Current status of renal replacement therapy in Japan: results of the annual survey of the Japanese Society for Dialysis Therapy


Abstract  Beginning in 1966, the Patient Registration Committee of the Japanese Society for Dialysis Therapy has conducted a survey once a year on renal replacement therapy in Japan. As of 1983, the survey covered the life/death of patients in the survey years, as well as the case mix of individual patients. In 1990 several laboratory variables were added to the survey items. The present report summarizes the data from the 1993 and 1994 surveys. The Committee mailed out questionnaire forms at the end of the survey year to the heads of all dialysis facilities. Survey forms were returned from 99.6% of the dialysis facilities in the 1993 survey, and from 99.8% of the facilities in the 1994 survey. Some 143,709 patients were treated by renal replacement therapy in 1994 (75,09 were treated by CAPD, and 131,016 by extracorporeal haemopurification). The gross mortality rate was 9.5% in the same year. The mean values of the laboratory variables among 88,693 patients undergoing thrice weekly haemodialysis were as follows in 1993: \( \text{Kt/V} \), 1.31 ± 0.30; protein catabolic rate, 1.04 ± 0.30 g/kg/day; haemodialysis time, 4.12 ± 0.50 h. In 1994, the variables were: predialysis serum creatinine concentration, 11.54 ± 2.85 mg/dl; predialysis serum albumin concentration, 3.91 ± 0.55 g/dl; predialysis haematocrit, 28.69 ± 4.36%.

Key words: haemodialysis; mortality; renal failure

Introduction

Beginning in 1966, the Patient Registration Committee of the Japanese Society for Dialysis Therapy has conducted a survey once a year on renal replacement therapy in Japan. The questionnaire surveys collect information on the number of patients treated in the dialysis facilities, the number of staff members, the number of haemodialysis machines, and other specifics concerning the facilities. Since 1983, the surveys have also collected information on survival of patients in the survey years, and characteristics of the individual patients, i.e. the case mix. In order to be able to evaluate the impact of various laboratory variables on survival, a few variables were added each year to the survey items, starting in 1990, and some were substituted for others every year. In 1993, information on \( \text{Kt/V} \), protein catabolic rate, pre- and postdialysis serum creatinine concentrations, predialysis serum phosphate concentration and predialysis albumin concentration was added, and this laboratory variable package was then changed in 1994 to include the predialysis serum phosphate concentration, predialysis serum albumin concentration, predialysis serum \( \beta_2 \)-microglobulin concentration, systolic/diastolic blood pressure, predialysis haematocrit value and dose of erythropoietin administered. The present report compiles the data on the number of patients on renal replacement therapy, the number of patients beginning renal replacement therapy in the survey year, life/death in the survey year, as of 1994, and summarizes the laboratory data from the 1993 and 1994 survey replies.

Subjects and methods

Facilities

Information was received by the Patient Registration Committee of the Japanese Society for Dialysis Therapy on 2641 dialysis facilities in 1993, and 2739 such facilities in 1994. Thus, the number of facilities increased by 118 (4.5%) in the course of 1 year. In 1994, private clinics were most numerous (998; 36.3%), followed by private hospitals (935; 34.0%), and public hospitals (650; 23.6%).

Survey method

On an annual basis, the Patient Registration Committee of the Japanese Society for Dialysis Therapy mails out the survey forms at the end of November to the heads of all dialysis facilities on record at the Society headquarters. When new facilities are established within the survey year after the survey questionnaires have been mailed out, survey forms are also sent to them, later. The heads of the facilities are requested to return the survey replies by the end of January of the following year. If the Committee fails to receive the
survey replies from a given institution, it sends out an enquiry. If still no reply is received, the Committee phones the head of the facility to request his or her cooperation. It is only after these efforts have failed by 30 April that the facility in question is considered to be a non-responder.

Survey forms and items covered

Four different survey forms are mailed out. The first covers the numbers of staff, haemodialysis machines, beds and patients on treatment at any time during the calendar year surveyed. The second form is a questionnaire covering patients beginning renal replacement therapy at the facility between 1 January and 31 December of the year surveyed. It includes patients’ characteristics (case mix) and laboratory data as well as relevant information on important events occurring in patients during the year surveyed (death, change in treatment modality, transplantation etc.). The third form covers all patients who have been on renal replacement therapy at the facility concerned, and collects the same type of data as the second form. The fourth form covers patients on renal replacement therapy who have been transferred from other facilities to the facility concerned at any time during the calendar year surveyed. Thus, the first form records conditions prevailing at each facility, and the second, third and fourth provide up-to-date information on each patient.

Response rate

Completed survey forms were obtained from 2629 (99.6%) of the 2641 institutions surveyed in 1993. Of the responding facilities however, 148 (5.6%) completed only the first of the four forms. For the 1994 survey, completed forms were mailed back from 2752 (99.8%) of the 2759 institutions surveyed, but again 136 facilities (4.9%) returned only the first form.

Results

Survey results on status of dialysis facilities in 1994

Number of haemodialysis machines. In 1994, the total number of haemodialysis machines was 58 561.

Number of patients beginning renal replacement therapy. Renal replacement therapy includes haemodialysis (HD), haemodiafiltration (HDF), haemofiltration (HF), haemodiabsorption, continuous ambulatory peritoneal dialysis (CAPD) and intermittent peritoneal dialysis (IPD). A total of 24 296 patients began renal replacement therapy in 1994.

Total number of patients on renal replacement therapy. As of the end of 1994, there were 24 296 patients (72.8%) on daytime extracorporeal haemopurification, including HD, HDF, HF and haemodiabsorption, 31 477 patients (21.9%) on night-time extracorporeal haemopurification, 98 patients (0.1%) on home HD, 7509 patients (5.2%) on CAPD, and 48 patients on IPD treatment. Here, since 96.3% of the patients on extracorporeal haemopurification were treated by HD, extracorporeal haemopurification virtually means HD.

Number of patient deaths (total among those on HD, HDF, HF haemodiabsorption, CAPD, and IPD) and annual gross mortality rates. Based on the replies to the survey on the present status of facilities, there was a total of 13 187 deaths among patients on renal replacement therapy in 1994. The gross mortality rate for a given year is the ratio of the number of patient deaths relative to the number of patients for the year. In 1994, the gross mortality rate was 9.5%.

1994 survey results on current status of individual patients

Patients beginning renal replacement therapy. According to the results of the 1994 survey dealing with the current status of each patient, among the 24 059 patients beginning renal replacement therapy in 1994, there were 22 305 (92.7%) on HD, 252 (1.1%) on HDF, 35 (0.1%) on HF, 30 (0.1%) on haemodiabsorption, 1374 (5.7%) on CAPD, 17 (0.1%) on IPD, and 20 (0.1%) on unspecified dialysis treatment. Some 26 (0.1%) patients received a transplant from a living donor, but no patients received a transplant from a cadaver donor.

Patients beginning extracorporeal haemopurification (i.e. HD, HDF, HF and haemodiabsorption). A total of 22 622 patients were categorized as extracorporeal haemopurification patients (including centre-based HD, HDF, HF and haemodiabsorption, and home HD). Again, since 98.6% of these patients received HD, extracorporeal haemopurification virtually means HD. Of the patients beginning extracorporeal haemopurification between 1 January and 31 December in 1994, 13 861 were males and 8743 were females (i.e. 61.3% males and 38.6% females). The mean age was 61.3 ± 13.9 (mean ± SD) for patients at the end of 1994 who had begun extracorporeal haemopurification therapy between 1 January and 31 December of that year.

The most frequent cause of chronic renal failure in patients beginning extracorporeal haemopurification therapy in 1994 was found to be chronic glomerulonephritis (39.8%), followed by diabetic nephropathy (31.2%), nephrosclerosis (6.2%), polycystic kidney (2.6%) and chronic pyelonephritis (1.4%).

Patients beginning CAPD. In the following, among patients beginning renal replacement therapy in 1994, data are compiled from those undergoing CAPD treatment (1372) at the close of 1994. Of patients beginning
status of dialysis therapy in Japan

CAPD treatment between 1 January and 31 December 1994, there were 867 males and 507 females (i.e. 63.1% males, 36.9% females). The mean age of patients who began CAPD treatment between 1 January and 31 December in 1994 was 54.1 ± 16.4 years.

The most frequent cause of chronic renal failure in patients beginning CAPD therapy in 1994 was chronic glomerulonephritis (51.8%), followed by diabetic nephropathy (21.9%), nephrosclerosis (4.9%), polycystic kidney (1.6%) and lupus nephritis (1.4%).

Patients on maintenance renal replacement therapy.

From the results of the 1994 individual patient status survey results, the types of therapy given to the 142 626 patients at the end of 1994 were as follows: HD 131 016 (91.9%) [including 93 (0.1%) patients treated at home], HDF 3485 (2.48%), HF 121 (0.1%), haemoabsorption 107 (0.1%), CAPD 7196 (5.0%), IPD 42 (0.03%), and unspecified dialysis therapy 659 (0.5%).

Patients on extracorporeal haemopurification (i.e. HD, HDF, HF and haemodiabsorption). Of patients undergoing extracorporeal haemopurification treatment as of the end of 1994, 59.1% were male and 40.8% female. The mean age was 57.6 ± 13.3 years. The mean length on extracorporeal haemopurification was 5.8 ± 5.5 years. Overall 72 359 patients (53.7%) were on the treatment for less than 5 years, 31 767 (23.3%) had been treated for more than 5 years but less than 10 years, 4997 (3.6%) more than 10 but less than 15 years, 10245 (7.6%) for more than 15 but less than 20 years, 2971 (2.2%) for more than 20 but less than 25 years, and 73 (0.1%) for more than 25 years. As of the end of 1994, the patient the longest on extracorporeal haemopurification (HD) had been treated for 28 years.

The causes of chronic renal failure in patients receiving maintenance extracorporeal haemopurification as of 31 December 1994 were chronic glomerulonephritis 77 471 (57.5%), diabetic nephropathy 26 318 (19.5%), nephrosclerosis 4822 (3.6%), polycystic kidney 4453 (3.3%) and chronic pyelonephritis 2470 (1.8%).

CAPD patients.

Among the CAPD patients on record as of the end of 1994, 60.2% were males and 39.7% were females. The mean age was 51.3 ± 15.0 years as of the end of 1994. The patients treated by CAPD at the end of 1994 had been treated for an average 3.9 ± 4.2 years by renal replacement therapy. Here, "years on renal replacement therapy" means the years a patient had been on any form of renal replacement therapy, not the actual number of years on CAPD itself. Years on renal replacement therapy in these patients were as follows: 4954 (68.8%) patients were on any form of renal replacement therapy for less than 5 years, 1561 (21.7%) patients more than 5 years but less than 10 years, 435 (6.0%) more than 10 but less than 15 years, 181 (2.5%) more than 15 but less than 20 years, 63 (0.9%) more than 20 but less than 25 years, and 2 (0.0%) more than 25 years.

The causes of renal failure in the CAPD patients of record at the end of 1994 were chronic glomerulonephritis 4468 (62.1%), diabetic nephropathy 1010 (14.0%), nephrosclerosis 254 (3.5%), polycystic kidney 131 (1.8%) and chronic pyelonephritis 100 (1.4%).

Patient deaths in 1994

Causes of death in extracorporeal haemopurification patients. The causes of death during 1994 were as follows: heart failure 3279 (28.5%), cerebrovascular diseases 1628 (14.2%), infectious diseases 1354 (11.8%), malignant tumor 867 (7.5%) and myocardial infarction 791 (6.9%).

Causes of death in CAPD patients. The causes of death during 1994 were as follows: heart failure 171 (24.5%), infectious diseases 123 (17.6%), cerebrovascular diseases 95 (13.6%), myocardial infarction 77 (11.0%) and cachexia/uraemia 55 (7.9%).

Compared with the extracorporeal haemopurification patients, the CAPD patients more often succumbed to infectious diseases or cachexia.

Cumulative survival rate of patients beginning renal replacement therapy in/after 1983

Patients on extracorporeal haemopurification. Figure 1 gives the cumulative survival rates for 199 424 patients beginning extracorporeal haemopurification in 1983 (the year the surveys of current individual patient status began) and following. The Cutler–Ederer method was used for the calculation [1]. Following the initiation of extracorporeal haemopurification treatment, the patients who were changed to a modality of treatment other than extracorporeal haemopurification, including kidney transplantation, or those who were lost to follow-up, were censored. The 1-year survival rate was 0.890, the 5-year survival rate 0.612, and the 10-year survival rate was 0.424 in these patients. As shown in Fig. 1, the survival rate for females was slightly better than for males. The older
the patients were, the less favourable was their prognosis.

Table 1 presents the survival rates of patients for each of the underlying diseases (i.e. causes of renal failure). The more favourable diseases in terms of 10-year survival were, in descending order, gestational toxicosis, renal hypoplasia, tuberculosis and chronic glomerulonephritis. The reason for the more favourable prognosis with gestational toxicosis and renal hypoplasia may be the young age at which the patients began their extracorporeal haemopurification (45.2 ± 11.7 years in patients with gestational toxicosis, 31.6 ± 21.7 years in patients with renal hypoplasia). Conversely, the underlying diseases with the poorest prognosis were as follows, in order of decreasing favourable outlook: myeloma of the kidney, amyloid nephropathy, malignant tumour of the kidney or urinary tract, metabolic disorder and diabetic nephropathy.

**CAPD patients.** Figure 2 gives the cumulative survival rates for 9680 patients who began CAPD in 1983 and following. The Cutler-Ederer method was also used in this calculation. Following the initiation of CAPD, patients who were changed to a modality of treatment other than CAPD, including kidney transplantation or those who were lost to follow-up, were censored. The overall 1-year survival rate was 0.940, and was 0.659 and 0.455 at 5 and 10 years, respectively. The respective rates for CAPD patients were slightly better than those for extracorporeal haemopurification patients.

**Laboratory data on maintenance haemodialysis patients in 1993**

Here we report the laboratory data results for patients undergoing thrice weekly HD at the end of 1993, based upon replies to the individual patient current status survey at the close of that year.

**Kt/V.** The Kt/V values were calculated from the serum urea nitrogen (SUN) concentration at the beginning and end of the first treatment of the week using the method of Shinzato et al. [2]. The mean Kt/V was 1.31 ± 0.30 among all 76188 HD patients for whom the complete data needed for calculation were obtained. The mean Kt/V level was higher in females (1.43 ± 0.33) than males (1.23 ± 0.24). This may be attributed to the lower body weight of females compared to males (post-dialysis body weight: males 55.2 ± 8.5 kg; females 45.6 ± 7.8 kg). Gotch et al. reported a method to calculate Kt/V ignoring the change in body weight during HD, and indicated that the risk of death or hospitalization increases once the Kt/V obtained by their method decreases below 1.0 [3]. When Kt/V was calculated according to Shinzato, taking into account the body weight decrease and urea generation during the treatment, the values were approximately 20% higher (data not shown). Therefore, a Kt/V value of 1.0 according to Gotch corresponds a Kt/V value of 1.2 according to Shinzato. As shown in Fig. 3, in the present calculations, patients whose Kt/V was less than 1.2 accounted for 34.8% of those for whom this value was computed.

**Protein catabolic rate (PCR).** The PCR was determined based on the SUN from the beginning and end of the first HD of the week using the method proposed by Shinzato et al. [2], together with Kt/V. Since the present questionnaire survey did not cover the residual renal function which significantly affects PCR calculation, the PCR value could not be calculated for all patients. Thus, among those on thrice weekly HD at the end of 1993, only the 59622 patients who were on HD for 2 years or more were used in the PCR calculation, assuming that their residual renal function was virtually zero.

Figure 4 gives the results. The mean PCR value was 1.04 ± 0.30 g/kg/day, slightly higher in females than in males (males 1.03 ± 0.34 g/kg/day; females 1.05 ± 0.25 g/kg/day). PCR values below 1.0 g/kg/day are assumed to involve a higher risk of death [4].

![Fig. 2. Survival rate of CAPD patients beginning the therapy after 1983 by sex.](image)

![Fig. 3. Distribution of hemodialysis patients by Kt/V.](image)
shown in Fig. 4, the patients whose PCR was less than 1.0 g/kg/day accounted for 43.5% of the overall population. Thus, one may assume that around 40% of Japanese HD patients suffer from protein deficiency. **Haemodialysis time.** Figure 5 gives the results compiled for the HD time. The mean duration of HD sessions was 4.12 ± 0.50 h overall, and was higher in males (4.15 ± 0.47 h) than females (4.08 ± 0.51 h). A total of 8728 (9.9%) patients were dialysed for less than 4 h per session among the 88,072 subjects surveyed; 67,698 patients (76.9%) were dialysed for more than 4 h but less than 5 h, while 11,646 patients (13.2%) were dialysed for more than 5 h.

**Laboratory data of maintenance haemodialysis patients surveyed in 1994**

Based on the results of the survey of individual patient current status at the end of 1994, we present the laboratory data compiled for patients undergoing thrice weekly maintenance HD.

**Predialysis serum creatinine concentration.** Figure 6 gives the results compiled for the predialysis serum creatinine concentration. The mean level of predialysis serum creatinine concentration was 11.51 ± 2.85 mg/dl overall, and was higher in males (12.4 ± 2.93 mg/dl) than females (10.34 ± 2.30 mg/dl).

**Predialysis serum albumin concentration.** Mean predialysis serum albumin concentration was 3.91 ± 0.55 g/dl overall, with no major difference between males (3.93 ± 0.60 g/dl) and females (3.87 ± 0.55 g/dl). HD patients whose serum albumin concentration was less than 3.0 g/dl accounted for no more than 3.4% of the total population whose serum albumin concentration was examined.

**Predialysis serum phosphate concentration.** The mean predialysis serum phosphate concentration was 5.76 ± 1.67 mg/dl for HD patients overall (males 5.80 ± 1.68 mg/dl; females 5.70 ± 1.65 mg/dl). Patients with predialysis serum phosphate levels in excess of 7.0 mg/dl represented 21.5% of the total population.

**Predialysis serum β2-microglobulin concentration.** The mean concentration of predialysis β2-microglobulin was 33.7 ± 10.9 mg/l for HD patients overall. In patients on HD for more than 2 years, no relation was noted between years on HD and serum β2-microglobulin concentration (Table 2).

**Mean blood pressure.** The mean predialysis blood pressure was calculated from the systolic and diastolic pressures using the following formula:

\[
\text{mean blood pressure} = \frac{2 \times \text{diastolic blood pressure} + \text{systolic blood pressure}}{3}
\]

The mean blood pressure for HD patients overall was 105.1 ± 15.5 mmHg. The mean blood pressure for
females (103.4 ± 15.8 mmHg) was approximately 3 mmHg lower than for males (106.3 ± 15.1 mmHg). Predialysis haematocrit value. The mean predialysis haematocrit value was approximately 1% higher in males (29.1 ± 4.4%; females 28.2 ± 4.1%; total 28.7 ± 4.4%). Patients whose haematocrit value was less than 29% accounted for 1.2% of the overall population. This may reflect the recent general use of recombinant human erythropoietin (rHuEPO).

**Correlation between rHuEPO dose, predialysis haematocrit value and mean blood pressure.** The weekly rHuEPO dose was surveyed in the questionnaire dealing with individual patient current status at the end of 1994. Patients were assessed according to their rHuEPO dose and haematocrit values. In Table 3, the mean predialysis blood pressure values are indicated for patients with the respective rHuEPO dose and corresponding haematocrit value. For example, the cross of the line with '1200-2999 units' of rHuEPO dose and the column with '30% haematocrit value gives '104.9 ± 15.4 mmHg' mean blood pressure. This means that the mean blood pressure in HD patients whose rHuEPO dose is more than 1500 units and less than 2999 units and whose haematocrit value is over 30% and less than 35%, is 104.9 ± 15.4 mmHg.

Looking across the table, we find a correlation between the haematocrit values of patients receiving the same dose of rHuEPO and the mean blood pressure. In patients receiving the same dose of rHuEPO, no clear relation was found between mean blood pressure and haematocrit. Next, looking down the table, we note a correlation between the rHuEPO dose in patients with the same haematocrit level and the mean blood pressure. Where the haematocrit value is the same, the mean blood pressure tends to be somewhat higher in the patient given a high dose of rHuEPO.

**Discussion**

**Rough totals**

The Patient Registration Committee of the Japanese Society for Dialysis Therapy is in contact with virtually all of the facilities in Japan providing renal replacement therapy. Thus, the institutions covered by the present questionnaire survey represent nearly all of those providing such services. The response rate was over 99% for both the 1993 and 1994 surveys. Therefore, virtually every patient receiving renal replacement treatment in Japan is considered to have been surveyed in this manner.

On the basis of this study, the population of patients receiving renal replacement therapy in 1994 was 143,709 persons, or 1149 persons per million general population. The figures in 1984 indicated a population of patients receiving renal replacement therapy in Japan of 59,811, or 498 persons per million general population. This would indicate that the population of renal replacement therapy patients grew more than 2-fold in that decade. Also, the mean age of such patients was 57.3 years in 1994, against 49.2 years 10 years earlier, reflecting the rapid ageing of the patient population in Japan. In the 1994 survey, diabetic patients accounted for 18.2% of the population of patients receiving renal replacement therapy, against only 8.5% in 1984. Thus in Japan, the proportion of diabetic patients among the population of patients receiving renal replacement treatment nearly doubled within a decade, but it was still lower than the proportion in the US (27.2% at the end of 1992) [5]. Nevertheless, if one can extrapolate the past trend, the ratio of diabetic patients among the Japanese population of patients receiving renal replacement therapy will some day approach the US level.

**Survival rate**

The gross mortality rate of Japanese patients receiving renal replacement therapy was 9.5% in 1994, compared with 23.8% in the US in 1993 according to the United States Renal Data System (USRDS), which is more than double the Japanese figure [6]. Since there is no report on the gross mortality rate of European patients, the mortality rate cannot be compared between Japanese and European patients. However, the prognosis may be better for Japanese patients than for European patients. Held et al. attempted to compare the HD patient prognosis in the US, Japan and Europe by matching for age and diabetic status. They found the prognosis was better for Japanese HD patients than their US and European counterparts [7].

On the basis of the present survey, the survival rate of CAPD patients in Japan was slightly better than for extracorporeal haemopurification patients. However, many researchers have reported that the survival rate of CAPD patients is less favourable than for HD patients [8], or that there is no difference between them [9]. The present survey results revealed that CAPD patients began treatment at an earlier age than HD patients (CAPD 51.6 years, HD 58.0 years), and that the proportion of diabetics was lower in the CAPD patient group than in the HD patient group (CAPD 19.5%, HD 25.6%). Hence, the more favourable survival rate among the CAPD patients in Japan might be due to the younger age and lower proportion of diabetic patients. Lowrie et al. found that when survival was adjusted for age, diabetes etc., the survival rate among CAPD patients was lower than for HD patients [10].

**Kt/V and haemodialysis time**

According to the USDRS report of 1995 [11], the mean Kt/V, calculated by the Daugirdas method, was 1.10 for 2455 randomly selected US patients on HD as of 1 January 1991. In our survey, the mean Kt/V was 1.31 among Japanese patients on HD. The Kt/V obtained by the method in the present survey and by the Daugirdas method [12] was virtually the same. Therefore, the Kt/V in Japanese HD patients may be
higher than in comparable US patients. Since there is no report on the $Kt/V$ among European HD patients, comparison of $Kt/V$ values is impossible between European and Japanese patients.

The present questionnaire survey results revealed that an HD session in Japan lasts an average of 4.12 h, and that only 9.9% of the overall number of patients underwent HD of less than 4 h per session. This is in marked contrast to the average of 3.2 h per HD session among the 2323 US patients randomly selected in the USRDS study [11]; 75% of the US patients had less than 3.75 h per session. From these findings, one might consider that the better survival in Japanese HD patients compared to US patients is due to the higher $Kt/V$ and/or the longer HD time per session in Japan.

The 1994 European Dialysis and Transplant Association Registry indicated that 54% of their patients on HD had 12 h of treatment per week (i.e. 4 h per session) in Europe in 1991, and about 30% of the patients had less [13].

**PCR and serum albumin concentrations**

The mean PCR level in the Japanese HD patients was 1.04 g/kg/day according to the present questionnaire survey, whereas it was 0.92 g/kg/day for 617 US HD patients according to the Delmez report [14]. Therefore, if the subjects of the Delmez report are representative of US HD patients, the PCR level among Japanese patients is higher than among their US counterparts.

The mean serum albumin level was 3.8 g/dl among 13000 US HD patients in 1990 according to Owen et al. [15], whereas it was 3.9 g/dl calculated for Japanese patients based on data from the present survey. Thus, there appears to be no difference between Japanese and US patients in this regard. PCR and predialysis serum albumin concentrations have not been reported for European HD patients, so we cannot compare European patients with Japanese patients in this respect.

**Predialysis serum creatinine concentration**

A lower predialysis serum creatinine concentration is known to be associated with higher death risk among HD patients [16]. The reason for this may be that the predialysis serum creatinine concentration reflects the muscle mass [17], which would be associated with the nitrogen balance level. Lowrie et al. reported that the mean predialysis serum creatinine concentration was 13.6 mg/dl in US HD patients [16], which was higher than the 11.5 mg/dl found in the present survey. This higher predialysis serum creatinine concentration of US patients might be, at least in part, the result of lower creatinine clearance by the artificial kidney and not exclusively due to greater muscle mass. In the present Japanese survey, the mean predialysis level of creatinine was higher in males than females. This may be due to greater muscle mass in male patients than in female patients.

**Phosphate**

The predialysis phosphate level was a mean of 5.8 mg/dl in the survey, compared with 6.2 mg/dl reported by Lowrie et al. in 12999 US patients.

**β2-Microglobulin**

From the present survey data, the β2-microglobulin concentration was virtually constant among patients on HD for more than 2 years. The lower level of β2-microglobulin among patients on HD for less than 2 years may be due to residual renal function.

**Haematocrit**

In the results compiled from the present survey, the mean haematocrit value was 28.7% among Japanese HD patients. This may be attributed to the fact that rHuEPO was administered with a target haematocrit value of 30% in Japan.

**Blood pressure**

Due to the lack of data from various nations, comparison of the present data on blood pressure with results in other countries is impossible.

**Dose of rHuEPO, haematocrit value and blood pressure**

Mean blood pressure was compared among patients with different rHuEPO dose and different haematocrit values. At a given level of haematocrit, the mean blood pressure tended to be higher the greater the rHuEPO dose administered. On the other hand, when the rHuEPO dose was the same, no significant correlation was found between the haematocrit level and the blood pressure. Increased blood viscosity at higher haematocrit and other confounding factors have been implicated in the genesis of high blood pressure associated with rHuEPO administration [18,19]. The present
results show that the elevation in the blood pressure in patients on rHuEPO is not the result of increased blood viscosity accompanying the elevation in haematocrit.

Conclusions

This report summarizes the latest results of the Japanese Society for Dialysis Therapy survey on Japanese patients on renal replacement therapy. The results suggest that, in Japanese HD patients, relatively few patients have extremely low indices of the \( Kt/V \), PCR, serum albumin levels etc., i.e. factors related to adverse prognosis.

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