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Evaluating the prevalence and etiology of chronic renal failure

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ABSTRACT

Introduction: Chronic renal failure is referred to as the progressive and irreversible loss of renal function, ultimately leading to the "end stage of renal disease" (ESRD), requiring one alternative treatment, including dialysis or grafting; in the final stage of renal disorders, kidney is unable to maintain metabolic function, fluid balance and electrolytes in the body; the ultimate consequence will be a dangerous and lethal condition called the uremia which, in turn, causes several serious complications in the body.

Methods: Searches were conducted by two independent researchers in international (PubMed, Web of science, Scopus and Google scholar) and national (SID, Magiran) databases for related studies from the inception of the databases to September 2017 (without time limitation) in English and Persian languages. To ensure literature saturation, the reference lists of included studies or relevant reviews identified through the search were scanned.

Discussion: CKD can have a range of etiologic causes; however, diabetes and hypertension are two of the main causes of the disease .Diabetic nephropathy is the most common type of glomerulopathy; it is also the most common cause of ESRD in the United States and Europe. In fact, about 50% of ESRD patients are diabetic. Only about 30% of patients with type 1 diabetes and 35-40% of patients with type 2 diabetes show, despite glycemic control, diabetic nephropathy .Hypertension is the second major cause of ESRD. About 51-63% of all patients with CKD are hypertensive, and this number has reached 90% in patients over the age of 65.

KEY WORDS: prevalence, etiology, chronic renal failure

INTRODUCTION:

Chronic renal failure is referred to as the progressive and irreversible loss of renal function, ultimately leading to the "end stage of renal disease" (ESRD), requiring one alternative treatment, including dialysis or grafting; in the final stage of renal disorders, kidney is unable to maintain metabolic function, fluid balance and electrolytes in the body; the ultimate consequence will be a dangerous and lethal condition called the uremia which, in turn, causes several serious complications in the body (1,2).

Methods:

1.1. Search strategy

Searches were conducted by two independent researchers in international (PubMed, Web of science, Scopus and Google scholar) and national (SID, Magiran) databases for related studies from the inception of the databases to September 2017 (without time limitation) in English and Persian languages. To ensure literature saturation, the reference lists of included studies or relevant reviews identified through the search were scanned. The specific search strategies were created by a Health Sciences Librarian with expertise in systematic review search using the MESH terms and free terms according to the PRESS standard. After the MEDLINE strategy was finalized, it was adapted to search in other databases. Accordingly, PROSPERO was searched for ongoing or recently related completed systematic reviews. The key words used in the search strategy were prevalence, etiology, chronic renal failure which were combined with Boolean operators including AND, OR, and NOT.

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1.2. Study selection

Results of the Literature review were exported to Endnote. Prior to the formal screening process, a calibration exercise was undertaken to pilot and refine the screening. Formal screening process of titles and abstracts were conducted by two researchers according to the eligibility criteria, and consensus method was used for solving controversies among the two researchers. The full text was obtained for all titles that met the inclusion criteria. Additional information was retrieved from the study authors in order to resolve queries regarding the eligibility criteria. The reasons for the exclusion criteria were recorded. Neither of the review authors was blinded to the journal titles, the study authors or institutions.

Prevalence

This disease has been quite progressive in recent years and its incidence has increased 10 times in the past 20 years in the United States (3). The annual growth rate of this disease in Iran, according to the reports issued by the Center for Transplant Management and Special Diseases of the Ministry of Health, was about 11%, reaching a number of 40000, in 2009. The annual incidence of this disease in Iran is 53 per 1 million people and its prevalence is 250 per 1 million people. In case of the United States, these figures are 200 and 975 per million, respectively. At the end of 2005, one million and 900,000 people were undergoing alternative therapies (4). The number of patients with end-stage renal disease in the world in 2006 exceeded 2 million and was 6% higher than world population growth (5). In Iran, with more than 13,000 dialysis patients, 150,000 dialysis sessions are conducted monthly (6).

Etiology

CKD can have a range of etiologic causes; however, diabetes and hypertension are two of the main causes of the disease. Diabetic nephropathy is the most common type of glomerulopathy; it is also the most common cause of ESRD in the United States and Europe (7). In fact, about 50% of ESRD patients are diabetic (8). Only about 30% of patients with type 1 diabetes and 35-40% of patients with type 2 diabetes show, despite glycemic control, diabetic nephropathy (9).Hypertension is the second major cause of ESRD. About 51-63% of all patients with CKD are hypertensive, and this number has reached 90% in patients over the age of 65 (10). Hypertension causes nephrocyclopedicglomerulo-nephrosis, which is characterized by the following characteristics: renalvasculopathy, which affects arterioles and glomerular plaque arteries, mainly due to atherosclerosis, endothelial dysfunction, fibrosis and thickening of the wall. 2. Microscopic node disease Glomerular tuft capillaries 3 - Distributed glomerulosclerosis and less commonly found focal and segmental glomerulosclerosis (FSGS) and 4 - Hyperthyroidism (11).

Staging

CKD is primarily staged in order to provide the most optimum management, including progression risk categorization and CKD complications. The classification of this disease is based on the GFR level, as shown in the followings (12):

G1 – GFR >90 mL/min per 1.73 m^2

G2 – GFR 60 to 89 mL/min per 1.73 m^2

G3a – GFR 45 to 59 mL/min per 1.73 m^2

G3b – GFR 30 to 44 mL/min per 1.73 m^2

G4 – GFR 15 to 29 mL/min per 1.73 m^2

G5 – GFR <15 mL/min per 1.73 m^2 or treatment by dialysis

CKD complications and required treatments

Increase in volume: Sodium balance and intravascular volume are usually maintained by homeostatic mechanisms until the eGFR value reaches below 10 to 15. Patients with CKD and increased volume usually respond to combination therapy of diuretics and oral salt restriction. Some researchers have argued that limiting oral sodium can slow down the progression of CKD by lowering interglobulin pressure (13).

Metabolic acidosis: There is an increasing desire for hydrogen ion retention in patients with CKD. This can result in a progressive metabolic acidosis, so that the bicarbonate serum concentration usually stays between 12 and 20 and rarely reaches below 10. Metabolic acidosis can be treated by giving bicarbonate (14).

Hypertension: Hypertension is seen in approximately 80% to 85% of patients with CKD. Treatment of hypertension can also reduce the progression of protinuclear CKD and reduce cardiovascular complications. Treatment for hypertension in patients with CKD can be treated with an angiotensin converting enzyme (ACEI) inhibitor or an ARB and a diuretic (15).

Anemia: Anemia is one of the most important complications of chronic kidney failure (16); it is,

also, one of the predictors of mortality in patients with advanced chronic renal failure; this disorder, in turn, leads to several pathophysiologic disorders and problems such as decreased tissue oxygenation, left ventricular hypertrophy, angina pectoris and heart failure, as well as impairment of the immune system. The main cause of anemia in chronic renal failure is the reduction of erythropoietin production. This complication has experienced significant decrease in recent years due to the widespread use of human recombinant erythropoietin in the treatment of these patients; however, erythropoietin is expensive and increases the cost of treatment (17).

Erythropoietin hematopoiesis is the main hormone regulator in human body. From the embryonic, neonatal and puberty period, the hematopoietic continuity factor is the main source of hormones, and, the erythrocyte precursors proliferate, differentiate into soft blood and prolong the life of red blood cells through the control of apoptosis (18). Erythropoietin is a glycoprotein 400/30 Daltonium with 165 amino acids, containing 40% carbohydrates. This hormone is produced in the liver in the fetus and in renal peri-tubular cells and a very small amount in the liver in the adults. Initially, it was thought that erythropoietin is only cytokine that affects hematopoiesis, but now it has been proven that its receptors are very broad andit is quite effective in the development of endothelial cells in the digestive tract and human brain (19).

Following the use of rhEPO and increased hemoglobin in patients with CKD, patients' quality of life is significantly improved (20).

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