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Adoption of Virtual 3-Dimensional Image Reconstruction in Robot-assisted Partial Nephrectomy: Evaluation of Selective Arterial Clamping Rate and Trifecta Outcomes

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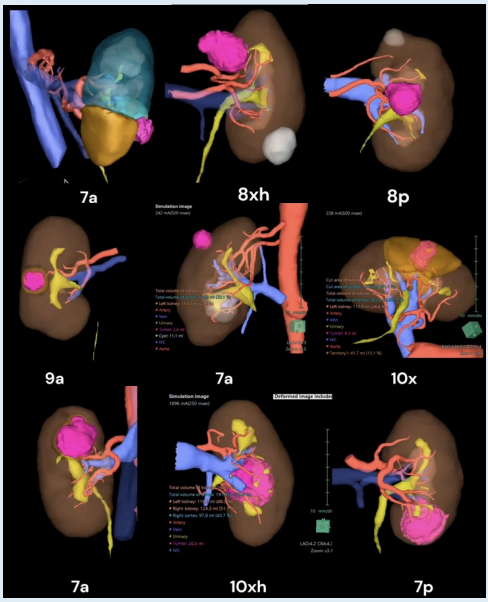
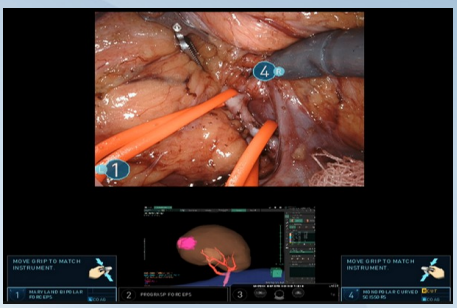
Objectives:

To evaluate the **selective arterial clamping rate** and **clinical outcomes** of adopting virtual 3-dimensional (3D) image reconstruction (IR) in robot-assisted partial nephrectomy (RAPN).

9 representatives of patient sample in 3D IR regarded as intermediate to high complexity (RENAL score 7a – 10xh)





Real-time incorporation of 3D IR in RAPN

Patients and Methods:

- Renal tumours from December 2023 to July 2025 undergoing RAPN
- Two independent robotic surgeons
- **Synapse 3D Fujifilm**, Japan for image analysis → TilePro multi-display function of the DaVinci Xi robot surgeon console
- Document the **selective arterial clamping rate** and warm ischemic time (WIT)
- **Trifecta outcome: (Clear Surgical Margin + Clavien ≥ III complications + ≤ 30% postoperative eGFR reduction)**

Results:

- 27 tumours from 25 patients (2 with synchronous tumours) → Mean age 63.4 (42 - 84)
- Mean diameter 2.52cm (0.6 – 6.5), 63% (17/27 tumours) had intermediate to high complexity (RENAL nephrometry score 7 – 10)
- 48.1% (13/27) had 2 – 4 tumour-feeding segmental arteries, while **selective arterial clamping rate is 92.5%** (25/27)
- **Mean WIT is 26.2 minutes (7 – 63)**
- Median WIT for low complexity (4 – 6) = **21.5 mins**
  Intermediate to high complexity (7 – 10) = **28 mins**
  U value = 35.5 (< 51, critical value at $p < 0.05$)
  P value = 0.00695 (< 0.05)
- ***Trifecta outcomes 100%***

Conclusion:

Virtual 3D IR is a valuable adjunct to guide RAPN, bringing about **exceptional selective arterial clamping rate** plus **excellent trifecta outcomes**.