Purpose: Tracking gold markers is a direct method of tumor localization in IGRT. Foldable gold anchor markers can be inserted using narrow needle (22 or 25 gauge) with less morbidity. We explored the feasibility of using anchor makers for IGRT.

Methods: The anchor markers are either 10 mm or 20 mm long gold wires. Small notches every 2.0 mm in the wire allow the wire to fold into a dense ball shape when injected, whose angled edge makes fiducial migration less possible. Alternatively, different combination of advancing stylet and retracting needle can place the gold wire into the tissue as either a linear or a tadpole shaped marker. In our phantom study, three 20-mm wires were placed into a bolus and each folded into ball, linear and tadpole shapes. The bolus was placed on top solid water phantom and scanned. The visualization of these markers on different imaging devices (OBI, cone beam CT, portal image, Acculoc and Cyberknife imaging tracking system) are evaluated. Clinical experience includes lung, liver, prostate and pancreases. The tracking ability of the imaging system on the anchor is evaluated.

Results: All markers are clearly visible with kilo-voltage imaging devices. In our Cyberknife test, anchor markers were visible under default X-ray parameters. The precision of the lock-on is within 1 mm, except for the linear marker. When employs mega voltage (MV) portal images with Acculoc system, the ball shaped anchor marker is the most visible in identification and linear one is the least. In clinic, no toxicity was observed resulting from the fiducial placement.

Conclusions: The gold anchor markers appear comparable with traditional solid gold markers.