

Chronic kidney disease in older adults

Abstract

In order to update existing information on chronic kidney disease, a literature review of articles based on level I-II evidence was conducted. Basically based on the publications of the Cochrane library, Dynamed, PubMed, Scielo among others. We tried to use the bibliography of the last 5 years, and reference is made to original articles of importance from previous years. The following aspects were reviewed: definitions, epidemiology, prevalence, physiopathology, functional and structural changes, causes of the disease, risk factors, estimation of glomerular filtration rate and progression. CKD is a global health problem, with high prevalence rates in the elderly, regardless of the functional and structural changes of this patient, in what influences diabetes mellitus, hypertension and glomerulopathies as the main causes; as well as the risk factors described and the presence of markers of kidney damage. It is important to have these markers present together with the estimation of the GFR for the diagnosis and evaluation of the progression of the disease. The promotion and prevention of health are the main strategies from the primary level of health to positively influence the care of patients with kidney disease, described in preventive nephrology and the preventive program of CKD in Cuba.

Keywords: chronic renal disease, elderly, chronic diseases not transmissible

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Abbreviations: CKD, chronic kidney disease; RRT, renal replacement therapy; NKF, national kidney foundation; SIN, society of nephrology; UN, united nations; NCDs, non - communicable diseases; HD, hemodialysis; DM, diabetes mellitus

Introduction

The chronic kidney disease (CKD) is a common I unnoticed relatively condition (one in 10 people suffer) generally is asymptomatic and often progress to CKD stage 5, so it is vital prevention and early stage detection.^{1,2} International data indicate an increase in the prevalence and incidence^{3,4} of more than 10% in the adult population 2-4 and 20% in older adults.⁵ The famous epidemiological floe, where a third emerges, which is the known and visible, but two thirds remain hidden, corresponds perfectly to this situation, giving rise to an unsustainable paradoxical situation, most of the scientific and technological resources are dedicated treatment with dialysis and transplantation, important but inferior options from all points of view when faced with promotional and preventive measures in the early stages of the disease. It will never be better for a patient to have to go to a health center several times a week to receive dialysis treatment or to undergo a transplant when compared with stabilizing or improving their situation with medical treatment and preventive measures; achieving benefits in many patients with this strategy. CKD generates numerous health expenses. It is difficult to estimate these costs in the early stages, because the vast majority of studies are referenced in subjects on renal replacement therapy (RRT). It has a great impact on people, their families and society, associated with high cardiovascular morbidity and mortality.⁶ In order to update the existing information on chronic kidney disease, a bibliographic review was carried out, based mainly on the publications of the Cochrane Library, Dynamed, PubMed, Scielo, among others, and in

its entirety, the abstracts or original works are stored of bibliographic data made in Excel, made by the author himself, with links to related works. An attempt was made to use the bibliography of the last five years, and reference is made to original articles of importance from previous years. The following aspects were reviewed: definitions, epidemiology, prevalence, pathophysiology, functional and structural changes, causes of the disease, risk factors, estimation of glomerular filtration rate and progression.

Development

The National Kidney Foundation (NKF) -Kidney Disease Outcomes Quality Initiative (K/DOQI) in its guidelines on evaluation, classification and stratification of CKD defines as its diagnostic criteria the existence of glomerular filtration (GFR) below 60 ml / min/1.73 m² for a period of time equal to or greater than three months or the presence of kidney injury, with or without decrease in the GFR, for a period of time equal to or greater than three months. The concept of kidney injury refers to structural or functional alterations of the kidney. It should be noted that in stages 1 and 2 the presence of kidney injury is itself diagnostic of CKD.⁸ The KDIGO Guidelines published in 2013 have proposed a new prognostic classification for CKD.⁹

CKD epidemiology

In September 2011, the International Society of Nephrology (SIN), welcomed the Declaration of the Meeting of High Level chronic non - communicable diseases (NCDs) which stated that "the General Assembly of the Organization of the United Nations (UN), recognizes that kidney diseases represent a major health threat in many countries, share common risk factors (RF) and at the same time can facilitate common responses to CNCD".¹⁰ When analyzing epidemiology in the adult population, the criteria used for its diagnosis must be

met, depending on the type of study population and the magnitude of the disease, differentiating the stages.² The number of patients in advanced stages, who require RRT, has increased in recent years as a consequence of the aging of the population and the fact that, at present, older individuals and other associated processes are included in dialysis.² Reports from Europe, Australia, Asia, Africa and Latin America confirm a high prevalence; While the magnitude has been better defined in developed countries, growing evidence indicates that the burden of this disease is as great or even greater in developing countries. Disadvantaged communities suffer a notable increase in incidence, prevalence or complications, even in developed countries they bear a disproportionate burden of the disease, suggesting the importance of learning from traditional RF that contribute to the onset of the disease and its complications.^{2,11,12}

In the last decade it has been the subject of scientific and political debate in Central America, where a dialytic CKD epidemic has been identified in young agricultural workers, mainly in the sugar cane fields.^{13,14-16} Cuba is a country with demographic old age, including aging group II with 12.6% of the elderly population and it is estimated that it will reach 23.4% in 2025. The aging of the Cuban population is one of the demographic implications and more important social factors derived from the decrease in fertility, mortality and the increase in life expectancy at birth, so that the incidence and prevalence of the disease is increasing.¹⁷ There is a global increase in the rates of older incident patients: Cuba, 258 per million people (pmp); Argentina, 698 pmp; United States 1,147 pmp. Regarding the prevalence of patients in dialysis RRT, average rates of 549 pmp are observed in Latin America, in the United States of 1 132 pmp and in Cuba, 269 pmp. Hemodialysis (HD) continues as the main modality (at least 80% of all prevalent patients) with great variations between countries.^{18,19} In developing countries, the number of patients with diabetes mellitus (DM) is forecast to increase from 99 million in 1995 to 286 million by 2025, which will influence the incidence and prevalence of the disease.²⁰

Prevalence of CKD in the MA

The prevalence has increased progressively, mainly due to the optimization of purification techniques that allow to stay longer in the procedure, the aging of the population and the high rate of cardiovascular disease, such as DM and hypertension (HT).^{4,21,22} To determine the prevalence of the disease, Zhang QL²³ performed a systematic review of 26 studies that include different population groups, identifying that the prevalence in the AM population ranged from 23.4% in the Manjunath²⁴ study to 35.7%. In Hemmelgarn's study²⁵ (in both studies the MDRD formula was used), and that the highest proportion of diagnosed patients had an estimated glomerular filtration rate ($eGFR \geq 30 \text{ ml/min}$), and a minority were in more stages advanced (stages 4-5). In the EPIRCE study, the overall prevalence in stages 3-5 (using the MDRD formula) was 6.8%: 3.3% for people between 40 and 64 years, with an increase in this percentage to 21, 4% in those over 64 years; age along with obesity and previous HT were the independent predictors for the development of the disease.²⁶ Glasscock questions the validity of the MDRD formula, since based on this equation a high prevalence in older adults, women, and white people is described, compared to the low incidence of CKD that requires RRT in these population groups.²⁷

Olechnowicz-Tietz²⁸ finds an average age of 64 years and a higher percentage of men (61.2%) in a population of patients with CKD and coronary syndrome. With the new CKD-EPI equation, the prevalence

is reduced in women and white people, while in older adults the prevalence remains high.²⁹ A study in Cuba found a greater number of patients aged between 61–70 years, for a global prevalence of 25 per 100,000 inhabitants in the province.³⁰ In Santiago de Cuba the majority of CKD patients in two health areas were reported to be 60–79 years old.³¹ Rodríguez³² refers to an average age of 65 years and similar gender behavior in dialysis and hypertensive patients from the same territory. A high percentage of people with decreased GFR is observed despite maintaining normal plasma creatinine levels.³³

CKD pathophysiology

When an attack occurs to the kidney, whether immunological or not, the nephron is damaged, then a process of adaptation takes place secondary to the reduction in the number of nephrons, which leads to alterations in the structure and function of the glomerulus and the tubules.³⁴ In the first, due to an increase in the glomerular filtration rate (IFG) and alterations in renal flow in said structure, which is nothing more than glomerular hyperfiltration and hypoperfusion; here, the most promising candidate among the vasomotor hormones, after the reduction of the number of nephrons, is the natriuretic atrial peptide, which contributes to the elevation of the IFG of the remaining nephron.^{3,4} In the latter, which concerns the alteration in the structure and function of the tubules, a compensatory renal hypertrophy mechanism occurs, consisting of biochemical changes and the presence of growth factors (renotrophic hormone). When the GF drops below 30 ml / min, these compensation mechanisms begin to fail, the homeostatic balance becomes increasingly precarious and then the retention of azoates becomes more evident, as well as the inability to handle the hydrogen ion.^{3,4}

Functional and structural changes in the kidney of the elderly

A series of functional and structural changes occur in the kidney, the common denominator of which is the decrease in the renal functional reserve.^{35,36}

Functional changes

Age-related decrease in GFR is associated with decreased renal blood flow, impaired urinary concentration, and structural findings of global glomerular sclerosis, vascular sclerosis, tubular atrophy, decreased cortical thickness, and decreased kidney size.³⁷ The longitudinal Baltimore study showed a decrease in GFR-estimated by creatinine clearance (CCr) -at an average rate of 0.75 ml / min / year, although a third of the subjects maintained the stability of the CCr.³⁸ The decline in kidney function with age per se may not be clinically significant, unless other acute or chronic diseases that affect functional reserve or kidney function overlap.^{35,36}

Disorders of tubular function include limiting the ability to retain sodium, which makes older adults more susceptible to volume depletion;³⁹ The capacity for excretion of potassium is also altered, which would explain the predisposition of older adults to develop drug-related hyperkalemia;³⁶ the ability to concentrate or dilute urine decreases with age, with the appearance of nocturia, predisposition to dehydration and hypernatremia or hyponatremia if excess fluids are administered,⁴⁰ reduction in the production of renal erythropoietin and renin, decreases the conversion of vitamin D 25OH to 1.25OH and a decrease in insulin clearance parallel to the decrease in kidney function in the elderly.^{36,41}

Structural changes

The weight of the kidney decreases progressively after the fifth decade of life, with more involvement of the cortex than of the kidney marrow;⁴² the number of viable glomeruli decreases, with an increase in the percentage of glomeruli with global sclerosis.³⁹ Tubular atrophy and interstitial fibrosis can be related to age or can be the consequence of processes of chronic inflammation or vascular disease. Simple renal cysts may also develop in the distal tubules and collectors, predisposing to the development of infections in older adults. Age-associated intimal fibrosis in the interlobular arteries is described, which may be aggravated by the presence of HT and / or DM.^{36,41}

CKD causes

The incidence and prevalence of CKD due to glomerulonephritis or type 1 DM have stabilized, with currently arteriosclerosis, type 2 DM and HT being the main causes of the disease; diseases that can affect kidney function silently, which is why the disease is detected in advanced stages of its evolution.¹² In the Third Nephrology Yearbook of Cuba it is specified that the main causes are DM (up to 50% of patients), followed by HT (20 to 30%) and glomerulopathies (4-5%).⁴³ Unknown causes have been described in Central America.^{3,20,11,13,44,45} To the above causes, due to traditional and common factors to chronic vascular damage (obesity, aging) or kidney damage (infections, drugs and nephrotoxic drugs), has emerged in different regions of the CKD world that cannot be explained by the classic factors, invoking, among others, the use of traditional herbs, exposure to toxic factors and pesticides, among other elements that contribute in a very important way to the burden that the disease represents for some countries like Sri Lanka, Egypt, India, Salvador, Nicaragua and Mexico.⁴⁶⁻⁵¹

A study conducted in patients with HT and DM without a history of CKD identified that 47.2% and 54% of patients with HT and DM, respectively, were stage 1 or 2.⁵² In some countries, three out of five patients starting they are diabetics with an income percentage that varies between Singapore, 65.7%; United States 43.7%; Argentina 36% and Cuba 32.1%.^{53-55,56} It is estimated that 15% of patients with type 1 DM and 20 to 40% of patients with type 2 DM will present diabetic nephropathy (DN) in the course of their disease, depending on the degree of control of FR such as HT, dyslipidemias, smoking cessation and adequate glycemic control. Some authors consider that 50% of patients with DM 2 are at risk of developing CKD during their illness. Thus, vascular and obstructive causes with greater predominance have also been described in the MA.^{21,57-59}

CKD risk factors: susceptibility, initiators, progression, and end stage

CKD is a FR for CVD and other complications.^{20,60-72} Susceptibility factors: increase the likelihood of kidney damage: and advanced dad, family history of CKD, decreased renal mass, low weight to the birth, hypertension, diabetes, race, obesity, low socioeconomic status. Initiators factors: directly initiate kidney damage: i urinary infection products , systemic infections, obstruction of the lower urinary tract, nephrolithiasis, autoimmune diseases, nephrotoxic drugs, hypertension, diabetes.^{20,60-72} Progression factors: worsen kidney damage and accelerate renal functional deterioration: poorly controlled HT, anemia, obesity, smoking, dyslipidemia, associated CVD, poorly controlled proteinuria, poorly controlled DM.^{20,60-72} Factors final stage: increased morbidity and mortality in renal failure: d low osis Kt / V: K (urea clearance in the dialyzer; t=time), anemia, hypoalbuminemia, temporary access for dialysis, delayed referral to nephrology.^{20,60-72}

Glomerular filtration estimation

It is widely accepted that GFR is the best marker of kidney function.⁷³ Accurate measurement of GFR, using exogenous markers such as inulin or iothalamate, is not routinely performed in clinical practice due to its laboriousness and cost,⁷⁴ is routinely performed using endogenous markers such as creatinine (Crs) or cystatin C.⁷⁵ The normal values of CCr are considered to be approximately 95±20 ml/min in women and 120±25 ml/min in men.⁷⁶ The drawback of using this formula is that it slightly overestimates the GFR due to the tubular excretion of Cr and the difficulties in the correct collection of urine in older adults.⁷⁷ Mathematical formulas derived from the Crs have been developed to determine the eGFR: Cockcroft Gault equation,^{73,77} MDRD formula;⁷⁷ however, none of these formulas for estimating the GFR have been validated in the elderly;^{53,36} the use of MDRD in the healthy population (without CKD) can underestimate the GFR (healthy people have more muscle mass and more protein intake and therefore, more generation of Cr than people with CKD);⁷⁸ therefore, we will be able to classify "healthy" older adults as suffering from CKD due to obtaining a decreased eGFR when using the MDRD formula in a systematic way. In recent years, the research group established by the National Institute of Diabetes and Digestive and Kidney Diseases has developed a new equation to estimate GFR from the Crs: Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) more accurate than the MDRD equation.⁷⁵ It cannot be ignored that one of the limitations of the design of the CKD-EPI equation has been the inclusion of a small number of older adults; however it presents greater accuracy and improves the predictive ability of the FG (especially between values 60 and 90 ml / min/1.73m²) and predicting overall mortality and cardiovascular or the risk for CKD Stage 5. 75 Knowledge of GFR also allows correct adjustment of the dosage of drugs excreted by the kidney.⁷⁹

CKD progression

In these years it has been shown that it is possible to slow down progression and decrease cardiovascular risk if acted early. 2 The current situation in Spain identifies that 23% of patients are still referred to the nephrologist late, often due to lack of prior follow-up and in others because follow-up was through other medical specialists, which considerably influences the progression of the disease and does not escape the realities of other countries like ours.⁵ Only a small proportion of individuals with CKD will progress to CKD in stages 4 or 5; There is an important subgroup (from 41 to 96% in stage 3) in which an eGFR <60 ml/min/1.73 m² does not mark the start of the decline in renal function. Individuals older than 70 years with eGFR in the 45-59 ml / min/1.73 m² range , stable over time and without other evidence of kidney injury, are considered unlikely to have complications related to stage 5 disease. In individuals older than 65 years, the rate of decline in renal function appears to be more important in relation to cardiovascular risk than the baseline value of GFR.⁸⁰ As the progression is usually slow, compensatory mechanisms allow that even with loss of 70% of the renal mass the patient remains asymptomatic. In these mechanisms we have hyperfiltration, this is achieved by increasing the hydrostatic pressure in the glomerular capillaries, particularly through vasodilation of the afferent arteriole, but also by increasing systemic pressure. Capillary hypertension leads to proliferation and fibrogenesis, which in turn means hypertrophy and glomerulosclerosis, which naturally favors the progression of the disease in hyperfunctioning glomeruli.⁸⁰

Conclusion

CKD is a global health problem, with high prevalence rates in the elderly, regardless of the functional and structural changes in this patient, with the main causes being DM, HT, and glomerulopathies; as well as the described RF and the presence of markers of kidney damage. It is important to keep these markers in mind along with estimating GFR for diagnosis and evaluation of disease progression. Health promotion and prevention are the main strategies from the primary health level to positively influence the care of kidney patients, described within the preventive nephrology and the CKD preventive program in Cuba.

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Conflicts of interest

The author declares there is no conflict of interest.

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