of the ipsilateral and contralateral ACA branches, posterior cerebral arteries, and contralateral MCA.

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Abstract P-002 Figure 1  A) microCT of Onyx 18 (18 cSt), showing shallow penetration into the 4th layer. B) microCT of the 10.7 cSt formulation showing penetration deep into the 6th layer. C) median and range of penetration for each formulation

REFERENCE

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Introduction  Currently available Liquid Embolic Materials (LEMs) have limitations of potential catheter entrapment or the cytotoxicity related to the use of organic solvents (e.g., Dimethyl Sulfoxide (DMSO)). Aqua Embolic System (AES) is a
new LEM mainly composed of multiple polysaccharides. When injected via a microcatheter, AES immediately forms a solid and elastic hydrogel cast upon exposure to Ca2+ in the blood vessel. AES does not require organic solvent, e.g., DMSO, does not cause catheter entrapment, and can be delivered using a 0.013 ID microcatheter system. The efficacy of AES was evaluated using an established AVM model utilizing swine rete-mirabile.

Methods Under general anesthesia, the left ascending pharyngeal artery (APA) of Yorkshire swine (40 kg) was catheterized using a microcatheter, and AES was slowly injected into the rete-mirabile under fluoroscopy. The follow-up angiogram was performed 2, 4, 12 weeks after the implantation, and angiographic and histologic assessments were performed. Onyx 18 was used as the control.

Results 9 left rete-mirabile in 9 swine were treated (6=AES & 3=Onyx 18), and all arteries were completely occluded without technical complications. During the pilot study (preliminary study), the AES’s superior tissue penetration and distal migration into the intracranial vessels (passing the retemirabile) was concerned; therefore, a balloon microcatheter was used to control the penetration level. The injected AES immediately formed the hydrogel cast in all treated vessels, followed by the reflux over the microcatheter. All catheters were withdrawn without any sign of catheter entrapment. The follow-up angiogram and histologic evaluation showed complete occlusion of the treated vessels in all 9 animals.

Conclusions AES, which is a DMSO-free, non-adhesive water-based LEM, may be used as an embolic material for the neuro-interventional treatment.

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Super Pump AR (ViVitro Labs). A data acquisition system with LabVIEW® software recorded real-time pressure waveforms and flow rates, mean arterial pressures and flows through each inlet and outlet branch of the models. The flow model also included an introducer for microcatheter and device delivery access. Models were used to recreate aneurysms and ischemic stroke events, verify computational fluid dynamics (CFD) simulations of fractional pressure ratios with real time pressure and flow data, assess the effectiveness of aneurysm treatment, and evaluate local flow arrest induced by aspiration catheters.

Results The CW models were able to be successfully 3D-printed with relevant mechanical properties and accurate anatomical parameters. Flow conditions were also found to be physiologically relevant. The comprehensive flow model was used to assess a liquid embolic agent for aneurysm occlusion and the local flow arrest of multiple aspiration catheters along with other novel or under-development microcatheter devices. Flow data from 3D printed vessel segments were also used to verify CFD fractional pressure ratios from stenosis.

Conclusion The assessments of medical devices using this comprehensive flow model have shown that in-vitro modeling could advance to a level that reduces the time and cost of medical device development and needed before FDA approval. To achieve this goal, future projects include: development of an in-line sterilization section, implementation of an in-line particle counting system, and development of new models, conditions/anatomies, and events such as delayed aneurysm rupture. This comprehensive flow model can also enable surgeons to train on new technologies and techniques and to serve as an experimental model for CFD verification.

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