Long-term Survival of Patients With End-stage Renal Disease on Maintenance Hemodialysis
A Multicenter Study in Iran

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Introduction. Although maintenance dialysis in patients with end-stage renal disease prevents death from uremia, patient survival remains an important issue. This study is the first in Iran to evaluate long-term survival of patients with ESRD.

Materials and Methods. This retrospective study was conducted on 1861 patients with ESRD referred to 12 hemodialysis centers in Khuzestan province, Iran. The period of study was 21 years, which was between 1989 to may 2010. The median follow-up duration was 46.0 months. Patients who died within 90 days of commencing dialysis were excluded. The patient's death as outcome measure was recorded and the survival was estimated by the Kaplan-Meier method.

Results. The mean age of 1861 patients at initiation of hemodialysis was 51.2 ± 17.2 years, and 1120 were men (60.2%). Diabetes mellitus (32.9%) and hypertension (24.1%) were the most common known causes of ESRD in our patients. Regardless of the cause of ESRD, 1-, 5-, 10-, and 15-year survival of hemodialysis patients was 83%, 25.2%, 3.8%, and 1.0% respectively. Survival of diabetic patients was significantly lower than nondiabetic patients ($P < .001$) and no one of diabetic patients survived up to 10 years.

Conclusions. Based on our findings, the survival of ESRD patients undergoing hemodialysis in Iran is relatively poor, especially among diabetics. This can be explained by socioeconomic differences and the fact that dialysis patients who are otherwise healthy and are more likely to survival for a longer time have higher chances of receiving a kidney transplant in Iran.

INTRODUCTION

End-stage renal disease (ESRD) is one of the most common life-threatening diseases. The number of patients with ESRD accepted for renal replacement therapy including hemodialysis, peritoneal dialysis, and kidney transplantation increases each year in developed and developing countries and imposes a major social and economic burden on these countries.[1,2] The prevalence and incidence of ESRD have been increasing in Iran from 137 per million people (pmp) and 13.82 pmp in 1997 to 238 pmp and 49.9 pmp in 2000 and to 357 pmp and 63.8 pmp in 2006, respectively.[3] The most common renal replacement therapy in Iran is hemodialysis, and then kidney transplantation, and peritoneal dialysis, respectively.[4] The prevalence and incidence rates of patients with ESRD undergoing hemodialysis is increasing from 98 pmp and 38.2 pmp to 169 pmp and 66 pmp in 2004, respectively.[4,5]

Although survival of patients with ESRD has

improved since the introduction of dialysis, it is still far below that of the general population. Some factors affecting short- and long-term survival of patients with ESRD include etiology of kidney failure, type of renal replacement therapy, dialysis adequacy, and comorbid diseases.[6-11] Many studies about the survival of patients with ESRD have performed in developed countries, but there are a few studies in developing countries. The aim of present study was to evaluate long-term (15-year) survival of ESRD patients undergoing maintenance hemodialysis in Khuzestan province of Iran.

MATERIALS AND METHODS

This epidemiologic retrospective study was conducted on 1861 ESRD patients referred to 12 hemodialysis centers in southwest of Iran. The studied period was 21 years, from 1989 to May 2010. The study was carried out upon the approval of Ahvaz Jundishapur University of Medical Sciences Ethical Committee. End-stage renal disease was defined as permanent and irreversible loss of kidney function requiring renal replacement therapy. Decision on the initiation of dialysis was made by nephrologists. Hemodialysis was performed for 9 to 12 hours, 3 times a week, using semi-synthetic (cellulose diacetate) or synthetic (polysulphone) dialysis membranes. Acetate-based dialysis solution had been using till January 2006, which was substituted by bicarbonate-based dialysis solution (35 mEq/L), thereafter.

We included only hemodialysis patients who had been on dialysis more than 90 days before entering the study. Patients who died within 90 days of commencing dialysis were excluded. Other exclusion criteria were incomplete data, hemodialysis because of acute kidney failure, and kidney transplantation or peritoneal dialysis as renal replacement therapy at any time during the studied period. Hemodialysis patients who were transferred to peritoneal dialysis or underwent

kidney transplantation were included in the survival analysis till the time that they were under hemodialysis and were censored thereafter.

The patients were divided in 2 groups according to the presence of diabetic nephropathy as the cause of ESRD and 3 groups based on age (< 40 years, 40 to 70 years, and > 70 years). The patient's death as outcome measure was recorded. Data are presented as the mean ± standard deviation for continuous variables and as frequencies (percent) for categorical variables. The SPSS software (Statistical Package for the Social Sciences, version 15.0, SPSS Inc, Chicago, Ill, USA) was used for data analysis. One-, 5-, 10- and 15-year cumulative survival functions of the patients were estimated by the Kaplan-Meier method. The differences between diabetic and non-diabetic patients and age groups were tested using the log-rank test. The significant differences between groups were determined at the level of less than .05.

RESULTS

During a 21-year follow-up period, 1861 patients with ESRD were receiving hemodialysis in 12 hemodialysis centers of Khuzestan province. Of these patients, 1120 (60.2%) were male. At the beginning of hemodialysis, mean age of the patients was 51.2 ± 17.2 years (range, 8 to 96 years). Forty-one patients (2.2%) were affected by hepatitis C virus and 16 (0.9%) by hepatitis B virus. Among known causes of ESRD in our patients, the leading cause was diabetes mellitus (32.9%). Other causes were hypertension (24.1%), glomerulonephritis (7.3%), polycystic kidney disease (3.1%), and urinary calculus (0.8%), respectively.

The mean and median follow-up duration were 32.7 and 23.0 months, respectively. One-, 5-, 10-, and 15-year survival rates were 83.0%, 25.5%, 3.8%, and 1.0%, respectively. Survival rates of diabetic and nondiabetic patients are shown in Table 1. A significantly lower survival was documented for

Table 1. Survival of Hemodialysis Patients by Diabetes Mellitus as Cause of Kidney Failure
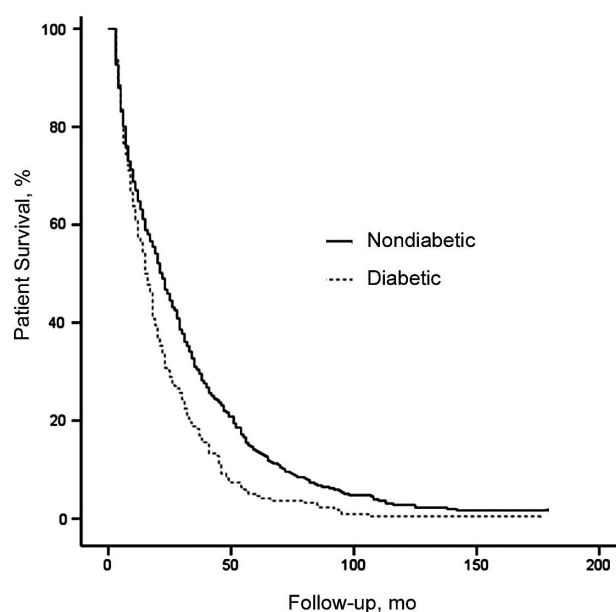
| | All | | Diabetic | | | | |
| | | | Yes | | No | | |
Time	n	Survival, %	n	Survival, %	n	Survival, %	*P*
1-year	1243	83.0	427	79.2	813	85.0	.01
5-year	711	25.2	243	11.5	468	32.3	< .001
10-year	605	3.8	226	0.4	379	5.8	< .001
15-year	537	1.0	218	0	355	1.7	< .001

diabetic patients compared to nondiabetic patients (Figure). The mean patient survival at the end of the study was 28.1 months (95% confidence interval, 25.7 to 30.6 months) in the entire cohort, 31.9 months (95% confidence interval, 28.4 to 35.4 months) in nondiabetic patients, and 22.0 months (95% confidence interval, 19.1 to 24.9 months) in diabetic patients.

There was no significant difference between the men and the women in survivals at 1 year (82.4% versus 81.5%; P = .59), 5 years (20.1% versus 27.5%; P =.09), 10 years (2.4% versus 4.9%; P = .44), and 15 years (0.5% versus 1.4%; P = .78). Overall, an increase in age at the start of the study was associated with lower survivals, especially after 1-year follow-up (Table 2).

DISCUSSION

Although maintenance dialysis in patients with ESRD prevents death from uremia, patient survival remains an important issue. In our search, we did

Fifteen-year survival of diabetic and nondiabetic patients on hemodialysis (P < .001).

not find any article in Iran which evaluated 15-year survival of patients on hemodialysis, and this paper is the first report with such a long follow-up period. This study showed that regardless of the cause of ESRD, 1-, 5-, 10-, and 10-year survival of our patients was 83%, 25.2%, 3.8%, and 1.0%, respectively. Unfortunately, survival of our patients was much lower than that reported from many centers in the United Kingdom, Europe, Japan, and France.[12-16] For example, the 5-, 10-, and 15-year survival of patients on hemodialysis in Tassin, France was 87%, 75%, and 55%, respectively, which is much longer than that of almost all other countries.[12] It may be because of shorter dialysis time in our study; the average hemodialysis time in our study was 9 to 12 hours per week, whereas this time in Charra and colleagues' study reaches 24 hours per week.[12] Many studies indicated a relationship between shorter dialysis time and poorer outcome.[17,18]

Some other causes of poor outcomes of patients on hemodialysis in Iran compared with other countries may include low socioeconomic status of hemodialysis patients, low social support by the government or other organizations, no close follow-up care, nonadherence to diet, depletion of nephrologists in most hemodialysis centers, and availability of kidney transplantation for healthier and younger patients with ESRD. Thus, older patients with lower economic and health status are remained on hemodialysis.

Although survival of our patients was lower than that reported from many centers in the developed countries, our results were approximately similar to the report of the United States Renal Data System (USRDS) in 2009.[19] The USRDS reported 1-, 3-, 5-, and 10-year patient survival on hemodialysis of 79%, 53%, 35%, and 11.2%, respectively.

Gender did not affect survival of our patients on hemodialysis, but an increase in age led to decline in patient survival, which was the same as other studies.[16,20] The United Kingdom Renal

Table 2. Survival of Hemodialysis Patients by Age Group

Time	< 40 Years		40 to 70 Years		> 70 Years		P
	n	Survival, %	n	Survival, %	n	Survival, %	
1-year	371	81.9	807	82.7	247	76.1	.11
5-year	199	36.2	472	21.4	175	12.0	< .001
10-year	153	9.8	414	2.4	167	0	.03
15-year	142	4.2	400	0	159	0	.24

Registry reported that the 5- and 10-year survival in patients in the age ranges of 15 to 44 years was 60% and 44% in 2010, but these values in patients older than 65 years was 16% and 4%, respectively.[16]

Today, diabetes mellitus is the most common cause of ESRD, accounting for approximately 44% of cases in the United States.[19,21] Similarly, the main cause of ESRD in our study was diabetes mellitus. In Iran, the percentage of patients with ESRD due to diabetes mellitus has increased from 16% in 1997 to 31% in 2006.[3] The rapid increase in the prevalence of diabetics with ESRD and the high treatment costs necessitates urgent approach to approve strategies to prevent diabetes mellitus, early diagnosis, and thigh control of its complications.

A main finding of the study was the poor survival of diabetic patients. Similar, the USRDS reported in 2009 that the five-year survival of non-diabetic patients with ESRD is between 30% and 50% and it is 25% in diabetic patients.[18] Although survival of our nondiabetic patients is comparable to that of the nondiabetics in the United States, our diabetic patients' chance of survival was significantly lower. All diabetic patients in our study died before 10 years follow-up. The survival rate of diabetics requiring dialysis remains poor, even in dialysis centers located in countries with relatively high survival rates. As an example, among 84 consecutive patients with type 2 diabetes requiring dialysis in a center in France, 32% died at a mean follow-up of 211 days.[22] Another study performed in Canada indicated that 5-year survival of nondiabetic patients in the age ranges of 15 to 44 years and more than 65 years were 85% and 20%, respectively, whereas survival of diabetic patients in these age ranges was 58% and 10%, respectively.[23] Lower survival of diabetic patients on hemodialysis compared with nondiabetics has been demonstrated in other studies, as well.[23-27] Some factors play their roles in poor prognosis of diabetic patients with ESRD, including cardiovascular diseases, problems with vascular access and arteriovenous fistula, foot ulcer, infection, weight gain during hemodialysis intervals, and decrease in blood pressure during hemodialysis.[28-30]

According to very poor prognosis of diabetic dialysis patients, it appears that using other replacement therapy including kidney transplantation is more important. There are many studies about comparison of dialysis versus kidney transplantation. Results showed that survival of diabetic patients undergoing kidney transplantation still markedly better than those seen with either hemodialysis or peritoneal dialysis. Also, kidney transplantation is associated with a better quality of life and a higher degree of rehabilitation in these patients.[31-33]

CONCLUSIONS

Based on our findings, the survival of ESRD patients undergoing hemodialysis in Iran, especially among diabetics was poor. Diabetic patients had even poorer survival rates. Thus, if ESRD presented in diabetic patients, the other renal replacement therapies, including kidney transplantation or simultaneous kidney and pancreas transplantation, should be considered.

CONFLICT OF INTEREST

None declared.

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