

VU Research Portal

I-125 seed implants for prostate brachytherapy

Steggerda, M.J.

2010

document version

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

citation for published version (APA)

Steggerda, M. J. (2010). *I-125 seed implants for prostate brachytherapy: Physical characteristics and relations with post-implant quality of life.*

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

E-mail address:

vuresearchportal.ub@vu.nl

Contents

1. General introduction	9
1.1 Treatment of prostate cancer	10
1.1.1 Incidence rates and considerations for treatment	10
1.1.2 Radical treatment	11
1.1.3 Androgen deprivation therapy (ADT)	11
1.2 Quality of life (QOL) after treatment	12
1.3 Brachytherapy: indications and PSA failure	13
1.3.1 Indications	13
1.3.2 PSA failure	13
1.4 Brachytherapy techniques	14
1.5 Evaluation of brachytherapy seed implants	16
1.6 Objective of this thesis	17
References	19
2. The applicability of simultaneous TRUS-CT imaging for the evaluation of prostate seed implants	23
Abstract	24
2.1 Introduction	25
2.2 Materials and methods	26
2.2.1 Scanning procedure and implant characteristics	26
2.2.2 Image fusion	26
2.2.3 Accuracy of registration procedure	31
2.2.4 Dose distribution evaluation	32
2.3 Results	33
2.3.1 Registration success rate	33
2.3.2 Accuracy of registration procedure	35
2.3.3 Image fusion and dose distribution evaluation	37
2.4 Discussion	40
2.5 Conclusion	43
References	45
3. The influence of geometrical changes on the dose distribution after I-125 seed implantation of the prostate	47
Abstract	48
3.1 Introduction	49
3.2 Materials and methods	50
3.2.1 Imaging of the urethra	50
3.2.2 Determination of dose distribution	51
3.2.3 Implant volume versus prostate volume	52
3.3 Results	52
3.3.1 DVHs based on scans at different post-implant time intervals	52
3.3.2 Integration of dose rates	53

3.3.3	DVHs based on a single scan compared to DVHs taking into account geometrical changes	54
3.3.4	Time dependence of dose-volume parameters	55
3.3.5	Physical characteristics of changes in prostate and implant geometry	56
3.4	Discussion	57
3.4.1	Influence of post-implant scan date on dose-volume parameters of the prostate	57
3.4.2	Dose to urinary system	58
3.4.3	Expected inaccuracies in geometry corrected dose-volume parameters	59
3.4.4	Physical aspects of geometrical changes	59
3.5	Conclusions	61
	References	62
4.	Predicting urinary morbidity after brachytherapy of localized prostate cancer	65
	Abstract	66
4.1	Introduction	67
4.2	Irritative and obstructive symptoms	67
4.3	Acute urinary retention	72
4.4	Androgen deprivation therapy	74
4.5	Transurethral resection and incontinence	74
4.6	Radionuclide	75
4.7	Use of α -blockers	76
4.8	Long-term urinary quality of life	77
4.9	Conclusions	77
	References	79
5.	An analysis of the relation between physical characteristics of prostate I-125 seed implants and lower urinary tract symptoms: bladder hotspot dose and prostate size are significant predictors	83
	Abstract	84
5.1	Introduction	85
5.2	Materials and methods	86
5.2.1	Patients and implants	86
5.2.2	Urinary symptom scores	86
5.2.3	Early urinary categories	87
5.2.4	Imaging and dosimetry	87
5.2.5	Statistics	88
5.3	Results	89
5.3.1	IPSS endpoints	89
5.3.2	Urinary retention and early symptoms	92
5.4	Discussion	94
5.4.1	Bladder hotspot dose and urinary morbidity	94

5.4.2	Predicting urinary morbidity	95
5.4.3	Irritative and obstructive complaints	96
5.4.4	Implications for clinical practice	97
5.5	Conclusions.	97
	References	99
6.	Minimizing the number of implantation needles for prostate I-125 brachytherapy; an investigation of possibilities and implications	101
	Abstract	102
6.1	Introduction	103
6.2	Methods and materials	104
6.2.1	Inter-seed spacing	104
6.2.2	Implantation planning and objectives for optimization	104
6.2.3	Sensitivity for random seed placement errors	108
6.2.4	Comparison of clinical cases	108
6.3	Results	109
6.3.1	Influence of needle reduction on the dose distribution	109
6.3.2	Sensitivity for random seed placement errors	110
6.3.3	Comparison of clinical cases	113
6.4	Discussion	114
6.4.1	Outcomes planning study	114
6.4.2	Geometrical uncertainties	115
6.4.3	Dose distribution of clinical cases	116
6.4.4	Facts from literature	117
6.5	Conclusions	118
	References	120
7.	General discussion	123
7.1	Multi-modality imaging of the prostate	124
7.2	Post-implant seed kinetics and anatomy changes	126
7.3	Relation between physical properties of seed implants and side effects	128
7.4	The potentials and future developments of prostate brachytherapy	130
7.4.1	BT compared with advanced EBRT techniques	130
7.4.2	Implantation techniques	134
7.4.3	Dose differentiation within the prostate	135
7.4.4	Future directions	136
	References	137
	Summary	141
	Samenvatting	147
	List of publications	154

Dankwoord
Over de auteur

156
160