Surgical Adhesion Prevention: Current Therapies and Beyond

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Introduction

Tissue adhesions consist of tissue surfaces attached by fibrous bands. In their normal state, these surfaces are separated. The adhesions can form after surgery or as a consequence of trauma or a variety of inflammatory processes. They pose a widespread and serious problem and can cause severe symptoms. Adhesions that occur within the abdominal or pelvic cavities are particularly insidious and prevalent. Estimates of post-surgery adhesion occurrence from autopsy and re-operations have exceeded 90% with some 30% of the cases being symptomatic. Adhesions account for some 49-74% of small bowel obstructions, 15-20% of infertility cases and 20-50% of chronic pelvic pain cases. Adhesiolysis procedures in the United States approximate 300,000 annually and Medicare payments for adhesion-related procedures are $3-4 billion.[1] Given the magnitude of tissue adhesions and the suffering of individuals, the problem is not generally understood or appreciated by the general public. However, within the medical community, many approaches to their mitigation have been explored. While some success has been achieved, treatable indications remain limited and work continues to improve therapeutic outcomes.

Pathology of Adhesions

Briefly, internal organs, injured by trauma, inflammation or surgery, produce a serofibrinous exudate which solidifies via the coagulation cascade. This sticky mass, which binds tissue surfaces together, is normally cleared by processes initiated by tissue plasminogen activator (TPA). If TPA is deficient as occurs with adhesive disease, the stable fibrin clot serves as a scaffold for the attachment, proliferation and matrix deposition of fibroblasts. The resulting collagenous bands mature to tough, stable structures that may or may not become symptomatic.

Current Methodologies for Prevention and Treatment of Adhesions

In surgical situations, approaches to mitigating post-surgical adhesions include careful surgical technique to minimize trauma and dehydration, the use of barrier coatings and pharmacological intervention such as with anti-inflammatory and fibrinolytic drugs. Adhesion barriers can be solid or liquid and have been proven to reduce post-surgical adhesions in certain clinical applications. Products introduced to commerce have not all survived due to side effects encountered during use. Two product lines hold dominant positions in the market. Genzyme Corporation's Sepra® line of barrier products consists of films, foams and gels targeting abdominal, pelvic and nasal surgery. They are based on blends of hydrogel-forming sodium hyaluronate and carboxymethyl cellulose which separate tissue planes when applied and are cleared within a few days. Ethicon's Interceed® consists of knitted oxidized, regenerated cellulose which is applied as a fabric over wounds to prevent adhesions, and also clears within a few days. A recently-approved product, Adept®, is a low viscosity 4% solution of the glucose polymer, icodextrin, which acts by "hydrofloatation" or aqueous separation of internal organs. W. L. Gore Preclude® expanded PTFE barrier, approved as a dural or pericardial patch, is effectively used off-label as a non-degradable implant for adhesion prevention.

Emerging Approaches to Preventing Post-Surgical Adhesions

Through surgeon and patient education, appreciation of the prevalence and severity of adhesions is growing and adhesion barrier adoption rates are rising for increasing indications such as caesarean section. This practice will reduce complications of post-surgical adhesions. With enhanced knowledge of adhesion pathology, promising new pharmacological approaches are being developed. Combination products that incorporate drugs into barriers show promise for enhanced efficacy in addressing difficult adhesions such as those reforming after adhesiolysis.[2]

Concluding Remarks

While effective surgical technique and adhesion barriers are the most successful commercial anti-adhesion therapies to date, there is no universal preventative for all adhesive conditions. Significant efforts continue on several fronts to develop compositions and procedures for more effective and user-friendly therapies that counter the formation and severity of adhesions.

References

[1]http://www.genzyme.ca/thera/adh/ca_en_p_tp_thera-adh.asp; www.ellisdigital.com/ntero/aaintest.gif; http://www.hcgresources.com/adhesions.htm;
[2]A. Coury, K. Baker *et al*, U. S. Patent 5,785,993, July 28, 1998.