

Major changes and improvements of dialysis therapy in Korea: review of end-stage renal disease registry

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The Korean Society of Nephrology (KSN) launched a nationwide end-stage renal disease (ESRD) patient registry in 1985 called the Insan Prof. Byung-Suk Min Memorial ESRD Patient Registry. KSN members voluntarily participate in this registry, which has been collecting data through the Internet since 2000. The KSN ESRD patient registry data were reviewed to elucidate the major changes and improvements in dialysis therapy in Korea. The data review revealed: a rapid increase in the number of patients with ESRD; an increase in the number of patients with diabetic nephropathy; a decrease in the proportion of patients undergoing peritoneal dialysis; an increase in the role of private dialysis clinics; an increase in the number of elderly patients undergoing dialysis and the number of patients undergoing long-term dialysis; a decrease in mean blood pressure and an increase in pulse pressure; improvement in anemia treatment; improvement in dialysis adequacy; and improvement in the survival of patients undergoing dialysis. In conclusion, improvements have been made in blood pressure control, anemia treatment, and dialysis adequacy despite increases in the number of elderly patients, diabetic patients, and patients on long-term dialysis during the last two decades in Korea.

Keywords: Kidney failure, chronic; Renal dialysis; Peritoneal dialysis; Dialysis registry

INTRODUCTION

Maintenance dialysis therapy was established as a standard therapy for end-stage renal disease (ESRD) in Korea in the late 1970s. The Korean Society of Nephrology (KSN) was subsequently founded in 1980. The KSN launched a nationwide ESRD patient registry in 1985, in which all KSN members voluntarily participate. The registry is called the Insan Prof. Byung-Suk Min Memorial ESRD Patient Registry [1,2].

The objectives of the patient registry and statistical evaluation of patients undergoing dialysis can be sum-

marized as follows: first, to estimate the numbers and regional distributions of patients undergoing target therapy by specialized dialysis physicians; second, to evaluate the characteristics of these patients and their dialysis therapy as well as the complications or results of the therapy based on scientific evidence; and third, to improve the quality of dialysis therapy and provide information for socioeconomic health administration and future health program planning. The present long-term review of the registry data was performed to identify changes in dialysis therapy and may prove to be very helpful for further improvements in dialysis therapy.

DATA COLLECTION METHOD

The ESRD registry committee of the KSN collected all registry data by post mail until 1994, but subsequently began collecting the data through an online Internet program that opened in 2001 and was revised in 2013 (Table 1). The current KSN dialysis registry program has a data security system for personal data protection. The items newly included in 2013 are vascular access, dialysate components, calcium and phosphorous control medications, and rehabilitation status. The program also has a graphic evaluation function to measure dialysis adequacy (single-pool Kt/V, normalized protein catabolic rate) and a peritoneal equilibrium test. The KSN ESRD registry Internet program runs throughout the year. Every KSN member can access the dialysis adequacy data of their own dialysis center at any time; this is helpful for dialysis prescriptions. The average KSN ESRD registry response rate during the past 3 years was about 70%.

MAJOR CHANGE 1: INCREASE IN NUMBER OF PATIENTS WITH ESRD

At the end of 2013 in Korea, the number of patients undergoing maintenance hemodialysis (HD) was reportedly 52,378, and the number of patients undergoing peritoneal dialysis (PD) was 7,540. In contrast, these numbers in the year 2000 were 15,853 and 4,671, respectively (Fig. 1A). The growth rate of the number of patients undergoing dialysis from 2000 to 2013 in Korea was about 9% per year. This high growth rate still seems far from the inflection point and is expected to be maintained for several years because the prevalence

rate of dialysis in Korea is lower than that in Japan and the USA [3,4]. The point prevalences of patients undergoing HD and PD per million general population (PMP) at the end of 2013 were 1,010 and 145, respectively (overall prevalence of dialysis, 1,155). This prevalence rate was less than half of the Japanese prevalence rate (2,300 PMP in 2011) and about 60% of that in the USA (1,924 PMP in 2011). The majority of these patients with ESRD were patients with diabetic nephropathy and elderly patients.

MAJOR CHANGE 2: INCREASE IN NUMBER OF PATIENTS WITH DIABETIC NEPHROPATHY

Diabetic nephropathy is the most common cause of ESRD worldwide. The incidence of this disease rapidly increased in the early 1990s and has been the causative factor of more than half of ESRD cases since 2010 in Korea. However, the incidence of chronic glomerulonephritis has decreased to <10% and that of hypertensive nephrosclerosis has increased slowly to 20% (Fig. 1B). The proportion of patients with diabetic nephropathy in Korea is slightly higher than that in Japan and the USA [3,4]. The proportion of patients with autosomal dominant polycystic kidney disease, lupus nephritis, and renal tuberculosis among patients with ESRD is relatively low (1.5%, 0.6%, and 0.1%, respectively).

MAJOR CHANGE 3: DECREASE IN PROPORTION OF PATIENTS UNDERGOING PERITONEAL DIALYSIS

At the end of 2013 in Korea, the proportion of patients

Table 1. Brief history of Korean end-stage renal disease patient registry

Period	Data collection method	Information
1985–1994	Post mail with paper questionnaire	Dialysis center & basic personal data
1995–2000	Electronic questionnaire Dial-up modem file transfer or diskette mailing	Dialysis center & basic personal data
2001–2012	Internet online questionnaire, password	Dialysis center & basic personal data, dialysis adequacy
2013–current	Internet online questionnaire with data security program	Dialysis center & basic personal data, dialysis adequacy, lab data, rehabilitation

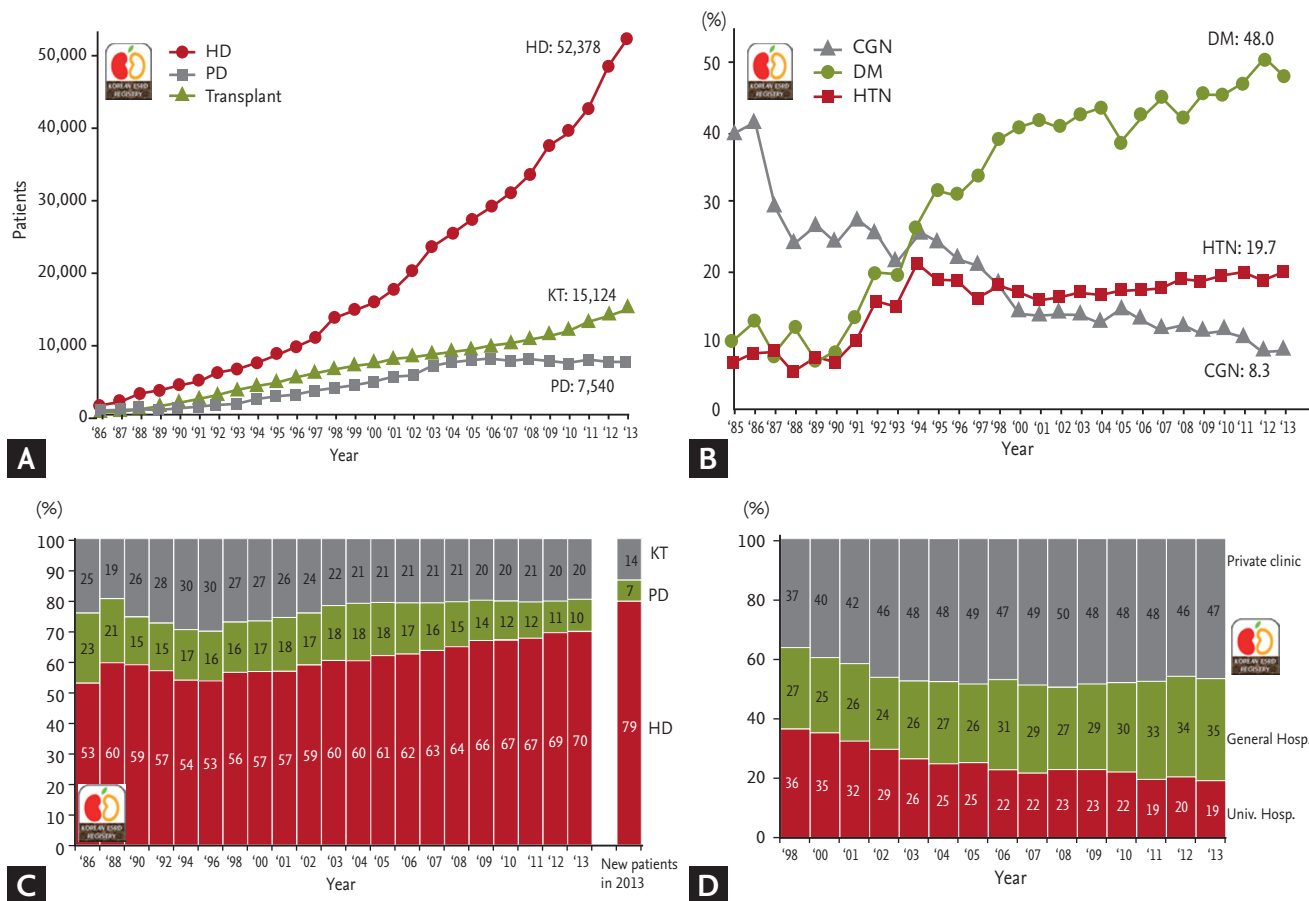


Figure 1. Prevalence and incidence of renal replacement therapy in Korea. (A) Number of patients undergoing renal replacement therapy at the end of each year. (B) Changes in the proportion of three major causes of end-stage renal disease. (C) Proportion of renal replacement modalities and incidence in 2013. (D) Percent distribution of patients undergoing hemodialysis (HD) according to dialysis center classification. PD, peritoneal dialysis; KT, kidney transplantation; DM, diabetic nephropathy; HTN, hypertensive nephrosclerosis; CGN, chronic glomerulonephritis.

undergoing HD and PD among those on renal replacement therapy was about 70% and 10%, respectively (Fig. 1C). From the 1990s to 2013, the percentage of patients undergoing HD gradually increased from 60% to 70%, but the percentage of patients undergoing PD decreased from 15% to 10%. Moreover, only 7% of patients newly diagnosed with ESRD elected to undergo PD in 2013. A decrease in the proportion of patients undergoing PD was also observed in the USA. The reason for this decrease is probably associated with an increase in the number of patients with diabetic nephropathy and the increase in erythropoietin (EPO) use. However, the rate of automated PD markedly increased from 4% in 2003 to 25% in 2013.

MAJOR CHANGE 4: INCREASE IN THE ROLE OF PRIVATE DIALYSIS CLINICS

As the medical technology of dialysis therapy has improved and stabilized, the major health care providers for patients undergoing maintenance HD therapy has changed from university hospitals to private clinics. In 2013, about 19% of patients undergoing maintenance HD were under the care of university hospitals, and about 47% were under the care of private clinics (Fig. 1D). The proportion of general hospitals (35%) has recently been increasing due to the increase in the number of rehabilitation hospitals.

MAJOR CHANGE 5: INCREASE IN AGED PATIENTS UNDERGOING DIALYSIS AND OVERALL PATIENTS UNDERGOING LONG-TERM DIALYSIS

Korea is one of the most rapidly aging countries worldwide. The proportion of aged persons (> 65 years old) among those undergoing dialysis is also rapidly increasing in Korea. In 2013, the aged population in Korea comprised 12.2% of the general population, but the proportion of aged patients among those undergoing dialysis was 39.5%. Additionally, the mean age of patients undergoing dialysis has increased. The average age of diabetic patients undergoing dialysis increased from 59.5 years in 2005 to 62.3 years in 2013 (Fig. 2A).

Additionally, the proportion of patients undergoing long-term dialysis is gradually increasing. At the end of 2013, about 46% of patients undergoing HD and 35% of patients undergoing PD had been treated for more than 5 years; these proportions in 2003 were only 36% and 17%, respectively.

MAJOR CHANGE 6: DECREASE IN MEAN BLOOD PRESSURE AND INCREASE IN PULSE PRESSURE

Blood pressure control is one of the main concerns in the management of patients undergoing dialysis because cardiovascular disease is the most common cause of death in these patients. The mean arterial pressure of patients undergoing HD was 104.9 mmHg in 2005 and gradually decreased to 99.7 mmHg in 2012 (mean arterial pressure = $[(2 \times \text{diastolic pressure}) + \text{systolic pressure}] / 3$) (Fig. 2B). The mean arterial pressure of patients undergoing PD also decreased from 100.4 to 98 mmHg during this period, but the pulse pressure (the difference between the systolic and diastolic pressure) did not change.

MAJOR CHANGE 7: IMPROVEMENT IN ANEMIA TREATMENT

EPO has played a big role in increasing the quality of life of patients undergoing dialysis for the past two decades. The mean hemoglobin level of patients undergo-

ing HD was only 9.1 g/dL in 2000, but increased to 10.4 g/dL in 2013. The mean hemoglobin level of patients undergoing PD also increased during this period, from 9.3 to 10.3 g/dL. These increases were achieved entirely in accordance with the initiation of the EPO cost reimbursement program and the change in the therapeutic target level by the national medical insurance system (Fig. 2C).

MAJOR CHANGE 8: IMPROVEMENT IN DIALYSIS ADEQUACY

The KSN online dialysis registry program has dialysis adequacy calculation functions. Every KSN member can evaluate a patient's dialysis adequacy by entering the patients' chemistry values, and the results are presented with graphs.

Considering the increase in the numbers of elderly patients, diabetic patients, and overall patients on long-term dialysis, a sufficient dialysis adequacy level is difficult to achieve. However, the dialysis adequacy indices have improved during the last 12 years in Korea. The single-pool Kt/V of male patients undergoing HD slightly increased from 1.526 in 2001 to 1.657 in 2013 (Fig. 2D). A difference in the Kt/V between male and female patients undergoing HD was continuously observed during that period.

MAJOR CHANGE 9: IMPROVEMENT IN SURVIVAL OF PATIENTS UNDERGOING DIALYSIS

The patient survival assessment in this mass voluntary registry may be overestimated because the death reports are easily missed. The KSN registry reported that the 5-year survival rate of registered patients undergoing HD was 71.7% among male patients and 74.2% among female patients; these rates are higher than the Japanese patient survival rates. Five years ago, the 5-year survival rate of patients undergoing HD was reportedly 64.2% among male patients and 66.3% among female patients.

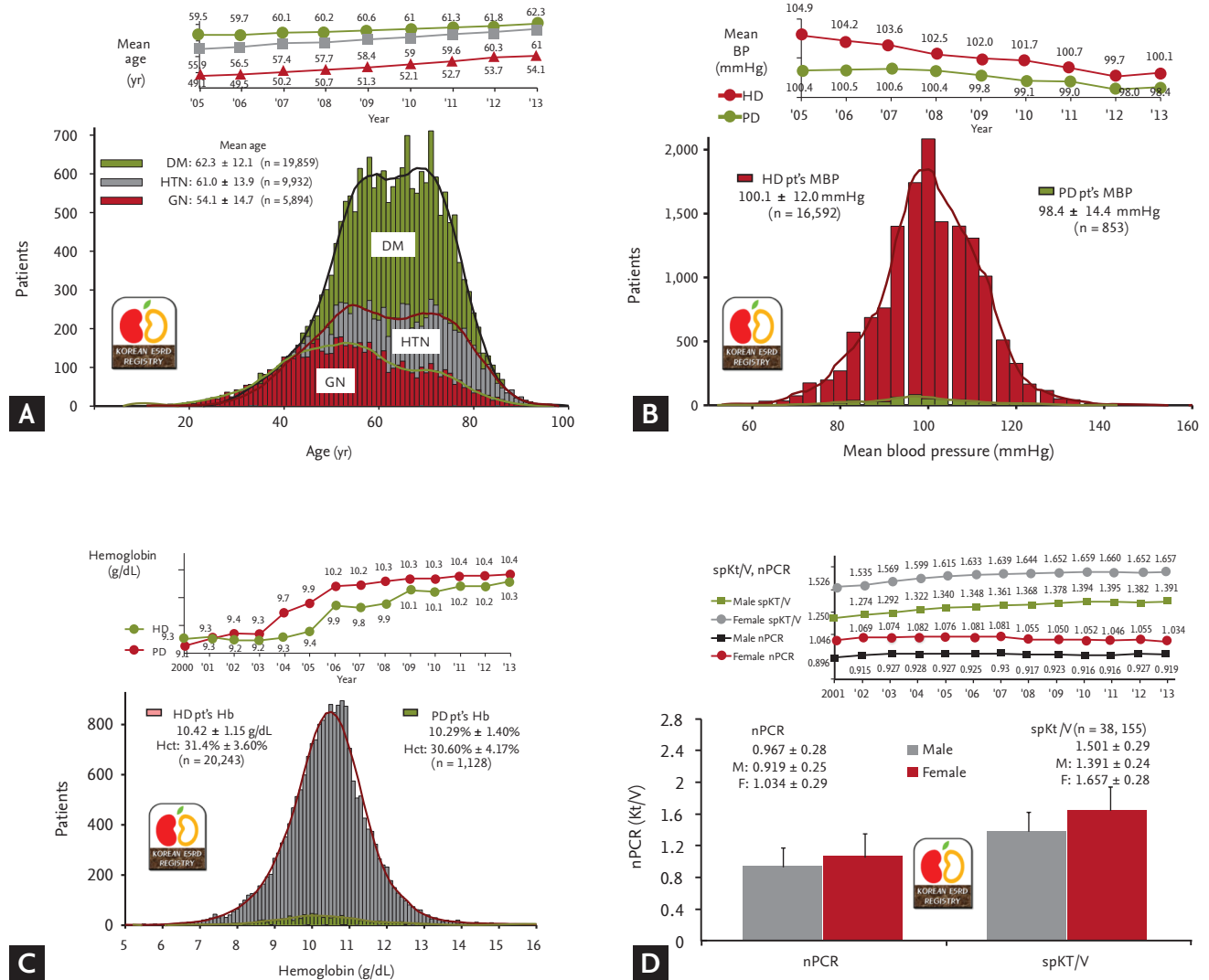


Figure 2. Major changes and improvements in dialysis therapy in Korea. (A) Age distribution of patients undergoing dialysis according to underlying diseases. (B) Distribution of mean blood pressure (MBP) in patients undergoing hemodialysis (HD) and peritoneal dialysis (PD). (C) Changes in hemoglobin among patients undergoing dialysis (HD vs. PD). (D) Dialysis adequacy parameters (normalized protein catabolic rate [nPCR] and single pool Kt/V [spKt/V]) in patients undergoing HD. DM, diabetes mellitus; HTN, hypertensive nephrosclerosis; GN, glomerulonephritis.

MISCELLANEOUS CHANGES

Other observed miscellaneous changes were as follows. (1) Hemodiafiltration therapy was introduced and slowly increased. Re-use of dialyzers was discontinued. (2) The number of HD machines per dialysis center increased from about 17 in 2000 to 28 in 2013. (3) Some regional patient distributions changed in Korea. A slight increase in the proportion of patients in the capital area and in the Youngnam area was reported. (4) The body

mass index of patients undergoing HD increased from 23.15 in 2005 to 23.98 in 2013. (5) The number of patients undergoing HD therapy three times weekly increased from 82% in 2000 to 91% in 2013.

CONCLUSIONS

The KSN ESRD patient registry data were reviewed for changes and improvement in dialysis therapy during

the last two decades in Korea. Major changes included rapid growth in the overall number of patients undergoing dialysis, the proportion of patients with diabetic nephropathy, and the overall number of patients undergoing long-term dialysis. The proportion of patients undergoing PD decreased, and the role of private dialysis clinics increased. In conclusion, blood pressure control, anemia treatment, and dialysis adequacy have improved despite the increase in elderly patients, diabetic patients, and patients overall undergoing long-term dialysis during the last two decades in Korea.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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