# INTRODUCTION

Studies examining the link between research evidence and clinical practice have consistently shown gaps between the evidence and current practice. Some studies in the United States suggest that 30%-40% of patients do not receive evidence-based care, while in 20% of patients care may be not needed or potentially harmful. However, relatively little information exists about how to apply evidence in clinical practice, and data on the effect of evidence-based guidelines on knowledge uptake, process of care or patient outcomes is limited ***(Locatelli et al., 2004).***

Guidelines practiced on anemia and actual practices are much different with different places and patients according to treatment. Moreover, in individual countries and individual units within countries local circumstances relating to economic conditions; organization of health care delivery or even legal constraints may render the immediate implementation of best practice guidelines difficult or impossible. Nevertheless, they provide a goal against which progress can be measured ***(Locatelli et al., 2004).***

Compliance with clinical guidelines is an important indicator of quality and efficacy of patient care, at the same time their adaptation in clinical practice may be initiated by numerous factors including; clinical experts, patient performance, constrains of public health policies, community standard, budgetary

limitation and methods of feeding back information concerning current practice ***(Cameron, 1999).***

End-stage renal disease (ESRD) is one of the main health problems in Egypt. Currently, hemodialysis represents the main mode for treatment of chronic kidney disease stage 5 (CKD5), previously called ESRD or chronic renal failure ***(Afifi and Karim, 1999).***

Although hemodialysis is often used for treatment of ESRD, no practice guidelines are available in Egypt. Healthcare facilities are seeking nowadays to develop practice guidelines for the sake of improving healthcare services ***(Ministry of Health and Population, 1999)***.

# Aim of the Work

To study the patterns of current clinical practice in hemodialysis prescription in regular hemodialysis patients in El Giza governorate sector (E) and to compare these patterns with the latest standard international guidelines in hemodialysis prescription stressing on anemia, bone disease management and adequacy of dialysis

*Chapter One*

# DIALYSIS OVERVIEW

Artificial support of the functions of failing organs has a history deeply rooted in the beginning of the last century. Although artificial respiration may have been used as early as Roman times by the physician *Galen,* and as late as 1908 by *GeorgePoe,* support of the failing kidney began as early as 1913. Two scholars are credited repeatedly in the literature, *Dr. John J. Abel and Dr. W. J. Kolff***,** as the forefathers of modern dialysis. "Vivi-diffusion" was coined in a paper given before the Association of American Physicians in 1913in which the blood of animals was cleaned of intermediaries of metabolism ***(Abel et al., 1990).***

Kidney transplantation is the treatment of choice for end-stage renal disease. A successful kidney transplant improves the quality of life and reduces the mortality risk for most patients, when compared with maintenance dialysis. To facilitate early transplantation, a 2008 NKF/KDOQI conference suggested early education and referral to a transplantation center plus the identification of potential living donors ***(Abecassis et al., 2008).***

However, not all patients are appropriate candidates for a kidney allograft because of absolute and/or relative contraindications to this procedure or the required medications. For these individuals and for those who are suitable transplant recipients but must wait for an available kidney, the choice

between hemodialysis or peritoneal dialysis is influenced by a number of considerations such as availability, convenience, co-morbid conditions, home situation, age, gender, and the ability to tolerate volume shifts ***(Mange et al., 2001).***

One potential outcome of chronic kidney disease (CKD) is end-stage renal disease (ESRD), requiring costly renal replacement therapy in the form of dialysis or transplantation. Although the incidence of ESRD shows signs of leveling off in developed countries, perhaps in part because of increased awareness of CKD, no such trend is seen in developing countries or minority populations. Over 2 million people now require renal replacement therapy to sustain life worldwide, but this likely represents less than 10% of those who need it ***(Codreanu et al., 2006).***

Chronic renal failure is a devastating medical, social, and economic problem for patients and their families. The availability and quality of dialysis programs largely depend on the prevailing economic conditions, the political-social structure, overall health care facilities, and the health care funding strategies of various countries. Large disparities separate the socio-economic structures of various countries, especially the developed and the developing countries. In the developed world, health care is generally available, whereas the vast population of people living in developing countries do not have access to even basic amenities like sanitation and safe

drinking water ***(REPORT, AD: 2000, in The World Bank, 2000, New York, Oxford).***

Support of renal function in modern times encompasses a wide array of methods and clinical scenarios, from the ambulatory patient to the critically ill. The primary indication for RRT is acute or chronic renal failure. However, much debate exists today regarding the optimal definition of renal failure, especially with acute renal disease. As many as 30 definitions of renal failure exist in the literature, yet recent consensus definitions and guidelines are becoming more widespread. The Kidney Dialysis Outcomes Initiative's (K/DOQI) clinical practice guidelines for chronic kidney disease. Define end stage kidney failure as Stage 5 with glomerular filtration rate (GFR) of <15 ml/min/1.73 $m^2$ or the use of dialysis ***(K/DOQI Clinical Practice Guidelines for chronic kidney disease, 2002).***

Once it is determined that renal replacement therapy will eventually be required, the patient should be counseled to consider the advantages and disadvantages of hemodialysis (in-center or at home), peritoneal dialysis (continuous or intermittent modalities), and renal transplantation (living or deceased donor).(Gomes CG et al.,1999).The 2006 K/DOQI guidelines recommend that patients with a GFR less than 30 mL/min per 1.73 m2 should be educated concerning these issues ***(K/DOQI Clinical Practice Guidelines and Clinical Practice Recommendations, 2006).***

Dialysis modality selection for end-stage renal disease patients should not solely be dictated by survival comparisons but also take into account patient preference. Nevertheless, potential mortality differences between dialysis modalities in (subgroups of) patients may contribute to modality choice. Survival comparisons have therefore frequently been made ***(Stel et al., 2007).***

Studies have shown that removal of toxins alone is insufficient for improving well-being of a dialysis patients. Finally, dialysis must improve the hard end-points namely, quality of life and long-term survival, Australia New Zealand DATA on survival outcome of patients who were on HD from 1997-2006 showed longer hours on dialysis had a clear dose-response relationship with survival ***(Kerr et al., 2008).***

The prevalence of ESRD is influenced by both the number of new patients requiring renal replacement therapy (incidence) and the number of deaths. Incidence typically reflects the interaction of genetic and environmental factors, as well as the efficacy of primary health care services ***(www.nejm.org., 2006).***

Currently, hemodialysis represents the main mode for treatment of chronic kidney disease stage 5 (CKD5), previously called ESRD or chronic renal failure ***(Afifi et al., 1999)***

For ESRD patients in economically advanced countries, the focus now is on improving quality of life and increasing long-term survival. In marked contrast, the developing countries are grappling with short-term patient survival and the enormous costs of therapy that limit continuation of treatment in the majority of patients with ESRD. Most of the developing world has a two-tier health care delivery system. In the government-run non-profit hospitals, patients do not have to pay for medical advice, basic examinations, or treatment, but they must pay for disposables (gowns, gloves, syringes, for example) and drugs. However, in the large number of private hospitals, patients do have to pay for all services ***(Kher et al., 2002).***

Although hemodialysis is often used for treatment of ESRD, no practice guidelines are available in Egypt. Healthcare facilities are seeking nowadays to develop practice guidelines for the sake of improving healthcare services. In the healthcare sector in Egypt, trials for establishing guidelines have been lead by the MOH ***(Ministry of Health and Population, 1999).***

It is evident that a vast majority of these patients die without receiving any form of dialysis. The number of patients accepted by dialysis programs is about 80 pmp in Egypt ***(Barsoum et al., 1992)*** 20 pmp2 in Malaysia ***(Lim et al., 1998)*** 3 to 5 pmp2 in India ***(Jha et al., 1996)*** and China, and even lower in other countries ***(Jha et al., 2000).***

Even though there is some heterogeneity in the results, these observational studies usually indicated that the mortality risk on hemodialysis treatment compared with that on peritoneal dialysis treatment changes over time, with the lowest relative risk for patients on peritoneal dialysis in the first 2 years of therapy. After these first 2 years, mortality risk increases for those who started on peritoneal dialysis and patient survival becomes similar for hemodialysis and peritoneal dialysis patients, or even somewhat better for patients on hemodialysis ***(Vonesh et al., 2006).***

In hemodialysis, your blood is pumped through a dialysis machine to remove waste products and excess fluids. You are connected to the dialysis machine using a surgically created path called a vascular access, also known as a fistula or graft. This allows blood to be removed from the body, circulate through the dialysis machine, and then return to the body ***(National Kidney Foundation. K/DOQI clinical practice guidelines, 2002).***

**Advantages** — It is not known if hemodialysis has clear advantages over the other type of dialysis (peritoneal dialysis) in terms of survival. The choice between the two types of dialysis is generally based upon other factors, including your preferences, home supports, and underlying medical problems. You should begin with the type of dialysis that you and your doctors think is best, although it is possible to switch to another type as circumstances and preferences change.

**Disadvantages** — Low blood pressure is the most common complication of hemodialysis and can be accompanied by lightheadedness, shortness of breath, abdominal cramps, nausea, or vomiting. Treatments and preventive measures are available for these potential problems. In addition, the access can become infected or develop blood clots Many patients who receive hemodialysis in a center are either unable to work or choose not to work due to the time required for travel and treatment ***(Williams et al., 2004).***

Continuous ambulatory peritoneal dialysis is becoming the preferred modality of dialysis in countries with limited resources. An increasing number of patients are utilizing CAPD in the UK, New Zealand, and Australia, where government-funded hospitals provide dialysis services. The procedure does not require expensive equipment, and after the initial training period, the patient no longer requires regular visits to the dialysis center. Thus, CAPD offers greater independence and mobility as well as a better quality of life compared to hemodialysis. These qualities should make CAPD the ideal modality for ESRD patients in developing countries. However, utilization of CAPD varies greatly among the developing countries. In contrast to that in the developed world, the cost of CAPD is two times higher than that of hemodialysis in developing countries. The main reason for this disparity is the lack of indigenous facilities to manufacture peritoneal dialysis fluid ***(Chugh et al., 1995).***

CKD is an important public-health problem that is closely linked to other major NCDs (Noncommunicable diseases) such as diabetes and cardiovascular disease (including hypertension)—but which independently increases the likelihood of adverse outcomes and high health-care costs, suggesting that it can be used to identify the highest risk subset of patients, who may benefit most from treatment. Further, optimal management of these other NCDs may require modification when CKD is also present ***(McCullough et al., 2007).***

According to the 2010 US Renal Data System Annual Data Report, the leading causes of CKD leading to kidney failure in the United States are diabetes (incident cases of ESRD of 153 per million population in 2009), hypertension (accounting for 99 per million population), and glomerulonephritis, which accounts for 23.7 per million population ***(Collins et al., 2008).***

The proportion of people with CKD not explained by diabetes or hypertension is substantially higher in developing countries. In developing countries, diabetes and hypertension now appear to be the leading causes of ESRD with a prevalence of about 30% and 21%, respectively, but glomerulonephritis and CKD of unknown origin account for a larger fraction of the total, especially in younger patients ***(Sharma et al., 2010).***

Risk factors for the development of ESRD include diabetes, hypertension, obesity, dyslipidemia, history of smoking, anaemia and proteinuria/albuminuria. Diabetic nephropathy occurs in up to 40% of diabetic subjects with microalbuminuria and is currently the major cause of ESRD in many regions of the world ***(Gowdak et al., 2007 & Zoccali et al., 2003).***

Five year survival among dialysis patients is best with chronic glomerular diseases and polycystic kidney disease, intermediate with hypertension-induced renal disease, and worst with diabetic nephropathy; five year survival of the patient with diabetic nephropathy is only 20% ***(USRDS, 2005).***

Cachexia, dementia, and withdrawal of dialysis therapy were important causes of death in patients who were older than 85 yr ***(Villar et al., 2007).***

Analyses based on the National Cooperative Dialysis Study (NCDS) provided the impetus for routine quantification of delivered dialysis dose in hemodialysis practice throughout the world, by suggesting minimum targets for small solute (urea) clearance. Morbidity and mortality in dialysis populations remain high despite many technological advances in dialysis delivery. A number of observational studies reported association between higher dose of dialysis as measured by Kt/V urea or urea reduction ratio with lower mortality risk ***(Saran et al., 2004).***

The poor outcomes with conventional thrice weekly HD have stimulated interest in more frequent sessions and the role of dose, session duration and frequency in determining outcomes ***(Diaz-Buxo et al., 2005).***

**Table (1):** Classification and characteristics of the various hemodialysis modalities.

| Modality | Sessions/ week | Duration/ session (hours) | Blood flow (ml/mt) | Dialysate fl (ml/mt) |
|---|---|---|---|---|
| Day time dialysis | | | | |
| Conventional HD | 3 | 3- 5 | 300 | 500 |
| Long day time intermittent HD | 3 | 6 - 9 | 300 | 500 |
| Short daily HD | 6-7 | 1.5 - 3 | 400-500 | 500-800 |
| Nocturnal HD (NHD) | | | | |
| In-center NHD (INHD) | 3 | 8 | 300- 400 | 500 |
| NHHD – 'Daily' | 5-7 | 6 - 10 | 200 -350 | 200- 300 |
| NHHD – 'Alternate days' | 3 | 8 | 300 | 500 |

***(Indian J Nephrol, 2012)***

Conventional HD **(Conventional hemodialysis is any close variant of ~4 hrs treatment 3 times each week at a dialysis facility**) remains the main modality of renal replacement therapy for patients with end-stage renal disease (ESRD) worldwide ***(Himmelfarb et al., 2010)***. Conventional HD treatment had, over many years, improved the survival rate of patients with ESRD ***(U.S. Renal Data System, 2010).***

In fact, conventional HD prescription provides only about 10% of the clearance power of the natural kidneys ***(De Francisco and Pinera, 2006).*** Although it is capable of removing excess water and small size uremic toxins, yet, conventional HD is not capable of removing middle and large

size (>500 Dalton) and protein-bound toxic molecules ***(Dhondt et al., 2000).*** These middle- and large-size molecules include $\beta_2$-microglobulin ($\beta_2$ -M), which is strongly associated with carpal tunnel syndrome and dialysis-related amyloidosis ***(Van Ypersele et al., 1991).***

Studies in both Germany and the United States have documented the relationship between shorter dialysis time and poorer outcome ***(Held et al., 1991)***. Patients dialyzed fewer than 3.5 hours three times per week have approximately twice the mortality risk compared to patients dialyzed four or more hours three times per week ***(Woods et al., 1996).***

Currently, hemodialysis represents the main mode for treatment of chronic kidney disease stage 5 (CKD5), previously called ESRD or chronic renal failure. The main hemodialysis regimen adopted in Egypt is three times per week. Most Egyptian centers are equipped with machines with controlled ultrafiltration and synthetic membranes. Many centers use bicarbonate buffer and high flux dialysers although they are not universally applied ***(Afifi and Karim, 1999).***

Survival rates among dialysis patients depend partly on the delivered dosage of dialysis ***(Owen et al., 1993)***.

The use of central venous catheters (CVCs) as dialysis access remains common and indeed is rising in many countries ***(Pisoni et al., 2010).***

A well-functioning vascular access (VA) remains the Achilles' heel of hemodialysis (HD) and is essential to providing efficient dialysis therapy. VA complications remain the leading cause of morbidity in the HD population and account for high healthcare costs. There are three main types of access: native arteriovenous fistula (AVF), AVF graft (AVG) and central vein catheter. Catheter use is linked to higher rates of infection and could compromise dialysis adequacy ***(Hoen et al., 1995 & Combe et al., 2001).***

However, AVF provides the best access for longevity and lowest association with morbidity and mortality ***(Feldman et al., 1996 & Pisoni et al., 2002).***

Guidelines from different countries strongly recommend AVF use ***(Tordoir et al., 2007).***

This is despite international and national guidelines identifying an arteriovenous fistula (AVF*)*, as the preferred form of vascular access and observational evidence of worse patient outcomes with CVC use. Previous studies have demonstrated an association between the use of CVCs and higher risks of mortality ***(Xue et al., 2003)*** and hospitalization, ***(Pisoni et al., 2009).***

Results from both the US Centers for Medicare and Medicaid Services (CMS) and international Dialysis Outcomes and Practice Patterns Study (DOPPS) data sources suggest