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Abstract

Background: Palliative radiation therapy (RT) is used to treat symptomatic rectal cancer although clinical benefits and toxicities are poorly documented. There is no consensus about the optimal RT regimen and clinical practice undergoes significant changes. Our aim was to evaluate the efficacy and toxicity of short-course (SC) RT in this setting of patients.

Materials and methods: Charts from patients with locally advanced disease not candidates for standard treatment or with symptomatic metastatic rectal cancer treated with SCRT (25 Gy/5 fractions in 5 consecutive days) were retrospectively reviewed. Clinical outcome measures were symptomatic response rate and toxicity.

Results: From January 2007 to December 2017, 59 patients (median age 80 years) received SCRT; 53 were evaluable. The median follow-up was 8 months (range, 1–70). Clinical response to RT for bleeding, pain and tenesmus was 100%, 95% and 89%, respectively. The compliance with the treatment was 100% and no patient experienced acute severe (≥ grade 3) toxicities. Median time to

symptoms recurrence was 11 months (range 3-69). Globally, the median overall survival was 12 months.

Conclusions: SCRT is a safe and effective regimen in symptomatic rectal cancer and may be considered the regimen of choice for standard treatment in unfit patients.

Kew words: rectal cancer; palliative radiation therapy; short-course

Introduction

Locally advanced rectal cancer may produce significant pelvic morbidities including bleeding, pain, obstruction and tenesmus [1]. In advanced disease, chemotherapy usually has a positive effect on the primary tumor, even if a subgroup of non-responsive patients still experiences pelvic symptoms unsuitable for surgery [2]. Moreover, patients may not be candidates for standard treatment due to advanced age and/or comorbidities. Radiation therapy (RT) is a potentially effective palliative treatment for patients with symptomatic rectal cancer. Nevertheless, almost all the evidence about palliative RT in this setting was largely outdated, retrospective and based on 2D conventional treatment, which is no longer used nowadays [3]. A recent systematic review of palliative RT for rectal cancer documented symptomatic improvement across a wide range of treatment schedules [3]. Unfortunately there is no consensus on how palliative treatment should optimally be delivered regarding indication, dose and timing [3]. Randomized studies of palliative RT in other scenarios have shown that hypofractionated schedules can be used as effectively as conventional treatment, without increased toxicity [4]. In symptomatic-rectal-cancer patients a strong rationale for using hypofractionated regimens is based on the excellent response to short-course (SC) RT as preoperative treatment, both in fit or unfit locally advanced rectal cancer patients [5–7] or as alternative to surgery in stage IV near-obstructing lesions [8].

The primary aim of the present study is to evaluate retrospectively the palliative effect of SCRT in symptomatic rectal cancer patients; the second one is to report treatment-related toxicity and patient’s compliance.

Materials and methods

We retrospectively reviewed the medical records of patients with rectal cancer, treated from January 2007 to December 2016 with palliative SCRT. The study was approved by the Regional Ethical Committee (ref. N.15898/19/ON).

Selection criteria

Eligible patients had to fulfill the following criteria: 1) histologically-proven diagnosis of extraperitoneal rectal adenocarcinoma, 2) locally advanced primary disease (cT3–T4 N0/N+) or recurrent disease unfit for standard treatment due to age and/or comorbidities, 3) metastatic disease, 4) symptomatic disease for at least one of the following signs: bleeding, pain, tenesmus, obstruction, 5) life expectancy longer than one month. Exclusion criteria were: 1) previous pelvic RT, 2) concomitant chemotherapy or chemotherapy administered less than 1 month from the beginning of radiotherapy. Staging included local tumor assessment by digital rectal examination, colonoscopy, chest and abdomen computed tomography (CT) scan. Local extension of disease was assessed by rectal endoscopic ultrasound (EUS) and/or pelvic magnetic resonance imaging (MRI).

Treatment

Patients were instructed to empty the bladder and drink 500 cc of water 30 minutes before CT simulation and before every daily RT fraction. Delineation of the clinical target volume (CTV) included the primary disease and the corresponding mesorectum plus 2 cm cranio-caudally. The planning target volume (PTV) was CTV plus a 1 cm margin in all directions. The following were contoured as organs at risk: small bowel, femoral heads, bladder, anal canal, uterus and vagina (in female), prostate and seminal vesicles (in male). Conformal 3DRT was planned using Philips-Pinnacle3 treatment planning system. The dose fractionation regimen was 25 Gy in 5 fractions in 5 consecutive days, delivered by an isocentric 3–4 field technique.

Symptom and toxicity assessment

Response to treatment was assessed clinically; in particular for bleeding, a response was defined as resolution or improvement with stable hemoglobin values. For pain and tenesmus, a response was scored as decreased pain and/or reduction/discontinuation of analgesic medications. All patients were evaluated before RT and clinical response was assessed one month after the end of treatment. Acute toxicity was evaluated according to the Common Terminology Criteria for Adverse Events (CTCAE) scale version 3.0. The duration of response was defined as the interval between the onset of clinical benefit and the relapse or the worsening of sign/symptoms of disease or death. The follow-up period was defined from the start of RT to death or to the last follow-up. For those patients who were unable to go to the hospital, the clinical update was performed by telephone with the patient's general practitioner.

Statistical analysis

The statistical analysis used a software program SPSS (version 22.0; Inc Chicago, IL, United States). The data are presented in tabular form. Quality variables are expressed as absolute frequency/frequency relative percentage. Continuous variables, such as the age of patients, are presented using descriptive statistical parameters. Kaplan Meyer curves are used to assess overall group survival.

Results

In the period study a total of 59 patients were retrospectively collected. Six out of 59 patients were not evaluable for the analysis: 1 patient as receiving a previous pelvic radiotherapy treatment (30 Gy in 10 fractions), 1 as having a pelvic relapse from sigmoid cancer, 2 for early death occurring less than one month from treatment, 1 as submitted to low anterior resection four months after RT without any signs of progressive disease and, lastly, 1 patient as lost to follow-up within 1 month from RT. Patient characteristics are shown in Table 1. Median age was 80 years (range 49–93 years) and median KPS, 70% (range 50–100%). Forty-one (77%) patients had lower rectal cancer, 9 (17%) had local relapse and 26 (49%) metastatic disease. Thirty-one (58%) patients had not received previous oncologic treatment and forty-six (87%) had disabling comorbidities such as cardiovascular and bronchopulmonary diseases, diabetes, stroke. The median follow-up was 8 months (range, 1–70). The patient's clinical symptoms before and after RT are reported in Table 2. At the beginning, 46 (87%) patients presented bleeding, 22 (42%) pain and 19 (36%) tenesmus. Seventeen (77%) out of twenty-two patients who had received previous treatments (surgery and/or chemotherapy) were referred to the radiation oncologist for a locally progressive disease. The clinical response to RT for bleeding, pain and tenesmus was 100%, 95% and 89%, respectively. No symptom worsening was reported. Patients' compliance to RT was 100%. Most (91%) of the cases did not experience any grade of acute toxicity. Seven (13%) patients experienced a temporary worsening of pain and/or rectal tenesmus. No patient interrupted RT for rising toxicities and no severe acute toxicity (≥ grade G3) was detected. Among the 53 evaluable cases, in fifteen (28%) the symptoms resumed, while 38 (72%) did not have symptom recurrence until death or the last clinical update. Duration of response was 8 months (range 1–70). The median time for symptom recurrence was 11 months (range 3–69). Eight out of 15 patients with symptom relapse, underwent RT retreatment for a total dose of 16–20 Gy in 4–5 fractions. Treatment was delivered by the intensity modulated radiotherapy (IMRT) technique and was well tolerated. The median OS was 12 months.

Discussion

Results from our study showed that patients with symptomatic rectal cancer, unfit for standard treatment due to age and/or comorbidities, may effectively be treated with SCRT, without toxicity. The clinical response was obtained in 100%, 95% and 89% of patients with bleeding, pain and tenesmus, respectively. The compliance to RT was 100% and no patients experienced acute severe (≥ grade 3) toxicities. Median overall survival was 12 months. RT maintained the clinical response for the remaining period of life (until death) in 2/3 of cases (72%).

Palliative RT is a potentially effective treatment in this setting of patients, although the data published in the literature are limited. Almost all the published studies on palliative RT was recently reviewed by Cameron et al. [3]. The review included 27 studies, 23 of which were retrospective. There were large variations in applied RT regimens, sample sizes, primary endpoints, outcome measures and follow-up periods. The overall symptom response rate was 75% and clinical benefit was reported for pain, bleeding and discharge, mass effect in 78% (range 78–93%), 81% (range 68–100%), 71% (range 35–88%) of cases, respectively. Median duration of symptoms relief was 6–9 months. However, due to methodological shortcomings in the reports and great inter-study variability, it is impossible to draw valid and reliable conclusions regarding indication, dose and timing of the palliative RT, or potential toxicity.

A clear relationship between RT dose and symptom response has yet to be conclusively established. Wong et al. reported a dose-response correlation in recurrent rectal cancer patients in terms of pain control, submitted to RT total dose going from less than 20 Gy to 45 Gy [9]. Wang et al. also documented an improvement of clinical benefit with increased dose of RT [10]. Crane et al. reported the results obtained with three different RT regimens (30 Gy/6 fractions, 35 Gy/14 fractions and 45 Gy/25 fractions) documenting that a biological equivalent dose (BED) < 35 Gy_{10} was associated with worse clinical control of pelvic disease [11]. Subsequently, Bae et al. demonstrated a statistically significant improvement of local control for a BED ≥ 40 Gy_{10}, even if 1/3 of cases had colon cancer. RT total dose ranged between 8–60 Gy with 1.8–8 Gy dose per fraction and 23% of patients were treated with concomitant chemo-radiotherapy [12]. Lastly, Chia et al. using a BED cut-off of 39Gy_{10} did not document any dose-response relationship. These results may be clearly related to a wide range of dose-fractionation schedules used [13].

In clinical practice, symptom relief could be obtained with both SC or long-course RT. To compare these two schedules with the linear-quadratic model, a moderately low □□□ (5.06 Gy) ratio estimated for rectal adenocarcinoma [14] and time correction for high tumor clonogen repopulation induced by radiation [15] were used in the BED calculation. For the SC schedule, the BED, both for tumor

control and late damage, compared favorably with respective doses calculated for conventionally fractionated schedules [16].

Randomized studies of palliative RT in other scenarios have shown that hypofractionated treatment can obtain symptom palliation as effectively as conventional treatment, without increased toxicity [4].

A strong rationale for using hypofractionated regimens is based on the excellent response to SCRT as preoperative treatment both in fit or unfit locally advanced rectal cancer patients [5–7, 17, 18]. Also in our experience, we confirm the safety and the efficacy of SC preoperative regimen in unfit locally advanced rectal cancer patients [19].

Apart from the review by Cameron et al. [3], few studies have been published, whose characteristics and symptomatic response are summarized in table 3 and table 4, respectively.

Two prospective phase II studies evaluating the role of palliative SCRT in stage IV symptomatic rectal cancer patients were published. The study by Tyc-Szczepaniak et al., carried out in 40 cases affected by symptomatic rectal adenocarcinoma (stage IV), demonstrated the feasibility and efficacy of up-front SCRT followed by chemotherapy both in terms of avoiding palliative surgery and clinical control. In particular, only 20% of patients underwent palliative surgery because of local symptom progression, most of them within 12 months from RT; 65% of patients had complete (30%) or significant improvement (35%) of pelvic symptoms after 2 years from RT. Median overall survival was 12 months and the 2-year overall survival rate was 23% [8]. These results were confirmed by Picardi et al.; 18 patients with symptomatic obstructing rectal cancer received SCRT. Globally, 89% of cases had complete response (39%) or improvement (50%) of obstructing symptoms. The response rates of pain and bleeding were 87.5% and 100%, respectively. About 70% of patients were colostomy-free at 2 years from RT. About 17% of patients experienced grade 3 acute toxicity, even if no one stopped RT. Median overall survival was 25 months [20].

At the same time, Chia et al. published the results of a retrospective study carried out in 99 patients with symptomatic rectal cancer. Dose-fractionation regimen ranged from 18 Gy/6 fractions to 54 Gy/30 fractions; even if the most prevalent fractionation schedule was 30 Gy/10 fractions. Relief from bleeding, pain and obstruction was documented in 86.7%, 79.3% and 62.5% of cases, respectively. The median duration of response ranged from 4.2 to 5.4 months. Median overall survival was 6.9 months. Grade 3 acute toxicity occurred in 3% of cases [13].

Lastly, Cameron et al. published the results of a prospective phase II study. Fifty-one symptomatic or recurrent rectal cancer patients were treated with hypofractionated palliative RT (30–39 Gy/10–13 fractions). In 33/51 evaluable patients, overall response rate was 85%. Eighteen (35%) patients

did not complete the study follow-up mostly due to deteriorating health. Clinical response for pain, rectal dysfunction, bleeding were 77%, 90% and 100% of cases, respectively. No grade 4 toxicity was reported. Median overall survival was 9 months [21].

The latest published studies concerning palliative RT (Table 3 and 4), were carried out in patients with advanced age (apart from the Polish trial), using two distinct hypofrationations and obtaining an overlapping overall clinical response. Nevertheless, there are some critical issues represented by differences in patient and disease characteristics, chemotherapy treatment, duration of response and survival. In particular, considering the limited life expectancy of the enrolled patients in the prospective study by Cameron et al. [21], it is advisable to use shorter treatment schedules (especially when bleeding is the target symptom) and using a more prolonged fractionation for only those patients with relatively long expected survival.

Due to the retrospective nature of our study, clinical response and toxicity were dependent upon information of clinical records. Despite these limitations, both the number of patients recruited and the symptoms response rates are consistent with those reported in the literature. Furthermore, considering the high feasibility, the low toxicity and the short duration, this type of fractionation can be considered an excellent treatment for symptom control in patients unfit for conventional treatments or in clinical situations where it can be easily integrated with chemotherapy phase for systemic disease control [22, 23].

The role of palliative RT, in stage IV rectal cancer, was recently documented independently of symptoms due to the primary site of disease. A large population-based and propensity score-matched study suggests that palliative RT, beyond the relief of a variety of pelvic symptoms, could provide significant survival benefits [24]. According to the subsequent publication, it should seem that patients receiving upfront radiotherapy, with or without chemotherapy, had fewer local complications due to primary tumor compared to those who only received chemotherapy [25]. These results need to be confirmed in prospective clinical trials to identify which patients might best benefit from RT.

Conclusions

SCRT is an effective and well-tolerated regimen in symptomatic rectal cancer patients. Further clinical research is needed to identify the optimal fractionation schedule based on the different prognostic factors related to both disease and patient.

References

1. Glimelius B, Cavalli-Björkman N. Metastatic colorectal cancer: current treatment and future options for improved survival. Medical approach--present status. Scand J Gastroenterol. 2012; 47(3): 296–314, doi: 10.3109/00365521.2012.640828, indexed in Pubmed: 22242568.

2. Poultsides GA, Servais EL, Saltz LB, et al. Outcome of primary tumor in patients with synchronous stage IV colorectal cancer receiving combination chemotherapy without surgery as initial treatment. J Clin Oncol. 2009; 27(20): 3379–3384, doi: 10.1200/JCO.2008.20.9817, indexed in Pubmed: 19487380.

3. Cameron MG, Kersten C, Vistad I, et al. Palliative pelvic radiotherapy of symptomatic incurable prostate cancer - a systematic review. Radiother Oncol. 2014; 110(1): 55–60, doi: 10.1016/j.radonc.2013.08.008, indexed in Pubmed: 24044801.

4. Lutz ST, Jones J, Chow E. Role of radiation therapy in palliative care of the patient with cancer. J Clin Oncol. 2014; 32(26): 2913–2919, doi: 10.1200/JCO.2014.55.1143, indexed in Pubmed: 25113773.

5. Radu C, Berglund A, Påhlman L, et al. Short-course preoperative radiotherapy with delayed surgery in rectal cancer - a retrospective study. Radiother Oncol. 2008; 87(3): 343–349, doi: 10.1016/j.radonc.2007.11.025, indexed in Pubmed: 18093674.

6. Pettersson D, Holm T, Iversen H, et al. Preoperative short-course radiotherapy with delayed surgery in primary rectal cancer. Br J Surg. 2012; 99(4): 577–583, doi: 10.1002/bjs.7796, indexed in Pubmed: 22241246.

7. Hatfield P, Hingorani M, Radhakrishna G, et al. Short-course radiotherapy, with elective delay prior to surgery, in patients with unresectable rectal cancer who have poor performance status or significant co-morbidity. Radiother Oncol. 2009; 92(2): 210–214, doi: 10.1016/j.radonc.2009.04.007, indexed in Pubmed: 19409638.

8. Tyc-Szczepaniak D, Wyrwicz L, Kepka L, et al. Palliative radiotherapy and chemotherapy instead of surgery in symptomatic rectal cancer with synchronous unresectable metastases: a phase II study. Ann Oncol. 2013; 24(11): 2829–2834, doi: 10.1093/annonc/mdt363, indexed in Pubmed: 24013512.

9. Wong CS, Cummings BJ, Brierley JD, et al. Treatment of locally recurrent rectal carcinoma--results and prognostic factors. Int J Radiat Oncol Biol Phys. 1998; 40(2): 427–435, doi: 10.1016/s0360-3016(97)00737-2, indexed in Pubmed: 9457832.

10. WANG CC, SCHULZ MD. The role of radiation therapy in the management of carcinoma of the sigmoid, rectosigmoid, and rectum. Radiology. 1962; 79: 1–5, doi: 10.1148/79.1.1, indexed in Pubmed: 14004836.

11. Crane CH, Janjan NA, Abbruzzese JL, et al. Effective pelvic symptom control using initial chemoradiation without colostomy in metastatic rectal cancer. Int J Radiat Oncol Biol Phys. 2001; 49(1): 107–116, doi: 10.1016/s0360-3016(00)00777-x, indexed in Pubmed: 11163503.

12. Bae SH, Park W, Choi DHo, et al. Palliative radiotherapy in patients with a symptomatic pelvic mass of metastatic colorectal cancer. Radiat Oncol. 2011; 6: 52, doi: 10.1186/1748-717X-6-52, indexed in Pubmed: 21600018.

13. Chia D, Lu J, Zheng H, et al. Efficacy of palliative radiation therapy for symptomatic rectal cancer. Radiother Oncol. 2016; 121(2): 258–261, doi: 10.1016/j.radonc.2016.06.023, indexed in Pubmed: 27745911.

14. Suwinski R, Wzietek I, Tarnawski R, et al. Moderately low alpha/beta ratio for rectal cancer may best explain the outcome of three fractionation schedules of preoperative radiotherapy. Int J Radiat Oncol Biol Phys. 2007; 69(3): 793–799, doi: 10.1016/j.ijrobp.2007.03.046, indexed in Pubmed: 17499451.

15. Suwinski R, Taylor JM, Withers HR. Rapid growth of microscopic rectal cancer as a determinant of response to preoperative radiation therapy. Int J Radiat Oncol Biol Phys. 1998; 42(5): 943–951, doi: 10.1016/s0360-3016(98)00343-5, indexed in Pubmed: 9869214.

16. Bujko K, Kolodziejczyk M. The 5 x 5 Gy with delayed surgery in non-resectable rectal cancer: a new treatment option. Radiother Oncol. 2008; 87(3): 311–313, doi: 10.1016/j.radonc.2007.12.020, indexed in Pubmed: 18207596.

17. Kapiteijn E, Marijnen CA, Nagtegaal ID, et al. Dutch Colorectal Cancer Group. Preoperative radiotherapy combined with total mesorectal excision for resectable rectal cancer. N Engl J Med. 2001; 345(9): 638–646, doi: 10.1056/NEJMoa010580, indexed in Pubmed: 11547717.

18. Bujko K, Nowacki MP, Nasierowska-Guttmejer A, et al. Long-term results of a randomized trial comparing preoperative short-course radiotherapy with preoperative conventionally fractionated chemoradiation for rectal cancer. Br J Surg. 2006; 93(10): 1215–1223, doi: 10.1002/bjs.5506, indexed in Pubmed: 16983741.

19. Lupattelli M, Lancellotta V, Montesi G, et al. Short-course radiotherapy with delayed surgery in unfit locally advanced rectal cancer patients. Int J Colorectal Dis. 2016; 31(6): 1233–1234, doi: 10.1007/s00384-015-2441-1, indexed in Pubmed: 26584815.

20. Picardi V, Deodato F, Guido A, et al. Palliative Short-Course Radiation Therapy in Rectal Cancer: A Phase 2 Study. Int J Radiat Oncol Biol Phys. 2016; 95(4): 1184–1190, doi: 10.1016/j.ijrobp.2016.03.010, indexed in Pubmed: 27215449.

21. Cameron MG, Kersten C, Vistad I, et al. Palliative pelvic radiotherapy for symptomatic rectal cancer - a prospective multicenter study. Acta Oncol. 2016; 55(12): 1400–1407, doi: 10.1080/0284186X.2016.1191666, indexed in Pubmed: 27332723.

22. van Dijk TH, Tamas K, Beukema JC, et al. Evaluation of short-course radiotherapy followed by neoadjuvant bevacizumab, capecitabine, and oxaliplatin and subsequent radical surgical treatment in primary stage IV rectal cancer. Ann Oncol. 2013; 24(7): 1762–1769, doi: 10.1093/annonc/mdt124, indexed in Pubmed: 23524865.

23. Yoon HIn, Koom WS, Kim TH, et al. Upfront Systemic Chemotherapy and Short-Course Radiotherapy with Delayed Surgery for Locally Advanced Rectal Cancer with Distant Metastases: Outcomes, Compliance, and Favorable Prognostic Factors. PLoS One. 2016; 11(8): e0161475, doi: 10.1371/journal.pone.0161475, indexed in Pubmed: 27536871.

24. Liu Qi, Shan Z, Luo D, et al. Palliative beam radiotherapy offered real-world survival benefit to metastatic rectal cancer: A large US population-based and propensity score-matched study. J Cancer. 2019; 10(5): 1216–1225, doi: 10.7150/jca.28768, indexed in Pubmed: 30854131.

25. Jonsson G, Philipson L, Villman K, et al. Upfront Radiotherapy in Patients With Asymptomatic Incurable Rectal Cancer: A Retrospective Cohort Study. Anticancer Res. 2020; 40(10): 5853–5860, doi: 10.21873/anticanres.14604, indexed in Pubmed: 32988915.

Table 1. Characteristics of evaluable patients

Variable	Values
Gender, n (%)	
Male	33 (62)
Female	20 (38)
Age (years)	
Median (range)	80 (49–93)
KPS	
Median (range)	70% (50–100%)
Disease site, n (%)	
Lower rectum (from AV to 7 cm)	41 (77)
Middle rectum (from 7 to 11 cm)	9 (17)
Higher rectum (above 11 cm)	3 (6)
Stage, n (%)	
II	7 (13)
III	11 (21)
IV	26 (49)
Local relapse	9 (17)
Comorbidities, n (%)	
Yes	46 (87)
No	7 (13)
Previous Treatments, n (%)	
Surgery (LAR, colostomy/ileostomy)	12 (23)
Chemotherapy	12 (23)
None	31 (58)
More than one therapy	5 (9)

KPS — Karnofsky Performance Status; AV — anal verge; LAR — low anterior resection

Table 2. Clinical response to treatment

Symptoms	Before RT		After RT	
	Yes	**No**	**Yes**	**No**

Bleeding	87% (46/53)	13% (7/53)	0%	100% (46/46)
Pain	42% (22/53)	58% (31/53)	5% (1/22)	95% (21/22)
Tenesmus	36% (19/53)	64% (34/53)	11% (2/19)	89% (17/19)

RT — radiation therapy

Table 3. Characteristics of published studies on palliative radiotherapy

Author/Year	**Study design**	**No. patients**	**Median age [yrs]**	**Stage IV**	**RT regimen**	**Chemo - therapy**
Tyc-Szczepaniak 2013	Prospective	40	65	100%	25 Gy/5 fr	100%
Picardi 2016	Prospective	18	77	44%	25 Gy/5 fr	100%
Cameron 2016	Prospective	33/51 ^	79	80%	30–39 Gy/10–13 fr	17%
Chia 2016	Retrospective	99	74	68%	30 Gy/10 fr*	10%
Our series	Retrospective	53	80	49%	25 Gy/5 fr	23%

No. — number; yrs —years; RT — radiation therapy; fr — fractions; ^ — number of evaluable patients; * — most prevalent fractionation

Table 4. Symptomatic response to palliative radiotherapy in recently published studies

Author/Year	**RT regimen**	**OSRR**	**Response for symptom**	**Duration of response**	**Overall survival**
Tyc-Szczepaniak 2013	25 Gy/5 fr	65%	Obstruction 65%	At 2 yrs 67%	11.5 ms
Picardi 2016	25 Gy/5 fr	89%	Bleeding 100% Pain 87.5%	Colostomy-free at 2 yrs 70%	25 ms
Cameron 2016	30–39 Gy/ 10–13 fr	85%	Bleeding 100% Tenesmus 90% Pain 77%	NR	9 ms

Chia 2016	30 Gy/10 fr*	NR	Bleeding 86.7% Pain 79.3% Obstruction 62.5%	4.2–5.4 ms	6.9 ms
Our series	25 Gy/5 fr	100%	Bleeding 100% Pain 95% Tenesmus 89%	8 ms	12 ms

RT — radiation therapy; OSRR — overall symptomatic response rate; fr — fractions; yrs — years; NR — not reported; ms — months; * — most prevalent fractionation