

**An-Najah National University
Faculty of Graduate Studies**

**Adequacy of Hemodialysis among End Stage Renal
Disease Patients at Al-Watani Hospital**

**By
Allam Muhammad Abdel-Hafiz Rizqallah**

**Supervisor
Dr. Nael Abu -Hasan**

**Co-supervisor
Dr. Hasan Hijaz**

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This Thesis was defended successfully on 6/11/2006 and approved by

Committee members

1. **Dr. Nael Abu-Hasan (Chairman)**
2. **Dr. Hasan Hijaz (Co-supervisor)**
3. **Dr. Abdullah Al-khateeb (External examiner)**
4. **Dr. Adham Abu Taha (Internal examiner)**

Signature

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Dedication

To my wife for her love and patience

To my family with love and respect

To my little kids

To my friends

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List of Abbreviation

CKD: Chronic Kidney Disease
ESRD: End Stage Renal Disease
USA: United States of America
USRDS: United States Renal Data System
GFR: Glomerular Filtration Rate
SUN: Serum Urea Nitrogen
ACE: Angiotensin Converting Enzyme
FSGS: Focal Segmental Glomerulosclerosis
NSAID: Non Steroidal Anti Inflammatory Drugs
CRI: Chronic Renal Insufficiency
VCUG: Voiding Cystourethrography
CrCl: Creatinine Clearance
RRT: Renal Replacement Therapy
CRF: Chronic Renal Failure
MDRD: Modification of Diet in Renal Disease
AVF: Arteriovenous Fistula
AVG: Arteriovenous Graft
URR: Urea Reduction ratio
HD: Hemodialysis
BUN: Blood Urea Nitrogen
SPSS: Social Package of Statistical Sciences

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Dr. Na'el Abu Al-hasan

Co-supervisor

Dr. Hasan Hijaz

Abstract

End stage renal disease is defined as total loss of kidney function, it is common problem worldwide caused by multitude of kidney disease either diabetes or hypertension, it is diagnosed by several laboratory and imaging diagnostic procedures. Hemodialysis is one of the treatment options in renal replacement therapy and many studies have shown strong correlation between hemodialysis dose and clinical outcome measured by kt/v. In the West Bank area of Palestine there are 8 dialysis centers serving 350 patients (at present), these units lack well trained technicians nephrologists and machines. The nurse patient ratio is 1:5 and due to limited access to dialysis units patients are noncompliance. The current study, aimed at evaluating hemodialysis adequacy among hemodialysis patients (88; 56.8% males, 43.2% females) enrolled at Al-Watani Hospital center at the city of Nablus. Data collected during June through July 2006 in a specially designed questionnaire. Data collected through direct interview after reviewing medical records of each patient and recirculation test carried out at the same dialysis session.

The results showed inadequate dialysis dose among 64% of the enrolled patients. Females showed a better clearance rate (44.7%) compared to males (32%). Percentage differences for kt/v values among males and females were statistically insignificant ($P = 0.429$). It was difficult to link between the other tested demographic variables and

clearance rates estimated by kt/v value. A strong association between higher clearance rates and both increased dialysis duration of each session (4hours; 69.2%) and frequency of dialysis per week (3 times/week; 48.3%) was noted and differences for both variables were statistically significant ($P = 000$). There was clear trend in improvement in kt/v values with increased ultra filtration. Low recirculation resulted in better dialysis adequacy (0-10%; 70.8% with $kt/v \geq 1.2$). Diabetic nephropathy represented 44.3% with a clearance rate of 28.2% ($kt/v \geq 1.2$). Clearance rates of 42.9% and 71.4% found among those suffering from glomerulonephrities and gouty, respectively. Hypertension cases represented by 2.3% of the study population, thus indicating that hypertension is not a major cause of ESRD among our population.

The results also showed that 68.2% of the study population was with AVF access for circulation and 42.3% of this group was with an acceptable clearance rates ($kt/v \geq 1.2$). Subclavian access was the major access among the rest of the patients with a clearance rate of 28.5%. Better clearance rates found in association with absence of patient complains (45.8% versus 29.7%). The findings of better clearance rates among those without any residual kidney function (44.3%) compared to those with some residual function (22.2%) was not clear and requires further investigations.

Our findings clearly showed that with increasing time and frequency of dialysis, blood flow rates, low recirculation percentages and reduction of intradialytic complain are associated with better dialysis adequacy. In accordance with such findings, the need for adoption and implementation of internationally used practice guidelines is essential in our dialysis system.

Chapter One
Introduction

1.1 Normal kidneys and their function

The kidneys are a pair of bean-shaped organs that lie on either side of spine in the lower middle of back. Each kidney weighs about $\frac{1}{4}$ pound and contains approximately one million filtering units called nephron. Each nephron is made of a glomerulus and a tubule. The glomerulus's is like a miniature filtering or sieving device while the tubule is a tiny tube like structure attached to the glomerulus. The kidneys are connected to the urinary bladder by which empties its contents to ureters. Urine is stored in the urinary bladder until emptied by the bladder. The bladder connected to the outside through urethra.

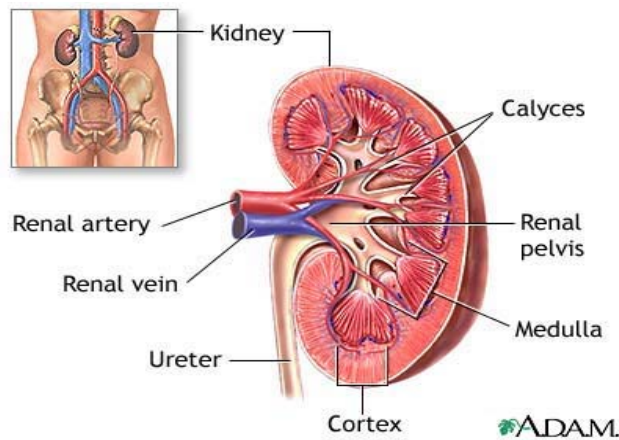


Figure 1.1 Anatomy of the kidney

The main function of the kidneys is to remove waste products and excess water from blood. The kidneys process about 200 liters of blood every day and produce about 2 liters of urine. Waste products generated from normal metabolic processes including the breakdown of active tissues, ingested foods, and other substances. Kidney also plays a major role in regulating levels of various minerals such as calcium, sodium, and potassium in the blood.

As the first step in filtration, blood delivered into the glomeruli by microscopic leaky blood vessels called capillaries. Blood filtered of waste products and fluid while red blood cells, proteins, and large molecules retained in the capillaries. In addition to wastes, some useful substances also filtered out and filtrate is collected in a sac called Bowman capsule and drains into the rest of the nephron tubules.

The tubules, next step in the filtration process, are lined with highly functional cells which process the filtrate reabsorbing water and several minerals useful to the body extra fluids including electrolyte and waste products where they are excreted to the pelvis through collecting tubules, then to the urinary bladder.

Kidneys also produce certain hormones that have important functions in the body, including the followings:

- Active form of vitamin D (calcitriol or 1,25 dihydroxy-vitamin D); involved in regulating calcium and phosphorus absorption from foods and promotes its storage in tissues
- Erythropoietin: Stimulates bone marrow to produce red blood cells
- Renin: Regulates blood pressure and blood volume.

1.2 Kidney failure and kidney disease

Kidney failure occurs when the kidneys partly or completely lose their ability to carry out normal functions. This situation considered dangerous as water, waste, and toxic substances build up and may result in other problems such as anemia, hypertension and bone disease.

Chronic kidney disease (CKD) usually results from gradual and usually permanent loss of kidney function over time and may take months

to years. Total loss of kidney function is known as End-stage renal disease (ESRD) where dialysis or transplantation is essential for survival. Unlike chronic kidney disease, acute kidney failure develops rapidly, over days or weeks; it usually develops in response to any disorder that might directly affect kidneys blood supply, or urine output. This condition is reversible and does not cause permanent damage. Treatments based in accordance to the underlying conditions. However, such disease conditions may progress to chronic kidney disease (Rose, Rennke, 1994).

1.3 Historical perspective of ESRD

Development of the indwelling arteriovenous Teflon shunt, Quinton-Scribner shunt, that maintenance hemodialysis became a reality for patients with ESRD in early 1960. At about the same time, advances in immunosuppression, such as development of azathioprine sodium (Immunuran), led to the modern era of kidney transplantation.

Studies reported from various neighboring as well as other countries showed that ESRD is a common problem worldwide. In Jordan, a total number of hemodialysis patients reported as 456 (Jordanian statistics, 1992), 25518 were reported in Egypt (Afifi, 2003). In the United States, about 222,000 persons were under long-term dialysis (USRDS, 1999a).

1.4 Causes of ESRD

Although ESRD caused by a multitude of kidney diseases, the majority of ESRD populations were either diabetic or suffering from hypertension disease. Studies by Anderson and Brenner showed that ESRD attributed to diabetes in 50% of patients admitted for treatment in the USA during the period from 1993 to 1997. The same study report that

patients with type 2 diabetes outnumber those with type 1 diabetes by almost three to one in the ESRD population. The incidence of ESRD attributed to diabetes showed an annual increase of 9% among this population.

Reports from Western European and Asian Pacific region, including Australia and New Zealand showed that diabetic nephropathy as the main cause of ESRD. Data showed an increase in both incidence and prevalence of diabetic nephropathy between 1998 and 2000 (Lee, 2003). Data presented in table 1.1 shows the prevalence of diabetic nephropathy as a cause of ESRD worldwide.

Table 1.1 Prevalence of diabetic nephropathy as a cause of ESRD in the world

Country	Prevalence of diabetic nephropathy %
USA	50
Western Europe	Leading cause
Japan	Leading cause
France	Leading cause
Germany	21
Norway	10% of the incident RRT population
Egypt	20.1

Studies from the USA showed that hypertension was the second major causative of ESRD and represented by 25% of the studied population. It is believed that this is an over estimation of the role of hypertension and ESRD as hypertension is a characteristic feature of almost all types of renal disease (Anderson, Brenner, 1988). In Egypt, hypertension was responsible for about 28% of renal failure cases (Ibrahim, *et al.*, 1995).

Glomerulonephritis considered as a third major cause of ESRD. Reports from the USA showed that Glomerulonephritis accounts for about

10.5% of ESRD (Anderson, Brenner, 1988). It also reported to represent 16.6% of new ESRD cases in Egypt (Barsoum, *et al.*, 1996).

Cystic, hereditary, and congenital diseases together constitute another 3.4% of ESRD cases as reported for the USA. The cause is unknown in 7.5% of patients (Anderson, Rennke, Brenner, 1986). Once ESRD is established, survival is closely associated with the underlying cause of renal disease and the quality of offered medical services.

1.5 Incidence and prevalence of ESRD

The United States Renal Data System (USRDS) defines ESRD patients to be those individuals who sustained by long-term dialysis or renal transplantation. Therefore, patients with acute renal failure excluded as they die without undergoing dialysis or renal transplantation.

The incidence of ESRD has increased dramatically over the past decade (USRDS, 1999a), from 150 new cases per million in 1988 to 287 per million in 1997. Expressed another way, one of every 3,480 persons in the United States initiated long-term dialysis or received their first kidney transplant in 1997. This incidence is similar to that of AIDS and 10 times greater than the incidence of Hodgkin's lymphoma. High incidence rates of ESRD reported in certain selected populations, for example, in 1997 about one of every 770 people aged 65 or older and one of every 1,145 African Americans started on treatment for ESRD. The overall incidence of ESRD is increasing at a rate of 5% per year, which actually represents a slowdown from the 10% increase seen in 1988. The steepest rise in incidence over the past 10 years has been in African Americans, diabetic patients, and the elderly.

Since 1988, the prevalence of ESRD has almost doubled, and at the end of 1997, more than 300,000 patients being treated for ESRD in the United States. This represents an ESRD prevalence rate of more than one in every 1,000 persons. About 54% of ESRD patients are male, and 27% are more than 64 years old. ESRD is more than four times more common among African Americans (3.6 cases per 1,000 population) than among whites (0.8 cases per 1,000). As a result, about 32% of the 1997 ESRD population was African American, despite the fact that this community represents only 12.7% of the total US population (USRDS. 1999a)

1.6 Morbidity and mortality in ESRD

Untreated ESRD, by definition, is universally fatal. Therefore, data regarding mortality in the ESRD population typically refer only to cases of treated ESRD. Nevertheless, patients undergoing treatment for ESRD represent a group with higher mortality compared with the general population, even when adjusted for age, race, sex, and co-morbid conditions. As noted previously, these patients are at increased risk for various life-threatening complications, including atherosclerotic disease, left ventricular hypertrophy, malnutrition, and infection.

Mortality rates are highest in older patients, diabetic patients, and whites compared to black population. Similarly, first-year death rates are very similar for men and women undergoing dialysis (Styblo and Wood, 1998). At present, reasons for improved survival among dialysis patients are not certain. Widespread acceptance of recombinant human erythropoietin for the treatment of anemia may have influenced survival by reducing myocardial hypertrophy and improving tissue oxygen delivery (Beusterien, Nissenson and Port, 1996). Increased clearance of nitrogenous

solutes through improved dialysis membrane technology and increased appreciation of the importance of the "adequacy" of dialysis may have resulted in enhanced nutrition and fewer infection complications may explain the reduced mortality rate. Improvements in general medical care may also contribute to the observed decrease in mortality in these patients.

Among dialysis patients in the United States, cardiovascular disease accounts for about 50% of all deaths (USRDS, 1999e). Infection complications constitute the second most frequent cause of death especially among patients undergoing peritoneal dialysis than in those having hemodialysis, and more infection-related deaths occur in peritoneal dialysis patients who have diabetes than in those who do not. With the high prevalence of diabetes and hypertension in the ESRD population there is a high degree of morbidity, because these diseases predispose patients to atherosclerotic disease as well as renal failure. In fact, clinically apparent coronary artery disease is present in 40% of dialysis patients (USRDS, 1999e), and left ventricular hypertrophy is present in 75% of patients at initiation of dialysis (Foley, Parfrey and Harnett, 1995). Diabetes is also associated with blindness, neuropathy, and increased susceptibility to infection, further adding to the morbidity observed in this group of patients.

1.7 Pathogenesis of progressive renal injury

1.7.1 Stages of kidney disease

Glomerular filtration rate (GFR) accepted as the best index of overall kidney function in health and disease. Several stages of CKD, defined as structural abnormalities of the kidney that can lead to decreased GFR, are recognized.

1. Stage I, is defined as the presence of structural or functional abnormalities of the kidney, initially without decreased GFR (**> 90 mL/min/1.73 m²**), which over time can lead to decreased GFR
2. Stage II characterized by mild reduction in GFR (**60 to 89- mL/min/1.73 m²**). At this stage, patients usually have hypertension and may have laboratory abnormalities indicative of dysfunction. This determined by measurements of serum creatinine levels.
3. Stage III, is characterized by moderate reduction in GFR (**30 to 59mL/min/1.73 m²**). This stage is distinguished by the presence of azotemia (nitrogen metabolism) and expressed by an elevation in serum creatinine and serum urea nitrogen. Erythropoietin production decreases, and laboratory abnormalities reflecting dysfunction in other organ systems are usually present. Although, patients may have symptoms, they often remain remarkably asymptomatic even though their kidney function reduced by as much as 70%.
4. Stage IV, is characterized by severe reduction in GFR (**15 to 29mL/min/1.73 m²**). In this extremely tenuous stage of CKD, the worsening of azotemia, anemia, and other laboratory abnormalities reflect dysfunction in several organ systems. However, patients usually have mild symptoms.
5. Stage V is characterized by Kidney failure (**GFR, <15 mL/min/1.73 m²**). In most cases, this level of kidney function accompanied by a constellation of symptoms and laboratory abnormalities in several organ systems, which collectively referred to as uremia. Initiation of kidney replacement therapy (dialysis or transplantation) is typically required for treatment of co-morbid conditions or complications of decreased GFR, which would otherwise increase the risk of morbidity and mortality.

Renal disease often attributed to classic antibody-mediated or cell-mediated immunologic renal injury. However, renal injury complicating such common disorders as diabetes and hypertension has no apparent immunologic basis. Therefore, the pathogenesis of injury in these conditions must occur by way of nontraditional (non-immune) pathways. This observation has advanced the hypothesis that nephron loss serves to promote further nephron loss, although the mechanisms responsible for this inexorable course remain incompletely understood. One possibility is that adaptive changes occur in the remaining functional nephrons promote progressive renal scarring. Studies in rats showed that experimental ablation of renal mass promotes progressive loss of renal function, and the relative reduction in total renal mass correlates with the rate of progressive renal injury (Anderson, Brenner, 1988). The remaining renal mass in such experimental animals showed histological characteristics similar to those observed in patients with ESRD.

Adaptive changes associated with nephron ablation have been the subject of intense investigation over the past decade. Among these "adaptations," changes are intraglomerular hemodynamics (Anderson, Rennke and Brenner, 1986). Remnant nephrons undergo marked sustained increases in single nephron plasma flow (hyper-perfusion), single nephron glomerular filtration rate (hyper-filtration), and glomerular hydraulic pressure (glomerular hypertension) in response to ablation of renal mass.

Glomerular hypertension, characterized by increased glomerular capillary hydrostatic pressure, appears to be of considerable importance. In fact, agents that attenuate glomerular hydraulic pressure, such as angiotensin-converting enzyme (ACE) inhibitors and protein-restricted diets, can protect against progressive renal scarring (Anderson, Rennke and

Brenner, 1986). The specific cellular and biochemical pathways that link altered glomerular hemodynamics with progressive renal scarring still poorly understood.

Studies by Remuzzi and Bertani suggested a variety of perhaps complementary mechanisms that contributes to progressive renal scarring. These mechanisms include proteinuria and alterations in levels of circulating lipids, hormones, and electrolytes (Remuzzi and Bertani, 1998). Collectively, these factors may contribute to progressive renal injury by changing the function of various resident renal cells, such as macrophages and mesangial cells. Therapies targeted at specific components of such pathways offer promise for future management of chronic renal insufficiency.

1.7. 2 Etiology of ESRD

The distribution of etiologies in the ESRD is influenced by the natural history of the underlying condition, the efficacy of the available treatment and practice patterns regarding diseases recognition and management.

Diabetes: There has been a dramatic and global increase in the incidence and prevalence of diabetes over the last decade the natural history of diabetic glomerulosclerosis appears to be similar for both types II & I. Diabetic nephropathy has been one of the epidemic proportion and has contributed to over all increased rate of ESRD (Nishimura, Dorman, Bosnyak, *et al.*, 2003)

Hypertension: It is the second most common attributed etiology, systolic hypertension is powerful promoter of kidney damage which in turn exacerbate in decline in renal injury in addition control of blood pressure

clearly decrease the risk of CKD. It is well known that the presence of atherosclerosis increase the prevalence of ischemic renal vascular (Young, Klag, Munter, *et al.*, 2002)

Glomerulonephrities: Most forms of Glomerulonephrities are not diagnosed by serological tests alone, therefore, the accuracy with which the occurrence of different forms are estimated will vary directly with timing and frequency with which kidney biopsies are performed. IgA and focal segmental glomerulosclerosis (FSGS) are the most common forms of glomerulonephrities (Briganti, Dowling, Finlay, *et al.*, 2001)

Tubulointerstitial kidney disease: It is often clinically silent and may occur because of allergic reaction, toxic exposure or autoimmune mechanisms (Chang, *et al.*, 2001).

1.8 Signs and symptoms of ESRD

Kidneys play an essential role in maintenance of normal homeostasis. A variety of diseases may affect the kidneys and lead to progressive nephron loss. As kidney function deteriorates, loss of excretory, regulatory, and endocrine functions takes place, and complications develop in virtually every organ system. Despite the diversity of causes, the clinical manifestations of progressive kidney disease are quite similar across the spectrum.

1.8.1 Systemic complications

The onset of uremia is slow and insidious, beginning with rather nonspecific symptoms such as malaise, weakness, insomnia, and a general feeling of being unwell. Patients may lose their appetite and complain of

morning nausea and vomiting. Eventually, signs and symptoms of multi-system failure are evident.

Gastrointestinal complications: Anorexia, nausea, and vomiting are common in advanced kidney failure (Etemad, 1998). These symptoms usually corrected by dialysis. However, malnutrition is a common problem in CKD patients, and nutritional support coordinated with an experienced renal dietitian is an important component of management of these patients (Ikizler, *et al.*, 1996).

Cardiovascular complications: The most common cause of death in patients with ESRD is cardiovascular disease. Thus, reduction of both traditional and CKD-related cardiovascular risk factors is of utmost importance to reduce morbidity and mortality from cardiovascular disease. Hypertension almost invariably develops in patients with CKD and is usually volume-dependent. Less often, high levels of rennin and angiotensin are important contributory factors (Preston, *et al.*, 1996). Aggressive management of blood pressure can, in addition to controlling a modifiable cardiovascular risk factor, slow the progression of kidney disease; the goal is to achieve a blood pressure of less than 130/85mm Hg.

Hematologic complications: A normochromic and normocytic anemia, defined as hemoglobin levels lower than physiologic norms, starts to develop in most patients when the GFR falls below 60-ml/min/1.73 m². It occurs mainly because of erythropoietin deficiency and, to a lesser degree, from hemolysis, presence of uremic inhibitors, blood loss (either occult or overt), and deficiency in iron, folate, or vitamin B₁₂. Although white blood cell count is usually within normal range when CKD is present, the function of these cells may be defective, leading to an increased

susceptibility to infections (Cohen, *et al.*, 1997). Other common effects include an increased capillary fragility and bleeding tendency resulting from defective platelet function.

Bone disease: Metabolism of calcium and phosphorus is abnormal in patients with CKD and is associated with the development of bone disease. Phosphate retention occurs as GFR declines. Both hyperphosphatemia and reduction in the active form of vitamin D (1.25-dihydroxycholecalciferol) lead to hypocalcaemia. As attempts made to normalize the serum calcium level, secondary hyperparathyroidism can develop, causing significant bone damage to occur (Hurska, *et al.*, 1995).

The spectrum of bone disease, also known as renal osteodystrophy, includes osteitis fibrosa, osteomalacia, and a dynamic bone disease. The most common form is osteitis fibrosa caused by secondary hyperparathyroidism. Although initially asymptomatic, osteitis fibrosa can produce bone pain, pathologic fractures, and metastatic calcifications in its more advanced stages. The complications associated with hyperparathyroidism prevented or minimized by controlling hyperphosphatemia or by lowering the parathyroid hormone level (Coburn, *et al.*, 1998).

Neurologic complications: Cerebrovascular accidents of all types are common in CKD. Uremic encephalopathy often seen in advanced kidney failure and characterized by insomnia, impairment of concentration, alterations in usual sleep rhythms, anxiety, and depression. Dialysis produces rapid clearing of the mental state and correction of abnormal electroencephalographic findings. Generalized motor seizures may also occur in patients with advanced kidney failure.

1.8.2 Electrolyte disturbances

CKD prompts a variety of disturbances in electrolytes (sodium and potassium), water balance and metabolic acidosis.

Sodium balance: Sodium balance remains virtually normal until very late in the course of CKD, because the kidney can markedly increase the amount of sodium excreted per nephron by reducing tubular sodium reabsorption. Although sodium balance maintained, the kidney loses its ability to adapt to large variations in salt intake. Indeed, intake of large amounts of sodium can easily overwhelm the excretory capacity of the failing kidney and result in fluid retention, edema, and hypertension. Likewise, if diuretics used overzealously, the patient may become volume-depleted, with further aggravation of the kidney failure.

Clinically evident edema is uncommon until the GFR falls to less than 15 mL/min/1.73m². However, edema can occur at higher GFR levels in patients with glomerular disease and significant proteinuria (ie, nephrotic syndrome) and in those with heart failure. The cornerstone of treatment of edema (and hypertension) is restriction of dietary sodium to a level lower than that recommended for uncomplicated hypertension (<100 mEq/day; 2.3 g of sodium or 6 g of salt). If sodium restriction is not effective or not achieved, diuretics use is advised (Suki, 1997).

Potassium balance: Potassium balance and plasma potassium level are also maintained until very late in CKD, mainly because of an increase in renal excretion of potassium per functioning nephron and an increase in potassium output in the stool (Allon, 1995). Hyperkalemia may develop earlier in the course of CKD. Hyperkalemia may occur in association with dietary indiscretion, use of potassium containing salt substitutes, increased catabolism, or metabolic acidosis. It is also seen with the use of potassium-

sparing diuretics, angiotensin-converting enzyme (ACE) inhibitors, and nonsteroidal anti-inflammatory drugs (NSAIDs). Hypokalemia may occasionally occur in patients with CKD, and it is usually due to gastrointestinal losses or excessive use of the cation exchange resin sodium polystyrene sulfonate (Kayexalate, SPS).

Water balance: The ability to concentrate or dilute urine is impaired in patients with CKD, which makes them more susceptible to hypernatremia and hyponatremia. Hypernatremia may occur if water consumption is not sufficient to replace fluid loss. More commonly, hyponatremia develops in patients with CKD because they either drink water or given hypotonic fluids in excess of their ability to excrete water

Metabolic acidosis: Most patients with CKD develop metabolic acidosis because of their reduced ability to excrete hydrogen ions generated mainly from the metabolism of sulfur containing amino acids (Warnock, 1998). As patient condition approaches ESRD, serum bicarbonate concentration often falls to between 12-20 mEq/L and the anion gap increases. A level below 10mEq/L is unusual, because buffering of the retained hydrogen ions by intracellular buffers prevents a progressive fall in the concentration of serum bicarbonate.

1. 9 Diagnosis of chronic renal failure

Patients whose renal adaptation maintains a GFR of 70-100 cc/min and those with CRI (GFR >30 cc/min) are generally entirely asymptomatic and do not experience clinically evident disturbances in water or electrolyte balance or endocrine/metabolic derangements. These disturbances generally become clinically manifest through the stages of CRF (GFR <30 cc/min) and ESRD (GFR <15 cc/min). Uremic manifestations in patients with ESRD are secondary to accumulation of toxins

Laboratory tests: Chronic kidney failure diagnosed using various biochemical assays that detect the levels of serum urea, creatinine, albumine, bicarbonate, phosphate and potassium. The followings are the most common criteria for diagnosis:

- Elevated serum urea and creatinine
- Hyperkalemia, low serum bicarbonate, hypocalcemia, hyperphosphatemia, hyponatremia (in ESRD with free-water excess)
- Hypoalbuminemia in patients who are nephrotic and/or malnourished
- Normochromic normocytic anemia - Other underlying causes of anemia ruled out.

Imaging studies: Imaging studies considered as essential diagnostic tools and the followings shed the light on use and importance for such tools of diagnosis of ESRD:

- Plain abdominal x-ray - Particularly useful to look for radio-opaque stones or nephrocalcinosis
- Renal ultrasound - Structural abnormalities, include hydronephrosis and polycystic kidneys
- CT scan - CT scan is useful to better define renal masses and cysts usually noted on ultrasound. It is the most sensitive test for identifying renal stones.
- MRI is very useful in patients who require a CT scan but who cannot receive intravenous contrast. Magnetic resonance angiography also is becoming more useful for diagnosis of renal artery stenosis.
- Voiding cystourethrogram (VCUG); Criterion standard for diagnosis of vesicoureteral reflux

Estimation of GFR

The Cockcroft-Gault formula for estimating CrCl used routinely as a simple means to provide a reliable approximation of residual renal function in all patients with CRF. The formulas are as follows:

- $\text{CrCl (male)} = ([140 - \text{age}] \times \text{weight in kg}) / (\text{serum creatinine} \times 72)$
- $\text{CrCl (female)} = \text{CrCl (male)} \times 0.85$.

1.10 Prognosis and treatment

The rate of decline in kidney function depends somewhat on the underlying disorder causing the kidney failure. For example, controlling the level of sugar in the blood as well as hypertension in people with diabetes substantially slows deterioration in kidney function. Drugs called angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers may decrease the rate of decline in kidney function in some people with chronic kidney failure. Meticulous attention to diet helps control a number of potential problems. Moderate or severe acidosis may require treatment with sodium bicarbonate. The decline in kidney function slowed slightly by restricting the amount of protein consumed daily and by lowering triglyceride levels.

During chronic kidney failure, changes in thirst usually determine how much water consumed. Occasionally, water intake needs to be restricted to prevent fluid overload. Foods extremely high in potassium, such as salt substitutes, and foods that are somewhat high in potassium, such as dates and figs must be avoided. A high potassium level in the blood increases the risk of abnormal heart rhythms and cardiac arrest. If potassium level becomes too high, drugs may help and dialysis may be required. The

elevated phosphorus level in the blood can cause deposits of calcium and phosphorus to form in tissues, including the blood vessels. Restricting the intake of foods high in phosphorus, such as dairy products, liver, legumes, nuts, and most soft drinks, lowers the phosphate concentration in the blood. Drugs that bind phosphate, such as calcium carbonate and calcium acetate, taken by mouth, may also lower the phosphorus level in the blood.

The anemia caused by kidney failure responds to erythropoietin. Blood transfusions given only if the anemia is severe with noticeable symptoms and patients do not respond to erythropoietin. Other causes of anemia must be treated, particularly dietary deficiencies of iron, folic acid, and vitamin B₁₂ or excesses of aluminum in the body. Most people receiving erythropoietin regularly need iron supplement to prevent iron deficiency, which impairs the body's response to these drugs.

1.10.1 Renal replacement therapy

Renal replacement therapy (RRT) is a lifesaving treatment ESRD. Provision has increased steadily in the UK, accounting for approximately 1.5% of NHS resources (Mallick, 1998) and demand predicted to double over the next 10–20 years (Davies, Rodrick, *et al.*, 1997). Prevention of ESRD is therefore critical. Evidence is accumulating that the progression of chronic renal disease to ESRD can be in some cases, delayed, halted or even reversed by a range of interventions (Ruggenti, Schieppati, Remuzzi, *et al.*, 2001)

Timely referral of patients with CRF to specialist nephrological care needed to ensure the introduction of such measures early enough in the disease process to provide benefit. However, 30–40% of patients referred to nephrologists at a very late stage of renal disease (Khan, *et al.*, 1994) and

this are associated with a poorer clinical state at start of RRT (Arora, *et al.*, 1999) a worse prognosis (Innes, *et al.*, 1992) and higher initial health costs. Earlier referral is also important in preparing the patient adequately for dialysis, with education, counseling and the formation of dialysis access.

1.10.2 The rationale for early referral

For patients who have a glomerular filtration rate (GFR) of 40-mL/min/1.73 m² or less, the risk of progressive kidney disease that culminates in ESRD is quite high. Data from the Modification of Diet in Renal Disease (MDRD) study suggest that patients in this group lose function at a rate of about 4-mL/min/1.73 m² per year. Once the GFR reaches 30-mL/min/1.73 m², the risk of progression to ESRD is extremely high, and appropriate preparation for RRT is in order. It should be emphasized that the appropriate measurement of kidney function is GFR, not creatinine clearance or estimated creatinine clearance.

When a patient's GFR has decreased to 40-mL/min/1.73 m² or less, the nephrology care team should become more involved so the patient properly prepared for RRT. Although the patient continues to receive care from the primary care team, increased emphasis on the nephrology care portion of management becomes necessary. In general, collaborative approach involving the primary care team and the nephrology team is essential when considering patients. The following sections address specific areas of preparation for RRT.

1.10.3 Timing of initiation of RRT

In view of the known complications caused by delays in starting RRT, therapy initiated sooner rather than later, urgent hemodialysis should be

done for patients having, hyperkalemia, pulmonary edema acidosis and pericardities. In patients who have symptoms, RRT initiated immediately. Symptoms of uremia include pruritus, restless legs, nausea, vomiting, sleeplessness, change in sleep pattern, intractable volume overload unmanageable by methods other than RRT, and less frequent side effects, such as muscle twitches, spasms, and seizures. For asymptomatic patients, many experts advocate initiating dialysis at a GFR that is less than 10- $\text{mL}/\text{min}/1.73\text{m}^2$ in those without diabetes and at less than 12- $\text{mL}/\text{min}/1.73\text{m}^2$ in those who have diabetes. Transplantation should be undertaken electively.

1.10.4 Hemodialysis

Hemodialysis removes waste and excess fluid from the blood when the kidneys cannot do so sufficiently. The blood drawn intravenously, sent to a dialyzer, and returned to the body through a blood vessel. During that blood is exposed to extracorporeal semi permeable membrane and on the other side of which a dialysate solution is flowing. Two major mechanisms govern the movement of molecules (diffusion and ultra filtration). Diffusion refers to the movement of a solute across a semi permeable membrane from a region of higher concentration to a region of lower concentration this transport is dependent on the physical size of the molecule relative to the size of the pores in the membrane . Ultrafiltration refers to plasma water removal by applying a negative transmembrane pressure across the dialysis membrane. This hydrostatic pressure forces plasma water from the patient out into a dialysate. The blood circulated and diffused numerous times during a dialysis session; each circulation

through the machine removes more waste and excess fluid. Hemodialysis usually performed three or more times a week for 4 hours or more.

There are three methods of accessing the bloodstream:

1.10.4.1 Arteriovenous fistula (AVF)

The forearm is a common site for intravenous access to the bloodstream. To form a fistula, a vascular surgeon joins an artery and a vein in the forearm, wrist, or upper-arm area on an outpatient basis with local anesthetic. As the fistula becomes stronger, a buzz (thrill) felt beneath the skin. Eventually, the new vein will bulge, indicating it is mature. After fistula maturation (4-6 weeks), the fistula is a stronger, larger vein that can better withstand increased blood flow and the intravenous needles required for dialysis. At the start of a dialysis session, the access area anesthetized before needles inserted. Blood directed from the fistula via a needle and tube, into the dialyzer, and returns to the body through a second tube and needle connected to the fistula. The needles placed carefully to avoid recirculation and re-cleaning.

The AVF is the most successful mode of access, with the lowest risk of malfunction and infection. It lasts the longest. However, many patient's veins and arteries weaken with age and are not strong enough to support an AVF. Other problems include obesity, medical problems, and small blood vessels that do not mature.

1.10.4.2 Arteriovenous Graft

To form an AVG, the vascular surgeon inserts a plastic (Cortex) tube, usually in the arm, that connects a vein and an artery. The tube accepts the dialysis needles for blood circulation. This typically carried out for people whose veins cannot tolerate a fistula. AVG only requires 10 to

14 days to heal before use, but frequently malfunctions, causes infection, and has a shorter life span than the AVF.

1.10.4.3 Temporary venous dialysis catheter

A catheter used for hemodialysis is a tube that has a needle at one end and two accessible ports at the other with Y shape. The needle end inserted through the skin into a vein in the neck (internal jugular vein), chest (subclavian vein), or thigh (femoral vein). The split tubing and two ports remain outside of the body so that the ports accessed with the dialysis needles. One tube carries blood to the dialyzer and the other returns it to the bloodstream after cleaning.

The catheter used in patients who do not have an AVF or AVG but who need hemodialysis urgently. It use temporarily as a means of access until an AVF or AVG can be inserted. The catheter used permanently in some people who cannot tolerate the standard methods of access. It poses significant risk for infection and failure, thus replacement is essential.

1.10.5 Hemodialysis adequacy

Many studies have shown a strong correlation between hemodialysis dose and clinical outcomes (Held, *et al.*, 1996). To check dialysis adequacy the hemodialysis units should periodically, normally once a month. Blood sampled at the start of dialysis and at the end, the level of urea in the two blood samples then compared. There are two methods generally used to assess dialysis adequacy URR and Kt/V.

Urea reduction ratio (URR) it is a percentage based on how much urea removed during treatment. Although urea is just one of the body waste

products, its removal indicates how other waste products removed. URR is calculated by subtracting the post dialysis urea from the pre dialysis urea and dividing this figure by the pre dialysis urea to get the ratio and then multiply by 100 to get the percentage URR should be above $> 65\%$. The second method in assessing adequacy is measuring kt/v , in this measurement (K) stands for dialyser clearance expressed in (ml/min) and the lower case (T) stands for time and (V) stands for volume of water a patients body contains (see chapter 2 for details).

The importance of dialysis dose, as measured by either the kt/v or the urea reduction ratio (URR), in relation to patient morbidity and mortality clearly demonstrated (Owen, *et al.*, 1993). Clinical practice guidelines recommend monthly monitoring of these adequacy measures to ensure optimal patient care. Measurements that are more frequent have been suggested for patients who are non-compliant with the dialysis prescription or under dialyzed or who have frequent problems with dialysis delivery, such as poor access blood flow (NKF-K/DOQI, 2000)

Numerous unanticipated events may occur during a patient's haemodialysis session, which can lead to variation in the quantity of dialysis received from one session to the next. Access recirculation or dialyser clotting are examples that may result in decreased efficiency of solute clearance. Alternatively, failure to account for treatment interruptions or premature discontinuation may lead to a reduction in treatment duration All of these events will reduce the overall quantity of dialysis delivered and yet may not be readily apparent from periodic review of adequacy measures without careful attention to all treatment sessions.

Monitoring of Kt/V requires blood sampling before and after HD. The logistical problems involved with this, and the inconvenience of measures taken to reduce the effect of post-dialytic rebound in serum urea, ensure that this is an infrequently taken measure in the majority of chronic HD units. Increased frequency of measurement of Kt/V only suggested in cases of under dialysis.

1.10.5.1 Factors interfering with adequate dialysis

Delivery of an inadequate dose of hemodialysis may be due to a variety of factors, which reduce the effective urea clearance, reduce the length of time of urea diffusion, or result from sampling errors in the measurement of urea kinetics.

1.10.5.1.1 Ineffective urea clearance

Ineffective urea clearance can result from:

1. Access recirculation
2. Inadequate blood flow to the dialyser
3. Inaccurate estimates of the urea clearance of the dialyzer
4. Inadequate reprocessing of the dialyzer resulting in decreased clearances, dialyzer clotting
5. Low dialysate flow
6. Underestimates of flow due to calibration errors and tubing collapse

These are only the principal technical factors that can interfere with the delivery of the minimum recommended dose of hemodialysis.

1.10.5.1.2 Reduction in treatment time

One of the major factors, which contribute to an inadequate delivery of hemodialysis, is a reduction in the actually delivered treatment time during

which diffusion of urea occurs at the prescribed blood and dialysate flow rates. This can occur for a variety of reasons, such as

1. Clerical errors
2. Faulty measurements of actual time
3. Premature discontinuation of dialysis for the convenience of the patient, staff, or facility

Many patients request a reduction in their time on hemodialysis because the procedure routinely produces on toward clinical complications such as a sense of feeling poorly, symptomatic hypotension, or muscle cramps. There is no compelling evidence in the literature to support the notion that hypotension achieved by aggressive ultra filtration is a reproducible and reasonable marker of achieving estimated dry weight in hemodialysis patients. It is reasonable to suggest that the dialysis prescription modified in patients who tolerate a “dry weight” that is above the historical values achieved in an individual patient. In addition, patients who are not complying with the dialysis prescription by reducing their time of effective dialysis because of frequent clinical episodes of symptomatic hypotension, cramps, or just feeling poorly on dialysis require an individualized hemodialysis prescription which avoids both the intradialytic and the interdialytic symptoms that hamper compliance with the hemodialysis prescription. There is little doubt that patient comfort while on dialysis should be a primary goal. By avoiding intradialytic symptoms, we will improve patient compliance with the entire dialysis prescription, not just with the delivery of an adequate dose of hemodialysis.

1.10.5.1.3 Blood sampling and timing errors

Blood sampling and timing errors include deviation from the standard method of measuring blood urea, errors of dilution, drawing the pre-

dialysis sample after the start of dialysis, or obtaining the post-dialysis sample before the end of dialysis or 0.5 minutes after dialysis. All of these may lead to erroneous estimates of Kt/V or URR.

1.10.6 Complications of hemodialysis

Most of the following complications are due to the repetition of hemodialysis sessions and the continual need to remove fluid that builds up between treatments:

- Fever, chills (rare)
- Hypotension (sudden drop in blood pressure) (20%)
- Itching (5%)
- Leg cramps (5% - 20%)
- Nausea and vomiting (15%)

Recent studies have shown that more frequent and prolonged treatments diminish many of these and other chronic symptoms.

1.10.6.1 Chronic complications

- Access problems (e.g., clotting, infection, malfunction)
- Amyloidosis (causing carpal tunnel syndrome, shoulder pain)
- Anemia (reduction in red blood cell count)
- Coronary artery disease
- Renal osteodystrophy (bone degeneration with kidney disease)

1.10.7 Peritoneal dialysis

Peritoneal dialysis cleans the blood without its removal. Dialysate injected into the peritoneal space in the abdomen through a two-way catheter (the Tenckhoff catheter). The membrane that lines the abdomen (the peritoneum) allows waste and fluid to pass from the blood into the dialysate, which pumped out. Peritoneal dialysate, made up mostly of salts

and sugar (glucose), encourages ultra filtration through the peritoneum. About 2 weeks before dialysis begins, a Tenckhoff catheter surgically inserted with one end in the peritoneal space, and the other extending a few inches away from the skin and this done with general or local anesthetic depending on patient tolerance. It remains permanently in place and is accessible any time. When not in use, the external end of catheter is sealed.

1.10.7.1 Complications of peritoneal dialysis

Complications of peritoneal dialysis include the following:

- Diabetes (requires blood sugar monitoring)
- Peritonitis (caused by bacterial infection of peritoneum or scarring)

Some patients develop infections every 12 to 18 months and in this case they treated with antibiotics and if the infection persists, catheter removed and the patient must switch to hemodialysis. An inadequate peritoneum membrane may be unable clean the blood, thus patients referred hemodialysis. Some patients develop diabetes mellitus or obesity from glucose content of the peritoneal dialysate (Mitchell, Mitchell, 1998).

1.10.8 Kidney transplant

Kidney transplant recommended for patients with ESRD. The kidney is the most frequently transplanted organ. A healthy kidney transplanted into a person with complete kidney failure. Approximately 12,000 kidney transplants performed every year in the United States. The donor and the recipient can function with one kidney and neither requires dialysis after successful transplantation. Surgery done under general anesthesia and typically takes 2 to 3 hours. The failed kidneys left in place and the healthy one transplanted extra peritoneal. Blood vessels attached to the blood vessels of the legs and the ureter attached to the bladder with a small plastic

catheter. It is necessary to monitor its function closely and to suppress the immune system with drugs such as tacrolimus (Prograf) or cyclosporine A (Sand immune). Immunosuppressive anti-rejection medications must be advised for the remainder of the patient's life.

1.11 Status of hemodialysis in Palestine

Almost all the governmental hospitals have hemodialysis unites except the districts of Salfet and Tubas. There are eight dialysis centers in West Bank serving about 350 patients (all registered cases). The majority of patients were on three times /week of dialysis sessions. Usually each dialysis session last between 3–4 hours. Unites lack well experienced nephrologists (3 in the whole area of the West Bank).

Dialysis machines are Fresenius 4008B, most of them are old and not enough to cover for the expanding number of patients. This situation keeps technicians under pressure and therefore, limits sufficient dialysis doses. The nurse patient ratio is 1:5, while the international standard recommends 1:3 ratios. The dialysis unites are crowded with patients and most of unites have small working areas, as a result, poor follow up occur to maintain adequate hemodialysis. Most of these patients started dialysis with catheters not AVF, which contributes to higher morbidity and mortality because lack of adequate knowledge concerning dialysis adequacy further complicates the situation.

In Al-Watani Hospital, there are 12 machines for hemodialysis covers the needs of 90 patients. The length of the treatment ranges from 10 - 12 hours per week. Due to the limited access to these machines, patients usually come to the center overloaded with fluids. The political situation

adds further complications, as many patients cannot get into the center on their scheduled time and many have died on way to dialysis unites due to several check points.

1.12 Aim of the study

The current study aimed at evaluating the adequacy of hemodialysis in Al-Watani Hospitals at the city of Nablus.

Chapter Two

Methodology

This chapter describes the research design, identification of population and sample, setting, ethical considerations, instruments, data collection and statistical analysis.

2.1 Research design

The study conducted in a quantitative phenomenological approach. This approach tried to describe the relation between hemodialysis adequacy and various variations.

2.2 Study sample

The population of the study included all hemodialysis patients (88; 50M, 35F) enrolled in Al-Watani Hospital in the city of Nablus. The mean age was 54.6 years.

2.3 Setting and experimental work

Al-Watani Hospital is located in the north of West Bank in the city of Nablus. The hospital is a governmental medical hospital and is the referral center for hemodialysis in the northern of the West Bank area including the districts of Nablus, Tulkarem, Jenin, and district of Qalqyia. The parameters for hemodialysis treatment were as follows: all the machines are Fresenius 4008B volumetric machines fed by reverse osmosis water treatment delivery system, temperature of dialysis bath set to 37.5°C. The dialysis bath consisted of bicarbonate, 32-35mmol/L; sodium, 138-145mmol/L; potassium, 2mmol/L; and calcium 1.25-1.75 mmol/L. The subjects were dialysed on low-flux polysulfone dialysers (F6 and F7, Fresenius).

Slandered dialysis maintained for all participants. Blood urea concentration measured for each patient in order to calculate the

recirculation percentage. Recirculation carried out using the stop flow technique. This requires stopping the blood pump for 10–20 seconds in order to draw blood samples. Blood then drawn from the arterial port, venous port and from the arterial needle after the withdrawal of 20cc as dead space. Blood samples then centrifuged in order to obtain blood serum. Urea levels were measured using fresh sera samples using selective chemistry analyzer (Kone-Lab version Pro using biosystem reagent).

Kt/v was calculated based upon the adjusted Daugirdas formula $\{-\ln(c_2/c_1 - 0.008 \times T) + (4 - 3.5 \times c_2/c_1) \times UF/W\}$, where c_1 = predialysis blood urea concentration; c_2 = post-dialysis blood urea concentration; and they adjust for urea generation; T= dialysis duration/h; UF= ultra-filtration /dialysis/L; W= post dialysis body mass/kg; UF/W adjust for ultra-filtration

2.4 Ethical consideration

Permission obtained from the Palestinian ministry of health to conduct this study and to use the facilities in the hospital. A signed consent obtained from each participant after discussing with each of them the purpose of the study and all related matters to the research purpose. All the patients informed that obtained data is confidential and only for research purposes.

2.5 Instruments

The study utilized two main instruments:

1. Direct instrument

Review of medical record and obtaining relative information to the study, and special coding system developed for patient files and

hemodialysis machines in order to make the process of gathering information for this study easier.

2. Indirect instrument – Questionnaire

A specially designed questionnaire was prepared for this purpose. The questionnaire included demographic and clinical parts concerning treatment and hemodialysis characteristics. Validity of the questionnaire was approved by a group of specialists both academic and medical staff. Data collected directly by interviewing the patients themselves while they are on hemodialysis sessions.

2.6 Statistical analysis

Statistical analysis was performed using statistical package for social sciences SPSS. Frequencies and percentages were calculated and chi-square test was performed to investigate the significance in the association of the different variables to the adequacy of hemodialysis correlation were considered significant if the observed significance level (P value) was < 0.05).

Chapter Three
Results and Discussion

Over the past ten years, published data indicated that survival of dialysis patients is strongly associated with delivered dialysis dose (Own, *et al.*, 1995; USRD, 1999). Improvements in survival rates at higher dialysis doses was reported with all major causes of mortality including coronary heart disease, other cardiac disease such as stroke and infection. This observation is compatible with the hypothesis that low doses of dialysis may promote atherosclerosis, infection malnutrition and failure to thrive (Bloembergen, 1996).

Increasing evidence demonstrates that mortality among ESRD patients is lower with sufficient hemodialysis treatments. At present, hemodialysis dose quantified by the parameter kt/v , which measures urea removal during treatment and a single – pool kt/v of 1.2 considered as adequate dose. Kt/v corresponds strongly with survival and reported to be inadequate even in developed countries as one sixth of Americans hemodialysis patients were suffering from inadequate hemodialysis treatments. Such situation expected to increase the suffering and hospitalization days of patients (Eknoyan, *et al.*, 2002).

In Palestine, studies on ESRD are limited and none directed towards adequacy of dialysis represented by kt/v . Data in figure 3.1 represent the first report on adequacy of hemodialysis among the Palestinian population of the northern part of the West Bank area using kt/v values.

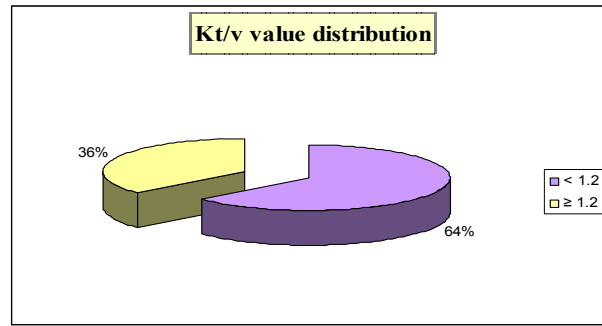


Figure 3.1 Adequacy of hemodialysis among the Palestinian population in the northern of the West Bank area based on kt/v values

The results of the current study showed that around 64% of the study population was with kt/v values less than 1.2, thus, indicating that patients are receiving inadequate hemodialysis dose. Hemodialysis inadequacy most likely to be due to several factors resides within hemodialysis treatment. Further discussion on these factors presented later in this chapter.

3.1 Demographic data

Data presented in table 3.1 showed the various tested variables in association with adequacy of hemodialysis based on kt/v values. Despite the observed percentage differences in all studied variables, no significant differences found with respect to gender, place of residence, career and academic levels among study population.

Table 3.1 Demographic data and kt/v

Demographic data						
Variables		No.	%	Kt/V		P-value
				< 1.2	≥ 1.2	
Gender	Male	50	56.8%	68%	32%	0.429
	Female	38	43.2%	55.3%	44.7%	
Age*	15 – 30 y	8	9.1%	62.5%	37.5%	0.119
	31 – 45 y	13	14.8%	30.8%	69.2%	

	46 – 60y	28	31.8%	60.7%	39.3%	
	Above 60y	39	44.3%	74.4%	25.6%	
Residency	Village	41	46.5%	65.5%	34.5%	0.963
	Camp	18	20.5%	66.7%	33.3%	
	City	29	33%	58.5%	41.5%	
Nature of work	Farmer	10	11.4%	80%	20%	0.557
	Worker	32	36.4%	71.9%	28.1%	
	Unemployed	36	40.8%	52.8%	47.2%	
	Academic	10	11.4%	50%	50%	
Level of education	Preparatory	48	54.5%	70.8%	29.2%	0.228
	Secondary	28	31.8%	53.6%	46.4%	
	Diploma	5	5.7%	20%	80%	
	University	7	8.1%	71.4%	28.6%	

Mean age = 54.6 year

3.1.1 Kt/v values and gender

The majority of ESRD patients in almost all countries are males rather than females (Schena, 2000). Our findings in this respect are consistent with various reports as males were represented by a higher percentage (56.8%) compared to females population (43.2%). Observational studies have shown that women respond more to higher dose of dialysis and recent data from the HEMO, nationally conducted study, suggested that women were with a better response to clearance of uremia toxins, compared to men (Depner, 2003). Our findings in this respect, demonstrated a higher level of clearance among female population as 68% of the males were with kt/v values < 1.2, compared to 55.3% among females population (see table 3.1). However, these variation were of no statistically significant values ($P = 0.429$; $\alpha = 0.005$).

3.1.2 Kt/v values and age

The mean age varied somewhat in the world (ranged from 58.1 – 62.1; USA 60years) with the average patients are being lowest in UK and Japan and high in Italy and Spain (Young, 2000). In the current study, the mean

age of the study population was 54.6 and age ranged between 18 and 78 years. The highest clearance rates was observed among age group 31-45 years, which represent around 15% of the study population, as 69.2% were with a kt/v value equals or more than 1.2. The reason behind this high rate of clearance within this age group could be that elderly age groups suffer from co morbid conditions, thus affecting clearance rates. Difference in clearance rates among the various age groups were statistical insignificant ($P = 0.119$; $\alpha = 0.005$).

3.1.3 Kt/v values and place of residence

Clearance rates of 41.5%, 34.5% and 33.3% ($kt/v \geq 1.2$) found among city, village and camp residence, respectively. Socioeconomic, educational levels and access to dialysis center might be behind such differences (Palestinian Independent Organization, 2003). Percentage differences was not statistical significant ($P = 0.963$; $\alpha = 0.005$).

3.1.4 Kt/v value in association with nature of work and educational level

The percentages of 20, 28.1, 47.2 and 50% with kt/v values ≥ 1.2 was found among farmers, workers, unemployed and those with academic careers, respectively. Farmers seems to show the lowest rates of clearance and this might be due to low income which is expected to affect early referral to medical care which in turn affects the health status and might interfere with the dialysis process. On the other hand, patients with academic careers expected to have better knowledge and awareness about disease and early referral, thus, better clearance response. Variation in educational levels dose not reflect any statistically significant clearance rates among patient with different educational levels.

3.2 Hemodialysis characteristics

Data presented in table 3.2 shows the various hemodialysis characteristics of the study population.

3.2.1 Blood flow and kt/v

Blood flow is one of the principle determinants of dialyzer urea clearance and low blood flow rates leads to lower urea clearance (Ward, 1999). Blood flow rates affected by poor vascular access, recirculation, insufficient anticoagulation and human errors, some of these problems can be solved especially when it comes to vascular access (Charra, 1998).

In the current study blood flow rates clustered in three groups. The first group 200–250cc/min and represented by 35.2% of the study population; the second group 250–300cc/min and represented by 43.2% and 300–350cc/min, represented by 21.6%. Increased blood flow rates found to be associated with increased rate of clearance. This is clear from the findings of kt/v values ≥ 1.2 (200–250cc/m, 23.3%; 250–300cc/m, 35.9%; 300–350cc/m, 63.2%). Variation in the clearance rates were statistically significant and was in favor of increased flow rates ($P = 0.021$). Our findings in this respect in consistent with previous reports that, indicates better clearance rates in association with increased flow rates (Ward, 1999; Charra, 1998).

3.2.2 Duration of hemodialysis process and kt/v

Determining the adequacy of dialysis therapy depends mainly on the duration of each dialysis treatment as an important independent factor in the process. The national cooperative dialysis study (Lowrie, 1983) reported a strong trend toward increasing morbidity with decreasing hemodialysis time. High survival rates also reported among French

patients receiving long treatment (eight hours three times /week) (Charra, Calemard and Laurent, 1996). The findings of the current study showed that all patients with a dialysis process of 2.5 hours were with a kt/v value < 1.2 , reflecting in adequate dialysis. For those patients who were on 3 hours program (18.2% of the study population), only 20% showed kt/v value ≥ 1.2 . Patients on 3.5 hours duration (62.5% of study population) showed improved dialysis adequacy as 26.1% of them were with kt/v value ≥ 1.2 . The rest of the study population were on a 4 hour program of duration dialysis time and this group showed the highest clearance rate as 69.2% were with a kt/v of ≥ 1.2 .

Our findings strongly indicate that clearance is strongly associated with increased duration time of dialysis process and is in agreement with previously reported data (Laurent, 1997). Improvement of clearance rates seems to be due to longer time of dialysis, which allows the retention of various molecular size molecules by the system (Laurent, 1997).

Variation in the clearance rates among the various duration periods were statistically significant ($P = 0.000$; $\alpha = 0.005$). It is important to note that patients non-compliance, lack of enough dialysis machines and facilities and access to these facilities are major time limiting factors for dialysis in this center.

Table 3.2 Hemodialysis characteristics

Hemodialysis characteristics						
Variable		No.	%	Kt/V		P value
				% <1.2	% ≥ 1.2	
Blood flow cc/m	200 – 250	31	35.2	76.7	23.3	0.021
	250 – 300	38	43.2	64.1	35.9	
	300 – 350	19	21.6	36.8	63.2	
Dialysis/ hrs	2.5 hrs	1	1.1	100	0	
	3 hrs	16	18.2	80	20	
	3.5 hrs	55	62.5	73.9	26.1	
	4 hrs	16	18.2	30.8	69.2	0.000
Dialysis sessions / week	Once	1	1.1	100	0	
	Twice	19	21.6	73.7	17.3	
	Thrice	68	77.3	51.7	48.3	0.002
Volume of U/F	0 – 1 kg	5	5.7	80	20	
	1 – 2 kg	19	21.6	73.7	26.3	
	2 – 3 kg	34	38.6	64.7	35.3	
	3 – 4 kg	22	25	36.4	63.6	0.048
	> 4 kg	8	9.1	87.5	12.5	
Effective surface area	1.5 m ²	15	17	87.5	12.5	0.032
	1.6 m ²	73	83	36.4	63.6	
Recirculation %	0 – 10	21	23.9	29.2	70.8	
	10 – 20	37	42	86.2	13.8	
	20 – 30	24	27.3	100	0	
	> 30	6	6.8	100	0	

3.2.3 Dialysis frequency per week and kt/v

Studies have documented the relationship between less frequent dialysis per week and poorer outcome (Lockridge and Pierratos, 1999 a, b). Patients dialysed fewer than three times per week have approximately twice the mortality risk compared to patients dialysed three times per week or more (Held, Levin, Bovbjerg *et al.*, 1991).

Data presented in table 3.2 shows that all patients who were on a single dialysis regime per weekly have kt/v value of < 1.2, in comparison,

17.3% of those who dialyze twice weekly showed a kt/v value ≥ 1.2 . The majority of the study population (77.3%) was dialyzing three times per week and 48.3% of them were with a kt/v value of ≥ 1.2 . These findings strongly indicate improvements in the clearance rates with increased dialysis frequency per week. Our findings in this respect were consistent with previous reports that link improvements in clearance rates and frequency of dialysis (Held, Levin, Bovbjerg *et al.*, 1991; Lockridge and Pierratos, 1999 a, b). Differences in the clearance rates were statistically significant ($P = 0.002$; $\alpha = 0.005$).

3.2.4 Volume of ultra filtration and kt/v

Ultra filtration volume and the rate of ultra filtration greatly affect blood pressure (De Vries, 1993). Due to this fact, patients with excessive weight gain are advised to decrease fluid intake, alternatively, if large fluid intake is a consequence of robust food intake, this will lead to increased ultra filtration volume, which in turn will result in patient complaints such as cramps, hypotension and increased risk of strokes and cardiac problems (Sherman, 1995). Few studies have examined the direct association of UFR on long-term outcomes in HD patients. The Netherlands Cooperative Study on the adequacy of dialysis recently reported the association between excessive ultrafiltration and mortality, independent of delivered Kt/V urea (Termorshuizen, Dekker, Van Manen *et al.*, 2004).

Our findings with respect to ultrafiltration rate and clearance show a clear trend of improvements in kt/v values with increased ultra filtration rate. This is evident from the findings of kt/v values of ≥ 1.2 with frequencies of 20, 26.3, 35.3 and 63.6% among those with ultra filtration volumes of 1-0, 1.1-2, 2.1-3 and 3.1-4 L /dialysis session, respectively (see

table 3.2). Data on the relationship between kt/v values and ultrafiltration rates is rare. This is an interesting finding and is in agreement with the findings of our study.

3.2.5 Effective surface area and kt/v

The use of larger surface area dialyzers permits high rates of urea clearance to be achieved offering theoretical advantage of improving blood purification by removing higher and middle molecular – weight solutes (Pascual, *et al.*, 1996). Furthermore, many studies reported excellent survival among patients treated with larger surface filter area, which in turn reflects to better dialysis adequacy (Stivelman, *et al.*, 1995).

With respect to filtration area, our study population placed on two different membrane size filters (1.5 and 1.6m²). When these two groups compared with regard to their clearance rates, 63.6% of those who were on 1.6m² were with a kt/v value of ≥ 1.2 compared to only 12.5% among those who were on 1.5m². Such finding is in agreement with previous reports on membrane size and clearance rates (Stivelman, *et al.*, 1995; Pascual, *et al.*, 1996).

3.2.6 Access recirculation and kt/v

Recirculation refers to mixing of the dialysed blood with the undialysed blood in the vascular access. This affects adequacy of dialysis and may result in falsely low post dialysis urea (Besarab and Sherman, 1997). Hemodialysis requires zero recirculation: any recirculation indicates unacceptably low access flow or incorrect needle placement. Access recirculation, reduces effective clearance by reducing the concentration gradient in the dialyzer (Sehgal, 1998).

Our results were consistent with the previous reports in literature, which, showed that low recirculation percentage would result in better dialysis adequacy. This is evident from the finding of 70.8% of our study population who were with $kt/v \geq 1.2$ have recirculation between 0 – 10%. We also found that when recirculation percentages reached 20% level or above, almost all of the subjects were with a kt/v value < 1.2 . This group represents 42% of our study population and the increased recirculation percentages reflect access problems including; stenosis, incorrect needle placement and needle placement close together. Differences in kt/v values among these recirculation groups were statistically significant ($P = 0.004$; $\alpha = 0.005$).

3.3 Clinical characteristics

Table 3.3 Clinical characteristics and dialysis adequacy

Clinical characteristics and dialysis adequacy*						
Variable	No.	%	Kt/v %		P-value	
			< 1.2	\geq 1.2		
Etiology of disease	Diabetic nephropathy	39	44.3	71.8	28.2	0.545
	Glumerulunephrities	28	31.8	57.1	42.9	
	Gouty nephritis	7	8	28.6	71.4	
	Hypertensive nephropathy	2	2.3	50	50	
	Interstitial nephropathy	12	13.6	66.7	33.3	
Vascular access	Arteriovenous fistula	60	68.2	57.7	42.3	0.003
	Arteriovenous cortex	3	3.4	33.3	66.7	
	Subclavian catheter	21	23.9	71.5	28.5	
	Femoral catheter	3	3.4	100		
	Permanent catheter	1	1.1	62.5	37.5	
Complication during dialysis	hypotension	4	4.5	75	25	0.256
	Cramps	4	4.5	50	50	
	Dizziness	21	23.9	85.7	14.3	
	No	59	67	54.2	45.8	
Venous pressure/	100-200	64	72.7	65.6	34.4	0.064
	200-300	23	26.1	52.2	47.8	

mmhg	300-400	1	1.1	100		
Residual renal function	Present	26	29.5	77.8	22.2	0.101
	Absent	62	70.5	55.7	44.3	
Dialysis duration / month	1 - 6	18	20.5	73.4	26.6	0.382
	6 - 12	14	15.9	61.1	38.9	
	12 - 36	22	25	76.2	23.8	
	> 36	34	38.6	50	50	
Weight/kg*	40 - 59.9	24	27.3	66.7	33.3	
	60 - 79.9	47	53.4	59.5	40.5	
	80 - 99.9	14	15.9	71.4	28.6	
	> 100	3	3.4	33.3	66.7	

* Dialysate flow 500cc/m / Mean weight is 68.2 kg, minimum weight, 41.6kg and maximum weight 111.5 kg

3.3.1 Etiology of disease and hemodialysis adequacy

In the current study, diabetic nephropathy represented by 44.3%, and adequate kt/v value of ≥ 1.2 was low (28.2%). Low adequacy levels could be due to hypoglycemia generated during dialysis, which may lead to premature discontinuation of dialysis that affects clearance rate. Aging and obesity among this group may contribute to the observed diabetic nephropathy as 76.1% of this group was above 45 years old and 69.3% of them were with a weight range of 60–100kg. Other factors including unawareness, knowledge and health education might contribute to diabetes complications. Our data in this respect is consistent with worldwide percentage for the etiology of ESRD. The prevalence of diabetic nephropathy among ESRD patients in Egypt increased from 8.9% in 1996 to 14.5% in 2001 (Afifi, 2003). In USA, diabetic nephropathy remains the most common cause of ESRD accounting for approximately 40% of the cases (USRD, 2004). Glomerulonephrities represents the second common cause (31.8%) of ESRD of which 42.9% have $kt/v \geq 1.2$. The third popular cause was gouty nephrities (8%) and 71.4% of this group were with kt/v

value of ≥ 1.2 . Interstitial nephropathy accounts for 13.6% of the study population and 33.3% of them were with a kt/v value of ≥ 1.2 .

Hypertension is the second most common cause of ESRD worldwide (REF). In our study, only 2.3% seems to suffer from hypertension and 50% of them were with kt/v value of ≥ 1.2 .

3.3.2 Vascular access and hemodialysis adequacy

Obtaining and maintaining adequate access to the circulation remains a major impediment to the long-term success of hemodialysis treatments (Feldman, Kobrin and Wasserstein, 1996) and it is considered one of the greatest challenges in the provision of reliable dependable of repeatedly accessing a patient's blood. Several options exist for permanent and temporary dialysis access including native arteriovenous fistula (AVF), artificial arteriovenous graft (AVG), and dual lumen tunneled dialysis catheter (permanent catheter) and temporary catheters (NKF-DOQI, 1997). The most common preferred method of dialysis access is AVF because it has the longest lifespan and with fewest complications (NKF-DOQI, 1997).

In our study 68.2% of the patients were with established AVF which known for its good dialysis adequacy. Among this group, 42.3% were with a kt/v value of ≥ 1.2 . Although AVF is the preferred access, several complications reported in association with it and the most important is failure of the veins segment to dilate and develop thick walls (Konner, *et al.*, 2003). Stenosis can also cause recirculation of blood, which diminishes the treatment effectiveness. Other complication related to access includes infection, formation of aneurysms and ischemia of the arm (Sukhatme, 1996).

In the event where AVF difficult to establish, AVG is the second best option (NKF-DOQI, 1997). In our study, about 3.4% of the study sample has AVG access and 66.7% of them were with a kt/v value ≥ 1.2 . Because they plagued by a high complication rate (Konner, 2004), AVG may develop stenosis, infection, thrombosis and long-term potency are poor (Abularrage, Sidawy, Weiswasser, *et al.*, 2004).

Most of the patients who started dialysis for the first time or have poor weak veins to form AVF or AVG usually have access through catheters inserted into subclavian, jugular and femoral vein. In our study, 23.9% have access through subclavian vien. This group is at high risk of recirculation and this might explain the finding of 71.5% of these patients were with a kt/v value < 1.2 . This group is also at risk for developing venous stenosis or thrombosis, which might interfere with the future creation of AVF. Internationally, jugular vein is becoming the method of choice due to the previously mentioned complication, thus, one should emphasize the need to reconsider the use of subclavian catheters in our system (Cimochowski, 1990).

In general, temporary access used for 2–3 weeks due to clotting, low blood flow and infection, which limits the life of the catheters. In our settings at Al-Watani Center, the use of such temporary access persists for months causing inadequate dialysis in addition to other complication. This is mainly due to lack of trained vascular surgeon to establish AVF. All dialysis centers in the area rely on a single surgeon to serve these patients.

3.3.3 Complications during hemodialysis and kt/v

Hypotension is one of the most common medical complications seen during the hemodialysis and occurs in 15 to 40% of dialysis session (Sherman R. A, 2002). In the current study, only 4.5% of the patients seem to suffer from hypotension. Adequate clearance rate of 25% found among this as based on their kt/v value (≥ 1.2). Such low clearance rate could be due to excessive ultra filtration, anemia, antihypertensive medications, cardiac disease and errors in estimation of patient's dry weight (Leypoldt, Cheung, 1998).

Cramps and dizziness are also common intradialytic complications (Pastan and Bailey, 1998). In our study, cramps reported by 4.5%, while 23.9% of the patients reported complain of dizziness. Dizziness found to be the more frequent complain during dialysis treatments and patients in this group were with the lowest clearance rate (14.3%; $kt/v \geq 1.2$). Dizziness seems to be associated with either hypotensive episodes or hypertensive episodes during treatments.

Our findings clearly indicate that better clearance rates achieved in absence of patients complains. This is evident from the finding of acceptable clearance rates of 65% among patients with no reported complains during dialysis. It is important to note that human factor plays an important role in reducing complains and this emphasizes the role of well-trained technicians in the field.

3.3.4 Venous pressure and dialysis adequacy

Minimum venous pressure has a positive correlation with Kt/v while maximum venous pressure correlates negatively as would be expected

(Sehgal, Snow, Singer, *et al.*, 1998). High venous pressure known to be associated with stenosis, clots in the extracorporeal circulation and dialysate compartment. In our study the majority of the patients (72.7%) were with venous pressure ranged from 100–200mmhg and 65.6% of them were with kt/v value < 1.2 . On the other hand 26.1% of our study population were with venous pressure ranged from 200–300mmhg, of which 52.2% were with kt/v value < 1.2 . The rest of the patients (1.1 %) were with venous pressure > 300 mmhg and all of patients were with inadequate dialysis. Differences in clearance rates among these three categories were of no significance ($P = 0.064$; $\alpha = 0.005$).

3.3.5 Residual renal function and adequacy of dialysis

A person with low kidney function has little shortening of his/her lifespan. DOQI and other guidelines promotes placing patients with impaired renal function on dialysis sooner rather than later although there is evidence that placing people on hemodialysis causes residual renal function to decline (Keshaviah, *et al.*, 1987). In the current study, the majority of the patients (70.5%) were on dialysis with absent renal function. Among this group, 44.3% were with kt/v value of ≥ 1.2 . The rest of the study sample (29.5%) was maintaining residual renal function from their native kidney and only 22.2% of them were with kt/v value of ≥ 1.2 . The reason behind such differences between the two groups is not clear, as one should expect much better clearance for those still maintaining residual renal function. To elucidate the reasons behind this discrepancy, further investigations are essential. Differences in the clearance rates were of no statistically significant value ($P = 0.101$; $\alpha = 0.005$).

3.3.6 Hemodialysis duration and adequacy of dialysis

The best survival results for hemodialysis are those reported by Charra *et al.*, 1992, where a 10-year patient survival of 75% was achieved, in addition the duration of dialysis allowed excellent control of fluid and blood pressure. Registry studies both in USA (Held, *et al.*, 1991) and in Australia (Kerr, 2002) have shown an increase in patient survival with an increase in dialysis duration. In the current study, 38.6% of the study population was over 36 months of dialysis duration and 50% of these patients were with a kt/v value of ≥ 1.2 . Patients who were on hemodialysis treatment for 12–36 months constitute 25% of the study population and 23.8% of them were with kt/v of ≥ 1.2 . Out of those who were on hemodialysis treatment for 6–12 months (15.9% of the study population), 38.9% showed a kt/v value of ≥ 1.2 . The rest of the patients (20.5%) were on hemodialysis treatment for 1–6 months and around 27% of them showed a kt/v value of ≥ 1.2 . Previous reports seem to agree and support the idea of increased survival rates with increased duration of hemodialysis. Such improvement could be due to the fact that patients with longer duration were used to the system and became more adapted and cooperative during the dialysis session, which in turn is expected to affect the clearance rate, patient health and survival. In our study, variations in the clearance rates among the various groups of dialysis duration were of no statistically significant value ($P = 0.382$; $\alpha = 0.005$).

3.3.7 Patients weight and adequacy of dialysis

The mean weight among patients in the current study was 68.2kg (minimum weight 41.6kg; maximum weight 111.5 kg). Data presented in table 3.3 shows that 27.3% of the patients in weight ranged from 40–59.9kg and 66.7% of them were with a kt/v value < 1.2 . Patients with a weight

ranged from 60–79.9 kg constitute 53.4% and 59.5% of them showed a $kt/v < 1.2$. The group weighing 80–99.9 kg constitute 15.9% and 71.4% of them showed a kt/v value < 1.2 . Patients with weights $> 100\text{kg}$ constitute 13.4% and 33.3% of them showed a kt/v value < 1.2 . Although patients with the lowest weight showed better clearance rates compared to the other two groups, differences in the clearance rates among the studied weights groups were statistically insignificant ($P = 0.256$; $\alpha = 0.005$).

3.4 Recommendations and concluding records

1. The findings of the current study indicate inadequate hemodialysis, influenced by several factors such as duration time, frequency of dialysis and patients complains. Facilities, staff as well as patients seems to contribute to the observed low level of clearance among the study population, thus adoption and implementation of internationally clinical practice guidelines is expected to improve adequacy.
2. Dialysis care includes far more than reviewing the laboratory data of a dialysis patient once a month, it requires both a trained nursing staff providing skilled nursing care and an analysis for each and every dialysis treatment of the patient clinical state so that dialysate bath appropriately adjusted, the ultra filtration turned to the patient dry weight.
3. Measuring dialysis adequacy (kt/v) on monthly bases in the dialysis unit in order to determine what degree of enough dialysis they are receiving during their treatments.

4. Intensive education for patient about the importance of being adhered to prescribed hemodialysis dose by nephrologists especially the duration of dialysis procedure, over weight nutritional status and other various issues.
5. The need of a comprehensive study regarding ESRD patients is essential in the West Bank area in order to detect the needs, prevalence, and incidence and explore the size of the problem. This is of great important for the Palestinian Ministry of Health future planes concerning ESRD patients.
6. Further studies are required for the evaluation of the needs of the hemodialysis units in all the districts regarding working areas, qualified staff and facilities.

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Appendices

Question near Form

Adequacy of Hemodialysis among End Stage Renal
Disease Patients at Al-Watani Hospital

Sample no:-.....

1. Gender:- Male Female
2. Age :- 15 – 30 yrs 31 – 45yrs
 46 – 60yrs above 61yrs
3. Place of residence:- Village Camp City
4. Nature of work: - Farmer Worker
 Unemployed Academic
5. Level of education: - Preparatory Secondary
 Diploma University
6. Dialysate flow:- 300ml/m 500ml/m 800ml/m
7. Blood flow: - 200 – 250ml/m 250 – 300ml/m
 300 – 350ml/m 350 – 400ml/m
8. Etiology of disease: -
9. Vascular access: - Arteriovenous fistula Arteriovenous cortex
Subclavian catheter Femoral catheter
Jugular catheter Permanent catheter
10. Dialysis hours: - 2hrs 2.5hrs 3hrs
 3.5hrs 4hrs
11. Dialysis session /week: - Once Twice Thrice
12. Complication during dialysis: - Hypotension Cramps
 Dizziness Headache
 No
13. Volume of ultra filtration: - 0 - 1L 1.1 – 2 L
 2.1 – 3 L 3.1 – 4 L
 > 4.1 L

14. Venous Pressure: - 100 – 200mmhg 201 – 300mmhg
 301 – 400mmhg 401 – 500mmhg
15. Effective Surface Area: - 1.5 m2 1.6m2
 1.7m2 1.8m2
16. Recirculation: - 0 – 10 % 10.1 – 20 %
 20.1 – 30 % > 30.1 %
17. Residual Renal Function: - Present Absent
18. Dialysis Duration: - 1 – 6 months 6 – 12months
 12 – 36 months > 36 months
19. Weight: - 40 – 59.9kg 60 – 79/9kg
 80 – 99.9 kg > 100kg

جامعة النجاح الوطنية
كلية الدراسات العليا

فاعلية الديلزه لمرضى الفشل الكلوي المزمن
في المستشفى الوطني

إعداد

علام محمد عبد الحافظ رزق الله

إشراف

د. نائل صدقي أبو الحسن

مشرف ثاني

د. حسن حجاز

قدمت هذه الأطروحة استكمالاً لمتطلبات درجة الماجستير في الصحة العامة بكلية الدراسات
العليا في جامعة النجاح الوطنية في نابلس، فلسطين.

2006

ب

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الملخص

يعرف الفشل الكلوي على انه فقدان كامل للوظائف الكلوية وان الأسباب الشائعة والمسببة لهذا الفشل كما هي شائعة عالميا عائدة وبشكل عام إلى كل من مرض السكري وارتفاع ضغط الدم. يشخص المرض باستخدام العديد من الفحوصات المخبرية والإشعاعية وان الديليزة الدموية هي إحدى الخيارات لمعالجة للمعالجة حيث بين العديد من الدراسات بوجود علاقة قوية ما بين جرعات الديليزة الدموية والنتائج الطبية من خلال قياس قيمة kt/v .

هنالك ثمانية مراكز للديليزة الدموية تخدم 350 مريضا في الوقت الحالي موزعة في مناطق الضفة الغربية وتفتقر هذه المراكز إلى الفنيين المؤهلين وأخصائيي الكلى وكذلك التجهيزات كما أن نسبة المرضى مقارنة بالمرضى هي واحد إلى خمسة. إن محدودية الوصول إلى هذه الوحدات وعدم توفر الإمكانيات السابقة أدى إلى الحد من الاستجابة والانضباط لدى المرضى في هذه المراكز. هدفت الدراسة الحالية إلى تقييم نجاعة وفاعلية الديليزة الدموية عند مرضى الديليزة (88 مريض منهم 56.8% ذكور و 43.2% إناث) والملتحقين بمركز الديليزة الدموية الخاص بالمستشفى الوطني في مدينة نابلس. ولتحقيق هذا الهدف تم جمع المعلومات الطبية المرتبطة بهذا الغرض في الفترة الزمنية الممتدة من بداية حزيران ولنهاية تموز في العام 2006 ميلادية وذلك باستخدام استبانة صممت خصيصا لهذا الغرض حيث تم جمع المعلومات من خلال المقابلة المباشرة مع المرضى ومراجعة ملفاتهم وتم كذلك إجراء الفحوصات وسحب عينات الدم أثناء فترة الديليزة لكل مريض.

لقد بنت النتائج عدم نجاعة وفاعلية الديليزة المتبعة لدى 64% من عينة الدراسة. على الرغم من وجود نجاعة وفاعلية بنسبة 44.7% لدى الإناث و 32% لدى الذكور فان هذه

ت

الفروقات لم تكن ذات دلالة إحصائية هامة ($P = 0.429$). ولم يكن من السهل إيجاد علاقة تربط المتغيرات الديمغرافية الأخرى التي تناولتها هذه الدراسة مع نسبة فاعلية الديليزة. بينت النتائج وجود علاقة ذات معنى لكل من متغير الفترة الزمنية للديليزة وفعاليتها (4 ساعات بنسبة 69.2%) وكذلك عدد مرات الديليزة الأسبوعية (3 مرات أسبوعيا بنسبة 48.3%) وكانت هذه الفروقات ذات قيم إحصائية دالة ($P = 0.000$). لوحظ كذلك تحسن واضح لفاعلية الديليزة الدموية مرتبًا بزيادة الكمية المفلترة من المريض وكذلك تبين وجود فاعلية أفضل باستخدام دورات تنقية بنسب 0 - 10% بالمقارنة مع نسب التنقية الأخرى حيث لوحظ أن ما نسبته 70.8% من هذه الفئة كانت بقيم فاعلية مقبولة بالاعتماد على قياس قيمة kt/v .

مثل الخلل الكلوي والنتاج عن مرض السكري ما نسبته 44.3% من عينة الدراسة وشكلت فاعلية الديليزة لدى هذه الفئة ما نسبته 28.2%. لوحظ كذلك بوجود نسب فاعلية 42.9% و 71.4% بين المرضى الذين يعانون من التهاب الكبيبات الكلوية ومرضى Gouty Nephritis على التوالي. مثل ارتفاع ضغط الدم 2.3% من عينة الدراسة مشيرًا بذلك أن هذا المرض ليس من مسببات الفشل الكلوي في مجتمعنا في حين يعتبر هذا المرض من المسببات الهامة في العالم. مثل مرضى الديليزة لدموية مستخدمي المدخل الشرياني الوريدي ما نسبته 68.2% من عينة الدراسة وأبدى ما نسبته 42.3% من هذه العينة مستويات تنقية مقبولة أما بقية العينة فكان الوريد تحت الترقوة هو الأكثر شيوعًا ومثلت فاعلية الديليزة لدى هذه الفئة بنسبة 28.5% لوحظ فاعلية ديليزة بنسب أفضل لدى الأشخاص والذين فقدوا الوظيفة الكلوية بشكل تام بالمقارنة مع الأشخاص الذين يملكون قدرات كلوية محدودة (45.8% مقابل 29.7%) إن الأسباب الكامنة وراء هذه الظاهرة غير واضحة وتحتاج إلى دراسات مستقبلية.

تشير نتائج هذه الدراسة وبوضوح إلى ازدياد فاعلية الديليزة بازدياد كل من وقت الديليزة، ازدياد عدد مرات الديليزة، وسرعة تدفق الدم، وكمية السوائل المستخرجة من المرضى وكذلك مع قلة الشكاوى من المرضى خلال عملية الديليزة مما يشير إلى الحاجة الملحة لتبني وتطبيق معايير مستخدمة عالميا في هذا المجال في وحدات الديليزة في نظامنا المستخدم.