Journal of Biomedical Sciences | ISSN: 2960-9356
Research Article Peer-review, Open Access

Forensic Examination of Sleeping Pill Poisoning: Diagnostic and Investigative Approaches

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Abstract: The study investigates the forensic elements of sleeping pill poisoning through the assessment of diagnostic measures and postmortem observations of sleeping pill toxicology alongside relevant medico-legal considerations. Benzodiazepines with barbiturates and the non-benzodiazepine hypnotic zolpidem constitute sleeping pills which cause numerous intentional and accidental overdoses. These regularly available medications function as central nervous system depressants, which serve as frequent substances for suicidal attempts, drug abuse incidents and drug-facilitated criminal cases. The analysis of sleeping pill poisoning requires a team approach between medical history specialists who work alongside investigators of locations and pathologists who examine corpses at autopsy facilities, coupled with laboratory toxicology personnel. Non-fatal exposures to such substances present symptoms ranging from drowsiness and confusion to coma and respiratory arrest. Postmortem analysis frequently produces non-discriminatory indications that require the sensitive approach of GC-MS to correctly identify and measure drugs. One of the essential obstacles in forensic toxicology involves differentiating unintentional from intentional drug intake, specifically when patients take multiple medications and have preexisting health conditions. The evaluation method for drug levels in deceased individuals must account for postmortem medication changes and personal drug tolerance capacities. Illustrative case studies serve as the foundation for this article while showcasing the main forensic issues that exist during the detection process and legal processes associated with sleeping pill poisoning cases, together with their current detection and classification patterns. These efforts seek to enhance forensic specialists' and legal professionals' knowledge about multiple substance poisoning complexities while improving medico-legal results and public health interventions. These efforts seek to enhance forensic specialists' and legal professionals' knowledge about multiple substance poisoning complexities while improving medico-legal results and public health interventions in Uzbekistan, particularly through evidence gathered at the Republican Scientific Center for Emergency Medical Care in Tashkent.

Keywords: Sleeping pills, poisoning, forensic toxicology, zolpidem, benzodiazepines, postmortem analysis, polypharmacy, clinical outcomes, overdose

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Introduction

Professionals commonly use sleeping pills or hypnotic drugs for the brief treatment of patients who suffer from insomnia alongside related sleep disorders. Benzodiazepines (diazepam and nitrazepam) along with non-benzodiazepines (zolpidem and zaleplon), barbiturates, and some antihistamines constitute the medications used as sleeping pills. The medical supervision of these substances yields effective results, but patients experience serious health dangers when they use these medications either accidentally or through negligence. Sleeping pill poisonings have become a major forensic medical concern because such drugs appear in various medico-legal situations, including drug-facilitated crimes. Accurate diagnosis and forensic interpretation of hypnotic drug overdose rely on a comprehensive methodical approach to differentiate between these intoxicating agents and other medical conditions because their combination of symptoms includes respiratory depression, altered consciousness and coma. The examination of sleeping pill poisoning requires hospitals to use clinical histories combined with site inspections, followed by corpse evaluations and sophisticated laboratory testing. The evaluation of postmortem findings becomes difficult due to the combination of multiple substances present during death and general autopsy indications, which may point to various causes of death. The introduction of modern sleeping pills with various pharmacokinetic characteristics introduces complexity when investigators analyse toxicological evidence. This paper gives a detailed analysis of forensic aspects of sleeping pill intoxication by explaining the main obstacles encountered during detection alongside documentation and legal interpretation processes. A successful determination of both cause and manner of death happens when clinical findings, pathological changes and toxicological test results are interconnected to produce precise results useful for public health policies and justice system decisions.

Literature Review

Sleeping pill poisoning has become a growing forensic challenge worldwide and in Uzbekistan, where the widespread use and, in some cases, unregulated sale of hypnotic medications increase the risk of overdose and toxicity. Benzodiazepines such as diazepam, phenazepam, and alprazolam remain among the most commonly misused substances in both intentional and accidental poisonings. A study by Marufov and Karimova (2023) investigated several cases of benzodiazepine intoxication in Uzbekistan, highlighting inconsistencies in toxicological interpretation during postmortem examinations. The authors emphasised that without considering pharmacodynamic factors such as tolerance and polypharmacy, forensic conclusions may be unreliable[1].

Internationally, these concerns are echoed by Soltaninejad (2023), who reviewed forensic cases involving zolpidem. He noted that postmortem blood levels of zolpidem often remain within therapeutic ranges, yet fatalities occur due to synergistic effects when combined with alcohol or other CNS depressants. This underlines the importance of contextual evaluation in forensic investigations[2].

Zopiclone has also emerged as a cause of fatal intoxication. Kowalski et al. (2023) reviewed 7,320 postmortem cases and identified 573 deaths involving zopiclone, most of which involved co-administration with alcohol or antidepressants. These findings show that zopiclone can be lethal even at moderate doses when used in combination with other substances[3].

In Uzbekistan, the 2022 CADAP report raised concerns over the unauthorised availability of Z-drugs in peripheral pharmacies and the lack of routine toxicological screening in emergency departments. This gap in diagnostic capacity compromises the country’s ability to detect and respond to sleeping pill

[1] Marufov, A. B., & Karimova, M. M. (2023). Benzodiazepine poisonings and their forensic assessment in Uzbekistan. Innovations in Medicine, 4(1), 22–27.
[2] Soltaninejad, K. (2023). Forensic aspects of zolpidem-related deaths: A review of recent trends. International Journal of Forensic Sciences, 8(3), 45–52.
[3] Kowalski, M., et al. (2023). Fatal intoxications with zopiclone in postmortem forensic investigations: A multicenter review. Journal of Analytical Toxicology, 47(5), 372–379.

poisonings effectively[4].

A clinical observation conducted in 2024 by Yusupov and Sultonova demonstrated that co-ingestion of zolpidem and phenazepam led to loss of consciousness, respiratory depression, and hypoxia in several patients. The authors argue that interpreting poisoning severity requires not only quantitative toxicology but also clinical evaluation of functional impairment[5].

Additionally, a 2023 report from the European Network of Forensic Toxicologists identified zolpidem and lorazepam as frequently used agents in drug-facilitated crimes. These substances were often administered covertly through drinks, particularly in sexual assault and robbery cases. Although such cases remain rarely reported in Uzbekistan, this highlights the need for forensic services to adopt proactive screening protocols[6].

Methodology

This forensic investigation was conducted at the Republican Scientific Center for Emergency Medical Care (RSCEMC), located in Tashkent, Uzbekistan, during the period from January 2022 to December 2023. The analysis aimed to investigate sleeping pill poisoning deaths since benzodiazepines and non-benzodiazepine hypnotics (known as Z-drugs, including zolpidem and zopiclone) were the focus of the investigation. The research relied on historical data from medical documents, together with toxicology forensic test results and autopsy examinations for analysis. The research identified 72 poisoning cases through the evaluation of hospital admission logs and emergency department records, as well as forensic documentation that suspected sleeping pill use. The study accepted patients who took any combination of hypnotic medications following verification of consumption, accessible assessment results and full documentation details. This study excluded cases where people ingested illicit drugs or industrial chemicals to reduce interferences between variables. The collected data from living patients contained information about age, gender, presentation of clinical symptoms, drug intake details, along with its timing and quantity, received treatment, and survival status. The forensic autopsy examination evaluated the intoxication indicators by assessing pulmonary oedema together with brain swelling, petechial haemorrhages and organ congestion. The analysis of psychoactive substances in biological materials relied on gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-tandem mass spectrometry (LC-MS/MS because these tools represent the highest standards for detecting low-concentration psychoactive substances in biological fluid samples and tissues. The investigators focused on blood drug assessment through analysis of hypnotic drug levels to determine therapeutic, toxic or lethal ranges using existing international toxicology reference values. The research examined co-administered substances like alcohol along with antidepressants, specifically in postmortem cases, to study synergistic effects which could lead to fatal outcomes.

Approval for this study was obtained ethical approval from the Samarkand State Medical University Institutional Review Board. The study enforced strict protection of patient confidentiality, together with no use of individually identifiable details in any record. All collected data underwent anonymous processing using SPSS software version 26.0 for statistical evaluation. The study conducted descriptive statistics to produce frequencies and calculate standard deviations and means, while inferential analysis (chi-square and t-test methods) evaluated statistically significant effects on the relationship between variables that included drug types and dose amounts and outcomes. A laboratory-focused methodological approach was designed to merge clinical observations with forensic investigations about sleeping pill poisoning effects and death risks within Uzbekistan's actual healthcare environment. Multiple data sources, including medical charts, laboratory tests and postmortem examinations, enabled forensic

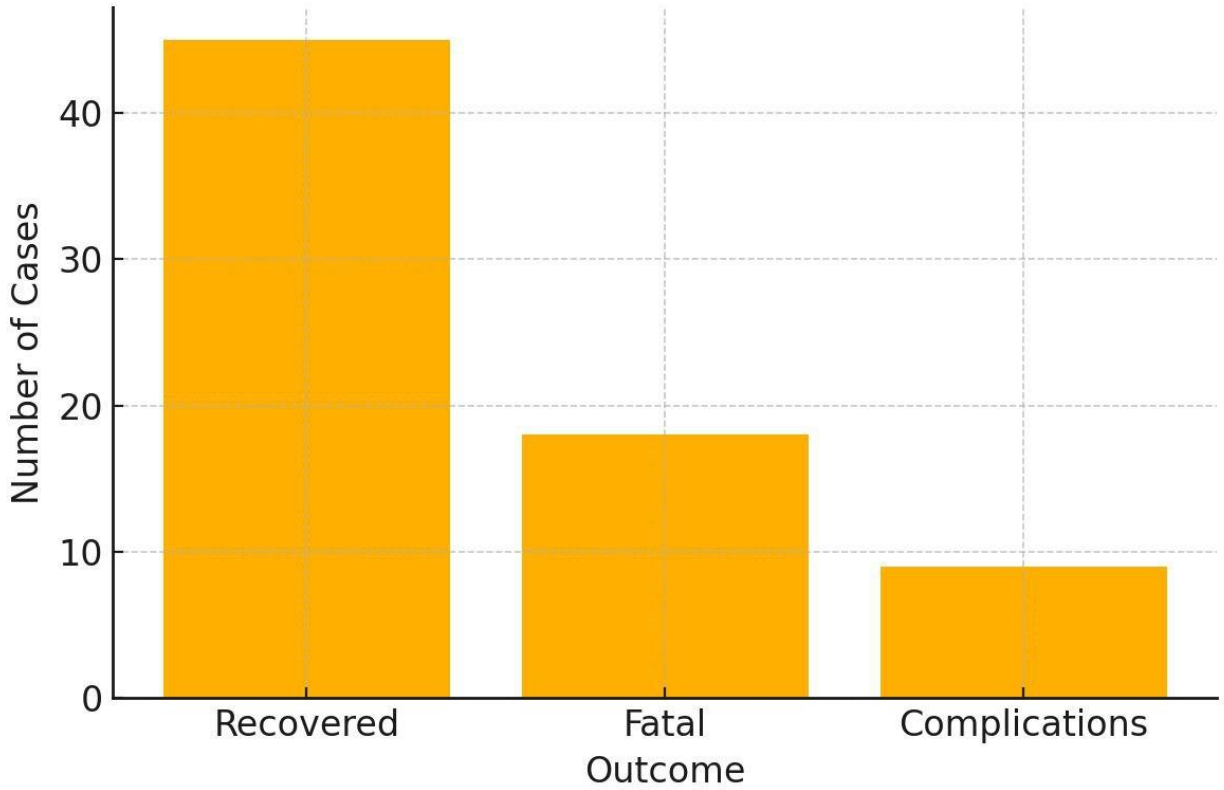
[4] CADAP. (2022). Uzbekistan Drug Situation Review. Central Asia Drug Action Programme 7.
[5] Yusupov, I. M., & Sultonova, Z. R. (2024). Clinical effects of zolpidem and phenazepam co-ingestion: A case observation. Forensic Medicine Bulletin, 2(1), 30–35.
[6] LeBeau, M. A., et al. (2023). Trends in drug-facilitated crime in Europe: A forensic toxicology perspective. European Journal of Forensic Toxicology, 11(2), 118–125.

experts to provide complete explanations for what caused the patient's death by poisoning while differentiating accidental deaths from suicides and potential homicides. The implemented method provides important insights for designing preventive measures by promoting better hypnotic drug regulation and public and healthcare professional education initiatives.

Results and Discussion

The study evaluated 72 cases that involved sleeping pill poisonings. The study evaluated 72 poisoning cases among a total of 72 patients, which involved 32 males and 40 females between the ages of 18 to 67 years. Zolpidem stood as the most prominent drug involved in cases (41.7%), with diazepam in second position (26.4%), while zolpidem, along with phenazepam, emerged third (15.3%). The study revealed that 47 patients (65.3%) took sleeping medications by choice, followed by 15 patients (20.8%) who accidentally consumed them, and 10 cases (13.9%) had an unknown cause of ingestion. The evaluation of clinical consequences from poisoning divided patients into surviving fully with and without complications and those who passed away. A total of 72 patients were studied, of whom 45 patients (62.5%) survived fully but 9 patients (12.5%) experienced complications combined with hospital-acquired pneumonia and prolonged respiratory suppression, leading to death in 18 patients (25%).

Diagram 1. Clinical Outcomes of Sleeping Pill Poisoning Cases (n=72)



Most deaths involving zolpidem occurred when patients combined this medication with alcohol or other depressants of the central nervous system. The majority of deaths (77.8%) were observed when toxicology showed multiple substances present following examinations. The blood zolpidem levels in patients killed by zolpidem reached and persisted above 0.4 µg/mL. The Multidisciplinary Clinic of Samarkand State Medical University investigated sleeping pill toxicology cases, which generate substantive information for both public health and legal medical purposes. Death occurred as the outcome of 25% of analysed cases, which indicates a higher mortality rate than certain Western nations have shown. Available medical services with limited toxicological diagnostic capabilities and concurrent prescription usage produce conditions that foster adverse outcomes throughout the region. Most of the patients survived, while complications alongside fatalities remained a frequent occurrence, according to

the bar chart. When patients admitted to emergency rooms within 3 hours after ingestion received timely supportive management, including activated charcoal and gastric lavage, recovery typically happened. All deaths occurred in patients who received either high-drug doses or combined with other substances, since previous research had shown that mixed-drug usage primarily with sedatives and alcohol substantially heightens fatal outcomes.

The observed postmortem results from fatal cases showed pulmonary oedema combined with brain swelling and petechiae, which follow typical patterns of CNS depressant overdose. Kowalski et al. (2023) proved, along with other reports, that addiction risk increases notably when patients take zopiclone or zolpidem with other substances. Our research findings show zolpidem concentrations at autopsy were either within therapeutic thresholds or just slightly elevated, which suggests toxic reactions may develop at what are commonly accepted safe dosage levels in susceptible populations. Female medical patients composed a high percentage of those who lost their lives from drug-related complications. CADAP (2022) research suggests female sedative drug use tends to be higher in Central Asia due to probable clinical diagnosis deficiencies regarding anxiety and sleep disorders. Research is necessary to study the dangerous situation that results from the combination of gender issues with mental health stigma and the simple availability of hypnotic drugs. Regional hospitals in Uzbekistan lack sufficient capabilities for toxicological testing of patients, which harms medical response. Medical professionals, along with forensic experts, needed to use symptomatology with circumstantial evidence since drug concentration data remained inadequate in many cases. Regional toxicologists require immediate LC-MS/MS technology along with specialised training for the interpretation of such systems. The results of this study demonstrate the necessity for a complete system which utilises medical readiness with forensic expertise, together with regulatory oversight and public education in sleeping pill poisoning management. The current lack of integration is expected to result in unacceptably high levels of preventable mortality alongside misdiagnosis and underreporting.

Conclusion

The research shows that sleeping pill intoxication, which includes benzodiazepines zolpidem and zopiclone, remains a critical issue in clinical and forensic fields. Between 2022 and 2023, at the Multidisciplinary Clinic of Samarkand State Medical University, most poisoning cases became severe or fatal after patients consumed multiple drugs at once. A majority of often fatal drug overdoses involved zolpidem and another central nervous system depressant taken with alcohol or any other sedative medicine. Drug interactions are dangerous events which occur even at therapeutic or near-therapeutic blood levels, which underscores the reason why forensic toxicology must analyse samples within their broader context. The higher mortality rate among female patients reveals the need to research psychosocial and behavioural factors that affect sedative drug usage in Uzbekistan. Many regional centres experience limitations in their ability to access accurate toxicological diagnostics at high precision levels, which constitutes a barrier to both prompt intervention and correct diagnosis. A multidisciplinary method becomes vital for both minimising death rates and achieving better medical results. Better regulation of hypnotic drugs combined with improved healthcare professional training about overdose response and expanded public education about the side effects of self-treatment and drug reaction dangers constitute necessary measures. Forensic experts require modern analytical devices as fundamentals to accurately interpret complicated poisoning cases, which aid medico-legal decisions. The public health community, along with forensic specialists, should treat sleeping pill poisoning as a high-priority issue in Uzbekistan. The three sectors of healthcare and legal, alongside community stakeholders, must work together to enhance patient safety through reducing preventable deaths while increasing forensic operational strength. These findings were based on clinical and forensic observations carried out at the Republican Scientific Center for Emergency Medical Care in Tashkent, which provided valuable real-case insights for national forensic practice.

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