Review Article

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A Multidisciplinary Approach to the Pre-Dialysis Patient

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ABSTRACT

The prevalence of chronic kidney disease (CKD) has reached epidemic levels, where 10 to 12 % of the population, and 50 % of the elderly, show signs of kidney dysfunction. Today, the stages of disease progression to dialysis are recognised, and the risk factors and conditions associated with kidney can be managed, including anaemia, malnutrition, bone disease, which affect morbidity and mortality. Treatment is extensive, and requires proactive prevention along with reducing cardiovascular risk. Timely referral of patients with CKD allows enough time for the adequate preparation of these patients for replacement therapy in the form of dialysis or transplantation. Patient education prior to dialysis, and health literacy, results in a series of key advantages for patients, including: Postponing initiation of dialysis, reducing morbidity and mortality, improving management of kidney disease complications, prepares patients for starting dialysis, and significantly improves quality of life for this group of patients.

Keywords

Chronic kidney disease, Pre-dialysis care, Structured pre-dialysis education.

Introduction

The prevalence of chronic kidney disease (CKD) has reached epidemic levels, where 10 to 12 % of the population, and 50 % of the elderly, show signs of kidney dysfunction. The estimated global prevalence for CKD ranges between 11 and 13 %, divided into stages based on the estimated glomerular filtration rate (eGFR): Stage I (eGFR > 90) 3 to 5 %, stage II (eGFR 60-89) 3 to 9 %, stage III (eGFR 30-59) 6 to 7 %, stage IV (eGFR 15-29) 0 to 4 %, stage V (eGFR < 15) 0 to 1 %. The largest number of patients falls within stage III, which allows for intervention and strategy to delay the progress of CKD, and improve treatment outcomes [1]. Reasons for the increase are relatively easy to recognise with evidence-based clinical practice. Clinical research and studies on large numbers of patients have identified risk factors associated with rapid loss of kidney function [2,3]. Causes of the increase in CKD include an ageing population, an increase in diabetes, as well as unregulated hypertension, obesity, excessive and uncontrolled non-steroidal anti-inflammatory drug use, and exposure to environmental toxins. Risk factors for the development of CKD can be summarised based on clinical practice:

- Factors for susceptibility (increased susceptibility for CKD development): Positive family history (kidney disease in family), older age, decreased kidney mass, low birth weight.
- Primary factors which directly affect the development of renal disease: Diabetes, high blood pressure, autoimmune disease, urinary system obstruction, hereditary disease.
- Progressive factors which after initial impairment cause progression of renal disease, and rapid loss of renal function: High proteinuria, unregulated hypertension, uncontrolled glycaemia, dyslipidemia, smoking [4,5].

During the last few years, the connection between CKD and cardiovascular morbidity and mortality has become increasingly evident. CKD is commonly symptomless, it is usually recognised only in its advanced stages, renal failure develops without prior symptoms, without awareness of kidney disease, and without

treatment which could have affected the course of disease. Early detection of kidney disease allows the chance to slow down the development of CKD, while early prevention of detrimental factors can prevent the development of cardiovascular disease (CVD), and significantly improve quality of life [6]. Historically speaking, the focus of kidney disease treatment was to secure access to dialysis, managing symptoms and complications of uraemia [7]. The focus today has changed, the stages of disease progression to dialysis are recognised, and the risk factorss and conditions associated with kidney disease can be managed, including anaemia, malnutrition, bone disease, which affect morbidity and mortality [8]. Treatment of CKD is extensive and requires proactive prevention along with reducing cardiovascular risk. Since the understanding of kidney and cardiovascular disease pathology among kidney patients has grown, it has become clear that recognition and intervention in the early stages of CKD will ensure the best care for individual patients [9-11]. Multidisciplinary treatment programmes have been proven effective in reducing the incidence of dialysis, morbidity, mortality, and have significantly reduced treatment costs [12]. However, the financial benefit of these interventions has not yet been evaluated in potential randomised studies [13].

Early Inclusion of Patients in Nephrological Care

Pre-dialysis can be defined based on the NKF-KDOQI guidelines as a glomerular filtration rate less than 60 mL/1.73 m2 or as the presence of microalbuminuria [14]. Timely referral of patients with CKD allows enough time for the adequate preparation of these patients for replacement therapy in the form of dialysis or transplantation. Adequate care of these patients should prevent urgent interventions and all complications such as premature vascular access, infection, and complications of initial, emergency dialysis procedures [15]. Many studies describe the ideal time for starting nephrological intervention and education [16,17]. European guidelines of good clinical practice recommend nephrological care and preparation for a method of replacement therapy at eGFR values of <30 mL/min/1.73 m^2. KDOQI recommends pre-dialysis education (PE) before construction of access for dialysis [14]. Construction of an arteriovenous fistule is recommend at eGFR values of <25 mL/min/ 1.73 m^2, peritoneal catheter placement at eGFR values of 12-15 mL/min/ 1.73 m^2, and preparation for pre-emptive transplantation six months before the start of dialysis at eGFR values of <20 mL/min/ 1,73 m^2. It is recommended that patients with CKD with an eGFR value of 15 mL/min/1.73 m^2 should be prepared for dialysis [14]. Several studies have reported that early referral to a nephrologist affects survival, especially in the first year of dialysis, but cohort studies which would confirm this are still lacking [18]. The issue of starting dialysis is commonplace. In recent years, there has been a tendency to start dialysis earlier with respect to eGFR in the hopes of achieving a better outcome for the patient [19]. However, some observational studies and one randomised controlled study did not find any basis for the early start of dialysis [20-22]. On the contrary, it was found that starting dialysis with a higher eGFR value was associated with higher mortality rates. These studies must be carefully interpreted in light of their basis of eGFR evaluation of kidney function for starting dialysis. The decision to initiate dialysis must not be based solely on predetermined eGFR values; rather the decision should be made based on careful, clinical evaluation of individual patients [23]. The treatment process and transition between the stages of kidney disease to stage V and dialysis represents a challenge for the patient, their family and surroundings, and requires careful clinical management which begins with early referral to a nephrologist, good coordination of healthcare, preventing complications of kidney disease, and managing co-morbidities. Multidisciplinary planning in an educative sense is necessary to provide patients with accurate information and to prepare patients for dialysis. Still, numerous patients begin dialysis rapidly without planning [24]. In comparison to long-term, monitored planned care, these patients start with haemodialysis, a temporary endovenous catheter, and not uncommonly stay on haemodialysis without knowledge of other replacement methods. Education of patients presents a challenge, but with group and individual work with patients, good results are achieved [25,26]. After planning multidisciplinary patient care after an urgent initiation of haemodialysis, managing complications of kidney disease, and completion of education, patients commonly choose, in cooperation with a nephrologist, peritoneal dialysis and transplantation work-up [27].

Pre-dialysis Patient Care

The successful care of patients with kidney disease primarily depends on precise diagnostics. Detailed information, as a base, must be collected on the duration and manifestation of disease symptoms, family medical history, and social status. None the less significant is information on medication use, and possible environmental exposure (exposure to harmful agents). It is crucial to collect basic information during the first patient check-up. Patients are often nervous, and interpreting disease symptoms can be difficult. It is necessary while collecting medical history to ask patients whether symptoms appear together or quickly after specific activities, for example, after tough physical work and haematuria, or sexual activity and dysuria. Three of the most common reasons for initiating treatment include: Patients are symptomless, but have specific, abnormal laboratory test results; patients describe specific symptoms which may point to kidney disease; or patients have a positive family history of kidney disease. The most common symptoms which patients describe are problems with urination, changes in the look or volume of urine, pain, oedema, or symptoms of reduced kidney function. Clinical examination includes inspection, palpation, percussion, and auscultation. Measuring blood pressure is an essential part of examining a kidney patient. For example, skin appearance may point to many abnormalities, and often may be dry, pale, or pigmented. In some kidney patient's purpura are seen. During patient evaluation, in clinical practice, an array of diagnostic tests is used. This namely includes examining urine and ordering biochemical tests which estimate renal function, radiological and radioisotope tests, and tissue biopsy for evaluating pathophysiological changes in the kidney.

Several factors must be considered when selecting patients for pre-dialysis treatment, education, or preparation for a selected method of dialysis or replacement therapy.

- Subjective symptoms: Nausea, vomiting, anorexia, fatigue,

weak appetite, consequent malnutrition. Some patients adapt to a chronic state, and symptoms are not as clearly presented, a number of medications can also minimise expression of symptoms.

- Objective symptoms: Decreased eGFR, and nutritional status are the two main indicators of advanced CKD.
- Evaluation and managing morbidity: Morbidity status at the beginning of treatment is a significant factor for a successful treatment outcome, while according to KDOQI guidelines, correcting anaemia, renal osteodystrophy, and malnutrition significantly affects co-morbidity, and correlates with cardiovascular risk.
- Method selection depends on: Education of patient, dialysis treatment options, co-morbidity, socio-economic status, experience of dialysis centre where patient is being treated. The patient and healthcare team must know the advantages and disadvantages of peritoneal dialysis (PD) and haemodialysis (HD).
- The socio-economic status of patients with advanced CKD is often very low, which often results in postponing treatment initiation, increasing morbidity, mortality, and decreasing quality of life.
- Culture can influence the choice of treatment, treatment in an institution (HD) or at home (PD, home haemodialysis) [28].

Pre-dialysis Treatment

Anaemia

Anaemia is common to all CKD patients, and increases with the decrease in eGFR. All patients must undergo laboratory analysis: A complete blood count, determining haemoglobin concentration (Hb), haematocrit (Htc), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC), reticulocyte count, plasma ferritin level (assessment of iron reserves), transferrin saturation (TSAT = Fe x 100/TIBC), C-reactive protein (CRP) (assessment of inflammation), analysis of folic acid or vitamin B12 deficiency, and analysis of secondary hyperparathyroidism (calcium (Ca), phosphorus (P), parathyroid hormone (PTH)C) is necessary. Anaemia in these patients requires evaluation and further testing for possible causes other than kidney disease. The frequency at which tests are repeated depends on the initial results, and on the use of erythropoiesis-stimulating agents (ESAs) or venous iron substitutes [29,30].

Mineral metabolism disorders

The term chronic kidney disease-mineral and bone disorder (CKD-MBD) is used to describe a clinical syndrome of mineral-bone metabolism disorder. Today, renal bone disease, or renal osteodystrophy, is used exclusively to describe disorders of bone morphology in CKD.

Disorders of mineral-bone metabolism in CKD manifests as one or more changes which includes: Abnormal laboratory values (Ca, P, PTH, vitamin D), changes in bone remodelling, volume, and growth, as well as pathological calcifications, most often in blood vessels and soft tissue.

Changes in the metabolism of calcium, phosphorus, and vitamin D which develop in CKD affect the secretion of PTH, whose increased secretion leads to hyperplasia of the parathyroid gland. Factors responsible for the development of hyperparathyroidism are associated with CKD, including hyperphosphatemia as a result of reduced phosphate secretion, hypocalcemia as a result of decreased production of active 1,25-dihydroxyvitamin D, and changes in PTH regulation. Fibroblast growth factor 23 (FGF 23) can indirectly promote hyperparathyroidism, which further inhibits the production of 1,25-dihydroxyvitamin D [31].

Protein-energy wasting (PEW)

Evaluation of the nutritional status of the pre-dialysis patient is complicated, which in CKD is due to intake and catabolism with significant effects of associated diseases and inflammatory changes. In clinical practice, the following is measured: Biochemical markers: Serum albumin, transferrin, cholesterol, body mass index (BMI); weight loss assessment; total body fat; measuring muscle mass (total muscle mass, arm muscle diameter, serum creatinine); measuring total intake (protein and energy intake); subjective global assessment of nutrition and malnutrition-inflammation score. Other measurements include noting appetite, food intake and energy consumption, measuring body mass (bioimpedance, CT, measuring muscle mass, C-reactive protein (CRP), interleukin-1 (IL-1), IL-6, tumour necrosis factor α (TNF-α), serum amyloid-A (SAA)). Nutritional support and treatment include oral and enteral measures, parenteral measures, and pharmacological measures [32].

Pre-Dialysis Education Programme (PEP)

PEP provides the CKD patient with a planned-out guide who will ensure understanding the disease process and available treatment options, and results in necessary lifestyle changes to improve quality of life [33]. Communication should be made by a healthcare worker of a high level of professional qualification who directly provides the patient with a form of healthcare. The multidisciplinary team is made up of a nephrologist, nephrology nurse (educated, minimum bachelor's degree in nursing) [34], psychologist, and nutritionist. It can be useful to expand the team to a family physician and/or social worker as deemed necessary. Members of the multidisciplinary team are required to honestly, in an understanding manner, and with empathy inform the patient of their condition, and necessary medical interventions. The patient has the right to actively participate in treatment, which means the patient's ability for judgement and decision-making on recommended medical interventions is recognised. Information must be presented to the patient in a clear and understanding manner, on their level, which will allow for independent decision-making on the current course of treatment [35]. Ideally, education should be simple, precise, focused, and repetitive to avoid overloading the patient with information. It is useful, during subsequent sessions, to review previous information, and evaluate patient understanding. Sometimes it is necessary to clarify misconceptions or misunderstandings of earlier topics [36]. Miscommunications can be the result of an ever-aging population, cognitive deficits in advanced uraemia, as a result of language or

cultural barriers, or personal health beliefs. The main goal of PEP is to establish adequate health literacy [37].

Patients are referred to PEP based on the recommendation of a nephrologist during pre-dialysis check-ups. The ideal time for referral is around stage 4-5 of CKD at an eGFR value < 30 mL/min/1.73m2 [14]. Timely referral of patients for PEP usually begins around 3-4 months before the start of dialysis, while late referral of patients is usually less than one month prior [38,39].

PEP is carried out in groups or at the individual level in various modules adapted to patients based on age, and education level. The education is conceptualised through five modules lead by a professional team, with patients as models during demonstrations, the president of the Association of Dialysis and Transplant Patients, and naturally, patients themselves. The education is carried out in small groups (5-6 patients), and patients are often accompanied by family members. Ideally, patients are grouped based on age and level of education, but necessity often dictates the constituents of the groups (urgent education, personal reasons, distance, work). Patients at the beginning of the education complete an anonymous questionnaire which contains questions about age, gender, and two multiple-choice questions are asked: "If you had to choose at this moment a form of renal replacement therapy, which one would it be?", with possible answers of dialysis, transplantation, or nothing. The second question asks "In the case of treatment with dialysis, which method would you choose?", with answers peritoneal dialysis, haemodialysis, or I am not aware of a single method. Analysis of anonymous answers serves as a tool to evaluate the level of knowledge of kidney disease and treatment methods. On the last module, patients complete another anonymous questionnaire, where the same two initial questions, along with age and gender, are asked. The questionnaire is supplemented with questions on the level of satisfaction of the education, understanding of knowledge gained, and the possibility to evaluate the education programme, with a numerical rating [1-5]. The last question offers the chance for patients to make suggestions to improve the programme [40,41]. Feedback of the education contributes to the quality and advancement of the programme.

The structured PEP being carried out in our institution since 2008 is designed in five [5] modules. Every module is prepared in detail by the members of the team. Medical documentation is prepared from pre-dialysis check-ups, and each meeting is noted in the medical documentation. For each module with a planned duration, an adequate space is prepared (the lack of which can cause disturbances, constant opening of the door or ringing of a telephone). The members of the team are familiar with teaching methods. It is essential to prepare teaching materials, teaching aids and printed materials intended for patients which are distributed at the end of each module.

Module Descriptions

First module	**Chronic Kidney Disease**
Participants	Small groups.
Team members	Nephrologist, nurse, psychologist.
Module Duration	90 minutes
Methods	Oral presentation, discussion.
Teaching Tools	PowerPoint presentation, projector, printed materials.
General Goals	Introduce patients to kidney disease. Describe symptoms and complications of kidney disease.
Specific Goals	Describe the location and role of the kidney. Describe kidney disease and kidney failure. Describe the causes of kidney disease onset. Describe treatment options. Implement and describe the role of patients in treatment. The role of family and environment in treatment. Psychological aspects of disease, patient and family reaction to kidney disease.
Second module	**Methods of Renal Function Replacement**
Participants	Small groups.
Team members	Nephrologist, nurse, psychologist.
Module Duration	90 minutes
Methods	Oral presentation, discussion.
Teaching Tools	PowerPoint presentation, projector, printed materials.
General Goals	Introduce patients to the methods of renal function replacement.
Specific Goals	Introduce patients to peritoneal dialysis (PD). Introduce patients to haemodialysis (HD). Introduce patients to kidney transplantation. Psychological aspects of replacement methods, patient and family reaction to methods.
Third module	**Methods of Renal Function Replacement – Methods in Practice**
Participants	Small groups.
Team members	Nephrologist, nurse.
Module Duration	150 minutes
Methods	Oral presentation, discussion, demonstrations.
Teaching Tools	Practical demonstrations of different methods.
General Goals	Introduce patients to the methods of renal function replacement. Present methods of renal function replacement
Specific Goals	Review of material from previous module. Demonstration of PD. Talk with patient on PD. Demonstration of HD. Talk with patient on HD. Talk with patient with kidney transplant.
Fourth module	**Nutrtion for Kidney Patients**
Participants	Small groups.
Team members	Nephrologist, nurse, nutritionist.
Module Duration	60 minutes
Methods	Oral presentation, discussion.
Teaching Tools	PowerPoint presentation, projector, printed materials.
General Goals	Introduce patients to nutrition for kidney patients.
Specific Goals	Introduce patients to dietary measures. Introduce patients to planning menus. Introduce patients to fluid intake.
Firth module	**Selection of Method of Renal Function Replacement**
Participants	Small groups, individual counselling (nephrologist–patient).

Team members	Nephrologist (different from the nephrologist who conducted earlier modules), nurse, psychologist.
Module Duration	60 minutes
Methods	Discussion.
General Goals	Select the best method of renal function replacement.
Specific Goals	Individual selection of method, recommendation of nephrologist in cooperation with patient. Prescribe further course of treatment Recommend possible start for kidney transplantation work-up. Psychological aspects of method selection, patient and family reaction to methods.

Conclusion

The prevalence of chronic kidney disease (CKD) has reached epidemic levels. During the last few years, the connection between CKD and cardiovascular morbidity and mortality has become increasingly evident. Early detection of kidney disease gives the chance to slow down the development of CKD. Timely referral of CKD patients allows enough time for the adequate preparation of these patients for replacement therapy in the form of dialysis or transplantation. Patient education prior to dialysis, and health literacy, results in a series of key advantages for patients, including: Postponing initiation of dialysis, reducing morbidity and mortality, improving management of anaemia, malnutrition, mineral-bone disorders, and affects the factors for developing cardiovascular disease, prepares patients for starting dialysis with remaining renal function preserved, and significantly affects quality of life.

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