Abdominal Aortic Aneurysm Response to Interleukin-10 Hydrogel-Based "Bio-Ink" Therapy in Rodent Models

Olivia Jimenez[1], Theresa Doiron[2], Stone Chen[1], Ali Sualeh[1], Jennifer Stashevsky[2], Mackenzie Madison[2], Chang-Hyundai Gil[2], Nicanor Moldovan[2], Steve Miller[2], Michael Murphy[2]

[1] Indiana University School of Medicine; [2] Department of Surgery, Indiana University School of Medicine

Abdominal Aortic Aneurysms (AAA) are the pathological expansion of the aorta, which can rupture and cause significant mortality. Approximately 200,000 AAA cases occur annually in the US, with more than 15,000 cases resulting in death. Risk factors for AAA are similar to those of cardiovascular disease states, particularly cigarette smoking, and AAA patients are generally elderly, Caucasian males. Currently, no medical therapy exists for AAA outside of surgical intervention. We previously hypothesized that the early initiation and propagation of stages in AAA development are inflammatory driven. This process results in a weaker aortic wall, which we have evidenced through increased elastin breakdown products and inflammatory markers in AAA patients in comparison to matched controls. This project investigated the use of a novel anti-inflammatory hydrogel to ameliorate AAA progression.

Our study uses a gelatin-based biodegradable bio-ink containing the anti-inflammatory cytokine interleukin-10 (IL-10), which was applied to the aorta with a novel hydrogel extruding "BIOPENCIL" device. We used a previously described rodent model consisting of intra-luminal injection of elastase in the infrarenal aorta combined with topical application of calcium chloride; alternatively, topical calcium chloride was used alone for AAA development. The BIOPENCIL was used to deliver the hydrogel containing IL-10 or control at the time of AAA creation. The animals were euthanized 14 or 21 days post-procedure and evaluated for AAA volume, surface area, and diameter alongside molecular analyses to evaluate for immunological changes between control and treatment groups. We predict that the rodent groups treated with IL-10 will not have AAA expansion, while the control group will see AAA expansion. This is based on longitudinal data from weekly ultrasounds and will be confirmed with microCT.