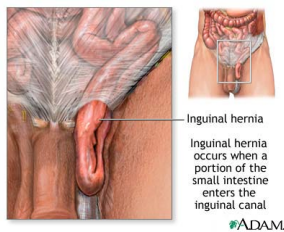


Polypropylene Meshes Used to Prevent Abdominal Herniation

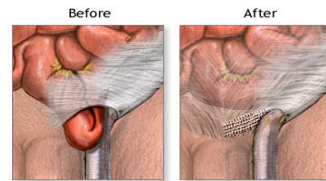
Chelsae Meier-Biomedical Engineering-University of Rhode Island

A hernia can be described as an occurrence of contents of a body cavity bulging from an area where they are normally contained. Hernias most often occur in the lower torso but commonly take places in other areas. However in the case of an abdominal hernia, the “bulging” contents contain portions of intestine or abdominal fatty tissue. A thin membrane encloses these portions which naturally line the inside of the cavity. An increasing risk (a range of 10 – 20%) associated with abdominal surgery is a weakness, separation, gap or opening in the muscles or supporting wall in the region of a prior surgical incision known as an incisional hernia. Pain and discomfort may result from nerves in the affected area which are irritated or stretched while the surrounding tissue is also stretched. In the most traumatic cases, the intestine may become trapped within the hernia and could lead to intestinal blockage or damage.



Most hernias are repaired with a synthetic mesh. The use of this material reduces tension at the wound and usually prevents recurrence. It must be taken as a precaution that the pressures which originally led to the hernia are still present. Implantation of synthetic meshes could cause serious adhesions between the material and the organs surrounding the affected area. These meshes are implanted in an open procedure or, with increasing frequency, a laparoscopic procedure. The majority of the meshes used in hernia repair are made of knitted polypropylene fibers because it is strong, chemically stable and highly hydrophobic (tends to repel and not absorb water). The underlying problem with the design of these meshes is the fact that they are not made for interaction of adjacent cells or tissues. An ideal mesh for hernia repair would have to show integration with the tissue of the abdominal wall but have no adhesions of any kind to surrounding organs.

The frequent reoccurrence in hernia repair using synthetic meshes can be blamed on the fact that the mesh may be too hydrophobic. Due to the high frequency of adhesions on the visceral side of the mesh, it was hypothesized that if the mesh was coated with a collagen, there would be less visceral adhesions. A team of researchers decided to coat a commercial PP mesh (Prolene®, Ethicon, Johnson & Johnson,



Somerville, NJ, USA) with an adherent hydrophilic (tending to dissolve in, mix with, or be wetted by water) copolymer. This material was created using NVP (N-vinylpyrrolidinone) and BMA (N-butylmethacrylate). Based on previous experiments, it was easy to choose these copolymers because they feature great biocompatibility with blood, bone, etc. This first proposed material was compared with an uncoated Prolene® and a coated Proceed® mesh.

Rats were used as models to implant such meshes and were monitored for several days. On day 7 and day 30, healing and inflammation was observed. The uncoated Prolene® invoked inflammatory response but a higher inflammatory response was seen in that of the Proceed® meshes. Initially the NVP/BMA-coated Prolene® meshes had a strong inflammatory response, but at the 30 day observation, the reaction had lowered to that of a mild response. Both Prolene® meshes had lower adhesion scores on day 7 than those of the Proceed® meshes, but by day 30 Prolene® meshes had dropped even more significantly. Proceed® meshes only rose in adhesion scores and were predicted to climb.

Resuturing hernias have become less common among doctor referrals and the amount of patients that receive mesh implantations have sky rocketed. The NVP/BMA-coated Prolene® meshes had improving adhesion scores and lowering inflammation responses and the hydrophilic surface played a significant role in prevention of bacterial infection. Long term observations will continue on this experiment.

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