

Multidisciplinary Evaluation of Chronic Renal Failure and Hemodialysis

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Abstract

Chronic renal failure is a irreversible deterioration of the renal regulatory mechanisms of the fluid electrolyte balance and metabolic-endocrine functions as a result of reduced glomerular filtration rate. Hemodialysis, one of the renal replacement therapy options, is a treatment based on the exchange of fluid and solutes between the patient's blood and the appropriate dialysate through a semi-permeable membrane. Hemodialysis treatment has many complications. Patients experience many problems, such as reaction periods, psychological conflicts and tendency to deny, body image disorders, etc., when they start hemodialysis treatment. Both hemodialysis treatment and chronic renal failure cause changes in the biochemical parameters of patients. The excess of stressors, stressors are as versatile as physical psychology, the individual has negative effects on the quality of life. The stress is high and the continuity of the stressors is the basis for the alexitimia. A multidisciplinary treatment approach is important for the treatment to be monitored and the care to be planned, as patients have problems that require the combination of many disciplines.

Keywords: Biochemistry, chronic kidney failure, hemodialysis, nursing, stress

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Chronic Renal Failure

Description

Chronic renal failure (CRF) represents an irreversible deterioration of the renal regulatory mechanism of the fluid–electrolyte balance and metabolic-endocrine functions as a result of a decrease in the glomerular filtration rate (GFR) (1). According to the 2002 Kidney Disease Evaluation and Classification Manual prepared by the National Kidney Foundation—Kidney Disease Outcomes Quality Initiative (NKF-KDOQI), CRF has been described as

- 1) The presence of structural or functional abnormalities in the kidney that persist for 3 months or longer, with or without a decrease in the GFR, and
- 2) GFR being $<60 \text{ mL/min/1.73 m}^2$ for 3 months or longer, with or without the presence of renal damage (2).

The normal value of GFR is $127 \pm 20 \text{ mL/min}$ in males and $118 \pm 20 \text{ mL/min}$ in females. It decreases 1 mL/min every year after 30 years of age. When it decreases to $\leq 15 \text{ mL/min}$, replacement therapies (RRT) are required, such as hemodialysis (HD), peritoneal dialysis (PD), and transplantation (Tx). CRF is a life-threatening disease that can cause serious organic, mental, and psychosocial problems; restrict all functions; and cause significant loss of labor (1, 3).

Etiology

The study named “Chronic Renal Disease in Turkey” performed by the Turkish Society of Nephrology showed that in our country, the prevalence of CRF is 15.7% in the adult population aged >18 years, and 5.2% of cases have an advanced stage CRF. It was concluded that the increasing prevalence of hypertension (HT), diabetes mellitus (DM), obesity, and metabolic syndrome poses a great risk for



both CRF and cardiovascular disease (4). When the etiology of CRF disease is examined in general, it is seen that many factors are involved in the etiology. These have been defined as

- DM
- Hypertension
- Chronic glomerulonephritis
- Renal cyst diseases
- Amyloidosis
- Obstructive uropathy
- Interstitial nephritis
- Collagen tissue diseases and malignancies
- High cholesterol
- Female gender
- Insufficient exercise
- Obesity
- Advanced age
- Malnutrition
- The presence of CRF in the family history
- Low birth weight
- Low socioeconomic status
- Low level of education
- Race
- Autoimmune diseases
- Systemic infection
- Urinary infection
- Smoking

- Proteinuria
- Poor glycemic control
- Drug toxicity
- Nephrotic syndrome
- Unknown reasons (1, 5, 6)

Clinical Features

Patients may be asymptomatic until the glomerular filtration value falls between 35 and 50 mL/min. The only way to know how the kidneys work is through blood and urine tests (7). When CRF develops, some signs and symptoms occur in our body. The clinical signs and symptoms of the patients are closely related to the underlying pathology, the degree of renal failure, and the rate of development. The initial symptoms of the patients are exhaustion and fatigue, usually due to nocturia and anemia. When the glomerular filtration value is 20-25 mL/min, uremic symptoms begin to appear (8) (Table 1).

In general, when the clinical picture of the affected systems is examined, many symptoms occur due to elevated blood urea nitrogen, and therefore other systems are affected. A problem occurring causes more clinical problems in a vicious cycle (1).

Renal Replacement Therapy Option: Hemodialysis

According to the center-based data in the Turkish Nephrology Association’s Registry System, a total of 74.475 patients re-

Table 1. Symptoms and Signs of Chronic Renal Failure According to the Systems (1, 8, 9)

Systems	Symptoms
Respiratory system	Kussmaul respiration, pulmonary edema after urinary fluid accumulation (uremic lung), pleural effusion, specific and nonspecific infections
Skin	Ischemic ulcers caused by calcium phosphate precipitation on the vessel wall (calciophylaxis), hyperpigmentation, itching, nail atrophy
Cardiovascular system	Hypertension, cardiomyopathy, heart failure, ischemic heart disease, left ventricular hypertrophy, arrhythmias, uremic pericarditis
Gastrointestinal system	Stomatitis, nausea, vomiting, persistent hiccups, mucosal ulceration, pancreatitis, hepatitis of various etiology, loss of appetite
Metabolic signs	Glucose intolerance, hypoglycemia in diabetics, hyperlipidemia, hyperuricemia, malnutrition
Hemopoietic system	Anemia, immunosuppression, bleeding, increased erythrocyte fragility, hemorrhage, lymphopenia, microcytic anemia (due to aluminum)
Endocrine system	Secondary hyperparathyroidism, impotence, sterility, frigidity, hyperprolactinemia, thyroid dysfunction
Locomotor system	Renal osteodystrophy, adynamic bone diseases, osteomalacia, spontaneous tendon rupture, pathological fracture, carpal tunnel syndrome, crystal arthropathies, myopathies
Fluid–electrolyte balance	Hypervolemia, hypovolemia, hyperpotasemia, hypopotasemia, hypernatremia, hyponatremia, metastatic calcifications, hypermagnesemia, hyperphosphatemia, metabolic acidosis
Neuromuscular system	Autonomic neuropathy, involuntary movements, convulsions, restless leg syndrome, dialysis imbalance syndrome, dialysis dementia
Psychiatric signs	Concentration problems, incompatibility with the environment, noncompliance with treatment, anxiety, agitation, depression, suicidal tendency

ceived RRT by the end of 2016. The tendency of an increase in the number of patients receiving RRT continues. The most common type of RRT is HD (n=56.687) followed by transplantation (n=14.280) and PD (n=3.508) (10).

HD is a treatment based on the exchange of fluids and solutes between the patient's blood and the appropriate dialysate via a semipermeable membrane. This method is applied on the principle of removing unwanted substances from body fluids through the semipermeable membrane. The movement of solute and fluid is generally directed toward the dialysate from the patient's blood and by removing this dialysate, the fluid-solute imbalance in the patient is brought closer to normal values. In this direction, the solute transition between blood and dialysate is provided in accordance with the physiological principles of osmosis, diffusion, and ultrafiltration. The substances that may accumulate in the body and cause problems to the systems act as a kind of artificial kidney by removing them from the body via the HD device (1). The mean duration of the HD treatment is 12 hours per week. Depending on the severity of renal failure and the amount of urine, the patient undergoes HD 2-3 times a week for 4-6 hours (11).

HD is a process during which the patient's blood is cleaned from unwanted substances and re-administered through the HD device. While the pores of the semipermeable membrane in the HD device allow the passage of water and small molecules, they do not allow the passage of larger structures, such as proteins and blood cells. A permanent or temporary vascular access route should be provided to ensure an adequate blood flow. The most common method used today to provide a temporary vascular access route is to obtain an adequate blood flow by placing a double lumen catheter into the femoral, subclavian, or internal jugular vein. At the same time, a shunt or fistula is opened in patients receiving HD therapy. The shunt is the connection of an artery and a vein outside the skin via a catheter. The fistula is the direct connection of the artery and vein with anastomosis. In addition to these, internal arteriovenous graft is used in patients with chronic HD. This method is applied in patients who do not have enough or appropriate blood vessels for fistula opening (1, 10, 11).

Indications for HD in CRF include uncontrolled HT and fluid burden, pulmonary edema, pericarditis, advanced encephalopathy, anorexia, nausea, vomiting, malnutrition, uncontrolled hyperkalemia, and metabolic acidosis (12). During the HD treatment, hypotension (20%-30%), cramps (5%-20%), nausea/vomiting (5%-15%), headache (5%), chest pain (2%-5%), back pain (2%-5%), itching (5%), and fever/chills (<1%) are common but generally non-life-threatening complications. Many complications may occur during the HD procedure; these complications are rare but may be serious and life threatening (12-14).

Patients receiving HD treatment may also be affected by many physical or psychological symptoms, such as constipation, nau-

sea, vomiting, diarrhea, anorexia, muscle cramps, limb edema, dizziness, restlessness, restless leg syndrome, coughing, dry mouth, dry skin, itching, difficulty in concentration, sleep problems, chest, back pain, restlessness, nervousness, and sexual dysfunction (15). These problems lead to further issues as the duration of treatment increases. Depending on the symptoms they experience, patients may find it difficult to control their daily life activities, entertainment, and social activities, they may lose their independence, have to retire early, experience economic problems, role changes, and deterioration in family life, and changes in the body image and self-esteem (16).

Losses due to hemodialysis

Loss of physical function: With the HD procedure, only partial renal functions can be performed. Especially when there are problems such as nausea/vomiting, itching, weakness, exertion etc., and when the symptoms related to the decrease in blood pressure are added during the HD treatment session, the patient feels worried that he or she may lose his or her health and autonomy and may not regain them (17). Also, during the HD procedure, complications such as dialysis disequilibrium syndrome, dialysis reactions, arrhythmia, cardiac tamponade, hemorrhage (intracranial, gastrointestinal system), convulsion, hemolysis, air embolism, rupture of dialysis, blood clotting in dialysis, fluid-electrolyte metabolism disorders, dialysate temperature changes, and hypoxemia may occur. Reduction in serum drug levels, complement activation, and transient neutropenia may also be observed. The occurrence of these complications and the physical problems related to chronic disease and the idea of disability come into focus (13, 14).

Loss of economic security: The entrance of an individual in the HD program can often lead to economic destruction (17). In addition to its medical aspects, CRF also affects the social, economic, and psychological conditions of both patients and their relatives. ESRD affects every organ system, and its complexity may vary from patient to patient, but it negatively affects the lifestyle of the patient without any exceptions (18). Since HD is a condition where time should be devoted to maintain life, the patients are not expected to work (17). In HD patients, the relationship between depression and loss, including job loss (inability to work, low level of education, and low socioeconomic level) should be considered. Many patients who develop ESRD lose their job before being diagnosed, retire as disabled, or have to work in the back service (19). When the patient is a male, sometimes his wife starts to work, and if the patient is a female, her husband disrupts his job. This leads to an increased economic loss (17).

Deterioration of family order and role change: It has been observed that at the beginning of the disease, family members show interest and are involved, but then they lose interest, and friends and relatives stop calling. On the other hand, hypersensitivity to the words and behaviors of family members emerge in patients (17). In general, the KRG process leads to many changes in family

and marital life, and also causes stress (20). It is a known fact that psychosocial distress and psychosocial adjustment problems are high in both patients undergoing HD treatment and their spouses and that patients and spouses react to the disease as a whole. An important reason to why HD spouses develop negative emotions toward patients is patients' sexual dysfunction (17, 20).

Psychological Characteristics Observed in Hemodialysis Patients

Continuous dependance of patients on the HD machine creates a conflict between dependance and independence. Patients tend to react with feelings such as being dependent during treatment, independent after treatment, or rejection of disease and the HD treatment (21). As a result of the HD treatment, prolonged lifespan along with prolonged health problems occur, and they may even be seen as more dominant than the fear of death from time to time (17).

Conflict of Dependence–Independence: No chronic patient is as dependent to an institution as HD patients. Those who fear dependance rebel against disease and treatment. Generally, patients with severe anxiety cannot tolerate the dependance required by the treatment program. It often happens that they do not follow treatment recommendations by the medical staff. In particular, they exhibit symptoms such as noncompliance with diet and medication, negativism, childlike behaviors, anger to health personnel, and bargaining (17, 22).

Life–Death Conflict: HD patients are individuals who have to cope with the difficulties of HD while trying to prolong their lives with the HD treatment. In addition to the long life promised by the HD treatment, they try to hold on to a lower quality of life. During this process, many patients lose hope for a better quality of life. If the sufferings go beyond the pleasure, actions to harm oneself may occur (23).

Tendency to Deny: HD patients tend to deny their diseases because the treatment is temporary. Many patients think that they will recover after a while. Denial is generally thought to increase the fighting power of the patient (17). However, Devins et al. reported that patients with the highest denial mechanism had a shorter life expectancy (24). Sometimes denial is so severe that the patient refuses treatment because he or she does not admit that he or she is sick.

Body Image Disorders: Many patients see the HD machine as an extension of their body or their bodies as an extension of the machine. They often install human characteristics on the machine. These perceptions are often unconscious. They rarely develop into psychosis. Another symbolism is to simulate the HD machine to the placenta (17).

Response Periods in Patients on Hemodialysis

Uremic period: It is the period when the HD treatment has not been started yet. In addition to the CRF symptoms, the patient

has fear of death and shows despair, weakness, and mental depression (17).

Anxiety Period (HD treatment onset): The treatment process is very new and is an unknown beginning for patients on HD. There is anxiety due to the fact that the treatment is new to the person and there is lack of information (17).

Honeymoon Period (first 3 weeks in HD treatment): With the regression of symptoms, the patient feels that he or she is returning from the dead, apathy decreases, and euphoria occurs (17).

Depression Period: After the first 3 weeks or 8-9 weeks of HD, the patient becomes aware of the situation, and euphoria decreases. It is a period when difficulty regarding treatment compliance and depression are common (17).

Adaptation Period: The patient has become accustomed to such a life and returned to life interests. There are prospective plans and expectations (17).

It is important that the health workers know about the treatment periods and are aware of the period in which the patient is. The fact that the information to be given to the patient during the anxiety period will prevent effective education. For this reason, it is the most important step of healthy communication that nursing care plans be made in line with the treatment periods.

Biochemical Parameters

Serum Albumin

In uremic patients, hypoalbuminemia is in close association with inflammation and metabolic acidosis. While chronic inflammation and chronic or acute stress result in increased albumin degradation and decreased protein intake leads to decreased protein synthesis. Serum albumin concentrations are inversely related to mortality in patients on HD. Although there is no single ideal measure of nutritional status, serum albumin concentration is one of the frequently used values to determine the protein–energy malnutrition in patients on HD (25, 26).

Blood Urea Nitrogen Concentration

Blood urea nitrogen concentration is an indicator of the balance between the urea production rate, protein synthesis, and degradation. Under a balanced metabolic state, the concentration of urea nitrogen in the blood depends directly on the intake of dietary protein. In catabolic cases, the endogenous protein is metabolized by additional nitrogen increase. In anabolic conditions, dietary protein is used for protein synthesis, resulting in reduced nitrogen and blood urea levels (25).

Serum Creatine

Creatine is the catabolic product of the muscle metabolism. Although creatine production depends on muscle mass and di-

etary intake of creatine-rich nutrition, the serum creatine level depends on residual renal function. In anuric patients, the serum creatine level before HD is proportional to dietary protein intake and skeletal muscle mass (25).

C-Reactive Protein

Positive acute-phase reactants hepatic CRP synthesis is affected by acute and chronic inflammations, infection, and stress. Elevated serum CRP levels are also a biochemical finding that should be evaluated primarily for inflammation and atherosclerosis. Depression is also associated with increased mortality in patients on HD. There is an increase in the expression of inflammatory markers in depression. In short, a further decrease in the renal function is a condition that triggers inflammation. The serum CRP level is also considered to be a good indicator of inflammation in patients with end-stage renal failure (25, 27).

Sodium

Patients on HD with anuria can take 1-1.5-2 g/day salt and maximum 1 liter of liquid. If patients have hypertension or heart failure, salt and water restrictions must be more cautiously performed. An excessive salt intake also increases the water intake by increasing thirst (28, 29).

Potassium

Approximately 30% of potassium taken into the body is excreted through the intestines, and the rest through the kidneys and dialysate. The risk of hyperkalemia is higher in patients with HD. Therefore, potassium restriction is applied in patients on HD. Severe vomiting, diuretic use, or diarrhea may cause potassium loss, and hypokalemia may develop. In this case, the potassium content of the diet should be increased (29).

Calcium-phosphorus

In patients on HD, calcium requirements increase due to protein and phosphorus restriction, loss of appetite, and vitamin D deficiency. A decrease in plasma calcium levels stimulates the secretion of parathyroid hormone (PTH) and causes an increase in plasma PTH level (1). Calcium supplementation and control of serum phosphorus levels are performed simultaneously using calcium-containing phosphorus-binding agents (29).

An addition of the active form of vitamin D, which cannot be converted to its active form in renal failure, is an important step in controlling the serum PTH activity. The absorption of dietary phosphorus from the gastrointestinal tract is approximately 80%, which requires the use of phosphorus-binding agents (29).

With the restriction of phosphorus intake, diets of patients on HD become more restricted than calcium. To maintain the calcium balance, patients on HD are given calcium and vitamin D. However, since the use of calcium and vitamin D in patients on HD may result in severe hypercalcemia and may cause renal osteodystrophy, as in patients with CRF who do not undergo HD treatment, this treatment should be performed with caution (30).

Stress

Stress refers to an elevated physical or mental state caused by a change in the internal or external environment. In humans, physical stress is caused by illness and trauma, and psychological stress is created by real, perceived, and expected threats. Stress manifests itself in three general areas: physical, social, and psychological. The physical symptoms of stress include:

- Fatigue and exhaustion
- Headache or migraine
- Neck and back pain or stiffness
- Gastrointestinal problems
- Chest pain or palpitations
- Weakened immune system and sleep disorders

The social symptoms of stress include family conflicts, work tensions, and changes in sex life. The psychological symptoms of stress are observed as subheadings as symptoms: emotional, intellectual, and behavioral symptoms (31, 32).

CRF and administered RRTs all lead to both physical and psychological stressors for patients. There are many sources of stressors, such as complications, role changes, disease symptoms, dependence on health care workers and a mechanical device, other than stress-causing disease and treatment methodologies. Loss of physical strength and endurance, fear of death, economic difficulties, diet, limitation of fluid intake, and dependence on medical treatment in CRF may cause this disease to be perceived as an extreme stressor. In addition, loss of body function and impaired body image, reduction in leisure, and participation in social activities are known as specific stress sources frequently reported by patients with HD. It is important that patients, their relatives, and health workers determine the sources of stress and develop effective methods of coping with stress (33, 34). In the study by Hiçdurmaz and Oz that investigated the stress-coping methods of patients under the HD and PD treatment, the first coping method is devoting oneself to religion, followed by the acceptance, positive re-interpretation, planning, and using active coping methods (35).

Alexithymia

Alexithymia is defined as the limitation in phantasy and fantasy life, inability to distinguish emotions, thoughts, and physiological responses and difficulties in recognizing and expressing emotions. Although it was first proposed to explain the symptoms seen in psychosomatic patients in the beginning, today, alexithymia is accepted as a personality encountered in many different psychiatric disorders and even in healthy populations (36, 37).

Alexithymia presents primarily as issues in emotional functions and interpersonal relationships. It is characterized by difficulty in explaining and distinguishing feelings. Alexithymia refers to personality traits that accompany the difficulty in recognizing, defining, and verbalizing feelings; the tendency to think concrete; problems with distinguishing between physical sensa-

tions and emotional sensations, and a decrease in the ability to imagine (38). There are three basic concepts that appear when explaining the characteristics of individuals with alexithymia. These concepts are the following:

- Affect is a mental orientation that includes both biological and psychological elements.
- Emotion is a state of mental life, such as pain, desire, hope.
- Feeling (satisfaction) or suffering is defined as the result of emotionally affected state (39).

Despite the different interpretations and definitions made on the subject, the experts gathered the symptoms of alexithymic personality traits under four main headings. These features are

- Difficulty in recognizing, distinguishing, and verbalizing emotions
- Limitations in imagination, phantasy, and life
- Operational thinking
- Eccentric-adaptive cognitive structure (36, 39)

Recently, the term alexithymia has begun to be studied in individuals with chronic diseases besides psychiatric patients. In a study by Şentürk et al. (2000), it was shown that 67.5% of individuals receiving HD treatment, and 57.5% of individuals who were diagnosed with CRF and also receiving conservative treatment, were alexithymic (40). The study by Pop-Jordanova and Polenakovic found that half of the patients undergoing HD were alexithymic, and 18% were possibly alexithymic. The authors also emphasized that there was a positive relationship between the duration of HD treatment and alexithymia (41).

CONCLUSION

CRF and HD therapy cause many symptoms as a result of changes in many parameters in the human body. These symptoms occur both physically and psychologically. This is a group of patients who are known to health care workers and who need a multidisciplinary treatment approach to ensure the quality of the patients.

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