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The Use of Prosthetics in Abdominal Wall Reconstruction

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The management of complex abdominal wall defects has been perplexing to general surgeons and reconstructive surgeons since the turn of the last century. The surgeon must have a thorough understanding of the reconstructive requirements of a particular defect and should try to restore structure and function of the abdominal wall whenever possible. The gold standard for abdominal wall reconstruction is with the use of autologous tissue including local flaps and tissue rearrangement techniques. When autologous tissue is not available for the reconstruction because of tissue loss, loss of domain, or other reasons, the use of prosthetics or bioprosthetics is required to assist in the reconstruction of the abdominal wall. Biomaterials also are used in the temporary coverage of these difficult soft tissue defects. Some of the advantages of using prosthetic materials include availability, absence of donor site morbidity, and strength of the prosthetic material. Obvious disadvantages are: susceptibility to infection (which may necessitate explanation), fistula formation secondary to bowel erosion, ex-

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trusion, and seroma formation. There is no "one mesh fits all" concept in abdominal wall reconstruction, and in efforts to address this surgical conundrum, numerous synthetic materials have been designed to facilitate closure of these defects. There are many different types of prosthetic and bioprosthetics materials available, and even more products that are being brought to the marketplace. Each new product is heralded as the next new and improved biomaterial. It is difficult to navigate through all of these new products, especially without long-term clinical and experimental data to support their use. Therefore, a thorough understanding of each prosthetic material, costs, applications, contraindications, and incidence of complications, and the management of these complications is of paramount importance.

This article reviews the most commonly used types of prosthetic and bioprosthetic materials available and discusses their application in the reconstruction of abdominal wall defects.

History

The term prosthesis derived from the Greek words prostithenai pros "add to" and tithenai "to place," is defined as an artificial substance used to replace a missing part or to change the characteristic of the whole. The ancient Greeks used gold wire for sutures. And in the centuries that followed, numerous surgeons used lead and silver wire sutures for wound repair. Sutures subsequently were woven into filigrees, and the composition of surgical filigrees or meshes evolved over time from metals and polymers to biodegradable materials.

In the late 19th century and early 20th century, woven metal was used as the primary reconstructive prosthesis for abdominal wall reconstruction. The first true mesh for hernia repair was tantalum gauze, which was created from fine tantalum wire. Its use was most popular in the 1940s to the 1960s [1]. Stainless steel also was researched, and Babcock published his experience with this material for surgical hernia repair in 1952 [2]. A great industrial development of the 20th century was the condensation of polymerized carbon rings into material that then was fashioned into meshes of different shapes and varying flexibility. Numerous materials were being evaluated in animal studies, including: Dacron (Dupont Corporation, Wilmington, Delaware), nylon, fiberglass, Mylar (Dupont Corporation, Wilmington, Delaware), Orlon (Dupont Corporation, Wilmington, Delaware), polyethylene, polyvinyl, Teflon (Dupont Corporation, Wilmington, Delaware), and Fortisan (Ethicon, Somerville, New Jersey) fabric. None of the early materials withstood infection, and explanation was common in contaminated wounds [3]. New plastics developed in the 1950s showed tremendous promise, and for years the use of polypropylene mesh was the gold standard for complex ventral hernia repair.

Preoperative evaluation

Before any operative intervention, a thorough evaluation is essential. A proper diagnosis first must be made by evaluating the anatomy and by defining the extent of the defect and understanding which anatomical structures are present or absent. Patient selection is also crucial. Performing a technically sound operation on a patient with multiple comorbidities may result in an outcome that is less than optimal. Comorbidities such as diabetes, poor nutrition, and obesity also may be detrimental to the surgical outcome. If in question, preoperative respiratory function should be assessed, as reconstruction of the abdominal wall can compromise vital capacity. Patients with actively infected wounds or systemic infections are poor candidates for reconstruction with prosthetic materials. Some of the most important concepts that a surgeon should consider before embarking on an abdominal wall reconstructive procedure with prosthetic materials are listed in Box 1.

The timing of reconstruction depends on several factors. Bowel edema, gross contamination, or patient instability may preclude definitive abdominal wall reconstruction. Wound preparation and control of infection are two key principles for successful reconstruction of the abdominal wall. If a patient has a contaminated wound with necrotic tissue present, irrigation and debridement should be the first line of therapy. Once adequate debridement is performed, wound coverage with occlusive dressings, vacuum-assisted wound closure devices (VAC), absorbable prosthetic material, or a prosthetic patch may be a temporizing solution. This method of delayed wound coverage allows for sta-

***Box 1:* Factors significant for abdominal wall reconstruction**

Establish diagnosis
Patient peri-operative condition
Define the anatomy/define the defect
Knowledge of prosthetics/bioprosthetics
Indications/limitations of prosthetics/bioprosthetics
Wound preparation
Control of infection
Technical competence
Pathophysiology of foreign body reaction
Management of complications or prosthetic-related complications