Supplementary material

**The clinical USgHIFU phased array system**

A USgHIFU phased array system (SUA-I, Zhonghui Medical Technology (Shanghai) Co., Ltd., China) was used in the study. Figure S1 provides a full view of the system. In the system there are several components: therapeutic unit, HIFU driving unit, diagnostic ultrasound machine, user-interface (UI) console and HIFU driving console, water cycle unit, and treatment bed.

The therapeutic unit consists of a 144-element HIFU phased array transducer and a 3.5 MHz B-mode US imaging probe. The US imaging probe was placed into the 80-mm-wide central hole of the aluminum spherical shell, and the probe was connected to a commercial diagnostic ultrasound machine (OPENO580, Jiangsu Sinoways Medical Technology Co., Ltd., Yangzhou, Jiangsu). The therapeutic unit can be controlled by the UI console to move with three degrees of freedom: rotation (<= 15°) along both X-axis and Y-axis and translation (<= 400mm) along Z-axis. The aperture and radius of curvature of HIFU phased array were 18 cm and 14 cm. The elements were distributed annularly and each ring included 24 elements. A customized silicone-rubber water bag could be fastened to the therapeutic unit for skin contact.

The rotation axis of the US imaging probe was the axis of HIFU propagation so that the imaging plane could be switched to the plane where the focus was steered. The probe was able to rotate in a −90°-to-90° range at a step of 1° to cover the target volume where the energy of HIFU beams was delivered. Therefore, image guidance and monitoring could be implemented through the rotation of the probe. And the spots targeted in the images can be mapped to the focal spots generated by the HIFU phased array. With the US images acquired during probe rotation, the treatment plane can be reconstructed with bilinear interpolation.



Figure S1. The USgHIFU phased array system.

**The square model and the phantom holder**



Figure S2. CAD drawing of the square model and the phantom holder.