H87 A Very Affordable Postmortem Computed Tomography (PMCT) Angiography Kit: A Feasibility Study Using an Immersion Pump and 3D-Printed Parts

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Learning Overview: After attending the presentation, attendees will better understand that it is not difficult to assemble all parts required for PMCT angiography (PMCTA) using parts from a normal hardware store and from pre-designed 3D models that they can get 3D-printed or print themselves.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by introducing a very low cost PMCTA kit (except contrast agent).

Introduction: A frequent objection to using PMCTA is the associated extreme costs. In that context, this study has not only identified a small immersion pump to be very affordable, but found it to also achieve better vascular filling than a heart lung machine. Using that pump as the core item, this study developed a PMCTA kit containing all materials needed (with the exception of contrast agent admixture).

Methods and Materials: This study developed a parts list made of items available at hardware stores and built the remaining items using 3D design and 3D printing. The kit contains a pump as well as a variable power supply. It contains a silicone tube to attach to a small immersion pump. The tube is fixed to the pump by use of a press-fit cylinder. The tube, at its other end, attaches to a femoral catheter. To make a distinction between the venous and arterial access line easier, red and blue colors may be used for 3D printing. The silicone tube and attached pump are kept in place with a spring clamp and a 3D-printed tube clamp fixture that allows for fast tube slide-in or slide-out. Last but not least, the kit contains two vascular tourniquet sets containing a stylet, an occlusion tube, and a quick-release clamp. These are required to fix the femoral catheter, once in position, to the femoral vessel into which it is inserted. The femoral catheter model appeared to be particularly difficult to design for flawless 3D printing using a standard PLA printer. This study employed Finite Element Analysis (FEM) to examine design issues in relation to repeatedly experienced breaks of earlier models. The kit was tested in an adult PMCTA. Its total cost is around 120 Swiss Francs (CHF) for all devices and parts and 170 CHF if a durable case is included.

Results: Vascular filling of the arteries contained scalp arteries; excellent filling also of intracranial arteries and upper extremities past the elbow. Vascular filling of the veins extends also past the Torcular herophili with a full staining of the superior sagittal sinus. Images will be presented.

Virtopsy, Postmortem CT Angiography, 3D Printing