

# The use of Polypropylene for Abdominal Wall Hernia Repair

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## PROVEN CLINICAL RESULTS



### Long-term Complications Associated With Prosthetic Repair of Incisional Hernias

*Archives of Surgery/ VOL 133, April 1998*

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**Objective:** To determine whether the type of prosthetic material and technique of placement influenced long term complications after repair of incisional hernias.

**Study Design:** 200 patients undergoing open repair of abdominal incisional hernias with prosthetic material between 1985 and 1994.

Four types of prosthetic material were used and placed either as an onlay, underlay, sandwich or finger interdigitation technique. The materials were monofilamented polypropylene mesh (Marlex, Davol Inc), double filamented mesh (Prolene, Ethicon Inc), expanded polytetrafluoroethylene patch (Gore\_Tex, WL Gore & Associates) or multifilamented polyester mesh (Mersilene, Ethicon Inc).

The incidence of recurrence and complications such as enterocutaneous fistula,

bowel obstruction, and infection with each type of material and technique were compared with univariate and multivariate analysis.

### Key Findings:

On univariate analysis, multifilamented polyester mesh had a significantly higher mean number of complications per patient, a higher incidence of fistula formation, a greater number infections, and more recurrent hernias than the other materials used.

The additional mean length of stay to treat complications was also significantly longer (30 vs 3-7 days) when polyester mesh was used. The deleterious effect of polyester mesh on long-term complications was confirmed on multiple logistic regression.

**Conclusion:** "Polyester mesh should no longer be used for incisional hernia repair."



### Strength of tissue attachment to mesh after ventral hernia repair with synthetic composite mesh in a porcine model

*Surgical Endoscopy (2006) 20:1671-1674*

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**Objective:** Our objective was to measure the strength of the abdominal wall-polypropylene interface at various time points after repair with a composite prosthetic mesh affixed with a tacking device only.

A prospective animal study involving 12 female swine aimed to measure the strength of tissue attachment to composite mesh at various time points after laparoscopic ventral hernia repair in a porcine.

**Study Design:** Each animal had two 10 x 16cm sheets of polypropylene/expanded polytetrafluoroethylene (ePTFE) composite mesh laparoscopically affixed to the abdominal wall with a helical tacking device. No transfascial sutures were used. The animals were euthanised 2, 4, 6, and 12 weeks after surgery, and abdominal walls were resected en-bloc with the patches. Each patch was cut into 2 · 7cm strips, and each strip was independently analysed. The strength of the tissue attachment to the mesh was measured using a servohydraulic tensile testing frame. The abdominal wall was peeled from the mesh, and the transverse, or "lap-shear" force was recorded. Data are reported as mean force in pounds.

**Conclusion:** "The findings demonstrate that the majority of tissue ingrowth and strength has occurred by 2 weeks after laparoscopic placement of a composite hernia prosthesis. Strength very gradually increases until 12 weeks after surgery."

### Key Findings:

The mean lap-shear force was:

0.83 ± 0.06 lbs at 2 weeks,

1.06 ± 0.07 lbs at 4 weeks,

0.88 ± 0.08 lbs at 6 weeks, and

1.13 ± 0.07 lbs at 12 weeks.

The mean force was higher at 12 weeks than at 2 weeks (p < 0.05). No other periods were significantly different from any Other.

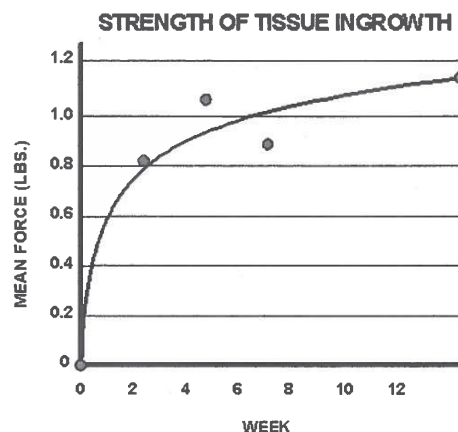


Fig. 2. Logarithmic regression curve of mean force of lap-shear strength as a function of time. 74% of the 12 week strength is achieved by 2 weeks post-operatively.

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### Polymers In Hernia Repair – common polyester vs polypropylene surgical meshes

*Journal of Materials Science 35 (2000) 4769 - 4776*

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**Background:** Within the last years, meshes have become essential for the repair of the abdominal wall hernias. While the type of mesh obviously influences the clinical result, the selection of the best suitable mesh-modification should have favourable effects onto the rate of complications. The most common meshes are made either of monofilament polypropylene (PP) or multifilament polyester (PET).

**Study Design:** In the following contribution with studied the functional and histological results of standard and commercially available surgical meshes : a standard heavyweight, large pore-sized PP-mesh (Prolene, Ethicon), a heavyweight, large pore-sized PET-mesh (Parietex, Congent coated with bovine collagen) and a low-weight small pore-sized PET-mesh (Mersilene, Ethicon) in a standardised rat model.

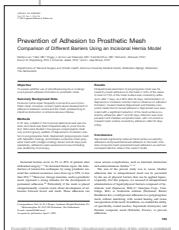
The meshes are studied by three dimensional stereography, tensiometry, light (LM) and transmission electron microscopy (TEM), as well as morphometry over implantation intervals of 3, 7, 14, 21 and 90 days.

#### Key Findings:

The results proved marked differences between the tested meshes in regard to textile properties, the mechanical function (tensile strength, abdominal wall mobility), as well as the histological proved tissue reaction.

Both heavyweight meshes (PP and PET) revealed an enormous and most similar strength whereas the low weight PET mesh showed a considerable increase of flexibility. However, the local tissue response of the interface mesh/recipient tissues revealed a significant reduction of the acute inflammatory activity and a significant decrease of connective tissue formation in the case of the low weight PET-mesh.

**Conclusion:** “Modifications of the mesh-structures (e.g. larger pores) should improve the functional results, in particular, abdominal wall flexibility. The use of PET in hernia surgery is at least questionable in respect to the obligate long-term degradation of this polymer.”



### Prevention of Adhesion to Prosthetic Mesh – Comparison of Different Barriers Using an Incisional Hernia Model

*Annals of surgery January 2003: 237: 123-128*

*Martijne van't Reit et al.*

**Objective:** To assess whether use of anti-adhesive liquids or coatings could prevent adhesion formation to prosthetic mesh.

**Study Design:** In 91 rats, mesh was placed intraperitoneally to cover a defect made in the muscular abdominal wall and divided into 5 mesh groups. The meshes placed were polypropylene mesh only (control group), addition of Sepracoat, Genzyme or Icodextrin solution, Baxter Healthcare to polypropylene mesh, SEPRAMESH™ polypropylene mesh with carboxymethylcellulose-sodium hyaluronate coating, and polyester mesh with collagen-polyethylene glycol-glycerol coating (Sofradim Parietex composite). At 7 and 30 days postoperative adhesions and incorporation were assessed and wound healing was studied by microscopy.

#### Key Findings:

##### Adhesion Coverage:

“When SEPRAMESH™ was used, a significant reduction in the mean percentage of mesh surface covered by adhesions was found after 7 days (55% vs 74%,  $P = .01$ ), as well as after 30 days (25% vs 48%,  $P = .03$ ), compared to the control group.”

“In addition, none of the animals with SEPRAMESH™ developed adhesions between bowel and the mesh compared to 57% of the animals with polypropylene mesh ( $P = .04$ ).

With Parietex composite mesh, there was no bowel adhesions to the mesh either ( $P = .04$ ), however, the percentage of mesh surface covered by adhesions was higher in the Parietex composite group (78%) than in the control group (48%,  $P = .03$ ).”

#### Inflammatory Response:

SEPRAMESH™ resulted in inflammation response comparable to all groups (grade 2) on the inflammation grading scale. However, in the Parietex composite group a more severe inflammatory response was found (grade 3) on the inflammation grading scale.

**Conclusion:** “SEPRAMESH™ significantly reduced mesh surface covered by adhesions and prevented bowel adhesion to the mesh. Parietex composite mesh prevented bowel adhesions as well but increased infection rates in the current model.”

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