

Effect Of Endovascular Revascularization On Renal Function

Botir T. Daminov¹, B.A. Alyvi², Shavkat K. Muminov³, Lola T. Daminova⁴

¹MD, Rector of the Tashkent Pediatric Medical Institute, Tashkent, Uzbekistan. E-mail:

²MD, professor assistant of Tashkent state dental institute, Tashkent, Uzbekistan. E-

³MD, professor of Tashkent state dental institute, Tashkent, Uzbekistan,

⁴MD, professor assistant of Tashkent Pediatric Medical Institute, Tashkent, Uzbekistan.

E-mail: ¹mail@tashpmi.uz, ²mail@tashpmi.uz, ³Shavkat1988@yahoo.com
⁴mail@tashpmi.uz

ABSTRACT

To research the short-term and long-term effect of coronary artery stenting on renal function. In patients with coronary heart disease within 3 months after endovascular revascularization-preserving renal dysfunction, despite the normalization of creatinine concentration.

Key words: chronic renal failure, contrast-induced nephropathy, sodium uretic peptide, creatinine, uric acid.

1. INTRODUCTION

With the advanced technology and therefore the widespread introduction of endovascular ways in cardiology, the danger of developing distinction kidney disease increases. The development of acute nephritic harm is understood once victimisation X-ray contrast agents (1). This condition is related to cannular necrosis. It is believed that inside a pair of weeks the renal operate is restored, however, taking into consideration the underlying pathology - coronary-artery disease vascular lesions, as well as renal arteries, that scale back capillary blood flow and, accordingly, glomerular filtration, the long-run impact of the administration of contrast agents in patients with artery disease with a requirement for endovascular interventional methods of examination and treatment, needs close study. This is one among the variants of the cardio renal syndrome (2).

Objective: To study the short-run and long-run impact of artery stenting on excretory organ function.

2. MATERIAL AND METHODS

The research included twenty one patients with arterial blood vessel disease, average age $55,62 \pm 9.28$ years, who underwent coronary X-ray photography and stenting of the coronary arteries and whose blood creatinine was determined at baseline, on the 2nd, third day when vascular intervention finishes, concentration u N- terminal end of the molecule of brain sodium uretic peptide (BSUP), excretion acid, parathyroid hormone, diagnostic procedure (EchoCG).

3. RESULTS AND DISCUSSION

Coronaroangiography discovered 50 stenoses in 35 coronary basins in sufferers covered in the study (1.63 of them have been determined to be affected, wherein 2.33 coronary stenoses have been determined). Damage to the trunk of the left coronary artery become detected in four sufferers (20.04%), the anterior interventricular artery in thirteen sufferers (62.90%), the envelope of the artery in 8 sufferers (34.33%), and the proper coronary artery in 11 sufferers (47.63%). According to the outcomes of coronary angiography, 43 stents have been implanted in sufferers (2.05 stents on common in line with patient).

Echocardiography revealed dilatation of the left chambers of the heart (Table 1) and a decrease in total left ventricular contractility (ejection fraction -LVEF) in the patients included in the study. All patients showed regional hypo- and akinesis, stress echocardiographic examination in all patients was positive for stress-induced ischemia, which at the initial examination served as the basis for referring patients to coronary angiography. After endovascular revascularization for 6 months significant change in the size of heart cavities. Systolic function showed a significant increase in LVEF (by 18.15% by month 3, $p < 0.001$; and by 21.25% by month 6, $p < 0.001$). Regional dysfunction also improved: by the end of the 3rd month, regional hypokinesis was observed in only 8 patients, chi-square = 18.94, $p < 0.001$; by the end of the 6th month - in 6 patients, chi-square = 23.44, $p < 0.001$. Stress echocardiography revealed stress-induced ischemia in 3 patients 3 months after revascularization, chi-square = 31.60, $p < 0.001$; and in 4 patients - after 6 months chi-square = 25.66, $p < 0.001$).

The concentration of cerebral sodium uretic peptide in the peripheral blood after endovascular revascularization through the third month considerably accelerated via way of means of 53.70% of the preliminary ($p < 0.001$) and remained on the identical stage for the following 3 months (growth from the preliminary statistics through the stop of the sixth month amounted to 48.69%, the importance of variations with the preliminary statistics became $p < 0.001$). A growth in the concentration of cerebral sodium uretic peptide shows renal disorder and is one of the markers of cardio renal syndrome (3,4). Assessment of the functional country of the kidneys on this study included serum concentrations of creatinine, reflecting the stages of glomerular filtration, uric acid and parathyroid hormone, an growth wherein is related to renal failure syndrome. Current suggestions are primarily based totally on proof based at the informative cost of serum creatinine concentrations earlier than evaluation is applied. The quality preventive method is the right choice of patients -the preliminary concentration of creatinine is a prognostic issue and have to serve as a criterion for the choice of patients (5.6).

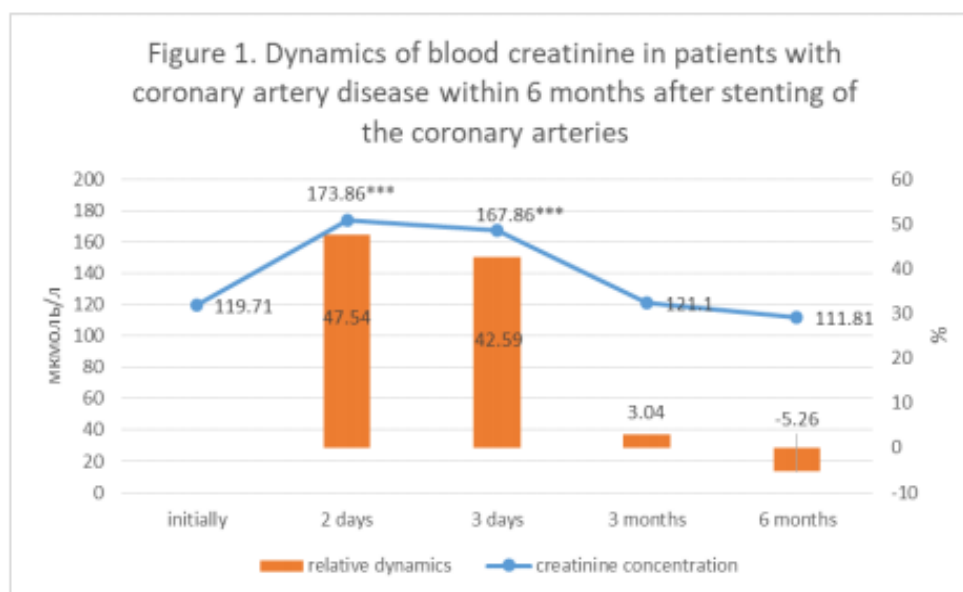
The concentration of serum creatinine considerably accelerated already by the 2d day after the radiopaque procedure (reliability with preliminary statistics - $p < 0.001$). By the 3rd day, the creatinine concentration reduced notably, however, it remained considerably better than the preliminary statistics ($p < 0.001$). By the 3rd month of therapy, the concentration of serum creatinine returns to the preliminary stage at which it stays for the following three months. The stages of uric acid and parathyroid hormone growth by the 3rd month of therapy (parathyroid hormone -by 28.21% of the preliminary stage, $p < 0.01$; uric acid -by 23.39%, nd). Subsequently, the concentration of each materials reduced, possibly reflecting the recuperation of renal function. Literature statistics additionally suggest the position of

parathyroid hormone in the pathogenesis of chronic coronary heart failure syndrome, complicating comparison-brought about nephropathy (7.8).

Table 1. Flow of echocardiography, biochemical parameters in patients with coronary supply route malady inside 6 months after endovascular revascularization

Indicator	Indicator	Indicator	Indicator
cerebral sodium urethic peptide, pg / ml	170,19±12,22	260,62±23,18***	252,00±39,48***
uric acid, mmol / l	9,92±2,57	11,54±3,10	7,97±1,94*
Parathyroid hormone, pg / ml	71,48±15,44	85,48±6,95**	69,14±12,17
The final diastolic volume of the left ventricle, ml	157,57±19,35	167,05±14,47	160,43±11,97
Left ventricular ejection fraction, %	51,43±6,64	60,05±4,70***	61,52±4,27***
LA, cm	4,02±0,25	4,03±0,16	4,01±0,10

Note: * -main aspects of differences with the source data: 1 character -p <0.05, 2 characters -p <0.01, 3 characters -p <0.001.



Note: * - importance of contrasts with the source information: one character - p <0.001.

4. CONCLUSION

In this way, the research revealed persistent renal dysfunction in patients with coronary heart illness within 3 months after endovascular revascularization, in spite of the normalization of creatinine concentration. Backhanded signs of impeded useful state of the kidneys are an

increment within the concentration of sodium uretic peptide, uric acid and parathyroid hormone.

REFERENCES

- [1] Kant, N., Saralch, S., & Singh, H. (2011). Ponderomotive self-focusing of a short laser pulse under a plasma density ramp. *Nukleonika*, 56, 149-153.
- [2] Patyar, S., & Patyar, R. R. (2015). Correlation between sleep duration and risk of stroke. *Journal of Stroke and Cerebrovascular Diseases*, 24(5), 905-911.
- [3] Khamparia, A., & Pandey, B. (2015). Knowledge and intelligent computing methods in e-learning. *International Journal of technology enhanced learning*, 7(3), 221-242.
- [4] Singh, A., Lin, Y., Quraishi, M. A., Olasunkanmi, L. O., Fayemi, O. E., Sasikumar, Y., ... & Kabanda, M. M. (2015). Porphyrins as corrosion inhibitors for N80 Steel in 3.5% NaCl solution: Electrochemical, quantum chemical, QSAR and Monte Carlo simulations studies. *Molecules*, 20(8), 15122-15146.
- [5] Singh, S., Kumar, V., Upadhyay, N., Singh, J., Singla, S., & Datta, S. (2017). Efficient biodegradation of acephate by *Pseudomonas pseudoalcaligenes* PS-5 in the presence and absence of heavy metal ions [Cu (II) and Fe (III)], and humic acid. *3 Biotech*, 7(4), 262.
- [6] Mia, M., Singh, G., Gupta, M. K., & Sharma, V. S. (2018). Influence of Ranque-Hilsch vortex tube and nitrogen gas assisted MQL in precision turning of Al 6061-T6. *Precision Engineering*, 53, 289-299.
- [7] Prakash, C., Singh, S., Pabla, B. S., & Uddin, M. S. (2018). Synthesis, characterization, corrosion and bioactivity investigation of nano-HA coating deposited on biodegradable Mg-Zn-Mn alloy. *Surface and Coatings Technology*, 346, 9-18.
- [8] Feng, X., Sureda, A., Jafari, S., Memariani, Z., Tewari, D., Annunziata, G., ... & Sychrová, A. (2019). Berberine in cardiovascular and metabolic diseases: from mechanisms to therapeutics. *Theranostics*, 9(7), 1923.
- [9] Bashir, S., Sharma, V., Lgaz, H., Chung, I. M., Singh, A., & Kumar, A. (2018). The inhibition action of analgin on the corrosion of mild steel in acidic medium: A combined theoretical and experimental approach. *Journal of Molecular Liquids*, 263, 454-462.
- [10] Sidhu, G. K., Singh, S., Kumar, V., Dhanjal, D. S., Datta, S., & Singh, J. (2019). Toxicity, monitoring and biodegradation of organophosphate pesticides: a review. *Critical Reviews in Environmental Science and Technology*, 49(13), 1135-1187.
- [11] Nanda, V., & Kant, N. (2014). Enhanced relativistic self-focusing of Hermite-cosh-Gaussian laser beam in plasma under density transition. *Physics of Plasmas*, 21(4), 042101.
- [12] Kotla, N. G., Gulati, M., Singh, S. K., & Shivapooja, A. (2014). Facts, fallacies and future of dissolution testing of polysaccharide based colon-specific drug delivery. *Journal of Controlled Release*, 178, 55-62.
- [13] Farooq, R., & Shankar, R. (2016). Role of structural equation modeling in scale development. *Journal of Advances in Management Research*.
- [14] Singh, S., Ramakrishna, S., & Gupta, M. K. (2017). Towards zero waste manufacturing: A multidisciplinary review. *Journal of cleaner production*, 168, 1230-1243.
- [15] Mahla, S. K., Dhir, A., Gill, K. J., Cho, H. M., Lim, H. C., & Chauhan, B. S. (2018). Influence of EGR on the simultaneous reduction of NO_x-smoke emissions trade-off under CNG-biodiesel dual fuel engine. *Energy*, 152, 303-312.

- [16] Nanda, V., Kant, N., & Wani, M. A. (2013). Self-focusing of a Hermite-cosh Gaussian laser beam in a magnetoplasma with ramp density profile. *Physics of Plasmas*, 20(11), 113109.
- [17] Kaur, P., Singh, S. K., Garg, V., Gulati, M., & Vaidya, Y. (2015). Optimization of spray drying process for formulation of solid dispersion containing polypeptide-k powder through quality by design approach. *Powder Technology*, 284, 1-11.
- [18] Sharma, D., & Saharan, B. S. (2016). Functional characterization of biomedical potential of biosurfactant produced by *Lactobacillus helveticus*. *Biotechnology Reports*, 11, 27-35.
- [19] Wani, A. B., Chadar, H., Wani, A. H., Singh, S., & Upadhyay, N. (2017). Salicylic acid to decrease plant stress. *Environmental Chemistry Letters*, 15(1), 101-123.
- [20] Mishra, V., Patil, A., Thakur, S., & Kesharwani, P. (2018). Carbon dots: emerging theranostic nanoarchitectures. *Drug discovery today*, 23(6), 1219-1232.
- [21] Kumar, V., Pitale, S. S., Mishra, V., Nagpure, I. M., Biggs, M. M., Ntwaeaborwa, O. M., & Swart, H. C. (2010). Luminescence investigations of Ce³⁺ doped CaS nanophosphors. *Journal of alloys and compounds*, 492(1-2), L8-L12.
- [22] Pudake, R. N., Swaminathan, S., Sahu, B. B., Leandro, L. F., & Bhattacharyya, M. K. (2013). Investigation of the *Fusarium virguliforme* fvtox1 mutants revealed that the FvTox1 toxin is involved in foliar sudden death syndrome development in soybean. *Current genetics*, 59(3), 107-117.
- [23] Kapoor, B., Singh, S. K., Gulati, M., Gupta, R., & Vaidya, Y. (2014). Application of liposomes in treatment of rheumatoid arthritis: quo vadis. *The scientific world Journal*, 2014.
- [24] Haldhar, R., Prasad, D., & Saxena, A. (2018). *Myristica fragrans* extract as an eco-friendly corrosion inhibitor for mild steel in 0.5 M H₂SO₄ solution. *Journal of Environmental Chemical Engineering*, 6(2), 2290-2301.
- [25] Bordoloi, N., Sharma, A., Nautiyal, H., & Goel, V. (2018). An intense review on the latest advancements of Earth Air Heat Exchangers. *Renewable and Sustainable Energy Reviews*, 89, 261-280.
- [26] Sharma, P., Mehta, M., Dhanjal, D. S., Kaur, S., Gupta, G., Singh, H., ... & Chellappan, D. K. (2019). Emerging trends in the novel drug delivery approaches for the treatment of lung cancer. *Chemico-biological interactions*, 309, 108720.
- [27] Goga, G., Chauhan, B. S., Mahla, S. K., & Cho, H. M. (2019). Performance and emission characteristics of diesel engine fueled with rice bran biodiesel and n-butanol. *Energy Reports*, 5, 78-83.
- [28] Umashankar, M. S., Sachdeva, R. K., & Gulati, M. (2010). Aquasomes: a promising carrier for peptides and protein delivery. *Nanomedicine: Nanotechnology, Biology and Medicine*, 6(3), 419-426.
- [29] Sharma, A., Shree, V., & Nautiyal, H. (2012). Life cycle environmental assessment of an educational building in Northern India: A case study. *Sustainable Cities and Society*, 4, 22-28.
- [30] Kaur, T., Kumar, S., Bhat, B. H., Want, B., & Srivastava, A. K. (2015). Effect on dielectric, magnetic, optical and structural properties of Nd-Co substituted barium hexaferrite nanoparticles. *Applied Physics A*, 119(4), 1531-1540.
- [31] Datta, S., Singh, J., Singh, S., & Singh, J. (2016). Earthworms, pesticides and sustainable agriculture: a review. *Environmental Science and Pollution Research*, 23(9), 8227-8243.
- [32] Vij, S., & Bedi, H. S. (2016). Are subjective business performance measures justified?. *International Journal of Productivity and Performance Management*.

- [33] Chawla, R., & Sharma, S. (2017). Molecular dynamics simulation of carbon nanotube pull-out from polyethylene matrix. *Composites Science and Technology*, 144, 169-177.
- [34] Prakash, C., & Uddin, M. S. (2017). Surface modification of β -phase Ti implant by hydroxyapatite mixed electric discharge machining to enhance the corrosion resistance and in-vitro bioactivity. *Surface and Coatings Technology*, 326, 134-145.
- [35] Saxena, A., Prasad, D., & Haldhar, R. (2018). Investigation of corrosion inhibition effect and adsorption activities of *Cuscuta reflexa* extract for mild steel in 0.5 M H₂SO₄. *Bioelectrochemistry*, 124, 156-164.
- [36] Prabhakar, P. K., Kumar, A., & Doble, M. (2014). Combination therapy: a new strategy to manage diabetes and its complications. *Phytomedicine*, 21(2), 123-130.
- [37] Wheeler, K. C., Jena, M. K., Pradhan, B. S., Nayak, N., Das, S., Hsu, C. D., ... & Nayak, N. R. (2018). VEGF may contribute to macrophage recruitment and M2 polarization in the decidua. *PLoS One*, 13(1), e0191040.
- [38] Singh, A., Lin, Y., Ansari, K. R., Quraishi, M. A., Ebenso, E. E., Chen, S., & Liu, W. (2015). Electrochemical and surface studies of some Porphines as corrosion inhibitor for J55 steel in sweet corrosion environment. *Applied Surface Science*, 359, 331-339.
- [39] Gill, J. P. K., Sethi, N., Mohan, A., Datta, S., & Girdhar, M. (2018). Glyphosate toxicity for animals. *Environmental Chemistry Letters*, 16(2), 401-426.
- [40] Kumar, V., Singh, S., Singh, J., & Upadhyay, N. (2015). Potential of plant growth promoting traits by bacteria isolated from heavy metal contaminated soils. *Bulletin of environmental contamination and toxicology*, 94(6), 807-814.
- [41] Patel, S. (2012). Potential of fruit and vegetable wastes as novel biosorbents: summarizing the recent studies. *Reviews in Environmental Science and Bio/Technology*, 11(4), 365-380.
- [42] Srivastava, G., Das, C. K., Das, A., Singh, S. K., Roy, M., Kim, H., ... & Philip, D. (2014). Seed treatment with iron pyrite (FeS₂) nanoparticles increases the production of spinach. *RSC Advances*, 4(102), 58495-58504.
- [43] Nagpal, R., Behare, P. V., Kumar, M., Mohania, D., Yadav, M., Jain, S., ... & Henry, C. J. K. (2012). Milk, milk products, and disease free health: an updated overview. *Critical reviews in food science and nutrition*, 52(4), 321-333.
- [44] Vaid, S. K., Kumar, B., Sharma, A., Shukla, A. K., & Srivastava, P. C. (2014). Effect of Zn solubilizing bacteria on growth promotion and Zn nutrition of rice. *Journal of soil science and plant nutrition*, 14(4), 889-910.
- [45] Lin, Y., Singh, A., Ebenso, E. E., Wu, Y., Zhu, C., & Zhu, H. (2015). Effect of poly (methyl methacrylate-co-N-vinyl-2-pyrrolidone) polymer on J55 steel corrosion in 3.5% NaCl solution saturated with CO₂. *Journal of the Taiwan Institute of Chemical Engineers*, 46, 214-222.
- [46] Mahesh, K. V., Singh, S. K., & Gulati, M. (2014). A comparative study of top-down and bottom-up approaches for the preparation of nanosuspensions of glipizide. *Powder technology*, 256, 436-449.
- [47] Singh, G., Gupta, M. K., Mia, M., & Sharma, V. S. (2018). Modeling and optimization of tool wear in MQL-assisted milling of Inconel 718 superalloy using evolutionary techniques. *The International Journal of Advanced Manufacturing Technology*, 97(1-4), 481-494.
- [48] Chauhan, C. C., Kagdi, A. R., Jotania, R. B., Upadhyay, A., Sandhu, C. S., Shirsath, S. E., & Meena, S. S. (2018). Structural, magnetic and dielectric properties of Co-Zr substituted M-type calcium hexagonal ferrite nanoparticles in the presence of α -Fe₂O₃ phase. *Ceramics International*, 44(15), 17812-17823.

- [49] Sharma, A., Shahzad, B., Kumar, V., Kohli, S. K., Sidhu, G. P. S., Bali, A. S., ... & Zheng, B. (2019). Phytohormones regulate accumulation of osmolytes under abiotic stress. *Biomolecules*, 9(7), 285.
- [50] Balakumar, P., Chakkarwar, V. A., Kumar, V., Jain, A., Reddy, J., & Singh, M. (2008). Experimental models for nephropathy. *Journal of the Renin-Angiotensin-Aldosterone System*, 9(4), 189-195.
- [51] Singh, A., Lin, Y., Liu, W., Kuanhai, D., Pan, J., Huang, B., ... & Zeng, D. (2014). A study on the inhibition of N80 steel in 3.5% NaCl solution saturated with CO₂ by fruit extract of *Gingko biloba*. *Journal of the Taiwan Institute of Chemical Engineers*, 45(4), 1918-1926.
- [52] Kaur, T., Kaur, B., Bhat, B. H., Kumar, S., & Srivastava, A. K. (2015). Effect of calcination temperature on microstructure, dielectric, magnetic and optical properties of Ba_{0.7}La_{0.3}Fe₁₁Co_{0.3}O₁₉ hexaferrites. *Physica B: Condensed Matter*, 456, 206-212.
- [53] Singh, P., Singh, A., & Quraishi, M. A. (2016). Thiopyrimidine derivatives as new and effective corrosion inhibitors for mild steel in hydrochloric acid: Electrochemical and quantum chemical studies. *Journal of the Taiwan Institute of Chemical Engineers*, 60, 588-601.
- [54] Anand, A., Patience, A. A., Sharma, N., & Khurana, N. (2017). The present and future of pharmacotherapy of Alzheimer's disease: A comprehensive review. *European journal of pharmacology*, 815, 364-375.
- [55] Saxena, A., Prasad, D., Haldhar, R., Singh, G., & Kumar, A. (2018). Use of *Sida cordifolia* extract as green corrosion inhibitor for mild steel in 0.5 M H₂SO₄. *Journal of environmental chemical engineering*, 6(1), 694-700.
- [56] Ahmadi, M. H., Ghazvini, M., Sadeghzadeh, M., Alhuyi Nazari, M., Kumar, R., Naeimi, A., & Ming, T. (2018). Solar power technology for electricity generation: A critical review. *Energy Science & Engineering*, 6(5), 340-361.
- [57] Kant, N., Wani, M. A., & Kumar, A. (2012). Self-focusing of Hermite–Gaussian laser beams in plasma under plasma density ramp. *Optics Communications*, 285(21-22), 4483-4487.
- [58] Gupta, V. K., Sethi, B., Upadhyay, N., Kumar, S., Singh, R., & Singh, L. P. (2011). Iron (III) selective electrode based on S-methyl N-(methylcarbamoyloxy) thioacetimidate as a sensing material. *Int. J. Electrochem. Sci*, 6, 650-663.
- [59] Mehta, C. M., Srivastava, R., Arora, S., & Sharma, A. K. (2016). Impact assessment of silver nanoparticles on plant growth and soil bacterial diversity. *3 Biotech*, 6(2), 254.
- [60] Gupta, V. K., Guo, C., Canever, M., Yim, H. R., Sraw, G. K., & Liu, M. (2014). Institutional environment for entrepreneurship in rapidly emerging major economies: the case of Brazil, China, India, and Korea. *International Entrepreneurship and Management Journal*, 10(2), 367-384.
- [61] Singh, A., Lin, Y., Obot, I. B., Ebenso, E. E., Ansari, K. R., & Quraishi, M. A. (2015). Corrosion mitigation of J55 steel in 3.5% NaCl solution by a macrocyclic inhibitor. *Applied Surface Science*, 356, 341-347.
- [62] Ansari, K. R., Quraishi, M. A., Singh, A., Ramkumar, S., & Obote, I. B. (2016). Corrosion inhibition of N80 steel in 15% HCl by pyrazolone derivatives: electrochemical, surface and quantum chemical studies. *RSC advances*, 6(29), 24130-24141.
- [63] Jnawali, P., Kumar, V., & Tanwar, B. (2016). Celiac disease: Overview and considerations for development of gluten-free foods. *Food Science and Human Wellness*, 5(4), 169-176.

- [64] Saggi, S., Sakeran, M. I., Zidan, N., Tousson, E., Mohan, A., & Rehman, H. (2014). Ameliorating effect of chicory (*Chichorium intybus* L.) fruit extract against 4-tert-octylphenol induced liver injury and oxidative stress in male rats. *Food and chemical toxicology*, 72, 138-146.
- [65] Bhatia, A., Singh, B., Raza, K., Wadhwa, S., & Katare, O. P. (2013). Tamoxifen-loaded lecithin organogel (LO) for topical application: development, optimization and characterization. *International Journal of Pharmaceutics*, 444(1-2), 47-59.
- [66] Singh, A., Lin, Y., Liu, W., Yu, S., Pan, J., Ren, C., & Kuanhai, D. (2014). Plant derived cationic dye as an effective corrosion inhibitor for 7075 aluminum alloy in 3.5% NaCl solution. *Journal of Industrial and Engineering Chemistry*, 20(6), 4276-4285.
- [67] Raza, K., Thotakura, N., Kumar, P., Joshi, M., Bhushan, S., Bhatia, A., ... & Katare, O. P. (2015). C60-fullerenes for delivery of docetaxel to breast cancer cells: a promising approach for enhanced efficacy and better pharmacokinetic profile. *International journal of pharmaceutics*, 495(1), 551-559.
- [68] Prabhakar, P. K., Prasad, R., Ali, S., & Doble, M. (2013). Synergistic interaction of ferulic acid with commercial hypoglycemic drugs in streptozotocin induced diabetic rats. *Phytomedicine*, 20(6), 488-494.
- [69] Chaudhary, A., & Singh, S. S. (2012, September). Lung cancer detection on CT images by using image processing. In *2012 International Conference on Computing Sciences* (pp. 142-146). IEEE.
- [70] Mishra, V., Bansal, K. K., Verma, A., Yadav, N., Thakur, S., Sudhakar, K., & Rosenholm, J. M. (2018). Solid lipid nanoparticles: Emerging colloidal nano drug delivery systems. *Pharmaceutics*, 10(4), 191.
- [71] Singh, A. (2012). Hydroxyapatite, a biomaterial: its chemical synthesis, characterization and study of biocompatibility prepared from shell of garden snail, *Helix aspersa*. *Bulletin of Materials Science*, 35(6), 1031-1038.
- [72] Arora, S., & Anand, P. (2019). Binary butterfly optimization approaches for feature selection. *Expert Systems with Applications*, 116, 147-160.
- [73] Chhikara, N., Kushwaha, K., Sharma, P., Gat, Y., & Panghal, A. (2019). Bioactive compounds of beetroot and utilization in food processing industry: A critical review. *Food Chemistry*, 272, 192-200.
- [74] Singh, S., Kumar, V., Chauhan, A., Datta, S., Wani, A. B., Singh, N., & Singh, J. (2018). Toxicity, degradation and analysis of the herbicide atrazine. *Environmental chemistry letters*, 16(1), 211-237.
- [75] Baranwal, T., & Pateriya, P. K. (2016, January). Development of IoT based smart security and monitoring devices for agriculture. In *2016 6th International Conference-Cloud System and Big Data Engineering (Confluence)* (pp. 597-602). IEEE.
- [76] Trukhanov, S. V., Trukhanov, A. V., Salem, M. M., Trukhanova, E. L., Panina, L. V., Kostishyn, V. G., ... & Sivakov, V. (2018). Preparation and investigation of structure, magnetic and dielectric properties of (BaFe₁₁. 9Al₀. 1O₁₉) 1-x-(BaTiO₃) x bicomponent ceramics. *Ceramics International*, 44(17), 21295-21302.
- [77] Singh, S., Singh, N., Kumar, V., Datta, S., Wani, A. B., Singh, D., ... & Singh, J. (2016). Toxicity, monitoring and biodegradation of the fungicide carbendazim. *Environmental chemistry letters*, 14(3), 317-329.
- [78] Bhyan, B., Jangra, S., Kaur, M., & Singh, H. (2011). Orally fast dissolving films: innovations in formulation and technology. *Int J Pharm Sci Rev Res*, 9(2), 9-15.
- [79] Saxena, A., Prasad, D., Haldhar, R., Singh, G., & Kumar, A. (2018). Use of *Saraca ashoka* extract as green corrosion inhibitor for mild steel in 0.5 M H₂SO₄. *Journal of Molecular Liquids*, 258, 89-97.

- [80] Panghal, A., Janghu, S., Virkar, K., Gat, Y., Kumar, V., & Chhikara, N. (2018). Potential non-dairy probiotic products—A healthy approach. *Food bioscience*, 21, 80-89.
- [81] Kumar, D., Agarwal, G., Tripathi, B., Vyas, D., & Kulshrestha, V. (2009). Characterization of PbS nanoparticles synthesized by chemical bath deposition. *Journal of Alloys and Compounds*, 484(1-2), 463-466.
- [82] Ansari, K. R., Quraishi, M. A., & Singh, A. (2015). Corrosion inhibition of mild steel in hydrochloric acid by some pyridine derivatives: an experimental and quantum chemical study. *Journal of Industrial and Engineering Chemistry*, 25, 89-98.
- [83] Singh, P. S., Singh, T., & Kaur, P. (2008). Variation of energy absorption buildup factors with incident photon energy and penetration depth for some commonly used solvents. *Annals of Nuclear Energy*, 35(6), 1093-1097.
- [84] Ansari, K. R., Quraishi, M. A., & Singh, A. (2015). Isatin derivatives as a non-toxic corrosion inhibitor for mild steel in 20% H₂SO₄. *Corrosion Science*, 95, 62-70.
- [85] Singh, A., Lin, Y., Ebenso, E. E., Liu, W., Pan, J., & Huang, B. (2015). Ginkgo biloba fruit extract as an eco-friendly corrosion inhibitor for J55 steel in CO₂ saturated 3.5% NaCl solution. *Journal of Industrial and Engineering Chemistry*, 24, 219-228.
- [86] Dey, A., Bhattacharya, R., Mukherjee, A., & Pandey, D. K. (2017). Natural products against Alzheimer's disease: Pharmaco-therapeutics and biotechnological interventions. *Biotechnology Advances*, 35(2), 178-216.
- [87] Ansari, K. R., Quraishi, M. A., & Singh, A. (2015). Pyridine derivatives as corrosion inhibitors for N80 steel in 15% HCl: Electrochemical, surface and quantum chemical studies. *Measurement*, 76, 136-147.
- [88] Patel, S. (2012). Threats, management and envisaged utilizations of aquatic weed Eichhornia crassipes: an overview. *Reviews in Environmental Science and Bio/Technology*, 11(3), 249-259.
- [89] Mia, M., Gupta, M. K., Singh, G., Królczyk, G., & Pimenov, D. Y. (2018). An approach to cleaner production for machining hardened steel using different cooling-lubrication conditions. *Journal of Cleaner Production*, 187, 1069-1081.
- [90] Kondrateva T.S. Biopharmaceutical studies of children's suppositories with phosphothiamine. Pharmacy.-Moscow, 1990.-No.5.-P.14-15.
- [91] Maksudova F.Kh., Kariyeva E.S., Tursunova M.Kh. Study of the pharmacological properties of the combined gel of sodium diclofenac and benzketozone ./Infection, immunity and pharmacologists I.- Tashkent.-2015.-№5.C.160-163 /
- [92] Maksudova F. Kh., Kariyeva E. S. In vitro equivalence evaluation of diclofenac sodium generic medicinal preparation. // Pharmacy, a scientific and practical journal, special issue, St. Petersburg, 2016, pp. 461-464.
- [93] Piotrovsky V.K. Model and model-independent methods for describing pharmacokinetics: advantages, disadvantages and interrelation. // Antibiotics and medical biotechnology. -Moscow, 1997.-№7.P.492-497.
- [94] Kukes V.G., Sychev D.A. Clinical pharmacology. 5th ed., Moscow, 2017, p. 478.
- [95] Tillaeva U. M., Azizov U. M. Development of a methodology for isolating the amount of fensulcal determination from a biological object. Materials of the scientific-practical conference "Actual issues of education, science and production in pharmacy. Tashkent, 2009.-P.172 .
- [96] Tillaeva U.M. Standardization and quality control of fensulcal in soft dosage forms. // Authors' dissertation for the study of the academician of the candidate of pharmaceuticals. Sciences . Tashkent. 2011.23 s.
- [97] Golovkin V.A. On the importance of pharmacokinetics modeling for increasing the efficiency of biopharmaceutical research. // Optimization of drug supply and ways to

- increase the effectiveness of pharmaceutical science : Sat. Tez.dokl.-Kharkov, 1986.- P.61-62.
- [98] Stefanova A.V. Preclinical studies of medicines. Kiev. -2002. -650 p.
- [99] Contrast - Induced Nephropathy (CIN): Current State of the Evidence on Contrast Media and Prevention of CIN. // John M. Eisenberg Center for Clinical Decisions and Communications Science Comparative Effectiveness Review Summary Guides for Clinicians [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2007-. 2016 Aug 18.
- [100] Lamby P, Jung F, Falter J, Mrowietz C, Graf S, Schellenberg L, Platz Batista da Silva N, Prantl L, Franke RP, Jung EM. Effect of radiographic contrast media on renal perfusion - First results. // Clin Hemorheol Microcirc . 2016; 64 (3): 287-295.
- [101] Jarai R, Dangas G, Huber K, Xu K, Brodie BR, Witzendichler B, Metzger DC, Radke PW, Yu J, Claessen BE, Genereux P, Mehran R, Stone GW. B-type natriuretic peptide and risk of contrast-induced acute kidney injury in acute ST-segment-elevation myocardial infarction: a substudy from the HORIZONS-AMI trial. // Circ Cardiovasc Interv . 2012 Dec; 5 (6): 813-20.
- [102] Wang K, Li HL, Chen LL, Bei WJ, Lin KY, Smyth B, Chen SQ, Guo XS, Guo W, Liu YH, Chen PY, Chen JY, Chen KH, Liu Y, Tan N. Association of N -terminal pro-brain natriuretic peptide with contrast-induced acute kidney injury and long-term mortality in patients with heart failure and mid-range ejection fraction: An observation study. // Medicine (Baltimore) . 2017 Mar; 96 (10): e6259.
- [103] Clinical practice guidelines for the prevention, diagnosis and treatment of contrast-induced nephropathy. // Society of Nephrologists of Russia. -2015
- [104] Nyman U , Björk J , Bäck SE , Sterner G , Grubb A Estimating GFR prior to contrast medium examinations - what the radiologist needs to know! // Eur Radiol. 2016 Feb; 26 (2): 425-35. doi: 10.1007 / s00330-015-3842-9.
- [105] Contrast - Induced Nephropathy (CIN): Current State of the Evidence on Contrast Media and Prevention of CIN. // John M. Eisenberg Center for Clinical Decisions and Communications Science Comparative Effectiveness Review Summary Guides for Clinicians [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2007-. 2016 Aug 18.
- [106] Clinical practice guidelines for the prevention, diagnosis and treatment of contrast-induced nephropathy. // Society of Nephrologists of Russia. -2015
- [107] Nyman U , Björk J , Bäck SE , Sterner G , Grubb A Estimating GFR prior to contrast medium examinations - what the radiologist needs to know! // Eur Radiol. 2016 Feb; 26 (2): 425-35. doi: 10.1007 / s00330-015-3842-9.
- [108] Azzalini L , Spagnoli V , Ly HQ . Contrast - Induced Nephropathy : From Pathophysiology to Preventive Strategies. // Can J Cardiol. 2016 Feb; 32 (2): 247-55.