International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 8; Issue 02(A); February 2019; Page No. 17145-17149
DOI: http://dx.doi.org/10.24327/ijcar.2019.17149.3201

Review Article

OVERVIEW OF CHRONIC KIDNEY DISEASE: ASSESSMENT, NUTRITIONAL MANAGEMENT AND TREATMENT

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A R T I C L E I N F O

Article History:
Received 13th November, 2018
Received in revised form 11th December, 2018
Accepted 8th January, 2018
Published online 28th February, 2019

Key words:
Chronic Kidney Disease, Glomerular filtration rate, Dialysis, End stage renal disease.

A B S T R A C T

Chronic kidney disease is defined as the presence of injury in kidney and impairment in kidney function. The definition of CKD (Chronic kidney disease) can also be defined in terms of GFR i.e. decreased GFR due to pathological conditions or abnormalities in blood as urine for more than 3 months can cause kidney damage or reduction of GFR by more than half of normal value that is 125/ml/min/1.73m^2. Prevalence for CKD stages 1 is 1.8%, for stage 2 is 3.2% for stage 3 it is 7.7% and it is 0.35% for stage 4 and 5. The causes for CKD are various factors like Susceptibility factors, Initiation factors, progression factors. Assessment of different stages of CKD can be done through physical examinations, fundoscopy, measuring GFR, albumin measurement, urine analysis. Treatment through medication therapy including diuretics and their mechanism, phosphate binders, sodium bicarbonate, anti-hypertensive and vitamin D, dialysis, kidney transplantation. Preventive measures includes changing lifestyle habit and nutritional management. Further advancements can be done to overcome the issues.

INTRODUCTION

Kidney is a vital organ in our body that helps in regulation of various metabolic functions and hence its maintenance is a global priority. It removes waste products (including the unused and processed medicaments) along with release of hormones for controlling blood pressure and also regulates the production of red blood cells (by which the risk of cause anaemia and cardiovascular diseases get reduced). It also activates vitamin D for various therapeutic necessary benefits of our body like bone health [1,2,3] progression of chronic kidney disease CKD is increasing rapidly. There are several causes for the progression of CKD like susceptibility and initiation factors. Firstly, it is good to prevent the disease instead of curing it. It can be prevented by making body healthy and avoid all the bad habits like smoking and drinking. It can be done by changing routine lifestyle otherwise the treatment for kidney failure can go from medication therapy like -diuretics, antihypertensive, Epo, vitamins, nutritional supplements to dialysis and lastly to the kidney transplant which is highly risky for saving life .During dialysis management of nutritional status is very essential as it takes much energy to withstand with the process of dialysis as several eating items get banned for the patient to eat because of reducing filtration load on the kidneys and patient already looses intrest in life-eating etc.

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On the other hand excess nutrition can lead to generate metabolic syndrome, cardiovascular disease and chronic kidney disease(CKD), elevate the risk of mortality in contrast the patients suffering from CKD and mostly in those patients who are undergoing dialysis, the commonly called malnutrition[4] can also be called as protein-energy wasting(PEW)which is demonstrated by the decreased levels of albumin or prealbumin [5]and the increase risk of outcome for death.

Chronic kidney disease

As per the national kidney foundation kidney diseases outcome quality initiative, CKD is defined as the presence of injury in kidney and impairment in kidney function. The definition of CKD can also be defined in terms of GFR i.e. decreased GFR due to pathological conditions or abnormalities in blood as urine for more than 3 months can cause kidney damage or reduction of GFR <60 ml/min/1.73 m^2 [6].

Causes for CKD

There are certain factors responsible for the cause of CKD:

Susceptibility factors

Alterations in candidate genes encoding for the mediators included in rennin angiotensin system can be susceptibility factor for CKD. CKD is shown to be highly prevalent among Africans, Native Americans and Asians in UK malnutrition and low birth rate is associated with malfunction in nephrons

which is a susceptible cause for CKD. Geriatric population are more susceptible to CKD [7].

Initiation factors

Diabetes accounts for nearly 45% of kidney disease and ranks as most common cause for CKD. Hypertension can be the second common cause for CKD in US, accounting for almost 23% of incidence of CKD and Cardiovascular disease-patient undergoing coronary artery bypasses surgery or in treatment with percutaneous coronary interventions are at a higher risk for developing CKD [7]

Progression factors

Progression of CKD depends on various factors such as, Non modifiable risk factors are sex, age, race, genetic factors and modifiable risk factors are hypertension, proteinuria, hyperglycaemia, hyperlipidemia, obesity, cigarette smoking, alcohol and analgesic abuse [7].

Stages of CKD

Stages of CKD can be divided on the basis of value of GFR as described below:

- Stage 1 (GFR>90ml/min/1.73m^2)
- Stage 2 (GFR= 60-89ml/min/1.73m^2)
- Stage 3 (GFR= 30-59ml/min/1.73m^2)
- Stage 4 (GFR= 15-29ml/min/1.73m^2)
- Stage 5 (It is the last stage of renal disease with GFR and 15ml/min/1.73m^2) [8].

Assessment of CKDS

Impairment in kidney function and associated complication should be evaluated as per the following assessment procedures:

Physical examination of CKD patient including general health weight variation and nutritional status. Fundoscopy should be used to examine hypertensive or diabetic changes in the eye of CKD patients measuring Glomerular filtration rate based on filtration markers such as serum creatinine and urine creatinine. Complete urine analysis should be done in CKD patient to understand the etiology of CKD. Albumin measurement in urine should be examined for improved detection of low levels of proteinuria when compared to normal protein measurements. Other methods for assessment may include serum ALT or BNP/NT-pro BNP levels [9].

Treatment

CKD treatment can be done in following ways

Medication therapy: It can be done by reducing high B.P and high cholesterol and in several other ways. Good conditioned kidneys have ability to produce the right amount of urine to match the fluid you take into your body through eating and drinking affected kidneys are very poor at producing urine. It can lead to fluid up in the body, swollen ankles, difficulty in breathing and high blood pressure. Loop diuretic such as furosemide, torsemide and ethacrynic acid are used in treatment of CKD. These diuretics act by reducing sodium reabsorption in renal tubules and thus increasing excretion of sodium and water through urine [10]. Phosphate binder controls the phosphate level and inhibit itchiness, boneweekness and reduces risk of heart problem [11] Marketed preparations are fosrenol, calcichew, adcal, renagel or phosex. Sodium bicarbonate helps us to inhibit the building up of acid in body. If there is less acid secreted in your urine it means your kidney function is getting decreased and it lead to drop in bicarbonate level .decreased in bicarbonate level show bad effect on heart and detoriate your kidney function[12]. Anti-hypertensive's (blood pressure tablets) need to maintain blood level. Continue high blood pressure can lead to harm your blood vessels, heart and kidneys [13]. There are various types of medication available in the market ex: doxazosin, atenolol, ramipril and irbesartan. Erythropoietin is commonly known as EPO. Healthy kidneys produces this hormone EPO it helps to produce red blood cells by bone marrow diseased kidneys cannot make sufficient EPO thus the condition anaemia arises and the patients becomes started to feel weak, tired, cold and generally unwell[14]. So to treat this condition patient prescribed with EPO injection as well as taught to do that at home yourself. Active vitamin D is required if CKD patient during dialysis can suffer from loss of bone minerals, including calcium and phosphorus. Phosphorus and calcium can mixed together it gets hard and build up in the feet small blood vessels, heart as well as intestine. The situation can cause amputations, abdominal pain, gangrene of the intestines and heart failure. These problems arises due to mixing of dietary calcium, phosphorus, vitamin D and the hormone called PTH (parathyroid hormone)[15].

1. ***Dialysis:*** The process by which excess water and waste is removed from blood artificially is known to as dialysis. It can be carried out by two different procedures are as follows Haemodialysis performed on patients having no residual renal function it carried out by using a machine/ like apparatus artificial kidney. Peritoneal dialysis it is carried out by using a peritoneal membrane as filter and it can be done at home and commonly performed on younger patients as they have enough flexibility[16]
2. ***Kidney transplant:*** Kidney transplantation is a surgical procedure which can be considered in patients with end stage renal disease (ESRD) and who have undergone hematopoietic cell transplantation [17].
3. ***Preventive options:*** CKD risk automatically reduced in patients who maintain a healthy lifestyle. Lifestyle should be managed in following ways:

- ***Exercise:*** Doing moderate exercise regularly prevents the risk of CKD. The lack of exercise give rise to the risk of CKD, metabolic syndrome, type 2 diabetes, hypertension and dyslipidemia. So daily or routine exercise can be factor to maintain a healthy lifestyle and in turn, preventing serious diseases.
- ***Eating:*** Taking meals on irregular intervals can give rise to increase in risk of occurrence of CKD or Cardiovascular diseases, and associated hypertension, obesity as well. So timely meals are highly recommended actions that can help in reducing risk for such diseases.
- ***Alcohol:*** alcohol is the most commonly used psychotropic substance globally and its long term consumption is excessive amount can be considered as a risk factor for CKD, cardiovascular disease and neural diseases [18].
- ***Smoking:*** Tobacco smoke consists of heavy metals such as lead cadmium and many gaseous which are

nephrotoxic and causes renal tubular injury with increase in blood pressure and heart rate [19].

Nutritional management in CKD patients: Maintenance of nutritional health is necessary in patients suffering from chronic kidney disease as well as in patients with haemodialysis (MHD). Serum albumin is the most considerable serum protein used for estimation of nutritional condition in MHD patients. A strong relation is studied between low level of serum albumin ad increased risk of morbidity and mortality in ESRD patients [20,21,22] change in serum level of prealbumin over time have shown by the two studies that it is related with compatible changes in survival of patients on dialysis[23,24]**.** Anorexia can be mediated by providing appetite regulators, like gastric moderator (like cholecystokinin, peptide YY, ghrelin or obestatin), adipokines (like leptin) or cytokines (like TNF, IL- 1)**[25].** The required dietary protein and calorie intake for MHD patients should be 1.2-1.4g/kg and 30-35 kcal/kg **[26].** A potential increase in intake of potentially harmful elements like phosphorus is a strategic way to improve dietary protein intake in MHD patients **[27].** On restricting phosphorus intake can indirectly lead to elevated risk of protein energy wasting (PEW) [28]. The supplementation can be provided by oral as well as IV route. Feeding through oral route results in robust improvement in skeletal muscle balance as well as in full body **[29].** Intradialytic parentral nutrition is mostly preferred for nutritional supplementation especially for the dialysis procedure (IDPN) it is safe, effective and convenient as well for who cannot tolerate oral or enteral route of administration [30]**.** Some examples of appetite stimulants are megestrol acetate, dronabinol, cyproheptadine, melatonin, thalidomide and ghrelin. In MHD patients with PEW most of these drugs have not been studied systematically but also used in other catabolic illnesses. For example megestrol acetate is a steroid like progestagen can result in rising up of appetite and gaining weight patients with breast cancer [31]**.**

Anabolic steroids –In reports it has been prove that significant improvements in body composition and physical functions of patients with MHD who are given nandrolone deaconate [32]**.** The dietary energy intake (DEI) advised for a patient with haemodialysis and peritoneal dialysis is 30-35 kcal/kg per day. For patients with haemodialysis recommended dietary protein intake is 1.2g/kg per day whereas it should be 1.3g/kg per day in patients with peritoneal dialysis[33,34,35,36,37]. With a functionally allograft successful renal transplantation patients commonly feels increase in weight and appetite[38,39] the use of immunosuppressive regimens can lead to cause PEW inflammatory responses can mediate deleterious effect PEW on clinical outcomes can cause worst anaemia[40]**,** erythropoietin hyporesponsivess and de novo diabetes mellitus[41] a poor nutritional status can be indicated by emerging data before or after renal transplantation is related with poor outcomes and elevation in mortality and decreased graft survival[42,43,44]. The transplant recipient can be given with the same enteral nutritional support as for patients with nondialysis dependent CKD

Challenges and issue during management of CKD

Challenges such as educating patients about diet and avoiding smoke should be given careful consideration for effective healthcare of CKD patients. In CKD when kidney fails completely in that case doctor prescribes a lot of medications to the patient but due to impairment in filtration by kidneys, the water taken with medication will not be eliminated and may lead to more water retention in the body of patient. So this gives rise to a decrease in GFR [45]. Patients on dialysis face nutritional problems due to fewer intakes of food and nutrition and suffer from lack to energy. Some diseases also arises during the treatment of kidney like during kidney dialysis for a long term a disease arises in patients known as dialysis dementia although the cause is still controversial[46]. Anaemia is normochronic normocytic accompanied in progressive CKD and the overall prevalence of CKD- associated anaemia is approximately 50%. End stage renal disease is associated with increased risk of cardiovascular diseases with a mortality rate of ten to one hundred folds higher among dialysis patients than age and sex-matched individual in the general population. There is a serious challenge faced by physician in assessing nutritional status of individual with CKD and such alterations causes' uremic malnutrition [47].

Future prospective

Educating patient about diet and motivate to avoiding smoking and drinking. The issue of less water intake should be managed with recommendation of developing a different formulation such as mouth dissolving tablet or any-other requiring less water intake. This will further help in reducing the filtration load to diseased or failed kidneys and thus will provide an ease in management of CKD**.** In the technique of dialysis, some changes should be made to prevent dialysis dementia and to develop some new formulations to treat such problems. To design such nutritional supplements for the patients on dialysis to overcome lack of energy.

CONCLUSION

Chronic kidney disease is a major health associated problem with several adverse outcomes like, reduced GFR, cardiovascular diseases (CVD) and premature death. The treatment should be provided accordingly to the different stages of CKD. The treatment needs to be supported by the nutritional management especially to the patient on dialysis. There are several unmet needs for the proper management of disease that the patient faces during treatment of ESRD. One of them is the issue of water intake with the medicaments prescribed by the doctor the issue arises due to decreased GFR. It can be solved by formulating such mouth dissolving formulations to overcome and eliminate the issue.

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How to cite this article:

Vaibhav Sharma., Anjali Kapoor and Geeta Aggarwal(2019) 'Overview of Chronic Kidney Disease: Assessment, Nutritional Management and Treatment', *International Journal of Current Advanced Research,* 08(02), pp. 17145-17149.
DOI: http://dx.doi.org/10.24327/ijcar.2019.17149.3201

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