

Etiology of end-stage renal disease amongst hemodialysis patients in Makkah city, Saudi Arabia



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ABSTRACT

In recent years, the number of hemodialysis (HD) patients has increased in the Kingdom of Saudi Arabia. End-stage renal disease (ESRD) is associated with increased rates of hospital admission, morbidity, and mortality. Globally, the most common causes of ESRD are diabetic nephropathy, hypertension, glomerulonephritis, infections, and chronic obstruction. However, very limited data have been presented regarding the etiology of ESRD in Saudi Arabia, especially in Makkah City. Therefore, this cross-sectional study is designed to determine the underlying etiologies of ESRD in hemodialysis patients. The study was conducted among 306 patients who were recruited from Makkah hospitals and HD centers. The obtained data showed that diabetes was the most common cause of ESRD (34.3%), followed by hypertension (20.9%), drug misuse (12.1%), hereditary conditions (10.1%), urinary tract obstruction, and urinary retention (9.8%), unknown reason (8.2%), and chronic inflammation of the kidneys (3.3%). In conclusion, this study highlights the most important factors contributing to ESRD in the Makkah region. Thus, national campaigns should be performed to increase awareness about these factors and to possibly reduce the incidence of the disease.

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1. Introduction

End-stage renal disease (ESRD) has become an increasing public health issue in both high- and middle-income countries. Even in developed nations, ESRD is the main fee driver of healthcare systems (Couser et al., 2011). Chronic kidney disease (CKD) is a condition associated with increased rates of hospital admission, morbidity, and mortality (Mathur et al., 2010; Kerr et al., 2012). In 2016, figures from the United States Renal Data System indicated that there were approximately 370 new cases per million people (PMP) annually in the USA (Saran et al., 2016). In Saudi Arabia, the incidence and prevalence of ESRD have risen in the last three decades and exceed those found in European and American populations. This increase is a result of large-scale urbanization, rapid lifestyle changes, and excessive population growth. Additionally, 2.21% of

annual deaths occur as a result of CKD patients who progress to ESRD (Al-Sayyari and Shaheen, 2011).

The understanding of the etiology of ESRD in the Kingdom of Saudi Arabia (KSA), especially in Makkah, is limited. Therefore, this study aims to determine the etiology factors leading to ESRD in hemodialysis (HD) patients in Makkah City, Saudi Arabia.

2. Subjects and methods

2.1. Subjects

This cross-sectional study appraised 306 patients from the in-patient wards of King Faisal Hospital, Al-Noor Specialist Hospital, and from the HD centers in Makkah, including Diaverum and Al-Jamiyyah Al-Khairiyyah. The study was conducted from November 2019 to January 2020. All adult HD patients from the hospitals and centers in Makkah were included. We excluded any patients younger than 18 years and who live outside Makkah City.

2.2. Methods

All patients were on regular HD and gave written consent. Data were collected from patient's medical

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records and were confirmed through standardized questionnaire-based (Almutairi et al., 2017) interviews with patients. The information acquired was focused on patients' demographic characteristics, family history, and factors associated with ESRD.

2.3. Statistical analyses

The obtained data were statistically analyzed using IBM SPSS Statistics for Windows, version 20. Statistical significance was defined by using the chi-square test at $p \leq 0.05$ for categorical variables.

3. Results

Table 1 shows the socio-demographic data of the patient cohort. The number of female and male patients who received HD were 193 and 113, respectively. Around 90.2% of the patients were Saudi. Most HD patients were in the age categories 45-61 years (43.1%) and 35-44 years (21.6%), followed by those over 61 years old (20.9%). The mean age of the study population was 46 ± 7.7 years. The lowest age was 18 years old and the highest was 86 years old. The lowest percentage of patients was in the younger age group, i.e. between 18 and 24 years (3.6%).

Most patients were married (65.7%), followed by those who were widowed (14.7%), and single (8.2%). Few patients had postgraduate degrees (0.3%); a small group had earned diploma-level educations (4.2%). About 58.5% of the patients were unemployed, and 16.8% were employed; the least represented group was the student group (1.9%). About 37.5% of the patients earned <5000 SAR/month, 26.1% earned 10000-20000 SAR/month, whilst only 10.9% of patients had an income >20000 SAR/month. No difference was seen in mean body mass index (BMI) values between male and female patients (27 ± 1.1 vs 27.6 ± 1 , respectively).

Table 2 represents the causes of ESRF identified in this patient cohort. These were significantly

different ($p < 0.05$) between them. The most common underlying etiology reported was diabetes (34.3%), followed by hypertension (20.9%); ESRD related to unknown causes was found in 8.2%.

Table 1: Frequency distribution of subjects according to their socio-demographic data

Variables	Frequency	Percent
Gender	Male	193
	Female	113
	Total	306
Nationality	Saudi	276
	Non-Saudi	30
	Total	306
Age-group (years)	18 - 24	11
	25 - 34	33
	35 - 44	66
	45 - 61	132
	Over 61	64
	Total	306
Social status	Married	201
	Single	25
	Widowed	45
	Divorced	35
	Total	306
Educational level	No schooling	63
	Primary school	52
	Middle School	43
	High School	83
	Diploma	13
	Bachelor's degree	51
	Postgraduate degree	1
	Total	306
Occupation	Student	6
	Employed	51
	Retired	70
	Unemployed	179
	Total	306
Income level (SAR)/month	Less than 5000	86
	5000-10000	78
	10000-20000	80
	More than 20000	62
	Total	306

Other etiological factors could be related to drug misuse (12.1%), hereditary conditions (10.1%), urinary tract obstruction and urinary retention (9.8%), and chronic inflammation of the kidneys (3.3%).

Table 2: Frequency distribution of subjects according to ESRF etiology

Variables	Frequency	Percent	p-value
Etiology of ESRD	Urinary tract obstruction and urinary retention	30	9.8
	Drug misuse (antibiotics/analgesics)	37	12.1
	Chronic inflammation of the kidneys	10	3.3
	Diabetes	105	34.3
	Hypertension	64	20.9
	Hereditary conditions	31	10.1
	Others	4	1.3
	Unknown	25	8.2
	Total	306	100.0

Table 3 demonstrates that the etiology of ESRD was significantly different between male and female patients ($p < 0.05$). The most common causes of ESRD in male patients were diabetes (31.1%), hypertension (22.3%), impaired kidney function from drug misuse, e.g., antibiotics or analgesics (14.5%), and urinary tract obstruction and urinary retention (10.4%). On the other hand, the majority of cases of ESRD in female patients were caused by

diabetes (39.8%), hypertension (18.6%), and hereditary conditions (15%).

4. Discussion

ESRD is characterized by progressive and irreversible impairment of renal function. Awareness of the cause of CRF helps the nephrologists to anticipate problems during renal

replacement therapy and plan preventive measures

for the community (Castro et al., 2006).

Table 3: Etiology of ESRD according to gender

Etiology of ESRD	Gender				Total	p-value
	Male		Female			
	No.	%	No.	%		
Urinary tract obstruction and urinary retention	20	10.4	10	8.9	30	P<0.05
Drug misuse (antibiotics/analgesics)	28	14.5	9	8	37	
Chronic inflammation of the kidneys	10	5.2	0	0	10	
Diabetes	60	31.1	45	39.8	105	
Hypertension	43	22.3	21	18.6	64	
Hereditary conditions	14	7.3	17	15	31	
Others	1	0.5	3	2.7	4	
Unknown	17	8.8	8	7.1	25	
Total	193	100	113	100	306	

The incidence of ESRD in the U.S in 2017 was 340.7 PMP with 124,500 new cases registered. The prevalence of ESRD continues to rise and reached 746,557 in 2017 (versus 727,912 in 2016). The total Medicare spending on both CKD and ESRD patients was in excess of 120 billion US dollars in 2017. For identified CKD (not ESRD), the total Medicare expenditure was 84 billion US dollars. Spending for ESRD patients totaled 35.9 billion US dollars, accounting for 7.2% of the overall Medicare-paid claims (Saran et al., 2020). This reflects how much ESRD is an economic burden and the need to prevent it.

The dialysis statistics prepared by the Saudi Centre for Organ Transplantation (SCOT) at the end of 2016 showed a total of 17,687 dialysis patients, 16,315 of them are treated by HD, and the remaining 1,372 by peritoneal dialysis. The prevalence of end-stage renal failure treated by dialysis is estimated to be 557 cases/PMP, total death was 1,769 (10%), while the incidence of treated ESRD is estimated at 145 cases/PMP (SCOT, 2018).

Our study was conducted in Makkah; the holy city for all Muslims located in the Western region of KSA, where the prevalence of end-stage renal failure treated by dialysis is estimated to be 585 cases/PMP, while the incidence of treated ESRD is estimated as 146 cases/PMP (SCOT, 2018). Our study showed that the prevalence of treated ESRD in male patients was almost twice that of females (6.1% vs 36.9%; Table 1). This male predominance among the ESRD population, is a poorly explained global phenomenon, with males constituting 58% in the US (NIH, 2020), 62.9 % in the UK (Byrne et al., 2018), and 56% in the KSA (SCOT, 2018). This study showed that the largest group of patients were in the age group 45-61 years (42.2%), and the second-largest group was aged over 61 years (26%). About 80% were of Saudi nationality and 20% were non-Saudi. These distributions were similar to those in a study of ESRD patients in the city of Tabuk in Saudi Arabia where the highest percentage of the patients were in the age group 40-59 years (40.11%), and the second-highest percentage were aged 60-79 years (27.79%); 84.2% of patients were Saudi and 15.8% were non-Saudi (Almutairi et al., 2017).

Diabetic nephropathy (DN) is the commonest cause of ESRD in our patients (34.3%), this is in agreement with 2016 SCOT data with DN

responsible for 40% of cases (SCOT, 2018) and many other studies showing DN as the leading cause of ESRD accounting for 50% of cases in the developed world (Tuttle et al., 2014), and many Arabic countries such as Libya (Goleg et al., 2014), Kuwait, Egypt, and Lebanon (Shaheen and Al-Khader, 2005). Reflecting that DN became an important public health problem due to changes in dietary habits and lifestyle mandating prevention and early detection and management. Hypertension was responsible for 20.9% of all cases in our ESRD patients, compared with 38% in the whole country (SCOT, 2018). Hypertension is highly prevalent in Saudi Arabia. It was reported that hypertension affected more than 25% of the adult Saudi population (Saeed et al., 2011). This high prevalence may be related to the dietary and lifestyle changes of the Saudis (Almutary et al., 2013). In the US, hypertension and diabetes are the two leading causes for an increasing number of individuals with ESRD (NIH, 2020). Hypertension is also a major cause of ESRD in other regional countries such as Egypt (El-Minshawy and Kamel, 2011), Iran (Nemati et al., 2008), Sudan (El-Amin et al., 2010), and Turkey (Sengul et al., 2013).

ESRD as a complication of medications intake as analgesics represents 12.1% of our patients compared to 5% in Tabuk (El-Minshawy et al., 2014) followed by hereditary causes and obstructive uropathy (9.8%) each. This denotes the importance of the wise use of medications under medical supervision. Glomerulonephritis was seen in 3.3% of our patients compared to 8.9% in Tabuk (Almutairi et al., 2017) and 9.6% in the US (NIH, 2020).

Our results showed that 8.2% of patients were with unknown causes of ESRD, but it was higher up to 10.5% in the Netherlands (ERA-EDTA, 2018), and 16.1% in the UK (ERA-EDTA, 2018); and much higher in developing countries whereas, in Yemen, there were more than 57% of patients with unknown cause of ESRD (Al-Rohani, 2003), and in Sudan more than 40% (El-Amin et al., 2010). This highlights the importance of medical services availability for early detection and management of possible causes and prevention of ESRD.

5. Conclusion

In conclusion, the study suggests that the etiology of ESRD amongst HD patients in Makkah City is

related to diabetes, hypertension, drug misuse, hereditary conditions, urinary tract obstruction, and urinary retention, unknown reason, and chronic inflammation of the kidneys. However, urbanization and rapid lifestyle changes increased the incidence of DN and hypertension as the leading causes of ESRD in KSA and a national program to control both is mandatory, but at the same time the unknown causes are decreasing due to the improvement of investigational facilities and increasing awareness of ESRD risk factors and we recommend a wide-scale screening of the relatives of patients with ESRD for early detection and management of risk factors of ESRD.

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Compliance with ethical standards

Ethical considerations

Informed written consent was obtained from each patient, and all patient details were kept confidential under the current legal framework. This study was approved by the ethics and research committees of the Ministry of Health of the KSA (Approval number H-02-K-076-0619-122).

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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