Purpose: ICRU report 83 recommends delineation of the wall for hollow organs such as the bladder. For image guided radiotherapy, there is no guidance as to how to delineate deformed walls as the filling of hollow organs change. This work investigates characteristics of bladder wall deformation as a function of bladder filling in a controlled process.

Methods: CT images of a fresh pig bladder are obtained in-air with different bladder air fillings. A plastic hose inserted into and glued to the bladder neck forms an air-tight seal for filling with a syringe. At each air-filling level, a helical CT (90kV, 90mAs) of the bladder is obtained. The pixel size on all CT images is <0.5 mm. Images are imported into a commercial planning system for delineation and statistical evaluation. Bladder walls at each filling status are auto-contoured, then edited for quality assurance slice by slice. The auto-contouring threshold is selected to obtain consistent volumes of the resulting region-of-interest at each filling status.

Results: When the bladder wall interior volume increases by 360 cm$^3$ from injecting air, the wall thickness decreases from 2.9 mm to 1.2 mm. The decrease in wall thickness is accompanied by a decrease in the wall CT number.

Conclusions: For a pig bladder, the wall thickness decreases with increased air filling. The CT number (hence apparent density) of the volume decreases as the bladder expands. Further investigation is ongoing to determine if the apparent density decrease is real, due to CT reconstruction, or due to the bladder being in an air, rather than liquid environment. Characterization of hollow organ wall thickness variations may be important for image guided radiation therapy and organ wall dose evaluation.

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