Reduction of Suture-Associated Inflammation using the Novel Biocompatible Pseudo-Protein Poly Ester Amide (PEA)

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Abstract

Background: Despite their routine use, surgical sutures are foreign bodies that induce a local immune reaction within adjacent tissue, the consequences of which include wound breakdown, “spitting,” and abscess formation. We have developed a novel pseudo-protein, Polyester amide (PEA), with the potential to modulate the immune response to implantable medical devices. We hypothesized that PEA-coating would reduce the immune response to typically inflammatory suture materials.

Methods: 28 C57BL/6 mice underwent suture implantation in the bilateral gluteal muscles: PEA (polymer 8-Phe-4)-coated suture was implanted in the right gluteal muscle, and non-coated, control suture was implanted in the left. Silk suture was used in half the mice, while plain-gut was used in the other half. Animals were sacrificed after 3, 7, 14 and 28d and the bilateral gluteal muscles were harvested and processed for histology. Serial sections were taken along the axis of the suture track and stained with Hematoxylin & Eosin. The area of inflammation surrounding each suture was quantified and compared between groups.

Results: PEA-coated sutures resulted in lower mean areas of inflammation than non-coated silk or plain-gut sutures at all time points. Furthermore, PEA-coated silk sutures resulted in a significantly decreased mean area of inflammation after 7 and 28d compared with non-coated silk controls ($686,897\mu m^2 \pm 99,646\mu m^2$ v. $2,095,447\mu m^2 \pm 385,461\mu m^2$, $p<0.002$ and $157,585\mu m^2 \pm 25,422\mu m^2$ v. $272,230\mu m^2 \pm 40,156\mu m^2$, $p<0.03$, respectively). PEA-coated plain-gut suture resulted in a similar significant decrease in local inflammation at 14d ($446,322 \pm 359,359\mu m^2$ v. $2,502,000\mu m^2 \pm 462,461\mu m^2$, $p<0.005$).

Conclusions: PEA-coating significantly decreases the immune response to plain-gut and silk sutures, materials typically associated with a robust inflammatory reaction. This reduction could potentially translate to a decrease in patient morbidity including hypertrophic scarring and granuloma formation. Although further study following longer time courses of implantation are warranted prior to clinical use, suture modification via PEA-coating may be an important means to improve the biocompatibility of next-generation sutures.

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