Fabrication of a Radiopaque Resorbable Polymer for Medical Device Development

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Resorbable medical devices are advantageous because they are there when you need them and then degrades into biologically safe byproducts when it is not. One application of resorbable medical device development is on pulmonary embolism (PE). PE affects about 10 million individuals per year worldwide. Resorbable inferior vena cava filters (IVCFs) were developed to prevent PE and to eliminate the need for retrieval. However, resorbable IVCFs are limited by radiolucency. Therefore, the objective of my study was to create radiopaque resorbable IVCFs for routine imaging. I hypothesize that by incorporating image enhancers made up of nanoparticles into the resorbable polymers, a radiopaque resorbable IVCFs can be created. IVCFs were fabricated by hand using poly-p-dioxanone (PPDO) sutures, braided using cork and nails. Synthesized gadolinium nanoparticles (GdNPs) with size of 35.76±3.71 nm were infused within PPDO. No significant difference between PPDO and GdNP-infused PPDO (PPDO-Gd) in terms of melting temperature (103.32-105.90°C, P>0.05) and load-at-break (4.39-5.38 kg, P>0.05). Micro-computed tomography (CT) showed that PPDO-Gd had radiopacity of 2,713±105 HU; while PPDO had -130±38 HU. PPDO-Gd showed gradual decrease in radiopacity over 6 weeks. There was no evidence of hemolysis or in vitro cellular toxicity between groups. The IVCFs were effective in capturing clots in vitro and CT imaging showed enhanced radiopacity. In conclusion, a novel radiopaque, resorbable IVCF made up of PPDO infused with GdNP was successfully fabricated. The addition of GdNPs improved the radiopacity without untoward effects on device mechanical strength, clot trapping efficacy, and cellular toxicity. Fabricated GdNP-infused PPDO allows for routine monitoring of absorbable IVCFs.

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