



REVIEW

Dual-Polymer Carboxymethyl Cellulose and Poly(Ethylene Oxide)-Based Gels for the Prevention of Postsurgical Adhesions

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Received: 26 October 2024 | **Accepted:** 5 December 2024

Funding: The authors received no specific funding for this work.

Keywords: adhesion barrier | carboxymethyl cellulose | composite gel | dual-polymer gel | gynecological surgery | peritoneal adhesions | poly(ethylene oxide) | postsurgical adhesions | spinal or epidural adhesions

ABSTRACT

Postsurgical adhesions are a common complication associated with surgical procedures; they not only impact the patient's well-being but also impose a financial burden due to medical expenses required for reoperative surgeries or adhesiolysis. Adhesions can range from a filmy, fibrinous, or fibrous vascular band to a cohesive attachment, and they can form in diverse anatomical locations such as the peritoneum, pericardium, endometrium, tendons, synovium, and epidural and pleural spaces. Numerous strategies have been explored to minimize the occurrence of postsurgical adhesions. These strategies include surgical approaches, adhesiolysis, antiadhesive agents, and mechanical barriers which have demonstrated the most promise in terms of efficacy and breadth of indications. In this review, we discuss the use of physical/mechanical barriers for adhesion prevention and outline the most commonly used, commercially available barriers. We then focus on a synthetic, dual-polymer gel composed of carboxymethyl cellulose (CMC) and poly(ethylene oxide) [PEO], which, unlike the more commonly used single-polymer hydrogels, has demonstrated higher efficacy across a greater range of indications and surgical procedures. We review the formulation, mechanical properties, and mechanisms of action of the CMC + PEO dual-polymer gel and summarize findings from clinical studies that have assessed the efficacy of CMC + PEO gels in multiple surgical settings in clinics across the world. In conclusion, the CMC + PEO dual-polymer gel represents an approach to preventing postsurgical adhesions that has been commonly used over the last 20 years and could therefore serve as a foundation for research into improving postsurgical outcomes as well as a drug delivery device to expand the use of gels in surgical settings.

1 | Introduction

Postsurgical adhesions are one of the most prevalent complications of any surgical procedure, occurring in up to 50%–95% of postoperative patients [1, 2]. Typical surgical procedures cause ischemia, tissue trauma and desiccation, inflammation, and exposure to foreign bodies including fibers, sutures, staples,

powder, lint, and, in some cases, intestinal contents [1, 3]. Postsurgical adhesions are pathological fibrotic linkages, or scar tissues, which develop following these surgery-induced tissue disturbances. These adhesions conjoin organs and the adjacent surfaces surrounding body cavities. In many cases, postsurgical adhesions are painless and cause no secondary complications; however, postsurgical adhesions can cause chronic pain,