

International Preoperative Rectal Cancer Management: Staging, Neoadjuvant Treatment, and Impact of Multidisciplinary Teams

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Abstract

Background Little is known regarding variations in preoperative treatment and practice for rectal cancer (RC) on an international level, yet practice variation may result in differences in recurrence and survival rates.

Methods One hundred seventy-three international colorectal centers were invited to participate in a survey of preoperative management of rectal cancer.

Results One hundred twenty-three (71%) responded, with a majority of respondents from North America, Europe, and Asia. Ninety-three percent have more than 5 years' experience with rectal cancer surgery. Fifty-five percent use CT scan, 35% MRI, 29% ERUS, 12% digital rectal examination and 1% PET scan in all RC cases. Seventy-four percent consider threatened circumferential margin (CRM) an indication for neoadjuvant treatment. Ninety-two

percent prefer 5-FU-based long-course neoadjuvant chemoradiation therapy (CRT). A significant difference in practice exists between the US and non-US surgeons: poor histological differentiation as an indication for CRT (25% vs. 7.0%, $p = 0.008$), CRT for stage II and III rectal cancer (92% vs. 43%, $p = 0.0001$), MRI for all RC patients (20% vs. 42%, $p = 0.03$), and ERUS for all RC patients (43% vs. 21%, $p = 0.01$). Multidisciplinary team meetings significantly influence decisions for MRI (RR = 3.62), neoadjuvant treatment (threatened CRM, RR = 5.67, stage II + III RR = 2.98), quality of pathology report (RR = 4.85), and sphincter-saving surgery (RR = 3.81).

Conclusions There was little consensus on staging, neoadjuvant treatment, and preoperative management of rectal cancer. Regular multidisciplinary team meetings influence decisions about neoadjuvant treatment and staging methods.

Members of the International Rectal Cancer Study Group are listed in Appendix.

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Introduction

A uniform international consensus regarding the optimal management of rectal cancer patients has yet to be developed. Recommendations and guidelines have been published [1–11], but guidelines may lag behind current standards in therapy and it is not known if they are used consistently or universally, even within their respective countries. Differences in practice may influence rectal cancer survival and morbidity. Furthermore, adherence to evidence-based clinical practice in colorectal surgery has been shown to be inconsistent in several reports [12, 13].

Scientific comparison of staging and preoperative treatment of rectal cancer may be hindered by the variety of practice patterns within countries and across international borders. In this context, it is important to evaluate inherent international trends and differences in the management and treatment of rectal cancer. We have conducted a survey regarding current practices of preoperative staging and treatment of rectal cancer among an international panel of colorectal surgeons. The aim of the study was to identify regional differences among international experts that may influence our interpretation of current and future studies regarding the preoperative management of rectal cancer. Furthermore, we wanted to detect the impact of multidisciplinary team meetings and department caseload upon the preoperative decision-making.

Materials and methods

The study group

A group of six surgeons from the US, Australia, and Europe constituted the working members of an International Rectal Cancer Study Group (IRCSG). All surgeons had more than 10 years of experience with rectal cancer. IRCSG is an independent group without financial support from any companies or organizations and has representatives from Asia, Europe, and North America. The aim of the study group was to evaluate current international treatment practices of rectal cancer.

Invited colorectal surgeons to IRCSG

Centers and representative surgeons were selected based on prior publications, presentations, or participation at national or international meetings and via a PubMed search for scientific reports on rectal cancer. All respondents were invited to become members of IRCSG. To ensure an experienced international panel, we used two strategies:

1. *PubMed search* We performed an unsystematic search using the search term *rectal cancer* combined with *staging, treatment, chemotherapy, radiation, surgery*. Based upon this search, corresponding authors were identified and included in the survey sample.
2. *Oral presentation at an international scientific meeting* The working committee of IRCSG participated in several international rectal cancer conferences from 2006 to 2008. Oral presenters in these conferences were identified and included in the survey sample.

The questionnaire

The questionnaire was developed and validated during several meetings of IRCSG. The aim was to cover all aspects of preoperative rectal cancer treatment. Modifications to the survey items were made by literature review and e-mail discussions. The questionnaire consisted of 59 questions. An average of 20 min was needed to complete the questionnaire.

Study logistics

The survey was sent to the identified colorectal surgeons both as a document attached to an e-mail and as a Web-based survey link forwarded to each participant. The Web-based option was offered through SurveyMonkey.com. Two follow-up e-mails were sent to nonresponders, and the survey was open for a total of 16 weeks.

Review of national guidelines

Six central rectal cancer treatment guidelines were reviewed (Table 1) to compare national recommendations for radiological T staging and neoadjuvant treatment. The aim was to gain insight in similarities and differences of guideline recommendations.

Statistics

Descriptive statistics were performed by percentages, 2×2 contingency tables, and Fisher's exact test. For comparison purposes, respondents were divided into three groups: US-based surgeons, non-US surgeons, and total. Bivariate logistic regression analyses were performed to detect the impact (measured by relative risk [RR]) of department caseload and team meetings upon preoperative decision-making. All tests were two-sided and $p < 0.05$ was considered statistically significant. All data were analyzed using SPSS v.16.1 (SPSS, Inc., Chicago, IL).

Table 1 Guideline recommendations for radiologic T staging and neoadjuvant treatment of rectal cancer [2, 6–8, 10, 11]

	NCCN USA 2009	World Congress 2007	French Guidelines 2007	Norwegian Guidelines 2008	ESMO 2008	Danish Guidelines 2009
<i>Radiological T staging</i>						
MRI	Either MRI or ERUS all patients	All patients (best to assess CRM, but ERUS + CT can also be used)	All T3–T4 or N+ after ERUS	All patients	MRI on all T3–T4	All patients
ERUS	Either MRI or ERUS all patients	ERUS + MRI or ERUS + CT	All patients	ERUS on all early tumors (T1–T2)	ERUS on all early tumors (cT1–T2)	ERUS on all early tumors
CT	CT abdomen/ thorax all patients not recommended for T staging	CT abdomen/thorax all patients	CT thorax/ abdomen all patients	CT pelvis is an alternative to MRI when no access to MRI	CT abdomen/thorax all patients (alternatively chest X-ray and ultrasound of liver)	CT thorax/ abdomen all patients
PET scan	Not routinely indicated	Indicated only when lesions in liver	Not routinely indicated	NA	NA	Only indicated when suspicion of extrahepatic metastasis
<i>Neoadjuvant treatment</i>						
T1–2, N0	No neoadjuvant treatment	RCT T2	No neoadjuvant treatment	No neoadjuvant treatment	No neoadjuvant treatment	No neoadjuvant treatment
T3, N0 or T any, N1–2 (stage II or III)	RCT	Radiation alone or RCT	Radiation alone or RCT (no treatment to T3N0 with CRM >1 mm)	See CRM	No RCT early T3. Radiation alone or RCT	RCT midrectal T3 with CRM <5 mm. All low rectal T3
T4	RCT	RCT	Radiation alone or RCT	RCT	RCT	RCT to mid and low T4
CRM	NA	NA	Radiation or RCT when CRM <1 mm	CRM <3 mm RCT	NA	See T3

NCCN National Comprehensive Cancer Network, ERUS endoscopic rectal ultrasound, CRM circumferential margin, NA no information, RCT chemoradiotherapy

Results

One hundred seventy-three colorectal surgeons were identified and contacted via e-mail. After one initial e-mail and two follow-up e-mails, 123 (71%) surgeons responded. One hundred one responded via the Web-based questionnaire, 20 by returning the questionnaire as an e-mail attachment, and 2 by fax. Of those that returned the survey, 110 (89%) fully completed all parts of the questionnaire.

Demographics (Table 2)

The colorectal centers were located in 28 countries representing five continents: 53 in North America, 43 in Europe, 18 in Asia, 8 in South America, and 1 in Africa. Seventy-eight percent were university hospitals.

Rectal surgery experience (Table 2)

Ninety-three percent of responding surgeons have more than 5 years' experience with rectal cancer surgery, and 70% work in departments that manage more than 50 rectal cancers per year. Twenty percent of the surgeons perform more than 50 rectal cancer operations annually.

Preoperative staging (Table 3)

Fifty-five percent of surgeons prefer CT scan, 35% MRI, 29% rectal ultrasound, 12% digital rectal examination, and 1% PET scan in all rectal cancer patients for preoperative staging. All use more than one imaging modality in all rectal cancer patients for preoperative staging. Significantly more non-US surgeons use MRI on all rectal cancer

Table 2 Hospital affiliation, department caseload, and rectal cancer surgical experience ($n = 123$)

	US [n (%)]	Non-US [n (%)]	Total [n (%)]
<i>Hospital location</i>			
City	1 (2.3)	11 (13.9)	12 (9.8)
Rural	1 (2.3)	0	1 (0.8)
Private	7 (15.9)	7 (8.8)	14 (11.4)
University	35 (79.5)	61 (77.2)	96 (78.0)
<i>Experience</i>			
<5 years	4 (9.1)	4 (5.0)	8 (6.5)
5–10 years	12 (27.3)	17 (21.5)	29 (23.6)
11–20 years	16 (36.4)	27 (34.1)	43 (35.0)
>20 years	12 (27.3)	31 (39.2)	43 (35.0)
<i>RC surgeries/year</i>			
<10	2 (4.5)	3 (3.7)	5 (4.1)
10–20	10 (22.7)	18 (22.7)	28 (22.8)
21–30	10 (22.7)	24 (30.3)	34 (27.6)
31–50	14 (31.8)	18 (22.7)	32 (26.0)
>50	8 (18.2)	16 (20.2)	24 (19.5)
<i>Hospital caseload</i>			
<10	0	2 (2.5)	2 (1.6)
11–30	4 (9.1)	4 (5.0)	8 (6.5)
31–50	11 (25.0)	16 (20.2)	27 (22.0)
51–70	7 (15.9)	13 (16.4)	20 (16.3)
71–90	11 (25.0)	21 (26.5)	32 (26.0)
>90	11 (25.0)	23 (29.1)	34 (27.6)

Experience Respondents experience with rectal cancer surgery, *RC surgeries/year* Respondents caseload of rectal cancer surgery, *Hospital caseload* Number of rectal cancer surgeries performed at the department each year

patients compared to US surgeons (42% vs. 20%, $p = 0.03$). US surgeons prefer ERUS significantly more than non-US surgeons do (43% vs. 21%, $p = 0.01$). Similarly, we detected a difference in PET scan use: 53% of non-US surgeons and 25% of US surgeons never use PET scan ($p = 0.005$).

Indications for preoperative chemoradiotherapy (CRT) (Table 4)

Eighty-one surgeons (73%) consider threatened circumferential margin (CRM) an indication for neoadjuvant treatment. Of those, 40% consider 1 mm or less, 39% consider 2 mm or less, and 21% consider 3 mm or less as threatened CRM. Sixty-seven (61%) always give neoadjuvant treatment to both stage II and stage III rectal cancer patients. However, two US surgeons and two non-US surgeons answered “others” for “give preoperative CRT treatment to all T3 cancers and greater,” which means stage II or higher.

Ninety-two percent of US surgeons compared to 43% non-US surgeons give CRT for stage II and stage III rectal

cancers ($p = 0.0001$). A significantly higher proportion of US surgeons consider rectal cancer with poor histological differentiation an indication for CRT (10/39 vs. 5/71, $p = 0.008$). Cancer in the distal third of the rectum is an indication for preoperative CRT for 15 (14%) surgeons, while cancer in the distal two-thirds is used by five (5%) surgeons, and one (1%) gives neoadjuvant treatment to all rectal cancer patients.

Neoadjuvant treatment and other preoperative considerations (Table 5)

Ninety-two percent prefer 5-fluorouracil (5-FU)-based long-course neoadjuvant CRT. Ten percent (4) of the US surgeons and 16% (12) of non-US surgeons prefer short-course radiation therapy. A significantly higher proportion of the US surgeons have radiation therapy available at their hospital (89% vs. 74%, $p = 0.04$), and significantly more of non-US surgeons have regular rectal cancer audits (74% vs. 51%, $p = 0.01$).

Institutional radiation rate (Fig. 1)

Twenty-nine of 39 US surgeons have an institutional irradiation rate (IRR) >50% and 31/71 non-US surgeons have an IRR >50% ($p = 0.001$). However, nine (8%) surgeons answered that their institution offers radiation to more than 90% of all rectal cancer patients, and a similar proportion (8%) have an IRR of 10–29%.

Impact of multidisciplinary teams and caseload (Table 6)

Departments with regular multidisciplinary team meetings are more likely to prefer MRI for local staging (RR = 3.62), and there is a trend toward significance ($p = 0.06$). Similarly, patients with threatened circumferential margin are more likely to receive neoadjuvant treatment in departments with team meetings (RR = 5.67, $p = 0.03$). Other significant impacts of team meetings were found upon pathology report quality (RR = 4.85, $p = 0.01$), new chemotherapy regimen if there are liver metastases (RR = 6.41, $p = 0.02$), and one-stage surgery when there are liver metastases (RR = 0.25, $p = 0.02$). Similar influences of caseload upon preoperative decision-making were not observed.

Discussion

This is the first survey of current practice among international colorectal centers regarding preoperative management of rectal cancer. The results demonstrate a wide variation

Table 3 Preference of image modality for staging of rectal cancer

	US [<i>n</i> (%)]	Non-US [<i>n</i> (%)]	Total [<i>n</i> (%)]	<i>p</i> value
MRI				
Never	7 (17.9)	5 (5.0)	13 (11.8)	NS
Selected	24 (61.5)	35 (49.2)	59 (53.6)	NS
All	8 (20.5)	30 (42.2)	38 (34.5)	0.03
ERUS				
Never	2 (5.1)	10 (14.0)	12 (10.9)	NS
Selected	20 (51.3)	46 (64.7)	66 (60.0)	NS
All	17 (43.6)	15 (21.1)	32 (29.1)	0.01
CT				
Never	6 (15.4)	13 (18.3)	19 (17.3)	NS
Selected	11 (28.2)	20 (28.1)	31 (28.2)	NS
All	22 (56.4)	38 (53.5)	60 (54.5)	NS
PET scan				
Never	10 (25.6)	38 (53.5)	48 (43.6)	0.005
Selected	28 (71.8)	33 (46.4)	61 (55.5)	0.01
All	1 (2.6)	0 (0.0)	1 (0.9)	NS
DRE under GA				
Never	20 (51.3)	43 (60.5)	63 (57.3)	NS
Selected	16 (41.0)	18 (25.3)	34 (30.9)	NS
All	3 (7.7)	10 (14.0)	13 (11.8)	NS
Total (missing)	39 (5)	71 (8)	110 (13)	

Question: Which of the following procedures for rectal cancer staging do you use in your daily practice? (Please choose an answer for each method)

All of the responding surgeons use more than one imaging modality in all rectal cancer patients

MRI magnetic resonance imaging, *ERUS* endoscopic rectal ultrasound, *CT* computerized tomography, *PET scan* positron emission tomography, *DRE under GA* digital rectal examination under general anesthesia, *NS* not significant

in preoperative staging procedures, inconsistencies in indications for preoperative CRT, and differences in treatment procedures for identical rectal cancers. These variations highlight the need for more and better scientific evidence to help guide rectal cancer treatment as well as the need for international focus upon development of guidelines.

There exist several guidelines for rectal cancer treatment, at both national and international levels. New guidelines have recently been published [9]. However, these guidelines vary in their recommendations (Table 1). Similarly, practice may vary between countries and continents because surgeons prefer treatment according to their own guidelines. Implementation of national guidelines of clinical practice seems slow, as pointed out in other surveys [12, 13] and has been demonstrated among colorectal surgeons [14–18]. The differences in preoperative staging and treatment options cannot be explained by the heterogeneity of the institutional affiliations of the participants. As the vast majority of the responding colorectal surgeons work in academic medical centers, the differences in current practices reflect the lack of clinical evidence or the slow implementation of such evidence. Evidence from the US about adherence to preoperative staging and treatment options suggests marked variation. For the eight centers that participate in the National Comprehensive Cancer Network (NCCN), adherence to guidelines and quality measures is variable [18]. Concordance with guidelines is recently discussed in an editorial by Browman [19].

Certainly, it is important to indicate how well a recommendation is aligned with the evidence from which it is derived, but it is uncertain how practitioners interpret, respond to, or act upon a recommendation. We think our study reflects this argument, showing inconsistent practice also within continents and national borders.

Variations in preoperative staging imaging will select identical rectal cancer patients to undergo different treatment regimens depending on the sensitivity and specificity of the selected imaging modality. MRI and rectal ultrasound have better diagnostic properties than CT for rectal cancer [20, 21], but still CT is used for local staging by 54.5% of the surgeons compared to 34.5% that prefer MRI for all rectal cancer patients. The distance to the CRM has been increasingly recognized as an important factor and a surrogate marker for local recurrence. In this context, MRI has increased in popularity because of its ability to help decide the distance to the CRM and it should be used widely for preoperative treatment planning. CT has little or no place in describing the distance to the CRM because of its low spatial resolution. A recently published review recommends the use of MRI for all rectal cancer patients [22]. In our study, 11% of respondents never use MRI and approximately 50% use it in selected cases. In our opinion these numbers are surprisingly low and might reflect the slow implementation of evidence-based medicine among colorectal surgeons. All centers in this study use more than one staging procedure. CT has a role in evaluating the

Table 4 Indications for preoperative chemoradiotherapy

	US [n (%)]	Non-US [n (%)]	Total [n (%)]	p value
All RC	0	1	1 (0.9)	NS
Stage II and III RC	36 (92.3)	31 (43.6)	67 (60.9)	0.001
CRM \leq 1 mm ^a	13 (33.3)	27 (38.0)	40 (36.4)	NS
CRM \leq 2 mm ^a	10 (25.6)	28 (39.4)	38 (34.5)	NS
CRM \leq 3 mm ^a	4 (10.3)	17 (23.9)	21 (19.1)	NS
Mesorectal growth \geq 5 mm ^a	5 (12.8)	16 (22.5)	21 (19.1)	NS
Mesorectal growth \geq 5 mm \leq 15 mm ^a	2 (5.1)	5 (7.0)	7 (6.4)	NS
Any RC in distal third of rectum	4 (10.3)	11 (15.4)	15 (13.6)	NS
Any RC in distal two-thirds of rectum	3 (7.7)	2 (2.8)	5 (4.5)	NS
Any RC with poor differentiation	10 (25.6)	5 (7.0)	15 (13.6)	0.008
Total (missing)	39 (5)	71 (8)	110 (13)	

CRM circumferential margin, CRT chemoradiotherapy, RC rectal cancer

^a Assessed by MRI, ERUS (endoscopic rectal ultrasound), or CT

Question: Which indications do you follow as indications for neoadjuvant treatment? (Please choose all that apply to you)

Indications for neoadjuvant treatment other than those listed: 1. Age of patient. 2. Nodal status, vascular invasion status. 3. Local fixity/invasion of adjacent organ on CT. 4. Any margins at risk, multiple nodes, and/or deep extension into mesorectum. 5. No CRT for proximal stage II rectal cancers. 6. N2 on MRI. 7. Selected stage I disease before local excision—part of a national trial. 8. Stage II or III in the lower 1/3 rectal cancer. 9. Anterior tumor, distal 1/3 rectum in a male patient. 10. Stage III in the lower third and infiltration of the sphincter. 11. Stage II or III low rectal cancers and T4 cancer any level. 12. MRI threatened margin, long-course CRT. For those with clear margin, short-course CRT. Any nodal disease, long-course CRT. 13. Preoperative staged higher than T3N1. 14. Distal third, not cT1 (all cT3 or cN+ or cT2 in lower third). 15. Presumed positive lymph node on MRI. 16. Bulky tumor. 17. More than four suspected LN (N2). 18. T3–T4, any suggestions of LN involvement. 19. Fixed rectal cancers or rectal cancers with large lymph nodes only. 20. T3 cancers, T2 cancers with enlarged nodes, tumors below the peritoneal reflection. 21. T3 male mid, lower rectal cancer, T4 female mid, lower rectal cancer. 22. Proportionally big tumors for the pelvis. 23. Histology: lymphovascular invasion. 24. Any cT3– or cN+ rectal cancer of the distal third; any ultralow T1/T2 cancer when sphincter preservation is a goal; bulky tumors of distal and middle third in male patients. 25. Lower threshold for CRT in lower third. 26. Fixed rectal cancers or rectal cancers with large lymph nodes only. 27. Sphincter involvement. 28. Anterior locations in males. 29. All N+. 30. Nodal involvement on preoperative imaging. 31. Large T3 and all T4 tumors (long course) and some borderline T2/T3 tumors (short course) independent of preop nodal status. 32. T4 cancers, multiple large lymph nodes, iv growth. 33. Candidates for APR and severe tumor fixation by digital rectal examination. 34. Anterior tumor. 35. Stage III rectal cancer, before Miles operation. 36. Locally advanced and stage III rectal cancers. 37. T4 cancer below the peritoneal reflection. 38. Enlarged nodes on imaging; T3 or greater; close enough to anorectal ring that shrinkage with neoadjuvant therapy may improve chance of sphincter-sparing surgery in patient with good performance status. 39. uT3, uT4, uN+. 40. Big tumors at the lower third of the rectum, especially in males. 41. But not all small posterior T3N0. 42. Positive mesorectal nodes on imaging

infiltration of other organs, usually for large T4 tumors. In addition, CT is used to determine metastatic disease in the liver and/or lungs (M stage in the TNM classification). Endoscopic rectal ultrasound (ERUS) has a role in evaluating small tumors for which local excision might be feasible. Retrospectively, it might be argued that some surgeons participating in the survey answered the question with respect to M staging and that this might bias the results regarding CT use (54% use it on all patients). However, the questionnaire specifically says “CT scan of the pelvis,” i.e., local staging, which reflects the actual use of CT for local staging (either alone or in combination with other modalities). In contrast, we do believe that CT is the most common modality for M staging.

Generalization of the results from this study must be made with care. The invited surgeons were selected based upon publications listed in PubMed and presentation or participation at national or international meetings, thus respondents could be prone to selection bias. However, the

respondents were from large university hospitals throughout the world (78%) as well as from other large hospitals with a relatively high volume of rectal cancer patients, and the participants are all published authors and teachers at national meetings. Similarly, the surgical experience among the respondents is high: 93% of the responding surgeons have experience with rectal cancer treatment for more than 5 years, and 35% have experience for more than 20 years (Table 2). Thus, in our opinion the respondents are thoroughly experienced and good representatives for their national rectal cancer practice.

This survey has revealed prominent variations in practice standards in the preoperative staging and treatment of rectal cancer. The survey emphasizes the need for establishing an international consensus for the management of patients with rectal cancer and for identifying areas for future research. An international consensus is needed in order to develop staging and preoperative treatment standards if outcomes are to be compared

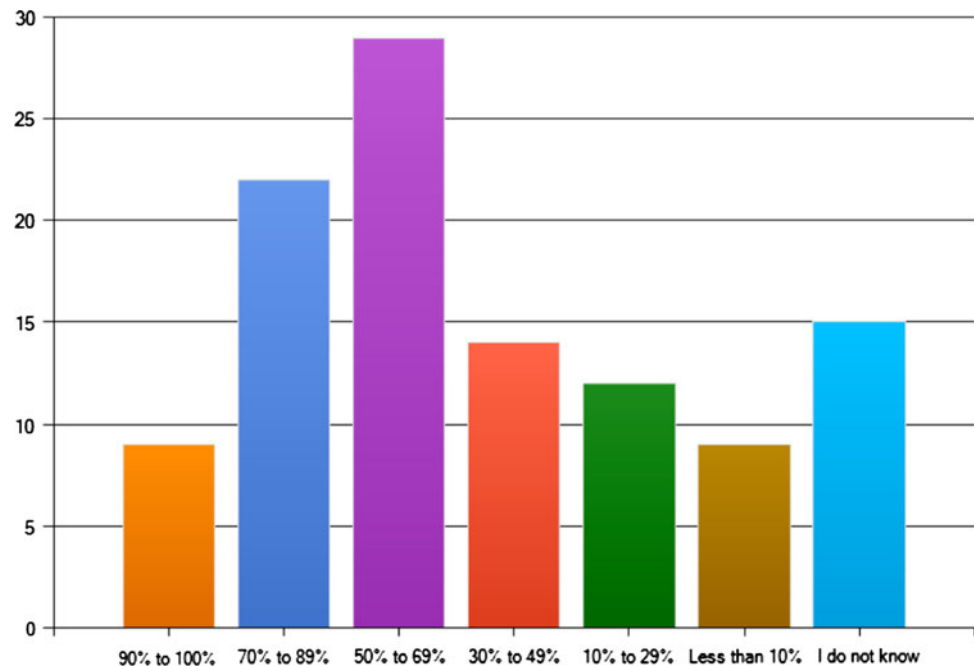
Table 5 Neoadjuvant treatment and preoperative considerations

	US [n (%)]	Non-US [n (%)]	Total [n (%)]	<i>p</i> value
Threatened CRM as an indication for neoadjuvant therapy	26 (66.7)	55 (77.4)	81 (73.6)	NS
Short-course radiation therapy (5 Gy × 5) ^a	4 (10.3)	12 (16.9)	16 (14.5)	NS
Long-term chemoradiation regimen (1.8–2 Gy × 25) ^a	37 (94.9)	64 (90.1)	101 (91.87)	NS
Other neoadjuvant therapy	2 (5.1)	11 (15.4)	13 (11.8)	NS
Radiation therapy available	35 (89.7)	53 (74.6)	88 (80.0)	0.04
Intraoperative radiation therapy available	11 (28.2)	14 (19.7)	25 (22.7)	NS
Internal sphincter-saving surgery in case of complete tumor response after neoadjuvant therapy	22 (56.4)	34 (47.8)	56 (50.9)	NS
External sphincter-saving surgery in case of complete tumor response after neoadjuvant treatment	5 (12.8)	11 (15.4)	16 (14.5)	NS
Alternation of neoadjuvant treatment if synchronous liver metastasis	20 (51.3)	28 (39.4)	48 (43.6)	NS
Treatment plans within an interdisciplinary team	37 (94.9)	60 (84.5)	97 (86.6)	NS
Only specialized centers	33 (84.6)	60 (84.5)	93 (83)	NS
Abdominoperineal resection is a surrogate marker for the quality of RC surgery	15 (38.5)	39 (54.9)	54 (48.2)	NS
Weekly/monthly RC audits	20 (51.3)	53 (74.6)	73 (65.2)	0.01
Total (missing)	39 (5)	71 (8)	110 (13)	

CRM circumferential margin

^a Thirteen (11.8%) surgeons report different practice than short- or long-course CRT, i.e., 8 oxaliplatin-based CRT, 1 long-term chemoradiation but wait 8–10 weeks, 1 short-term radiation with delayed surgery (5–7 weeks), 1 both regimens depending on MRI findings, 1 no radiation

Fig. 1 Institutional irradiation rate (IRR) for rectal cancer at 123 international centers. Significantly more US centers (29/39) have IRR >50% compared to non-US centers (31/71) ($p = 0.001$)



between institutions and countries. Focusing on standardization and documentation as a process may also improve results [23]. The survey also points out the need for agreement on the staging and neoadjuvant treatment modalities used if we are to compare outcomes in rectal cancer treatment.

The different indications for neoadjuvant treatment will select noncomparable groups of patients in outcome

studies. Different staging procedures and treatment algorithms could certainly reflect the published differences in local recurrence rates and 5-year cancer-specific survival rates [24, 25]. Heald [26] standardized the surgical technique for rectal cancer surgery with a significant impact on the risk of local recurrence. Probably an evidence-based standardization of preoperative practices will also benefit rectal cancer patients [27].

Table 6 Impact of caseload and multidisciplinary teams upon preoperative decision-making

		Relative risk	<i>p</i>	95% confidence interval	
				Lower bound	Higher bound
<i>Staging method</i>					
MRI	Cload	1.33	0.21	0.82	2.15
	Team	3.62	0.06	0.93	14.03
ERUS	Cload	0.89	0.80	0.54	1.47
	Team	3.12	0.23	0.65	15.03
PET	Cload	1.24	0.11	0.93	1.66
	Team	2.27	0.16	0.73	7.07
CT Pelvis	Cload	1.30	0.14	0.96	2.06
	Team	0.67	0.62	0.27	6.78
DRE	Cload	1.15	0.27	0.86	1.52
	Team	1.17	0.79	0.38	3.61
<i>Indication for neoadjuvant treatment</i>					
Stg II + III	Cload	1.24	0.07	0.91	1.68
	Team	2.98	0.08	0.91	9.74
CRM	Cload	1.06	0.69	0.73	1.33
	Team	5.67	0.003	1.80	17.89
Mesorectal <5 mm	Cload	1.09	0.60	0.77	1.55
	Team	1.60	0.55	0.33	7.73
Mesorectal 5–15 mm	Cload	0.99	0.99	0.55	1.78
	Team	<0.01	0.99	<0.01	<0.01
Distal 1/3	Cload	0.97	0.91	0.64	1.48
	Team	<0.01	0.91	<0.01	<0.01
Distal 2/3	Cload	1.84	0.09	0.90	3.76
	Team	<0.01	0.99	<0.01	<0.01
Poor differentiation	Cload	0.74	0.14	0.50	1.10
	Team	1.71	0.45	0.41	7.14
<i>Other preoperative preferences</i>					
Pathology report	Cload	1.17	0.45	0.77	1.76
	Team	4.85	0.01	1.34	17.46
IORT	Cload	1.36	0.11	0.94	1.97
	Team	<0.01	0.99	<0.01	<0.01
SSS initial imaging	Cload	1.00	0.88	0.76	1.34
	Team	3.81	0.09	0.98	14.72
New regimen liver met	Cload	1.38	0.03	0.52	0.97
	Team	6.41	0.02	1.34	30.64
One-stage surgery	Cload	1.23	0.17	0.91	1.64
	Team	0.25	0.02	0.08	0.80
APR rate <10%	Cload	1.00	0.91	0.72	1.39
	Team	1.05	0.87	0.31	3.90
IRR >50%	Cload	0.91	0.59	0.66	1.26
	Team	0.22	0.01	0.62	0.78

Cload caseload, divided into 6 groups, see Table 1, *Team* = regular multidisciplinary team meetings to plan rectal cancer treatment, *MRI* magnetic resonance imaging, *ERUS* = endoscopic rectal ultrasound, *PET* PET scan, *DRE* digital rectal exam under anesthesia, *Stg II + III* stage II and III rectal cancer, *CRM* use of the preoperatively assessed circumferential margin (by CT, MRI, or ERUS) as an indication of neoadjuvant treatment, *Mesorectal <5 mm* tumor mesorectal growth less than 5 mm, *Mesorectal 5–15 mm* tumor mesorectal growth 5–15 mm, *Distal 1/3* any cancer located in distal 1/3 of the rectum, *Distal 2/3* any cancer located in the distal 2/3 of rectum, *Poor differentiation* any cancer with histological description of poor differentiation, *Pathology report* pathology report always describes the circumferential resection margin measured in mm, *IORT* intraoperative radiation therapy available, *SSS initial imaging* sphincter-saving surgery decided upon initial imaging, *New regimen liver met* new regime of neoadjuvant treatment if synchronous rectal cancer and liver metastases, *One-stage surgery* one-stage surgery if resectable rectal cancer and liver metastasis, *APR rate <10%* institutional abdominoperineal resection rate less than 10%; *IRR >50%* institutional irradiation rate greater than 50%

The wide variation in indications for neoadjuvant treatment and radiation rates should alert both national and international rectal cancer expert organizations as well as health-care administrators. The individualized treatment plans for rectal cancer patients should reflect the complexity of the disease and not geography or the surgeons' or institutions' preferences and traditions. Establishment of multidisciplinary teams (MDTs) comprising surgeons, oncologists, radiologists, and pathologists can hopefully elevate the decisions regarding the individual rectal cancer patient to a level where documentation and up-to-date knowledge are focused. In our study we have shown that MDTs significantly influence preoperative decision-making (Table 6). Interestingly, regular MDT meetings significantly influence decisions on choice of staging modality, neoadjuvant treatment, and several other critical factors in the preoperative planning of rectal cancer treatment. We believe that regular MDT meetings will improve guideline adherence and quality of rectal cancer care, as recently addressed by Taflampas [22]. According to our analysis, department caseload does not have as much influence on preoperative decision-making.

Over- and understaging as well as over- or undertreatment will have an impact on health-care costs, frequency of side effects of CRT, and surgery, including a patient's quality of life and local recurrence and cancer-specific survival. Continuous education of rectal cancer surgeons seems necessary to increase implementation of evidence-based clinical practice. Health-care authorities should develop quality control systems in order to ensure adherence to national and international recommendations and guidelines. The national and international societies associated with rectal cancer treatment have the challenge of developing such updated evidence-based recommendations.

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Appendix

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