以絲膠蛋白為基底製備可注射水凝膠用於心肌梗塞治療

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摘要

心肌梗塞是全球主要死亡原因之一，其治療除及時恢復血液流通外，如何修復壞死組織亦是關鍵。可注射水凝膠因具生物相容性、可精準注射與支撐作用，被視為促進心肌再生的潛力材料。絲膠蛋白為蠶絲副產物，具有良好生物相容性、抗氧化與促進細胞附著等特性，但其單獨成膠能力不足，需與其他材料複合使用。動物實驗顯示，口服絲膠可減輕 isoproterenol 誘導的大鼠心肌壞死，降低心臟肥大、炎症與氧化壓力，並改善血清生化指標與心肌結構，證明絲膠具心臟保護作用。材料應用方面，絲膠加入海藻酸鹽/明膠水凝膠後，可提升其機械強度、黏彈性與耐久性，並增加孔隙度與親水性，利於細胞存活與心肌組織修復。進一步結合脂肪來源幹細胞與層黏連蛋白的絲膠基水凝膠，能促進內皮細胞增殖與血管新生，減少心肌纖維化及梗塞面積，顯著改善大鼠心臟功能。本文綜合多篇研究，探討絲膠蛋白於心肌梗塞治療水凝膠中的應用潛力，絲膠蛋白能透過抗發炎與抗氧化機制保護心肌，並在水凝膠中增強成膠性能與生物活性。其與幹細胞或其他高分子材料複合後，不僅可提升組織再生效果，亦展現臨床應用於心肌梗塞治療的高度潛力。

Development of Injectable Sericin Based Hydrogel for Myocardial Infarction

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Outline

VI. Introduction
VII. Effectual endeavors of silk protein sericin against isoproterenol induced cardiac toxicity and hypertrophy in wistar rats
VIII. Sericin improves alginate-gelatin hydrogels' mechanical properties, porosity, durability, and viability of fibroblasts in cardiac spheroids
IX. Engineering of injectable hydrogels associate with Adipose-Derived stem cells delivery for anti-cardiac hypertrophy agents
X. Conclusion

Abstract

Myocardial infarction (MI) is a leading cause of mortality worldwide, and effective repair of necrotic tissue remains a major therapeutic challenge beyond timely reperfusion. Injectable hydrogels, with their biocompatibility, injectability, and structural support, represent promising materials for cardiac regeneration. Sericin, a silk byproduct, possesses favorable biocompatibility, antioxidant activity, and cell-adhesive properties, though its poor gelling ability requires combination with other biomaterials. Experimental studies have shown that oral sericin attenuates isoproterenol-induced myocardial necrosis, reduces cardiac hypertrophy, inflammation, and oxidative stress, and improves biochemical and structural outcomes, confirming its cardioprotective effects. When incorporated into alginate/gelatin hydrogels, sericin enhances mechanical strength, viscoelasticity, porosity, and hydrophilicity, thereby supporting cell survival and tissue repair. Moreover, sericin-based hydrogels combined with adipose-derived stem cells and laminin promote endothelial proliferation, angiogenesis, and functional recovery while reducing fibrosis and infarct size. Collectively, current evidence highlights sericin’s dual role in myocardial protection and hydrogel reinforcement, underscoring its potential as a clinically relevant biomaterial for MI therapy.

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