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Published in:
Radiotherapy and Oncology

DOI:
10.1016/S0167-8140(18)31131-9

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2018

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):
Hammer, C., Brouwer, C. L., Klinker, P., Both, S., Aluwini, S., & Langendijk, J. A. (2018). Radiation-induced late rectal toxicity for IMPT vs VMAT in patients with localized prostate cancer. Radiotherapy and Oncology, 127(Suppl.1), S428-S429. https://doi.org/10.1016/S0167-8140(18)31131-9

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Download date: 21-05-2019

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Purpose or Objective
An ongoing multicenter observational study, registered at ClinicalTrials.gov, is assessing the intestinal, hematologic and urinary toxicity from whole-pelvis radiotherapy (WPRT) in the radical, adjuvant or salvage RT treatment of prostate cancer. The Inflammatory Bowel Disease Questionnaire (IBDQ) is used to evaluate radiation-induced Intestinal Toxicity (IT): it explores 10 Bowel symptoms and their possible detrimental effect on Emotional, Social and Systemic Domains. The responses are scored from 7 (best function) to 1 (worst). This analysis focuses on acute IT.

Material and Methods
Patients (pts) treated with conventional fractionation or moderate hypofractionation are included. Static-field IMRT (SS-IMRT), Tomotherapy (TOMO) and VMAT are allowed. WPRT is at the discretion of the referring radiation oncologist. The IBDQ was completed at baseline, at RT mid-point and end. For this analysis, focused on the first 303 pts with complete IBDQ at baseline and radiotherapy mid-point and end, a worsening in single bowel symptoms ≥3 points was set as endpoint for IT definition. This worsening corresponds to 50% of the total possible score, which could be of interest from a clinical perspective. The largest IBDQ worsening between baseline and RT mid-point or end was considered. Associations between IT and patient/treatment related factors were evaluated through logistic regression (LR). Further analyses were performed to identify the symptoms more closely associated with detriment in Social, Emotional and Systemic domains.

Results
303 pts having the complete set of IBDQs were considered. Eight per cent were treated by means of SS-IMRT, 42% of TOMO and 50% of VMAT. The median EQDQ2 (a/b=3Gy) dose to the prostate/prostatic bed was 72.58 Gy, that to pelvic lymph-nodes/pelvic lymph-nodal area was 50 Gy. Rates of significant worsening for each symptom are reported in Table 1a. SS-IMRT was associated with an increased risk (OR≈0.3, p=0.01÷0.05, as compared to VMAT/TOMO) of abdominal pain, cramps, rectal bleeding and nausea/feeling sick. In addition, the volume of lymph-nodal PTV (median 1020cc, range 338-1606) was associated with an increased risk of abdominal pain and cramps (OR≈1.2 for 100cc, p=0.01÷0.05). The results of multivariable analysis pertaining to QoL domains are reported in Table 1b.

1a

Bowel symptoms – evaluation at RT mid-point/end			
Symptoms	No. Patients without moderate/severe worsening	No. Patients with moderate/severe worsening	% Patients with moderate/severe worsening
Frequent bowel symptom	141	151	51.2
Loose bowel movement	193	98	33.7
Abdominal cramp	260	32	11.0
Abdominal pain	258	33	11.4
Gas passage	225	61	21.3
Abdominal bloating	238	48	16.8
Rectal bleeding	258	27	9.5
Urge to defecate	227	63	21.7
Accidental soiling	266	25	8.6
Nausea & Feeling sick	270	22	7.5
Quality of Life Domains			
Domains	No. Patients without moderate/severe detriment	No. Patients with moderate/severe detriment	% Patients with moderate/severe detriment
Emotional	267	7	2.6
Social	257	20	7.2
Systemic	278	10	3.5

1b

DETRIMENT in SOCIAL domain		
Variables	Odds Ratio	p-value
Frequent bowel symptom	1.5	0.007
Loose bowel movement	1.5	0.007
DETRIMENT in EMOTIONAL domain		
Variable	Odds Ratio	p-value
Rectal bleeding	1.8	<0.001
DETRIMENT in SYSTEMIC domain		
Variable	Odds Ratio	p-value
Abdominal pain	2.0	0.001
Nausea&feeling seek	1.4	0.05

Conclusion
Even in the era of modern IMRT, WPRT-induced IT is non-negligible, leading to moderate/severe symptom rates ranging from 7 to 50%. Extended WPRT fields are related to increased abdominal pain/cramps, while RT technique impacts abdominal pain, cramps, rectal bleeding and nausea, as a possible consequence of the reduced ability of SS-IMRT in sparing bowel volumes receiving 40-50 Gy. Social domain is highly influenced by frequent bowel movements and loose stool, while rectal bleeding impacts Emotional wellbeing.

PO-0821 Radiation-induced late rectal toxicity for IMPT vs VMAT in patients with localized prostate cancer

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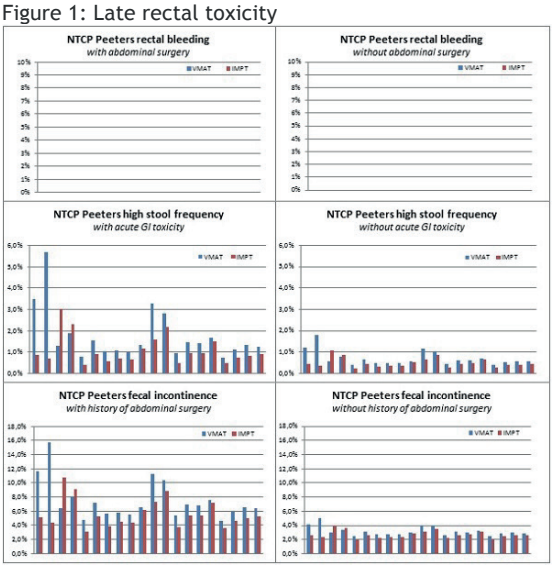
Purpose or Objective
Over the years, multiple NTCP models have been published regarding radiation-induced late rectal toxicity, but only a few included other toxicities besides rectal bleeding. Peeters *et al.*[1] published NTCP models for high stool frequency, fecal incontinence and rectal bleeding.
Recent improved planning techniques for photon therapy (VMAT dual-arc) as well as proton therapy (CTV-based robust IMPT) could further reduce late rectal toxicity. The purpose of this in silico planning study was to asses predicted radiation-induced late rectal toxicity after treatment of localized prostate cancer for these modern photon and proton techniques.

Material and Methods
For this study, 20 planning-CT scans were used of patients treated at our department in 2015-2017 for localized prostate cancer. The dose prescription included 77 Gy(RBE) to the prostate (and part of/whole vesicles), and 70 Gy(RBE) to (part of) the vesicles (depending on tumor stage), where RBE=1.1. The CTV-PTV margin for the photon plans was 5 mm laterally and 6 mm in other directions. Proton therapy plans were robustly optimized using 5 mm setup laterally and 6 mm in other directions and 3% range uncertainty. Plans were evaluated for robustness using shifts in 26 directions (photons and protons) and range uncertainties +/- 3% (only protons). Plans were optimized until ≥ 98% of the CTV was covered with ≥ 95% of the dose in the voxel wise minimum scenario. Late rectal toxicity grade ≥ 2 was assessed using NTCP models of Peeters *et al.*[1] for rectal bleeding, stool frequency and fecal incontinence.

Results
Overall, most proton plans resulted in a slightl y lower predicted incidence of late rectal toxicity than thephoton plans (Figure 1). Most absolute differences were seen for

fecal incontinence in patients with a history of abdominal surgery, i.e., 7.5% (mean; photons) and 5.6% (mean; protons).
For high stool frequency the differences were smaller, but in most patients in favor of proton therapy. Rectal bleeding was 0% in both groups. In the Netherlands, one of the indications to receive proton therapy for the treatment of localized prostate cancer is a reduction ≥ 10% for grade 2 toxicity. Using these models, only maximal 1 of 20 patients would be selected for proton therapy, which was a patient with endpoint fecal incontinence (with history of abdominal surgery).

Figure 1: Late rectal toxicity



Conclusion
CTV-based robust IMPT resulted in slightly lower NTCP's for late rectal toxicity and thus have a potential benefit relative to VMAT. Application of the Dutch guideline and the use of above mentioned NTCP models and endpoints would lead to a relative small selection of approximately 0-5% of the patients with localized prostate cancer for proton therapy.
References
1 Peeters STH, Hoogeman MS, Heemsbergen WD, *et al*. Rectal bleeding, fecal incontinence and high stool frequency after conformal radiotherapy for prostate cancer: normal tissue complication probability modeling. *Int J Radiat Oncol Biol Phys* 2006;66:11-19.

PO-0822 Patient-reported outcomes after hypofractionated radiotherapy to 66Gy for prostate cancer.
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Purpose or Objective
Purpose: to evaluate biochemical control, toxicity and patient function after prostate cancer treatment with moderate hypofractionated and dose-escalated image-guided volumetric modulated arc therapy (VMAT) for localized prostate cancer in an observational study.
Material and Methods
Material and methods: From 2010 to 2017, men with localized prostate cancer (from low to high-risk) who received VMAT to a dose of 66 Gy in 22 fractions of 3 Gy, and had over 2 years follow-up, were eligible. After the treatment, patients were followed every three months the first two years and then every six months. Endpoints included acute toxicity at the end of treatment and late gastrointestinal (GI) and genitourinary (GU) toxicity using the Radiation Therapy Oncology Group (RTOG) scoring, biochemical control and patient reported outcomes using the Expanded Prostate Cancer Index (EPIC-26).
Results
Results: One hundred and sixteen men became eligible. With a median follow-up of 40 months, acute GI and GU Grade2 toxicity were 26% and 12%, respectively. Cumulative late Grade2 GI and GU toxicity was 1% and 4% respectively. No Grade3 acute or late toxicity were reported. Biochemical control was 97%. Ninety patients (78%) completed the EPIC-26 form. Patient-reported outcomes showed no urinary and bowel general problems in 76% and 91%, respectively. The proportion of patients reporting moderate urinary problems was 2,2% (2 patients). No moderate or severe bowel problems were reported.
Conclusion
Conclusion: Dose escalation to 66 Gy with moderate hypo fractionated VMAT is associated with favourable late toxicity, biochemical control and good patient reported outcomes with over two years follow-up.

PO-0823 TRAC: Automated atlas based machine learning QA of contouring accuracy for the PROMETHEUS trial
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Purpose or Objective
Variation in radiotherapy target volume and OAR delineation is one of the largest contributing factors to the global uncertainty in treatment delivery. Further, it is acknowledged that it is also an obstacle to effective clinical trials in advanced treatment techniques if not accounted for in the experimental design. However, manual expert review of delineation for all patients enrolled prior to treatment is logistically arduous and expensive. We propose a scalable cloud based automated solution for trial specific review of delineation accuracy, The Radiotherapy Atlas Contouring (TRAC) tool. TRAC has the added benefit of enabling rapid clinical translation of study findings into regular practice.

Material and Methods
Retrospective data from the prostate SBRT trial PROMETHEUS (ACTRN12615000223538) was utilised for this study. Multi-atlas generation consisted of MRI data from 10 patients, five observers, three anatomical structures and a rectal stabilisation device. The rectal stabilisation devices approved for use in the study included the RectaFix™ and SpaceOAR® hydrogel. Tolerance for delineation acceptability was based on observer variation in multi-atlas generation. Where necessary the manual expert reviewer delineated a corrected contour for comparison. Thus, for each patient there were a number of structures deemed correct and incorrect by manual review for testing. A random forest classifier was trained using a number of contour features (DSC, Components, Volume, Elongation, Perimeter,