Utilizing the Multidisciplinary Team for Planning and Monitoring Care and Quality Improvement

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Abstract

Multidisciplinary team management of patients with rectal cancer requires a dedicated group of surgeons, medical and radiation oncologists, pathologists, radiologists, and mid-level providers who meet to discuss every patient with rectal cancer. The data from that meeting is collected prospectively, recommendations made for case, follow-up obtained, and quality issues monitored. Improved case is the result.

Keywords

- multidisciplinary team
- outcomes
- rectal cancer
- quality

Rectal cancer represents a significant health care problem in terms of incidence, complex management, and use of resources. There are approximately 40,000 patients who are diagnosed with carcinoma of the rectum each year in the United States, and almost half will ultimately die as a consequence of the disease. Rectal cancer has different patterns of presentation at diagnosis, which greatly influences both the prognosis and treatment choices. Treatment strategies vary depending on the level of the tumor, extension through the rectal wall in the mesorectum, presence of involved nodes inside and outside the mesorectum, presence of perforation, histological type and grade, and presence of distant metastases. Historically, a huge variation among surgeons has been described in results of colon and rectal cancer surgery, with statistically significant differences in curative resection, postoperative morbidity and mortality, and long-term survival.[1]

The treatment of rectal cancer is extremely complex. The anatomy of the rectum presents a unique challenge and strict planes of dissection must be maintained to increase chances of cure. However, surgical therapy is only one aspect of rectal cancer care. Health care providers are faced with decisions regarding the risks and benefits of neoadjuvant and adjuvant therapy. These decisions rely heavily on other aspects, such as high-quality preoperative imaging and postoperative pathology assessment of the primary tumor and lymph nodes. There is a broad spectrum of treatment modalities that have been examined, including postoperative chemotherapy with different 5FU-based schedules, preoperative short-course radiotherapy versus long-course radiotherapy, alone or in combination with 5FU-based regimens or with new drugs as well as IORT (intraoperative radiation therapy) in primary disease. These various strategies in different combinations are aimed at improvement in standards of care, improving quality of life with better local control, fewer complications, and improved survival. These decisions need communication between the surgeon, the pathologist, the radiologist, the medical oncologist, and the radiation oncologist. The establishment of a multidisciplinary team (MDT) to manage patients with rectal cancer does just that.

It is no surprise that the quality of rectal cancer care in the United States is highly variable. Only a small percentage of patients with rectal cancer receive treatment at the busiest and most highly specialized rectal cancer centers in the world. In sharp contrast, the majority of patients with rectal cancer are treated in low-volume hospitals by surgeons and providers with no specialty training. Close to 75% of the surgeries for rectal cancer is done in low-volume hospitals. A wide disparity in outcomes is found when patients are treated by general surgeons as opposed to colorectal-trained specialists. Local recurrence rates vary between 0 and 13% for colorectal surgeons and between 21 and 37% for general surgeons treating rectal cancer. There are differences in mortality rates based on surgeon specialization: 1.4% for colorectal surgeons and 7% for general surgeons.[2]

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The management of rectal cancer has fundamentally changed over the past few decades, which has led to significant reductions in rates of local recurrence, increase in disease-free and overall survival, and reduction in permanent stoma rates. Five main principles have been identified that have changed the management of rectal cancer[3]:

1. Rectal surgery according to the principles of total mesorectal excision (TME)
2. Measurement of quality of surgery and accurate staging by specific techniques of pathology assessment
3. Specialist imaging techniques identifying those patients at high risk of local recurrence
4. The use of newer, more effective neoadjuvant and adjuvant therapies including radiotherapy and chemotherapy
5. An MDT approach that identifies, coordinates, delivers, and monitors the ideal treatment on an individual patient-by-patient basis.

Several European countries have established centers of excellence (CoEs) that over the past decade have tried to address this disparity in care through establishment of MDT. The multidisciplinary colorectal cancer team involves the participation of surgeons, radiologists, pathologists, oncologists, and sometimes other specialists. The MDT allows identification of future research and implementation of steps to improve outcome. It facilitates audit of activity and outcome. This was initially established in the United Kingdom in 2000 following recommendation in the Calman–Hine report from 1995.[4] The International Agency for Research on Cancer (IARC) data from 1995 showed that survival rates for colorectal cancer in England and Scotland were among the worst in the United Kingdom compared with other European countries such as Denmark, the Netherlands, Finland, France, Germany, Italy, Spain, and Switzerland. This led to a process to identify the cause of poor outcome in the United Kingdom, and to standardize and optimize the management of the rectal cancer. The Calman–Hine Policy Framework for Commissioning Cancer Services highlighted the need to deliver improved and coordinated cancer services through a cancer network infrastructure.[4] The NHS Cancer Plan was introduced to improve the diagnosis and treatment for patients with colorectal cancer.[7] As a part of this, the formation of the MDT was identified as a key recommendation. MDTs were seen as a central element for cancer care. Individual MDTs were made subject to a peer review process whereby professionals from the team worked with the cancer networks to assess the MDTs according to nationally standardized processes and criteria. The process was economically supported by the government and MDTs are now the rule in the United Kingdom. The example set in the United Kingdom has now been implemented in other European countries. In countries and centers that have implemented such programs, the cancer-specific outcomes from rectal cancer now match those of colon cancer for the first time.[5] In the United States, this is now being addressed by Consortium for Optimizing Surgical Treatment of Rectal Cancer (OSTRiCh) program. The evidence behind establishing these teams comes from data seen in England, Spain, Denmark, Norway, and Sweden.

A critical first step, however, is performing surgery adhering to the principles of TME and assessing the quality of surgery by critiquing the specimen. This process is viable through creation of MDTs and discussion between professionals.

Total Mesorectal Excision Education in Europe and Scandinavia

In 1982, Heald et al[6] introduced the concept of TME. The aim of this technique is to achieve tumor-free margins, particularly circumferentially, and to remove the lymph nodes within the mesorectum, while preserving sexual and bladder function. Using this technique, Heald and Ryall[7] reported local recurrence rates of less than 5% in 1986. TME has since been widely adopted and local recurrence rates below 10% after 5-year follow-up are regularly reported.

Various European countries have invited teams from the United Kingdom to run a technical and multidisciplinary course to help educate the surgeons, radiologists, pathologists, and oncologists on various aspects of rectal cancer treatment. The workshops that have been held in the participating countries usually involve invited leading surgeons who educate the other surgeons on the technical aspects of TME surgery in the operating rooms as well as on cadavers. The radiologists have benefitted from establishment of imaging and reporting protocols to adequately stage patients both preoperatively and after neoadjuvant treatment. This greatly benefits the surgeons at the time of surgery to obtain a negative circumferential margin. The workshops held also involve invited pathologists who have helped establish standardization in the way pathology is reported as well as grading the TME specimen. The evaluation of a TME specimen with regard to its intactness is an example of one of the variables which has shown to be pivotal in reducing local recurrence rates.

Swedish, Dutch, and Norwegian physicians have successfully introduced changes in rectal cancer management as national policies. They have adopted TME as the standard operation for rectal cancer in their countries. Whereas local recurrence rates for rectal cancer in these countries were approximately 30 to 40% before the change to TME surgery, after TME training local recurrence rates fell to less than 10%. Similar efforts have been undertaken in Spain, Ireland, and Canada. The success in Europe has also led to lower rates of local recurrence and permanent stoma, more patients receiving evidence-based care adhering to accepted guidelines, better recruitment to clinical trials, and improved monitoring of standards and outcomes.

Swedish Experience

Stockholm Colorectal Cancer Study Group (SCCSG) started a collaborative educational project, including surgical and pathological workshops, to introduce TME to colorectal surgeons and pathologists in the Stockholm area (the TME project). In 1994, the TME project was initiated by the SCCSG with the aim of introducing the concept of TME-based

surgery to surgeons in Stockholm County who treat patients with colorectal cancer. The project comprised 3 workshops, including 11 video-based live surgery sessions and 2 histopathology sessions. Time was allocated for discussion around prerecorded videos describing the details of the TME technique. The majority of surgeons in Stockholm who treat patients with colorectal cancer attended all three symposia and assisted in the operating room at least once. To assess the impact of the TME training program, compulsory central registration of all patients with colorectal cancer in Stockholm was introduced in 1995. The study population comprised all 447 patients who underwent abdominal operations for rectal cancer in Stockholm County during 1995 and 1996. Outcomes were compared with those in the Stockholm I (790 patients) and Stockholm II (542 patients) radiotherapy trials. The permanent stoma rate was reduced from 60.3 and 55.3% in the Stockholm I and II trials, respectively, to 26.5% in the TME project ($p < 0.001$). Five-year local recurrence rates decreased from 21.9 and 19.1% to 8.2%, respectively ($p < 0.001$). Five-year cancer-specific survival rates increased from 66.0 and 65.7% in the Stockholm trials to 77.3% in the TME project.[8]

Danish Experience

Colorectal MDTs were established in 2003 at all major Danish hospitals treating colorectal cancer. The aim was to improve the prognosis by multidisciplinary evaluation and decision about surgical and oncological treatment. A subsequent study to evaluate the effect of the introduction of colorectal MDT at two Danish hospitals was performed. A retrospective cohort study was conducted comparing the outcome during the 3 years preceding the introduction of MDTs with the first 2 years after implementation of MDT. A total of 811 patients were diagnosed with primary rectal cancer from 2001 to 2006 at the two hospitals. The frequency of preoperative MRI scans increased in the MDT cohort and perioperative mortality decreased. More metachronous distant metastases were found in the MDT cohort.[9] The five-year survival increased from 37 to 51%.

Spanish Experience

In 2002, the Spanish Association of Surgery performed a voluntary survey involving 43 university, general, and community center care providers on the outcome of colorectal cancer surgery. It showed that TME was used in only 69% of patients having surgery. During that period, data on local recurrence, metastasis, and survival were not collected. The Spanish Rectal Cancer Project was established in 2006. An observational cohort study was performed including all patients ($n = 4{,}700$) with rectal cancer operated on in 51 Spanish hospitals between March 2006 and June 2010. Curative resection was defined as a resection with an uninvolved circumferential margin in patients without distant metastases and without intraoperative rectal perforation. The effectiveness of the program was measured by a central registry with feedback to participating institutions of their own results compared with the national average. The main outcome measures were local recurrence rates and adverse effects in curative resections. Of the 4,700 patients, 3,213 had a resection considered to be curative. Local recurrence rates were 4.7%, metastasis rate was 16%, and overall survival was 87.8%. With the introduction of MDT in Spain, the level of auditing increased, leading to superior outcomes.[10]

Norwegian Experience

The Norwegian Rectal Cancer Project was initiated in 1993 and was aimed at improving the outcome of patients with rectal cancer by implementing TME as the standard rectal resection technique. The objectives of the project were to enhance the quality of rectal cancer surgery by introduction of TME, reduce local recurrence rates, improve survival after curative surgery, and establish a rectal cancer registry which could be utilized as an audit tool which can provide feedback to participating institutions of their own results compared with the national average. As part of the project, training of surgeons in the TME principles was organized, and several training courses and "master classes" were arranged in different Health Regions in Norway, supervised by Professor R. J. Heald. Pathologists were taught standardized handling and reporting of the specimen, specifically the role of the circumferential resection margin. In the subsequent cohort study,[11] the outcome of 3,319 patients with newly diagnosed rectal cancer from 1993 to 1997 was evaluated. The proportion of patients undergoing TME was 78% in 1994, increasing to 92% in 1997. The observed local recurrence rate for patients undergoing a curative resection was 6% in the group treated by TME and 12% in the conventional surgery group. Four-year survival rate was 73% after TME and 60% after conventional surgery.

Consortium for Optimizing Surgical Treatment of Rectal Cancer

The OSTRiCh group has been created in an attempt to transform the delivery of rectal cancer care in the United States through implementation of a CoE program based on previously mentioned five principles of rectal cancer care that have led to dramatic improvements in outcomes in several European countries. The hope is that this model, based largely on that already in existence in the United Kingdom, would improve access of U.S. patients to uniform and high-quality rectal cancer treatment.

OSTRiCh is a consortium of 18 North American (17 United States and 1 Canadian) health care institutions with the goal of changing the delivery of rectal cancer care in the United States.[3] The group was founded in 2011 at the inaugural meeting in Cleveland, Ohio, at which time the evidence for and causes of the existing disparities in U.S. rectal cancer care were reviewed and plans to address the problem were created based on European protocols over the past two decades. Although this may be difficult to replicate in the United States due to significant economic and political barriers that exist in the United States, the OSTRiCh group

remains committed to raising the quality and uniformity of rectal cancer care. The OSTRiCh Consortium is a diverse group with no formal ties to any particular society and individual representatives of the member institutions are active in all of the pertinent surgical societies (American College of Surgeons [ACS], Commission on Cancer, American Society of Colon and Rectal Surgeons [ASCRS], Society of Surgical Oncology, Society for Surgery of the Alimentary Tract, Society of Gastrointestinal and Endoscopic Surgeons). While OSTRiCh is clearly a surgeon-led initiative, the multidisciplinary nature of rectal cancer management demands that the group include representatives from pathology, radiology, and medical and radiation oncology similar to an MDT. Members of the College of American Pathologist (CAP) and the American College of Radiology (ACR) have been added and the OSTRiCh plan has been presented at the annual meeting of the American Society of Clinical Oncology (ASCO). At the institutional level, OSTRiCh members represent most facets of the U.S. health care delivery system—both large and small private clinics, university-affiliated hospitals, large health care systems, and smaller community hospitals.

The OSTRiCh committee set proposed standards which are summarized in ►**Tables 1** to **3**. These pertain to the program structure (►**Table 1**) and the process of patient care (►**Table 2**). The quality standards proposed by the OSTRiCh committee is summarized in ►**Table 3**.

One of the underlying principles of OSTRiCh is a spirit of inclusion rather than exclusion, as the ultimate goal is to provide access to high-quality rectal cancer care for all Americans, not just those living in proximity to existing expert centers. Achieving this goal will require the creation of new CoEs throughout the United States, each housing a highly trained MDT administering a standard care pathway based on the five core principles of evidence-based rectal cancer care outlined earlier.

A proposal by the OSTRiCh group is in place with emphasis on comprehensive education and training program that would require all members of a proposed CoE MDT to attend a 2- to 3-day session where the evidence-based care pathways would be presented and the individual members of the team would undergo parallel expert level training in their particular functions (training in rectal cancer MRI [radiologists], training in pathology assessment and reporting [pathologists], etc.). The ASCRS is also developing a TME training module which will be incorporated into the program for the education and certification of surgeons in the proper technique of rectal cancer surgery. MDT members would also receive group training in team building, patient communication, data collection and reporting, internal validation, and program administration.

Our Experience

A rectal cancer MDT conference was instituted at Baylor University Medical Center in January 2013. The meeting occurs biweekly and is attended by surgeons, medical oncologists, radiation therapists, radiologists, pathologists, surgical oncologists, and database/research coordinator. The colorectal surgery residents accumulate a list of patients that are to be discussed at the meeting. This includes patients with newly diagnosed rectal cancer, patient with recurrence, or any patient that is awaiting surgical intervention for rectal cancer. The meeting also includes patients who underwent surgery for rectal cancer in the two weeks preceding the meeting. All identified patients are then entered into a prospectively maintained database. Regarding preoperative patients, the meeting gives the participants an opportunity to review history, imaging studies, and available pathology, and then formulate a care plan for the patient. The aim of discussing postoperative patients is to review pathology, learn whether there was concordance with preoperative radiology finding, evaluate quality of surgery performed, and formulate plan for adjuvant treatment. Shortly after the institution of MDT at our institution, we decided to perform an audit.

From our database, all patients were presented at MDT and were compared with a cohort of patients not discussed at MDT from an earlier time period of January to December 2012. Preoperative evaluation and treatment, surgical management, and pathological findings were compared, as well as outcomes. The results are summarized in ►**Table 4**. A total of 71 patients were included in the study, of which 44

Table 1 Structure standards

Standard 1.1	The institution must have a defined MDT with a minimum of one named member from each of the following specialties: surgery, pathology, radiology, medical oncology, radiation oncology, patient tracker
Standard 1.2	The institution must have a named MDT leader
Standard 1.3	All members of the MDT must complete the prescribed OSTRiCh MDT training program
Standard 1.4	The institution must be a member of the American College of Surgeons Commission on Cancer (CoC)
Standard 1.5	The institutions pathology laboratory must be accredited by the College of American Pathologists (CAP)
Standard 1.6	The institutions MRI facility must be accredited by the American College of Radiology
Standard 1.7	The institutions radiation oncology facility must be accredited by either the American College of Radiology (ACR), American Society of Oncology (ASCO), or American College of Radiation Oncology (ACRO)

Abbreviations: MDT, multidisciplinary team; OSTRiCh, Optimizing Surgical Treatment of Rectal Cancer.

Table 2 Process standards

Standard 2.1	Diagnosis of rectal cancer confirmed by biopsy prior to treatment (target rate: 95%)
Standard 2.2	Patients must be registered into OSTRiCh database
Standard 2.3	Both systemic and local staging must be performed prior to definitive treatment. Systemic staging should consist of CT scan of the chest, abdomen, and pelvis. Local tumor staging should consist of MRI ± TRUS. Results of the MRI should be conveyed by a standardized synoptic reporting (target rate: 95%)
Standard 2.4	CEA level should be obtained prior to definitive treatment (target rate: 100%)
Standard 2.5	Individualized treatment planning discussion must occur at MDT prior to definitive treatment (target rate: 100%)
Standard 2.6	A Treatment Recommendation Summary (TRS) must be sent to the patient and referring or primary care physician prior to commencement of therapy (target rate: 100%)
Standard 2.7	Definitive treatment must begin within 30 days of patient's initial clinical evaluation at the institution (Target rate: 90%)
Standard 2.8	Standardized synoptic pathology report must be issued within 2 weeks of definitive surgical resection of the primary tumor. Tumor regression grade, budding, and growth border should be included in the report. (target rate: 90%)
Standard 2.9	Individualized treatment-outcome discussion must occur at MDT (target rate: 100%)
Standard 2.10	Adjuvant treatment (if selected) must begin within 6 weeks of definitive surgical resection of the primary tumor in uncomplicated cases (target rate: 75%)
Standard 2.11	Pretreatment staging, neoadjuvant therapy details, surgery details, pathology details, and adjuvant therapy details should be entered into database within 6 months of surgery (target rate:100%)
Standard 2.12	A Treatment Completion Summary and follow-up plan document must be sent to the patient and referring or primary care physician within 4 weeks of treatment completion (target rate: 100%)
Standard 2.13	The MDT must conduct an Annual Performance Review (target rate: 100%)
Standard 2.14	Molecular markers should be assessed when appropriate (target rate: 90%)

Abbreviations: CT, computed tomography; CEA, carcinoembryonic antigen; MDT, multidisciplinary team; MRI, magnetic resonance imaging; OSTRiCh, Optimizing Surgical Treatment of Rectal Cancer.

were treated in 2012 (pre-MDT) and 27 patients were treated after the institution of MDT and were discussed at the conference (post-MDT). Comparing pre-MDT versus post-MDT groups, full colonoscopy was performed, or the report was reviewed in 42 patients (95%) versus 27 patients (100%) ($p = 0.5219$). Preoperative imaging was performed or reviewed in 39 patients (89%) versus 27 patients (100%) ($p = 0.1489$).The completeness of TME was reported in the pathology report of none of the patients (0%) compared with 15 patients (65%) ($p < 0.0001$). Local recurrence was seen in two patients (5%) compared with two patients (7%) ($p = 0.6320$) and distant recurrence was seen in four patients (9%) compared with one patient (4%) ($p = 0.6430$). The MDT conference appears to allow for improvement in preoperative evaluation and treatment, surgical management, and pathological reporting. The impact of MDT conference was greatest for reporting TME following resection for rectal cancer. The impact on survival, both disease-free and overall, will require further evaluation with longer follow-up.

Setting Up a Multidisciplinary Team

The United Kingdom has led the way in the use of MDTs in management of colorectal cancer. A framework put forward by the National Institute for Clinical Excellence has established guidelines entitled "Improving Outcomes in Colorectal Cancers: Manual Update" that serves as an excellent guide to organizing an MDT.[12]

The MDT consists of primary team members that include colorectal surgeons, radiologist, pathologist, oncologist, meeting coordinator, and clinical nurse specialists. Other specialists such as gastroenterologist, hepatobiliary surgeons, interventional radiologist, clinical geneticist, stoma nurse, thoracic surgeon, dietician, social worker, and research nurse are usually peripherally involved. The meetings should occur weekly and be set up by the team coordinator. Case notes, patient data, diagnostic data, staging, and pathologic information should also be available during the meeting. The cases to be discussed should include any new patient with a diagnosis of colorectal cancer, all patients who have undergone resection of a colorectal cancer, patients newly identified with recurrent or metastatic disease, and any other colorectal cancer patients that members of the team feel should be discussed. The clinical history and imaging data in these patients are reviewed. A radiologist reviews imaging with the team with particular focus on operative planning. Histopathologic data are also reviewed and in many cases help to monitor the quality of surgery. Review of the raw data serves to educate all members, gets all members well versed on staging issues, and promotes the overall assessment and analysis of a case. Postoperative cases are reviewed and the pathology is discussed. In regard to rectal cancer, the

Table 3 Quality indicators

1	Abdominoperineal resection rate
2	Anastomotic leak rate
3	Reoperation rate
4	30-day mortality rate after surgery
5	Involved CRM rate
6	Involved distal resection margin rate
7	Mesorectal grade rate
8	Lymph node yield greater than or equal to 12
9	Local recurrence rate
10	3-year disease-free survival rate

Abbreviation: CRM, circumferential resection margin.

pathologist provides valuable insight into quality of TME which is reviewed grossly and histologically. This can lead to an improvement in surgical technique. With regard to preoperative patients, the consensus management plan is recorded by the team coordinator who assists in all aspects of conference coordination, including data collection, referral coordination, and outcomes monitoring. Regular team audits should take place and protocols annually examined. A surgeon's and MDT's experience in relation to patient survival and cancer recurrence rates should be tracked.

Function of the MDT

The MDT accumulates information and opinions so that management decisions can be made on patient treatment. It allows individualization of patient care so that care can be tailored for that particular patient. Another key element of the MDT is capturing the data on a database so that internal

Table 4 Effects of institutional multidisciplinary consensus conferences as it relates to the treatment of rectal cancer and delivery of care

	All ($N = 71$)	Pre-MDT ($N = 44$)	Post-MDT ($N = 27$)	*p*-Value
Summary of demographics, comorbidities, and imaging				
Age	61.5	61.9	60.9	0.7692
BMI	28.3	28.8	27.7	0.6075
Comorbidities	43 (61%)	29 (67%)	14 (52%)	0.1921
Cardiovascular	36 (51%)	22 (51%)	14 (52%)	
Diabetes	16 (23%)	12 (28%)	4 (52%)	
COPD	4 (6%)	3 (7%)	1 (4%)	
Hyperlipidemia	14 (20%)	10 (23%)	4 (15%)	
Chronic kidney disease	1 (1%)	1 (2%)	0 (0%)	
End-stage renal disease	2 (3%)	1 (2%)	1 (4%)	
Ulcerative colitis	2 (3%)	1 (2%)	1 (4%)	
Crohn's disease	0 (0%)	0	0	
Type of preop imaging				
MRI	22 (37%)	4 (12%)	18 (69%)	<0.0001
EUS	9 (15%)	6 (18%)	3 (12%)	0.4811
CT	45 (76%)	27 (82%)	18 (69%)	0.2592
PET	2 (3%)	1 (3%)	1 (4%)	1.000
Neoadjuvant therapy	40 (56%)	20 (45%)	20 (74%)	0.0183
Summary of disease severity data and recurrence rates				
Clinical stage reported	39 (55%)	18 (41%)	21 (78%)	0.0024
Clinical stage (if reported)				
0	1 (3%)	1 (6%)	0 (0%)	
1	11 (28%)	5 (28%)	6 (29%)	
2	4 (10%)	3 (17%)	1 (5%)	
2a	3 (8%)	1 (6%)	2 (10%)	
3a	3 (8%)	1 (6%)	2 (10%)	
3b	6 (15%)	2 (11%)	4 (19%)	

(*Continued*)

Table 4 (*Continued*)

	All ($N = 71$)	Pre-MDT ($N = 44$)	Post-MDT ($N = 27$)	*p*-Value
3c	2 (5%)	0 (0%)	2 (10%)	
4	8 (21%)	4 (22%)	4 (19%)	
4a	1 (3%)	1 (6%)	0 (0%)	
Median nodes harvested (range)		15.5 (9–29)	19 (11–28)	0.7397
Documented distance from anal verge/dentate line by rigid proctoscopy	34 (48%)	18 (41%)	16 (59%)	0.1329
Distance from anal verge/ dentate line by rigid proctoscopy (if documented)	7.3 ± 4.0	8.6 ± 5.1	5.9 ± 4.5	0.1136
CEA level preop documented	47 (66%0	33 (75%)	14 (52%)	0.0453
CEA level preop (if documented)	2.6 ± 3.2	2.2 ± 2.2	3.6 ± 4.8	0.3276
Local recurrence 1 year				
Yes	4 (6%)	2 (5%)	2 (7%)	
No	67 (94%)	42 (95%)	25 (93%)	0.6320
Distant recurrence 1 year				
Yes	5 (7%)	4 (9%)	1 (4%)	
No	66 (93%)	40 (91%)	29 (96%)	0.6430
Comparison of patients pre-MDT and post-MDT implementation				
Evaluation of outside pathology				
Yes	2 (7%)	1 (4%)	1 (14%)	
No	28 (93%)	22 (96%)	6 (86%)	0.4184
Colonoscopy complete				
Yes	69 (97%)	42 (95%)	27 (100%)	
No	2 (3%)	2 (5%)	0 (0%)	0.5219
Pre-op imaging complete				
Yes	66 (93%)	39 (89%)	27 (100%)	
No	5 (7%)	5 (11%)	0 (0%)	0.1489
All three complete				
Yes	2 (7%)	1 (4%)	1 (14%)	
No	28 (93%)	22 (96%)	6 (86%)	0.4184
Colonoscopy and imaging complete				
Yes	66 (93%)	39 (89%)	27 (100%)	
No	5 (7%)	5 (11%)	0 (0%)	0.1489
TME reported				
Yes	21 (35%)	0 (0%)	21 (91%)	
TME complete			8 (38%)	
TME nearly complete			8 (38%)	
TME incomplete			5 (24%)	
TME not reported	39 (65%)	37 (100%)	2 (9%)	<0.0001
Circumferential margin involvement				
Yes	70 (99%)	43 (98%)	27 (100%)	
No	1 (1%)	1 (2%)	0 (0%)	1.000
Extravascular mural invasion		0	0	

Table 4 (*Continued*)

	All ($N = 71$)	Pre-MDT ($N = 44$)	Post-MDT ($N = 27$)	*p*-Value
Depth of tumor		0	0	
Proximity to TME		0	0	

Abbreviations: BMI, body mass index; CEA, carcinoembryonic antigen; COPD, chronic obstructive pulmonary disease; CT, computed tomography; EUS, endorectal ultrasound; MDT, multidisciplinary team; MRI, magnetic resonance imaging; TME, total mesorectal excision; PET, positron emission tomography.

audits can be performed to monitor outcomes. This may require addition of research or database personnel. Key steps identified in the function of MDT include the following[13]:

- *Protocols and guidelines*. Guidelines must be formulated based on the consensus of the team and should integrate the complementary areas of their expertise.[14] This includes reporting by template or pro forma which includes all the data needed for research and treatment.
- *Planning local service delivery*. Identification of gaps in current service provision in line with national guidelines should be identified and endorsed through the MDT. Also, a key element is that members of the team make others aware of the developments within their area of expertise.
- *Communication/coordination of care*. Identification of a key worker for the patient throughout the patient pathway is a responsibility of the MDT to ensure effective communication between the MDT, the patient, and their primary health care services.
- *Service redesign and improvement*. Process mapping, capacity and demand planning, and identification of areas for improvements in service should be undertaken by all MDTs. This includes efficiently staging, scheduling, and treating patients to optimize all aspects of the treatment protocol—radiation, chemotherapy, surgery, surveillance, and testing.
- *Data collection and audit*. Audit is a vital part of health care provision to allow monitoring of performance against the accepted standard. Audit should focus on case management and clinical outcomes.[14] The comparison of MRI and pathology slides allows comparison of findings and improves each of the services accuracy in staging. A photo of the TME specimen educates the surgeon and stimulates the search for excellence.
- *Research*. Participation in trials benefits the patient. Participation in clinical trials improves clinical outcome most likely due to meticulous predefined management algorithms and rigorous follow-up which are routinely part of the trial procedure. All patients should therefore be considered for enrollment in current clinical trials.

Problems with MDT and the Future

There are many reasons why setting up MDTs is challenging. One of the most difficult challenges seen in the United States as well as in other European and Australasian countries has been acceptance of the concept of the multidisciplinary approach and reluctance to be a part of the process. This is a problem within the U.S. institutions especially outside of the academic process. The process becomes more difficult as hospital systems expand with establishment of multiple satellite facilities. One option is teleconferencing, but this may still require significant time commitment. There may also be concern of satellite facilities losing patients to the main campus and therefore there could be reluctance from these satellite centers.[15] Issues with access to adequate imaging such as obtaining MRI scans are routinely seen especially at satellite facilities. Also, access to an MDT-trained medical and radiation oncologist can be difficult in the rural areas in the United States and not all treatment modalities may be available. These are some of the roadblocks that need to be addressed to be able to deliver specialized care in a problem as complex as rectal cancer. The ultimate result may be consolidation of care at capable institutions which have made the commitment and investment in optimizing care, as has occurred in the United Kingdom and Europe.

Conclusion

MDT care of patients with rectal cancer has been shown to improve process and oncologic outcomes. The process requires full commitment from all involved in the care of rectal cancer patients. It should become the standard of care in the future.

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