



Review

Post-Operative Adhesions: A Comprehensive Review of Mechanisms

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Abstract: Post-surgical adhesions are common in almost all surgical areas and are associated with significant rates of morbidity, mortality, and increased healthcare costs, especially when a patient requires repeat operative interventions. Many groups have studied the mechanisms driving post-surgical adhesion formation. Despite continued advancements, we are yet to identify a prevailing mechanism. It is highly likely that post-operative adhesions have a multifactorial etiology. This complex pathophysiology, coupled with our incomplete understanding of the underlying pathways, has resulted in therapeutic options that have failed to demonstrate safety and efficacy on a consistent basis. The translation of findings from basic and preclinical research into robust clinical trials has also remained elusive. Herein, we present and contextualize the latest findings surrounding mechanisms that have been implicated in post-surgical adhesion formation.

Keywords: post-surgical adhesions; underlying mechanisms; translational research



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1. Introduction

Post-operative adhesions are pathological bonds that form between surfaces within body cavities, and range from a thin film of connective tissue to thick fibrous bridges that contain blood vessels and nerve tissue [1]. Previous publications describe post-surgical adhesions as scar tissue, whereas current understanding reflects their dynamic and regenerating nature, which can be characterized by distinct cellular and immune responses [2–4]. Post-operative adhesion formation following pelvic, peritoneal, and thoracic surgeries is a common response to tissue trauma and ischemia. It has been reported that pathologic adhesions develop after 95% of all operations, regardless of procedure or location in the body [5]. These fibrous bonds can directly or indirectly cause complications including severe chronic pain, organ dysfunction, and the increased need for “redo surgeries”, which may include surgeries to release the adhesions themselves (a procedure known as adhesiolysis).

Post-surgical adhesions can prolong operative time in repeat surgeries, but can also increase the risk of mortality, as well as conferring major financial burden on the healthcare system [6–11]. The treatment of post-operative adhesions costs the US healthcare system over USD 2.5 billion annually, while complications related to post-surgical adhesions results in nearly one million additional days of inpatient care annually [12]. This staggering estimate of cost excludes expenditures such as imaging, diagnostic, and laboratory tests, ambulance and transport service, long-term morbidity costs, mental health implications, or the societal cost of early mortality [11]. Thus, there is an unmet clinical need for the development of safe and effective therapeutic options that can be used to mitigate post-operative adhesion formation. Success in such an endeavor requires a better understanding of the different mechanisms that contribute to post-surgical adhesions. Herein, we comprehen-