Association of volume estimation accuracy obtained using USS, CT and volume calculation formulae for different shaped objects

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Ultrasonography (USS) and computer-tomography (CT) are frequently warranted for volume estimation of internal organs. Volume estimation accuracy is said to be influenced by the shape of the object. The scanner utilizes formula to calculate the volume of a specific shaped object. Therefore the volume estimation error described for non-globular objects may be related to the calculation formula used. The study aimed to evaluate the association of volume estimation error among USS, CT and volume estimation formula. Globular (Gb); elongated (IR) and near spherical (NGb) shaped hollow plastic objects were filled with water and subjected to USS and CT to obtain length, width, depth and estimated volume (EV). Manual volume calculation was performed using prolate (PV), ellipsoid (SV) and Lambert (LV) formulae. The actual volume (AV), EV and calculated volume was compared. The AV ranged from 10 to 445ml. Mean EV of USS; CT;SV;PV and LV were 97.9ml (r=0.98;p<0.001); 89.1ml (r=0.97;p<0.001);97ml (r=0.99;p<0.001); 108.5ml (r=0.97;p<0.001) and 132.5ml (r=0.99;p<0.001) respectively. Volume of all shapes were estimated with highest and lowest accuracy using PV (bias =-0.7) and LV (bias=+23.3) respectively. Regardless of the shape of object, EV of PV and LV has shown the highest (bias=-0.7; precession=19.8) and lowest accuracy (bias=21.8; precession=12.8) respectively. Among all shapes, volume of Gb were estimated with highest accuracy irrespective of the method used: (USS[bias=-0.31]; CT[bias=-0.14]; SV[bias=-1.5]; PV[bias=-0.7]; LV[bias=32.9]); volume of IR were estimated with lowest accuracy:(USS[bias=-17.5]; CT[bias=-32.6]; SV[bias=-18.4]; PV[bias=-0.3]; LV[bias=11.4]).Shape of the object and calculation formula used were shown to have an impact on the volume estimation accuracy.