among young patients, the ratio of the lowest systolic blood pressure during treatment and the predialysis systolic blood pressure was high, and tended to decline with age (Fig. 4). No correlation was found between dialysis length and the ratio of the lowest systolic blood pressure during treatment and the predialysis systolic blood pressure (results not shown).

In relation to the systolic blood pressure at the start of dialysis, it was found that the ratio of the lowest systolic blood pressure during treatment and the predialysis systolic blood pressure decreased in conjunc-

TABLE 20. *Causes of death for mortality cases in 2001*

	Male	Female	Sub-total	Not specified	Grand total
Heart failure	2 576 (23.3)	2048 (28.9)	4 624 (25.5)	2 (28.6)	4 626 (25.5)
Cerebrovascular disorder	1 249 (11.3)	852 (12.0)	2 101 (11.6)		2 101 (11.6)
Infectious disease	1 873 (17.0)	1089 (15.4)	2 962 (16.3)	1 (14.3)	2 963 (16.3)
Bleeding	225 (2.0)	193 (2.7)	418 (2.3)		418 (2.3)
Malignant tumor	1 120 (10.1)	413 (5.8)	1 533 (8.5)	1 (14.3)	1 534 (8.5)
Cachexia/Uremia	428 (3.9)	382 (5.4)	810 (4.5)	3 (42.9)	813 (4.5)
Myocardial infarction	892 (8.1)	447 (6.3)	1 339 (7.4)		1 339 (7.4)
Potassium intoxication	484 (4.4)	262 (3.7)	746 (4.1)		746 (4.1)
Chronic hepatitis/Cirrhosis	256 (2.3)	104 (1.5)	360 (2.0)		360 (2.0)
Encephalopathy	4 (0.0)	5 (0.1)	9 (0.0)		9 (0.0)
Suicide/rejection	140 (1.3)	47 (0.7)	187 (1.0)		187 (1.0)
Ileus	75 (0.7)	66 (0.9)	141 (0.8)		141 (0.8)
Pulmonary thomboembolis	47 (0.4)	38 (0.5)	85 (0.5)		85 (0.5)
Accidental death	76 (0.7)	37 (0.5)	113 (0.6)		113 (0.6)
Other	953 (8.6)	701 (9.9)	1 654 (9.1)		1 654 (9.1)
Cause unknown	641 (5.8)	398 (5.6)	1 039 (5.7)		1 039 (5.7)
Subtotal	11 039 (100.0)	7082 (100.0)	18 121 (100.0)	7 (100.0)	18 128 (100.0)
Not specified	83	70	153		153
Grand total	11 122	7152	18 274	7	18 281

TABLE 21. *Trend in year-to-year change in primary cause of death*

Year	Mortalities, all causes	Heart failure		Infectious disease		Cerebrovascular disorder		Other causes		Malignant tumor		Myocardial infarction	
		No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%	No. of patients	%
1983	4 097	1240	30.6	451	11.1	580	14.3	210	5.2	316	7.8	216	5.3
1984	4 179	1273	30.7	480	11.6	643	15.5	206	5.0	289	7.0	199	4.8
1985	5 460	1709	31.5	630	11.6	773	14.2	309	5.7	351	6.5	289	5.3
1986	5 688	1890	33.4	682	12.0	794	14.0	265	4.7	393	6.9	349	6.2
1987	6 098	1995	33.2	733	12.2	865	14.4	317	5.3	353	5.9	363	6.0
1988	6 925	2525	37.0	848	12.4	894	13.1	329	4.8	478	7.0	377	5.5
1989	6 669	2229	34.7	781	12.2	881	13.7	292	4.5	505	7.9	355	5.5
1990	8 409	2558	31.9	976	12.2	1168	14.6	390	4.9	689	8.6	490	6.1
1991	9 407	2885	32.2	1134	12.6	1292	14.4	412	4.6	712	7.9	543	6.1
1992	10 966	3406	33.1	1244	12.1	1486	14.4	494	4.8	774	7.5	631	6.1
1993	11 492	3438	31.6	1397	12.8	1555	14.3	468	4.3	852	7.8	658	6.0
1994	12 256	3462	29.6	1548	13.2	1729	14.8	547	4.7	899	7.7	869	7.4
1995	13 442	3415	26.8	1856	14.5	1809	14.2	777	6.1	973	7.6	1002	7.9
1996	14 200	3429	25.5	2076	15.5	1837	13.7	901	6.7	1096	8.2	1050	7.8
1997	14 962	3577	25.0	2230	15.6	1880	13.2	996	7.0	1208	8.5	1253	8.8
1998	15 172	3662	25.5	2274	15.8	1830	12.7	1063	7.4	1168	8.1	1194	8.3
1999	15 999	3894	25.8	2611	17.3	1804	11.9	1225	8.1	1212	8.0	1191	7.9
2000	16 601	3859	23.7	2764	17.0	1882	11.6	1314	8.1	1382	8.5	1165	7.2
2001	18 281	4626	25.5	2963	16.3	2101	11.6	1654	9.1	1534	8.5	1339	7.4

TABLE 22. *Trend in year-to-year change in crude mortality rate*

Year	Crude mortality rate (%)
1991	8.9
1992	9.7
1993	9.4
1994	9.5
1995	9.7
1996	9.4
1997	9.4
1998	9.2
1999	9.7
2000	9.4
2001	9.3

tion with higher systolic blood pressure at the start of dialysis, and this tendency became pronounced when the blood pressure at the start of dialysis was 160 mm Hg or higher (Fig. 5a). This result suggests a large blood pressure decrease during treatment might be expected among patients who have a high blood pressure at the start of dialysis.

In relation to the post-dialysis systolic blood pressure, the lower the post-dialysis blood pressure for a given patient, the lower was the ratio of the lowest systolic blood pressure during treatment and the pre-dialysis systolic blood pressure (Fig. 5b).

Blood pressure fluctuation patterns

Gender, age, dialysis length, diabetic status Fewer female patients had stable blood pressure compared with male patients (males, 25.1%; females, 21.4%), whereas more females had a large drop/small recovery blood pressure pattern during dialysis (males,

TABLE 23. *Trend in change in survival rates at 1, 5, and 10 years after initial dialysis treatment*

Year initiated	One-year survival	Five-year survival	Ten-year survival
1983	0.837	0.628	0.473
1984	0.837	0.621	0.457
1985	0.816	0.605	0.434
1986	0.820	0.607	0.427
1987	0.836	0.602	0.419
1988	0.845	0.590	0.405
1989	0.868	0.602	0.408
1990	0.857	0.597	0.403
1991	0.847	0.582	0.396
1992	0.843	0.576	—
1993	0.854	0.589	—
1994	0.850	0.590	—
1995	0.861	0.599	—
1996	0.854	0.602	—
1997	0.860	—	—
1998	0.866	—	—
1999	0.871	—	—
2000	0.873	—	—

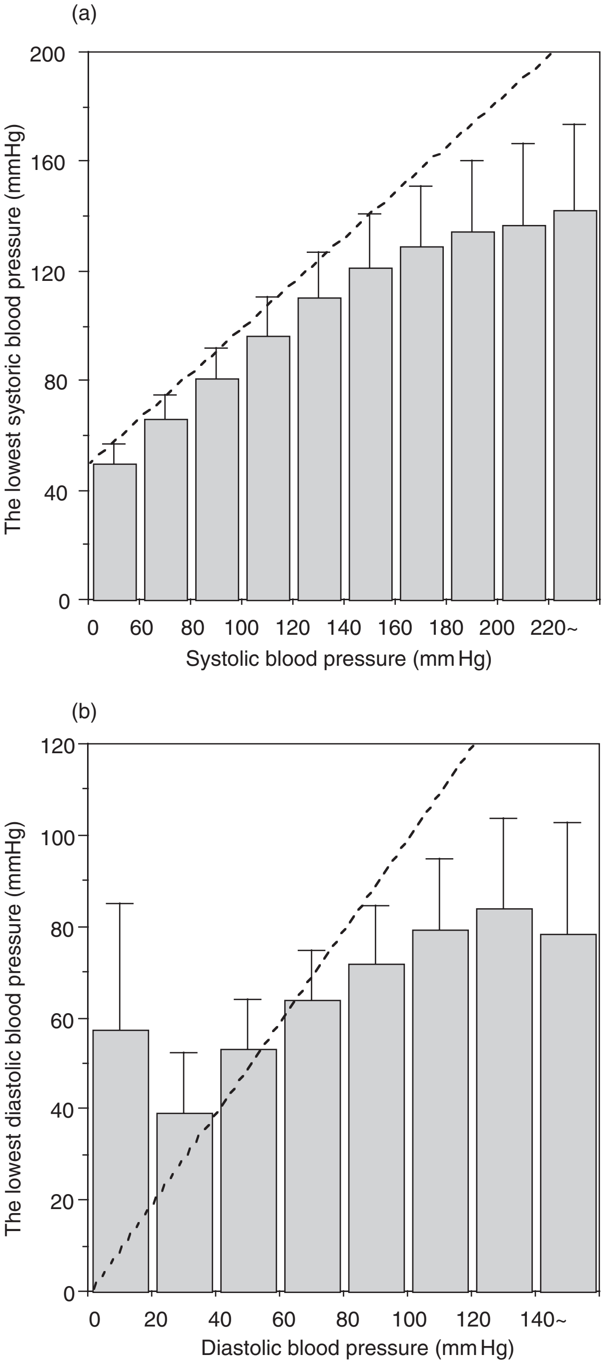

FIG. 2. Relationship between blood pressure at the start of dialysis and the lowest blood pressure (hemodialysis patients). (a) Systolic blood pressure at the start of dialysis, (b) diastolic blood pressure at the start of dialysis.

13.5%; females, 17.0%). However, no large gender differences were observed in the drop/recovery pattern (males, 30.7%; females, 29.8%); or drop/no recovery pattern (males, 30.6%; females, 31.9%).

The relationship between blood pressure fluctuation patterns and age (Fig. 6) shows most patients with stable blood pressure are young, and that the percentage of patients with stable blood pressure decreases with advancing age. More elderly patient tended to have a drop/recovery pattern. Patients whose blood pressure was classified in the drop/no recovery pattern were relatively young, and the percentage of patients classified in this blood pressure pattern decreased with advancing age.

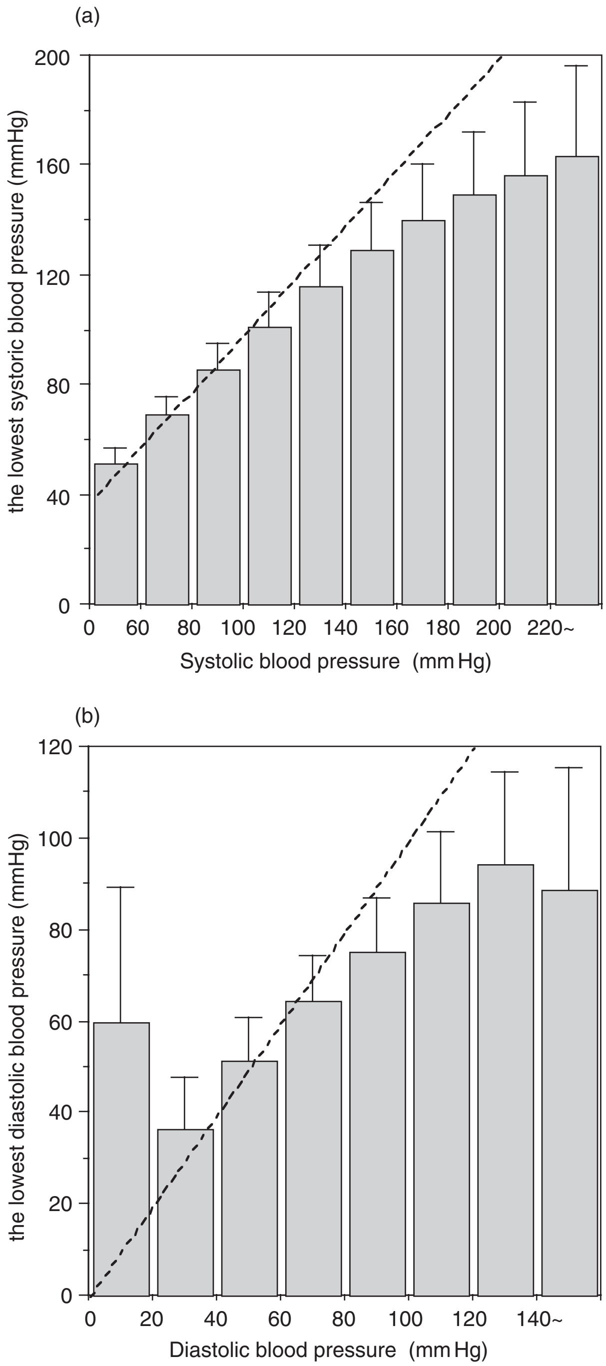

FIG. 3. Relationship between blood pressure at the end of dialysis and the lowest blood pressure (hemodialysis patients). (a) Systolic blood pressure at the end of dialysis, (b) diastolic blood pressure at the end of dialysis.

TABLE 24. *Ratio of lowest and predialysis blood pressure (systolic) by treatment mode*

	Hemodialysis	Hemodiafiltration	Hemofiltration	Hemodiabsorption	Home hemodialysis	Total
>0.3	78 (0.1)	2 (0.0)	2 (0.7)	82 (0.1)		
0.3~	854 (0.6)	45 (0.6)	1 (1.8)	1 (0.3)	901 (0.6)	
0.4~	3 072 (2.2)	194 (2.7)	2 (3.6)	5 (1.7)	3273 (2.2)	
0.5~	7 888 (5.6)	472 (6.7)	5 (9.1)	21 (7.2)	3 (4.2)	8 389 (5.7)
0.6~	17 772 (12.6)	1003 (14.2)	9 (16.4)	46 (15.8)	10 (14.1)	18 840 (12.7)
0.7~	31 942 (22.7)	1680 (23.7)	7 (12.7)	71 (24.4)	18 (25.4)	33 718 (22.7)
0.8~	40 583 (28.8)	1931 (27.2)	19 (34.5)	91 (31.3)	22 (31.0)	42 646 (28.7)
0.9~	27 126 (19.2)	1228 (17.3)	7 (12.7)	37 (12.7)	15 (21.1)	28 413 (19.1)
1.0	11 635 (8.3)	533 (7.5)	5 (9.1)	17 (5.8)	3 (4.2)	12 193 (8.2)
<1.0						
Subtotal	140 950 (100.0)	7088 (100.0)	55 (100.0)	291 (100.0)	71 (100.0)	148 455 (100.0)
Not specified	50 084	2405	36	91	16	52 632
Grand total	191 034	9493	91	382	87	201 087
Average	0.80	0.79	0.78	0.78	0.81	0.80
SD	0.14	0.14	0.16	0.14	0.11	0.14

With regard to dialysis length (Fig. 7), most patients with a short dialysis length fell into the stable and drop/recovery groups, and the percentages gradually decreased with longer dialysis length. However, the percentage increased among patients with long dialysis length in the drop recovery group. Roughly the same percentage occurred in the large drop/small recovery group regardless of dialysis length.

Patients were broadly divided into diabetic and non-diabetic groups based on the primary disease at initiation of dialysis. It was found that the stable blood pressure pattern occurred less frequently in the diabetic group compared with the non-diabetic group, and conversely the large drop/small recovery blood pressure pattern appeared more often in the diabetic group. It was also observed that the drop/recovery pattern was more frequent in the diabetic group, whereas the drop/no recovery pattern was rather less frequent compared with the non-diabetic group (Fig. 8).

Systolic blood pressure at the start of dialysis session It was found that among patients whose systolic blood pressure at the start of treatment was less than 100 mm Hg, 29.0% showed the stable blood pressure pattern during treatment, and nearly half (49.9%) were classified in the drop/recovery group (Fig. 9). These results indicate the most patients with low blood pressure at the start of dialysis tended to recover by the end of treatment even when their blood pressure dropped during treatment.

Among patients whose systolic blood pressure at the start of treatment was 100–139 mm Hg, 31.4% were classified in the stable group, and the majority of the remaining patients fell in the drop/recovery and drop/no recovery groups. Few patients were classified in the large drop/small recovery group.

Few patients whose systolic blood pressure at the start of treatment was 140 mm Hg and higher were classified in the stable group, and most were in the large drop/small recovery and drop/no recovery groups. This suggests that most patients with high blood pressure at the start of a dialysis session will have a reduction in blood pressure during treatment.

Weight loss rate during hemodialysis The figures for weight loss rate during hemodialysis (Fig. 10) show that remarkably few patients who had a large

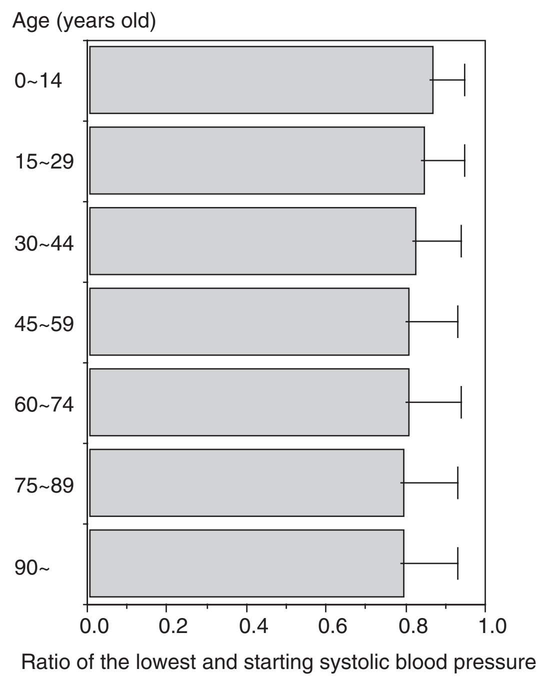

FIG. 4. Ratio of the lowest and starting systolic blood pressure of hemodialysis patients.

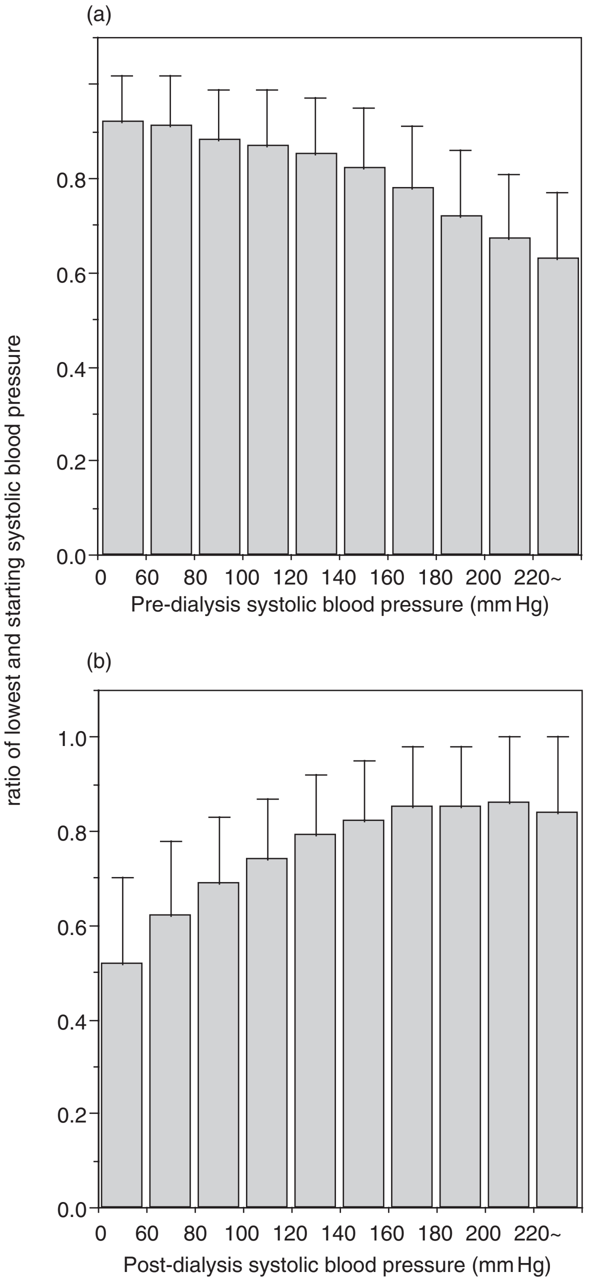

FIG. 5. The relationship between the ratio of lowest and starting systolic blood pressure and pre- or post-dialysis systolic blood pressure of hemodialysis patients. (a) Predialysis systolic blood pressure, (b) Post-dialysis systolic blood pressure.

weight loss rate were in the stable group, while many were in the large drop/small recovery and drop/no recovery groups. Many patients with a small weight loss rate were classified in the stable and drop/recovery groups. This finding indicates that many patients who have a large amount of water removed during treatment will experience a reduction in blood pressure during treatment.

Vasopressor therapy during dialysis Figure 11 indicates the correlation between the blood pressure fluctuation pattern and vasopressor therapy during dialysis. In comparison with patients who used vasopressors, the majority of patients who did not use vasopressor therapy during dialysis fell in the stable group, and few were in the large drop/small recovery group, as might be expected.

The blood pressure fluctuation patterns of patients who use vasopressor therapy during dialysis show closely similar trends among the various vasopressor therapies. Only 12–15% of patients who use vasopressor therapy fell in the stable group, against 25–30% in the large drop/small recovery group. Surprisingly, among the patients who use vasopressor therapy, the percentages of the drop/recovery and drop/no recovery patients were both about 30%, respectively, and there was no large difference in the percentage of the drop/recovery or the drop/no recovery patients between those who did and did not use vasopressor therapy during dialysis.

Many patients who did not use vasopressor therapy during dialysis were in the stable group, How-

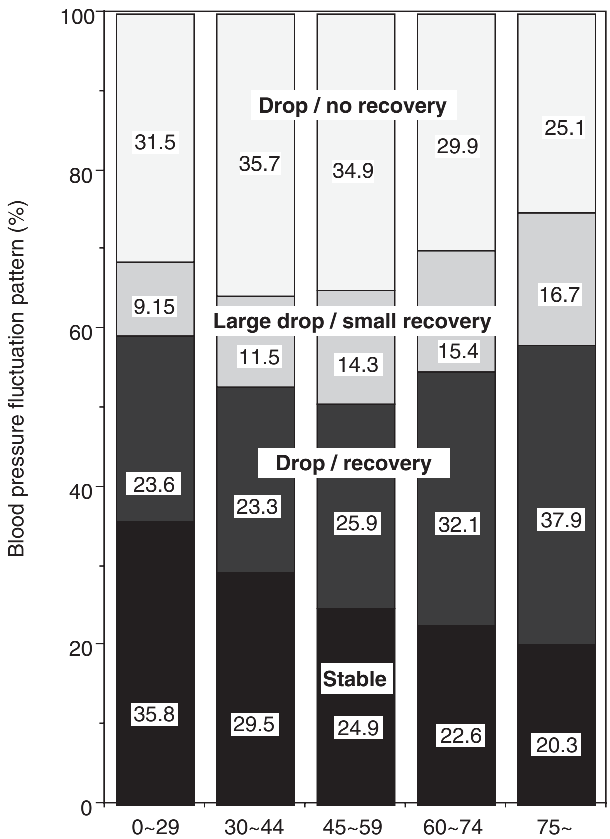

FIG. 6. Age and systolic blood pressure fluctuation pattern on the basis of the ratio of lowest and post-dialysis systolic blood pressure and the ratio of pre- and post-systolic blood pressure of hemodialysis patients.

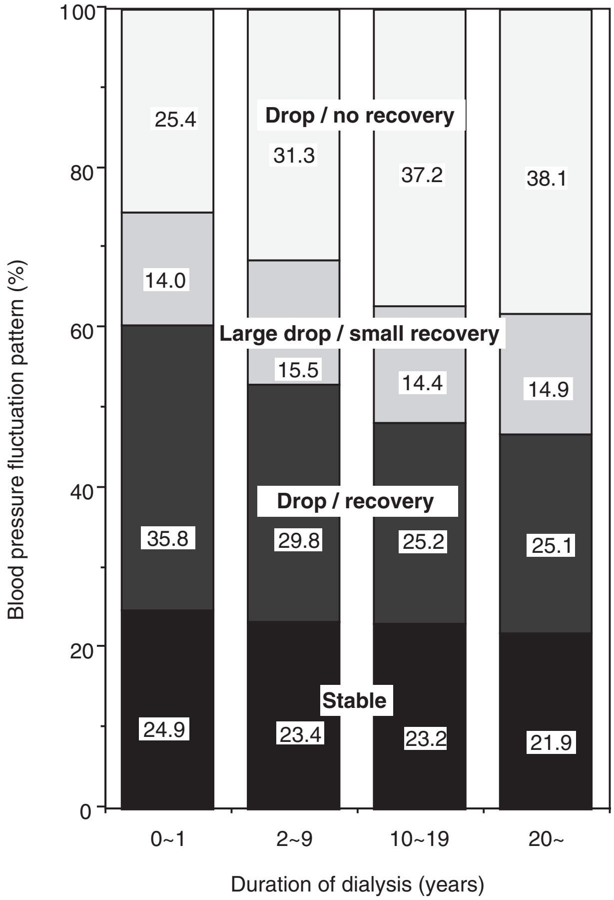

FIG. 7. Duration of dialysis and blood pressure fluctuation pattern on the basis of the ratio of lowest and post-dialysis systolic blood pressure and the ratio of pre- and post-dialysis systolic blood pressure of hemodialysis patients.

ever, many patients who did use vasopressor therapy during dialysis were in the large drop/small recovery group. This might be due to the fact that vasopressor therapy is often applied when there is a large drop in blood pressure. The vasopressor therapy may result in a small recovery after a large drop of blood pressure during hemodialysis.

Among patients who used four or more types of vasopressor therapy, only 6.3% fell in the stable group, while most were in the large drop/small recovery group. Among these patients, however, the percentage of the patients in the drop/recovery group is almost equivalent to that among the patients who used less than three types of vasopressor therapy. Among the patients who used four or more types of vasopressor therapy, the drop/no recovery group evidenced a relatively low percentage.

Patients treated with four or more types of vasopressor therapy might be considered clinically as those having a very severe blood pressure reduction during dialysis, or for whom recovery from a blood pressure reduction is difficult. This assumption is actually supported by the survey results, which show the stable pattern was very rare among patients who received four or more types of vasopressor therapy, while conversely the drop/recovery and large reduction/small recovery patterns were common. The fact that the drop/no recovery pattern was relatively uncommon among patients receiving four or more types of vasopressor therapy suggests that many patients who must receive such treatment cannot

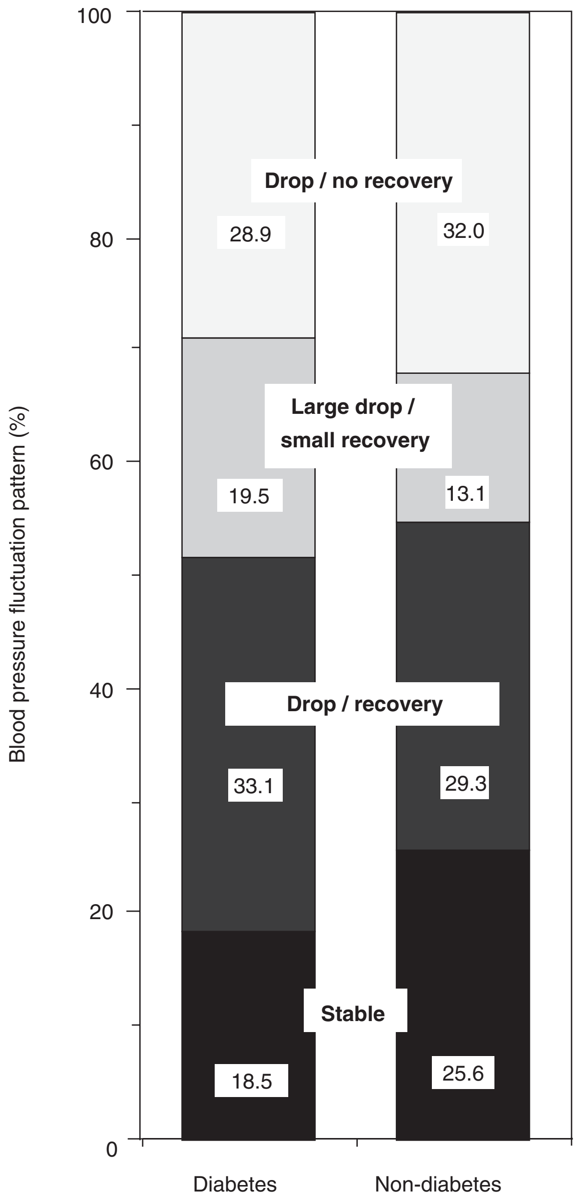

FIG. 8. Primary disease at initiation and blood pressure fluctuation pattern on the basis of the ratio of lowest and post-dialysis systolic blood pressure and the ratio of pre- and post-dialysis systolic blood pressure of hemodialysis patients.

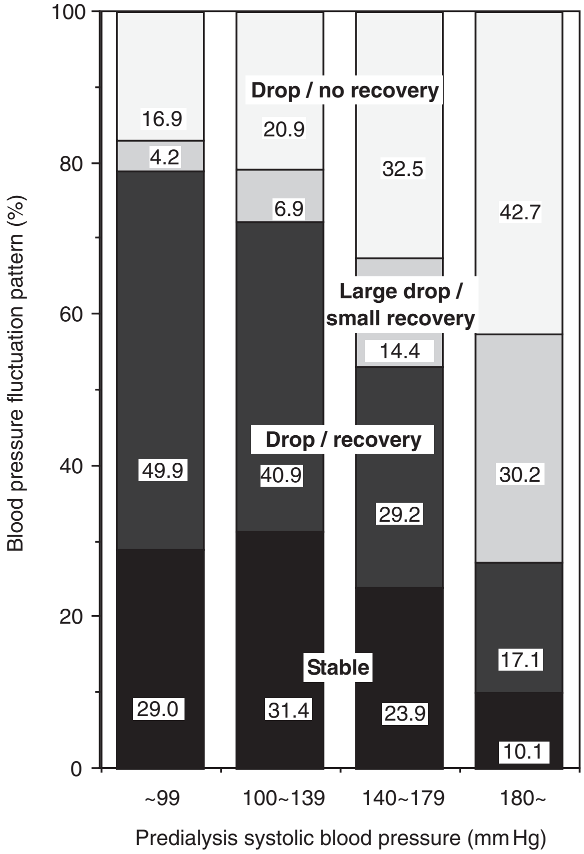

FIG. 9. Predialysis systolic blood pressure and blood pressure fluctuation pattern on the basis of the ratio of lowest and post-dialysis systolic blood pressure and the ratio of pre- and post-dialysis systolic blood pressure.

continue treatment after blood pressure drop, as the blood pressure failed to recover.

Vasopressor therapy before dialysis

Patients who used vasopressor therapy before dialysis were compiled by vasopressor type, and those who used multiple vasopressor therapies were included in this group. Thus, the total number of patients using individual vasopressor therapies in the following tables does not match the actual patient total due to the overlap of patients using multiple therapies.

As patients using four or more types of vasopressor therapies were not counted, the number using each vasopressor therapy in table 25 is not strictly the actual number of patients using that vasopressor therapy. Among all dialysis patients, however, only 13 (0.00%) were confirmed to have used four or more types of vasopressor therapy before dialysis. Therefore, the number of patients using each vasopressor therapy in the table below may well be considered as equivalent to the actual number of patients using that vasopressor therapy.

In the table, the actual total number of patients (who responded to the survey) in each category was used as the denominator in calculating the percentages for each vasopressor therapy. Compiles of vasopressor therapy used before dialysis (Table 25) indicate that 10.8% of dialysis patients have used oral vasopressors, but very few used other vasopressor modalities. Similarly, when looking at the relationship with age in Table 25, it was verified that while a high percentage of young patients did not use a vasopressor before dialysis, the percentage of those using vasopressor therapy increased with age.

Vasopressor therapy during dialysis

Similar to vasopressor therapy before dialysis, patients using the various vasopressor therapies during dialysis were compiled, including those using multiple vasopressor therapies. Just as for the use of vasopressor therapy before dialysis, patients using four or more vasopressor therapies during dialysis are not included in the patient number using each

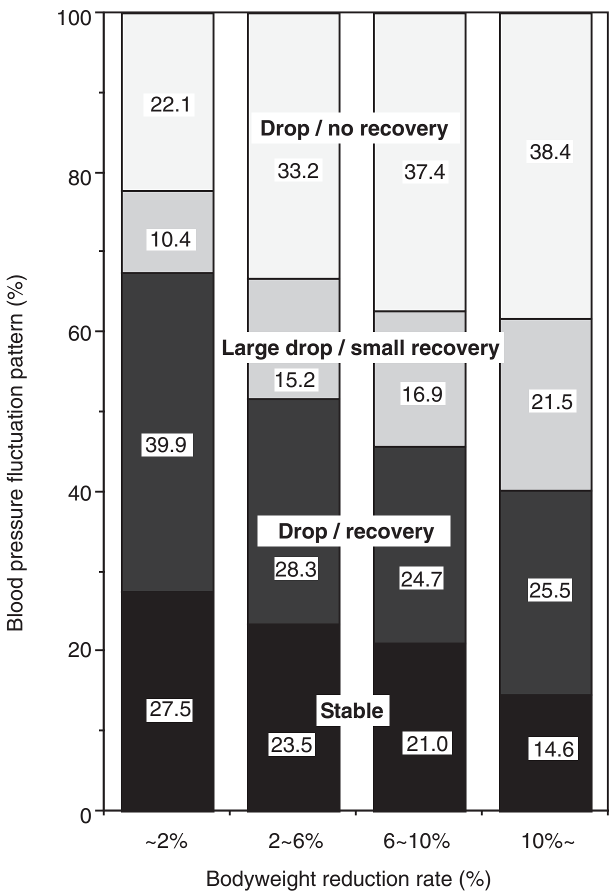

FIG. 10. Weight loss rate and blood pressure fluctuation pattern on the basis of the ratio of lowest and post-dialysis systolic blood pressure and the ratio of pre- and post-dialysis systolic blood pressure.

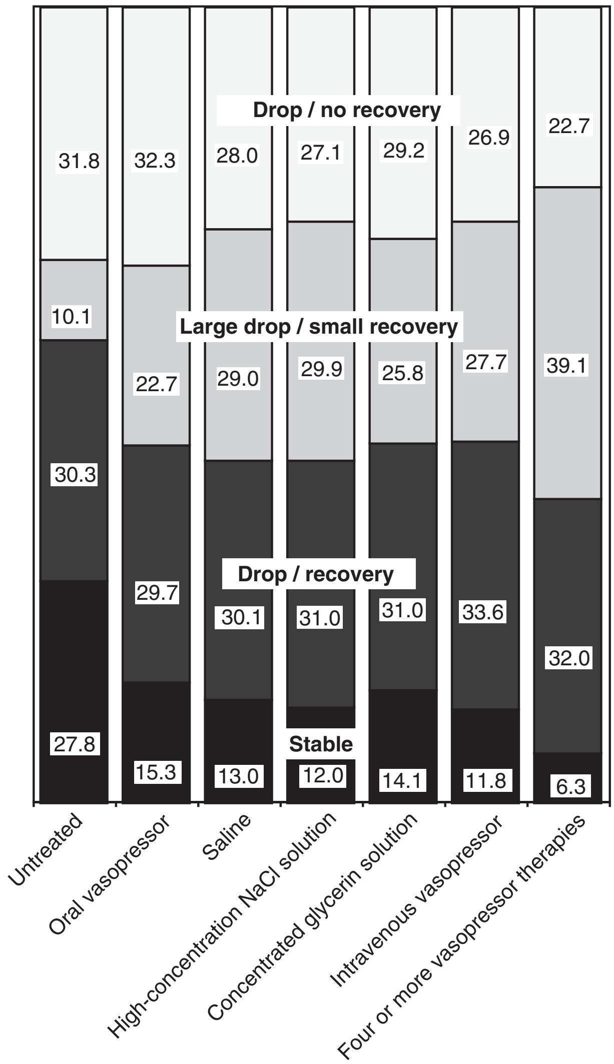

FIG. 11. Vasopressor therapy during dialysis and blood pressure fluctuation pattern on the basis of the ratio of lowest and post-dialysis systolic blood pressure and the ratio of pre- and post-dialysis systolic blood pressure.

type of vasopressor therapy in table 26. However, among all dialysis patients, only relatively few (169 [0.1%]) used four or more vasopressor therapies during dialysis. Therefore, the percentage of users of vasopressor therapy in each category in the table below may be considered virtually equivalent to the actual percentage.

Among all dialysis patients, 68.6% did not use vasopressor therapy during dialysis. Among the various vasopressor therapies, patients using physiological saline solution were most numerous (18.3%), followed by those using high-concentration NaCl solution (8.5%), oral vasopressor (7.0%), intravenous vasopressor (6.3%), and concentrated glycerin solution (2.1%). As mentioned before, only 0.1% of patients used four or more vasopressor therapies. In analysis of the relationship between gender and vasopressor therapy during dialysis (Table 26), it was indicated that more females than males used vasopressor therapy during dialysis. Regarding the relationship with age (Table 27), the number of patients using vasopressor therapy during dialysis increased with age. The majority of patients using vasopressor therapy during dialysis, at all age levels, used physiological saline solution. As shown in Table 28, most patients who did not use vasopressor therapy during dialysis were on dialysis less than 2 years, and the number of these patients decreased over time. There was a clear trend of an increasing number of patients using physiological saline solution as dialysis length prolonged. When patients were divided into diabetic and non-diabetic groups (Table 29), use of vasopressor therapy was more common in the diabetic group than in the non-diabetic group.

Antihypertensive usage status

As for the relationship between gender and antihypertensive usage status among dialysis patients (Table 30), it was found that more males used antihypertensives than females.

Hemopurification modalities to prevent hypotension during treatment

Tables 31 and 32 show analytic results on the relationship between age and hemopurification modalities to prevent hypotension during treatment. Patients undergoing conventional hemodialysis comprised 97.1% of all hemodialysis patients responding to this question, and 2.6% of patients who responded used high-Na dialysate solution. Among all hemodiafiltration patients who responded to this question, the majority, 69.8%, had off-line HDF, followed by 20.6% who received on-line HDF. These were followed by 2.9% with biofiltration (AFBF), 2.3% with original push-pull HDF, and 1.3% using pressure-controlled push-pull HDF. A further 3.1% of patients replied they used ‘another type of hemodiafiltration.

Analysis of the relationship between blood access type at initiation of hemodialysis therapy and life prognosis

Figure 12 gives the results of analysis of the relationship between type of blood access at initiation of hemodialysis therapy and life prognosis. The mortality risk of the group with an arteriovenous fistula (AV fistula) using a prosthetic graft was 2.238 times that of the group with a Brescia-Cimino fistula. A significantly high risk was also found in the external shunt and catheterized groups, and the risk levels of these

TABLE 25. *Predialysis vasopressor therapy by age (hemodialysis patients)*

Age	Pre-dialysis vasopressor therapy: Untreated	Oral vasopressor	Saline	High-concentration NaCl solution	Concentrated glycerin solution	Intravenous vasopressor	Four or more vasopressor therapies	Total
0~	13	0	0	0	0	0	0	13
%	(100.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(100.0)
15~	1 659	66	2	4	1	1	0	1 730
%	(95.9)	(3.8)	(0.1)	(0.2)	(0.1)	(0.1)	(0.0)	(100.0)
30~	10 270	616	27	6	10	13	0	10 932
%	(93.9)	(5.6)	(0.2)	(0.1)	(0.1)	(0.1)	(0.0)	(100.0)
45~	40 311	3 545	142	63	28	91	1	44 071
%	(91.5)	(8.0)	(0.3)	(0.1)	(0.1)	(0.2)	(0.0)	(100.0)
60~	51 765	6 941	196	110	78	205	0	59 118
%	(87.6)	(11.7)	(0.3)	(0.2)	(0.1)	(0.3)	(0.0)	(100.0)
75~	19 363	3 811	80	69	50	125	0	23 377
%	(82.8)	(16.3)	(0.3)	(0.3)	(0.2)	(0.5)	(0.0)	(100.0)
90~	525	126	3	2	0	4	0	658
%	(79.8)	(19.1)	(0.5)	(0.3)	(0.0)	(0.6)	(0.0)	(100.0)
Total	123 906	15 105	450	254	167	439	1	139 899
%	(88.6)	(10.8)	(0.3)	(0.2)	(0.1)	(0.3)	(0.0)	(100.0)

Note: The number of patients in the table includes those using multiple vasopressor therapies. Thus, the total number of patients in all cells does not match the "total number of patients."

groups were about equivalent to that of the group with AV fistula using a prosthetic graft. No significant risk was associated with groups beginning dialysis with superficially repositioned artery, hemacyte, or peritoneal dialysis.

In this analysis, the results were mathematically adjusted by the impact on prognosis due to skewing of the patient distribution in terms of type of blood access, gender, age at initiation, with/without diabetes, and the period from blood access creation to initiation of hemodialysis therapy, using the proportional hazard. However, the background of patients with each type of blood access is considered to vary greatly due to factors for which such blood access was chosen. For example, if one supposes there was a reason for a given patient to receive a superficially repositioned artery, catheter, or external shunt rather than Brescia-Cimino fistula when he or she first began dialysis treatment, the above basic factors alone could not be the reason. In other words, differences in prognosis confirmed by each type of blood access cannot be laid to the differences in the circulatory dynamics among the individual type of blood access. The results of the current analysis must be interpreted as outcome of a comparison of the prognoses of patients for whom a particular type of blood access had to be used for some reason or other.

Table 33 shows the results of analysis of the relationship between the period from blood access creation to initiation of hemodialysis therapy and life prognosis. A significantly low mortality risk was found when the period from blood access creation to initiation was 3–6 months. When this period was 2–3 months, a nearly significant low mortality risk trend was observed. There was no significant risk associated with other periods.

TABLE 26. *During dialysis vasopressor therapy by gender (hemodialysis patients)*

Sex	Predialysis vasopressor therapy: Untreated	Oral vasopressor	Saline	High-concentration NaCl solution	Concentrated glycerin solution	Intravenous vasopressor	Four or more vasopressor therapies	Total
Male	61 848	4468	13 594	6263	1403	4345	66	84 594
%	(73.1)	(5.3)	(16.1)	(7.4)	(1.7)	(5.1)	(0.1)	(100.0)
Female	34 760	5363	12 138	5740	1514	4483	87	56 204
%	(61.8)	(9.5)	(21.6)	(10.2)	(2.7)	(8.0)	(0.2)	(100.0)
Total	96 608	9831	25 732	12 003	2917	8828	153	140 798
%	(68.6)	(7.0)	(18.3)	(8.5)	(2.1)	(6.3)	(0.1)	(100.0)

Note: The number of patients in the table includes those using multiple vasopressor therapies. Thus, the total number of patients in all cells does not match the "total number of patients."

TABLE 27. *Use of vasopressor therapy during dialysis by age (hemodialysis patients)*

Age	Predialysis vasopressor therapy: Untreated	Oral vasopressor	Saline	High-concentration NaCl solution	Concentrated glycerin solution	Intravenous vasopressor	Four or more vasopressor therapies	Total
0~	11	1	1	1	0	0	0	13
%	(84.6)	(7.7)	(7.7)	(7.7)	(0.0)	(0.0)	(0.0)	(100.0)
15~	1 432	38	219	73	16	45	1	1 732
%	(82.7)	(2.2)	(12.6)	(4.2)	(0.9)	(2.6)	(0.1)	(100.0)
30~	8 577	398	1 542	638	126	364	8	10 987
%	(78.1)	(3.6)	(14.0)	(5.8)	(1.1)	(3.3)	(0.1)	(100.0)
45~	31 948	2432	7 737	3 338	734	2156	24	44 389
%	(72.0)	(5.5)	(17.4)	(7.5)	(1.7)	(4.9)	(0.1)	(100.0)
60~	39 787	4725	11 142	5 346	1273	4037	79	59 478
%	(66.9)	(7.9)	(18.7)	(9.0)	(2.1)	(6.8)	(0.1)	(100.0)
75~	14 422	2179	4 902	2 509	738	2149	40	23 448
%	(61.5)	(9.3)	(20.9)	(10.7)	(3.1)	(9.2)	(0.2)	(100.0)
90~	388	54	158	80	29	72	1	667
%	(58.2)	(8.1)	(23.7)	(12.0)	(4.3)	(10.8)	(0.1)	(100.0)
Total	96 565	9827	25 701	11 985	2916	8823	153	140 714
%	(68.6)	(7.0)	(18.3)	(8.5)	(2.1)	(6.3)	(0.1)	(100.0)

Note: The number of patients in the table includes those using multiple vasopressor therapies. Thus, the total number of patients in all cells does not match the 'total number of patients.'

TABLE 28. *Use of vasopressor therapy during dialysis, by duration of dialysis (hemodialysis patients)*

Dulation of dialysis (years)	Predialysis vasopressor therapy: Untreated	Oral vasopressor	Saline	High-concentration NaCl solution	Concentrated glycerin solution	Intravenous vasopressor	Four or more vasopressor therapies	Total
0~	25 957	1936	5 998	2 816	701	2052	35	36 014
%	(72.1)	(5.4)	(16.7)	(7.8)	(1.9)	(5.7)	(0.1)	(100.0)
2~	25 836	2975	6 655	3 208	831	2500	40	37 868
%	(68.2)	(7.9)	(17.6)	(8.5)	(2.2)	(6.6)	(0.1)	(100.0)
5~	23 483	2603	6 352	3 076	682	2218	45	34 528
%	(68.0)	(7.5)	(18.4)	(8.9)	(2.0)	(6.4)	(0.1)	(100.0)
10~	10 793	1161	3 099	1 290	325	1000	17	16 009
%	(67.4)	(7.3)	(19.4)	(8.1)	(2.0)	(6.2)	(0.1)	(100.0)
15~	5 853	567	1 898	865	189	556	6	8 894
%	(65.8)	(6.4)	(21.3)	(9.7)	(2.1)	(6.3)	(0.1)	(100.0)
20~	3 281	391	1 174	497	116	322	4	5 145
%	(63.8)	(7.6)	(22.8)	(9.7)	(2.3)	(6.3)	(0.1)	(100.0)
25~	1 431	203	563	257	74	181	6	2 380
%	(60.1)	(8.5)	(23.7)	(10.8)	(3.1)	(7.6)	(0.3)	(100.0)
Total	96 634	9836	25 739	12 009	2918	8829	153	140 838
	(68.6)	(7.0)	(18.3)	(8.5)	(2.1)	(6.3)	(0.1)	(100.0)

Note: The number of patients in the table includes those using multiple vasopressor therapies. Thus, the total number of patients in all cells does not match the 'total number of patients.'

TABLE 29. *Use of vasopressor therapy during dialysis by primary disease (hemodialysis patients)*

Primary disease	Predialysis vasopressor therapy: Untreated	Oral vasopressor	Saline	High-concentration NaCl solution	Concentrated glycerin solution	Intravenous vasopressor	Four or more vasopressor therapies	Total
Diabetes	25 152	3580	7 706	4 100	1051	3145	50	39 426
%	(63.8)	(9.1)	(19.5)	(10.4)	(2.7)	(8.0)	(0.1)	(100.0)
Non-diabetes	70 457	6153	17 772	7 809	1844	5592	103	99 932
%	(70.5)	(6.2)	(17.8)	(7.8)	(1.8)	(5.6)	(0.1)	(100.0)
Total	95 609	9733	25 478	11 909	2895	8737	153	139 358
%	(68.6)	(7.0)	(18.3)	(8.5)	(2.1)	(6.3)	(0.1)	(100.0)

Note: The number of patients in the table includes those using multiple vasopressor therapies. Thus, the total number of patients in all cells does not match the 'total number of patients.'

TABLE 30. *Antihypertensive usage status by gender (hemodialysis patients)*

	Male	Female	Subtotal	Not specified	Grand total
Not used	32 205 (37.8)	24 832 (44.0)	57 037 (40.2)	18 (45.0)	57 055 (40.3)
Used but the dosage was reduced	31 161 (36.6)	16 128 (28.5)	47 289 (33.4)	14 (35.0)	47 303 (33.4)
Used and the dosage was not reduced	20 662 (24.2)	14 791 (26.2)	35 453 (25.0)	7 (17.5)	35 460 (25.0)
Used but the dosage reduction was unknown	1 190 (1.4)	740 (1.3)	1 930 (1.4)	1 (2.5)	1 931 (1.4)
Total	85 218 (100.0)	56 491 (100.0)	141 709 (100.0)	40 (100.0)	141 749 (100.0)
Unknown	197	112	309	309	
Not specified	29 457	19 577	49 034	29	49 063
Grand total	114 872	76 180	191 052	69	191 121

TABLE 31. *Mode of treatment for hypotension by age (hemodialysis patients)*

	Conventional hemodialysis	High-Na dialysate solution	Other hemodialysis	Subtotal	Not specified	Grand total
Age						
>15	10 (90.9)	1 (9.1)		11 (100.0)	14	25
15~	1 687 (98.1)	28 (1.6)	4 (0.2)	1 719 (99.9)	701	2 420
30~	10 506 (97.9)	195 (1.8)	31 (0.3)	10 732 (100.0)	4 204	14 936
45~	42 112 (97.4)	1009 (2.3)	134 (0.3)	43 255 (100.0)	17 130	60 385
60~	56 242 (97.0)	1550 (2.7)	175 (0.3)	57 967 (100.0)	22 439	80 406
75~	22 086 (96.5)	732 (3.2)	74 (0.3)	22 892 (100.0)	8 919	31 811
90~	630 (97.1)	19 (2.9)		649 (100.0)	287	936
Sub-total	133 273 (97.1)	3534 (2.6)	418 (0.3)	137 225 (100.0)	53 694	190 919
Not specified	121 (96.8)	3 (2.4)	1 (0.8)	125 (100.0)	77	202
Grand total	133 394 (97.1)	3537 (2.6)	419 (0.3)	137 350 (100.0)	53 771	191 121
Average	61.96	64.06	62.09	62.01	61.95	61.99
SD	12.94	12.50	12.58	12.93	13.02	12.96

Regarding the relationship between the period from blood access creation to initiation of hemodialysis and life prognosis, the discussion is much like that for the analysis of blood access type and life prognosis. A more favorable prognosis for patients whose period from blood access creation to dialysis initiation was longer cannot be interpreted as suggesting that a longer period from blood access creation to dialysis initiation of itself improved the life prognosis. These results could be interpreted as suggesting that a favorable prognosis for patients would be due to management of renal failure by a nephrologist for sufficiently long period before initiating dialysis.

Because a patient assured of a sufficient period from blood access creation to initiation of dialysis is considered to have been treated by a nephrologist a sufficient time prior to initiation of dialysis, the present results may be construed as agreeing with past reports indicating a favorable prognosis for

TABLE 32. *Mode of treatment for hypotension by age (hemodiafiltration patients)*

	Off-line HDF	On-line HDF	Original push-pull HDF	Pressure-controlled push-pull HDF	Biofiltration (AFBF)	Other HDF	Subtotal	Not specified	Grand total
Age									
>15								2	2
15~	23 (53.5)	17 (39.5)		1 (2.3)		2 (4.7)	43 (100.0)	56	99
30~	291 (65.8)	116 (26.2)	10 (2.3)	5 (1.1)	6 (1.4)	14 (3.2)	442 (100.0)	496	938
45~	1214 (65.5)	445 (24.0)	47 (2.5)	34 (1.8)	46 (2.5)	68 (3.7)	1854 (100.0)	2083	3937
60~	1258 (74.5)	284 (16.8)	40 (2.4)	17 (1.0)	51 (3.0)	38 (2.3)	1688 (100.0)	1826	3514
75~	365 (74.5)	70 (14.3)	7 (1.4)	2 (0.4)	27 (5.5)	19 (3.9)	490 (100.0)	478	968
90~	14 (87.5)	1 (6.3)			1 (6.3)		16 (100.0)	9	25
Subtotal	3165 (69.8)	933 (20.6)	104 (2.3)	59 (1.3)	131 (2.9)	141 (3.1)	4533 (100.0)	4950	9483
Not specified	4 (100.0)						4 (100.0)	6	10
Grand total	3169 (69.8)	933 (20.6)	104 (2.3)	59 (1.3)	131 (2.9)	141 (3.1)	4537 (100.0)	4956	9483
Average	60.00	56.36	58.70	55.10	63.08	58.38	59.20	58.68	58.93
SD	12.23	12.16	11.43	10.44	12.40	12.12	12.29	12.17	12.23

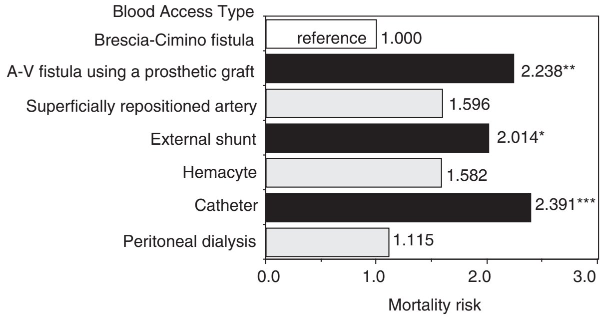

FIG. 12. Blood access type when beginning dialysis treatment and mortality risk for hemodialysis patients only; corrected for gender, age, diabetic status, and period from blood access creation to initiation. AV, arterio-venous; $^{*}P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.0001$.

patients who receive early treatment by a nephrologist. The effects of treatment by a nephrologist before initiation of dialysis on prognosis after initiation of dialysis have been reported (4).

Analysis of factors determining life prognosis

Initiation year of dialysis and risk of death

Figure 13 represents the annual variation of mortality risk 1, 5, and 10 years after beginning dialysis treatment. The respective prognoses for 1, 5 and 10 years indicated low risk of death for patients recently initiating dialysis. The results suggest that, if the effects of the increase in elderly and/or diabetic patients are excluded, the prognosis after initiation is reliably improved on a year-to-year basis.

Factors affecting the 1-year prognosis of hemodialysis patients

The results of analyzing the influence of basic factors such as gender, age, dialysis length, and diabetic status on life prognosis are shown in Table 34. A total of 133 796 patients were used in the analysis. Among these patients, 8962 patients died by the end of the year 2001. A high mortality risk was associated with age, males, presence of diabetes, and a 5-year or longer dialysis length.

TABLE 33. *Mortality risk during period from blood access creation to initial dialysis treatment (hemodialysis patients)*

Period from blood access creation to initial dialysis treatment (months)	Hazard ratio	(95% confidence limits)	P-value
0~	1.000	(reference)	reference
1~	0.851	(0.654~1.107)	0.2284
2~	0.630	(0.378~1.048)	0.0752
3~	0.630	(0.409~0.972)	0.0369
6~	0.951	(0.693~1.305)	0.7556

Post-dialysis blood pressure

Table 35 shows the results of the analysis of post-dialysis systolic blood pressure. A significantly high mortality risk was found both when the post-dialysis systolic blood pressure was less than 120 mm Hg and 180 mm Hg or higher. Results for post-dialysis diastolic blood pressure are presented in Table 36, and those for post-dialysis mean blood pressure are in Table 37. Similar to results for systolic blood pressure, a significantly greater mortality risk was associated with both low and high blood pressure in post-dialysis diastolic blood pressure and mean blood pressure.

The 1995 survey report indicated that low predialysis blood pressure is associated with a high mortality risk (3). The report pointed out that many patients with low predialysis blood pressure were also in a state of poor nutrition, indicating a possible association with the high mortality risk of patients with low blood pressure.

Results of the current survey investigating the relationship between post-dialysis blood pressure and various nutrition indices confirm a trend of low serum albumin levels in patients who had low post-dialysis blood pressure. However, among these patients, there was no definite trend of low levels regarding normalized protein catabolic rate (nPCR, an index of protein uptake), percentage creatinine generation rate (%CGR, an index of muscle mass) (5), or serum total cholesterol level (results not shown). Accordingly, background factors affecting the mortality risk of patients found to have low post-dialysis blood pressure in the current survey cannot necessarily be considered to reflect the poor nutrition of these patients.

Although past surveys did not find a high mortality risk necessarily associated with patients with high predialysis blood pressure (3), analysis results of

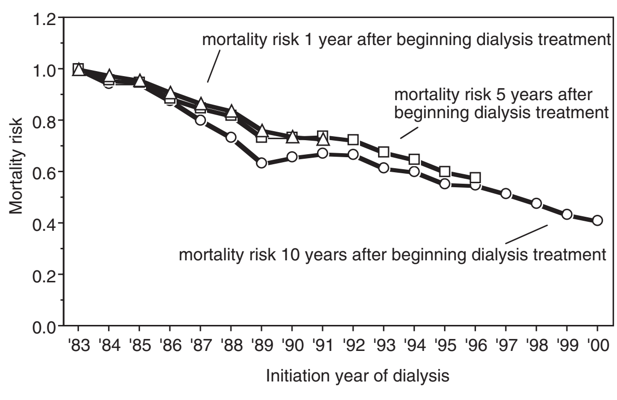

FIG. 13. Change in mortality risk 1, 5, and 10 years after beginning dialysis treatment (hemodialysis patients) corrected for gender, age, and diabetic status.

TABLE 34. *Basic risk factors affecting one-year survival of hemodialysis patients*

Risk factors	Hazard ratio	(95% confidence limits)	*P*-value
Sex			
Male	1.000	(reference)	reference
Female	0.853	(0.817~0.890)	0.0001
Age			
Every one year old	1.063	(1.061~1.066)	0.0001
Duration of dialysis (year)			
0~	0.856	(0.807~0.907)	0.0001
2~	0.876	(0.828~0.927)	0.0001
5~	1.000	(reference)	reference
10~	1.112	(1.032~1.198)	0.0051
15~	1.110	(1.005~1.227)	0.0400
20~	1.124	(0.986~1.280)	0.0794
25~	1.434	(1.184~1.736)	0.0002
Primary disease			
Non-diabetes	1.000	(reference)	reference
Diabetes	1.651	(1.579~1.726)	0.0001

post-dialysis blood pressure in the present survey indicate a significantly high mortality risk associated with high post-dialysis blood pressure. Among patients who had high predialysis blood pressure, only a few patients had low post-dialysis blood pressure, as recorded in the new survey items. It is therefore possible that a high predialysis blood pressure does not necessarily indicate the patient has continuously high blood pressure.

In contrast, the post-dialysis blood pressure is generally considered to be the lowest blood pressure experienced by the dialysis patient in his or her daily life. Therefore, it is more common for the patient who has a high post-dialysis blood pressure to have continuously high blood pressure until the next dialysis session. Kooman et al. conducted 24-h monitoring of the blood pressure of dialysis patients and pointed out a close correlation between the blood pressure of the interdialyitic period and the post dialysis blood pressure (6). This finding corroborates the earlier mentioned hypothesis. Accordingly, the high mortality risk associated with patients who have high post-dialysis blood pressure can be considered to suggest that the consistently high blood pressure increases the risk of death. The current survey results for patients with high post-dialysis blood pressure should be taken to indicate such patients have continuously high blood pressure, and treatment to lower the blood pressure should be undertaken.

TABLE 35. *One-year mortality risk and post-dialysis systolic blood pressure (hemodialysis patients)*

Post-dialysis systolic blood pressure (mm Hg)	Hazard ratio	(95% confidence limits)	*P*-value
<100	1.475	(1.264~1.723)	0.0001
100 ≦ < 120	1.157	(1.045~1.280)	0.0048
120 ≦ < 140	1.020	(0.938~1.111)	0.6390
140 ≦ < 160	1.000	(reference)	reference
160 ≦ < 180	1.064	(0.969~1.169)	0.1936
180 ≦	1.281	(1.129~1.454)	0.0001

TABLE 36. *One-year mortality risk and post-dialysis diastolic blood pressure (hemodialysis patients)*

Post-dialysis diastolic blood pressure (mm Hg)	Hazard ratio	(95% confidence limits)	*P*-value
<60	1.426	(1.284~1.583)	0.0001
60 ≦ < 80	1.049	(0.977~1.126)	0.1877
80 ≦ < 100	1.000	(reference)	reference
100 ≦	1.327	(1.118~1.575)	0.0012

TABLE 37. *One-year mortality risk and post-dialysis mean blood pressure (hemodialysis patients)*

Post-dialysis mean blood pressure (mm Hg)	Hazard ratio	(95% confidence limits)	*P*-value
<80	1.291	(1.163~1.433)	0.0001
80 ≦ < 90	1.133	(1.028~1.247)	0.0114
90 ≦ < 100	0.984	(0.898~1.079)	0.7301
100 ≦ < 110	1.000	(reference)	reference
110 ≦ < 120	1.039	(0.928~1.164)	0.5035
120 ≦ < 130	1.128	(0.958~1.328)	0.1492
130 ≦	1.802	(1.448~2.241)	0.0001

Pre- and post-dialysis blood pressure ratio

Table 38 shows the relationship between the ratio of the pre- and post-dialysis systolic blood pressure and life prognosis. Patients who had a ratio greater than 1.0, (i.e. those whose post-dialysis blood pressure was elevated) were found to have a significantly higher mortality risk. Table 39 represents the relationship between pre- and post-dialysis diastolic blood pressure and life prognosis. Unlike the case for systolic blood pressure, the mortality was not found to be higher for patients whose post-dialysis diastolic blood pressure was higher.

The relationship between the mean pre- and post-dialysis blood pressure and life prognosis is shown in Table 40. Reflecting the trend observed for systolic blood pressure, a significantly high mortality risk was noted among patients who had higher post-dialysis blood pressure.

The high mortality risk recognized in patients with higher post-dialysis than predialysis systolic blood pressure may be explained as similar to the high mortality risk of patients with high post-dialysis blood pressure. These results may suggest the necessity of lowering the blood pressure of patients who experience elevated blood pressure after dialysis even though they did not necessarily have high blood pressure before dialysis.

Serum high density lipoprotein cholesterol level Figure 14 represents the results analyzing diabetic and non-diabetic patients in terms of serum HDL cholesterol level. Among both diabetic and non-diabetic patients, the risk was significantly high for patients whose serum HDL cholesterol level was less than 30 mg/dL, and significantly low for those whose serum HDL cholesterol level was 50 mg/dL and higher.

There is a high risk of a cardiovascular event among patients with a low serum HDL cholesterol level, and a conversely low risk among those with a high serum HDL cholesterol level (7). Results of the current survey indicate that the serum HDL cholesterol level is a factor in life prognosis among diabetic dialysis patients similar to the case for patients with normal renal function.

Water removal rate Results of analysis of the relationship between water removal rate and life prognosis are shown in Table 41. A high mortality risk was confirmed for patients who had a high water removal rate. The effect of the total water removal volume during hemodialysis was mathematically adjusted in the present analysis. Thus, these results may be considered to indicate that a high water removal rate increases mortality risk even at a total water removal volume was identical.

Analysis of the relationship between death caused by myocardial infarction/cardiac insufficiency and intervention in ischemic heart disease patients

The results of analysis are given in Figure 15. Among diabetic patients, the risk was significantly lower for patients treated by PTCA. The risk was 0.438 times that of patients who did not receive intervention; however, a significant risk was not observed among patients treated by CABG, or PTCA + stenting. There was no significant risk observed in non-diabetic patients treated by CABG, PTCA, or PTCA + stenting. Diabetic patients with ischemic heart disease often had difficulty adapting to PTCA due to serious stenosis of the coronary arteries. Considering this fact, interpreting the following results is not an easy matter.

Considering that many ischemic heart disease patients with diabetes are in a serious condition, the low risk associated with diabetic PTCA patients might be interpreted as indicating a favorable prognosis for patients whose severity of disease allows PTCA. No information was obtained on the background of patients who did not receive intervention. If many of these patients did not receive intervention because they were not in a therapeutic environment in which they could receive such intervention regardless of whether they were in a condition allowing such intervention, the above results might be interpreted as indicating PTCA should be actively applied to ischemic heart disease patients with diabetes. Among non-diabetic patients, however, there was no significant difference in life prognosis between the various modes of intervention.

As was the case with diabetic patients, interpretation of the analysis results is not easy for non-diabetic

TABLE 38. *One-year mortality risk and ratio of pre- and post-dialysis systolic blood pressure (hemodialysis patients)*

Ratio of pre- and post-dialysis systolic blood pressure	Hazard ratio	(95% confidence limits)	*P*-value
<0.7	0.986	(0.856~1.137)	0.8499
0.7 ≦ < 0.8	0.889	(0.796~0.993)	0.0372
0.8 ≦ < 0.9	1.000	(reference)	reference
0.9 ≦ < 1.0	0.946	(0.863~1.037)	0.2352
1.0 ≦ < 1.1	1.115	(1.014~1.227)	0.0245
1.1 ≦ < 1.2	1.216	(1.075~1.377)	0.0019
1.2 ≦	1.346	(1.168~1.552)	0.0001

TABLE 39. *One-year mortality risk and ratio of pre- and post-dialysis diastolic blood pressure (hemodialysis patients)*

Ratio of pre- and post-dialysis diastolic blood pressure	Hazard ratio	(95% confidence limits)	*P*-value
<0.7	1.243	(1.074~1.438)	0.0034
0.7 ≦ < 0.8	1.017	(0.902~1.148)	0.7782
0.8 ≦ < 0.9	1.000	(reference)	reference
0.9 ≦ < 1.0	1.026	(0.929~1.133)	0.6110
1.0 ≦ < 1.1	1.005	(0.911~1.109)	0.9184
1.1 ≦ < 1.2	1.004	(0.891~1.130)	0.9531
1.2 ≦	1.061	(0.935~1.204)	0.3567

TABLE 40. *One-year mortality risk and ratio of pre- and post-dialysis mean blood pressure (hemodialysis patients)*

Ratio of pre- and post-dialysis mean blood pressure	Hazard ratio	(95% confidence limits)	*P*-value
<0.7	1.158	(0.989~1.354)	0.0680
0.7 ≦ < 0.8	0.966	(0.862~1.083)	0.5539
0.8 ≦ < 0.9	1.000	(reference)	reference
0.9 ≦ < 1.0	0.964	(0.881~1.055)	0.4249
1.0 ≦ < 1.1	1.067	(0.973~1.169)	0.1664
1.1 ≦ < 1.2	1.137	(1.010~1.281)	0.0340
1.2 ≦	1.218	(1.052~1.410)	0.0085

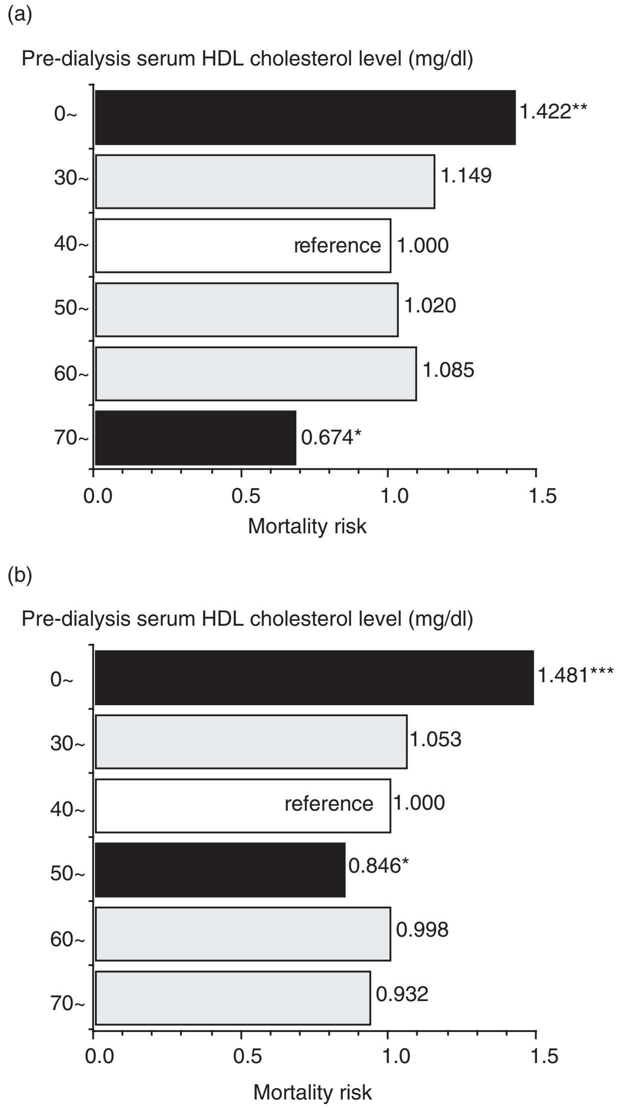

FIG. 14. 1-year mortality risk and predialysis serum high density lipoprotein (HDL) cholesterol level (hemodialysis patients). (a) Diabetes; (b) non-diabetes. $*P < 0.05$; $**P < 0.0005$; $***P < 0.0001$; no mark, not significant.

patients. If each mode of intervention is properly undertaken in accordance with the condition of the patient, the present results could be taken to suggest that the severity of the patient's condition is at odds with the improvement of the prognosis by treatment. In any case, because the application of each mode of intervention is considered to be dependent on the severity of the patient's condition, it is difficult to make a fair comparison of intervention in the present analysis because information on this condition is lacking. Because there have been reports of a high stenotic recurrence rate after PTCA among dialysis patients (8), long-term prognoses (i.e. 2-year and 5-year prognoses) require further study.

TABLE 41. *One-year mortality risk and water removal rate (hemodialysis patients)*

Water removal rate (%/hour)	Hazard ratio	(95% confidence limits)	P-value
0.0 ≦ < 0.3	1.038	(0.872~1.236)	0.6745
0.3 ≦ < 0.6	0.852	(0.750~0.967)	0.0132
0.6 ≦ < 0.9	0.873	(0.806~0.945)	0.0008
0.9 ≦ < 1.2	1.000	(reference)	reference
1.2 ≦ < 1.5	1.218	(1.135~1.307)	<0.0001
1.5 ≦ < 1.8	1.689	(1.509~1.891)	<0.0001
1.8 ≦	2.317	(2.033~2.640)	<0.0001

Adjusted for gender, age, dialysis length, other than primary disease, and weight loss rate.

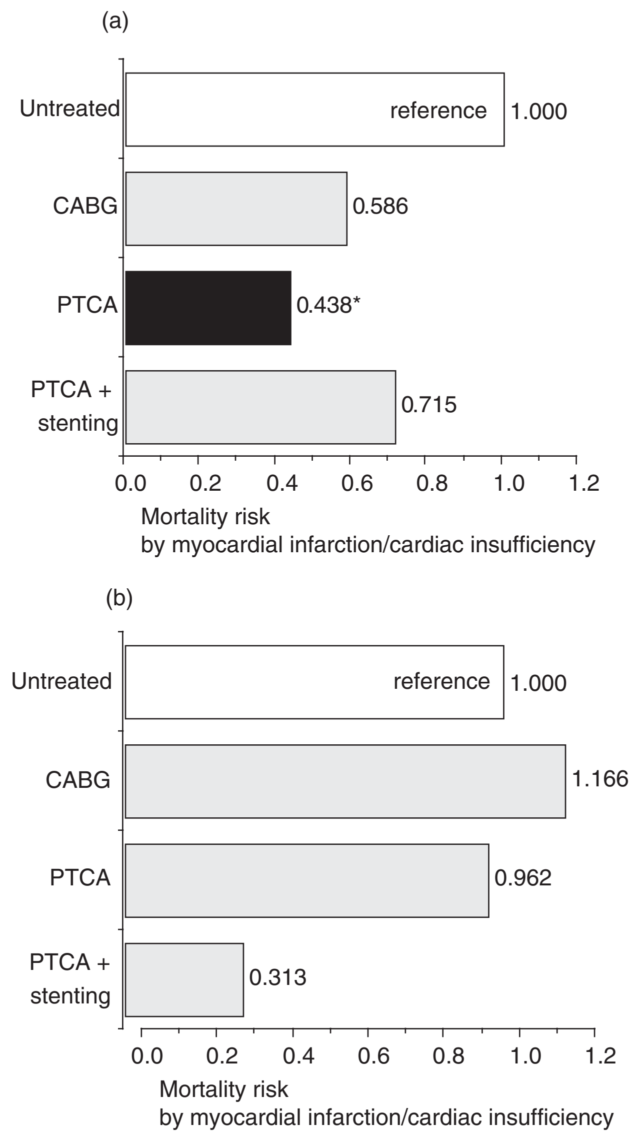

FIG. 15. Mortality risk by myocardial infarction/cardiac insufficiency and intervention with ischemic heart disease patients. (a) Diabetes; (b) non-diabetes. CABG, Coronary artery bypass grafting; PTCA, percutaneous transluminal coronary angioplasty. $*P < 0.05$; no mark, not significant.

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