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Characteristics of ESRD Patients who have been on Long-term Hemodialysis Therapy in Egypt

Abir Farouk Megahed[1*] and Nagy Sayed-Ahmed[2]

[1]MOH Nephrology Administration, Mansoura Military Hospital, Department of Nephrology, Mansoura, Ministry of Health, Mansoura, Egypt.
[2]Nephrology and Dialysis Unit (MNDU), Faculty of Medicine, Mansoura University, Mansoura, Egypt.

Authors' contributions

This work was carried out in collaboration among all authors. Research idea, study design, data analysis/interpretation, and data acquisition. Author AFM providing intellectual content of critical importance to the work described and supervision or mentorship. Author NSA. Author AFM takes responsibility that this study has been reported honestly, accurately and transparently, and accepts accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved. All authors read and approved the final manuscript

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ABSTRACT

Background: It is well-known that hemodialysis extends the life of end-stage renal disease (ESRD) patients, who would have otherwise died. The characteristics of long-term patients on hemodialysis (HD) were not evaluated before in Egypt. We aimed at identifying the specific characteristics of the patients who have survived on hemodialysis for more than 20 years in Egypt.
Subjects and Methods: During the years 2018 and 2019, the twenty-seven governorate health affairs Directories of the Egyptian Ministry of Health were contacted to participate in data collection. The dialysis physicians in each hemodialysis unit were sent a questionnaire form requesting to submit information, on the characteristics of patients who have been on HD therapy for twenty years or more.
Results: Seventy-three patients were encountered from a total number of 26000 HD patients to have been on HD therapy; with a range between 20 and 30 years. Males constituted the majority of these patients. Sixty-eight patients were dialyzed through working arteriovenous fistulas (A-V

**Corresponding author: E-mail: dnps2016@gmail.com;*

fistulas). The mean urea reduction ratio (URR) of these patients was 0.65±0.095. Acute intradialytic complications afflicted only 20.3% of these patients. More than three-quarters of the patients had a positive serology test for HCV antibodies. None of these patients has diabetes mellitus. On the other hand, complaints related to the skeletal system were present in 47.4% of the patients. There is a statistically significant higher rate of acute complications in the female gender and a statistically significant higher fertility rate after hemodialysis in the male gender.
Conclusion: Long-term dwellers on hemodialysis therapy are not unusual in Egyptian ESRD patients and their characteristics are reasonable.

Keywords: Hemodialysis dwellers; long-term patients; ESRD; Egypt.

1. INTRODUCTION

Hemodialysis is the commonest modality of renal replacement therapy (RRT) in Egypt and many other countries. It is well-known that HD alleviates many of the uremic manifestations and extends the life of ESRD patients, who would have otherwise died. However, in spite of the progress in dialysis techniques and science, the life expectancy of HD patients could vary depending on concomitant medical comorbidities and the treatment plan that the patients follow. The average life expectancy on dialysis is five to ten years; however, many patients have lived well on dialysis for 20 to 30 years [1]. There is much confusion in the public awareness of longevity on HD, with many possible survivals more than 20 years. However, several patients have been observed with survival periods for more than thirty-five years [2].

In long-term dialysis, there are complications as amyloidosis, bone disease, endocrine disturbances, infection, cardiovascular complications, vascular access, and nutrition complication [3]. Many long-term dialysis patients suffer from a multitude of health care problems that disturb their quality of life. Nevertheless, renal physicians and dialysis scientists hope that recent advancements and appropriate care of dialysis practice will close these gaps. The characteristics of long-term patients on HD were not assessed before in Egypt.

1.1 Aim of the Work

The present study aimed at recognizing the specific characteristics of the patients who have survived on hemodialysis for more than 20 years in Egypt.

2. PATIENTS AND METHODS

During the years 2018 and 2019, the twenty-seven governorate health affairs Directories of the Egyptian Ministry of Health, comprising 313 hemodialysis units, were contacted by fax-mails and WhatsApp to participate in data collection. The dialysis physicians in each hemodialysis unit were sent a questionnaire form requesting to submit information, as comprehensive as possible, on the characteristics of patients who have been on hemodialysis therapy for twenty years or more. The data have included their age, gender, marital status and fertility, BMI, vascular access, etiology of CKD, associated comorbidities, acute and chronic HD complications, and available routine investigations. We review the full list of the patients at the end of December 2019. Confidentiality and personal privacy were respected at all levels of the study.

2.1 Statistical Analysis

After the collection of data, they were analyzed using the statistical package of social science (SPSS, IBM) software version 24. Categorical data were expressed as numbers and percentages and were analyzed by Chi-square and Fisher-Exact tests. Scale data were expressed as means ± SD or medians (Q1-Q3) as appropriate. Normality was tested using Shapiro Wilkinson or Kolmogorov-Simiranov tests, as appropriate. Parametric data were analyzed using an independent sample T-test, while the Mann-Whitney test was used to analyze non-parametric data. P-value was considered significant if it was < 0.05.

3. RESULTS

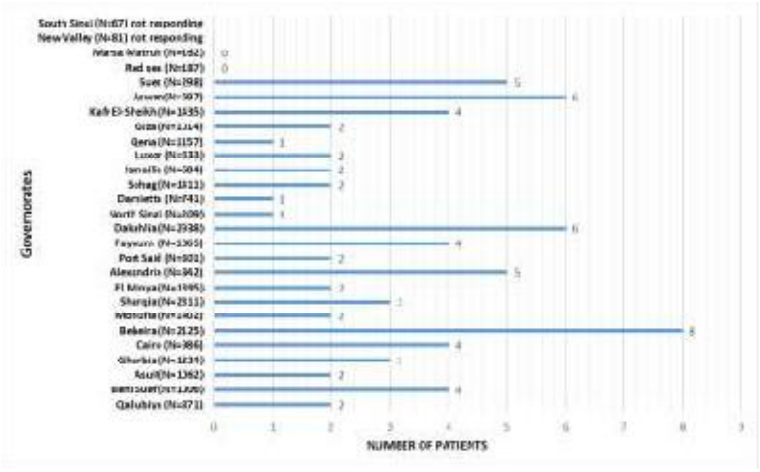
298 units of the approached Health Affairs Directories belonging to 25 Egyptian governorates responded satisfactorily to the questionnaire and participated in data collection. On data analysis of the collected results, Seventy-three patients were encountered from a total number of 26000 HD patients to have been on hemodialysis therapy for 20 years or more;

with a range between 20 and 30 years. Males constituted the majority of these patients (68.5%). Their mean age was 50±9.63, and they started hemodialysis therapy at a mean age of 27.8 with a range between 10 and 54 years of age. Their mean body mass index was 23.8, with a range between 15.9 and 41.7 kg/m2. (Table 1) Sixty-eight patients were dialyzed through working A-V fistulas, while five patients have utilized dialysis catheters (Table1). Two patients were maintained on two hemodialysis sessions weekly, while the remaining patients have received three sessions weekly; each session lasted for four hours in the majority of patients; although three patients were dialyzed 10 hours weekly (Data were not shown). All sessions have utilized bicarbonate-based dialysate with a dialysate flow rate of 500 ml/min and a blood flow rate of 300 ml/min unless there were compelling problems to do otherwise. Egyptian MOH guidelines were followed for water treatment in all the included HD units (https://manshurat.org/node/14544) (Data were not shown). The mean urea reduction ratio of these patients was 0.65±0.095. Acute intradialytic complications afflicted only 20.3% of these patients. Only two patients were smokers; while the majorities (97.3%) were nonsmokers. More than three-quarters of the patients had a positive serology test for HCV antibodies, while only three patients had a positive test for HB surface antigen. Eight cases of total HCV positive patients have received HCV treatment and showed PCR negative results. None of these patients has diabetes mellitus, while 19.2% have ischemic heart disease and 54.8% have hypertension. On the other hand, complaints related to the skeletal system were present in as much as 47.4% of the patients, while 19 patients were dependent on walking aids or bound to wheeling chairs (Table 2). Table 3 shows the laboratory data of the studied patients.

Tables 4 a, b, c show gender differences regarding demographic, clinical, and laboratory variables. There are no statistically significant differences even comparable results in different variables between both genders. However, there is a statistically significant higher rate of acute complications including hypotension and muscle cramps in the female gender and a statistically significant higher fertility rate after hemodialysis in the male gender.

Graph 1: Shows the distribution of long-term patients in different governorates all over the country. **Graph 2:** Shows histograms of the age distribution of long-term patients at the start of HD and in December 2019, while Graph 3: shows a histogram of dialysis duration distribution in long-term patients by months. The commonest possible etiologies are hypertension (27.4%) followed by urological causes (20.6%), and then unknown etiology (13.7%) are shown in Graph 4. None of these long-term patients has diabetes mellitus. Graph 5: shows the relationship between gender and marital status. Graph 6: shows a histogram of Hemoglobin distribution in the studied group.

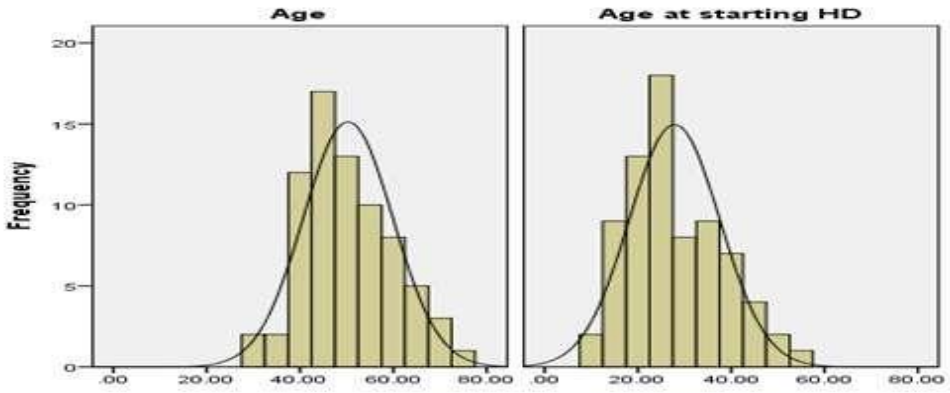
Graphs and Tables



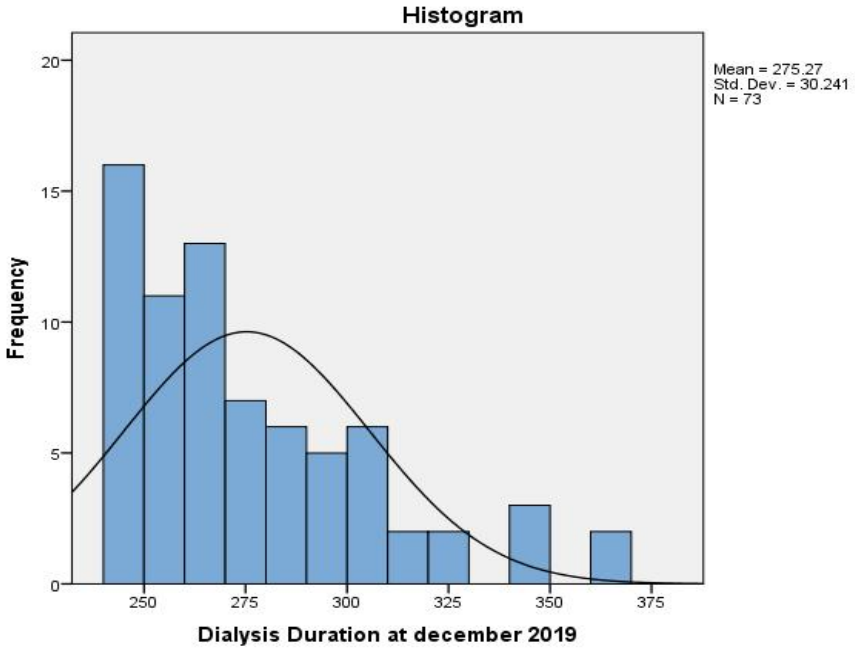
Graph 1. Total number of patients on HD over twenty years /each governorate considering that the total number of HD patients in participating HD units around 26319 patients

Table 1-a, b. General and HD characteristics of the studied group

Table 1-a: General characteristics of the studied group			
Gender n=73	Female	23 (31.5%)	Minimum-Maximum
	Male	50 (68.5%)	
Marital Status n=73	Married after HD	25 (36.2%)	
	Married before HD	19(27.5%)	
	Not married Mean±SD	25 (36.2%)	
Age n=73	Median(Q1-Q3)	50.29±9.63	
		50.00 (43.00-56.50)	31-75
Age of patients at start of dialysis n=73	Mean±SD Median (Q1-Q3)	27.84±9.74	
		26.00 (20.5-33.5)	10-54
DBW n=72	Mean±SD	59.81±12.8	
Height n=72 BMI n=72	Median(Q1-Q3) Mean±SD	60.00 (50.50-65.00)	35.0-94.0
	Median(Q1-Q3) Mean±SD	158.85±13.9	
	Median(Q1-Q3)	160.00 (1.50-1.69)	100-181
		23.81±4.9	
		22.50 (20.25-25.61)	15.92-41.67
Smoking n=73	No-Smoking	71 (97.3%)	
	Smoking	2 (2.7%)	
Serology n=72	Negative	14 (19.4%)	
	Positive HCV*	55 (76.4%)	
	Positive HBV	3 (4.2%)	
Table (1-b): HD characteristics in the studied group			
Sessions/week n=73	Mean±SD	2.97±0.164	Minimum-maximum 2-3
	Median (Q1-Q3)	3.00 (3-3)	
Blood flow rate (ml/m) n=73	Mean±SD Median (Q1-Q3)	294.11±22.23	
		300.00 (300-300)	200-350
Vascular Access n=73	AV Fistula	68 (93.2%)	
	Permanent Catheter n (%)	4 (5.4%)	
	Temporary catheter n (%)	1 (1.4%)	
	Free n (%)		
Anticoagulant n=73		1 (1.4%)	
	Heparin n (%)	70 (95.9%)	
Duration of HD (years) n=73	Clexane n (%) Mean±SD	2 (2.7%)	
Dialyzer size n=73	Median (Q1-Q3) Mean±SD	22.45±2.48	
		22 (21-24)	20-30
		1.51±0.17	
UF (Litre /session) n=20	Median(Q1-Q3)	1.40 (1.4-1.6)	1.3-2.2
	Mean±SD Median(Q1-Q3)	2.60±0.69	
		2.50 (2.00-2.38)	1.5-3.5



Graph 2. Histograms of the age distribution of long term patients at the start of HD and in December 2019



Graph 3. Histogram of dialysis duration (months) distribution in long-term patients

Table 2. Medical characteristics of the studied group

Systolic Blood Pressure (mmhg) n=69		**Mean±SD**	**120.58±17.05**	**Minimum-maximum**
		Median (Q1-Q3)	120.00 (110-130)	90-160
Median (Q1-Q3)		80.00 (70-90)	50-100	
		Median (Q1-Q3)	80.00 (70-90)	50-100
Hypertension n=73			40	54.8
Ischemic Heart Disease n=73			14	19.2
Acute Complication n=69	No		55	79.7
	Hypotension or cramps		13	18.8
	Resistant Hypertension		1	1.4
Chronic Complication n=69	No Bone Disease		37	53.6
	Bone Disease (Including, Arthritis, Osteoporosis and MBD		32	47.37
Wheeling chair n=56			19	33.9

***There is no diabetes in the studied group*

Table 3. Laboratory data of the studied group

	N	**Mean±SD**	**Median (Q1-Q3)**	**Minimum-maximum**
Haemoglobin	71	10.45±1.84	10.40 (9-11.5)	6.5-15.7
Albumin	15	3.74±0.57	3.80 (3.5-4)	2.9-4.9
Calcium	29	8.93±0.94	8.8 (8.45 -9.4)	7.2-11.00
Pre-dialytic Bl. Urea	68	119.24±31.81	114.65 (100-144)	40.0 200.0
Post-dialytic Bl. Urea	35	41.25±11.28	40.00 (31-51)	17.0-61.0
Urea Reduction Ratio	36	0.65±0.095	0.65 (0.60-0.72)	0.3-0.8
S. Creatinine	59	7.91±2.71	7.80 (6.30-10.00)	2.40-16.00
Phosphorus	25	5.04±1.78	5.00 (4.00-5.70)	2.4-10.0
S. Potassium	15	5.01±1.54	5.20 (3.7-6.00)	2.50-8.20
S. Ferritin	4	576.25±448.62	450.00 (228.75-1050)	205-1200
PTH	12	613.75±760.89	269.00 (188.75-777)	105-2505

Table 4 -a, b, and c. Gender difference regarding demographic characters, clinical variables, and laboratory variables

Table 4-a: Gender difference regarding demographic characters

	Male	Female	p
	Mean±SD/ Median (Q1-Q3)		
Age	48.48±9.67	51.12±9.59	0.279#
DBW	59.22±16.63	60.09±10.76	0.789#
BMI	22.86 (20.20-30.11)	22.49 (20.33-25.48)	0.436*
Dialysis hours	12.00 (12.00-12.00)	12.00 (12.00-12.00)	0.684*
Sessions per week	3.00 (3.00-3.00)	3.00 (3.00-3.00)	0.571*
Systolic Blood Pressure	120.00 (107.50-140.00)	120.00 (110.00-130.00)	0.989*
Diastolic Blood Pressure	80.00 (70.00-90.00)	80.00 (70.00-80.00)	0.873*
Age of patients at start of dialysis	25.00 (20.00-36.00)	26.00 (21.00-33.25)	0.699*
Dialyzer size	1.60 (1.40-1.60)	1.40(1.40-1.60)	0.687*
UF (L/session)	2.50 (2.00-3.50)	2.50 (2.00-3.13)	0.877*

Table 4-b. Gender difference regarding clinical variables

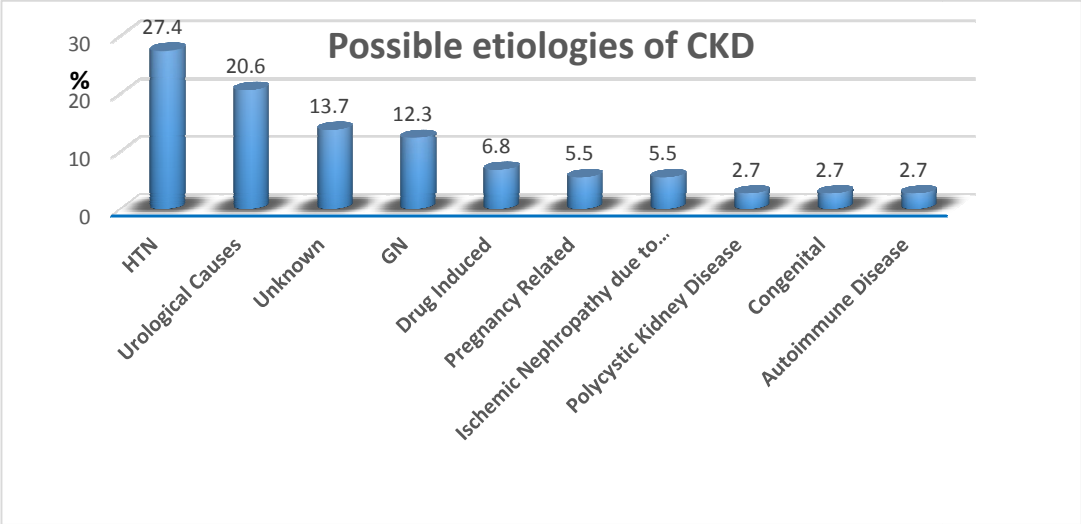
		Gender				P
		Female		Male		
		N*	% within Gender	N*	% within Gender	
Bone Disease	No	13	59.1%	23	50.0%	0.482*
	Yes	9	40.9%	23	50.0%	
HTN	No	8	34.8%	25	50.0%	0.225*
	Yes	15	65.2%	25	50.0%	
Smoking	No	23	100.0%	48	96.0%	1*
	Yes	0	0.0%	2	4.0%	
Ischemic Heart	No	18	78.3%	41	82.0%	0.706*
Disease	Yes	5	21.7%	9	18.0%	
Acute	No	14	60.9%	41	89.1%	0.006
Complication	Yes	9	39.1%	5	10.9%	
Wheeling chair	No	13	72.2%	24	63.2%	0.503*
	Yes	5	27.8%	14	36.8%	
Children after	No	20	87.0%	27	54.0%	0.008#
HD	Yes	3	13.0%	23	46.0%	

**p value was measured with Chi square*

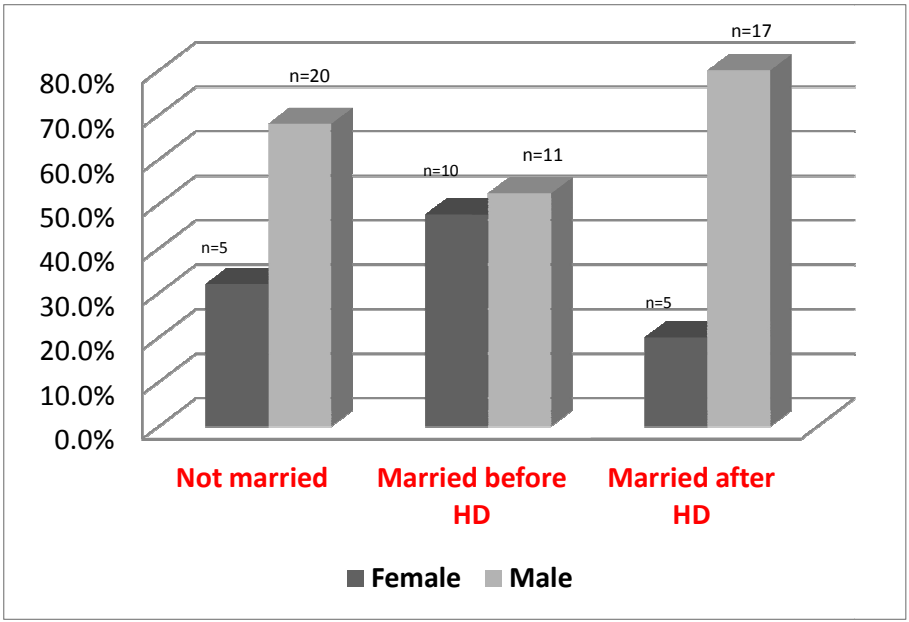
Table 4-c. Gender difference regarding laboratory variables

	Male	Female	p
	Mean±SD/ Median (Q1-Q3)		
Haemoglobin	10.40 (9.00-11.50)	10.30 (9.00-11.55)	0.743*
Albumin	.3.75 (3.05-4.00)	3.80 (3.50-4.30)	0.436*0.743*
Ca	9.00 (8.55-9.60)	1 8.75 (8.35-9.45)	0.582*
Urea Reduction Ratio	0.64 (0.57-0.71)	0.66 (0.62-0.74)	0.339*
Creatinine	7.65 (6.23-9.00)	7.80 (6.30-10.10)	0.752*
Ph	5.25 (4.48-7.43)	4.50 (3.65-5.35)	0.109*
SK	4.98 (3.83-5.73)	5.20 (3.25-6.35)	0.768*
Ferritin	600 (600-600)	300 (250)	1
PTH	900 (211)	250 (162.5-397)	0.209

#p value was measured by Fisher-Exact test.N is the number of available data.*p value was measured by Mann-Whitney test*
#p value was measured by T test



Graph 4. Possible etiology of CKD in the studied group



Graph 5. Relation between Gender and marital status

4. DISCUSSION

Although maintenance dialysis prevents death from uremia, mortality among patients with ESRD remains high. Most of the data concerning the survival of patients treated with maintenance dialysis therapies published in the literature over the years are limited to five to ten-year survival after the commencement of RRT. Long-term survival on HD had been claimed for individual patients. The aim of the current study is to identify ESRD patients who have spent more than 20 years on hemodialysis in Egypt and their health-related characteristics.

In the current work, 73 patients had been on HD from 20 to 30 years not interrupted by transplant periods, and this is partially in accordance with many international studies. Kirkus et al. have described two patients who had been dialyzed for 35 years, interrupted by short transplant periods [4]. While Heaf et al. stated that patients should be aware that there is no theoretical upper limit for patient survival on HD [2].

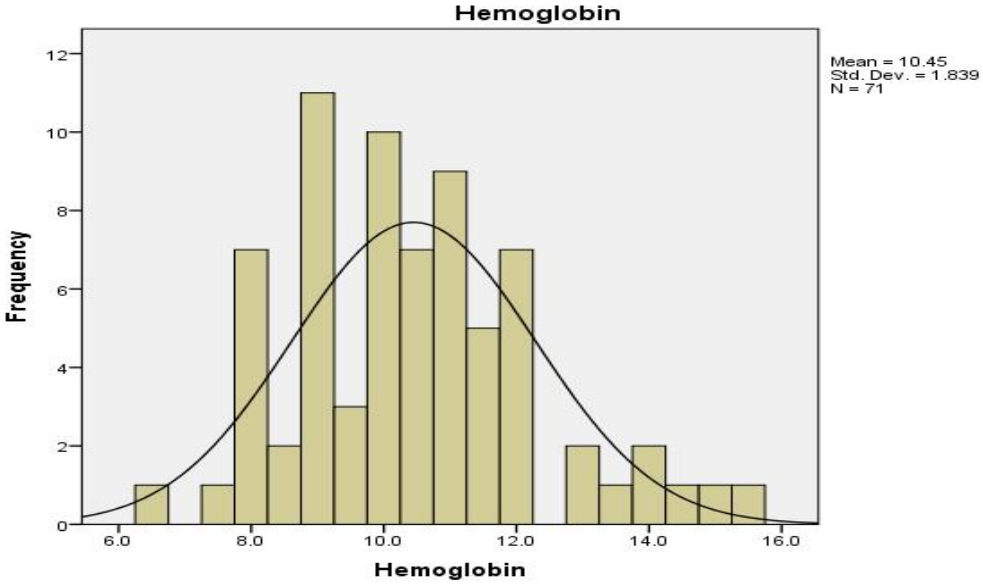
Additionally, Buturovic- Ponikvar (2009) suggested that hemodialysis is neither better nor much worse than kidney transplantation [5].

Long term survival on HD in this survey could be attributed to many factors such as starting dialysis at a young age (mean age 27.8 years old), mostly nonsmokers, and none of them was diabetic, only 27 % having CKD due to HTN and characterized by compliance to local dialysis guidelines. It was observed, during the collection of data, that there was a strong presence of acceptable family support to this group of HD population. This is supported by many international reports that referred to factors associated with long survival on HD including younger ages at the start of HD, norm-tension, absence of diabetes and psychological factors; patient compliance, and willingness to live [6], [2].

In the current study, the majority of cases have functioning A-V Fistula. This is similar to a national study organized by ElSharkawy and his colleagues, 2017 [7]. The A-V fistula is considered the best access for HD because of its lower frequency of complications, higher access survival rate, and decreased mortality when compared with either arterio-venous grafts or central venous dialysis catheters. Woods and his associates, 1997, support this finding [8].

The existing survey encountered two patients who persistently insisted to receive only two sessions/week; both of them had low body mass index and low dry body weight (48, 41 kilograms). This finding is reinforced by Weigert et al, 2020 who found that significantly higher treated blood volume per kilogram per session resulting in significantly higher adequacy of HD [9]. However, the presence of low birth weight in these two long-term patients on HD is in divergence with Cohen, 2019 who stated that there is no benefit to having obesity for patients with early stages of CKD, while thin patients on HD have more mortality risks than obese ones [10]. The reason for this survival benefit could be that patients with obesity have a greater caloric reserve making them more resistant to weight loss and causing them to live longer [10].

The commonest identifiable potential causes of CKD on HD in this studied group are HTN, urological etiology then-unknown etiology in a chronological arrangement. This is in dissimilarity with the other national studies that were considered the first three potential causes of CKD; HTN, DM, unknown etiology; to be variable in different studies [11-16]. The distribution of possible etiology of CKD in this survey could be a reason for the long-term survival of the studied group; while there is no diabetes mellitus as a possible etiology; many patients have tubule-interstitial diseases with supposed renal reserve for a few years after the start of HD.



Graph 6. Histogram of Hemoglobin distribution in the studied group

One of the characteristics of these long-term patients on HD is the presence of a low frequency of acute complications (<20 % of patients) that could occur during HD sessions. The low frequency of acute complications could be attributed to lower associated comorbidities especially the absence of diabetes and diabetic nephropathy. This finding is in disagreement with a study on Egyptian HD patients performed by El-Sheikh and El-Ghazaly, 2016, showed that 23% of the study population complained of hypotension, 8%complained of Cramps while 19% of the patients reported complaints of dizziness; however their group of patients has diabetic nephropathy in 30 % [17].

The present survey showed some chronic complications and some associated comorbidities. Firstly, 47% of patients have one or more skeletal manifestations around 60 % of them using wheeling chair or walking aid, which might be due to CKD-MBD, and or HD associated amyloidosis. Many studies supported our findings in these aspects; severe spinal cord compression and spondyloarthropathy due to β-M amyloid deposition occurs often after ten years of HD while β-M amyloidosis pathology is not well established and poorly understood. (Habas et al. as well as Otsubo et al, 2007who observed that Hemodialysis-associated amyloidosis was common in long-term survivors [3], [6]. Another study reported that CKD–MBD, and hyperparathyroidism is a common etiology that could be related to skeletal complain in long-term patients on HD [18]. Secondly, the frequency of HTN increased from 27 % at the start of HD to near 55 % at the time of the study, and only 19% of them having IHD while none of them having DM as comorbidity at the time of the study. Despite the high prevalence of comorbidities, there is a long-term follow-up on HD. This may be attributable to the recent advances in hemodialysis technologies similar to a previous publication [19].

More than three-quarters of this group of patients had positive serology tests for HCV antibodies and this could be related to the higher frequency of HCV antibodies positive in relation to hemodialysis vintage. This finding is strengthened by many various studies that found higher frequencies of positive HCV antibodies with the increase in hemodialysis duration [20-21].

There are comparable results in different variables between both genders of the studied group. However, there is a statistically significant higher rate of acute complications including hypotension and muscle cramps in the female gender. This is in concordance with Bilal et al, 2020 that found the incidence of some dialysis-associated complications is more in females, but they studied CKD secondary to diabetes mellitus [22]. Infertility is markedly more common in women and men with CKD, as compared to the general population. Multiple factors contribute to the reduction in female and male fertility, alongside progressive impairment of the hypothalamic-pituitary-gonadal axes associated with increasing severity of kidney dysfunction. Approaches to improve fertility in CKD focus on the intensification of hemodialysis [23]. The frequency of marital status in the current group is higher in the male gender than in females. Hecking and his colleagues, 2014 who found that men on HD were more frequently married, support this finding [24]. There is statistically significant higher fertility after hemodialysis in the male gender in the current studied group. Early abortion could occur in females on HD and passed unnoticed that possibly will result in lower apparent fertility in females than males.

An idea about good nutrition can be anticipated from reasonable levels of blood hemoglobin, serum creatinine, serum phosphorus and serum albumin. Moreover, near target level of URR gives an idea about accepted range of adequacy of dialysis. These satisfactory laboratory data and reasonable dialysis adequacy are expected to lead to a better health related quality of life in patients with long-term HD.

Unfortunately, not all laboratory investigations dictated by the KIDOKI guidelines [25] were fulfilled in all the patient population in the present study; serum ferritin was performed for 5% of patients while parathyroid hormone was performed for 16.4% of patients. These limitations are similar to another recent national report that showed low frequencies of the same laboratory tests [26]. It is suggested that the national nephrology community and different nephrology societies pay more attention to the serial laboratory follow up of HD patients with special concern towards iron studies and parathyroid hormone assay.

5. CONCLUSION

Long-term dwellers on hemodialysis therapy are not uncommon in Egyptian ESRD patients.

Patients could live longer on HD, particularly if they were offered good dialysis care. Furthermore, among the special characteristics of these long-term dwellers are younger age at the start of HD with absence of diabetes mellitus and being compliant to dialysis and health care staff instructions and enjoying family support. Compared to females, males had less frequent acute complications on HD, were more frequently married, and had better fertility.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

DECLARATION

The authors declare that there is no conflict of interest. We, hereby declare that this manuscript is an unpublished work which is not under consideration elsewhere and the results contained in this paper have not been published previously in whole or part.

DATA AVAILABILITY

All data generated or analyzed during this study are included in this published article.

INFORMED CONSENT

Informed consent was obtained from each study participant.

ETHICAL APPROVAL

All procedures were approved by the research ethics committee at the ministry of health, Egypt and carried out under Mansoura University Hospital guidelines.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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