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Biomaterials used in peritoneal wound healing (incisional hernia repair model) and abdominal skin wound healing

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Statement of the Problem: Incisional hernia repair often involve exposing the peritoneal cavity, desiccation and risk of infection leading to complications. These complications have spurred research for biological meshes. Biologic grafts are acellular collagen matrices implanted during hernia repair to aid in host tissue incorporation. It is anticipated that they provide the extracellular components necessary for a normal peritoneal and skin healing, reconstruction, mechanical and functional restoration of the abdominal wall. Biological meshes differ based on their source (human or animal), composition (dermal, pericardial or submucosal) and methods of processing (stripping, cross-linking). Cutaneous injuries also have a high prevalence due to rising co-morbidities. The tissue engineering field has also developed in response to the shortcomings related to the tissue replacement: Donor tissue rejection, chronic inflammation and donor tissue shortages. The main aim is to avoid the mentioned issues by creating the biological substitutes capable of replacing the damaged tissue. This increases the need for new and innovative treatments to address postsurgical peritoneal wound healing and abdominal skin healing.

Methodology & Theoretical Orientation: Currently, incisional hernia models treated with biomaterials study the effectiveness of biomaterials in improving postoperative peritoneal healing. Substitutes made from skin can harbor the latent viruses and artificial skin grafts may heal with extensive scarring, failing to regenerate structures such as glands, nerves and hair follicles. Thus, new and practical skin scaffold biomaterials are being developed by combining the scaffolds, cells and signals to create the living, physiological, three-dimensional tissue.

Findings: Collagen cross-linking increases the strength of the biologic graft. As the density of collagen cross-linking increases there is decreased cellular infiltration (decreased angiogenesis) but increased fibroblast encapsulation and resistance to degradation by the body. Biologic grafts that undergo stripping or collagen cross-linking are less able to stimulate or retain cellular growth factors to promote angiogenesis, reducing graft integration into host tissue. Current biomaterials being explored for skin wound healing include recombinant collagen due to its high tensile strength and biocompatibility, fibrin from pooled plasma due to its occurrence as a natural wound healing matrix, alginate hydrogels which have antibacterial, good water absorptivity and biodegradability, hyaluronic acid due to its non-immunogenic, non-adhesive and pro-angiogenic characteristics, as well as, chitosan which supports wound healing with its film-forming capacity and tissue adhesive and blood coagulation property.

Conclusion & Significance: Peritoneal wound and skin wound healing can lead to adverse complications and a financial burden. Primary closure at the time of initial operation or a second look laparotomy with biomaterials may prevent the need for highly morbid staged repairs, enhance cell growth and wound healing while avoiding the associated complications.

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