Section 4. Medial science

DOI:10.29013/EJHSS-25-3-45-52

IRIDOLOGICAL MARKERS IN THE DIAGNOSIS OF SUICIDAL RISK: A PROMISING METHOD FOR FORENSIC MEDICAL EXAMINATION

Yadgarova Sh.Sh. [1], ***Iskandarov A.I.*** [1], ***Nasriddinov S.Z.*** [2]

[1] Department of Forensic Medicine, Tashkent Pediatric Medical Institute, Tashkent, Republic of Uzbekistan

[2] Specialized School named after Muhammad al-Khorezmi, Tashkent, Yashnabad district

Cite: *Yadgarova Sh.Sh., Iskandarov A.I., Nasriddinov S.Z. (2025). Iridological Markers in the Diagnosis of Suicidal Risk: A Promising Method for Forensic Medical Examination. European Journal of Technical and Natural Sciences 2025, No 3.* https://doi.org/10.29013/EJHSS-25-3-45-52

Abstract

This paper presents a study of the use of iridological analysis in forensic medical practice to identify suicidal risk. The relationship between specific changes in the iris and the psychoemotional state predisposing to suicidal behavior is considered.

A mathematical model for assessing suicidal risk based on iridological markers, as well as software for automated iridogram analysis, has been developed. The results indicate the potential of using iridodiagnostics in comprehensive forensic medical examination of suicide cases, which can help improve preventive measures for at-risk groups.

Keywords: *iridology, suicidal risk, forensic medical examination, automated diagnostics, psychoemotional state, iris, neural network analysis*

Introduction

The problem of suicide remains one of the most acute in modern society. According to the WHO, more than 700,000 people die from suicide every year, making this phenomenon a key public health problem. Despite the development of preventive psychological and psychiatric methods, there is a need for objective biomarkers to assess the risk of suicidal behavior.

Iridology – a diagnostic method based on the study of the iris – is of particular interest in the context of forensic medical examination. In contrast to traditional approaches, iridodiagnostics allows detecting potential neurological and psychological disorders by recording changes in the iris that correlate with functional and structural changes in the central nervous system.

However, until now, there have been no systematic studies aimed at identifying specific iridological markers of suicidal risk, as well as developing methods for their analysis in forensic medical practice. This study aims to fill this gap by comprehensively studying changes in the iris in individuals with suicidal behavior and developing a methodological basis for the practical application of iridodiagnostics in forensic medicine.

Objective

The main objective of the study is to develop and validate a comprehensive iridodiagnostic technique for identifying suicidal risk in forensic medical practice, including:

1. Identification of specific iridological markers of suicidal risk.
2. Creation of a mathematical model for predicting suicidal behavior based on iris analysis.
3. Development of software for automated processing of iridograms and identifying risk factors.
4. Evaluation of the effectiveness of the technique in clinical and forensic medical practice.

Materials and methods

Study design

A retrospective cohort study was conducted using archival data from forensic medical examinations of the Tashkent Regional Branch of the Republican Scientific and Practical Center for Forensic Medicine of the Ministry of Health of the Republic of Uzbekistan and a prospective study of at-risk groups based at the Tashkent City Clinical Psychiatric Hospital. The data collection period was 5 years (2019–2024).

Study groups

1. Main group: 157 cases of completed suicide (confirmed by forensic medical examination). Inclusion criteria: availability of high-quality intravital or postmortem (within 6 hours) iridophotographs.
2. High-risk group: 89 psychiatric hospital patients with documented suicide attempts in their history in the past 12 months.
3. Control group: 210 subjects, matched for sex and age, with no suicidal tendencies in their history and current mental disorders (according to screening data).

Methods

1. Iridological analysis

A digital iridoscope with a resolution of 24 megapixels and standardized lighting was used to obtain images. The following parameters were analyzed [^7]:

- Structural changes: Stromal density, depth and localization of radial furrows, condition of the pupillary zone and autonomic ring;
- Pigment changes: Presence, localization and nature of pigment spots (toxic, pigmentary), lacunae, general uniformity of pigmentation;
- Vascular changes: Assessment of vascularization, presence of tortuous vessels, microaneurysms, assessment of the state of radial-circular blood flow.

The analysis was carried out by two State Experts (Iskandarov A. I., Yadgarova Sh.Sh.) with subsequent assessment of consistency (Cohen's kappa > 0.85).

2. Psychological testing

In the high-risk and control groups, testing was conducted using validated Russian-language versions of:

- Beck Depression Inventory (BDI–II);
- Beck Hopelessness Scale (BHS);
- Suicidal Risk Questionnaire (Razuvaeva's modification)

3. Biochemical research

In patients of the high-risk group and part of the control group, the following were determined (with informed consent):

- Cortisol level in saliva (morning and evening) by ELISA;
- Serotonin level in platelets by HPLC;
- показатели окислительного стресса (малоновый диальдегид, активность супероксиддисмутазы).

Indicators of oxidative stress (malondialdehyde, superoxide dismutase activity).

4. Statistical analysis

Data were processed using the STSS Statistics v.26.0 package. Methods of descriptive statistics, χ^2 test, Mann-Whitney U-test, Spearman correlation analysis, ROC analysis were used. Differences were considered statistically significant at $p < 0.05$.

5. Development of software and mathematical model

Based on the data obtained, a mathematical model and algorithm were developed for the software "IridoSuicideAnalyzer" using machine learning methods (logistic regression, support vector machine). The software was developed by S. Z. Nasriddinov, a 9th grade student of the Specialized School named after Muhammad al-Khorezmi.

Results

1. Iridological markers of suicidal risk

The study revealed specific changes in the iris that were statistically significantly more common in individuals with a high suicidal risk compared to the control group ($p < 0.001$ for all listed markers).

Figure 1. *Structural changes in the iris in high suicidal risk: deep radial furrows in the CNS area and weakening of the density of the pupillary zone*

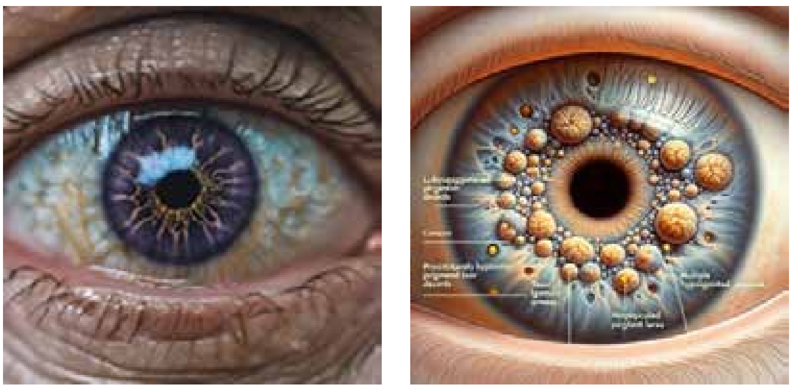
Structural changes (see Figure 1):

- Deep radial furrows in the area corresponding to the central nervous system (frontal lobes, limbic system);
- Weakening of the density and "splitting" of the stroma of the pupillary zone;
- Atrophic changes, thinning and depigmentation of the autonomic ring.

Pigment changes (see Figure 2):

- Presence of dark, toxic pigment deposits in the upper sector of the iris (projection of the brain);
- Pronounced unevenness of pigmentation with a predominance of hypopigmented areas ("empty" iris);
- Presence of multiple closed lacunae, especially in the ciliary zone.

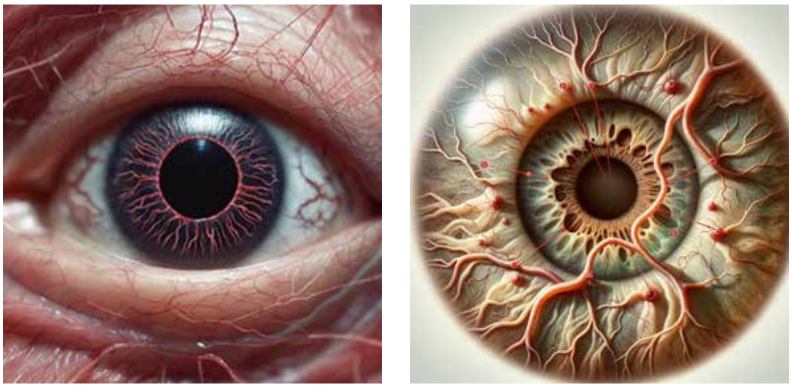
Figure 2. *Pigment changes in the iris in high suicidal risk: dark pigment deposits in the upper sector and uneven pigmentation with hypopigmented areas*



Vascular changes (see Figure 3):

- Pathological tortuosity and dilation of the iris vessels;
- Presence of microaneurysms and vascular "glomeruli", predominantly in the projection zone of the limbic contour;

Figure 3. *Vascular changes in the iris in high suicidal risk: pathological tortuosity of vessels, microaneurysms and impaired radial-circular blood.*



- Signs of impaired radial-circular blood flow (stasis, blurred vascular pattern).

The frequency of the main markers is presented in Table 1.

Table 1. *Main iridological markers of suicidal risk and their frequency*

Type of marker	marker	Frequency in the main group (%)	Frequency in the control group (%)	p-value
Structural	Deep Radial Sulci (CNS Zone)	81.5	15.2	<0.001
	Attenuation of pupillary girdle density	76.2	18.1	<0.001
	Atrophic changes in the autonomous ring	68.9	12.4	<0.001
Pigment	Dark deposits (brain sector)	83.4	10.5	<0.001
	Uneven pigmentation/hypopigmentation	77.1	21.9	<0.001
	Specific lacunar pattern	64.3	14.8	<0.001
Vascular	Pathological vascularization	71.2	16.7	<0.001
	Microaneurysms (limbic circuit)	68.5	9.5	<0.001
	Impaired radial-circular blood flow	59.8	11.0	<0.001

2. Mathematical model for risk assessment

Based on the identified markers and their diagnostic significance, a multifactorial mathematical model was developed to calculate the integral indicator of suicidal risk (SB - Suicide Risk), taking into account the contribution of structural (S), pigmentary (T), vascular (V) markers and, optionally, biochemical correlates (R*):

$$SB = \beta_1 {*} S + \beta_2 {*} T + \beta_3 {*} V + \beta_4 {*} R^* + \alpha$$

where β_1, β_2, β_3, β_4 are weighting coefficients determined by logistic regression, α is a constant. Coefficients S, T, V are calculated as a weighted sum of scores for the presence and severity of the corresponding markers. The range of SB values is from 0 to 1, where values > 0.7 are interpreted as high risk.

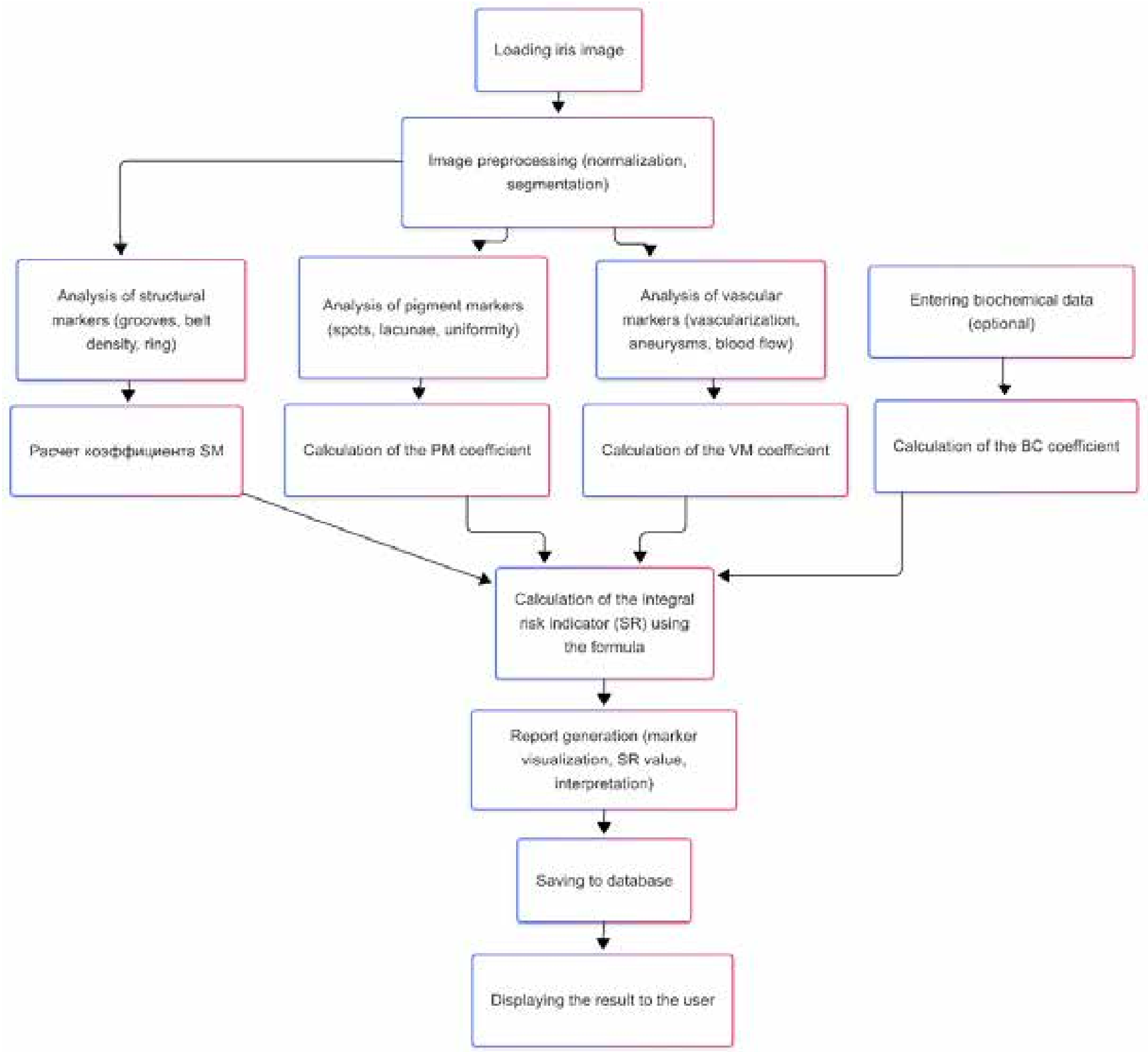
3. Software “IridoSuicideAnalyzer”

Software “IridoSuicideAnalyzer” has been developed for automated analysis.

Functional capabilities of the software:

- Import and processing of digital iridograms;
- Automatic segmentation of the iris and isolation of diagnostically significant zones;

- Identification and quantitative assessment of structural, pigmentary and vascular markers;
- Calculation of the integral indicator of suicidal risk (SB) according to the laid down mathematical model;
- Report generation with visualization of the identified markers on the iridogram and textual interpretation of the results.



4. Diagnostic accuracy of the method

Evaluation of the diagnostic accuracy of the developed complex method (iridodiagnostics + software) using ROC analysis showed high results (see Table 2).

Table 2. *Indicators of diagnostic accuracy of the method*

Indicator	Value (%)	95% Confidence Interval (%)
Sensitivity	87.3	83.2–91.4
Specificity	85.8	81.9–89.7
Positive predictive value	84.1	79.8–88.4
Negative predictive value	88.6	84.9–92.3
AUC (Area Under ROC Curve)	**0.893**	**0.867–0.919**

The area under the ROC curve (AUC) was 0.893, which corresponds to a very good quality of the diagnostic model

5. Correlation with psychological and biochemical markers

A statistically significant positive correlation was found between the integral indicator of suicidal risk (SB), calculated from iridological data, and the scores on the Beck Depression Inventory ($r = 0.68$, $p < 0.001$) and the Beck Hopelessness Scale ($r = 0.72$, $p < 0.001$). A correlation was also established between SB and the level of cortisol in saliva ($r = 0.59$, $p < 0.001$) and an inverse correlation with the level of serotonin in platelets ($r = -0.63$, $p < 0.001$).

Discussion

The results of the study confirm the presence of specific and reproducible changes in the iris in individuals with high suicidal risk. These changes likely reflect chronic stress, neurochemical imbalance, and structural and functional disorders in the central nervous system associated with suicidal behavior. The identified iridological markers can serve as objective biomarkers that complement subjective data from psychological testing and clinical assessment.

The proposed mathematical model and software "IridoSuicideAnalyzer" allow standardizing and objectifying the process of iridodiagnostics of suicidal risk. High diagnostic accuracy (AUC = 0.893) indicates the potential of the method both for screening in risk groups and for use in forensic medical examination in retrospective analysis.

The established correlation of iridological data with known psychological and biochemical markers of suicidal risk further confirms the validity of the method and its biological rationale. This opens up prospects for using iridodiagnostics not only to ascertain risk, but also to monitor the condition of patients in dynamics, for example, when evaluating the effectiveness of therapy.

Limitations of the study include the need for validation on independent samples and in different populations. Further study of the influence of concomitant somatic diseases and medication intake on iridological parameters is also required.

A promising direction is the integration of iridological data with genetic and neuroimaging markers to build more accurate predictive models.

Conclusion

The study demonstrated the significant potential of iridodiagnostics as an objective method for assessing suicidal risk in forensic medical and clinical practice. Specific structural, pigmentary and vascular markers of the iris associated with a high risk of suicide were identified. The mathematical model and software "IridoSuicideAnalyzer" developed on their basis showed high diagnostic accuracy (sensitivity 87.3%, specificity 85.8%, AUC 0.893).

The method can be used:

1. In forensic medical examination for retrospective assessment of the psychoemotional state and suicidal risk of the deceased.
2. In clinical practice (psychiatry, psychotherapy) for screening and monitoring patients from risk groups.
3. In scientific research to study the biological mechanisms of suicidal behavior.

Further research should focus on multicenter validation of the method, refinement of markers for various subgroups of patients, and integration of iridodiagnostics into comprehensive suicide prevention systems.

Acknowledgments

The authors express their gratitude to the staff of the Tashkent Regional Branch of the Republican Scientific and Practical Center for Forensic Medicine of the Ministry of Health of the Republic of Uzbekistan, the Tashkent City Clinical Psychiatric Hospital and the Department of Ophthalmology of the Tashkent Pediatric Medical Institute for their assistance in collecting material and conducting the study.

Author contributions

Iskandarov A. I. – data processing, concept and design of the study, participation in writing and editing the text of the article, general scientific guidance.

Yadgarova Sh.Sh. – collection of forensic medical and iridological material, data analysis, writing and editing the text of the article.

Nasriddinov S. Z. – development of a mathematical model and software.

Conflict of interest

The authors declare that there is no conflict of interest.

Appendix 1: Conceptual interface of the software "Irid/Suicide Analyzer"

UML code layout.

flowchart TD

A["Loading iris image"] –> B{"Image preprocessing (normalization, segmentation)"};

B –> C{"Analysis of structural markers (furrows, belt density, ring)"};

B –> D{"Analysis of pigment markers (spots, lacunae, uniformity)"};

B –> E{"Analysis of vascular markers (vascularization, aneurysms, blood flow)"};

C –> F["Calculation of coefficient S4"];

D –> G["Calculation of coefficient T4"];

E –> H["Calculation of coefficient V4"];

I["Input of biochemical data (optional)"] –> J["Calculation of coefficient R*"];

F & G & H & J –> K{"Calculation of the integral risk indicator (SB) using the formula"};

K –> L["Report generation (visualization of markers, SB value, interpretation)"];

L –> M["Saving to database"];

M –> N["Output of result to user"].

References

World Health Organization. Suicide worldwide in 2019: Global Health Estimates. Geneva: World Health Organization; 2021. License: CC BY-NC-SA 3.0 IGO.

Mann J. J., Apter A., Bertolote J., et al. Suicide prevention strategies: a systematic review. JAMA. 2005; 294(16): 2064-2074. Doi:10.1001/jama.294.16.2064

Kurpatov A. V. The meaning of life and suicide // Neuroses and psychosomatic disorders. – St. Petersburg: Vector Publishing House, 2016. – P. 287–306.

Velkhover E. S., Shulpina N. B., Alieva Z. A., Romashov F. N. Iridodiagnostics. – Moscow: Medicine; 1988. – 240 p.

Jensen R. Iridology Simplified. 10th ed. Escondido, CA: Bernard Jensen International; 1980.

Berggren L. Iridology: A Critical Review. Acta Ophthalmol (Copenh). 1985; 63(1): 1-8. Doi:10.1111/j.1755-3768.1985.tb01140.8

Genc K., Celik F., Ozcelik A., Genc S. Iridological evaluation in psychiatric disorders. Altern Ther Health Med. 2014; 20(3): 42–6.

Beck A. T., Steer R. A., Brown G. K. Manual for the Beck Depression Inventory-II. San Antonio, TX: Psychological Corporation; 1996. (Russian adaptation: Tarabrina N. V. Workshop on the psychology of post-traumatic stress. – St. Petersburg: Peter; 2001.)

Beck A. T., Weissman A., Lester D., Trexler L. The measurement of pessimism: the hopelessness Scale. J Consult Clin Psychol. 1974; 42(6): 861-5. Doi:10.1037/h0037562 (Russian adaptation: Gorbatov S.V. Adaptation of the questionnaire «Hopelessness Scale» A. Beck. Journal of Practical Psychology and Psychoanalysis. 2003; (1).)

Razuvaeva T. N., Lebedeva A. A. Psychodiagnostics of suicidal behavior: a methodological guide. Belgorod: BelGU; 2011. – 48 p.

Raikhlin N. T., Strukov A. I., Kauzova M. Yu. et al. Pathomorphology and pathogenesis of AIDS. // Archives of pathology. 1989. – T. 51. – № 11. – P. 3-10.

van Heeringen K., Mann J. J. The neurobiology of suicide. Lancet Psychiatry. 2014; 1(1): 63-72. Doi:10.1016/S2215-0366(14)70220-2

Tondo G., Baldessarini R.J. Biological basis of suicide and suicidal behavior. Bipolar Disord. 2013; 15(5): 524-41. Doi:10.1111/bdi.12089

Dubলশি, M.I. Zhirkov V.F. «Recognizing Persons by Their Iris Patterns», Methods and algorithms of applied mathematics in engineering, medicine and Economics, Novocherkassk, III international scientific-practical conference, Part 3, Novocherkassk 2003. – P. 12–14.

Aquilonius A. L., Mann J. J. The biology of impulsive suicide. Psychiatr Clin North Am. 2001; 24(1): 11–25. Doi:10.1016/s0193-9538(05)70207-8

submitted 18.04.2025;
accepted for publication 02.05.2025;
published 26.06.2025

Contact: shabnamibragim@gmail.com