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Chronic kidney disease a global public health problem: approaches and some initiatives

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Abstract

In the present study an attempt has been made to analysis of the chronic kidney disease (CKD) which is a global public health problem. Understanding the relationship between CKD and other chronic diseases is important to developing a public health policy to improve outcomes. This report contains, how the food habit could be changed with the change of cultural habituation. However, despite the magnitude of the resources committed to the treatment to show about the kidney function, causes of kidney disease and conceptual framework on different type of renal calculi and its prevention and some giving recommendation. It is now well recognized that the prevalence of CKD is increasing all over the world. The global annual growth of number of ESRD patients is reported at 7%. In view of high disease burden, it became an uneven distribution, expensive treatment and because of fact that organized preventive strategies which are not in place in most countries. So, CKD has assumed the proportions of a significant public health problem.

Keyword: CKD, Erythropoietin, ESRD, glomerulonephritis, KDIGO.

Introduction

Chronic kidney disease (CKD) is increasingly recognized as a global public health problem. The declaration of World Kidney Day to be observed annually beginning in March 2006 sends a clear message to the public, government health officials, physicians, allied health professionals, patients, and families that 'CKD is common, harmful, and treatable (Levey al al., 2007). The recognition of CKD as a public health problem has evolved, in part, from the acceptance of the conceptual model, definition, and classification of CKD proposed by the National Kidney Foundation Kidney Disease Outcome Quality Initiative in 2002 and modified by Kidney Disease Improving Global Outcomes (KDIGO) in 2004 (Levey et al., 2005). As a result, physicians, investigators, and public health officials across the world can now more easily ascertain CKD irrespective of cause, study its antecedents and outcomes, determine risk factors for its development and progression, and develop strategies for its detection, evaluation, and treatment. Food habit is the most important

influencing factor of health. Family, society and most of culture play crucial role to controlling the food habits. Statement of complete and perfect list of food is also responsible to developed the healthy food habit. Wrong information of consumption of food responsible for wrong food habit. Change of urbanization, socialization and habituation of food has affected the traditional food habit. In connection with, blood pressure and heart attack, diabetes has increased with changing consumption of western food and culture. Production of food & it's supply influence on food habit, Geographical location, Religion, Society, belief on generation, habituation play vital role to develop food habit of human being. I spite of that awareness of environment, personal demand, purchasing capacity, nutritional demand of food affect on food habit. Natural hazard, migration, war etc are also responsible for influence on changing food habit. A balanced diet can be defined as one which contains different type of food in such quantities and proportions that the need for calories, minerals, vitamins and other nutrients is adequately met and small provision of extra nutrients is made withstand short of leanness.

NIM, ICMR recommended balanced diet

A long period of time, National institute of nutrition has worked on research about Indian balanced diet. Integrated Council of Medical Research (ICMR) has decided some nutritional element for Indian in 1944. In 1958 & 1968, it has changed. Further, 1980 it become also changed. Last of all, in 1989 and 1999, ICMR had recommended the list of balanced diet sheet for Indian. Balanced diet depend on personally, regional basis, economic ability. Balanced sheet method for food habit, Consumption of food/head/day = (Total amount of food x 365) /Population of half of the year Nutritional allowances for Indians –Balanced diet.

Outline of kidney

Like the liver, kidneys play a vital role in maintaining the body's normal state (homeostasis). There are two kidneys in the human body. The nephron is the basic functional unit out the kidney. Each kidney has about a million nephron. Each nephron has two parts. Bowman's capsule (a cup shaped top of the nephron) with a network of capillaries called glomeruli (Plural of word glomerulus) in it and the renal tubule. The tubule is a ling winding tube, the first part of which surrounds the glomerulus. The fluid is driven by a pressure gradient from glomerulus in to the tubule and the filtration begins. As the filtrate moves along, the materials needed are returned to blood and waste material is carried to the bladder for the storage and discharge at the normal intervals. Each nephron functions independently to produce urine. The glomerulus part of each nephron filters only a small drop of fluid a day. But the volume of plasma filtered by two million glomeruli amount to a formidable 150-180 liters in 24 hours. The Glomerular Filtration Rate (G. F. R.) is the total amount of fluid filtered each minute by all the glomeruli of the both kidneys. This is normally about 125ml. per minute and is on index of kidney function. Most of the fluid (approx. 98.9 to 99.4 percent) that passes through the winding tubule is reabsorbed; only 1 to 2 liters of urine gets excreted each day. This means that over 99percent of the filtered water, all the glucose and vitamin C, almost all amino acid, sodium and other substances are returned to the blood. But if the intake of salt exceeds the body's needs the excess is excreted and extra water is need to excrete it.

Function of Kidneys

The kidneys help to regulate the internal harmony by performing the following functions:

1. Filtration

The kidneys are the filters, through which all dissolved substances pass and selectively absorb those to be retained. Figure-1. Depicts the urinary system. The end products of protein metabolism (urea, creatinine, uric acid and urates) are removed from blood by filtration to be discarded in urine. Excess of chloride, potassium, sodium and hydrogen ions are also filtered out from the blood. By being selective filters, kidneys try to maintain a constant blood composition and volume.

2. Maintenance of fluid

Electrolyte and Acid-base balance. Ions from the blood are secreted into the urine to maintain acid-base balance. In this process they monitor the composition and volume of blood and other body fluids. Kidney maintains fluid electrolyte and acid-base balance as they carry out selective filtration.

3. Excretion

The kidneys excrete dissolved unwanted substances filtered out of blood as urine.

4. The Kidneys help regulate the blood pressure.

5. Kidneys produce Erythropoietin (a hormone) which stimulates maturation of red blood cells in the bone marrow.

6. The conversion of vitamin D to its most active from calcitroil occurs in the kidneys. Activated vitamin D. regulates the absorption of calcium and phosphorus and thus helps regulate calcium and phosphorus levels in the blood When kidney function is disturbed due to disease or trauma, all the above functions are affected adversely.

Causes of diseases of the kidney

Kidney disease leading to ESRD has many causes. The prevalence varies by country, region, ethnicity, gender, and age.

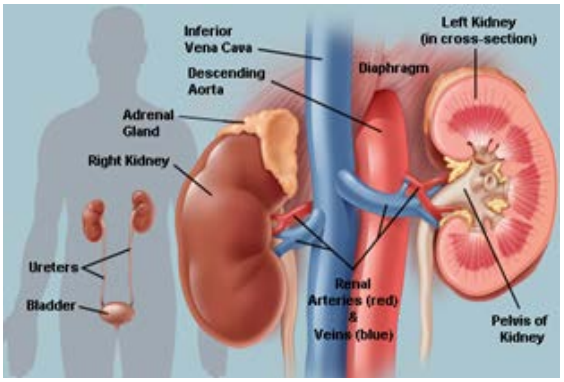

Fig. 1. Urinary system.

Table 1. Source: Nutrient Requirement and Recommended Dietary Allowances for Indians, NIN ICMR, 2002.

Community	Introduce	Body wt./Kg	Total Energy/Cal	Protein /gm	Fat/gram	Calcium/mg	Iron/mg
Male	Normal laborious	60	2875	60	20	400	28
Female	Normal Laboriou s	50	2225	50	20	-	-
Child	Months 6-12	5.4 8.6	108/kg 98/kg	2.05/kg 1.65/kg	-	500	-

Genetic Diseases

Knowledge of inherited kidney disease has changed radically with advances in molecular biology and gene-sequencing technology. The characterization of inherited kidney diseases has improved, and novel mutations leading to selective renal defects have been described. Inherited kidney diseases are rare, with the exception of autosomal dominant polycystic kidney disease, the fourth most common

cause of ESRD in developed countries. This disease has a prevalence of 1 in 1,000 people and affects approximately 10 million people worldwide (Grantham et al., 1997). Autosomal recessive polycystic kidney disease is less frequent, with an incidence of 1 in 40,000, but is an important hereditary disease of childhood (Guay-Woodford et al., 2000). Many other inherited diseases can lead to ESRD, but together they account for only a small percentage of all people with ESRD.

Glomerulonephritis

Glomerulo-nephritides are a group of kidney diseases that affect the glomeruli. They fall into two major categories: glomerulonephritis refers to an inflammation of the glomeruli and can be primary or secondary, and *glomerulosclerosis* refers to scarring of the glomeruli. Even though glomerulonephritis and glomerulosclerosis have different causes, both can lead toESRD. Glomerulonephritis ranks second after diabetes as the foremost cause of ESRD in Europe. (Stengel et al., 2003) and is the second leading cause of ESRD in the United States, according to the United States Renal Data System. Approximately 20 to 35 percent of patients requiring RRT have a glomerular disease. Glomerular diseases are more prevalent and severe in tropical regions and low-income countries (Seedat, 2003). A common mode of presentation is the nephrotic syndrome, with the age of onset at five to eight years. Estimates indicate that 2 to 3 percent of medical admissions in tropical countries are caused by renal related complaints, most resulting from glomerulonephritis. A number of kidney diseases that result from infectious diseases, such as malaria, schistosomiasis, leprosy, filariasis, and hepatitis B virus, are exclusive to the tropics. HIV/AIDS can be complicated by several forms of kidney disease; however, patient data are sparse (Seedat, 2003). Acute post-streptococcal nephritis following a throat or skin infection caused by Group A streptococcus has almost disappeared in high-income countries because of improved hygiene and treatment but remains an important glomerular disease in India and Africa, where epidemics have been reported (Seedat, 2003). The eradication of endemic infections, along with improvements in socioeconomic status, education, sanitation, and access to treatment, is a crucial step toward decreasing the incidence of glomerular diseases in developing countries.

Infections, Stones, and Obstructive Uropathy

Infections of the urinary tract are a common health problem worldwide and can be categorized as either uncomplicated or complicated. Uncomplicated infections include bladder infections such as cystitis, seen almost exclusively in young women (Hooton, 2000). Among sexually active women, the incidence of cystitis is 0.5 episodes per person annually, and recurrence develops in 27 to 44 percent of cases. Acute, uncomplicated pyelonephritis, involving the kidney, is less frequent in women than is cystitis. Males are less susceptible to acute, uncomplicated infections of the bladder or the kidney, with an incidence of five to eight episodes per 10,000 men annually. Even though uncomplicated urinary tract infections are considered benign, they have significant medical and financial implications estimated at approximately US$1.6 billion per year (Foxman, 2003). As for complicated urinary tract infections, hospitalization results in almost 1 million such infections per year in the United States. Bladder catheterization is the most important cause. Developing countries exhibit a different pattern of urinary

tract infection. Obstructive or reflux nephropathy is often attributed to urinary schistosomiasis (Barsoum, 2003).

Table 2. Contribution of disease of the Kidney and Urinary System to the Global Burden of Disease by Gender and Region (thousands). Source: Mather's et al., (2006).

Gender and region	population	Death	Disability-adjusted Life years	Years lived with disability	Year of Life Lost
Female	3,056,384	397	8008	2546	5450
Male	3,093,849	433	10459	4493	5960
World	6,150,233	830	18647	7039	11415
East Asia &Pacific	1,850,775	233	5400	1858	3530
Europe & Central Asia	447,180	53	1417	623	793
Latin America & Caribbean	526,138	70	1667	779	888
Middle East & North Africa	309,762	57	1283	460	823
South Asia	1,387,873	156	3991	1373	2619
Sub-Saharan Africa	667,663	107	2623	1046	1576

Worldwide, 200 million people are affected and an estimated 300 million are at risk. The disease causes lesions in the bladder and predisposes those with the condition to secondary infections, bladder cancers, and chronic pyelonephritis. Some 15 to 20 million people have tuberculosis (TB) worldwide, of whom 8 million to 10 million are infectious. Genitourinary TB is a common form of extra-pulmonary TB and is always secondary to the primary lesion, which usually occurs in the lung (Pasternak and Rubin, 1997). Lesions referred to as *ulcero-cavernous* or *miliary* affect the kidneys. If left untreated, such lesions may progress to kidney destruction.

Early recognition of and effective therapy for TB substantially decrease the consequences in relation to kidney function. In the industrial countries, kidney stones are a common problem (Morton et al., 2002), affecting 1 person in 1,000 annually, and the incidence is increasing in tropical developing countries (Robertson, 2003). Factors such as age, sex, and ethnic and geographic distribution determine prevalence. The peak age of onset is in the third decade, and prevalence increases with age until 70. Although largely idiopathic, the following risk factors are associated with stone disease: low urine volume, hyperuricosuria, hyperoxaluria, hypomagnesuria, and hypocitraturia. Diarrhea, malabsorption, low protein, low calcium, increased consumption of oxalate-rich foods, and low fluid intake may play a role in the genesis of stone disease. In developing countries, 30 percent of all pediatric urolithiasis cases occur as bladder stones in children. The formation of bladder stones in children is caused by a poor diet high in cereal content and low in animal protein, calcium, and phosphates. Kidney stones can have different clinical presentations, ranging from asymptomatic to

large obstructing calculi in the upper urinary tract that can severely impair renal function and lead to ESRD. Although specific causes of kidney stones should be treated appropriately, general treatment includes increased fluid intake, limited daily salt intake, moderate animal protein intake, and medical treatment with alkali and thiazides. The Afro-Asian stone-forming belt stretches from Sudan, the Arab Republic of Egypt, Saudi Arabia, the United Arab Emirates, the Islamic Republic of Iran, Pakistan, India, Myanmar, Thailand, and Indonesia to the Philippines. The disease affects all age groups from less than 1 year old to more than 70, with a male to female ratio of 2 to 1. The prevalence of calculi ranges from 4 to 20 percent (Hussain et al., 1996). Urolithiasis accounts for some 50 percent of the urological workload and the bulk of urological emergencies. Patients may present with major complications leading to eventual ESRD and resulting in significant morbidity and mortality. In developed countries, only about 1 percent of patients are on dialysis because of obstructive uropathy, whereas in developing countries such as Indonesia and Thailand, obstructive uropathy is often the leading cause of ESRD, accounting for 20 percent or more of patients on dialysis. The availability of appropriately trained medical and surgical personnel and of equipment essential for treating stone disease promptly would reduce the incidence of obstructive uropathy and ESRD. Cost analyses indicate that the medical prevention of stones saves more than US$2,000 per person annually (Parks and Coe, 1996).

Benign Prostatic Hypertrophy

Benign prostatic hypertrophy is a major cause of lower urinary tract symptoms and leads to obstructive renal failure and ESRD. By age 80, 80 percent of men have benign prostatic hypertrophy. The World Health Organization quotes a mortality rate of 0.5 to 1.5 per 100,000 (La Vecchia et al., 1995). The actual incidence of benign prostatic hypertrophy is difficult to assess because of the lack of epidemiological data. In the developed world, the incidence varies between 0.24 and 10.90 per 1,000 annually from age 50 to 80, and the probability of prostate surgery for benign prostatic hypertrophy ranges from 1.4 to 6.0 percent (Oishi et al., 1998).

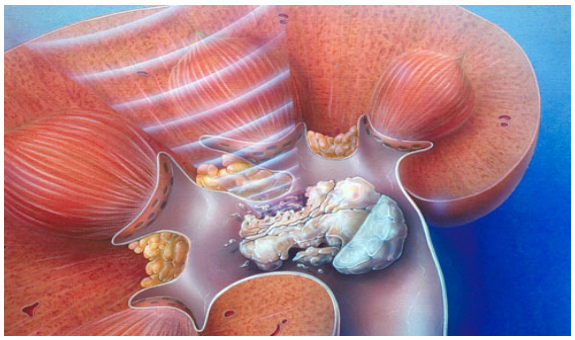

Fig. 2. Kidney Stone

Acute Renal Failure

Acute renal failure refers to a sudden and usually temporary loss of kidney function that may be so severe that RRT is needed until kidney function recovers. Even though acute renal failure can be a reversible condition, it carries a high mortality rate. Acute renal failure is a prominent feature of major earthquakes, where many suffer from crush syndrome accompanied by severe dehydration and rapid release of muscle cell contents, including potassium. Kidney function shuts down unless body fluid and blood pressure are rapidly corrected and frequent hemodialysis is available. Recent earthquake rescues in the Islamic Republic of Iran and Turkey have demonstrated the benefits of rapid hydration and dialysis (Sever et al., 2001).

Diabetes

Diabetes is one of the most common non-communicable diseases. With the serious complication of nephropathy, diabetes has become the single most important cause of ESRD in the United States and Europe, according to Stengel et al., (2003) and the United States Renal Data System (http://www.ifrr.net/). Diabetes may account for one third of all ESRD cases. Family-based studies and segregation analyses suggest that inherited factors play a major role in people's susceptibility to diabetic renal complications (Seaquist et al., 1989). In the United States, the burden of ESRD is threefold to fivefold greater among African Americans, Mexican Americans, and Native Americans than other Americans, and Imperatore et al., (2000) find a 200 percent greater possibility of the occurrence of inherited diabetic nephropathy. A family history of hypertension has also been associated with an increased risk of diabetic nephropathy. When specific markers of risk are found, high-risk individuals can be identified early and monitored for the development of proteinuria and kidney dysfunction. The earliest sign of diabetic nephropathy is the appearance of small amounts of protein in the urine (*proteinuria*). As proteinuria increases and blood pressure rises, kidney function declines. The complete loss of kidney function occurs at different rates among type 2 diabetes patients, but it eventually occurs in 30 percent of proteinuria cases. The latter have a 10-fold increased risk of dying from associated coronary artery disease, which may obviate the progression of diabetic nephropathy to ESRD. As therapies and interventions for coronary artery disease improve, patients with type 2 diabetes may survive long enough to develop kidney failure.

Hypertension

Hypertension and kidney disease are closely related. Most primary renal diseases eventually produce hypertension. Arterial hypertension accelerates many forms of renal disease and hastens the progression to ESRD (Luke, 1999). Recent studies have firmly established the importance of continuous blood pressure reduction to slow the progression of many forms of renal injury, particularly glomerular disease (Agodoa et al., 2001; Peterson et al., 1995). Over the long term, damage to the heart and cardiovascular system resulting from hypertension represents the major cause of morbidity and mortality among ESRD patients (Martinez-Maldonado, 1998). Before the development of effective antihypertensive agents, 40 percent of hypertensive patients developed kidney damage and 18 percent developed renal insufficiency over time. Elevated serum creatinine develops in 10 to 20 percent of hypertensive patients, with African Americans and Africans at particularly high risk. In 2 to 5 percent of hypertensive patients, progression toward ESRD will occur in 10 to 15 years. Despite the relatively low rate of progression, hypertension remains the most common cause of ESRD after diabetes in the United States, is the foremost cause of death in all developed countries, and is a likely primary cause in developing countries given its high global prevalence rate. Native Americans and Hispanic Americans are disproportionately affected relative to Caucasian Americans.

Different types of kidney stone

Kidney stones are also known as renal calculi, urolithiasis, or nephrolithias. These may be found in the bladder, kidney, ureter or urethra. Deposition of varied sizes crystals in an organic matrix leads to the formation of these stones. As stones of varied sizes form,

they normally move towards the ureter. Small smooth stones pass into the ureter but large ones can block the ureter opening which impedes normal flow and causes intense pain. The pain may be accompanied by nausea, vomiting, even chills are fever. Only 10 percent stone are large and cause such reactions. Dietary correlation to kidney stone formation is not easy to prove. They occur in conjunction with other disease, which infect or weaken the urinary track. Excessive excretion of calcium (e.g. in osteoporosis) and concentration of urine may promote stone formation. Low intake of water, leading to concentration of urine may leads to the formation and deposition of crystals in the renal tract. Calcium salts (with carbonate, phosphate, and ammonium), magnesium oxalate, sulfate etc. account for 90 percent of the stones; uric acid and rarely cystine or xanthine account for the rest. So renal calculi are as follows-

Calsium Stones, Oxalate Stones, Uric acid stones, Stuvite stones and Cystine stone.

Most of the small stones pass through the ureter. Those which are too large and obstruct function and cause pain need to be removed surgically. A modern procedure (laparoscopy) in which the stone is broken into bits and flushed out has done away with the need for painful surgery.

Recommendations

- All countries should have a targeted screening program for CKD (Table 3).
- Target groups should include patients with hypertension, diabetes and cardiovascular disease. Other groups might include families of patients with CKD, individuals with hyperlipidemia, obesity, metabolic syndrome, smokers, patients treated with potentially nephrotoxic drugs, some chronic infectious diseases and cancers (see reports from groups 5 and 6), and age 460 years.
- Tests for CKD screening should include both a urine test for proteinuria and a blood test for creatinine to estimate GFR. Tests for proteinuria should be selected and performed according to local guidelines. (This article refers to tests for proteinuria as tests for detection of proteinuria, including tests for albumin only; and tests for albuminuria as tests for detection of albumin only.) Verification of proteinuria would require two out of three positive tests. In selected populations with an increased risk for glomerulonephritis, testing for hematuria should also be performed. Equations for estimating GFR should be appropriate for standardization of the serum creatinine assay and application to majority racial and ethnic groups.
- Frequency of testing should be according to available guidelines and the target group to be tested. In the absence of specific recommendations, testing need not be more frequent than once per year.
- All countries should have a surveillance program for CKD stages 4–5 and strive to include earlier stages. If possible, data on risk factors for development and progression of CKD most relevant for the specific population should be included. Surveillance for CKD could be incorporated into existing surveillance programs (such as those for hypertension, diabetes, cardiovascular diseases, infectious diseases, and cancer) and data from such programs should be used for surveillance of CKD risk factors.
- Data could be obtained from random samples of the general population or (possibly) populations receiving medical care or (ideally) registries of stages 4 and 5 CKD. Data should be collected at a frequency of every 5–10 years, or more often, depending

on disease dynamics, interventional strategies, and regional resources. Additional components of a CKD surveillance program could be: consequences of CKD (mortality), education/awareness (public and professionals), health system capabilities (primary and specialty care), quality of care markers (appropriate treatment/referrals), and health policy goals. High-risk groups for targeted screening program for CKD.

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