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# 3D augmented reality Robot-assisted partial nephrectomy (3D AR RAPN): a better guidance for better surgical results

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# Introduction and objectives

The introduction of robotics gave a huge contribution in surgical tecnical improvement. Notwithstanding this stepforward, the management of complex/endophytic renal masses remains challenging. The available technologies for intraoperative imaging, as Ultrasound (US), may help the surgeon during these challenging procedures but still have important limitations in showing the intraparenchymal anatomy. In order to overcome these limits we developed our 3D static and elastic Augmented Reality (AR) system from hyper accuracy 3D models (HA3DTM) and we compared this technology with US in driving the surgeon during the two main steps of RAPN: tumor resection and parenchymal suture.





#### Methods

91 patients underwent RAPN from 07/2017 to 05/2019 were included: 48 with **3D-AR guidance** and 43 with **2D** US guidance only. All procedures were performed by only one super experienced surgeon. Demographic, perioperative and follow-up data were collected and analized. Statistical significance was set at p<0.05.



# AUA VIRTUAL EXPERIENCE

## Results

in US group; p=0.01).

### **Preoperative and pathological data**

Number of patients Clinical stage, no (%)

CT-based PADUA score, median (IQR) 3D-based PADUA score, median (IQR) Pathological stage

Positive surgical margin rate, no (%)

### Conclusions

The use of HA3DTM models during RAPN for complex tumours can be useful for identifying the lesion and intraparenchymal structures that are difficult to visualize with US only. This translates to a potential improvement in the quality of the resection phase and a better functional recovery.

Comparing the two groups, the use of 3D guidance showed better intraoperative results as a lower rate of global ischemia (45.8% in 3D group vs. 69.7% in US group; p=0.03), higher rate of enucleation (62.5% vs. 37.5% in 3D and US group respectively; p=0.02) and lower rate of collecting system violation (10.4% vs. 45.5%; p= 0.003). Moreover these results correlates with a better functional outcome: lower drop in estimated renal plasma flow (ERPF) at renal scan at three months of follow-up (-12.38 in 3D group vs. -18.14

		<b>3D AR-RAPN</b>	2D US-RAPN	рv
		48	43	
	cT1a	21 (43.8)	19 (44.2)	0.8
	cT1b	22 (45.8)	22 (51.2)	0.7
	> cT2	5 (10.4)	2 (4.6)	0.5
	11 (10-12)	10 (10-11)	0.65	
	10 (9-11)	//	NA	
	Benign	8 (16.6)	5 (11.6)	0.7
	pT1a	14 (29.2)	10 (23.2)	0.0
	pT1b	19 (39.6)	20 (46.5)	0.6
	pT2	2 (4.2)	2 (4.6)	0.6
	pT3	5 (10.4)	6 (13.9)	0.8
		2 (4.2)	2 (4.6)	0.6







