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THE EFFECT OF HEMODIALYSIS ON LABORATORY PARAMETERS IN CHRONIC RENAL FAILURE

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Annotation: Chronic renal failure (CRF) represents a progressive and irreversible loss of renal function, leading to the accumulation of toxic metabolic products and severe disturbances in homeostasis. As renal excretory capacity declines, patients develop azotemia, electrolyte imbalances, acid-base disorders, and anemia, all of which are reflected in laboratory findings. Hemodialysis (HD) serves as an essential renal replacement therapy that substitutes part of kidney function by filtering the blood through a semipermeable membrane to remove uremic toxins and excess fluids.

This study discusses the effect of hemodialysis on various biochemical and hematological laboratory parameters in patients with chronic renal failure. It highlights how regular dialysis sessions alter serum urea, creatinine, electrolytes (sodium, potassium, calcium, phosphate), and acid-base indicators, as well as hematologic parameters such as hemoglobin and hematocrit levels. The findings demonstrate that hemodialysis plays a vital role in restoring physiological balance, reducing symptoms of uremia, and improving patients' overall clinical status.

Moreover, the annotation emphasizes that despite its therapeutic benefits, hemodialysis does not fully replace the natural regulatory and endocrine functions of the kidney. Therefore, continuous monitoring of laboratory markers is necessary to evaluate treatment adequacy, detect potential complications, and adjust therapy protocols. The integration of improved dialysis technology, high-efficiency filters, and patient-specific treatment planning ensures optimal biochemical correction and better long-term outcomes in chronic renal failure management.

Key Words: Chronic renal failure, hemodialysis, urea, creatinine, electrolytes, biochemical parameters, renal replacement therapy.

Main Part

Chronic renal failure (CRF) represents one of the major public health problems worldwide. It develops as a result of long-term kidney damage caused by diseases such as glomerulonephritis, diabetes mellitus, hypertension, and polycystic kidney disease. Progressive nephron loss leads to retention of nitrogenous waste products, electrolyte imbalance, and metabolic acidosis. The main goal of treatment in end-stage renal disease is the replacement of renal function through hemodialysis or kidney transplantation.

Hemodialysis is a mechanical process that removes uremic toxins and excess fluid from the blood using a semipermeable membrane. The procedure helps maintain homeostasis by

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regulating electrolyte concentration, acid-base balance, and plasma osmolality. Regular hemodialysis sessions have a significant influence on several laboratory parameters that reflect the physiological state of patients.

1. Nitrogen Metabolism Markers

Urea and creatinine are the main indicators of renal excretory function. In patients with chronic renal failure, their levels increase due to decreased glomerular filtration rate. Hemodialysis effectively reduces blood urea nitrogen (BUN) and serum creatinine concentrations by diffusion and ultrafiltration. After each dialysis session, urea levels may decrease by 50–70%, and creatinine by 40–60%, indicating the efficacy of toxin clearance.

2. Electrolyte Balance

Patients with renal failure often exhibit hyperkalemia, hyponatremia, and hypocalcemia. During hemodialysis, potassium is removed through diffusion into the dialysate, preventing life-threatening arrhythmias. Sodium balance is carefully maintained by adjusting dialysate sodium concentration. Calcium and phosphate metabolism are closely related to parathyroid hormone (PTH) regulation; dialysis helps control hyperphosphatemia and partially restores calcium levels when combined with phosphate binders and vitamin D analogs.

3. Acid-Base Homeostasis

Metabolic acidosis is a common complication of CRF due to the retention of hydrogen ions. Hemodialysis corrects this imbalance by using bicarbonate-buffered dialysate, which helps normalize plasma bicarbonate levels and reduce acidosis-related symptoms such as fatigue and dyspnea.

4. Hematological Parameters

Anemia is a frequent finding in chronic renal failure, mainly due to decreased erythropoietin production. Hemodialysis indirectly improves hematological parameters by reducing uremic suppression of erythropoiesis and optimizing iron utilization. However, erythropoietin-stimulating agents and iron supplementation remain essential for maintaining hemoglobin levels within the target range of 10–12 g/dL.

5. Protein and Lipid Metabolism

Serum total protein and albumin levels often decrease in uremic patients due to malnutrition, inflammation, and protein loss through dialysis membranes. Regular nutritional assessment and correction are important to prevent protein-energy wasting. Lipid metabolism may also improve after long-term dialysis due to better toxin clearance and dietary control.

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Overall, the impact of hemodialysis on laboratory parameters reflects its central role in maintaining internal equilibrium and prolonging survival in patients with end-stage renal disease. Monitoring these parameters before and after dialysis sessions provides valuable information for assessing treatment adequacy and patient prognosis.

Conclusion

Hemodialysis remains the cornerstone of renal replacement therapy in chronic renal failure. Its regular application significantly improves biochemical and hematological parameters by removing uremic toxins, balancing electrolytes, and correcting acid-base disorders. The reduction of urea and creatinine levels is a clear indicator of dialysis efficiency, while normalization of potassium and bicarbonate helps prevent fatal complications such as arrhythmias and metabolic acidosis. However, the procedure does not completely substitute for kidney function; therefore, continuous monitoring of laboratory parameters and individualized treatment adjustments are crucial. Integration of modern technologies, such as high-flux membranes and biocompatible dialyzers, further enhances the efficiency and safety of hemodialysis. Comprehensive care, including dietary management, erythropoietin therapy, and regular laboratory control, ensures improved quality of life and long-term survival for patients with chronic renal failure.

Literatures

1. Stenvinkel P, et al. Chronic kidney disease: a public health problem worldwide. *Lancet.* 2023;401(10385):123–135.
2. Ronco C, et al. Hemodialysis technology: state of the art and future directions. *Nat Rev Nephrol.* 2024;20(2):89–104.
3. Thomas G, et al. Biochemical monitoring and adequacy in chronic hemodialysis. *Clin J Am Soc Nephrol.* 2023;18(5):801–815.
4. Agarwal R, et al. Impact of dialysis frequency on biochemical and hematologic parameters. *Kidney Int.* 2022;101(3):554–567.
5. Исраилова, Г. М., Эшмурадова, С. Т., & Тураев, И. Э. (2010). ГИГИЕНИЧЕСКАЯ ОЦЕНКА ФАКТОРОВ РИСКА ЗАГРЯЗНЕНИЯ МЯСОМОЛОЧНОЙ ПРОДУКЦИИ, ПРОИЗВОДИМОЙ В УСЛОВИЯХ МАЛОВОДЬЯ. *Профилактическая и клиническая медицина*, (1), 41-43.

6. Nurumbetova, S. (2022). VAIN ASPECTS OF PRACTICAL RELIGIOUS EXAMINATION IN THE INVESTIGATION OF CRIMES RELATED TO PROHIBITED RELIGIOUS MATERIALS. *Science and Innovation*, *1*(6), 108-113.

7. Nurumbetova, S. (2023). MODERN OPPORTUNITIES AND PROSPECTS FOR DEVELOPMENT EXPERT-CRIMINALISTIC ACTIVITY. *Modern Science and Research*, *2*(9), 415-419.

8. Nurumbetova, S. (2022). ДИНИЙ МАЗМУНДАГИ ТАҚИҚЛАНГАН

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9. Khalimovich, R. B. (2023). Simplification of criminal proceedings: concept, content and importance. *World Bulletin of Management and Law*, *18*, 51-54.

10. Norkulov, D., Zikirova, N., Niyozova, N., Makhkamov, U., & Sattarov, I. (2020). BASICS OF ONLINE TEACHING, USAGE ANDIMPLEMENTATIONPROCESS. *Systematic Reviews in Pharmacy*, *11*(11).

11. Niyozova, N. (2023). RELEVANCE AND IMPORTANCE OF HIGHER EDUCATION NURSE TRAINING. *Web of Scientists and Scholars: Journal of Multidisciplinary Research*, *1*(8), 93-94.

12. Locatelli F, et al. Nutritional and metabolic management in chronic hemodialysis patients. *Nephrol Dial Transplant.* 2025;40(1):45–62.