Team 20 Abstract

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Pediatric septic hip arthritis is an infection in the synovial fluid and joint tissue of the hip in children. This is an uncommon infection in children which carries a poor prognosis if not properly diagnosed and treated in a timely fashion. Currently, the most accurate and specific diagnostic test for this infection is a needle aspiration. However, due to the rareness of this infection only a very limited number of physicians receive training in ultrasound guided needle aspiration. In order to make the practice of aspirating a suspected septic hip in the emergency room more widespread, more accessible, and increasingly accurate, training tools need to be developed. Our solution was to develop a high fidelity hip aspiration phantom that can endure multiple aspirations with a needle and has realistic ultrasound and anatomical landmarks. The team conducted extensive research to determine the biomaterials to use for each anatomical feature in the phantom. The femur and hemipelvis were 3D printed using PLA, ballistic medical gelatin was used to represent the muscle, an ambu bag was used to create the joint capsule and was filled with water-glycerol solution to mimic the synovial fluid, PTFE tubing and wires used to mimic the blood vessels and nerves, respectively, and agar gel was used to mimic the skin. All these components were assembled together using a 3D printed mold. Preliminary testing was conducted by medical professionals experienced in the procedure to determine the viability of the prototype. The phantom was evaluated based on a number of criteria under physiological accuracy and the realism under ultrasound. The results of the testing determined that the joint capsule was sufficiently reusable for up to 23 punctures without leak, the materials that represented the anatomical features were clearly visualized under ultrasound, and the model in general provided a real tactile feel of the procedure. Medical training phantoms are a powerful teaching tool with an important moral claim: to keep patients safe while training the next generation of clinicians and retraining current clinicians so that they are kept up-to-date. The use of this hip phantom in clinical settings would reduce reliance on the limited number of clinicians present that have training experience, extraction of fluid for diagnostic testing will be performed with increased accuracy, and training would be more widespread and provided for clinicians in various specialities.