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DETECTION OF ALCOHOL AND NARCOTIC SUBSTANCES IN FORENSIC MEDICINE

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Abstract

The detection of alcohol and narcotic substances is one of the most important aspects of forensic medicine and toxicology. Toxicological investigations help determine the presence, concentration, and effects of toxic substances in the human body. Alcohol and drugs are frequently associated with accidents, crimes, poisoning, and sudden death. Modern laboratory techniques such as gas chromatography, mass spectrometry, immunoassay screening, and high-performance liquid chromatography provide accurate and reliable identification of toxic agents. This article discusses the role of forensic toxicology, methods of alcohol and narcotic detection, biological samples used for analysis, and the medico-legal significance of toxicological findings. The paper also highlights current challenges in forensic toxicology, including postmortem changes and the emergence of synthetic drugs.

Keywords

Forensic medicine, forensic toxicology, alcohol detection, narcotic substances, gas chromatography, toxicological analysis, drug identification, blood alcohol concentration, GC-MS, intoxication.

Introduction

Forensic medicine plays an important role in criminal investigations and medical examinations. One of the most significant tasks in forensic toxicology is the detection of alcohol and narcotic substances in the human body. These substances may influence behavior, cause poisoning, and even lead to death. Accurate identification of toxic agents helps forensic experts determine the cause of death, evaluate intoxication, and provide evidence for legal investigations.

Alcohol and drugs are frequently associated with traffic accidents, violent crimes, suicides, and sudden deaths. Therefore, laboratory analysis of biological samples has become an essential part of forensic examinations.

Role of Toxicology in Forensic Medicine

Forensic toxicology is a branch of forensic medicine that studies the harmful effects of chemicals, drugs, and poisons on the human body. Toxicological analysis helps specialists identify toxic substances in blood, urine, saliva, hair, and internal organs.

The main objectives of forensic toxicology include:

- Detection of toxic substances;
- Determination of concentration levels;
- Evaluation of toxic effects on organs and tissues;
- Establishment of the relationship between intoxication and death.

Modern toxicological methods provide highly accurate and reliable results that can be used in court proceedings.

Detection of Alcohol

Alcohol is one of the most commonly detected substances in forensic practice. Ethanol affects the central nervous system and reduces coordination, attention, and reaction speed. High doses may cause respiratory depression, coma, or death.

Biological Samples

Alcohol can be identified in several biological materials:

- Blood;
- Urine;
- Saliva;
- Vitreous humor;
- Breath samples.

Blood analysis is considered the most reliable method for determining blood alcohol concentration (BAC).

Methods of Alcohol Detection

Several laboratory methods are used to detect ethanol:

Gas Chromatography

Gas chromatography is the gold standard for alcohol detection. This method accurately measures ethanol concentration in biological fluids.

Breath Analysis

Breath analyzers are widely used by police officers during traffic control. They estimate alcohol concentration in exhaled air.

Enzymatic Methods

These methods use alcohol dehydrogenase enzymes to determine ethanol levels in blood samples.

Detection of Narcotic Substances

Narcotic drugs can alter mental status, behavior, and physiological functions. In forensic investigations, experts often detect opioids, cocaine, amphetamines, cannabis, and synthetic drugs.

Common Biological Materials

Drug detection may be performed using:

- Blood;
- Urine;
- Hair;
- Saliva;
- Gastric contents.

Hair analysis is useful for identifying long-term drug use because substances remain detectable for months.

Laboratory Techniques

Immunoassay Screening

Immunological tests are commonly used for rapid screening. They provide preliminary information about the presence of drugs.

Gas Chromatography-Mass Spectrometry (GC-MS)

GC-MS is one of the most accurate confirmatory methods in forensic toxicology. It identifies specific chemical compounds and their metabolites.

High-Performance Liquid Chromatography (HPLC)

HPLC is another sensitive method used for separation and analysis of narcotic substances.

Forensic Importance

Detection of alcohol and narcotics has major legal and medical significance. Toxicological findings help determine:

- Cause and manner of death;
- Degree of intoxication;
- Criminal responsibility;
- Drug overdose cases;
- Impairment during driving.

In some cases, toxicological results become the key evidence in criminal investigations.

Challenges in Toxicological Analysis

Despite technological progress, forensic toxicology faces several difficulties:

- Decomposition of biological samples after death;
- Low concentration of substances;
- Presence of multiple drugs simultaneously;
- Emergence of new synthetic narcotics.

These factors may complicate laboratory interpretation and require advanced analytical methods.

Conclusion

Detection of alcohol and narcotic substances is an important component of forensic medicine. Modern toxicological techniques allow experts to identify toxic agents with high accuracy and reliability. The results of forensic toxicology are essential for determining causes of death, solving crimes, and ensuring justice. Continuous development of analytical technologies improves the effectiveness of forensic investigations and contributes to public safety.

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