

Preoperative high dose rate brachytherapy for rectal cancer

HealthTech guidance
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Your responsibility

This guidance represents the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, healthcare professionals are expected to take this guidance fully into account, and specifically any special arrangements relating to the introduction of new interventional procedures. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

Commissioners and/or providers have a responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity, and foster good relations. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties. Providers should ensure that governance structures are in place to review, authorise and monitor the introduction of new devices and procedures.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

Contents

1 Recommendations	4
2 Indications and current treatments	5
3 The procedure	6
4 Efficacy	7
5 Safety	9
6 Committee comments	11
Update information	12

This guidance replaces IPG201 and IPG531.

1 Recommendations

- 1.1 Current evidence on the safety of preoperative high dose rate brachytherapy for rectal cancer and its efficacy in reducing tumour size appears adequate. However, there is no evidence that the procedure provides additional benefit when used as a boost to external beam radiotherapy. Evidence on the clinical efficacy of the procedure if used without external beam radiotherapy is inadequate in quantity. Therefore this procedure should only be used with special arrangements for clinical governance, consent and audit or research.
- 1.2 Clinicians wishing to do preoperative high dose rate brachytherapy for rectal cancer should take the following actions:
 - Inform the clinical governance leads in their NHS trusts.
 - Ensure that patients understand the uncertainty about the procedure's efficacy and provide them with clear written information. In addition, the use of NICE's information for the public is recommended.
 - Audit and review clinical outcomes of all patients having preoperative high dose rate brachytherapy for rectal cancer (see NICE's interventional procedure outcomes audit tool).
- 1.3 Patient selection should be done by a colorectal cancer multidisciplinary team which includes a clinical oncologist and a colorectal surgeon with expertise in local excision techniques.
- 1.4 NICE encourages further research into preoperative high dose rate brachytherapy for rectal cancer. Trials should be designed to provide clear data on the efficacy of this procedure, whether or not other adjunctive treatments are used. Research should document adjunctive treatments and details of patient selection. Outcomes should include local recurrence, survival, disease-free survival and quality of life. NICE may update the guidance on publication of further evidence.

2 Indications and current treatments

- 2.1 Rectal cancer is a common form of bowel cancer. The likelihood of developing it rises sharply with age. Symptoms include rectal bleeding and change in bowel habit, although the early stages may be asymptomatic.
- 2.2 Surgery is the main treatment for patients with rectal cancer who are treated with curative intent. It involves resection of the affected part of the rectum and the mesorectum. The anal sphincter is preserved whenever possible: a colostomy is formed when this is not possible.
- 2.3 In some patients, radiotherapy or chemotherapy or both are used before, during or after surgery to decrease the chances of local recurrence and metastatic disease. Radiotherapy may take the form of external beam radiation therapy (EBRT) or brachytherapy. EBRT uses radiation from outside the body, which is focused on the cancer and surrounding lymph nodes. Brachytherapy involves placing a radioactive source (pellet, seed or catheter) directly into or near the tumour. In contact brachytherapy (the Papillon technique) a low energy X-ray tube is used to deliver radiation to the tumour with limited penetration.
- 2.4 Preoperative high dose rate endorectal brachytherapy uses localised radiotherapy, with the aim of shrinking the tumour before surgery with fewer side effects than EBRT.

3 The procedure

- 3.1 Endorectal high dose rate (HDR) brachytherapy for rectal cancer is usually carried out with the patient under sedation. Before treatment the tumour size and stage are determined using imaging techniques. A 3-dimensional CT-based treatment planning system may be used to guide the positioning and dose of radiation. Radio-opaque clips may be placed, using proctoscopy or sigmoidoscopy, to mark the margins of the tumour.
- 3.2 A rigid or flexible endorectal applicator is inserted into the rectum and used to deliver the radiation source to the tumour. The radioactive material is moved from the brachytherapy machine into the applicator and is left in place to deliver the correct dose of radiation to the tumour. A balloon may be placed over the applicator to displace the uninvolved rectal mucosa away from the radioactive material, to reduce toxicity. When the balloon is inflated, it immobilises the applicator and also helps to facilitate close contact with the tumour. When the treatment is over, the radioactive material is moved back into the machine and the applicator is taken out. Surgery to remove any remaining tumour is done a few weeks after completion of brachytherapy.

4 Efficacy

This section describes efficacy outcomes from the published literature that the Committee considered as part of the evidence about this procedure. For more detailed information on the evidence, see the [interventional procedure overview](#).

- 4.1 A randomised controlled trial (RCT) of 221 patients treated by a preoperative high dose rate (HDR) brachytherapy boost and external beam radiotherapy (EBRT) or by EBRT alone, with concomitant chemotherapy, reported that 66% of 2-year survivors and 65% of 5-year survivors had a stoma, with no difference between the groups ($p=1.00$). A non-randomised comparative study of 230 patients treated by preoperative brachytherapy or by surgery alone reported that the sphincter was preserved in 72% (69/96) of patients treated by preoperative brachytherapy compared against 42% (48/115) of patients treated by surgery alone ($p<0.0001$).
- 4.2 An RCT of 243 patients treated by a preoperative HDR brachytherapy boost and EBRT or by EBRT alone, with concomitant chemotherapy, reported R0 resection (complete resection with no microscopic residual tumour) in 99% (87/90) and 90% (83/92) of patients, respectively ($p=0.03$). A non-randomised comparative study of 954 patients treated by preoperative HDR brachytherapy, by short course EBRT or by surgery alone reported R0 resection in 97% (307/318), 83% (265/318) and 74% (236/318) of patients, respectively ($p=0.03$ for preoperative brachytherapy compared against short course EBRT).
- 4.3 The RCT of 243 patients treated by a preoperative HDR brachytherapy boost and EBRT or by EBRT alone, with concomitant chemotherapy, reported a 'major response' in 44% (35/80) and 28% (23/82) of patients, respectively ($p=0.04$). The difference in response rate was greater for tumours less than 3.7 cm in diameter. A case series of 285 patients reported a complete pathological response rate of 27% after preoperative HDR brachytherapy and surgery.
- 4.4 The non-randomised comparative study of 230 patients reported that 8% (8/96) of patients treated by preoperative brachytherapy developed local recurrence, compared against 21% (24/115) of patients treated by surgery alone ($p=0.005$). The case series of 285 patients reported an actuarial local recurrence rate of 5%

at 5 years after preoperative HDR brachytherapy and surgery.

- 4.5 The RCT of 221 patients treated by a preoperative HDR brachytherapy boost and EBRT or by EBRT alone, with concomitant chemotherapy, reported progression-free 5-year survival of 52% and 64%, respectively ($p=0.32$). The non-randomised comparative study of 230 patients reported disease-free survival of 72% (69/96) for patients treated by preoperative brachytherapy (median follow-up 49.5 months) compared against 65% (75/115) for patients treated by surgery alone (median follow-up 47.5 months; p value not stated). The case series of 285 patients reported 5-year disease-free survival of 65% after preoperative HDR brachytherapy and surgery.
- 4.6 The RCT of 221 patients treated by a preoperative HDR brachytherapy boost and EBRT or by EBRT alone, with concomitant chemotherapy, reported overall 5-year survival of 64% and 71%, respectively ($p=0.34$). The non-randomised comparative study of 230 patients reported actuarial probability of 5-year survival of 62% for patients treated by preoperative brachytherapy and 65% for patients treated by surgery alone. The case series of 285 patients reported 5-year overall survival of 68% after preoperative HDR brachytherapy and surgery.
- 4.7 The specialist advisers listed the following key efficacy outcomes: sphincter preservation rate compared with conventional therapy; histopathological outcomes of surgery; R0 resection rates; quality of life; bowel, urinary and sexual function; local recurrence rates; disease-free survival and overall survival.

5 Safety

This section describes safety outcomes from the published literature that the Committee considered as part of the evidence about this procedure. For more detailed information on the evidence, see the [interventional procedure overview](#).

5.1 The following grade 2 toxicity events were reported in patients treated by a preoperative high dose rate (HDR) brachytherapy boost and external beam radiotherapy (EBRT) with concomitant chemotherapy in a randomised controlled trial (RCT) of 243 patients: 'skin' (20%), diarrhoea (19%), proctitis (18%), nausea (6%), dysuria (6%), vomiting (2%), stomatitis (2%), and neutropenia (1%). Similar rates were seen in patients treated by preoperative EBRT alone with concomitant chemotherapy. Grade 3 acute proctitis was reported in 1% (2/285) of patients in a case series of 285 patients treated by preoperative HDR brachytherapy. Rectal pain was reported in 71% (12/17) of patients treated by preoperative HDR brachytherapy in a non-randomised comparative study of 36 patients.

5.2 Wound infection was reported in 15% (16/106) of patients treated by a preoperative HDR brachytherapy boost and EBRT compared against 11% (12/109) of patients treated by preoperative EBRT alone in the RCT of 243 patients. 'Infection' was reported in 9% (30/318), 8% (26/318) and 6% (20/318) of patients treated by preoperative HDR brachytherapy, by EBRT or by surgery alone, respectively, in the non-randomised comparative study of 954 patients ($p=0.2$). In the same study wound infection was reported in 9% (29/318), 12% (39/318) and 6% (19/318) of patients treated by preoperative HDR brachytherapy, by EBRT or by surgery alone, respectively ($p=0.25$), and intra-abdominal infection was reported in 4% (12/318), 3% (8/318) and 3% (9/318) of patients, respectively ($p=0.4$). Pelvic sepsis and wound sepsis were each reported in 4% (4/106) of patients in a case series of 106 patients.

5.3 Wound dehiscence was reported in 3% (9/318), 3% (8/318) and 2% (5/318) of patients treated by preoperative HDR brachytherapy, by EBRT or by surgery alone, respectively, in the non-randomised comparative study of 954 patients ($p=0.4$). Anastomotic dehiscence was reported in 4% (13/318), 6% (20/318) and 4% (13/318) of patients treated by preoperative HDR brachytherapy, by EBRT or by surgery alone, respectively, in the non-randomised comparative study ($p=0.2$)

and in 4% (4/106) of patients in the case series of 106 patients.

5.4 Fistula was reported in less than 1% (1/106) of patients treated by a preoperative HDR brachytherapy boost and EBRT, and in 2% (2/109) of patients treated by preoperative EBRT alone, in the RCT of 243 patients. Fistula was reported in 7% (7/106) of patients in the case series of 106 patients.

5.5 'Stricture' was reported in 1 patient in a case series of 34 patients. Anastomotic stricture was reported in 3% (3/106) of patients in the case series of 106 patients.

5.6 Small bowel obstruction was reported in 8% (8/106) of patients in the case series of 106 patients; all were successfully treated without surgery.

5.7 Reoperation was reported in 5% (5/106) of patients treated by a preoperative HDR brachytherapy boost and EBRT compared against 8% (9/109) of patients treated by EBRT alone, in the RCT of 243 patients (p value not reported). Reoperation rates of 4% (13/318), 14% (45/318) and 12% (39/318) were reported for patients treated by preoperative HDR brachytherapy, by short course EBRT or by surgery alone, respectively (p=0.0005), in the non-randomised comparative study of 954 patients. Surgical intervention for complications was reported in 11% (12/106) of patients in the case series of 106 patients.

5.8 In addition to safety outcomes reported in the literature, specialist advisers are asked about anecdotal adverse events (events which they have heard about) and about theoretical adverse events (events which they think might possibly occur, even if they have never done so). For this procedure, specialist advisers listed the following anecdotal adverse events: rectal fistula formation, small bowel stricture, and persisting proctitis. They considered that the following were theoretical adverse events: bladder perforation, mucosal damage causing ulceration and bleeding, stenosis of the rectal lumen or small bowel, and skin changes on the perineum.

6 Committee comments

6.1 The Committee was advised that imaging technology and application techniques are evolving.

Update information

Minor changes after publication

January 2026: Interventional procedures guidance 531 has been migrated to HealthTech guidance 383. The recommendations and accompanying content remain unchanged.

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Endorsing organisation

This guidance has been endorsed by Healthcare Improvement Scotland.