Improved Canine Surgical Model for an Implantable Hemofilter

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Background:

Patients with end-stage renal disease have high mortality and morbidity rates on dialysis. Transplantation offers the best treatment option; however, donor kidneys are in short supply. An artificial kidney using silicon nanoporous membranes is in development to address this problem. The objective of these experiments was to determine a reproducible surgical model to continue pre-clinical evaluations.

Methods:

Our Institutional Animal Care and Use Committee approved the operative protocol for hemofilter placement in Class A canines. A laparotomy incision is made to enter the peritoneal cavity. Intravenous heparin is administered to achieve adequate levels of anticoagulation during the operation. The abdominal viscera is medially rotated to expose the left retroperitoneum. The aorta and inferior vena cava (IVC) are dissected free of tissue. Seven millimeter, ringed, Polytetrafluroethylene (PTFE) grafts are used to create the venous and arterial anastomosis to the IVC and aorta, respectively (graft length 2.5–3.0 centimeters). The arterial inflow and venous outflow PTFE grafts are connected to the hemofilter. Blood flow is established through the hemofilter. The hemofilter is secured to the psoas muscle adjacent to the inferior pole of the left kidney. Effluent reservoir bags that collect filtered fluid from across each membrane are placed in the abdomen. The midline incision is re-approximated. The canine receives 3 mg/kg of acetylsalicylic acid per day post-operatively.

Results:

The surgical approach and post-operative anti-platelet therapy described above has been implemented successfully in five experiments. There have been no complications or thrombosis formation. The experiments have averaged 9 days.

Conclusion:

These experiments highlight a successful and reproducible surgical model, as well as the efficacy and safety of post-operative anti-platelet therapy strengthening the foundation for further preclinical experiments aimed towards the future realization of an implantable artificial kidney.