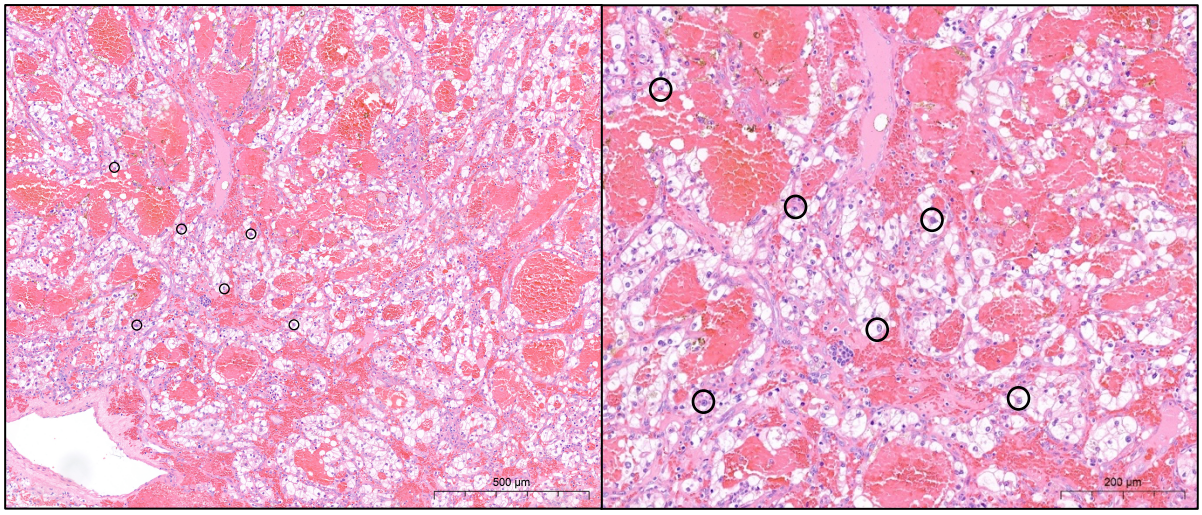
Supplementary Table 1 - Scanner characteristics and acquisition protocol.

Acquisition parameters	GE Healthcare Omni Legend	
	PET	CT
[89Zr]Zr-girentuximab	37 MBq ± 10%	–
Min/bed position	5	–
Crystal	Digital BGO	–
Reconstruction	Qclear 1500	–
DFOV (CM)	70	-
Matrix (pixels)	384×384	512×512
Resolution (mm)	1.82X1.82	1.37X1.37
Slice thickness (mm)	2.07	2.5
Slices	963	943
Voltage (kV)	–	120
Tube current (mA)	–	150

Supplementary Figure 1 - The photomicrographs provide a detailed view of the lesion, which displays a rich vascular network and is composed of neoplastic cells with abundant clear cytoplasm, arranged in a complex tubular and nested architectural pattern. Importantly, no areas of necrosis were identified. At low magnification (100X; circles, left), the nuclei of the neoplastic cells already showed conspicuous eosinophilic nucleoli, which became more prominent and sharply delineated at higher magnification (200X; circles, right). These cytological and features are consistent with an overall grade 3, in accordance with the ISUP/WHO nucleolar grading system currently applied to renal neoplasms.



Supplementary Figure 2 - Descriptive analysis of the overlap between *ex-vivo* imaging at preclinical PET/CT and immunohistochemistry staining for CAIX by manual supoerinposition with increasing transparency showing spatial correspondence of regions with increased radiopharmaceutical uptake and regions with high expression of CAIX at immunohistochemistry.