Application of IRIS™ 3D anatomical model for preoperative surgical planning in the management of renal masses

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OBJECTIVE:
- Surgeons traditionally rely on two-dimensional (2D) imaging such as computed tomography (CT) for preoperative planning. Three-dimensional (3D) anatomical models assist surgeons by providing a complementary visual adjunct.
- IRIS™ is an interactive software that processes medical images and delivers 3D anatomical models that can be manipulated (altering transparency, rotating, zooming and panning).
- The objective of the study was to assess the IRIS 3D model for preoperative surgical planning compared to 2D CT scans.

METHODS:
- CT scans of 40 patients with renal carcinoma were reviewed by six urologists (1 resident, 1 fellow, 2 mid-senior surgeons with 5-10 years’ experience and 2 senior surgeons with >10 years’ experience) first using CT alone then using CT + IRIS 3D model.
- After each review, surgeons reported whether they would perform a partial or radical nephrectomy (PN or RN) – Fig 1.
- Confidence in their ability to complete the planned procedure and their experience using the model were measured using a Likert-type scale.

RESULTS:
- A total of 231 reviews were analysed (Fig 2).
- In 64% of the reviews, surgeons rated that IRIS helped achieve a better spatial orientation of the anatomy compared to the 2D CT. The rating was consistent among both low RENAL score (4-7) and high RENAL score (8-12) cases.
- The addition of the IRIS 3D model impacted the planned procedure in 20% of the reviews (3.5% changed decision from PN to RN and 16.5% changed from RN to PN).
- When IRIS did not impact the surgeon decision (80%), surgeon confidence in completing the planned procedure increased from 78% with the 2D CT to 87% with the IRIS 3D model (p=0.02), which was more pronounced in cases with a high RENAL score (p=0.009) (Fig 3).
- Greater consensus on the planned procedure was observed between the Fellow and Senior Surgeons when the IRIS 3D model was used (48.3% agreement with CT alone and 84% with IRIS, p=0.003) (Fig 4).
- In 99% of the reviews, surgeons rated that the IRIS 3D model accurately represented the anatomical details of all kidney components.

CONCLUSIONS:
- Using the IRIS™ 3D model for preoperative planning offered a better spatial orientation of patient’s anatomy, which in turn increased surgeons’ confidence in completing the planned procedure compared to 2D CT alone. This software tool has potential to reduce variation in preoperative planning among surgeons.

Source of funding
- This study was sponsored and funded by Intuitive Surgical Inc., Sunnyvale, CA, USA.

METHODS:

Figure 1. Flow diagram of the study protocol. URMC=University of Rochester Medical Center

Figure 2. IRIS™ 3D models: (A) Anterior coronal view, (B) Anterior coronal view utilizing the “rotation” function towards the right, (C) Rotated anterior coronal view utilizing the “subtraction” function to remove the renal cortex, (D) Posterior coronal view with subtraction of the tumour.

Colour keys: Tumour (orange), Cortex (light purple), Collecting system (yellow), Artery (red), Vein (blue).