Diabetes mellitus: the leading cause of haemodialysis in Jordan

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السكَّري هو السبب الرئيسي لإجراء الديال الدموي (الغسيل الكلوي) في الأردن

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الخلاصة: أُجريت هذه الدراسة بُغْيَةَ تحديد دور السكَّري كسبب لتطوُّر مرض الكلى ووصوله إلى مرحلته النهائية التي تستلزم إجراء ديال دموي (غسيل كلوي)، في الأردن، وبُغْيَةَ عقد مقارنة بين السكَّريِّين وغير السكَّريِّين من هؤلاء المرضى. وتمت مقابلة من كان يخضع للديال الدموي (الغسيل الكلوي) في الأردن، وقت إجراء هذا المسح عام 2003 وعددهم 1711 مريضاً، وجُمعت معلومات إضافية عن حالاتهم من سجلاتهم الطبية. وقد تبيَّن أن السكَّري هو أكثر الأسباب شيوعاً لتطوُّر المرض ووصوله إلى مرحلته النهائية (29.2٪ من الحالات). وكان متوسط أعمار المرضى أعلى في مجموعة السكَّريِّين (57.5 عاماً، بانحراف معياري 12.3) منه في مجموعة غير السكَّريِّين (45.4 عاماً – بانحراف معياري 17.1)، وكانت الفترة التي أُجري على مداها الديال الدموي (الغسيل الكلوي) أقصر بدرجة يُعتدُّ بها إحصائياً لدى السكَّريِّين منها لدى غير السكَّريِّين من هؤلاء المرضى.

ABSTRACT This study aimed to define the role of diabetes mellitus as a cause of end-stage renal disease requiring haemodialysis in Jordan, and to compare diabetic and nondiabetic patients. All patients on haemodialysis in Jordan at the time of the survey in 2003 (*n* = 1711) were personally interviewed and additional data were obtained from medical records. Diabetes mellitus was the most common cause of end-stage renal disease (29.2% of cases). The mean age of patients was higher in diabetics [57.5 years, standard deviation (SD) 12.3] than nondiabetics (45.4 years, SD 17.1). Duration on haemodialysis was significantly shorter in diabetics compared to nondiabetic patients.

Le diabète sucré, indication majeure de l'hémodialyse en Jordanie

RÉSUMÉ Cette étude menée en Jordanie avait pour double objectif de définir le rôle du diabète sucré dans l'étiologie de l'insuffisance rénale terminale nécessitant une hémodialyse et de comparer les populations diabétiques et non diabétiques. Tous les hémodialysés jordaniens au moment de l'enquête, soit 1711 patients en 2003, ont été soumis à un entretien individuel, les données complémentaires étant extraites des dossiers médicaux. Le diabète sucré est apparu comme la principale cause d'insuffisance rénale terminale (29,2 % des cas). Chez les diabétiques, l'âge moyen s'est avéré supérieur à celui des non-diabétiques (57,5 ans [E.T. : 12,3] contre 45,4 ans [ET : 17,1]). Chez les diabétiques, la durée du traitement par hémodialyse a été significativement plus brève que chez les non-diabétiques.

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Introduction

End-stage renal disease (ESRD) is a growing problem worldwide and renal replacement therapy is exerting an increasing pressure on health systems [*1*]. The situation is particularly serious in developing countries where health resources are limited. ESRD is defined as a glomerular filtration rate < 15 mL/minute/1.73 m^2. Studies from many countries showed that the incidence of ESRD has increased [*2–4*]. In Jordan for example, the number of patients on haemodialysis has at least doubled over the past 5 years [*5*], posing a serious challenge to the already strained health care resources. The increasing trend of diabetes mellitus (DM) is believed to be a major contributing factor for the observed increase in the incidence of ESRD. The prevalence of DM has been increasing on a worldwide scale [*6,7*]. In Jordan, the reported prevalence of DM is 13.4% for people over 25 years of age [*8*]. Furthermore, different reports indicate that about half the patients with type 2 DM are undetected [*9,10*].

Key factors for the observed increase in DM include demographic changes, increase in the size of highly susceptible populations, such as the elderly, and sociocultural developments that breed a more sedentary population and expose the people to added environmental risk factors for this disease. At present, DM is the leading cause of ESRD in many countries [*4,11–14*]. In the Eastern Mediterranean Region, data from Bahrain [*15*], Oman [*16*] and Saudi Arabia [*17*] showed that DM is the cause of ESRD in 30%, 14.5% and 60% of patients respectively. A study from the Czech Republic showed that diabetic nephropathy affects 4%–8% of diabetic patients attending diabetes clinics [*18*]. One study from the United States reported that diabetic nephropathy occurs in a high percentage (20%–40%) of all diabetic patients [*19*]. Another study from the United States showed that the incidence of ESRD attributed to DM has grown at the rate of 9% annually since 1992 [*11*].

Once a patient has ESRD, renal replacement therapy by dialysis (haemodialysis or peritoneal dialysis) or renal transplantation should be applied. Diabetic patients with ESRD are at higher risk of morbidity and mortality because of the presence of other complications of DM, such as atherosclerotic diseases, neuropathy and increased susceptibility to infections [*7,20*]. Diabetic nephropathy could be reduced and its progression to ESRD significantly delayed with better overall management of the underlying DM [*20,21*].

Although data on the prevalence of diabetes mellitus are available in Jordan, little is known about the status of control of the disease and its associated complications, including ESRD. The only available study was conducted in 1992 and reported that diabetes was the cause of ESRD in 10.5% of patients on haemodialysis [*22*]. The purpose of the present study is to report on the role of diabetes as a cause of ESRD necessitating haemodialysis in Jordan, and to determine some of the significant differences between diabetic and nondiabetic patients on haemodialysis as regards age, sex, duration on haemodialysis, family history of DM, history of renal transplantation and rate of hospital admissions.

Methods

As the government reimburses the costs of all haemodialysis services in Jordan, it was possible to ascertain all the patients on haemodialysis in the country. Approval to conduct this study was obtained from all the concerned health sectors in Jordan, namely, the Ministry of Health, the Royal Medical Services and the private sector. We collected data on all patients (n = 1711) who were

on haemodialysis at the time of the survey (1 September to 31 October 2003) in all haemodialysis units in Jordan (56 units).

Each patient was personally interviewed in the haemodialysis unit using a structured questionnaire prepared by the investigators (nephrologists and epidemiologists). The questionnaire collected comprehensive data on a wide range of issues related to haemodialysis. Relevant data for the present study included sociodemographic variables such as age and sex, family history of DM and renal transplantation, in addition to date of starting haemodialysis, duration of haemodialysis and history of hospital admission. The objectives of the study and questionnaire were fully explained to the haemodialysis personnel who were responsible for data collection and background information about the study and its objectives were provided to all patients. Haemodialysis units provide this treatment in 1 to 3 shifts daily according to the number of haemodialysis machines and patients in each unit. The cause of ESRD was provided by the attending physician.

Epi-Info 2002 software was used for data entry and analysis. The distribution of patients by relevant variables was obtained. Diabetic and nondiabetic patients were compared according to a number of relevant variables. The chi-squared test was used to assess the statistical significance of observed differences in proportions while the independent *t*-test was used to assess the statistical significance of the differences in continuous variables.

Results

Causes of ESRD

At the time of the survey (1 September 2003 to 31 October 2003), a total of 1711 patients on haemodialysis were identified in Jordan. The leading cause of ESRD was DM (29.2% of cases), followed by hypertension (18.4%) and glomerulonephritis (12.3%); the cause was unknown in 21.4% of patients (Table 1). In patients who were initiated on haemodialysis in 2002 (n = 329), DM was responsible for 33.4% and in patients who were initiated on haemodialysis in

Table 1 **Causes of end-stage renal disease in patients on haemodialysis (HD) in Jordan, 2004**

Cause	All patients on HD		Patients started HD in 2002		Patients started HD in 2003	
	No.	%	No.	%	No.	%
Diabetes mellitus	499	29.2	110	33.4	181	44.0
Hypertension	315	18.4	70	21.3	81	19.7
Glomerulonephritis	210	12.3	40	12.2	30	7.3
Obstructive uropathy	70	4.1	11	3.3	18	4.4
Reflux uropathy	70	4.1	8	2.4	8	1.9
Polycystic kidney disease	40	2.3	5	1.5	5	1.2
Other causes	141	8.2	28	8.5	28	6.8
Unknown	366	21.4	57	17.3	57	13.9
Total	1711	100.0	329	100.0	411	100.0

2003 (n = 411), DM was responsible for an even higher proportion (44.0%) (Table 1). Hypertension and glomerulonephritis kept their second and third ranks, respectively, in both years. It is noteworthy that hypertension was an associated condition in 63.0% of diabetic patients, and ischaemic heart disease in 22.4% of this population.

Sex and age

More males were on haemodialysis in Jordan (n = 957) than females (n = 754) resulting in a male to female ratio of 1.3:1 approximately. Comparison between diabetic and nondiabetic patients showed that 61.1% of diabetic patients were males compared with 53.8% of nondiabetics (Table 2). The age of diabetic patients ranged from 11 to 88 years with a mean age of 57.5 years [standard deviation (SD) 12.3], while the age of nondiabetics ranged from 5 to 86 years with a mean age of 45.4 years (SD 17.1). More than half of the diabetic patients were ≥ 60 years of age (51.3%) compared with only 25.8% of nondiabetics.

Duration on dialysis

Duration on haemodialysis was significantly shorter in diabetic patients [mean 25 months (SD 25.3), median 17 months] com-

Table 2 **Comparison of characteristics of diabetic and nondiabetic patients (n = 1711), Jordan, 2004**

Variable	Diabetic		Nondiabetic		*P*-value
	No.	%	No.	%	
Sex					
Male	305	61.1	652	53.8	
Female	194	38.9	560	46.2	< 0.006
Age (years)					
0–19	4	0.8	78	6.4	
20–39	48	9.6	392	32.4	
40–59	191	38.3	429	35.4	
60+	256	51.3	313	25.8	< 0.001
Duration on haemodialysis (months)					
< 12	191	38.3	253	20.9	
12–36	185	37.1	373	30.8	
> 36	123	24.6	586	48.3	< 0.001
Family history of diabetes mellitus					
Yes	282	56.5	349	28.8	
No	217	43.5	863	71.2	< 0.001
Family history of renal transplantation					
Yes	7	1.4	103	8.5	
No	492	98.6	1109	91.5	< 0.001
Admission to hospital[a]					
Yes	288	57.8	505	41.7	
No	211	42.3	707	58.3	< 0.001

[a] *In the year prior to the study.*

pared with nondiabetics [mean 50 months, (SD 48.8), median 34 months] ($P < 0.001$). Among all diabetic patients, 38.3% were on haemodialysis < 1 year compared with 20.9% of nondiabetics (Table 2). Only 1% of the diabetic patients were on haemodialysis for > 10 years compared with 10% of non-diabetics.

Family history of DM

As shown in Table 2, and as expected, a significantly higher proportion of diabetics had a positive family history of DM in first-degree relatives (56.5%) as compared with nondiabetics (28.8%) ($P < 0.001$).

History of renal transplantation

The frequency of previous renal transplants among diabetics was 1.4% compared to 8.5% among nondiabetics ($P < 0.001$), indicating that diabetic patients are less likely to undergo renal transplantation.

Hospital admission

Admission to hospital during the year prior to the study was significantly more common in diabetic (57.8%) than in nondiabetic patients (42.3%) ($P < 0.001$) (Table 4).

Discussion

As shown previously in several countries of the world [*10,11,15,16*], this study confirms that DM is the leading cause of ESRD among patients on haemodialysis in Jordan. ESRD attributed to DM has increased significantly over the years. In Jordan, DM was the cause of ESRD in 10.5% of patients on haemodialysis in 1992 [*22*] and was the cause of 29% of such cases in 2003. The observation that DM accounted for an even higher proportion of patients who started haemodialysis in 2002 and 2003 (33% and 44% respectively), could indicate that DM has been increasing as a cause of ESRD requiring haemodialysis. This could be attributed, at least partially, to the fact that diabetic patients have a higher overall mortality and spend less time on haemodialysis before they succumb to any of the several complications of DM. It is true that the prognosis of patients who have diabetes and are on renal replacement therapy has improved, but survival remains worse than that of nondiabetic patients. A study published in 1997 showed that the 5-year survival of diabetic patients on haemodialysis was 30% compared with 60% in nondiabetics [*23*]. Consistent with these figures, the current study suggests a worse survival for diabetics as reflected by the shorter period on haemodialysis among diabetic patients.

Our data suggest a preferential access of males to haemodialysis services. This is evident by the higher number of males on haemodialysis, for which we have no plausible explanation. The abundance of males in the diabetic group as compared to the nondiabetic group ($P < 0.006$) could be related to a restricted access of women to haemodialysis services if they also have diabetes or other comorbidities.

In the present study, diabetic patients on haemodialysis were less likely to have had renal transplantation, which may relate to the fact that patients in this group are older, and tend to have comorbid conditions and, therefore, were denied this form of intervention.

The association of DM and a positive family history of DM is not surprising, and has been reported by studies in several countries including Kuwait and Mexico [*24–26*].

In conclusion, the study showed that DM is the leading cause of ESRD in Jordan and suggests that its role is on the increase. The study also suggests a poorer survival of diabetics on haemodialysis compared to nondiabetics. The high personal, social

and financial costs of managing ESRD and the other complications associated with diabetic nephropathy make a powerful case for the need for better detection and better control of patients with DM.

References

1. Stengel B et al. Trends in the incidence of renal replacement therapy for end-stage renal disease in Europe, 1990–1999. *Nephrology, dialysis, transplantation*, 2003, 18:1824–33.
2. Usami T et al. Regional variations in the incidence of end-stage renal failure in Japan. *Journal of the American Medical Association*, 2000, 284:2622–4.
3. Disney AP. Some trends in chronic renal replacement therapy in Australia and New Zealand, 1997. *Nephrology, dialysis, transplantation*, 1998, 13:854–859.
4. US Renal Data System. *USRDS 2001 annual data report: incidence of reported ESRD*. Bethesda, Maryland, National Institute of Diabetes and Digestive and Kidney Diseases, 2001.
5. Sultan A. *Haemodialysis in Jordan* [MSc thesis]. Amman, Jordan University of Science and Technology, 1998.
6. Gorus FK et al. Epidemiology of type 1 and type 2 diabetes. The added value of diabetes registries for conducting clinical studies: the Belgian paradigm. *Acta clinica belgica*, 2004, 59(1):1–13.
7. Bonow RO, Gheorghiade M. The diabetes epidemic: a national and global crisis. *American journal of medicine*, 2004, 116(Suppl. 5A):2S–10S.
8. Ajlouni K, Jaddou H, Batieha A. Diabetes and impaired glucose tolerance in Jordan: prevalence and associated risk factors. *Journal of internal medicine*, 1998, 244:317–23.
9. Harris MI et al. Prevalence of diabetes and impaired glucose tolerance and plasma glucose levels in US adults. *Diabetes care*, 1998, 21(4):518–24.
10. Simmons D, Williams DRR, Powell MJ. The Coventry Diabetes Study: prevalence of diabetes and impaired glucose tolerance in Europids and Asians. *Quarterly journal of medicine, new series*, 1991, 81:1021–30.
11. Reikes ST. Trends in end-stage renal disease. *Postgraduate medicine*, 2000, 108(1):124–6.
12. Konner K. Increasing the proportion of diabetics with AV fistulas. *Seminars in dialysis*, 2001, 14(1):1–4.
13. Ritz E et al. End-stage renal failure in type 2 diabetes: a medical catastrophe of worldwide dimensions. *American journal of kidney diseases*, 1999, 34(5):795–808.
14. Stein G, Funfstuck, Schel R. Diabetes mellitus and dialysis. *Minerva urologica e nefrologica*, 2004, 56(3):289–303.
15. Al Arrayed S. Renal replacement therapy in Bahrain. *Saudi journal of kidney diseases and transplantation*, 1998, 9(4):457–8.
16. Al-Marhubi H. Renal replacement therapy in Sultanate of Oman. *Saudi journal of kidney diseases and transplantation*, 1998; 9(4):459–60.
17. Alkhunaizi AM et al. Experience in a general hospital in Eastern Saudi Arabia. *Saudi medical journal*, 2003, 24(7):798–800.
18. Rychlik I, Sulkova S. Diabetes mellitus a chronicka renalni insuficience. [Diabetes mellitus and chronic renal insufficiency.] *Vnitrni lekarstvi*, 2003, 49(5):395–402.
19. Rabkin R. Diabetic nephropathy. *Clinical cornerstone*, 2003; 5(2):1–11.
20. UK Prospective Diabetes Study Group. Intensive blood control with sulphonyl-

ureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *Lancet*, 1998, 352:837–53.

21. UK Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes UKRDS 38. *British medical journal*, 1998, 317:703–13.

22. Takruri HR, Hamzeh YS, Sweiss A. Hemodialysis patients in Jordan: a comprehensive survey. *Archives of dialysis and transplantation*, 1995, 24:678–82.

23. Rodriguez JA et al. Diabetic patients on renal replacement therapy: analysis of Catalan registry data. *Nephrology, dialysis, transplantation*, 1997, 12:2501–9.

24. UK Prospective Diabetes Study. IV. Characteristics of newly presenting type 2 diabetic patients: male preponderance and obesity at different ages: multi center study. *Diabetic medicine*, 1998, 5:154–9.

25. Abdella N et al. Known type II diabetes mellitus among the Kuwaiti population. A prevalence survey. *Acta diabetologica*, 1996, 16:145–9.

26. Guerrero RJF, Rodriguez MM, Sandoval HF. Prevalencia de diabetes mellitus no insulinodependiente en la población rural de Durango, México [The prevalence of non-insulin-dependent diabetes in the rural population of Durango, Mexico]. *Revista panamericana de salud pública*, 1997, 2:386–91.

Guidelines for the prevention, management and care of diabetes mellitus

Diabetes mellitus is one of the most common noncommunicable diseases worldwide. In the WHO Eastern Mediterranean Region there has been a rapid increase in the incidence of the disease, and it is now the fourth leading cause of death. The increasing prevalence, the emergence of complications as a cause of early morbidity and mortality, and the enormous burden on health care systems make diabetes a priority health concern. These guidelines provide up-to-date, reliable and balanced information for the prevention and care of diabetes mellitus in the Region. The information is evidence-based and clearly stated to facilitate the use of the guidelines in daily practice. The guidelines are intended to benefit physicians at primary, secondary and tertiary levels, general practitioners, internists and family medicine specialists, clinical dietitians and nurses as well as policy-makers at ministries of health. They provide the information necessary for decision-making by health care providers and patients themselves about disease management in the most commonly encountered situations.

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