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COMPREHENSIVE EVALUATION OF LOCAL HEMOSTATIC AGENTS IN LIVER TRAUMA

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Introduction:

Liver trauma ranks among the most severe and life-threatening abdominal injuries, accounting for a significant proportion of emergency surgical cases. Mortality rates in severe forms may reach 20–30%, particularly when associated with combined injuries, massive blood loss, and hemorrhagic shock. Over the past decades, advances in surgical tactics have shifted the focus from extensive liver resections toward organ-preserving approaches, supported by the development and implementation of modern local hemostatic agents. However, despite the availability of numerous topical hemostatics, the choice of an optimal agent remains a critical and unresolved issue. This decision must consider not only the hemostatic efficacy and technical convenience of the material but also the morphological characteristics of the injury, the dynamics of tissue repair, and the potential for biliary complications. Morphological consequences of certain widely used agents—particularly those based on oxidized cellulose or collagen—may include coagulation necrosis, intense inflammatory infiltration, bile extravasation, and the development of coarse subcapsular fibrosis, leading to deformation of the liver capsule and impairment of its microarchitecture. These risks are especially pronounced in anatomically biliary-related zones, where bile leakage can provoke persistent inflammation, delay regenerative processes, and increase the likelihood of postoperative complications. In contrast, agents with high biocompatibility, flexible structure, and uniform adherence to the wound surface may promote a softer, physiological pattern of morphogenesis, characterized by uniform granulation tissue formation, preserved microvascular framework, and restoration of the beam-sinusoidal architecture without excessive fibrotic remodeling.
Given these considerations, the selection of a local hemostatic agent in liver trauma should be based on a comprehensive evaluation integrating clinical, technical, and

morphological parameters, ensuring both immediate hemostatic control and optimal long-term tissue recovery.

Objective: To compare the effectiveness of various local hemostatic agents in liver trauma using a clinical and experimental model with morphological, behavioral, and quantitative assessment.

Materials and Methods:

The clinical study included 44 patients with liver injury, divided into main (n=21) and control (n=23) groups. The experimental study involved 80 Wistar rats with standardized blunt or incised liver injuries treated with Surgicel®, TachoSil®, Biatravm®, or BloodSTOP IX; control groups received no agent. Morphological evaluation was performed on days 3, 7, and 14.

Results:

In blunt trauma, BloodSTOP IX achieved hemostasis in under one minute with minimal blood loss and no reapplication. In incised wounds, it provided the highest adhesion, no need for compression, and resistance to displacement. Morphology showed moderate inflammation without coagulation necrosis, biliary infiltration, or fibrosis, with restoration of the liver's beam-sinusoidal architecture.

Conclusion:

BloodSTOP IX demonstrated the highest biocompatibility and lowest tissue aggressiveness, offering rapid, stable hemostasis and making it preferable for organ-preserving liver surgery.