

## Imaging protocol

A PET/CT scan (Biograph mCT Siemens Healthcare, Knoxville TN) was acquired 5 min. after i.v. administration of a mean dose of  $627 \pm 25$  MBq of  $^{11}\text{C}$ -choline combined with a diagnostic CT in venous phase (120 ml Ultravist 370 Bayer Healthcare Pharmaceuticals, Berlin, Germany, flow rate 2.5 ml/s). Additional late pelvic images were performed 20 min after injection. On the same day at least 3 hours later, a second PET scan was performed using  $165 \pm 13$  MBq of  $^{68}\text{Ga}$  PSMA. If possible, the tracer injection was combined with an injection of 40 mg furosemide to facilitate micturition before PET examination. To reduce radiation exposure, a low dose CT scan was performed for attenuation correction of the  $^{68}\text{Ga}$ -PSMA PET data (n=83). In patients with contraindications for contrast agents, a diagnostic CT scan without contrast was performed (n=4). Examination field ranged from the skull base to mid-thigh. For the detailed examination protocol, see Schwenck et al. 2017 (16).

**Supplemental Table 1.** Treatment strategy depending on PET-staging, postoperative stage and previous radiotherapy.

PET Staging at BCR			Postoperative stage			Curative radiotherapeutic options without previous RT				Remaining options after	
rcT	rcN	cM	pT	pN	cM	P. fossa	Pelvis	N1-Boost	SBRT	RT	RT
										P. fossa	pelvis
0	0	0	2-4	0	0	66Gy				palliative	palliative
0	0	0	2-4	1	0	66Gy	50.4Gy			palliative	palliative
2-4	0	0	2-4	0	0	$\geq 70$ Gy				palliative	palliative
2-4	0	0	2-4	1	0	$\geq 70$ Gy	50.4Gy			palliative	palliative
0	1	0	any	any	0	66Gy	50.4Gy	$\geq 60$ Gy		~	palliative
2-4	1	0	any	any	0	$\geq 70$ Gy	50.4Gy	$\geq 60$ Gy		palliative	palliative
0	0	oligo	any	any	0				x	~	~
2-4	0	oligo	any	any	0	$\geq 70$ Gy	Option		x	palliative	palliative
2-4	1	oligo	any	any	0	$\geq 70$ Gy	50.4Gy	$\geq 60$ Gy	x	palliative	palliative
0	1	oligo	any	any	0	66Gy	50.4Gy	$\geq 60$ Gy	x	~	palliative

Abbreviations: RT=radiotherapy, BCR= biochemical recurrence, P=prostatic, “~” means equal curative treatment options like group without previous RT

**Supplemental Table 2.** Patients' characteristics

<b>Characteristic</b>	<b>n/measure</b>	<b>%</b>
<b>pTumor stage</b>		
T2a	1	1.2
T2b	3	3.6
T2c	15	18.1
T3a	19	22.9
T3b	37	44.6
T4	3	3.6
n.a.	5	6.0
<b>Gleason score</b>		
≤6	5	6.0
7a (3+4)	11	13.3
7b (4+3)	22	26.5
8	18	21.7
9	21	25.3
10	1	1.2
n.a.	5	6.0
<b>PSA-level at PET date (ng/ml)</b>		
Mean (Median): 4.0 (1.9)		
≤0.5	9	10.8
0.5-1	7	8.4
1-2	27	32.5
2-5	26	31.3
>5	13	15.7
n.a.	1	1.2
<b>Initial PSA level at time of surgery (ng/ml)</b>		
Mean (Median): 17.8 (10.5)		
≤5	7	8.4
5-10	24	28.9
10-20	25	30.1
20-50	13	15.7
>50	2	2.4
n.a.	12	14.5

**Supplemental Table 3.** TNM-staging according to PET and CT depending on previous radiotherapy. The given numbers indicate the findings of local recurrences, nodal and distant metastases. Oligometastases (M1a-c; n≤5) were distinguished from multiple distant metastases (M1; n>5). Manifestation of oligometastases at different locations was indicated (i.e. M1a/b=M1a and M1b).

Previous radiotherapy	Imaging modality	rT+	rN1	cM1	Oligo-			Multiple	
					M1a	M1b	M1c	M1a/b	M1
<b>None</b> (n=39)	<sup>68</sup> Ga-PSMA-PET	5	23	13	2	5	0	3	3
	<sup>11</sup> C-choline-PET	4	16	10	3	3	0	2	2
	CT	4	23	14	3	4	0	5	2
<b>Prostatic fossa</b> (n=33)	<sup>68</sup> Ga-PSMA-PET	6	18	16	5	5	1	0	5
	<sup>11</sup> C-choline-PET	7	16	15	5	6	1	0	3
	CT	5	15	19	4	6	1	3	5
<b>Pelvis</b> (n=11)	<sup>68</sup> Ga-PSMA-PET	0	1	9	2	4	0	0	3
	<sup>11</sup> C-choline-PET	0	2	10	3	4	0	0	3
	CT	1	4	8	3	2	0	1	2
<b>All</b> (n=83)	<sup>68</sup> Ga-PSMA-PET	11	42	38	9	14	1	3	11
	<sup>11</sup> C-choline-PET	11	34	35	11	13	1	2	8
	CT	10	42	41	10	12	1	9	9

**Supplemental Table 4.** Down- and upstaging for T-, N- and M-stage depending on imaging modality and previous radiotherapy.

<b>Previous radiotherapy</b>	<b>Migration of T-, N-, M- findings</b>	<b>PSMA-PET vs. Choline-PET</b>	<b>PSMA-PET vs. CT</b>	<b>Choline-PET vs. CT</b>
<b>None (n=39)</b>	T-Upstaging	1	4	4
	T-Downstaging	0	3	4
	N-Upstaging	8	6	1
	N-Downstaging	1	6	8
	M-Upstaging	5	4	3
	M-Downstaging	2	5	7
<b>Prostatic fossa (n=33)</b>	T-Upstaging	0	3	4
	T-Downstaging	1	2	2
	N-Upstaging	2	7	5
	N-Downstaging	0	4	4
	M-Upstaging	2	6	4
	M-Downstaging	1	9	8
<b>Pelvis (n=11)</b>	T-Upstaging	0	0	0
	T-Downstaging	0	1	1
	N-Upstaging	0	1	1
	N-Downstaging	1	4	3
	M-Upstaging	0	2	2
	M-Downstaging	1	1	0
<b>All (n=83)</b>	T-Upstaging	1	7	8
	T-Downstaging	1	6	7
	N-Upstaging	10	14	7
	N-Downstaging	2	14	15
	M-Upstaging	7	12	9
	M-Downstaging	4	15	15

**Supplemental Table 5.** Treatment routines and respective costs according to German “EBM” and “Rote Liste”.

<b>Curative radiotherapeutic options</b>				<b>Costs</b>
<b>Prostate bed</b>	<b>Pelvis</b>	<b>N1-Boost</b>	<b>SBRT</b>	
66Gy				3,304.46 €
66Gy	50.4Gy			6,086.86 €
≥70Gy				3,414.20 €
≥70Gy	50.4Gy			6,196.60 €
66Gy	50.4Gy	≥60Gy		6,352.90 €
≥70Gy	50.4Gy	≥60Gy		6,462.64 €
			x	1,658.36 €
≥70Gy	Option		x	5,072.56 €
≥70Gy	50.4Gy	≥60Gy	x	7,854.96 €
66Gy	50.4Gy	≥60Gy	x	8,011.26 €
<b>Palliative treatment (5 years ADT)</b>				<b>9,731.60 €</b>

## **ABBREVIATIONS**

ADT (androgen deprivation therapy)

BCR (biochemical recurrence)

CT (Computed tomography)

DM (distant metastasis)

EBM („Einheitlicher Bewertungsmaßstab“)

i.v. (intravenous)

LR (local recurrence)

MBq (mega Becquerel)

NR (nodal recurrence)

PC (Prostate cancer)

PET (Positron-Emission Tomography)

PSMA (prostate-specific membrane antigen)

RT (radiotherapy)

SRT (salvage radiotherapy)

SBRT (stereotactic body radiotherapy)

TNM (tumor, node, metastasis)

vs. (versus)