Clinical Potential of Chitosan-Gelatin Hemostatic Sponges for Surgical Use, with Specific Application in Brain Neurosurgery

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Abstract

Effective bleeding control is essential in neurosurgery, where even minor hemorrhage can compromise operative conditions and increase the risk of complications. This study evaluated chitosan–gelatin composite sponges with varying ratios, with a particular focus on a 1:1 formulation, to assess their physicochemical properties and in vitro hemostatic performance.

The 1:1 chitosan–gelatin sponge exhibited a mean pore diameter of 212.29 ± 76.47 µm, which falls within the 100–300 µm range considered favorable for rapid fluid absorption and cellular infiltration. The swelling ratio was 84.70 ± 3.41%, indicating adequate capacity to absorb blood and wound exudates without excessive expansion. Cytocompatibility testing showed 75.69% cell viability, consistent with non-cytotoxic behavior. The material also demonstrated antibacterial activity against both Gram-positive and Gram-negative bacteria.

Scanning electron microscopy (SEM) analysis revealed platelet adhesion on the sponge surface, suggesting its potential to support the early stages of clot formation. These findings indicate that the chitosan–gelatin (1:1) sponge possesses physicochemical and biological properties relevant to hemostatic applications. However, further in vivo studies and functional hemostasis testing are required to confirm its effectiveness in neurosurgical settings.

Keywords: *hemostatic agents, chitosan, gelatine, sponges, bleeding control*