

Evaluation of intraperitoneal placement of absorbable and nonabsorbable barrier coated mesh secured with fibrin sealant in a New Zealand white rabbit model.

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Abstract:

BACKGROUND: This study aimed to evaluate the acute and chronic fixation strength of fibrin sealant (FS) as an alternative method of fixation for laparoscopic ventral hernia repair (LVHR).

METHODS: Representative mesh types for LVHR included one nonabsorbable barrier mesh (Composix) and three absorbable barrier meshes (Sepramesh, Proceed, and Parietex composite). Macroporous polypropylene mesh (Prolite Ultra) served as the control mesh. Three methods of fixation were used, namely, 0-polypropylene suture+FS (ARTISS 4 IU), FS alone (ARTISS), and tacks alone, to secure 3x4-cm pieces of mesh (10 of each combination) to the peritoneal surface of New Zealand white rabbit abdominal wall. After 2 h of incubation at 37 degreeC, specimens underwent acute testing. Subsequently, a chronic phase was completed using the aforementioned fixation methods (10 of each combination), in which two 4x4-cm pieces of mesh were secured intraperitoneally in each of 75 New Zealand white rabbits, which survived 8 weeks until they were sacrificed. A transparent grid overlay was used to measure the mesh and adhesion area. Adhesion tenacity was characterized using the Garrard adhesion scale. In both the acute and chronic samples, a 3x3-cm area of mesh-tissue interface underwent lap shear testing at a rate of 0.42 mm/s using a tensiometer (Instron 5542). The maximum load sustained by the mesh-tissue construct was recorded as the acute fixation strength in newtons (N). Data are given as means+/-standard error of the mean. Statistical significance ($p<0.05$) was determined using a one-way analysis of variance

(ANOVA) with Fisher's least significant difference (LSD) posttest or a nonparametric Kruskal-Wallis test (adhesion scores).

RESULTS: The acute fixation strength was significantly greater for all the meshes secured with either suture+FS or tacks alone than for FS alone ($p<0.001$ for all comparisons). All the meshes except Proceed demonstrated greater acute fixation strength with suture+FS than with tacks alone ($p\leq 0.016$). Composix achieved greater acute fixation with suture+FS than all the other meshes ($p\leq 0.022$). Acute fixation with suture + FS was greater for Parietex Composite and ProLite Ultra than for Proceed ($p\leq 0.015$). When the animals were sacrificed, 48 of 50 meshes fixed with FS alone were insufficiently affixed to the abdominal wall, which may have resulted in hernia recurrence in a hernia model. The chronic fixation strength was greater for all the mesh types with either suture+FS or tacks only than with FS alone ($p\leq 0.0005$). The chronic fixation strength was greater with suture+FS than with tacks for Proceed and ProLite Ultra ($p\leq 0.013$). Neither mesh area nor adhesion tenacity differed significantly with any mesh/fixation method combination.

CONCLUSIONS: In a chronic rabbit model of LVHR, fixation strength with FS alone was inadequate for selected nonabsorbable and absorbable barrier-coated meshes. The acute and chronic fixation strengths of suture+FS were equivalent or superior to the fixation strength of tacks alone. Using a combination of suture and FS for mesh fixation in LVHR may provide adequate fixation while decreasing postoperative pain due to spiral titanium tacks. In this preclinical series, mesh secured to the peritoneal surface by FS alone may have led to early recurrence.