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)***

Appropriately then, the care of dialysis patients has been the prime focus of nephrology, particularly after the widespread availability of maintenance dialysis when it became evident that mortality of dialyzed patients was high and their quality of life far from adequate.***(Eknoyan et al,2002)***

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 ,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 pattern of current clinical practice in hemodialysis prescription in regular hemodialysis patients in Egypt and to compare this pattern with standard international guidelines in hemodialysis prescription , stressing on anemia, bone disease management and adequacy of dialysis.

Chapter (1)
Hemodialysis in Egypt

The Arab Republic of Egypt is a country mainly in North Africa, with the Sinai Peninsula forming a land bridge in Southwest Asia. Egypt is thus a transcontinental country, and a major power in Africa, the Mediterranean Basin, the Middle East, and the Muslim world. Covering an area of about 1,010,000 km2 (390,000 square miles), Egypt is bordered by the Mediterranean Sea to the north, the Gaza Strip and Israel to the northeast, the Red Sea to the east, Sudan to the south, and Libya to the west. Egypt is one of the most populous countries in Africa and the Middle East. The great majority of its estimated 80 million people1 live near the banks of the Nile River, in an area of about 40,000km2 (15,000 square miles)***(Agency for Public Mobilization and Statistic, 2011).***

Chronic kidney disease (CKD) has become a major public health problem worldwide over the past decades. This is probably due to the increased prevalence of hypertension, diabetes mellitus, and other risk factors for CKD in most countries***(Perico et al., 2009).***

A national registry for ESRD in Egypt has not yet been developed. Therefore, the incidence and prevalence of ESRD are not known accurately. The incidence was defined as the total number of patients with ESRD who underwent renal replacement therapy in the current year, while the incidence rate was the number per million people. The prevalence was defined as the total number of patients alive ***(Soliman et al.,2012).***

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Diabetes mellitus was the leading cause of ESRD in patients who underwent hemodialysis (34.7%),followed by hypertension (21.5%) and obstructive infective kidney diseases (11.3%). These features are similar to those reported by other countries in the developed world. Data in the last 15 years showed that diabetes mellitus has been the cause of significantly increasing ESRD. These data also suggest that both incidence and prevalence rates of ESRD have increased***(Soliman et al.,2012).***

On the other hand, the Egyptian renal registry showed in its year 2000 report that hypertension was the most common cause of ESRD in Egypt***(Egyptian Society of Nephrology,2000).***

End-stage renal disease (ESRD) is a major medical and economic problem worldwide. Both incidence and prevalence of treated ESRD are increasing in the developing world. Reasons for this include an actual increase in incidence, improved survival from other diseases, and wider acceptance criteria for renal replacement therapy (RRT) The global incidence is estimated to be about 100 new patients per million population***(Locatelli,2000).***

According to the most recent Egyptian renal registry in 2008, the prevalence of ESRD is 483 per million population and the total recorded number of ESRD patients on dialysis is 40000. Ninety-eight percent of these patients are on hemodialysis (HD) and are treated using about 3000 machines in just over 600 dialysis units, of which 25% are government run and 75% are private. Of the 2% of patients being treated with peritoneal dialysis (PD), 1.9% are on intermittent PD, less than 0.1% are on continuous ambulatory PD (CAPD), and no one is on automated PD***(Khaled et al., 2010).***

Males constitute 55.2% of Egyptian ESRD patients. More than half the patients are between 40 and 59 years of age (mean 49.8 ± 19 years). Hypertension is responsible for 36.6% of ESRD cases in Egypt. The other significant causes are ESRD of unknown etiology (15.2%), diabetic nephropathy (13.5%), and chronic glomerulonephritis (7.8%)***(Khaled et al., 2010).***

Hemodialysis started earlier than peritoneal dialysis in Egypt. The first hemodialysis was performed in AinShams

University hospital in 1958, while the first intermittent peritoneal dialysis (IPD) was performed at the Cairo University Hospital in 1963. When continuous ambulatory peritoneal dialysis (CAPD) started to become popular, the doctors of Al-Salam Hospital in Cairo introduced this procedure 1982, as a method for renal replacement therapy***(Barsoum, 1997)***.

More than 1050 HD units are now available and distributed in many parts of the country. Dialysis still imposes high costs for treatment on most patients with ESRD. Most patients with ESRD have low income as reported by the Central Board of Statistics of Egypt. In 2009, the gross national income per capita was US$547.0 per year. On the other hand, yearly costs for thrice-weekly HD, 4 h per session, were US$3250. Since health insurance is primarily limited to government officials, army soldiers, and companies' personnel, most dialysis costs must be covered by the Ministry of Health. Continuous ambulatory peritoneal dialysis (CAPD) is an alternative dialysis treatment, but it is not offered in majority of centers because the costs are still not fully covered by health insurance and the Ministry of Health. The cost for a CAPD catheter insertion was US$150, while yearly costs for three to four fluid exchanges were US$4500– $6000 ***(Soliman et al.,2012).***

Infrequent, poorly targeted and inadequate inspections by survey agencies allow facilities quality of care problems to go undetected or remain uncorrected. Even when deficiencies are identified and facilities take corrective actions, little incentive exists for these facilities to remain in compliance. This problem is often seen in the developing countries' dialysis units where financial restrictions lie behind inability of dialysis units to reach proposed targets ***(Ibrahim, 2010).***

Hemodialysis centers in Egypt exist in governmental, military, and university hospitals as well in the private sector. 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 ***(Afifi,1999).***

The practice of hemodialysis in some university centers; considered the highest level of care provision, showed no more than partial compliance with the international guidelines***(Ibrahim, 2010).***

The hemodialysis centers, whether private or governmental, are under supervision by the Egyptian Ministry of Health (MOH). However, no Egyptian guidelines or approved guidelines to standardize the practice of hemodialysis are implemented in Egypt Therefore, hemodialysis is not uniformly practiced across the different centers in Egypt***(Ibrahim, 2010).***

Applying international guidelines for hemodialysis in Egypt would not be suitable or feasible, because of different health system and lack of resources. The main aim of Development of practice guidelines for hemodialysis in Egypt project was the development of evidence- and consensus-based clinical practice guidelines for hemodialysis in Egypt***(Ahmed et al., 2010).***

The Egyptian guidelines were adopted from the standards developed by The College of Physicians and Surgeons of Alberta (Canada), The National Kidney Foundation (USA), The Clinical Standards Board for Scotland (Scotland), and The College of Physicians and Surgeons of Ontario (Canada). In addition, the guidelines published in Oxford Handbook of Dialysis were reviewed. Thereafter, a panel of Egyptian experts in the field of nephrology and hemodialysis was selected and invited to participate in this project of Development of practice guidelines for hemodialysis in Egypt***(Ahmed et al., 2010).***

The Delphi technique was applied to build up the consensus among the experts on the formulated guidelines. The final version of the first Egyptian Hemodialysis Practice Guidelines included five main sections; personnel, patient care practices, infection prevention and control, facility, and documentation/records ***(Ahmed et al.,2010)***.

Worldwide rise in number of patients with CKD and ESRD nesestating RRT is threatening to reach epidemic porpotions over the next decade, and only small number of countries have robust economies to meet the challanging posed. In egypt , one of the developing countries, poverty has emrged as one of the most challanging socioeconomic problems ,with 23% of population within the national poverty line. A change in global approach to CKD from treatment of ESRD to more aggressive primary and secondry preventions is therfore imperative***(Gouda et al., 2011).***

Currently, the Ministry of Health is designing a program titled “Screening and Prevention of Chronic Kidney Disease in Egypt.” The objective of this program is to determine the prevalence of proteinuria, hypertension, diabetes mellitus, and obesity in the study population. Data that will be collected from this program could assist and guide the national policy in prevention of chronic kidney disease***(Soliman et al.,2012).***

Chapter (2)
Hemodialysis prescription

End stage kidney failure(ESRD) was defined by estimated Glomerular Filtration Rate (eGFR) less than 15ml/min/1.73m2, bilateral shrunken kidneys on ultrasound scan and presence of clinical features of ureamia (such as hypertension, anemia and bone disease) and need for dialysis***(NKF K/DOQI guidelines,2002).***

Hemodialysis (HD) refers to the transport process by which a solute passively diffuses down its concentration gradient from one fluid compartment (either blood or dialysate) into the other. During HD, urea, creatinine, and potassium move from blood to dialysate, while other solutes, such as calcium and bicarbonate, move from dialysate to blood. The dialysate flows countercurrent to blood flow through the dialyzer to maximize the concentration gradient between the compartments and therefore to maximize the rate of solute removal. The net effect is the production of desired changes in the plasma concentrations of these solutes***(Golper,2010).***

Solute is cleared from the intravascular compartment by either diffusive or convective transport. Such transport depends upon multiple factors, including the concentration gradient between the blood and dialysate for a particular solute, the type and amount of blood and dialysate flow, the properties of the dialysis membrane, and the size and physicochemical property of the solute being removed***(Rebecca and Holley,2011)***.

The degree of diffusive transport is a function of the concentration difference of the solute with respect to blood and dialysate, membrane surface area, porosity and thickness of the membrane, molecular size of the solute, and flow rate of blood and dialysate. The mass transfer coefficient (KoA) of a dialyzer , which defines its capacity, varies with the depth and porosity of the membrane, the molecular size of a given solute, and the flow rates of blood and dialysate ***(Rebecca and Holley,2011)*** **.**

The second mechanism of solute transport across semipermeable membranes is ultrafiltration (convective transport). Water molecules are extremely small and can pass through all semipermeable membranes. Ultrafiltration occurs when water driven by either a hydrostatic or an osmotic force is pushed through the membrane. (Analogous processes are wind in the atmosphere and current in the ocean.) Those solutes that can pass easily through the membrane pores are swept along with the water (a process called solvent drag). The water being pushed through the membrane is accompanied by such solutes at close to their original concentrations. Larger solutes, especially those that are larger than the membrane pores, are held back. For such large solutes, the membrane acts as a sieve***(Daugirdas,2007).***

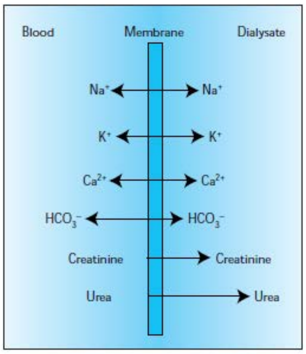

FIGURE 1-3

Membrane fluxes in dialysis. Dialysis is the process of separating elements in a solution by diffusion across a semipermeable membrane (diffusive solute transport) down a concentration gradient. This is the principal process for removing the end-products of nitrogen metabolism (urea, creatinine, uric acid), and for repletion of the bicarbonate deficit of the metabolic acidosis associated with renal failure in humans. The preponderance of diffusic as the result of gradient is shown by the displacement of the *arrow.*

Figure (1):Mechanisms of solutes removal in hemodialysis *(Hamilton,1999)*

Despite the widespread use of peritoneal dialysis and renal transplantation, hemodialysis (HD) remains the main renal replacement therapy in most countries worldwide ***(Eknoyan, 2005).***

Optimal care of the patient receiving long-term HD requires broad knowledge of the HD technique and appropriate prescription according to patient- and device-dependent variables***(Ikizler and Schulman,2005)***.

Table: (1): Elements of the Dialysis Prescription

Dialyzer
Time and frequency
Blood flow rate
Dialysate flow rate
Ultrafiltration rate
Dialysate composition
Dialysate temperature
Anticoagulation

(Brenner and Rectors,2008).

1-dialyzer

Porous capillary-like fibers carrying blood are bundled together within the dialyzer shell and serve collectively as the dialyzer membrane across which blood and dialysate flow ***(Salem et al.,1993).***

Dialyzer types are categorized by the following characteristics; type of membrane (synthetic, cellulose, substituted cellulose),Blood volume capacity, Surface area, ultrafiltration coefficient, Clearance of various substances, Capacity for reuse, Sterilization requirement***(Bouri et al., 2004).***

The choice of dialyzer should also be guided by measures of dialysis adequacy, the perceived need for biocompatibility, and particular patient characteristics***(Bouri et al., 2004).***

Membrane material — There are multiple types of membranes currently used to manufacture dialyzers :-

1. Unmodified cellulose, is a polysaccharide-based membrane
2. Substituted cellulose membranes are obtained by chemical bonding of a material. The most common type is cellulose acetate.
3. Cellulosynthetic membranes are modified by the addition of a synthetic material to liquefied cellulose during its formation.
4. Synthetic noncellulose membranes have a higher permeability and are more biocompatible than the cellulose membranes**.**

(Bouri et al., 2004).

Clearance of various solutes from blood is a function of dialyzer efficiency. Mass transfer area coefficient (K0A). is the maximum theoretical clearance of the dialyzer in milliliters per minute for a given solute at infinite blood and dialysis solution flow rates. For any given membrane, K0A will be proportional to the surface area of the membrane in the dialyzer. K0A FOR UREA, is a measure of dialyzer efficiency in clearing urea and solutes of similar molecular weight***(Daugirdaset al., 2007).***