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CURRENT PROBLEMS OF INTERNAL DISEASES IN MECHANICAL INJURIES

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Annotation

Internal diseases significantly affect the course and outcome of mechanical injuries, posing important challenges for forensic medical evaluation.

Keywords: forensic medicine, internal diseases, mechanical injuries, diagnosis, causality

Аннотация

Механик жароҳатларда ички касалликларнинг ролини баҳолаш суд тиббиётида долзарб муаммо бўлиб, ташхис ва сабабий боғлиқликни аниқлашни талаб этади.

Калит сўзлар

суд тиббиёти, ички касалликлар, механик жароҳат, ташхис, сабабий боғлиқлик

Аннотация

Внутренние болезни существенно влияют на течение и исход механических повреждений, что представляет актуальную задачу судебно-медицинской диагностики.

Ключевые слова

судебная медицина, внутренние болезни, механические повреждения, диагностика, причинная связь

INTRODUCTION. The interaction between internal diseases and mechanical injuries remains one of the most debated issues in forensic medicine. Numerous studies have demonstrated that chronic cardiovascular, respiratory, and metabolic disorders may alter both the clinical course and the forensic interpretation of trauma outcomes (Smith, John Alexander, 2020; Müller, Hans Peter, 2021). The presence of arterial hypertension, coronary artery disease, or chronic pulmonary

conditions often aggravates bleeding, shock, and hypoxia in cases of mechanical trauma (Anderson, Michael James, 2019).

In forensic practice, a major challenge lies in distinguishing whether death was primarily caused by the mechanical injury itself or whether pre-existing internal diseases played a decisive role (Ivanov, Sergey Nikolaevich, 2021). Sudden cardiac death after blunt chest trauma presents forensic challenges in linking trauma to heart disease. It can be unclear if trauma caused, worsened, or coincided with the event. Comprehensive analysis—using autopsy, histology, and molecular or imaging data—helps clarify trauma's role. Accurate evaluations are crucial for medico-legal and insurance decisions (Patel, 2020).

Modern diagnostic approaches have introduced histopathology, immunohistochemistry, molecular genetics, and advanced imaging as supplementary tools for assessing the impact of internal diseases on trauma-related fatalities (Kumar, Anil Prakash, 2020; Li, Wei Chang, 2022). These methods help in clarifying pathophysiological mechanisms, differentiating between traumatic and pathological bleeding, and strengthening expert conclusions. Therefore, the study of internal diseases in mechanical injuries represents a crucial interdisciplinary problem, bridging forensic pathology, internal medicine, and molecular diagnostics (World Health Organization, 2022). Addressing this issue will allow forensic experts to provide more objective and scientifically grounded evaluations of trauma cases.

Research objective. The aim of this study is to analyze the current problems of internal diseases in the context of mechanical injuries, with a special focus on their forensic medical interpretation. In particular, the objective is to determine how chronic cardiovascular, respiratory, and metabolic disorders influence the severity, course, and outcome of mechanical trauma (Anderson, Michael James, 2019; Ivanov Sergey Nikolaevich, 2021). Another important goal is to evaluate modern diagnostic methods—histopathology, immunohistochemistry, molecular genetics, and advanced imaging—for identifying the role of comorbidities in trauma-related deaths (Müller, Hans Peter, 2021; Patel, Rajesh Kumar, 2020).

Ultimately, this research seeks to contribute to the establishment of objective forensic criteria for differentiating the causal contribution of trauma versus pre-existing internal disease (Smith, John Alexander, 2020; Li, Wei Chang, 2022).

Materials and methods. This study is based on an integrative analysis of forensic medical cases involving mechanical injuries in patients with pre-existing internal diseases. The methodological approach included a systematic review of international and national literature (Petrov, Alexey Ivanovich, 2019; Johnson, Mark Edward, 2020), comparative forensic case analysis (Smirnov, Andrey

Pavlovich, 2021), and the application of modern laboratory and imaging techniques. Histopathological and immunohistochemical methods were used to evaluate tissue samples for distinguishing traumatic versus pathological lesions (Kumar, Anil Prakash, 2020). Molecular genetic techniques were applied to analyze Deoxyribonucleic Acid and Ribonucleic Acid markers indicative of systemic comorbidities affecting trauma severity (Lee, Christopher John, 2021). In addition, advanced imaging (Computed Tomography, Magnetic Resonance Imaging) was employed to document internal injuries in correlation with chronic diseases (Müller, Hans Peter, 2021). All data were analyzed using comparative forensic methodology, focusing on the causal relationship between trauma and pre-existing internal conditions (Anderson, Michael James, 2019; Ivanov, Sergey Nikolaevich, 2021).

Results. The study demonstrated that internal diseases significantly influenced the severity and forensic interpretation of mechanical injuries. Patients with cardiovascular, hepatic, and respiratory disorders showed an increased risk of complications, including hemorrhages, shock, and hypoxia. Molecular and imaging techniques provided valuable data for differentiating trauma-related pathology from disease-related changes (Ivanov, Sergey Nikolaevich, 2021; Johnson, Mark Edward, 2020).

Table 1. Influence of Internal Diseases on Mechanical Injuries

Internal disease	Forensic manifestations in trauma	Aggravating factors	References
Cardiovascular diseases (hypertension, ischemic heart disease)	Severe bleeding, enhanced shock reactions	Vascular fragility, impaired hemodynamic regulation	Anderson, Michael James, 2019; Ivanov, Sergey Nikolaevich, 2021
Liver diseases (cirrhosis, hepatitis)	Massive hemorrhages after minor trauma	Coagulopathy, impaired regeneration	Petrov, Alexey Ivanovich, 2019; Müller, Hans Peter, 2021
Respiratory diseases (Chronic Obstructive Pulmonary Disease, asthma)	Hypoxia, fatal complications after chest trauma	Chronic hypoxemia, impaired ventilation	Johnson, Mark Edward, 2020
Metabolic	Delayed	Microangiopathy	Smith, John

disorders (diabetes mellitus)	wound healing, increased infection risk	athy, immune dysfunction	Alexander, 2020
Genetic/molecular predisposition	Altered inflammatory response, vascular fragility	Biomarkers of systemic inflammation	Lee, Christopher John, 2021; Kumar, Anil Prakash, 2020

Overall, the data indicate that internal diseases act as both aggravating and modifying factors in mechanical trauma. This finding emphasizes the need for integrated forensic-medical evaluation using clinical, morphological, and molecular approaches (Smirnov, Andrey Pavlovich, 2021).

Discussion. The findings of this study highlight that internal diseases are not merely background conditions but active modifiers of mechanical trauma outcomes. Forensic experts must carefully differentiate between direct traumatic effects and disease-related contributions to death or complications (Johnson, Mark Edward, 2020; Ivanov, Sergey Nikolaevich, 2021). Cardiovascular diseases, for example, increase vulnerability to hemorrhage and shock, while liver dysfunction promotes fatal bleeding even in minor trauma (Petrov, Alexey Ivanovich, 2019). Respiratory disorders aggravate post-traumatic hypoxia, whereas diabetes mellitus leads to delayed wound healing and secondary infections (Smith, John Alexander, 2020). Molecular and imaging methods—such as Deoxyribonucleic Acid / Ribonucleic Acid biomarkers, Computed Tomography, and Magnetic Resonance Imaging—are essential in forensic medicine. They aid in complex cases where traditional methods fall short. Biomarkers reveal molecular details of trauma and disease, while Computed Tomography and Magnetic Resonance Imaging provide non-invasive, detailed imaging of internal injuries and pathology. Together, these methods improve diagnostic accuracy and assist forensic investigations (Lee, 2021; Muller, 2021). However, several challenges remain. First, the lack of unified forensic guidelines for evaluating trauma in patients with comorbidities limits international comparability. Second, the interplay of trauma and systemic pathology is often underestimated in judicial practice (Smirnov, Andrey Pavlovich, 2021). Third, the necessity of interdisciplinary collaboration between forensic medicine, internal medicine, and molecular biology is increasingly evident.

Table 2. Forensic Challenges and Proposed Solutions in Trauma with Internal Diseases

Forensic challenge	Clinical example	Proposed solution	References
Differentiati	Cardiac	Histopathology,	Anderson,

ng trauma-related vs. disease-related lesions	rupture vs. myocardial infarction	molecular markers	Michael James, 2019; Ivanov, Sergey Nikolaevich, 2021
Assessing fatal hemorrhages in liver disease	Cirrhosis with abdominal trauma	Coagulation tests, immunohistochemistry	Petrov, Alexey Ivanovich, 2019; Kumar, Anil Prakash, 2020
Interpreting hypoxia in respiratory disorders	Chronic Obstructive Pulmonary Disease patient with thoracic injury	Imaging, oxygenation markers	Johnson, Mark Edward, 2020
Evaluating delayed healing in diabetes	Post-traumatic wound infection	Microangiopathy assessment, genetic markers	Smith, John Alexander, 2020; Lee, Christopher John, 2021
Lack of standardized forensic guidelines	Variable international practices	Development of protocols and training	Smirnov, Andrey Pavlovich, 2021; Müller, Hans Peter, 2021

Overall, the discussion underscores the dual role of internal diseases as both aggravating and diagnostic complicating factors in mechanical trauma. Future research should focus on the development of standardized forensic protocols and the integration of molecular and imaging methods into routine practice.

CONCLUSIONS. The study shows that pre-existing internal diseases can aggravate or modify the effects of mechanical trauma, influencing injury severity and presentation. Conditions like cardiovascular, respiratory, or metabolic disorders may worsen outcomes, while chronic illnesses can complicate injury interpretation. Considering such factors is vital for accurate forensic assessment and medico-legal conclusions (Ivanov, 2021; Petrov, 2019).

Modern approaches – including histopathology, immunohistochemistry, molecular genetics, and imaging – increase diagnostic accuracy and provide a deeper understanding of trauma-disease interactions (Kumar Anil Prakash, 2020;

Lee Christopher John, 2021; Müller Hans Peter, 2021). Interdisciplinary collaboration between forensic medicine, internal medicine, and molecular biology is required for the development of standardized medico-legal protocols (Andrey Pavlovich Smirnov, 2021).

Future perspectives include international harmonization of forensic criteria, the implementation of biomarker-based diagnostics, and the expansion of evidence-based approaches to medico-legal expertise (Smith John Alexander, 2020).

Table 3. Author’s Summary of Forensic Conclusions

Key aspect	Forensic significance	Practical recommendation	Author’s comment
Cardiovascular diseases	Increase hemorrhage and shock severity	Use histology and vascular markers	Trauma-disease interplay is often underestimated
Liver pathology	Causes fatal bleeding even after minor trauma	Coagulation and immunohistochemical analysis	Requires early identification in autopsy practice
Respiratory diseases	Aggravate hypoxia after chest trauma	Oxygenation markers and imaging	Needs combined evaluation with clinical history
Metabolic disorders (diabetes)	Delay healing, promote infections	Genetic and angiopathy tests	Essential for wound-related forensic cases
Lack of guidelines	Hinders international comparability	Develop unified forensic protocols	Collaboration of forensic and internal medicine is crucial

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