Chapter 1

INTRODUCTION

BACKGROUND ON MAINTENANCE HEMO-DIALYSIS.

Dialysis is an artificial process used to purify the blood. Dialysis will not cure kidney disease but it removes the waste products and excess water from the body and stabilizes the blood chemistries. Dialysis is a treatment that simulates the function of healthy kidneys. When an individual’s kidneys are no longer able to do their job adequately (85-90% loss of functioning), dialysis becomes necessary to remove waste, salt and extra water, while keeping normal levels of certain chemicals in the blood and helping control blood pressure. Most often, dialysis will become a regular activity for patients with ESRD for the rest of their lives, unless they are eligible and a suitable kidney becomes available for a transplant. There are two kinds of dialysis that a patient can choose to undergo, and both come with specific nutritional recommendations.

Maintenance hemodialysis (MHD) is the only long term form of mechanical organ replacement therapy utilized today. From its conceptual origin in the laboratory of Abel and Rowntree at Johns Hopkins University in 1913, to the first practical extension of life by repetitive hemodialysis in 1960, hemodialytic therapy has burgeoned through the years to the present, when more than one million people around the world with end-stage renal disease (ESRD) are kept alive.

Hemodialysis involves circulating the blood through dialyzer with semi-permeable membrane separating the blood from dialysate fluid which has an electrolyte composition similar to normal serum. As the blood is pumped through the dialyzer, it is cleared of waste products electrolyte concentrations
are restored to normal levels and excess water is removed by process of diffusion and ultra-filtration. This dialysis process is conducted for 4 to 6 hours two to three times in a week. Identifying the presence of malnutrition is important in the overall management of these, because prevention and early detection may be the most important steps in reducing the incidence of malnutrition.

India, with a population base of one billion and an estimated incidence of ESRD of 1000 pmp, approximately 100,000 patients develop ESRD each year. Of these 90% never see a nephrologist. Renal replacement therapy is initiated in 90%; the other 10% are unable to afford any cost of therapy.

End stage renal disease population has exceeded 7,00,000 by turn of the century. Therapeutic options for such patients are limited, the choice is between two forms of replacement therapy i.e., maintenance dialysis and renal transplantation. The latter is the most desirable treatment, nevertheless the major limiting factor is the lack of available organs, hence, majority have to remain on long term/lifelong dialysis. Gulati (2001).

MALNURITION IN MAINTENANCE HEMODIALYSIS

Malnutrition, defined as insufficient protein-calorie intake, is highly prevalent in hemodialysis (HD) patients. It is commonly associated with decreased body weight, depleted energy stores (fat tissue) and loss of somatic proteins. It has been suggested that there may be at least two different types of malnutrition in HD patients. The first is related to low protein and energy intake. This type of malnutrition may be amenable to adequate nutritional and dialysis support. In contrast, the second type of malnutrition is associated with inflammation and atherosclerotic cardiovascular disease. This type of malnutrition is much more difficult to reverse with nutritional support and dialysis therapy, unless the underlying co-morbid conditions and chronic inflammatory response are treated adequately.

Malnutrition is a serious concern in patients with end-stage renal disease (ESRD) who are treated with maintenance dialysis. The reason for concern is the association
between evidence for malnutrition and poor patient outcome. Maintenance hemodialysis (MHD) is the only long term form of mechanical organ replacement therapy utilized today.

The prevalence of malnutrition in patients of end stage renal disease on maintenance hemodialysis ranges from 10-54%. In this population, protein energy malnutrition (PEM) is common and several studies have identified hypoalbuminemia as the strongest predictor of not only malnutrition but also morbidity and mortality. Serum albumin is routinely available and is the most commonly used biochemical index having the power of predicting clinical outcomes. However, recent literature has emphasized the negative influence of inflammation on serum albumin concentration, regardless of nutritional status.

Malnutrition is common in hemodialysis patients and is a powerful predictor of morbidity and mortality. Although much progress has been made in recent years in identifying the causes and pathogenesis of malnutrition in hemodialysis patients, as well as recognizing the link between malnutrition and morbidity and mortality, no consensus has been reached concerning its management. Along with such conventional interventions as nutritional counseling, oral nutritional supplements, and intradialytic parenteral nutrition and therapeutic strategies have been tested, such as appetite stimulants, growth hormone, androgenic anabolic steroids, and anti-inflammatory drugs, with contradictory and non-conclusive results.

Diabetes and hypertension are the most common causes and account for approximately two third of cases of chronic renal failure. Other major causes include glomerulitis, polycystic kidney diseases, kidney stone, infection etc.

**CAUSES OF MALNUTRITION**
Malnutrition is not uncommon in dialysis patients and the causes are numerous. The dialysis procedure itself results in losses of nutrients into dialysate and, independent of these losses of nutrients, appears to result in an increase in catabolism during hemodialysis, overall, the hemodialysis treatment was a catabolic event because of amino acid losses into dialysate and decreased protein synthesis during treatment. The presence of metabolic acidosis, which is common in patients with ESRD, may also be associated with increased catabolism in these patients.

Amino acids are lost into dialysate and with high flux dialyzers, protein losses are also increased. Losses of vitamins into dialysate also occur. Symptoms of uremia include anorexia, nausea, and vomiting, and these symptoms are not always well controlled in maintenance dialysis patients, leading to reduced dietary protein and energy intake.

Protein-energy malnutrition (PEM) is very common among patients with advanced chronic kidney disease (CKD). In the Indian scenario, where malnutrition is widely prevalent in the general population, this problem becomes even more intense in patients with CKD.

As per guidelines for the management of nutrition (2005). The main causes of malnutrition are:

a) Inadequate food intake secondary to: Anorexia caused by the uremic state altered taste sensation intercurrent illness emotional distress or illness impaired ability to procure, prepare, or mechanically ingest foods unpalatable prescribed diets.
b) The catabolic response to superimposed illnesses
c) The dialysis procedure itself, which may promote wasting by removing such nutrients as amino acids, peptides, protein, glucose, water-soluble vitamins, and other bioactive compounds, and may promote protein catabolism, due to bio incompatibility
d) Conditions associated with chronic kidney disease that may induce a chronic inflammatory state and may promote hyper catabolism and anorexia
e) Loss of blood due to: Gastrointestinal bleeding frequent blood sampling blood sequestered in the hemodialyzer and tubing
f) Endocrine disorders of uremia (resistance to the actions of insulin and IGF-I, hyperglucagonemia, and hyperparathyroidism)
g) Possibly the accumulation of endogenously formed uremic toxins or the ingestion of exogenous toxins.

Several studies have shown that nutritional status is an important factor determining the outcome of patients with CKD. Nutritional therapy therefore deserves as much emphasis, if not more, as medical therapy. Guidelines are now available for optimum management of nutritional status of patients with CKD. These guidelines, called Dialysis Outcome Quality Initiative (DOQI) have been prepared by the American National Kidney Foundation (NKF). Considering differences in the dietary habits of Indian subjects, the guidelines have been modified to suit the conditions prevailing in our country.

Maintenance hemodialysis patients who self-selected their diets were in danger of developing protein-calorie malnutrition. Patients with ESRD treated with hemodialysis demonstrate altered patterns of food intake.

The cause of reduced appetite is not entirely understood, but elevated serum leptin or other factors, which suppress appetite, may be involved. All of these abnormalities can result in the development of malnutrition

**ASSESSMENT OF MALNUTRITION IN HEMODIALYSIS.**

There is no single measurement which can be used to determine the presence of malnutrition. Therefore, a panel of measurements is recommended, including a measure of body composition, a measure of dietary protein intake and at least one measure of serum protein status.
Malnutrition is a common in patients treated with maintenance dialysis and appears to influence mortality in these patients. Thus assessment of the nutritional status of dialysis patients is important. Malnutrition and nutritional assessment can be define as the interpretational information obtained from anthropometric, Bio-chemical, clinical and dietary studies.

Nutritional intervention can decrease malnutrition and mortality the first step is careful evaluation of protein-energy status and followed by intestinal nutritional counseling then by oral nutritional supplementation appetite stimulation or enteral tube feedings.

Hemodialysis patients often have poor appetites, to correct poor nutritional status use of favorite foods may be a important intervention. Decreased taste sensitivity has been shown to contribute to poor nutritional status in patients with chronic uremic or on maintenance hemodialysis.

Nutritional intake should also be frequently assessed in dialysis patients. Renal dietitians are well trained to determine nutrient intake from food records, and computer programs exist that can quickly and accurately translate dietary food intake into accurate amounts of protein and energy. Dietary recall over 1 to 3 day is commonly used, but the longer the period of recall, the more likely the patient will become bored with keeping a diary, and this may compromise the information obtained. Dietary history does not require much work on the part of the patient, but its accuracy depends on the patient’s memory. The normalized protein equivalent of nitrogen appearance (nPNA) has also been used to assess dietary protein intake in stable patients who are in neutral nitrogen balance.

Guidelines for the management of nutrition (2005) recommended that nutritional status should be assessed with a combination of valid, complementary measures rather than any single measure alone. In our situation, the nutritional status could be assessed by:
(a) Dietary interviews and diaries
(b) Urea nitrogen appearance (una) for assessment of protein intake.
(c) Subjective global assessment (SGA)
(d) Anthropometry
(e) Biochemical parameters like creatinine, bicarbonate, albumin and cholesterol.

Nutritional status should be assessed on a regular basis in all dialysis patients, so that any decline in nutritional status can be quickly addressed. Serum proteins should be monitored monthly to every 3 month, anthropometry should be carried out every 6 month, and food intake from dietary history, food records and nPNA should be assessed simultaneously.

MANAGEMENT OF MALNUTRITION

Once malnutrition occurs, patient outcomes may decline. Therefore, prevention of malnutrition becomes very important. Patients must be prescribed adequate protein and energy to prevent the development of malnutrition. Although no studies exist to demonstrate that prevention of malnutrition will change patient outcomes such as morbidity or mortality, the clear association between poor nutritional status and increased risk of death strongly suggests that malnutrition should be avoided.

Malnutrition, defined by insufficient protein calorie intake (the so called protein-energy malnutrition), and cachexia, defined by defective food assimilation or utilization in the presence of hypercatabolism.

Protein-calorie malnutrition is sometimes considered the most prevalent form of malnutrition in renal patients. Prevention is the most important approach in treating malnutrition and primary to prevention is recognizing the condition.

Determining dietary compliance is important for preventing malnutrition. Methods for monitoring compliance of patients with chronic renal disease should include determination of blood levels of urea, nitrogen, potassium, creatinine and phosphorus, and by observing the amount of weight gained between dialysis treatments.
Compliance with dietary fluid and medication instruction is critically significant factor in the continued health and wellbeing of the patient undergoing chronic hemodialysis. Compliance is defined as the extent to which an individual chooses behavior that coincides with clinical prescription. Compliance in dialysis population is generally poor, with less than 25% of patients meriting a good compliance rating.

Currently, it is widely believed that wasting and malnutrition are no longer prevalent in the patients undergoing maintenance dialysis. However, there is evidence suggesting that many factors which promote malnutrition in renal failure persist even with modern methods of dialysis treatment. There is no single measurement that can be used to determine or exclude the presence of malnutrition. Therefore, a panel of measurements is recommended, including measurement of body composition, measurement of dietary protein intake, and at least one measure of serum protein status.

Patients who receive maintenance dialysis experience a loss of nutrients as a direct result of dialysis. HD results in a loss of 6-12 gm amino acids, 2-3g peptides and negligible amounts of protein per dialysis sessions. Patients receiving maintenance dialysis also have protein losses due to frequent blood sampling for labs. A patient with normal hemoglobin will lose approximately 16g protein with each 100mls of blood removed.

MAINTENANCE HEMODIALYSIS AND NUTRITION

Due to the kidney’s unique role in nutrients metabolism and the nature of disease progression, patients with renal failure are uniquely susceptible to malnutrition. The type and degree of malnutrition depend on the type and length of treatment. The malnutrition is the main cause of high morbidity and mortality among hemodialysis patients.

Dietary Protein Intake

Dietary protein intake has been the subject of a number of studies, as a strategy to slow the progression of ESRD, to reduce uremic symptoms, and to evaluate the
appropriate dietary protein requirements of people with ESRD treated with maintenance dialysis therapy. The issues surrounding use of diet to reduce symptoms of uremia and to delay the progression of ESRD are beyond the scope of this discussion.

For an understanding of the protein requirements for people treated with maintenance dialysis, one can look at those studies carried out in metabolic units to determine the level of dietary protein intake that will result in neutral or positive nitrogen balance.

In hemodialysis patients, there are no randomized, prospective trials that examine dietary protein intake and outcomes. However, several studies carried out by measurement of nitrogen balance demonstrate that approximately 1.2 g/kg per d of high biologic value protein is associated with positive nitrogen balance.

These higher protein requirements may be due to losses of protein and amino acids into dialysate, or the catabolic effect of the hemodialysis procedure. Several studies report losses of approximately 1 to 2 g of protein into dialysate with conventional hemodialyzers, but may be higher with high-flux dialyzers. Losses of amino acids into hemodialysate average 6 to 12 g per treatment.

NKF/KDOQI GUIDLINE 2000 based on the aforementioned studies, it is recommended that MHD patients consume a diet with a total daily energy intake of 35 kcal/kg body weight/d. It is therefore recommended that a safe DPI that will maintain protein balance in almost all clinically stable MHD patients is 1.2 g protein/kg BW/d; at least 50% of the protein should be of high biological value.

NKF/KDOQI Clinical Practice Guidelines for Nutrition 2000 recommend that patients on maintenance hemodialysis should have > 50% of protein from HBV sources. This recommendation was not graded. The other guidelines reviewed did not make any recommendation.
It is difficult for some MHD patients to maintain this level of daily protein intake. Techniques must be developed to ensure this level of intake for all patients. Education and dietary counseling should be the first steps in attempting to maintain adequate protein intake. Daily dietary sodium intake should be restricted to no more than 5 g of sodium chloride (2.0 g or 85 mmol of sodium). (Clinical Practice Guidelines, 2006, NKF GUIDELINES).

Protein requirements for patients receiving dialysis are increased above requirements for healthy adults. Hemodialysis increase nitrogen losses. In addition, there is information that HD is an inflammatory and catabolic process. The European guideline is 1.0-1.2g protein/kg/day for stable hemodialysis patients.

Protein-calorie malnutrition is sometimes considered the most prevalent form of malnutrition in renal patients. Prevention is the most important approach in treating malnutrition and primary to prevention is recognizing the condition.

Protein energy malnutrition and wasting are common among patients with end-stage renal disease (ESRD).

Therapeutic interventions in malnutrition of HD patients include dietary prescription, correction of metabolic acidosis, therapeutic intervention for co morbidities, an adequate dose of dialysis and finally interventions on dialysis techniques, membrane and dialysate quality. It is a widespread belief that convective treatments give a clinical advantage over standard diffusive HD, when considering the physiological outcomes, such as hemodynamic instability.

NEED AND SIGNIFICANCE OF THE STUDY

Kidney diseases leading to chronic renal failure (CRF) and in many cases progressing to end stage of renal disease (ESRD) deserve careful attention from both scientists and service providers alike. ESRD can be a devastating medical social and economic problem for the patients and their families. The initial diagnosis of the disease
and recognition of the need for continued therapy including dietary compliance may make the patient to feel vulnerable and helpless. Patients beginning dialysis have a high incidence rate of malnutrition because their disease has progressed over time till the end stage organ failure. Malnutrition often exists despite ongoing efforts to optimize dietary regimens and is one of the main risk factors for morbidity and mortality in these patients.

The information available about nutritional status of dialysis patients and prevalence of malnutrition in these patients in India is very little. Therefore, this study was carried out to assess the nutritional status of the dialysis patients in the dialysis center in Sanjay Gandhi institute of Medical Sciences, Lucknow, because in this study centre patients came from all over Uttar Pradesh, so maybe this study will be helpful in academics to know the prevalence of malnutrition, cause and factors effecting the nutritional status of dialysis patients and how nutritional status will improve. In India, till date no study has been conducted to assess the nutritional status of HD patients. So researcher conducted this study in S.G.P.G.I.M.S. center to assess the nutritional status of hemodialysis patients, cause of malnutrition.

DEFINITION OF VARIOUS TERMS USED IN RESEARCH WORK.

- **Anthropometric Assessment:** It is indices of the physical dimensions and the gross composition of the human body. It is important indicator of nutritional status. Weight, height, Body mass index and mid upper arm circumference are measured in the present study.
- **Baseline:** Hemodialysis patients who had registered first time for the study.
- **Bio-chemical Assessment:** It is the most important assessment bio-chemical test carried out in the assessment of malnutrition hemodialysis patients. Hemoglobin, blood urea nitrogen (BUN), serum creatinine serum sodium, potassium, serum
albumin and total protein levels are a useful index for the assessment of nutritional status and electrolyte imbalance of these patients.

- **Demographical Profile:** Various demographical factors and their effect on nutritional status of hemodialysis taken in the present study.
- **Dialysis doses:** Dialysis doses means number of dialysis in week as thrice, twice and weekly as per required.
- **Dialysis:** Dialysis is a treatment that simulates the function of healthy kidneys. When an individual’s kidneys are no longer able to do their job adequately (85-90% loss of functioning), dialysis becomes necessary to remove waste, salt and extra water, while keeping normal levels of certain chemicals in the blood and helping control blood pressure.
- **Dietary Assessment:** Intake of the food mainly the protein, calories, fat and carbohydrates and its interaction with malnutrition of hemodialysis patients.
- **Dietary habits:** Dietary habits regarding vegetarian, non-vegetarian and vegetarian but taking egg is taken in study because dietary habits help to achieve the targeted required protein intake.
- **Dietary recall:** The 24-hour dietary recall method is frequently used for dietary assessment, with the help of recall method patient’s dietary intake are calculated.
- **Duration of dialysis:** Period of hemodialysis since patients was started taking regular maintenance dialysis.
- **End Stage of Renal Disease (ESRD):** End-stage renal disease is also known as chronic kidney disease (CKD), specifically the fifth stage of CKD.
- **Energy intake:** Energy need during maintenance dialysis increases NKF K/DOQI GUIDLINE 2000 35 Kcal/kg/body weight.
- **Follow-up:** Hemodialysis patients who had registered first time for the study and came for study after interventions.
• **Hemodialysis (HD):** Hemodialysis involves circulating the blood through dialyzer with semi-permeable membrane separating the blood from dialysate fluid which has an electrolyte composition similar to normal serum.

• **Knowledge assessment-** Dietary awareness is an important factor for the prevention of malnutrition in hemodialysis patients. To aware the patients objective questions and answers are formulate regarding dialysis and dietary principles in HD.

• **Maintenance Hemodialysis (MHD):** Hemodialysis treatment usually performed three times per week for approximately 4 hours (National Kidney Foundation, retrieved 2009).

• **Nutritional Assessment:** Today a nutrition assessment includes computerized food intake analysis, clinical nutrition body composition assessment (bioelectrical impedance), laboratory blood test results if applicable, nutrigenomix, anthropometrics, review of medications, lifestyle and fitness indicators.

• **Nutritional Status:** State of the body in relation to the consumption and utilization of nutrients.

• **Prevalence:** The term ‘disease prevalence’ refers specially to all current cases (old and new) existing at a given point in time or over period of time in a given population. A broader definition of prevalence is as follows.

• The total number of all individuals who have an attribute or disease at a particular time (or during a particular period) divided by the population at risk of having the attribute or disease of this point in time or mid-way through the period.

• **Protein Energy Malnutrition:** Malnutrition, defined by insufficient protein calorie intake (the so called protein-energy malnutrition).

• **Protein Requirement** – During maintenance hemodialysis protein requirement is high. 1.2 gm/kg/body weight and 50% protein by high biological of protein.

**STATEMENT OF THE PROBLEM**

To assess the nutritional status of dialysis patients at S.G.P.G.I.M.S., Lucknow.
OBJECTIVES OF THE STUDY-

Present study is conducted to assess the malnutrition in hemodialysis patients with the following objectives:

1. Prevalence of malnutrition in dialysis patients.
2. Effect of dialysis on nutritional status.
3. To assess the nutritional status of the patients by anthropometrically.
4. To assess the nutritional status of the patients by bio-chemical parameters.
5. To assess the nutritional status of patients by three days dietary recall methods.
6. To educate the dialysis patients through multi and print media on nutrition and health.

Hypothesis

Hypothesis assumed with reference to each factors are as follows-

1. There exists no relationship between malnutrition in hemodialysis patients.
2. There is no relationship between dialysis doses and nutritional status.
3. There is no relationship between nutritional status of hemodialysis and anthropometric parameters.
4. There is no relationship between nutritional status of hemodialysis and bio-chemical parameters.
5. There is no relationship between nutritional status of hemodialysis and dietary assessments.
6. There is no relationship between awareness and nutritional status and health.