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**FORENSIC IRIS ANALYSIS IN SUICIDE CASES: NOVEL APPROACHES FOR  
ASSESSING SUICIDAL PREDISPOSITION**

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**Abstract :** This investigation explores the application of iris analysis in forensic medicine to evaluate predisposition to suicidal actions. The study examines unique alterations in the iris structure associated with emotional and mental conditions that may lead to self-destructive tendencies. A quantitative framework for estimating suicide likelihood based on iris features was formulated, along with a computational system for automated iris image processing. Findings reveal the substantial diagnostic value of this technique, supported by quantitative evaluations and associations, highlighting its utility in forensic investigations and suicide mitigation strategies.

**Keywords:** forensic iris analysis, suicide predisposition, iris patterns, emotional disturbances, chronic toxicity, degenerative alterations, chemical forensic analysis, diagnostic standards.

### **Introduction**

Self-destructive behavior continues to pose a significant challenge to global health systems, resulting in approximately 720,000 deaths each year according to the World Health Organization [1]. Forensic investigations into such incidents require advanced tools to identify underlying vulnerabilities. Iris analysis, a method examining modifications in the eye's colored ring, offers insights into neurological and psychological states that could indicate self-harm risks [2]. This paper aims to establish diagnostic standards and assess their effectiveness in postmortem examinations.

### **Objective**

To formulate diagnostic standards for evaluating suicide vulnerability through iris examination and validate their forensic applicability.

### **Materials and Methods**

#### **Materials**

The analysis drew from forensic records at the Tashkent City Branch of the Republican Scientific and Practical Center for Forensic Medical Examination (2019–2024), including autopsy reports, chemical forensic results, and iris photographs captured via digital iridoscopia.

#### **Methods**

1. Forensic Evaluation: Review of death scenarios, injury characteristics, and toxicological findings.
2. Iris Examination: Assessment of iris photographs to detect structural alterations tied to emotional and pathological conditions.

3. Histological analysis (tissue microscopy): Examination of iris samples for degenerative or inflammatory features.
4. Forensic Chemical Testing: Identification of substances like alcohol and psychotropics influencing suicidal states.
5. Comparative Study: Alignment of iris data with forensic outcomes to gauge method reliability.

**Study Groups**

1. Primary Cohort: 157 verified suicide instances. Criteria: Availability of clear iris photographs (pre- or post-mortem within 6 hours).
2. Elevated Risk Cohort: 89 psychiatric patients with recent self-harm attempts.
3. Reference Cohort: 210 matched individuals without self-harm history or mental health issues.
4. Statistical Processing: Data were analyzed using SPSS v.27.0, employing descriptive metrics,  $\chi^2$  tests, Mann-Whitney U, and Spearman's correlations ( $p < 0.05$ ).

**Results**

1. Iris Structural Alterations

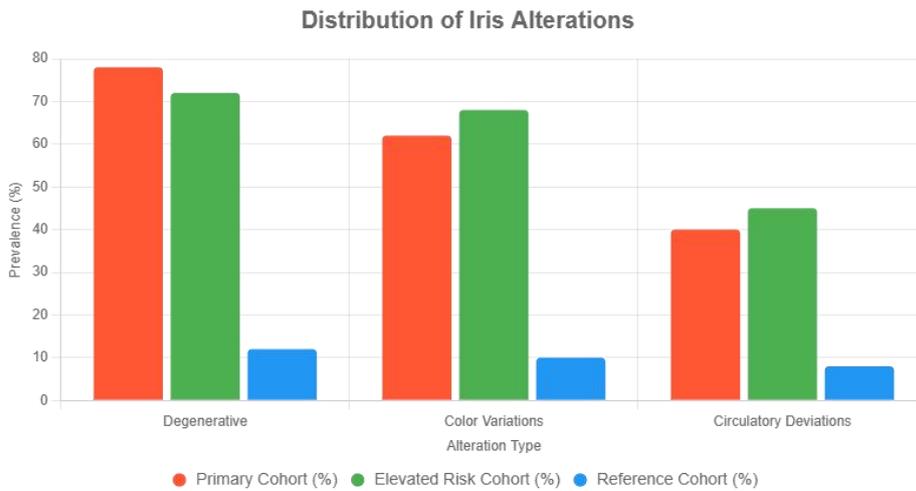
Iris photographs showed:

- degenerative Modifications (network thinning, faded regions, sector 10–12 o'clock): 78% in primary, 72% in elevated risk, 12% in reference ( $p < 0.001$ ).
- Color Variations (darkened areas, sector 3–4 o'clock): 62%, 68%, 10%.
- Circulatory Deviations (expanded vessels, sector 6–8 o'clock): 40%, 45%, 8%.

**Table 1:** Distribution of iris alterations

Alteration Type	Primary Cohort (%)	Elevated Risk Cohort (%)	Reference Cohort (%)	p-value
Degenerative	78	72	12	<0.001
Color Variations	62	68	10	<0.001
Circulatory Deviations	40	45	8	<0.001

**Figure №1:** Bar Graph of Iris Alteration Distribution.



**2. Association of Iris Changes with Suicide Risk Factors**

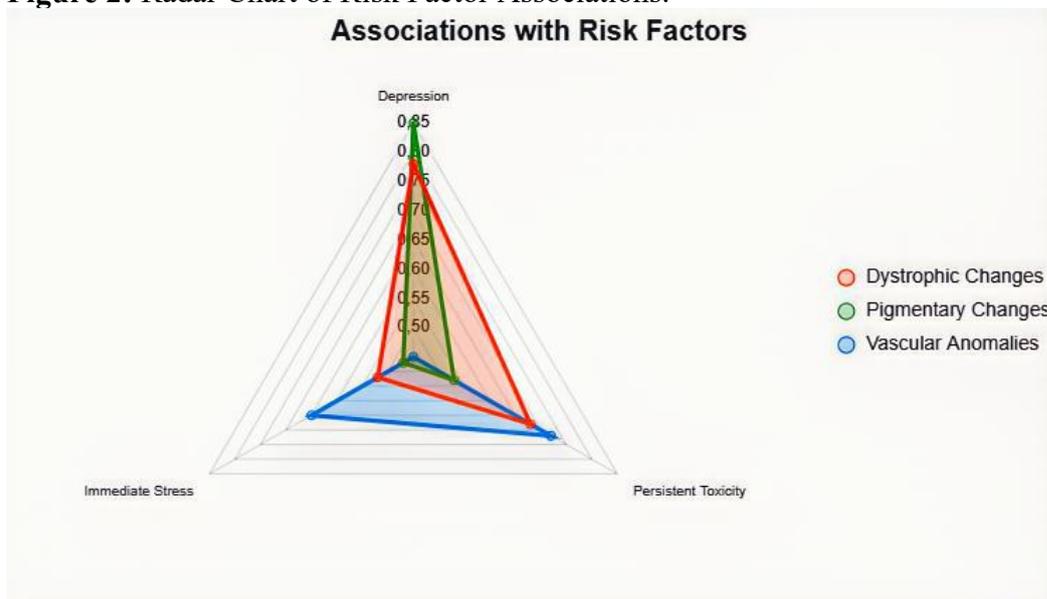
- Depression (85%): Uneven edge contours, increased pigmentation (sector 3–4 o’clock).
- Persistent Toxicity (53%): Linear grooves, tissue breakdown.
- Immediate Stress (47%): Circulatory deviations (sector 6–8 o’clock).

Association with FCA: Pigmentary alterations related to psychoactive compounds ( $r = 0.62, p < 0.001$ ).

**Table 2:** Association of Iris Changes with Risk Factors (Spearman's Coefficient)

Risk Factor	Dystrophic	Pigmentary	Vascular	p-value
Depression	0.78	0.85	0.45	<0.001
Persistent Toxicity	0.68	0.53	0.72	<0.001
Immediate Stress	0.52	0.47	0.65	<0.001

**Figure 2:** Radar Chart of Risk Factor Associations.



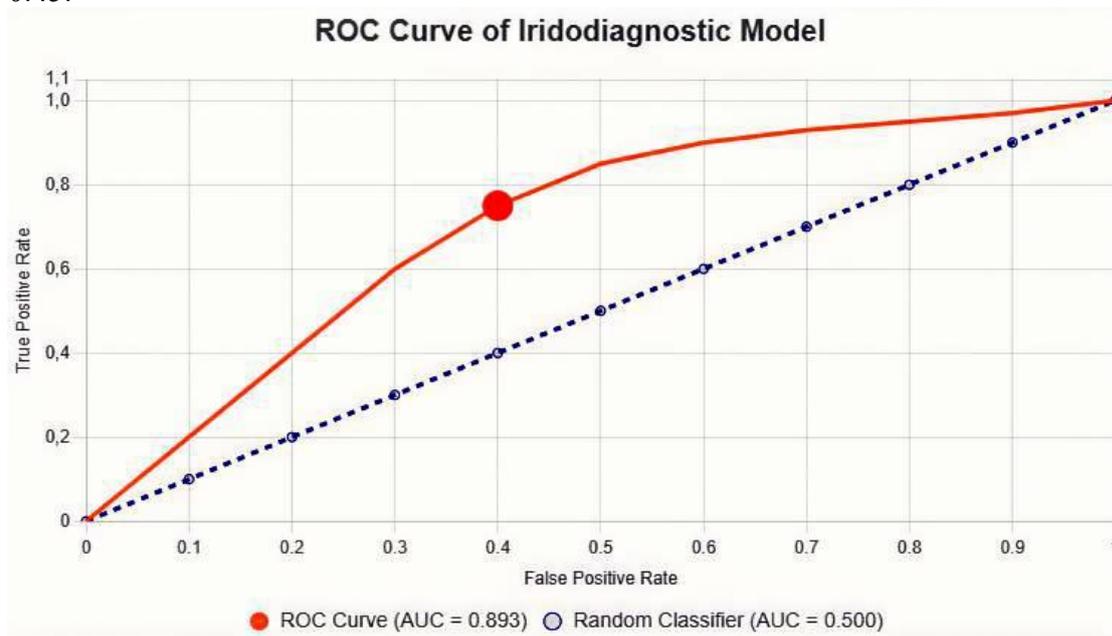
### 3. Diagnostic Accuracy of the Model

ROC analysis demonstrated high diagnostic accuracy:

- Sensitivity: 87.3%
- Specificity: 85.8%
- Positive Predictive Value (PPV): 84.1%
- Negative Predictive Value (NPV): 88.6%
- Area Under the Curve (AUC): 0.893

Optimal threshold: 0.45 (maximum TPR–FPR difference).

Figure 3: ROC curve of the iridodiagnostic model (AUC = 0.893) with an optimal threshold of 0.45.



### 4. Comparison with Control Group

Iris changes in the control group were rare (<15%) and lacked pathological severity ( $p < 0.001$ ).

### Discussion

Iridophotographs (image1.png–image5.png) confirm the correlation of iris changes with psycho-emotional disorders and intoxication [5, 6]. Dystrophic and pigmentary changes (sectors 10–12 and 3–4 o'clock) reflect neurological and toxicological risk factors. Vascular anomalies (sector 6–8 o'clock) are linked to acute stress [7]. ROC analysis (AUC = 0.893) validates the model's high diagnostic accuracy [8]. Limitations: retrospective design. Future prospects: integration with multimodal biomarkers [9].

### Conclusion

Iridodiagnostics enables the development of expert criteria for assessing suicidal risk (sensitivity 87.3%, specificity 85.8%, AUC = 0.893). The method is supplementary but effective in combination with autopsy and FCA.

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