

Use of intraoperative Gallium-PSMA Cerenkov Luminescence Imaging for surgical margins in radical prostatectomy – a feasibility study

Darr C.¹, Hadaschik B.A.¹, Grootendorst M.², Herrmann K.³, Binse I.³, Fragoso Costa P.³, Harke N.N.¹

1 University Hospital Essen, Department of Urology and Urological Oncology, Essen, Germany | 2 Lightpoint Medical Ltd., Clinical Research, Chesham, United Kingdom | 3 University Hospital Essen, Department of Nuclear Medicine, Essen, Germany

Introduction

Cerenkov Luminescence Imaging (CLI) is a molecular imaging technique that detects light emitted by Positron Emission Tomography (PET) radio-pharmaceuticals. This first-in-men study evaluates ⁶⁸Ga-PSMA for intraoperative assessment of tumor margins at time of prostatectomy and after preoperative PSMA-PET/CT.

Material and Methods

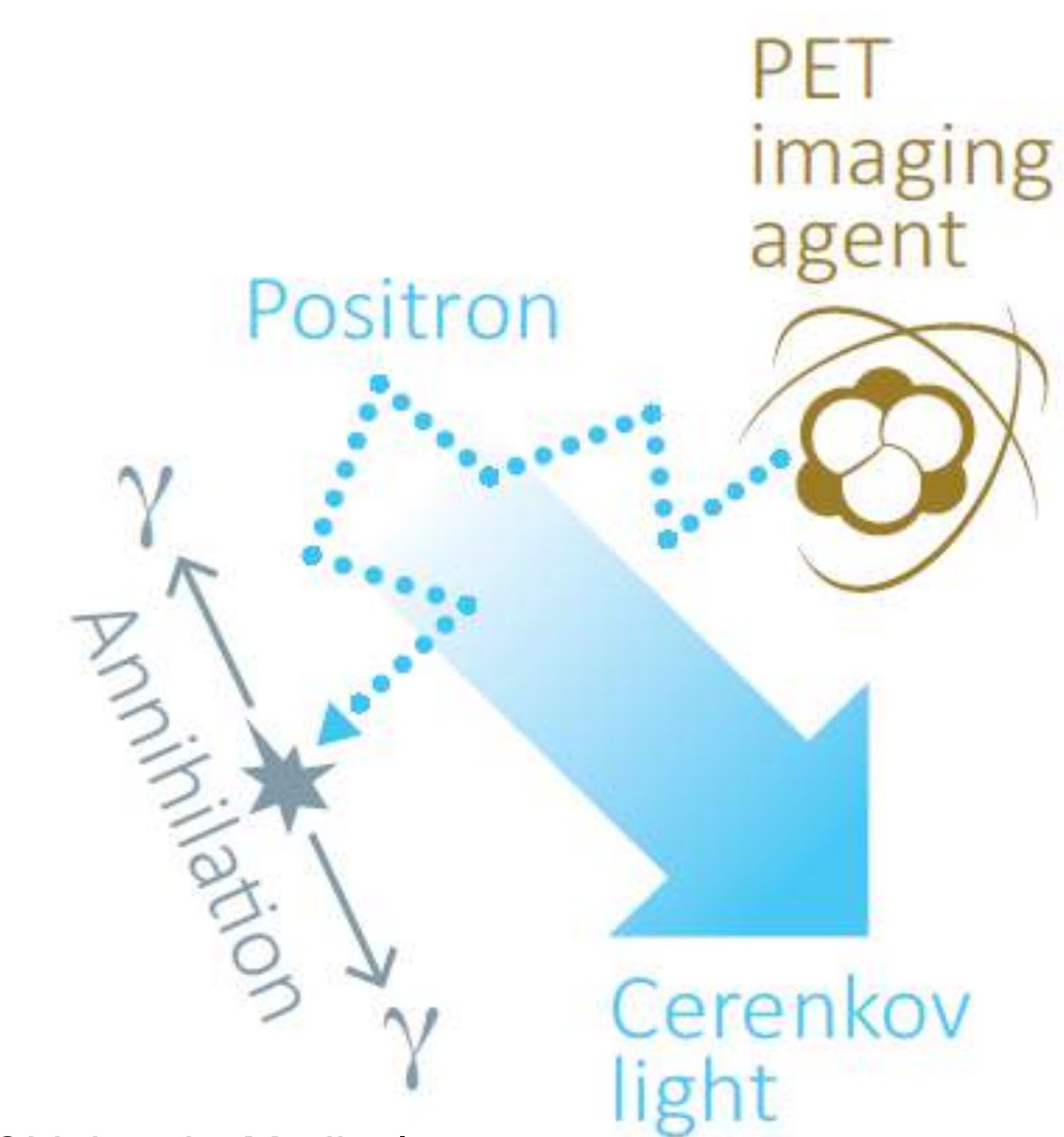
3-4 hours prior to surgery, PSMA-PET/CT was performed after intravenous injection of ⁶⁸Ga-PSMA with varying doses. Scan results were assessed by the specialists of nuclear medicine and urology. Radical prostatectomy was performed robotically and the prostate specimen was imaged with a CLI imager (Lightpoint Medical Ltd, UK) intraoperatively immediately after excision in order to assess the radiance on the surface. The agreement of margin distance on histopathology and CLI was assessed.

Results

CLI was used in five patients after preoperative injection of 144 mBq Ga-PSMA (mean, range 95-202). Intraprostatic lesions were detected by PSMA-PET/CT in 100%, positive lymph nodes could be seen in 3 of 5 patients. CLI was performed intraoperatively after a mean of 329 minutes after tracer injection. Mean background radiance was 1441 with 2430 photons/s/cm²/sr for prostate radiance. Positive surgical margins (PSM) were found in two patients based on histopathology (patient 1: pT3b, pN1, Gleason score 5+3=8, patient 5: pT3a, pN1, Gleason score 4+5=9). In these patients, elevated radiance levels were found in the tumor positive areas (mean radiance: 4254 photons/s/cm²/sr). In two other patients with suspicious signals, tumor distance to the surface was < 1mm.

Conclusion

Intraoperative ⁶⁸Ga-PSMA CLI seems to be a promising technique for intraoperative assessment of surgical margins in robot-assisted radical prostatectomy. A prospective trial is mandatory to elucidate further results concerning sensitivity and specificity.



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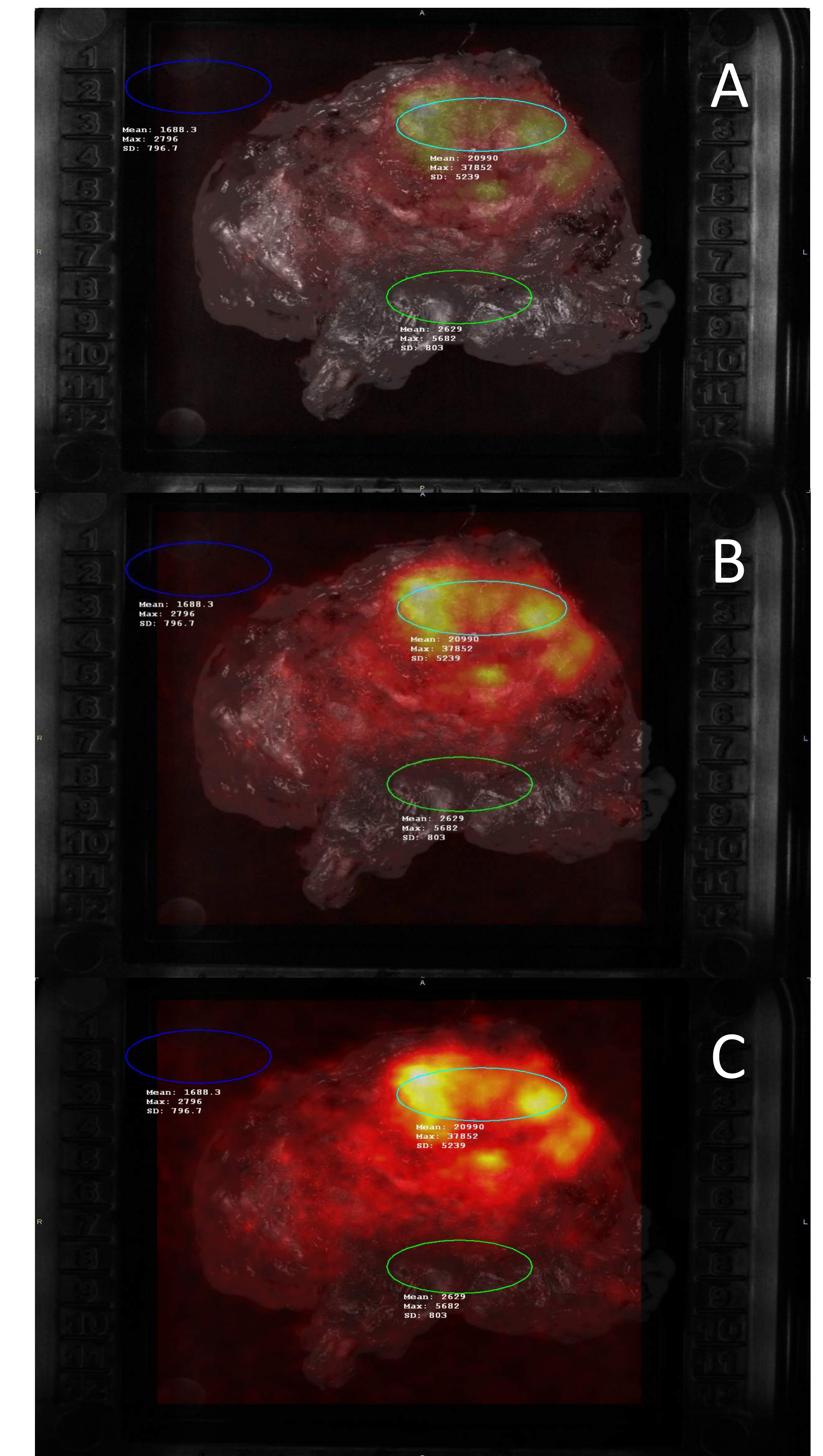
Cerenkov Luminescence

Corresponding author:

Dr. Christopher Darr, University of Essen, Department of Urology, Essen
christopher.darr@uk-essen.de



CLI Imager



Gray-scale prostate image overlaid with Cerenkov signal
A) 25%, B) 50%, C) 75%

#	Tracer Activity [mBq]	Time from injection to CLI [min]	Mean prostate radiation background [photons/s/cm ² /sr]	Mean radiation in CLI/tumor positive areas [photons/s/cm ² /sr]	PSM	Location	TNM-classification	Gleason-Score
1	202	313	2650,4	15171,6	Yes	Right lobe, dorso-basal	pT3b, pN1, L1, V0, Pn1, R1	5+3=8
2	95	340	2278,7	8318,95	< 1 mm	Ventral	pT3a, pN0, L1, V0, Pn1, R0	4+5=9
3	108	429	1746,3	2992,6	< 1 mm	ventral	pT3b, pN1, L1, V0, Pn1, R0	4+5=9
4	150	285	1725,3	---	---	---	pT2a, pN0, L0, V0, Pn1, R0	4+3=7b
5	163	282	3753,2	6259,8	Yes	Left lobe, apex	pT3a, pN1, L1, V0, Pn1, R1	4+5=9