Journal of Medical Genetics and Clinical Biology
Homepage : https://journal.antispublisher.id/index.php/JMGCB
Email : admin@antispublisher.com

e-ISSN : 3032-1085
JMGCB, Vol. 2, No. 1, January 2025
Page 136-146
© 2025 JMGCB :
Journal of Medical Genetics and Clinical Biology

The Origin, Diagnosis and Modern Clinical Diagnostic Methods of Myocardial Infarction

[1]Appazova Lenura Madjidovna, [2]Shaymatova Dil'shod Firdavsovna, [3]Uzoqova Oyjamol Narzullayevna
[1]Samarkand Regional Multidisciplinary Medical Center, Uzbekistan
[2]Samarkand Regional Multidisciplinary Medical Center, Uzbekistan
[3]Samarkand State Medical University, Uzbekistan

DOI : https://doi.org/10.61796/jmgcb.v2i1.1206

Sections Info
Article history:
Submitted: December 25, 2024
Final Revised: January 01, 2025
Accepted: January 08, 2025
Published: January 15, 2025
Keywords:
Heart attack
Myocardial infarction
Its causes
Types and stages

ABSTRACT
Objective: *This study aims to explore the origin, diagnosis, and modern clinical diagnostic methods of myocardial infarction, a critical condition caused by the disruption of blood supply to the heart muscle.* ***Method:*** *A comprehensive review of current literature and clinical guidelines was conducted, focusing on the pathophysiological mechanisms, diagnostic criteria, and advancements in diagnostic technologies. The study analyzed data from clinical trials, imaging techniques, and biomarker evaluations to assess the effectiveness of contemporary diagnostic approaches.* ***Results:*** *The findings indicate that myocardial infarction predominantly results from coronary artery occlusion, leading to ischemia and necrosis of the myocardial tissue. Diagnostic advancements include high-sensitivity cardiac troponin assays, electrocardiography (ECG), echocardiography, and coronary angiography, which have significantly improved early detection and risk stratification. Additionally, non-invasive imaging modalities such as cardiac MRI and CT angiography enhance diagnostic accuracy.* ***Novelty:*** *This study highlights the integration of novel biomarkers with advanced imaging techniques as a transformative approach in the early diagnosis and management of myocardial infarction, offering new insights into improving patient outcomes through rapid and precise clinical assessment.*

INTRODUCTION

Myocardial infarction, its causes, types and stages

Myocardial infarction (ischemia) is the necrosis of the heart muscle, most often in the left ventricle. It occurs when blood flow in a coronary artery is impaired or stopped.

Due to insufficient blood supply, cells do not receive oxygen, die, and the affected area of the myocardium loses its ability to contract and relax. This can lead to cardiac dysfunction until a heart attack occurs.

Men over 40 and women in menopause are more susceptible to myocardial infarction. In general, myocardial infarction is less common in women than in men, but after age 70, the risks are equal.

Causes of myocardial infarction

The most common cause of myocardial infarction is atherosclerosis, which is accompanied by the formation of atherosclerotic plaques. This pathology accounts for 90% of all cases of myocardial infarction.

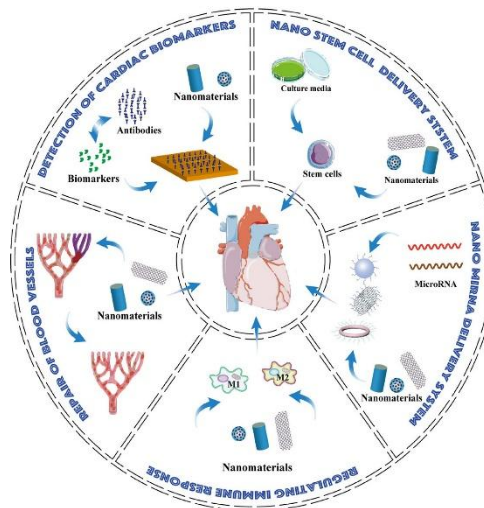

Figure 1.

Atherosclerosis

Narrowing of the lumen of the vessel in atherosclerosis

With atherosclerosis, cholesterol plaques with blood clots form on the walls of blood vessels, which partially or completely block blood flow.

Other causes of myocardial infarction:

1. Spasm - local narrowing of the lumen of the artery. For example, with drug use, severe stress, and extreme physical activity;
2. Thrombosis - blockage of a vessel with a blood clot (thrombus), for example, due to rupture of an atherosclerotic plaque or a blood clotting disorder;
3. Embolism - partial or complete blockage of a vessel by a foreign body (embolism). For example, a blood clot that formed in a large artery and then broke off, moving with the blood flow, "stuck" in the lumen of a narrower coronary artery. In oncological diseases, embolism can become part of a neoplasm;
4. Hypoxia - insufficient supply of oxygen in the bloodstream;
5. Aortic or coronary artery dissection;
6. Hereditary pathologies of the coronary arteries.

Types of myocardial infarction

a. **According to the symptoms:**

1. Typical - pain in the heart area, behind the sternum, cold sweat, increased anxiety and inexplicable fear of death;
2. Atypical - with or without unusual pain symptoms.

RESEARCH METHOD

Atypical myocardial infarction with pain syndrome:

1. Peripheral - with pain in various parts of the body: arm, back, lower jaw;

2. Abdominal pain - pain in the stomach area, radiating to the chest, sometimes accompanied by nausea and vomiting;

Abdominal infarction

1. With an abdominal infarction, pain occurs in the stomach and spreads to the chest.
2. Painless atypical myocardial infarction:

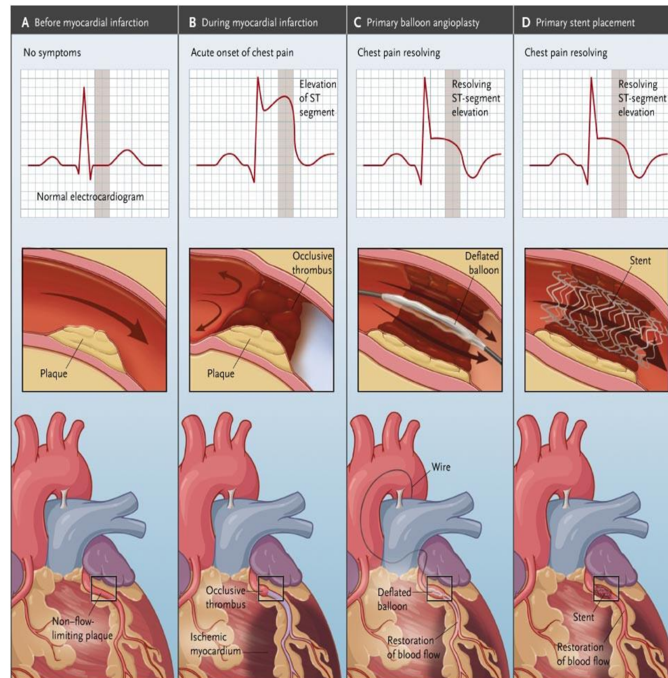

Figure 2.

1. Asthmatic - symptoms similar to an asthma attack with shortness of breath;
2. Arrhythmic - manifested by heart rhythm disturbances;
3. Brain - associated with impaired cerebral circulation, may resemble a stroke. Nausea, dizziness, and loss of consciousness may also be present;
4. Asymptomatic - a dangerous and uncomfortable form, since according to the patient's feelings, the symptoms of a heart attack are not detected or are absent at all, which makes it difficult to self-diagnose and call an ambulance in a timely manner.

According to the depth of the injury:

1. Transmural - by damaging the entire thickness of the myocardium from the outer shell (epicardium) to the inner shell (endocardium);
2. Intramural - infarction in the thickness of the myocardium;
3. Subendocardial - infarction near the inner lining of the myocardium;
4. Subepicardial - infarction near the outer layer of the myocardium.
5. Transmural myocardial infarction usually occurs when a coronary artery is completely blocked and the blood supply is cut off.

By size:

1. Macrofocal,
2. Fine-focus.

By localization:
1. Right ventricle
2. Left ventricle.

According to the presence of complications:
1. Complicated,
2. Without complications.

Stages of development of myocardial infarction

Regardless of the type of myocardial infarction, it goes through four main stages:
1. Acute - lasts from 10-20 minutes to 2 hours;
2. Acute - from 2 hours to 14 days;
3. Subacute - up to 1 month;
4. Post-infarction period - from 1 month.

Symptoms of myocardial infarction

Myocardial infarction is an acute condition that occurs as a result of damage to an area of heart muscle tissue. Contrary to popular belief, a heart attack is not always accompanied by sharp chest pain on the left side.

With repeated myocardial infarction, as well as with diabetes mellitus, the symptoms of myocardial infarction can be erased.

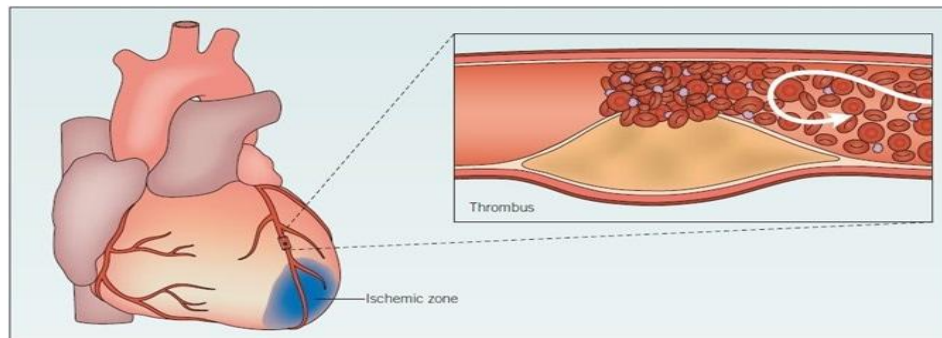

Figure 3.

Common symptoms of a heart attack:
1. Sharp, constant pain in the middle of the chest, which may radiate to the left shoulder blade, jaw, neck, left arm, shoulder, or back;
2. Paroxysmal toothache, pain in the left side of the jaw, left shoulder, elbow, or leg (attacks last 10-15 minutes, then pass);
3. Cold, clammy sweat, pale skin;
4. A feeling of constant fear of death (especially during attacks), anxiety that is unusual for the patient, and sometimes panic;
5. A feeling of tightness or burning in the heart area (left chest) or esophagus;
6. Symptoms similar to food poisoning: nausea, abdominal pain, vomiting, and diarrhea;
7. Symptoms reminiscent of an asthma attack: severe weakness, dizziness, shortness of breath, feeling of lack of air;
8. A sharp, unexplained rise in temperature to 38.5 ° c.

If you have one or more symptoms of a heart attack, you should not endure and wait for the pain attack to pass, but immediately call an ambulance: call 103 or 112, tell the dispatcher your address, gender and age. about the patient, as well as tell about the symptoms.

A heart attack is a life-threatening condition. The sooner treatment begins, the better the chances of recovery.

First aid for myocardial infarction

The main and most common symptoms of myocardial infarction are persistent chest pain, cold sweat, pale skin, nausea, shortness of breath, a feeling of inexplicable fear, dizziness, and loss of consciousness.

If you suspect a heart attack, you should do the following:

Call an ambulance (103 or 112). The dispatcher should provide the patient's address, gender, and age, as well as a brief description of any symptoms, so that a specialized cardiology or intensive care team can respond to the call.

Call your family, neighbors, or passersby for help.

Open the front door or gate in advance for emergency medical personnel.

Open the window to let fresh air into the room.

The patient should take a semi-sitting or lying position, without sudden movements. Avoid physical and emotional stress, do not walk, do not eat and do not smoke. Relatives should not disturb the patient or scare him with possible diagnoses.

Do not take nitroglycerin, as it significantly lowers blood pressure. Chewable aspirin is acceptable - 250 mg (half a tablet), unless you are allergic to the drug.

If possible, relatives can help prepare the patient for hospitalization: gathering necessary items and regularly taken medications.

Complications of myocardial infarction

The main cause of death in patients with myocardial infarction is the complications that provoke it. They can occur if medical care is not provided in the first hours after the onset of a heart attack. In most cases, complications lead to the death of the patient.

RESULTS AND DISCUSSION

Cardiogenic shock is often accompanied by heart failure, pulmonary edema, rupture of the interventricular septum and myocardium, myocardial aneurysms, cardiac arrhythmias, pericardial inflammation, and postinfarction syndrome (Dressler syndrome).

Acute heart failure is a condition in which the myocardium is unable to contract normally. It can lead to pulmonary edema, thromboembolic complications, and cardiogenic shock.

Cardiogenic shock is an extreme degree of heart failure of the left ventricular myocardium, which pumps arterial blood. The pathology leads to a decrease in blood pressure and impaired general circulation. The mortality rate from cardiogenic shock is from 50 to 90%.

In the first day after the onset of a heart attack, 1-3% of patients develop a ruptured interventricular septum. Without surgical intervention, more than 50% of patients die within the first week, and 92% within a year.

Pulmonary edema is the accumulation of fluid in the lungs due to impaired or stopped blood circulation. It causes suffocation, manifests itself as foamy breathing and a bluish discoloration of the extremities (cyanosis).

Rupture of the left ventricular wall (myocardial rupture or cardiac rupture) occurs in 1-3% of patients and occurs within the first day to 3 weeks. It most often occurs within the first 24 hours or 4-7 days after the onset of a heart attack. Myocardial rupture leads to the filling of the outer lining of the heart with blood (hemopericardium) and death within minutes.

Left ventricular aneurysm - thinning and protrusion of the heart wall damaged by necrosis. Significantly increases the risk of myocardial rupture.

Acute mitral valve insufficiency - mild in half of patients. Severe in 4% of patients, but without surgical treatment leads to death in 24% of cases.

Ventricular fibrillation is a "wavy", chaotic contraction of the ventricles with cessation of blood circulation. The condition is tantamount to death and will lead to it if resuscitation is not started.

Post-infarction syndrome, or Dressler syndrome, is an autoimmune reaction of the body to proteins in the heart that have changed after a heart attack. It causes inflammation of the left shoulder blade, the pericardium (pericarditis), and individual parts of the lungs - the membrane (pleurisy) and the alveoli (pneumonitis). As a rule, it is controlled by taking medications, like other autoimmune diseases, but there is no cure.

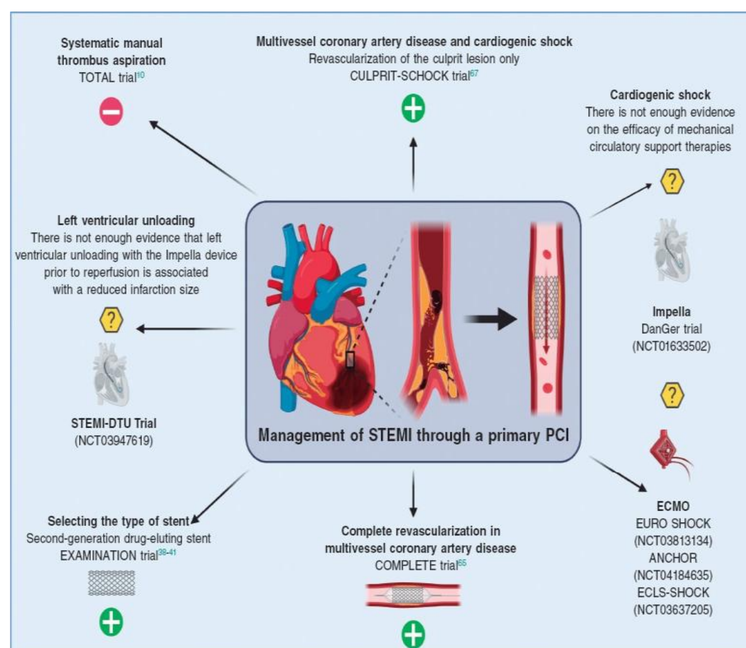

Figure 4.

Ischemic stroke - occurs in about 2% of cases as a complication of myocardial infarction. It can lead to various disorders of brain function and, if not treated in time, can lead to death.

Diagnosis of myocardial infarction

The main diagnosis of a heart attack includes:

1. Collecting patient history and complaints;
2. Electrocardiography (ecg);
3. Rapid blood test for troponin i, myoglobin, cpk mb;
4. Troponin t test;
5. Echocardiography;
6. Coronary angiography.

When diagnosing a heart attack, the doctor must assess the patient's condition and determine what symptoms he has. If the patient has previously been diagnosed with heart disease, he or his relatives should inform him about it. It is also important to provide the doctor with all medical documents (extracts from hospitals, research reports), if any.

Electrocardiography allows you to assess the nature and extent of functional damage to the heart muscle. However, in the early stages of some types of heart attack, the ECG may not show any abnormalities. Therefore, if a heart attack is suspected, the doctor may also perform a rapid blood test for troponin I, myoglobin, and creatine kinase MB - the main markers of myocardial damage. A positive test result confirms the diagnosis.

Coronary angiography and echocardiography are performed in the hospital. To perform angiography, a contrast agent is injected into a vein, which allows you to see the blood vessels in the image, detect a blood clot, and determine further treatment tactics.

Echocardiography is designed to assess the condition of the heart muscle tissue. It is used to determine the safety of the heart's pumping function, exclude concomitant cardiac pathologies (cardiomyopathies, pericarditis, cardiomegaly, endocarditis), and identify complications of myocardial infarction, such as rupture of the interventricular septum or aneurysm.

Treatment of myocardial infarction

Myocardial infarction requires urgent hospitalization, bed rest, and treatment with fibrinolytic agents, anticoagulants, and antiplatelet agents, which dissolve existing blood clots and prevent the formation of new ones.

The earlier treatment for myocardial infarction begins, the higher the chances of recovery.

The first is pain relief. Pain increases the workload on the heart, increases blood pressure, and causes reflex vasoconstriction, which further impairs blood supply to the heart muscle.

When saturation decreases, oxygen therapy is performed, which saturates the blood with oxygen and helps slow the development of necrosis.

Some laboratory tests are also recommended to select therapy.

Complete blood count with leukocyte count and ESR, smear microscopy (venous blood) for pathological changes in leukocyte count

In most cases, surgical treatment is performed to restore blood flow to the myocardium. The main surgical interventions include stent placement, angioplasty, and coronary artery bypass grafting.

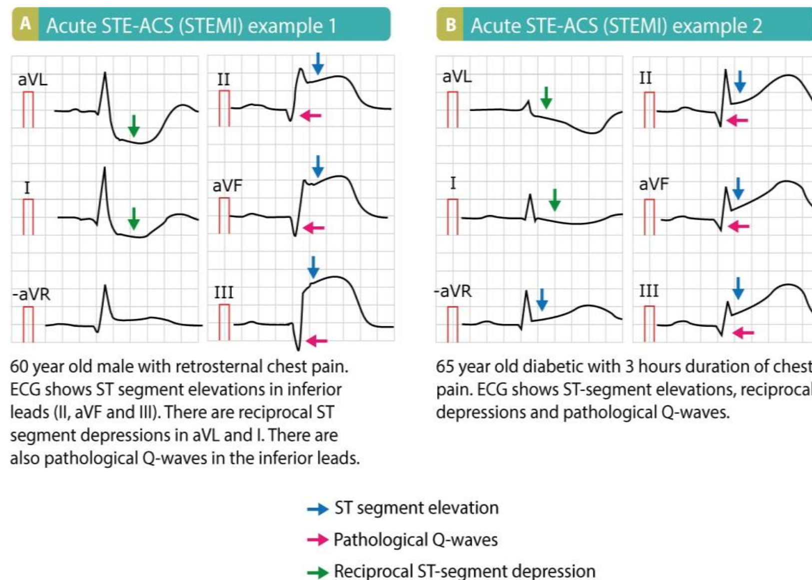

Figure 5.

Stenting

Stenting is an intravenous treatment that aims to artificially widen a narrowed part of an artery. The operation is performed under real-time X-ray control.

Stenting

Coronary artery stenting

A balloon and a special metal structure called a stent are inserted into a coronary artery through a vein in the thigh or arm. The stent can expand and contract according to the size of the balloon.

When the device reaches the narrowed area of the artery, the doctor inflates the balloon with a special liquid, thereby pressing the stent against the vessel walls. The metal structure forms a frame in the lumen of the vessel, expanding it and restoring blood circulation. After successful stent implantation, the balloon and guidewire are removed.

After the operation, the patient remains in the hospital for several days under the supervision of doctors. Stenting is a relatively safe and less traumatic procedure, with a minimal risk of complications.

Angioplasty

Angioplasty is also an intravenous treatment method similar to stenting, but less effective. The essence of angioplasty is to introduce a stentless balloon into the narrowed artery. When inflated, it widens the lumen of the vessel.

The procedure may be performed alone or with or after stent placement to correct the fit of the stent to the artery walls. Balloon angioplasty is also used if a suitable stent is not available.

In cases where angioplasty and stent placement are not possible (for example, if the condition of the vessels that can access the coronary artery is poor), bypass surgery is performed.

Bypass surgery

Bypass surgery is a method of replacing part of the artery, bypassing the affected area. It is used in cases where the degree of arterial damage does not allow the use of other treatment methods. The essence of the method is to transplant a part of your own healthy artery (shunt). A small incision is made in the main artery of the heart, the aorta, into which one end of the shunt is sewn, and the other end is sewn into the incision in the coronary artery below the narrowed or blocked area. Thus, the blood supply to the myocardium bypasses the problem area through the shunt.

Detour 2

1. The essence of bypass surgery is to restore blood flow by bypassing the damaged area by transplanting a healthy artery.
2. Bypass surgery requires direct access to the heart through an incision in the sternum or multiple holes (for endoscopy).
3. The operation can be performed under anesthesia in a heartbeat, but in severe cases it must be stopped using a heart-lung machine, which increases the risk of complications and also eliminates the use of endoscopy.
4. Even after successful treatment, the dead area of the myocardium does not heal and turns into a scar, and the heart weakens.
5. Prevention and prognosis of myocardial infarction
6. Prevention of myocardial infarction includes:
7. moderate physical activity, active lifestyle;
8. quitting smoking and alcohol;
9. proper nutrition: more vegetables, less salty and fatty foods;
10. good sleep;
11. blood pressure control;
12. blood glucose control;
13. Periodic examination by a therapist or cardiologist with an ECG, even if there are no complaints. This is especially important if close relatives have had a heart attack.

CONCLUSION

Fundamental Finding: This study concludes that effective management of myocardial infarction relies on a combination of timely medical intervention, adherence to prescribed medications, and lifestyle modifications. Key strategies include following medical recommendations, engaging in moderate physical activity, avoiding harmful habits, maintaining a heart-healthy diet low in salt and fats, and monitoring blood pressure for early detection of abnormalities. **Implication:** These findings highlight the critical role of patient education and regular monitoring in preventing recurrent cardiac events and improving long-term cardiovascular outcomes. Comprehensive follow-up,

including assessments of NT-proBNP, complete blood counts, electrolyte and iron levels, lipid and carbohydrate metabolism, thyroid function, ECG, and echocardiography, is essential for early identification of chronic myocardial pathology. **Limitation:** The study's limitations include the variability in patient adherence to lifestyle recommendations and the lack of individualized data on the effectiveness of specific diagnostic markers in diverse populations. **Future Research:** Future research should focus on personalized approaches to post-myocardial infarction care, the development of predictive biomarkers for early risk stratification, and the evaluation of novel therapeutic strategies to enhance recovery and reduce the incidence of adverse cardiovascular events.

REFERENCES

[1] L. Y. L. Chiu, K. Stewart, C. Woo, L. N. Yatham, and R. W. Lam, "The relationship between burnout and depressive symptoms in patients with depressive disorders," *J Affect Disord*, vol. 172, pp. 361–366, Feb. 2015, doi: 10.1016/j.jad.2014.10.029.

[2] A. Pitman, "Temporal Risk Factors for Suicide After Suicide Bereavement," in *2023 Intuition, Imagination and Innovation in Suicidology Conference*, Založba Univerze na Primorskem, 2023, p. 15. doi: 10.26493/978-961-293-251-0.6.

[3] A. M. Conjoh, Z. Zhou, and J. Xiong, "Socio-Cultural Factors Affecting the Spread of HIV/AIDS among Adolescents in Sierra Leone," *The Social Sciences*, vol. 6, no. 4, pp. 269–276, Apr. 2011, doi: 10.3923/sscience.2011.269.276.

[4] O. Pityk, "Alexithymia and Non-Psychotic Mental Disorders in Patients with Hypothyroidism," Feb. 2018, doi: 10.26226/morressier.5a6ef3ebd462b80290b57fd0.

[5] J. A. Deisinger, "Diagnosis and assessment of autistic spectrum disorders," in *Autistic Spectrum Disorders: Educational and Clinical Interventions*, Emerald (MCB UP), pp. 181–209. doi: 10.1016/s0270-4013(01)80013-1.

[6] S. M. Labott, "Ethics and professional issues.," in *Psychological treatment of patients with chronic respiratory disease.*, American Psychological Association, 2020, pp. 139–148. doi: 10.1037/0000189-012.

[7] A. Javaid, "The Sadness of Goats," in *Dwelling Together. Urban Housing, Neighborliness and Multilocal Homemaking*, PubPub, 2023. doi: 10.21428/f4c6e600.00fcd79f.

[8] P. Chassagne and S. N'Guyen, "Hydratation et natrémie," in *Gériatrie*, Elsevier, 2023, pp. 356–360. doi: 10.1016/b978-2-294-77815-5.00039-1.

[9] C. S. Copeland, "Commentary on Craft et al.: Drug contaminants and substitutions in illicit vapes represent a major health risk," *Addiction*, Jan. 2025, doi: 10.1111/add.16777.

[10] S. P S, "Understanding the Complexities of Adolescent Drug Abuse: Causes, Consequences, and Prevention - A Review Article," *International Journal of Science and Research (IJSR)*, vol. 12, no. 8, pp. 1404–1407, Aug. 2023, doi: 10.21275/sr23814151343.

[11] E. Kraepelin, "Lecture XXIII: Senile dementia.," in *Lectures on clinical psychiatry.*, William Wood & Co, 1904, pp. 221–230. doi: 10.1037/10789-023.

[12] H. Elkis, D. L. Melzer-Ribeiro, and I. C. Napolitano, "Response to Markota et al. 'Clinical heterogeneity and ECT in patients with clozapine resistant schizophrenia' SCHRES-D-24-00481," *Schizophr Res*, vol. 272, pp. 110–111, Oct. 2024, doi: 10.1016/j.schres.2024.08.003.

[13] J. D. Rawat and S. Singh, "Disorder of Testicular Development," in *Children with Differences in Sex Development*, Springer Nature Singapore, 2024, pp. 245–251. doi: 10.1007/978-981-97-1639-5_22.

[14] N. Nacca, D. Vatti, R. Sullivan, P. Sud, M. Su, and J. Marraffa, “The Synthetic Cannabinoid Withdrawal Syndrome,” *J Addict Med*, vol. 7, no. 4, pp. 296–298, Jul. 2013, doi: 10.1097/adm.0b013e31828e1881.

[15] R. L. Nail and L. M. Dean, “Drug abuse: A manifestation of the cyclic nature of human behavior,” *Drug Alcohol Depend*, vol. 1, no. 6, pp. 429–434, Oct. 1976, doi: 10.1016/0376-8716(76)90007-7.

[16] V. I. Borodin and I. I. Puchkov, “P.1.023 Clinical and psychological predictorsof pharmacotherapy refusals in patients with non-psychotic depressions,” *European Neuropsychopharmacology*, vol. 15, pp. S115–S116, Jan. 2005, doi: 10.1016/s0924-977x(05)80251-2.

[17] I. Belokrylov, “The Effectiveness of Psychoanalytic Psychotherapy in the Somatoform Disorders Treatment,” Feb. 2018, doi: 10.26226/morressier.5a7070ded462b80290b56a4a.

[18] A. K. Bachu, “Mal de Débarquement Syndrome Complicated by Psychiatric Comorbidities: Response to Maruta et al,” *Prim Care Companion CNS Disord*, vol. 25, no. 4, Jul. 2023, doi: 10.4088/pcc.23lr03518a.

[19] B. Barahona-Corrêa, “The High-Functioning Group: High-Functioning Autism and Asperger Syndrome in Adults,” in *Autism Spectrum Disorders in Adults*, Springer International Publishing, 2017, pp. 129–178. doi: 10.1007/978-3-319-42713-3_5.

[20] A. Zabotina, A. Taraskina, and E. Krupitsky, “Risk for antipsychotic-induced extrapyramidal symptoms: a focus on monoamine receptors on peripheral blood lymphocytes,” Sep. 2018, doi: 10.26226/morressier.5b681761b56e9b005965c39d.

[21] “A Companion to Cognitive Science,” in *A Companion to Cognitive Science*, Blackwell Publishing Ltd, 1999, pp. 282–288. doi: 10.1111/b.9780631218517.1999.00022.x.

*** Appazova Lenura Madjidovna (Corresponding Author)**
Samarkand Regional Multidisciplinary Medical Center, Uzbekistan

Shaymatova Dil'shod Firdavsovna
Samarkand Regional Multidisciplinary Medical Center, Uzbekistan

Uzoqova Oyjamol Narzullayevna
Samarkand State Medical University, Uzbekistan