Fabrication of aneurysm biomodel using 3D printing technology

Jamil Ahmad Hisam[a], Muhamad Yusof Salehudin[a], Muhammad Ismaill Mat Lizah[a], Muhammad Izzat Ahmad Suhaimi[a], Muhammad Haqim Muhammad Hisham[a], Ismayuzri Ishak[a] & Mohd Jamil Mohamed Mokhtarudin[a,b]

[a] Faculty of Manufacturing and Mechatronic Engineering Technology, Universiti Malaysia Pahang, Pahang, Pekan, 26600, Malaysia

[b] Centre for Research in Advanced Fluid and Processes (Fluid Centre), Universiti Malaysia Pahang, Lebuhraya Tun Razak, Pahang, Kuantan, 26300, Malaysia

ABSTRACT

Performing endovascular treatment requires highly skilled surgeons to avoid surgical errors. The development of an in vitro training tool for endovascular treatment is essential and requires the development of an artificial blood vessel or a biomodel. In this project, an aneurysm biomodel is fabricated using 3D printing technology. Firstly, an idealized saccular-type aneurysm geometry is developed. Then, a mould is fabricated using 3D printing following the geometry. The biomodel must be transparent and hollow to ease the visualization while performing fluid flow experiment. In order to fabricate this, the lost core method is used. The mould core is fabricated using poly-vinyl alcohol (PVA), which can easily be dissolved when soaked in water. Meanwhile, other parts of the mould are fabricated using poly-lactic acid (PLA). Then, an agar–water mixture is used to make the biomodel by pouring into the mould and then froze at 0 °C for 30 min. The biomodel produced has about 5% shrinkage from the original geometry. In addition, the biomodel fabricated is flexible but is easily teared depending on the agar–water ratio used, which prevents it from being used for the in vitro experiment. Improvement of the biomodel materials could overcome the limitations from the current technique.

KEYWORDS

3D printing; Aneurysm; Biomodel

ACKNOWLEDGEMENTS

This research is funded by the Universiti Malaysia Pahang Prototype Development Grant (PDU213212).