Multiple Amino Acid Biodegradable Poly Ester-Amide (PEA) Polymer Coating Significantly Reduces Inflammation Associated with Suture Implantation

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Background: Although ubiquitous and irreplaceable in the practice of surgery, sutures themselves can cause morbidity. The inflammatory reaction that is elicited via the foreign body implantation can lead to complications such as suture “spitting”, abscess formation, keloids, hypertrophic scarring, and granuloma formation. We have developed a novel [2-Arg-4]-[2-Phe-4] Poly Ester-Amide (Arg-Phe-PEA) coating, a biocompatible molecule shown previously to reduce the inflammatory reaction to certain implanted devices. We thus hypothesized that this material would decrease the inflammation associated with Silk and Plain-gut sutures, two of the more “reactive” sutures available.

Methods: 32 C57BL/6 mice underwent Silk or Plain-gut suture implantation in bilateral gluteal muscles: Arg-Phe-PEA coated in the right and non-coated, control suture in the left. Animals were sacrificed after 3, 7, 14 and 28 days. Gluteal muscles were harvested and processed for histology. The area of inflammation surrounding each suture was quantified and compared between experimental groups and controls at each time point.

Results: Both Silk and Plain-gut Arg-Phe-PEA coated sutures showed consistent reduction of inflammation from their controls. Statistically significant percent reduction of inflammation was present at 3 days (61.3%+/-18.7, p=0.0051), 7 days (44.7%+/-9.4, p=0.0003), and 28 days (38.3%+/-13.5, p=0.0126) for Silk Arg-Phe-PEA coated sutures and at 7 days (55.0%+/-15.6, p=0.0030), 14 days (46.0%+/-9.3, p=0.0002) and 28 days (59.0%+/-15.8, p=0.0020) for Plain-gut Arg-Phe-PEA coated sutures. When compared to our previously investigated 8-Phe-4 Poly Ester-Amide (Phe-PEA) polymer, both PEA coatings showed similar percent reduction of inflammation from their respective controls.

Conclusions: Our novel multiple amino acid Arg-Phe PEA coating proves to significantly decrease the local immune response to typically inflammatory Plain-gut and Silk sutures. The reduction in inflammation induced by Arg-Phe-PEA was not different than that seen with our previously described Phe-PEA coating. This leads us to believe that the number of amino acids used in the production of PEA coatings is not as important as their presence, which seems to be sufficient to increase the biocompatibility of sutures. Although further studies are warranted before clinical application is possible, the Arg-Phe-PEA coating is a simple, inexpensive and promising means of decreasing complications that are associated with suture induced inflammation.

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