



ISSN NO. 2320-5407

Journal homepage: <http://www.journalijar.com>

INTERNATIONAL JOURNAL
OF ADVANCED RESEARCH

RESEARCH ARTICLE

Demographic study with risk factors of hemodialysis patients in Damietta Governorate, Egypt

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Manuscript Info

Manuscript History:

Received: 14 September 2015

Final Accepted: 22 October 2015

Published Online: November 2015

Key words:

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Abstract

Background: The causes of end-stage renal disease (ESRD) vary from one geographical area to another due to genetic and environmental factors. Renal registries offer an important source of information for characterizing the ESRD population, describing the prevalence and incidence of ESRD and investigating relationships among their demographics, treatment modalities, morbidity and mortality. The aim of this study was to map and define the magnitude of ESRD on maintenance hemodialysis (HD), its epidemiology, prevalence, etiology, and risk factors in Damietta Governorate, Egypt.

Subjects and methods: This descriptive study was carried out in Damietta Governorate, Egypt, during the period from January 2013-December 2013. All dialysis centers in Damietta Governorate (11 centers); governmental and private were included, serving a total number of 673 ESRD patients. Face to face interviews and renal registries using a data collection-complementary questionnaire (divided into 4 parts) have been conducted to patients at the dialysis centers. The first part: demographic information (gender, age, place of living, marital status, number of children, occupation, special habits, weight, height, and menstrual cycles in females). The second part: dialysis data (type of dialysis, access, duration and number of sessions per week, type of dialyzer and dialysate, and complications during and in-between dialysis sessions). The third part: medical history and risk factors. The fourth part: laboratory investigations.

Results: The prevalence of ESRD under HD in Damietta Governorate, Egypt in the year 2013 was found to be 611 per million population (pmp). The total number of ESRD patients under HD was 673 patients, in 11 centers. Their data were as follows; mean age $\pm$ SD (52.73 $\pm$ 13.31 years), males (61.4%), females (38.6%), urban areas (52.0%), rural areas (48.0%), not working (86.3%) and furniture laborers (34.6%). Hypertension was the cause of ESRD in 55.1% of patients, followed by obstructive uropathy in 19.0%, and diabetes mellitus in 17.9%. The commonest complications during dialysis were hypotension in 52.1% of patients, followed by hypertension in 16.5%, while in-between sessions, the commonest complications were hypertension in 45.9% of patients, followed by itching in 13.5%. The number of patients per 10.000 population varied among centers; being highest in Kafr Saad (41/10.000) and lowest in New Damietta (3/10.000).

Conclusion: Hypertension, obstructive uropathy and diabetes mellitus were found to be the commonest causes of ESRD in dialysis patients in Damietta Governorate, Egypt. The prevalence of ESRD varied among centers, reflecting genetic and environmental factors.

INTRODUCTION

The causes of chronic renal failure (CRF) vary from one geographical area to another due to genetic and environmental factors (1). The prevalence of end stage renal disease (ESRD) is increasing worldwide; being 1500 per million population (pmp) in the United States, and about 800 pmp in the European Union. In developing countries, the prevalence may vary from less than 100 pmp in sub-Saharan, to about 400 pmp in Latin America (2). In Egypt, the estimated annual incidence of ESRD is around 74 per million, and the total prevalence of patients on dialysis is 264 pmp (3). The prevalence of chronic kidney disease (CKD) in developing countries is expected to dramatically increase over the next two decades due to increases in the prevalence of major risk factors including diabetes, hypertension, and cardiovascular disease (4). There is strong evidence supporting the detection and treatment of CKD for people at high risk and in developing countries. Simple and inexpensive measurements for proteinuria, and if affordable, glomerular filtration rate (GFR), can be used for case finding, especially in high risk populations, including people over 55 years and those with diabetes, hypertension, cardiovascular disease, and a family history of kidney disease (5). Renal registries offer an important source of information on several aspects of CKD. They are useful in characterizing the ESRD population, describing the prevalence and incidence of ESRD and trends in mortality and disease rates, and investigating relationships among patient demographics, treatment modalities, and morbidity. Renal registries are very useful to gain insight on the burden of kidney diseases and allow comparisons among countries (6). The demographics of the Japanese dialysis population have been markedly changed in terms of age, primary diagnoses, and dialysis (7). Demographic data in El-Minia Governorate, Egypt had shown that ESRD prevalence is increasing, as it jumped from 250 pmp in the year 2002, to 308 pmp in the year 2006 (8). The aim of this study was to map and define the magnitude of ESRD on maintenance hemodialysis (HD), its epidemiology, prevalence, etiology, and risk factors in Damietta Governorate, Egypt.

Subjects and methods:

This descriptive study was carried out in Damietta Governorate, Egypt, during the period from January 2013-December 2013. All dialysis centers in Damietta Governorate (11 centers); governmental and private were included, serving a total number of 673 ESRD patients. Face to face interviews and renal registries using a data collection-complementary questionnaire (divided into 4 parts) have been conducted to patients at the dialysis centers. The response rate was 100 % and no exclusion criteria were included. The first part: demographic information (gender, age, place of living, marital status, number of children, occupation, special habits, weight, height, and menstrual cycles in females). The second part: dialysis data (type of dialysis, access, duration and number of sessions per week, type of dialyzer and dialysate, and complications during and in-between dialysis sessions). The third part: medical history and risk factors (diabetes mellitus, hypertension, glomerulonephritis, polycystic kidney disease, lupus nephritis, urinary tract problems, HCV, HBV, Bilharziasis, vasculitis, rhabdomyolysis, cryoglobulinemia, antiphospholipid syndrome, contrast nephropathy, post partum renal failure, drug toxicity, family history of renal disease, history of renal transplantation, malignancy, or unknown causes) . The fourth part: Laboratory investigations (pre and post dialysis serum creatinine and blood urea, serum uric acid, blood hemoglobin, serum albumin, liver enzymes (ALT and AST), serum calcium and phosphorous, serum parathyroid hormone (PTH), fasting blood glucose (FBS), and lipid profile). Statistical Package for Social Science (SPSS) was used to analyze data. Permission was obtained from the Egyptian Ministry of Health in Damietta and patients were informed about the aim of the study, and that their participation will be as volunteers.

Results:

This study was carried out in Damietta Governorate, Egypt, during the period from January 2013 to December 2013 including all governmental and private dialysis centers (11 centers) in Damietta governorate. It included 673 patients, (0.06%) of total population in Damietta, which constitute 100% of total number of ESRD patients under dialysis in Damietta Governorate according to the records of the Ministry of Health. Damietta Governorate is located in the North East of Egypt, and its total population is about one million and one hundred thousands. The prevalence of ESRD under hemodialysis (HD) in Damietta Governorate, Egypt in the year 2013 was found to be 611 per million population (pmp). All ESRD patients were on HD, as there is no peritoneal dialysis in Damietta. **Table (1)** shows demographic data of studied ESRD patients under HD, in Damietta Governorate, Egypt. **Table (2)** shows demographic data as regards location and number of dialysis centers, number of patients, total population, number of patients per 10.000 population, main cause of ESRD and its percentage. **Figure (1)** shows a map for Damietta Governorate, Egypt and the distribution of dialysis centers and number of patients in each center. **Figure (2)** shows causes of ESRD in patients under HD in Damietta Governorate, Egypt. **Table (3)** shows dialysis data of ESRD

patients under HD in Damietta Governorate, Egypt. **Figure (3)** shows complications during dialysis in Damietta Governorate, Egypt. **Figure (4)** shows complications in-between dialysis sessions in Damietta Governorate, Egypt. **Table (4)** shows laboratory data of studied ESRD patients under dialysis in Damietta Governorate, Egypt.

Table (1) Demographic data of studied ESRD patients under HD, in Damietta Governorate, Egypt.

Parameter	Number	%	Parameter	Number	%
Total number under HD	673 ESRD patients	0.06% of total population	No special habits	421 patients	62.6%
Total number of centers	11 dialysis centers		Cigarette smokers	188 patients	27.9%
Urban areas	350 patients	52.0%	Goza smokers	10 patients	1.5%
Rural areas	323 patients	48.0%	Both	54 patients	8.0%
Males	413 patients	61.4%	Married	514 patients	76.4%
Females	260 patients	38.6%	Widowed	80 patients	11.9%
Mean age $\pm$ SD years	52.73 $\pm$ 13.31 years	Range (10-95) years	Single	59 patients	8.8%
Not working currently	381 patients	86.3%	Divorced	20 patients	3.0%
Working currently	92 patients	13.7%	1-3 Offspring	304 patients	45.2%
Furniture laborers	233 patients	34.6%	4-6 Offspring	273 patients	40.6%
Public sector	137 patients	20.4%	No offspring	81 patients	12.0%
Farmers	111 patients	16.5%	$\geq$ Offspring	15 patients	2.2%
Housewives	102 patients	15.2%	BMI 18.5-24.9	251 patients	37.3%
Private sector	78 patients	11.6%	BMI 25-29.9	243 patients	36.1%
Absent menstrual cycles	198 female patients	76.2%	BMI < 18.5	63 patients	9.4%
Irregular cycles	33 female patients	12.6%	BMI 30-34.9	97 patients	2.8%
Regular cycles	29 female patients	11.2%			

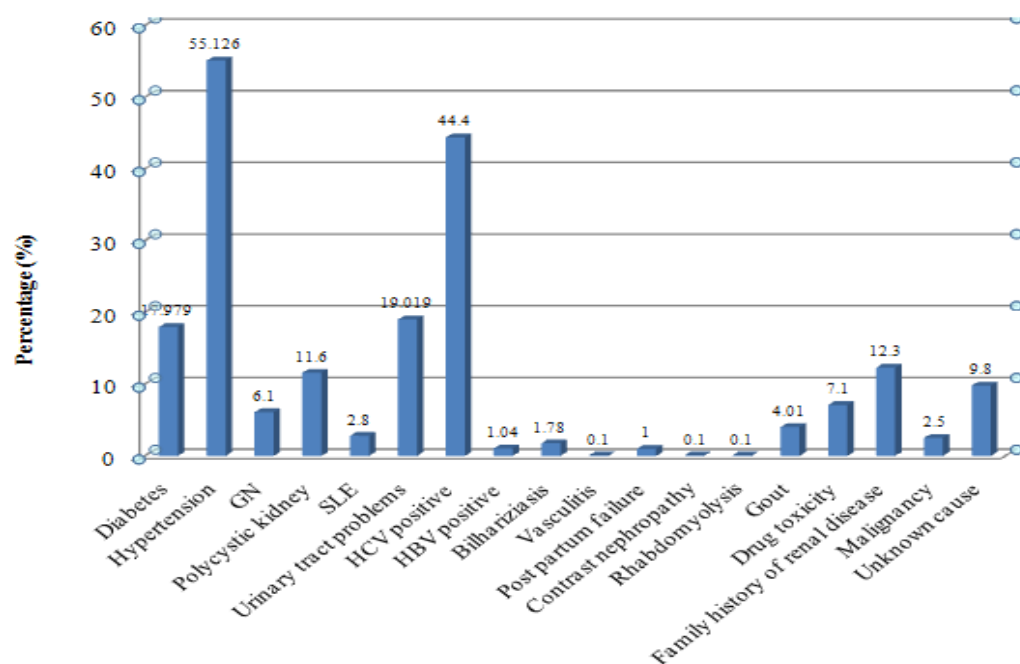
Table (2): Demographic data as regards location and number of dialysis centers, number of patients, total population, number of patients per 10.000 population, main cause of ESRD and its percentage (Total number of ESRD patients on HD=673 patients).

Location	Total population	Number of dialysis centers	Number of ESRD patients on HD	Number of patients per 10.000 population	Main cause of ESRD	%
Damietta	222.000	3	346	16/10.000	Hypertension	41%
Kafr Saad	18.586	1	77	41/10.000	Hypertension	49%
Al-Zarqa	19.253	1	62	32/10.000	Hypertension Diabetes mellitus	40% 36%
Farskur	34.349	1	45	13/10.000	Hypertension Diabetes mellitus	38% 36%
Ezbet Al-Borg	36.018	1	45	13/10.000	Hypertension Obstructive uropathy	41% 35%

New Damietta	135.000	1	37	3/10.000	Hypertension	51%
Kafr Al-Battekh	31.664	1	22	7/10.000	Polycystic kidney disease	44%
Al-Rouda	23.065	1	21	9/10.000	Unknown causes	
Met Abu Ghaleb	16.019	1	18	11/10.000	Unknown Causes	

Figure (1): A map for Damietta Governorate, Egypt and the distribution of dialysis centers and number of patients in each center.



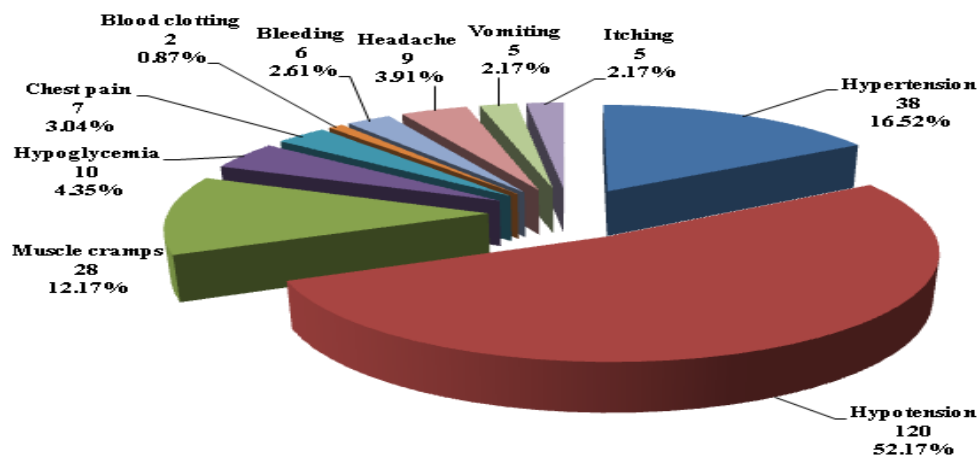
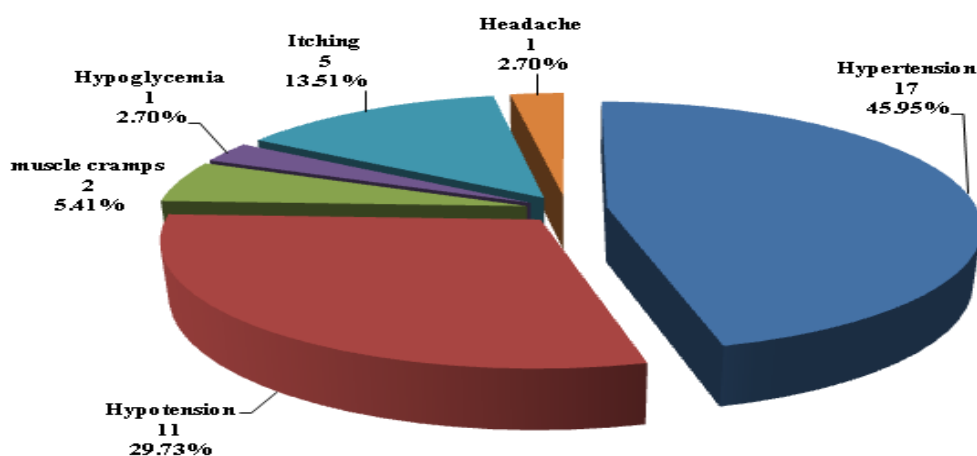
Figure (2): Causes of ESRD in patients under HD in Damietta Governorate, Egypt.**Table (3): Dialysis data of ESRD patients (n=673) under HD in Damietta Governorate, Egypt.**

Parameter	Number	%	Parameter	Number	%
Type of dialysis			Iron supplement		
Hemodialysis	673 patients	100 %	Not supplied	399 patients	59.3 %
Vascular access			Supplied	274 patients	40.7 %
A-V fistula	621 patients	92.3 %	Type of iron		
Temporary catheter	40 patients	5.9 %	Iron dextran	142 patients	51.8 %
Permanent catheter	12 patients	1.8 %	Iron sucrose	132 patients	48.2 %
Access infection	476 patients	70.7 %	Erythropoietin		
Single access infection	88 patients	13.1 %	Supplied	589 patients	87.5 %
Repeated access infection	109 patients	16.2 %	Not supplied	84 patients	12.5 %
Number of sessions/week			Frequency of erythropoietin/week		
Three sessions/week	646 patients	96.0 %	Twice/week	301 patients	51.1 %
Two sessions/week	27 patients	4.0 %	Once/week	248 patients	42.1 %
Duration of			Three times/week	40 patients	6.8 %

each session					
Four hours	463 patients	68.8 %	Complications during dialysis		
Three hours	210 patients	31.2 %	Absent	443 patients	65.8 %
Type of dialyzer			Present	230 patients	34.2 %
Polysulfone	673 patients	100 %	Complications in-between sessions		
Type of dialysate			Absent	636 patients	94.5 %
Sodium bicarbonate	479 patients	71.2 %	Present	37 patients	5.5 %
Sodium acetate	194 patients	28.8 %	Weight gain in-between sessions	mean±SD 2.55 ± 1.05 kg	Range (0.5-5) kg
Pump speed					
300 ml/min	535 patients	79.5 %			
250 ml/min	138 patients	20.5 %			

Table (4) shows laboratory data of studied ESRD patients under dialysis in Damietta Governorate, Egypt.

Parameter	No. of patients	%	Mean ±SD	Range	Parameter	No.	%	Mean ±SD	Range
Serum creatinine pre-dialysis	458 patients	68.1 %	8.65±2.38 mg/dl	2.3-19 mg/dl	Serum creatinine post-dialysis	652 patients	96.9 %	4.08±1.21 mg/dl	1.7-10 mg/dl
Blood urea pre-dialysis	458 patients	68.1 %	155.3 ± 48.2 mg/dl	51-340 mg/dl	Blood urea post-dialysis	652 patients	96.9 %	73.6±27.2 mg/dl	23-210 mg/dl
Serum uric acid	197 patients	26.3 %	6.2±1.5 mg/dl	3.5-11 mg/dl	Blood Hb	673 patients	100 %	9.9±1.7 gm/dl	5.3-17.2 gm/dl
AST levels	218 patients	32.4 %	25.3 ± 11.9 IU/l	10-120 IU/l	ALT levels	218 patients	32.4 %	27.6±19.5 IU/l	10-237 IU/l
Serum calcium	436 patients	64.8 %	8.8±0.9 mg/dl	5.7-12.6 mg/dl	Serum phosphorous	436 patients	64.8 %	5.6±1.5 mg/dl	2-12.8 mg/dl
Serum PTH	79 patients	11.7 %	301.9 ± 402.8 pg/ml	5-1900 pg/ml	Serum albumin	254 patients	37.7 %	3.8±0.5 gm/dl	2.0-5.1 gm/dl
Fasting blood glucose	218 patients	32.4 %	111.9 ± 39.3 mg/dl	60-280 mg/dl	Blood cholesterol levels	94 patients	13.9 %	182.1 ± 45.9 mg/dl	80-371 mg/dl

Figure (3): Complications during dialysis in Damietta Governorate, Egypt.**(4): Complications in-between dialysis sessions in Damietta Governorate, Egypt.**

Discussion:

This study represents the first comprehensive description of the epidemiology of dialysis-treated end-stage renal diseases (ESRD) in Damietta Governorate, Egypt. Demographic data and prevalence of risk factors for chronic kidney disease (CKD) among patients in Damietta Governorate have been collected in the year 2013. The total population in Damietta Governorate was about one million and one hundred thousand in the year 2013, and the prevalence rate of ESRD patients in Damietta who are under dialysis was found to be (611 pmp), which is higher than rates reported in El-Minia city (208 pmp), (8) Saudi Arabia (475 pmp) (9), Kuwait (240 pmp) and Oman (220 pmp) (10). Total number of ESRD patients under dialysis in Damietta was 673 patients, in 11 centers; Governmental and private. In the current study, the mean age was 52 ± 13 years, while in France (11), the median age of patients on renal replacement therapy (RRT) was 70.4 years. This increase in median age in patients in the European countries may reflect the improvement in ESRD care that requires strong support from the government. This may reflect also, that ESRD occurs in Damietta, Egypt, at younger age, which may be due to certain risk factors in the environment, which should be identified and prevented. Prevalence rate was substantially higher in the urban areas, with center to center variation, being highest in Kafr Saad (41/10,000) and lowest in New Damietta (3/10,000). Regional variation in incidence of ESRD has been reported in other studies as in South Asia, a large number of people live in extreme poverty in rural areas and have limited access to healthcare (12). In our study male patients were more than female patient (61.4% vs. 38.6%) which is consistent with studies from most other countries where

males outnumbered females in the prevalent and incident populations **(13)**. Also, we found that 36.1% of patients were overweight, and 14.4% of them were obese, while 2.8% had morbid obesity. In addition, 37.7% of patients had normal body weight, while 9.4% of them were underweight. This study showed that 37.4% of ESRD patients were smokers. Studies conducted in USA showed that obesity and smoking are important independent risk factors for CKD and ESRD **(14)**. The majority of participants (86.3%) were jobless at the time of the study, ESRD was found to be more common among furniture laborers (34.6%) in our study, which may be because furniture workers constitute a large section of Damietta population. A large number of patients from rural areas were farmers (16.5%) and were exposed to pesticides, which may be an etiological factor for ESRD. A study by **(15)** reported an evidence of greater inhibition of acetyl cholinesterase among patients with chronic renal dysfunction in the same study area compared with the patients with chronic renal dysfunction from non agricultural area. Hypertension, diabetes and obstructive uropathy were the commonest risk factors for development of CKD in our study. Center to center variation was also observed, as regards the leading cause of ESRD. Hypertension was the cause of ESRD in about 55% of patients, while it accounted for about 20% of cases of ESRD in El-Minia city, Egypt **(8)**. In Iran, the most common cause of ESRD among hemodialysis (HD) patients was hypertension (30.5%) **(1)**, which is in agreement with the results of the current study. Diabetic nephropathy was responsible for about 18% of causes of ESRD in this study, while it was 8% El-Minia city **(8)**. The prevalence of diabetic nephropathy is estimated to be 14-16% in South Africa, 23.8% in Zambia, 9% in Sudan, and 6.1% in Ethiopia **(16)**. This study showed that there is an association between diabetes mellitus and hypertension with the development of ESRD. This can be explained on the light of rapid urbanization, transformation into sedentary life style, increase in prevalence and incidence in diabetes mellitus and hypertension. Lack of compliance of patients on life style changes and medications prescribed for diabetes mellitus and hypertension may play a role in the acceleration of their passing into ESRD and the start of dialysis. Chronic glomerulonephritis was the cause of ESRD in 6.1 % of the patients in our study, which reflects the high prevalence of bacterial, viral and parasitic infections such as schistosomiasis and nephritogenic strains of hemolytic streptococci. Higher rates were reported in China and Kuwait of approximately 35% **(17)**. This study showed that 19% of patients have urinary tract problems like infection, obstruction, ureteric stricture or reflux which may cause obstructive uropathy. A study conducted in Saudi Arabia showed that obstructive uropathy causes about **(8%)** of incident of ESRD **(18)**. In the US, according to the USRDS data, analgesic nephropathy was seen in only 0.2% of patients, while it was 6% in the current study; this reflects awareness of the people themselves in the US about the risk of excessive intake of analgesics. The etiology of ESRD was unknown in the US in only 3.7% of the patients **(19)**, while in the current study the etiology of ESRD was unknown in 10% of cases. This difference reflects lack of awareness of the treating physicians to refer patients to nephrology centers, as well as lack of awareness of the patients themselves about the proper time to seek medical advice. This is in agreement with **(20)** who concluded that late referral to nephrology is associated with greater risk of death in new patients with ESRD and more frequent pre-ESRD care can increase survival benefits. We can see that family members with a medical history of positive renal disease and ESRD are more likely to develop ESRD (12.3 % of patients in our study), this can be explained on the light of genetic factors can play a role in progressive renal failure. Furthermore, this result agrees with other studies conducted in the USA that indicates an association between family history and incidence of ESRD **(21)**. Polycystic kidney disease was the main genetic disease that causes ESRD with a percent of (11.6%) in this study, as in the US **(22)**. Patients with ESRD from chronic systemic lupus erythematosus (SLE) represent 1.5% to 2.0% of all patients on dialysis in the United States and 1% of all patients with lupus **(23)**, while in the current study about 3% of patients developed ESRD due to lupus nephritis. The HCV infection continues to be a major disease burden on the world. For example, the prevalence of HCV antibodies among dialysis patients has been reported to range from: 8 to 36% in North America, 39% in South America, 1 to 54% in Europe, 17 to 51% in Asia 1.2 to 10% in New Zealand and Australia **(24)**. In our study the prevalence of HCV antibodies among dialysis patients was 44%, which may be due to frequent blood transfusions, long duration of end-stage renal disease, mode of dialysis, breakdown in standard infection control practices and high prevalence of HCV infection in Egypt. The observed prevalence of HBV infection in our study was 1%, while HBV sero-positivity was 4.6% in the Saudi HD population **(25)**. In general, the prevalence and incidence of HBV and HCV infections in HD patients reflects the prevalence of these infections in the general population. There is general consensus that the target of anemia treatment is to achieve partial anemia correction, which means Hb in the range of 11 to 12 g/dl **(26)**. In our study all patients had blood test for hemoglobin level as a routine laboratory investigation monthly, 51% of patients received erythropoietin twice per week and 6.8 % only received it three times per week. This may be due to high cost of erythropoietin (EPO) and less than full dose was supplied by the government. This high cost of EPO led patients to receive many blood transfusions to treat anemia. In our study 100% of ESRD were under HD, as it is the only available modality of renal replacement therapy (RRT) in Damietta Governorate and 96% of patients are haemodialyzed three times a week for maintenance dialysis, and dialysis duration is 4 hours in 69% of them (12 hours/week). While the patients are having

improved quality of life with maintenance HD, it is also accompanied with complications. In this study the complications of HD occurred in 40% of the patients, either during dialysis or in-between sessions. The most frequent complication which was found to occur during dialysis was hypotension that observed in 52% of patients, while it occurred in 30% of patients post dialysis. This is in agreement with a study in Pakistan, where hypotension occurred in 55% of patients during dialysis (27). It has been suggested that hypotension and associated symptoms may be related to the biochemical changes caused by cellulosic membranes or due to hypovolemia or excessive ultra filtration of water at the time of dialysis. The ultrafiltration depends upon the condition of the patient, if hypotension and hypovolemia is evident, then no ultrafiltration is advised. Hypertension is a major problem among patients with ESRD. Hypertension in most dialysis patients is mainly dependent on salt and water retention. Restricting fluid and salt intake and removing fluid during dialysis are effective in about 80% of cases. Anti-hypertensive treatment promotes dialysis hypotension and prevents adequate fluid removal during dialysis (28). In our study, hypertension occurred in 16% of patients during dialysis and in 46% after dialysis. Cardiac complications like chest pain and arrhythmias occurred in 3.04% of patients. These appeared to occur mostly after the first three hours of dialysis, may be due to rapid electrolyte and fluid shifts, acid base alterations, alteration in parathyroid and calcium metabolism, reduced oxygen saturation levels and changes in erythrocytes potassium levels. Muscle cramps, headache, hypoglycemia and itching were complications observed in 12%, 4%, 4% and 2% respectively. The commonly observed GIT related complications during HD included vomiting, pain in abdomen and bleeding, 2% of the patients had vomiting during dialysis. These results are low in comparison to the results of the study conducted by (27), where vomiting occurred in 60% of males and 40% of females, bleeding occurred in 55% of patients. Heparinization during HD can precipitate upper gastrointestinal bleeding responsible for haematemesis, though it is not a very common problem. In this study, six patients experienced bleeding. In our study, about 30% of patients had a history of either single or frequent vascular access infection which is higher than rate reported by (28), in a study done in Kuwait, where the vascular access infection observed in about 20% of patients. Lack of hygiene by the patients and incomplete sterile steps by the nurses may be the cause. Strengths of this study come from the inclusion of all current dialysis units in Damietta Governorate, Egypt, to ensure collection of the most possible complete data. Limitations include reliance on limited and partially incomplete medical records and lack of histology to confirm the cause of ESRD in the majority of cases. We have described the epidemiology of ESRD among patients receiving dialysis but there are no data regarding patients with ESRD who died without the benefit of dialysis. Incidence of new cases of ESRD getting HD was not studied. It is therefore likely that the true incidence of ESRD is higher than what we have observed. Further research is required to investigate how many patients with ESRD are not offered dialysis and the reasons for this.

Acknowledgement:

Special thanks to Dr Azza M Abu Mustafa, Nephrology Center, Damietta General Hospital, Egypt, for her great help in this study.

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