Technical Innovations & Patient Support in Radiation Oncology 6 (2018) 1–4

Contents lists available at ScienceDirect

Technical Innovations & Patient Support in Radiation Oncology

Case reports and case series

A biodegradable rectal balloon implant to protect the rectum during prostate cancer radiotherapy for a patient with active Crohn's disease

Ben G.L. Vanneste [a,*], Evert J. Van Limbergen [a], Kees van de Beek [b], Emile van Lin [c], Ludy Lutgens [a], Philippe Lambin [a]

[a] Department of Radiation Oncology (MAASTRO), GROW – School for Oncology and Developmental Biology, Maastricht University Medical Center+, Maastricht, The Netherlands
[b] Department of Urology, Maastricht University Medical Center+, Maastricht, The Netherlands
[c] Radiotherapy Bonn-Rhein-Sieg, Troisdorf, Germany

ARTICLE INFO

Article history:
Received 20 September 2017
Accepted 26 January 2018

Keywords:
Prostate cancer
Radiotherapy
Rectal balloon implant
Inflammatory bowel disease

ABSTRACT

Background: Radiotherapy in patients with active inflammatory bowel disease (IBD) is usually considered an absolute exclusion criterion for prostate cancer radiotherapy treatment.

There are no reports available on the use of a biodegradable rectal balloon implantation (RBI) in patients with active IBD for prostate cancer radiotherapy.

Case presentation: We report on a patient with high-risk prostate cancer with the comorbidity of an active IBD with pancolitis location. He was treated with neo-adjuvant hormonal therapy and high-dose external beam radiotherapy to the prostate and the seminal vesicles. Before radiotherapy treatment, a biodegradable RBI was implanted between the prostate and the anterior rectal wall to push the rectum outside of the high-dose area. This patient at high-risk for rectal toxicity was successfully irradiated to his prostate with only a grade I urinary toxicity, no acute rectal toxicity or toxicity flare of the IBD.

Conclusions: This case describes the use of a RBI implantation in patients with active IBD for prostate cancer radiotherapy. The use of a biodegradable RBI proved to be a promised solution for such patients, and have to be further investigated.

Introduction

Inflammatory bowel disease (IBD) is a chronic inflammation of the gastrointestinal (GI) tract in individuals with a genetic predisposition, who have been exposed to environmental risk factors, without an infectious cause [1]. IBD refers to a disease comprising two major disorders: ulcerative colitis and Crohn's disease. Active and medically controlled IBD are generally considered to be absolute or relative contraindications for using ionising radiation because of the severely increased risk of GI toxicity, with reported grade $\geq$3 late GI complications attributable to external beam radiation therapy (EBRT), up to as much as 73% using conventional EBRT techniques [2,3].

The current standard of care for locally advanced prostate cancer is high-dose EBRT and/or brachytherapy or radical prostatectomy [4,5]. EBRT for prostate cancer may lead to GI toxicity as a common side-effect, which has a negative impact on the quality of life even many years after the EBRT [6,7]. Several devices have been developed to spare anorectal structures [8]. Implantable rectum spacers (IRS) push the anterior rectal wall away from the prostate by injection of an absorbable hydrogel [9], a hyaluronic acid [10], a saline-filled balloon [11], or a collagen implant [12]. Several studies have confirmed that an IRS decreases the rectal dose leading to decreasing acute and late rectal toxicity, and consequently increasing cost-effectiveness [13–15].

In this report, we present a patient with a high-risk cT2N0 Gleason 4 + 5 prostate cancer treated with neo-adjuvant hormonal therapy and concurrent EBRT using volumetric-modulated arc therapy (VMAT). A biodegradable rectal balloon implant (RBI) was applied before the start of EBRT to protect and push the anterior rectal wall out of the irradiation field. This case report illustrates a possible workaround for the problem of active IBD for a patient in need of prostate cancer radiotherapy.

Case presentation

A 73-year-old man was diagnosed with a Gleason 4 + 5 = 9 adenocarcinoma of the prostate by a routine blood measurement

* Corresponding author at: MAASTRO Clinic, P.O. Box 3035, 6202 NA Maastricht, The Netherlands.
E-mail address: ben.vanneste@maastro.nl (B.G.L. Vanneste).

https://doi.org/10.1016/j.tipsro.2018.01.004

(PSA 9.2 ng/ml). Transrectal ultrasound-guided biopsies of the prostate revealed a Gleason 4 + 5 prostate cancer, 6/6 in the right side in 30 to 80% of the biopsies. Left side was negative. The patient was in good condition, with a World Health Organization (WHO) performance status of 0, but with active IBD status (Crohn's). Crohn's-associated ulcerative lesions were reported over the whole colon-rectum, with approximately monthly exacerbations. The patient reported more than four stools a day, with loss of mucus, and urgency. He was on sustained medical treatment (golimumab 100 mg), adjusted with prednisone 15 mg for an exacerbation. Magnetic resonance imaging (MRI) revealed a tumour in the right side of the prostate with dubious extra-prostatic spread to the apex (Fig. 1). No suspected lymph nodes or seminal vesicles invasion were observed. A bone scan revealed no metastases. Clinical staging was a high-risk cT2-3a (dubious MRI) N0 prostate cancer.

The patient was discussed at a multi-disciplinary tumour board. In light of the patient's relatively young age and good life expectancy, a curative treatment was recommended. Brachytherapy as monotherapy was not considered because of the high Gleason score and the high-volume disease. Radical prostatectomy was not considered due to the high Gleason score, the dubious extra-prostatic spread to the apex, and the possible adhesions. The risk of a positive section margin was assumed to be very high, with consequentially the need for salvage EBRT with associated high rectal toxicity. Moreover, radical prostatectomy would preclude the implantation of an RBI to decrease GI toxicity. Therefore, primary neo-adjuvant hormonal therapy for six months was suggested to attempt a possible downstage of the prostate cancer and to diminish the activity of the Crohn's disease, followed with high-dose EBRT in combination with an RBI.

We started with neo-adjuvant hormonal therapy for six months to downstage [16]. After three months, the PSA had decreased to 0.4 ng/ml, with testosterone at castration level (<0.3 nmol/L). The IBD was relatively stable with one flare during these three months. After approximately six months the preparations for EBRT were started: First, fiducial markers were implanted intra-prostatically. Secondly, an RBI was implanted between the prostate and the anterior rectal wall. The RBI was implanted transperineally under bi-plane transrectal ultrasonography guidance. The injection technique has been described previously [17]. A bubble-free (sterile) saline solution was used to fill and inflate the RBI. The saline solution was mixed with approximately 1.5 cm^3 iodinated contrast medium to enhance the visualisation of the RBI on computed tomography (CT) scans and cone-beam CT scans. The volume of the prostate was adequately decreased with hormonal therapy (<35 cm^3), and therefore a 12 cm^3 of saline liquid was as enough to guarantee a prostate-rectum separation of at least 1 cm [17].

The implantation procedure was tolerated well, without complications. No pain or discomfort in the perineal region (according to Visual Analogue Scale (VAS)) was reported in the week after the implantation. The perineal region showed no signs of infection.

A CT scan and an MRI scan (Fig. 1) were performed 7 days after RBI implantation in supine position with a slice thickness of 3 mm for treatment planning and delineation purposes, respectively. A filled bladder was asked for the planning scans and every treatment fraction. The CT and MRI scans were co-registered on the fiducial markers.

Delineation of the prostate (: CTV = clinical target volume) was performed on the T2-weighted MRI scan, while the RBI, the base of the seminal vesicles (according to the prognostic Partin risk group) and the organs at risk were delineated on the CT scan [18]. The planning target volume (PTV1) was constructed according to the institutional protocol (CTV + 10 mm cranial - caudal, +7 mm anterior - posterior, +6 mm left - right).

This patient was treated using VMAT radiotherapy to a dose of 70 Gray (Gy) [19] (28 fractions of 2.5 Gy) with 10 MV photon beams (Eclipse Version ICD-10, Varian Medical Systems Inc., Palo Alto, USA) (Fig. 2). The overall treatment time was 7 weeks, at 4 fractions a week. The irradiation plan revealed a V65 (relative volume of rectum receiving 65 Gy or more) of 0.2%, a V54 of 8.4% and a maximum point dose on the rectum of 66.5 Gy.

The EBRT treatment was very well tolerated: the patient only had a slight difference in urinary excretion reported as a grade I according to the Common Terminology Criteria for Adverse Events (Version 4.0) [20]. The acute urinary side effects consisted only of slightly raised frequency with nocturia 2 to 3 times a night. No acute rectal toxicity, pain or urgency were reported by the patient. No additional medication was prescribed. Three weeks after EBRT, the patient reported no complaints at all. The IBD was unremarkable, and no exacerbation was observed during and after the EBRT. Ten months after EBRT, the PSA had dropped to an undetectable level and the patient reported no complaints.

Discussion

In the literature, an (active) IBD has long been considered to be a relative (or even absolute) contraindication for the use of ionising radiation therapy to sites including bowel structures, because of the extremely increased risk of GI toxicity (grade 3 up to 73% using

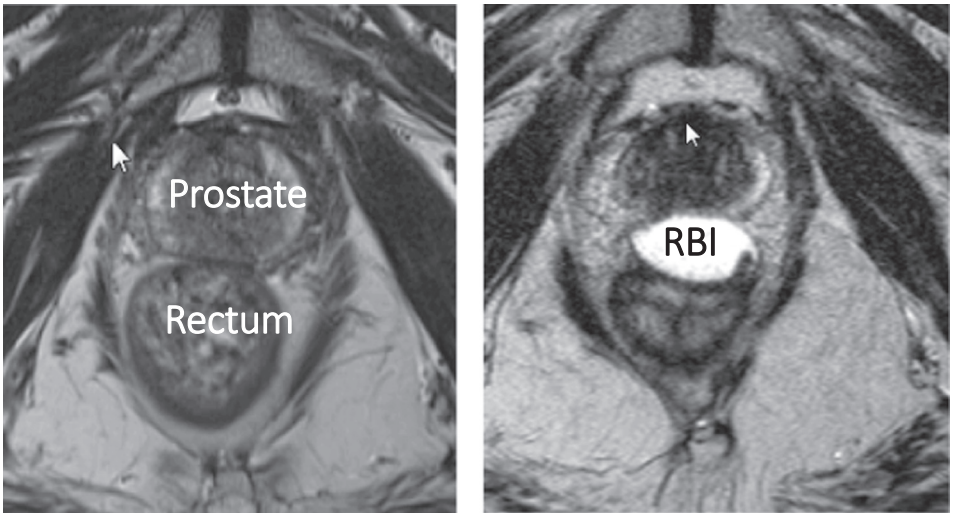

Fig. 1. Axial T2-weighted MRI of a patient with an RBI before (a) and after implantation (b). *Abbreviation*: MRI = Magnetic Resonance Image; RBI = Rectal Balloon Implant.