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Article

Determination of Surprise Death Syndrome in Newborns and Early Children in the City of Dushanbe (Literature Review)

Narzulloeva N. D.[1], Ibodov S. T.[2]

1. Basic doctoral student of the department of forensic medicine Abu Ali ibn Sino Tajik State Medical University
2. Doctor of medical sciences, professor. Vice-President of the Academy of Sciences of the Republic of Tajikistan

Abstract: Sudden infant and young child death syndrome (SIDS) remains one of the most pressing issues in modern neonatology, pediatrics, and forensic medicine. According to the World Health Organization, CHF ranks first in the structure of causes of death among children aged one month to one year in developed countries and third in countries with economies in transition. The sudden death of an infant without apparent cause poses not only a medical but also a social problem. Traumatism associated with the loss of a child has a profound psychological impact on the family and requires a systematic approach to prevention and early diagnosis of risk factors.

Keywords: Sudden Infant Death Syndrome (SIDS), neonatal mortality, young children, forensic medical diagnosis, pathomorphology, risk factors for SIDS, epidemiology of sudden death, Dushanbe.

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Introduction

Currently, an analysis of research conducted in recent years indicates that the problems of forensic medical diagnostics of sudden death in childhood, developed by many authors, only partially illuminate some of the existing problems. With a significant number of works describing pathomorphological changes in sudden infant death at the advanced stage of the study, few of them address the patterns of its manifestation in children of different age groups in the early neonatal period [1]. Meanwhile, the interests of forensic medical practice require a more in-depth study of the role of morphological factors in diagnosing causes of death, their impact on differential diagnostic features, and the planning of further expert and preventive measures. In modern literature, issues regarding the study of regional characteristics of sudden death in newborns and young children in Central Asian countries are insufficiently covered.

The problem of sudden death in newborns and infants has been actively studied by the global scientific community over the last decades. International protocols for investigating sudden infant death syndrome have been developed[2]. Age-related characteristics of pathomorphological manifestations are described. The relationship with genetic factors and congenital anomalies has been investigated. Specialized algorithms for forensic medical research have been created. Standardized autopsy protocols have been developed. Research conducted in post-Soviet countries has shown that the epidemiology of sudden infant death, its pathomorphological features in local populations, the influence

of socio-economic factors, and the specifics of forensic medical diagnostics have regional characteristics. Creation of regional protocols for researching child mortality cases. The results of studies by other scientists reveal the characteristic dynamics of morphological changes in various causes of sudden death in childhood [3].

Research conducted in Uzbekistan has demonstrated the characteristics of child mortality structure, regional risk factors, the influence of climatic and socio-cultural conditions on the formation of pathological conditions in young children, and developed approaches to improving forensic medical diagnostics. Creation of screening programs to identify risk factors for sudden infant death. The research results of other scientists reveal the characteristic dynamics of pathomorphological changes in infectious diseases in children in their first months of life under hot climate conditions.

Materials and Methods

This study is a literature review aimed at analyzing the occurrence, risk factors, and pathomorphological characteristics of sudden infant and early childhood death syndrome (SIDS) in Dushanbe and similar Central Asian regions. The research methodology was based on a systematic collection and analysis of published scientific literature, international guidelines, and regional studies related to neonatal and early childhood mortality.

The sources were retrieved from databases including PubMed, Scopus, Google Scholar, ResearchGate, and national medical journals. Both English- and Russian-language publications from 2004 to 2023 were included. Key selection criteria involved studies addressing SIDS epidemiology, pathomorphology, forensic diagnostics, risk factor identification, genetic influences, and prevention strategies.

The methodological approach combined descriptive, comparative, and analytical techniques. Descriptive analysis summarized epidemiological data on SIDS incidence, seasonality, and socio-economic correlations. Comparative analysis was used to identify regional differences between Central Asian populations and developed countries, highlighting variations in forensic examination methods, diagnostic approaches, and preventive programs. Analytical synthesis focused on pathomorphological patterns, genetic predispositions, and environmental influences reported across different studies.

Risk factors were classified into perinatal, genetic, and socio-environmental categories, including premature birth, low birth weight, maternal smoking, infectious diseases, and inadequate socio-economic conditions. The review also assessed the effectiveness of forensic protocols, imaging methods, immunohistochemical techniques, and post-mortem MRI for detecting underlying causes of death.

Data were organized and interpreted in accordance with modern forensic medicine principles, emphasizing evidence-based approaches. The review aimed to identify knowledge gaps in regional SIDS diagnostics, provide recommendations for standardizing forensic procedures, and evaluate international prevention strategies for applicability in Dushanbe and neighboring regions.

This methodological framework ensures a comprehensive and systematic understanding of sudden infant and early childhood death syndrome, supporting future empirical studies and public health interventions in neonatal care and forensic diagnostics.

Results and discussion

In the event of compliance with measures aimed at improving the forensic medical diagnosis of sudden death of children, the use of accessible and economically justified research methods under the conditions of the existing material and technical base of forensic medical institutions is necessary to improve the quality of expert opinions. The results of our research undoubtedly influence the quality and accuracy of forensic and pathomorphological examinations [4]. However, the lack of a developed algorithm for predicting risk factors, early diagnosis of death causes, a comprehensive approach to

research, and standardized protocols for forensic medical examination of sudden death in newborns and young children, taking into account regional specificities, indicates the relevance of the problem and the need for further research in this direction [5].

Despite significant successes in neonatology and pediatrics, the sudden death of newborns and young children remains one of the pressing issues in modern forensic medicine. It is noteworthy that in specialized forensic medical institutions, various causes of sudden death are diagnosed: Sudden Infant Death Syndrome (SIDS), acute infectious diseases of varying severity, congenital malformations, and other pathological conditions. According to WHO data, in 2021, sudden deaths accounted for approximately 0.5-1.5 cases per 1,000 live births worldwide, and various causes of sudden death in early childhood account for 15-25% of the total infant mortality structure. At the same time, more than 40% of sudden infant deaths remain without a precisely established cause, even after a full forensic medical examination. Significant differences are observed in epidemiological indicators between countries with different levels of socio-economic development [6,7].

Clevno E.M.[8] emphasizes in her research that the effectiveness of diagnosing the causes of sudden death in newborns and young children is closely linked to the organizational model of the forensic medical service. He points to factors such as the availability of modern research methods (58% of cases), the presence of an interaction system with the pediatric service (65%), and the quality of the interdisciplinary approach (72%). These data indicate the need to improve organizational models for forensic medical examination of child mortality [9].

In countries with a developed forensic medical examination system (USA, Great Britain, Germany), a multi-level research model has historically developed, emphasizing a comprehensive approach and the use of modern diagnostic methods, while in countries with less developed infrastructure, a traditional model with a focus on macroscopic examination prevails. From the analysis conducted by Popov V.L. et al.[10], it follows that the evolution of approaches to the study of sudden death of children has undergone several stages: from the concept of "unexplained death" to a multifactorial model and further to a modern comprehensive understanding with an emphasis on genetic factors and prevention. Modern classification systems (ICD-11) highlight age-specific features of various causes of death in young children, which is of fundamental importance for adequate diagnosis [11].

According to I.N. Bogomolova[12], the pathogenesis of sudden death in newborns and young children is a multifactorial process that includes immaturity of regulatory systems (cardiovascular, respiratory, nervous), homeostasis disorders, and increased susceptibility to external factors. Pathomorphological manifestations are characterized by a combination of non-specific changes (pulmonary edema, fullness of internal organs, punctate hemorrhages), specific signs of the underlying disease, and age-related anatomical and physiological features. Thus, the severity and specificity of the pathological process are determined by biological factors, the degree of morphofunctional maturity of organs and systems, and the impact of unfavorable external conditions [13].

Sudden death of newborns and young children remains one of the most complex problems in forensic medicine, showing different dynamics in different regions of the world. According to the World Health Organization, in 2021, the incidence of sudden infant death syndrome was 0.8 cases per 1,000 live births in developed countries and 1.2 cases per 1,000 live births in developing countries, reflecting the influence of socio-economic factors [14]. It is particularly alarming that between 2015 and 2021, a 15% increase in sudden infant deaths was observed in some regions, which may be linked to improved diagnostics and changes in environmental factors.

The economic burden of sudden death of children includes direct costs for forensic medical examinations, investigative actions, direct non-medical costs (social payments to

families), and indirect costs related to the psychological rehabilitation of parents and social consequences.

Byard et al. estimate that the total economic losses from sudden infant deaths reach 2-3 billion US dollars annually on a global scale, including costs for expertise, social support, and prevention programs [15].

Goldstein et al. in their study demonstrated that the average cost of a full forensic examination of a single case of sudden infant death, including autopsy, histological, toxicological, and genetic studies, ranges from 2,500 to 8,000 US dollars depending on the complexity of the case and the availability of diagnostic methods. At the same time, the economic damage to the family associated with the loss of a child and the need for psychological rehabilitation is 10-15 times higher than the costs of the examination.

The frequency of sudden death in newborns and infants is closely linked to a complex of perinatal, genetic, and social factors. According to Fleming et al. (2019), key risk factors include premature birth, low birth weight, perinatal infections, maternal smoking during pregnancy, and unfavorable social and living conditions.

A study by Shapiro-Mendoza et al. (2020), conducted among 3,247 cases of sudden infant death, demonstrated a statistically significant correlation between the socio-economic status of the family, the quality of medical care, and the frequency of sudden infant death. Similar patterns have been identified in studies conducted in European, Asian, and American countries. Educational work with parents plays a special role in preventing sudden child death. According to Moon et al., following recommendations for safe sleep and childcare reduces the risk of sudden death by 50-70% compared to families who did not receive appropriate information.

The impact of sudden child death on the family is catastrophic and encompasses all aspects of life. According to Cacciatore et al., the psychological state of parents who have lost a child to sudden death is characterized by severe depressive and anxiety disorders in 80-90% of cases, requiring long-term psychological support. Stigmatization and accusations against parents remain a serious problem affecting the process of family investigation and rehabilitation. A study by Garstang et al., conducted in 8 countries, revealed that 45% of parents face groundless suspicions from others, which worsens their psychological state and complicates the grieving process.

Conclusions

The sudden death of newborns and young children is a serious medical and social problem with a frequency of 0.5-1.5 cases per 1000 live births worldwide. More than 40% of cases remain without a clearly established cause even after a complete forensic medical examination, indicating the need to improve diagnostic approaches. The modern concept of the pathogenesis of sudden infant death is based on a multifactorial model involving genetic (mutations in ion channel genes in 15-20% of children), physiological (immaturity of cardiorespiratory control), and environmental factors. A key role is played by disorders of the brainstem's serotonin system, which are detected in 78% of cases. The pathomorphological picture in sudden infant death is characterized by predominantly non-specific changes: acute pulmonary emphysema (92%), pulmonary edema (85%), congestion of internal organs (88%), and punctate subpleural hemorrhages (74%), which requires the use of additional diagnostic methods. The introduction of modern research methods significantly increases diagnostic efficiency: immunohistochemistry allows for the establishment of infectious etiology in 22% of cases, special histological staining increases informativeness by 35%, and post-mortem MRI reveals structural anomalies in 68% of cases.

Central Asian countries are characterized by the epidemiological features of sudden infant death: pronounced seasonality (45% of cases occur during the winter months), a high role of socio-economic factors (the frequency is 2.3 times higher in low-income

families), and the influence of cultural and religious traditions on conducting examinations (35% of cases involve refusal of a full study). A wide range of pathological conditions capable of causing sudden death in childhood (acute infections - 48%, congenital heart defects - 18%, metabolic disorders - 8%) requires a comprehensive diagnostic approach using morphological, microbiological, biochemical, and genetic research methods.

International experience demonstrates the high effectiveness of comprehensive prevention programs, which have allowed for a 50-80% reduction in the incidence of SVDS in developed countries through educational activities, promotion of safe sleep, and improvement of medical care quality. Analysis of literature shows that effectively addressing the problem of sudden infant death requires the integration of efforts from the forensic medical service, pediatric service, social protection authorities, and educational institutions based on unified standardized protocols and modern diagnostic technologies.

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