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A novel custom-made renal biopsy training model for nephrology fellows

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Case Study: Kidney biopsy is one of the important procedures in the fellowship training of nephrology and significant simulation training is necessary to avoid biopsy-related complications before starting a kidney biopsy for patients. It usually has been limited to trying biopsy devices on fruits such as oranges or bananas, however, most centers apply ultrasound-guided techniques during the renal biopsy procedure, therefore there has been a necessity to practice optimizing appropriate ultrasound imaging and guiding a biopsy needle to target points in real-time ultrasound images. Commercial renal biopsy models have been developed, but they are so expensive that rarely used in Korea, and previously reported custom-made renal biopsy models were hard to be reproduced due to difficulty in preparing materials and complicated construction processes. We applied a custom-made renal biopsy training model with Konjac and soft-boiled chicken or duck eggs to simulate the renal biopsy procedures. The yolk and white of soft-boiled eggs are clearly divided in the grayscale image of ultrasound due to their difference in echogenicity, and they seem like the medulla and cortex of the lower pole in the kidney, respectively (Figure 1). The trainees are instructed to sample only the egg white selectively. The biopsied egg yolk and white are easily distinguished by the naked eye (Figure 2), hence this model is useful to recognize whether the sample is successfully acquired from the target region and enable the trainees to get self-assessment with immediate feedback. Moreover, the materials are easy to access and affordable, and the model is simple to construct and reproduce. Trainees can simulate how to operate biopsy devices, optimize ultrasound imaging, and real-time guide the biopsy needle at the same time. It may help nephrology fellows get familiar with biopsy procedures and become proficient in their skills before beginning renal biopsy in clinical practice.

Figure 1. Grayscale image of ultrasound-guided biopsy simulation for the custom-made model (Arrow (white): white of egg Arrow (yellow): yolk of egg Arrow (black): biopsy needle targeting the white of egg Box: the egg white sampled by the biopsy needle)