

Ultrasound simulator in nephrology- a new method of teaching

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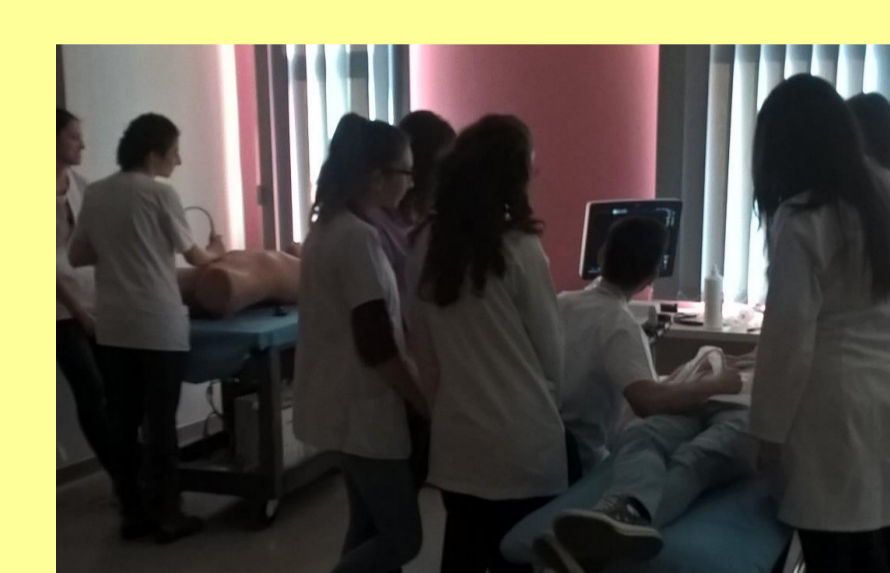
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Objectives:

In our university, students are trained in clinical nephrology on the fifth year of preparation. There are many methods to improve the teaching of the nephrology, but one of them was less studied. Because in this medical specialty, performing ultrasound is mandatory, we started a project for preparing students to perform ultrasound in different kidney pathologies, concomitant with the clinical characteristics of each disease using a simulator. The aim of this study was to increase student's ability to recognize different kidney pathologies.

Methods:

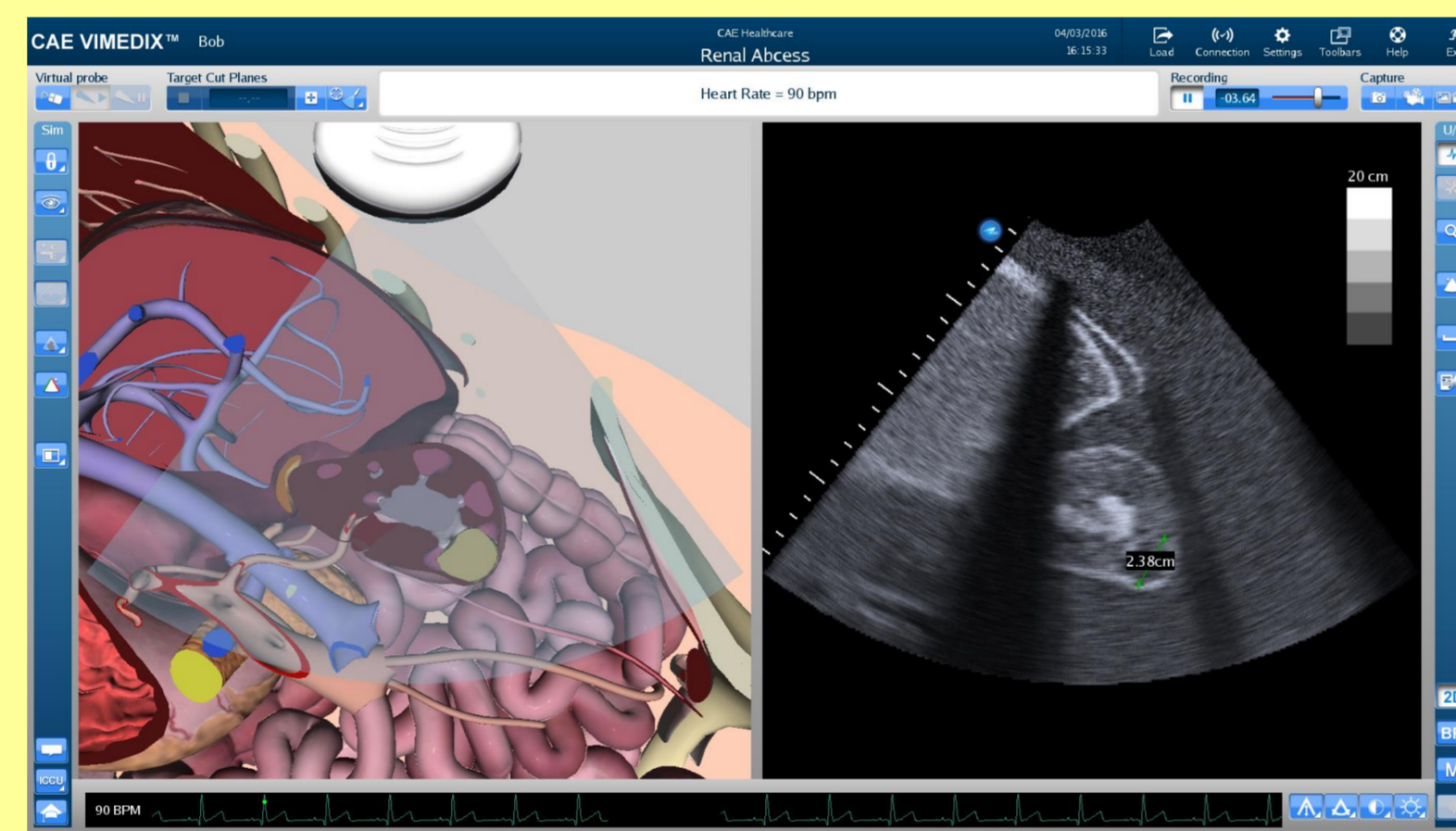
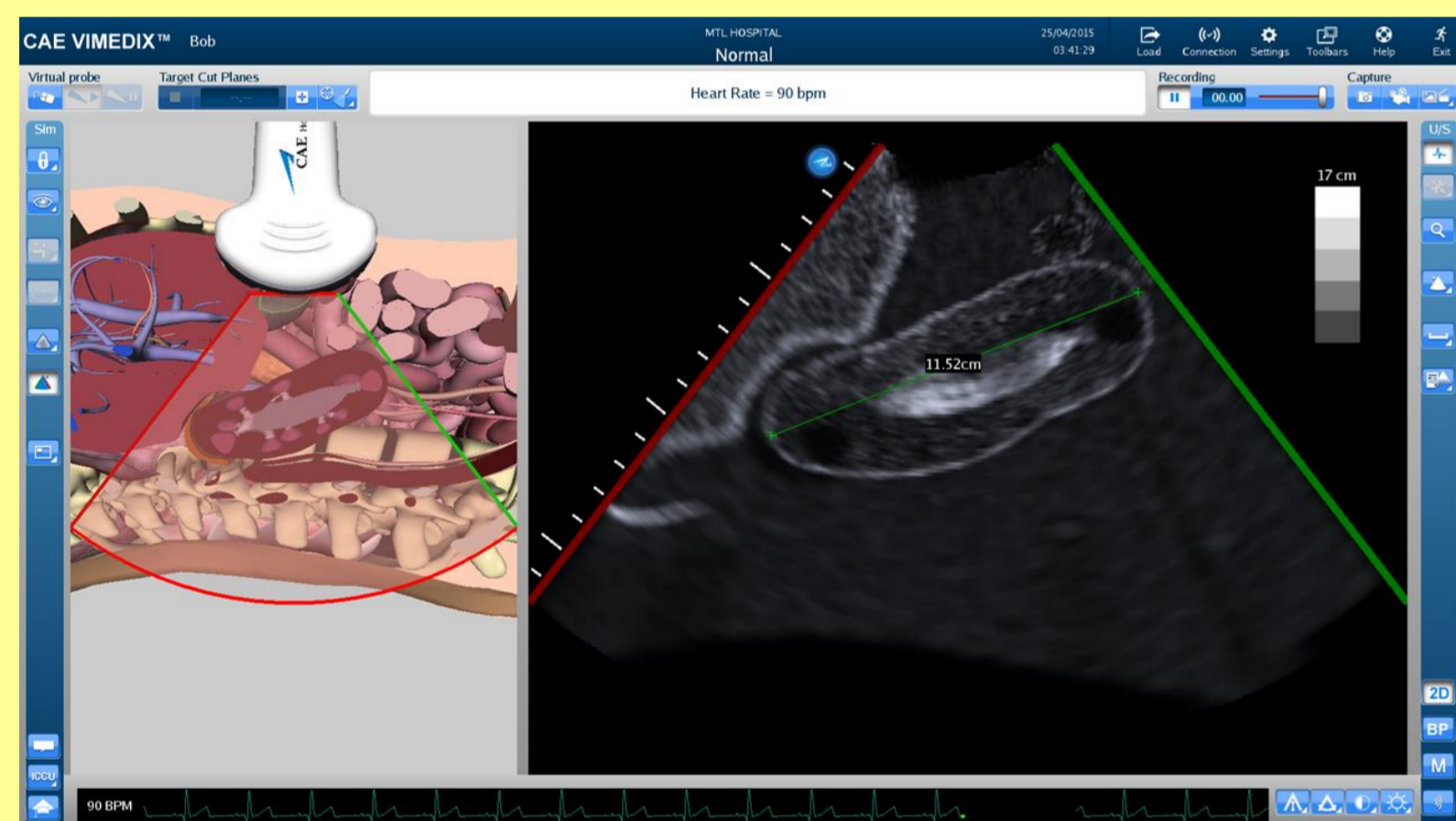
We used an advanced ultrasound simulator (CAE Vimedix, abdominal probe) and an ultrasound machine (GE Logiq P5 with convex probe). 45 voluntary medical students given informed consent to participate in the study. We evaluate the ultrasound knowledge regarding normal kidney (position, length, parenchymal index, cortex, medulla and central echogenicity) and three common kidney pathologies: lithiasis, kidney cysts and tumors. We used a multiple choice *test* MCT before and after the lesson. The lesson consisted in two hours of theoretical case based learning and four hours of US examination on the simulator and real US machine. Both, theoretical and practical preparations were started to the simulator and after that to the real ultrasound machine, who capture most the student's attention.



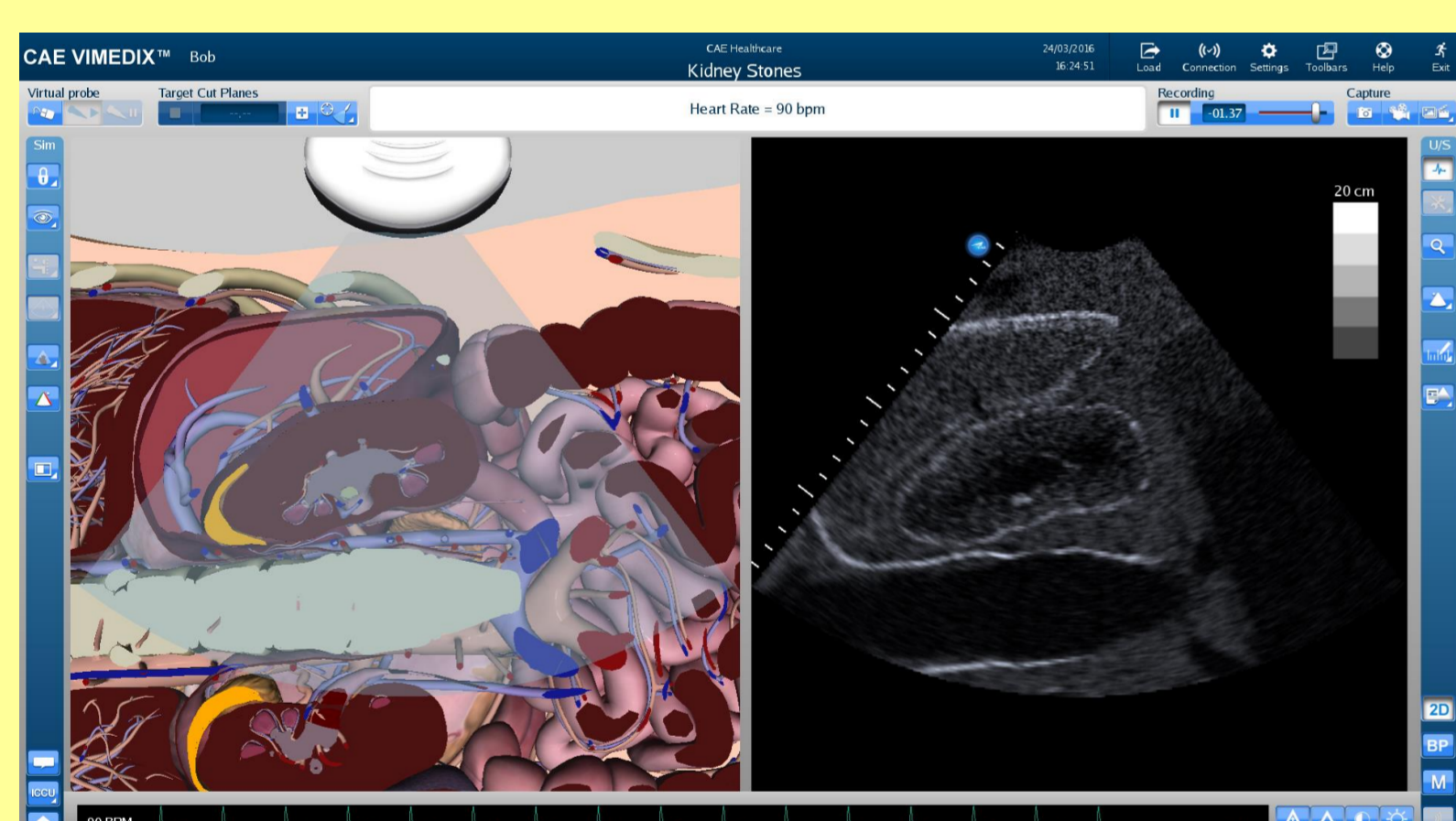
Students from fifth grade practicing at the simulator and real scanning on the ultrasound machine, also available at the Simulation Center. Small groups of 7-14 participants.

Results:

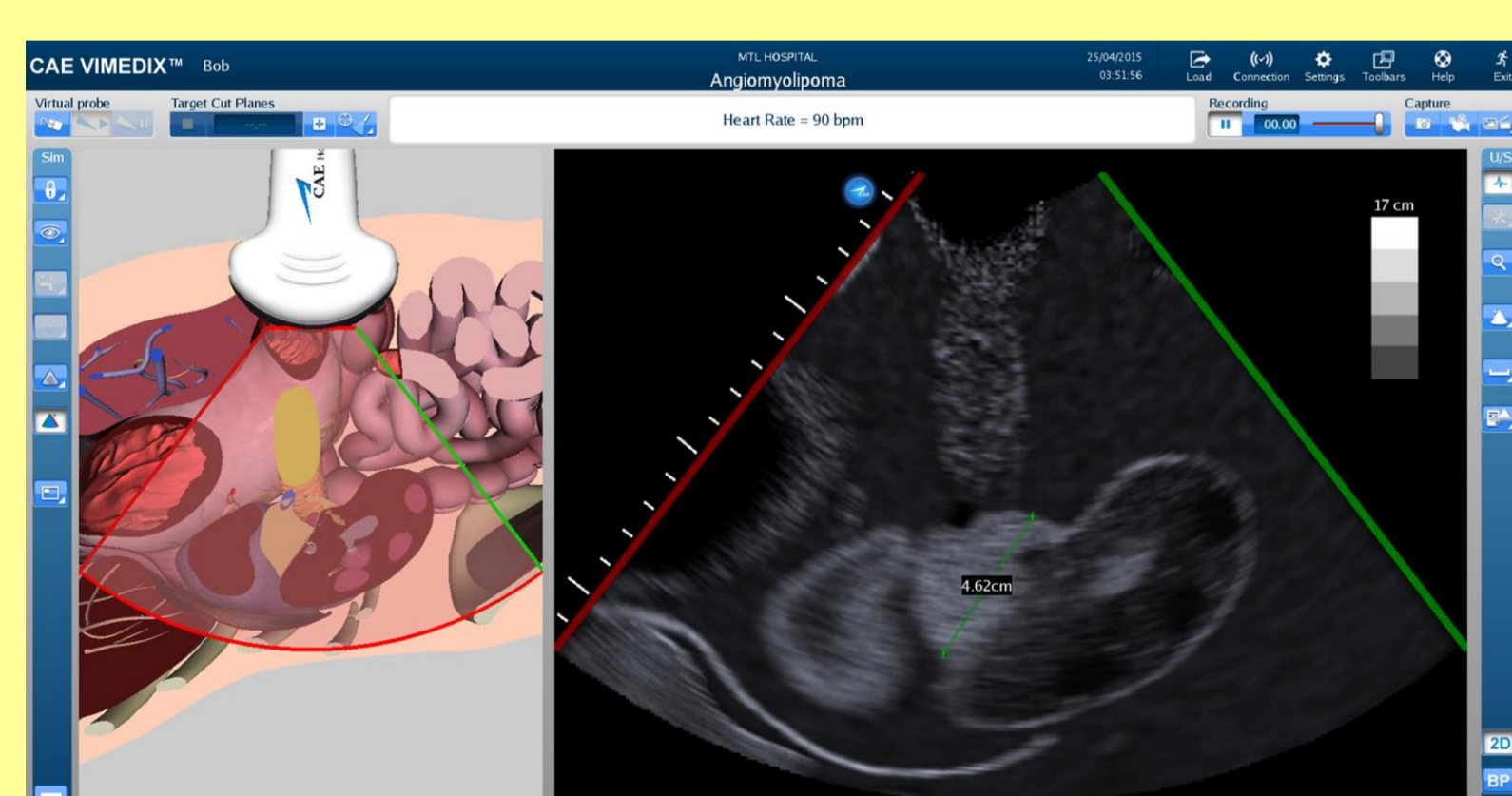
At the beginning test, only 25 (55%) participants were able to recognize the normal renal characteristics and only 13 (28%) of students confirmed the pathology. After the lesson, 42 (93%) ($p=0.03$) recognize normal kidney structures and 44 (97%) ($p=0.02$) recognized all three pathologies. We choose common kidney pathologies in order to fulfill student's needs in diagnosis and clinical management of the disease. We described the pathology in accordance with the curricula as a real case presentation and depicted the importance of the ultrasonography in the final diagnosis.



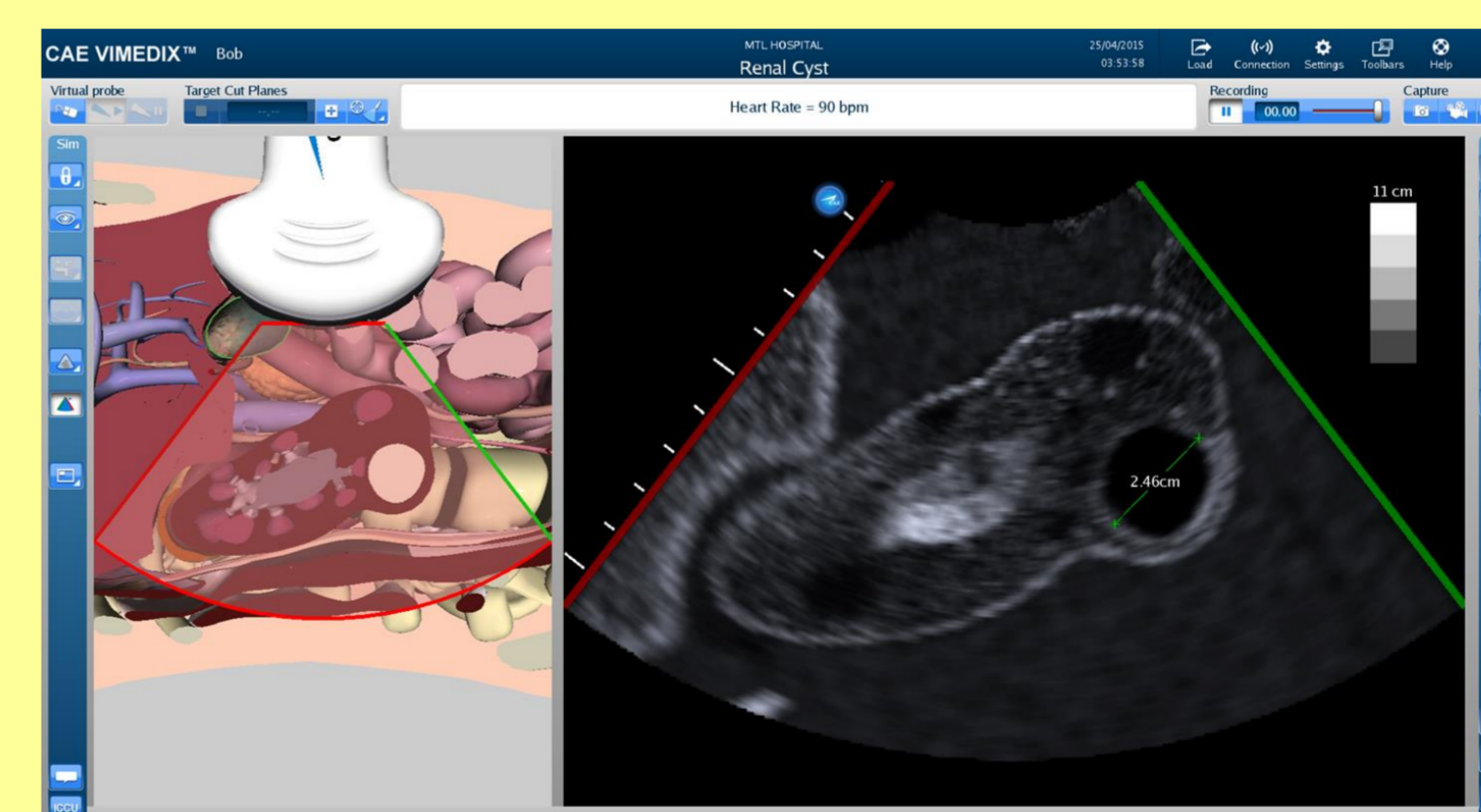
Simulator images captured during examination. Normal kidney, in longitudinal view and transverse view. The normal characteristics of cortical zone, medulla, renal capsule and central echogenic complex are explained. Artifact of the costal shadow is also explicated for a good recognition of the image and section planes are demonstrated before the examination.



Simulator image comparative with real ultrasound image of a kidney stone. Students have to learn about difficult, "hard to see" renal pathology, but the anatomical comparator help them to better understand the image. The possibility of a false image has been also discussed, because the small kidney stones are one of the most frequent pitfalls in kidney lithiasis.



Angiomyolipoma of the kidney: simulator image comparative with real image: Hyperechogenicity



Renal cyst: simulator image comparative with real image: anechoic mass (transonic)

Conclusions:

Hands-on training on an US simulator improved the student's diagnostic skills in kidney diseases and increased student's compliance as it a reliable new technology, easy to perform.

Case based learning, ultrasound case based learning, ultrasound principles, artifacts and pitfalls were all covered by simulator teaching, comparative with real US machine. This method of teaching capture most student's attention and interest in nephrology.

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