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Forensic Medical Analysis of Internal Organ Injuries Caused by Blunt Force Trauma

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INTRODUCTION

Traumatic injuries of internal organs caused by the impact of inert objects represent a significant challenge in forensic medical practice. Contusions of internal organs are often a result of blunt force trauma and may lead to severe functional impairments or fatal outcomes. The aim of this study is to analyze the morphological changes in internal organs following contusions, determine the mechanisms of trauma, and identify specific pathomorphological manifestations.

MATERIALS AND METHODS

The study included data from 62 forensic autopsies conducted on individuals who sustained internal organ contusions due to the impact of inert objects. The analysis involved macroscopic and microscopic examination of tissue samples from the liver, spleen, lungs, kidneys, and heart.

RESULTS AND DISCUSSION

Internal organ contusions were most commonly observed in cases of road traffic accidents (42 cases, 67.7%), falls from height (12 cases, 19.3%), and mechanical impact from blunt objects due to criminal actions (8 cases, 12.9%). In 70% of cases (n=44), contusions were accompanied by capsular ruptures and hemorrhages into the parenchyma. Morphological changes in the affected organs varied. In the liver, contusions were observed in 31 deceased individuals and were characterized by subcapsular and intraparenchymal hemorrhages, with deep tissue ruptures in 12 cases. Among 24 deceased individuals, 15 exhibited organ ruptures with massive hemorrhages, while 9 showed diffuse blood infiltration without capsular rupture.

Pulmonary injuries were identified in 28 cases, including hemorrhages in the alveolar septa, interstitial edema, and areas of atelectasis. In 16 cases, death occurred due to hematoma formation in the renal cortex, which was detected in 12 cases, while 4 cases involved parenchymal ruptures with vascular damage. One case presented with myocardial rupture, whereas in the remaining 6 cases, hemorrhages into the pericardium and myocardium were observed. Depending on the force and nature of the impact, contusions ranged from minor pinpoint hemorrhages to extensive tissue ruptures. In 29% of cases, multiple organ injuries were present, complicating clinical diagnosis

and necessitating a comprehensive autopsy analysis. Morphological examination allowed for the determination of trauma chronology based on the staging of the inflammatory response and hemorrhage organization.

The presented microscopic image of the liver (Figure 1) demonstrates trauma-related damage, with massive hemorrhagic areas, hepatocyte edema in the stroma, as well as dystrophic and necrotic hepatocyte changes.

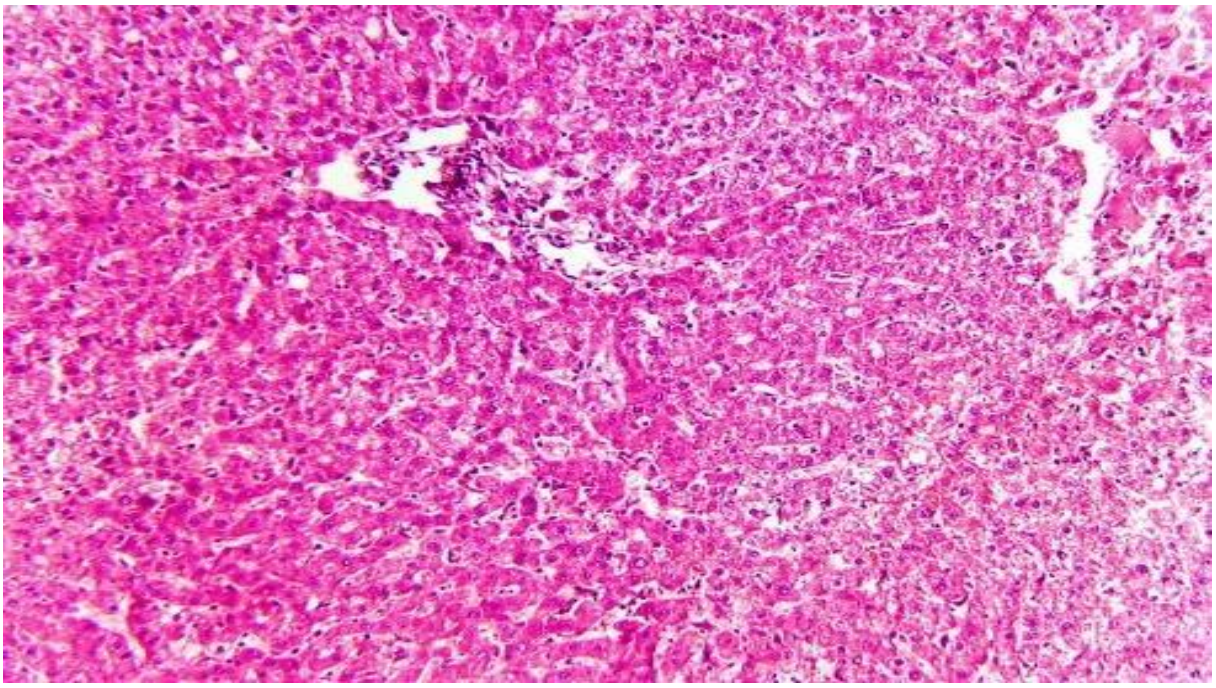

Figure 1. Patient U.E. The histological section shows areas of massive hepatocyte hemorrhage and stromal edema. Stained with hematoxylin-eosin, magnification: 10×10.

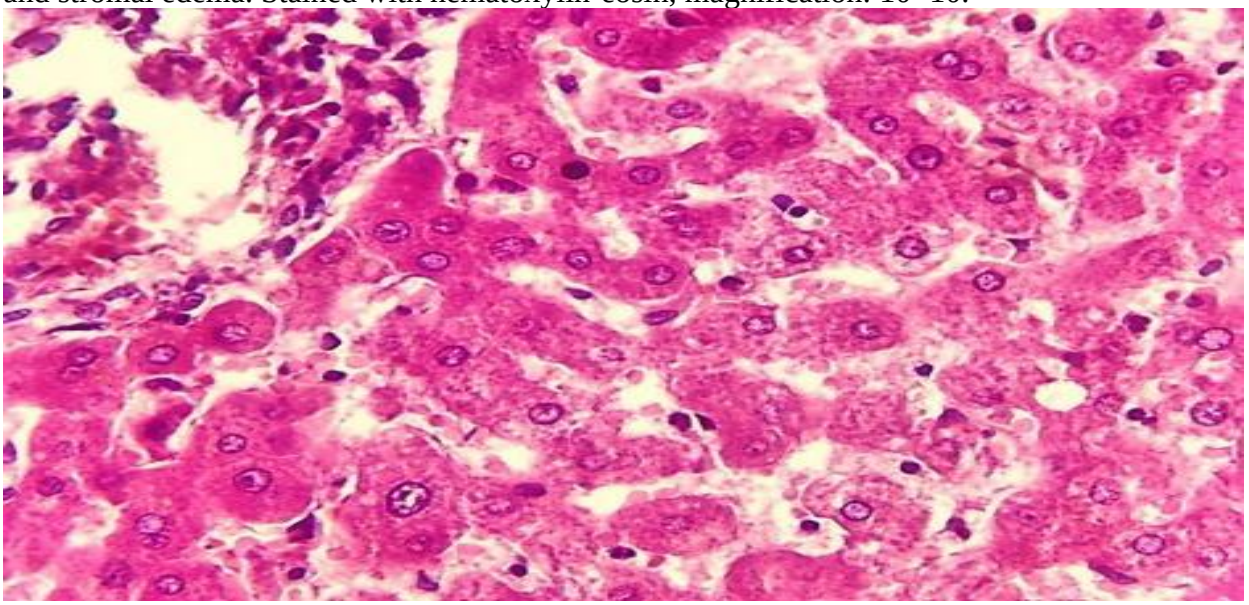

Figure 2. Patient U.E. The histological section shows areas of massive hepatocyte hemorrhage and stromal edema. Stained with hematoxylin-eosin, magnification: 10×40.

The presented second microscopic image of the liver also reveals trauma-associated damage, including dystrophic and necrotic changes in hepatocytes. An increase in cell size with signs of ballooning degeneration is observed. The cell nuclei remain intact, but in some areas, pyknosis, karyorrhexis, and karyolysis are noted, indicating necrotic processes. Hemorrhagic foci are visualized in the interlobular spaces, along with sinusoidal capillary dilation and congestion. Some hepatocytes exhibit vacuolization, suggesting hydropic or fatty degeneration. The intercellular

space appears widened, indicating possible tissue edema. In certain regions, clusters of inflammatory cells, including lymphocytes and macrophages, are present, pointing to reactive inflammation.

CONCLUSION

The analysis of 62 autopsy cases demonstrated that internal organ contusions caused by the impact of inert objects exhibit significant variability in morphological changes. Forensic medical examination of such injuries requires a comprehensive approach, integrating macro- and microscopic data, trauma mechanisms, and associated injuries. The study results emphasize the need for improving diagnostic methodologies to accurately determine the mechanism and timing of trauma.

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