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CHEMICAL WORKING ACTION OF BIO-ARTIFICIAL KIDNEY APPARATUS

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Annotation: *Due to the importance and function of the kidneys in the human body, one of the most widely used modern diagnostic methods in chronic diseases caused by renal insufficiency, and impaired renal function, is the analysis of the chemical mechanism of artificial kidneys.*

Keywords: *Renal failure, hemodialysis, artificial kidney, petrology, diffusion, osmosis, dialysate.*

Аннотация: *Анализ химического механизма искусственной почки является одним из наиболее широко используемых современных методов диагностики при хронических заболеваниях, обусловленных поражением почек, в связи с ролью и функцией почек в организме человека.*

Ключевые слова: *почечная недостаточность, гемодиализ, искусственная почка, нефрология, распространение, осмос, диализовать.*

The kidney is a substantial clue organ that provides for creating urine, controlling metabolism, maintaining water-salt content normally, and keeping acid-base balance. Nephrological disorders can occur due to the impact of external and internal factors on normal function. Renal failure is the most common type of kidney disease. According to statistics from the International Society of Nephrology, approximately 850 mln people have been

suffering from this disorder in the world over the past year. Meanwhile, the mortality rate is increasing year by year. In Uzbekistan, more than 4000 patients because of kidney insufficiency have felt the need for hemodialysis. Currently, they are requested to receive 3-time procedures with the hemodialysis process. Therefore, on July 12, 2018, by the President's decision "On measures to increase the efficiency of nephrology and hemodialysis assistance to the population of the Republic of Uzbekistan", on October 30, the "Uzbekistan Hemodialysis Society" was established. Apart from that, the "Nephrology, Hemodialysis and Kidney Transplantation" department of the Tashkent Medical Training Institute was established at the Republican Scientific and Practical Medical Center of Nephrology and Kidney Transplantation.

Renal failure is a syndrome that refers to reduced function of the kidney. Clinical manifestations such as urinary incontinence, swelling in the legs and arms, increased blood pressure, muscle tension, shortness of breath, and arrhythmia are observed in this disease. The major causes of this disease are circulatory problems with the kidney, cirrhosis and liver diseases, dehydration, poisoning, inflammation in the kidney, and injuries. In patients with acute and chronic kidney failure, only 10-15% of kidney function is available. Such patients are treated with modern diagnostic methods and artificial kidney devices.

An artificial kidney, a hemodialyzer is a device that temporarily performs the excretory function of a diseased kidney. Its main function is to maintain electrolyte and acid-alkaline balance in the body, normal blood composition, to remove toxic metabolites and excess water. In modern medicine, there are two artificial methods of blood purification:

- Hemodialysis
- Peritoneal dialysis

Figure 1- Appearance of kidneys in acute and chronic kidney failure patients.

Hemodialysis is a method of extrarenal purification of blood from toxic substances, normalization of blood environment, and balance of water-mineral exchange in acute and chronic kidney failure. Hemodialysis session patients with end-stage renal failure usually need hemodialysis at least three times a week, each session lasting 3 to 4 hours. The hemodialysis machine consists of 3 main components: a blood supply device, a device for preparing and delivering dialyzerite, and a dialyzer. During the procedure, users are given heparin administration to suppress clot formation.

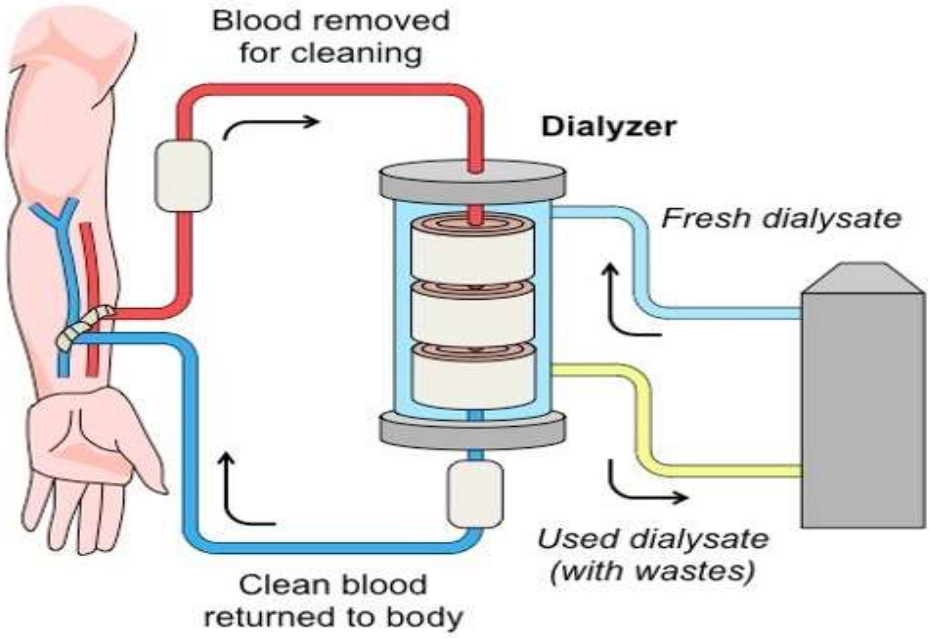

Figure. 2-The structure, components, and working principle of the hemodialyzer apparatus.

The dialyzer is the main part of the device. Its most important functional element is a semi-permeable membrane made of natural or synthetic materials based on cellulose and polysulfone.

Dialysis is the beginning of the treatment of chronic renal failure and acute pre-renal uremia. Bleeding complications can occur at the site of a fistula or graft, blood flow problems can arise during hemodialysis. There are two main types of filters used in dialysis machines:

Capillary (hollow fiber) dialyzers consist of several thousand very fine capillary tubes. The blood flows inside these tubules. The dialysate flows outside the capillary walls. The capillaries are half-permeable membranes made of synthetic material.

Plate or layered dialyzers are made from multiple layers of membranes placed parallel to each other. These dialyzers function without any space between the layers. If necessary, waste substances are filtered through the spaceless part. When using such a device, the risk of blood clots is reduced [Table 1].

Table 1.

The standard dose of heparin

Hemodialysis duration	Hemoglobin <100g/l		Hemoglobin >100g/l	
	bolus	dosed	bolus	dosed
4 hours	5000 UI	5000 UI	6000 UI	6000 UI
5 hours	6000 UI	6000 UI	7000 UI	7000 UI

Two types of dialyzers are distinguished by high efficiency and quality of blood purification. [Table 2].

Dosage of drugs:

Table 2.

Hemodialysis duration	nadroparin		dalteparin		enoxaparin	
	bolus	dosed	bolus	dosed	bolus	dosed
4 hours	0.3 ml	0.6 ml	2500 UI	5000 UI	0.2 ml	0.4 ml
5 hours	0.6 ml	0.6 ml	5000 UI	5000 UI	0.4 ml	0.4 ml

Peritoneal dialysis is one of the dialysis methods, a relatively new technology. The essence of this method is that it is filtered through a catheter inserted into the abdominal cavity. There is no need for special equipment: dialysate is infused into the catheter and drained after several hours. The convenience of this method is that it can be performed at home, without the need to visit a special center.

The effectiveness of hemodialysis therapy depends on the connection of hemodialyzers to the dialyzer's surface. The improvement of the technical characteristics of dialyzers, the modernization of artificial kidney devices, and the increase in the speed of blood circulation through the dialyzer have led to an improvement in the quality of life of patients undergoing

hemodialysis. In addition, the psychological preparation of patients for treatment is also of great importance.

Conclusion: All of the above dialysis methods operate based on chemical processes: osmosis and diffusion processes.

Osmosis - the concentration of dissolved substances in water or a solvent moving from an area of low concentration to an area of high concentration through a semipermeable membrane.

Diffusion, the movement of molecules from an area of higher concentration to an area of lower concentration, occurs until the concentrations are equal throughout the entire space.

Specifically, harmful and unnecessary substances in the blood, as well as excess water in the body, diffuse through the semi-permeable membrane via osmosis and diffusion paths and collect in the dialysate. Thus, all physiological processes in the human body are carried out through chemical mechanisms.

Quality of life and prognoses

If there are doubts about the benefits of hemodialysis, it is necessary to consider how long a person has lived. According to statistics, extracorporeal blood purification extends life expectancy by 15-20 years. Important conditions include being unable to postpone sessions to the next day, sending them regularly, stopping taking medications independently, and limiting the diet. If you do not undergo organ transplantation but regularly use an "artificial kidney" machine, you may live for another 20 years, but then life expectancy is needed.

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